RECLAMATION

Managing Water in the West

Economics Technical Report for the Yakima River Basin Water Storage Feasibility Study Final Planning Report/ Environmental Impact Statement

A component of
Yakima River Basin Water Storage Feasibility Study, Washington

Technical Series No. TS-YSS-27

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado

December 2008

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Economics Technical Report for the Yakima River Basin Water Storage Feasibility Study Final Planning Report/ Environmental Impact Statement

A component of
Yakima River Basin Water Storage Feasibility Study, Washington

Technical Series No. TS-YSS-27

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado

December 2008

PREFACE

The Congress directed the Secretary of the Interior, acting through the Bureau of Reclamation, to conduct a feasibility study of options for additional water storage in the Yakima River basin. Section 214 of the Act of February 20, 2003 (Public Law 108-7), contains this authorization and includes the provision "… with emphasis on the feasibility of storage of Columbia River water in the potential Black Rock Reservoir and the benefit of additional storage to endangered and threatened fish, irrigated agriculture, and municipal water supply."

Reclamation initiated the Yakima River Basin Water Storage Feasibility Study (Storage Study) in May 2003. As guided by the authorization, the purpose of the Storage Study is to identify and examine the viability and acceptability of alternate projects by: (1) diversion of Columbia River water to a potential Black Rock reservoir for further water transfer to irrigation entities in the lower Yakima River basin as an exchange supply, thereby reducing irrigation demand on Yakima River water and improving Yakima Project stored water supplies; and (2) creation of additional water storage within the Yakima River basin. In considering the benefits to be achieved, study objectives are to modify Yakima Project flow management operations to improve the flow regime of the Yakima River system for fisheries, provide a more reliable supply for existing proratable water users, and provide water supply for future municipal demands.

State support for the Storage Study was provided in the 2003 Legislative session. The 2003 budget included appropriations for the Washington State Department of Ecology (Ecology) with the provision that the funds ". . . are provided solely for expenditure under a contract between the department of ecology and the United States bureau of reclamation for the development of plans, engineering, and financing reports and other preconstruction activities associated with the development of water storage projects in the Yakima river basin, consistent with the Yakima river basin water enhancement project, P.L. 103-434. The initial water storage feasibility study shall be for the Black Rock reservoir project." Since that initial legislation, the State of Washington has appropriated additional matching funds.

Storage Study alternatives were identified from previous studies by other entities and Reclamation, appraisal assessments by Reclamation in 2003 through 2006, and public input. Reclamation filed a Notice of Intent and Ecology filed a Determination of Significance to prepare a combined Planning Report and Environmental Impact Statement (PR/EIS) on December 29, 2006. A scoping process, including two public scoping meetings in January 2007, identified

several concepts to be considered in the Draft PR/EIS. Those concepts have been developed into "Joint" and "State" Alternatives.

The Joint Alternatives fell under the congressional authorization and the analyses were cost-shared by Reclamation and Ecology. The State Alternatives were outside the congressional authorization, but within the authority of State legislation, and were be analyzed by Ecology only. Analyses of all alternatives were included in the Draft PR/EIS.

Some comments pointed out that Yakima River basin issues were not being adequately addressed in the Draft PR/EIS. Given those comments and the narrow focus of the congressional authorization, the State of Washington has decided to not participate further in the joint NEPA/SEPA process. The State will continue the SEPA process to look at a broader range of solutions to water resource problems that are not limited to storage solutions. As a consequence, the State Alternatives have been deleted from the Final PR/EIS and will be addressed in a separate SEPA process.

This technical document and others explain the analyses performed to determine how well the alternatives meet the goals of the Storage Study and the impacts of the alternatives on the environment. These documents will address such issues as hydrologic modeling, sediment modeling, temperature modeling, fish habitat modeling, and designs and costs. All technical documents were the basis for the Draft and Final Planning Reports/Environmental Impact Statements and are available for review.

CONTENTS

TABLES

Chapter 1. INTRODUCTION

This technical report provides comprehensive analytical information on the range of economic analyses (e.g., benefit-cost, regional economic impact, cost allocation and repayment) developed for the Yakima River Basin Water Storage Feasibility Study (Storage Study). The economics discussion in the *Yakima River Basin Water Storage Feasibility Study Final Planning Report/Environmental Impact Statement* (PR/EIS) reflects a summary of the information presented in this report.

As part of the feasibility study, Reclamation completed appraisal designs and cost estimates of the three Joint Alternatives which were included in Reclamation's *Draft Planning Report/Environmental Impact Statement* (PR/EIS) (Reclamation, 2008d). To accurately portray the costs required to construct the alternatives in the Draft PR/EIS, a cost-risk analysis was prepared for two of the alternatives, Black Rock and Wymer Dam and Reservoir, for the Final PR/EIS. A third alternative, the Wymer Dam Plus Yakima River Pump Exchange Alternative, was not subjected to the cost-risk analysis because of high costs, very low benefit-cost ratio and minimal irrigation, fishery, and municipal benefits as identified in the Draft PR/EIS. The cost-risk analysis resulted in a range of costs indicating the lowest, highest and mean total project costs that could be expected if these alternatives were to be constructed. This report displays the economic analyses using that range of costs for the Black Rock and Wymer Dam and Reservoir Alternatives and the cost estimate for the Wymer Dam Plus Yakima River Pump Exchange Alternative. All cost and benefit estimates are at the April 2007 level.

Chapter 2. NATIONAL ECONOMIC DEVELOPMENT BENEFIT-COST ANALYSIS

This section describes the results of a National Economic Development (NED) benefit-cost analysis (BCA) developed for the Storage Study's Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives.

The *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (U. S. Water Resources Council, 1983), otherwise referred to as the *P&Gs*, represent the main set of guidelines for Federal water management agency economic analyses. The *P&Gs* describe two accounts to facilitate the evaluation of the economic effects of proposed alternative plans–the National Economic Development (NED) account and the Regional Economic Development (RED) account. According to the *P&Gs*, a primary distinction between an NED benefit-cost analysis and a RED regional economic impact analysis is geographic. The RED analysis focuses on economic impacts to the local region, whereas NED analysis focuses on economic benefits to the entire Nation. The RED evaluation recognizes the NED benefits accruing to the local region plus the transfers of income into the region. However, since the RED analysis focuses purely on the local region, it does not take into account potential offsetting effects occurring outside the region, as does the NED analysis. As a Federal agency, Reclamation must analyze the NED effects so as not to favor one area of the country over another. Reclamation also analyzes the RED effects to the local economy to provide specific information on the primary impact area. However, economic justification is determined for each alternative solely by the benefit-cost analysis and must be demonstrated on the basis of NED benefits exceeding NED costs.

In addition to the geographic differences between the analyses, the RED analysis includes not only the initial or direct impact on the primary affected industries (as does the NED analysis), but also the secondary or indirect effects on those industries providing inputs to the directly affected industries (referred to as the multiplier effect). This multiplier effect is not included in the NED analysis.

Finally, yet another difference between the analyses relates to the distinction between economic impacts and economic benefits. Economic impacts measure total or gross economic activity within a given region using such indicators as output (sales or gross receipts), income, and employment. Gross measures simply

show the amount of money changing hands (e.g., sales reflect income to the business, but expenditures to the purchaser). Economic impacts stem from changes in expenditures/revenues within the region. Conversely, benefits measure economic welfare based on a net value concept. For consumers, economic welfare reflects the value of goods and services consumed above what is actually paid for them (willingness-to-pay in excess of cost; also referred to as consumer surplus). For producers or businesses, economic welfare can be estimated by gross revenues minus operating costs (profit). One way to visualize the difference between impacts and benefits is to consider how each reacts to increases in expenditures only. Regional economic impacts increase as in-region expenditures increase, whereas benefits (i.e., consumer surplus or profitability) tend to decrease as costs or expenditures increase.

While benefits and economic impacts often move in unison (since they typically rise or fall with levels of production), there are many situations where changes in benefits and economic impacts diverge. This potential for divergence, combined with the need to consider both national and regional perspectives, and the fact that different user groups are often interested in different economic measures, creates a need for both NED and RED analyses.

2.1 NED BCA Results

BCA compares the present value of a proposed project's benefits to the present value of its costs. If benefits exceed costs, the project is considered economically justified. Since both benefits and costs can occur at various points throughout the period of analyses (also referred to as the study period), it is important to convert them to a common point in time (i.e., present value or future value) before the benefit-cost comparison is made. The period of analysis can be separated into the construction period (timeframe during which construction costs are incurred) and the benefits period (timeframe during which project benefits are incurred, as well as annual operating, maintenance, replacement, and energy [OMR&E] costs). For this analysis, the costs and benefits were measured as of the start of the benefits period (which is equivalent to the end of the construction period). As a result, construction costs are converted or compounded into a "future value" as of the end of the construction period and annual benefits and OMR&E costs are converted or discounted into a "present value" as of the start of the benefits period. The benefits period was assumed to be 100 years as suggested by the *P&Gs* for this type of dam construction project. The interest rate used to convert costs and benefits to a common year was Reclamation's fiscal year 2007 planning rate of 4.875 percent.

Table 2–1 presents the results of the NED BCA for the Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives. This table displays the total NED costs, total NED benefits, net benefits (i.e., total NED benefits minus total NED costs), and benefit-cost ratios (i.e., total NED benefits divided by total NED costs) for each alternative.

As discussed in detail in the *Cost-Risk Analysis for Black Rock and Wymer Alternatives* (Reclamation, 2008b) (TS-YSS-26), a range of six cost estimates (i.e., most probable-low [MPL], Monte Carlo 0% [MC-0%], most probable [MP], Monte Carlo-mean [MC-M], Monte Carlo 100% [MC-100%], and most probable-high [MPH]) are presented for the Black Rock and Wymer Dam and Reservoir Alternatives, which results in a range of net benefits and benefit-cost ratios for those alternatives. Three of the cost estimates for those alternatives (i.e., Monte Carlo 0%, Most Probable, and Monte Carlo 100%) were deemed to best reflect the true range of costs for these alternatives and were presented in the Final PR/EIS. Because of the very low benefit-cost ratio and minimal benefits identified in the Draft PR/EIS, Reclamation decided to not calculate a range of costs for the Wymer Dam Plus Yakima River Pump Exchange Alternative; the benefit-cost analysis was computed using the same costs that were presented in the Draft PR/EIS.

Each piece of information in Table 2–1 is shown in both present value and annual equivalent terms. The annual equivalent estimate converts the present/future value figure to an average annual value over the 100-year benefits period. Details on the individual costs and benefits associated with each alternative can be found in the cost analysis and benefit analysis sections presented below.

The cost categories aggregated into total NED costs include: 1) total project costs comprised of field costs and noncontract costs, 2) interest during construction (IDC), and 3) annual operations, maintenance, replacement, and energy (OMR&E) costs. The 100-year stream of annual OMR&E costs was discounted to a present value as of the start of the benefits period before being combined into the total NED cost estimate. For the Black Rock and Wymer Dam and Reservoir Alternatives, the low end cost estimates (MPL, MC-0%) are based on noncontract costs estimated at 20 or 25 percent of field costs, the midrange cost estimates (MP, MC-M) assume noncontract costs at 25 or 30 percent of field costs, and the high end cost estimates (MC-100%, MPH) assumed noncontract costs at 30 or 35 percent of field costs. Low and high cost estimates for the Wymer Dam Plus Yakima River Pump Exchange Alternative are based on noncontract costs estimated at 20 percent and 35 percent of field costs. All alternatives assume a 10-year construction period. This results in a total of fourteen benefit-cost estimates across the three alternatives (six for Black Rock and Wymer Dam and

Reservoir Alternatives, and two for the Wymer Dam Plus Yakima River Pump Exchange Alternative).

Table 2–1. Benefit-cost analysis summary (million $)

Black Rock Alternative								
	Value Option[1]	Cost Option:	Most Probable Low	Monte Carlo 0%	Most Probable	Monte Carlo Mean	Monte Carlo 100%	Most Probable High
		Noncontract Cost Percent:[2]	20%	20%	25%	25%	30%	30%
Total NED Costs	PV:		6,312.4	7,390.2	8,308.4	8,963.1	10,907.8	14,253.5
	Annual:		310.4	363.4	408.5	440.7	536.4	700.9
Total NED Benefits	PV:		1,068.0	1,068.0	1,068.0	1,068.0	1,068.0	1,068.0
	Annual:		52.5	52.5	52.5	52.5	52.5	52.5
Net Benefits	PV:		-5,244.5	-6,322.3	-7,240.5	-7,895.1	-9,839.9	-13,185.6
	Annual:		-257.9	-310.9	-356.0	-388.2	-483.8	-648.4
Benefit-Cost Ratios	PV & Annual		.17	.14	.13	.12	.10	.07
Wymer Dam and Reservoir Alternative								
	Value Option[1]	Cost Option:	Most Probable Low	Monte Carlo 0%	Most Probable	Monte Carlo Mean	Monte Carlo 100%	Most Probable High
		Noncontract Cost Percent:[2]	25%	25%	30%	30%	35%	35%
Total NED Costs	PV:		898.8	1,148.4	1,340.6	1,427.2	1,751.6	2,204.7
	Annual:		44.2	56.5	65.9	70.2	86.1	108.4
Total NED Benefits	PV:		411.5	411.5	411.5	411.5	411.5	411.5
	Annual:		20.2	20.2	20.2	20.2	20.2	20.2
Net Benefits	PV:		-487.4	-737.0	-929.1	-1,015.8	-1,340.2	-1,793.3
	Annual:		-24.0	-36.2	-45.7	-49.9	-65.9	-88.2
Benefit-Cost Ratios	PV & Annual		.46	.36	.31	.29	.23	.19
Wymer Dam Plus Yakima River Pump Exchange Alternative								
	Value Option[1]	Cost Option:	Low	High				
		Noncontract Cost Percent:[2]	20%	35%				
Total NED Costs	PV:		5,350.3	5,926.8				
	Annual:		263.1	291.4				
Total NED Benefits	PV:		440.0	440.0				
	Annual:		21.6	21.6				
Net Benefits	PV:		-4,910.3	-5,486.8				
	Annual:		-241.4	-269.8				
Benefit-Cost Ratios	PV & Annual		.08	.07				

[1] Value Option: Includes present value (PV) and annual equivalent value (annual).

[2] Cost Option: For the Black Rock and Wymer Dam and Reservoir Alternatives, there are six cost options based on different cost estimation approaches (Most Probable and Monte Carlo) and noncontract cost percentages (20%, 25% and 30%). For the Wymer Dam Plus Yakima River Pump Exchange Alternative, there are only two cost options, based on the different noncontract cost percentages (20% and 35%)

The benefit categories aggregated into total NED benefits include:

1) agriculture

2) municipal

3) recreation (both at the proposed reservoirs and at existing reservoirs and rivers)

4) hydropower (Black Rock and Sunnyside powerplants plus lost hydropower benefits from Federal and non-Federal facilities, e.g., Priest Rapids powerplant)

5) fisheries use values (i.e., commercial, sport, Tribal subsistence).

While these benefit categories were included in the BCA, the valuation of threatened and endangered (T&E) fish was not included in the analysis; as a result, the fishery benefits may be considered understated (for more discussion on this T&E nonuse valuation topic, see the fisheries benefit section). For each alternative, the 100-year stream of annual benefits was discounted to a present value as of the start of the benefits period before being compared to the NED cost estimate.

2.1.1 Black Rock Alternative

As presented in Table 2–1, six benefit-cost scenarios are presented for the Black Rock Alternative. Although the total NED benefits are the same for each scenario, the NED costs vary, since they were developed using different cost estimation procedures and different noncontract cost percentages (20%, 25%, and 30%). Across these six scenarios, the estimated NED benefits for the Black Rock Alternative cover from 7 to 17 percent of total NED costs. This implies negative net benefits (or uncovered costs) ranging from $5.2 billion to $13.2 billion. Based on the results of this benefit-cost analysis, this alternative is not economically justified.

2.1.2 Wymer Dam and Reservoir Alternative

As presented in Table 2–1, six benefit-cost scenarios are presented for the Wymer Dam and Reservoir Alternative. Although the total NED benefits are the same for each scenario, the NED costs vary, since they were developed using different cost estimation procedures and different noncontract cost percentages (20%, 25%, and 30%). Across these six scenarios, the estimated NED benefits for the Wymer Dam and Reservoir Alternative cover from 19 to 46 percent of total NED costs.

This implies negative net benefits (or uncovered costs) ranging from $487.4 million to $1,793.3 million. Based on the results of this benefit-cost analysis, this alternative is not economically justified.

2.1.3 Wymer Dam Plus Yakima River Pump Exchange Alternative

As presented in Table 2–1, two benefit-cost scenarios are presented for the Wymer Dam Plus Yakima River Pump Exchange Alternative. Although the total NED benefits are the same for both scenarios, the costs vary, since they were estimated using both a 20-percent and 35-percent noncontract cost component. For the Wymer Dam Plus Yakima River Pump Exchange Alternative, estimated NED benefits cover from 7 to 8 percent of total NED costs. This implies negative net benefits (or uncovered costs) ranging from $4.9 billion to $5.5 billion. Based on the results of this benefit-cost analysis, this alternative is not economically justified.

2.2 Cost Analysis

The cost analysis for each alternative is broken down into two primary subsections: 1) up-front NED construction costs including interest during construction (IDC); and 2) annual NED OMR&E costs.

NED construction costs occur up-front during the construction period for each alternative and include total project costs (i.e., field costs and noncontract costs), and IDC. As noted above, six total project cost estimates (i.e., most-probable low [MPL], Monte Carlo 0% [MC-0%], most probable [MP], Monte Carlo mean [MCM], Monte Carlo 100% [MC-100%], and most-probable high [MPH[1]]) were developed by Reclamation cost estimators for the Black Rock and Wymer Dam and Reservoir Alternatives, but only two total project cost estimates were developed for the Wymer Dam Plus Yakima River Pump Exchange Alternative. Three cost estimates—Monte Carlo 0%, Most Probable, and Monte Carlo 100%—were presented in the Final PR/EIS for the Black Rock and Wymer Dam and Reservoir Alternatives, and one cost estimate was presented for the Wymer Dam Plus Yakima River. Noncontract costs were estimated as a percentage of field costs—20 to 35 percent, depending on the alternative and scenario. The total project costs were measured in April 2007 dollars and reflect appraisal-level

[1] Note that the Monte Carlo cost estimates reflect the probability of not being exceeded. Therefore, a 0% probability of not being exceeded is equivalent to a 100% probability of being exceeded-which implies the lower-bound cost estimate. Conversely, a 100% probability of not being exceeded is equivalent to a 0% probability of being exceeded-which implies the upper-bound cost estimate.

estimates. A 10-year construction period was assumed for each alternative. The IDC calculation represents the opportunity cost of forgone interest earned (i.e., the lost opportunity to earn interest) on Federal funds during the construction period. IDC provides the basis for converting/compounding costs incurred throughout the construction period into a future value as of the start of the benefits period (same as the end of the construction period).

NED OMR&E costs, which occur annually across the 100-year benefits period, reflect the costs for operations, maintenance, replacements, and pumping energy. The 100-year stream of NED OMR&E costs was converted/discounted into a present value as of the start of the benefits period. Combining the future value of the NED construction costs and the present value of the NED OMR&E costs provides an estimate of total NED cost by alternative and scenario as of the start of the benefits period. The results of the cost analyses are presented in Table 2–2.

The field cost is largest component of total NED cost (more than half), generally followed by IDC, noncontract costs, pumping costs, and finally, operating, maintenance, and replacement costs.

2.2.1 Black Rock Alternative

As shown in Table 2–2, total field costs for the Black Rock Alternative were estimated to range from $3.440 to $8.075 billion. Noncontract costs were estimated at 20, 25, and 30 percent of the total field cost and range from $644 to $2,380 million. Adding these costs results in a range of total project cost (before IDC) from $4.084 to $10.455 billion.

Using construction cost estimates allocated across the 10-year construction period as provided by Reclamation cost engineers, IDC was calculated using Reclamation's fiscal year 2007 planning rate of 4.875 percent. IDC estimates ranged from $1.005 to $2.575 billion (see Table 2–3, Table 2–4, Table 2–5, Table 2–6, Table 2–7, and Table 2–8). The IDC calculation converts all construction costs to a common future point in time as of the end of the construction period for comparison to project benefits. The total NED construction cost (total project cost plus IDC) ranged from $5.089 to $13.030 billion.

NED OMR&E costs occur on an annual basis. To calculate a present value, these annual costs were assumed to occur each year of the 100-year benefits period. The annual operations, maintenance, and replacement costs were estimated at $10.17 million ($206.8 million in present value) and the annual energy costs at $50 million ($1.017 billion in present value), for a total annual NED OMR&E cost of $60.17 million ($1.224 billion in present value). Total NED cost,

representing the sum of total NED construction cost plus the present value of the 100-year stream of annual NED OMR&E costs (total NED OMR&E costs), ranges from $6.31 to $14.25 billion, depending on the cost option.

Table 2–2. Up-front NED construction costs and annual NED OMR&E costs by alternative

Black Rock Alternative						
Cost Estimate	Most Probable Low	Monte Carlo 0%	Most Probable	Monte Carlo Mean	Monte Carlo 100%	Most Probable High
Construction Period	10	10	10	10	10	10
Noncontract Percentage	20%	20%	25%	25%	30%	30%
I. Up-Front NED Construction Costs (million $)						
Field	3,440.0	4,100.0	4,560.0	4,920.0	6,020.0	8,075.0
Noncontract	644.0	850.0	1,130.0	1,260.0	1,710.0	2,380.0
Subtotal: Total Project Costs	4,084.0	4,950.0	5,690.0	6,180.0	7,730.0	10,455.0
IDC	1,004.8	1,216.6	1,394.8	1,559.4	1,954.2	2,574.9
Total NED Construction Costs	5,088.8	6,166.6	7,084.8	7,739.4	9,684.2	13,029.9
II. Annual NED Operations, Maintenance, Replacement, and Energy (OMR&E) Costs (million $)						
OM&R	10.17	10.17	10.17	10.17	10.17	10.17
Energy	50.0	50.0	50.0	50.0	50.0	50.0
Total Annual NED OMR&E	60.17	60.17	60.17	60.17	60.17	60.17
PV of 100 Years of NED OMR&E Costs	1,223.7	1,223.7	1,223.7	1,223.7	1,223.7	1,223.7
III. Total NED Cost (millions $)						
Total NED Construction Cost + PV of NED OMR&E Costs	6,312.4	7,390.2	8,308.4	8,963.1	10,907.8	14,253.5
Wymer Dam and Reservoir Alternative						
Cost Estimate	Most Probable Low	Monte Carlo 0%	Most Probable	Monte Carlo Mean	Monte Carlo 100%	Most Probable High
Construction Period	10	10	10	10	10	10
Noncontract Percentage	25%	25%	30%	30%	35%	35%
I. Up-Front NED Construction Costs (million $)						
Field	537.0	704.0	786.0	831.0	1,010.0	1,285.0
Noncontract	132.0	163.0	238.0	249.0	330.0	430.0
Subtotal: Total Project Costs	669.0	867.0	1,024.0	1,080.0	1,340.0	1,715.0
IDC	169.2	220.8	255.9	286.6	351.0	429.1

Total NED Construction Costs	838.2	1,087.8	1,279.9	1,366.6	1,691.0	2,144.1
II. Annual NED Operations, Maintenance, Replacement, and Energy (OMR&E) Costs (million $)						
OM&R	1.08	1.08	1.08	1.08	1.08	1.08
Energy	1.90	1.90	1.90	1.90	1.90	1.90
Total Annual NED OMR&E	2.98	2.98	2.98	2.98	2.98	2.98
PV of 100 Years of NED OMR&E Costs	60.6	60.6	60.6	60.6	60.6	60.6
III. Total NED Cost (millions $)						
Total NED Construction Cost + PV of NED OMR&E Costs	898.8	1,148.4	1,340.6	1,427.2	1,751.6	2,204.7
Wymer Dam Plus Yakima River Pump Exchange Alternative						
I. Up-Front NED Construction Costs (million $)						
Cost Estimate	Low End	High End				
Construction Period	10	10				
Noncontract Percentage	20%	35%				
Field	2,980.0	2,980.0				
Noncontract	596.0	1,043.0				
Subtotal: Total Project Costs	3,576.0	4,023.0				
IDC	1,001.1	1,130.6				
Total NED Construction Costs	4,577.1	5,153.6				
II. Annual NED Operations, Maintenance, Replacement, and Energy (OMR&E) Costs (million $)						
OM&R	18.20	18.20				
Energy	19.82	19.82				
Total Annual NED OMR&E	38.02	38.02				
PV of 100 Years of NED OMR&E Costs	773.1	773.1				
III. Total NED Cost (millions $)						
Total NED Construction Cost + PV of NED OMR&E Costs	5,350.3	5,926.8				

Table 2–3. Interest During Construction for the Black Rock Alternative – Most Probable Low Estimate ($) (10-year construction period; 20% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	80,000,000	40,000,000	0	0	0	40,000,000	1,950,000
2	252,000,000	126,000,000	80,000,000	0	1,950,000	207,950,000	10,137,563
3	414,000,000	207,000,000	332,000,000	0	12,087,563	551,087,563	26,865,519
4	414,000,000	207,000,000	746,000,000	0	38,953,081	991,953,081	48,357,713
5	576,000,000	288,000,000	1,160,000,000	0	87,310,794	1,535,310,794	74,846,401
6	576,000,000	288,000,000	1,736,000,000	0	162,157,195	2,186,157,195	106,575,163
7	576,000,000	288,000,000	2,312,000,000	0	268,732,358	2,868,732,358	139,850,702
8	404,000,000	202,000,000	2,888,000,000	0	408,583,061	3,498,583,061	170,555,924
9	394,000,000	197,000,000	3,292,000,000	0	579,138,985	4,068,138,985	198,321,776
10	398,000,000	199,000,000	3,686,000,000	4,084,000,000	777,460,761	4,662,460,761	227,294,962
11	0	0	4,084,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	4,084,000,000						1,004,755,723

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	4,084,000,000
IDC:	1,004,755,723
	5,088,755,723
Factor:	0.049171225
	250,220,350
Annual OM&R:	10,170,000
Annual Energy Costs:	50,000,000
Total Annual Cost:	310,390,350

Table 2–4. Interest During Construction for the Black Rock Alternative – Monte Carlo 0% Estimate ($) (10-year construction period; 20% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	100,000,000	50,000,000	0	0	0	50,000,000	2,437,500
2	305,000,000	152,500,000	100,000,000	0	2,437,500	254,937,500	12,428,203
3	500,000,000	250,000,000	405,000,000	0	14,865,703	669,865,703	32,655,953
4	500,000,000	250,000,000	905,000,000	0	47,521,656	1,202,521,656	58,622,931
5	695,000,000	347,500,000	1,405,000,000	0	106,144,587	1,858,644,587	90,608,924
6	695,000,000	347,500,000	2,100,000,000	0	196,753,511	2,644,253,511	128,907,359
7	695,000,000	347,500,000	2,795,000,000	0	325,660,869	3,468,160,869	169,072,842
8	490,000,000	245,000,000	3,490,000,000	0	494,733,712	4,229,733,712	206,199,518
9	490,000,000	245,000,000	3,980,000,000	0	700,933,230	4,925,933,230	240,139,245
10	480,000,000	240,000,000	4,470,000,000	4,950,000,000	941,072,475	5,651,072,475	275,489,783
11	0	0	4,950,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	4,950,000,000						1,216,562,258

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	4,950,000,000
IDC:	1,216,562,258
	6,166,562,258
Factor:	0.049171225
	303,217,417
Annual OM&R:	10,170,000
Annual Energy Costs:	50,000,000
Total Annual Cost:	363,387,417

Table 2–5. Interest During Construction for the Black Rock Alternative – Most Probable ($) (10-year construction period; 25% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	120,000,000	60,000,000	0	0	0	60,000,000	2,925,000
2	348,000,000	174,000,000	120,000,000	0	2,925,000	296,925,000	14,475,094
3	576,000,000	288,000,000	468,000,000	0	17,400,094	773,400,094	37,703,255
4	566,000,000	283,000,000	1,044,000,000	0	55,103,348	1,382,103,348	67,377,538
5	794,000,000	397,000,000	1,610,000,000	0	122,480,887	2,129,480,887	103,812,193
6	794,000,000	397,000,000	2,404,000,000	0	226,293,080	3,027,293,080	147,580,538
7	794,000,000	397,000,000	3,198,000,000	0	373,873,617	3,968,873,617	193,482,589
8	566,000,000	283,000,000	3,992,000,000	0	567,356,206	4,842,356,206	236,064,865
9	566,000,000	283,000,000	4,558,000,000	0	803,421,071	5,644,421,071	275,165,527
10	566,000,000	283,000,000	5,124,000,000	5,690,000,000	1,078,586,599	6,485,586,599	316,172,347
11	0	0	5,690,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	5,690,000,000						1,394,758,945

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	5,690,000,000
IDC:	1,394,758,945
	7,084,758,945
Factor:	0.049171225
	348,366,273
Annual OM&R:	10,170,000
Annual Energy Costs:	50,000,000
Total Annual Cost:	408,536,273

Table 2–6. Interest During Construction for the Black Rock Alternative – Monte Carlo Mean Estimate ($) (10-year construction period; 25% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	170,000,000	85,000,000	0	0	0	85,000,000	4,143,750
2	416,000,000	208,000,000	170,000,000	0	4,143,750	382,143,750	18,629,508
3	662,000,000	331,000,000	586,000,000	0	22,773,258	939,773,258	45,813,946
4	642,000,000	321,000,000	1,248,000,000	0	68,587,204	1,637,587,204	79,832,376
5	838,000,000	419,000,000	1,890,000,000	0	148,419,580	2,457,419,580	119,799,205
6	838,000,000	419,000,000	2,728,000,000	0	268,218,785	3,415,218,785	166,491,916
7	838,000,000	419,000,000	3,566,000,000	0	434,710,701	4,419,710,701	215,460,897
8	592,000,000	296,000,000	4,404,000,000	0	650,171,597	5,350,171,597	260,820,865
9	592,000,000	296,000,000	4,996,000,000	0	910,992,463	6,202,992,463	302,395,883
10	592,000,000	296,000,000	5,588,000,000	6,180,000,000	1,213,388,345	7,097,388,345	345,997,682
11	0	0	6,180,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	6,180,000,000						1,559,386,027

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	6,180,000,000
IDC:	1,559,386,027
	7,739,386,027
Factor:	0.049171225
	380,555,088
Annual OM&R:	10,170,000
Annual Energy Costs:	50,000,000
Total Annual Cost:	440,725,088

Table 2–7. Interest During Construction for the Black Rock Alternative – Monte Carlo 100% Estimate ($) (10-year construction period; 30% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	200,000,000	100,000,000	0	0	0	100,000,000	4,875,000
2	501,000,000	250,500,000	200,000,000	0	4,875,000	455,375,000	22,199,531
3	802,000,000	401,000,000	701,000,000	0	27,074,531	1,129,074,531	55,042,383
4	802,000,000	401,000,000	1,503,000,000	0	82,116,915	1,986,116,915	96,823,200
5	1,103,000,000	551,500,000	2,305,000,000	0	178,940,114	3,035,440,114	147,977,706
6	1,103,000,000	551,500,000	3,408,000,000	0	326,917,820	4,286,417,820	208,962,869
7	1,103,000,000	551,500,000	4,511,000,000	0	535,880,689	5,598,380,689	272,921,059
8	712,000,000	356,000,000	5,614,000,000	0	808,801,747	6,778,801,747	330,466,585
9	702,000,000	351,000,000	6,326,000,000	0	1,139,268,332	7,816,268,332	381,043,081
10	702,000,000	351,000,000	7,028,000,000	7,730,000,000	1,520,311,413	8,899,311,413	433,841,431
11	0	0	7,730,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	7,730,000,000						1,954,152,845

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	7,730,000,000
IDC:	1,954,152,845
	9,684,152,845
Factor:	0.049171225
	476,181,654
Annual OM&R:	10,170,000
Annual Energy Costs:	50,000,000
Total Annual Cost:	536,351,654

Table 2–8. Interest During Construction for the Black Rock Alternative – Most Probable High Estimate ($) (10-year construction period; 30% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	260,000,000	130,000,000	0	0	0	130,000,000	6,337,500
2	663,750,000	331,875,000	260,000,000	0	6,337,500	598,212,500	29,162,859
3	1,037,500,000	518,750,000	923,750,000	0	35,500,359	1,478,000,359	72,052,518
4	1,037,500,000	518,750,000	1,961,250,000	0	107,552,877	2,587,552,877	126,143,203
5	1,441,250,000	720,625,000	2,998,750,000	0	233,696,080	3,953,071,080	192,712,215
6	1,441,250,000	720,625,000	4,440,000,000	0	426,408,295	5,587,033,295	272,367,873
7	1,441,250,000	720,625,000	5,881,250,000	0	698,776,168	7,300,651,168	355,906,744
8	1,037,500,000	518,750,000	7,322,500,000	0	1,054,682,912	8,895,932,912	433,676,729
9	1,037,500,000	518,750,000	8,360,000,000	0	1,488,359,642	10,367,109,642	505,396,595
10	1,057,500,000	528,750,000	9,397,500,000	10,455,000,000	1,993,756,237	11,920,006,237	581,100,304
11	0	0	10,455,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	10,455,000,000						2,574,856,541

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	10,455,000,000
IDC:	2,574,856,541
	13,029,856,541
Factor:	0.049171225
	640,694,001
Annual OM&R:	10,170,000
Annual Energy Costs:	50,000,000
Total Annual Cost:	700,864,001

2.2.2 Wymer Dam and Reservoir Alternative

As shown in Table 2–2, total field costs for the Wymer Dam and Reservoir Alternative were estimated to range from $537 to $1,285 million. Noncontract costs were estimated at 25-, 30-, and 35-percent of the total field cost and range from $132 to $430 million). Adding these costs results in a range of total project cost (before IDC) from $669 to $1,715 million.

Using construction cost estimates allocated across the 10-year construction period as provided by Reclamation cost engineers, IDC was calculated using Reclamation's fiscal year 2007 planning rate of 4.875 percent. IDC estimates ranged from $169.2 to $429.1 million (see Table 2–9 through Table 2–14). The total NED construction cost (total project cost plus IDC) ranged from $838.2 to $2,144.1 million.

NED OMR&E costs occur on an annual basis. To calculate a present value, the annual costs were assumed to occur each year of the 100-year benefits period. The annual operations, maintenance, and replacement (OM&R) costs were estimated at $1.08 million ($21.96 million in present value) and the annual energy costs at $1.9 million ($38.64 million in present value), for a total annual NED OMR&E cost of $2.98 million ($60.6 million in present value).

Total NED cost, representing the sum of total NED construction cost plus the present value of the 100-year stream of annual NED OMR&E costs (total NED OMR&E costs), ranges from $898.8 to $2,204.7 million, depending on the cost option.

