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TESTIMONY of

STEVEN R. KERNS, KATHERINE L. BEALE,

JUERGEN M. BERMEJO, and KIERAN P. CONNOLLY

Witnesses for Bonneville Power Administration

SUBJECT: PROVISION OF BALANCING RESERVE CAPACITY FROM THE FEDERAL COLUMBIA RIVER POWER SYSTEM

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Section 1: Introduction and Purpose of Testimony

Q. Please state your names and qualifications.

A. My name is Steven R. Kerns, and my qualifications are contained in BP-14-Q-BPA-34.

A. My name is Katherine L. Beale, and my qualifications are contained in BP-14-Q-BPA-03

A. My name is Juergen M. Bermejo, and my qualifications are contained in BP-14-Q-BPA-05.

A. My name is Kieran P. Connolly, and my qualifications are contained in BP-14-Q-BPA-13.

Q: What is the purpose of your testimony?

A. The purpose of our testimony is to describe the amount of *inc* and *dec* balancing reserve capacity that BPA proposes to provide from the Federal Columbia River Power System (FCRPS) for the provision of balancing reserve capacity for the FY 2014–2015 rate period. As more fully explained in Puyleart *et al.*, BP-14-E-BPA-22, the North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) have established reliability standards that require BPA to maintain a sufficient amount of balancing reserve capacity to ensure a reliable balancing authority area. In order to meet these reliability standards, BPA must set aside or acquire an amount of capacity necessary to support the balancing reserve capacity needs of BPA's various transmission users. The amount, or quantity, of balancing reserve capacity that is needed

for system reliability for all users is described in Puyleart *et al.*, BP-14-E-BPA-22, and the accompanying studies. In this testimony, we explain how much of this total need for balancing reserve capacity can be supplied from the FCRPS.

Section 2: Overview

Q. Why are you assessing how much balancing reserve capacity can be supplied from the FCRPS in this rate proceeding?

A. We are assessing how much balancing reserve capacity can be supplied from the FCRPS because such an assessment is needed for both ratemaking and operational planning purposes. For ratemaking purposes, such an assessment informs other components of the Initial Proposal, such as the cost allocation of embedded and variable costs to the various uses of balancing reserve capacity. *See* Power Rates Study, BP-14-E-BPA-01, section 4.3. For planning purposes, our assessment informs whether and to what extent BPA must attempt to acquire *inc* and *dec* balancing reserve capacity from sources other than the FCRPS to meet balancing authority area reliability needs.

Q. Please explain what you mean by inc *and* dec *balancing reserve capacity.*

A: *Inc* is short for incremental and refers to the ability to increase generation as needed. *Dec* is short for decremental and refers to the ability to reduce generation as needed. Balancing reserve capacity is used to respond to changes in generation and load in response to a signal from the balancing authority area, within scheduling periods. In general, BPA supplies both *inc* and *dec* balancing reserve capacity from flexible capacity of the FCRPS.

Q. Please briefly describe what you mean by flexible capacity.

A. Flexible capacity describes an estimate of the flexibility that may be available from the FCRPS to respond to within scheduling period differences between actual generation and

load and scheduled generation and load, assuming limited energy content, and assuming that BPA manages its surplus power marketing to shape less water from light load hours to heavy load hours to ensure that the planned amount of such flexibility is available.

Q. What do you mean by "flexibility" of the FCRPS?

A. By "flexibility" we mean the amount of operational changes the hydro projects that comprise the FCRPS can accommodate without risking operational objectives. While "flexibility" can refer to changes in any of the parameters associated with a hydroelectric project (*e.g.*, forebay, tailwater, discharge, generation), this testimony will limit the use of the term "flexibility" to refer to changes in generation that the FCRPS can accommodate.

Q. Why are you measuring FCRPS flexibility to determine how much flexible capacity the FCRPS can provide for balancing reserve capacity?

A. After other obligations and needs are accounted for, the remaining ability of the FCRPS to increase or decrease generation within a scheduling period defines the available amount of balancing reserve capacity.

Q. In general, how do you assess the amount of FCRPS flexibility that will be set aside as capacity for balancing reserve capacity?

A. We assessed how much flexible capacity to provide from the FCRPS for balancing reserve capacity by considering the many constraints and limitations that may affect FCRPS hydro operations during different times of the year. Those constraints and limitations arise from Endangered Species Act (ESA) fish requirements, reliability concerns, flood control issues, and other operational objectives.

