BAKER RIVER PROJECT RELICENSE

Technical Scenario Teamlet Conference Call

May 21, 2003

1:00 p.m. – 3:00 p.m.
Dial in: (866) 280-6429
Guest #: 144995
OBC-14N Conference Room

AGENDA

1) Review Notes	1:00 – 1:10
2) Review Action Items	1:10 – 1:40
3) Datum Discussion	1:40 – 2:00
4) Hydroclimate Scenarios	2:00 – 2:30
5) Energy Price Schedules	2:30 – 2:45
6) HYDROPS Status	2:45 – 2:50
7) Set Agenda for May 30 teleconference	2:50 – 3:00

May 21, 2003

BAKER RIVER PROJECT RELICENSE

Technical Scenario Teamlet

May 21, 2003
10:00 to noon
PSE Office (One Bellevue Center)
Bellevue, WA

FINAL DRAFT MEETING NOTES

Teamlet Leader: Paul Wetherbee, 425-462-3746, paul.wetherbee@pse.com

PRESENT: Paul Wetherbee, Lloyd Pernela, and Bob Barnes (PSE), Stan Walsh on phone (Skagit System Cooperative), Ruth Mathews on phone (The Nature Conservancy), Margaret Beilharz on phone (USFS), Mark Killgore (The Louis Berger Group), Chuck Howard on phone (Consultant), Gary Sprague on phone (WDFW), Phil Hilgert and Stuart Beck on phone (R2), and Lyn Wiltse, facilitator (PDSA Consulting, Inc.).

FUTURE REGULAR WORKING GROUP DATES/LOCATIONS

NOTE: The May 30 meeting will be only an hour long (from 1:00 to 2:00 PM and will focus on a limited Agenda)

May 30 (changed 10 to noon to 1:00 to 2:00), June 6 from 10:00 to 2:00 at Louis Berger Office in Bellevue.* Phone number there is 425-467-6111 or 425-451-7400.

* Driving directions to Louis Berger Office at 12011 Bellevue-Redmond Road, Suite 200, Bellevue WA:

Heading SOUTH on 405: Take Exit #13B and take the NE 8th East ramp, and merge onto NE 8th. Turn left onto Bellevue-Redmond Road. The office is on the south side of the road just beyond Barrier Motors and on the second floor.

Heading NORTH on 405: Take Exit #13B and keep right at the fork in the ramp. Merge onto NE 8th. Turn left onto Bellevue-Redmond Road. The office is on the south side of the road just beyond Barrier Motors and on the second floor.

To Attend these meetings by conference call: Dial 1-866-280-6429. Enter participant code 144995#.

AGENDA FOR MAY 21, 2003

10:00 – noon at PSE Office in Bellevue (14th floor conference room)

1. Review Notes
2. Review Action Items
3. Datum Discussion
4. Hydroclimate Scenarios
5. Energy Price Schedules
6. HYDROPS Status Report
7. Set agenda for May 30 meeting

NEW ACTION ITEMS

- Paul: By May 28, send out background information on soft constraints.
- Paul: By May 28, send out suggested approach for ranking implementation.
- Phil: Generate new time series for unregulated flows for the Baker River. Include updated area-volume curves for both reservoirs and historic hydrologic data including flows and reservoir elevations. Make these data available on CD for those interested.
- Phil: Prepare memo outlining when SCL fisheries settlement was actually implemented. Review and revise if necessary the rankings of the biologically-based ratios for selection of periods of analysis.
- Mark: Analyze Phil's selected periods (see above) for their reasonableness in supporting economic analyses. Identify additional periods of analysis if necessary.
- Paul/Mark: Send out seasonal analysis with transmittal memo for Lower Baker inflows (1981 – present).
- Paul: Send out example sensitivity runs to demonstrate the effects of the soft prioritizing.
- Lloyd: Talk with Gary about why power prices jump around so much in 2006 and 2007 (according to Appendix K).
- Paul: Send out sample scenarios (proposed base-case) run and results.
- Paul: Send out list of all HYDROPS technical background information available on the website.
- Paul: Check back with Powel to see when they can update and distribute HYDROPS demonstration PowerPoint slides.
- Paul: Analyze sensitivity of spawning/incubation flow calculation method, prepare short brief and present to TST at next meeting.
- Paul: Complete example model run request form using Margaret's changes, distribute to group, and discuss at the next meeting.

REPORT ON OLD ACTION ITEMS

- Stuart: Met with Bob Barnes to resolve the geographic datum issue and reported back.
- Stuart/Bob: Developed updated area-volume curves for both reservoirs.
- Paul: Distributed meeting notes from 5/2/03 meeting of the Instream Flows Technical Teamlet to TST members.

- Paul/Mark: Investigated the ability of HYDROPS to model reserve capacity and reported that some of the information on this is available on the PSE website, in the Least Cost Plan that they submitted to the UTC the end of April. Note: The information in the Plan is not specific to any Combustion Turbine or Hydro plant. HYDROPS is limited in its capacity to do this.
- Paul/Lloyd: Distributed whiter paper or other supporting information on the energy pricing schedules to be used in the model.
- Paul: Distributed brief on what has been done to define representative hydroclimate sequences in the Econ/Ops and Aquatic Resource Working Groups.

DATUM DISCUSSION
All have received Kris Olin's memo on how moving to the 1988 North American Vertical Datum (NAVD) will affect various aspects of the relicensing process.

Stuart reported that he first checked how converting to the new datum would affect Upper Baker. He noted that there was not much change between the storage volume vs. elevation curve. The flood control level of 707.8 might change by a fraction of a foot. There is still 74K acre-feet between that level and full pool.

When he checked Lake Shannon, he found some significant differences in volume below the elevation of 420 ft. He performed a sensitivity analysis and found that for high flow regimes there was not much difference. With corrected values to account for the changes in the stage-volume curve, there was a difference in the annual low flow regimes and low flows are likely to increase. This will be important for incubation periods and also for winter power generation

R2 will generate a new time series for unregulated flows for the Baker River.

HYDROCLIMATE SCENARIOS
We agreed that it made sense to revise the range of years we use to select representative high, median, and low flow years to the period between the implementation of the SCL fisheries agreement (in the early 1990's) to the present. This will give us more accurate indicators going forward since it would include the current SCL regime as well as the current flood control regime which was set in the early 1980's. We are fortunate that during the last decade, we have experienced a full range of water conditions!