Table 2–9. Interest During Construction for the Wymer Dam and Reservoir Alternative – Most Probable Low Estimate ($) (10-year construction period, 25% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	20,000,000	10,000,000	0	0	0	10,000,000	487,500
2	46,850,000	23,425,000	20,000,000	0	487,500	43,912,500	2,140,734
3	73,700,000	36,850,000	66,850,000	0	2,628,234	106,328,234	5,183,501
4	63,700,000	31,850,000	140,550,000	0	7,811,736	180,211,736	8,785,322
5	90,550,000	45,275,000	204,250,000	0	16,597,058	266,122,058	12,973,450
6	90,550,000	45,275,000	294,800,000	0	29,570,508	369,645,508	18,020,219
7	90,550,000	45,275,000	385,350,000	0	47,590,727	478,215,727	23,313,017
8	63,700,000	31,850,000	475,900,000	0	70,903,743	578,653,743	28,209,370
9	63,700,000	31,850,000	539,600,000	0	99,113,113	670,563,113	32,689,952
10	65,700,000	32,850,000	603,300,000	669,000,000	131,803,065	767,953,065	37,437,712
11	0	0	669,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	669,000,000						169,240,777

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	669,000,000
IDC:	169,240,777
	838,240,777
Factor:	0.049171225
	41,217,325
Annual OM&R:	1,080,000
Annual Energy Costs:	1,900,000
Total Annual Cost:	44,197,325

Table 2–10. Interest During Construction for the Wymer Dam and Reservoir Alternative – Monte Carlo 0% Estimate ($) (10-year construction period, 25% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	30,000,000	15,000,000	0	0	0	15,000,000	731,250
2	55,200,000	27,600,000	30,000,000	0	731,250	58,331,250	2,843,648
3	90,400,000	45,200,000	85,200,000	0	3,574,898	133,974,898	6,531,276
4	90,400,000	45,200,000	175,600,000	0	10,106,175	230,906,175	11,256,676
5	125,600,000	62,800,000	266,000,000	0	21,362,851	350,162,851	17,070,439
6	115,600,000	57,800,000	391,600,000	0	38,433,290	487,833,290	23,781,873
7	115,600,000	57,800,000	507,200,000	0	62,215,163	627,215,163	30,576,739
8	80,400,000	40,200,000	622,800,000	0	92,791,902	755,791,902	36,844,855
9	80,400,000	40,200,000	703,200,000	0	129,636,757	873,036,757	42,560,542
10	83,400,000	41,700,000	783,600,000	867,000,000	172,197,299	997,497,299	48,627,993
11	0	0	867,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	867,000,000						220,825,292

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	867,000,000
IDC:	220,825,292
	1,087,825,292
Factor:	0.049171225
	53,489,702
Annual OM&R:	1,080,000
Annual Energy Costs:	1,900,000
Total Annual Cost:	56,469,702

Table 2–11. Interest During Construction for the Wymer Dam and Reservoir Alternative – Most Probable Estimate ($) (10-year construction period, 30% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	30,000,000	15,000,000	0	0	0	15,000,000	731,250
2	69,300,000	34,650,000	30,000,000	0	731,250	65,381,250	3,187,336
3	108,600,000	54,300,000	99,300,000	0	3,918,586	157,518,586	7,679,031
4	98,600,000	49,300,000	207,900,000	0	11,597,617	268,797,617	13,103,884
5	137,900,000	68,950,000	306,500,000	0	24,701,501	400,151,501	19,507,386
6	137,900,000	68,950,000	444,400,000	0	44,208,886	557,558,886	27,180,996
7	137,900,000	68,950,000	582,300,000	0	71,389,882	722,639,882	35,228,694
8	98,600,000	49,300,000	720,200,000	0	106,618,576	876,118,576	42,710,781
9	98,600,000	49,300,000	818,800,000	0	149,329,357	1,017,429,357	49,599,681
10	106,600,000	53,300,000	917,400,000	1,024,000,000	198,929,038	1,169,629,038	57,019,416
11	0	0	1,024,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	1,024,000,000						255,948,454

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	1,024,000,000
IDC:	255,948,454
	1,279,948,454
Factor:	0.049171225
	62,936,633
Annual OM&R:	1,080,000
Annual Energy Costs:	1,900,000
Total Annual Cost:	65,916,633

Table 2–12. Interest During Construction for the Wymer Dam and Reservoir Alternative – Monte Carlo Mean Estimate ($) (10-year construction period, 30% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	42,000,000	21,000,000	0	0	0	21,000,000	1,023,750
2	81,550,000	40,775,000	42,000,000	0	1,023,750	83,798,750	4,085,189
3	123,100,000	61,550,000	123,550,000	0	5,108,939	190,208,939	9,272,686
4	123,100,000	61,550,000	246,650,000	0	14,381,625	322,581,625	15,725,854
5	144,650,000	72,325,000	369,750,000	0	30,107,479	472,182,479	23,018,896
6	144,650,000	72,325,000	514,400,000	0	53,126,375	639,851,375	31,192,755
7	139,650,000	69,825,000	659,050,000	0	84,319,129	813,194,129	39,643,214
8	93,100,000	46,550,000	798,700,000	0	123,962,343	969,212,343	47,249,102
9	93,100,000	46,550,000	891,800,000	0	171,211,445	1,109,561,445	54,091,120
10	95,100,000	47,550,000	984,900,000	1,080,000,000	225,302,565	1,257,752,565	61,315,438
11	0	0	1,080,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	1,080,000,000						286,618,003

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	1,080,000,000
IDC:	286,618,003
	1,366,618,003
Factor:	0.049171225
	67,198,281
Annual OM&R:	1,080,000
Annual Energy Costs:	1,900,000
Total Annual Cost:	70,178,281

Table 2–13. Interest During Construction for the Wymer Dam and Reservoir Alternative – Monte Carlo 100% Estimate ($) (10-year construction period, 35% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	50,000,000	25,000,000	0	0	0	25,000,000	1,218,750
2	100,500,000	50,250,000	50,000,000	0	1,218,750	101,468,750	4,946,602
3	151,000,000	75,500,000	150,500,000	0	6,165,352	232,165,352	11,318,061
4	141,000,000	70,500,000	301,500,000	0	17,483,412	389,483,412	18,987,316
5	181,500,000	90,750,000	442,500,000	0	36,470,729	569,720,729	27,773,886
6	181,500,000	90,750,000	624,000,000	0	64,244,614	778,994,614	37,975,987
7	171,500,000	85,750,000	805,500,000	0	102,220,602	993,470,602	48,431,692
8	121,000,000	60,500,000	977,000,000	0	150,652,294	1,188,152,294	57,922,424
9	121,000,000	60,500,000	1,098,000,000	0	208,574,718	1,367,074,718	66,644,892
10	121,000,000	60,500,000	1,219,000,000	1,340,000,000	275,219,610	1,554,719,610	75,792,581
11	0	0	1,340,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	1,340,000,000						351,012,191

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	1,340,000,000
IDC:	351,012,191
	1,691,012,191
Factor:	0.049171225
	83,149,140
Annual OM&R:	1,080,000
Annual Energy Costs:	1,900,000
Total Annual Cost:	86,129,140

Table 2–14. Interest During Construction for the Wymer Dam and Reservoir Alternative – Most Probable High Estimate ($) (10-year construction period, 35% noncontract costs, 0.04875 interest rate)

Year	Annual Expense	1/2 Current Expense	All Previous Years	Plant in Service	All Previous Interest	Interest Bearing Amount	(IDC Method) Compound Interest
0	0	0	0	0	0	0	0
1	50,000,000	25,000,000	0	0	0	25,000,000	1,218,750
2	114,250,000	57,125,000	50,000,000	0	1,218,750	108,343,750	5,281,758
3	178,500,000	89,250,000	164,250,000	0	6,500,508	260,000,508	12,675,025
4	168,500,000	84,250,000	342,750,000	0	19,175,533	446,175,533	21,751,057
5	232,750,000	116,375,000	511,250,000	0	40,926,590	668,551,590	32,591,890
6	232,750,000	116,375,000	744,000,000	0	73,518,480	933,893,480	45,527,307
7	232,750,000	116,375,000	976,750,000	0	119,045,787	1,212,170,787	59,093,326
8	168,500,000	84,250,000	1,209,500,000	0	178,139,113	1,471,889,113	71,754,594
9	168,500,000	84,250,000	1,378,000,000	0	249,893,707	1,712,143,707	83,467,006
10	168,500,000	84,250,000	1,546,500,000	1,715,000,000	333,360,713	1,964,110,713	95,750,397
11	0	0	1,715,000,000	0	0	0	0
12	0	0	0	0	0	0	0
	1,715,000,000						429,111,110

Annual Equivalent Costs:

Annual Equivalent Period: 100 years

Construction:	1,715,000,000
IDC:	429,111,110
	2,144,111,110
Factor:	0.049171225
	105,428,569
Annual OM&R:	1,080,000
Annual Energy Costs:	1,900,000
Total Annual Cost:	108,408,569

2.2.3 Wymer Dam Plus Yakima River Pump Exchange Alternative

The appraisal-level construction costs for the Wymer Dam Plus Yakima River Pump Exchange Alternative are shown in the Draft PR/EIS.

Total field costs were estimated at $2.98 billion. Noncontract costs were estimated at both 20 and 35 percent of the total field cost ($596.0 million and $1.043 billion). Adding these costs results in a total project cost (before IDC) of either $3.576 or $4.023 billion.

For the Wymer Dam Plus Yakima River Pump Exchange Alternative, based on annual construction cost estimates provided by Reclamation cost engineers, IDC was calculated using a 10-year construction period and was estimated at either $1.001 or $1.131 billion (see Table 2–15 and Table 2–16). The total NED construction cost (total project costs plus IDC) was estimated at either $4.577 or $5.154 billion.

NED OMR&E costs occur on an annual basis. To calculate a present value, the annual costs were assumed to occur each year of the 100-year benefits period. The annual OM&R costs were estimated at $18.198 million ($370.1 million in present value) and the annual energy costs at $19.815 million ($403.0 million in present value) for a total annual NED OMR&E cost of $38.013 million ($773.1 million in present value).

Total NED cost, representing the sum of total NED construction cost plus the present value of the 100-year stream of annual NED OMR&E costs (total NED OMR&E costs), ranges from $5.4 to $5.9 billion, depending on the cost option.

Table 2–15. Interest During Construction for the Wymer Dam Plus Yakima River Pump Exchange Alternative ($) (10-year construction period, 20% noncontract costs, 0.04875 interest rate)

Year	Annual expense	½ current expense	All previous years	Plant in service	All previous interest	Interest bearing amount	IDC method compound interest
0	0	0	0	0	0	0	0
1	70,000,000	35,000,000	0	0	0	35,000,000	1,706,250
2	368,000,000	184,000,000	70,000,000	0	1,706,250	255,706,250	12,465,680
3	517,000,000	258,500,000	438,000,000	0	14,171,930	710,671,930	34,645,257
4	507,000,000	253,500,000	955,000,000	0	48,817,186	1,257,317,186	61,294,213
5	497,000,000	248,500,000	1,462,000,000	0	110,111,399	1,820,611,399	88,754,806
6	348,000,000	174,000,000	1,959,000,000	0	198,866,205	2,331,866,205	113,678,477
7	348,000,000	174,000,000	2,307,000,000	0	312,544,682	2,793,544,682	136,185,303
8	348,000,000	174,000,000	2,655,000,000	0	448,729,986	3,277,729,986	159,789,337
9	358,000,000	179,000,000	3,003,000,000	0	608,519,322	3,790,519,322	184,787,817
10	215,000,000	107,500,000	3,361,000,000	3,576,000,000	793,307,139	4,261,807,139	207,763,098
11	0	0	3,576,000,000	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
	3,576,000,000						1,001,070,237

Annual Equivalent Costs

Annual Equivalent Period: 100 years

Construction:	3,576,000,000
IDC:	1,001,070,237
	4,577,070,237
Factor:	0.049171225
	225,060,148
Annual OM&R:	18,198,000
Annual Energy Costs:	19,815,000
Total Annual Cost:	263,073,148

Table 2–16. Interest During Construction for the Wymer Dam Plus Yakima River Pump Exchange Alternative ($) (10-year construction period, 35% noncontract costs, 0.04875 interest rate)

Year	Annual expense	½ current expense	All previous years	Plant in service	All previous interest	Interest bearing amount	IDC method compound interest
0	0	0	0	0	0	0	0
1	120,000,000	60,000,000	0	0	0	60,000,000	2,925,000
2	408,000,000	204,000,000	120,000,000	0	2,925,000	326,925,000	15,937,594
3	557,000,000	278,500,000	528,000,000	0	18,862,594	825,362,594	40,236,426
4	557,000,000	278,500,000	1,085,000,000	0	59,099,020	1,422,599,020	69,351,702
5	557,000,000	278,500,000	1,642,000,000	0	128,450,722	2,048,950,722	99,886,348
6	398,000,000	199,000,000	2,199,000,000	0	228,337,070	2,626,337,070	128,033,932
7	388,000,000	194,000,000	2,597,000,000	0	356,371,002	3,147,371,002	153,434,336
8	388,000,000	194,000,000	2,985,000,000	0	509,805,339	3,688,805,339	179,829,260
9	388,000,000	194,000,000	3,373,000,000	0	689,634,599	4,256,634,599	207,510,937
10	262,000,000	131,000,000	3,761,000,000	4,023,000,000	897,145,536	4,789,145,536	233,470,845
11	0	0	4,023,000,000	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
	4,023,000,000						1,130,616,381

Annual Equivalent Costs

Annual Equivalent Period: 100 years

Construction:	4,023,000,000
IDC:	1,130,616,381
	5,153,616,381
Factor:	0.049171225
	253,409,628
Annual OM&R:	18,198,000
Annual Energy Costs:	19,815,000
Total Annual Cost:	291,422,628

2.3 Benefit Estimation

This section estimates economic benefits for the following areas: (1) agriculture; (2) municipal; (3) recreation; (4) hydropower; and (5) fisheries.

As noted in the introduction to the NED BCA section, to the extent possible, these analyses follow the criteria for measuring NED benefits defined in the *P&Gs*. A P&G analysis of NED benefits is a "with versus without" project comparison. Comparisons were therefore made between the "with project" Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives and the "without project" No Action Alternative.

Instead of measuring all the costs and benefits associated with the No Action Alternative and Joint Alternatives separately, and then subtracting the No Action Alternative effects from the Joint Alternative effects to estimate the overall net effect of each Joint Alternative, an incremental analysis was performed. An incremental analysis focuses from the onset on the change in costs and benefits for each Joint Alternative over the No Action Alternative. For each Joint Alternative, the changes in costs and benefits are summed to measure the overall net effect. This focus upon the sum of the change in costs and benefits for each Joint Alternative as compared to the No Action Alternative provides the same net result as if one analyzed each alternative separately and then subtracted the No Action Alternative results from the results of each of the Action Alternatives. By focusing on the incremental changes of each Joint Alternative over the No Action Alternative, the analysis does not present the results for the No Action Alternative.

Table 2–17 presents the results of the benefits analyses. The Black Rock Alternative generates the most benefits ($1.068 billion), followed by the Wymer Dam Plus Yakima River Pump Exchange Alternative ($440.0 million), and the Wymer Dam and Reservoir Alternative ($411.5 million). For the Black Rock Alternative, recreation provided the largest share of the total benefits (57.6%), followed by municipal water (26.7%). Agriculture and fisheries provided less than 10 percent of the total benefits (recall that benefits for T&E fish were not measured). For the Wymer Dam and Reservoir Alternative and the Wymer Dam Plus Yakima River Pump Exchange Alternative, municipal water generated the largest share of total benefits (68.0% and 64.2% respectively), followed by recreation (25.3% and 27.0% respectively). Again, agriculture and fisheries provided less than 10 percent of the total benefits for these alternatives. The total incremental benefits of each alternative are compared to the total incremental costs of each alternative within the benefit-cost analysis displayed in Table 2–1.

Table 2–17. Total benefits by alternative (million $) compared to each alternative

Benefit Category	Value Option[1]	Black Rock Alternative		Wymer Dam and Reservoir Alternative		Wymer Dam Plus Yakima River Pump Exchange Alternative	
		$	%	$	%	$	%
Agriculture	Present Value: Annual:	84.6 4.2	7.9	26.4 1.3	6.4	26.4 1.3	6.0
Municipal	Present Value: Annual:	284.6 14.0	26.7	280.0 13.8	68.0	282.5 13.9	64.2
Recreation	Present Value: Annual:	615.4 30.3	57.6	103.9 5.1	25.3	118.9 5.8	27.0
Hydropower	Present Value: Annual:	62.5 3.1	5.9	0 0	0	0 0	0
Fisheries	Present Value: Annual:	20.9 1.0	1.9	1.1 0.1	0.3	12.2 0.6	2.8
Total Benefits:	Present Value: Annual:	1,068.0 52.5		411.5 20.2		440.0 21.6	

[1] Value Options: Include present value and annual equivalent value (Annual).

2.3.1 Agricultural Benefits

Agricultural benefits for each alternative are realized only in drought years when the proration level is less than 70 percent. The Black Rock Alternative replaces part of the annual Yakima River water deliveries for Roza and Sunnyside Irrigation Districts used for irrigated agriculture with Columbia River water. This Columbia River water exchange provides enough water so all Yakima River basin entities with proratable irrigation entitlements will receive a proratable water supply of not less than 70 percent of their entitlements in dry years.

The Wymer Dam and Reservoir and the Wymer Dam Plus Yakima River Pump Exchange Alternatives provide the same amount of agricultural benefits. The Wymer Dam acts as a reregulation reservoir to store irrigation water released from Cle Elum Reservoir in the winter. These releases provide instream flows for fish habitat purposes. The water stored in Wymer is then released for irrigation later in the year. This operation is the same for Wymer Dam and for Wymer Dam Plus the Yakima Pump Exchange Alternatives. The Wymer Dam Plus the Yakima Pump Exchange Alternative is the Wymer Dam with a pumping plant below the mouth of the Yakima River to pump irrigation water upstream to the Roza and Sunnyside Irrigation Districts. This pump exchange only pumps the amount of water that those districts would divert from the Yakima River based on the hydrologic conditions in the basin. If there is prorationing for Roza, then the

pump exchange would only pump the water that Roza is entitled to, based on the prorationing rules. This does not provide more agricultural benefits, but does provide instream flow benefits from the point of diversion of the Roza and Sunnyside Districts to the mouth of the Yakima River. More detail is available in the Final PR/EIS.

2.3.1.1 Methodology

The agricultural benefits are based on (1) the cropping pattern for both with and without the Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives, (2) the benefit unit value per acre for each crop, and (3) the probability of occurrence of dry years (below a 70-percent proration).

The agricultural benefits are based on (1) the annual water supply, (2) the cropping patterns for both with and without the Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives, and (3) the benefit unit value per acre for each crop. The Yakima Agricultural Impact (YAI) model measures the cropping pattern for the alternatives, including the No Action Alternative, based on proration levels. The benefit unit values, estimated using a farm budget methodology, are applied to the cropping patterns, incremental to the No Action Alternative, and averaged over the 25-year hydrologic period of record to estimate the average annual NED agricultural benefit for both the with- and without-alternatives scenarios. The YAI model and the benefit unit values are discussed below.

2.3.1.1.1 Yakima Agricultural Production Model

The YAI model, developed by the Technical Service Center (TSC) Economics Group, estimates the crop acreages for (1) the Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives and (2) the dry years without the Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives.

The YAI model is a positive mathematical programming model, which simulates crop production. The modeling framework allows the model to respond in a manner consistent with grower behaviors. The model first replicates the agricultural producers' maximize profit subject to physical (water supply) and economic (prices, production costs) constraints. The YAI model utilized in this study attempts to capture farmers' decisions on a regional level. As physical and/or economic constraints change, the model estimates the optimal mix of crops that maximize profit.

The data inputs for the YAI model are discussed below.

Irrigated Acres and Crop Data

Information on prices, yields, acres, and production costs were not available for all the crops grown in the study area; therefore, the model relies on information for representative crops. The representative crops included in the YAI model are shown in Table 2–18.

Table 2–18. Representative crops included in the YAI model

Representative Crop	Crops Included
Asparagus	Asparagus
Cherries	Cherries, Apricots, and Peaches
Pears	Pears
Alfalfa (flood irrigated)	Pasture, and Alfalfa (flood irrigated)
Alfalfa (center-pivot irrigated)	Alfalfa
Apples	Apples
Silage	Silage
Hops	Hops
Concord Grapes	Concord Grapes
Wine Grapes	Wine Grapes
Sweet Corn	Processed Sweet Corn and Fresh Sweet Corn
Potato	Potato
Timothy Hay	Other Hay
Wheat	Spring Wheat, Winter Wheat, Corn Grain, Oats, and Barley
Mint	Peppermint and Spearmint

The YAI model estimates the changes in crop acreages for 7 irrigation districts based on the available water supply. The decision to include these districts in the YAI model is based on the availability of Reclamation Crop Reports. The average (2002-2004) district acreages for those districts included are shown in Table 2–19.

The agricultural model relies on county-level yield statistics. Prices were collected on a statewide basis. Data for prices and yields are obtained from the *Washington State Annual Agricultural Bulletin* for 2002-2004 for all crops except apples and grapes. These data are compiled by the Washington Agricultural Statistics Service. The average crop prices and yields used in the YAI model are summarized in Table 2–20 and Table 2–21.

Table 2–19. Crop acres by district

Crop	Roza	Kittitas	Tieton	Wapato	Sunny-side	Union Gap	Yakima Valley Canal
Asparagus	1,919				3,672		
Cherries	4,354		1,175	1,847	3,986	678	
Pears	2,154		2,350	822	642	669	300
Pasture	7,450	23,648	150	13,278	44,110	107	
Alfalfa (flood irrigated)		5,714					
Alfalfa (center-pivot irrigated)	3,373		3,650	30,638	9,731	14	250
Apple	22,731	985	19,975	11,651	4,910	996	800
Silage	3,599			2,414	7,927		
Hop	4,789			9,199	8,140		
Concord	9,051			4,804	11,512		
Wine Grapes	9,687				1,174	65	
Sweet Corn				12,328			
Potato				1,506			
Timothy Hay		21,480					
Wheat	1,449	4,137		19,324	1,903		
Mint	578			5,294	1,537		

Source *Reclamation Crop and Water Data, 2002-2004*.

Table 2–20. Average Crop Prices (2002-2004)

Crop	Unit	Roza	Kittitas	Tieton	Wapato	Sunny-side	Union Gap	Yakima Valley Canal
Asparagus	cwt	74.90				74.90		
Cherries	tons	1,616.67		1,616.67		1,616.67	1,616.67	
Pears	tons	309.67		309.67		309.67	309.67	309.67
Alfalfa (flood irrigated)	tons		100.83					
Alfalfa (center pivot irrigated)	tons	100.83		100.83	100.83	100.83	100.83	100.83
Apple	tons	412.67	412.67	412.67		412.67	412.67	412.67
Silage	tons	31.67			31.67	31.67		
Hops	lbs	1.85			1.85	1.85		
Concord Grapes	tons	178.00			178.00	178.00		
Wine Grapes	tons	907.67				907.67	907.67	
Sweet Corn	cwt				3.66			
Potato	cwt				5.23			
Timothy Hay	tons		123.33					
Wheat	bu	3.69			3.69	3.69		
Mint	lbs	11.40			11.40	11.40		

Source *Washington State Annual Agricultural Bulletin* (2002-2004).

Table 2–21. Average Yields by County (2002-2004)

Crop	Unit	Benton	Kittitas	Yakima	Yakima Valley Fruit Growing Area
Asparagus	cwt	39.47		39.45	
Cherries	tons				4.11
Pears	tons				14.87
Alfalfa (flood irrigated)	tons		4.10		
Alfalfa (center pivot irrigated)	tons	6.90		6.07	
Apple	tons				16.42
Corn Grain	bu			184.57	
Silage	tons			26.40	
Carrots	cwt	635.00			
Hops	lbs	2,106.67		2,106.67	
Concord Grapes	tons	8.04		8.04	
Wine Grapes	tons	4.12		4.12	
Sweet Corn	cwt	196.00	192.00	220.00	
Potato	cwt	640.67	370.00	385.00	
Timothy Hay	tons	4.40	4.93	3.30	
Wheat	bu	91.35		86.65	
Mint	lbs			106.50	

Source: *Washington State Annual Agricultural Bulletin* (2002-2004).

Washington State University compiled the costs of production from various crops grown in this region. These costs represent average production practices in the area. The variable costs of production used in the model are summarized in Table 2–22 below.

Table 2–22. Variable Costs by Crop and District

Crop	Roza	Kittitas	Tieton	Wapato	Sunny-side	Union Gap	Yakima Valley Canal
	($ per Acre)						
Asparagus	1,213.11				1,213.01		
Cherries	4,006.66		4,006.66		4,006.66	4,006.66	
Pears	3,617.06		3,617.06		3,617.06	3,617.06	3,617.06
Alfalfa (flood irrigated)		277.63					
Alfalfa (center-pivot irrigated)	370.40		351.11	351.11	360.75	351.11	351.11
Apple	3,314.56	3,314.56	3,314.56		3,314.56	3,314.56	3,314.56
Silage	335.28			558.80	447.04		
Hops	2,102.63			2,102.63	2,102.63		
Concord Grapes	647.44			647.44	647.44		
Wine Grapes	1,418.36				1,418.36	1,418.36	
Sweet Corn				419.18			
Potato				1,202.30			
Timothy Hay		211.46					
Wheat	272.92			267.13	270.02		
Mint	855.34			1,425.57	1,140.46		

Source: *Washington State University Extension Budgets (various years).*

2.3.1.1.2 W ater Supply

The cropping acreages estimated by the YAI model are based on water data supplied by the Yakima River Basin RiverWare (Yak-RW) model. Irrigation benefits accrue in those years where the proration level is 70 percent or below. The Yak-RW model shows that the water supply fell under the 70-percent threshold in 6 years out of the 25-year period of record. Table 2–23 shows the proration levels for the 6 dry years. It should be noted that conservation actions included in the No-Action Alternative raised the 1992 proration level to 70 percent; therefore, there are only 5 years where the No-Action Alternative fell below 70 percent.

Table 2–23. Irrigation proration levels by alternative

Water Year	Irrigation proration level (percent)		
	No Action Alternative	Black Rock Alternative	Wymer and Wymer Plus Alternatives
1987	69	82	73
1992	70	80	76
1993	57	73	68
1994	27	70	29
2001	44	70	59
2005	45	70	49

The YAI model assumes that districts with a combination of nonproratable and proratable entitlements receive 100 percent of their nonproratable entitlements and some percentage of their proratable entitlements based on the proration levels shown in Table 2–24.

Table 2–24. Water Entitlements by District

Entity	Proratable Water Entitlement (acre-feet)	Nonproratable Water Entitlement (acre-feet)
Only Proratable Water Entitlements		
Kittitas Reclamation District	336,000	0
Roza Irrigation District	375,000	0
Subtotal	711,000	0
Combination of Nonproratable and Proratable Water Entitlements		
Sunnyside Division	142,684	315,836
Wapato Irrigation Project	350,000	305,613
Union Gap Irrigation District	4,642	20,697
Yakima Valley Canal Company	4,305	23,720
Yakima-Tieton	38,181	75,868
Subtotal	539,812	741,734
Other Proratable Water Entitlements	29,062	
Total all proratable water entitlements	1,279,874	

Source: *Yakima Basin Interim Operating Plan* (Reclamation, 2002)

Irrigation diversions downstream from Parker are included in the Yak-RW model. The major diverter is the Kennewick Division, which has a water service contract to divert flows in excess of the Title XII instream target flow at the Prosser Diversion Dam. This water supply is all proratable and is provided from unregulated flows and return flows of upstream irrigation diversions. While the water supply available to the Kennewick Diversion has been prorated a few times, it has not been prorated at the same levels as for diverters upstream of the Parker gage and does not require the release of stored water. The Yak-RW model and the operation studies conducted for the various alternatives indicate the Kennewick Diversion's water supply is greater than the 70-percent proratable irrigation goal in all years of the 25-year period of record. Thus, no additional proratable water supply was provided in dry years, and no irrigation benefits were included for the Kennewick Division.

2.3.1.1.3 Agricultural Benefit Unit Values

After the YAI model calculates acreages by crop for each alternative, benefit unit values are applied to estimate NED agricultural benefits for the alternatives. The benefit unit values follow the criteria for measuring NED agricultural benefits

defined in the *P&Gs*. The *P&Gs* are the Federal guidelines by which Reclamation determines NED benefits of Federal actions or project implementation. A *P&G*s analysis of NED agricultural benefits is a "with and without" project comparison that identifies the change in net farm income related to a change in crop acreage while maintaining the same cropping pattern. Net farm income is estimated using a farm budget methodology.

Table 2–25 summarizes the benefit unit values. These values were derived by a previous study conducted by the Bureau of Reclamation. While some of the unit values are negative, this does not indicate a negative benefit value for these crops, nor does it suggest that growing these crops is unprofitable. Benefit values are derived by taking the absolute difference between the with- and without-cropping patterns multiplied by the unit value. See the example below.

Table 2–25. Crop Benefit Unit Values for the Reclamation's Yakima Irrigation Project

Crop	Unit Value ($ per acre)	Crop	Unit Value ($ per acre)	Crop	Unit Value ($ per acre)
Alfalfa (center-pivot irrigation)	-23.42	Alfalfa (flood irrigation)	-109.39	Apples	1,015.70
Asparagus	1,516.28	Carrots	-955.56	Cherries	366.73
Corn Silage	-174.50	Corn Grain	-307.54	Hops	871.19
Mint	-647.58	Onions	2,326.95	Pears	-520.50
Potatoes	143.83	Sweet Corn	-110.25	Timothy Hay	288.39
Wheat	-372.97	Wine	1,097.93		

Example of Computing Benefits for Crops with Negative Unit Values

The hypothetical District Z is able to grow 20 acres of alfalfa with center-pivot irrigation in year X with the action (with-project) alternative, as shown in row 1 of Table 2–26 below. Under the No-Action (without-project) Alternative, District Z is able to grow 10 acres during water year X, also shown in row 1 below. The benefit unit value of alfalfa with center-pivot irrigation is $-23.42. As shown in row 3, the action (with-project) acres multiplied by the unit value is $-468.40. The No-Action (without-project) acres multiplied by the unit value is $-234.40. The absolute difference between the action (with-project) and the No Action (without-project) Alternative is $234.20, as shown in row 4. This calculation is shown below.

$$|-\$468.40| - |-\$234.20| = \$\ 234.20.$$

Because dry years do not occur annually, benefits are averaged over the period of record and an average annual benefit value.

Table 2–26. Computing benefits for crops with negative unit values

Row		Year	No Action (without-project) Alternative	Action (with-project) Alternative
1	Alfalfa acres (center-pivot irrigation)	X	10	20
2	Benefit Unit Values (per acre)		$ -23.42	$ -23.42
3	Acres times Unit Value		$ -234.20	$ -468.40
4	Absolute difference between Action and No Action projects		$ 234.20	

2.3.1.2 Findings

The present value of the 100-year stream of agricultural benefits equals $84.6 million (the annual equivalent is equal to $4.16 million) for the Black Rock Alternative, $26.5 million (the annual equivalent equals $1.3 million) for the Wymer Dam and Reservoir and Wymer Dam Plus Yakima River Pump Exchange Alternatives (see Table 2–27). It should be noted that the Tieton and Sunnyside Districts are included in the benefits calculation to be consistent with the hydrology data.

Table 2–27. Agricultural benefits by alternative

District	Black Rock		Wymer/Wymer Plus	
	Annual	Present Value	Annual	Present Value
Roza	$3,096,113	$62,965,640	$972,787	$19,783,560
Kittitas	$295,058	$6,000,595	$88,949	$1,808,947
Tieton	$90,411	$1,838,691	$27,551	$560,305
Wapato	$445,934	$9,068,950	$140,821	$2,863,880
Sunnyside	$218,516	$4,443,951	$69,005	$1,403,353
Union Gap	$14,066	$286,070	$4,452	$90,544
Total	$4,160,097	$84,603,896	$1,303,565	$26,510,589

2.3.2 Municipal Benefits

Providing a portion of future municipal water demand is a component of the Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives. The goal of each alternative is to supply approximately 82,000 acre-feet of future municipal water demand to the communities in the Yakima River basin by the year 2050. The future municipal demand is treated as a prorated water right, which reduces the amount of water the municipalities receive during a prorated irrigation season. Due to the effect of having to prorate municipal water supply in dry years, the Black Rock Alternative

is expected to supply, on average, 81,100 acre-feet; the Wymer Dam and Reservoir Alternative, 79,800 acre-feet; and the Wymer Dam Plus Yakima River Pump Exchange Alternative, 80,500 acre-feet.

2.3.2.1 Methodology

A $235.66-per acre-foot wholesale price of municipal water was used to value the annual supply of municipal water associated with each alternative ($221.06 in 2005 dollars indexed to April 2007 dollars to be consistent with cost estimates) using the *Western Region Consumer Price Index*, as obtained from Reclamation's *2006 M&I Water Rate Survey Data* (Contract Services Office, 2006). The $235.66 value reflects the average of Pacific Northwest Region municipal water prices for the Yakima Project.

The basic assumption of this alternative cost method to valuation is that municipal water demand must be addressed. If municipal water needs are assumed to be met regardless of the selected alternative, then the benefits associated with the provision of municipal water become irrelevant, since they are the same for all alternatives and the analysis can focus on the cost differentials between the various water supply provision options inherent within each alternative. In this case, we are assuming that approximately 82,000 acre-feet of municipal water will be provided by each of the Joint Alternatives (i.e., Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange), with the No Action Alternative source of municipal water being a water market purchase. The costs of providing approximately 82,000 acre-feet of municipal water are reflected in the construction and annual operating costs for the Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives, whereas the "avoided-cost benefits" (i.e., avoided market purchases associated with the No Action Alternative) are presented as a "benefit" in this section.

As with the other benefit measures, by including the municipal water supply cost of the No Action Alternative as an avoided-cost benefit for the Joint Alternatives, the municipal benefit analysis becomes an incremental analysis as compared to the No Action Alternative. If the costs of providing municipal water associated with a Joint Alternative falls below (exceeds) the costs of a water market purchase associated with the No Action Alternative, then the net effect of the Joint Alternative would be positive (negative) from a municipal water supply perspective.

Since the maximum municipal water supply target for each Joint Alternative was identified as the additional water supply needed for year 2050, it was necessary to project a growth in municipal water supply for each alternative from the start of

the benefit period to year 2050. Each alternative was assumed to involve a 10-year construction period, plus some additional time to complete the planning process; therefore, the assumption was made that the benefit period would not start until the year 2020. Therefore, a projection was developed from year 2020 to year 2050 for each alternative.

The approximately 82,000 acre-feet of unmet municipal water demand in year 2050 for the Yakima River basin was obtained from the *Watershed Management Plan, Yakima River Basin* (Yakima River Basin Watershed Planning Unit and Tri-County Water Resources Agency, 2003). This report also provided a graphic (Exhibit 2-2) which depicted estimates of future total municipal water demand in years 2010, 2020, 2030, 2040 and 2050. Deducting current surface- and groundwater supply sources of 104,000 acre-feet allowed for the estimation of unmet demand in each of these years. The report presented Yakima River basin water demand separated into four subareas – Upper Yakima, Middle Yakima, Naches, and Lower Yakima. Since only a small portion of the municipal demand in the Richland and West Richland areas of the Lower Yakima Subarea actually occurs within the Yakima Basin, the Richland and West Richland out-of-basin demand was subtracted from the total. The year 2020 out-of-basin demand for Richland and West Richard was estimated as a percentage of total demand across the four subareas (about 13.25 percent) and that percentage was used to calculate the Richland and West Richland out-of-basin deduction for future years. The difference in unmet demand between each 10-year period (e.g., 2030 minus 2020) was spread equally across each year of the 10-year periods (e.g., 2021, 2022, . . . 2030) to develop a projection for each alternative. These annual unmet demand estimates were then prorated by applying the proration percentages associated with each alternative. The proration percentages by alternative were calculated by dividing the year 2050 prorated demand by the year 2050 unprorated demand (i.e., Black Rock: 81,100/82,000 = .989, Wymer: 79,800/82,000 = .973, and Wymer +: 80,500/82,000 = .982). It was then assumed that the year 2050 prorated municipal supply for each alternative would be provided from year 2050 to the end of the 100-year benefit period (i.e., year 2119). Finally, the $235.66-value-per-acre-foot estimate was applied to each annual municipal water supply estimate associated with each alternative. The resulting annual municipal values by alternative were discounted to the start of the benefit period (i.e., year 2020) and added into a present value estimate by alternative (note that an annual equivalent value was also estimated). Since the year 2050 municipal benefit estimate actually represents the value for years 2050-2119, the discount factor had to discount the 70-year stream of equal annual benefits back to year 2050 before further discounting the result to year 2020.