In addition, BPA is obligated by contract to commit a significant portion of its power production capacity and operational flexibility for long-term energy sales to preference power customers. After BPA ensures that its long-term firm power sales obligations are met, the remaining power production capacity and operational flexibility

on the system must be allocated between two types of uses. These two types of uses are surplus power marketing and provision of operating and balancing reserve capacity. Surplus sales move water with relative certainty, allowing BPA to ensure that high priority FCRPS operational objectives are met. Providing reserve capacity moves water in uncertain ways, using flexibility that may remain after other water management constraints and firm load obligations are met. BPA cannot allocate all available flexibility to provision of balancing reserve capacity because of the uncertainty about whether the balancing reserve capacity will be deployed and because of the uncertainty associated with moving water through the system.

We also considered the actual operations of the FCRPS. That is, we looked at past specific events that led to changes in the amount of balancing reserve capacity the FCRPS was able to carry.

All of these factors and limitations, as well as real-time operations, taken together, helped inform our assessment of the amount of balancing reserve capacity available from the FCRPS.

Section 3: Physical and Operational Characteristics of the FCRPS

Q. Why are you describing the physical and operational characteristics of the FCRPS?

A. The amount of flexible capacity the FCRPS may have during the rate period depends in large part on the operational objectives placed upon the operations of the dams and the uncertainties resulting from the physical characteristics of the FCRPS.

Q. Please describe the physical characteristics of the FCRPS.

A. The FCRPS is a complex system of 31 interconnected dams on the Columbia, Snake, and Willamette rivers. The dams were authorized for many purposes besides the production of power; in fact, power production in many instances is an incidental purpose of the

FCRPS when faced with certain operational conditions. The primary purposes of the FCRPS include navigation, recreation, fish mitigation, irrigation, and flood control. The Army Corps of Engineers (COE) and the Bureau of Reclamation (Reclamation), which own and operate the dams, direct BPA in their operation to ensure that the flow of water through the dams is managed to achieve their various purposes.

The need to use water for multiple purposes means that the Federal agencies cannot simply operate the dams to provide capacity whenever needed. For example, the large upriver dams are storage dams, meaning they have reservoirs behind them that can store water for later use. Every winter, however, BPA must lower the reservoir behind Grand Coulee Dam (its largest power producer) to leave room for the spring runoff that refills it. Water in the reservoirs must be held at levels low enough to ensure that the runoff does not cause overfilling and flooding, but high enough to ensure there is enough water to meet irrigation, navigation, and fish mitigation requirements. Similarly, the amount of water released to the lower river projects must be enough to ensure sufficient flows for fish migration and barge passage, but not so much as to flood downstream communities.

Q. How is capacity produced on the FCRPS?

A. Capacity is the instantaneous potential of a generator to produce power. The FCRPS has about 22,000 MWs of installed capacity, but only enough fuel (water) under dry conditions to produce about 6,000 aMW of energy annually. This means that the FCRPS is an energy-limited system, and the operators of the FCRPS must constantly make choices of how to allocate and use that limited amount of water to produce power to meet firm power obligations. In addition to being energy-limited, the FCRPS is storage limited and can only store about 30 percent to 40 percent of its annual average run-off. This means that the timing of when the limited amounts of fuel are available is often

dictated by precipitation patterns. Finally, the availability of water to produce power is frequently dictated by other non-power requirements of the multi-purpose FCRPS such as flood risk management, fisheries mitigation, recreation, navigation and irrigation operations. Taken all together, these factors mean that the ability for BPA to make determinations of when there is fuel available to place behind turbines to create the flexible ability to produce capacity on any hour, is extremely limited by other factors.

Q. *Flexible capacity is largely produced by the "Big 10" dams. If that is true, why are you considering the operational characteristics of the entire FCRPS?*

A. The FCRPS is a large, interconnected system. The 21 dams that are not part of the "Big 10" either produce small amounts of generation or are non-dispatchable, meaning that their generation schedules are set a day in advance and that changes to their generation schedule during the day require manual intervention, and, in some cases, declaration of a system emergency. Some of these dams, such as Libby, Hungry Horse, Albeni Falls, and Dworshak, are storage reservoirs that can affect the operational flexibility available at the downstream "Big 10" projects.

Q. *How do the operational objectives of the FCRPS inform your assessment of the amount of flexible capacity the FCRPS will have available during the rate period?*

A. Because the FCRPS is used for multiple purposes, we have to take into account how certain high-priority operational objectives may affect the amount of flexibility the FCRPS will have at any given time. These higher-priority operational objectives include safety, reliability, flood control, navigation, and operations for fish listed under the Endangered Species Act.