Phil explained that the fish WG is concluding that spawning flows and subsequent incubation flow levels are critical. They have looked at the ratio of flows during the fall spawning period to flows during the subsequent incubation period. These ratios can be ranked (exceedance) and excellent fish years, medium and poor fish years identified. We agreed to use this approach. We also decided to reconsider our water years to range from August 1 through July 31. This makes more sense from a fish point of view since it encompasses spawning and incubation periods.

We will look at selecting our new representative subset of post SCL settlement agreement energy years based on Phil's recommendations at our June 6 meeting.

HYDROPS STATUS REPORT
Paul reported that he is in the midst of rigorous quality testing on the latest version of the HYDROPS Software delivered by the Powel Group. We will get a more detailed report at our June 6 meeting.

FUTURE ISSUES TO ADDRESS
Dependable Capacity
Fisheries Definition: Tie to R2 outputs format (flow sections from A24)

DRAFT AGENDA FOR MAY 30, 2003
1:00 – 2:00 at PSE Office in Bellevue (14th floor conference room)

1. Review Notes
2. Discussion of Soft Constraints and ranking
3. Set agenda for June 6 (in-person) meeting
4. Set additional future meeting dates and times

PARKING LOT

- The capability to construct artificial periods of record by selecting seasons within selected/different years for analysis purposes.

