RECREATION USE AND NED BENEFITS TECHNICAL CHAPTER

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PURPOSE

This chapter summarizes results of four recreation use surveys conducted to estimate the visitation and benefits associated with current reservoir recreation, major system improvements and potential river recreation with natural river drawdown. References to the detailed reports are provided for interested readers. This chapter also applies the results of those surveys to the EIS alternatives. Passive use or existence values associated with species recovery is presented in a separate technical chapter.

METHODS

The Principles and Guidelines (U.S. Water Resources Council, 1983) which governs the conduct of benefit-cost analyses by federal agencies such as the U.S. Army Corps of Engineers (COE), requires that benefits to the visitor be measured as the additional amount the visitor would pay for the recreation experience over and above their current costs. This benefit measure is referred to as net willingness to pay (WTP) and is the measure the COE uses when measuring National Economic Development (NED) benefits. The economics profession also recommends net WTP as the conceptually correct measure of gains in a benefit-cost analysis (Sassone and Schaeffer, 1978; Loomis and Walsh, 1997).

The actual expenditures of visitors are costs to visitors (not benefits) but contribute to regional economic development (RED). The local income and employment generated from recreation visitor spending is reported in a separate chapter entitled Regional Economic Development.

Techniques Used to Measure Visitor Benefits

The Principles and Guidelines (U.S. Water Resources Council, 1983) recommends that either the Travel Cost Method (TCM) or Contingent Valuation Method (CVM) be used to quantify visitors net WTP. Both of these methods are used by other Federal agencies and frequently used by economists (Loomis and Walsh, 1997). In this study TCM is applied to estimate net WTP for the current reservoir recreation, river recreation above Lewiston, Idaho and in the Snake River basin in central Idaho. TCM uses the actual number of trips taken by an individual as the quantity variable and the visitor's travel cost as the price variable to statistically trace out a demand curve for recreation using multiple regression. From this demand curve the net WTP is calculated. See Agricultural Enterprises Inc. (1999a,b,c) for more details on the TCM demand models used.

Since natural river conditions do not exist in the Lower Snake River, one cannot survey existing users and directly apply a standard TCM to estimate the value of river recreation with dam removal. Therefore a hybrid TCM approach known as "contingent behavior" (CB) is used to estimate the value of river recreation under the Natural River Drawdown Alternative. This hybrid approach involves: (a) describing the new recreation conditions--e.g., natural river scenario; (b) asking whether the person would visit and if so, how many times per year; (c) asking the distance, travel cost and travel time to their most likely spot on the river they would visit. Thus, the variables are similar to what is used in the TCM for current reservoir recreation. In addition,

the same statistical regression models are applied to the data for all alternatives. Thus, the same general recreation valuation approaches are used to value the different types of recreation across alternatives. The contingent behavior approach is becoming widely used in economics, previously applied in the Columbia River System Operation Review (Callaway, et al., 1995) and has been shown to be reliable (Loomis, 1993). See Loomis, 1999 for discussion of the contingent behavior TCM.

Surveys

Surveys were designed to allow estimation of both types of Travel Cost Method demand models. Questions included travel expenditures, travel time, time on site, discretionary time available for recreation and questions regarding visitor demographics.

Reservoir Recreation Surveys: Two separate travel cost method mail survey instruments were developed, an angler survey and a general recreation survey. These two surveys were relatively short, being three pages in length. Visitor names and addresses to allow mailing of these surveys were collected by University of Idaho students stationed at recreation access points along the lower Snake River. Visitors were sampled at the reservoirs from May to October of 1997. A total of 408 completed surveys were mailed back from non-angler river visitors, representing a response rate of 65%. A total of 537 completed surveys were mailed back by anglers, representing a response rate of 59%. Copies of the reservoir visitor survey instrument is in Agricultural Enterprises (1999a) while the reservoir sport fishing survey is in Normandeau, et al., 1999.

Snake River Above Lewiston, Idaho Survey: This was a survey of anglers, generally fishing for steelhead in the 30 mile stretch of the Snake River, above the town of Lewiston, Idaho. The names and addresses were collected from September 1997 to March 1998. A total of 247 completed surveys were returned, yielding a response rate of 72%. A copy of the survey instrument is in Normandeau, et al., 1999.