2.3.2.2 Assumptions

- Current surface- and groundwater supply sources are sustainable in the long run at 104,000 acre-feet.
- Assuming a 10-year construction period for each Joint Alternative, municipal water supply benefits from each alternative would start at year 2020.
- Municipal water supplied by each alternative would reach its maximum in year 2050 and continue at that level to the end of the period of analysis (year 2119).
- Unmet municipal water demands must be provided for regardless of the selected alternative.
- The best option for obtaining the needed municipal water under the No Action Alternative would be a market purchase.
- The assumption was made that municipalities in search of municipal water under the No Action Alternative could obtain the water at wholesale rates.

2.3.2.3 Results

The results of the municipal water unmet demand projection and benefit estimation by alternative is presented in Table 2–28

2.3.2.3.1 Black Rock Alternative

The value of the growth in annual municipal water supply to 81,100 acre-feet in year 2050 and beyond was estimated to average $14.0 million annually, or $284.6 million in present value over the 100-year study period for the Black Rock Alternative.

2.3.2.3.2 Wymer Dam and Reservoir Alternative

The value of the growth in annual municipal water supply to 79,800 acre-feet in year 2050 and beyond was estimated to average $13.8 million annually, or $280.0 million in present value over the 100-year study period for the Wymer Dam and Reservoir Alternative.

2.3.2.3.3 Wymer Dam Plus Yakima River Pump Exchange Alternative

The value of the growth in annual municipal water supply to 80,500 acre-feet in year 2050 and beyond was estimated to average $13.9 million annually, or $282.5 million in present value over the 100-year study period for the Wymer Dam Plus Yakima River Pump Exchange Alternative.

Table 2–28. M&I water and value projection

2005 Value per Acre Foot	221.06
2005 Average CPI:	198.9
April 2007 CPI:	212.036
April 2007 to Average 2005 CPI Ratio:	1.066043
April 2007 Value per Acre Foot:	235.66
Discount Rate:	0.04875

1) Black Rock Alternative:

Area	Year 2000%	2000	Year 2010%	2010	Year 2020%	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Year #						1	2	3	4	5	6	7	8	9	10	11
Upper Yakima Subarea:		15585		19,130		22451	Change									
Middle Yakima Subarea:		48430		57,274		63539	from 2030									
Naches Subarea:		4565		5,623		6481	to 2020:	16,685								
Lower Yakima Subarea		46992		56,172		70844										
Subtotal:		115,572		138,199		163,315	165000	166700	168400	170100	171800	173500	175200	176900	178600	180000
Minus: Richland and West Richland: (*)	-0.10476	-12107	-0.09897	-13,677	-0.13248	-21636	-21900	-22100	-22300	-22500	-22800	-23000	-23200	-23400	-23700	-23800
Total Yakima Basin Demand:		103,465		124,522		141,679	143,100	144,600	146,100	147,600	149,000	150,500	152,000	153,500	154,900	156200
Current Water Supply:		104,000		104,000		104,000	104,000	104,000	104,000	104,000	104,000	104,000	104,000	104,000	104,000	104000
Unprorated Unmet Demand:		-535		20,522		37,679	39,100	40,600	42,100	43,600	45,000	46,500	48,000	49,500	50,900	52,200
Wtd. Average Prorated Unmet Demand:				Proration Percentage (***):	0.989	37,265	38,671	40,154	41,638	43,121	44,506	45,990	47,473	48,957	50,341	51,627
Annual Benefits:						8,781,958	9,113,155	9,462,764	9,812,374	10,161,983	10,488,286	10,837,895	11,187,505	11,537,114	11,863,416	12,166,411
Discounted Factor:						0.95352	0.90919	0.86693	0.82663	0.78821	0.75157	0.71663	0.68332	0.65156	0.62127	0.59239
Annual Discounted Benefits:						8,373,738	8,285,616	8,203,555	8,111,220	8,009,743	7,882,658	7,766,782	7,644,647	7,517,084	7,370,383	7,207,270

Area	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050-2119	Total Present Value:	Annual Equivalent
Year #	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	(70 Years, Years 31-100) 31		
Upper Yakima Subarea:	Change										Change											
Middle Yakima Subarea:	from 2040										from 2040											
Naches Subarea:	to 2030:	20,000									to 2030:	15,000										
Lower Yakima Subarea																						
Subtotal:	182000	184000	186000	188000	190000	192000	194000	196000	198000	200000	201500	203000	204500	206000	207500	209000	210500	212000	213500	215000		
Minus: Richland and West Richland: (*)	-24100	-24400	-24600	-24900	-25200	-25400	-25700	-26000	-26200	-26500	-26700	-26900	-27100	-27300	-27500	-27700	-27900	-28100	-28300	-29000		
Total Yakima Basin Demand:	157900	159600	161400	163100	164800	166600	168300	170000	171800	173500	174800	176100	177400	178700	180000	181300	182600	183900	185200	186000		
Current Water Supply:	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000		
Unprorated Unmet Demand:	53,900	55,600	57,400	59,100	60,800	62,600	64,300	66,000	67,800	69,500	70,800	72,100	73,400	74,700	76,000	77,300	78,600	79,900	81,200	82,000		
Wtd. Average Prorated Unmet Demand:	53,308	54,990	56,770	58,451	60,133	61,913	63,594	65,276	67,056	68,737	70,023	71,309	72,594	73,880	75,166	76,452	77,737	79,023	80,309	81,100		
Annual Benefits:	12,562,635	12,958,859	13,378,391	13,774,615	14,170,839	14,590,371	14,986,595	15,382,819	15,802,350	16,198,574	16,501,569	16,804,564	17,107,559	17,410,554	17,713,549	18,016,544	18,319,539	18,622,534	18,925,529	19,111,987		
Discounted Factor:	0.56485	0.53860	0.51356	0.48969	0.46693	0.44522	0.42453	0.40479	0.38598	0.36803	0.35093	0.33461	0.31906	0.30423	0.29009	0.27660	0.26375	0.25149	0.23980	4.52268		
Annual Discounted Benefits:	7,096,057	6,979,609	6,870,625	6,745,278	6,616,739	6,495,951	6,362,202	6,226,850	6,099,331	5,961,634	5,790,843	5,623,049	5,458,341	5,296,796	5,138,475	4,983,428	4,831,692	4,683,296	4,538,254	86,437,326	284,608,472	13,994,547

Footnotes:
* Assumed Richland and West Richland demand at year 2020% of the subtotal (13.248%) for projections. Subtracted off "out-of-basin" demand in these areas.
** Subtotal estimates for 2030 and 2040 from Exhibit 2-2 in Watershed Management Plan Yakima River Basin (Yakima River Basin Watershed Planning Unit and Tri-County Water Resources Agency (January 2003)
*** Unmet Demand Proration Percentage: 2050 Wtd Average Prorated Unmet Demand (81,100) divided by 2050 Total Unmet Demand (82,000) = .989

2) Wymer Dam and Reservoir Alternative:

Area	Year 2000%	2000	Year 2010%	2010	Year 2020%	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Upper Yakima Subarea:		15585		19,130		22451	Change									
Middle Yakima Subarea:		48430		57,274		63539	from 2030									
Naches Subarea:		4565		5,623		6481	to 2020:	16,685								
Lower Yakima Subarea		46992		56,172		70844										
Subtotal:		115,572		138,199		163,315	165000	166700	168400	170100	171800	173500	175200	176900	178600	180000
Minus: Richland and West Richland: (*)	-0.10476	-12107	-0.09897	-13,677	-0.13248	-21636	-21900	-22100	-22300	-22500	-22800	-23000	-23200	-23400	-23700	-23800
Total Yakima Basin Demand:		103,465		124,522		141,679	143,100	144,600	146,100	147,600	149,000	150,500	152,000	153,500	154,900	156200
Current Water Supply:		104,000		104,000		104,000	104,000	104,000	104,000	104,000	104,000	104,000	104,000	104,000	104,000	104000
Unprorated Unmet Demand:		-535		20,522		37,679	39,100	40,600	42,100	43,600	45,000	46,500	48,000	49,500	50,900	52,200
Wtd. Average Prorated Unmet Demand:				Proration Percentage (***):	0.973	36,668	38,051	39,511	40,970	42,430	43,793	45,252	46,712	48,172	49,534	50,800
Annual Benefits:						8,641,187	8,967,075	9,311,080	9,655,085	9,999,091	10,320,163	10,664,168	11,008,173	11,352,179	11,673,251	11,971,389
Discounted Factor:						0.95352	0.90919	0.86693	0.82663	0.78821	0.75157	0.71663	0.68332	0.65156	0.62127	0.59239
Annual Discounted Benefits:						8,239,511	8,152,801	8,072,055	7,981,201	7,881,351	7,756,302	7,642,284	7,522,106	7,396,589	7,252,238	7,091,740

Area	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050-2119	Total Present Value:	Annual Equivalent
Upper Yakima Subarea:	Change										Change											
Middle Yakima Subarea:	from 2040										from 2040											
Naches Subarea:	to 2030:	20,000									to 2030:	15,000										
Lower Yakima Subarea																						
Subtotal:	182000	184000	186000	188000	190000	192000	194000	196000	198000	200000	201500	203000	204500	206000	207500	209000	210500	212000	213500	215000		
Minus: Richland and West Richland: (*)	-24100	-24400	-24600	-24900	-25200	-25400	-25700	-26000	-26200	-26500	-26700	-26900	-27100	-27300	-27500	-27700	-27900	-28100	-28300	-29000		
Total Yakima Basin Demand:	157900	159600	161400	163100	164800	166600	168300	170000	171800	173500	174800	176100	177400	178700	180000	181300	182600	183900	185200	186000		
Current Water Supply:	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000		
Unprorated Unmet Demand:	53,900	55,600	57,400	59,100	60,800	62,600	64,300	66,000	67,800	69,500	70,800	72,100	73,400	74,700	76,000	77,300	78,600	79,900	81,200	82,000		
Wtd. Average Prorated Unmet Demand:	52,454	54,108	55,860	57,514	59,169	60,920	62,575	64,229	65,981	67,635	68,900	70,166	71,431	72,696	73,961	75,226	76,491	77,756	79,021	79,800		
Annual Benefits:	12,361,261	12,751,134	13,163,941	13,553,813	13,943,686	14,356,493	14,746,366	15,136,238	15,549,045	15,938,918	16,237,056	16,535,194	16,833,332	17,131,470	17,429,608	17,727,746	18,025,884	18,324,022	18,622,160	18,805,630		
Discounted Factor:	0.56485	0.53860	0.51356	0.48969	0.46693	0.44522	0.42453	0.40479	0.38598	0.36803	0.35093	0.33461	0.31906	0.30423	0.29009	0.27660	0.26375	0.25149	0.23980	4.52268		
Annual Discounted Benefits:	6,982,310	6,867,729	6,760,492	6,637,154	6,510,675	6,391,824	6,260,218	6,127,036	6,001,561	5,866,072	5,698,019	5,532,914	5,370,846	5,211,890	5,056,107	4,903,546	4,754,242	4,608,224	4,465,508	85,051,771	280,046,314	13,770,220

Footnotes:
*** Unmet Demand Proration Percentage: 2050 Wtd Average Prorated Unmet Demand (79,800) divided by 2050 Total Unmet Demand (82,000) = .973

3) Wymer Dam Plus Yakima River Pump Exchange Alternative:

Area	Year 2000%	2000	Year 2010%	2010	Year 2020%	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Upper Yakima Subarea:		15585		19,130		22451	Change									
Middle Yakima Subarea:		48430		57,274		63539	from 2030									
Naches Subarea:		4565		5,623		6481	to 2020:	16,685								
Lower Yakima Subarea		46992		56,172		70844										
Subtotal:		115,572		138,199		163,315	165000	166700	168400	170100	171800	173500	175200	176900	178600	180000
Minus: Richland and West Richland: (*)	-0.10476	-12107	-0.09897	-13,677	-0.13248	-21636	-21900	-22100	-22300	-22500	-22800	-23000	-23200	-23400	-23700	-23800
Total Yakima Basin Demand:		103,465		124,522		141,679	143,100	144,600	146,100	147,600	149,000	150,500	152,000	153,500	154,900	156200
Current Water Supply:		104,000		104,000		104,000	104,000	104,000	104,000	104,000	104,000	104,000	104,000	104,000	104,000	104000
Unprorated Unmet Demand:		-535		20,522		37,679	39,100	40,600	42,100	43,600	45,000	46,500	48,000	49,500	50,900	52,200
Wtd. Average Prorated Unmet Demand:				Proration Percentage (***):	0.982	36,990	38,385	39,857	41,330	42,802	44,177	45,649	47,122	48,595	49,969	51,245
Annual Benefits:						8,716,987	9,045,733	9,392,756	9,739,779	10,086,802	10,410,690	10,757,713	11,104,736	11,451,759	11,775,647	12,076,401
Discounted Factor:						0.95352	0.90919	0.86693	0.82663	0.78821	0.75157	0.71663	0.68332	0.65156	0.62127	0.59239
Annual Discounted Benefits:						8,311,787	8,224,317	8,142,863	8,051,211	7,950,485	7,824,339	7,709,321	7,588,090	7,461,471	7,315,854	7,153,948

Area	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050-2119	Total Present Value:	Annual Equivalent
Upper Yakima Subarea:	Change										Change											
Middle Yakima Subarea:	from 2040										from 2040											
Naches Subarea:	to 2030:	20,000									to 2030:	15,000										
Lower Yakima Subarea																						
Subtotal:	182000	184000	186000	188000	190000	192000	194000	196000	198000	200000	201500	203000	204500	206000	207500	209000	210500	212000	213500	215000		
Minus: Richland and West Richland: (*)	-24100	-24400	-24600	-24900	-25200	-25400	-25700	-26000	-26200	-26500	-26700	-26900	-27100	-27300	-27500	-27700	-27900	-28100	-28300	-29000		
Total Yakima Basin Demand:	157900	159600	161400	163100	164800	166600	168300	170000	171800	173500	174800	176100	177400	178700	180000	181300	182600	183900	185200	186000		
Current Water Supply:	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000		
Unprorated Unmet Demand:	53,900	55,600	57,400	59,100	60,800	62,600	64,300	66,000	67,800	69,500	70,800	72,100	73,400	74,700	76,000	77,300	78,600	79,900	81,200	82,000		
Wtd. Average Prorated Unmet Demand:	52,914	54,583	56,350	58,019	59,688	61,455	63,124	64,793	66,560	68,229	69,505	70,781	72,057	73,334	74,610	75,886	77,162	78,438	79,715	80,500		
Annual Benefits:	12,469,693	12,862,986	13,279,414	13,672,707	14,065,999	14,482,427	14,875,720	15,269,012	15,685,440	16,078,733	16,379,486	16,680,239	16,980,993	17,281,746	17,582,499	17,883,252	18,184,006	18,484,759	18,785,512	18,970,591		
Discounted Factor:	0.56485	0.53860	0.51356	0.48969	0.46693	0.44522	0.42453	0.40479	0.38598	0.36803	0.35093	0.33461	0.31906	0.30423	0.29009	0.27660	0.26375	0.25149	0.23980	4.52268		
Annual Discounted Benefits:	7,043,558	6,927,972	6,819,794	6,695,375	6,567,786	6,447,893	6,315,132	6,180,782	6,054,207	5,917,529	5,748,001	5,581,448	5,417,959	5,257,609	5,100,459	4,946,559	4,795,946	4,648,647	4,504,679	85,797,839	282,502,861	13,891,012

Footnotes:
*** Unmet Demand Proration Percentage: 2050 Wtd Average Prorated Unmet Demand (80,500) divided by 2050 Total Unmet Demand (82,000) = 982

2.3.3 Recreation Benefits

The recreation benefit analysis evaluated recreation effects at both proposed recreation sites (i.e., the proposed Black Rock and Wymer reservoirs) and existing recreation sites (i.e., existing reservoirs and rivers reaches). The recreation effects at the proposed reservoirs would obviously stem from the existence of those reservoirs and their associated recreational facilities. The recreation effects at the existing reservoirs and river reaches would result from reservoir water level and river instream flow changes as a result of the construction and operation of the proposed reservoirs.

Positive or negative recreational effects could also be experienced outside the Yakima River basin due to site substitution. With the alternatives under consideration, the effects upon recreation within the Yakima River Basin are generally assumed to be positive. Therefore, in this case, site substitution generally refers to reductions in recreation use of sites outside the Yakima River Basin as a result of the construction of new sites or quality improvements at existing sites within the basin. Given the difficulty and speculative nature of attempts to quantitatively measure the degree of possible site substitution, site substitution effects have not been included in the recreation analysis. As a result, the estimated recreation benefits, both at the proposed and existing sites, may be overstated.

2.3.3.1 Recreation Effects at Proposed Reservoirs

This section analyzes the potential recreation economic benefits at the proposed Black Rock and Wymer reservoirs. The initial estimates of recreation effects, as measured by changes in visitation by recreation activity, are described in the recreation section of the Final PR/EIS. This section describes the methods and results in terms of the economic valuation of those estimates of visitation changes.

Note that both the Wymer Dam and Reservoir and Wymer Dam Plus Yakima River Pump Exchange Alternatives would produce the same recreational effects at the proposed Wymer Reservoir, but different recreational effects at the existing reservoirs and rivers within the region (see section 2.3.3.2 below for an analysis of the effects at existing reservoir and rivers).

2.3.3.1.1 Met hodology

The proposed reservoir recreation economic methodology used estimates of changes in recreation visitation by activity as compared to the No Action Alternative as described and presented in the recreation section of the

Final PR/EIS. Since the No Action Alternative does not include the proposed reservoirs, the entire estimate of visitation at each proposed reservoir would reflect a change from the No Action Alternative.

Initial estimates of annual visitation by activity were projected over the 100-year study period based on annual growth rate assumptions also noted in the recreation section (i.e., Black Rock, 5 percent for the first 10 years and 3 percent thereafter; Wymer, 3 percent for entire study period). Recreation specialists also provided carrying capacity estimates of 700,000 visits for Black Rock and 200,000 for Wymer based on reservoir surface acreage at high pool, boating acreage requirements, nonboating visitation estimates, associated parking lot size and turnover, and the length of the high and low use recreation seasons (see Table 2-29 below). The carrying capacity estimates were assumed to reflect an upper bound on annual visitation and were therefore used to constrain the visitation growth projection.

Reclamation recreation development at new reservoirs would remain at the minimum level to maintain safety and protect resources for the first 5 years. As a result, the recreation specialists provided both a preliminary (year 1) visitation estimate as well as a subsequent (year 6) visitation estimate. Incorporating both the year 1 and year 6 visitation estimates resulted in a break in the projection in year 6. Years 7-100 then followed the growth rates mentioned above.

Proposals have been made by a local group (Yakima Basin Storage Alliance [YBSA]) to include a resort-type development near the Black Rock Reservoir. This development would be funded privately and would be located outside the lands acquired for the Black Rock Reservoir. This proposed development does not represent a nationally oriented recreation benefit and therefore is not included in the NED benefit analysis.

To estimate annual recreation economic benefits by alternative, per-visit economic benefits were applied to the estimated annual visitation levels at each reservoir. Since economic benefits or values per visit vary by recreation activity, it was important that the visitation estimates were broken down by recreation activity. Values per visit for the activities identified in the recreation visitation analysis were obtained from a nationwide recreation valuation study (Kaval and Loomis, 2003). The Kaval and Loomis study gathered information from hundreds of recreation economic studies throughout the United States. Average values per visit by recreation activity from the Pacific Coast region were used in the analysis. Since the values were presented by Kaval and Loomis in 1996 dollars, they were updated to April 2007 dollars using consumer price indexes in order to be consistent with the cost estimates. The annual values were then discounted to a present value before incorporating them into the BCA.

Table 2-29. Proposed reservoir carrying capacity

Considerations	Wymer	Black Rock
1) Boats-at-one-time capacity based upon Level 1 WROS analysis	High pool=16 boats	High pool = 161 boats
2) Percent of visitation that is boating	20%	50%
3) Projected parking facility limits (#1 ÷ #2)	80 (60 single vehicles + 20 vehicles with trailers)	322 (161 single vehicles + 161 vehicles with trailers)
4) Parking turnover rate per day	3.0 (assumes local visitation and short visits)	2.0 (assumes regional visitation and longer length of stay)
5) Overnight accommodations	None	50 developed campsites
6) Average number of visitors per vehicle	3.5	3.5
7) Length of recreation season	180 days	240 days
8) Estimate of maximum visitation during recreation season [(#3 x #4 x #6 x #7) + (#5 x #6 x #7)]	151,200	582,960
9) Estimate of maximum visitation during non-recreation season (assumes 15% of recreation season)	22,680	87,444
10) Estimated maximum visitation that could be accommodated per year (after which visitation would be expected to decline due to inadequate facilities, crowding, conflicts, public safety, and visitor displacement).	173,880 visitors	670,404 visitors
11) Carrying Capacity Estimate (#10 rounded up)	200,000 visits	700,000 visits

As noted above, the recreation analysis did not attempt to estimate the effects of potential site substitution. In the proposed reservoir case, site substitution refers to the extent to which recreators may visit the new Black Rock or Wymer Reservoirs as opposed to visiting other reservoirs in the area. If substitution occurs, it would draw visitation from the other sites, implying that the change in total visitation regionwide would actually be less than the gain experienced at Black Rock or Wymer. While the reservoirs within the Yakima Basin may not be significantly affected by the construction of Black Rock or Wymer reservoirs strictly from a site-substitution perspective (since they probably cater to a different type of recreator—mountain reservoir versus dry-land reservoir), there are several dry-land reservoirs in the region whose visitation might be adversely affected by the proposed reservoirs. To provide a more realistic picture of the overall impact upon regional recreation of Black Rock or Wymer Reservoir, the analysis would need to try to account for the potential lost visitation and value at other reservoir sites in the region. Unfortunately, attempting to estimate the substitution effect within a region is typically quite difficult and ultimately fairly speculative. As a result, quantification of possible site-substitution effects has not been included.

2.3.3.1.2 Proposed Reservoir Results

Black Rock Alternative

Table 2–30 presents the results of the visitation projection by recreation activity for the proposed Black Rock reservoir. Note that the visitation projection is constrained by the estimated carrying capacity of the reservoir (700,000 visits) in year 23, so years 23 through 100 are assumed to be at the 700,000-visit carrying capacity. The economic valuation results are presented at the end of Table 2–30. The economic values per visit by recreation activity, ranging from $20.32 for horseback riding to $81.26 for wildlife viewing, are presented as well as the present value of the 100-year stream of recreation benefits for each activity. The economic values per visit by activity were multiplied by the estimated annual visits by activity to estimate the annual economic benefit by activity (result not shown). The annual recreation benefit by activity was then discounted to the beginning of the 100-year benefit period. Adding the present value estimates across the various recreation activities provides the $578.1 million total discounted recreation benefit estimate for the proposed Black Rock reservoir.

Table 2–30. Black Rock reservoir visitation projection (growth rates: 5% first 10 years, 3% thereafter)

Year (Percent of Total =>)	Recreation Activities									Total Visits
	Boat Fishing	Shoreline Fishing	Swim	Picnic	Water Ski, Jet Ski	Walking, Hiking	Wildlife Viewing	Horse Riding	Off-Road Vehicle Riding	
	0.25	0.1	0.15	0.15	0.25	0.03	0.03	0.02	0.02	
1	62,500	25,000	37,500	37,500	62,500	7,500	7,500	5,000	5,000	250,000
2	65,630	26,250	39,380	39,380	65,630	7,880	7,880	5,250	5,250	262,530
3	68,910	27,560	41,350	41,350	68,910	8,270	8,270	5,510	5,510	275,640
4	72,360	28,940	43,420	43,420	72,360	8,680	8,680	5,790	5,790	289,440
5	75,980	30,390	45,590	45,590	75,980	9,110	9,110	6,080	6,080	303,910
6	100,000	40,000	60,000	60,000	100,000	12,000	12,000	8,000	8,000	400,000
7	105,000	42,000	63,000	63,000	105,000	12,600	12,600	8,400	8,400	420,000
8	110,250	44,100	66,150	66,150	110,250	13,230	13,230	8,820	8,820	441,000
9	115,760	46,310	69,460	69,460	115,760	13,890	13,890	9,260	9,260	463,050
10	121,550	48,630	72,930	72,930	121,550	14,580	14,580	9,720	9,720	486,190
11	125,200	50,090	75,120	75,120	125,200	15,020	15,020	10,010	10,010	500,790
12	128,960	51,590	77,370	77,370	128,960	15,470	15,470	10,310	10,310	515,810
13	132,830	53,140	79,690	79,690	132,830	15,930	15,930	10,620	10,620	531,280
14	136,810	54,730	82,080	82,080	136,810	16,410	16,410	10,940	10,940	547,210
15	140,910	56,370	84,540	84,540	140,910	16,900	16,900	11,270	11,270	563,610
16	145,140	58,060	87,080	87,080	145,140	17,410	17,410	11,610	11,610	580,540
17	149,490	59,800	89,690	89,690	149,490	17,930	17,930	11,960	11,960	597,940
18	153,970	61,590	92,380	92,380	153,970	18,470	18,470	12,320	12,320	615,870
19	158,590	63,440	95,150	95,150	158,590	19,020	19,020	12,690	12,690	634,340
20	163,350	65,340	98,000	98,000	163,350	19,590	19,590	13,070	13,070	653,360
21	168,250	67,300	100,940	100,940	168,250	20,180	20,180	13,460	13,460	672,960
22	173,300	69,320	103,970	103,970	173,300	20,790	20,790	13,860	13,860	693,160
23-100	175,000	70,000	105,000	105,000	175,000	21,000	21,000	14,000	14,000	700,000
Economic value per visit by activity (4/2007 $):	49.74	49.74	30.59	72.01	63.87	26.06	81.26	20.32	45.26	
Present value of 100-year stream of benefits (million $):	134.9	54.0	49.8	117.2	173.2	8.5	26.4	4.4	9.8	578.1

Wymer Dam and Reservoir Alternative and Wymer Dam Plus Yakima River Pump Exchange Alternative

Table 2–31 presents the results of the visitation projection by recreation activity for the proposed Wymer Reservoir included within both the Wymer Dam and Reservoir and Wymer Dam Plus Yakima River Pump Exchange Alternatives. The visitation projection is constrained by the estimated carrying capacity of the reservoir (200,000 visits) in year 42, so years 42 through 100 are assumed to be at the 200,000-visit carrying capacity. The economic valuation results are presented at the end of Table 2–31. The economic values per visit by recreation activity, ranging from $26.06 for walking/hiking to $81.26 for wildlife viewing, are presented as well as the present value of the 100-year stream of recreation benefits for each activity. Adding the present value estimates across the various recreation activities provides the $97.7 million total discounted recreation benefit estimate for Wymer Reservoir.

Table 2–31. Wymer reservoir visitation projections (growth rate: 3% annually over entire benefit period)

Year (Percent of Total =>)	Recreation Activities							Total Visits/ Value
	Canoe, Kayak, Small Sailboats	Boat Fishing	Shoreline Fishing	Swimming	Picnicking	Walking, Hiking	Wildlife Viewing	
	0.2	0.1	0.25	0.15	0.15	0.1	0.05	
1	8,000	4,000	10,000	6,000	6,000	4,000	2,000	40,000
2	8,240	4,120	10,300	6,180	6,180	4,120	2,060	41,200
3	8,490	4,240	10,610	6,370	6,370	4,240	2,120	42,440
4	8,740	4,370	10,930	6,560	6,560	4,370	2,180	43,710
5	9,000	4,500	11,260	6,760	6,760	4,500	2,250	45,030
6	14,000	7,000	17,500	10,500	10,500	7,000	3,500	70,000
7	14,420	7,210	18,030	10,820	10,820	7,210	3,610	72,120
8	14,850	7,430	18,570	11,140	11,140	7,430	3,720	74,280
9	15,300	7,650	19,130	11,470	11,470	7,650	3,830	76,500
10	15,760	7,880	19,700	11,810	11,810	7,880	3,940	78,780
11	16,230	8,120	20,290	12,160	12,160	8,120	4,060	81,140
12	16,720	8,360	20,900	12,520	12,520	8,360	4,180	83,560
13	17,220	8,610	21,530	12,900	12,900	8,610	4,310	86,080
14	17,740	8,870	22,180	13,290	13,290	8,870	4,440	88,680
15	18,270	9,140	22,850	13,690	13,690	9,140	4,570	91,350
16	18,820	9,410	23,540	14,100	14,100	9,410	4,710	94,090
17	19,380	9,690	24,250	14,520	14,520	9,690	4,850	96,900
18	19,960	9,980	24,980	14,960	14,960	9,980	5,000	99,820
19	20,560	10,280	25,730	15,410	15,410	10,280	5,150	102,820
20	21,180	10,590	26,500	15,870	15,870	10,590	5,300	105,900

21	21,820	10,910	27,300	16,350	16,350	10,910	5,460	109,100
22	22,470	11,240	28,120	16,840	16,840	11,240	5,620	112,370
23	23,140	11,580	28,960	17,350	17,350	11,580	5,790	115,750
24	23,830	11,930	29,830	17,870	17,870	11,930	5,960	119,220
25	24,540	12,290	30,720	18,410	18,410	12,290	6,140	122,800
26	25,280	12,660	31,640	18,960	18,960	12,660	6,320	126,480
27	26,040	13,040	32,590	19,530	19,530	13,040	6,510	130,280
28	26,820	13,430	33,570	20,120	20,120	13,430	6,710	134,200
29	27,620	13,830	34,580	20,720	20,720	13,830	6,910	138,210
30	28,450	14,240	35,620	21,340	21,340	14,240	7,120	142,350
31	29,300	14,670	36,690	21,980	21,980	14,670	7,330	146,620
32	30,180	15,110	37,790	22,640	22,640	15,110	7,550	151,020
33	31,090	15,560	38,920	23,320	23,320	15,560	7,780	155,550
34	32,020	16,030	40,090	24,020	24,020	16,030	8,010	160,220
35	32,980	16,510	41,290	24,740	24,740	16,510	8,250	165,020
36	33,970	17,010	42,530	25,480	25,480	17,010	8,500	169,980
37	34,990	17,520	43,810	26,240	26,240	17,520	8,760	175,080
38	36,040	18,050	45,120	27,030	27,030	18,050	9,020	180,340
39	37,120	18,590	46,470	27,840	27,840	18,590	9,290	185,740
40	38,230	19,150	47,860	28,680	28,680	19,150	9,570	191,320
41	39,380	19,720	49,300	29,540	29,540	19,720	9,860	197,060
42-100	40,000	20,000	50,000	30,000	30,000	20,000	10,000	200,000
Economic value per visit by activity (4/2007 $):	31.21	49.74	49.74	30.59	72.01	26.06	81.26	
Present Value of 100-year stream of benefits (million $):	13.3	10.6	26.6	9.8	23.1	5.6	8.7	97.7

2.3.3.2 Recreation Benefits at Existing Reservoirs and Rivers

This section analyzes the potential recreational effects of each alternative at existing reservoirs and river reaches within the Yakima River Basin. The following lakes and rivers were included in the analysis: Kachess Lake, Cle Elum Lake, Clear Lake, Bumping Lake, Rimrock Lake, Keechelus Lake, Lake Easton, Yakima River, Tieton River, Cle Elum River, Naches River, and Bumping River. Of these sites, only four showed differences in hydrologic measures (e.g., reservoir water levels and river flows) resulting in visitation impacts as compared to the No Action Alternative: Kachess Lake, Cle Elum Lake, Yakima River, and Tieton River. This section presents the results of the recreation visitation and economic valuation analysis for these four sites.

2.3.3.2.1 Met hodology

As with the proposed reservoir recreation analysis, the existing site recreation economic methodology used estimates of recreation visitation (measured in visitor days) as described and presented in the recreation section of the Final PR/EIS. For the affected existing sites, changes in recreation visitation as compared to the No Action Alternative were estimated based on differences in the number of months in which reservoir water levels or river instream flows fell within acceptable ranges. The acceptable reservoir water levels and river instream flows were obtained from a recreation survey (see the *Yakima River Basin Reservoir and River Recreation Survey Report of Findings* [Reclamation, 2008a]).

The estimates of changes in visitation by alternative varied with the water year type—average, dry, and wet. To calculate an average annual change in visitation estimate, the changes in visitation by water year type were multiplied by the probability of occurrence of each water year type (i.e., 50 percent for average year and 25 percent each for dry and wet years). Table 2–32, Table 2–33, and Table 2–34 display the weighted average (expected value) annual change in visitation by site for each alternative.

Table 2–32. Differences in recreation visitation and value at existing sites under the Black Rock Alternative

Site	Water year type	Difference in recreation days compared to the No Action Alternative Alternative[1]							Probability	Difference in days (expected value)
		May	Jun	Jul	Aug	Sep	Oct	Total		
Kachess Lake	Wet							0	0.25	0
	Dry		8,610	8,610				17,220	0.25	4,305
	Average				8,610			8,610	0.5	4,305
									Total:	8,610
Cle Elum Lake	Wet		2,736		2,736			5,472	0.25	1,368
	Dry							0	0.25	0
	Average							0	0.5	0
									Total:	1,368
Yakima River	Wet			3,630	1,815		1,815	7,260	0.25	1,815
	Dry	-667		3,630	1,815			4,778	0.25	1,195
	Average			3,630	1,815		1,815	7,260	0.5	3,630
									Total:	6,640
Tieton River	Wet						-2,250	-2,250	0.25	-563
	Dry							0	0.25	0
	Average					-1,125		-1,125	0.5	-563
									Total:	-1,126
Combined total										15,492

[1] Monthly visitation estimates obtained from recreation analysis described in Chapter 4 of Final PR/EIS.

Table 2–33. Differences in recreation visitation and value at existing sites under the Wymer Dam and Reservoir Alternative

Site	Water year type	Difference in recreation days compared to the No Action Alternative Alternative[1]							Probability	Difference in days (expected value)
		May	Jun	Jul	Aug	Sep	Oct	Total		
Kachess Lake							None	0		
Cle Elum Lake	Wet				2,736			2,736	0.25	684
	Dry		-1,231					-1,231	0.25	-308
	Average							0	0.5	0
									Total:	376
Yakima River	Wet			1,815	908		908	3,631	0.25	908
	Dry			3,630	1,815			5,445	0.25	1,361
	Average			1,815	908		908	3,631	0.5	1,816
									Total:	4,085
Tieton River							None	0		
Combined total										4,461
[1] Monthly visitation estimates obtained from recreation analysis described in Chapter 4 of Final PR/EIS.										

Table 2–34. Differences in recreation visitation and value at existing sites under Wymer Dam Plus Yakima River Pump Exchange Alternative

Site	Water year type	Difference in recreation days compared to the No Action Alternative Alternative[1]							Probability	Difference in days (expected value)
		May	Jun	Jul	Aug	Sep	Oct	Total		
Kachess Lake	Wet							0	0.25	0
	Dry		8,610	8,610				17,220	0.25	4,305
	Average							0	0.5	0
									Total:	4,305
Cle Elum Lake	Wet				2,736			2,736	0.25	684
	Dry							0	0.25	0
	Average							0	0.5	0
									Total:	684
Yakima River	Wet			1,815	908		908	3,631	0.25	908
	Dry			3,630	1,815			5,445	0.25	1,361
	Average			1,815	908		908	3,631	0.5	1,816
									Total:	4,085
Tieton River							None	0		
Combined total										9,074
[1] Monthly visitation estimates obtained from recreation analysis described in Chapter 4 of Final PR/EIS.										

This weighted average change in visitation at each site for each alternative reflects current conditions. These current conditions estimates were used as the starting point in a 100-year change in visitation projection by site and alternative similar to that developed for the proposed reservoirs. Assuming the planning process is not completed until the end of 2009, along with a 10-year construction period, the 100-year benefits period would run from 2020 through 2119. Study recreation

planners recommended using a two-percent annual visitation growth rate for each site as well as visitor capacity estimates to constrain the projected visitation estimates (i.e., visitor capacities: 82,500 for Kachess Lake, 67,000 for Cle Elum Lake, 44,900 for Yakima River, and 34,700 for Tieton River as presented in Table 2–35). Since the changes in visitation were not estimated by recreation activity, the general assumption was made that the changes in visitation would follow the current distribution of recreation by activity seen at each impacted site.