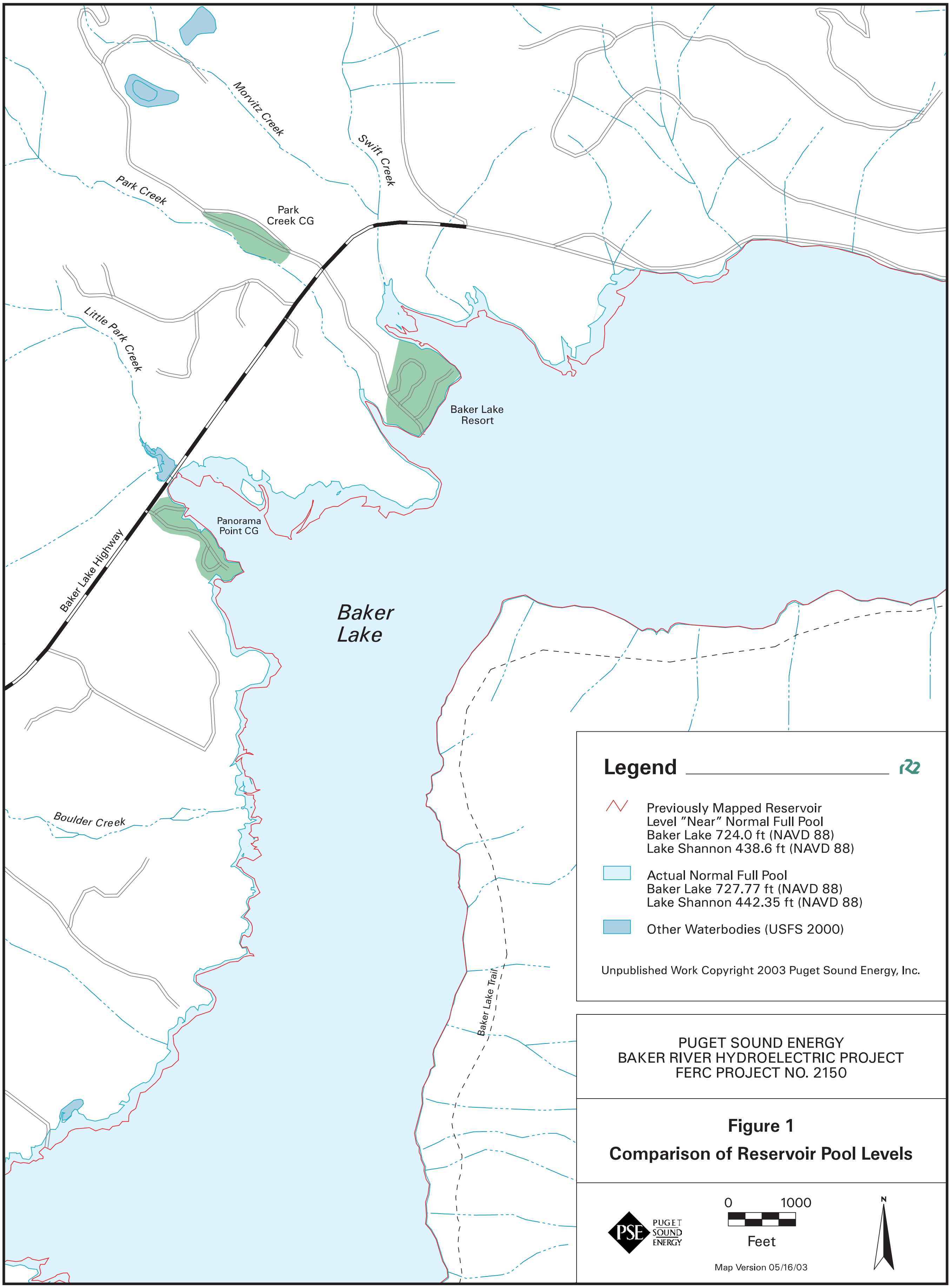


Figure 1

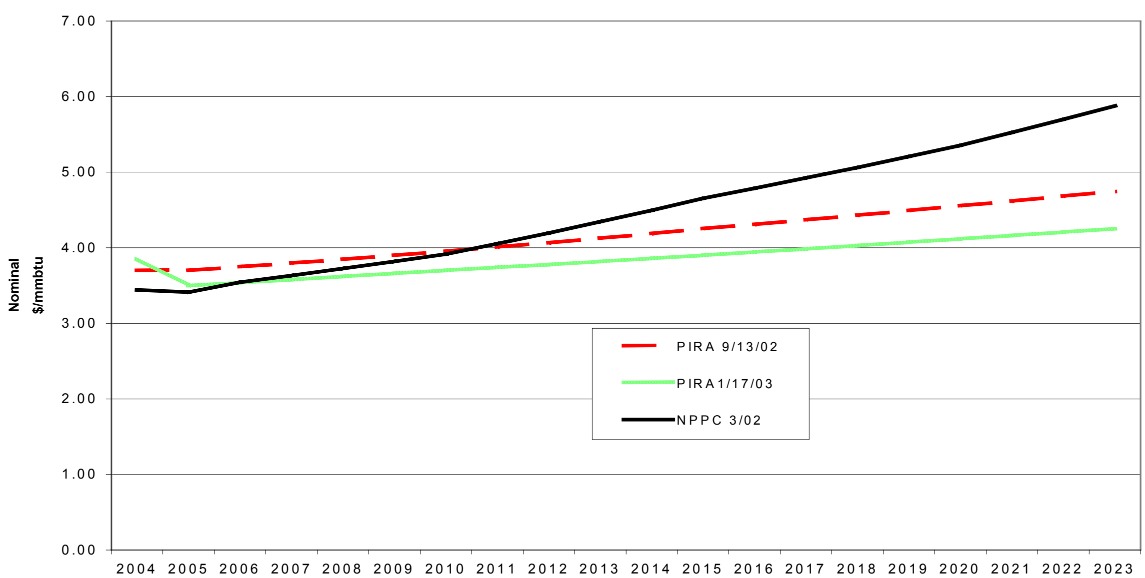
Comparison of Reservoir Pool Levels

APPENDIX K
KEY ASSUMPTIONS FOR AURORA MARKET POWER PRICE FORECAST

Gas Prices

PIRA Energy Group forecasts for the primary hubs were updated in January 2003, replacing the September 2002 PIRA forecast which was an input for the December 2002 Draft LCP. An alternative forecast, published in March 2002, was available through NPPC. The PIRA forecast for the Sumas hub more closely tracks the current forward market and has a less steep escalator than the NPPC forecast

Exhibit K-1
Natural Gas Forecast: Sumas

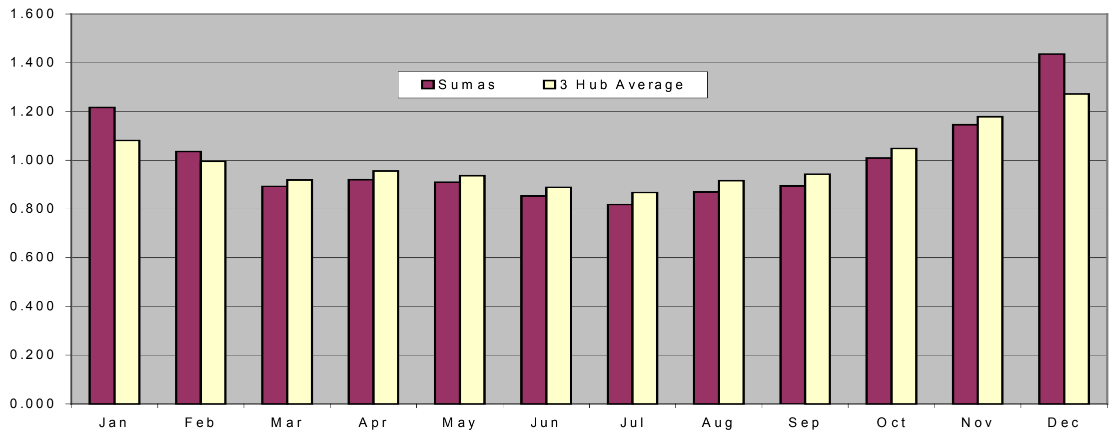


The PIRA forecast includes monthly estimates for 2004, then annual values for 2005, 2010 and 2015. The gas prices for the other years, up to 2023, are estimated with arithmetic interpolation and geometric extrapolation.

Each annual price requires that a monthly shape factor be applied to generate 12 monthly prices. The monthly shape factors are the average of the three Northwest hubs, Sumas, AECO and Rockies, for the years 1991-1999. More recent data do not have any consistent pattern and the prices show extreme volatility and randomness.

Exhibit K-2 illustrates the traditional pattern of higher prices in the winter and lower in the summer. The three-hub average was applied to all eight hubs in the model other than Henry Hub which has its own monthly shaping.

Exhibit K-2
Monthly Shaping



Electricity Demand

AURORA divides the WECC into 13 subregions with individual growth rates. Exhibit K-3 lists the regions along with the new and previously assumed long-run regional growth rates. The new growth rates were adopted from the NPPC, "Draft Forecast of Electricity Demand of the 5th Pacific Northwest Conservation and Electric Power Plan," August 2, 2002. Short-run demand was adjusted downward to take into account the current recession, following the assumptions in the NPPC's 5th Draft of Wholesale Electric Price Forecast. Intermediate-term growth rates were increased so that the long-run growth rate was unchanged.

Exhibit K-3
Regional New and Previous Demand Rates

Region	New Demand (%)	Previous (%)
OR / WA / No. ID	1.50	1.53
No. California	1.71	1.63
So. California	1.87	1.63
British Columbia	1.53	1.53
Idaho South	1.71	1.53
Montana	0.90	1.53
Wyoming	0.23	2.37

Region	New Demand (%)	Previous (%)
Colorado	1.22	2.37
New Mexico	2.43	2.45
Arizona / So. Nevada	1.39	2.45
Utah	2.32	1.53
No. Nevada	1.65	1.53
Alberta	1.53	1.53

New Northwest Resources

In 2002 there were over 8,000 MW of new resources under development; however, most of the proposals did not make it beyond the planning stage. PSE currently assumes that 2,055 MW of new natural gas-fired resources will be available in the region. Presently three plants have been completed, with three under construction to be on line by mid-2004. Exhibit K-4 lists those plants.

Exhibit K-4
New Natural Gas-Fired Resources

Plant	Owner/Developer	Capacity MW)	Online Date
Coyote Springs II	Avista-Mirant	260	Q2/03
Hermiston	Calpine	530	Online
Goldendale	Calpine	248	Q2/04
Big Hanaford	TransAlta	248	Online
Frederickson I	EPCOR	249	Online
Chehalis	Tractebel	520	Q3/03

Other well known gas-fired resources that once were expected to be developed, such as the Duke Grays Harbor plant, have not been assumed into the model. Wind resources that could be built in 2003, or later, were not assumed to be built. The AURORA database includes 473 MW of wind generation which their developers listed as going online in 2002.

New Resources

Three aspects of new resource costs need to be considered – the debt/equity ratio and their corresponding costs; assumptions about who will be building plants in the future; and the fixed and variable costs for each technology. To reflect the current market difficulties of merchant companies (IPP's), new projects will have to be financed with a mix of private equity and fairly high-yielding debt. However, it could be expected that this period of comparatively expensive cost of capital will give way to a long-term equilibrium with lower cost of capital assumptions.