Central Idaho Surveys for Angling and Rafting: Due to the variety of access points, these surveys were distributed to anglers and rafters using several methods including on-site contacts and via guides. A total of 257 useable responses were obtained from anglers, while 190 useable surveys were returned by other river recreation users such as rafters. Copies of the survey instrument are in Agricultural Enterprises (1999b,c)

Natural River Conditions Recreation Survey: Because the free-flowing lower Snake River does not exist, a stratified sample of households was mailed an eight page survey. The sample was determined by evaluating the origin of current visitors to the Snake River and from guidance from the Drawdown Review Economics Workgroup (DREW). The sample included residents of Idaho, Oregon, Washington, western Montana and California. A local sample strata of counties surrounding the lower Snake River was included to insure adequate representation of these households. The overall response rate was 54% representing 4,780 completed surveys. Only a portion of the 4,780 households returning surveys indicated they would visit the lower Snake River under the Natural River Drawdown condition, however. A copy of the survey instrument is in Loomis (1999). However, the response rate for California was only 28% while for the rural areas surrounding the Snake River, the response rate was 56%. Two of our visitor use estimates

adjust for these response rates when generalizing from the sample to the population to minimize any sample selection bias in the visitor use estimate.

The survey instrument was constructed to determine which types of recreation users would visit the area under a drawdown scenario. The survey further asked the visitors how many times per year those recreation visitors would visit the site. The Corps believes that because responses of one visit per year or more for some of the distant travelers does not appear reasonable, the survey may bias the results and over estimate usage. Those individuals coming from outside the region may not visit annually. Individuals from outside the region may only visit once every 5 years, or once every 10 years or once in a lifetime. Therefore, the Corps believes this may tend to over-estimate the recreation usage estimates of those from outside the region. This is an issue that will be further investigated for the final report.

SURVEY FINDINGS

Lower Snake River Reservoir

The average net WTP per trip of reservoir fishing was $29.23 (many of these are very short trips of a day or less). Using information on angler hours per day and angler days per year from the Normandeau et al., survey, it is estimated 2,831 anglers took 57,338 angler trips during 1997. Multiplying the value per trip times the estimated number of trips yields annual benefits of $1.676 million in 1997.

The average net WTP or net benefit per day of non-angling reservoir recreation such as boating and waterskiing was $71.31 per trip. COE visitation data is used to estimate the total number of hours. Subtracting the estimate of angler hours obtained from the Normnadeau et al. data yields hours of reservoir recreation. Using the Agricultural Enterprises Inc. survey data on average length of stay allows an estimate of days, which can be converted to trips. Annual recreation benefits are calculated by multiplying the value per trip times an estimated 442,834 trips yields an annual recreation benefit of $31.578 million. Details of the per trip and annual TCM benefits methodology for general reservoir recreation analyses can be found in Agricultural Enterprise Inc. (1999a) while the reservoir fishing is detailed in Normandeau, et al. 1999.

These benefits per trip can be compared to the benefit estimate CSOR recreation travel cost method demand model for Lower Granite reservoir recreation. Callaway, et al. estimated an average consumer surplus of $32.74 per day. This value is greater than the reservoir angling estimate, but less than general reservoir recreation value, even when adjusted to a per trip basis.

Upriver of Lewiston, Idaho

The average net WTP for anglers fishing in the 30 mile stretch of the Snake River above Lewiston, Idaho is $35.71 per trip. Angler use estimates were made using a combination of aerial surveys, ground based counts and the visitor intercept surveys. Multiplying the benefit per trip times the resulting estimate of 11,437 angler trips yields an annual value of $408,408. Details of the per trip and annual benefits of this upriver angler analysis can be found in Normandeau, et al. (1999).

Central Idaho

Anglers in Central Idaho (Snake River Basin) had an average net WTP per trip of $37.68. When

multiplied by an estimated 129,026 steelhead trips yields an annual benefit of $4,861,700 (see Agricultural Enterprises Inc, 1999b). The average net WTP per trip for non-angling upriver recreation such as rafting is $87.24. Using survey data information, the estimated use is 180,000 non-angler visitors to the region (Agricultural Enterprises Inc. 1999c). It is estimated these visitors take 497,480 trips annually. Multiplying the trip value times the estimated number of trips yields an annual value of $43,400,000.

Table R-1 lists existing reservoir recreation use and benefits (Alternative A1) which total 500,172 trips worth $33.254 million annually.

Table R-1 Summary of Existing Recreation Use and Benefits (1998 dollars)

Recreation Activity	Trips	Annual Benefits
Lower Snake River Reservoirs		
Fishing	57,338	$1,676,000
General Reservoir Recreation	442,834	$31,578,000
Subtotal	500,172	$33,254,000
Upriver of Lewiston, ID		
Fishing	11,437	$408,408
Central Idaho Rivers		
Steelhead Fishing	129,026	$4,861,700

