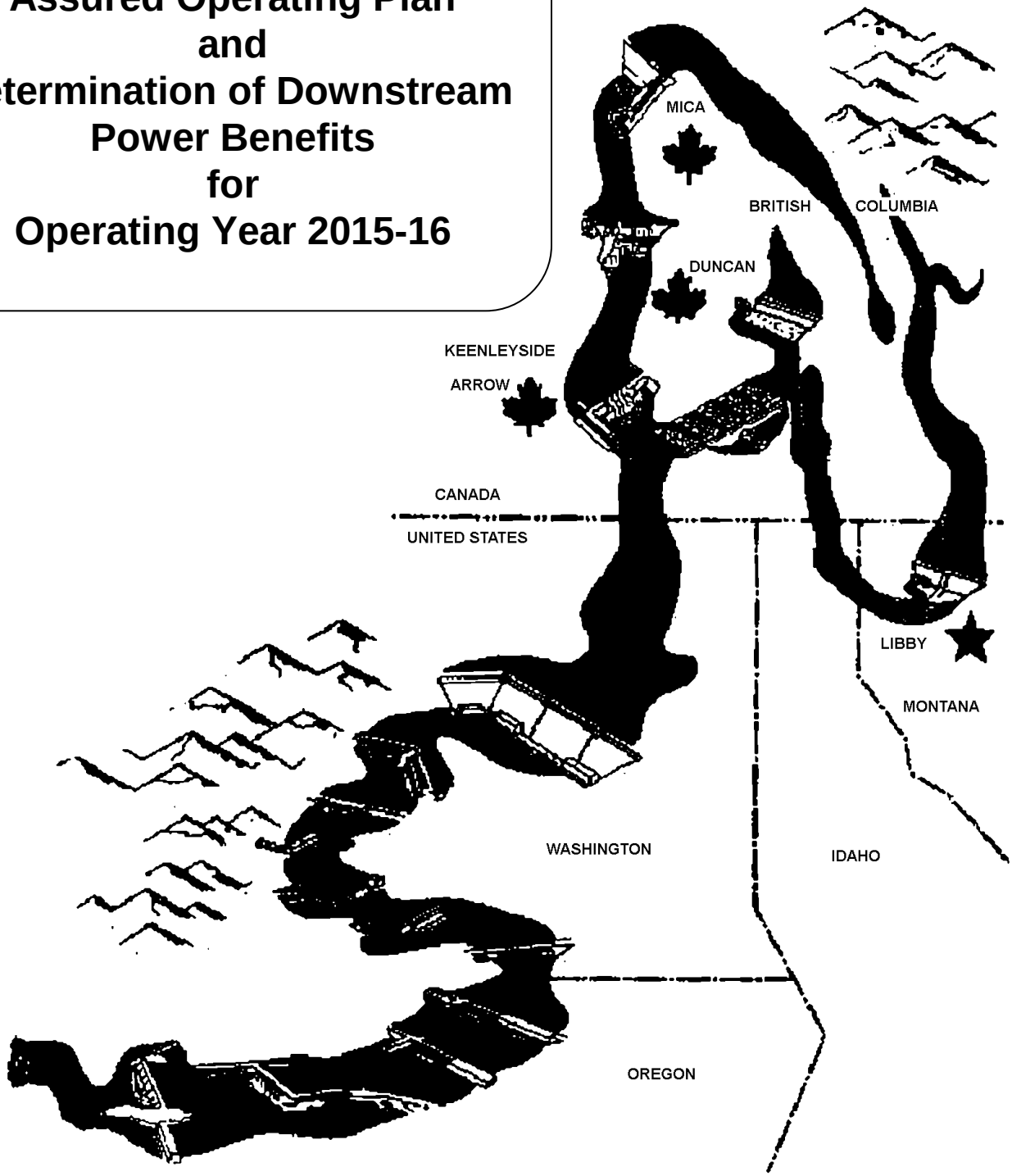
COLUMBIA RIVER TREATY
Assured Operating Plan
and
Determination of Downstream Power Benefits
for
Operating Year 2015-16



Columbia River Treaty Operating Committee September 2011

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COLUMBIA RIVER TREATY ENTITY AGREEMENT ON THE ASSURED OPERATING PLAN AND DETERMINATION OF DOWNSTREAM POWER BENEFITS FOR OPERATING YEAR 2015-16

The Columbia River Treaty between Canada and the United States of America requires that the Entities agree annually on an assured plan of operation for Canadian Treaty Storage and the resulting downstream power benefits for the sixth succeeding year.

The Entities agree that the attached reports entitled "Columbia River Treaty Hydroelectric Operating Plan: Assured Operating Plan for Operating Year 2015-16" and "Columbia River Treaty Determination of Downstream Power Benefits for the Assured Operating Plan for Operating Year 2015-16," both dated September 2011, shall be the Assured Operating Plan and Determination of Downstream Power Benefits for the 2015-16 Operating Year.

In witness thereof, the Entities have caused this Agreement to be executed.

Executed for the Canadian Entity this 8th day of September, 2011.

By: _____
David G. Cobb
Chair

Executed for the United States Entity this 20th day of September, 2011.

By: _____
Stephen J. Wright
Chairman

By: _____
Brigadier General John R. McMahon
Member

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COLUMBIA RIVER TREATY
HYDROELECTRIC OPERATING PLAN

ASSURED OPERATING PLAN
FOR OPERATING YEAR 2015-16

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HYDROELECTRIC OPERATING PLAN
ASSURED OPERATING PLAN
FOR OPERATING YEAR 2015-16

September 2011

1. Introduction

The "Treaty between Canada and the United States of America relating to the cooperative development of the water resources of the Columbia River Basin" (Treaty), dated 17 January 1961, requires that each year the Entities designated by the two governments will formulate and carry out operating arrangements necessary to implement the Treaty and will agree on an Assured Operating Plan (AOP) for the Treaty storage in Canada (Canadian Treaty Storage) and resulting downstream power benefits for the sixth succeeding operating year. This AOP for operating year 2015-16 (AOP16) provides the Entities with an operating plan for Canadian Treaty Storage and information for planning the power systems that are dependent on or coordinated with the operation of the Canadian Treaty Storage projects.

2. Development of the Assured Operating Plan

a) Procedures

This AOP was prepared in accordance with the Treaty, the "Protocol - Annex to Exchange of Notes, Dated January 22, 1964 Between the Governments of Canada and the United States Regarding the Columbia River Treaty" (Protocol), and the following Entity Agreements:

- The Entity Agreements, signed 28 July and 12 August 1988, on "Principles for the Preparation of the AOP and Determination of Downstream Power Benefit (DDPB) Studies" and "Changes to Procedures for the Preparation of the AOP and DDPB Studies" (1988 Entity Agreements);

- The "Columbia River Treaty Entity Agreement on Resolving the Dispute on Critical Period Determination, the Capacity Entitlement, for the 1998-99, 1999-00, and 2000-01 AOP/DDPBs, and Operating Procedures for the 2001-02 and Future AOPs," signed 29 August 1996 (29 August 1996 Entity Agreement); and

- Except for the changes noted below, the "Columbia River Treaty Entity Agreement on the Principles and Procedures for Preparing and Implementing Hydroelectric Operating Plans For Operation of Canadian Treaty Storage" (POP), dated October 2003 and signed 16 December 2003, including the November 2003 update to Appendix 1 - Refill Curves, the November 2004 additions of Appendix 6 - Streamline Procedures, and

Appendix 7 - Table of Median Stream flows, and the September 2007 addition of Appendix 8 concerning Water Supply Forecasts.

Special terms used in this document, but not defined herein, have the meanings defined in the Treaty, Protocol, or the above Entity Agreements. The POP is based on criteria contained in Annex A and Annex B of the Treaty, the Protocol, and the May 2003 Columbia River Treaty Flood Control Operating Plan (FCOP). For this AOP, the Entities have agreed to use only the first of the three streamline procedures defined in Appendix 6 of the POP, which is "Forecasting Loads and Resources" for determining the thermal installations, as described in Subsection 7(b) of this document.

In addition, the Entities have agreed to add to or modify certain procedures defined in POP as follows:

- Include an import from Canada equal to 53% of the estimated Canadian Entitlement, as was done since AOP13;

- Allocate available uncommitted PNWA resources and available uncommitted imports from Canada and California to balance the White Book (WB) firm load/resource deficit, as was done since the AOP/DDPB13 and described in Subsection 7(b). For the AOP16, seasonal exchanges are no longer used to balance firm WB loads and resources;

- Adjust thermal installation maintenance schedules as in AOP15 and described in Subsection 7(d);

- Shape generic thermal installations based on the full amount of WB large thermal, co-generation and combustion turbines and 30% of unreported CT energy capability that are estimated to be needed to meet the WB load, as described in Subsection 7(d);

- For Critical Period Studies, in accordance with the POP Section 2.2.A, the March ARC may be a storage upper limit for the first year critical rule curve. Because a critical period study must be completed before a refill study is started, the March ARC from the prior AOP refill study is used as an estimate for the March ARC for critical period studies, except at Grand Coulee where the Operating Committee has agreed to use 5732.6 hm^3 (2343.1 ksfd) for Step I and 5593.9 hm^3 (2286.4 ksfd) for Step II, as discussed in Subsection 7(f) of this document;

- For Refill Studies, the ARC is developed in the manner outlined in POP Section 2.3.B(1) except as revised to initialize the ARCs at project minimum release discharge requirement and the ARC only refill test is not performed; and

- For Refill Studies, the VRC is developed in the manner outlined in POP Section 2.3.B(2), except as revised to include the following: i) initialize Variable Refill Curves (VRC) at project minimum release discharge requirement; ii) apply a Variable Refill Curve Lower Limit (VRCLL) at Grand

Coulee for all volume runoff levels of 373.4 m (1225.0 ft) in March and April, 378.0 m (1240.0 ft) in May, 391.7 m (1285.0 ft) in June, and the January and February Grand Coulee VRCLL values the same as its Operating Rule Curve Lower Limit (ORCLL); and iii) VRCLLs apply only to individual months and do not require raising prior months by the same amount.

In accordance with Protocol VII(2), this AOP provides a reservoir-balance relationship for each month for the whole of the Canadian Treaty Storage. This relationship is determined from the following:

- The Critical Rule Curves (CRCs), Upper Rule Curves (URCs), and the related rule curves and data for each project used to compute the individual project Operating Rule Curves (ORCs);

- Operating rules and criteria for operation of the Canadian Treaty Storage in accordance with the principles contained in the above references; and

- The supporting data and model used to simulate the 30-year operation for the Step I Joint Optimum (AOP16-41) System Regulation Study[1].

This AOP includes both metric (International Standard) and English units[2]. The System Regulation Studies and supporting data were based on English units. The metric units are approximations derived by rounding conversions from English units. Metric values are displayed with either one or two decimal places to assure consistency with English units and do not imply that level of precision. The inclusion of metric units complies with USA Federal statutory requirements. Tables referred to in the text are in English units. Metric tables use the same numbering system with the letter “M” after the table number.

b) System Regulation Studies

This AOP was prepared in accordance with Annex A, paragraph 7, of the Treaty, which requires Canadian Treaty Storage operation for joint optimum power generation in both Canada and the USA. Downstream power benefits were computed with the Canadian Treaty Storage operation based on the same criteria for joint optimum power generation as in the Step I study.

System regulation studies for the AOP16 were based on 2015-16 operating year estimated loads and resources in the USA PNWA, including estimated flows of power from and to adjacent areas, and hydro resources in the Columbia River Basin in British Columbia.

In accordance with Protocol VIII, the AOP16 is based on a 30-year stream flow period and the Entities have agreed to use an operating year of 1 August to 31 July. The studies used historical flows for the period August 1928 through July 1958, modified by estimated irrigation depletions for the 2000 level[3] and including updated estimates of Grand Coulee pumping requirements.

The CRCs were determined from a critical period study of optimum power generation in both Canada and the USA. The study indicated a 42.5 calendar-month critical period for the USA system resulting from the low flows

during the period from 16 August 1928 through 29 February 1932. With the exception of Brownlee and Dworshak, it was assumed that all reservoirs, both in the USA and Canada, were full at the beginning of the critical period except where minimum release requirements made this impossible.

The flood control operation at Canadian projects was based on individual project flood control criteria instead of a composite curve. The Canadian Entity selected a 5.03/4.44 cubic kilometer (km^3) (4.08/3.6 million acre-feet (Maf)) Mica/Arrow flood control allocation in accordance with Section 6 of the FCOP. Flood Control and Variable Refill Curves are based on historical inflow volumes. Although only 19.12 km^3 (15.5 Maf) of usable storage are committed for power operation purposes under the Treaty, the FCOP provides for the full draft of the total 25.29 km^3 (20.5 Maf) of usable storage for on-call flood control purposes. Flood Control Rule Curves are implemented in the System Regulation Studies as URCs.

c) Evaluation of the Joint Optimum Study

In accordance with Subsections 3.2.A and 3.3.A(3) of the POP, the changes in Canadian Treaty Storage operation for an optimum power generation at-site in Canada and downstream in Canada and the USA (Joint Optimum), compared to an operation for optimum power only in the USA (USA Optimum), were evaluated as required by Annex A, paragraph 7, of the Treaty using the two criteria described below.

(1) Determination of Optimum Generation in Canada and the USA

To determine whether optimum power generation in both Canada and the USA was achieved in the system regulation studies, the annual firm energy capability, dependable peaking capability, and average annual usable secondary energy were computed for both the Canadian and USA systems. The Canadian Treaty Storage operation in the Joint Optimum Study was designed to achieve a weighted sum of these three quantities that was greater than the weighted sum achieved in the USA Optimum Study.

In order to measure optimum power generation for the AOP16, the Columbia River Treaty Operating Committee agreed that the three quantities would be assigned the following relative values:

Quantity	Relative Value
Annual firm energy capability (average megawatts (aMW))	3
Dependable peaking capability (MW)	1
Average annual usable secondary energy (aMW)	2

The sum of the three weighted quantities showed a net gain in the Joint Optimum Study compared to the USA Optimum Study. The Entities agree that this result is in accordance with Subsection 3.2.A of the POP. The results of these calculations are shown in Table 2.

(2) Maximum Permitted Reduction in Downstream Power Benefits

Annex A, paragraph 7 of the Treaty defines the limits to any reduction in the downstream power benefits in the USA resulting from a change in operation to achieve a joint optimum operation. Separate Step II system regulation studies were developed reflecting: (i) Canadian Treaty Storage operation for optimum generation in the USA alone; and (ii) Canadian Treaty Storage operation for optimum generation in both Canada and the USA. Using the storage operation for optimum generation in both Canada and the USA, there is a 3.7 aMW increase in the Canadian Entitlement for average annual usable energy and a 1.2 aMW increase in the dependable capacity compared to the operation for optimum generation in the USA alone. (See Table 5 of the DDPB16, columns A and B.)

Since there is no reduction in entitlement, the Entities have determined in Section 4 of the DDPB16 that the calculation of maximum permitted reduction in downstream power benefits is not necessary.

3. Rule Curves

The operation of Canadian Treaty Storage during the 2015-16 Operating Year shall be guided by the ORCs and CRCs for the whole of Canadian Treaty Storage, Flood Control Curves for the individual projects, and project operating criteria for Mica and Arrow. The ORCs and CRCs are first determined for the individual Canadian projects and then summed to yield the Composite ORC for the whole of Canadian Treaty Storage, in accordance with paragraph VII (2) of the Protocol. The ORCs are derived from the various curves described below.

a) Critical Rule Curves

The CRC is defined by the end-of-period storage content of Canadian Treaty Storage during the critical period. It is used to determine proportional draft below the ORCs as defined in Subsection 4(b). Generally, CRCs are adjusted for crossovers by the hydroregulation model as defined in Section 2.3.A of the POP. CRC crossovers occur when the second, third, or fourth year CRCs are higher than any of the lower numbered CRCs, and past practice was for the hydro regulation model to lower the storage amounts in the higher numbered CRCs at all projects as needed to eliminate the crossover. For the Canadian Treaty projects, this adjustment is applied only if the sum of Mica + Arrow + Duncan Treaty storage has a composite CRC crossover. The adjustment is made to Arrow first unless or until Arrow is empty, then the adjustment is made to Duncan. The CRCs for Duncan, Arrow, Mica, and the Composite CRCs for the whole of Canadian Treaty Storage are tabulated in Table 3.

b) Refill Curves

There are two types of refill curves, Assured Refill Curves (ARCs) and Variable Refill Curves (VRCs), which are discussed in the following subsections. Tabulations of the ARCs and VRCs, and supporting data used in determining the

ARCs and VRCs for Mica, Arrow, and Duncan are provided in Tables 4, 5, and 6, respectively.

(1) Assured Refill Curves

The ARCs indicate the minimum August through June end-of-period storage contents required to meet firm load and refill the Coordinated System storage by 31 July, based on the 1930-31 inflows. The upstream storage requirements and the Power Discharge Requirements (PDR) are determined in accordance with Section 2.3.B and Appendix 1 of the POP, and revisions defined in Subsection 2(a) and discussed in Subsection 7(f) of this document. The 1930-31 inflows are the second lowest January through July unregulated stream flows at The Dalles, Oregon, during the 30-year (1928-58) stream flow period, which has approximately a 95% probability of exceedance.

(2) Variable Refill Curves

The VRCs indicate the minimum January through June end-of-period storage contents required to refill the Coordinated System storage by 31 July based on the 95% confidence forecasted inflow volume. The upstream storage refill requirements and PDRs are determined in accordance with Section 2.3.B and Appendix 1 of the POP. In the system regulation studies, historical volume inflows, adjusted for the 95% confidence forecast error, were used instead of forecast inflows. The PDRs are a function of the unregulated January through July runoff volume at The Dalles, Oregon. In those years when the January through July runoff volume at The Dalles is between 98.68 km^3 (80 Maf) and 135.69 km^3 (110 Maf), the PDRs are interpolated linearly between the values shown in Tables 4-6. In those years when the January through July runoff volume at The Dalles is less than 98.68 km^3 (80 Maf), or greater than 135.69 km^3 (110 Maf), the PDR values for 98.68 km^3 and 135.69 km^3 (80 Maf and 110 Maf), respectively, are used. For AOP16, as in the AOP12 through AOP15, the VRC Lower Limit (VRCLL) was applied as a fixed rule curve for Grand Coulee only.

Tables 4-6 illustrate the range of VRCs for Mica, Arrow, and Duncan for the 30-year stream flow period. In actual operation in 2015-16, the PDRs and VRCLLs will be based on the forecast of unregulated runoff at The Dalles.

c) Operating Rule Curve Lower Limits (ORCLLs)

The ORCLLs indicate the minimum 31 January through 15 April end-of-period storage contents that must be maintained to protect the ability of the system to meet firm load during the period 1 January through 30 April. The ORCLLs protect the system's ability to meet firm load in the event that the VRCs permit storage to be emptied and sufficient natural flow is not available to carry the load prior to the start of the freshet. Such rule curves shall limit the ORC to be no lower than the ORCLLs. The ORCLLs are developed for 1936-37 water conditions which include the lowest January through April unregulated stream

flows at The Dalles during the 30-year stream flow period. The ORCLLs for Mica, Arrow, and Duncan are shown in Tables 4, 5, and 6 respectively.

d) Upper Rule Curves (Flood Control)

The URCs indicate the end-of-period storage content to which each individual Canadian Treaty Storage project shall be evacuated for flood control. The URCs used in the studies were based upon Flood Control Storage Reservation Diagrams contained in the FCOP and analysis of system flood control simulations. URCs for Mica, Arrow, and Duncan for the 30-year stream flow period are shown in Tables 7, 8, and 9 respectively. Tables 7 and 8 reflect an agreed transfer of flood control space in Mica and Arrow to maximum drafts of 5.03 km^3 and 4.44 km^3 (4.08 Maf and 3.6 Maf) respectively. In actual operation, the URCs will be computed as outlined in the FCOP using the latest forecast of runoff available at that time.

e) Operating Rule Curves

The ORCs define the normal limit of storage draft to produce secondary energy and provide a high probability of refilling the reservoirs. In general, the Operating Plan does not permit serving secondary loads at the risk of failing to refill storage and thereby jeopardizing the firm load carrying capability of the USA or Canadian systems during subsequent years.

During the period 1 August through 31 December, the ORC is defined as the CRC for the first year of the critical period (CRC1) or the ARC, whichever is higher. During the period 1 January through 31 July, the ORC is defined as the higher of the CRC1 and the ARC, unless the VRC (limited by the VRCLL) is lower, then the VRC defines the ORC. During the period 1 January through 15 April, the ORC will not be lower than the ORCLL. The ORC shall be less than or equal to the URC at each individual project. The composite ORCs for the whole of Canadian Treaty Storage for the 30-year stream flow period are included in Table 10 to illustrate the probable future range of these curves based on historical water conditions.

4. Operating Rules

The System Regulation Study storage operation results for the whole of Canadian Treaty Storage for the 30-year stream flow period are shown in Table 11. The Study contains the agreed-upon ORCs and CRCs, and operating procedures and constraints, such as maximum and minimum project elevations, discharges, and draft rates. These constraints are included as part of this operating plan and are listed in Appendix A.

The following rules and other operating criteria included in the AOP16-41 System Regulation Study will apply to the operation of Canadian Treaty Storage in the 2015-16 Operating Year, subject to the provisions under Section 5.

a) Operation at or above ORC

The whole of Canadian Treaty Storage will be drafted to its ORC as required to produce optimum generation in Canada and the USA in accordance with Annex A, paragraph 7, of the Treaty, subject to project physical characteristics and operating constraints.

b) Operation below ORC

The whole of Canadian Treaty Storage will be drafted below its ORC as required to produce optimum power generation, to the extent that a System Regulation Study determines that proportional draft below the ORC is required to produce the hydro firm energy load carrying capability (FELCC) of the USA system. FELCC is determined by the applicable Critical Period Regulation Study. Proportional draft between rule curves will be determined as described in Section 2.4.C of the POP.

c) Canadian Treaty Project Operating Criteria

Mica and Arrow reservoirs will be operated in accordance with project operating criteria listed in Tables 1 and 1.1, respectively, so as to optimize generation at Mica, Revelstoke, and Arrow, and downstream in the USA. Under these operating criteria, outflows will be increased as required to avoid storage above the URC at each reservoir.

(1) Mica Project Operating Criteria

In general, the Mica operation in each period is either a target flow or target content, as listed in Table 1 and determined by Arrow's storage content at the end of the previous period. In the event that Mica's operation to the Table 1 operating criteria results in more or less than the project's share of draft from the whole of Canadian Treaty Storage as described in Subsections 4(a) or 4(b) above, compensating changes will be made from Arrow to the extent possible.

Mica storage releases in excess of 8.63 km^3 (7.0 Maf) that are required to maintain the Mica outflows specified under this plan will be retained in the Arrow reservoir, subject to flood control and other project operating criteria at Arrow. The total combined storage draft from Mica and Arrow will not exceed 17.39 km^3 (14.1 Maf), unless flood control or minimum flow criteria will not permit the excess Mica storage releases to be retained at Arrow. Based on this AOP, the probability of a combined Mica + Arrow storage release in excess of 17.39 km^3 (14.1 Maf) occurring has been judged to be negligible; however, in actual operations, should Treaty specified constraints require combined Mica + Arrow storage draft in excess of 17.39 km^3 (14.1 Maf), it is mutually agreed for the sole purpose of this AOP that such releases may occur. If such a release should occur, the target Mica operation will remain as specified in Table 1, and the excess release will be returned as soon as the operating criteria permit.

The adoption of the above described procedure for addressing total combined storage draft from Mica and Arrow in this AOP16 is not intended to set a precedent for future AOPs and is subject to change in future AOPs.

(2) Arrow Project Operating Criteria (APOC)

In general, Arrow reservoir will be operated to provide the balance of the required Canadian Treaty Storage as described in 4(a) or 4(b) above, subject to physical and operating constraints. These constraints include, but are not limited to, the URC, rate-of-draft and minimum flows limits, and the Arrow Project Operating Criteria (APOC).

The APOC is shown in Table 1.1(a) and consists of maximum storage limits, maximum outflow limits and minimum outflow limits at Arrow. The maximum storage limits apply from February to June depending on the forecast for The Dalles residual unregulated runoff for the current month through July. The maximum and minimum outflow limits apply under all water conditions, subject to flood control requirements and a maximum combined draft of 17.39 km^3 (14.1 Maf) at Mica + Arrow, respectively. In no circumstance shall the minimum outflow be reduced below the Treaty specified minimum of 142 m^3/s (5,000 cfs).

The implementation of the APOC storage limits in the Detailed Operating Plan will use the distribution factors shown in Table 1.1(c). These distribution factors are multiplied by the current month through July forecast volumes at The Dalles, to calculate future month through July volume forecasts. The resulting residual month-July volumes are then used to determine the maximum storage levels from the criteria provided in Table 1.1(a). To assist implementation of this procedure, an example is shown at the bottom of Table 1.1(c).

d) Other Canadian Project Operation

Revelstoke, Upper Bonnington, Lower Bonnington, South Slocan, Brilliant, Seven Mile, and Waneta are included in the AOP16 as run-of-river projects. Generation at Arrow is modeled in the studies. Corra Linn and Kootenay Canal are included and operated in accordance with criteria utilized in prior AOPs.

5. Preparation of the Detailed Operating Plan

The Entities have to this date agreed that each year a Detailed Operating Plan (DOP) will be prepared for the immediately succeeding operating year. Such DOPs are made under authority of Article XIV.2 of the Columbia River Treaty, which states in part:

". . . the powers and the duties of the entities include: . . .

"(k) preparation and implementation of detailed operating plans that may produce results more advantageous to both countries than those that would arise from operation under the plans referred to in Annexes A and B."

The 2015-16 DOP (DOP16) will reflect the latest available load, resource, and other pertinent data to the extent the Entities agree that this data should be included in the plan. The data and criteria contained herein may be reviewed and updated as agreed by the Entities to form the basis for a DOP16. Failing agreement on updating the data and/or criteria, the DOP16 for Canadian Treaty Storage shall include the rule curves, Mica and Arrow operating criteria, and other data and criteria provided in this AOP. Actual operation of Canadian Treaty Storage during the 2015 -16 Operating Year shall be guided by the DOP16.

The values used in the AOP studies to define the various rule curves were period-end values only. In actual operation, it is necessary to operate in such a manner during the course of each period that these period-end values can be achieved in accordance with the operating rules. Due to the normal variation of power load and stream flow during any period, straight-line interpolation between the period-end points should not be assumed. During the storage drawdown season, Canadian Treaty Storage should not be drafted below its period-end point at any time during the period unless it can be conservatively demonstrated that sufficient inflow is available, in excess of the minimum outflow required to serve power demand, to refill the reservoir to its end-of-period value as required.

During the storage evacuation and refill season, operation will be consistent with the FCOP. When refill of Canadian Treaty Storage is being guided by Flood Control Refill Curves, such curves will be computed on a day-by-day basis using the residual volume-of-inflow forecasts depleted by the volume required for minimum outflow, unless higher flows are required to meet firm load, for each day through the end of the refill season.

6. Canadian Entitlement

The amount of Canadian Entitlement is defined in the companion document "Determination of Downstream Power Benefits for the Assured Operating Plan for Operating Year 2015-16."

The Treaty specifies return of the Canadian Entitlement at a point near Oliver, British Columbia, unless otherwise agreed by the Entities. Because no cross-border transmission exists near Oliver, the Entities completed an agreement on Aspects of the Delivery of the Canadian Entitlement for 1 April 1998 through 15 September 2024, dated 29 March 1999[4]. This arrangement covers the full 1 August 2015 through 31 July 2016 period covered by this AOP, and includes transmission losses and scheduling guidelines for delivery of the Canadian Entitlement.

7. Summary of Changes Compared to the 2014-15 AOP and Notable Assumptions

Data from the recent AOPs are compared and summarized in Table 12. An explanation of the more important changes and notable assumptions follows.

a) Pacific Northwest Area (PNWA) Firm Load

Loads for the AOP16 are based on Bonneville Power Administration's (BPA) April 2010 Draft White Book (WB10)[5] expected load forecast. The Draft WB10 forecast for the 2015-16 regional firm load is 22,957 annual aMW, which is 538 aMW (2.3%) lower than the AOP15. As there were only minor changes to the Idaho portion of the Utah Power & Light load and to the Coulee pumping requirements, the net PNWA firm load also decreased by 536 annual aMW (2.3%) from the AOP15 to AOP16.

The average critical period load factor decreased from 74.76% in AOP15 (WB09) to 73.93% in AOP16 (WB10). This was mainly due to changes in the load forecast.

b) Flows of Power at Points of Interconnection

The Step I System Load includes the net effect of flows of power at points of interconnection which are all imports and exports, except those classified as thermal installations, plant sales, and flow-through-transfers.