Table 2–35. Calculation of Visitor Capacities for Cle Elum and Kachess Lakes and the Tieton and Yakima Rivers

Recreation Areas	WROS Management Prescription (a)	Length of Recreation Season (Days)	Facility Limits at one point in time	Turnover rate per group per day	Average # of people per group	Daily visitor capacity (number of people per day at full capacity)	Theoretical Visitor Capacity (100% occupancy across recreation season)	Practical Visitor Capacity (80% of theoretical capacity)
Cle Elum Lake	RD=4,478 acres at full pool	132	• Boats at one time=89 • Campsites=70 • Picnic/Pull-offs=6 undesignated sites	1.8 1 2	2.5 3.0 2.0	400 210 24 634 daily	83,688 (132 x 634)	67,000
Kachess Lake	RD=1,684 RN=2,595 acres at full pool	132	• Boats at one time=58 • Campsites=160 • Picnic/Pull-offs=10 undesignated sites	1.8 1 2	2.5 3.0 2.0	261 480 40 781 daily	103,092 (132 x 781)	82,500
Tieton River (Rimrock Lake to Hwy 410)	RN=21 miles	45 days for flip-flop boating; 132 days for shoreline activities	• Boats launched per day=48 • Campsites=81 • Picnic/Pull-offs= 5 undesignated sites	NA 1 2	4 3.0 2.0	192 (b) 243 20 455 daily	43,356 (8,640 flip-flop boating + 34,716 other)	34,700
Yakima River (Lake Easton to Yakima)	RD/RN=75 miles	240 (tubing 60 days)	• Boats launched per day=72 • Warm water tubing=200 • Picnic/Pull-offs= 10 undesignated sites	NA NA 2	2 1 2.0	144 200 (c) 40 384	56,160 (34,560 + 12,000 + 9,600)	44.900

(a) The WROS approach categorizes recreation areas into Urban (U), Suburban (SU), Rural Developed (RD), Rural Natural (RN), Semi-Primitive (SP), and Primitive (P).

(b) 192 per day for only 30 days of the recreation season

(c) 2 launch with 100 tubers per day for 60 days of the recreation season

Instead of estimating the change in visitation for each site by recreation activity as was done for the proposed reservoir analysis, a weighted average economic value for each site was developed by multiplying the percent of visitation by primary recreation activity at each site (as obtained from the recreation survey) by the April 2007 indexed economic values per visit by recreation activity (as obtained from the Kaval and Loomis 2003 study). As shown in Table 2–36, the weighted average values per visit at each site were estimated as follows: Kachess Lake, $90.28; Cle Elum Lake, $69.00; Yakima River, $53.93; and Tieton River, $31.21. The projected annual change in recreation visitation by alternative at each site was multiplied by the weighted average economic value by site to estimate the 100-year stream of recreation economic values. These 100-year streams of annual recreation economic values by site and alternative were then discounted into present value estimates. These four present value estimates for each alternative were added together to measure the change in economic value at the existing sites.

2.3.3.2.2 Existing Reservoir and River Results

Black Rock Alternative

As shown in Table 2-37 through Table 2–40, the present value of the 100-year stream of incremental recreation effects was expected to be positive at Kachess Lake (+$27.2 million), Cle Elum Lake (+$3.85 million), and the Yakima River (+$7.6 million), with the Black Rock Alternative. Negative incremental recreation effects were estimated for the Tieton River (-$1.4 million) with this alternative. The combined incremental change in value across all four existing sites was estimated at a discounted present value of $37.3 million.

Table 2–36. Percentage of survey respondents by primary recreation activity at existing reservoir and river sites

Source of Values: Kaval, P. and J. Loomis. 10/2003. "Updated Outdoor Recreation Use Values with Emphasis on National Park Recreation." Dept. fo Ag. & Resource Economics, CSU, Ft Collins, report to NPS under Cooperative Agreement # CA 1200-99-009, project # IMDE-02-0070. Used Pacific Coast values except for horseback riding (multiple area studies) and waterskiing (intermountain).

CPI Value (1996): 157.6
CPI Value (April 2007): 212.036
CPI Indexing Value: 1.345406091

					Kachess Lake			Cle Elum Lake			Tieton River			Yakima River		
Primary recreation activity	Kaval & Loomis Activity	Kaval & Loomis Region	Original Value per Day (1996)	Indexed Value per Day (4/2007)	Original % (Sum >100%)	Reweighted %s (Sum = 100%)	Weighted Average Value per Day (4/2007 $)	Original % (Sum >100%)	Reweighted %s (Sum = 100%)	Weighted Average Value per Day (4/2007 $)	Original % (Sum >100%)	Reweighted %s (Sum = 100%)	Weighted Average Value per Day (4/2007 $)	Original % (Sum >100%)	Reweighted %s (Sum = 100%)	Weighted Average Value per Day (4/2007 $)
Motorboating	Motorboating	Pacific	22.45	30.20	0.060	0.055	1.65	0.110	0.082	2.48	0.000	0.000	0.00	0.010	0.008	0.25
Boat fishing (guided)	Fishing	Pacific	36.97	49.74	0.000	0.000	0.00	0.020	0.015	0.74	0.010	0.008	0.41	0.010	0.008	0.41
Boat fishing (private)	Fishing	Pacific	36.97	49.74	0.040	0.036	1.81	0.090	0.067	3.34	0.010	0.008	0.41	0.110	0.092	4.56
Bank/Shoreline fishing	Fishing	Pacific	36.97	49.74	0.010	0.009	0.45	0.020	0.015	0.74	0.030	0.025	1.22	0.060	0.050	2.49
Kayaking/Canoeing	Floatboating/Rafting /Canoeing	Pacific	23.2	31.21	0.100	0.091	2.84	0.010	0.007	0.23	0.180	0.148	4.61	0.070	0.058	1.82
Hunting	Hunting	Pacific	37.91	51.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.010	0.008	0.43
Sailing	Motorboating	Pacific	22.45	30.20	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00
Water-skiing	Waterskiing	Intermountain	47.47	63.87	0.040	0.036	2.32	0.070	0.052	3.34	0.000	0.000	0.00	0.000	0.000	0.00
PWC (Jet skiing)	Motorboating	Pacific	22.45	30.20	0.000	0.000	0.00	0.090	0.067	2.03	0.000	0.000	0.00	0.050	0.042	1.26
Swimming	Swimming	Pacific	22.74	30.59	0.060	0.055	1.67	0.200	0.149	4.57	0.010	0.008	0.25	0.030	0.025	0.76
Camping	Camping	Pacific	86.96	117.00	0.730	0.664	77.64	0.520	0.388	45.40	0.320	0.262	30.69	0.210	0.175	20.47
Sightseeing	Sightseeing	Pacific	16.89	22.72	0.040	0.036	0.83	0.130	0.097	2.20	0.070	0.057	1.30	0.020	0.017	0.38
Wildlife viewing	Wildlife viewing	Pacific	60.4	81.26	0.010	0.009	0.74	0.030	0.022	1.82	0.000	0.000	0.00	0.010	0.008	0.68
Nature study	Wildlife viewing	Pacific	60.4	81.26	0.000	0.000	0.00	0.010	0.007	0.61	0.010	0.008	0.67	0.010	0.008	0.68
Picnicking	Picnicking	Pacific	53.52	72.01	0.000	0.000	0.00	0.020	0.015	1.07	0.040	0.033	2.36	0.090	0.075	5.40
Rafting (guided)	Floatboating/Rafting /Canoeing	Pacific	23.2	31.21	0.000	0.000	0.00	0.000	0.000	0.00	0.120	0.098	3.07	0.000	0.000	0.00
Rafting (private)	Floatboating/Rafting /Canoeing	Pacific	23.2	31.21	0.000	0.000	0.00	0.000	0.000	0.00	0.300	0.246	7.68	0.330	0.275	8.58
Wade fishing	Fishing	Pacific	36.97	49.74	0.000	0.000	0.00	0.000	0.000	0.00	0.050	0.041	2.04	0.070	0.058	2.90
Trail use	Hiking	Pacific	19.37	26.06	0.000	0.000	0.00	0.010	0.007	0.19	0.020	0.016	0.43	0.010	0.008	0.22
Tubing	Floatboating/Rafting /Canoeing	Pacific	23.2	31.21	0.000	0.000	0.00	0.000	0.000	0.00	0.010	0.008	0.26	0.070	0.058	1.82
Wading	Swimming	Pacific	22.74	30.59	0.000	0.000	0.00	0.010	0.007	0.23	0.020	0.016	0.50	0.020	0.017	0.51
Other	General Recreation	Pacific	26.96	36.27	0.010	0.009	0.33	0.000	0.000	0.00	0.020	0.016	0.59	0.010	0.008	0.30
Total:					1.100	1.000	90.28	1.340	1.000	69.00	1.220	1.000	56.48	1.200	1.000	53.93

Table 2-37. Changes in Recreation Visitation and Value at Kachess Lake – Black Rock Alternative

2007 Visitor Days (PR/EIS Table 4.45):	17,668
Average Annual Change in Visitor Days (PR/EIS Table 2.54):	8,610
Visitation Growth Rate:	0.02
Carrying Capacity:	82,500
April 2007 Value per Visit (Kaval & Loomis, 2003):	90.28
Discount Rate:	0.04875

(Discount to Start of Benefits Period)

			No Action Alternative - Kachess Lake				Black Rock Alternative - Kachess Lake					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year	Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		17,668	17,668			8,610	26,278	26,278	8,610		
2008	Planning		18,021	18,021			8,782	26,803	26,803	8,782		
2009	Planning		18,381	18,381			8,958	27,339	27,339	8,958		
2010	Construction		18,749	18,749			9,137	27,886	27,886	9,137		
2011	Construction		19,124	19,124			9,320	28,444	28,444	9,320		
2012	Construction		19,506	19,506			9,506	29,012	29,012	9,506		
2013	Construction		19,896	19,896			9,696	29,592	29,592	9,696		
2014	Construction		20,294	20,294			9,890	30,184	30,184	9,890		
2015	Construction		20,700	20,700			10,088	30,788	30,788	10,088		
2016	Construction		21,114	21,114			10,290	31,404	31,404	10,290		
2017	Construction		21,536	21,536			10,496	32,032	32,032	10,496		
2018	Construction		21,967	21,967			10,706	32,673	32,673	10,706		
2019	Construction		22,406	22,406			10,920	33,326	33,326	10,920		
2020	Benefits	1	22,854	22,854	2,063,259	1,967,351	11,138	33,992	33,992	11,138	1,005,539	958,797
2021	Benefits	2	23,311	23,311	2,104,517	1,913,412	11,361	34,672	34,672	11,361	1,025,671	932,533
2022	Benefits	3	23,777	23,777	2,146,588	1,860,941	11,588	35,365	35,365	11,588	1,046,165	906,952
2023	Benefits	4	24,253	24,253	2,189,561	1,809,961	11,820	36,073	36,073	11,820	1,067,110	882,107
2024	Benefits	5	24,738	24,738	2,233,347	1,760,339	12,056	36,794	36,794	12,056	1,088,416	857,897
2025	Benefits	6	25,233	25,233	2,278,035	1,712,098	12,297	37,530	37,530	12,297	1,110,173	834,370
2026	Benefits	7	25,738	25,738	2,323,627	1,665,185	12,543	38,281	38,281	12,543	1,132,382	811,501
2027	Benefits	8	26,253	26,253	2,370,121	1,619,551	12,794	39,047	39,047	12,794	1,155,042	789,264
2028	Benefits	9	26,778	26,778	2,417,518	1,575,150	13,050	39,828	39,828	13,050	1,178,154	767,634
2029	Benefits	10	27,314	27,314	2,465,908	1,531,994	13,311	40,625	40,625	13,311	1,201,717	746,591
2030	Benefits	11	27,860	27,860	2,515,201	1,489,982	13,577	41,437	41,437	13,577	1,225,732	726,112
2031	Benefits	12	28,417	28,417	2,565,487	1,449,126	13,849	42,266	42,266	13,849	1,250,288	706,230
2032	Benefits	13	28,985	28,985	2,616,766	1,409,384	14,126	43,111	43,111	14,126	1,275,295	686,871
2033	Benefits	14	29,565	29,565	2,669,128	1,370,761	14,409	43,974	43,974	14,409	1,300,845	668,064
2034	Benefits	15	30,156	30,156	2,722,484	1,333,170	14,697	44,853	44,853	14,697	1,326,845	649,742
2035	Benefits	16	30,759	30,759	2,776,923	1,296,618	14,991	45,750	45,750	14,991	1,353,387	631,932
2036	Benefits	17	31,374	31,374	2,832,445	1,261,066	15,291	46,665	46,665	15,291	1,380,471	614,616
2037	Benefits	18	32,001	32,001	2,889,050	1,226,477	15,597	47,598	47,598	15,597	1,408,097	597,774
2038	Benefits	19	32,641	32,641	2,946,829	1,192,855	15,909	48,550	48,550	15,909	1,436,265	581,389
2039	Benefits	20	33,294	33,294	3,005,782	1,160,160	16,227	49,521	49,521	16,227	1,464,974	565,445
2040	Benefits	21	33,960	33,960	3,065,909	1,128,360	16,552	50,512	50,512	16,552	1,494,315	549,959
2041	Benefits	22	34,639	34,639	3,127,209	1,097,422	16,883	51,522	51,522	16,883	1,524,197	534,882
2042	Benefits	23	35,332	35,332	3,189,773	1,067,344	17,221	52,553	52,553	17,221	1,554,712	520,229
2043	Benefits	24	36,039	36,039	3,253,601	1,038,095	17,565	53,604	53,604	17,565	1,585,768	505,956
2044	Benefits	25	36,760	36,760	3,318,693	1,009,643	17,916	54,676	54,676	17,916	1,617,456	492,077
2045	Benefits	26	37,495	37,495	3,385,049	981,960	18,274	55,769	55,769	18,274	1,649,777	478,579
2046	Benefits	27	38,245	38,245	3,452,759	955,043	18,639	56,884	56,884	18,639	1,682,729	465,448
2047	Benefits	28	39,010	39,010	3,521,823	928,864	19,012	58,022	58,022	19,012	1,716,403	452,693
2048	Benefits	29	39,790	39,790	3,592,241	903,396	19,392	59,182	59,182	19,392	1,750,710	440,278
2049	Benefits	30	40,586	40,586	3,664,104	878,635	19,780	60,366	60,366	19,780	1,785,738	428,212
2050	Benefits	31	41,398	41,398	3,737,411	854,554	20,176	61,574	61,574	20,176	1,821,489	416,481
2051	Benefits	32	42,226	42,226	3,812,163	831,129	20,580	62,806	62,806	20,580	1,857,962	405,073
2052	Benefits	33	43,071	43,071	3,888,450	808,354	20,992	64,063	64,063	20,992	1,895,158	393,976

2053	Benefits	34	43,932	43,932	3,966,181	786,186	21,412	65,344	65,344	21,412	1,933,075	383,179
2054	Benefits	35	44,811	44,811	4,045,537	764,640	21,840	66,651	66,651	21,840	1,971,715	372,671
2055	Benefits	36	45,707	45,707	4,126,428	743,675	22,277	67,984	67,984	22,277	2,011,168	362,458
2056	Benefits	37	46,621	46,621	4,208,944	723,286	22,723	69,344	69,344	22,723	2,051,432	352,528
2057	Benefits	38	47,553	47,553	4,293,085	703,452	23,177	70,730	70,730	23,177	2,092,420	342,858
2058	Benefits	39	48,504	48,504	4,378,941	684,167	23,641	72,145	72,145	23,641	2,134,309	333,465
2059	Benefits	40	49,474	49,474	4,466,513	665,410	24,114	73,588	73,588	24,114	2,177,012	324,326
2060	Benefits	41	50,463	50,463	4,555,800	647,163	24,596	75,059	75,059	24,596	2,220,527	315,432
2061	Benefits	42	51,472	51,472	4,646,892	629,419	25,088	76,560	76,560	25,088	2,264,945	306,785
2062	Benefits	43	52,501	52,501	4,739,790	612,159	25,590	78,091	78,091	25,590	2,310,265	298,378
2063	Benefits	44	53,551	53,551	4,834,584	595,377	26,102	79,653	79,653	26,102	2,356,489	290,201
2064	Benefits	45	54,622	54,622	4,931,274	579,056	26,624	81,246	81,246	26,624	2,403,615	282,245
2065	Benefits	46	55,714	55,714	5,029,860	563,177	27,156	82,870	82,500	26,786	2,418,240	270,763
2066	Benefits	47	56,828	56,828	5,130,432	547,736	27,699	84,527	82,500	25,672	2,317,668	247,439
2067	Benefits	48	57,965	57,965	5,233,080	532,724	28,253	86,218	82,500	24,535	2,215,020	225,488
2068	Benefits	49	59,124	59,124	5,337,715	518,118	28,818	87,942	82,500	23,376	2,110,385	204,850
2069	Benefits	50	60,306	60,306	5,444,426	503,910	29,394	89,700	82,500	22,194	2,003,674	185,451
2070	Benefits	51	61,512	61,512	5,553,303	490,096	29,982	91,494	82,500	20,988	1,894,797	167,221
2071	Benefits	52	62,742	62,742	5,664,348	476,658	30,582	93,324	82,500	19,758	1,783,752	150,104
2072	Benefits	53	63,997	63,997	5,777,649	463,593	31,194	95,191	82,500	18,503	1,670,451	134,035
2073	Benefits	54	65,277	65,277	5,893,208	450,884	31,818	97,095	82,500	17,223	1,554,892	118,964
2074	Benefits	55	66,583	66,583	6,011,113	438,527	32,454	99,037	82,500	15,917	1,436,987	104,832
2075	Benefits	56	67,915	67,915	6,131,366	426,508	33,103	101,018	82,500	14,585	1,316,734	91,594
2076	Benefits	57	69,273	69,273	6,253,966	414,814	33,765	103,038	82,500	13,227	1,194,134	79,205
2077	Benefits	58	70,658	70,658	6,379,004	403,439	34,440	105,098	82,500	11,842	1,069,096	67,615
2078	Benefits	59	72,071	72,071	6,506,570	392,379	35,129	107,200	82,500	10,429	941,530	56,779
2079	Benefits	60	73,512	73,512	6,636,663	381,620	35,832	109,344	82,500	8,988	811,437	46,659
2080	Benefits	61	74,982	74,982	6,769,375	371,157	36,549	111,531	82,500	7,518	678,725	37,214
2081	Benefits	62	76,482	76,482	6,904,795	360,984	37,280	113,762	82,500	6,018	543,305	28,404
2082	Benefits	63	78,012	78,012	7,042,923	351,090	38,026	116,038	82,500	4,488	405,177	20,198
2083	Benefits	64	79,572	79,572	7,183,760	341,464	38,787	118,359	82,500	2,928	264,340	12,565
2084	Benefits	65	81,163	81,163	7,327,396	332,102	39,563	120,726	82,500	1,337	120,704	5,471
2085	Benefits	66	82,786	82,500	7,448,100	321,881	39,563	122,063	82,500	0	0	0
2086	Benefits	67	84,442	82,500	7,448,100	306,919	39,563	122,063	82,500	0	0	0
2087	Benefits	68	86,131	82,500	7,448,100	292,652	39,563	122,063	82,500	0	0	0
2088	Benefits	69	87,854	82,500	7,448,100	279,048	39,563	122,063	82,500	0	0	0
2089	Benefits	70	89,611	82,500	7,448,100	266,077	39,563	122,063	82,500	0	0	0
2090	Benefits	71	91,403	82,500	7,448,100	253,709	39,563	122,063	82,500	0	0	0
2091	Benefits	72	93,231	82,500	7,448,100	241,915	39,563	122,063	82,500	0	0	0
2092	Benefits	73	95,096	82,500	7,448,100	230,670	39,563	122,063	82,500	0	0	0
2093	Benefits	74	96,998	82,500	7,448,100	219,948	39,563	122,063	82,500	0	0	0
2094	Benefits	75	98,938	82,500	7,448,100	209,724	39,563	122,063	82,500	0	0	0
2095	Benefits	76	100,917	82,500	7,448,100	199,975	39,563	122,063	82,500	0	0	0
2096	Benefits	77	102,935	82,500	7,448,100	190,679	39,563	122,063	82,500	0	0	0
2097	Benefits	78	104,994	82,500	7,448,100	181,816	39,563	122,063	82,500	0	0	0
2098	Benefits	79	107,094	82,500	7,448,100	173,364	39,563	122,063	82,500	0	0	0
2099	Benefits	80	109,236	82,500	7,448,100	165,306	39,563	122,063	82,500	0	0	0
2100	Benefits	81	111,421	82,500	7,448,100	157,622	39,563	122,063	82,500	0	0	0
2101	Benefits	82	113,649	82,500	7,448,100	150,295	39,563	122,063	82,500	0	0	0
2102	Benefits	83	115,922	82,500	7,448,100	143,308	39,563	122,063	82,500	0	0	0
2103	Benefits	84	118,240	82,500	7,448,100	136,647	39,563	122,063	82,500	0	0	0
2104	Benefits	85	120,605	82,500	7,448,100	130,295	39,563	122,063	82,500	0	0	0
2105	Benefits	86	123,017	82,500	7,448,100	124,238	39,563	122,063	82,500	0	0	0
2106	Benefits	87	125,477	82,500	7,448,100	118,463	39,563	122,063	82,500	0	0	0
2107	Benefits	88	127,987	82,500	7,448,100	112,957	39,563	122,063	82,500	0	0	0
2108	Benefits	89	130,547	82,500	7,448,100	107,706	39,563	122,063	82,500	0	0	0
2109	Benefits	90	133,158	82,500	7,448,100	102,699	39,563	122,063	82,500	0	0	0
2110	Benefits	91	135,821	82,500	7,448,100	97,926	39,563	122,063	82,500	0	0	0
2111	Benefits	92	138,537	82,500	7,448,100	93,374	39,563	122,063	82,500	0	0	0
2112	Benefits	93	141,308	82,500	7,448,100	89,033	39,563	122,063	82,500	0	0	0
2113	Benefits	94	144,134	82,500	7,448,100	84,895	39,563	122,063	82,500	0	0	0

2114	Benefits	95	147,017	82,500	7,448,100	80,948	39,563	122,063	82,500	0	0	0
2115	Benefits	96	149,957	82,500	7,448,100	77,186	39,563	122,063	82,500	0	0	0
2116	Benefits	97	152,956	82,500	7,448,100	73,598	39,563	122,063	82,500	0	0	0
2117	Benefits	98	156,015	82,500	7,448,100	70,177	39,563	122,063	82,500	0	0	0
2118	Benefits	99	159,135	82,500	7,448,100	66,914	39,563	122,063	82,500	0	0	0
2119	Benefits	100	162,318	82,500	7,448,100	63,804	39,563	122,063	82,500	0	0	0
			Average Annual:	54,368		65,599,118 (TOTAL)		Average Annual:	65,196	10,828		$27,219,037 (TOTAL)
								High:	82,500	26,786		
								Low:	26,278	0		

Table 2–38. Changes in Recreation Visitation and Value at Cle Elum Lake – Black Rock Alternative

2007 Visitor Days (PR/EIS Table 4.45):	8,976
Average Annual Change in Visitor Days (PR/EIS Table 2.54):	1,368
Visitation Growth Rate:	0.02
Carrying Capacity:	67,000
April 2007 Value per Visit (Kaval & Loomis, 2003):	69.00
Discount Rate:	0.04875

			No Action Alternative - Cle Elum Lake				Black Rock Alternative - Cle Elum Lake					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year	Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year (Discount to Start of Benefits Period)
2007	Planning		8,976	8,976			1,368	10,344	10,344	1,368		
2008	Planning		9,156	9,156			1,395	10,551	10,551	1,395		
2009	Planning		9,339	9,339			1,423	10,762	10,762	1,423		
2010	Construction		9,526	9,526			1,451	10,977	10,977	1,451		
2011	Construction		9,717	9,717			1,480	11,197	11,197	1,480		
2012	Construction		9,911	9,911			1,510	11,421	11,421	1,510		
2013	Construction		10,109	10,109			1,540	11,649	11,649	1,540		
2014	Construction		10,311	10,311			1,571	11,882	11,882	1,571		
2015	Construction		10,517	10,517			1,602	12,119	12,119	1,602		
2016	Construction		10,727	10,727			1,634	12,361	12,361	1,634		
2017	Construction		10,942	10,942			1,667	12,609	12,609	1,667		
2018	Construction		11,161	11,161			1,700	12,861	12,861	1,700		
2019	Construction		11,384	11,384			1,734	13,118	13,118	1,734		
2020	Benefits	1	11,612	11,612	801,228	763,984	1,769	13,381	13,381	1,769	122,061	116,387
2021	Benefits	2	11,844	11,844	817,236	743,025	1,804	13,648	13,648	1,804	124,476	113,173
2022	Benefits	3	12,081	12,081	833,589	722,663	1,840	13,921	13,921	1,840	126,960	110,065
2023	Benefits	4	12,323	12,323	850,287	702,874	1,877	14,200	14,200	1,877	129,513	107,060
2024	Benefits	5	12,569	12,569	867,261	683,581	1,915	14,484	14,484	1,915	132,135	104,150
2025	Benefits	6	12,820	12,820	884,580	664,822	1,953	14,773	14,773	1,953	134,757	101,279
2026	Benefits	7	13,076	13,076	902,244	646,577	1,992	15,068	15,068	1,992	137,448	98,500
2027	Benefits	8	13,338	13,338	920,322	628,875	2,032	15,370	15,370	2,032	140,208	95,807
2028	Benefits	9	13,605	13,605	938,745	611,646	2,073	15,678	15,678	2,073	143,037	93,197
2029	Benefits	10	13,877	13,877	957,513	594,874	2,114	15,991	15,991	2,114	145,866	90,622
2030	Benefits	11	14,155	14,155	976,695	578,585	2,156	16,311	16,311	2,156	148,764	88,126
2031	Benefits	12	14,438	14,438	996,222	562,720	2,199	16,637	16,637	2,199	151,731	85,706
2032	Benefits	13	14,727	14,727	1,016,163	547,303	2,243	16,970	16,970	2,243	154,767	83,357
2033	Benefits	14	15,022	15,022	1,036,518	532,316	2,288	17,310	17,310	2,288	157,872	81,077
2034	Benefits	15	15,322	15,322	1,057,218	517,708	2,334	17,656	17,656	2,334	161,046	78,862
2035	Benefits	16	15,628	15,628	1,078,332	503,502	2,381	18,009	18,009	2,381	164,289	76,711
2036	Benefits	17	15,941	15,941	1,099,929	489,712	2,429	18,370	18,370	2,429	167,601	74,620
2037	Benefits	18	16,260	16,260	1,121,940	476,293	2,478	18,738	18,738	2,478	170,982	72,586
2038	Benefits	19	16,585	16,585	1,144,365	463,230	2,528	19,113	19,113	2,528	174,432	70,609
2039	Benefits	20	16,917	16,917	1,167,273	450,540	2,579	19,496	19,496	2,579	177,951	68,685
2040	Benefits	21	17,255	17,255	1,190,595	438,180	2,631	19,886	19,886	2,631	181,539	66,813

2041	Benefits	22	17,600	17,600	1,214,400	426,166	2,684	20,284	20,284	2,684	185,196	64,990
2042	Benefits	23	17,952	17,952	1,238,688	414,483	2,738	20,690	20,690	2,738	188,922	63,216
2043	Benefits	24	18,311	18,311	1,263,459	403,119	2,793	21,104	21,104	2,793	192,717	61,488
2044	Benefits	25	18,677	18,677	1,288,713	392,064	2,849	21,526	21,526	2,849	196,581	59,806
2045	Benefits	26	19,051	19,051	1,314,519	381,325	2,906	21,957	21,957	2,906	200,514	58,167
2046	Benefits	27	19,432	19,432	1,340,808	370,871	2,964	22,396	22,396	2,964	204,516	56,570
2047	Benefits	28	19,821	19,821	1,367,649	360,711	3,023	22,844	22,844	3,023	208,587	55,014
2048	Benefits	29	20,217	20,217	1,394,973	350,815	3,083	23,300	23,300	3,083	212,727	53,498
2049	Benefits	30	20,621	20,621	1,422,849	341,193	3,145	23,766	23,766	3,145	217,005	52,037
2050	Benefits	31	21,033	21,033	1,451,277	331,833	3,208	24,241	24,241	3,208	221,352	50,612
2051	Benefits	32	21,454	21,454	1,480,326	322,741	3,272	24,726	24,726	3,272	225,768	49,222
2052	Benefits	33	21,883	21,883	1,509,927	313,892	3,337	25,220	25,220	3,337	230,253	47,866
2053	Benefits	34	22,321	22,321	1,540,149	305,292	3,404	25,725	25,725	3,404	234,876	46,558
2054	Benefits	35	22,767	22,767	1,570,923	296,918	3,472	26,239	26,239	3,472	239,568	45,280
2055	Benefits	36	23,222	23,222	1,602,318	288,774	3,541	26,763	26,763	3,541	244,329	44,034
2056	Benefits	37	23,686	23,686	1,634,334	280,852	3,612	27,298	27,298	3,612	249,228	42,829
2057	Benefits	38	24,160	24,160	1,667,040	273,156	3,684	27,844	27,844	3,684	254,196	41,652
2058	Benefits	39	24,643	24,643	1,700,367	265,666	3,758	28,401	28,401	3,758	259,302	40,513
2059	Benefits	40	25,136	25,136	1,734,384	258,384	3,833	28,969	28,969	3,833	264,477	39,401
2060	Benefits	41	25,639	25,639	1,769,091	251,304	3,910	29,549	29,549	3,910	269,790	38,324
2061	Benefits	42	26,152	26,152	1,804,488	244,417	3,988	30,140	30,140	3,988	275,172	37,272
2062	Benefits	43	26,675	26,675	1,840,575	237,716	4,068	30,743	30,743	4,068	280,692	36,252
2063	Benefits	44	27,209	27,209	1,877,421	231,204	4,149	31,358	31,358	4,149	286,281	35,255
2064	Benefits	45	27,753	27,753	1,914,957	224,864	4,232	31,985	31,985	4,232	292,008	34,289
2065	Benefits	46	28,308	28,308	1,953,252	218,699	4,317	32,625	32,625	4,317	297,873	33,352
2066	Benefits	47	28,874	28,874	1,992,306	212,703	4,403	33,277	33,277	4,403	303,807	32,435
2067	Benefits	48	29,451	29,451	2,032,119	206,869	4,491	33,942	33,942	4,491	309,879	31,545
2068	Benefits	49	30,040	30,040	2,072,760	201,197	4,581	34,621	34,621	4,581	316,089	30,682
2069	Benefits	50	30,641	30,641	2,114,229	195,683	4,673	35,314	35,314	4,673	322,437	29,843
2070	Benefits	51	31,254	31,254	2,156,526	190,320	4,766	36,020	36,020	4,766	328,854	29,022
2071	Benefits	52	31,879	31,879	2,199,651	185,102	4,861	36,740	36,740	4,861	335,409	28,225
2072	Benefits	53	32,517	32,517	2,243,673	180,030	4,958	37,475	37,475	4,958	342,102	27,450
2073	Benefits	54	33,167	33,167	2,288,523	175,093	5,057	38,224	38,224	5,057	348,933	26,697
2074	Benefits	55	33,830	33,830	2,334,270	170,291	5,158	38,988	38,988	5,158	355,902	25,964
2075	Benefits	56	34,507	34,507	2,380,983	165,625	5,261	39,768	39,768	5,261	363,009	25,251
2076	Benefits	57	35,197	35,197	2,428,593	161,084	5,366	40,563	40,563	5,366	370,254	24,558
2077	Benefits	58	35,901	35,901	2,477,169	156,668	5,473	41,374	41,374	5,473	377,637	23,884
2078	Benefits	59	36,619	36,619	2,526,711	152,373	5,582	42,201	42,201	5,582	385,158	23,227
2079	Benefits	60	37,351	37,351	2,577,219	148,195	5,694	43,045	43,045	5,694	392,886	22,592
2080	Benefits	61	38,098	38,098	2,628,762	144,132	5,808	43,906	43,906	5,808	400,752	21,973
2081	Benefits	62	38,860	38,860	2,681,340	140,181	5,924	44,784	44,784	5,924	408,756	21,370
2082	Benefits	63	39,637	39,637	2,734,953	136,338	6,042	45,679	45,679	6,042	416,898	20,782
2083	Benefits	64	40,430	40,430	2,789,670	132,601	6,163	46,593	46,593	6,163	425,247	20,213
2084	Benefits	65	41,239	41,239	2,845,491	128,967	6,286	47,525	47,525	6,286	433,734	19,658
2085	Benefits	66	42,064	42,064	2,902,416	125,432	6,412	48,476	48,476	6,412	442,428	19,120
2086	Benefits	67	42,905	42,905	2,960,445	121,993	6,540	49,445	49,445	6,540	451,260	18,595
2087	Benefits	68	43,763	43,763	3,019,647	118,648	6,671	50,434	50,434	6,671	460,299	18,086
2088	Benefits	69	44,638	44,638	3,080,022	115,395	6,804	51,442	51,442	6,804	469,476	17,589
2089	Benefits	70	45,531	45,531	3,141,639	112,232	6,940	52,471	52,471	6,940	478,860	17,107
2090	Benefits	71	46,442	46,442	3,204,498	109,157	7,079	53,521	53,521	7,079	488,451	16,638
2091	Benefits	72	47,371	47,371	3,268,599	106,165	7,221	54,592	54,592	7,221	498,249	16,183
2092	Benefits	73	48,318	48,318	3,333,942	103,253	7,365	55,683	55,683	7,365	508,185	15,739
2093	Benefits	74	49,284	49,284	3,400,596	100,422	7,512	56,796	56,796	7,512	518,328	15,307
2094	Benefits	75	50,270	50,270	3,468,630	97,670	7,662	57,932	57,932	7,662	528,678	14,887
2095	Benefits	76	51,275	51,275	3,537,975	94,992	7,815	59,090	59,090	7,815	539,235	14,478
2096	Benefits	77	52,301	52,301	3,608,769	92,388	7,971	60,272	60,272	7,971	549,999	14,081
2097	Benefits	78	53,347	53,347	3,680,943	89,856	8,130	61,477	61,477	8,130	560,970	13,694
2098	Benefits	79	54,414	54,414	3,754,566	87,392	8,293	62,707	62,707	8,293	572,217	13,319
2099	Benefits	80	55,502	55,502	3,829,638	84,996	8,459	63,961	63,961	8,459	583,671	12,954
2100	Benefits	81	56,612	56,612	3,906,228	82,666	8,628	65,240	65,240	8,628	595,332	12,599
2101	Benefits	82	57,744	57,744	3,984,336	80,400	8,801	66,545	66,545	8,801	607,269	12,254