Natural River Drawdown Recreation

Using the contingent behavior TCM, the value per trip of salmon and steelhead fishing in what would be the free flowing lower Snake River if the dams are breached has an estimated value of $256 per trip of 3.36 days or $76 per day. The value for mainstem free-flowing river recreation activities such as rafting, canoeing, kayaking and swimming as well as river related recreation is estimated at $297 per trip of 2.6 days using survey respondents reported trip cost (this is consistent with how the mainstem river anadromous fishing TCM benefits are calculated above). In the tables and analysis below, this river recreation value of $114 per day is considered the High NED value. Using a definition of the cost per mile price variable in the TCM demand function consistent with Agricultural Enterprises Inc. (1999a) reservoir recreation yields a value of $71.36 per trip of 2.6 days. This resulting value per day is more consistent with the literature on the value of non-boating types of river related recreation activities respondents indicated in the survey. A similar definition of the price variable consistent with Agricultural Enterprises Inc (1999a) reservoir angler travel cost per mile is used with the Loomis (1999) contingent behavior TCM to estimate the value of salmon fishing in the reservoirs ($39 per day) with the non-drawdown alternatives. For the mainstem river anadromous fishing this $39 per day is

considered the Low NED value, while the $76 per day is considered the High NED Value. The High NED value is more consistent with the value of salmon and steelhead river fishing in the literature than (Walsh, et al., 1992).

Four estimates of river recreation demand and benefits are provided that range from a **Low Estimate** (using just households that indicated they would **definitely** visit with dam removal and assuming zero visitation from survey non-respondents) to a **High Estimate** based on households that indicated they definitely *or* probably would visit and assuming that survey non-respondents would visit at the same rate as survey respondents. **Middle Use Estimates** of demand are provided by assuming that households that did not respond to the survey would visit at the same rate as households that did respond to the survey but applying this assumption only to the fraction of the population that would **definitely** visit. Lastly, a **Middle-high** demand estimate is provided which uses the households that indicated they definitely *or* probably would visit but assuming that survey non-respondents would not visit. Thus both the **Low** and **Middle-high** estimates explicitly adjust for potential concerns over low response rates from more distant areas by using zero visits for non-respondents. This yields a very conservative visitor estimate for the **Low** and **Middle-high**. Alternatively, the **Middle** and **High** use estimates are not corrected for sample selection effects and they may yield over-estimates of recreation use.

These demand estimates are also phased in over time as the natural river system recovers from dam removal. Table R-2 presents the expected suitability of the area for river recreation with dam removal. This table was initially developed by recreation planners at the COE and then refined and applied to the Natural River Drawdown survey data. As can be seen in this table, suitability for some activities recover more slowly than others. For example, river and shorebased recreation takes up two decades to become completely suitable for recreation activities.

Table R-2 Recreation Suitability Recovery after Dam Removal

	YEAR	YEAR	YEAR	YEAR
ACTIVITY	1	5	10	20
Jet Boating, Jet Skiing	0.2	0.5	0.7	1
Raft/Kayak/Canoe	0.3	0.5	0.8	1
Swimming	0.2	0.4	1	1
Picnic/Primitive Camping	0.8	1	1	1
Developed Camping	0.6	0.9	1	1
Hike & Mtn Bike	0.8	1	1	1
Hunting	0.5	0.8	1	1

Further, the demand estimates are compared to availability of developed campgrounds, dispersed

camping areas and boat ramp capacity to determine how much of the demand can be accommodated given the recreation facilities after Natural River Drawdown. The visitation estimates for General River Recreation given in Table R-3, reflect the application of these capacity constraints to the demand estimates. In particular, three key capacities were examined: boat ramps, developed campsites and areas available for primitive camping. COE recreation planners provided information on the number of boat ramps, developed campsites and suitable areas for primitive camping. To calculate visitor day capacities, we took the recreation season as April through October. This time period coincides with spring break through the steelhead fishing season as well as summer vacations. This area is attractive in spring and fall, due to the early warm temperatures. While rather hot during the summer, the area receives high use during the vacation months of July and August. Given the average party size of three persons, the maximum number of visitor days that could be accommodated during this April through October time period with the current number of developed campsites was calculated. This figure initially limited the amount of developed camping demand that could be accommodated in all scenarios during the first decade. By the end of the first decade, the river areas have sufficiently stabilized and the number of developed campsites is expected to be more than doubled, which fully meets demand with the low estimate. However, this more than doubling of developed campsites accommodates about 75% of the demand in the middle use and high use estimates. This is probably not out of line with the percentage of developed camping demand met in many popular areas. Primitive camping and primitive camping was limited during the first few years until the receding beaches became suitable for camping and picnicking. Boat ramp capacity was sufficient for all use scenarios, although they would be used at close to capacity in the middle-high use and high use estimates. The use estimates presented in Table R-3 reflect the assumption that non-fishing river recreation use would not need to be limited to protect the anadromous fishery.