Cost of Capital

Exhibit K-5 presents the cost of capital assumptions for PSE. The company expects that the spread between the return for debt and equity for the IOU's should be four to five percent, consistent with recent practice. The debt/equity ratio and the corresponding rates of return were used to determine a weighted cost of capital for each developer segment. For the IPP's the model uses the higher rates for years 2004 and 2005.

Exhibit K-5
PSE Cost of Capital Assumptions

Cost of Capital			
Return %	Public	IOU's	IPP's
Debt	6.5	7.5	10 to 8.5
Equity	0	11.5	30 to 17
Debt/Equity Ratio			
Debt	100	55	40
Equity	0	45	60
Total Cost (%)			
Weighted	6.5	9.3	22.0 to 14

New Resource Development

The second set of assumptions focus on which entities will be building new generation for each technology over the next 20 years. PSE used the developer mix assumptions made by the NPPC listed in Exhibit K-6.

Table K-6
NPPC Developer Mix Assumptions

	Developer Mix (%)			**Mix Weighted Cost of Capital**
Technology	Public	IOUs	IPPs	PSE
CCCT	15	15	70	**17.8 to 11.9**
SCCT	40	40	20	**10.7 to 9.0**

	Developer Mix (%)			Mix Weighted Cost of Capital
Wind	20	20	60	**16.4 to 11.3**
Coal	25	25	50	**15.0 to 10.8**
Solar	50	25	25	**11.1 to 9.0**

The developer mix percentages were applied to the weighted cost of capital for each developer segment (i.e. 6.5 percent, 9.3 percent, 13.6 percent) to produce a mix weighted cost of capital (values in bold font under PSE in Exhibit K-5) for each technology. The mix-weighted cost of capital was then applied to the investment costs discussed in the following section.

Timing of New Resource Development

In AURORA, new plants are brought online at the optimal time without regard to planning horizons. To replicate realistic planning needs, the higher overall cost of new resources was extended for additional years based on construction lead time. Simple cycle turbines and wind generation can be brought online in a year so the higher cost was extended through 2006. For combined cycle the higher cost is extended for an additional year through 2007. For coal, with it long lead time, the higher development cost is included through 2010 with a significant price drop in 2011.

Cost of Various Technologies

The AURORA model selects new resources for addition from a set of generic resources which will result in lowest overall cost. The cost and performance characteristics were provided by Tenaska for the combined cycle and simple cycle gas plants, as well as the coal plant. The wind data were provided by Navigant Consulting, Inc. and confirmed by other sources, while the solar data are from the NPPC.

The capacity of most new generation resources (i.e., the capacity of individual projects in MWs) can be scaled to meet the specific needs of the developer; hence there is not one correct size or correct estimate for each technology. Furthermore, with shared ownership, even greater flexibility of capacity can be achieved for a utility. PSE, in collaboration with Tenaska, selected a representative plant for each gas and coal technology based both on economies of scale and current development practices. Exhibit K-7 provides a list of the primary characteristics.

Exhibit K-7
Cost and Performance Characteristics

Technology	Capacity (mw)	Heat Rate (btu/kwh)	All-In Cost ($/kw)	Fixed O&M ($/kw)	Fixed Fuel ($/kw)	Variable O&M ($/mwh)
CCCT	516	6,900	645	11.00	15.55	2.00
SCCT	168	11,700	441	3.00	15.74	2.00
Coal	900	9,425	1,500	20.0	0	2.00
Wind	100	0	1,003	26.10	0	0
Solar	20	0	6,000	15.00	0	0.80

The CCCT represents a two-by-one configuration – two turbines with a heat recovery system. These plants are typically scaled by increments of about 250 MW, with variations around those figures depending on specific configurations.

The SCCT represents a lower-cost traditional peak using "frame" FA or EA gas turbines in simple cycle. More expensive aero-derivative plants are available which have a better heat rate at a much higher cost. Throughout the industry and its literature, one can find a wide variety of capacities, heat rates and costs for the numerous simple cycle options. The least-cost option is site and application dependent. The costs provided by Tenaska are based on the same assumptions as the combined cycle and coal plants which allows for a fair comparison between the technologies. For example, the SCCT listed starts with an EPC cost (engineering, procurement and construction) of $327/kw before taking into account "soft" costs such as insurance, contingencies, and costs related to financing, startup and spares etc. before arriving at a total installed capacity cost of $441/kW.