2102	Benefits	83	58,899	58,899	4,064,031	78,196		8,977	67,876	67,000	8,101	558,969	10,755
2103	Benefits	84	60,077	60,077	4,145,313	76,052		9,157	69,234	67,000	6,923	477,687	8,764
2104	Benefits	85	61,279	61,279	4,228,251	73,968		9,340	70,619	67,000	5,721	394,749	6,906
2105	Benefits	86	62,505	62,505	4,312,845	71,941		9,527	72,032	67,000	4,495	310,155	5,174
2106	Benefits	87	63,755	63,755	4,399,095	69,968		9,718	73,473	67,000	3,245	223,905	3,561
2107	Benefits	88	65,030	65,030	4,487,070	68,050		9,912	74,942	67,000	1,970	135,930	2,061
2108	Benefits	89	66,331	66,331	4,576,839	66,185		10,110	76,441	67,000	669	46,161	668
2109	Benefits	90	67,658	67,000	4,623,000	63,745		10,110	77,110	67,000	0	0	0
2110	Benefits	91	69,011	67,000	4,623,000	60,782		10,110	77,110	67,000	0	0	0
2111	Benefits	92	70,391	67,000	4,623,000	57,957		10,110	77,110	67,000	0	0	0
2112	Benefits	93	71,799	67,000	4,623,000	55,262		10,110	77,110	67,000	0	0	0
2113	Benefits	94	73,235	67,000	4,623,000	52,694		10,110	77,110	67,000	0	0	0
2114	Benefits	95	74,700	67,000	4,623,000	50,244		10,110	77,110	67,000	0	0	0
2115	Benefits	96	76,194	67,000	4,623,000	47,909		10,110	77,110	67,000	0	0	0
2116	Benefits	97	77,718	67,000	4,623,000	45,682		10,110	77,110	67,000	0	0	0
2117	Benefits	98	79,272	67,000	4,623,000	43,558		10,110	77,110	67,000	0	0	0
2118	Benefits	99	80,857	67,000	4,623,000	41,533		10,110	77,110	67,000	0	0	0
2119	Benefits	100	82,474	67,000	4,623,000	39,603		10,110	77,110	67,000	0	0	0
			Average Annual:	32,487		$26,079,307 (TOTAL)			Average Annual:	36,130	3,643		$3,850,778 (TOTAL)
									High:	67,000	8,801		
									Low:	10,344	0		

Table 2–39. Changes in Recreation Visitation and Value at Yakima River – Black Rock Alternative

2007 Visitor Days (PR/EIS Table 4.45):	18,900
Average Annual Change in Visitor Days (PR/EIS Table 2.54):	6,640
Visitation Growth Rate:	0.02
Carrying Capacity:	44,900
April 2007 Value per Visit (Kaval & Loomis, 2003):	53.93
Discount Rate:	0.04875

(Discount to Start of Benefits Period)

			No Action Alternative - Yakima River				Black Rock Alternative - Yakima River					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year	Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		18,900	18,900			6,640	25,540	25,540	6,640		
2008	Planning		19,278	19,278			6,773	26,051	26,051	6,773		
2009	Planning		19,664	19,664			6,908	26,572	26,572	6,908		
2010	Construction		20,057	20,057			7,046	27,103	27,103	7,046		
2011	Construction		20,458	20,458			7,187	27,645	27,645	7,187		
2012	Construction		20,867	20,867			7,331	28,198	28,198	7,331		
2013	Construction		21,284	21,284			7,478	28,762	28,762	7,478		
2014	Construction		21,710	21,710			7,628	29,338	29,338	7,628		
2015	Construction		22,144	22,144			7,781	29,925	29,925	7,781		
2016	Construction		22,587	22,587			7,937	30,524	30,524	7,937		
2017	Construction		23,039	23,039			8,096	31,135	31,135	8,096		
2018	Construction		23,500	23,500			8,258	31,758	31,758	8,258		
2019	Construction		23,970	23,970			8,423	32,393	32,393	8,423		
2020	Benefits	1	24,449	24,449	1,318,535	1,257,244	8,591	33,040	33,040	8,591	463,313	441,776
2021	Benefits	2	24,938	24,938	1,344,906	1,222,779	8,763	33,701	33,701	8,763	472,589	429,674
2022	Benefits	3	25,437	25,437	1,371,817	1,189,270	8,938	34,375	34,375	8,938	482,026	417,883
2023	Benefits	4	25,946	25,946	1,399,268	1,156,679	9,117	35,063	35,063	9,117	491,680	406,438
2024	Benefits	5	26,465	26,465	1,427,257	1,124,974	9,299	35,764	35,764	9,299	501,495	395,282
2025	Benefits	6	26,994	26,994	1,455,786	1,094,122	9,485	36,479	36,479	9,485	511,526	384,447
2026	Benefits	7	27,534	27,534	1,484,909	1,064,133	9,675	37,209	37,209	9,675	521,773	373,919
2027	Benefits	8	28,085	28,085	1,514,624	1,034,973	9,869	37,954	37,954	9,869	532,235	363,687
2028	Benefits	9	28,647	28,647	1,544,933	1,006,611	10,066	38,713	38,713	10,066	542,859	353,704

2029	Benefits	10	29,220	29,220	1,575,835	979,018	10,267	39,487	39,487	10,267	553,699	343,997
2030	Benefits	11	29,804	29,804	1,607,330	952,167	10,472	40,276	40,276	10,472	564,755	334,556
2031	Benefits	12	30,400	30,400	1,639,472	926,063	10,681	41,081	41,081	10,681	576,026	325,371
2032	Benefits	13	31,008	31,008	1,672,261	900,676	10,895	41,903	41,903	10,895	587,567	316,462
2033	Benefits	14	31,628	31,628	1,705,698	875,981	11,113	42,741	42,741	11,113	599,324	307,790
2034	Benefits	15	32,261	32,261	1,739,836	851,979	11,335	43,596	43,596	11,335	611,297	299,345
2035	Benefits	16	32,906	32,906	1,774,621	828,617	11,562	44,468	44,468	11,562	623,539	291,147
2036	Benefits	17	33,564	33,564	1,810,107	805,899	11,793	45,357	44,900	11,336	611,350	272,187
2037	Benefits	18	34,235	34,235	1,846,294	783,800	12,029	46,264	44,900	10,665	575,163	244,172
2038	Benefits	19	34,920	34,920	1,883,236	762,320	12,270	47,190	44,900	9,980	538,221	217,868
2039	Benefits	20	35,618	35,618	1,920,879	741,413	12,515	48,133	44,900	9,282	500,578	193,211
2040	Benefits	21	36,330	36,330	1,959,277	721,082	12,765	49,095	44,900	8,570	462,180	170,098
2041	Benefits	22	37,057	37,057	1,998,484	701,322	13,020	50,077	44,900	7,843	422,973	148,433
2042	Benefits	23	37,798	37,798	2,038,446	682,093	13,280	51,078	44,900	7,102	383,011	128,161
2043	Benefits	24	38,554	38,554	2,079,217	663,395	13,546	52,100	44,900	6,346	342,240	109,195
2044	Benefits	25	39,325	39,325	2,120,797	645,208	13,817	53,142	44,900	5,575	300,660	91,469
2045	Benefits	26	40,112	40,112	2,163,240	627,528	14,093	54,205	44,900	4,788	258,217	74,905
2046	Benefits	27	40,914	40,914	2,206,492	610,322	14,375	55,289	44,900	3,986	214,965	59,460
2047	Benefits	28	41,732	41,732	2,250,607	593,587	14,663	56,395	44,900	3,168	170,850	45,061
2048	Benefits	29	42,567	42,567	2,295,638	577,319	14,956	57,523	44,900	2,333	125,819	31,642
2049	Benefits	30	43,418	43,418	2,341,533	561,489	15,255	58,673	44,900	1,482	79,924	19,165
2050	Benefits	31	44,286	44,286	2,388,344	546,092	15,560	59,846	44,900	614	33,113	7,571
2051	Benefits	32	45,172	44,900	2,421,457	527,927	15,560	60,460	44,900	0	0	0
2052	Benefits	33	46,075	44,900	2,421,457	503,387	15,560	60,460	44,900	0	0	0
2053	Benefits	34	46,997	44,900	2,421,457	479,987	15,560	60,460	44,900	0	0	0
2054	Benefits	35	47,937	44,900	2,421,457	457,676	15,560	60,460	44,900	0	0	0
2055	Benefits	36	48,896	44,900	2,421,457	436,401	15,560	60,460	44,900	0	0	0
2056	Benefits	37	49,874	44,900	2,421,457	416,115	15,560	60,460	44,900	0	0	0
2057	Benefits	38	50,871	44,900	2,421,457	396,773	15,560	60,460	44,900	0	0	0
2058	Benefits	39	51,888	44,900	2,421,457	378,329	15,560	60,460	44,900	0	0	0
2059	Benefits	40	52,926	44,900	2,421,457	360,743	15,560	60,460	44,900	0	0	0
2060	Benefits	41	53,985	44,900	2,421,457	343,974	15,560	60,460	44,900	0	0	0
2061	Benefits	42	55,065	44,900	2,421,457	327,985	15,560	60,460	44,900	0	0	0
2062	Benefits	43	56,166	44,900	2,421,457	312,739	15,560	60,460	44,900	0	0	0
2063	Benefits	44	57,289	44,900	2,421,457	298,202	15,560	60,460	44,900	0	0	0
2064	Benefits	45	58,435	44,900	2,421,457	284,340	15,560	60,460	44,900	0	0	0
2065	Benefits	46	59,604	44,900	2,421,457	271,123	15,560	60,460	44,900	0	0	0
2066	Benefits	47	60,796	44,900	2,421,457	258,520	15,560	60,460	44,900	0	0	0
2067	Benefits	48	62,012	44,900	2,421,457	246,503	15,560	60,460	44,900	0	0	0
2068	Benefits	49	63,252	44,900	2,421,457	235,044	15,560	60,460	44,900	0	0	0
2069	Benefits	50	64,517	44,900	2,421,457	224,119	15,560	60,460	44,900	0	0	0
2070	Benefits	51	65,807	44,900	2,421,457	213,701	15,560	60,460	44,900	0	0	0
2071	Benefits	52	67,123	44,900	2,421,457	203,767	15,560	60,460	44,900	0	0	0
2072	Benefits	53	68,465	44,900	2,421,457	194,295	15,560	60,460	44,900	0	0	0
2073	Benefits	54	69,834	44,900	2,421,457	185,264	15,560	60,460	44,900	0	0	0
2074	Benefits	55	71,231	44,900	2,421,457	176,652	15,560	60,460	44,900	0	0	0
2075	Benefits	56	72,656	44,900	2,421,457	168,440	15,560	60,460	44,900	0	0	0
2076	Benefits	57	74,109	44,900	2,421,457	160,611	15,560	60,460	44,900	0	0	0
2077	Benefits	58	75,591	44,900	2,421,457	153,145	15,560	60,460	44,900	0	0	0
2078	Benefits	59	77,103	44,900	2,421,457	146,026	15,560	60,460	44,900	0	0	0
2079	Benefits	60	78,645	44,900	2,421,457	139,238	15,560	60,460	44,900	0	0	0
2080	Benefits	61	80,218	44,900	2,421,457	132,766	15,560	60,460	44,900	0	0	0
2081	Benefits	62	81,822	44,900	2,421,457	126,594	15,560	60,460	44,900	0	0	0
2082	Benefits	63	83,458	44,900	2,421,457	120,710	15,560	60,460	44,900	0	0	0
2083	Benefits	64	85,127	44,900	2,421,457	115,099	15,560	60,460	44,900	0	0	0
2084	Benefits	65	86,830	44,900	2,421,457	109,748	15,560	60,460	44,900	0	0	0
2085	Benefits	66	88,567	44,900	2,421,457	104,647	15,560	60,460	44,900	0	0	0
2086	Benefits	67	90,338	44,900	2,421,457	99,783	15,560	60,460	44,900	0	0	0
2087	Benefits	68	92,145	44,900	2,421,457	95,144	15,560	60,460	44,900	0	0	0
2088	Benefits	69	93,988	44,900	2,421,457	90,722	15,560	60,460	44,900	0	0	0
2089	Benefits	70	95,868	44,900	2,421,457	86,504	15,560	60,460	44,900	0	0	0

2090	Benefits	71	97,785	44,900	2,421,457	82,483		15,560	60,460	44,900	0	0	0
2091	Benefits	72	99,741	44,900	2,421,457	78,649		15,560	60,460	44,900	0	0	0
2092	Benefits	73	101,736	44,900	2,421,457	74,993		15,560	60,460	44,900	0	0	0
2093	Benefits	74	103,771	44,900	2,421,457	71,507		15,560	60,460	44,900	0	0	0
2094	Benefits	75	105,846	44,900	2,421,457	68,183		15,560	60,460	44,900	0	0	0
2095	Benefits	76	107,963	44,900	2,421,457	65,014		15,560	60,460	44,900	0	0	0
2096	Benefits	77	110,122	44,900	2,421,457	61,992		15,560	60,460	44,900	0	0	0
2097	Benefits	78	112,324	44,900	2,421,457	59,110		15,560	60,460	44,900	0	0	0
2098	Benefits	79	114,570	44,900	2,421,457	56,363		15,560	60,460	44,900	0	0	0
2099	Benefits	80	116,861	44,900	2,421,457	53,743		15,560	60,460	44,900	0	0	0
2100	Benefits	81	119,198	44,900	2,421,457	51,244		15,560	60,460	44,900	0	0	0
2101	Benefits	82	121,582	44,900	2,421,457	48,862		15,560	60,460	44,900	0	0	0
2102	Benefits	83	124,014	44,900	2,421,457	46,591		15,560	60,460	44,900	0	0	0
2103	Benefits	84	126,494	44,900	2,421,457	44,425		15,560	60,460	44,900	0	0	0
2104	Benefits	85	129,024	44,900	2,421,457	42,360		15,560	60,460	44,900	0	0	0
2105	Benefits	86	131,604	44,900	2,421,457	40,391		15,560	60,460	44,900	0	0	0
2106	Benefits	87	134,236	44,900	2,421,457	38,514		15,560	60,460	44,900	0	0	0
2107	Benefits	88	136,921	44,900	2,421,457	36,723		15,560	60,460	44,900	0	0	0
2108	Benefits	89	139,659	44,900	2,421,457	35,016		15,560	60,460	44,900	0	0	0
2109	Benefits	90	142,452	44,900	2,421,457	33,389		15,560	60,460	44,900	0	0	0
2110	Benefits	91	145,301	44,900	2,421,457	31,837		15,560	60,460	44,900	0	0	0
2111	Benefits	92	148,207	44,900	2,421,457	30,357		15,560	60,460	44,900	0	0	0
2112	Benefits	93	151,171	44,900	2,421,457	28,946		15,560	60,460	44,900	0	0	0
2113	Benefits	94	154,194	44,900	2,421,457	27,600		15,560	60,460	44,900	0	0	0
2114	Benefits	95	157,278	44,900	2,421,457	26,317		15,560	60,460	44,900	0	0	0
2115	Benefits	96	160,424	44,900	2,421,457	25,094		15,560	60,460	44,900	0	0	0
2116	Benefits	97	163,632	44,900	2,421,457	23,927		15,560	60,460	44,900	0	0	0
2117	Benefits	98	166,905	44,900	2,421,457	22,815		15,560	60,460	44,900	0	0	0
2118	Benefits	99	170,243	44,900	2,421,457	21,755		15,560	60,460	44,900	0	0	0
2119	Benefits	100	173,648	44,900	2,421,457	20,743		15,560	60,460	44,900	0	0	0
		Average Annual:	39,042			$37,419,842 (TOTAL)			Average Annual:	42,145	3,103		$7,598,075 (TOTAL)
									High:	44,900	11,562		
									Low:	25,540	0		

Table 2–40. Changes in Recreation Visitation and Value at Tieton River – Black Rock Alternative

2007 Visitor Days (PR/EIS Table 4.45):	9,108
Average Annual Change in Visitor Days (PR/EIS Table 2.54):	-1,126
Visitation Growth Rate:	0.02
Carrying Capacity:	34,700
April 2007 Value per Visit (Kaval & Loomis, 2003):	31.21
Discount Rate:	0.04875

(Discount to Start of Benefits Period)

			No Action Alternative - Tieton River				Black Rock Alternative - Tieton River					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year	Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		9,108	9,108			-1,126	7,982	7,982	-1,126		
2008	Planning		9,290	9,290			-1,149	8,141	8,141	-1,149		
2009	Planning		9,476	9,476			-1,172	8,304	8,304	-1,172		
2010	Construction		9,666	9,666			-1,195	8,471	8,471	-1,195		
2011	Construction		9,859	9,859			-1,219	8,640	8,640	-1,219		
2012	Construction		10,056	10,056			-1,243	8,813	8,813	-1,243		
2013	Construction		10,257	10,257			-1,268	8,989	8,989	-1,268		
2014	Construction		10,462	10,462			-1,293	9,169	9,169	-1,293		
2015	Construction		10,671	10,671			-1,319	9,352	9,352	-1,319		
2016	Construction		10,884	10,884			-1,345	9,539	9,539	-1,345		

2017	Construction		11,102	11,102			-1,372	9,730	9,730	-1,372		
2018	Construction		11,324	11,324			-1,399	9,925	9,925	-1,399		
2019	Construction		11,550	11,550			-1,427	10,123	10,123	-1,427		
2020	Benefits	1	11,781	11,781	367,685	350,594	-1,456	10,325	10,325	-1,456	-45,442	-43,329
2021	Benefits	2	12,017	12,017	375,051	340,993	-1,485	10,532	10,532	-1,485	-46,347	-42,138
2022	Benefits	3	12,257	12,257	382,541	331,636	-1,515	10,742	10,742	-1,515	-47,283	-40,991
2023	Benefits	4	12,502	12,502	390,187	322,541	-1,545	10,957	10,957	-1,545	-48,219	-39,860
2024	Benefits	5	12,752	12,752	397,990	313,698	-1,576	11,176	11,176	-1,576	-49,187	-38,769
2025	Benefits	6	13,007	13,007	405,948	305,098	-1,608	11,399	11,399	-1,608	-50,186	-37,718
2026	Benefits	7	13,267	13,267	414,063	296,731	-1,640	11,627	11,627	-1,640	-51,184	-36,680
2027	Benefits	8	13,532	13,532	422,334	288,589	-1,673	11,859	11,859	-1,673	-52,214	-35,679
2028	Benefits	9	13,803	13,803	430,792	280,685	-1,706	12,097	12,097	-1,706	-53,244	-34,692
2029	Benefits	10	14,079	14,079	439,406	272,989	-1,740	12,339	12,339	-1,740	-54,305	-33,738
2030	Benefits	11	14,361	14,361	448,207	265,514	-1,775	12,586	12,586	-1,775	-55,398	-32,817
2031	Benefits	12	14,648	14,648	457,164	258,231	-1,811	12,837	12,837	-1,811	-56,521	-31,926
2032	Benefits	13	14,941	14,941	466,309	251,153	-1,847	13,094	13,094	-1,847	-57,645	-31,047
2033	Benefits	14	15,240	15,240	475,640	244,271	-1,884	13,356	13,356	-1,884	-58,800	-30,197
2034	Benefits	15	15,545	15,545	485,159	237,577	-1,922	13,623	13,623	-1,922	-59,986	-29,374
2035	Benefits	16	15,856	15,856	494,866	231,066	-1,960	13,896	13,896	-1,960	-61,172	-28,563
2036	Benefits	17	16,173	16,173	504,759	224,730	-1,999	14,174	14,174	-1,999	-62,389	-27,777
2037	Benefits	18	16,496	16,496	514,840	218,563	-2,039	14,457	14,457	-2,039	-63,637	-27,016
2038	Benefits	19	16,826	16,826	525,139	212,573	-2,080	14,746	14,746	-2,080	-64,917	-26,278
2039	Benefits	20	17,163	17,163	535,657	206,751	-2,122	15,041	15,041	-2,122	-66,228	-25,562
2040	Benefits	21	17,506	17,506	546,362	201,080	-2,164	15,342	15,342	-2,164	-67,538	-24,856
2041	Benefits	22	17,856	17,856	557,286	195,567	-2,207	15,649	15,649	-2,207	-68,880	-24,172
2042	Benefits	23	18,213	18,213	568,428	190,204	-2,251	15,962	15,962	-2,251	-70,254	-23,508
2043	Benefits	24	18,577	18,577	579,788	184,987	-2,296	16,281	16,281	-2,296	-71,658	-22,863
2044	Benefits	25	18,949	18,949	591,398	179,921	-2,342	16,607	16,607	-2,342	-73,094	-22,237
2045	Benefits	26	19,328	19,328	603,227	174,988	-2,389	16,939	16,939	-2,389	-74,561	-21,629
2046	Benefits	27	19,715	19,715	615,305	170,195	-2,437	17,278	17,278	-2,437	-76,059	-21,038
2047	Benefits	28	20,109	20,109	627,602	165,527	-2,486	17,623	17,623	-2,486	-77,588	-20,463
2048	Benefits	29	20,511	20,511	640,148	160,988	-2,536	17,975	17,975	-2,536	-79,149	-19,905
2049	Benefits	30	20,921	20,921	652,944	156,573	-2,587	18,334	18,334	-2,587	-80,740	-19,361
2050	Benefits	31	21,339	21,339	665,990	152,278	-2,639	18,700	18,700	-2,639	-82,363	-18,832
2051	Benefits	32	21,766	21,766	679,317	148,105	-2,692	19,074	19,074	-2,692	-84,017	-18,317
2052	Benefits	33	22,201	22,201	692,893	144,043	-2,746	19,455	19,455	-2,746	-85,703	-17,816
2053	Benefits	34	22,645	22,645	706,750	140,094	-2,801	19,844	19,844	-2,801	-87,419	-17,328
2054	Benefits	35	23,098	23,098	720,889	136,254	-2,857	20,241	20,241	-2,857	-89,167	-16,853
2055	Benefits	36	23,560	23,560	735,308	132,519	-2,914	20,646	20,646	-2,914	-90,946	-16,391
2056	Benefits	37	24,031	24,031	750,008	128,885	-2,972	21,059	21,059	-2,972	-92,756	-15,940
2057	Benefits	38	24,512	24,512	765,020	125,354	-3,031	21,481	21,481	-3,031	-94,598	-15,500
2058	Benefits	39	25,002	25,002	780,312	121,916	-3,092	21,910	21,910	-3,092	-96,501	-15,077
2059	Benefits	40	25,502	25,502	795,917	118,574	-3,154	22,348	22,348	-3,154	-98,436	-14,665
2060	Benefits	41	26,012	26,012	811,835	115,323	-3,217	22,795	22,795	-3,217	-100,403	-14,262
2061	Benefits	42	26,532	26,532	828,064	112,161	-3,281	23,251	23,251	-3,281	-102,400	-13,870
2062	Benefits	43	27,063	27,063	844,636	109,087	-3,347	23,716	23,716	-3,347	-104,460	-13,491
2063	Benefits	44	27,604	27,604	861,521	106,096	-3,414	24,190	24,190	-3,414	-106,551	-13,122
2064	Benefits	45	28,156	28,156	878,749	103,187	-3,482	24,674	24,674	-3,482	-108,673	-12,761
2065	Benefits	46	28,719	28,719	896,320	100,358	-3,552	25,167	25,167	-3,552	-110,858	-12,412
2066	Benefits	47	29,293	29,293	914,235	97,606	-3,623	25,670	25,670	-3,623	-113,074	-12,072
2067	Benefits	48	29,879	29,879	932,524	94,930	-3,695	26,184	26,184	-3,695	-115,321	-11,740
2068	Benefits	49	30,477	30,477	951,187	92,329	-3,769	26,708	26,708	-3,769	-117,630	-11,418
2069	Benefits	50	31,087	31,087	970,225	89,799	-3,844	27,243	27,243	-3,844	-119,971	-11,104
2070	Benefits	51	31,709	31,709	989,638	87,338	-3,921	27,788	27,788	-3,921	-122,374	-10,800
2071	Benefits	52	32,343	32,343	1,009,425	84,944	-3,999	28,344	28,344	-3,999	-124,809	-10,503
2072	Benefits	53	32,990	32,990	1,029,618	82,615	-4,079	28,911	28,911	-4,079	-127,306	-10,215
2073	Benefits	54	33,650	33,650	1,050,217	80,351	-4,161	29,489	29,489	-4,161	-129,865	-9,936
2074	Benefits	55	34,323	34,323	1,071,221	78,148	-4,244	30,079	30,079	-4,244	-132,455	-9,663
2075	Benefits	56	35,009	34,700	1,082,987	75,334	-4,244	30,456	30,456	-4,244	-132,455	-9,214
2076	Benefits	57	35,709	34,700	1,082,987	71,832	-4,244	30,456	30,456	-4,244	-132,455	-8,786
2077	Benefits	58	36,423	34,700	1,082,987	68,493	-4,244	30,456	30,456	-4,244	-132,455	-8,377

2078	Benefits	59	37,151	34,700	1,082,987	65,310	-4,244	30,456	30,456	-4,244	-132,455	-7,988
2079	Benefits	60	37,894	34,700	1,082,987	62,274	-4,244	30,456	30,456	-4,244	-132,455	-7,616
2080	Benefits	61	38,652	34,700	1,082,987	59,379	-4,244	30,456	30,456	-4,244	-132,455	-7,262
2081	Benefits	62	39,425	34,700	1,082,987	56,619	-4,244	30,456	30,456	-4,244	-132,455	-6,925
2082	Benefits	63	40,214	34,700	1,082,987	53,987	-4,244	30,456	30,456	-4,244	-132,455	-6,603
2083	Benefits	64	41,018	34,700	1,082,987	51,477	-4,244	30,456	30,456	-4,244	-132,455	-6,296
2084	Benefits	65	41,838	34,700	1,082,987	49,085	-4,244	30,456	30,456	-4,244	-132,455	-6,003
2085	Benefits	66	42,675	34,700	1,082,987	46,803	-4,244	30,456	30,456	-4,244	-132,455	-5,724
2086	Benefits	67	43,529	34,700	1,082,987	44,627	-4,244	30,456	30,456	-4,244	-132,455	-5,458
2087	Benefits	68	44,400	34,700	1,082,987	42,553	-4,244	30,456	30,456	-4,244	-132,455	-5,204
2088	Benefits	69	45,288	34,700	1,082,987	40,575	-4,244	30,456	30,456	-4,244	-132,455	-4,963
2089	Benefits	70	46,194	34,700	1,082,987	38,689	-4,244	30,456	30,456	-4,244	-132,455	-4,732
2090	Benefits	71	47,118	34,700	1,082,987	36,890	-4,244	30,456	30,456	-4,244	-132,455	-4,512
2091	Benefits	72	48,060	34,700	1,082,987	35,176	-4,244	30,456	30,456	-4,244	-132,455	-4,302
2092	Benefits	73	49,021	34,700	1,082,987	33,540	-4,244	30,456	30,456	-4,244	-132,455	-4,102
2093	Benefits	74	50,001	34,700	1,082,987	31,981	-4,244	30,456	30,456	-4,244	-132,455	-3,911
2094	Benefits	75	51,001	34,700	1,082,987	30,495	-4,244	30,456	30,456	-4,244	-132,455	-3,730
2095	Benefits	76	52,021	34,700	1,082,987	29,077	-4,244	30,456	30,456	-4,244	-132,455	-3,556
2096	Benefits	77	53,061	34,700	1,082,987	27,726	-4,244	30,456	30,456	-4,244	-132,455	-3,391
2097	Benefits	78	54,122	34,700	1,082,987	26,437	-4,244	30,456	30,456	-4,244	-132,455	-3,233
2098	Benefits	79	55,204	34,700	1,082,987	25,208	-4,244	30,456	30,456	-4,244	-132,455	-3,083
2099	Benefits	80	56,308	34,700	1,082,987	24,036	-4,244	30,456	30,456	-4,244	-132,455	-2,940
2100	Benefits	81	57,434	34,700	1,082,987	22,919	-4,244	30,456	30,456	-4,244	-132,455	-2,803
2101	Benefits	82	58,583	34,700	1,082,987	21,854	-4,244	30,456	30,456	-4,244	-132,455	-2,673
2102	Benefits	83	59,755	34,700	1,082,987	20,838	-4,244	30,456	30,456	-4,244	-132,455	-2,549
2103	Benefits	84	60,950	34,700	1,082,987	19,869	-4,244	30,456	30,456	-4,244	-132,455	-2,430
2104	Benefits	85	62,169	34,700	1,082,987	18,945	-4,244	30,456	30,456	-4,244	-132,455	-2,317
2105	Benefits	86	63,412	34,700	1,082,987	18,065	-4,244	30,456	30,456	-4,244	-132,455	-2,209
2106	Benefits	87	64,680	34,700	1,082,987	17,225	-4,244	30,456	30,456	-4,244	-132,455	-2,107
2107	Benefits	88	65,974	34,700	1,082,987	16,424	-4,244	30,456	30,456	-4,244	-132,455	-2,009
2108	Benefits	89	67,293	34,700	1,082,987	15,661	-4,244	30,456	30,456	-4,244	-132,455	-1,915
2109	Benefits	90	68,639	34,700	1,082,987	14,933	-4,244	30,456	30,456	-4,244	-132,455	-1,826
2110	Benefits	91	70,012	34,700	1,082,987	14,239	-4,244	30,456	30,456	-4,244	-132,455	-1,741
2111	Benefits	92	71,412	34,700	1,082,987	13,577	-4,244	30,456	30,456	-4,244	-132,455	-1,661
2112	Benefits	93	72,840	34,700	1,082,987	12,946	-4,244	30,456	30,456	-4,244	-132,455	-1,583
2113	Benefits	94	74,297	34,700	1,082,987	12,344	-4,244	30,456	30,456	-4,244	-132,455	-1,510
2114	Benefits	95	75,783	34,700	1,082,987	11,770	-4,244	30,456	30,456	-4,244	-132,455	-1,440
2115	Benefits	96	77,299	34,700	1,082,987	11,223	-4,244	30,456	30,456	-4,244	-132,455	-1,373
2116	Benefits	97	78,845	34,700	1,082,987	10,701	-4,244	30,456	30,456	-4,244	-132,455	-1,309
2117	Benefits	98	80,422	34,700	1,082,987	10,204	-4,244	30,456	30,456	-4,244	-132,455	-1,248
2118	Benefits	99	82,030	34,700	1,082,987	9,730	-4,244	30,456	30,456	-4,244	-132,455	-1,190
2119	Benefits	100	83,671	34,700	1,082,987	9,277	-4,244	30,456	30,456	-4,244	-132,455	-1,135
			Average Annual:	25,280		$11,446,656 (TOTAL)		Average Annual:	22,173	-3,107		-$1,413,215 (TOTAL)
								High:	30,456	-1,126		
								Low:	7,982	-4,244		

Wymer Dam and Reservoir Alternative

As shown in Table 2–41 through Table 2–44, the present value of the 100-year stream of incremental recreation effects was expected to be positive at Cle Elum Lake (+$1.07M) and the Yakima River (+$5.1M) with the Wymer Dam and Reservoir Alternative. No impacts were estimated at Kachess Lake and the Tieton River with this alternative. The combined incremental change in value across all four existing sites was estimated at $6.2 million.

Table 2–41. Changes in Recreation Visitation and Value at Kachess Lake – Wymer Dam and Reservoir Alternative

2007 Visitor Days (PR/EIS Table 4.45): 17,668
Average Annual Change in Visitor Days (PR/EIS Table 2.55): 0

			No Action Alternative - Kachess Lake				Wymer Alternative - Kachess Lake					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year	Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		17,668	17,668			0	17,668	17,668	0		
2008	Planning		18,021	18,021			0	18,021	18,021	0		
2009	Planning		18,381	18,381			0	18,381	18,381	0		
2010	Construction		18,749	18,749			0	18,749	18,749	0		
2011	Construction		19,124	19,124			0	19,124	19,124	0		
2012	Construction		19,506	19,506			0	19,506	19,506	0		
2013	Construction		19,896	19,896			0	19,896	19,896	0		
2014	Construction		20,294	20,294			0	20,294	20,294	0		
2015	Construction		20,700	20,700			0	20,700	20,700	0		
2016	Construction		21,114	21,114			0	21,114	21,114	0		
2017	Construction		21,536	21,536			0	21,536	21,536	0		
2018	Construction		21,967	21,967			0	21,967	21,967	0		
2019	Construction		22,406	22,406			0	22,406	22,406	0		
2020	Benefits	1	22,854	22,854	2,063,259	1,967,351	0	22,854	22,854	0	0	0
2021	Benefits	2	23,311	23,311	2,104,517	1,913,412	0	23,311	23,311	0	0	0
2022	Benefits	3	23,777	23,777	2,146,588	1,860,941	0	23,777	23,777	0	0	0
2023	Benefits	4	24,253	24,253	2,189,561	1,809,961	0	24,253	24,253	0	0	0
2024	Benefits	5	24,738	24,738	2,233,347	1,760,339	0	24,738	24,738	0	0	0
2025	Benefits	6	25,233	25,233	2,278,035	1,712,098	0	25,233	25,233	0	0	0
2026	Benefits	7	25,738	25,738	2,323,627	1,665,185	0	25,738	25,738	0	0	0
2027	Benefits	8	26,253	26,253	2,370,121	1,619,551	0	26,253	26,253	0	0	0
2028	Benefits	9	26,778	26,778	2,417,518	1,575,150	0	26,778	26,778	0	0	0
2029	Benefits	10	27,314	27,314	2,465,908	1,531,994	0	27,314	27,314	0	0	0
2030	Benefits	11	27,860	27,860	2,515,201	1,489,982	0	27,860	27,860	0	0	0
2031	Benefits	12	28,417	28,417	2,565,487	1,449,126	0	28,417	28,417	0	0	0
2032	Benefits	13	28,985	28,985	2,616,766	1,409,384	0	28,985	28,985	0	0	0
2033	Benefits	14	29,565	29,565	2,669,128	1,370,761	0	29,565	29,565	0	0	0
2034	Benefits	15	30,156	30,156	2,722,484	1,333,170	0	30,156	30,156	0	0	0
2035	Benefits	16	30,759	30,759	2,776,923	1,296,618	0	30,759	30,759	0	0	0
2036	Benefits	17	31,374	31,374	2,832,445	1,261,066	0	31,374	31,374	0	0	0
2037	Benefits	18	32,001	32,001	2,889,050	1,226,477	0	32,001	32,001	0	0	0
2038	Benefits	19	32,641	32,641	2,946,829	1,192,855	0	32,641	32,641	0	0	0
2039	Benefits	20	33,294	33,294	3,005,782	1,160,160	0	33,294	33,294	0	0	0
2040	Benefits	21	33,960	33,960	3,065,909	1,128,360	0	33,960	33,960	0	0	0
2041	Benefits	22	34,639	34,639	3,127,209	1,097,422	0	34,639	34,639	0	0	0
2042	Benefits	23	35,332	35,332	3,189,773	1,067,344	0	35,332	35,332	0	0	0
2043	Benefits	24	36,039	36,039	3,253,601	1,038,095	0	36,039	36,039	0	0	0
2044	Benefits	25	36,760	36,760	3,318,693	1,009,643	0	36,760	36,760	0	0	0
2045	Benefits	26	37,495	37,495	3,385,049	981,960	0	37,495	37,495	0	0	0
2046	Benefits	27	38,245	38,245	3,452,759	955,043	0	38,245	38,245	0	0	0
2047	Benefits	28	39,010	39,010	3,521,823	928,864	0	39,010	39,010	0	0	0
2048	Benefits	29	39,790	39,790	3,592,241	903,396	0	39,790	39,790	0	0	0
2049	Benefits	30	40,586	40,586	3,664,104	878,635	0	40,586	40,586	0	0	0
2050	Benefits	31	41,398	41,398	3,737,411	854,554	0	41,398	41,398	0	0	0
2051	Benefits	32	42,226	42,226	3,812,163	831,129	0	42,226	42,226	0	0	0
2052	Benefits	33	43,071	43,071	3,888,450	808,354	0	43,071	43,071	0	0	0
2053	Benefits	34	43,932	43,932	3,966,181	786,186	0	43,932	43,932	0	0	0
2054	Benefits	35	44,811	44,811	4,045,537	764,640	0	44,811	44,811	0	0	0
2055	Benefits	36	45,707	45,707	4,126,428	743,675	0	45,707	45,707	0	0	0
2056	Benefits	37	46,621	46,621	4,208,944	723,286	0	46,621	46,621	0	0	0