Unlike current conditions, the contingent behavior surveys predict that a large percentage of total river recreation trips would come from more distant areas such as Portland, Seattle and California with the 140 miles of free flowing river. Three of the four visitor estimate scenarios indicate that 30-45% of the total trips are from California depending on the sample expansion assumptions. This percentage of trips is not out of line with the fact California represents 60%-70% of the population of our sampling area. Table R-3 illustrates the distribution of trips for each of the three sampling areas with the High and Low NED values.

Table R-3					
Number & Distribution of River Trips & Benefits in Year 10					
			River Rec	Annual	Annual
		Percentage	Trips	Low NED/1	High NED/1
Low Estimate				(Millions)	(Millions)
Rural ID,OR,WA		19.50%	47,823	$3.41	$14.20
Rest of Pac NW		50.10%	122,920	$8.77	$36.51
California		30.40%	74,595	$5.32	$22.15
Total		100.00%	245,338	$17.51	$72.87
Middle Estimate					
Rural ID,OR,WA		14.41%	66,617	$4.75	$19.79
Rest of Pac NW		40.66%	188,014	$13.42	$55.84
California		44.94%	207,824	$14.83	$61.72
Total		100.00%	462,456	$33.00	$137.35
Middle-High Estimate					
Rural ID,OR,WA		16.87%	128,633	$9.18	$38.20
Rest of Pac NW		39.61%	295,557	$21.09	$87.78
California		43.52%	331,841	$23.68	$98.56
Total		100.00%	756,031	$53.95	$224.54
High Estimate					
Rural ID,OR,WA		11.45%	200,989	$14.34	$59.69
Rest of Pac NW		29.51%	518,201	$36.98	$153.91
California		59.04%	1,037,003	$74.00	$307.99
Total		100.00%	1,756,193	$125.32	$521.59

/1 The Low NED values are consistent with literature for general recreation, while the High NED values are consistent with literature for river angling.

This change in distribution of the origin of visitors with the free flowing river is consistent with the pattern found in Agricultural Enterprise travel cost analyses of actual visitation. Specifically, the current reservoirs are primarily local use areas with a majority of visitors coming from within 100-120 miles (Normandeau, et al. 1999, Agricultural Enterprises 1999a). However, in the free-flowing river sections of Central Idaho, 21% of the river visitors come from 1,000 miles or more away, with 12% coming from 1,500 miles or further (Agricultural Enterprises Inc, 1999b,c). This pattern is consistent with the lack of availability of substitute rivers of the size and magnitude of what the Lower Snake River will be with the dams removed. Thus people are willing to travel greater distances to visit free flowing rivers. Besides the limited number of major rivers in the western U.S., many existing rivers such as the Rogue, Salmon or the Colorado have use limits and permits are rationed by lottery. By contrast, reservoir visitors do not have to travel great distances as there are numerous reservoirs in the local area, including Lake Wallula downstream from Ice Harbor dam very near the Tri-Cities area, Dworshak Reservoir near Lewiston, ID and three large lakes near Spokane, Washington.

Salmon and Steelhead Fishing

As explained in more detail below, salmon and steelhead fishing demand with natural river condition is constrained by availability of salmon and steelhead. The availability of salmon for harvest was estimated by the interagency PATH biologists as extended by Shannon Davis (see Radtke, Davis and Johnson, 1999). The limited availability of salmon for recreational fishing constrains the angler trips demanded that can be realized to an annual average of about 500 trips during the first five years and an annual average of about 14,000 angler trips over the remaining period of analysis. This is about 6% of the low estimate of salmon angler demand. The same pattern is evident for steelhead, where numbers of fish available for recreational harvest limit angler days to an annual average of 100,000 on the mainstem of the Lower Snake River over the period of analysis. This represents 50% of the lowest estimated demand. As explained in more detail in the next section, a portion of the resident fishing angler demand is also supplied with the Natural River Drawdown Alternative.

APPLICATION OF SURVEY RESULTS TO EIS ALTERNATIVES

There are several different alternatives evaluated in the EIS. However, from the standpoint of general/non-fishing recreation, these alternatives can be grouped into two main categories: (1) alternatives in which the dams remain; and (2) Natural River Drawdown (A3). Group (1) includes Existing System (A1), Existing System with Maximize salmon transport (A-2a) and Major System Improvements for salmon such as surface bypass collectors (A-2b).

River Recreation

For the Natural River Drawdown Alternative, the estimated time path of river recovery following dam removal and its influence on recreation suitability and facility availability was estimated by COE recreation staff. In Table R-2 these recreation carrying capacity estimates by time interval were refined and used to estimate the percentage of the different recreation activities that could be accommodated in each time period. These percentages were applied to the four different estimates of non-angling river recreation demand calculated from the survey. These resulting visitation figures were reduced by the carrying capacity of the developed campgrounds in all but

the lowest estimate river visitor demand. The resulting visitor days are valued using the benefits calculated from the TCM as described above. In particular, there is a High NED value scales the TCM demand curve based on the visitor survey responses. The Low NED value scales the TCM demand curve based on cost per mile of reservoir visitors as used in the reservoir recreation valuation model of Agricultural Enterprises Inc.