- For the AOP16, the estimate of the amount of Canadian Entitlement energy and other uncommitted imports that would be assumed to serve load in the PNWA was based on a similar procedure being used since AOP13, except that the use of added seasonal exchanges to balance firm WB loads and resources has been eliminated. This procedure assumes all of the Canadian Entitlement is returned to Canada, but is then available as an uncommitted import for the PNWA. The procedure determines the WB10 firm energy deficit without uncommitted thermal resources and then uses a two-step pro rata approach to allocate uncommitted PNWA resources (including unreported combustion turbine (CT) capability) and available uncommitted imports from Canada and California to eliminate deficits. The first step reduces or eliminates the monthly deficits using available uncommitted PNWA resources (without unreported CT capability) and available Canadian imports. For the AOP16, the Entities had agreed that 53% (264 annual aMW) of the estimated Canadian Entitlement would be used as a Canadian import for serving PNWA load, with the uncommitted PNWA resources (without unreported CT capability) being allocated next to reduce or eliminate the monthly deficits. Any remaining deficits are then allocated based on the proportion of available unreported CT capability and assumed available California imports. The resulting amount of allocated imports are included in the Step I load/resource balance. Compared to AOP15, this procedure results in an 8 annual aMW increase in Entitlement energy serving load in the U.S.

- The estimated Canadian Entitlement included in export loads was 499 average annual MW of energy and 1367 MW of capacity. The amount computed for the DDPB16 is 488.7 average annual MW of energy and 1332.3 MW of capacity. Iterative studies to update the Canadian Entitlement assumed in the load estimate (see DDPB Table 1) were not performed because the effect on the amount of thermal installations would not affect the results of the studies in a noticeable manner.
- For the AOP16 as well as the AOP15, a seasonal exchange to reshape the residual hydro load to reflect differences between AOP and WB hydro capabilities was not used. In addition, the AOP16 did not use seasonal exchanges to balance the firm WB loads and resources.
- Compared to the AOP15, power flows-out (exports that are mostly to the southwest but also include the Entitlement) decreased by 1 annual aMW, and power flows-in (imports) decreased by 88 annual aMW. These differences are primarily due to changes in WB imports, WB exports and seasonal exchanges.

c) Non-Step I Hydro and Other Non-Thermal Resources

The Step I System Load is reduced by hydro independent generation, non-Step I coordinated hydro, and miscellaneous non-thermal resources. For the AOP16, these resources have increased by 103 annual aMW over the AOP15. This is primarily due to the addition of wind projects.

d) Thermal Installations

Because of increasing difficulty in forecasting Thermal Installations, the Entities again used the Streamline Procedure for "Loads and Resources" for determining Thermal Installations, as used since AOP07. The procedure includes the Columbia Generating Station (CGS, formerly called Washington Public Power Supply System #2 nuclear power plant) plus one generic Thermal Installation, sized as needed to balance loads and resources in the critical period. In this AOP, an average of the two year (2014-15 and 2015-16) maintenance cycle at CGS was used, which resulted in the same annual average generation for AOP15 and AOP16.

As in the AOP15, thermal installation maintenance schedules were adjusted to include a two week maintenance outage for the five combustion turbines that did not have maintenance outages in previous AOPs.

For the AOP16 it was agreed that the coordinated thermal installations used to determine the shape of the generic thermal installation for the AOP load and resource balance are the full amount of WB10 large thermal, co-generation, and combustion turbines and 30% of unreported CT energy capability that are estimated to be needed to meet the WB10 load.

The total thermal installations decreased by 538 annual aMW from AOP15 to AOP16 due to a combination of all changes in loads and resources as explained above.

e) Hydro Project Modified Stream flows

The unregulated base stream flows for the Step I System Regulation Studies were the same as the AOP15 studies which were based on the 2000 Level Modified Stream flows, with updates provided for Grand Coulee pumping from the PNCA 1 February 2010 data submittal.

f) Hydro Project Rule Curves

The AOP16 did not utilize the Streamline Procedure "Multi-Year Use of Same Operating Criteria for Canadian Treaty Storage"; instead, the full Step I, II and III hydroregulation studies were performed. Some notable assumptions include:

- The use of a fixed VRCLL at Grand Coulee only, equal to the ORCLL for January and February, and based on historic minimum elevations for firm power operation for March to June (373.4 m (1225.0 ft) for March to April, 378.0m (1240.0 ft) for May, and 391.7 m (1285.0 ft) for June);

- The agreed allocation of flood control space in Mica and Arrow is 5.03 and 4.44 km^3 (4.08 and 3.6 Maf), respectively;

- The use of the AOP16, 30-year URC data developed by the Corps of Engineers;

- For the AOP16 Critical Period Study, the March ARC contents at Grand Coulee are 5732.6 hm^3 (2343.1 ksfd) and 5593.9 hm^3 (2286.4 ksfd) for Steps I and II, respectively. These March ARC storage limits are based on the average of the AOP11, 12 and 15 ARCs from the ARC optimization study, and limited by flood control. Up to the AOP15, the March ARCs were calculated using the final ARCs from the previous AOP study. However, from AOP11 to AOP15, this procedure resulted in significant year-to-year reductions in the March ARC contents at Grand Coulee, which may potentially reduce system firm and secondary energy. The revised procedure for AOP16 is intended to avoid this impact; and

- The PDRs developed during the Refill Study for all steps started with minimum flows and were increased as needed to pass the Refill Test.

g) Other Hydro Project Operating Procedures, Constraints, and Plant Data

The AOP16 hydro project operating procedures, constraints and plant data were updated from the PNCA 1 February 2010 data submittal in accordance with POP procedures, except as noted below.

The nonpower requirements for Base System projects were agreed to in the 29 August 1996 Entity Agreement. These requirements are essentially the nonpower requirements included in the 1979-80 and prior AOP/DDPB studies. Nonpower constraints for non-Base System projects are updated to current requirements, except for Libby, which uses the values specified in the February

2000 Libby Coordination Agreement. Some notable assumptions include:

- Brownlee minimum flow requirements are 166 m^3/s (5,850 cfs), in all periods plus the flow needed to reach 368 m^3/s (13,000 cfs) at Lime Point during July through September;

- Dworshak is operated to a minimum flow or flood control October through May, and a target operation June through September to obtain uniform outflows July through August;

- Grand Coulee, which is normally drafted 0.61 m (2 ft) at the beginning of the critical period, is held full through August 31, 1928 to avoid a surplus.

- Hungry Horse is operated to a maximum flow of 269.0 m^3/s (9500 cfs) to reflect transmission constraints with Libby;

- The 30-year storage operation at Mossyrock, Cushman 1, Alder, Swift #1, Merwin, Yale, and Timothy was set to a fixed operation (first coded) from the 2006 AOP because they are no longer coordinated resources in PNCA Planning. Although included in the Step I hydroregulation model, these projects are now essentially the same as a hydro-independent project;

- Ross and Gorge operating data were updated to the PNCA 1 February, 2010 data submittal; and

- Hydro-independent projects are not yet updated for the 2000 Modified Flows.

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[1] "BPA Hydroelectric Power Planning Program, Assured Operating Plan 30-year System Regulation Study 16-41," dated 14 July, 2011.

[2] The conversion factors used are:
(a) million acre-feet (Maf) times 1.2335 equals cubic kilometers (km^3);
(b) thousand second-foot-days (ksfd) times 2.4466 equals cubic hectometers (hm^3);
(c) cubic feet per second (cfs) divided by 35.3147 equals cubic meters per second (m^3/s); and
(d) feet (ft) times 0.3048 equals meters (m).

[3] "Report on 2000 Level Modified Streamflow, 1928 to 1999, Columbia River and Costal Basins," prepared by BPA, dated May 2004.

[4] "Columbia River Treaty Entity Agreement on Aspects of the Delivery of the Canadian Entitlement for April 1, 1998 Through September 15, 2024" between the Canadian Entity and the United States Entity, dated 29 March 1999.

[5] April 2010 Draft (study #67) of the "2010 Pacific Northwest Loads & Resources Study, Operating Years 2010 through 2019," dated 21 April, 2010 and published 7 October, 2010.

TABLE 1
(English Units)
MICA PROJECT OPERATING CRITERIA
2015-16 ASSURED OPERATING PLAN

		Target Operation		Target Operation Limits		
Month	End of Previous Month **Arrow** Storage Content (ksfd)	Month Average Outflow (cfs)	End-of-Month Treaty Storage Content 1/ (ksfd)	Minimum Treaty Storage Content 2/ (ksfd)	Maximum Outflow 1/ (cfs)	Minimum Outflow (cfs)
August 1-15	3,300 - FULL	-	3,379.2	-	34,000	15,000
	2,150 - 3,300	25,000	-	0	-	15,000
	0 - 2,150	32,000	-	0	-	15,000
August 16-31	3,500 - FULL	-	3,529.2	-	34,000	15,000
	2,150 - 3,500	25,000	-	0	-	15,000
	0 - 2,150	32,000	-	0	-	15,000
September	3,530 - FULL	-	3,529.2	-	34,000	10,000
	3,500 - 3,530	25,000	-	0	-	10,000
	2,100 - 3,500	27,000	-	0	-	10,000
	0 - 2,100	32,000	-	0	-	10,000
October	3,340 - FULL	-	3,404.1	-	34,000	10,000
	2,970 - 3,340	22,000	-	0	-	10,000
	1,200 - 2,970	26,000	-	0	-	10,000
	0 - 1,200	32,000	-	0	-	10,000
November	3,160 - FULL	21,000	-	0	-	10,000
	3,000 - 3,160	20,000	-	0	-	10,000
	1000 - 3,000	26,000	-	0	-	10,000
	0 - 1,000	32,000	-	0	-	10,000
December	3,000 - FULL	17,000	-	204.1	-	10,000
	2,430 - 3,000	24,000	-	204.1	-	10,000
	500 - 2,430	28,000	-	204.1	-	10,000
	0 - 500	32,000	-	204.1	-	10,000
January	2,250 - FULL	24,000	-	204.1	-	12,000
	1,960 - 2,250	26,000	-	204.1	-	12,000
	1,800 - 1,960	27,000	-	204.1	-	12,000
	0 - 1,800	29,000	-	204.1	-	12,000
February	1,090 - FULL	26,000	-	0	-	12,000
	730 - 1,090	23,000	-	0	-	12,000
	680 - 730	20,000	-	0	-	12,000
	0 - 680	27,000	-	0	-	12,000
March	420 - FULL	25,000	-	0	-	12,000
	150 - 420	18,000	-	0	-	12,000
	0 - 150	26,000	-	0	-	12,000
April 1-15	890 - FULL	21,000	-	0	-	12,000
	290 - 890	12,000	-	0	-	12,000
	130 - 290	17,000	-	0	-	12,000
	0 - 130	21,000	-	0	-	12,000
April 16-30	220 - FULL	10,000	-	0	-	10,000
	130 - 220	14,000	-	0	-	10,000
	30 - 130	10,000	-	0	-	10,000
	0 - 30	15,000	-	0	-	10,000
May	220 - FULL	8,000	-	0	-	8,000
	160 - 220	15,000	-	0	-	8,000
	0 - 160	10,000	-	0	-	8,000
June	1,440 - FULL	8,000	-	0	-	8,000
	870 - 1,440	10,000	-	0	-	8,000
	0 - 870	16,000	-	0	-	8,000
July	2,950 - FULL	-	3,436.2	-	34,000	10,000
	2,000 - 2,950	18,000	-	0	-	10,000
	0 - 2,000	32,000	-	0	-	10,000

Notes:

1/ If the Mica target end-of-month storage content is less than 3529.2 ksfd, then a maximum outflow of 34000 cfs will apply.

2/ Mica outflows will be reduced to minimum to maintain the reservoir above the minimum Treaty storage content. This will override any flow target.

TABLE 1.1a
(English Units)
ARROW PROJECT OPERATING CRITERIA
DEFINITION
2015-16 ASSURED OPERATING PLAN

Period	Vol Runoff Period	The Dalles Vol Runoff (Maf)	Max Storage Limit 1/, 2/ (ksfd)	Max Outflow Limit 3/ (cfs)	Min Outflow Limit 4/ (cfs)
15 Aug - 31-Dec	-		URC	-	10,000
31-Jan	-		URC	70,000	10,000
29 Feb	1 Feb - 31 Jul	≤ 70	URC	60,000	20,000
		>70 to <80	URC to 1800		
		≥ 80	1800		
31-Mar	1 Mar - 31 Jul	≤ 65	URC	-	20,000
		>65 to <75	URC to 900		
		≥ 75	900		
15-Apr	1 Apr - 31 Jul	≤ 61	URC	-	15,000
		>61 to <70	URC to 900		
		≥ 70	900		
30-Apr	1 Apr - 31 Jul	≤ 61	URC	-	12,000
		>61 to <70	URC to 1000		
		≥ 70	1000		
31-May	1 May - 31 Jul	≤ 68	URC	-	5,000
		>68 to <70	URC to 2200		
		≥ 70	2200		
30-Jun	1 Jun - 31 Jul	≤ 33	URC	-	5,000
		>33 to <35	URC to 3300		
		≥ 35	3300		
31-Jul	-		URC	-	10,000

Notes:

1/ If the Maximum Storage Limit is computed to be above the URC, then the URC will apply.

2/ Interpolate when there are two values. For example, if the February-July volume runoff is between 70 Maf and 80 Maf, then the Maximum Storage Limit is interpolated between February's URC and 1800 ksfd.

3/ The Maximum Average Monthly Outflow Limit takes precedence over the Maximum Storage Limit. However, the Maximum Outflow Limit may be exceeded to avoid storage above the URC.

4/ The Minimum Average Monthly Outflow Limit is an operating limit and may be reduced to as low as 5,000 cfs (Treaty minimum) to avoid drafting Mica+Arrow storage beyond 14.1 Maf.

TABLE 1.1b
(English Units)
ARROW PROJECT OPERATING CRITERIA
30 YEAR OPERATING DATA
FOR 2015-16 ASSURED OPERATING PLAN

	AUG15-DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
Maximum Average Monthly Flow Limits (cfs)									
	-	70,000	60,000	-	-	-	-	-	-
Minimum Average Monthly Flow Limits (cfs)									
	10,000	10,000	20,000	20,000	15,000	12,000	5,000	5,000	10,000
End-of-Period Maximum Storage Limits (ksfd)									
1928-29	-	-	URC	URC	URC	URC	URC	URC	-
1929-30	-	-	URC	URC	URC	URC	URC	URC	-
1930-31	-	-	URC	URC	URC	URC	URC	URC	-
1931-32	-	-	1800.0	900.0	900.0	1000.0	2200.0	3300.0	-
1932-33	-	-	1800.0	900.0	900.0	1000.0	URC	URC	-
1933-34	-	-	1800.0	900.0	900.0	1000.0	URC	URC	-
1934-35	-	-	1800.0	900.0	900.0	1000.0	URC	3300.0	-
1935-36	-	-	1825.0	900.0	900.0	1000.0	URC	URC	-
1936-37	-	-	URC	URC	URC	URC	URC	3548.8	-
1937-38	-	-	1800.0	900.0	900.0	1000.0	URC	3300.0	-
1938-39	-	-	1947.9	960.4	1525.2	1574.3	URC	URC	-
1939-40	-	-	2203.3	1562.3	2333.2	2345.9	URC	URC	-
1940-41	-	-	URC	URC	URC	URC	URC	URC	-
1941-42	-	-	1800.0	900.0	900.0	1000.0	URC	URC	-
1942-43	-	-	1800.0	900.0	900.0	1000.0	2200.0	3300.0	-
1943-44	-	-	URC	URC	URC	URC	URC	URC	-
1944-45	-	-	1940.5	1116.9	1303.6	1370.2	URC	3300.0	-
1945-46	-	-	1800.0	900.0	900.0	1000.0	URC	3300.0	-
1946-47	-	-	1800.0	900.0	900.0	1000.0	2200.0	3300.0	-
1947-48	-	-	1800.0	900.0	900.0	1000.0	URC	3300.0	-
1948-49	-	-	1800.0	900.0	900.0	1000.0	URC	URC	-
1949-50	-	-	1800.0	900.0	900.0	1000.0	URC	URC	-
1950-51	-	-	1800.0	900.0	900.0	1000.0	URC	3300.0	-
1951-52	-	-	1800.0	900.0	900.0	1000.0	2200.0	3300.0	-
1952-53	-	-	1800.0	900.0	900.0	1000.0	URC	3300.0	-
1953-54	-	-	1800.0	900.0	900.0	1000.0	URC	URC	-
1954-55	-	-	1800.0	900.0	900.0	1000.0	URC	URC	-
1955-56	-	-	1800.0	900.0	900.0	1000.0	2200.0	3300.0	-
1956-57	-	-	1800.0	900.0	900.0	1000.0	2200.0	3300.0	-
1957-58	-	-	1800.0	900.0	900.0	1000.0	2200.0	3300.0	-

TABLE 1.1c
APOC IMPLEMENTATION
DISTRIBUTION FACTORS FOR THE DALLES
2015-16 ASSURED OPERATING PLAN

Forecast Date	Forecast Period	The Dalles Distribution Factors 1/					
		Jan-Jul	Feb-Jul	Mar-Jul	Apr-Jul	May-Jul	Jun-Jul
1-Jan	1 Jan - 31 Jul	1.0000	0.9392	0.8589	0.7735	0.7174	0.4393
1-Feb	1 Feb - 31 Jul		1.0000	0.9145	0.8235	0.7638	0.4677
1-Mar	1 Mar - 31 Jul			1.0000	0.9005	0.8352	0.5114
1-Apr	1 Apr - 31 Jul				1.0000	0.9275	0.5679
1-May	1 May - 31 Jul					1.0000	0.6123
1-Jun	1 Jun - 31 Jul						1.0000

Notes:

1/ Unless otherwise agreed, the DOP16 will apply these distribution factors to the monthly volume forecast at The Dalles for computing the Month-July runoff volumes required by the APOC. These distribution factors are calculated from the median 71 year Jan-Jul, Feb-Jul, etc., volumes.

For Example, in the month of May:

	From Table 1.1c			Look up Table 1.1a			
1 May Forecast Forecast Volume = 65 Maf (May-Jul)	The Dalles Distribution Factor	Month-Jul Volume Runoff		The Dalles Volume Runoff		Maximum Storage Limit	
		(Maf)	(km^3)	(Maf)	(km^3)	(ksfd)	(hm^3)
May	1.0000	65.0	80.2	≤ 68	≤ 83.9	URC	URC
June	0.6123	39.8	49.1	≥ 35	≥ 43.2	3300	8073.7

TABLE 2
COMPARISON OF 2015-16 ASSURED OPERATING PLAN
STUDY RESULTS

Study 16-41 provides Optimum Generation in Canada and in the United States.
Study 16-11 provides Optimum Generation in the United States only.

	Study No. 16-41	Study No. 16-11	Net Gain	Weight	Value
1. Firm Energy Capability (aMW)					
U.S. System 1/	11935.6	11935.6	0.0		
Canada 2/, 3/	3017.5	2993.6	24.0		
Total	14953.1	14929.2	23.9	3	71.7
2. Dependable Peaking Capacity (MW)					
U.S. System 4/	28018.8	28020.9	-2.1		
Canada 2/, 5/	6423.7	6395.5	28.2		
Total	34442.5	34416.4	26.1	1	26.1
3. Average Annual Usable Secondary Energy (aMW)					
U.S. System 6/	3236.2	3218.6	17.6		
Canada 2/, 7/	289.9	306.1	-16.2		
Total	3526.1	3524.7	1.4	2	2.8
				Net Change in Value =	100.6

1/ U.S. system firm energy capability was determined over the U.S. system critical period beginning 16 August 1928 and ending 29 February 1932.

2/ Canadian system includes Mica, Arrow, Revelstoke, Kootenay Canal, Corra Linn, Upper Bonnington, Lower Bonnington, South Slocan, Brilliant, Seven Mile and Waneta.

3/ Canadian system firm energy capability was determined over the Canadian system critical period beginning 1 October 1940 and ending 30 April 1946.

4/ U.S. system dependable peaking capability was determined from February 1932.

5/ Canadian system dependable peaking capability was determined from December 1944.

6/ U.S. system 30-year average secondary energy limited to secondary market.

7/ Canadian system 30-year average generation minus firm energy capability.

TABLE 3
(English Units)
CRITICAL RULE CURVES
END OF PERIOD TREATY STORAGE CONTENTS (KSFD)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
							MICA							
1928-29	3529.2	3529.2	3492.2	3125.4	2872.8	2313.8	1989.8	757.0	652.1	626.9	604.1	1065.0	2665.1	3410.1
1929-30	3529.2	3529.2	3529.2	3168.1	3174.1	2204.1	752.1	74.1	0.0	0.0	215.6	862.8	2209.3	3508.8
1930-31	3484.6	3528.3	3482.1	3089.4	2878.2	2233.3	798.7	42.1	0.0	0.0	0.0	777.0	1646.9	2675.4
1931-32	3231.5	2402.2	1784.4	1445.6	891.7	146.2	0.3	0.0						
							ARROW							
1928-29	3579.6	3579.6	3451.4	3404.2	2733.9	2348.7	810.1	665.5	353.9	271.1	290.4	1207.2	2791.1	3501.3
1929-30	3501.9	3500.3	2961.3	2449.7	962.4	828.9	349.0	293.3	1.5	1.3	327.2	1427.1	2670.4	3156.8
1930-31	3421.1	3491.0	3255.7	2844.3	1684.7	763.8	467.3	112.6	0.0	0.0	0.0	393.8	1946.5	1490.1
1931-32	894.7	1654.0	1810.0	1287.3	675.6	138.5	11.7	0.0						
							DUNCAN							
1928-29	705.8	705.8	705.4	680.4	602.7	430.0	257.9	112.0	121.0	126.5	137.8	255.3	530.1	674.5
1929-30	704.5	703.8	600.0	575.0	550.0	504.1	260.9	76.2	0.0	0.0	33.1	148.1	314.8	524.5
1930-31	591.1	651.3	561.5	422.9	361.8	327.8	154.2	0.0	0.0	0.0	0.0	157.2	394.7	570.9
1931-32	576.9	564.3	471.7	308.7	102.0	0.0	0.0	0.0						
							COMPOSITE							
1928-29	7814.6	7814.6	7649.0	7210.0	6209.4	5092.5	3057.8	1534.5	1127.0	1024.5	1032.3	2527.5	5986.3	7585.9
1929-30	7735.6	7733.3	7090.5	6192.8	4686.5	3537.1	1362.0	443.6	1.5	1.3	575.9	2438.0	5194.5	7190.1
1930-31	7496.8	7670.6	7299.3	6356.6	4924.7	3324.9	1420.2	154.7	0.0	0.0	0.0	1328.0	3988.1	4736.4
1931-32	4703.1	4620.5	4066.1	3041.6	1669.3	284.7	12.0	0.0						

Note: Individual project rule curves are input to the AOP16 Step 1 study and adjusted to eliminate any Canadian composite crossovers according to Subsection 3(a) of this AOP document.

TABLE 4
(English Units)
MICA
ASSURED AND VARIABLE REFILL CURVES
DISTRIBUTION FACTORS AND FORECAST ERRORS
POWER DISCHARGE REQUIREMENTS, AND OPERATING RULE CURVE LOWER LIMITS
2015 - 16 ASSURED OPERATING PLAN

	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
ASSURED REFILL CURVE (KSFD)	0.0	238.2	840.6	1019.2	1084.5	1101.0	1095.8	1084.3	1091.1	1116.1	1074.3	1603.4	2723.4	3529.2
VARIABLE REFILL CURVES (KSFD)														
1928-29							2023.0	1838.6	1781.3	1777.1	1817.4	2335.1	2919.8	3529.2
1929-30							999.6	773.8	708.0	723.1	878.8	1732.0	2629.7	"
1930-31							1257.7	1041.4	970.8	963.9	1053.4	1750.9	2706.1	"
1931-32							629.3	419.3	355.8	350.2	466.7	1277.2	2552.8	"
1932-33							535.8	361.1	315.0	307.3	384.0	1176.6	2386.6	"
1933-34							0.0	0.0	0.0	0.0	0.0	923.9	2643.8	"
1934-35							838.7	645.8	611.7	623.7	693.1	1414.7	2472.2	"
1935-36							639.1	446.2	401.0	392.9	487.1	1379.5	2740.4	"
1936-37							2009.7	1804.6	1732.6	1717.5	1805.9	2347.2	2952.1	"
1937-38							908.5	715.9	652.1	650.6	742.9	1500.3	2646.7	"
1938-39							1033.5	885.4	828.8	847.9	958.3	1745.2	2938.5	"
1939-40							816.7	631.3	592.4	605.7	734.4	1544.7	2693.9	"
1940-41							1442.9	1247.7	1196.3	1208.6	1384.9	2127.3	2933.9	"
1941-42							1342.8	1151.4	1091.9	1080.8	1156.2	1833.8	2808.8	"
1942-43							1546.1	1332.5	1269.7	1258.2	1410.0	2124.6	2890.1	"
1943-44							2115.4	1894.8	1836.3	1830.2	1898.2	2456.3	3094.8	"
1944-45							1996.9	1813.3	1768.7	1773.3	1822.3	2337.3	3004.4	"
1945-46							329.3	105.1	40.2	22.5	113.2	976.9	2548.7	"
1946-47							443.2	273.0	236.8	240.6	356.5	1236.3	2618.4	"
1947-48							392.0	201.1	149.8	127.5	206.9	1032.8	2502.6	"
1948-49							2090.3	1877.3	1797.3	1784.8	1861.7	2401.8	3291.3	"
1949-50							747.8	518.1	442.8	424.9	508.9	1252.9	2309.7	"
1950-51							739.1	557.1	513.8	513.7	626.8	1371.4	2679.2	"
1951-52							1146.2	922.4	853.2	829.2	910.2	1665.3	2829.8	"
1952-53							1427.8	1222.4	1162.5	1150.9	1209.9	1819.7	2796.0	"
1953-54							302.4	107.0	72.9	68.7	151.7	949.4	2281.2	"
1954-55							1063.0	885.1	842.0	843.5	929.3	1591.9	2479.9	"
1955-56							610.9	414.5	351.1	335.9	423.8	1269.9	2591.9	"
1956-57							779.7	576.3	527.4	524.2	612.8	1355.6	2929.8	"
1957-58							613.2	422.5	380.2	382.6	487.2	1252.9	2687.1	"
DISTRIBUTION FACTORS							0.9760	0.9800	0.9760	0.9820	0.9660	0.7910	0.5060	N/A
FORECAST ERRORS (KSFD)							728.0	522.0	455.0	420.0	420.0	401.0	397.0	N/A
POWER DISCHARGE REQUIREMENTS (CFS):														
ASSURED REFILL CURVE	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	10000	11000	22800	30500
VARIABLE REFILL CURVES					80 MAF		3000	3000	3000	3000	3000	3000	21000	25000
(BY VOLUME RUNOFF AT THE DALLE					95 MAF		3000	3000	3000	3000	3000	3000	16000	24000
					110 MAF		3000	3000	3000	3000	3000	3000	16000	24000
VARIABLE REFILL CURVE LOWER LIMIT					80 MAF		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(BY VOLUME RUNOFF AT THE DALLES					95 MAF		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					110 MAF		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPERATING RULE CURVE LOWER LIMITS (KSFD)							529.2	22.2	0.0	0.0				

TABLE 5
(English Units)
ARROW
ASSURED AND VARIABLE REFILL CURVES
DISTRIBUTION FACTORS AND FORECAST ERRORS
POWER DISCHARGE REQUIREMENTS, AND OPERATING RULE CURVE LOWER LIMITS
2015 - 16 ASSURED OPERATING PLAN