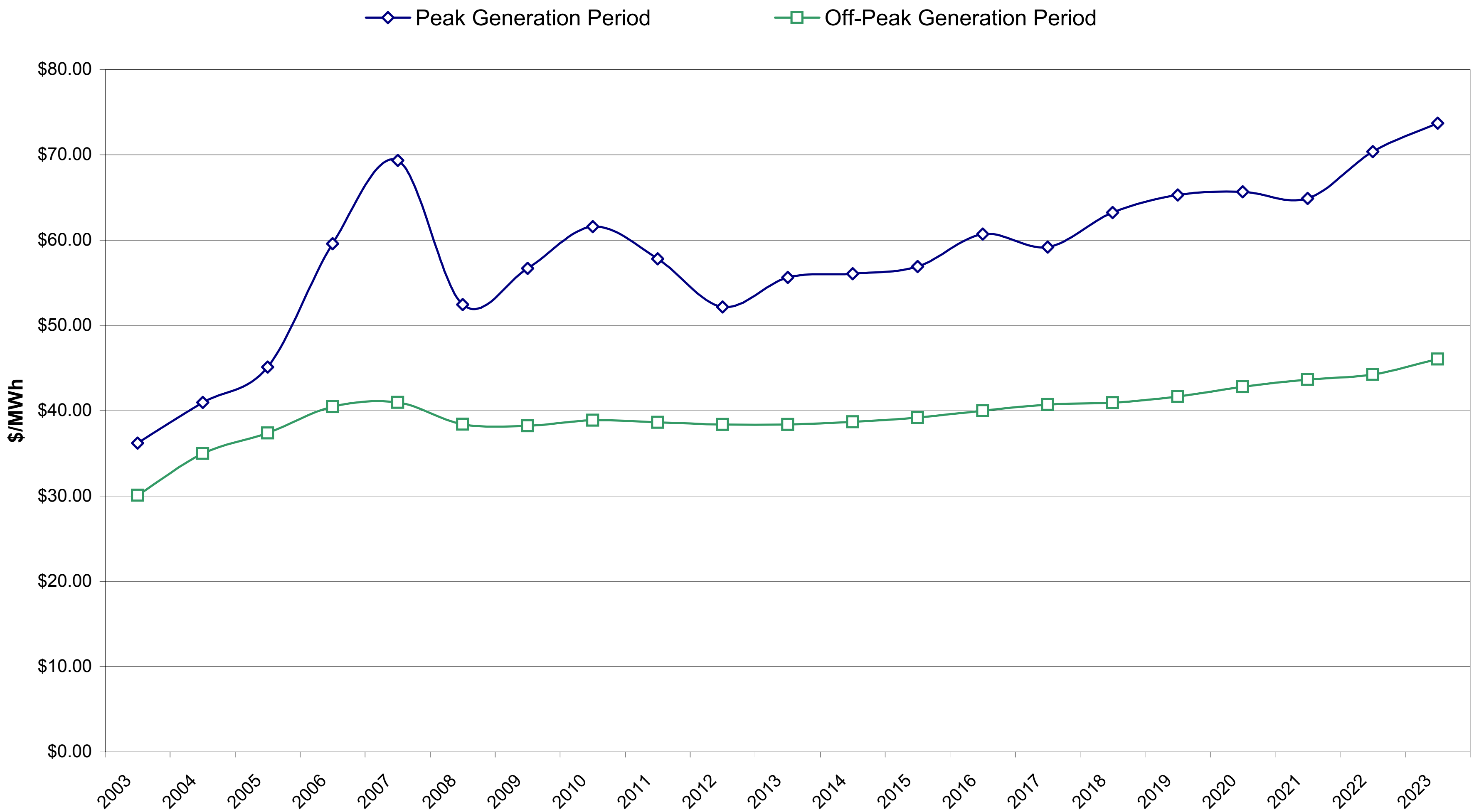
The coal plant represents a new site with a supercritical boiler design. An alternative would be a plant with two percent to four percent lower costs but with a two percent to four percent higher heat rate. Again the least-cost option depends upon the site and application.

The wind plant is based on the assumption that 100 MW is necessary to achieve economies of scale.

AURORA MARKET POWER PRICE FORECAST

SOURCE: DRAFT LEAST COST PLAN

March 31, 2003

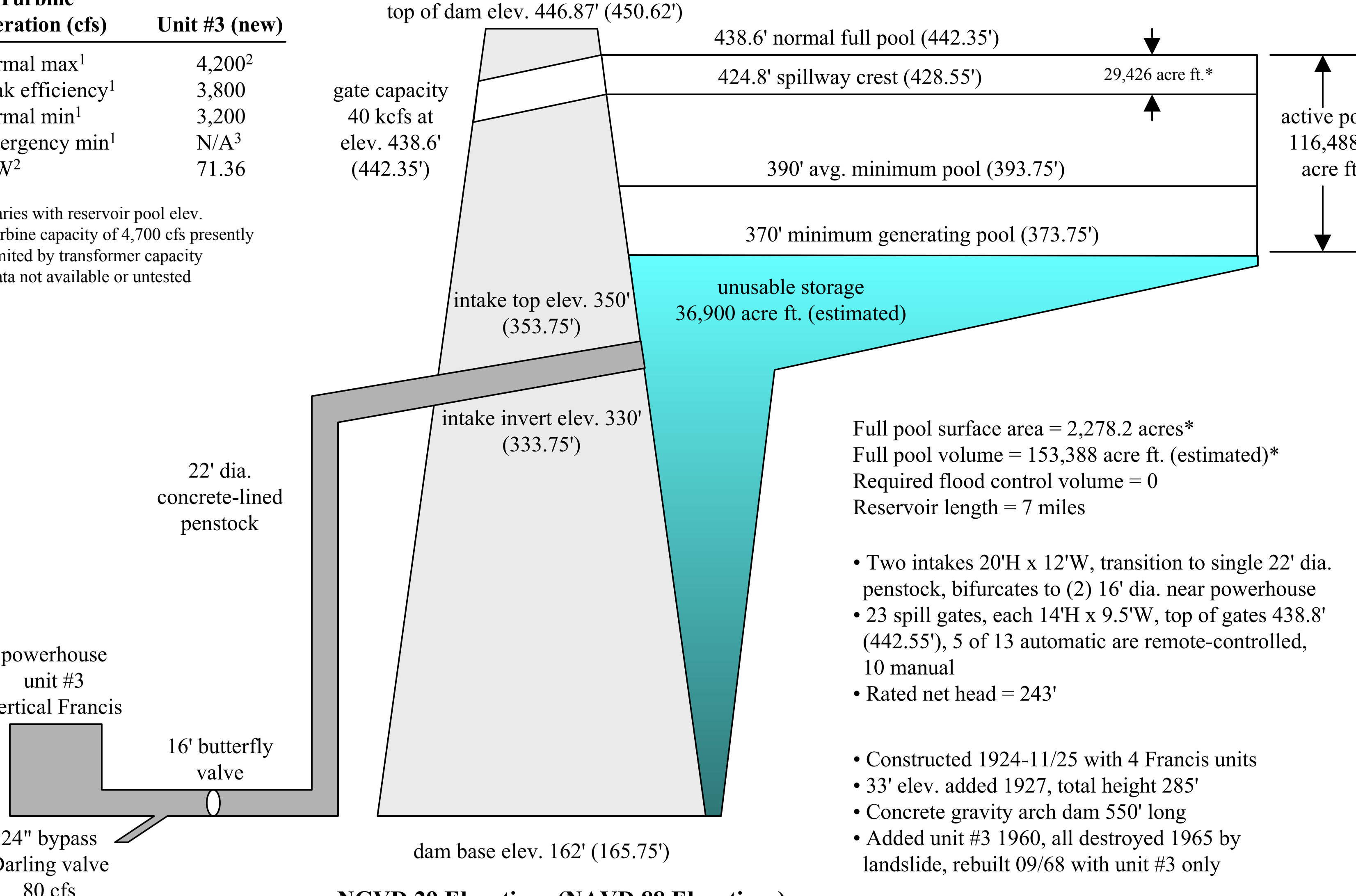


Lower Baker Dam

Section View - Not to Scale

Turbine Operation (cfs)	Unit #3 (new)
normal max[1]	4,200[2]
peak efficiency[1]	3,800
normal min[1]	3,200
emergency min[1]	N/A[3]
MW[2]	71.36