Recreational Fishing

The estimated salmon and steelhead that can be recreationally harvested with each alternative was provided by Shannon Davis (see Radtke, Davis and Johnson, 1999 for details). Davis based his estimates on PATH analysis and made additional assumptions to generalize the seven PATH index stocks to all Snake River stocks. He also used information from various international and national fishery treaties to allocate the total stocks to commercial, tribal and recreational catch. The biological availability of salmon and steelhead for recreational harvest was used to constrain the river angler demand calculated from the household survey data. Specifically, only the proportion of river angler demand compatible with salmon and steelhead available for recreational harvest was counted in any given year. This results in only a small fraction of the angler demand indicated in the survey being met.

Details of Resident and Steelhead Fishing Calculation Procedures

Using Davis' generalization of PATH's estimates of salmon and steelhead with existing reservoirs (A1, A-2a, A-2b) we calculated the time path of anadromous fishing benefits with these three alternatives. These changes in salmon and steelhead available for recreational harvest reflect fisheries improvements recently put in place (Alternative A1) or proposed improvements with alternatives A-2a or A-2b. Specifically, to estimate the number of angler resident fish trips and steelhead fishing trips we started with current reservoir fishing trips and the fishing trips in the free-flowing stretch above Lewiston. These trips were separated into resident fish species trips and steelhead trips based on information from the Normandeau et al (1999: I2-51, II2-14) analysis. Generally Normandeau and Bennett conclude there will be minor effects on resident fish for the non-drawdown alternatives (e.g., A1, A-2a, A-2b). Thus, with alternatives A-1, A2a and A2b, these resident trips and their value are expected to continue into the future. The remaining steelhead trips were related to baseline steelhead harvest figures to calculate trips per steelhead harvested. This factor was applied to future estimates of steelhead harvests provided by Shannon Davis (based on PATH) to calculate future steelhead fishing trips. The mainstem resident and steelhead fishing use and benefits is then the sum of the resident fishing and the estimated future steelhead fishing.

To estimate the effect of natural river drawdown (A3) on mainstem resident fish, information from Normandeau and Bennett's Table 4-3 on acres of habitat quantity and Table 4-4 on productivity per hectare was used. With natural river drawdown, surface area of habitat falls from 33,890 to 13,162. However, estimated biomass will increase from 50.9 to 84.7 kg/ha with natural river conditions. If we combine the two effects, there appears to be a net loss, as the loss in habitat area is greater than the gain productivity. Based on these two factors it appears that the loss is about a one-third reduction in resident fish carrying capacity with natural river drawdown. Thus the estimated resident fishing benefits with A3 is two-thirds of estimated current resident angler trips and benefits.

To estimate the mainstem river steelhead fishing days with alternative A3, we relied upon two sources of information. First, was the hours to harvest a steelhead. Since this was the same information used in formulating the baseline steelhead catch rate in the contingent behavior survey, we used the same number from Idaho Fish and Game (24 hours to harvest one steelhead). Second was the conversion of angler hours to angler days. The average steelhead angler in the free-flowing section of the Lower Snake River fishes 7.2 hours per day (Normandeau, et al. (1999: II-2-35)). To estimate the benefits of steelhead fishing in the free flowing mainstem of the Lower Snake River we relied upon the contingent behavior TCM of Loomis (1999) described above. This study yields a low and high value per day ($39 and $76, respectively) based on whether one scales the demand curve by the average cost per mile of reservoir anglers used by McKean in his work with Normandeau, et al. (1999) or the survey reported costs of anglers that would use the free flowing mainstem Lower Snake River.

To estimate the number of steelhead fishing days in the tributaries we used a similar process as described above except for some tributary specific information. Recreational steelhead harvests in the tributaries were estimated by Shannon Davis for each alternative. However, we calculated trips per steelhead in year zero using current steelhead fishing trips (129,026 trips in Central Idaho tributaries of the Snake River as estimated by Agricultural Enterprises Inc (1999b)) divided by year zero recreational steelhead harvest. This steelhead per trip was then applied to Davis' estimate of number of steelhead over the 100 year time period of analysis.