	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
ASSURED REFILL CURVE (KSFD)														
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	274.2	355.7	436.5	710.2	2043.4	3579.3	3579.6
VARIABLE REFILL CURVES (KSFD)														
1928-29							1559.3	2115.7	2001.2	1931.6	2167.3	3000.7	3488.3	3579.6
1929-30							864.4	769.7	812.9	813.9	1090.4	2388.7	3369.3	"
1930-31							1111.0	977.9	961.9	958.3	1149.8	2243.6	3313.5	"
1931-32							0.0	0.0	0.0	0.0	0.0	1404.9	2966.3	"
1932-33							165.2	79.8	92.5	84.9	305.9	1549.1	2900.3	"
1933-34							0.0	0.0	0.0	0.0	62.4	2015.4	3396.4	"
1934-35							427.5	371.8	481.0	501.3	693.9	1805.3	3034.6	"
1935-36							508.8	356.7	310.3	274.1	450.6	1816.0	3329.9	"
1936-37							1868.6	2380.4	2255.4	2157.0	2414.0	3175.0	3579.6	"
1937-38							738.7	651.3	668.2	696.8	929.0	2050.8	3212.6	"
1938-39							1061.5	909.9	891.2	861.6	1110.1	2333.3	3579.6	"
1939-40							799.9	708.7	757.3	841.0	1126.1	2171.0	3395.6	"
1940-41							1561.3	1619.8	1563.9	1650.2	2196.4	3285.5	3579.6	"
1941-42							1632.6	1595.7	1533.1	1500.2	1776.3	2787.3	3526.1	"
1942-43							1890.3	1988.2	1899.7	1816.1	2220.3	3283.1	3579.6	"
1943-44							2380.8	2946.5	2844.7	2749.3	3025.3	3579.6	"	"
1944-45							1738.1	2349.3	2272.8	2231.4	2462.3	3192.5	"	"
1945-46							0.0	0.0	0.0	0.0	223.1	1528.8	3104.6	"
1946-47							517.1	433.4	437.1	455.3	715.3	1949.8	3204.0	"
1947-48							296.7	305.2	301.9	264.6	443.1	1643.7	3131.9	"
1948-49							1121.2	1695.5	1629.0	1571.6	1913.0	3017.3	3579.6	"
1949-50							322.8	211.1	227.5	224.1	433.2	1565.6	2776.0	"
1950-51							626.6	548.3	589.9	551.0	803.2	1919.3	3275.2	"
1951-52							659.9	540.6	560.6	530.1	723.0	2028.3	3351.0	"
1952-53							1038.7	1063.0	1009.6	952.8	1211.2	2292.6	3297.9	"
1953-54							0.0	0.0	0.0	0.0	57.1	1270.7	2785.0	"
1954-55							401.9	345.4	384.8	356.6	576.7	1760.0	2755.7	"
1955-56							104.8	6.3	25.2	16.1	257.0	1639.3	3134.6	"
1956-57							173.7	56.1	67.1	46.7	280.4	1496.2	3469.9	"
1957-58							0.0	0.0	0.0	0.0	290.2	1525.6	3171.2	"
DISTRIBUTION FACTORS							0.9740	0.9770	0.9710	0.9750	0.9520	0.7430	0.4680	N/A
FORECAST ERRORS (KSFD)							1485.0	1095.0	954.0	810.0	810.0	723.0	679.0	N/A
POWER DISCHARGE REQUIREMENTS (CFS):														
ASSURED REFILL CURVE														
	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	9000	25900	62800
VARIABLE REFILL CURVES					80	MAF	5000	5000	5000	5000	5000	5000	30000	48000
(BY VOLUME RUNOFF AT THE DALLE					95	MAF	5000	5000	5000	5000	5000	5000	30000	48000
					110	MAF	5000	5000	5000	5000	5000	5000	30000	48000
VARIABLE REFILL CURVE LOWER LIMIT					80	MAF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(BY VOLUME RUNOFF AT THE DALLES					95	MAF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					110	MAF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPERATING RULE CURVE LOWER LIMITS (KSFD)							129.2	60.9	0.0	0.0				

TABLE 6
(English Units)
DUNCAN
ASSURED AND VARIABLE REFILL CURVES
DISTRIBUTION FACTORS AND FORECAST ERRORS
POWER DISCHARGE REQUIREMENTS, AND OPERATING RULE CURVE LOWER LIMITS
2015 - 16 ASSURED OPERATING PLAN

	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
ASSURED REFILL CURVE (KSFD)														
	0.0	0.0	0.0	0.0	15.8	27.0	37.2	46.4	60.5	71.3	86.9	244.1	482.0	705.8
VARIABLE REFILL CURVES (KSFD)														
1928-29							340.2	322.5	331.6	329.7	345.7	451.0	604.7	705.8
1929-30							338.6	320.5	329.4	327.1	350.8	471.4	616.5	"
1930-31							282.9	266.2	278.7	281.5	303.7	421.1	604.7	"
1931-32							0.0	0.0	3.1	11.4	45.9	229.5	505.0	"
1932-33							"	"	0.0	0.0	0.0	55.1	366.6	"
1933-34							15.0	17.1	42.2	56.6	102.2	309.0	577.7	"
1934-35							65.5	55.5	79.5	81.5	105.0	268.9	501.9	"
1935-36							42.8	27.1	39.8	40.4	67.2	266.6	559.6	"
1936-37							275.8	257.2	268.4	266.5	286.9	406.3	585.9	"
1937-38							58.5	49.6	66.8	75.5	104.9	278.5	533.8	"
1938-39							118.9	107.7	121.5	125.2	156.2	326.7	588.4	"
1939-40							105.9	99.6	121.1	134.3	168.0	329.7	574.6	"
1940-41							191.5	182.4	199.8	214.7	259.6	410.6	599.2	"
1941-42							178.2	171.5	188.8	192.5	221.2	366.5	572.4	"
1942-43							188.5	174.5	190.4	192.6	230.7	386.5	563.0	"
1943-44							346.3	333.2	347.0	347.0	370.1	478.0	635.8	"
1944-45							266.5	253.7	268.6	269.3	286.9	404.6	591.8	"
1945-46							0.0	0.0	0.0	0.0	0.0	170.9	502.7	"
1946-47							"	"	"	"	12.0	215.1	512.5	"
1947-48							21.4	9.5	28.4	29.2	53.3	232.5	527.4	"
1948-49							247.9	230.9	243.4	242.4	267.1	403.6	629.8	"
1949-50							47.8	31.3	46.6	46.2	71.9	236.2	462.5	"
1950-51							0.0	0.0	0.0	0.0	13.2	200.7	494.8	"
1951-52							78.7	64.2	82.8	83.4	108.6	293.5	545.8	"
1952-53							75.8	"	80.7	82.8	105.0	268.0	508.2	"
1953-54							0.0	0.0	0.0	0.0	0.0	130.4	437.4	"
1954-55							11.6	"	16.1	19.2	46.4	212.9	437.3	"
1955-56							0.0	"	0.0	0.0	0.0	181.3	495.6	"
1956-57							31.6	13.2	27.9	30.4	58.8	231.1	564.1	"
1957-58							0.0	0.0	0.0	0.0	0.0	170.8	515.8	"
DISTRIBUTION FACTORS							0.9750	0.9810	0.9760	0.9790	0.9580	0.7530	0.4820	N/A
FORECAST ERRORS (KSFD)							128.0	104.0	105.0	94.0	94.0	87.0	78.0	N/A
POWER DISCHARGE REQUIREMENTS (CFS):														
ASSURED REFILL CURVE														
	100	100	100	100	100	100	100	100	100	100	100	100	100	100
VARIABLE REFILL CURVES					80	MAF	100	100	100	100	100	100	1200	2800
(BY VOLUME RUNOFF AT THE DALLE					95	MAF	100	100	100	100	100	100	1200	2500
					110	MAF	100	100	100	100	100	100	1200	2500
VARIABLE REFILL CURVE LOWER LIMIT					80	MAF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(BY VOLUME RUNOFF AT THE DALLES					95	MAF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					110	MAF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPERATING RULE CURVE LOWER LIMITS (KSFD)							113.0	41.5	0.0	0.0				

TABLE 7
(English Units)
MICA
UPPER RULE CURVES (FLOOD CONTROL)
END OF PERIOD TREATY STORAGE CONTENTS (KSFD)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
1928-29	3529.2	3529.2	3529.2	3428.4	3428.4	3331.6	3203.9	3088.6	2960.8	2960.8	2960.8	3091.6	3529.2	3529.2
1929-30	,,	,,	,,	,,	,,	,,	3145.9	2978.5	2792.8	2792.8	2792.8	2825.9	3261.9	,,
1930-31	"	"	"	"	"	"	3331.6	3331.6	3331.6	3331.6	3331.6	3331.6	3529.2	"
1931-32	"	"	"	"	"	"	2698.3	2105.4	1472.2	1472.2	1472.2	2299.1	3387.3	"
1932-33	"	"	"	"	"	"	2691.3	2112.5	,,	,,	,,	1661.5	2868.9	"
1933-34	"	"	"	"	"	"	,,	,,	"	"	1838.3	2743.4	3216.5	"
1934-35	"	"	"	"	"	"	"	"	"	"	1472.2	1918.6	2873.0	"
1935-36	"	"	"	"	"	"	2698.3	2105.4	"	"	1556.5	2718.7	3529.2	"
1936-37	"	"	"	"	"	"	3109.9	2910.0	2688.3	2688.3	2688.3	2801.9	3394.7	"
1937-38	"	"	"	"	"	"	2691.3	2112.5	1472.2	1472.2	1513.3	2307.3	3253.6	"
1938-39	"	"	"	"	"	"	2835.9	2387.7	1892.0	1892.0	1959.1	3159.2	3306.6	"
1939-40	"	"	"	"	"	"	2993.8	2677.7	2339.9	2339.9	2339.9	3117.7	3340.1	"
1940-41	"	"	"	"	"	"	3319.5	3308.6	3296.5	3296.5	3296.5	3337.0	3394.4	"
1941-42	"	"	"	"	"	"	2691.3	2112.5	1472.2	1472.2	1472.2	1955.6	3280.3	"
1942-43	"	"	"	"	"	"	,,	,,	,,	,,	,,	1754.0	2831.9	"
1943-44	"	"	"	"	"	"	3331.6	3331.6	3331.6	3331.6	3331.6	3410.6	3529.2	"
1944-45	"	"	"	"	"	"	2829.2	2375.0	1872.6	1872.6	1872.6	2392.8	,,	"
1945-46	"	"	"	"	"	"	2691.3	2112.5	1472.2	1472.2	1472.2	2710.5	3296.8	"
1946-47	"	"	"	"	"	"	,,	,,	,,	,,	,,	2535.7	3529.2	"
1947-48	"	"	"	"	"	"	2698.3	2105.4	"	"	"	2327.9	,,	"
1948-49	"	"	"	"	"	"	2691.3	2112.5	"	"	1498.9	2430.8	3525.1	"
1949-50	"	"	"	"	"	"	,,	,,	"	"	1472.2	1472.2	2727.0	"
1950-51	"	"	"	"	"	"	"	"	"	"	,,	2469.8	3119.9	"
1951-52	"	"	"	"	"	"	2698.3	2105.4	"	"	1546.2	2498.6	3249.4	"
1952-53	"	"	"	"	"	"	2691.3	2112.5	"	"	1472.2	1953.5	3109.6	"
1953-54	"	"	"	"	"	"	,,	,,	"	"	,,	1863.0	2342.3	"
1954-55	"	"	"	"	"	"	"	"	"	"	"	1472.2	2926.5	3516.8
1955-56	"	"	"	"	"	"	2698.3	2105.4	"	"	"	2284.7	3282.4	3529.2
1956-57	"	"	"	"	"	"	2691.3	2112.5	"	"	"	3000.5	3529.2	"
1957-58	"	"	"	"	"	"	,,	,,	"	"	"	2574.8	,,	"

TABLE 8
(English Units)
ARROW
UPPER RULE CURVES (FLOOD CONTROL)
END OF PERIOD TREATY STORAGE CONTENTS (KSFD)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
1928-29	3579.6	3579.6	3579.6	3453.6	3453.6	3223.7	3188.4	3156.6	3121.4	3121.4	3121.4	3230.9	3579.6	3579.6
1929-30	,,	,,	,,	,,	,,	,,	3134.4	3053.9	2964.6	2964.6	2964.6	2964.6	,,	,,
1930-31	"	"	"	"	"	"	3223.7	3223.7	3223.7	3223.7	3223.7	3579.6	"	"
1931-32	"	"	"	"	"	"	2726.5	2261.7	1764.6	1764.6	1764.6	2359.9	"	"
1932-33	"	"	"	"	"	"	2721.0	2267.2	,,	,,	,,	1764.6	3211.2	"
1933-34	"	"	"	"	"	"	,,	,,	"	"	2151.2	2445.2	3579.6	"
1934-35	"	"	"	"	"	"	"	"	"	"	1764.6	2036.8	,,	"
1935-36	"	"	"	"	"	"	2726.5	2261.7	"	"	2180.2	2889.9	"	"
1936-37	"	"	"	"	"	"	3100.7	2989.8	2866.9	2866.9	2866.9	2895.3	"	"
1937-38	"	"	"	"	"	"	2721.0	2267.2	1764.6	1764.6	1764.6	2073.1	"	"
1938-39	"	"	"	"	"	"	2845.9	2504.8	2127.0	2127.0	2127.0	2283.9	"	"
1939-40	"	"	"	"	"	"	2990.9	2773.5	2540.8	2540.8	2540.8	3125.6	"	"
1940-41	"	"	"	"	"	"	3223.7	3223.7	3223.7	3223.7	3223.7	3342.5	"	"
1941-42	"	"	"	"	"	"	2721.0	2267.2	1764.6	1764.6	1764.6	2004.2	2908.0	"
1942-43	"	"	"	"	"	"	,,	,,	,,	,,	2289.1	2612.2	3579.6	"
1943-44	"	"	"	"	"	"	3223.7	3223.7	3223.7	3223.7	3223.7	3297.0	,,	"
1944-45	"	"	"	"	"	"	2840.2	2493.8	2110.3	2110.3	2110.3	2201.4	"	"
1945-46	"	"	"	"	"	"	2721.0	2267.2	1764.6	1764.6	1764.6	1933.4	"	"
1946-47	"	"	"	"	"	"	,,	,,	,,	,,	,,	2231.0	"	"
1947-48	"	"	"	"	"	"	2726.5	2261.7	"	"	"	2080.4	"	"
1948-49	"	"	"	"	"	"	2721.0	2267.2	"	"	"	2991.5	"	"
1949-50	"	"	"	"	"	"	,,	,,	"	"	"	1764.6	2621.3	"
1950-51	"	"	"	"	"	"	"	"	"	"	"	2107.6	3579.6	"
1951-52	"	"	"	"	"	"	2726.5	2261.7	"	"	1949.7	2724.7	,,	"
1952-53	"	"	"	"	"	"	2721.0	2267.2	"	"	1764.6	1764.6	"	"
1953-54	"	"	"	"	"	"	,,	,,	"	"	,,	2180.2	2675.7	"
1954-55	"	"	"	"	"	"	"	"	"	"	"	1770.0	2741.1	"
1955-56	"	"	"	"	"	"	2726.5	2261.7	"	"	1918.9	2626.7	3579.6	"
1956-57	"	"	"	"	"	"	2721.0	2267.2	"	"	1764.6	2664.8	,,	"
1957-58	"	"	"	"	"	"	,,	,,	"	"	,,	2697.5	"	"

TABLE 9
(English Units)
DUNCAN
UPPER RULE CURVES (FLOOD CONTROL)
END OF PERIOD TREATY STORAGE CONTENTS (KSFD)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
1928-29	705.8	705.8	705.8	705.8	705.8	504.1	418.0	340.3	340.3	340.3	340.3	432.4	705.8	705.8
1929-30	,,	,,	,,	,,	,,	,,	408.7	322.6	322.6	322.6	322.6	436.1	655.2	,,
1930-31	"	"	"	"	"	"	390.7	288.3	288.3	288.3	292.9	434.1	656.1	"
1931-32	"	"	"	"	"	"	277.3	93.2	65.5	65.5	65.5	275.5	626.4	"
1932-33	"	"	"	"	"	"	273.7	,,	,,	,,	,,	132.7	492.6	689.8
1933-34	"	"	"	"	"	"	,,	"	"	"	509.2	605.3	687.2	705.8
1934-35	"	"	"	"	"	"	"	"	"	"	65.5	168.0	485.5	"
1935-36	"	"	"	"	"	"	277.3	"	"	"	104.6	337.0	660.3	"
1936-37	"	"	"	"	"	"	374.8	258.1	258.1	258.1	258.1	377.6	621.2	"
1937-38	"	"	"	"	"	"	290.1	115.9	96.8	96.8	116.9	294.1	631.5	"
1938-39	"	"	"	"	"	"	285.1	109.0	87.2	87.2	111.9	337.7	558.6	"
1939-40	"	"	"	"	"	"	301.1	126.5	111.4	111.4	111.4	305.7	582.7	"
1940-41	"	"	"	"	"	"	344.4	200.1	200.1	200.1	216.3	372.0	619.8	"
1941-42	"	"	"	"	"	"	326.1	165.6	165.3	165.3	165.3	316.7	540.9	"
1942-43	"	"	"	"	"	"	329.3	171.4	171.4	171.4	171.4	241.9	443.9	"
1943-44	"	"	"	"	"	"	412.5	327.2	327.2	327.2	327.2	440.4	672.1	"
1944-45	"	"	"	"	"	"	381.5	270.7	270.7	270.7	270.7	393.8	653.6	"
1945-46	"	"	"	"	"	"	273.7	93.2	65.5	65.5	73.2	326.8	677.6	"
1946-47	"	"	"	"	"	"	,,	,,	,,	,,	83.5	314.0	637.9	"
1947-48	"	"	"	"	"	"	277.3	"	"	"	65.5	249.9	658.4	"
1948-49	"	"	"	"	"	"	368.0	245.0	245.0	245.0	264.3	485.5	705.8	"
1949-50	"	"	"	"	"	"	273.7	93.2	65.5	65.5	65.5	181.4	534.2	"
1950-51	"	"	"	"	"	"	,,	,,	,,	,,	,,	527.8	606.5	"
1951-52	"	"	"	"	"	"	277.3	"	"	"	95.6	295.4	595.0	"
1952-53	"	"	"	"	"	"	273.7	"	"	"	65.5	188.4	489.4	"
1953-54	"	"	"	"	"	"	,,	"	"	"	,,	189.7	435.6	689.2
1954-55	"	"	"	"	"	"	"	"	"	"	"	72.6	435.0	694.9
1955-56	"	"	"	"	"	"	277.3	"	"	"	"	321.0	636.6	705.8
1956-57	"	"	"	"	"	"	273.7	"	"	"	71.9	376.7	691.7	"
1957-58	"	"	"	"	"	"	,,	"	"	"	65.5	334.4	683.4	"

TABLE 10
(English Units)
COMPOSITE OPERATING RULE CURVES
FOR THE WHOLE OF CANADIAN TREATY STORAGE
END OF PERIOD TREATY STORAGE CONTENTS (KSFD)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
1928-29	7814.6	7814.6	7649.0	7210.0	6209.4	5092.5	3057.8	1861.8	1567.8	1679.1	1922.3	3902.1	6741.8	7814.6
1929-30	"	"	"	"	"	"	2067.6	1551.3	1184.7	1286.1	1726.8	3902.1	6529.1	,,
1930-31	"	"	"	"	"	"	2325.7	1818.9	1447.5	1526.9	1901.4	3902.1	6549.7	,,
1931-32	"	"	"	"	"	"	871.5	521.7	358.9	361.6	512.6	2911.6	6024.1	,,
1932-33	"	"	"	"	"	"	814.0	482.4	407.5	392.2	689.9	2780.8	5653.5	7798.6
1933-34	"	"	"	"	"	"	771.4	124.6	42.2	56.6	164.6	3194.6	6570.3	7814.6
1934-35	"	"	"	"	"	"	1379.2	1073.1	1032.9	1125.7	1452.5	3388.0	5992.3	,,
1935-36	"	"	"	"	"	"	1260.9	844.4	751.1	707.4	1004.9	3450.8	6583.4	,,
1936-37	"	"	"	"	"	"	3057.8	1861.8	1567.8	1679.1	1922.3	3902.1	6832.8	,,
1937-38	"	"	"	"	"	"	1760.2	1416.8	1074.6	1162.6	1558.0	3799.0	6389.4	,,
1938-39	"	"	"	"	"	"	1962.5	1658.6	1271.7	1371.6	1780.4	3902.1	6832.8	,,
1939-40	"	"	"	"	"	"	1729.6	1396.4	1059.5	1153.6	1556.0	3843.4	6619.6	,,
1940-41	"	"	"	"	"	"	2444.5	1861.8	1567.8	1679.1	1922.3	3902.1	6832.8	,,
1941-42	"	"	"	"	"	"	2331.1	1861.8	1567.8	1643.8	1922.3	3862.9	6161.5	,,
1942-43	"	"	"	"	"	"	2544.7	1861.8	1567.8	1679.1	1922.3	3888.7	6746.6	,,
1943-44	"	"	"	"	"	"	3057.8	1861.8	1567.8	1679.1	1922.3	3902.1	6832.8	,,
1944-45	"	"	"	"	"	"	3057.8	1861.8	1567.8	1679.1	1922.3	3902.1	6832.8	,,
1945-46	"	"	"	"	"	"	771.4	207.5	40.2	22.5	336.3	2676.6	6156.0	,,
1946-47	"	"	"	"	"	"	1159.3	747.9	592.5	677.1	1078.7	3401.2	6334.9	,,
1947-48	"	"	"	"	"	"	938.9	547.8	480.1	421.3	703.3	2909.0	6161.9	,,
1948-49	"	"	"	"	"	"	3047.8	1861.8	1567.8	1679.1	1922.3	3902.1	6832.8	,,
1949-50	"	"	"	"	"	"	1183.6	770.7	716.9	695.2	1007.6	2999.9	5393.5	,,
1950-51	"	"	"	"	"	"	1478.7	1146.9	869.5	950.2	1350.2	3491.4	6449.2	,,
1951-52	"	"	"	"	"	"	1919.1	1527.2	1274.4	1331.2	1716.0	3887.0	6604.5	,,
1952-53	"	"	"	"	"	"	2350.9	1814.0	1512.3	1618.1	1850.0	3556.4	6510.7	,,
1953-54	"	"	"	"	"	"	771.4	209.4	72.9	68.7	208.8	2350.5	5392.5	7798.0
1954-55	"	"	"	"	"	"	1577.9	1272.0	1213.8	1219.3	1552.4	3304.8	5656.0	7791.3
1955-56	"	"	"	"	"	"	853.1	516.9	376.3	352.0	680.8	3090.5	6222.1	7814.6
1956-57	"	"	"	"	"	"	1066.4	678.7	622.4	601.3	952.0	3082.9	6723.4	,,
1957-58	"	"	"	"	"	"	855.4	524.9	380.2	382.6	777.4	2949.3	6374.1	,,

TABLE 11
(English Units)
COMPOSITE END STORAGE
FOR THE WHOLE OF CANADIAN STORAGE
END OF PERIOD TREATY STORAGE CONTENTS (KSFD)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
1928-29	7814.6	7814.6	7649.0	7210.0	6209.4	5092.5	3057.8	1534.5	1127.0	1024.5	1032.3	2527.5	5986.2	7585.9
1929-30	7735.6	7733.3	7090.5	6192.8	4686.5	3537.1	1362.0	443.6	1.5	1.3	575.9	2438.0	5194.5	7188.9
1930-31	7496.9	7670.6	7299.3	6356.5	4924.7	3324.9	1420.2	154.7	0.0	0.0	0.0	1328.0	3988.1	4736.0
1931-32	4702.8	4620.2	4065.8	3041.2	1668.9	284.4	11.6	0.0	2.6	122.4	462.8	2545.2	5979.7	7612.5
1932-33	7769.1	7814.6	7252.1	6476.2	6067.3	5092.5	2986.1	1356.8	407.5	342.7	550.3	2316.1	5653.5	7705.6
1933-34	7814.6	7814.6	7649.0	7210.0	6209.4	5166.6	3139.1	1549.7	920.0	771.1	1417.3	3194.6	5977.8	7519.8
1934-35	7673.6	7719.6	7053.5	6339.3	6209.4	5092.5	2996.1	1496.0	1032.9	692.3	851.2	2688.1	5801.3	7721.6
1935-36	7814.6	7799.2	7528.1	6765.0	5366.6	3876.6	1687.0	772.2	364.4	267.4	884.9	3450.8	6583.4	7669.9
1936-37	7731.5	7733.9	7169.5	6316.7	4685.1	3253.5	1229.1	170.5	0.0	0.0	0.0	1491.2	4467.0	6126.9
1937-38	6036.4	5934.4	5372.0	4617.9	4054.4	3346.7	1771.6	1334.8	647.9	547.2	680.9	2558.4	5657.7	7576.8
1938-39	7625.2	7705.8	7351.6	6660.5	5465.5	4560.9	2409.4	1648.6	1081.2	1113.3	1527.4	3600.9	5659.6	7721.6
1939-40	7811.4	7736.4	7103.7	6503.1	5350.5	4617.3	2496.3	1396.4	1059.5	1142.8	1453.2	3843.4	5798.8	7273.0
1940-41	7411.9	7371.5	7024.6	6672.0	5339.8	4119.3	2204.5	1248.3	1011.9	1228.6	1648.0	2980.2	4597.3	5333.9
1941-42	5284.9	5302.0	5194.6	5490.5	4775.5	4908.3	2758.7	1861.8	793.4	678.6	779.5	2488.4	4793.4	7020.0
1942-43	7490.2	7752.3	7300.8	6585.8	5744.0	5092.5	2871.2	1861.8	1021.0	988.9	1203.3	2545.0	4942.1	7277.0
1943-44	7664.6	7814.6	7567.5	7137.6	6067.6	5072.0	3057.8	1636.6	1085.1	1049.7	1124.5	2360.2	4385.5	4850.4
1944-45	4882.9	4844.4	4322.8	3560.6	2319.1	940.6	482.5	56.2	0.0	0.0	0.0	1827.9	4792.9	6367.8
1945-46	6231.9	6129.1	5562.7	4905.9	4080.7	3270.9	1103.1	207.5	0.0	0.0	283.0	2676.6	6156.0	7721.6
1946-47	7814.6	7814.6	7649.0	7174.6	6209.4	5092.5	2903.4	1276.6	592.5	617.4	1055.4	3401.2	6334.9	7814.6
1947-48	7814.6	7799.5	7649.0	7210.0	6209.4	5092.5	2935.0	1225.5	494.5	388.7	596.0	2909.0	6161.9	7814.6
1948-49	7814.6	7814.6	7649.0	7210.0	6209.4	5092.5	3047.8	1861.8	1468.4	1392.5	1489.7	3902.1	6115.6	7152.9
1949-50	7546.2	7684.7	7118.7	6489.8	5946.4	5092.5	2901.7	1247.9	716.9	653.1	735.2	2052.8	4954.3	7814.6
1950-51	7814.6	7814.6	7649.0	7210.0	6209.4	5092.5	3060.6	1443.1	935.0	957.8	1148.4	3491.4	6243.1	7814.6
1951-52	7814.6	7814.6	7649.0	7210.0	6209.4	5092.5	2902.8	1527.2	1109.1	1043.2	1509.3	3774.1	6490.8	7721.6
1952-53	7814.6	7790.4	7421.4	6693.9	5328.3	4150.2	2434.8	1814.0	965.5	787.8	854.8	2287.5	5477.8	7386.2
1953-54	7664.6	7814.6	7649.0	7210.0	6209.4	5092.5	2962.1	1409.9	543.8	280.0	208.8	2350.5	5358.1	7798.0
1954-55	7814.6	7814.6	7649.0	7210.0	6209.4	5092.5	3010.0	1416.2	1000.6	967.5	701.4	1883.1	5271.8	7791.3
1955-56	7814.6	7814.6	7649.0	7210.0	6209.4	5092.5	3034.0	1300.4	430.4	352.0	680.8	3090.5	6222.1	7721.6
1956-57	7776.9	7814.6	7649.0	7210.0	6209.4	5092.5	2923.0	1290.3	622.4	590.3	775.4	3082.9	6632.5	7721.6
1957-58	7677.7	7731.4	7274.0	6815.4	5791.8	5037.3	2897.2	1316.3	380.2	382.6	569.4	2949.3	6374.1	7721.6
Max	7814.6	7814.6	7649.0	7210.0	6209.4	5166.6	3139.1	1861.8	1468.4	1392.5	1648.0	3902.1	6632.5	7814.6
Median	7733.6	7771.4	7326.2	6683.0	5869.1	5082.3	2899.5	1345.8	682.4	635.3	777.5	2617.5	5729.2	7641.2
Average	7339.2	7361.1	7007.1	6429.8	5405.9	4358.7	2401.9	1195.3	660.5	612.8	826.6	2734.5	5601.7	7242.7
Min	4702.8	4620.2	4065.8	3041.2	1668.9	284.4	11.6	0.0	0.0	0.0	0.0	1328.0	3988.1	4736.0

TABLE 12
(English Units)
COMPARISON OF RECENT ASSURED OPERATING PLAN STUDIES

	2009-10	2010-11	2011-12 through 2013-14 1/	2014-15	2015-16
MICA TARGET OPERATION (ksfd or cfs)					
AUG 15	3454.2	3439.2	3364.2	3379.2	3379.2
AUG 31	FULL	FULL	FULL	FULL	FULL
SEP	FULL	FULL	FULL	FULL	FULL
OCT	3428.4	3428.4	3428.4	3428.4	3404.1
NOV	22000	21000	21000	22000	21000
DEC	25000	25000	25000	22000	17000
JAN	23000	27000	24000	24000	24000
FEB	20000	21000	21000	21000	26000
MAR	17000	21000	17000	25000	25000
APR 15	18000	22000	20000	17000	21000
APR 30	11000	10000	10000	10000	10000
MAY	10000	8000	8000	8000	8000
JUN	10000	8000	8000	10000	8000
JUL	3436.2	3467.2	3467.2	3467.2	3436.2
COMPOSITE CRC1 CANADIAN TREATY STORAGE CONTENT (ksfd)					
1928 AUG 31	7811.6	7794.1	7814.4	7814.6	7814.6
1928 DEC	5110.5	5086	5204.0	5282.1	5092.5
1929 APR15	671.5	1048.2	1084.4	1078.2	1024.5
1929 JUL	7168.9	7233.2	7329.8	7500.9	7585.9
COMPOSITE CANADIAN TREATY STORAGE CONTENT (ksfd)					
Pre AOP15: 60-Yr Avg, AOP15 -16: 70-Yr Avg 2/					
AUG 31	7455.5	7438.0	7362.8	7406.8	7415.3
DEC	4640.3	4612.9	4630.0	4644.6	4490.1
APR15	877.8	842.6	908.6	889.3	716.3
JUL	7277.6	7268.9	7147.1	7279.9	7303.8
STEP I GAINS AND LOSSES DUE TO REOPERATION (MW)					
U.S. Firm Energy	-0.3	-0.3	0.1	0.0	0.0
U.S. Dependable Peaking Capacity	-2.7	-19.1	-22.9	-3.9	-2.1
U.S. Average Annual Usable Secondary Energy	13.8	16.0	21.6	21.3	17.6
BCH Firm Energy	50.2	34.4	43.6	44.0	24.0
BCH Dependable Peaking Capacity	44.9	43.8	41.7	47.8	28.2
BCH Average Annual Usable Secondary Energy	-28.2	-20.8	-13.9	-33.4	-16.2
COORDINATED HYDRO MODEL LOAD (MW)					
AUG 15	11138	11138	10969	11187	11367
AUG 31	11166	11167	11104	10971	10944
SEP	10850	11025	11081	9756	9822
OCT	9783	9958	9920	9758	10051
NOV	11157	11333	11458	11821	12152
DEC	13193	13369	13316	13836	13744
JAN	13076	13076	12878	13323	13933
FEB	11901	11902	11721	13179	12876
MAR	11316	10967	10501	12022	11269
APR 15	10590	10241	9786	10476	10894
APR 30	12823	12475	11502	11012	11600
MAY	13491	13493	13287	12198	12166
JUN	14079	14080	13867	12208	11291
JUL	12724	12725	12531	11954	11812
ANNUAL AVERAGE	12038	12039	11856	11819	11794

1/ The AOP 2013-14 and 2012-13 utilize the same system regulation study as the 2011-12.