1 varies with reservoir pool elev.
2 turbine capacity of 4,700 cfs presently limited by transformer capacity
3 data not available or untested



NGVD 29 Elevations (NAVD 88 Elevations)

Full pool surface area = 2,278.2 acres*
Full pool volume = 153,388 acre ft. (estimated)*
Required flood control volume = 0
Reservoir length = 7 miles

- Two intakes 20'H x 12'W, transition to single 22' dia. penstock, bifurcates to (2) 16' dia. near powerhouse
- 23 spill gates, each 14'H x 9.5'W, top of gates 438.8' (442.55'), 5 of 13 automatic are remote-controlled, 10 manual
- Rated net head = 243'

- Constructed 1924-11/25 with 4 Francis units
- 33' elev. added 1927, total height 285'
- Concrete gravity arch dam 550' long
- Added unit #3 1960, all destroyed 1965 by landslide, rebuilt 09/68 with unit #3 only

Reservoir pool volumes and full pool surface areas have been adjusted using reservoir storage-elevation relationships updated as of May 2003 based on 2001 survey data.

version May 16, 2003

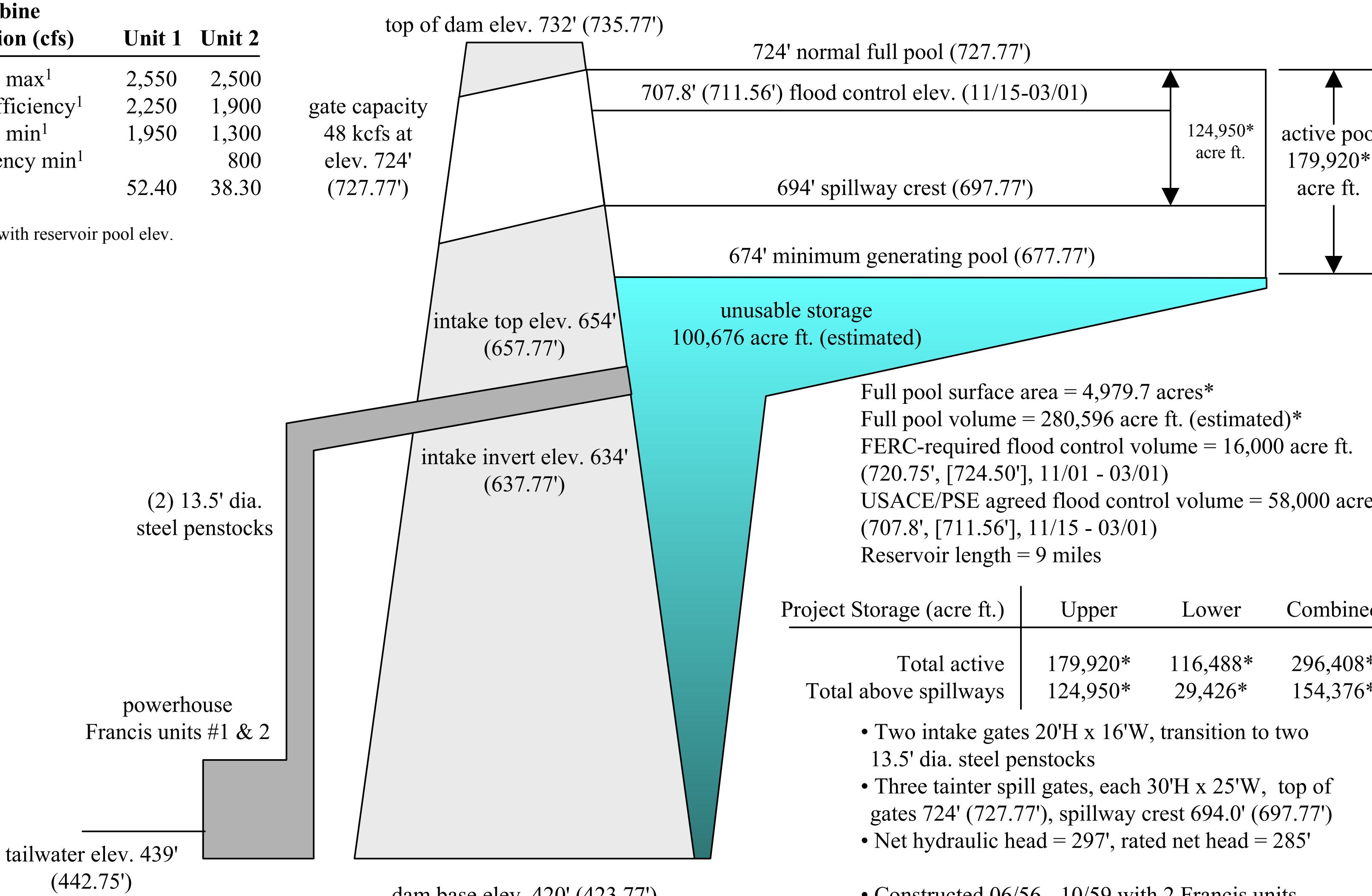
Upper Baker Dam

Section View - Not to Scale

PUGET SOUND ENERGY

Turbine Operation (cfs)	Unit 1	Unit 2
normal max[1]	2,550	2,500
peak efficiency[1]	2,250	1,900
normal min[1]	1,950	1,300
emergency min[1]		800
MW	52.40	38.30

1 varies with reservoir pool elev.