2057	Benefits	38	47,553	47,553	4,293,085	703,452	0	47,553	47,553	0	0	0
2058	Benefits	39	48,504	48,504	4,378,941	684,167	0	48,504	48,504	0	0	0
2059	Benefits	40	49,474	49,474	4,466,513	665,410	0	49,474	49,474	0	0	0
2060	Benefits	41	50,463	50,463	4,555,800	647,163	0	50,463	50,463	0	0	0
2061	Benefits	42	51,472	51,472	4,646,892	629,419	0	51,472	51,472	0	0	0
2062	Benefits	43	52,501	52,501	4,739,790	612,159	0	52,501	52,501	0	0	0
2063	Benefits	44	53,551	53,551	4,834,584	595,377	0	53,551	53,551	0	0	0
2064	Benefits	45	54,622	54,622	4,931,274	579,056	0	54,622	54,622	0	0	0
2065	Benefits	46	55,714	55,714	5,029,860	563,177	0	55,714	55,714	0	0	0
2066	Benefits	47	56,828	56,828	5,130,432	547,736	0	56,828	56,828	0	0	0
2067	Benefits	48	57,965	57,965	5,233,080	532,724	0	57,965	57,965	0	0	0
2068	Benefits	49	59,124	59,124	5,337,715	518,118	0	59,124	59,124	0	0	0
2069	Benefits	50	60,306	60,306	5,444,426	503,910	0	60,306	60,306	0	0	0
2070	Benefits	51	61,512	61,512	5,553,303	490,096	0	61,512	61,512	0	0	0
2071	Benefits	52	62,742	62,742	5,664,348	476,658	0	62,742	62,742	0	0	0
2072	Benefits	53	63,997	63,997	5,777,649	463,593	0	63,997	63,997	0	0	0
2073	Benefits	54	65,277	65,277	5,893,208	450,884	0	65,277	65,277	0	0	0
2074	Benefits	55	66,583	66,583	6,011,113	438,527	0	66,583	66,583	0	0	0
2075	Benefits	56	67,915	67,915	6,131,366	426,508	0	67,915	67,915	0	0	0
2076	Benefits	57	69,273	69,273	6,253,966	414,814	0	69,273	69,273	0	0	0
2077	Benefits	58	70,658	70,658	6,379,004	403,439	0	70,658	70,658	0	0	0
2078	Benefits	59	72,071	72,071	6,506,570	392,379	0	72,071	72,071	0	0	0
2079	Benefits	60	73,512	73,512	6,636,663	381,620	0	73,512	73,512	0	0	0
2080	Benefits	61	74,982	74,982	6,769,375	371,157	0	74,982	74,982	0	0	0
2081	Benefits	62	76,482	76,482	6,904,795	360,984	0	76,482	76,482	0	0	0
2082	Benefits	63	78,012	78,012	7,042,923	351,090	0	78,012	78,012	0	0	0
2083	Benefits	64	79,572	79,572	7,183,760	341,464	0	79,572	79,572	0	0	0
2084	Benefits	65	81,163	81,163	7,327,396	332,102	0	81,163	81,163	0	0	0
2085	Benefits	66	82,786	82,500	7,448,100	321,881	0	82,500	82,500	0	0	0
2086	Benefits	67	84,442	82,500	7,448,100	306,919	0	82,500	82,500	0	0	0
2087	Benefits	68	86,131	82,500	7,448,100	292,652	0	82,500	82,500	0	0	0
2088	Benefits	69	87,854	82,500	7,448,100	279,048	0	82,500	82,500	0	0	0
2089	Benefits	70	89,611	82,500	7,448,100	266,077	0	82,500	82,500	0	0	0
2090	Benefits	71	91,403	82,500	7,448,100	253,709	0	82,500	82,500	0	0	0
2091	Benefits	72	93,231	82,500	7,448,100	241,915	0	82,500	82,500	0	0	0
2092	Benefits	73	95,096	82,500	7,448,100	230,670	0	82,500	82,500	0	0	0
2093	Benefits	74	96,998	82,500	7,448,100	219,948	0	82,500	82,500	0	0	0
2094	Benefits	75	98,938	82,500	7,448,100	209,724	0	82,500	82,500	0	0	0
2095	Benefits	76	100,917	82,500	7,448,100	199,975	0	82,500	82,500	0	0	0
2096	Benefits	77	102,935	82,500	7,448,100	190,679	0	82,500	82,500	0	0	0
2097	Benefits	78	104,994	82,500	7,448,100	181,816	0	82,500	82,500	0	0	0
2098	Benefits	79	107,094	82,500	7,448,100	173,364	0	82,500	82,500	0	0	0
2099	Benefits	80	109,236	82,500	7,448,100	165,306	0	82,500	82,500	0	0	0
2100	Benefits	81	111,421	82,500	7,448,100	157,622	0	82,500	82,500	0	0	0
2101	Benefits	82	113,649	82,500	7,448,100	150,295	0	82,500	82,500	0	0	0
2102	Benefits	83	115,922	82,500	7,448,100	143,308	0	82,500	82,500	0	0	0
2103	Benefits	84	118,240	82,500	7,448,100	136,647	0	82,500	82,500	0	0	0
2104	Benefits	85	120,605	82,500	7,448,100	130,295	0	82,500	82,500	0	0	0
2105	Benefits	86	123,017	82,500	7,448,100	124,238	0	82,500	82,500	0	0	0
2106	Benefits	87	125,477	82,500	7,448,100	118,463	0	82,500	82,500	0	0	0
2107	Benefits	88	127,987	82,500	7,448,100	112,957	0	82,500	82,500	0	0	0
2108	Benefits	89	130,547	82,500	7,448,100	107,706	0	82,500	82,500	0	0	0
2109	Benefits	90	133,158	82,500	7,448,100	102,699	0	82,500	82,500	0	0	0
2110	Benefits	91	135,821	82,500	7,448,100	97,926	0	82,500	82,500	0	0	0
2111	Benefits	92	138,537	82,500	7,448,100	93,374	0	82,500	82,500	0	0	0
2112	Benefits	93	141,308	82,500	7,448,100	89,033	0	82,500	82,500	0	0	0
2113	Benefits	94	144,134	82,500	7,448,100	84,895	0	82,500	82,500	0	0	0
2114	Benefits	95	147,017	82,500	7,448,100	80,948	0	82,500	82,500	0	0	0
2115	Benefits	96	149,957	82,500	7,448,100	77,186	0	82,500	82,500	0	0	0
2116	Benefits	97	152,956	82,500	7,448,100	73,598	0	82,500	82,500	0	0	0
2117	Benefits	98	156,015	82,500	7,448,100	70,177	0	82,500	82,500	0	0	0

2118	Benefits	99	159,135	82,500	7,448,100	66,914	0	82,500	82,500	0	0	0
2119	Benefits	100	162,318	82,500	7,448,100	63,804	0	82,500	82,500	0	0	0
		Average Annual:		54,368		65,599,118 (TOTAL)		Average Annual:	54,368	0		$0 (TOTAL)
								High:	82,500	0		
								Low:	17,668	0		

Table 2–42. Changes in Recreation Visitation and Value at Cle Elum Lake – Wymer Dam and Reservoir Alternative

2007 Visitor Days (PR/EIS Table 4.45): 8,976
Average Annual Change in Visitor Days (PR/EIS Table 2.55): 376

			No Action Alternative - Cle Elum Lake				Wymer Alternative - Cle Elum Lake					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year	Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		8,976	8,976			376	9,352	9,352	376		
2008	Planning		9,156	9,156			384	9,540	9,540	384		
2009	Planning		9,339	9,339			392	9,731	9,731	392		
2010	Construction		9,526	9,526			400	9,926	9,926	400		
2011	Construction		9,717	9,717			408	10,125	10,125	408		
2012	Construction		9,911	9,911			416	10,327	10,327	416		
2013	Construction		10,109	10,109			424	10,533	10,533	424		
2014	Construction		10,311	10,311			432	10,743	10,743	432		
2015	Construction		10,517	10,517			441	10,958	10,958	441		
2016	Construction		10,727	10,727			450	11,177	11,177	450		
2017	Construction		10,942	10,942			459	11,401	11,401	459		
2018	Construction		11,161	11,161			468	11,629	11,629	468		
2019	Construction		11,384	11,384			477	11,861	11,861	477		
2020	Benefits	1	11,612	11,612	801,228	763,984	487	12,099	12,099	487	33,603	32,041
2021	Benefits	2	11,844	11,844	817,236	743,025	497	12,341	12,341	497	34,293	31,179
2022	Benefits	3	12,081	12,081	833,589	722,663	507	12,588	12,588	507	34,983	30,328
2023	Benefits	4	12,323	12,323	850,287	702,874	517	12,840	12,840	517	35,673	29,488
2024	Benefits	5	12,569	12,569	867,261	683,581	527	13,096	13,096	527	36,363	28,662
2025	Benefits	6	12,820	12,820	884,580	664,822	538	13,358	13,358	538	37,122	27,900
2026	Benefits	7	13,076	13,076	902,244	646,577	549	13,625	13,625	549	37,881	27,147
2027	Benefits	8	13,338	13,338	920,322	628,875	560	13,898	13,898	560	38,640	26,403
2028	Benefits	9	13,605	13,605	938,745	611,646	571	14,176	14,176	571	39,399	25,671
2029	Benefits	10	13,877	13,877	957,513	594,874	582	14,459	14,459	582	40,158	24,949
2030	Benefits	11	14,155	14,155	976,695	578,585	594	14,749	14,749	594	40,986	24,280
2031	Benefits	12	14,438	14,438	996,222	562,720	606	15,044	15,044	606	41,814	23,619
2032	Benefits	13	14,727	14,727	1,016,163	547,303	618	15,345	15,345	618	42,642	22,967
2033	Benefits	14	15,022	15,022	1,036,518	532,316	630	15,652	15,652	630	43,470	22,325
2034	Benefits	15	15,322	15,322	1,057,218	517,708	643	15,965	15,965	643	44,367	21,726
2035	Benefits	16	15,628	15,628	1,078,332	503,502	656	16,284	16,284	656	45,264	21,135
2036	Benefits	17	15,941	15,941	1,099,929	489,712	669	16,610	16,610	669	46,161	20,552
2037	Benefits	18	16,260	16,260	1,121,940	476,293	682	16,942	16,942	682	47,058	19,977
2038	Benefits	19	16,585	16,585	1,144,365	463,230	696	17,281	17,281	696	48,024	19,440
2039	Benefits	20	16,917	16,917	1,167,273	450,540	710	17,627	17,627	710	48,990	18,909
2040	Benefits	21	17,255	17,255	1,190,595	438,180	724	17,979	17,979	724	49,956	18,386
2041	Benefits	22	17,600	17,600	1,214,400	426,166	738	18,338	18,338	738	50,922	17,870
2042	Benefits	23	17,952	17,952	1,238,688	414,483	753	18,705	18,705	753	51,957	17,386
2043	Benefits	24	18,311	18,311	1,263,459	403,119	768	19,079	19,079	768	52,992	16,908
2044	Benefits	25	18,677	18,677	1,288,713	392,064	783	19,460	19,460	783	54,027	16,437
2045	Benefits	26	19,051	19,051	1,314,519	381,325	799	19,850	19,850	799	55,131	15,993
2046	Benefits	27	19,432	19,432	1,340,808	370,871	815	20,247	20,247	815	56,235	15,555
2047	Benefits	28	19,821	19,821	1,367,649	360,711	831	20,652	20,652	831	57,339	15,123
2048	Benefits	29	20,217	20,217	1,394,973	350,815	848	21,065	21,065	848	58,512	14,715

2049	Benefits	30	20,621	20,621	1,422,849	341,193	865	21,486	21,486	865	59,685	14,312
2050	Benefits	31	21,033	21,033	1,451,277	331,833	882	21,915	21,915	882	60,858	13,915
2051	Benefits	32	21,454	21,454	1,480,326	322,741	900	22,354	22,354	900	62,100	13,539
2052	Benefits	33	21,883	21,883	1,509,927	313,892	918	22,801	22,801	918	63,342	13,168
2053	Benefits	34	22,321	22,321	1,540,149	305,292	936	23,257	23,257	936	64,584	12,802
2054	Benefits	35	22,767	22,767	1,570,923	296,918	955	23,722	23,722	955	65,895	12,455
2055	Benefits	36	23,222	23,222	1,602,318	288,774	974	24,196	24,196	974	67,206	12,112
2056	Benefits	37	23,686	23,686	1,634,334	280,852	993	24,679	24,679	993	68,517	11,774
2057	Benefits	38	24,160	24,160	1,667,040	273,156	1,013	25,173	25,173	1,013	69,897	11,453
2058	Benefits	39	24,643	24,643	1,700,367	265,666	1,033	25,676	25,676	1,033	71,277	11,136
2059	Benefits	40	25,136	25,136	1,734,384	258,384	1,054	26,190	26,190	1,054	72,726	10,835
2060	Benefits	41	25,639	25,639	1,769,091	251,304	1,075	26,714	26,714	1,075	74,175	10,537
2061	Benefits	42	26,152	26,152	1,804,488	244,417	1,097	27,249	27,249	1,097	75,693	10,253
2062	Benefits	43	26,675	26,675	1,840,575	237,716	1,119	27,794	27,794	1,119	77,211	9,972
2063	Benefits	44	27,209	27,209	1,877,421	231,204	1,141	28,350	28,350	1,141	78,729	9,695
2064	Benefits	45	27,753	27,753	1,914,957	224,864	1,164	28,917	28,917	1,164	80,316	9,431
2065	Benefits	46	28,308	28,308	1,953,252	218,699	1,187	29,495	29,495	1,187	81,903	9,170
2066	Benefits	47	28,874	28,874	1,992,306	212,703	1,211	30,085	30,085	1,211	83,559	8,921
2067	Benefits	48	29,451	29,451	2,032,119	206,869	1,235	30,686	30,686	1,235	85,215	8,675
2068	Benefits	49	30,040	30,040	2,072,760	201,197	1,260	31,300	31,300	1,260	86,940	8,439
2069	Benefits	50	30,641	30,641	2,114,229	195,683	1,285	31,926	31,926	1,285	88,665	8,206
2070	Benefits	51	31,254	31,254	2,156,526	190,320	1,311	32,565	32,565	1,311	90,459	7,983
2071	Benefits	52	31,879	31,879	2,199,651	185,102	1,337	33,216	33,216	1,337	92,253	7,763
2072	Benefits	53	32,517	32,517	2,243,673	180,030	1,364	33,881	33,881	1,364	94,116	7,552
2073	Benefits	54	33,167	33,167	2,288,523	175,093	1,391	34,558	34,558	1,391	95,979	7,343
2074	Benefits	55	33,830	33,830	2,334,270	170,291	1,419	35,249	35,249	1,419	97,911	7,143
2075	Benefits	56	34,507	34,507	2,380,983	165,625	1,447	35,954	35,954	1,447	99,843	6,945
2076	Benefits	57	35,197	35,197	2,428,593	161,084	1,476	36,673	36,673	1,476	101,844	6,755
2077	Benefits	58	35,901	35,901	2,477,169	156,668	1,506	37,407	37,407	1,506	103,914	6,572
2078	Benefits	59	36,619	36,619	2,526,711	152,373	1,536	38,155	38,155	1,536	105,984	6,391
2079	Benefits	60	37,351	37,351	2,577,219	148,195	1,567	38,918	38,918	1,567	108,123	6,217
2080	Benefits	61	38,098	38,098	2,628,762	144,132	1,598	39,696	39,696	1,598	110,262	6,046
2081	Benefits	62	38,860	38,860	2,681,340	140,181	1,630	40,490	40,490	1,630	112,470	5,880
2082	Benefits	63	39,637	39,637	2,734,953	136,338	1,663	41,300	41,300	1,663	114,747	5,720
2083	Benefits	64	40,430	40,430	2,789,670	132,601	1,696	42,126	42,126	1,696	117,024	5,562
2084	Benefits	65	41,239	41,239	2,845,491	128,967	1,730	42,969	42,969	1,730	119,370	5,410
2085	Benefits	66	42,064	42,064	2,902,416	125,432	1,765	43,829	43,829	1,765	121,785	5,263
2086	Benefits	67	42,905	42,905	2,960,445	121,993	1,800	44,705	44,705	1,800	124,200	5,118
2087	Benefits	68	43,763	43,763	3,019,647	118,648	1,836	45,599	45,599	1,836	126,684	4,978
2088	Benefits	69	44,638	44,638	3,080,022	115,395	1,873	46,511	46,511	1,873	129,237	4,842
2089	Benefits	70	45,531	45,531	3,141,639	112,232	1,910	47,441	47,441	1,910	131,790	4,708
2090	Benefits	71	46,442	46,442	3,204,498	109,157	1,948	48,390	48,390	1,948	134,412	4,579
2091	Benefits	72	47,371	47,371	3,268,599	106,165	1,987	49,358	49,358	1,987	137,103	4,453
2092	Benefits	73	48,318	48,318	3,333,942	103,253	2,027	50,345	50,345	2,027	139,863	4,332
2093	Benefits	74	49,284	49,284	3,400,596	100,422	2,068	51,352	51,352	2,068	142,692	4,214
2094	Benefits	75	50,270	50,270	3,468,630	97,670	2,109	52,379	52,379	2,109	145,521	4,098
2095	Benefits	76	51,275	51,275	3,537,975	94,992	2,151	53,426	53,426	2,151	148,419	3,985
2096	Benefits	77	52,301	52,301	3,608,769	92,388	2,194	54,495	54,495	2,194	151,386	3,876
2097	Benefits	78	53,347	53,347	3,680,943	89,856	2,238	55,585	55,585	2,238	154,422	3,770
2098	Benefits	79	54,414	54,414	3,754,566	87,392	2,283	56,697	56,697	2,283	157,527	3,667
2099	Benefits	80	55,502	55,502	3,829,638	84,996	2,329	57,831	57,831	2,329	160,701	3,567
2100	Benefits	81	56,612	56,612	3,906,228	82,666	2,376	58,988	58,988	2,376	163,944	3,469
2101	Benefits	82	57,744	57,744	3,984,336	80,400	2,424	60,168	60,168	2,424	167,256	3,375
2102	Benefits	83	58,899	58,899	4,064,031	78,196	2,472	61,371	61,371	2,472	170,568	3,282
2103	Benefits	84	60,077	60,077	4,145,313	76,052	2,521	62,598	62,598	2,521	173,949	3,191
2104	Benefits	85	61,279	61,279	4,228,251	73,968	2,571	63,850	63,850	2,571	177,399	3,103
2105	Benefits	86	62,505	62,505	4,312,845	71,941	2,622	65,127	65,127	2,622	180,918	3,018
2106	Benefits	87	63,755	63,755	4,399,095	69,968	2,674	66,429	66,429	2,674	184,506	2,935
2107	Benefits	88	65,030	65,030	4,487,070	68,050	2,727	67,757	67,000	1,970	135,930	2,061
2108	Benefits	89	66,331	66,331	4,576,839	66,185	2,782	69,113	67,000	669	46,161	668
2109	Benefits	90	67,658	67,000	4,623,000	63,745	2,782	69,782	67,000	0	0	0

2110	Benefits	91	69,011	67,000	4,623,000	60,782		2,782	69,782	67,000	0	0	0
2111	Benefits	92	70,391	67,000	4,623,000	57,957		2,782	69,782	67,000	0	0	0
2112	Benefits	93	71,799	67,000	4,623,000	55,262		2,782	69,782	67,000	0	0	0
2113	Benefits	94	73,235	67,000	4,623,000	52,694		2,782	69,782	67,000	0	0	0
2114	Benefits	95	74,700	67,000	4,623,000	50,244		2,782	69,782	67,000	0	0	0
2115	Benefits	96	76,194	67,000	4,623,000	47,909		2,782	69,782	67,000	0	0	0
2116	Benefits	97	77,718	67,000	4,623,000	45,682		2,782	69,782	67,000	0	0	0
2117	Benefits	98	79,272	67,000	4,623,000	43,558		2,782	69,782	67,000	0	0	0
2118	Benefits	99	80,857	67,000	4,623,000	41,533		2,782	69,782	67,000	0	0	0
2119	Benefits	100	82,474	67,000	4,623,000	39,603		2,782	69,782	67,000	0	0	0
			Average	32,487		$26,079,307 (TOTAL)			Average High: Low:	33,551 67,000 9,352	1,064 2,674 0		$1,067,701 (TOTAL)

Table 2–43. Changes in Recreation Visitation and Value at the Yakima River – Wymer Dam and Reservoir Alternative

2007 Visitor Days (PR/EIS Table 4.45): 18,900
Average Annual Change in Visitor Days (PR/EIS Table 2.55): 4,085

			No Action Alternative - Yakima River					Wymer Alternative - Yakima River					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year		Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		18,900	18,900				4,085	22,985	22,985	4,085		
2008	Planning		19,278	19,278				4,167	23,445	23,445	4,167		
2009	Planning		19,664	19,664				4,250	23,914	23,914	4,250		
2010	Construction		20,057	20,057				4,335	24,392	24,392	4,335		
2011	Construction		20,458	20,458				4,422	24,880	24,880	4,422		
2012	Construction		20,867	20,867				4,510	25,377	25,377	4,510		
2013	Construction		21,284	21,284				4,600	25,884	25,884	4,600		
2014	Construction		21,710	21,710				4,692	26,402	26,402	4,692		
2015	Construction		22,144	22,144				4,786	26,930	26,930	4,786		
2016	Construction		22,587	22,587				4,882	27,469	27,469	4,882		
2017	Construction		23,039	23,039				4,980	28,019	28,019	4,980		
2018	Construction		23,500	23,500				5,080	28,580	28,580	5,080		
2019	Construction		23,970	23,970				5,182	29,152	29,152	5,182		
2020	Benefits	1	24,449	24,449	1,318,535	1,257,244		5,286	29,735	29,735	5,286	285,074	271,823
2021	Benefits	2	24,938	24,938	1,344,906	1,222,779		5,392	30,330	30,330	5,392	290,791	264,385
2022	Benefits	3	25,437	25,437	1,371,817	1,189,270		5,500	30,937	30,937	5,500	296,615	257,144
2023	Benefits	4	25,946	25,946	1,399,268	1,156,679		5,610	31,556	31,556	5,610	302,547	250,095
2024	Benefits	5	26,465	26,465	1,427,257	1,124,974		5,722	32,187	32,187	5,722	308,587	243,231
2025	Benefits	6	26,994	26,994	1,455,786	1,094,122		5,836	32,830	32,830	5,836	314,735	236,545
2026	Benefits	7	27,534	27,534	1,484,909	1,064,133		5,953	33,487	33,487	5,953	321,045	230,071
2027	Benefits	8	28,085	28,085	1,514,624	1,034,973		6,072	34,157	34,157	6,072	327,463	223,762
2028	Benefits	9	28,647	28,647	1,544,933	1,006,611		6,193	34,840	34,840	6,193	333,988	217,612
2029	Benefits	10	29,220	29,220	1,575,835	979,018		6,317	35,537	35,537	6,317	340,676	211,652
2030	Benefits	11	29,804	29,804	1,607,330	952,167		6,443	36,247	36,247	6,443	347,471	205,839
2031	Benefits	12	30,400	30,400	1,639,472	926,063		6,572	36,972	36,972	6,572	354,428	200,200
2032	Benefits	13	31,008	31,008	1,672,261	900,676		6,703	37,711	37,711	6,703	361,493	194,699
2033	Benefits	14	31,628	31,628	1,705,698	875,981		6,837	38,465	38,465	6,837	368,719	189,360
2034	Benefits	15	32,261	32,261	1,739,836	851,979		6,974	39,235	39,235	6,974	376,108	184,176
2035	Benefits	16	32,906	32,906	1,774,621	828,617		7,113	40,019	40,019	7,113	383,604	179,115
2036	Benefits	17	33,564	33,564	1,810,107	805,899		7,255	40,819	40,819	7,255	391,262	174,198
2037	Benefits	18	34,235	34,235	1,846,294	783,800		7,400	41,635	41,635	7,400	399,082	169,421
2038	Benefits	19	34,920	34,920	1,883,236	762,320		7,548	42,468	42,468	7,548	407,064	164,776
2039	Benefits	20	35,618	35,618	1,920,879	741,413		7,699	43,317	43,317	7,699	415,207	160,260
2040	Benefits	21	36,330	36,330	1,959,277	721,082		7,853	44,183	44,183	7,853	423,512	155,867

2041	Benefits	22	37,057	37,057	1,998,484	701,322	8,010	45,067	44,900	7,843	422,973	148,433
2042	Benefits	23	37,798	37,798	2,038,446	682,093	8,170	45,968	44,900	7,102	383,011	128,161
2043	Benefits	24	38,554	38,554	2,079,217	663,395	8,333	46,887	44,900	6,346	342,240	109,195
2044	Benefits	25	39,325	39,325	2,120,797	645,208	8,500	47,825	44,900	5,575	300,660	91,469
2045	Benefits	26	40,112	40,112	2,163,240	627,528	8,670	48,782	44,900	4,788	258,217	74,905
2046	Benefits	27	40,914	40,914	2,206,492	610,322	8,843	49,757	44,900	3,986	214,965	59,460
2047	Benefits	28	41,732	41,732	2,250,607	593,587	9,020	50,752	44,900	3,168	170,850	45,061
2048	Benefits	29	42,567	42,567	2,295,638	577,319	9,200	51,767	44,900	2,333	125,819	31,642
2049	Benefits	30	43,418	43,418	2,341,533	561,489	9,384	52,802	44,900	1,482	79,924	19,165
2050	Benefits	31	44,286	44,286	2,388,344	546,092	9,572	53,858	44,900	614	33,113	7,571
2051	Benefits	32	45,172	44,900	2,421,457	527,927	9,572	54,472	44,900	0	0	0
2052	Benefits	33	46,075	44,900	2,421,457	503,387	9,572	54,472	44,900	0	0	0
2053	Benefits	34	46,997	44,900	2,421,457	479,987	9,572	54,472	44,900	0	0	0
2054	Benefits	35	47,937	44,900	2,421,457	457,676	9,572	54,472	44,900	0	0	0
2055	Benefits	36	48,896	44,900	2,421,457	436,401	9,572	54,472	44,900	0	0	0
2056	Benefits	37	49,874	44,900	2,421,457	416,115	9,572	54,472	44,900	0	0	0
2057	Benefits	38	50,871	44,900	2,421,457	396,773	9,572	54,472	44,900	0	0	0
2058	Benefits	39	51,888	44,900	2,421,457	378,329	9,572	54,472	44,900	0	0	0
2059	Benefits	40	52,926	44,900	2,421,457	360,743	9,572	54,472	44,900	0	0	0
2060	Benefits	41	53,985	44,900	2,421,457	343,974	9,572	54,472	44,900	0	0	0
2061	Benefits	42	55,065	44,900	2,421,457	327,985	9,572	54,472	44,900	0	0	0
2062	Benefits	43	56,166	44,900	2,421,457	312,739	9,572	54,472	44,900	0	0	0
2063	Benefits	44	57,289	44,900	2,421,457	298,202	9,572	54,472	44,900	0	0	0
2064	Benefits	45	58,435	44,900	2,421,457	284,340	9,572	54,472	44,900	0	0	0
2065	Benefits	46	59,604	44,900	2,421,457	271,123	9,572	54,472	44,900	0	0	0
2066	Benefits	47	60,796	44,900	2,421,457	258,520	9,572	54,472	44,900	0	0	0
2067	Benefits	48	62,012	44,900	2,421,457	246,503	9,572	54,472	44,900	0	0	0
2068	Benefits	49	63,252	44,900	2,421,457	235,044	9,572	54,472	44,900	0	0	0
2069	Benefits	50	64,517	44,900	2,421,457	224,119	9,572	54,472	44,900	0	0	0
2070	Benefits	51	65,807	44,900	2,421,457	213,701	9,572	54,472	44,900	0	0	0
2071	Benefits	52	67,123	44,900	2,421,457	203,767	9,572	54,472	44,900	0	0	0
2072	Benefits	53	68,465	44,900	2,421,457	194,295	9,572	54,472	44,900	0	0	0
2073	Benefits	54	69,834	44,900	2,421,457	185,264	9,572	54,472	44,900	0	0	0
2074	Benefits	55	71,231	44,900	2,421,457	176,652	9,572	54,472	44,900	0	0	0
2075	Benefits	56	72,656	44,900	2,421,457	168,440	9,572	54,472	44,900	0	0	0
2076	Benefits	57	74,109	44,900	2,421,457	160,611	9,572	54,472	44,900	0	0	0
2077	Benefits	58	75,591	44,900	2,421,457	153,145	9,572	54,472	44,900	0	0	0
2078	Benefits	59	77,103	44,900	2,421,457	146,026	9,572	54,472	44,900	0	0	0
2079	Benefits	60	78,645	44,900	2,421,457	139,238	9,572	54,472	44,900	0	0	0
2080	Benefits	61	80,218	44,900	2,421,457	132,766	9,572	54,472	44,900	0	0	0
2081	Benefits	62	81,822	44,900	2,421,457	126,594	9,572	54,472	44,900	0	0	0
2082	Benefits	63	83,458	44,900	2,421,457	120,710	9,572	54,472	44,900	0	0	0
2083	Benefits	64	85,127	44,900	2,421,457	115,099	9,572	54,472	44,900	0	0	0
2084	Benefits	65	86,830	44,900	2,421,457	109,748	9,572	54,472	44,900	0	0	0
2085	Benefits	66	88,567	44,900	2,421,457	104,647	9,572	54,472	44,900	0	0	0
2086	Benefits	67	90,338	44,900	2,421,457	99,783	9,572	54,472	44,900	0	0	0
2087	Benefits	68	92,145	44,900	2,421,457	95,144	9,572	54,472	44,900	0	0	0
2088	Benefits	69	93,988	44,900	2,421,457	90,722	9,572	54,472	44,900	0	0	0
2089	Benefits	70	95,868	44,900	2,421,457	86,504	9,572	54,472	44,900	0	0	0
2090	Benefits	71	97,785	44,900	2,421,457	82,483	9,572	54,472	44,900	0	0	0
2091	Benefits	72	99,741	44,900	2,421,457	78,649	9,572	54,472	44,900	0	0	0
2092	Benefits	73	101,736	44,900	2,421,457	74,993	9,572	54,472	44,900	0	0	0
2093	Benefits	74	103,771	44,900	2,421,457	71,507	9,572	54,472	44,900	0	0	0
2094	Benefits	75	105,846	44,900	2,421,457	68,183	9,572	54,472	44,900	0	0	0
2095	Benefits	76	107,963	44,900	2,421,457	65,014	9,572	54,472	44,900	0	0	0
2096	Benefits	77	110,122	44,900	2,421,457	61,992	9,572	54,472	44,900	0	0	0
2097	Benefits	78	112,324	44,900	2,421,457	59,110	9,572	54,472	44,900	0	0	0
2098	Benefits	79	114,570	44,900	2,421,457	56,363	9,572	54,472	44,900	0	0	0
2099	Benefits	80	116,861	44,900	2,421,457	53,743	9,572	54,472	44,900	0	0	0
2100	Benefits	81	119,198	44,900	2,421,457	51,244	9,572	54,472	44,900	0	0	0
2101	Benefits	82	121,582	44,900	2,421,457	48,862	9,572	54,472	44,900	0	0	0

2102	Benefits	83	124,014	44,900	2,421,457	46,591		9,572	54,472	44,900	0	0	0
2103	Benefits	84	126,494	44,900	2,421,457	44,425		9,572	54,472	44,900	0	0	0
2104	Benefits	85	129,024	44,900	2,421,457	42,360		9,572	54,472	44,900	0	0	0
2105	Benefits	86	131,604	44,900	2,421,457	40,391		9,572	54,472	44,900	0	0	0
2106	Benefits	87	134,236	44,900	2,421,457	38,514		9,572	54,472	44,900	0	0	0
2107	Benefits	88	136,921	44,900	2,421,457	36,723		9,572	54,472	44,900	0	0	0
2108	Benefits	89	139,659	44,900	2,421,457	35,016		9,572	54,472	44,900	0	0	0
2109	Benefits	90	142,452	44,900	2,421,457	33,389		9,572	54,472	44,900	0	0	0
2110	Benefits	91	145,301	44,900	2,421,457	31,837		9,572	54,472	44,900	0	0	0
2111	Benefits	92	148,207	44,900	2,421,457	30,357		9,572	54,472	44,900	0	0	0
2112	Benefits	93	151,171	44,900	2,421,457	28,946		9,572	54,472	44,900	0	0	0
2113	Benefits	94	154,194	44,900	2,421,457	27,600		9,572	54,472	44,900	0	0	0
2114	Benefits	95	157,278	44,900	2,421,457	26,317		9,572	54,472	44,900	0	0	0
2115	Benefits	96	160,424	44,900	2,421,457	25,094		9,572	54,472	44,900	0	0	0
2116	Benefits	97	163,632	44,900	2,421,457	23,927		9,572	54,472	44,900	0	0	0
2117	Benefits	98	166,905	44,900	2,421,457	22,815		9,572	54,472	44,900	0	0	0
2118	Benefits	99	170,243	44,900	2,421,457	21,755		9,572	54,472	44,900	0	0	0
2119	Benefits	100	173,648	44,900	2,421,457	20,743		9,572	54,472	44,900	0	0	0
			Average	39,042		$37,419,842 (TOTAL)			Average	41,161	2,119		$5,099,294 (TOTAL)
									High:	44,900	7,853		
									Low:	22,985	0		

Table 2–44. Changes in Recreation Visitation and Value at the Tieton River – Wymer Dam and Reservoir Alternative

2007 Visitor Days (PR/EIS Table 4.45):	9,108
Average Annual Change in Visitor Days (PR/EIS Table 2.55):	0

			No Action Alternative - Tieton River					Wymer Alternative - Tieton River					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year	Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		9,108	9,108			0	9,108	9,108	0		
2008	Planning		9,290	9,290			0	9,290	9,290	0		
2009	Planning		9,476	9,476			0	9,476	9,476	0		
2010	Construction		9,666	9,666			0	9,666	9,666	0		
2011	Construction		9,859	9,859			0	9,859	9,859	0		
2012	Construction		10,056	10,056			0	10,056	10,056	0		
2013	Construction		10,257	10,257			0	10,257	10,257	0		
2014	Construction		10,462	10,462			0	10,462	10,462	0		
2015	Construction		10,671	10,671			0	10,671	10,671	0		
2016	Construction		10,884	10,884			0	10,884	10,884	0		
2017	Construction		11,102	11,102			0	11,102	11,102	0		
2018	Construction		11,324	11,324			0	11,324	11,324	0		
2019	Construction		11,550	11,550			0	11,550	11,550	0		
2020	Benefits	1	11,781	11,781	367,685	350,594	0	11,781	11,781	0	0	0
2021	Benefits	2	12,017	12,017	375,051	340,993	0	12,017	12,017	0	0	0
2022	Benefits	3	12,257	12,257	382,541	331,636	0	12,257	12,257	0	0	0
2023	Benefits	4	12,502	12,502	390,187	322,541	0	12,502	12,502	0	0	0
2024	Benefits	5	12,752	12,752	397,990	313,698	0	12,752	12,752	0	0	0
2025	Benefits	6	13,007	13,007	405,948	305,098	0	13,007	13,007	0	0	0
2026	Benefits	7	13,267	13,267	414,063	296,731	0	13,267	13,267	0	0	0
2027	Benefits	8	13,532	13,532	422,334	288,589	0	13,532	13,532	0	0	0
2028	Benefits	9	13,803	13,803	430,792	280,685	0	13,803	13,803	0	0	0
2029	Benefits	10	14,079	14,079	439,406	272,989	0	14,079	14,079	0	0	0
2030	Benefits	11	14,361	14,361	448,207	265,514	0	14,361	14,361	0	0	0
2031	Benefits	12	14,648	14,648	457,164	258,231	0	14,648	14,648	0	0	0
2032	Benefits	13	14,941	14,941	466,309	251,153	0	14,941	14,941	0	0	0