Q. *Please describe what you mean by the operational objective of "safety."*

A. In general, rapid changes in operations can create waves or turbulence in the water that can create safety issues. A specific example is when there are divers in the water at

various times for equipment maintenance; other examples include rescue operations and minimizing turbulence or wave impacts in reservoirs for recreational boating. Flood control also relates to public health and safety.

Q. Please describe what you mean by the operational objective of "reliability."

A. In simplest terms, reliability means dependable service to load to avoid load shedding and blackouts. A myriad of factors interact to ensure system reliability. In an electrical system, generation must equal loads at all times and voltage stability must be maintained, or the system risks blackouts. Most interconnected generators in an electrical system are required to contribute to system stability by providing voltage control and by responding to automatic or manual signals from dispatchers. Operating reserve capacity contributes to reliability by providing a planned amount of capacity to respond to unexpected events in the system.

Q. Please describe what you mean by the operational objective of "flood control."

A. The COE and Reclamation establish specific operational targets at certain times of year to ensure that there is sufficient storage space in reservoirs to use to prevent flooding during spring runoff. As the winter snows melt, river operations are carefully coordinated to avoid causing floods.

Q. Please describe what you mean by the operational objective of "navigation."

A. The Columbia River is a major transportation corridor of high economic value. Barge movement through the river is facilitated by operation of locks which affect the movement of water downstream. Operational constraints are placed on the FCRPS to ensure proper channel depth or current conditions are maintained to allow upstream and downstream barge movement.

Q. Please describe what you mean by the operational objective of "operations for fish listed under the ESA."

A. In considering the ecological objectives of the ESA and the Clean Water Act (CWA), operations are planned to comply with the ESA Biological Opinions ("BiOps") and applicable state and tribal water quality standards, to the extent practicable. Spring and summer spill and water quality constraints have also been adopted by court order. There are a number of operational requirements associated with endangered fish species as required by court order from the US District Court:

- Spill during juvenile migration season to aid in fish passage, which diverts fish from passing through turbines to passing through spillways or other passage routes.
- Limit on the total dissolved gas in the river water; dissolved gas causes nitrogen to form bubbles in the fishes' bloodstream and can cause the fish to die of gas bubble disease, which is like "the bends" that affects divers.
- Reservoir elevation targets designed to store water in the winter to augment flows in the spring and summer with the goal of providing adequate volume and velocity to assist juvenile migration downstream.
- Reservoir draft timed to provide water temperature control during hot weather.
- Limits on generating unit operations, which narrow the operating range in order to improve survival for fish that pass through the turbines.
- Restricted forebay ranges to provide steady velocity conditions.

Q. How do these high-priority operational objectives affect the amount of flexibility you project the FCRPS will have to provide flexible capacity?

A. In general, operational requirements limit the flexibility of the FCRPS. In some cases, generally in very high and very low flow conditions, it is not possible to meet all of the high-priority objectives simultaneously. BPA coordinates with the COE and

Reclamation to operate the FCRPS to meet as many of the high-priority operational objectives as possible. Any remaining operational flexibility that exists after meeting these high-priority objectives can be used for other purposes, such as providing balancing reserve capacity.

Q: What uncertainties can affect the operational flexibility of the FCRPS?

A. Although there are a variety of events that can cause the FCRPS to lose operational flexibility, we identify here four uncertainties that commonly restrict flexibility. First, there is uncertainty in streamflow. The drainage basin of the Columbia River system is massive and encompasses an area slightly larger than France. The result of unpredictable weather patterns that build snowpack across the basin is a large amount of uncertainty in runoff volume and location. As the snow pack melts, it is not uncommon to see localized impacts and spikes in the runoff as weather systems pass through the basin. During high-flow conditions, operational flexibility is very limited.

Q. What is the second uncertainty?

A. There is uncertainty in flood control objectives and operations for fish listed under the Endangered Species Act, especially during the spring. Coordinating these operations of the FCRPS with the COE and Reclamation is a day-to-day activity in the spring that can result in quick changes to operational objectives that may result in the FCRPS having very limited operational flexibility.