Full pool surface area = 4,979.7 acres*
Full pool volume = 280,596 acre ft. (estimated)*
FERC-required flood control volume = 16,000 acre ft. (720.75', [724.50'], 11/01 - 03/01)
USACE/PSE agreed flood control volume = 58,000 acre ft. (707.8', [711.56'], 11/15 - 03/01)
Reservoir length = 9 miles

Project Storage (acre ft.)	Upper	Lower	Combined
Total active	179,920*	116,488*	296,408*
Total above spillways	124,950*	29,426*	154,376*

- Two intake gates 20'H x 16'W, transition to two 13.5' dia. steel penstocks
- Three tainter spill gates, each 30'H x 25'W, top of gates 724' (727.77'), spillway crest 694.0' (697.77')
- Net hydraulic head = 297', rated net head = 285'

- Constructed 06/56 - 10/59 with 2 Francis units
- Concrete gravity dam 1200' long, 312' high
- 12' roadway at elev. 732' (735.77')

NGVD 29 Elevations (NAVD 88 Elevations)

**** Reservoir pool volumes and full pool surface areas have been adjusted using reservoir storage-elevation relationships updated as of May 2003 based on 2001 survey data.***

version May 16, 2003

Datum and Document Standardization - Background Information

Project Vertical Datum – In historical documents, drawings, and maps related to the Baker River Project, all elevations were reported with respect to the National Geodetic Vertical Datum of 1929 (NGVD 29) that was referenced to local mean sea level. However, even after time-averaging of tidal fluctuations, local mean sea level will vary from a level surface geographically due to the influence of permanent ocean circulation patterns, salinity, temperature and wind set-up. Until recently, these geographic variations in sea level were not considered significant enough to warrant local adjustments.

The recently developed satellite-based Global Positioning System (GPS) has become an important tool for surveying and has created the need for a standard North American datum that corresponds with a level surface. The North American Vertical Datum of 1988 (NAVD 88) is a newer datum referenced to mean sea level at the Father Point Lighthouse near Rimouski, Quebec. The difference between NGVD 29 and NAVD 88 can be calculated based on latitude and longitude. This difference is 3.77 ft at the location of the USGS gage used to measure reservoir levels in Baker Lake. Thus, when the reservoir level is at full pool in Baker Lake, it corresponds with elevation 724 ft (NGVD 29) or elevation 727.77 ft (NAVD 88). The reservoir pool level does not change; it is simply called by a different elevation corresponding to the newer vertical datum. Similarly, the difference between NGVD 29 and NAVD 88 is 3.75 ft at the location of the USGS gage used to measure reservoir levels in Lake Shannon. When the reservoir level is at full pool in Lake Shannon, it corresponds with elevation 438.6 ft (NGVD 29) or elevation 442.35 ft (NAVD 88).

The Baker Project Relicensing GIS database is referenced to the NAVD 88. In addition, maps produced from recent survey and mapping efforts such as the Corps of Engineer's survey of the Little Baker River channel, and Lake Shannon bathymetry are referenced to the newer datum. The Federal Energy Regulatory Commission has requested that, at a minimum, all project drawings reference the newer NAVD 88. Although the United States Geological Survey (USGS) in Washington State will use NGVD 29 for at least the next few years, the USGS is gradually changing to the newer datum on a state-by-state basis. Several sites in Washington State are currently reported using the NAVD 88 datum at the request of the site cooperator. As the Baker River Project moves forward in the relicensing process, we had to consider whether to adapt to the newer NAVD 88 or continue using the NGVD 29. Although switching to datum NAVD 88 at this time may be slightly premature, relicensing of the Baker River Project looks to the future. We recognize there will be some confusion in the near term, but we believe that making the change to the newer datum during relicensing will reduce future confusion as more reports, maps and documents reference the newer datum. All elevations cited in new Baker River relicensing documents, drawings and maps should be reported with respect to the newer North American Vertical Datum of 1988 (NAVD 88).

Unregulated Baker River Flows – Baker River flows under theoretical unregulated conditions are calculated by accounting for changes in reservoir storage and records of flow released through generation and spill. These synthesized unregulated flow conditions are an important input to the HYDROPS modeling process and habitat modeling efforts in the middle Skagit River. Average daily values were calculated using storage-elevation relationships developed in 1959. Recent bathymetric surveys performed in 2001 indicate that there is now less storage available in both Upper and Lower Baker Reservoirs due to sedimentation over the 42-year period between 1959 and 2001. The updated reservoir storage-elevation data will affect calculations of unregulated flows since the unregulated flows are derived, in part, from daily changes in reservoir storage. A comparison of unregulated daily flows derived using the 1959 bathymetry and the 2001 bathymetry indicates that the primary difference is the volume of daily flows under cold winter periods. Since these periods of low winter flows are important for both power generation and salmonid incubation, we want to update the flow data to reflect the best available information.

We are currently in the process of recalculating unregulated Baker River flows and these data will be made available for distribution shortly. Unregulated flow data for the Baker River at Concrete, storage-elevation tables, records of forebay fluctuations at both reservoirs and other relevant hydrologic data will be compiled onto a compact disk and clearly labeled copies will be made available to interested parties. Ongoing and future analyses using unregulated flow records and reservoir storage-elevation tables should use the updated data and cite the date of the source information in the report.

Changes in the storage-elevation relationships will also affect reservoir pool levels associated with storage volumes. Elevations that referenced available reservoir storage, for instance the winter flood control pool, will be recalculated using the updated reservoir storage-elevation data and referenced to the NAVD 88. For instance, the Baker Lake winter flood control pool of elevation 707.8 ft (NGVD 29) will be referenced as 711.56 ft (NAVD 88).

Full Pool and FERC Boundary Delineation – In support of the Baker River Project relicensing process, all elevation-oriented GIS mapping and analyses have been based on the Walker and Associates spring 2001 aerial topographic survey. This survey is referenced to the newer vertical datum NAVD 88. Past requests for surface area, reservoir perimeter and project boundaries referenced to the NGVD 29 datum were delineated without accounting for the difference between NGVD 29 and NAVD 88. For instance, reservoir levels such as Baker Lake 724.0 ft were computed from the 2001 topographic survey data and are therefore "near normal full pool" rather than the actual normal full pool levels of 727.77 ft (NAVD 88) for Baker Lake. These boundaries have now been re-mapped.

Surface areas and perimeter lengths for the full pool condition have been adjusted to reflect the appropriate normal full pool condition (Table 1). Reservoir surface areas associated with the datum adjustment increase the normal full pool surface area by about 3.8 percent for each reservoir, and decrease the perimeter of each reservoir by about 0.5 percent. The difference between the "near normal full pool" boundary and the actual "normal full pool" boundary is difficult to discern on Lake Shannon and the east side of Baker Lake where the reservoir shoreline is steep. The difference is more apparent along the west side of Baker Lake and along some tributary deltas where the shoreline gradient is less steep (see Figure 1).

Table 1. Baker Lake and Lake Shannon Reservoir Levels and percent change in water surface area and perimeter. Note that an increase in reservoir surface area results in a decrease in reservoir perimeter since shoreline complexity is reduced at the higher pool level.