Details of Salmon Fishing Calculations

To estimate days of salmon fishing in the mainstem of the Snake River with all alternatives, we used an estimate of 35 hours to recreationally harvest one salmon. This was the information obtained from the special recreational salmon fishing season on the Hanford reach of the Columbia River and was used as the low salmon fishing catch rate baseline in the contingent behavior recreation survey. This figure was applied to Shannon Davis' estimate of recreational harvest allocation for spring/summer and fall Chinook salmon with each alternative in each time period to estimate total hours of salmon fishing. As with steelhead we took the average length of a fishing day as 7.2 hours on the mainstem of the Lower Snake River. The estimate of salmon fishing benefits comes from the contingent behavior survey of Loomis (1999) described above. With alternatives A1, A2a and A2b, mainstem Lower Snake River salmon fishing would take place in a reservoir setting. Therefore we use the value per day of salmon fishing from the demand curve scaled by the reservoir anglers cost per mile used by the reservoir fishing analysis. This value is $39 per day for salmon fishing. This is also the low value for the free flowing river in alternative A3. The high value for A3 reflects scaling the demand curve by the reported costs of anglers that said they would come to fish the free flowing river Lower Snake River ($76 per day).

To estimate salmon angler days in the tributaries the same basic approach was used. In particular, we used the same 35 hours per salmon harvested. The average length of a fishing day was 6.72 hours per Agricultural Enterprises Inc. (1999b) survey of Central Idaho rivers.

Calculation of Present and Annualized Value of Recreation Benefits.
These annual values over the 100 year time period are used to calculate the present value and annualized value of recreation. When using a positive discount rate, the timing of when the different recreation benefits are received influences the present or annualized value of recreation under each alternative. The time profile of benefits is quite different among the alternatives. The existing system alternative (A1) currently provide their annual level of non-fishing reservoir recreation benefits and these would be expected to continue each year into the future. However, future fishing benefits are influenced by the future effect of recent actions taken to enhance steelhead and salmon populations. Thus for the fishery recreation benefits of A1, the future is slightly different than simply extrapolating the current annual benefits. The future recreational fishing benefits for Alternative A1 is estimated using PATH estimates of steelhead and salmon fishing benefits with Alternative A1. Alternatives involving Major System Improvements and Natural River Drawdown take several years into the future to deliver some of their benefits and several decades for the salmon fishing benefits to be fully realized.

To put all dollars of benefits on an equal footing with respect to their worth today, the present worth or present value is calculated using two positive discount rates. These are 4.75% which is the rate used by BPA and the discount rate is the rate used by the COE for Fiscal Year 1999 which is equal to 6.875%. This discount rate weights benefits (and costs) in the near future more heavily than those received in the distant future. For purposes of comparison, the tribal discount rate of zero is presented in Table R4-C. This weights all benefits and costs equally overtime. The present value of recreation benefits over the 100 year period are converted into average annual equivalent values (AAEV). This is an annualized present value and to conserve space just the AAEV is presented in the following tables. The ranking of program alternatives is the same using the AAEA or present values.

SUMMARY OF RECREATION RESULTS
Tables R-4A-C displays the average annual equivalent value of the recreation benefits of each of the EIS alternatives at the three different discount rates, respectively. Each table calculates the benefits of Alternative A3 at the Low NED value per day and a High NED value. The Low NED value is based on scaling the river recreation and river fishing demand curve using the cost per mile of reservoir visitors and the High NED estimate based on scaling the demand curve using costs of visitors to the free-flowing section as they reported them in the Loomis (1999) contingent behavior survey. We also present overall benefit estimates using the Middle Use estimate for river recreation (this uses only those visitors that said they would definitely visit and applies this visitation rate to all households in the region). This Middle Use estimate is bracketed by the Low Use estimate which also relies upon the visitation rate of only those stating they would definitely visit, but conservatively assumes no visitation from households not returning the survey. Finally, an upper bound is calculated using the visitation rate of households that would definitely and probably visit, applies this to all households in the region.

While there has been some debate about the difficulty in predicting anadromous fish populations, as is evident from Tables R-4A to R-4C, recreational anadromous fishing is not the majority of the total benefits. In part this is due to the small allocation of available salmon and steelhead to recreational fishing as compared to commercial fishing. All four alternatives have increasing fishing benefits over time, although PATH estimates for Alternative A3 has the largest salmon

and steelhead gains.

Much of the overall gain in recreation benefits of A3 over A1, A2a, A2b is due to the gain in river recreation days and the value of these days being substantially higher than the loss in recreation activities that can only be undertaken in a reservoir (e.g., waterskiing, etc.). A small part of the gain of A3 High NED fishing is driven by survey respondents reported desirability of fishing for anadromous fish in a free-flowing river environment as compared to a reservoir.