2/ Prior to AOP15, average content based on 60 years of modified flows. AOP15 and AOP16 averages based on 70 years of modified flows.

TABLE 1M
(Metric Units)
MICA PROJECT OPERATING CRITERIA
2015-16 ASSURED OPERATING PLAN

		Target Operation		Target Operation Limits		
Month	End of Previous Month **Arrow** Storage Content	Month Outflow (m^3/s)	End-of-Month Treaty Storage Content 1/ (hm^3)	Minimum Treaty Storage Content 2/ (hm^3)	Maximum Outflow 1/ (m^3/s)	Minimum Outflow (m^3/s)
August 1-15	8073.8 - FULL	-	8,267.6	-	962.77	424.75
	5260.2 - 8073.8	707.92	-	0.0	-	424.75
	0.0 - 5260.2	906.14	-	0.0	-	424.75
August 16-31	8563.1 - FULL	-	8,634.5	-	962.77	424.75
	5260.2 - 8563.1	707.92	-	0.0	-	424.75
	0.0 - 5260.2	906.14	-	0.0	-	424.75
September	8636.5 - FULL	-	8,634.5	-	962.77	283.17
	8563.1 - 8636.5	707.92	-	0.0	-	283.17
	5137.9 - 8563.1	764.55	-	0.0	-	283.17
	0.0 - 5137.9	906.14	-	0.0	-	283.17
October	8171.6 - FULL	-	8,328.5	-	962.77	283.17
	7266.4 - 8171.6	622.97	-	0.0	-	283.17
	2935.9 - 7266.4	736.24	-	0.0	-	283.17
	0.0 - 2935.9	906.14	-	0.0	-	283.17
November	7731.3 - FULL	594.65	-	0.0	-	283.17
	7339.8 - 7731.3	566.34	-	0.0	-	283.17
	2446.6 - 7339.8	736.24	-	0.0	-	283.17
	0.0 - 2446.6	906.14	-	0.0	-	283.17
December	7339.8 - FULL	481.39	-	499.4	-	283.17
	5945.2 - 7339.8	679.60	-	499.4	-	283.17
	1223.3 - 5945.2	792.87	-	499.4	-	283.17
	0.0 - 1223.3	906.14	-	499.4	-	283.17
January	5504.9 - FULL	679.60	-	499.4	-	339.80
	4795.3 - 5504.9	736.24	-	499.4	-	339.80
	4403.9 - 4795.3	764.55	-	499.4	-	339.80
	0.0 - 4403.9	821.19	-	499.4	-	339.80
February	2666.8 - FULL	736.24	-	0.0	-	339.80
	1786.0 - 2666.8	651.29	-	0.0	-	339.80
	1663.7 - 1786.0	566.34	-	0.0	-	339.80
	0.0 - 1663.7	764.55	-	0.0	-	339.80
March	1027.6 - FULL	707.92	-	0.0	-	339.80
	367.0 - 1027.6	509.70	-	0.0	-	339.80
	0.0 - 367.0	736.24	-	0.0	-	339.80
April 1-15	2177.5 - FULL	594.65	-	0.0	-	339.80
	709.5 - 2177.5	339.80	-	0.0	-	339.80
	318.1 - 709.5	481.39	-	0.0	-	339.80
	0.0 - 318.1	594.65	-	0.0	-	339.80
April 16-30	538.3 - FULL	283.17	-	0.0	-	283.17
	318.1 - 538.3	396.44	-	0.0	-	283.17
	73.4 - 318.1	283.17	-	0.0	-	283.17
	0.0 - 73.4	424.75	-	0.0	-	283.17
May	538.3 - FULL	226.53	-	0.0	-	226.53
	391.5 - 538.3	424.75	-	0.0	-	226.53
	0.0 - 391.5	283.17	-	0.0	-	226.53
June	3523.1 - FULL	226.53	-	0.0	-	226.53
	2128.5 - 3523.1	283.17	-	0.0	-	226.53
	0.0 - 2128.5	453.07	-	0.0	-	226.53
July	7217.5 - FULL	-	8,407.0	-	962.77	283.17
	4893.2 - 7217.5	509.70	-	0.0	-	283.17
	0.0 - 4893.2	906.14	-	0.0	-	283.17

1/ If the Mica target end-of-month storage content is less than 8634.5 hm^3, then a maximum outflow of 962.77 m^3/s will apply.
2/ Mica outflows will be reduced to minimum to maintain the reservoir above the minimum Treaty storage content. This will override any flow target.

TABLE 1.1aM
(Metric Units)
ARROW PROJECT OPERATING CRITERIA
DEFINITION
2015-16 ASSURED OPERATING PLAN

Period	Volume Runoff Period	The Dalles Volume Runoff (km^3)	Maximum Storage Limit 1/ 2/ (hm^3)	Maximum Outflow Limit 3/ (m^3/s)	Minimum Outflow Limit 4/ (m^3/s)
August 15 - December	-		URC	-	283.2
January	-		URC	1,982	283.2
February	1 Feb - 31 Jul	≤ 86	URC	1,699	566.3
		>86 to <99	URC to 4404.0		
		≥ 99	4404.0		
March	1 Mar - 31 Jul	≤ 80	URC	-	566.3
		>80 to <93	URC to 2202.0		
		≥ 93	2202.0		
April 15	1 Apr - 31 Jul	≤ 75	URC	-	424.8
		>75 to <86	URC to 2202.0		
		≥ 86	2202.0		
April 30	1 Apr - 31 Jul	≤ 75	URC	-	339.8
		>75 to <86	URC to 2447.0		
		≥ 86	2447.0		
May	1 May - 31 Jul	≤ 84	URC	-	141.6
		>84 to <86	URC to 5382.0		
		≥ 86	5382.0		
June	1 Jun - 31 Jul	≤ 41	URC	-	141.6
		>41 to <43	URC to 8074.0		
		≥ 43	8074.0		
July	-		URC	-	283.2

Notes:

1/ If the Maximum Storage Limit is computed to be above the URC, then the URC will apply.

2/ Interpolate when there are two values. For example, if the February-July volume runoff is between 86 km^3 and 99 km^3, then the Maximum Storage Limit is interpolated between February's URC and 4404 hm^3.

3/ The Maximum Average Monthly Outflow Limit takes precedence over the Maximum Storage Limit. However, the Maximum Outflow Limit may be exceeded to avoid storage above the URC.

4/ The Minimum Average Monthly Outflow Limit is an operating limit and may be reduced to as low as 141.6 m^3/s (Treaty minimum) to avoid drafting Mica+Arrow storage beyond 17.0 km^3.

TABLE 1.1bM
(Metric Units)
ARROW PROJECT OPERATING CRITERIA
30 YEAR OPERATING DATA
FOR 2015-16 ASSURED OPERATING PLAN

	AUG15-DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
Maximum Average Monthly Flow Limits (m^3/s)									
	-	1,982	1,699	-	-	-	-	-	-
Minimum Average Monthly Flow Limits (m^3/s)									
	283.2	283.2	566.3	566.3	424.8	339.8	141.6	141.6	283.2
End-of-Period Maximum Storage Limits (hm^3)									
1928-29	-	-	URC	URC	URC	URC	URC	URC	-
1929-30	-	-	URC	URC	URC	URC	URC	URC	-
1930-31	-	-	URC	URC	URC	URC	URC	URC	-
1931-32	-	-	4403.8	2201.9	2201.9	2446.6	5382.5	8073.7	-
1932-33	-	-	4403.8	2201.9	2201.9	2446.6	URC	URC	-
1933-34	-	-	4403.8	2201.9	2201.9	2446.6	URC	URC	-
1934-35	-	-	4403.8	2201.9	2201.9	2446.6	URC	8073.7	-
1935-36	-	-	4465.0	2201.9	2201.9	2446.6	URC	URC	-
1936-37	-	-	URC	URC	URC	URC	URC	8682.4	-
1937-38	-	-	4403.8	2201.9	2201.9	2446.6	URC	8073.7	-
1938-39	-	-	4765.7	2349.7	3731.5	3851.6	URC	URC	-
1939-40	-	-	5390.5	3822.3	5708.4	5739.4	URC	URC	-
1940-41	-	-	URC	URC	URC	URC	URC	URC	-
1941-42	-	-	4403.8	2201.9	2201.9	2446.6	URC	URC	-
1942-43	-	-	4403.8	2201.9	2201.9	2446.6	5382.5	8073.7	-
1943-44	-	-	URC	URC	URC	URC	URC	URC	-
1944-45	-	-	4747.6	2732.6	3189.4	3352.3	URC	8073.7	-
1945-46	-	-	4403.8	2201.9	2201.9	2446.6	URC	8073.7	-
1946-47	-	-	4403.8	2201.9	2201.9	2446.6	5382.5	8073.7	-
1947-48	-	-	4403.8	2201.9	2201.9	2446.6	URC	8073.7	-
1948-49	-	-	4403.8	2201.9	2201.9	2446.6	URC	URC	-
1949-50	-	-	4403.8	2201.9	2201.9	2446.6	URC	URC	-
1950-51	-	-	4403.8	2201.9	2201.9	2446.6	URC	8073.7	-
1951-52	-	-	4403.8	2201.9	2201.9	2446.6	5382.5	8073.7	-
1952-53	-	-	4403.8	2201.9	2201.9	2446.6	URC	8073.7	-
1953-54	-	-	4403.8	2201.9	2201.9	2446.6	URC	URC	-
1954-55	-	-	4403.8	2201.9	2201.9	2446.6	URC	URC	-
1955-56	-	-	4403.8	2201.9	2201.9	2446.6	5382.5	8073.7	-
1956-57	-	-	4403.8	2201.9	2201.9	2446.6	5382.5	8073.7	-
1957-58	-	-	4403.8	2201.9	2201.9	2446.6	5382.5	8073.7	-

TABLE 3M
(Metric Units)
CRITICAL RULE CURVES
END OF PERIOD TREATY STORAGE CONTENTS (hm^3)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
							MICA							
1928-29	8634.5	8634.5	8544.0	7646.6	7028.6	5660.9	4868.2	1852.1	1595.4	1533.8	1478.0	2605.6	6520.4	8343.2
1929-30	8634.5	8634.5	8634.5	7751.1	7765.8	5392.6	1840.1	181.3	0.0	0.0	527.5	2110.9	5405.3	8584.6
1930-31	8525.4	8632.3	8519.3	7558.5	7041.8	5464.0	1954.1	103.0	0.0	0.0	0.0	1901.0	4029.3	6545.6
1931-32	7906.2	5877.2	4365.7	3536.8	2181.6	357.7	0.7	0.0						
							ARROW							
1928-29	8757.8	8757.8	8444.2	8328.7	6688.8	5746.3	1982.0	1628.2	865.9	663.3	710.5	2953.5	6828.7	8566.3
1929-30	8567.7	8563.8	7245.1	5993.4	2354.6	2028.0	853.9	717.6	3.7	3.2	800.5	3491.5	6533.4	7723.4
1930-31	8370.1	8541.1	7965.4	6958.9	4121.8	1868.7	1143.3	275.5	0.0	0.0	0.0	963.5	4762.3	3645.7
1931-32	2189.0	4046.7	4428.3	3149.5	1652.9	338.9	28.6	0.0						
							DUNCAN							
1928-29	1726.8	1726.8	1725.8	1664.7	1474.6	1052.0	631.0	274.0	296.0	309.5	337.1	624.6	1296.9	1650.2
1929-30	1723.6	1721.9	1468.0	1406.8	1345.6	1233.3	638.3	186.4	0.0	0.0	81.0	362.3	770.2	1283.2
1930-31	1446.2	1593.5	1373.8	1034.7	885.2	802.0	377.3	0.0	0.0	0.0	0.0	384.6	965.7	1396.8
1931-32	1411.4	1380.6	1154.1	755.3	249.6	0.0	0.0	0.0						
							COMPOSITE							
1928-29	19119.2	19119.2	18714.0	17640.0	15191.9	12459.3	7481.2	3754.3	2757.3	2506.5	2525.6	6183.8	14646.1	18559.7
1929-30	18925.9	18920.3	17347.6	15151.3	11466.0	8653.9	3332.3	1085.3	3.7	3.2	1409.0	5964.8	12708.9	17591.3
1930-31	18341.7	18766.9	17858.5	15552.1	12048.8	8134.7	3474.7	378.5	0.0	0.0	0.0	3249.1	9757.3	11588.1
1931-32	11506.6	11304.5	9948.1	7441.6	4084.1	696.5	29.4	0.0						

TABLE 4M
(Metric Units)
MICA
ASSURED AND VARIABLE REFILL CURVES,
DISTRIBUTION FACTORS AND FORECAST ERRORS,
POWER DISCHARGE REQUIREMENTS, AND OPERATING RULE CURVE LOWER LIMITS
2015 - 16 ASSURED OPERATING PLAN

	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
ASSURED REFILL CURVE (hm^3)														
	0.0	582.8	2056.6	2493.6	2653.3	2693.7	2681.0	2652.8	2669.5	2730.7	2628.4	3922.9	6663.1	8634.5
VARIABLE REFILL CURVES (hm^3)														
1928-29							4949.5	4498.3	4358.1	4347.9	4446.5	5713.1	7143.6	8634.5
1929-30							2445.6	1893.2	1732.2	1769.1	2150.1	4237.5	6433.8	"
1930-31							3077.1	2547.9	2375.2	2358.3	2577.2	4283.8	6620.7	"
1931-32							1539.6	1025.9	870.5	856.8	1141.8	3124.8	6245.7	"
1932-33							1310.9	883.5	770.7	751.8	939.5	2878.7	5839.1	"
1933-34							0.0	0.0	0.0	0.0	0.0	2260.4	6468.3	"
1934-35							2052.0	1580.0	1496.6	1525.9	1695.7	3461.2	6048.5	"
1935-36							1563.6	1091.7	981.1	961.3	1191.7	3375.1	6704.7	"
1936-37							4916.9	4415.1	4239.0	4202.0	4418.3	5742.7	7222.6	"
1937-38							2222.7	1751.5	1595.4	1591.8	1817.6	3670.6	6475.4	"
1938-39							2528.6	2166.2	2027.7	2074.5	2344.6	4269.8	7189.3	"
1939-40							1998.1	1544.5	1449.4	1481.9	1796.8	3779.3	6590.9	"
1940-41							3530.2	3052.6	2926.9	2957.0	3388.3	5204.7	7178.1	"
1941-42							3285.3	2817.0	2671.4	2644.3	2828.8	4486.6	6872.0	"
1942-43							3782.7	3260.1	3106.4	3078.3	3449.7	5198.0	7070.9	"
1943-44							5175.5	4635.8	4492.7	4477.8	4644.1	6009.6	7571.7	"
1944-45							4885.6	4436.4	4327.3	4338.6	4458.4	5718.4	7350.6	"
1945-46							805.7	257.1	98.4	55.0	277.0	2390.1	6235.6	"
1946-47							1084.3	667.9	579.4	588.7	872.2	3024.7	6406.2	"
1947-48							959.1	492.0	366.5	311.9	506.2	2526.8	6122.9	"
1948-49							5114.1	4593.0	4397.3	4366.7	4554.8	5876.2	8052.5	"
1949-50							1829.6	1267.6	1083.4	1039.6	1245.1	3065.3	5650.9	"
1950-51							1808.3	1363.0	1257.1	1256.8	1533.5	3355.3	6554.9	"
1951-52							2804.3	2256.7	2087.4	2028.7	2226.9	4074.3	6923.4	"
1952-53							3493.3	2990.7	2844.2	2815.8	2960.1	4452.1	6840.7	"
1953-54							739.9	261.8	178.4	168.1	371.1	2322.8	5581.2	"
1954-55							2600.7	2165.5	2060.0	2063.7	2273.6	3894.7	6067.3	"
1955-56							1494.6	1014.1	859.0	821.8	1036.9	3106.9	6341.3	"
1956-57							1907.6	1410.0	1290.3	1282.5	1499.3	3316.6	7168.0	"
1957-58							1500.3	1033.7	930.2	936.1	1192.0	3065.3	6574.3	"
DISTRIBUTION FACTORS							0.9760	0.9800	0.9760	0.9820	0.9660	0.7910	0.5060	N/A
FORECAST ERRORS (hm^3)							1781.1	1277.1	1113.2	1027.6	1027.6	981.1	971.3	N/A
POWER DISCHARGE REQUIREMENTS (m^3/s):														
ASSURED REFILL CURVE														
	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	283.17	311.49	645.62	863.66
VARIABLE REFILL CURVES					98.68	km^3	84.95	84.95	84.95	84.95	84.95	84.95	594.65	707.92
(BY VOLUME RUNOFF AT THE DALLES)					117.18	km^3	84.95	84.95	84.95	84.95	84.95	84.95	453.07	679.60
					135.69	km^3	84.95	84.95	84.95	84.95	84.95	84.95	453.07	679.60
VARIABLE REFILL CURVE LOWER LIMITS (hm^3)					98.68	km^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(By VOLUME RUNOFF AT THE DALLES)					117.18	km^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					135.69	km^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPERATING RULE CURVE LOWER LIMITS (hm^3)							1294.7	54.3	0.0	0.0				

TABLE 5M
(Metric Units)
ARROW
ASSURED AND VARIABLE REFILL CURVES,
DISTRIBUTION FACTORS AND FORECAST ERRORS,
POWER DISCHARGE REQUIREMENTS, AND OPERATING RULE CURVE LOWER LIMITS
2015 - 16 ASSURED OPERATING PLAN

	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
ASSURED REFILL CURVE (hm^3)														
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	670.9	870.3	1067.9	1737.6	4999.4	8757.1	8757.8
VARIABLE REFILL CURVES (hm^3)														
1928-29							3815.0	5176.3	4896.1	4725.9	5302.5	7341.5	8534.5	8757.8
1929-30							2114.8	1883.1	1988.8	1991.3	2667.8	5844.2	8243.3	"
1930-31							2718.2	2392.5	2353.4	2344.6	2813.1	5489.2	8106.8	"
1931-32							0.0	0.0	0.0	0.0	0.0	3437.2	7257.3	"
1932-33							404.2	195.2	226.3	207.7	748.4	3790.0	7095.9	"
1933-34							0.0	0.0	0.0	0.0	152.7	4930.9	8309.6	"
1934-35							1045.9	909.6	1176.8	1226.5	1697.7	4416.8	7424.5	"
1935-36							1244.8	872.7	759.2	670.6	1102.4	4443.0	8146.9	"
1936-37							4571.7	5823.9	5518.1	5277.3	5906.1	7768.0	8757.8	"
1937-38							1807.3	1593.5	1634.8	1704.8	2272.9	5017.5	7859.9	"
1938-39							2597.1	2226.2	2180.4	2108.0	2716.0	5708.7	8757.8	"
1939-40							1957.0	1733.9	1852.8	2057.6	2755.1	5311.6	8307.7	"
1940-41							3819.9	3963.0	3826.2	4037.4	5373.7	8038.3	8757.8	"
1941-42							3994.3	3904.0	3750.9	3670.4	4345.9	6819.4	8627.0	"
1942-43							4624.8	4864.3	4647.8	4443.3	5432.2	8032.4	8757.8	"
1943-44							5824.9	7208.9	6959.8	6726.4	7401.7	8757.8	"	"
1944-45							4252.4	5747.8	5560.6	5459.3	6024.3	7810.8	"	"
1945-46							0.0	0.0	0.0	0.0	545.8	3740.4	7595.7	"
1946-47							1265.1	1060.4	1069.4	1113.9	1750.1	4770.4	7838.9	"
1947-48							725.9	746.7	738.6	647.4	1084.1	4021.5	7662.5	"
1948-49							2743.1	4148.2	3985.5	3845.1	4680.3	7382.1	8757.8	"
1949-50							789.8	516.5	556.6	548.3	1059.9	3830.4	6791.8	"
1950-51							1533.0	1341.5	1443.2	1348.1	1965.1	4695.8	8013.1	"
1951-52							1614.5	1322.6	1371.6	1296.9	1768.9	4962.4	8198.6	"
1952-53							2541.3	2600.7	2470.1	2331.1	2963.3	5609.1	8068.6	"
1953-54							0.0	0.0	0.0	0.0	139.7	3108.9	6813.8	"
1954-55							983.3	845.1	941.5	872.5	1411.0	4306.0	6742.1	"
1955-56							256.4	15.4	61.7	39.4	628.8	4010.7	7669.1	"
1956-57							425.0	137.3	164.2	114.3	686.0	3660.6	8489.5	"
1957-58							0.0	0.0	0.0	0.0	710.0	3732.5	7758.7	"
DISTRIBUTION FACTORS							0.9740	0.9770	0.9710	0.9750	0.9520	0.7430	0.4680	N/A
FORECAST ERRORS (hm^3)							3633.2	2679.0	2334.1	1981.7	1981.7	1768.9	1661.2	N/A
POWER DISCHARGE REQUIREMENTS (m^3/s):														
ASSURED REFILL CURVE														
	141.58	141.58	141.58	141.58	141.58	141.58	141.58	141.58	141.58	141.58	141.58	254.85	733.41	1778.30
VARIABLE REFILL CURVES					98.68	km^3	141.58	141.58	141.58	141.58	141.58	141.58	849.50	1359.21
(BY VOLUME RUNOFF AT THE DALLES)					117.18	km^3	141.58	141.58	141.58	141.58	141.58	141.58	849.50	1359.21
					135.69	km^3	141.58	141.58	141.58	141.58	141.58	141.58	849.50	1359.21
VARIABLE REFILL CURVE LOWER LIMITS (hm^3)					98.68	km^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(By VOLUME RUNOFF AT THE DALLES)					117.18	km^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					135.69	km^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPERATING RULE CURVE LOWER LIMITS (hm^3)							316.1	149.0	0.0	0.0				

TABLE 6M
(Metric Units)
DUNCAN
ASSURED AND VARIABLE REFILL CURVES,
DISTRIBUTION FACTORS AND FORECAST ERRORS,
POWER DISCHARGE REQUIREMENTS, AND OPERATING RULE CURVE LOWER LIMITS
2015 - 16 ASSURED OPERATING PLAN

	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
ASSURED REFILL CURVE (hm^3)														
	0.0	0.0	0.0	0.0	38.7	66.1	91.0	113.5	148.0	174.4	212.6	597.2	1179.3	1726.8
VARIABLE REFILL CURVES (hm^3)														
1928-29							832.3	789.0	811.3	806.6	845.8	1103.4	1479.5	1726.8
1929-30							828.4	784.1	805.9	800.3	858.3	1153.3	1508.3	"
1930-31							692.1	651.3	681.9	688.7	743.0	1030.3	1479.5	"
1931-32							0.0	0.0	7.6	27.9	112.3	561.5	1235.5	"
1932-33							"	"	0.0	0.0	0.0	134.8	896.9	"
1933-34							36.7	41.8	103.2	138.5	250.0	756.0	1413.4	"
1934-35							160.3	135.8	194.5	199.4	256.9	657.9	1227.9	"
1935-36							104.7	66.3	97.4	98.8	164.4	652.3	1369.1	"
1936-37							674.8	629.3	656.7	652.0	701.9	994.1	1433.5	"
1937-38							143.1	121.4	163.4	184.7	256.6	681.4	1306.0	"
1938-39							290.9	263.5	297.3	306.3	382.2	799.3	1439.6	"
1939-40							259.1	243.7	296.3	328.6	411.0	806.6	1405.8	"
1940-41							468.5	446.3	488.8	525.3	635.1	1004.6	1466.0	"
1941-42							436.0	419.6	461.9	471.0	541.2	896.7	1400.4	"
1942-43							461.2	426.9	465.8	471.2	564.4	945.6	1377.4	"
1943-44							847.3	815.2	849.0	849.0	905.5	1169.5	1555.5	"
1944-45							652.0	620.7	657.2	658.9	701.9	989.9	1447.9	"
1945-46							0.0	0.0	0.0	0.0	0.0	418.1	1229.9	"
1946-47							"	"	"	"	29.4	526.3	1253.9	"
1947-48							52.4	23.2	69.5	71.4	130.4	568.8	1290.3	"
1948-49							606.5	564.9	595.5	593.1	653.5	987.4	1540.9	"
1949-50							116.9	76.6	114.0	113.0	175.9	577.9	1131.6	"
1950-51							0.0	0.0	0.0	0.0	32.3	491.0	1210.6	"
1951-52							192.5	157.1	202.6	204.0	265.7	718.1	1335.4	"
1952-53							185.5	"	197.4	202.6	256.9	655.7	1243.4	"
1953-54							0.0	0.0	0.0	0.0	0.0	319.0	1070.1	"
1954-55							28.4	"	39.4	47.0	113.5	520.9	1069.9	"
1955-56							0.0	"	0.0	0.0	0.0	443.6	1212.5	"
1956-57							77.3	32.3	68.3	74.4	143.9	565.4	1380.1	"
1957-58							0.0	0.0	0.0	0.0	0.0	417.9	1262.0	"
DISTRIBUTION FACTORS							0.9750	0.9810	0.9760	0.9790	0.9580	0.7530	0.4820	N/A
FORECAST ERRORS (hm^3)							313.2	254.4	256.9	230.0	230.0	212.9	190.8	N/A
POWER DISCHARGE REQUIREMENTS (m^3/s):														
ASSURED REFILL CURVE														
	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83
VARIABLE REFILL CURVES					98.68 km^3		2.83	2.83	2.83	2.83	2.83	2.83	33.98	79.29
(BY VOLUME RUNOFF AT THE DALLES)					117.18 km^3		2.83	2.83	2.83	2.83	2.83	2.83	33.98	70.79
					135.69 km^3		2.83	2.83	2.83	2.83	2.83	2.83	33.98	70.79
VARIABLE REFILL CURVE LOWER LIMITS (hm^3)					98.68 km^3		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(By VOLUME RUNOFF AT THE DALLES)					117.18 km^3		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					135.69 km^3		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPERATING RULE CURVE LOWER LIMITS (hm^3)							276.5	101.5	0.0	0.0				