	Baker Lake Reservoir Levels		**Lake Shannon Reservoir Levels**	
	724.0 ft (NAVD 88)	**727.77 ft (NAVD 88)**	**438.6 ft (NAVD 88)**	**442.35 ft (NAVD 88)**
Water Surface Area (acres) (percent change)	4,794.2	4,979.7 (+3.87%)	2,195.9	2,278.2 (+3.75%)
Water Surface Perimeter (feet) (percent change)	189,138.4	188,165.4 (-0.51%)	144,747.3	144,051.5 (-0.48%)

The effect of this discrepancy depends on the type of technical study underway:

- **Baker Lake and Lake Shannon Reservoir Levels** – Normal full pool has been recalculated to 727.77 ft (NAVD 88) for Baker Lake and 442.35 ft (NAVD 88) for Lake Shannon. At a minimum, studies using the term "normal full pool" will need to add a footnote describing the actual meaning to be "near normal full pool." Future documentation of any reservoir level should include a reference to the vertical datum [e.g., 700.0 ft (NAVD 88)].
- **Baker River Project FERC Boundary** – The FERC boundary is primarily a contour of 729.0 ft (NGVD 29) around Baker Lake and 440.0 ft (NGVD 29) around Lake Shannon except for areas within the Town of Concrete, around Depression Lake, and Sockeye Spawning Beaches 2 and 3. These values will be recalculated to 732.77 ft and 443.75 ft (NAVD 88) and incorporated into the existing GIS-based FERC boundary.
- **Project Land Ownership and Flooding Rights** – Land ownership and easements that are dependent on the spatial representation of normal full pool and/or the FERC boundary will be corrected.

SUMMARY

Addressing these three issues will affect those conducting analyses involving reservoir fluctuations, flow modeling and surveying, and those preparing documents, drawings, and maps in connection with the Baker River Project relicensing process.

The transition will affect parties working with the Baker River Project in various ways:

- All elevations mentioned in a document, map or database should include a reference to the appropriate datum.
- Elevations will be reported with respect to NAVD 88. To convert elevations of fixed structures from NGVD 29 to NAVD 88, simply add 3.77 ft to elevations for Upper Baker structures and 3.75 ft to elevations for Lower Baker structures (see attached dam schematics).

- Reference to reservoir pool elevations that are associated with specific storage volumes should reflect the updated storage-elevation tables and cite the date of the source information.
- Ongoing and future hydrologic analyses using unregulated flow records or reservoir storage-elevation tables should use the updated data and cite the date of the source information in any accompanying report.
- If you have been using normal full pool surface area values or reservoir perimeter lengths calculated prior to the date of this memo, consider whether your analyses should be modified to incorporate the updated information. In some cases, an errata page may suffice, noting that the elevations in the document are referenced to NGVD 29 and the full pool calculations represent "near full pool" rather than full pool. You will have to evaluate whether the approximate 3.8 percent difference is significant enough to warrant more than an errata page at the front of the report.
- Previously delineated FERC boundaries will be re-mapped; you will have to decide whether the difference warrants document revision or an errata page.

For additional information regarding any GIS-based calculations, please contact Joetta Zablotney, R2 Resource Consultants at 425-556-1288; for reservoir storage-elevation data or updated hydrology information, please contact Bob Barnes or Paul Wetherbee at PSE, or Stuart Beck at R2 Resource Consultants.

May 20, 2003

To: Baker Relicense Team Leaders

From: Kris Olin

Subject: Datum and Document Standardization

We recently became aware of a conflict in elevation datum used for the Baker Project that will affect three inter-related issues. The three issues are identification of a standard project datum, changes in reservoir storage-elevation tables, and inconsistent reference datums in Geographic Information System (GIS) products. As work proceeds on the Baker River Project relicensing process, it is important that everyone use or reference the same project data to ensure consistency among complementary analyses.

Summary

In historical documents, drawings, and maps related to the Baker River Project, all elevations were reported with respect to the National Geodetic Vertical Datum of 1929 (NGVD 29) that was referenced to local mean sea level. Satellite-based Global Positioning Systems (GPS) have become an important tool for surveying and created the need for a standard North American datum that corresponds with a level surface. The North American Vertical Datum of 1988 (NAVD 88) was developed as a result.

The difference between NGVD 29 and NAVD 88 can be calculated based on latitude and longitude. This difference is 3.77 ft at the location of the USGS gage used to measure reservoir levels in Baker Lake. Thus, when the reservoir level is at full pool in Baker Lake, it corresponds with elevation 724 ft (NGVD 29) or elevation 727.77 ft (NAVD 88). The reservoir pool level does not change; it is simply called by a different elevation corresponding to the newer vertical datum. Similarly, the difference between NGVD 29 and NAVD 88 is 3.75 ft at the location of the USGS gage used to measure reservoir levels in Lake Shannon. When the reservoir level is at full pool in Lake Shannon, it corresponds with elevation 438.6 ft (NGVD 29) or elevation 442.35 ft (NAVD 88).

The Baker Project Relicensing GIS database, the Corps of Engineer's survey of the Little Baker River channel, and Lake Shannon bathymetry are all referenced to NAVD 88. Also, the Federal Energy Regulatory Commission has requested that, at a minimum, all project drawings reference the newer NAVD 88.

Although the United States Geological Survey (USGS) in Washington State will use NGVD 29 for at least the next few years, the USGS is gradually changing to the newer datum on a state-by-state basis. Several sites in Washington State are currently using the NAVD 88 datum at the request of the site operator. As the Baker River Project moves forward in the relicensing process, we had to consider whether to adapt to the newer NAVD 88 or continue using the NGVD 29.

Conclusion

Please inform your respective consultants and participants within the Working Groups that all elevations cited in new Baker River relicensing documents, drawings and maps will be referenced to the newer North American Vertical Datum of 1988 (NAVD 88). We recognize there will be some confusion in the near term, but we believe that making the change to the newer datum during relicensing will reduce future confusion as more reports, maps and documents reference the newer datum.

For additional information regarding any GIS-based calculations, please contact Joetta Zablotney, R2 Resource Consultants at 425-556-1288; for reservoir storage-elevation data or updated hydrology information, please contact Bob Barnes or Paul Wetherbee at PSE, or Stuart Beck at R2 Resource Consultants.

Enclosure