2033	Benefits	14	15,240	15,240	475,640	244,271	0	15,240	15,240	0	0	0
2034	Benefits	15	15,545	15,545	485,159	237,577	0	15,545	15,545	0	0	0
2035	Benefits	16	15,856	15,856	494,866	231,066	0	15,856	15,856	0	0	0
2036	Benefits	17	16,173	16,173	504,759	224,730	0	16,173	16,173	0	0	0
2037	Benefits	18	16,496	16,496	514,840	218,563	0	16,496	16,496	0	0	0
2038	Benefits	19	16,826	16,826	525,139	212,573	0	16,826	16,826	0	0	0
2039	Benefits	20	17,163	17,163	535,657	206,751	0	17,163	17,163	0	0	0
2040	Benefits	21	17,506	17,506	546,362	201,080	0	17,506	17,506	0	0	0
2041	Benefits	22	17,856	17,856	557,286	195,567	0	17,856	17,856	0	0	0
2042	Benefits	23	18,213	18,213	568,428	190,204	0	18,213	18,213	0	0	0
2043	Benefits	24	18,577	18,577	579,788	184,987	0	18,577	18,577	0	0	0
2044	Benefits	25	18,949	18,949	591,398	179,921	0	18,949	18,949	0	0	0
2045	Benefits	26	19,328	19,328	603,227	174,988	0	19,328	19,328	0	0	0
2046	Benefits	27	19,715	19,715	615,305	170,195	0	19,715	19,715	0	0	0
2047	Benefits	28	20,109	20,109	627,602	165,527	0	20,109	20,109	0	0	0
2048	Benefits	29	20,511	20,511	640,148	160,988	0	20,511	20,511	0	0	0
2049	Benefits	30	20,921	20,921	652,944	156,573	0	20,921	20,921	0	0	0
2050	Benefits	31	21,339	21,339	665,990	152,278	0	21,339	21,339	0	0	0
2051	Benefits	32	21,766	21,766	679,317	148,105	0	21,766	21,766	0	0	0
2052	Benefits	33	22,201	22,201	692,893	144,043	0	22,201	22,201	0	0	0
2053	Benefits	34	22,645	22,645	706,750	140,094	0	22,645	22,645	0	0	0
2054	Benefits	35	23,098	23,098	720,889	136,254	0	23,098	23,098	0	0	0
2055	Benefits	36	23,560	23,560	735,308	132,519	0	23,560	23,560	0	0	0
2056	Benefits	37	24,031	24,031	750,008	128,885	0	24,031	24,031	0	0	0
2057	Benefits	38	24,512	24,512	765,020	125,354	0	24,512	24,512	0	0	0
2058	Benefits	39	25,002	25,002	780,312	121,916	0	25,002	25,002	0	0	0
2059	Benefits	40	25,502	25,502	795,917	118,574	0	25,502	25,502	0	0	0
2060	Benefits	41	26,012	26,012	811,835	115,323	0	26,012	26,012	0	0	0
2061	Benefits	42	26,532	26,532	828,064	112,161	0	26,532	26,532	0	0	0
2062	Benefits	43	27,063	27,063	844,636	109,087	0	27,063	27,063	0	0	0
2063	Benefits	44	27,604	27,604	861,521	106,096	0	27,604	27,604	0	0	0
2064	Benefits	45	28,156	28,156	878,749	103,187	0	28,156	28,156	0	0	0
2065	Benefits	46	28,719	28,719	896,320	100,358	0	28,719	28,719	0	0	0
2066	Benefits	47	29,293	29,293	914,235	97,606	0	29,293	29,293	0	0	0
2067	Benefits	48	29,879	29,879	932,524	94,930	0	29,879	29,879	0	0	0
2068	Benefits	49	30,477	30,477	951,187	92,329	0	30,477	30,477	0	0	0
2069	Benefits	50	31,087	31,087	970,225	89,799	0	31,087	31,087	0	0	0
2070	Benefits	51	31,709	31,709	989,638	87,338	0	31,709	31,709	0	0	0
2071	Benefits	52	32,343	32,343	1,009,425	84,944	0	32,343	32,343	0	0	0
2072	Benefits	53	32,990	32,990	1,029,618	82,615	0	32,990	32,990	0	0	0
2073	Benefits	54	33,650	33,650	1,050,217	80,351	0	33,650	33,650	0	0	0
2074	Benefits	55	34,323	34,323	1,071,221	78,148	0	34,323	34,323	0	0	0
2075	Benefits	56	35,009	34,700	1,082,987	75,334	0	34,700	34,700	0	0	0
2076	Benefits	57	35,709	34,700	1,082,987	71,832	0	34,700	34,700	0	0	0
2077	Benefits	58	36,423	34,700	1,082,987	68,493	0	34,700	34,700	0	0	0
2078	Benefits	59	37,151	34,700	1,082,987	65,310	0	34,700	34,700	0	0	0
2079	Benefits	60	37,894	34,700	1,082,987	62,274	0	34,700	34,700	0	0	0
2080	Benefits	61	38,652	34,700	1,082,987	59,379	0	34,700	34,700	0	0	0
2081	Benefits	62	39,425	34,700	1,082,987	56,619	0	34,700	34,700	0	0	0
2082	Benefits	63	40,214	34,700	1,082,987	53,987	0	34,700	34,700	0	0	0
2083	Benefits	64	41,018	34,700	1,082,987	51,477	0	34,700	34,700	0	0	0
2084	Benefits	65	41,838	34,700	1,082,987	49,085	0	34,700	34,700	0	0	0
2085	Benefits	66	42,675	34,700	1,082,987	46,803	0	34,700	34,700	0	0	0
2086	Benefits	67	43,529	34,700	1,082,987	44,627	0	34,700	34,700	0	0	0
2087	Benefits	68	44,400	34,700	1,082,987	42,553	0	34,700	34,700	0	0	0
2088	Benefits	69	45,288	34,700	1,082,987	40,575	0	34,700	34,700	0	0	0
2089	Benefits	70	46,194	34,700	1,082,987	38,689	0	34,700	34,700	0	0	0
2090	Benefits	71	47,118	34,700	1,082,987	36,890	0	34,700	34,700	0	0	0
2091	Benefits	72	48,060	34,700	1,082,987	35,176	0	34,700	34,700	0	0	0
2092	Benefits	73	49,021	34,700	1,082,987	33,540	0	34,700	34,700	0	0	0
2093	Benefits	74	50,001	34,700	1,082,987	31,981	0	34,700	34,700	0	0	0

2094	Benefits	75	51,001	34,700	1,082,987	30,495	0	34,700	34,700	0	0	0
2095	Benefits	76	52,021	34,700	1,082,987	29,077	0	34,700	34,700	0	0	0
2096	Benefits	77	53,061	34,700	1,082,987	27,726	0	34,700	34,700	0	0	0
2097	Benefits	78	54,122	34,700	1,082,987	26,437	0	34,700	34,700	0	0	0
2098	Benefits	79	55,204	34,700	1,082,987	25,208	0	34,700	34,700	0	0	0
2099	Benefits	80	56,308	34,700	1,082,987	24,036	0	34,700	34,700	0	0	0
2100	Benefits	81	57,434	34,700	1,082,987	22,919	0	34,700	34,700	0	0	0
2101	Benefits	82	58,583	34,700	1,082,987	21,854	0	34,700	34,700	0	0	0
2102	Benefits	83	59,755	34,700	1,082,987	20,838	0	34,700	34,700	0	0	0
2103	Benefits	84	60,950	34,700	1,082,987	19,869	0	34,700	34,700	0	0	0
2104	Benefits	85	62,169	34,700	1,082,987	18,945	0	34,700	34,700	0	0	0
2105	Benefits	86	63,412	34,700	1,082,987	18,065	0	34,700	34,700	0	0	0
2106	Benefits	87	64,680	34,700	1,082,987	17,225	0	34,700	34,700	0	0	0
2107	Benefits	88	65,974	34,700	1,082,987	16,424	0	34,700	34,700	0	0	0
2108	Benefits	89	67,293	34,700	1,082,987	15,661	0	34,700	34,700	0	0	0
2109	Benefits	90	68,639	34,700	1,082,987	14,933	0	34,700	34,700	0	0	0
2110	Benefits	91	70,012	34,700	1,082,987	14,239	0	34,700	34,700	0	0	0
2111	Benefits	92	71,412	34,700	1,082,987	13,577	0	34,700	34,700	0	0	0
2112	Benefits	93	72,840	34,700	1,082,987	12,946	0	34,700	34,700	0	0	0
2113	Benefits	94	74,297	34,700	1,082,987	12,344	0	34,700	34,700	0	0	0
2114	Benefits	95	75,783	34,700	1,082,987	11,770	0	34,700	34,700	0	0	0
2115	Benefits	96	77,299	34,700	1,082,987	11,223	0	34,700	34,700	0	0	0
2116	Benefits	97	78,845	34,700	1,082,987	10,701	0	34,700	34,700	0	0	0
2117	Benefits	98	80,422	34,700	1,082,987	10,204	0	34,700	34,700	0	0	0
2118	Benefits	99	82,030	34,700	1,082,987	9,730	0	34,700	34,700	0	0	0
2119	Benefits	100	83,671	34,700	1,082,987	9,277	0	34,700	34,700	0	0	0
			Average	25,280		$11,446,656 (TOTAL)		Average	25,280	0		$0 (TOTAL)
								High:	34,700	0		
								Low:	9,108	0		

Wymer Dam Plus Yakima River Pump Exchange Alternative

As shown in Table 2–45 through 48 the present value of the 100-year stream of incremental recreation effects was expected to be positive at Kachess Lake (+$14.1M), Cle Elum Lake (+$1.9M), and the Yakima River (+$5.1M) with the Wymer Dam Plus Yakima River Pump Exchange Alternative. No impacts were identified for the Tieton River with this alternative. The combined incremental change in value across all four existing sites approaches $21.2 million.

Table 2–45. Changes in Recreation Visitation and Value at Kachess Lake – Wymer Dam Plus Yakima River Pump Exchange Alternative

2007 Visitor Days (PR/EIS Table 4.45): 17,668
Average Annual Change in Visitor Days (PR/EIS Table 2.56): 4,305

			No Action Alternative - Kachess Lake				Wymer Plus Alternative - Kachess Lake					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year	Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		17,668	17,668			4,305	21,973	21,973	4,305		
2008	Planning		18,021	18,021			4,391	22,412	22,412	4,391		
2009	Planning		18,381	18,381			4,479	22,860	22,860	4,479		
2010	Construction		18,749	18,749			4,569	23,318	23,318	4,569		
2011	Construction		19,124	19,124			4,660	23,784	23,784	4,660		
2012	Construction		19,506	19,506			4,753	24,259	24,259	4,753		
2013	Construction		19,896	19,896			4,848	24,744	24,744	4,848		

2014	Construction		20,294	20,294			4,945	25,239	25,239	4,945		
2015	Construction		20,700	20,700			5,044	25,744	25,744	5,044		
2016	Construction		21,114	21,114			5,145	26,259	26,259	5,145		
2017	Construction		21,536	21,536			5,248	26,784	26,784	5,248		
2018	Construction		21,967	21,967			5,353	27,320	27,320	5,353		
2019	Construction		22,406	22,406			5,460	27,866	27,866	5,460		
2020	Benefits	1	22,854	22,854	2,063,259	1,967,351	5,569	28,423	28,423	5,569	502,769	479,399
2021	Benefits	2	23,311	23,311	2,104,517	1,913,412	5,680	28,991	28,991	5,680	512,790	466,225
2022	Benefits	3	23,777	23,777	2,146,588	1,860,941	5,794	29,571	29,571	5,794	523,082	453,476
2023	Benefits	4	24,253	24,253	2,189,561	1,809,961	5,910	30,163	30,163	5,910	533,555	441,053
2024	Benefits	5	24,738	24,738	2,233,347	1,760,339	6,028	30,766	30,766	6,028	544,208	428,948
2025	Benefits	6	25,233	25,233	2,278,035	1,712,098	6,149	31,382	31,382	6,149	555,132	417,219
2026	Benefits	7	25,738	25,738	2,323,627	1,665,185	6,272	32,010	32,010	6,272	566,236	405,783
2027	Benefits	8	26,253	26,253	2,370,121	1,619,551	6,397	32,650	32,650	6,397	577,521	394,632
2028	Benefits	9	26,778	26,778	2,417,518	1,575,150	6,525	33,303	33,303	6,525	589,077	383,817
2029	Benefits	10	27,314	27,314	2,465,908	1,531,994	6,656	33,970	33,970	6,656	600,904	373,323
2030	Benefits	11	27,860	27,860	2,515,201	1,489,982	6,789	34,649	34,649	6,789	612,911	363,083
2031	Benefits	12	28,417	28,417	2,565,487	1,449,126	6,925	35,342	35,342	6,925	625,189	353,141
2032	Benefits	13	28,985	28,985	2,616,766	1,409,384	7,064	36,049	36,049	7,064	637,738	343,484
2033	Benefits	14	29,565	29,565	2,669,128	1,370,761	7,205	36,770	36,770	7,205	650,467	334,055
2034	Benefits	15	30,156	30,156	2,722,484	1,333,170	7,349	37,505	37,505	7,349	663,468	324,893
2035	Benefits	16	30,759	30,759	2,776,923	1,296,618	7,496	38,255	38,255	7,496	676,739	315,987
2036	Benefits	17	31,374	31,374	2,832,445	1,261,066	7,646	39,020	39,020	7,646	690,281	307,328
2037	Benefits	18	32,001	32,001	2,889,050	1,226,477	7,799	39,800	39,800	7,799	704,094	298,906
2038	Benefits	19	32,641	32,641	2,946,829	1,192,855	7,955	40,596	40,596	7,955	718,177	290,713
2039	Benefits	20	33,294	33,294	3,005,782	1,160,160	8,114	41,408	41,408	8,114	732,532	282,740
2040	Benefits	21	33,960	33,960	3,065,909	1,128,360	8,276	42,236	42,236	8,276	747,157	274,980
2041	Benefits	22	34,639	34,639	3,127,209	1,097,422	8,442	43,081	43,081	8,442	762,144	267,457
2042	Benefits	23	35,332	35,332	3,189,773	1,067,344	8,611	43,943	43,943	8,611	777,401	260,130
2043	Benefits	24	36,039	36,039	3,253,601	1,038,095	8,783	44,822	44,822	8,783	792,929	252,992
2044	Benefits	25	36,760	36,760	3,318,693	1,009,643	8,959	45,719	45,719	8,959	808,819	246,066
2045	Benefits	26	37,495	37,495	3,385,049	981,960	9,138	46,633	46,633	9,138	824,979	239,316
2046	Benefits	27	38,245	38,245	3,452,759	955,043	9,321	47,566	47,566	9,321	841,500	232,761
2047	Benefits	28	39,010	39,010	3,521,823	928,864	9,507	48,517	48,517	9,507	858,292	226,370
2048	Benefits	29	39,790	39,790	3,592,241	903,396	9,697	49,487	49,487	9,697	875,445	220,162
2049	Benefits	30	40,586	40,586	3,664,104	878,635	9,891	50,477	50,477	9,891	892,959	214,128
2050	Benefits	31	41,398	41,398	3,737,411	854,554	10,089	51,487	51,487	10,089	910,835	208,261
2051	Benefits	32	42,226	42,226	3,812,163	831,129	10,291	52,517	52,517	10,291	929,071	202,556
2052	Benefits	33	43,071	43,071	3,888,450	808,354	10,497	53,568	53,568	10,497	947,669	197,007
2053	Benefits	34	43,932	43,932	3,966,181	786,186	10,707	54,639	54,639	10,707	966,628	191,607
2054	Benefits	35	44,811	44,811	4,045,537	764,640	10,921	55,732	55,732	10,921	985,948	186,352
2055	Benefits	36	45,707	45,707	4,126,428	743,675	11,139	56,846	56,846	11,139	1,005,629	181,237
2056	Benefits	37	46,621	46,621	4,208,944	723,286	11,362	57,983	57,983	11,362	1,025,761	176,272
2057	Benefits	38	47,553	47,553	4,293,085	703,452	11,589	59,142	59,142	11,589	1,046,255	171,436
2058	Benefits	39	48,504	48,504	4,378,941	684,167	11,821	60,325	60,325	11,821	1,067,200	166,740
2059	Benefits	40	49,474	49,474	4,466,513	665,410	12,057	61,531	61,531	12,057	1,088,506	162,163
2060	Benefits	41	50,463	50,463	4,555,800	647,163	12,298	62,761	62,761	12,298	1,110,263	157,716
2061	Benefits	42	51,472	51,472	4,646,892	629,419	12,544	64,016	64,016	12,544	1,132,472	153,393
2062	Benefits	43	52,501	52,501	4,739,790	612,159	12,795	65,296	65,296	12,795	1,155,133	149,189
2063	Benefits	44	53,551	53,551	4,834,584	595,377	13,051	66,602	66,602	13,051	1,178,244	145,100
2064	Benefits	45	54,622	54,622	4,931,274	579,056	13,312	67,934	67,934	13,312	1,201,807	141,122
2065	Benefits	46	55,714	55,714	5,029,860	563,177	13,578	69,292	69,292	13,578	1,225,822	137,251
2066	Benefits	47	56,828	56,828	5,130,432	547,736	13,850	70,678	70,678	13,850	1,250,378	133,493
2067	Benefits	48	57,965	57,965	5,233,080	532,724	14,127	72,092	72,092	14,127	1,275,386	129,833
2068	Benefits	49	59,124	59,124	5,337,715	518,118	14,410	73,534	73,534	14,410	1,300,935	126,278
2069	Benefits	50	60,306	60,306	5,444,426	503,910	14,698	75,004	75,004	14,698	1,326,935	122,815
2070	Benefits	51	61,512	61,512	5,553,303	490,096	14,992	76,504	76,504	14,992	1,353,478	119,448
2071	Benefits	52	62,742	62,742	5,664,348	476,658	15,292	78,034	78,034	15,292	1,380,562	116,175
2072	Benefits	53	63,997	63,997	5,777,649	463,593	15,598	79,595	79,595	15,598	1,408,187	112,992
2073	Benefits	54	65,277	65,277	5,893,208	450,884	15,910	81,187	81,187	15,910	1,436,355	109,894
2074	Benefits	55	66,583	66,583	6,011,113	438,527	16,228	82,811	82,500	15,917	1,436,987	104,832

2075	Benefits	56	67,915	67,915	6,131,366	426,508	16,553	84,468	82,500	14,585	1,316,734	91,594
2076	Benefits	57	69,273	69,273	6,253,966	414,814	16,884	86,157	82,500	13,227	1,194,134	79,205
2077	Benefits	58	70,658	70,658	6,379,004	403,439	17,222	87,880	82,500	11,842	1,069,096	67,615
2078	Benefits	59	72,071	72,071	6,506,570	392,379	17,566	89,637	82,500	10,429	941,530	56,779
2079	Benefits	60	73,512	73,512	6,636,663	381,620	17,917	91,429	82,500	8,988	811,437	46,659
2080	Benefits	61	74,982	74,982	6,769,375	371,157	18,275	93,257	82,500	7,518	678,725	37,214
2081	Benefits	62	76,482	76,482	6,904,795	360,984	18,641	95,123	82,500	6,018	543,305	28,404
2082	Benefits	63	78,012	78,012	7,042,923	351,090	19,014	97,026	82,500	4,488	405,177	20,198
2083	Benefits	64	79,572	79,572	7,183,760	341,464	19,394	98,966	82,500	2,928	264,340	12,565
2084	Benefits	65	81,163	81,163	7,327,396	332,102	19,782	100,945	82,500	1,337	120,704	5,471
2085	Benefits	66	82,786	82,500	7,448,100	321,881	19,782	102,282	82,500	0	0	0
2086	Benefits	67	84,442	82,500	7,448,100	306,919	19,782	102,282	82,500	0	0	0
2087	Benefits	68	86,131	82,500	7,448,100	292,652	19,782	102,282	82,500	0	0	0
2088	Benefits	69	87,854	82,500	7,448,100	279,048	19,782	102,282	82,500	0	0	0
2089	Benefits	70	89,611	82,500	7,448,100	266,077	19,782	102,282	82,500	0	0	0
2090	Benefits	71	91,403	82,500	7,448,100	253,709	19,782	102,282	82,500	0	0	0
2091	Benefits	72	93,231	82,500	7,448,100	241,915	19,782	102,282	82,500	0	0	0
2092	Benefits	73	95,096	82,500	7,448,100	230,670	19,782	102,282	82,500	0	0	0
2093	Benefits	74	96,998	82,500	7,448,100	219,948	19,782	102,282	82,500	0	0	0
2094	Benefits	75	98,938	82,500	7,448,100	209,724	19,782	102,282	82,500	0	0	0
2095	Benefits	76	100,917	82,500	7,448,100	199,975	19,782	102,282	82,500	0	0	0
2096	Benefits	77	102,935	82,500	7,448,100	190,679	19,782	102,282	82,500	0	0	0
2097	Benefits	78	104,994	82,500	7,448,100	181,816	19,782	102,282	82,500	0	0	0
2098	Benefits	79	107,094	82,500	7,448,100	173,364	19,782	102,282	82,500	0	0	0
2099	Benefits	80	109,236	82,500	7,448,100	165,306	19,782	102,282	82,500	0	0	0
2100	Benefits	81	111,421	82,500	7,448,100	157,622	19,782	102,282	82,500	0	0	0
2101	Benefits	82	113,649	82,500	7,448,100	150,295	19,782	102,282	82,500	0	0	0
2102	Benefits	83	115,922	82,500	7,448,100	143,308	19,782	102,282	82,500	0	0	0
2103	Benefits	84	118,240	82,500	7,448,100	136,647	19,782	102,282	82,500	0	0	0
2104	Benefits	85	120,605	82,500	7,448,100	130,295	19,782	102,282	82,500	0	0	0
2105	Benefits	86	123,017	82,500	7,448,100	124,238	19,782	102,282	82,500	0	0	0
2106	Benefits	87	125,477	82,500	7,448,100	118,463	19,782	102,282	82,500	0	0	0
2107	Benefits	88	127,987	82,500	7,448,100	112,957	19,782	102,282	82,500	0	0	0
2108	Benefits	89	130,547	82,500	7,448,100	107,706	19,782	102,282	82,500	0	0	0
2109	Benefits	90	133,158	82,500	7,448,100	102,699	19,782	102,282	82,500	0	0	0
2110	Benefits	91	135,821	82,500	7,448,100	97,926	19,782	102,282	82,500	0	0	0
2111	Benefits	92	138,537	82,500	7,448,100	93,374	19,782	102,282	82,500	0	0	0
2112	Benefits	93	141,308	82,500	7,448,100	89,033	19,782	102,282	82,500	0	0	0
2113	Benefits	94	144,134	82,500	7,448,100	84,895	19,782	102,282	82,500	0	0	0
2114	Benefits	95	147,017	82,500	7,448,100	80,948	19,782	102,282	82,500	0	0	0
2115	Benefits	96	149,957	82,500	7,448,100	77,186	19,782	102,282	82,500	0	0	0
2116	Benefits	97	152,956	82,500	7,448,100	73,598	19,782	102,282	82,500	0	0	0
2117	Benefits	98	156,015	82,500	7,448,100	70,177	19,782	102,282	82,500	0	0	0
2118	Benefits	99	159,135	82,500	7,448,100	66,914	19,782	102,282	82,500	0	0	0
2119	Benefits	100	162,318	82,500	7,448,100	63,804	19,782	102,282	82,500	0	0	0
			Average Annual:	54,368		65,599,118 (TOTAL)		Average Annual:	60,504	6,136		$14,141,434 (TOTAL)
								High:	82,500	15,917		
								Low:	21,973	0		

Table 2–46. Changes in Recreation Visitation and Value at Cle Elum Lake – Wymer Dam Plus Yakima River Pump Exchange Alternative

2007 Visitor Days (PR/EIS Table 4.45): 8,976
Average Annual Change in Visitor Days (PR/EIS Table 2.56): 684

			No Action Alternative - Cle Elum Lake					Wymer Plus Alternative - Cle Elum Lake					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year		Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		8,976	8,976					9,660	9,660	684		
2008	Planning		9,156	9,156					9,854	9,854	698		
2009	Planning		9,339	9,339					10,051	10,051	712		
2010	Construction		9,526	9,526					10,252	10,252	726		
2011	Construction		9,717	9,717					10,458	10,458	741		
2012	Construction		9,911	9,911			684		10,667	10,667	756		
2013	Construction		10,109	10,109			698		10,880	10,880	771		
2014	Construction		10,311	10,311			712		11,097	11,097	786		
2015	Construction		10,517	10,517			726		11,319	11,319	802		
2016	Construction		10,727	10,727			741		11,545	11,545	818		
2017	Construction		10,942	10,942			756		11,776	11,776	834		
2018	Construction		11,161	11,161			771		12,012	12,012	851		
2019	Construction		11,384	11,384			786		12,252	12,252	868		
2020	Benefits	1	11,612	11,612	801,228	763,984	802	885	12,497	12,497	885	61,065	58,226
2021	Benefits	2	11,844	11,844	817,236	743,025	818	903	12,747	12,747	903	62,307	56,649
2022	Benefits	3	12,081	12,081	833,589	722,663	834	921	13,002	13,002	921	63,549	55,093
2023	Benefits	4	12,323	12,323	850,287	702,874	851	939	13,262	13,262	939	64,791	53,558
2024	Benefits	5	12,569	12,569	867,261	683,581	868	958	13,527	13,527	958	66,102	52,102
2025	Benefits	6	12,820	12,820	884,580	664,822		977	13,797	13,797	977	67,413	50,665
2026	Benefits	7	13,076	13,076	902,244	646,577		997	14,073	14,073	997	68,793	49,299
2027	Benefits	8	13,338	13,338	920,322	628,875		1,017	14,355	14,355	1,017	70,173	47,951
2028	Benefits	9	13,605	13,605	938,745	611,646		1,037	14,642	14,642	1,037	71,553	46,621
2029	Benefits	10	13,877	13,877	957,513	594,874		1,058	14,935	14,935	1,058	73,002	45,354
2030	Benefits	11	14,155	14,155	976,695	578,585		1,079	15,234	15,234	1,079	74,451	44,104
2031	Benefits	12	14,438	14,438	996,222	562,720		1,101	15,539	15,539	1,101	75,969	42,911
2032	Benefits	13	14,727	14,727	1,016,163	547,303		1,123	15,850	15,850	1,123	77,487	41,734
2033	Benefits	14	15,022	15,022	1,036,518	532,316		1,145	16,167	16,167	1,145	79,005	40,574
2034	Benefits	15	15,322	15,322	1,057,218	517,708		1,168	16,490	16,490	1,168	80,592	39,465
2035	Benefits	16	15,628	15,628	1,078,332	503,502		1,191	16,819	16,819	1,191	82,179	38,372
2036	Benefits	17	15,941	15,941	1,099,929	489,712		1,215	17,156	17,156	1,215	83,835	37,325
2037	Benefits	18	16,260	16,260	1,121,940	476,293		1,239	17,499	17,499	1,239	85,491	36,293
2038	Benefits	19	16,585	16,585	1,144,365	463,230		1,264	17,849	17,849	1,264	87,216	35,304
2039	Benefits	20	16,917	16,917	1,167,273	450,540		1,289	18,206	18,206	1,289	88,941	34,329
2040	Benefits	21	17,255	17,255	1,190,595	438,180		1,315	18,570	18,570	1,315	90,735	33,394
2041	Benefits	22	17,600	17,600	1,214,400	426,166		1,341	18,941	18,941	1,341	92,529	32,471
2042	Benefits	23	17,952	17,952	1,238,688	414,483		1,368	19,320	19,320	1,368	94,392	31,585
2043	Benefits	24	18,311	18,311	1,263,459	403,119		1,395	19,706	19,706	1,395	96,255	30,711
2044	Benefits	25	18,677	18,677	1,288,713	392,064		1,423	20,100	20,100	1,423	98,187	29,871
2045	Benefits	26	19,051	19,051	1,314,519	381,325		1,451	20,502	20,502	1,451	100,119	29,043
2046	Benefits	27	19,432	19,432	1,340,808	370,871		1,480	20,912	20,912	1,480	102,120	28,247
2047	Benefits	28	19,821	19,821	1,367,649	360,711		1,510	21,331	21,331	1,510	104,190	27,480
2048	Benefits	29	20,217	20,217	1,394,973	350,815		1,540	21,757	21,757	1,540	106,260	26,723
2049	Benefits	30	20,621	20,621	1,422,849	341,193		1,571	22,192	22,192	1,571	108,399	25,994
2050	Benefits	31	21,033	21,033	1,451,277	331,833		1,602	22,635	22,635	1,602	110,538	25,274
2051	Benefits	32	21,454	21,454	1,480,326	322,741		1,634	23,088	23,088	1,634	112,746	24,581
2052	Benefits	33	21,883	21,883	1,509,927	313,892		1,667	23,550	23,550	1,667	115,023	23,912
2053	Benefits	34	22,321	22,321	1,540,149	305,292		1,700	24,021	24,021	1,700	117,300	23,251
2054	Benefits	35	22,767	22,767	1,570,923	296,918		1,734	24,501	24,501	1,734	119,646	22,614
2055	Benefits	36	23,222	23,222	1,602,318	288,774		1,769	24,991	24,991	1,769	122,061	21,998
2056	Benefits	37	23,686	23,686	1,634,334	280,852		1,804	25,490	25,490	1,804	124,476	21,391

2057	Benefits	38	24,160	24,160	1,667,040	273,156	1,840	26,000	26,000	1,840	126,960	20,803
2058	Benefits	39	24,643	24,643	1,700,367	265,666	1,877	26,520	26,520	1,877	129,513	20,235
2059	Benefits	40	25,136	25,136	1,734,384	258,384	1,915	27,051	27,051	1,915	132,135	19,685
2060	Benefits	41	25,639	25,639	1,769,091	251,304	1,953	27,592	27,592	1,953	134,757	19,143
2061	Benefits	42	26,152	26,152	1,804,488	244,417	1,992	28,144	28,144	1,992	137,448	18,617
2062	Benefits	43	26,675	26,675	1,840,575	237,716	2,032	28,707	28,707	2,032	140,208	18,108
2063	Benefits	44	27,209	27,209	1,877,421	231,204	2,073	29,282	29,282	2,073	143,037	17,615
2064	Benefits	45	27,753	27,753	1,914,957	224,864	2,114	29,867	29,867	2,114	145,866	17,128
2065	Benefits	46	28,308	28,308	1,953,252	218,699	2,156	30,464	30,464	2,156	148,764	16,657
2066	Benefits	47	28,874	28,874	1,992,306	212,703	2,199	31,073	31,073	2,199	151,731	16,199
2067	Benefits	48	29,451	29,451	2,032,119	206,869	2,243	31,694	31,694	2,243	154,767	15,755
2068	Benefits	49	30,040	30,040	2,072,760	201,197	2,288	32,328	32,328	2,288	157,872	15,324
2069	Benefits	50	30,641	30,641	2,114,229	195,683	2,334	32,975	32,975	2,334	161,046	14,906
2070	Benefits	51	31,254	31,254	2,156,526	190,320	2,381	33,635	33,635	2,381	164,289	14,499
2071	Benefits	52	31,879	31,879	2,199,651	185,102	2,429	34,308	34,308	2,429	167,601	14,104
2072	Benefits	53	32,517	32,517	2,243,673	180,030	2,478	34,995	34,995	2,478	170,982	13,719
2073	Benefits	54	33,167	33,167	2,288,523	175,093	2,528	35,695	35,695	2,528	174,432	13,346
2074	Benefits	55	33,830	33,830	2,334,270	170,291	2,579	36,409	36,409	2,579	177,951	12,982
2075	Benefits	56	34,507	34,507	2,380,983	165,625	2,631	37,138	37,138	2,631	181,539	12,628
2076	Benefits	57	35,197	35,197	2,428,593	161,084	2,684	37,881	37,881	2,684	185,196	12,284
2077	Benefits	58	35,901	35,901	2,477,169	156,668	2,738	38,639	38,639	2,738	188,922	11,948
2078	Benefits	59	36,619	36,619	2,526,711	152,373	2,793	39,412	39,412	2,793	192,717	11,622
2079	Benefits	60	37,351	37,351	2,577,219	148,195	2,849	40,200	40,200	2,849	196,581	11,304
2080	Benefits	61	38,098	38,098	2,628,762	144,132	2,906	41,004	41,004	2,906	200,514	10,994
2081	Benefits	62	38,860	38,860	2,681,340	140,181	2,964	41,824	41,824	2,964	204,516	10,692
2082	Benefits	63	39,637	39,637	2,734,953	136,338	3,023	42,660	42,660	3,023	208,587	10,398
2083	Benefits	64	40,430	40,430	2,789,670	132,601	3,083	43,513	43,513	3,083	212,727	10,112
2084	Benefits	65	41,239	41,239	2,845,491	128,967	3,145	44,384	44,384	3,145	217,005	9,835
2085	Benefits	66	42,064	42,064	2,902,416	125,432	3,208	45,272	45,272	3,208	221,352	9,566
2086	Benefits	67	42,905	42,905	2,960,445	121,993	3,272	46,177	46,177	3,272	225,768	9,303
2087	Benefits	68	43,763	43,763	3,019,647	118,648	3,337	47,100	47,100	3,337	230,253	9,047
2088	Benefits	69	44,638	44,638	3,080,022	115,395	3,404	48,042	48,042	3,404	234,876	8,800
2089	Benefits	70	45,531	45,531	3,141,639	112,232	3,472	49,003	49,003	3,472	239,568	8,558
2090	Benefits	71	46,442	46,442	3,204,498	109,157	3,541	49,983	49,983	3,541	244,329	8,323
2091	Benefits	72	47,371	47,371	3,268,599	106,165	3,612	50,983	50,983	3,612	249,228	8,095
2092	Benefits	73	48,318	48,318	3,333,942	103,253	3,684	52,002	52,002	3,684	254,196	7,873
2093	Benefits	74	49,284	49,284	3,400,596	100,422	3,758	53,042	53,042	3,758	259,302	7,657
2094	Benefits	75	50,270	50,270	3,468,630	97,670	3,833	54,103	54,103	3,833	264,477	7,447
2095	Benefits	76	51,275	51,275	3,537,975	94,992	3,910	55,185	55,185	3,910	269,790	7,244
2096	Benefits	77	52,301	52,301	3,608,769	92,388	3,988	56,289	56,289	3,988	275,172	7,045
2097	Benefits	78	53,347	53,347	3,680,943	89,856	4,068	57,415	57,415	4,068	280,692	6,852
2098	Benefits	79	54,414	54,414	3,754,566	87,392	4,149	58,563	58,563	4,149	286,281	6,664
2099	Benefits	80	55,502	55,502	3,829,638	84,996	4,232	59,734	59,734	4,232	292,008	6,481
2100	Benefits	81	56,612	56,612	3,906,228	82,666	4,317	60,929	60,929	4,317	297,873	6,304
2101	Benefits	82	57,744	57,744	3,984,336	80,400	4,403	62,147	62,147	4,403	303,807	6,131
2102	Benefits	83	58,899	58,899	4,064,031	78,196	4,491	63,390	63,390	4,491	309,879	5,962
2103	Benefits	84	60,077	60,077	4,145,313	76,052	4,581	64,658	64,658	4,581	316,089	5,799
2104	Benefits	85	61,279	61,279	4,228,251	73,968	4,673	65,952	65,952	4,673	322,437	5,641
2105	Benefits	86	62,505	62,505	4,312,845	71,941	4,766	67,271	67,000	4,495	310,155	5,174
2106	Benefits	87	63,755	63,755	4,399,095	69,968	4,861	68,616	67,000	3,245	223,905	3,561
2107	Benefits	88	65,030	65,030	4,487,070	68,050	4,958	69,988	67,000	1,970	135,930	2,061
2108	Benefits	89	66,331	66,331	4,576,839	66,185	5,057	71,388	67,000	669	46,161	668
2109	Benefits	90	67,658	67,000	4,623,000	63,745	5,057	72,057	67,000	0	0	0
2110	Benefits	91	69,011	67,000	4,623,000	60,782	5,057	72,057	67,000	0	0	0
2111	Benefits	92	70,391	67,000	4,623,000	57,957	5,057	72,057	67,000	0	0	0
2112	Benefits	93	71,799	67,000	4,623,000	55,262	5,057	72,057	67,000	0	0	0
2113	Benefits	94	73,235	67,000	4,623,000	52,694	5,057	72,057	67,000	0	0	0
2114	Benefits	95	74,700	67,000	4,623,000	50,244	5,057	72,057	67,000	0	0	0
2115	Benefits	96	76,194	67,000	4,623,000	47,909	5,057	72,057	67,000	0	0	0
2116	Benefits	97	77,718	67,000	4,623,000	45,682	5,057	72,057	67,000	0	0	0
2117	Benefits	98	79,272	67,000	4,623,000	43,558	5,057	72,057	67,000	0	0	0