TABLE 7M
(Metric Units)
MICA
UPPER RULE CURVES (FLOOD CONTROL)
END OF PERIOD TREATY STORAGE CONTENTS (hm^3)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
1928-29	8634.5	8634.5	8634.5	8387.9	8387.9	8151.1	7838.7	7556.6	7243.9	7243.9	7243.9	7563.9	8634.5	8634.5
1929-30	"	"	"	"	"	"	7696.8	7287.2	6832.9	6832.9	6832.9	6913.8	7980.6	"
1930-31	"	"	"	"	"	"	8151.1	8151.1	8151.1	8151.1	8151.1	8151.1	8634.5	"
1931-32	"	"	"	"	"	"	6601.7	5151.1	3601.9	3601.9	3601.9	5625.0	8287.4	"
1932-33	"	"	"	"	"	"	6584.5	5168.4	"	"	"	4065.0	7019.1	"
1933-34	"	"	"	"	"	"	"	"	"	"	4497.6	6712.0	7869.5	"
1934-35	"	"	"	"	"	"	"	"	"	"	3601.9	4694.0	7029.1	"
1935-36	"	"	"	"	"	"	6601.7	5151.1	"	"	3808.1	6651.6	8634.5	"
1936-37	"	"	"	"	"	"	7608.7	7119.6	6577.2	6577.2	6577.2	6855.1	8305.5	"
1937-38	"	"	"	"	"	"	6584.5	5168.4	3601.9	3601.9	3702.4	5645.0	7960.3	"
1938-39	"	"	"	"	"	"	6938.3	5841.7	4629.0	4629.0	4793.1	7729.3	8089.9	"
1939-40	"	"	"	"	"	"	7324.6	6551.3	5724.8	5724.8	5724.8	7627.8	8171.9	"
1940-41	"	"	"	"	"	"	8121.5	8094.8	8065.2	8065.2	8065.2	8164.3	8304.7	"
1941-42	"	"	"	"	"	"	6584.5	5168.4	3601.9	3601.9	3601.9	4784.6	8025.6	"
1942-43	"	"	"	"	"	"	"	"	"	"	"	4291.3	6928.5	"
1943-44	"	"	"	"	"	"	8151.1	8151.1	8151.1	8151.1	8151.1	8344.4	8634.5	"
1944-45	"	"	"	"	"	"	6921.9	5810.7	4581.5	4581.5	4581.5	5854.2	"	"
1945-46	"	"	"	"	"	"	6584.5	5168.4	3601.9	3601.9	3601.9	6631.5	8066.0	"
1946-47	"	"	"	"	"	"	"	"	"	"	"	6203.8	8634.5	"
1947-48	"	"	"	"	"	"	6601.7	5151.1	"	"	"	5695.4	"	"
1948-49	"	"	"	"	"	"	6584.5	5168.4	"	"	3667.2	5947.2	8624.5	"
1949-50	"	"	"	"	"	"	"	"	"	"	3601.9	3601.9	6671.9	"
1950-51	"	"	"	"	"	"	"	"	"	"	"	6042.6	7633.1	"
1951-52	"	"	"	"	"	"	6601.7	5151.1	"	"	3782.9	6113.1	7950.0	"
1952-53	"	"	"	"	"	"	6584.5	5168.4	"	"	3601.9	4779.4	7607.9	"
1953-54	"	"	"	"	"	"	"	"	"	"	"	4558.0	5730.7	"
1954-55	"	"	"	"	"	"	"	"	"	"	"	3601.9	7160.0	8604.2
1955-56	"	"	"	"	"	"	6601.7	5151.1	"	"	"	5589.7	8030.7	8634.5
1956-57	"	"	"	"	"	"	6584.5	5168.4	"	"	"	7341.0	8634.5	"
1957-58	"	"	"	"	"	"	"	"	"	"	"	6299.5	"	"

TABLE 8M
(Metric Units)
ARROW
UPPER RULE CURVES (FLOOD CONTROL)
END OF PERIOD TREATY STORAGE CONTENTS (hm^3)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
1928-29	8757.8	8757.8	8757.8	8449.6	8449.6	7887.1	7800.7	7722.9	7636.8	7636.8	7636.8	7904.7	8757.8	8757.8
1929-30	"	"	"	"	"	"	7668.6	7471.7	7253.2	7253.2	7253.2	7253.2	"	"
1930-31	"	"	"	"	"	"	7887.1	7887.1	7887.1	7887.1	7887.1	8757.8	"	"
1931-32	"	"	"	"	"	"	6670.7	5533.5	4317.3	4317.3	4317.3	5773.7	"	"
1932-33	"	"	"	"	"	"	6657.2	5546.9	"	"	"	4317.3	7856.5	"
1933-34	"	"	"	"	"	"	"	"	"	"	5263.1	5982.4	8757.8	"
1934-35	"	"	"	"	"	"	"	"	"	"	4317.3	4983.2	"	"
1935-36	"	"	"	"	"	"	6670.7	5533.5	"	"	5334.1	7070.4	"	"
1936-37	"	"	"	"	"	"	7586.2	7314.8	7014.2	7014.2	7014.2	7083.6	"	"
1937-38	"	"	"	"	"	"	6657.2	5546.9	4317.3	4317.3	4317.3	5072.0	"	"
1938-39	"	"	"	"	"	"	6962.8	6128.2	5203.9	5203.9	5203.9	5587.8	"	"
1939-40	"	"	"	"	"	"	7317.5	6785.6	6216.3	6216.3	6216.3	7647.1	"	"
1940-41	"	"	"	"	"	"	7887.1	7887.1	7887.1	7887.1	7887.1	8177.8	"	"
1941-42	"	"	"	"	"	"	6657.2	5546.9	4317.3	4317.3	4317.3	4903.5	7114.7	"
1942-43	"	"	"	"	"	"	"	"	"	"	5600.5	6391.0	8757.8	"
1943-44	"	"	"	"	"	"	7887.1	7887.1	7887.1	7887.1	7887.1	8066.4	"	"
1944-45	"	"	"	"	"	"	6948.8	6101.3	5163.1	5163.1	5163.1	5385.9	"	"
1945-46	"	"	"	"	"	"	6657.2	5546.9	4317.3	4317.3	4317.3	4730.3	"	"
1946-47	"	"	"	"	"	"	"	"	"	"	"	5458.4	"	"
1947-48	"	"	"	"	"	"	6670.7	5533.5	"	"	"	5089.9	"	"
1948-49	"	"	"	"	"	"	6657.2	5546.9	"	"	"	7319.0	"	"
1949-50	"	"	"	"	"	"	"	"	"	"	"	4317.3	6413.3	"
1950-51	"	"	"	"	"	"	"	"	"	"	"	5156.5	8757.8	"
1951-52	"	"	"	"	"	"	6670.7	5533.5	"	"	4770.1	6666.3	"	"
1952-53	"	"	"	"	"	"	6657.2	5546.9	"	"	4317.3	4317.3	"	"
1953-54	"	"	"	"	"	"	"	"	"	"	"	5334.1	6546.4	"
1954-55	"	"	"	"	"	"	"	"	"	"	"	4330.5	6706.4	"
1955-56	"	"	"	"	"	"	6670.7	5533.5	"	"	4694.8	6426.5	8757.8	"
1956-57	"	"	"	"	"	"	6657.2	5546.9	"	"	4317.3	6519.7	"	"
1957-58	"	"	"	"	"	"	"	"	"	"	"	6599.7	"	"

TABLE 9M
(Metric Units)
DUNCAN
UPPER RULE CURVES (FLOOD CONTROL)
END OF PERIOD TREATY STORAGE CONTENTS (hm^3)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
1928-29	1726.8	1726.8	1726.8	1726.8	1726.8	1233.3	1022.7	832.6	832.6	832.6	832.6	1057.9	1726.8	1726.8
1929-30	"	"	"	"	"	"	999.9	789.3	789.3	789.3	789.3	1067.0	1603.0	"
1930-31	"	"	"	"	"	"	955.9	705.4	705.4	705.4	716.6	1062.1	1605.2	"
1931-32	"	"	"	"	"	"	678.4	228.0	160.3	160.3	160.3	674.0	1532.6	"
1932-33	"	"	"	"	"	"	669.6	"	"	"	"	324.7	1205.2	1687.7
1933-34	"	"	"	"	"	"	"	"	"	"	1245.8	1480.9	1681.3	1726.8
1934-35	"	"	"	"	"	"	"	"	"	"	160.3	411.0	1187.8	"
1935-36	"	"	"	"	"	"	678.4	"	"	"	255.9	824.5	1615.5	"
1936-37	"	"	"	"	"	"	917.0	631.5	631.5	631.5	631.5	923.8	1519.8	"
1937-38	"	"	"	"	"	"	709.8	283.6	236.8	236.8	286.0	719.5	1545.0	"
1938-39	"	"	"	"	"	"	697.5	266.7	213.3	213.3	273.8	826.2	1366.7	"
1939-40	"	"	"	"	"	"	736.7	309.5	272.6	272.6	272.6	747.9	1425.6	"
1940-41	"	"	"	"	"	"	842.6	489.6	489.6	489.6	529.2	910.1	1516.4	"
1941-42	"	"	"	"	"	"	797.8	405.2	404.4	404.4	404.4	774.8	1323.4	"
1942-43	"	"	"	"	"	"	805.7	419.3	419.3	419.3	419.3	591.8	1086.0	"
1943-44	"	"	"	"	"	"	1009.2	800.5	800.5	800.5	800.5	1077.5	1644.4	"
1944-45	"	"	"	"	"	"	933.4	662.3	662.3	662.3	662.3	963.5	1599.1	"
1945-46	"	"	"	"	"	"	669.6	228.0	160.3	160.3	179.1	799.5	1657.8	"
1946-47	"	"	"	"	"	"	"	"	"	"	204.3	768.2	1560.7	"
1947-48	"	"	"	"	"	"	678.4	"	"	"	160.3	611.4	1610.8	"
1948-49	"	"	"	"	"	"	900.3	599.4	599.4	599.4	646.6	1187.8	1726.8	"
1949-50	"	"	"	"	"	"	669.6	228.0	160.3	160.3	160.3	443.8	1307.0	"
1950-51	"	"	"	"	"	"	"	"	"	"	"	1291.3	1483.9	"
1951-52	"	"	"	"	"	"	678.4	"	"	"	233.9	722.7	1455.7	"
1952-53	"	"	"	"	"	"	669.6	"	"	"	160.3	460.9	1197.4	"
1953-54	"	"	"	"	"	"	"	"	"	"	"	464.1	1065.7	1686.2
1954-55	"	"	"	"	"	"	"	"	"	"	"	177.6	1064.3	1700.1
1955-56	"	"	"	"	"	"	678.4	"	"	"	"	785.4	1557.5	1726.8
1956-57	"	"	"	"	"	"	669.6	"	"	"	175.9	921.6	1692.3	"
1957-58	"	"	"	"	"	"	"	"	"	"	160.3	818.1	1672.0	"

TABLE 10M
(Metric Units)
COMPOSITE OPERATING RULE CURVES
FOR THE WHOLE OF CANADIAN TREATY STORAGE
END OF PERIOD TREATY STORAGE CONTENTS (hm^3)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
1928-29	19119.2	19119.2	18714.0	17640.0	15191.9	12459.3	7481.2	4555.1	3835.8	4108.1	4703.1	9546.9	16494.5	19119.2
1929-30	"	"	"	"	"	"	5058.6	3795.4	2898.5	3146.6	4224.8	9546.9	15974.1	"
1930-31	"	"	"	"	"	"	5690.1	4450.1	3541.5	3735.7	4652.0	9546.9	16024.5	"
1931-32	"	"	"	"	"	"	2132.2	1276.4	878.1	884.7	1254.1	7123.5	14738.6	"
1932-33	"	"	"	"	"	"	1991.5	1180.2	997.0	959.6	1687.9	6803.5	13831.9	19080.1
1933-34	"	"	"	"	"	"	1887.3	304.8	103.2	138.5	402.7	7815.9	16074.9	19119.2
1934-35	"	"	"	"	"	"	3374.4	2625.4	2527.1	2754.1	3553.7	8289.1	14660.8	"
1935-36	"	"	"	"	"	"	3084.9	2065.9	1837.6	1730.7	2458.6	8442.7	16106.9	"
1936-37	"	"	"	"	"	"	7481.2	4555.1	3835.8	4108.1	4703.1	9546.9	16717.1	"
1937-38	"	"	"	"	"	"	4306.5	3466.3	2629.1	2844.4	3811.8	9294.6	15632.3	"
1938-39	"	"	"	"	"	"	4801.5	4057.9	3111.3	3355.8	4355.9	9546.9	16717.1	"
1939-40	"	"	"	"	"	"	4231.6	3416.4	2592.2	2822.4	3806.9	9403.3	16195.5	"
1940-41	"	"	"	"	"	"	5980.7	4555.1	3835.8	4108.1	4703.1	9546.9	16717.1	"
1941-42	"	"	"	"	"	"	5703.3	4555.1	3835.8	4021.7	4703.1	9451.0	15074.7	"
1942-43	"	"	"	"	"	"	6225.9	4555.1	3835.8	4108.1	4703.1	9514.1	16506.2	"
1943-44	"	"	"	"	"	"	7481.2	4555.1	3835.8	4108.1	4703.1	9546.9	16717.1	"
1944-45	"	"	"	"	"	"	7481.2	4555.1	3835.8	4108.1	4703.1	9546.9	16717.1	"
1945-46	"	"	"	"	"	"	1887.3	507.7	98.4	55.0	822.8	6548.6	15061.3	"
1946-47	"	"	"	"	"	"	2836.3	1829.8	1449.6	1656.6	2639.1	8321.4	15499.0	"
1947-48	"	"	"	"	"	"	2297.1	1340.2	1174.6	1030.8	1720.7	7117.2	15075.7	"
1948-49	"	"	"	"	"	"	7456.7	4555.1	3835.8	4108.1	4703.1	9546.9	16717.1	"
1949-50	"	"	"	"	"	"	2895.8	1885.6	1754.0	1700.9	2465.2	7339.6	13195.7	"
1950-51	"	"	"	"	"	"	3617.8	2806.0	2127.3	2324.8	3303.4	8542.1	15778.6	"
1951-52	"	"	"	"	"	"	4695.3	3736.4	3117.9	3256.9	4198.4	9509.9	16158.6	"
1952-53	"	"	"	"	"	"	5751.7	4438.1	3700.0	3958.8	4526.2	8701.1	15929.1	"
1953-54	"	"	"	"	"	"	1887.3	512.3	178.4	168.1	510.9	5750.7	13193.3	19078.6
1954-55	"	"	"	"	"	"	3860.5	3112.1	2969.7	2983.1	3798.1	8085.5	13838.0	19062.2
1955-56	"	"	"	"	"	"	2087.2	1264.6	920.7	861.2	1665.6	7561.2	15223.0	19119.2
1956-57	"	"	"	"	"	"	2609.1	1660.5	1522.8	1471.1	2329.2	7542.6	16449.5	"
1957-58	"	"	"	"	"	"	2092.8	1284.2	930.2	936.1	1902.0	7215.8	15594.9	"

TABLE 11M
(Metric Units)
COMPOSITE END STORAGE
FOR THE WHOLE OF CANADIAN STORAGE
END OF PERIOD TREATY STORAGE CONTENTS (hm^3)
2015 - 16 ASSURED OPERATING PLAN

YEAR	AUG15	AUG31	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR15	APR30	MAY	JUN	JUL
1928-29	19119.2	19119.2	18714.0	17640.0	15191.9	12459.3	7481.2	3754.3	2757.3	2506.5	2525.6	6183.8	14645.8	18559.7
1929-30	18925.9	18920.3	17347.6	15151.3	11466.0	8653.9	3332.3	1085.3	3.7	3.2	1409.0	5964.8	12708.9	17588.4
1930-31	18341.9	18766.9	17858.5	15551.8	12048.8	8134.7	3474.7	378.5	0.0	0.0	0.0	3249.1	9757.3	11587.1
1931-32	11505.9	11303.8	9947.4	7440.6	4083.1	695.8	28.4	0.0	6.4	299.5	1132.3	6227.1	14629.9	18624.7
1932-33	19007.9	19119.2	17743.0	15844.7	14844.3	12459.3	7305.8	3319.5	997.0	838.4	1346.4	5666.6	13831.9	18852.5
1933-34	19119.2	19119.2	18714.0	17640.0	15191.9	12640.6	7680.1	3791.5	2250.9	1886.6	3467.6	7815.9	14625.3	18397.9
1934-35	18774.2	18886.8	17257.1	15509.7	15191.9	12459.3	7330.3	3660.1	2527.1	1693.8	2082.5	6576.7	14193.5	18891.7
1935-36	19119.2	19081.5	18418.2	16551.2	13129.9	9484.5	4127.4	1889.3	891.5	654.2	2165.0	8442.7	16106.9	18765.2
1936-37	18915.9	18921.8	17540.9	15454.4	11462.6	7960.0	3007.1	417.1	0.0	0.0	0.0	3648.4	10929.0	14990.1
1937-38	14768.7	14519.1	13143.1	11298.2	9919.5	8188.0	4334.4	3265.7	1585.2	1338.8	1665.9	6259.4	13842.1	18537.4
1938-39	18655.8	18853.0	17986.4	16295.6	13371.9	11158.7	5894.8	4033.5	2645.3	2723.8	3736.9	8810.0	13846.8	18891.7
1939-40	19111.4	18927.9	17379.9	15910.5	13090.5	11296.7	6107.4	3416.4	2592.2	2796.0	3555.4	9403.3	14187.3	17794.1
1940-41	18134.0	18035.1	17186.4	16323.7	13064.4	10078.3	5393.5	3054.1	2475.7	3005.9	4032.0	7291.4	11247.8	13049.9
1941-42	12930.0	12971.9	12709.1	13433.1	11683.7	12008.6	6749.4	4555.1	1941.1	1660.3	1907.1	6088.1	11727.5	17175.1
1942-43	18325.5	18966.8	17862.1	16112.8	14053.3	12459.3	7024.7	4555.1	2498.0	2419.4	2944.0	6226.6	12091.3	17803.9
1943-44	18752.2	19119.2	18514.6	17462.9	14845.0	12409.2	7481.2	4004.1	2654.8	2568.2	2751.2	5774.5	10729.6	11867.0
1944-45	11946.5	11852.3	10576.2	8711.4	5673.9	2301.3	1180.5	137.5	0.0	0.0	0.0	4472.1	11726.3	15579.5
1945-46	15247.0	14995.5	13609.7	12002.8	9983.8	8002.6	2698.8	507.7	0.0	0.0	692.4	6548.6	15061.3	18891.7
1946-47	19119.2	19119.2	18714.0	17553.4	15191.9	12459.3	7103.5	3123.3	1449.6	1510.5	2582.1	8321.4	15499.0	19119.2
1947-48	19119.2	19082.3	18714.0	17640.0	15191.9	12459.3	7180.8	2998.3	1209.8	951.0	1458.2	7117.2	15075.7	19119.2
1948-49	19119.2	19119.2	18714.0	17640.0	15191.9	12459.3	7456.7	4555.1	3592.6	3406.9	3644.7	9546.9	14962.4	17500.3
1949-50	18462.5	18801.4	17416.6	15877.9	14548.5	12459.3	7099.3	3053.1	1754.0	1597.9	1798.7	5022.4	12121.2	19119.2
1950-51	19119.2	19119.2	18714.0	17640.0	15191.9	12459.3	7488.1	3530.7	2287.6	2343.4	2809.7	8542.1	15274.4	19119.2
1951-52	19119.2	19119.2	18714.0	17640.0	15191.9	12459.3	7102.0	3736.4	2713.5	2552.3	3692.7	9233.7	15880.4	18891.7
1952-53	19119.2	19060.0	18157.2	16377.3	13036.2	10153.9	5957.0	4438.1	2362.2	1927.4	2091.4	5596.6	13402.0	18071.1
1953-54	18752.2	19119.2	18714.0	17640.0	15191.9	12459.3	7247.1	3449.5	1330.5	685.0	510.9	5750.7	13109.1	19078.6
1954-55	19119.2	19119.2	18714.0	17640.0	15191.9	12459.3	7364.3	3464.9	2448.1	2367.1	1716.0	4607.2	12898.0	19062.2
1955-56	19119.2	19119.2	18714.0	17640.0	15191.9	12459.3	7423.0	3181.6	1053.0	861.2	1665.6	7561.2	15223.0	18891.7
1956-57	19027.0	19119.2	18714.0	17640.0	15191.9	12459.3	7151.4	3156.8	1522.8	1444.2	1897.1	7542.6	16227.1	18891.7
1957-58	18784.3	18915.6	17796.6	16674.6	14170.2	12324.3	7088.3	3220.5	930.2	936.1	1393.1	7215.8	15594.9	18891.7
Max	19119.2	19119.2	18714.0	17640.0	15191.9	12640.6	7680.1	4555.1	3592.6	3406.9	4032.0	9546.9	16227.1	19119.2
Median	18920.9	19013.4	17924.3	16350.5	14359.3	12434.2	7093.8	3292.6	1669.6	1554.2	1902.1	6404.0	14017.1	18695.0
Average	17956.0	18009.7	17143.5	15731.3	13226.0	10664.0	5876.4	2924.4	1616.0	1499.3	2022.4	6690.2	13705.2	17720.1
Min	11505.9	11303.8	9947.4	7440.6	4083.1	695.8	28.4	0.0	0.0	0.0	0.0	3249.1	9757.3	11587.1

TABLE 12M
(Metric Units)
COMPARISON OF RECENT ASSURED OPERATING PLAN STUDIES

	2009-10	2010-11	2011-12 through 2013-14 1/	2014-15	2015-16
MICA TARGET OPERATION (hm^3 or m^3/s)					
AUG 15	8451.0	8414.3	8230.9	8267.6	8267.6
AUG 31	FULL	FULL	FULL	FULL	FULL
SEP	FULL	FULL	FULL	FULL	FULL
OCT	8387.9	8387.9	8387.9	8387.9	8328.5
NOV	622.97	594.65	594.65	622.97	594.65
DEC	707.92	707.92	707.92	622.97	481.39
JAN	651.29	764.55	679.60	679.60	679.60
FEB	566.34	594.65	594.65	594.65	736.24
MAR	481.39	594.65	481.39	707.92	707.92
APR 15	509.70	622.97	566.34	481.39	594.65
APR 30	311.49	283.17	283.17	283.17	283.17
MAY	283.17	226.53	226.53	226.53	226.53
JUN	283.17	226.53	226.53	283.17	226.53
JUL	8407.0	8482.9	8482.9	8482.9	8407.0
COMPOSITE CRC1 CANADIAN TREATY STORAGE CONTENT (hm3)					
1928 AUG 31	19111.9	19069.0	19118.7	19119.2	19119.2
1928 DEC	12503.3	12443.4	12732.1	12923.2	12459.3
1929 APR15	1642.9	2564.5	2653.1	2637.9	2506.5
1929 JUL	17539.4	17696.7	17933.1	18351.7	18559.7
COMPOSITE CANADIAN TREATY STORAGE CONTENT (hm3)					
Pre AOP15: 60-Yr Avg, AOP15 -16: 70-Yr Avg 2/					
AUG 31	18240.6	18197.7	18013.8	18121.4	18142.2
DEC	11353.0	11286.0	11327.8	11363.5	10985.4
APR15	2147.6	2061.6	2222.9	2175.9	1752.6
JUL	17805.4	17784.1	17486.1	17811.0	17869.5
STEP I GAINS AND LOSSES DUE TO REOPERATION (MW)					
U.S. Firm Energy	-0.3	-0.3	0.1	0.0	0.0
U.S. Dependable Peaking Capacity	-2.7	-19.1	-22.9	-3.9	-2.1
U.S. Average Annual Usable Secondary Energy	13.8	16.0	21.6	21.3	17.6
BCH Firm Energy	50.2	34.4	43.6	44.0	24.0
BCH Dependable Peaking Capacity	44.9	43.8	41.7	47.8	28.2
BCH Average Annual Usable Secondary Energy	-28.2	-20.8	-13.9	-33.4	-16.2
COORDINATED HYDRO MODEL LOAD (MW)					
AUG 15	11138	11138	10969	11187	11367
AUG 31	11166	11167	11104	10971	10944
SEP	10850	11025	11081	9756	9822
OCT	9783	9958	9920	9758	10051
NOV	11157	11333	11458	11821	12152
DEC	13193	13369	13316	13836	13744
JAN	13076	13076	12878	13323	13933
FEB	11901	11902	11721	13179	12876
MAR	11316	10967	10501	12022	11269
APR 15	10590	10241	9786	10476	10894
APR 30	12823	12475	11502	11012	11600
MAY	13491	13493	13287	12198	12166
JUN	14079	14080	13867	12208	11291
JUL	12724	12725	12531	11954	11812
ANNUAL AVERAGE	12038	12039	11856	11819	11794

1/ The AOP 2013-14 and 2012-13 utilize the same system regulation study as the 2011-12.

2/ Prior to AOP15, average content based on 60 years of modified flows. AOP15 and AOP16 averages based on 70 years of modified flows.

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Project Name (Number)	Constraint Type	Requirements English	Requirements Metric	Explanation	Source
Canadian Projects					
Mica (1890)	Minimum Flow	3000 cfs	85.0 m^3/s		In place in AOP79, AOP80, AOP84.
Arrow (1831)	Minimum Flow	5000 cfs	141.6 m^3/s		In place in AOP79, AOP80, AOP84.
	Draft Rate Limit	1.0 ft/day	0.30 m/day		
Duncan (1681)	Minimum Flow	100 cfs	2.8 m^3/s		In place in AOP79, AOP80, AOP84.
	Maximum Flow	10000 cfs	283.2 m^3/s		
	Draft Rate Limit	1.0 ft/day	0.30 m/day		
	Other			Operate to meet IJC orders for Corra Linn.	CRTOC agreement on procedures to implement 1938 IJC order.
Base System					
Hungry Horse (1530)	Minimum Flow	400 cfs	11.3 m^3/s	Minimum project discharge.	In place in AOP79, AOP80, AOP84.
	Maximum Flow			None	
	Minimum Content			None	
	Other			No VECC limit.	VECC limit not in place in AOP79.
Kerr (1510)	Minimum Flow	1500 cfs	42.5 m^3/s	All periods	In place in AOP80, AOP84.
	Maximum Flow			None	
	Minimum Content	614.7 ksfd 2893.0 ft 426.3 ksfd 2890.0 ft 0.0 ksfd 2883.0 ft	1503.9 hm^3 881.79 m 1043 hm^3 880.9 m 0 hm^3 878.74 m	Jun - Sep May Empty Apr 15	MPC 2-1-92, PNCA submittal similar operation, Jun-Aug 15, in AOP80. FERC, AOP80.
	Maximum Content	58.6 ksfd 2884.0 ft	143.37 hm^3 879.04 m	March (Included to help meet the Apr 15 FERC requirement.)	In place in AOP80, AOP84.
	Other	0.0 ksfd 2883.0 ft	0 hm^3 878.74 m	Conditions permitted, should be on or about, empty Mar and Apr 15.	FERC, AOP80.
Thompson Falls (1490)				None Noted	

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Noxon Rapids (1480)	Minimum Content				
	For Step I:	116.3 ksfd	284.54 hm^3	May - Aug 31,	In place in AOP84, similar operation in AOP80.
		2331.0 ft	710.49 m		
		112.3 ksfd	274.75 hm^3	Sep - Jan,	
		2330.0 ft	710.18 m		
		78.7 ksfd	192.55 hm^3	Feb,	
		2321.0 ft	707.44 m		
		26.5 ksfd	64.834 hm^3	Mar,	
		2305.0 ft	702.56 m		
		0.0 ksfd	0 hm^3	Empty Apr 15, Apr 30, and for end of CP.	
		2295.0 ft	699.52 m		
	Minimum & Maximum Content				
	For Steps II & III:	116.3 ksfd	284.54 hm^3	All periods	In place in AOP79, AOP84.
		2331.0 ft	710.49 m		
Cabinet Gorge (1475)				None Noted	
Albeni Falls (1465)	Minimum Flow	4000 cfs	113.3 m^3/s	All periods	In place in AOP80, AOP84.
	Minimum Content	(Dec may fill on restriction, note below)			
		582.4 ksfd	1424.9 hm^3	Jun - Aug 31	In place in AOP80, AOP84.
		2062.5 ft	628.65 m		
		465.7 ksfd	1139.4 hm^3	Sep	
		2060.0 ft	627.89 m		
		190.4 ksfd	465.83 hm^3	Oct	
		2054.0 ft	626.06 m		
		57.6 ksfd	140.92 hm^3	Nov-Apr 15	
		2051.0 ft	625.14 m		
		190.4 ksfd	465.83 hm^3	Apr 30 (empty at end of CP)	
		2054.0 ft	626.06 m		
		279.0 ksfd	682.59 hm^3	May	
		2056.0 ft	626.67 m		
	For Steps I & II:	Optimum to run CP & LT to Jun-Oct SMINs.			
	For Step III:	Keep full at beginning of CP. Often (not always) optimum to run higher than SMIN in CP & LT (except when occasionally drafting below SMIN to meet load).			
		57.6 ksfd	140.9 hm^3	Nov - Mar	
		2051.0 ft	625.14 m		
		458.4 ksfd	1121.5 hm^3	May	
		2059.8 ft	627.8 m		
		582.4 ksfd	1424.9 hm^3	Sep	
		2062.5 ft	628.7 m		
		465.7 ksfd	1139.4 hm^3	Oct	
		2060.0 ft	627.89 m		