Q. And the third uncertainty?

A. Non-Federal projects interconnected to the FCRPS can change operations unexpectedly. While BPA plans for and coordinates with non-Federal hydro operations (with BC Hydro and the mid-Columbia projects being particularly important to the FCRPS), there can be unexpected flow from non-Federal projects. Like the FCRPS, non-Federal projects have their own operational objectives and load obligations to meet. Unexpected flows from

these projects can lead to higher or lower flows than necessary to maximize FCRPS flexibility and result in a loss of the operational flexibility necessary for balancing reserve capacity.

Q. What is the fourth uncertainty that commonly restricts flexibility?

A. There is uncertainty in the amount of real-time load that the FCRPS may be called upon to serve to ensure reliable load service. Loads are generally a function of temperature. Deviations in actual temperatures from forecast temperatures can result in actual loads being very different from the planned load. BPA also has contractual obligations that grant preference power customers the ability to change their schedules 30 minutes prior to the hour of delivery. To address all of these variables, BPA's hydro schedulers and short-term planners cover hour-to-hour load uncertainty and schedule change rights by creating an "operational buffer" that "stands ready" to provide power production capacity in the event conditions change. The more that BPA experiences these uncertainties during the rate period, the larger the buffer BPA hydro-schedulers generally hold out to maintain system reliability and to meet FCRPS operational objectives, and the less flexibility BPA has to provide other services, such as balancing reserve capacity.

Section 4: Assessing the Amount of Flexible Capacity Available from the FCRPS

Q. In light of the limitations and complexities you have noted, how do you determine the amount of flexible capacity available from the FCRPS during the FY 2014–2015 rate period?

A. Our assessment of the amount of reserve capacity the FCRPS can reasonably and reliably provide is based on our experience with and observations of the FCRPS's historical capability under the limitations and operational objectives described above. We also

considered as part of our assessment the operational ability of the FCRPS to provide balancing reserve capacity under various flow conditions.

Q. What do you mean by "experience with and observations of the FCRPS's historical capability under the limitations and operational objectives described above"?

A. We identified specific times in the past when BPA has experienced problems maintaining flexible capacity at planned levels, and we considered how those events, if they were to reoccur during the rate period, or under different flow conditions, would affect the ability of the FCRPS to provide balancing reserve capacity.

Q. What do you mean by "flow conditions"?

A. The term "flow condition" is used to qualitatively describe the volume and rate of water flow on the Columbia and Snake rivers. A high flow condition describes some period where the rate of flow is above average. Conversely, a low flow condition generally describes some period where the rate of flow is below average.

Q. Why did you consider flow conditions as part of your assessment?

A. Flow condition directly combines with both machine and operational constraints to either limit or free up FCRPS flexibility.

Q. Please describe the flow conditions you considered.

A. We looked at a high-flow scenario that considered the joint conditions of meeting non-power objectives while carrying and deploying balancing reserve capacity.

Q: Was operational flexibility limited in the high flow conditions you considered?

A. Yes.

Q. Why is there limited operational flexibility in high flow conditions?

A. First, the FCRPS is a storage-limited system, which means that the ability to store water from a high water year into a future year is very limited. Federal storage is about 30 million acre-feet (Maf), which is a fraction of the annual runoff. Other river systems

in the United States, such as the Colorado and Missouri river systems, can store two to three times the annual runoff. In addition, operations for fish listed under the ESA require the FCRPS reservoirs to refill annually.

Second, as discussed above, excess spill can be harmful to fish listed under the ESA by increasing the concentration of nitrogen gas in the river. High Total Dissolved Gas (TDG) levels can result in gas bubble trauma in fish. The states of Oregon and Washington have enacted even more stringent specifications. Operations for fish listed under the ESA require that all practicable steps be taken to reduce the amount of spill when these TDG limits are being exceeded. Therefore, attempts are made to minimize TDG on a system-wide basis at and beyond the spill and water quality constraints to minimize saturation throughout the system. Reducing the amount of balancing reserve capacity frees up generating capacity that can be used to pass additional water through turbines rather than spilling.

This is why, in high flow conditions, there is limited ability to make operational changes at FCRPS hydro projects without risking operational objectives.

Q. Has the FCRPS experienced high flow conditions in the recent past?

A. Yes. We have experienced these conditions in actual operations in the springs of 2011 and 2012, which were both above-average water years.

Q. How did these flow conditions operationally affect the ability of the FCRPS to provide balancing reserve capacity?

A. In 2011, balancing reserve capacity was periodically limited between May 10th and July 13th. In 2012, balancing reserve capacity was periodically limited between April 8th and July 31st. In June 2010, which was a below-average water year that had a delayed runoff, BPA also experienced a period of high flow conditions during the runoff. In 2010, balancing reserve capacity was periodically limited from June 5th to June 12th.