Table R-5 illustrates the **net** effect of alternatives A-2a, A-2b and A3 as compared to alternative A1 calculated at the COE discount rate of 6.875%. Specifically, Table R-5 shows the gain or loss in recreation benefits of each alternative compared to the current baseline (A1), which is used as the future without. Based on the PATH fish estimates as extended from the PATH stocks to all stocks by Shannon Davis, there are small gains to salmon and steelhead fishing with A2a and A2b as compared to A1. The gains in fishing benefits with A3 High NED value are significant, amounting to over $30 million, enough to offset the lost reservoir recreation. In addition, there are large net gains overall due to river recreation with alternative A3, ranging from $11.33 million to $1525 million annually with central estimates between $56 and $342 million annually.

Given that the figures in the Low NED column are consistent with literature for general recreation, and that the figures in the High NED column are consistent with literature for river angling, the Corps believes that the most likely estimates due to river recreation with alternative A3 must be a composite of portions from both the Low NED and High NED columns presented in Table R-5. This composite would result in the most likely estimate of a benefit of an annual value of $82 million for alternative A3 (Dam Breaching). In fact, this was the methodology presented in the earlier draft of this report. However, to address the concerns of DREW Recreation workgroup members, this current report includes only the Low NED and High NED ranges, rather than the composite.

Table R-4A Annualized (AAEV) Value of Recreation Benefits over 100 years
Millions of 1998 dollars @ 6.875% (COE rate)

	A1	A2a	A2b	A3 /1 (Low NED)	A3 /1 (High NED)
Reservoir Recreation	$31.6	31.6	31.6		
River Recreation					
Low Use Est				$36.18	$150.12
Middle Use Est				$80.85	$335.53
High Use Est				$367.18	$1523.74
Recreational Fishing					
Resident&Steelhead	2.32	2.35	2.35	3.25	5.44
Mainstem Salmon	.26	.36	.34	.62	1.20
Steelhead-Tributaries	19.21	21.07	21.15	24.51	47.61
Salmon-Tributaries	.164	.20	.19	.32	.62
TOTAL Middle Use Est	$53.55	$55.58	$55.63	$109.55	$390.4
TOTAL Low Use Est				$64.88	$204.99
TOTAL High Use Est				$395.88	$1578.61

/1 The Low NED values are consistent with literature for general recreation, while the High NED values are consistent with literature for river angling.

Table R-4B Annualized (AAEV) Value of Recreation Benefits over 100 years
Millions of 1998 dollars @ 4.75%(BPA Rate)

	A1	A2a	A2b	A3 /1 (Low NED)	A3 /1 (High NED)
Reservoir Recreation	$31.6	$31.6	$31.6		
River Recreation					
Low Use Est				$38.1	$158.3
Middle Use Est				$85.5	$354.9
High Use Est				$385.3	$1599.1
Recreational Fishing					
Resident & Steelhead	2.43	2.46	2.45	3.64	6.21
Mainstem Salmon	.33	.45	.42	.82	1.60
Steelhead-Tributaries	20.75	22.55	22.58	27.04	52.52
Salmon-Tributaries	.19	.23	.22	.42	.81
TOTAL Middle	$ 55.3	$57.24	$57.27	$117.42	$416.04
TOTAL Low				$70.02	$219.44
TOTAL High				$ 417.22	$1660.24

/1 The Low NED values are consistent with literature for general recreation, while the High NED values are consistent with literature for river angling.

Table R-4C Annualized (AAEV) Value of Recreation Benefits over 100 years
Millions of 1998 dollars @ Zero% (Tribal Rate)

	A1	A2a	A2b	A3 /1 (Low NED)	A3 /1 (High NED)
Reservoir Recreation	$31.6	31.6	31.6		
River Recreation					
Low Use Est				$44.0	$182.6
Middle Use Est				$99.4	$412.6
High Use Est				$441.5	$1832.0
Recreational Fishing					
Resident&Steelhead	2.86	2.89	2.88	5.05	8.95
Mainstem Salmon	.55	.73	.68	1.50	2.93
Steelhead-Tributaries	26.35	27.5	27.34	35.42	68.79
Salmon-Tributaries	.27	.33	.31	.81	1.58
TOTAL Middle Use Est	$61.63	$63.05	$62.81	$142.18	$494.85
TOTAL Low Use Est				$86.78	$264.85
TOTAL High Use Est				$484.28	$1914.25

/1 The Low NED values are consistent with literature for general recreation, while the High NED values are consistent with literature for river angling.