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	Kokanee Spawning	1.0 ft	0.30 m	Draft limit below Nov. 20th Elevation through Dec. 31st.	In place before AOP80 and supported by minimum contents noted above.
		0.5 ft	0.15 m	If project fills, draft no more than this amount.	
				Dec. 31 - Mar 31, operate between SMIN and URC within above noted draft limits.	
	Other Spill	50 cfs	1.4 m^3/s	All periods	
				None Noted	
Grand Coulee (1280)	Minimum Flow	30000 cfs	849.5 m^3/s	All periods	In place in AOP79, AOP80, AOP84.
	Minimum Content	0.0 ksfd	0.0 hm^3	Empty at end of CP.	
		1208.0 ft	368.20 m		
	Step I only:	843.7 ksfd	2064.2 hm^3	May and June	Retain as a power operation (for pumping).
		1240.0 ft	377.95 m		
	Steps II & III only:	868.8 ksfd	2125.6 hm^3	May and June	
		1240.0 ft	378.0 m		
	Maximum Content				
	Step I only:	2.0 ft	0.61 m	Operating room Sep - Nov	In place in AOP89
		3.0 ft	0.91 m	Operating room Dec - Feb	Retain as a power operation.
	Steps II & III only:	2557.1 ksfd	6256.1 hm^3	Aug-Nov	
		1288.0 ft	392.58 m		
		2518.3 ksfd	6161.2 hm^3	Dec-Feb	
		1287.0 ft	392.28 m		
	Draft Rate Limit	1.3 ft/day	0.40 m/day	(bank sloughage)	
		1.5 ft/day	0.46 m/day	(Constraint submitted as 1.5 ft/day interpreted as 1.3 ft/day mo.ave.)	
Chief Joseph (1270)	Other Spill	500 cfs	14.2 m^3/s	All periods	
Wells (1220)	Other Spill	1000 cfs	28.3 m^3/s	All periods	2/1/05 C. Wagers, Douglas With fish ladder
	Fish Spill			None	
Rocky Reach (1200)	Fish Spill/Bypass			None	
	Other Spill	200 cfs	5.7 m^3/s	Aug 31 - Apr 15 (leakage)	
Rock Island (1170)	Fish Spill/Bypass			None	
Wanapum (1165)	Fish Spill/Bypass			None	
	Other Spill	2200 cfs	62.3 m^3/s	All periods	With fish ladder

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Priest Rapids (1160)	Minimum Flow			Limit removed	
	Fish Spill/Bypass			None	
	Other Spill	2200 cfs	62.3 m^3/s	All periods	With fish ladder
Brownlee (767)	Minimum Flow	5850 cfs	165.7 m^3/s	All years, all periods in CP & LT studies.	4-04 C. Henriksen
	Downstream Minimum Flow	13000 cfs	368.1 m^3/s	July-Sep in all years for navigation requirement downstream at Lime Point (project #760). Draft Brownlee to help meet this requirement in CP and LT studies.	4-04 C. Henriksen
	Power Operation			Agree to use “old” power operation (first codes) provided by IPC and used in AOP since AOP97 for CP.	2-1-91 PNCA submittal
				LT run to PDP using rule curves from CP with BECC created from regulation spreadsheet to meet flow requirements at Lime Pt., and Brownlee and mimic the "old" historic first code operation on a 60 year average and median comparison. Consistent w/ TSR.	7-00 J. Hyde
Oxbow (765)	Other Spill	100 cfs	2.8 m^3/s	All periods	
Ice Harbor (502)	Fish Spill/Bypass			None	
	Other Spill	740 cfs	21.0 m^3/s	All periods	
	Incremental Spill			None	
	Minimum Flow			None	
	Other	204.8 ksfd 440.0 ft	83.7 hm^3 134.11 m	Run at all periods	
McNary (488)	Other Spill	3475 cfs	98.4 m^3/s	All periods	
	Incremental Spill			None	
John Day (440)	Fish Spill/Bypass			None	
	Other Spill	800 cfs	22.7 m^3/s	All periods	
	Incremental Spill			None	
	Minimum Flow	50000 cfs 12500 cfs	1415.8 m^3/s 354.0 m^3/s	Mar - Nov Dec - Feb	

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	Other				
	Step I:	269.7 ksfd	659.8 hm^3	June - Aug 15	In place AOP80
		268.0 ft	81.69 m		
		242.5 ksfd	593.3 hm^3	Aug 31 - Sep	
		267.0 ft	81.38 m		
		153.7 ksfd	376.0 hm^3	Oct - Mar	
		263.6 ft	80.35 m		
		114.9 ksfd	281.1 hm^3	Apr - May	
		262.0 ft	79.86 m		
	Steps II & III:	190.0 ksfd	464.8 hm^3	Use JDA as run-of-river plant.	
		265.0 ft	80.77 m		
The Dalles (365)	Fish Spill/Bypass			None	
	Other Spill	1300 cfs	36.8 m^3/s	All periods	
	Incremental Spill			None	
	Minimum Flow	50000 cfs	1415.8 m^3/s	Mar - Nov	
		12500 cfs	354.0 m^3/s	Dec - Feb	
Bonneville (320)	Fish Spill/Bypass			None	
	Other Spill	8040 cfs	227.7 m^3/s	All periods	
	Incremental Spill			None	
Kootenay Lake (Corra Linn (1665))	Minimum Flow	5000 cfs	141.6 m^3/s	All periods	BCHydro agreements 1969.
	Other			Operate to IJC orders.	CRTOC agreement on procedures to implement 1938 IJC order.
Chelan (1210)	Minimum Flow	50 cfs	1.4 m^3/s	All periods	In place in AOP79, AOP80, AOP84
	Minimum Content	308.5 ksfd	126.1 hm^3	Jul - Sep (except as needed to empty at end of critical period).	In place in AOP79, AOP80, AOP84
		1098.0 ft	334.7 m		
Couer d'Alene L (1341)	Minimum Flow	50 cfs	1.4 m^3/s	All periods	In place in AOP79.
	Minimum Content	112.5 ksfd	275.2 hm^3	May - Aug	
		2128.0 ft	648.6 m	Flood control may override these minimum contents.	2-1-00 PNCA submittal
Post Falls (1340)	Minimum Flow	50 cfs	1.4 m^3/s	All periods	In place in AOP79, AOP80, AOP84.
Other Major Step I Projects					
Libby (1760)	Minimum Flow	4000 cfs	113.3 m^3/s	All periods	
	Other Spill	200 cfs	5.7 m^3/s	All periods	

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Minimum Content

By contract year: Aug-Jul i.e., 1929 = Aug 1928 - Jul 1929

776.9 ksfd	1900.7 hm^3	1929 Dec	2-1-93 PNCA submittal, in plac in AOP99.
2363.0 ft	720.24 m		
676.5 ksfd	1655.1 hm^3	1929 Jan	
2355.0 ft	717.80 m		
603.6 ksfd	1476.8 hm^3	1929 Feb	
2349.0 ft	715.98 m		
2147.7 ksfd	5254.5 hm^3	1929 Jul	
2443.0 ft	744.63 m		
652.0 ksfd	1595.2 hm^3	1930 Dec	
2353.0 ft	717.19 m		
433.2 ksfd	1059.9 hm^3	1930 Jan	
2334.0 ft	711.40 m		
389.3 ksfd	952.5 hm^3	1930 Feb	
2330.0 ft	710.18 m		
348.5 ksfd	852.6 hm^3	1930 Mar	
2326.0 ft	708.96 m		
297.4 ksfd	727.6 hm^3	1930 Apr 15	
2321.0 ft	707.44 m		
444.2 ksfd	1086.8 hm^3	1930 Apr 30	
2335.0 ft	711.71 m		
499.1 ksfd	1221.1 hm^3	1930 May	
2340.0 ft	713.23 m		
1344.6 ksfd	3289.7 hm^3	1930 Jun	
2402.0 ft	732.13 m		
1771.9 ksfd	4335.1 hm^3	1930 Jul	
2425.0 ft	739.14 m		
317.8 ksfd	777.5 hm^3	1931 Dec	
2323.0 ft	708.05 m		
192.2 ksfd	470.2 hm^3	1931 Jan	
2310.0 ft	704.09 m		
103.1 ksfd	252.2 hm^3	1931 Feb-Apr 30	
2300.0 ft	701.04 m		
192.2 ksfd	470.2 hm^3	1931 May	
2310.0 ft	704.09 m		
676.5 ksfd	1655.1 hm^3	1931 Jun	
2355.0 ft	717.80 m		
868.0 ksfd	2123.6 hm^3	1931 Jul	
2370.0 ft	722.38 m		
174.4 ksfd	426.7 hm^3	1932 Dec	
2308.0 ft	703.48 m		
103.1 ksfd	252.2 hm^3	1932 Jan	
2300.0 ft	701.04 m		
0.0 ksfd	0.0 hm^3	Empty at end of CP***	
2287.0 ft	697.08 m		
776.9 ksfd	1900.7 hm^3	All Dec	
2363.0 ft	720.24 m		
	0.0 hm^3		
373.1 ksfd	152.5 hm^3	July 1930 - No more than this amount lower than July 1929.	2-1-94 PNCA submittal, in place in AOP00 and AOP01.
857.1 ksfd	350.3 hm^3	July 1931 - No more than this amount lower than July 1930.	

March - Implement PNCA 6(c)2(c).

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	Max Summer Draft	5.0 ft	1.52 m		
	Other			Operate to meet IJC orders for Corra Linn.	CRTOC agreement on procedures to implement 1938 IJC order.
Dworshak (535)	Minimum Flow	1500 cfs	42.5 m^3/s	All periods	2-1-10 PNCA submittal through powerhouse
	Maximum Flow	14000 cfs	396.4 m^3/s	All periods (model includes maximum 14000 cfs for all periods, but URC may override.)	2-11-02 PNCA submittal
		25000 cfs	707.9 m^3/s	Up to 25 kcfs for flood control all periods.	
	Minimum Content	395.8 ksfd	968.4 hm^3	SMIN Apr - Aug 31	
	Start 3 yr CP at:	395.8 ksfd	968.4 hm^3	Aug 15	
	End 3 yr CP at:	218.4 ksfd	534.3 hm^3	Feb	
	Other	Run on minimum flow or flood control observing maximum & minimum flow requirements Oct-May and meets target operation Jun-Sep to obtain uniform ouflows Jul-Aug			2-1-05 PNCA submittal
	Target Operation:				
		782.6 ksfd	1914.7 hm^3	Jul	2-1-10 PNCA submittal (2011)
		1573.6 ft	479.63 m		
		658.5 ksfd	1611.1 hm^3	Aug 15	for Jul-Aug 15 and Sep based use 70 yr Median .
		1557.6 ft	474.76 m		
		497 ksfd	1215.9 hm^3	Aug 31	
		1535 ft	467.87 m		
		390.7 ksfd	955.88 hm^3	Sep	
		1519.2 ft	463.05 m		
		1016 ksfd	2485.7 hm^3	Jun	
		1600 ft	487.68 m		
	Other Spill	100 cfs	2.8 m^3/s	All periods	
Lower Granite (520)	Bypass Date			None	
	Other Spill	450 cfs	12.7 m^3/s	Jul	2-1-09 PNCA submittal
		510 cfs	14.4 m^3/s	15-Aug	
		470 cfs	13.3 m^3/s	30-Aug	
		480 cfs	13.6 m^3/s	Sep	
		530 cfs	15.0 m^3/s	Oct	
		410 cfs	11.6 m^3/s	Nov	
		340 cfs	9.6 m^3/s	Dec	
		100 cfs	2.8 m^3/s	Jan	
		130 cfs	3.7 m^3/s	Feb	
		230 cfs	6.5 m^3/s	Mar	
		420 cfs	11.9 m^3/s	15-Apr	
		440 cfs	12.5 m^3/s	Apr 30 - May	
		460 cfs	13.0 m^3/s	Jun	
	Incremental Spill			Removed	
	Fish Spill				
		17333 cfs	490.8 m^3/s	Apr 15 [20 kcfs for 13 days]	2-1-10 PNCA submittal
		20000 cfs	566.3 m^3/s	Apr 30 [20 kcfs]	2-1-10 PNCA submittal
		10968 cfs	310.6 m^3/s	May spill 1 - 6 and 21 - 31 at 20000	2-1-10 PNCA submittal
		18000 cfs	509.7 m^3/s	Jun - Aug 15	

Appendix A
Project Operating Procedures for the 2015-16
Assured Operating Plan and Determination of Downstream Power Benefits

Definition of split months: Apr=Apr.1-30, Apr.15=Apr.1-Apr.15, Apr30=Apr.15-Apr.30; Aug=Aug.1-31, Aug.15=Aug.1-15, Aug.31=Aug.16-31.

	Maximum Fish Spill	20000 cfs	566.3 m^3/s	Apr 15 - May	
		18000 cfs	509.7 m^3/s	Jun - Aug 15	
	Minimum Flow	11500 cfs	325.6 m^3/s	All periods	
	Other	224.9 ksfd	550.2 hm^3	On MOP Apr - Oct 31.	
		733 ft	223.42 m	On MOP Apr - Oct 31.	
		245.8 ksfd	601.4 hm^3	On full pool Nov 30 - Mar 31.	
		738 ft	224.94 m	On full pool Nov 30 - Mar 31.	
Little Goose (518)	Bypass Date			None	
	Other Spill	590 cfs	16.7 m^3/s	Jul	2-1-09 PNCA submittal
		620 cfs	17.6 m^3/s	15-Aug	
		500 cfs	14.2 m^3/s	30-Aug	
		750 cfs	21.2 m^3/s	Sep	
		640 cfs	18.1 m^3/s	Oct	
		500 cfs	14.2 m^3/s	Nov	
		460 cfs	13.0 m^3/s	Dec	
		120 cfs	3.4 m^3/s	Jan	
		240 cfs	6.8 m^3/s	Feb	
		380 cfs	10.8 m^3/s	Mar	
		530 cfs	15.0 m^3/s	15-Apr	
		580 cfs	16.4 m^3/s	Apr 30 - May	
		660 cfs	18.7 m^3/s	May	
		590 cfs	16.7 m^3/s	Jun	
	Incremental Spill			Removed	
	Fish Spill (% of outflow)	22%		Apr 15 [30%*11/15]	2-1-09 PNCA submittal
		30%		Apr 30	2010 data submittial
		16%		May spill 30% May 1 - 6 and May 21 - 31	2010 data submittial
		30%		Jun - Aug 15	
	Maximum Fish Spill	30000 cfs	849.5 m^3/s	Apr 15 - Apr 31	
		28000 cfs	792.9 m^3/s	May	
		30000 cfs	849.5 m^3/s	Jun	
		28000 cfs	792.9 m^3/s	Jul - Aug 15	
	Minimum Flow	11500 cfs	325.6 m^3/s	All periods	
	Other	260.5 ksfd	106.5 hm^3	On MOP Apr - Aug 31.	
		633 ft	192.94 m		
		285.0 ksfd	697.3 hm^3	On full pool Sep 30 - Mar 31.	
		638 ft	194.46 m		
Lower Monumental (504)	Bypass Date			A bypass date of 2010 was assumed.	
	Other Spill	790 cfs	22.4 m^3/s	Jul	2-1-09 PNCA submittal
		860 cfs	24.4 m^3/s	15-Aug	
		770 cfs	21.8 m^3/s	30-Aug	
		780 cfs	22.1 m^3/s	Sep	
		840 cfs	23.8 m^3/s	Oct	
		750 cfs	21.2 m^3/s	Nov	
		720 cfs	20.4 m^3/s	Dec	
		450 cfs	12.7 m^3/s	Jan	
		410 cfs	11.6 m^3/s	Feb	
		560 cfs	15.9 m^3/s	Mar	
		770 cfs	21.8 m^3/s	15-Apr	
		780 cfs	22.1 m^3/s	Apr 30 - May	
		840 cfs	23.8 m^3/s	May	
		780 cfs	22.1 m^3/s	Jun	
	Fish Spill	15600 cfs	441.7 m^3/s	Apr 15 [26000*(9/15)]	2-1-09 PNCA submittal
		25000 cfs	707.9 m^3/s	Apr 31	
		12065 cfs	341.6 m^3/s	May spill 22000 May 1 - 6 and May 21 - 31	2010 data submittial
		17000 cfs	481.4 m^3/s	Jun - Aug 15	

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Definition of split months: Apr=Apr.1-30, Apr.15=Apr.1-Apr.15, Apr30=Apr.15-Apr.30; Aug=Aug.1-31, Aug.15=Aug.1-15, Aug.31=Aug.16-31.

	Maximum Fish Spill	26000 cfs	736.2 m^3/s	Apr 15	
		25000 cfs	707.9 m^3/s	Apr 30	
		22000 cfs	623.0 m^3/s	May	
		17000 cfs	481.4 m^3/s	Jun - Aug 15	
	Minimum Flow	11500 cfs	325.6 m^3/s	All period	
	Other	180.5 ksfd	441.6 hm^3	On MOP Apr - Aug 31.	
		537 ft	163.68 m		
		190.1 ksfd	465.1 hm^3	On full pool Sep 30 - Mar 31.	
		540 ft	164.59 m		
Cushman (2206)	Other Spill	240 cfs	6.8 m^3/s	All periods	2-1-09 PNCA submittal
LaGrande (2188)	Other Spill	30 cfs	0.8 m^3/s	All periods	
White River (2160)	Other Spill	130 cfs	3.7 m^3/s	All periods	
Lower Baker (2025)	Max Storage Limits	67.0 ksfd	163.9 hm^3	Jul - Aug 31	2-1-05 PNCA submittal
		442.4 ft	134.84 m		
		40.1 ksfd	98.1 hm^3	Sep	
		415.9 ft	126.77 m		
		34.7 ksfd	84.9 hm^3	Oct - Dec	
		409.8 ft	124.91 m		
		45.2 ksfd	110.6 hm^3	Jan - Mar	
		421.4 ft	128.44 m		
		46.7 ksfd	114.3 hm^3	Apr 15	
		423.0 ft	128.93 m		
		67.0 ksfd	163.9 hm^3	Apr 30 - Jun	
		442.4 ft	134.84 m		
	Min Storage Limit	11.2 ksfd	27.4 hm^3	All periods	
		378.8 ft	115.46 m		
Upper Baker (2028)	Max Storage Limits	107.4 ksfd	262.8 hm^3	Jul - Sep	2-1-05 PNCA submittal
		727.8 ft	221.83 m		
		82.3 ksfd	201.4 hm^3	Oct	
		717.0 ft	218.54 m		
		70.9 ksfd	173.5 hm^3	Nov - Feb	
		711.7 ft	216.93 m		
		107.4 ksfd	262.8 hm^3	Mar - Jun	
		727.8 ft	221.83 m		
	Min Storage Limits	69.3 ksfd	169.5 hm^3	Jul - Aug 31	
		710.8 ft	216.65 m		
		65.6 ksfd	160.5 hm^3	Sep - Oct	
		708.8 ft	216.04 m		
		16.6 ksfd	40.6 hm^3	Nov - Mar	
		677.8 ft	206.59 m		
		38.0 ksfd	93.0 hm^3	Apr 15 - Apr 30	
		693.8 ft	211.47 m		
		69.3 ksfd	169.5 hm^3	May - Jun	
		710.8 ft	216.65 m		

Appendix A
Project Operating Procedures for the 2015-16
Assured Operating Plan and Determination of Downstream Power Benefits

Definition of split months: Apr=Apr.1-30 , Apr.15=Apr.1-Apr.15, Apr30=Apr.15-Apr.30; Aug=Aug.1-31, Aug.15=Aug.1-15, Aug.31=Aug.16-31.

Timothy (117)	Minimum Content	24.5 ksfd 3180.0 ft	59.9 hm^3 969.26 m	Oct - May	3-6-01 PNCA submittal
		31.1 ksfd 3190.0 ft	76.1 hm^3 972.31 m	Jun - Aug 31	
		27.8 ksfd 3185.0 ft	68.0 hm^3 970.79 m	Sep	
Long Lake (1305)	Minimum Content	50.1 ksfd 1535.0 ft	122.6 hm^3 467.87 m	Apr - Nov	2-5-02 PNCA submittal
		19.7 ksfd 1522.0 ft	48.2 hm^3 463.9 m	Dec - Mar	
	Draft Rate Limit	1.0 ft/day	0.30 m/day		2-1-03 PNCA submittal
Priest Lake (1470)	Maximum Content	0.0 ksfd 0.0 ft	0.0 hm^3 0.00 m	Oct	2-1-03 PNCA submittal
	Max/Min Content	35.5 ksfd 3.0 ft	86.9 hm^3 0.91 m	Maintain at or near after runoff through Sep.	
Ross (2070)	Minimum Content/			Dependent on Skagit Fisheries.	2-1-06 PNCA submittal
		Fixed ARCs and VRCs			2-1-10 PNCA submittal
Gorge (2065)	Minimum Flow			Settlement; monthly data, varies by water year.	2-1-06 PNCA submittal

COLUMBIA RIVER TREATY
DETERMINATION OF DOWNSTREAM POWER BENEFITS

FOR THE ASSURED OPERATING PLAN
FOR OPERATING YEAR 2015-16

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DETERMINATION OF DOWNSTREAM POWER BENEFITS (DDPB) FOR THE ASSURED OPERATING PLAN FOR OPERATING YEAR 2015-16

September 2011

1. Introduction

The "Treaty between Canada and The United States of America relating to Cooperative Development of The Water Resources of The Columbia River Basin" (Treaty), dated 17 January 1961, requires that downstream power benefits from the operation of the Treaty storage in Canada (Canadian Treaty Storage) to be determined in advance by the two Entities created by the Treaty. The purpose of this document is to describe the results of the Determination of Downstream Power Benefits for operating year 2015-16 (DDPB16).

2. Procedures

The procedures followed in the benefit studies are those provided in Article VII; Annex A, paragraph 7, and Annex B of the Treaty; in paragraphs VIII, IX, and X of the "Protocol - Annex to Exchange of Notes, Dated January 22, 1964 Between the Governments of Canada And the United States Regarding the Columbia River Treaty" (Protocol), and in the following Entity agreements:

- The Entity agreements, signed 28 July and 12 August 1988, on "Principles for the Preparation of the AOP and Determination of Downstream Power Benefit (DDPB) Studies" and "Changes to Procedures for the Preparation of the AOP and DDPB Studies" (1988 Entity Agreements);

- The "Columbia River Treaty Entity Agreement on Resolving the Dispute on Critical Period Determination, the Capacity Entitlement for the 1998-99, 1999-00, and 2000-01 AOP/DDPBs, and Operating Procedures for the 2001-02 and Future AOPs," signed 29 August 1996 (1996 Entity Agreement); and

- Except for the changes noted below, the "Columbia River Treaty Entity Agreement on the Principles and Procedures for Preparing and Implementing Hydroelectric Operating Plans For Operation of Canadian Treaty Storage" (POP), dated October 2003 and signed 16 December 2003, including the November 2003 update to Appendix 1 - Refill Curves, the November 2004 additions of Appendix 6 - Streamline Procedures, and Appendix 7 - Table of Median Stream flows, and the September 2007 addition of Appendix 8 concerning Water Supply Forecasts.

Special terms used in this document, but not defined herein, have the meanings defined in the Treaty, Protocol, or the above Entity agreements. The POP is based on criteria contained in Annex A and Annex B of the Treaty, the Protocol, and the "Columbia River

Treaty Flood Control Operating Plan" (FCOP) dated May 2003. For this DDPB, the Entities have agreed to use only the first of the three streamline methods defined in Appendix 6 of the POP, which is "Forecasting Loads and Resources," for determining the thermal installations, and is described in Subsection 7(d) of the AOP16.

In addition to the changes discussed in Subsection 2(a) of the AOP16 document, the Entities have agreed to modify the DDPB16 Table 2 calculation of Thermal Displacement Market (TDM), as was done in the DDPB15, to use thermal imports (e.g. market purchases of power from California, but not Canadian Entitlement (CE) or Skagit Treaty power) to support exports (not including CE, plant sales, flow-through-transfers (FTT), seasonal exchanges (SE) or excess extra-regional thermal installations), on an annual basis, as either FTTs or SEs.

The Canadian Entitlement Benefits were computed from the following studies:

Step I -- Operation of the total USA Columbia Basin hydro and thermal system, with 19.12 cubic kilometers[1] (km^3) (15.5 million acre-feet (Maf)) of Canadian Treaty Storage operated for flood control and optimum power generation in both countries including coordination with other generation in Canada and the USA;

Step II -- Operation of the Step I thermal system, the base hydro system, and 19.12 km^3 (15.5 Maf) of Canadian Treaty Storage operated for flood control and optimum power generation in both countries; and

Step III -- Operation of the Step I thermal system and the base hydro system operated for flood control and optimum power generation in the United States.

As part of the DDPB, separate determinations may be carried out relating to the limit of year-to-year reduction in benefits attributable to the operation of Canadian Treaty Storage in operating plans designed to achieve optimum power generation at-site in Canada and downstream in Canada and the USA (Joint Optimum). However, as indicated in Section 4 below, the calculations were not needed for the 2015-16 operating year.

3. Results of Canadian Entitlement Computations

The Canadian Entitlement to the downstream power benefits in the USA attributable to operation in accordance with Treaty Annex A, paragraph 7, for optimum power generation in Canada and the USA, which is one-half the total downstream power benefits, was determined to be (see Joint Optimum results in Table 5):

Dependable Capacity	= 1332.3 megawatts (MW)
Average Annual Usable Energy	= 488.7 average annual MW

All downstream power benefit computations are rounded to the nearest tenth of a MW.

4. Computation of Maximum Allowable Reduction in Downstream Power Benefits

Treaty Annex A, paragraph 7, states in part that:

> *". . . Any reduction in the downstream power benefits in the United States of America resulting from that change in operation of the Canadian storage shall not exceed in any one year the reduction in downstream power benefits in the United States of America which would result from reducing by 500,000 acre-feet the Canadian storage operated to achieve optimum power generation in the United States of America and shall not exceed at any time during the period of the Treaty the reduction in downstream power benefits in the United States of America which would result from similarly reducing the Canadian storage by 3,000,000 acre-feet."*

Step II studies based on the assumption of optimum power generation in Canada and the USA resulted in a 3.7 average annual megawatt (aMW) increase in the Energy Entitlement and a 1.2 MW increase in the Capacity Entitlement, when compared to the Step II study based on optimum power generation only in the USA (see Table 5, columns A and B). Since there was no reduction in the downstream power benefits for the Joint Optimum study, the computation of the maximum allowable reduction in downstream power benefits, as defined in Section 3.3.A(3) of the POP, was not necessary.

5. Delivery of the Canadian Entitlement

See Section 6 of the AOP16.

6. Summary of Information Used for Canadian Entitlement Computations

The following tables and chart summarize the study results:

Table 1A Determination of Step I Firm Energy Hydro Loads
and
Table 1B Determination of Step I Firm Peak Hydro Loads

These tables show the loads and resources used in the Step I studies and the computation of the coordinated hydro load for the Step I hydroregulation study. These tables follow the definition of Step I loads and resources defined by Treaty Annex B, paragraph 7, and clarified by the 1988 Entity Agreements. Table 1A shows the Step I energy loads and resources while Table 1B shows the Step I peak loads and resources.

Table 2 Determination of Thermal Displacement Market

This table shows the computation of the TDM for the downstream power benefit determination of average annual usable energy. The TDM is the thermal installations shown in Table 1A with subsequent reductions for

estimated minimum thermal generation and system sales. System sales are all exports except for Canadian Entitlement, plant sales, seasonal exchanges, and flow-through-transfers, as defined in POP and modified in Section 2 of this DDPB.

Table 3 Determination of Loads for Step II and Step III Studies

This table shows the computation of the Step II and III loads. The monthly loads for Steps II and III studies have the same ratios between each month and the annual average as the PNWA load (to maintain the same annual load shape). The PNWA firm loads were based on the Bonneville Power Administration (BPA) Draft 2010 White Book (WB10) load forecast as described in Subsection 7(a) of the AOP16. The Grand Coulee pumping load is included in this estimate. The method for computing the firm load for the Steps II and III studies is described in the 1988 Entity Agreements and in the POP.

Table 4 Summary of Steps I, II, and III Power Regulations

This table summarizes the results of the Steps I, II, and III power regulation studies for each project and the total system. The determination of the Steps I, II, and III loads and thermal installations is shown in Tables 1 to 3.

Hydro maintenance, transmission losses and peaking reserves (for capacity balance) are summed together in the Step I load-resource balance as a resource adjustment. The Steps II and III capacity balance includes the hydro maintenance and the peaking reserves based on the same percentage as the Step I system.

The firm energy load carrying capability for the Steps I, II, and III Systems is based on the same critical periods as recent studies. The firm peak load carrying capability for each system is based on the period with the least surplus firm peak capability over the thirty water years. For the AOP/DDPB16, these periods are February 1932, February 1932, and February 1931 for the Steps I, II and III systems, respectively.

Table 5 Computation of Canadian Entitlement

A. Joint Optimum Generation in Canada and the USA
B. Optimum Generation in the USA Only
C. Optimum Generation in the USA and a 0.62 km^3 (0.5 Maf) Reduction in Total Canadian Treaty Storage.

The essential elements used in the computation of the Canadian Entitlement arising from the downstream power benefits under the Joint Optimum and USA Optimum are shown under Columns A and B respectively. The elements for the computation of maximum allowable reduction in downstream power benefits are shown in column C.