In each of these events, balancing reserve capacity carried by the FCRPS was reduced to a minimal level necessary to maintain reliability for load service.

Q. Have there been other times in the past three years when there has been a need to limit balancing reserve capacity due to limited flexibility on the FCRPS?

A. Yes. On May 19 and 20, 2010, *inc* balancing reserve capacity was reduced due to transmission congestion. On April 24, 2012, BPA observed *inc* balancing reserve capacity was limited due to a transmission emergency that occurred at the same time a barge broke free on the Columbia River. On April 25, 2012, BPA reduced *inc* balancing reserve capacity due to the combination of above-average uncertainty on contracts with hourly change rights combined with higher than expected loads and the need to maintain Operating Reserve.

Q. Given the complexity of operating the FCRPS to meet high-priority objectives while dealing with a significant amount of uncertainty, what minimum amount of balancing reserve capacity do you project can be sourced from the FCRPS during the rate period?

A. The FCRPS must be planned to meet the high-priority operational objectives discussed above. In light of these limitations, the minimum amount of balancing reserve capacity we project would be physically available on a planning basis from the FCRPS 365 days of the year is 400 MW of *inc* balancing reserve capacity and 300 MW of *dec* balancing reserve capacity. These amounts of balancing reserve capacity are the current estimate of the amount necessary to ensure load service is not interrupted and voltage stability is maintained. Variable energy resources can use this flexibility if such use does not interfere with reliability for load service. This amount of balancing reserve capacity also reflects the minimum amount of balancing reserve capacity we have seen held out by the FCRPS in situations where operational flexibility has been reduced because of weather, fish, or other operational constraints.

Q. Does the 400/300 MW limit represent the minimum amount BPA expects to provide from the FCRPS on a forecast basis or on a real-time basis?

A. The 400/300 MW limit is the minimum amount BPA can provide on a forecast basis to maintain system reliability for load. At times, unpredictable events may cause less balancing reserve capacity to be available from the FCRPS. At times, more flexibility may be available, but BPA sells its system capability in various product forms, over various time horizons, to various customers in various markets. In order to provide a larger amount of flexibility from the FCRPS for balancing service, BPA must determine the amount to set aside well in advance.

Q. What amount of flexible capacity from the FCRPS are you proposing to provide for the FY 2014–2015 rate period?

A. Our answer above (400/300 MW) reflects our assessment of the amount of flexible capacity that could be sourced from the FCRPS at all times during the rate period. However, we recognize that most of the time operational conditions do not limit balancing reserve capacity to these minimal levels. Providing balancing reserve capacity beyond the minimal levels depends in large part on how much additional operational and forced marketing risk BPA wishes to take. Based on our assessment of the expected operational flexibility of the FCRPS, our assessment of BPA's other committed or planned uses of the FCRPS, and assuming BPA retains certain risk mitigation features, we estimate that BPA can offer up to 900 MW in *inc* balancing reserve capacity and up to 1100 MW in *dec* balancing reserve capacity from the FCRPS, most of the time during the rate period.

Q. Please explain why the inc *limit is lower than the* dec *limit.*

A. In addition to providing balancing reserve capacity, BPA must also supply Operating Reserve. Operating Reserve is an additional *inc* obligation meant to cover contingencies

such as power plant equipment and transmission equipment failures. Operating Reserve must be held above and beyond balancing reserve capacity so BPA can supply these reserves even if fully deploying *inc* balancing reserve capacity for balancing purposes. In terms of priority, Operating Reserve takes precedence over balancing reserve capacity.

Q. In concluding that BPA could offer 900 MW in inc *balancing reserve capacity and 1100 MW in* dec *balancing reserve capacity, what "risk mitigation features" do you assume would be in place during the FY 2014–2015 rate period?*

A. The ability of the FCRPS to provide these amounts of balancing reserve capacity is dependent on maintaining certain risk mitigation tools that allow BPA to limit balancing reserve capacity to levels necessary for reliable load service when there is insufficient operational flexibility to meet high-priority operational objectives. This includes DSO 216 and other tools that ensure the FCRPS is not deployed beyond the amounts BPA has agreed to commit. Assuming these tools are in place, offering more flexible capacity than the long-term planning limit can be accommodated most of the time during the rate period.