Table R-5 Difference in Annualized AAEV Value of Recreation Benefits from Alternative A1
Millions of 1998 dollars @ 6.875% (COE rate)

	A2a	A2b	A3 /1 (Low NED)	A3 /1 (High NED)
Reservoir Recreation	$0	$0	-31.6	-31.6
River Recreation				
Low Use Est			+36.18	+150.12
Middle Use Est			+80.85	+335.53
High Use Est			+367.18	+1523.74
Recreational Fishing				
Resident&Steelhead	.03	.03	.93	3.12
Mainstem Salmon	.10	.08	.36	.94
Steelhead-Tributaries	1.86	1.94	5.30	28.40
Salmon-Tributaries	.04	.03	.16	.46
TOTAL Middle Use	$2.03	$2.08	$56.0	$336.85
TOTAL Low Use Est			$11.33	$151.44
TOTAL High Use Est			$ 342.33	$1525.06

/1 The Low NED values are consistent with literature for general recreation, while the High NED

values are consistent with literature for river angling.

RISK AND UNCERTAINTY

As in any survey and statistical analysis, there is a degree of uncertainty regarding the exact magnitude of the estimates of the visitor use and recreation benefits. This section expands upon the potential range of river visitor use estimates, and provides a range of benefit per trip associated with the various recreation uses.

Reservoir recreation benefits represent three-fourths of the benefits of alternatives A1, A-2a and A-2b. The reservoir value per trip from Agricultural Enterprises Inc (1999a) is $71.31. The 95% confidence interval around the mean is $47 to $148 per trip. Using the 95% confidence interval, the annual value of recreation changes from the mean estimate of $31.6 million to a low of $20.8 million to a high of $65.5 million annually.

River recreation benefits also reflect a large part of the benefits for alternative A3. The mean benefits per trip using the low NED value is $71.36 per trip, with a 95% confidence interval of $39 to $446 per trip. If we use visitors' entire reported trip costs as the price variable in the demand function, then river recreation benefits have a mean value of $297 per trip, with a 95% confidence interval of $181 to $831 per trip.

The Low and Middle estimates in all of the tables presented in this chapter uses just those indicating they would definitely visit. Based on the research by Champ, et al. (1997) respondents that are definitely sure of their responses had criterion validity with actual cash payments. Since it is likely that at least some of the respondents indicating they would Probably Visit the Lower Snake River if the dams were removed may visit, the Low and Middle estimates are conservative due to the omission of the Probably Visit respondents. Further, the Low estimate reduces the Definitely Yes visitation estimate by the survey non-response rate. That is, the Low estimate assumes that none of the non-respondents to the survey would visit the Lower Snake River if the dams were removed. Thus, the Low estimate is doubly conservative.

Avoided Cost Analysis

Removal of the dams in alternative A3 will not result in any significant recreation management costs avoided to the COE. Most of the COE recreation maintenance cost is related to the developed campground areas and other developed facilities that will remain under all alternatives. The labor costs associated with rangers will continue as well.

Mitigation

The reservoir recreation effects from removal of the dams in alternative A3 will not be directly mitigated. Much of the same water based recreation is expected to continue as today, with the major exception being activities such as waterskiing. The availability of existing nearby reservoirs such as Lake Wallula downstream from Ice Harbor dam and near Tri-Cities, Dworshak Reservoir near Lewiston Idaho and three large lakes near Spokane (Rufus Woods Lake, Coeur d'Alene and Lake Pend Oreille) provide opportunities for flat water recreation.

CONCLUSION

Table R-5 presents the net changes for each alternative from the base case. Alternatives A2a (Maximum Transport) and A2b (System Improvements) both provide benefits of approximately $2 million annually.

Table R-5 also presents the net changes for alternative A3 (Dam Breaching). However, these benefits are presented as a range with Low and High NED values. The Low NED values are consistent with literature for general recreation, while the High NED values are consistent with literature for river angling. Therefore, the Corps believes that the most likely estimate of the net changes for alternative A3 (Dam Breaching) would be a composite of portions from both the Low NED and High NED columns presented in Table R-5. This composite would result in the most likely estimate of a benefit of an annual value of $82 million for alternative A3 (Dam Breaching).

UNRESOLVED ISSUES

The survey instrument was constructed to determine which types of recreation users would visit the area under a drawdown scenario. The survey further asked the visitors how many times per year those recreation visitors would visit the site. The Corps believes that because responses of one visit per year or more for some of the distant travelers does not appear reasonable, the survey may bias the results and over estimate usage. Those individuals coming from outside the region may not visit annually. Individuals from outside the region may only visit once every 5 years, or once every 10 years or once in a lifetime. Therefore, the Corps believes this may tend to over-estimate the recreation usage estimates of those from outside the region. This is an issue that will be further investigated for the final report.

Additionally, a discrepancy was noted during the final stages of this analysis; while the analysis assumes increased benefits from added capacity, the increased costs to create the facilities were not added. This has the effect of understating NED costs, and understating RED short term benefits (from new construction). This is an issue that should be resolved between the draft and final reports.

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