Table 6 Comparison of Recent DDPB Studies

Chart 1 Duration Curves of 30 Years Monthly Hydro Generation

This chart shows duration curves of the hydro generation in aMW from the USA Optimum Steps II and III system regulation studies[2] which graphically illustrate the change in average annual usable hydro energy. Usable hydro energy consists of firm energy plus usable nonfirm energy. Firm energy is the firm hydro loads shown in Table 5, and nonfirm energy is the monthly hydro energy capability in excess of the firm hydro loads. The usable nonfirm energy is computed in accordance with Annex B, paragraphs 3(b) and 3(c), as the portion of nonfirm energy that can be used to displace thermal installations designated to meet PNWA firm loads, plus the remaining usable energy. The Entities agree that remaining usable energy is computed on the basis of 40 % of the nonfirm energy remaining after thermal displacement.

7. Summary of Changes Compared to the 2014-15 DDPB and Notable Assumptions

Data from recent DDPBs are summarized in Table 6. The following is an explanation of changes and notable assumptions that impact computation of the Entitlement compared to the 2014-15 DDPB (DDPB15) studies.

a) Steps II and III Firm Loads

The Steps II and III hydro firm loads shown on Table 3 are noticeably different from the DDPB15. For DDPB16, loads are substantially higher in the fall months and lower in most spring months, as shown in the table below. This is mainly due to the change in PNWA load shape and thermal maintenance schedules, which are explained in Subsection 7(b).

Differences between DDPB16 and DDPB15 Table 3 Hydro Loads

	Aug15	*Aug31*	*Sept*	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*	*Mar*	*Apr15*	*Apr30*	*May*	*June*	*July*	*Avg*	*CPavg*
DDPB16 S2	8129	8043	6934	6970	8968	10630	10740	9640	8900	8442	8973	10033	8861	9039	8962	8952
DDPB15 S2	7940	7801	6666	6902	8861	10491	10782	9937	9270	8138	8721	10343	8936	9047	8961	8945
Difference	189	242	268	68	107	139	-42	-297	-371	305	252	-310	-75	-8	0	7
DDPB16 S3	5640	5559	4598	4629	6355	7783	7884	6934	6379	6049	6574	7701	6424	6459	6424	6982
DDPB15 S3	5343	5207	4224	4453	6125	7522	7779	7051	6618	5631	6208	7898	6380	6349	6300	6899
Difference	296	352	374	176	230	261	104	-118	-240	418	367	-197	44	110	124	83

The average critical period load factor decreased slightly from 74.76% in AOP15 (Draft WB09) to 73.93% in AOP16 (Draft WB10).

b) Thermal Installations

The total thermal installation energy capability shown in Tables 1 to 3 decreased by 538.4 annual aMW compared to the DDPB15. This is due mainly to a 535.5 aMW decrease in the PNWA firm load, an 87 aMW increase in the net exports and imports, a 113 aMW increase in the Step I renewable resources (mostly wind), and changes in the thermal maintenance schedules.

Beginning with AOP06, Columbia Generating Station changed from an annual maintenance cycle to a 24 month cycle. This created a circumstance where this maintenance was included only in alternate years of the AOP with a resulting effect of swings in Energy Entitlement. Beginning with AOP/DDPB14 and continuing with this AOP/DDPB, the Entities have agreed to use the average of the two year maintenance schedule, thereby eliminating the year to year Energy Entitlement variability and reducing the effect on the AOP storage operations.

In addition, the thermal installation shape has changed due to the agreed upon procedure described in Section 7(d) of the AOP16 and more significantly, due to changes in thermal maintenance schedules (mostly coal but also combustion turbines and co-generation).

The TDM decreased by 597 annual aMW, due to a combination of the changes in thermal installations and system sales. Both the thermal installation and TDM changes are shown in the following table.

DDPB16 minus DDPB15 Table 2 Thermal Installations and Thermal Displacement Market

	Aug1	*Aug2*	*Sept*	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*	*Mar*	*15-Apr*	*30-Apr*	*May*	*June*	*July*	*Avg.*	*CPavg*
DDPB16 T.I.	10055	10106	10129	10135	10122	10170	10126	10130	9516	9040	8550	7007	8945	9813	*9579*	*9662*
DDPB15 T.I.	10675	10798	10841	10658	10754	10796	10745	10752	9744	9833	9297	7191	9388	10299	*10117*	*10216*
Difference	-620	-692	-711	-522	-632	-626	-619	-622	-228	-793	-747	-184	-442	-485	*-538*	*-553*
TDM 16	9578	9627	9650	9656	9643	9689	9647	9651	9052	8588	8110	6599	8483	9339	*9111*	*9193*
TDM 15	10255	10374	10416	10237	10331	10372	10323	10330	9346	9433	8911	6850	8986	9884	*9709*	*9805*
Difference	-677	-747	-766	-581	-689	-683	-676	-679	-294	-846	-801	-252	-503	-545	*-597*	*-612*

c) Hydro Project Modified Stream Flows

The base unregulated stream flows used in the Steps II and III System Regulation Studies are the same as the Step I studies (see Subsection 7(e) of AOP16), except for adjustments to add the effect of natural lake regulation and remove reservoir evaporation at projects not included in Steps II or III.

d) Hydro Project Rule Curves

The critical rule curves and refill curves were updated in accordance with procedures defined in POP, except for the changes described in Subsection 7(f) of the AOP16. The Mica/Arrow operating criteria for the Step I study is also used in the Step II study.

e) Other Hydro Project Operating Procedures, Constraints, and Plant Data

Changes to operating procedures, constraints, and plant data are described in Subsection 7(g) of the AOP16.

f) Steps II and III Critical Period and 30-year System Regulation Studies

The Entities conducted a full set of Step II (-42, -12, and -22) and Step III (-13) critical period and 30-year System Regulation Studies for the 2015-16 operating year in accordance with procedures described in Section 3.3 of the POP. The System Regulation studies used version 28 of the HYDSIM model. The critical period studies establish the length of the critical stream flow period, the hydro firm load carrying capability, and critical rule curves.

The Step II and Step III critical stream flow periods were unchanged from the DDPB15 studies. The Step II critical period comprised the 20 calendar-months from 1 September 1943 through 30 April 1945, and the Step III critical period consisted of the 5.5 calendar-months from 1 November 1936 through 15 April 1937. The Step II critical period generation, compared to DDPB15, increased by 6.6 aMW, and the average annual firm energy increased by 0.3 MW. The Step III critical period generation increased by 83.0 aMW, due to increased hydro load during most months of the critical period, and slightly decreased hydro load during February and March. The average annual firm energy increased by 123.6 aMW, again caused by the increase in hydro loads during most months.

The Step II 30-year average generation, compared to DDPB15, increased by 6 aMW, and the Step III 30-year average generation increased by 13 aMW, both due mainly to changes in storage operations caused by changes in the hydro load shape.

g) Downstream Power Benefits

The Canadian Capacity Entitlement decreases from 1368.6 MW in the DDPB15 to 1332.3 MW in the DDPB16, a decrease of 36.3 MW. This is mainly due to the smaller increase (6.6 aMW) in the Step II critical period generation relative to the larger increase (83.0 aMW) in the Step III critical period generation, making the Step II minus Step III difference much smaller. This is caused by changes in the Step II and Step III hydro load shape arising from changes in the PNWA load shape and the seasonal shape of thermal generation.

The Canadian Energy Entitlement increases from 479.9 annual aMW in the DDPB15 to 488.7 annual aMW in the DDPB16, an increase of 8.8 annual aMW. This increase is caused mainly by the reduction in thermal resources due to decreased firm load, which decreases the Step II Usable Energy by 22.8 aMW, and also decreases the Step III usable energy by 40.5 aMW, making the Step II minus Step III difference larger.

End Notes:

[1] The Treaty defines the Canadian Treaty Storage in English units. The metric conversion is a rounded approximation.

[2] The Step II DDPB16-42 30 year system regulation study dated 7 July 2011 and the Step III DDPB16-13 30-year system regulation study dated 29 April 2011 were used to determine the critical period and 30-year system generation.

TABLE 1A
DETERMINATION OF STEP I FIRM ENERGY HYDRO LOADS
FOR 2015-16 ASSURED OPERATING PLAN
(Average MW)

	Aug15	Aug31	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr15	Apr30	May	Jun	Jul	Ann. Avg.	CP Avg. 1/
1. Pacific Northwest Area (PNWA) Firm Load																
a) White Book Regional Firm Load 2/	22501	22501	21118	21182	23587	25714	25819	24528	22760	21627	21627	21108	22112	23417	22957	23047
b) Exclude 99% of UPL's Idaho load 3/	-487	-487	-452	-452	-451	-485	-455	-485	-438	-414	-414	-463	-536	-593	-476	-474
c) Update Coulee pumping 4/	32	-11	22	8	8	-13	-66	-74	5	-18	32	14	13	33	-2	-5
d) …Total PNWA Firm Loads	**22046**	**22003**	**20688**	**20738**	**23144**	**25217**	**25298**	**23969**	**22327**	**21195**	**21245**	**20659**	**21589**	**22857**	**22478**	**22568**
e) Annual Load Shape in Percent	98.1	97.9	92.0	92.3	103.0	112.2	112.5	106.6	99.3	94.3	94.5	91.9	96.0	101.7	100.0	100.4
2. Flows-Out of firm power from PNWA																
a) White Book Exports, incl firm sp 5/	1324	1348	1302	1084	1045	1034	1022	1019	1159	1126	1141	1032	1286	1349	1150	1144
b) Remove WB Canadian Entitlement	-497	-497	-497	-497	-497	-497	-497	-497	-497	-497	-497	-497	-497	-497	-497	-497
c) Add est. Can. Entitle. Exported 6/	499	499	499	499	499	499	499	499	499	499	499	499	499	499	499	499
d) Added export for WB surplus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
e) Added SeEx for WB Surplus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
f) Added SeEx for AOP Hydro 7/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
g) Imp. Thermal used out of region 8/	256	274	291	208	138	61	54	78	62	80	83	149	252	248	157	156
h) …Subtotal for Table 2	1582	1624	1595	1293	1185	1097	1078	1098	1222	1208	1226	1182	1539	1599	1309	1302
i) Remove Plant Sales	-406	-422	-411	-403	-402	-386	-382	-376	-497	-424	-433	-340	-492	-474	-417	-414
j) Remove Flow-through-transfer	-75	-75	-75	-45	-45	-45	-45	-45	-45	-75	-75	-75	-75	-75	-60	-59
k) …Total	**1101**	**1127**	**1109**	**845**	**738**	**666**	**650**	**677**	**680**	**708**	**717**	**768**	**972**	**1051**	**832**	**829**
3. Flows-In of firm power to PNWA, except from coordinated thermal installations																
a) White Book Imports 9/	-824	-810	-755	-814	-1095	-1268	-1181	-1149	-1000	-905	-851	-758	-856	-932	-958	-968
b) Remove UP&L imports for 1(b)	498	498	463	463	462	496	465	480	448	423	423	474	549	607	486	484
c) Remove Eastern Thermal Instal 10/	221	205	190	273	342	422	426	403	386	343	314	181	193	223	298	303
d) Added SeEx for WB Surplus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
e) Added Can.Import for WB deficits 11/	0	-499	-415	0	0	-499	-499	-499	-499	0	0	0	0	-499	-264	-274
f) Added Calif.Import for WB deficits12/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
g) Added Seas.Exch. for Aop hydro 7/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
h) Remove Flow-Through-Xfers	75	75	75	45	45	45	45	45	45	75	75	75	75	75	60	59
i) …Total	**-30**	**-530**	**-442**	**-32**	**-246**	**-804**	**-743**	**-721**	**-620**	**-64**	**-39**	**-29**	**-39**	**-526**	**-379**	**-396**
4. PNWA Non-Step I Hydro and Non-Thermal Resources																
a) Hydro Independents (1929 water)	-1011	-1003	-989	-1040	-1122	-1060	-1020	-851	-966	-1145	-1162	-1438	-1348	-1117	-1093	-970
b) Non-Step I Coordinated Hydro(1929)	-512	-459	-552	-940	-912	-957	-1273	-673	-714	-718	-684	-634	-1086	-659	-799	-812
c) WB Regional Hydro NUGs	-304	-303	-224	-146	-113	-106	-97	-102	-134	-262	-263	-385	-417	-401	-225	-213
d) WB Renewable NUGs	-46	-46	-46	-46	-54	-54	-54	-54	-54	-54	-46	-46	-46	-46	-50	-50
e) WB Renewables	-1011	-870	-763	-746	-745	-669	-700	-602	-1098	-1064	-923	-975	-1118	-910	-856	-835
f) …Total (1929)	**-2884**	**-2681**	**-2574**	**-2917**	**-2946**	**-2846**	**-3144**	**-2282**	**-2965**	**-3243**	**-3079**	**-3479**	**-4016**	**-3133**	**-3022**	**-2880**
5. Step I System Load (1929) 13/	**20233**	**19919**	**18781**	**18634**	**20691**	**22233**	**22061**	**21644**	**19422**	**18596**	**18844**	**17919**	**18506**	**20249**	**19909**	**20121**
6. Coordinated Thermal Installations 14/																
a) Columbia Generation Station (CGS)	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	764	515	897	954	965
b) Generic Thermal Installations	9025	9076	9099	9105	9092	9140	9096	9100	8486	8010	7520	6243	8430	8916	8625	8697
c) ...Total	**10055**	**10106**	**10129**	**10135**	**10122**	**10170**	**10126**	**10130**	**9516**	**9040**	**8550**	**7007**	**8945**	**9813**	**9579**	**9662**
7. Step I Hydro Resources (1929) 15/	**10855**	**10484**	**9270**	**9111**	**11241**	**12787**	**12660**	**12203**	**10555**	**10176**	**10916**	**11532**	**10205**	**11153**	**10995**	**11124**
8. Step I Resource Adjustments																
a) Hydro Maintenance	-30	-25	-9	-9	-4	0	0	0	-5	-7	-8	-20	-14	-49	-12	-11
b) Transmission System Losses 16/	-647	-647	-609	-603	-668	-724	-726	-689	-643	-612	-614	-599	-631	-668	-652	-654
9. Total Step I System Resources(1929)	**20233**	**19919**	**18781**	**18634**	**20691**	**22233**	**22061**	**21644**	**19422**	**18596**	**18844**	**17919**	**18506**	**20249**	**19909**	**20121**
10. Coordinated Hydro Load (1929) 17/	**11367**	**10944**	**9822**	**10051**	**12152**	**13744**	**13933**	**12876**	**11269**	**10894**	**11600**	**12166**	**11291**	**11812**	**11794**	**11936**
a) Coord. Hydro Load Shape (1929) 18/	96.4%	92.8%	83.3%	85.2%	103.0%	116.5%	118.1%	109.2%	95.5%	92.4%	98.4%	103.2%	95.7%	100.2%	100.0%	

Notes:

1/ The Step I critical period is the 42.5 months beginning 16 August 1928 and ending 29 February 1932.

2/ BPA Draft 2010 White Book (WB10) total regional firm load estimate on April 21, 2010, which includes estimated Coulee pumping and Idaho loads served by Utah P&L.

3/ Annex B requires exclusion of Idaho load (and corresponding import) from area served by Utah Power Light in 1964.

4/ Although a minor change, Coulee pumping loads were updated to the 2010 PNCA data submittal to be consistent with the pumping flows in the Base Flows.

5/ WB10 exports include Firm Seasonal Exchanges, Flow-Through Transfers, Plant Sales, and an estimate of the Canadian Entitlement.

6/ Assumes 499 MW Energy Entitlement exported to Canada.

7/ Seasonal Exchanges were not employed in this AOP, but line 2. e) was retained for continuity.

8/ Added thermal export to balance difference between thermal import and equivalent thermal installation based on generic annual shape.

9/ White Book Imports include coordinated thermal installations, seasonal & capacity exchanges, flow-through-transfers, and Skagit Treaty power.

10/ Imports identified as coordinated thermal installations are excluded, to be replaced by a portion of the Generic Thermal Installations.

11/ Added Canadian import as a portion of the resources needed to balance WB deficits, based on 53% of estimated 499 aMW of Energy Entitlement .

12/ None needed.

13/ Line 1(d) + line 2(k) + line 3(i) + line 4(f), based on 1929 hydro independent capability.

14/ Thermal installations are CGS, plus a generic thermal installation that is sized to meet the Step 1 System load minus Step I Hydro.

15/ Step I Hydro (US hydro projects at and upstream of Bonneville Dam) critical period capability shaped to 1929 load, line 5 - line 6(c) - line 8(a) - line 8(b).

16/ Transmission losses are 2.72% of all resources including imports.

17/ The Coordinated Hydro Model Load is the Step I Hydro Resources plus Non-Step I Coordinated Hydro, lines 7 - 4(b).

18/ The Coordinated Hydro Model Load Shape shows the net effect of loads and nonhydro resources on the coordinated system hydro resources.

AOP16 Errata in Table 1B, incorrect data in line 2 d)

Table 1B
2015-16 AOP/DDPB
DETERMINATION OF STEP I FIRM PEAK LOADS AND RESOURCES (MW)

Based on **1932** water year which has minimum peak surplus

	Aug15	Aug31	Sept	Oct	Nov	Dec	Jan	Feb	March	Apr15	Apr30	May	June	July
1. Pacific Northwest Area (PNWA) Firm Load														
a) White Book Regional Firm Load	29828	29828	27762	28901	32594	35154	35278	33675	30799	28910	28910	28382	29497	31072
b) Exclude 99% of UPL's Idaho load	-463	-463	-432	-431	-431	-461	-439	-452	-423	-400	-400	-446	-517	-570
c) Adj.for Federal Peak Diversity 1/	-445	-478	-507	-320	-293	-507	-302	-306	-349	-467	-481	-476	-471	-385
d) Updates to Coulee pumping forec.	321	302	293	387	257	337	170	189	325	183	155	257	290	293
e) …Total PNWA Firm Loads	**29240**	**29188**	**27116**	**28537**	**32127**	**34522**	**34707**	**33106**	**30352**	**28226**	**28184**	**27715**	**28799**	**30409**
f) Monthly Load Factors in Percent	75.40	75.39	76.29	72.67	72.04	73.05	72.89	72.40	73.56	75.09	75.38	74.54	74.96	75.16
2. Flows-Out of firm power from PNWA														
a) White Book Exports	2488	2488	2486	2125	1991	1990	1988	1989	1991	2020	2027	1870	2374	2364
b) Remove WB Canadian Entitlement	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350
c) Add estimated Can.Entitle. exported	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367
d) Added export for WB surplus	-3292	-3288	-3284	-3281	-3284	-3287	-3289	-3286	-2609	-2650	-2647	-1984	-3281	-3290
e) Add Seasonal Exch. WB Export	0	0	0	0	0	0	0	0	0	0	0	0	0	0
f) Add Seasonal Exch. Shape Export	0	0	0	0	0	0	0	0	0	0	0	0	0	0
g) Thermal Inst. used outside region 2/	258	258	279	152	117	10	0	77	55	39	15	140	256	249
h) …Subtotal for Table 2	*-529*	*-526*	*-502*	*-988*	*-1159*	*-1270*	*-1284*	*-1203*	*-546*	*-574*	*-587*	*43*	*-634*	*-660*
i) Remove Plant Sales	-563	-563	-563	-563	-555	-552	-552	-552	-555	-555	-563	-419	-563	-563
j) Remove Flow-through-transfer	-75	-75	-75	-45	-45	-45	-45	-45	-45	-75	-75	-75	-75	-75
k) …Total	**-1167**	**-1163**	**-1140**	**-1596**	**-1759**	**-1867**	**-1881**	**-1801**	**-1146**	**-1204**	**-1225**	**-451**	**-1272**	**-1298**
3. Flows-In of firm power to PNWA, except from coordinated thermal installations														
a) White Book Imports	-1073	-1073	-1010	-1113	-1438	-1613	-1625	-1593	-1278	-1171	-1171	-1059	-1130	-1206
b) Remove UP&L imports for	542	542	498	498	505	528	498	511	476	451	451	525	630	666
c) Remove Eastern Thermal Instal	309	309	291	423	462	571	581	503	498	486	486	313	279	319
d) Added SeEx for WB Surplus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
e) Added Can.Import for WB deficits	0	-1367	-1137	0	0	-1367	-1367	-1367	-1367	0	0	0	0	-1367
f) Added Calif.Import for WB deficits	0	0	0	0	0	0	0	0	0	0	0	0	0	0
g) Added Seas.Exch. for Aop hydro	0	0	0	0	0	0	0	0	0	0	0	0	0	0
h) Remove Flow-Through-Xfers	75	75	75	45	45	45	45	45	45	75	75	75	75	75
i) …Total	**-146**	**-1513**	**-1283**	**-147**	**-427**	**-1837**	**-1868**	**-1901**	**-1626**	**-159**	**-159**	**-147**	**-146**	**-1513**
4. PNWA Non-Step I Hydro and Non-thermal Resources														
a) Hydro Independents (1932)	-1569	-1554	-1582	-1342	-1584	-1497	-1568	-1395	-1789	-1775	-1818	-1968	-2005	-1749
b) Non-Step I Coord. Hydro (1932)	-1821	-1980	-2006	-2075	-2142	-2114	-2019	-1867	-1752	-1711	-1811	-2012	-2361	-2440
c) WB Regional Hydro NUGs	-371	-369	-297	-214	-156	-143	-135	-146	-183	-297	-306	-433	-454	-444
d) WB Renewable NUGs	-76	-76	-76	-76	-76	-76	-76	-76	-76	-76	-76	-76	-76	-76
e) WB Renewables	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29
f) …. Total (1932)	**-3866**	**-4008**	**-3990**	**-3737**	**-3987**	**-3860**	**-3828**	**-3513**	**-3829**	**-3888**	**-4040**	**-4519**	**-4925**	**-4738**
5. Step I System Load 3/ (1932)	**24061**	**22503**	**20703**	**23057**	**25953**	**26959**	**27130**	**25891**	**23751**	**22976**	**22760**	**22598**	**22456**	**22860**
6. Coordinated Thermal Installations														
a) Columbia Generating Station (cgs)	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	565	565	1140
b) Generic Thermal Installations	10738	10738	10794	10889	10953	10997	11007	10978	10468	9955	9489	8581	10125	10741
c) ...Total	**11878**	**11878**	**11934**	**12029**	**12093**	**12137**	**12147**	**12118**	**11608**	**11095**	**10629**	**9146**	**10690**	**11881**
7. Step I Hydro Resc. Needed (1932) 4/	**22506**	**20576**	**18515**	**20211**	**22884**	**23089**	**22720**	**21867**	**20309**	**20164**	**20183**	**21421**	**20101**	**20835**
8. Step I Resource Adjustments														
a) Hydro Maintenance 5/	-4595	-4032	-3787	-3208	-2935	-2037	-1561	-2286	-2626	-2751	-2483	-2360	-2202	-3720
b) Transmission System Losses 6/	-1196	-1271	-1273	-1248	-1279	-1344	-1334	-1258	-1195	-1156	-1164	-1172	-1281	-1316
c) Reserves (assume 11%) 7/	-4532	-4648	-4685	-4727	-4811	-4886	-4842	-4550	-4344	-4376	-4405	-4437	-4852	-4819
d) ...Total maint., losses, & reserves	-10323	-9952	-9745	-9183	-9024	-8268	-7737	-8094	-8166	-8283	-8052	-7969	-8334	-9856
e) Hydro maint. as %reg. hydro cap.=	15.3%	13.3%	12.4%	10.5%	9.6%	6.7%	5.3%	8.2%	9.8%	10.0%	8.9%	8.1%	7.2%	12.0%
f) Peak Resv. as % resources	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
9. Required Step I Resources	**24061**	**22503**	**20703**	**23057**	**25953**	**26959**	**27130**	**25891**	**23751**	**22976**	**22760**	**22598**	**22456**	**22860**
10. Coordinated Hydro load and Surplus/Deficit (1932)														
a) Coordinated Hydro Load (1932) 8/	24327	22556	20520	22286	25026	25203	24740	23734	22061	21875	21993	23433	22461	23274
b) Actual Coord. Hydro Gen (1932) 9/	30052	30403	30451	30416	30590	30463	29605	28019	26684	27550	27864	29035	30694	30914
c) ...Surplus/Deficit (1932)	5725	7847	9931	8130	5564	5260	4865	4285	4623	5675	5871	5602	8233	7640

Notes:

1/ Federal peak diversity is a reduction in peak load due to peak loads not all being coincidental.

2/ Export or import to balance difference betw een excluded thermal imports and generic thermal installation.

3/ Total Step I Firm Peak Load is the sum of lines 1(e) + 2(k) + 3(i) + 4(f)

4/ Step I hydro resources needed to meet the load = line 5 - line 6(c) - line 8(d). Actual resource capability is higher. Used 1932 because has low est surplus.

5/ From WB, based on 5-year PNCA average as a MW reduction from installed capacity. May need to revise next year as a reduction from 1937 capability.

6/ Transmission losses are 3.25% of all resources including imports, net of reserves and maintenance.

7/ Reserves are 11% of resources, i.e. 4(f), 6(c), 10(b) - 8(a)

8/ Lines 4b and 7

9/ System Instantaneous Peak (1932)

AOP16 Table 1B – Corrected data in line 2 d)

Table 1B

2015-16 AOP/DDPB

DETERMINATION OF STEP I FIRM PEAK LOADS AND RESOURCES (MW)

Based on **1932** water year which has minimum peak surplus

	Aug15	Aug31	Sept	Oct	Nov	Dec	Jan	Feb	March	Apr15	Apr30	May	June	July
1. Pacific Northwest Area (PNWA) Firm Load														
a) White Book Regional Firm Load	29828	29828	27762	28901	32594	35154	35278	33675	30799	28910	28910	28382	29497	31072
b) Exclude 99% of UPL's Idaho load	-463	-463	-432	-431	-431	-461	-439	-452	-423	-400	-400	-446	-517	-570
c) Adj.for Federal Peak Diversity 1/	-445	-478	-507	-320	-293	-507	-302	-306	-349	-467	-481	-476	-471	-385
d) Updates to Coulee pumping forec.	321	302	293	387	257	337	170	189	325	183	155	257	290	293
e) …Total PNWA Firm Loads	**29240**	**29188**	**27116**	**28537**	**32127**	**34522**	**34707**	**33106**	**30352**	**28226**	**28184**	**27715**	**28799**	**30409**
f) Monthly Load Factors in Percent	75.40	75.39	76.29	72.67	72.04	73.05	72.89	72.40	73.56	75.09	75.38	74.54	74.96	75.16
2. Flows-Out of firm power from PNWA														
a) White Book Exports	2488	2488	2486	2125	1991	1990	1988	1989	1991	2020	2027	1870	2374	2364
b) Remove WB Canadian Entitlement	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350	-1350
c) Add estimated Can.Entitle. exported	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367
d) Added export for WB surplus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
e) Add Seasonal Exch. WB Export	0	0	0	0	0	0	0	0	0	0	0	0	0	0
f) Add Seasonal Exch. Shape Export	0	0	0	0	0	0	0	0	0	0	0	0	0	0
g) Thermal Inst. used outside region 2/	258	258	279	152	117	10	0	77	55	39	15	140	256	249
h) …Subtotal for Table 2	*2763*	*2763*	*2782*	*2293*	*2125*	*2017*	*2005*	*2082*	*2063*	*2076*	*2059*	*2027*	*2647*	*2630*
i) Remove Plant Sales	-563	-563	-563	-563	-555	-552	-552	-552	-555	-555	-563	-419	-563	-563
j) Remove Flow-through-transfer	-75	-75	-75	-45	-45	-45	-45	-45	-45	-75	-75	-75	-75	-75
k) …Total	**2125**	**2125**	**2144**	**1686**	**1525**	**1419**	**1408**	**1485**	**1463**	**1446**	**1422**	**1533**	**2009**	**1992**
3. Flows-In of firm power to PNWA, except from coordinated thermal installations														
a) White Book Imports	-1073	-1073	-1010	-1113	-1438	-1613	-1625	-1593	-1278	-1171	-1171	-1059	-1130	-1206
b) Remove UP&L imports for	542	542	498	498	505	528	498	511	476	451	451	525	630	666
c) Remove Eastern Thermal Instal	309	309	291	423	462	571	581	503	498	486	486	313	279	319
d) Added SeEx for WB Surplus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
e) Added Can.Import for WB deficits	0	-1367	-1367	0	0	-1367	-1367	-1367	-1367	0	0	0	0	-1367
f) Added Calif.Import for WB deficits	0	0	0	0	0	0	0	0	0	0	0	0	0	0
g) Added Seas.Exch. for Aop hydro	0	0	0	0	0	0	0	0	0	0	0	0	0	0
h) Remove Flow-Through-Xfers	75	75	75	45	45	45	45	45	45	75	75	75	75	75
i) …Total	**-146**	**-1513**	**-1513**	**-147**	**-427**	**-1837**	**-1868**	**-1901**	**-1626**	**-159**	**-159**	**-147**	**-146**	**-1513**
4. PNWA Non-Step I Hydro and Non-thermal Resources														
a) Hydro Independents (1932)	-1569	-1554	-1582	-1342	-1584	-1497	-1568	-1395	-1789	-1775	-1818	-1968	-2005	-1749
b) Non-Step I Coord. Hydro (1932)	-1821	-1980	-2006	-2075	-2142	-2114	-2019	-1867	-1752	-1711	-1811	-2012	-2361	-2440
c) WB Regional Hydro NUGs	-371	-369	-297	-214	-156	-143	-135	-146	-183	-297	-306	-433	-454	-444
d) WB Renewable NUGs	-76	-76	-76	-76	-76	-76	-76	-76	-76	-76	-76	-76	-76	-76
e) WB Renewables	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29
f) …. Total (1932)	**-3866**	**-4008**	**-3990**	**-3737**	**-3987**	**-3860**	**-3828**	**-3513**	**-3829**	**-3888**	**-4040**	**-4519**	**-4925**	**-4738**
5. Step I System Load 3/ (1932)	**27353**	**25791**	**23757**	**26338**	**29238**	**30245**	**30419**	**29177**	**26360**	**25625**	**25407**	**24582**	**25737**	**26149**
6. Coordinated Thermal Installations														
a) Columbia Generating Station (CGS)	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	565	565	1140
b) Generic Thermal Installations	10738	10738	10794	10889	10953	10997	11007	10978	10468	9955	9489	8581	10125	10741
c) ...Total	**11878**	**11878**	**11934**	**12029**	**12093**	**12137**	**12147**	**12118**	**11608**	**11095**	**10629**	**9146**	**10690**	**11881**
7. Step I Hydro Resc. Needed (1932) 4/	**25798**	**23865**	**21569**	**23492**	**26169**	**26376**	**26009**	**25152**	**22918**	**22814**	**22830**	**23405**	**23381**	**24125**
8. Step I Resource Adjustments														
a) Hydro Maintenance 5/	-4595	-4032	-3787	-3208	-2935	-2037	-1561	-2286	-2626	-2751	-2483	-2360	-2202	-3720
b) Transmission System Losses 6/	-1196	-1271	-1273	-1248	-1279	-1344	-1334	-1258	-1195	-1156	-1164	-1172	-1281	-1316
c) Reserves (assume 11%) 7/	-4532	-4648	-4685	-4727	-4811	-4886	-4842	-4550	-4344	-4376	-4405	-4437	-4852	-4819
d) ...Total maint., losses, & reserves	-10323	-9952	-9745	-9183	-9024	-8268	-7737	-8094	-8166	-8283	-8052	-7969	-8334	-9856
e) Hydro maint. as %reg. hydro cap.=	15.3%	13.3%	12.4%	10.5%	9.6%	6.7%	5.3%	8.2%	9.8%	10.0%	8.9%	8.1%	7.2%	12.0%
f) Peak Resv. as % resources	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
	Aug15	Aug31	Sept	Oct	Nov	Dec	Jan	Feb	March	Apr15	Apr30	May	June	July
9. Required Step I Resources	**27353**	**25791**	**23757**	**26338**	**29238**	**30245**	**30419**	**29177**	**26360**	**25625**	**25407**	**24582**	**25737**	**26149**
10. Coordinated Hydro load and Surplus/Deficit (1932)														
a) Coordinated Hydro Load (1932) 8/	27619	25844	23574	25568	28311	28490	28029	27019	24670	24525	24640	25417	25742	26564
b) Actual Coord. Hydro Gen (1932) 9/	30052	30403	30451	30416	30590	30463	29605	28019	26684	27550	27864	29035	30694	30914
c) ...Surplus/Deficit (1932)	2433	4559	6877	4848	2279	1973	1576	1000	2014	3025	3224	3618	4952	4350

Notes:

1/ Federal peak diversity is a reduction in peak load due to peak loads not all being coincidental.