Q. If the risk mitigation tools you identified were not available, would your assessment change?

A. Yes. If BPA is unable to ensure, through DSO 216 and other operational risk mitigation tools, that the amount of balancing reserve capacity deployed is consistent with the amount we have made available and accounted for in operational planning, then we would offer the amount available to ensure reliability of load service, and we would reassess whether any amount beyond the base level of 400/300 MW in balancing reserve capacity could be made available.

Q. Why are you proposing to provide 900 MW of inc *and 1100 MW of* dec *balancing reserve capacity?*

A. Provision of additional balancing reserve capacity supports the integration of variable energy resources, which is an important agency policy. Moreover, operationally, BPA has been able to manage the risk of carrying an amount of balancing reserve capacity larger than what was needed for reliability for load service in the past. For example, in October 2012, BPA is offering 773 MW of *inc* balancing reserve capacity and 991 MW of *dec* balancing reserve capacity. After assessing past experience with providing significant amounts of balancing reserve capacity and the operational constraints and flexibility of the FCRPS, as well as BPA's existing obligations for energy sales, we project BPA can offer for this rate period 900 MW of *inc* balancing reserve capacity and 1100 MW of *dec* balancing reserve capacity, which is more than the minimum amount necessary for load service reliability, and more than the limited amount that is feasible to offer continuously with 100 percent certainty.

Q. How was the 900 MW inc *and 1100 MW* dec *limit determined?*

A. As noted above, there are many operational objectives that BPA, the COE, and Reclamation must meet when operating the system. In assessing the amount of balancing reserve capacity to source from the FCRPS beyond what is necessary to maintain reliability for load, we consider BPA's historical performance in carrying large amounts of balancing reserve capacity, and we consider how well BPA's risk limitation tools are working.

Q. Please give examples.

A. During calendar year 2010, BPA provided an average allocation of 800 MW *inc* and 990 MW *dec* and was able to make the balancing reserve capacity required available over 99 percent of the time. During 2011, the average allocation was 759 MW *inc* and

933 MW *dec*, and BPA was able to make the *inc* balancing reserve capacity available about 92 percent of the time and the *dec* balancing reserve capacity available about 88 percent of the time. In 2012, BPA has provided less balancing reserve capacity and has also encountered more instances of needing to limit balancing reserve capacity. During this entire time, BPA was able to effectively limit balancing reserve capacity to lower levels when necessary. We have also established policies and procedures to encourage wind generators to improve their scheduling accuracy.

Q. What have you concluded from these examples?

A. Qualitatively, we considered BPA's history with carrying balancing reserve capacity, BPA's ability to manage risk of overdeployment, and the ongoing improvement in scheduling accuracy, and concluded that BPA could offer most of the time for this rate period somewhat higher levels of balancing reserve capacity than it provided in the past. BPA's ability to offer the higher levels is contingent on having the ability to limit below these levels when operational constraints make that necessary.

Q. In your answers above, you state in several places that your assessment is that BPA could provide 900 MW of inc *and 1100 MW of* dec *in balancing reserve capacity "most of the time." What do you mean by "most of the time"?*

A. Provided BPA has the ability to occasionally limit the amount of balancing reserve capacity to the 400/300 MW minimum we noted above when operational constraints affect the ability of the FCRPS to source balancing reserve capacity, we believe BPA can provide additional amounts of balancing reserve capacity at a high probability for the remaining hours of the year. While we cannot predict exactly how conditions may play out in any particular year, our general assessment, which accounts for both time and quantity of availability, is that BPA can make up to 900 MW *inc* and 1100 MW *dec*

balancing reserve capacity available approximately 98 percent of the time on an annual average basis.

Q. Please explain how you determined the 98 percent.

A. As mentioned above, at times during the last three years BPA had to reduce the balancing reserves. The limit amount can vary greatly depending on the hydro conditions and operational objectives at the time. During the last three years, the annual average percent of reserves supplied by the FCRPS ranged between 90-99 percent of the rate case amounts. Since two of the three previous years were above average water years, and because we are assuming average water for this rate period, we recommend assuming 98 percent of the rate case planned amounts can be supplied from the FCRPS on an annual average basis. Because this is a rough approximation based on limited data and experience, we expect to refine the expectation for future rate periods. The actual limit amount and duration in any year will vary.

Q. Will the 900/1100 MW amount be revisited in future rate cases?

A. Yes. In future rate cases, we expect that BPA will revise its assessment of the amount of balancing reserve capacity available from the FCRPS based on the operational and policy objectives relevant at that time.

Q. Does this conclude your testimony?

A. Yes.