2/ Export or import to balance difference between excluded thermal imports and generic thermal installation.

3/ Total Step I Firm Peak Load is the sum of lines 1(e) + 2(k) + 3(i) + 4(f)

4/ Step I hydro resources needed to meet the load = line 5 - line 6(c) - line 8(d). Actual resource capability is higher. Used 1932 because has lowest su

5/ From WB, based on 5-year PNCA average as a MW reduction from installed capacity. May need to revise next year as a reduction from 1937 capability

6/ Transmission losses are 3.25% of all resources including imports, net of reserves and maintenance.

7/ Reserves are 11% of resources, i.e. 4(f), 6(c), 10(b) - 8(a)

8/ Lines 4b and 7

9/ System Instantaneous Peak (1932)

TABLE 2
DETERMINATION OF THERMAL DISPLACEMENT MARKET FOR 2015-16 AOP/DDPB STEPS II AND III STUDIES (Average MW)

	Aug15	Aug31	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr15	Apr30	May	Jun	Jul	Annual Average	CP Avg (42.5 mon)
1. STEP I THERMAL INSTALLATIONS																
a) From Table 1A, line 6(c)	10055	10106	10129	10135	10122	10170	10126	10130	9516	9040	8550	7007	8945	9813	9578.8	9662.4
2. DISPLACEABLE THERMAL RESOURCES																
a) Minimum Gen. from % of Thermal	225	226	227	227	226	228	226	227	211	199	187	155	210	222	214.8	216.6
b) Net Displaceable Thermal Resources	**9830**	**9880**	**9903**	**9909**	**9895**	**9942**	**9900**	**9904**	**9305**	**8840**	**8363**	**6851**	**8736**	**9591**	**9364.0**	**9445.8**
3. SYSTEM SALES (i.e. Amount of Coordinated Thermal Installation Power Used Outside PNWA)																
a) Flows-Out (Table 1A, line 2(g))	1582	1624	1595	1293	1185	1097	1078	1098	1222	1208	1226	1182	1539	1599	1309.5	1301.8
b) ...Exclude Can.Entitlement Exported	-499	-499	-499	-499	-499	-499	-499	-499	-499	-499	-499	-499	-499	-499	-499.0	-499.0
c) ...Exclude Plant Sales	-406	-422	-411	-403	-402	-386	-382	-376	-497	-424	-433	-340	-492	-474	-417.2	-414.0
d) ...Exclude WB Flow-Through-Transfer	-75	-75	-75	-45	-45	-45	-45	-45	-45	-75	-75	-75	-75	-75	-60.0	-58.8
e) ...Exclude WB. Seasonal Exchange	-215	-215	-208	-25	-3	-3	-3	-3	-3	-3	-3	0	-79	-189	-61.3	-60.4
f) ...Exclude SeEx for WB Surp/Def	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
g) ...Exclude SeEx for AOP Hydro Diff.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
h) ...Exclude Other Flow-ThruTransfer	-17	-18	-18	-18	-27	-27	-28	-27	-27	-26	-10	-7	-8	-9	-19.4	-20.1
i) ...Exclude Other Seasonal Exchange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
j) ...Total System Sales	369	394	384	302	209	137	121	148	152	181	206	261	386	354	252.6	249.5
k) Uniform Average Ann.System Sales	253	253	253	253	253	253	253	253	253	253	253	253	253	253	252.6	252.6
4 THERMAL DISPLACEMENT MARKET																
a) Line 2b minus line 3k	**9578**	**9627**	**9650**	**9656**	**9643**	**9689**	**9647**	**9651**	**9052**	**8588**	**8110**	**6599**	**8483**	**9339**	**9111.5**	**9193.3**

Notes:

2a Minimum generation is 0.0249 times the monthly average Step 1 thermal, without CGS; based on 2006 AOP data.

3b Canadian Entitlement exports are assumed to be supported by hydro instead of thermal.

3c Plant sales include approximately 25 percent of Boardman; line 2(h), Table 1A.

3d Flow-through-transfers from the White Book

3e Seasonal Exchanges from the White Book

3f Seasonal Exchanges were not employed in this AOP, but line 3(f) was retained for continuity.

3g Seasonal Exchanges were not employed in this AOP, but line 3(g) was retained for continuity.

3h Other flow through transfers are remaining flows-out supported by remaining thermal imports in the same period.

3i Other Season Exchanges remaining exports supported by thermal imports greater than imports on an annual basis

3j Total System Sales are total exports excluding exchanges, plant sales, flow-thru-xfers, and the Canadian Entitlement. The sum of Lines 3(a) through 3(i).

3k Average Annual System Sales shaped uniformly per 1988 Entity Agreement assumption that shaping is supported by hydro system.

4 PNW Area Thermal Displacement Market is the Total Displaceable Thermal Resources used to meet PNW Area firm loads. Lines 2(b) minus 3(k).

TABLE 3
DETERMINATION OF LOADS FOR STEP II AND STEP III STUDIES
FOR 2015-16 AOP/DDPB STUDIES

	PACIFIC NORTHWEST AREA LOADS				THERMAL INSTALLATIONS			
Period	Area Energy Load 1/ aMW	Annual Energy Load Shape Percent	Peak Load MW	Load Factor Percent	Energy Capability 2/ aMW	Annual Energy Shape Percent	Peak Capability MW	Capacity Factor Percent
August 1-15	22046	98.08	29240	75.40	10055	105.0%	11878	84.7%
August 16-31	22003	97.89	29188	75.39	10106	105.5%	11878	85.1%
September	20688	92.03	27116	76.29	10129	105.7%	11934	84.9%
October	20738	92.26	28537	72.67	10135	105.8%	12029	84.3%
November	23144	102.96	32127	72.04	10122	105.7%	12093	83.7%
December	25217	112.19	34522	73.05	10170	106.2%	12137	83.8%
January	25298	112.55	34707	72.89	10126	105.7%	12147	83.4%
February (29 days)	23969	106.63	33106	72.40	10130	105.8%	12118	83.6%
March	22327	99.33	30352	73.56	9516	99.3%	11608	82.0%
April 1-15	21195	94.29	28226	75.09	9040	94.4%	11095	81.5%
April 16-30	21245	94.51	28184	75.38	8550	89.3%	10629	80.4%
May	20659	91.91	27715	74.54	7007	73.1%	9146	76.6%
June	21589	96.04	28799	74.96	8945	93.4%	10690	83.7%
July	22857	101.68	30409	75.16	9813	102.5%	11881	82.6%
Annual Avg. 7/	22478.2	100.00		74.02	9578.8	100.0%		82.8%
SI CP Avg(42.5mon)	22567.8			**73.93**	9662.4			
S2 CP Avg(20mon)	22616.3				9702.7			
S3 CP Avg(5.5mon)	23743.9	AvgAnnEn/JanPk=		64.8%	9922.0	AvgAnnEn/JanPk=		78.9%

	STEP II SYSTEM				STEP III SYSTEM			
Period	Total Energy Load 3/ aMW	Total Peak Load MW	Hydro Energy Load 4/ aMW	Hydro Peak Load MW	Total Energy Load 3/ aMW	Total Peak Load MW	Hydro Energy Load 4/ aMW	Hydro Peak Load MW
August 1-15	18183.9	24117	8128.8	12239	15695.0	20816	5639.9	8938
August 16-31	18148.6	24074	8042.6	12196	15664.6	20779	5558.5	8901
September	17063.3	22366	6933.9	10432	14727.8	19304	4598.4	7371
October	17105.2	23537	6969.8	11508	14764.0	20316	4628.6	8286
November	19089.6	26499	8967.9	14405	16476.7	22872	6355.1	10778
December	20799.4	28474	10629.9	16337	17952.6	24577	7783.0	12440
January	20866.2	28627	10739.9	16480	18010.2	24708	7883.8	12562
February (29 days)	19769.8	27306	9639.7	15188	17063.8	23568	6933.7	11450
March	18415.4	25035	8899.5	13427	15894.8	21608	6378.9	10001
April 1-15	17481.8	23281	8442.2	12186	15089.0	20094	6049.4	9000
April 16-30	17522.8	23246	8972.7	12617	15124.4	20065	6574.2	9436
May	17039.7	22860	10033.0	13714	14707.4	19731	7700.7	10585
June	17806.6	23754	8861.1	13064	15369.3	20503	6423.8	9813
July	18852.4	25082	9038.9	13201	16272.0	21649	6458.5	9768
Annual Avg. 7/	18540.3		8961.5		16002.6		6423.8	
S2 CP Avg(20mon)	18654.2		8951.5					
S3 CP Avg(5.5mon)					16903.7		6981.7	
Joint Optimum S2 CP capability 5/ =			**8951.50**		S3 CP capability 6/ =		**6981.65**	

Notes:

1/ The PNW Area load does not include the exports, but does include pumping.

2/ The thermal installations include all thermal used to meet the Step I system load. (Table 2, line 1a).

3/ The total firm load for the Step II/III studies is computed to have the same shape as the load of the PNW Area.

4/ The hydro load is equal to the total load minus the Step I study thermal installations for each period.

5/ Input is the assumed critical period average generation for the Step II hydro studies and is used to calculate the residual hydro loads.

6/ Input is the assumed critical period average generation for the Step III hydro studies and is used to calculate the residual hydro loads.

7/ The Annual Average is for the operating year. The Critical Period (CP) averages are for the historic water years.

TABLE 4
SUMMARY OF STEPS I, II, & III POWER REGULATIONS
FOR 2015-16 ASSURED OPERATING PLAN

	BASIC DATA		STEP I				STEP II					STEP III				
	NUMBER OF UNITS	MAXIMUM INSTALLED PEAKING CAPACITY MW	USABLE STORAGE kaf	USABLE STORAGE hm^3	CRITICAL CAPACITY FPLCC Feb.1932 MW	CRITICAL ENERGY FELCC Avg.Gen MW	USABLE STORAGE kaf	USABLE STORAGE hm^3	CRITICAL CAPACITY FPLCC Feb.1932 MW	CRITICAL PERIOD FELCC Avg.Gen MW	30 YEAR AVERAGE ANNUAL GEN. MW	USABLE STORAGE kaf	USABLE STORAGE hm^3	CRITICAL CAPACITY FPLCC Feb.1931 MW	CRITICAL PERIOD FELCC Avg.Gen MW	30 YEAR AVERAGE ANNUAL GEN. MW
1. HYDRO RESOURCES																
a) CANADIAN STORAGE																
Mica			7000	8634			7000	8634								
Arrow			7100	8758			7100	8758								
Duncan			1400	1727			1400	1727								
Subtotal			15500	19119			15500	19119								
b) BASE SYSTEM																
Hungry Horse	4	428	3072	3789	133	99	3008	3710	132	115	105	3008	3710	226	245	103
Kerr	3	160	1219	1504	167	123	1219	1504	169	112	129	1219	1504	179	159	126
Thompson Falls	6	85	0	0	85	55	0	0	85	53	58	0	0	85	66	58
Noxon Rapids	5	554	231	285	415	147	0	0	528	128	194	0	0	528	173	195
Cabinet Gorge	4	239	0	0	238	98	0	0	238	86	118	0	0	238	113	119
Albeni Falls	3	50	1155	1425	15	22	1155	1425	20	22	21	1155	1425	19	15	19
Box Canyon	4	74	0	0	70	46	0	0	71	45	48	0	0	70	56	47
Grand Coulee	24+3SS	6684	5185	6396	4703	2060	5072	6256	5449	1856	2413	5072	6256	4509	1226	2312
Chief Joseph	27	2535	0	0	2535	1062	0	0	2535	965	1302	0	0	2535	701	1231
Wells	10	840	0	0	840	419	0	0	840	388	488	0	0	840	287	441
Chelan	2	54	677	835	49	38	676	834	51	38	44	676	834	51	51	43
Rocky Reach	11	1267	0	0	1267	571	0	0	1267	528	690	0	0	1267	384	642
Rock Island	18	513	0	0	547	262	0	0	547	245	313	0	0	547	182	289
Wanapum	10	986	0	0	825	500	0	0	825	463	587	0	0	825	329	520
Priest Rapids	10	912	0	0	770	487	0	0	770	454	558	0	0	770	330	492
Brownlee	5	675	975	1203	607	243	974	1201	577	301	318	974	1201	592	263	319
Oxbow	4	220	0	0	220	101	0	0	220	126	130	0	0	220	116	130
Ice Harbor	6	693	0	0	693	215	0	0	693	231	303	0	0	693	163	303
McNary	14	1127	0	0	1127	625	0	0	1127	601	768	0	0	1127	443	716
John Day	16	2484	535	660	2484	940	0	0	2484	916	1251	0	0	2484	683	1214
The Dalles	22+2F	2074	0	0	2074	748	0	0	2074	730	991	0	0	2074	563	970
Bonneville	18+2F	1088	0	0	1047	564	0	0	1047	549	681	0	0	1047	433	640
Kootenay Lake	0	0	673	830	0	0	673	830	0	0	0	673	830	0	0	0
Coeur d'Alene Lake	0	0	223	275	0	0	223	275	0	0	0	223	275	0	0	0
Total Base System 1/		23742	29445	36320	20911	9426	28500	35154	21748	8951	11514	13000	16035	20926	6981.6	10930
c) ADDITIONAL STEP I PROJECTS																
Libby	5	600	4980	6143	170	195										
Boundary	6	1055	0	0	855	366										
Spokane Rivr Plnts 2/	24	173	104	128	152	94										
Hells Canyon	3	450	0	0	450	199										
Dworshak	3	450	2015	2485	435	156			NOT APPLICABLE TO STEPS II & III							
Lower Granite	6	932	0	0	930	182										
Little Goose	6	932	0	0	928	187										
Lower Monumental	6	932	0	0	922	183										
Pelton, Rereg,& RB	7	423	274	338	397	136										
Total added Step I		5947	7373	9094	5240	1698										
d) Total Hydro		29689	52318	64533	26151	11124	44000	54273	21748	8951	11514	13000	16035	20926	6982	10930
2. THERMAL INSTALLATIONS 3/			CpEn/AnnPk=80%		12118	9662	CpEn/AnnPk=80%		12118	9703	9579	CpEn/AnnPk=82%		12118	9922	9579
3. RESOURCE ADJUSTMENTS																
a) Hydro maintenance 4/					-2286	-11	-8.2% of hydro		-1774	n.a.	n.a.	-8.2% of hydro		-1707	n.a.	n.a.
b) Peaking reserves 5/					-4550	n.a.	-11% of resc.		-3725	n.a.	n.a.	-11% of resc.		-3635	n.a.	n.a.
c) Transmission losses 6/					-1258	-654			n.a.	n.a.	n.a.			n.a.	n.a.	n.a.
4. TOTAL RESOURCES 7/			CpEn/AnnPk=67%		30176	20121	CpEn/AnnPk=66%		28367	18654	21093	CpEn/AnnPk=61%		27703	16904	20509
5. Steps I, II, & III System Loads																
a) PNW Area firm load			CpEn/AnnPk=68%		33106	22568										
b) Net of Exports + Imports					-416	433										
c) Non-Step I resources					-1867	-812										
d) Hydro Independents					-1395	-970										
e) Miscellaneous resources					-252	-1098										
f) ...Net Step I,II,III System Load 8/			CpEn/AnnPk=69%		29177	20121	CpEn/AnnPk=68%		27306	18654	18540	CpEn/AnnPk=72%		23568	16904	16003
6. SURPLUS (4 - 5f)					999	0			1061	0	2553			4134	0	4506
CRITICAL PERIOD	Starts		August 16, 1928				September 1, 1943					November 1, 1936				
	Ends		February 29, 1932				April 30, 1945					April 15, 1937				
	Length (Months)		42.5 Months				20 Months					5.5 Months				
	Study Identification		16-41				16-42					16-13				

Notes

1/ The above totals may not exactly equal the sum of the above values due to rounding. The total Base System Storage for Steps I & II includes Canadian storage.

2/ Spokane River Plants include: Little Falls, Long Lake, Nine Mile, Monroe, Upper Falls, and Post Falls.

3/ From Tables 1a, 1b and 3.

4/ Step I hydro maintenance from Tables 1a and 1b. Steps II/III peak hydro maint. same percent as Step I coord. Hydro; no energy maint. loss because impact is negligible. Hydro maintenance energy losses are not included in Steps II & III.

5/ Step I peak reserves from Table 1b. Steps II & III Peak Reserves are same as Step I categories, i.e. 7% large thermal (use WBk 81% of thermal is large), and 5% for hydro and other thermal. Energy reserves for thermal installations are included in the thermal installation energy forecast.

6/ Step I transmission losses from Table 1a and 1b. Steps II & III transmission losses are not included, since it would change the energy load by the same amount.

7/ Total Resources are the sum of total lines 1(b) + 1(c) + 2 + 3. For Step I, this does not include non-Step I coordinated hydro or hydro-independents.

8/ Step I energy load from Table 1a, line 5, and February peak load from Table 1b, line 5. Steps II & III energy load from Table 3. Steps II & III peak loads are equal to Steps II and III February energy loads, divided by the PNWA February load factors.

TABLE 5
COMPUTATION OF CANADIAN ENTITLEMENT
FOR 2015-16 ASSURED OPERATING PLAN

A. Joint Optimum Power Generation in Canada and the U.S. (From 16-42 and 16-13)
B. Optimum Power Generation in the U.S. Only (From 16-12 and 16-13)
C. Optimum Power Generation in the U.S. and a 0.5 Million Acre-Feet (0.6 km3) Reduction in Total Canadian Treaty Storage (From 16-22). For information only, not needed for this DDPB.

Determination of Dependable Capacity Credited to Canadian Storage (MW)			
	(A)	**(B)**	**(C)**
Step II - Critical Period Average Generation 1/	8951.5	8949.7	8914.2
Step III - Critical Period Average Generation 2/	6981.7	6981.7	6981.7
Gain Due to Canadian Storage	1969.9	1968.1	1932.6
Average Critical Period Load Factor in percent 3/	73.93	73.93	73.93
Dependable Capacity Gain 4/	2664.6	2662.2	2614.1
Dependable Capacity Limit (from Table 4) 5/	3737.5	3737.5	3737.5
Canadian Share of Dependable Capacity 6/	**1332.3**	**1331.1**	**1307.1**
Determination of Increase in Average Annual Usable Hydro Energy (aMW)			
Step II (with Canadian Storage) 1/	**(A)**	**(B)**	**(C)**
Firm Energy 7/	8960.1	8958.3	8923.0
Thermal Displacement Energy 8/	2383.9	2376.8	2403.3
Remaining Usable Energy 9/	68.1	69.4	71.3
System Average Annual Usable Energy	11412.0	11404.5	11397.6
Step III (without Canadian Storage) 2/			
Firm Energy 7/	6422.8	6422.8	6422.8
Thermal Displacement Energy 8/	3681.8	3681.8	3681.8
Remaining Usable Energy 9/	330.0	330.0	330.0
System Average Annual Usable Energy	10434.6	10434.6	10434.6
Average Annual Usable Energy Gain 10/	977.4	969.9	963.0
Canadian Share of Average Annual Energy Gain 5/	**488.7**	**485.0**	**481.5**

1/ Step II values were obtained from AOP 16-42, 16-12 and 16-22 studies.
2/ Step III values were obtained from AOP 16-13 study .
3/ Critical period load factor from Table 3.
4/ Dependable Capacity Gain credited to Canadian storage equals gain in critical period average generation divided by the average critical period load factor.
5/ From Table 4. Does not set a precedent or necessarily imply agreement on calculation of this value.
6/ One-half Dependable Capacity or Usable Energy Gain, as limited by Capacity Credit Limit.
7/ From 30-year average firm load served, which includes 7 leap years (29 days in Feb.), so slightly diff. than Table 3.
8/ Average secondary generation limited to Potential Thermal Displacement Market.
9/ Forty percent (40%) of the remaining secondary energy.
10/ Difference between Step II and Step III Annual Average Usable Energy.

TABLE 6
COMPARISON OF RECENT DDPB STUDIES
(English and Metric units)

	2011-12		2012-13		2013-14		2014-15		2015-16	
AVERAGE PNWA ENERGY LOAD										
Annual Load (MW)	21710.9		22614.8		22802.6		23013.7		22478.2	
January Load Factor (%) 1/	113.8		113.5		113.6		112.8		112.5	
Critical Period (CP) Avg. Load Factor (%)	76.1		74.9		74.6		74.8		73.9	
Annual Firm Exports 2/	1188.0		1363.0		1605.0		833.0		832.3	
Annual Firm Imports 3/	624.0		958.0		1177.0		467.0		378.6	
Annual Non-Step 1 Hydro & Misc Rsrc 4/	2442.0		2665.0		2841.0		2919.0		3022.4	
Total Annual Step 1 Load 5/	19833.0		20355.0		20390.0		20462.0		19909.5	
THERMAL INSTALLATIONS (MW) 6/										
January Peak Capability	11454.7		12878.0		12838.8		13734.6		12146.7	
CP Energy	9480.3		10085.9		10125.5		10215.7		9662.4	
CP Minimum Generation	211.2		228.7		228.1		230.3		216.6	
Average Annual System Export Sales	231.9		207.0		227.0		180.5		252.6	
Average Annual Displaceable Market	8968.9		9548.1		9577.7		9708.5		9111.5	
Average Annual Energy 7/	9410.0		9982.0		10031.0		10117.0		9578.8	
HYDRO RESOURCES (aMW)										
Average Annual Step 1 Hydro Resources 8/	11063.0		11058.0		11057.0		11021.0		10994.7	
Average Annual Step 1 Coord Hydro Load 9/	11855.0		11851.0		11850.0		11819.0		11793.9	
STEP I/II/III CP (MONTHS)	42.5/20/5.5		42.5/20/5.5		42.5/20/5.5		42.5/20/5.5		42.5/20/5.5	
BASE STREAMFLOWS AT THE DALLES 10/										
Step I 30-yr Avg Streamflow, cfs and m^3/s	175361	4966	175361	4966	175361	4966	175120	4959	175084	4958
Step I CP Average, cfs and m^3/s	114734	3249	114734	3249	114734	3249	114518	3243	114487	3242
Step II CP Average, cfs and m^3/s	101578	2876	101578	2876	101578	2876	101396	2871	101376	2871
Step III CP Average, cfs and m^3/s	56027	1587	56027	1587	56027	1587	56034	1587	56088	1588
CAPACITY BENEFITS (MW)										
Step II CP Generation	8944.6		8940.2		8934.7		8944.9		8951.5	
Step III CP Generation	6945.5		6962.9		6942.3		6898.7		6981.7	
Step II Gain over Step III	1999.1		1977.3		1992.4		2046.2		1969.9	
CANADIAN ENTITLEMENT	1314.0		1320.8		1335.5		1368.6		1332.3	
Change due to Mica Reoperation	0.0		0.0		0.0		1.5		1.2	
ENERGY BENEFITS (aMW)										
Step II Annual Firm	8904.7		8902.5		8897.9		8961.8		8960.1	
Step II Thermal Displacement	2448.7		2484.0		2469.5		2423.9		2383.9	
Step II Remaining Usable Secondary	69.1		55.9		55.9		49.1		68.1	
Step II System Average Annual Usable	11422.5		11422.5		11423.3		11434.8		11412.0	
Step III Annual Firm	6227.6		6233.5		6169.1		6300.7		6422.8	
Step III Thermal Displacement	3776.2		3874.9		3920.9		3879.6		3681.8	
Step III Remaining Usable Secondary	366.8		325.0		326.3		294.7		330.0	
Step III System Average Annual Average	10370.6		10433.4		10416.3		10475.1		10434.6	
CANADIAN ENTITLEMENT	525.9		504.5		505.5		479.9		488.7	
Change due to Mica Reoperation	2.0		1.6		2.0		9.9		3.7	
STEP II PEAK CAPABILITY (MW)	29985		31439		31326		30944		28367	
STEP II PEAK LOAD (MW)	28338		29265		29400		29236		27306	
STEP III PEAK CAPABILITY (MW)	29855		31289		31215		30063		27703	
STEP III PEAK LOAD (MW)	24195		25129		25162		25158		23568	

FOOTNOTES FOR TABLE 6

Enhancements were made to the content and layout of Table 6 in DDPB16 and changes are included below. Corresponding parameters were identified in recent DDPB Studies and are also displayed in Table 6.

1. 100 x (January) / (average annual PNWA) firm loads (Table 1A, row 1(d)).

2. Average annual total firm exports (Table 1A, row 2(k)).

3. Absolute value of average annual total firm imports (Table 1A, row 3(i)).

4. Absolute value of average annual PNWA Non-Step I Hydro and Non-Thermal Resources (Table 1A, row 4(f)).

5. Average annual total Step I load (Table 1A, row 5).

6. Beginning with the 2006-07 DDPB, thermal installations include Columbia Generating Station and a generic thermal installation sized as needed to meet the Step I load. January thermal peak capability is shown, but actual minimum peak surplus month is February.

7. Average annual Energy from the thermal installations (Table 1A, 6(c)).

8. Average annual Step I Hydro Resources (Table 1A, row 7).

9. Average annual Step I Coordinated Hydro load.

10. The 2000 level modified flows were used beginning with the 2009-10 DDPB with adjustments for the Grand Coulee pumping and return flows. The 2011-12, 2012-13, 2013-14, 2014-15 and 2015-16 DDPBs include updated adjustments for the Grand Coulee pumping but not for return flows.

11. The Step II energy benefits for 2015-16 are based on 30-Year Joint Optimum Hydroregulation studies.

CHART 1
DURATION CURVES OF 30-YEAR MONTHLY HYDRO GENERATION
(Average monthly MW)