2118	Benefits	99	80,857	67,000	4,623,000	41,533		5,057	72,057	67,000	0	0	0
2119	Benefits	100	82,474	67,000	4,623,000	39,603		5,057	72,057	67,000	0	0	0
			Average	32,487		$26,079,307 (TOTAL)			Average	34,384	1,897		$1,935,367 (TOTAL)
									High:	67,000	4,673		
									Low:	9,660	0		

Table 2–47. Changes in Recreation Visitation and Value at the Yakima River – Wymer Dam Plus Yakima River Pump Exchange Alternative

2007 Visitor Days (PR/EIS Table 4.45): 18,900
Average Annual Change in Visitor Days (PR/EIS Table 2.56): 4,085

			No Action Alternative - Yakima River				Wymer Plus Alternative - Yakima River					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year	Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		18,900	18,900			4,085	22,985	22,985	4,085		
2008	Planning		19,278	19,278			4,167	23,445	23,445	4,167		
2009	Planning		19,664	19,664			4,250	23,914	23,914	4,250		
2010	Construction		20,057	20,057			4,335	24,392	24,392	4,335		
2011	Construction		20,458	20,458			4,422	24,880	24,880	4,422		
2012	Construction		20,867	20,867			4,510	25,377	25,377	4,510		
2013	Construction		21,284	21,284			4,600	25,884	25,884	4,600		
2014	Construction		21,710	21,710			4,692	26,402	26,402	4,692		
2015	Construction		22,144	22,144			4,786	26,930	26,930	4,786		
2016	Construction		22,587	22,587			4,882	27,469	27,469	4,882		
2017	Construction		23,039	23,039			4,980	28,019	28,019	4,980		
2018	Construction		23,500	23,500			5,080	28,580	28,580	5,080		
2019	Construction		23,970	23,970			5,182	29,152	29,152	5,182		
2020	Benefits	1	24,449	24,449	1,318,535	1,257,244	5,286	29,735	29,735	5,286	285,074	271,823
2021	Benefits	2	24,938	24,938	1,344,906	1,222,779	5,392	30,330	30,330	5,392	290,791	264,385
2022	Benefits	3	25,437	25,437	1,371,817	1,189,270	5,500	30,937	30,937	5,500	296,615	257,144
2023	Benefits	4	25,946	25,946	1,399,268	1,156,679	5,610	31,556	31,556	5,610	302,547	250,095
2024	Benefits	5	26,465	26,465	1,427,257	1,124,974	5,722	32,187	32,187	5,722	308,587	243,231
2025	Benefits	6	26,994	26,994	1,455,786	1,094,122	5,836	32,830	32,830	5,836	314,735	236,545
2026	Benefits	7	27,534	27,534	1,484,909	1,064,133	5,953	33,487	33,487	5,953	321,045	230,071
2027	Benefits	8	28,085	28,085	1,514,624	1,034,973	6,072	34,157	34,157	6,072	327,463	223,762
2028	Benefits	9	28,647	28,647	1,544,933	1,006,611	6,193	34,840	34,840	6,193	333,988	217,612
2029	Benefits	10	29,220	29,220	1,575,835	979,018	6,317	35,537	35,537	6,317	340,676	211,652
2030	Benefits	11	29,804	29,804	1,607,330	952,167	6,443	36,247	36,247	6,443	347,471	205,839
2031	Benefits	12	30,400	30,400	1,639,472	926,063	6,572	36,972	36,972	6,572	354,428	200,200
2032	Benefits	13	31,008	31,008	1,672,261	900,676	6,703	37,711	37,711	6,703	361,493	194,699
2033	Benefits	14	31,628	31,628	1,705,698	875,981	6,837	38,465	38,465	6,837	368,719	189,360
2034	Benefits	15	32,261	32,261	1,739,836	851,979	6,974	39,235	39,235	6,974	376,108	184,176
2035	Benefits	16	32,906	32,906	1,774,621	828,617	7,113	40,019	40,019	7,113	383,604	179,115
2036	Benefits	17	33,564	33,564	1,810,107	805,899	7,255	40,819	40,819	7,255	391,262	174,198
2037	Benefits	18	34,235	34,235	1,846,294	783,800	7,400	41,635	41,635	7,400	399,082	169,421
2038	Benefits	19	34,920	34,920	1,883,236	762,320	7,548	42,468	42,468	7,548	407,064	164,776
2039	Benefits	20	35,618	35,618	1,920,879	741,413	7,699	43,317	43,317	7,699	415,207	160,260
2040	Benefits	21	36,330	36,330	1,959,277	721,082	7,853	44,183	44,183	7,853	423,512	155,867
2041	Benefits	22	37,057	37,057	1,998,484	701,322	8,010	45,067	44,900	7,843	422,973	148,433
2042	Benefits	23	37,798	37,798	2,038,446	682,093	8,170	45,968	44,900	7,102	383,011	128,161
2043	Benefits	24	38,554	38,554	2,079,217	663,395	8,333	46,887	44,900	6,346	342,240	109,195
2044	Benefits	25	39,325	39,325	2,120,797	645,208	8,500	47,825	44,900	5,575	300,660	91,469
2045	Benefits	26	40,112	40,112	2,163,240	627,528	8,670	48,782	44,900	4,788	258,217	74,905
2046	Benefits	27	40,914	40,914	2,206,492	610,322	8,843	49,757	44,900	3,986	214,965	59,460
2047	Benefits	28	41,732	41,732	2,250,607	593,587	9,020	50,752	44,900	3,168	170,850	45,061
2048	Benefits	29	42,567	42,567	2,295,638	577,319	9,200	51,767	44,900	2,333	125,819	31,642

2049	Benefits	30	43,418	43,418	2,341,533	561,489	9,384	52,802	44,900	1,482	79,924	19,165
2050	Benefits	31	44,286	44,286	2,388,344	546,092	9,572	53,858	44,900	614	33,113	7,571
2051	Benefits	32	45,172	44,900	2,421,457	527,927	9,572	54,472	44,900	0	0	0
2052	Benefits	33	46,075	44,900	2,421,457	503,387	9,572	54,472	44,900	0	0	0
2053	Benefits	34	46,997	44,900	2,421,457	479,987	9,572	54,472	44,900	0	0	0
2054	Benefits	35	47,937	44,900	2,421,457	457,676	9,572	54,472	44,900	0	0	0
2055	Benefits	36	48,896	44,900	2,421,457	436,401	9,572	54,472	44,900	0	0	0
2056	Benefits	37	49,874	44,900	2,421,457	416,115	9,572	54,472	44,900	0	0	0
2057	Benefits	38	50,871	44,900	2,421,457	396,773	9,572	54,472	44,900	0	0	0
2058	Benefits	39	51,888	44,900	2,421,457	378,329	9,572	54,472	44,900	0	0	0
2059	Benefits	40	52,926	44,900	2,421,457	360,743	9,572	54,472	44,900	0	0	0
2060	Benefits	41	53,985	44,900	2,421,457	343,974	9,572	54,472	44,900	0	0	0
2061	Benefits	42	55,065	44,900	2,421,457	327,985	9,572	54,472	44,900	0	0	0
2062	Benefits	43	56,166	44,900	2,421,457	312,739	9,572	54,472	44,900	0	0	0
2063	Benefits	44	57,289	44,900	2,421,457	298,202	9,572	54,472	44,900	0	0	0
2064	Benefits	45	58,435	44,900	2,421,457	284,340	9,572	54,472	44,900	0	0	0
2065	Benefits	46	59,604	44,900	2,421,457	271,123	9,572	54,472	44,900	0	0	0
2066	Benefits	47	60,796	44,900	2,421,457	258,520	9,572	54,472	44,900	0	0	0
2067	Benefits	48	62,012	44,900	2,421,457	246,503	9,572	54,472	44,900	0	0	0
2068	Benefits	49	63,252	44,900	2,421,457	235,044	9,572	54,472	44,900	0	0	0
2069	Benefits	50	64,517	44,900	2,421,457	224,119	9,572	54,472	44,900	0	0	0
2070	Benefits	51	65,807	44,900	2,421,457	213,701	9,572	54,472	44,900	0	0	0
2071	Benefits	52	67,123	44,900	2,421,457	203,767	9,572	54,472	44,900	0	0	0
2072	Benefits	53	68,465	44,900	2,421,457	194,295	9,572	54,472	44,900	0	0	0
2073	Benefits	54	69,834	44,900	2,421,457	185,264	9,572	54,472	44,900	0	0	0
2074	Benefits	55	71,231	44,900	2,421,457	176,652	9,572	54,472	44,900	0	0	0
2075	Benefits	56	72,656	44,900	2,421,457	168,440	9,572	54,472	44,900	0	0	0
2076	Benefits	57	74,109	44,900	2,421,457	160,611	9,572	54,472	44,900	0	0	0
2077	Benefits	58	75,591	44,900	2,421,457	153,145	9,572	54,472	44,900	0	0	0
2078	Benefits	59	77,103	44,900	2,421,457	146,026	9,572	54,472	44,900	0	0	0
2079	Benefits	60	78,645	44,900	2,421,457	139,238	9,572	54,472	44,900	0	0	0
2080	Benefits	61	80,218	44,900	2,421,457	132,766	9,572	54,472	44,900	0	0	0
2081	Benefits	62	81,822	44,900	2,421,457	126,594	9,572	54,472	44,900	0	0	0
2082	Benefits	63	83,458	44,900	2,421,457	120,710	9,572	54,472	44,900	0	0	0
2083	Benefits	64	85,127	44,900	2,421,457	115,099	9,572	54,472	44,900	0	0	0
2084	Benefits	65	86,830	44,900	2,421,457	109,748	9,572	54,472	44,900	0	0	0
2085	Benefits	66	88,567	44,900	2,421,457	104,647	9,572	54,472	44,900	0	0	0
2086	Benefits	67	90,338	44,900	2,421,457	99,783	9,572	54,472	44,900	0	0	0
2087	Benefits	68	92,145	44,900	2,421,457	95,144	9,572	54,472	44,900	0	0	0
2088	Benefits	69	93,988	44,900	2,421,457	90,722	9,572	54,472	44,900	0	0	0
2089	Benefits	70	95,868	44,900	2,421,457	86,504	9,572	54,472	44,900	0	0	0
2090	Benefits	71	97,785	44,900	2,421,457	82,483	9,572	54,472	44,900	0	0	0
2091	Benefits	72	99,741	44,900	2,421,457	78,649	9,572	54,472	44,900	0	0	0
2092	Benefits	73	101,736	44,900	2,421,457	74,993	9,572	54,472	44,900	0	0	0
2093	Benefits	74	103,771	44,900	2,421,457	71,507	9,572	54,472	44,900	0	0	0
2094	Benefits	75	105,846	44,900	2,421,457	68,183	9,572	54,472	44,900	0	0	0
2095	Benefits	76	107,963	44,900	2,421,457	65,014	9,572	54,472	44,900	0	0	0
2096	Benefits	77	110,122	44,900	2,421,457	61,992	9,572	54,472	44,900	0	0	0
2097	Benefits	78	112,324	44,900	2,421,457	59,110	9,572	54,472	44,900	0	0	0
2098	Benefits	79	114,570	44,900	2,421,457	56,363	9,572	54,472	44,900	0	0	0
2099	Benefits	80	116,861	44,900	2,421,457	53,743	9,572	54,472	44,900	0	0	0
2100	Benefits	81	119,198	44,900	2,421,457	51,244	9,572	54,472	44,900	0	0	0
2101	Benefits	82	121,582	44,900	2,421,457	48,862	9,572	54,472	44,900	0	0	0
2102	Benefits	83	124,014	44,900	2,421,457	46,591	9,572	54,472	44,900	0	0	0
2103	Benefits	84	126,494	44,900	2,421,457	44,425	9,572	54,472	44,900	0	0	0
2104	Benefits	85	129,024	44,900	2,421,457	42,360	9,572	54,472	44,900	0	0	0
2105	Benefits	86	131,604	44,900	2,421,457	40,391	9,572	54,472	44,900	0	0	0
2106	Benefits	87	134,236	44,900	2,421,457	38,514	9,572	54,472	44,900	0	0	0
2107	Benefits	88	136,921	44,900	2,421,457	36,723	9,572	54,472	44,900	0	0	0
2108	Benefits	89	139,659	44,900	2,421,457	35,016	9,572	54,472	44,900	0	0	0
2109	Benefits	90	142,452	44,900	2,421,457	33,389	9,572	54,472	44,900	0	0	0

2110	Benefits	91	145,301	44,900	2,421,457	31,837		9,572	54,472	44,900	0	0	0
2111	Benefits	92	148,207	44,900	2,421,457	30,357		9,572	54,472	44,900	0	0	0
2112	Benefits	93	151,171	44,900	2,421,457	28,946		9,572	54,472	44,900	0	0	0
2113	Benefits	94	154,194	44,900	2,421,457	27,600		9,572	54,472	44,900	0	0	0
2114	Benefits	95	157,278	44,900	2,421,457	26,317		9,572	54,472	44,900	0	0	0
2115	Benefits	96	160,424	44,900	2,421,457	25,094		9,572	54,472	44,900	0	0	0
2116	Benefits	97	163,632	44,900	2,421,457	23,927		9,572	54,472	44,900	0	0	0
2117	Benefits	98	166,905	44,900	2,421,457	22,815		9,572	54,472	44,900	0	0	0
2118	Benefits	99	170,243	44,900	2,421,457	21,755		9,572	54,472	44,900	0	0	0
2119	Benefits	100	173,648	44,900	2,421,457	20,743		9,572	54,472	44,900	0	0	0
			Average	39,042		$37,419,842 (TOTAL)			Average	41,161	2,119		$5,099,294 (TOTAL)
									High:	44,900	7,853		
									Low:	22,985	0		

Table 2–48. Changes in Recreation Visitation and Value at the Tieton River – Wymer Dam Plus Yakima River Pump Exchange Alternative

2007 Visitor Days (PR/EIS Table 4.45): 9,108
Average Annual Change in Visitor Days (PR/EIS Table 2.56): 0

			No Action Alternative - Tieton River				Wymer Plus Alternative - Tieton River					
Year	Period	Benefit Period Year	Days	Carrying Capacity Constrained Days	Value per Year	Discounted Value per Year	Change in Days	Total Days	Carrying Capacity Constrained Total Days	Carrying Capacity Constrained Change in Days	Change in Value per Year	Discounted Change in Value per Year
2007	Planning		9,108	9,108			0	9,108	9,108	0		
2008	Planning		9,290	9,290			0	9,290	9,290	0		
2009	Planning		9,476	9,476			0	9,476	9,476	0		
2010	Construction		9,666	9,666			0	9,666	9,666	0		
2011	Construction		9,859	9,859			0	9,859	9,859	0		
2012	Construction		10,056	10,056			0	10,056	10,056	0		
2013	Construction		10,257	10,257			0	10,257	10,257	0		
2014	Construction		10,462	10,462			0	10,462	10,462	0		
2015	Construction		10,671	10,671			0	10,671	10,671	0		
2016	Construction		10,884	10,884			0	10,884	10,884	0		
2017	Construction		11,102	11,102			0	11,102	11,102	0		
2018	Construction		11,324	11,324			0	11,324	11,324	0		
2019	Construction		11,550	11,550			0	11,550	11,550	0		
2020	Benefits	1	11,781	11,781	367,685	350,594	0	11,781	11,781	0	0	0
2021	Benefits	2	12,017	12,017	375,051	340,993	0	12,017	12,017	0	0	0
2022	Benefits	3	12,257	12,257	382,541	331,636	0	12,257	12,257	0	0	0
2023	Benefits	4	12,502	12,502	390,187	322,541	0	12,502	12,502	0	0	0
2024	Benefits	5	12,752	12,752	397,990	313,698	0	12,752	12,752	0	0	0
2025	Benefits	6	13,007	13,007	405,948	305,098	0	13,007	13,007	0	0	0
2026	Benefits	7	13,267	13,267	414,063	296,731	0	13,267	13,267	0	0	0
2027	Benefits	8	13,532	13,532	422,334	288,589	0	13,532	13,532	0	0	0
2028	Benefits	9	13,803	13,803	430,792	280,685	0	13,803	13,803	0	0	0
2029	Benefits	10	14,079	14,079	439,406	272,989	0	14,079	14,079	0	0	0
2030	Benefits	11	14,361	14,361	448,207	265,514	0	14,361	14,361	0	0	0
2031	Benefits	12	14,648	14,648	457,164	258,231	0	14,648	14,648	0	0	0
2032	Benefits	13	14,941	14,941	466,309	251,153	0	14,941	14,941	0	0	0
2033	Benefits	14	15,240	15,240	475,640	244,271	0	15,240	15,240	0	0	0
2034	Benefits	15	15,545	15,545	485,159	237,577	0	15,545	15,545	0	0	0
2035	Benefits	16	15,856	15,856	494,866	231,066	0	15,856	15,856	0	0	0
2036	Benefits	17	16,173	16,173	504,759	224,730	0	16,173	16,173	0	0	0
2037	Benefits	18	16,496	16,496	514,840	218,563	0	16,496	16,496	0	0	0
2038	Benefits	19	16,826	16,826	525,139	212,573	0	16,826	16,826	0	0	0
2039	Benefits	20	17,163	17,163	535,657	206,751	0	17,163	17,163	0	0	0
2040	Benefits	21	17,506	17,506	546,362	201,080	0	17,506	17,506	0	0	0

2041	Benefits	22	17,856	17,856	557,286	195,567	0	17,856	17,856	0	0	0
2042	Benefits	23	18,213	18,213	568,428	190,204	0	18,213	18,213	0	0	0
2043	Benefits	24	18,577	18,577	579,788	184,987	0	18,577	18,577	0	0	0
2044	Benefits	25	18,949	18,949	591,398	179,921	0	18,949	18,949	0	0	0
2045	Benefits	26	19,328	19,328	603,227	174,988	0	19,328	19,328	0	0	0
2046	Benefits	27	19,715	19,715	615,305	170,195	0	19,715	19,715	0	0	0
2047	Benefits	28	20,109	20,109	627,602	165,527	0	20,109	20,109	0	0	0
2048	Benefits	29	20,511	20,511	640,148	160,988	0	20,511	20,511	0	0	0
2049	Benefits	30	20,921	20,921	652,944	156,573	0	20,921	20,921	0	0	0
2050	Benefits	31	21,339	21,339	665,990	152,278	0	21,339	21,339	0	0	0
2051	Benefits	32	21,766	21,766	679,317	148,105	0	21,766	21,766	0	0	0
2052	Benefits	33	22,201	22,201	692,893	144,043	0	22,201	22,201	0	0	0
2053	Benefits	34	22,645	22,645	706,750	140,094	0	22,645	22,645	0	0	0
2054	Benefits	35	23,098	23,098	720,889	136,254	0	23,098	23,098	0	0	0
2055	Benefits	36	23,560	23,560	735,308	132,519	0	23,560	23,560	0	0	0
2056	Benefits	37	24,031	24,031	750,008	128,885	0	24,031	24,031	0	0	0
2057	Benefits	38	24,512	24,512	765,020	125,354	0	24,512	24,512	0	0	0
2058	Benefits	39	25,002	25,002	780,312	121,916	0	25,002	25,002	0	0	0
2059	Benefits	40	25,502	25,502	795,917	118,574	0	25,502	25,502	0	0	0
2060	Benefits	41	26,012	26,012	811,835	115,323	0	26,012	26,012	0	0	0
2061	Benefits	42	26,532	26,532	828,064	112,161	0	26,532	26,532	0	0	0
2062	Benefits	43	27,063	27,063	844,636	109,087	0	27,063	27,063	0	0	0
2063	Benefits	44	27,604	27,604	861,521	106,096	0	27,604	27,604	0	0	0
2064	Benefits	45	28,156	28,156	878,749	103,187	0	28,156	28,156	0	0	0
2065	Benefits	46	28,719	28,719	896,320	100,358	0	28,719	28,719	0	0	0
2066	Benefits	47	29,293	29,293	914,235	97,606	0	29,293	29,293	0	0	0
2067	Benefits	48	29,879	29,879	932,524	94,930	0	29,879	29,879	0	0	0
2068	Benefits	49	30,477	30,477	951,187	92,329	0	30,477	30,477	0	0	0
2069	Benefits	50	31,087	31,087	970,225	89,799	0	31,087	31,087	0	0	0
2070	Benefits	51	31,709	31,709	989,638	87,338	0	31,709	31,709	0	0	0
2071	Benefits	52	32,343	32,343	1,009,425	84,944	0	32,343	32,343	0	0	0
2072	Benefits	53	32,990	32,990	1,029,618	82,615	0	32,990	32,990	0	0	0
2073	Benefits	54	33,650	33,650	1,050,217	80,351	0	33,650	33,650	0	0	0
2074	Benefits	55	34,323	34,323	1,071,221	78,148	0	34,323	34,323	0	0	0
2075	Benefits	56	35,009	34,700	1,082,987	75,334	0	34,700	34,700	0	0	0
2076	Benefits	57	35,709	34,700	1,082,987	71,832	0	34,700	34,700	0	0	0
2077	Benefits	58	36,423	34,700	1,082,987	68,493	0	34,700	34,700	0	0	0
2078	Benefits	59	37,151	34,700	1,082,987	65,310	0	34,700	34,700	0	0	0
2079	Benefits	60	37,894	34,700	1,082,987	62,274	0	34,700	34,700	0	0	0
2080	Benefits	61	38,652	34,700	1,082,987	59,379	0	34,700	34,700	0	0	0
2081	Benefits	62	39,425	34,700	1,082,987	56,619	0	34,700	34,700	0	0	0
2082	Benefits	63	40,214	34,700	1,082,987	53,987	0	34,700	34,700	0	0	0
2083	Benefits	64	41,018	34,700	1,082,987	51,477	0	34,700	34,700	0	0	0
2084	Benefits	65	41,838	34,700	1,082,987	49,085	0	34,700	34,700	0	0	0
2085	Benefits	66	42,675	34,700	1,082,987	46,803	0	34,700	34,700	0	0	0
2086	Benefits	67	43,529	34,700	1,082,987	44,627	0	34,700	34,700	0	0	0
2087	Benefits	68	44,400	34,700	1,082,987	42,553	0	34,700	34,700	0	0	0
2088	Benefits	69	45,288	34,700	1,082,987	40,575	0	34,700	34,700	0	0	0
2089	Benefits	70	46,194	34,700	1,082,987	38,689	0	34,700	34,700	0	0	0
2090	Benefits	71	47,118	34,700	1,082,987	36,890	0	34,700	34,700	0	0	0
2091	Benefits	72	48,060	34,700	1,082,987	35,176	0	34,700	34,700	0	0	0
2092	Benefits	73	49,021	34,700	1,082,987	33,540	0	34,700	34,700	0	0	0
2093	Benefits	74	50,001	34,700	1,082,987	31,981	0	34,700	34,700	0	0	0
2094	Benefits	75	51,001	34,700	1,082,987	30,495	0	34,700	34,700	0	0	0
2095	Benefits	76	52,021	34,700	1,082,987	29,077	0	34,700	34,700	0	0	0
2096	Benefits	77	53,061	34,700	1,082,987	27,726	0	34,700	34,700	0	0	0
2097	Benefits	78	54,122	34,700	1,082,987	26,437	0	34,700	34,700	0	0	0
2098	Benefits	79	55,204	34,700	1,082,987	25,208	0	34,700	34,700	0	0	0
2099	Benefits	80	56,308	34,700	1,082,987	24,036	0	34,700	34,700	0	0	0
2100	Benefits	81	57,434	34,700	1,082,987	22,919	0	34,700	34,700	0	0	0
2101	Benefits	82	58,583	34,700	1,082,987	21,854	0	34,700	34,700	0	0	0

2102	Benefits	83	59,755	34,700	1,082,987	20,838		0	34,700	34,700	0	0	0
2103	Benefits	84	60,950	34,700	1,082,987	19,869		0	34,700	34,700	0	0	0
2104	Benefits	85	62,169	34,700	1,082,987	18,945		0	34,700	34,700	0	0	0
2105	Benefits	86	63,412	34,700	1,082,987	18,065		0	34,700	34,700	0	0	0
2106	Benefits	87	64,680	34,700	1,082,987	17,225		0	34,700	34,700	0	0	0
2107	Benefits	88	65,974	34,700	1,082,987	16,424		0	34,700	34,700	0	0	0
2108	Benefits	89	67,293	34,700	1,082,987	15,661		0	34,700	34,700	0	0	0
2109	Benefits	90	68,639	34,700	1,082,987	14,933		0	34,700	34,700	0	0	0
2110	Benefits	91	70,012	34,700	1,082,987	14,239		0	34,700	34,700	0	0	0
2111	Benefits	92	71,412	34,700	1,082,987	13,577		0	34,700	34,700	0	0	0
2112	Benefits	93	72,840	34,700	1,082,987	12,946		0	34,700	34,700	0	0	0
2113	Benefits	94	74,297	34,700	1,082,987	12,344		0	34,700	34,700	0	0	0
2114	Benefits	95	75,783	34,700	1,082,987	11,770		0	34,700	34,700	0	0	0
2115	Benefits	96	77,299	34,700	1,082,987	11,223		0	34,700	34,700	0	0	0
2116	Benefits	97	78,845	34,700	1,082,987	10,701		0	34,700	34,700	0	0	0
2117	Benefits	98	80,422	34,700	1,082,987	10,204		0	34,700	34,700	0	0	0
2118	Benefits	99	82,030	34,700	1,082,987	9,730		0	34,700	34,700	0	0	0
2119	Benefits	100	83,671	34,700	1,082,987	9,277		0	34,700	34,700	0	0	0
			Average	25,280		$11,446,656			Average	25,280	0		$0
						(TOTAL)			High:	34,700	0		(TOTAL)
									Low:	9,108	0		

2.3.3.3 Combined Recreation Results

This section combines the present value of the 100-year recreational benefit estimate stream at both the proposed reservoirs and the existing reservoir and river sites for each alternative.

The analysis does not take into account possible site substitution from other recreation sites outside the region. As a result, this analysis may overstate recreational benefits associated with each alternative.

2.3.3.3.1 Black Rock Alternative

The combined 100-year stream of incremental recreational benefits at both the proposed Black Rock reservoir and the existing reservoir and river sites results in a total present value of $615.4 million ($578.1 million for the proposed Black Rock reservoir and $37.3 million at the existing sites) for the Black Rock Alternative.

2.3.3.3.2 Wymer Dam and Reservoir Alternative

The combined 100-year stream of incremental recreational benefits at both the proposed Wymer reservoir and the existing reservoir and river sites results in a total present value of $103.9 million ($97.7 million for the proposed Wymer reservoir and $6.2 million at the existing sites) for the Wymer Dam and Reservoir Alternative.

2.3.3.3.3 Wymer Dam Plus Yakima River Pump Exchange Alternative

The combined 100-year stream of incremental recreational benefits at both the proposed Wymer reservoir and the existing reservoir and river sites results in a total present value of $118.9 million ($97.7 million for the proposed Wymer reservoir and $21.2 million at the existing sites) for the Wymer Dam Plus Yakima River Pump Exchange Alternative.

2.3.4 Hydropower Benefits

The Black Rock Alternative includes construction of two new hydropower facilities—a Black Rock powerplant and a Sunnyside powerplant. Since both the Wymer Dam and Reservoir Alternative and the Wymer Dam Plus Yakima River Pump Exchange Alternative have no hydropower generation component, the Black Rock Alternative is the only alternative which provides hydropower benefits. In addition, by pumping water up to the proposed Black Rock reservoir from the Columbia River at Priest Rapids Dam, a certain amount of hydropower

generation is forgone at Priest Rapids Dam and other hydropower facilities both upstream and downstream. Some of the diverted water at Priest Rapids Dam is replaced by increased flows downstream at the mouth of the Yakima River as a result of decreased irrigation diversions. This water replacement does not occur instantaneously, but is accomplished on an annual basis.

2.3.4.1 Methodology

Average annual power generation at the Black Rock and Sunnyside powerplants was estimated at 71,671.1 and 125,080.0 megawatt hours (MWh) respectively. These annual generation estimates were distributed by month based on monthly water delivery percentages and the resultant monthly generation is multiplied by average monthly energy values to estimate total annual hydropower value. The average monthly energy values, as used by Bonneville Power Administration (BPA), were obtained from the BPA Rate Case (August, 2003). The average annual hydropower values were discounted to a present value as of the start of the benefits period based on the assumption that they would occur each year over the 100-year study period.

In addition, annual lost (foregone) hydropower benefits result from pumping water out of the Columbia River at Priest Rapids Dam to the new Black Rock reservoir. The water that is pumped to Black Rock reservoir is no longer available to generate hydropower at Priest Rapids Dam and at downstream Columbia River hydropower facilities. Losses in hydropower generation were also estimated at facilities upstream of Priest Rapids Dam due to adjustments in the operation of the overall Columbia River power system. While there are both positive and negative generation effects, the *Summary Report, Black Rock Appraisal Assessment* (Reclamation, 2004) *Report* estimated the net result as a loss in annual hydropower benefits of $4 million. To calculate a present value, the annual costs were assumed to occur each year of the 100-year study period. This loss in hydropower benefits was deducted from the additional hydropower benefits generated at the Black Rock and Sunnyside powerplants to estimate a net hydropower benefit.

2.3.4.2 Results

2.3.4.2.1 Black Rock Alternative

As presented in Table 2–49, the hydropower generation at both the Black Rock and Sunnyside powerplants was expected to average approximately 196,751.1 MWh annually, with a combined monthly generation ranging from a low of about 14,508.0 MWh in October to a high of 35,637.6 MWh in July and August. Total generation was valued at about $7.1 million annually. The present value of the

100-year stream of annual hydropower benefits was estimated at $143.9 million. The lost hydropower generation at Priest Rapids and other upstream and downstream dams was estimated at $4 million annually or $81.3 million in present value over the 100-year study period. Combining the gains and losses in hydropower value results in a net positive hydropower benefit of approximately $3.1 million annually, or $62.5 million in present value. Note that this combined hydropower benefit accrues only to the Black Rock Alternative.

Table 2–49. Hydropower benefits for the Black Rock Alternative

Powerplant	Month	Monthly Generation (MWh)	Average Energy Value per Month ($/MWh)	Total Annual Value (thousand $)	Present Value of 100-year Benefit Stream (thousand $)
Black Rock	April	7,820.0	$37.60	294.0	
	May	10,742.5	$31.92	342.9	
	June	12,144.0	$22.68	275.4	
	July	13,689.6	$32.24	441.4	
	August	13,689.6	$40.69	557.0	
	September	8,832.0	$43.64	385.4	
	October	4,753.3	$55.56	264.1	
	Totals:	71,671.1		2,560.2	52,063.0
Sunnyside	April	11,800.0	$37.60	443.7	
	May	19,509.3	$31.92	622.7	
	June	21,240.0	$22.68	481.7	
	July	21,240.0	$32.24	707.6	
	August	21,240.0	$40.69	893.1	
	September	18,880.0	$43.64	823.9	
	October	9,754.7	$55.56	542.0	
	Totals:	125,080.0		4,514.7	91,822.0
Black Rock and Sunnyside total	April	19,620.0		737.7	
	May	30,251.9		965.6	
	June	33,384.0		757.1	
	July	35,637.6		1,149.0	
	August	35,637.6		1,450.1	
	September	27,712.0		1,209.4	
	October	14,508.0		806.1	
		196,751.1	Total:	7,075.0	143,885.0
Value of lost generation at Priest Rapids and other Columbia River Dams:				-4,000.0	-81,348.4
Net hydropower benefit:				3,075.0	62,536.6

2.3.4.2.2 Wymer Dam and Reservoir Alternative

The Wymer Dam and Reservoir Alternative has no hydropower generation effects.

2.3.4.2.3 Wymer Dam Plus Yakima River Pump Exchange Alternative

The Wymer Dam Plus Yakima River Pump Exchange Alternative has no hydropower generation effects.

2.3.5 Fish Benefits

This section presents the results of the anadromous fisheries benefits analysis for salmon (i.e., spring Chinook, fall Chinook, Coho).

The anadromous fisheries analysis focuses primarily on use values. Use values refer to values individuals obtain by using the fishery resource. In the case of anadromous fisheries, use values accrue to individuals that use/consume the fish (e.g., commercial, sport, or Tribal fishermen) and are typically based on the quantity of fish actually used (e.g., harvested/caught). Use values can be further categorized into consumptive and nonconsumptive. Consumptive use values derive from the consumption of the fish (i.e., harvested or kept fish), whereas nonconsumptive use values imply the fish are not consumed (as with catch-and-release fishing). To clarify, the fisheries analysis focuses on consumptive use values; nonconsumptive use values are addressed under the recreation analysis. Finally, an insignificant amount of Tribal commercial and subsistence harvest occurs for steelhead in both the Columbia River and the Yakima River. However, since the Tribes do not target steelhead, but only catch them incidentally when targeting other species, no attempt was made to value the steelhead harvest.

It should be noted that consideration was also given to the estimation of nonuse values. Nonuse values reflect values individuals hold for a resource even if they will never actually use it (e.g., threatened and endangered species). Since Yakima River steelhead are a federally listed (threatened) species and, generally, cannot be harvested (except for a minor amount of Tribal subsistence harvest), this implies little fishery use value. However, since steelhead were expected to be impacted by the alternatives under consideration, it was speculated the nonuse values may be applicable to this study. As will be discussed in section 2.3.5.2 below, nonuse values were not included within the benefit-cost analysis for various reasons, mostly related to measurement.

Another potential fish-related "benefit" that was considered, but deemed inappropriate for the proposed alternatives, was avoided costs to increase salmon and steelhead abundance. If it could be shown that a portion of the costs to increase salmon and steelhead abundance associated with the No Action Alternative would no longer be necessary under one or more of the Joint Alternatives, then those cost savings could be considered an "avoided-cost benefit" for those proposed alternatives. Possible avoided costs considered

include the Yakima River Basin Water Enhancement Program (YRBWEP) water conservation measures, which provide additional water supply through agricultural conservation; and potential habitat restoration actions that will be considered in Ecology's upcoming Supplemental Draft EIS. The current YRBWEP water conservation measures were included in all the alternatives and, therefore, generate no avoided costs. The habitat restoration actions associated with Ecology's Supplemental Draft EIS have not been finalized, so were not included in any of the alternatives and, therefore, also generate no avoided costs. Even if Ecology's actions were finalized, they would likely be included under all the alternatives, again resulting in no avoided costs. This is because the water-supply-oriented actions (e.g., storage and conservation) of the Joint Alternatives do not offset the need for habitat restoration actions. As a result, the costs associated with potential habitat restoration actions will be incurred in addition to those costs associated with the water-supply-oriented actions of the Joint Alternatives.

2.3.5.1 Fishery Use Values

The fisheries benefits discussed below refer to the harvest use values generated by the proposed Storage Study alternatives. The use value analysis represents the traditional commercial and recreational fisheries analysis found in many Reclamation BCAs, with the added dimension of attempting to value Tribal subsistence harvest.

2.3.5.1.1 Met hodology

For this analysis, fish harvests were valued for the following harvest categories:

- Pacific Ocean Commercial
- Pacific Ocean Sport
- Lower Columbia River (zones 1-5) Non-Indian Commercial
- Lower Columbia River (zones 1-5) Sport
- Columbia River (zone 6) Tribal Commercial
- Columbia River (zone 6) Tribal Ceremonial and Subsistence
- Yakima River Sport, and
- Yakima River Tribal Ceremonial and Subsistence.

These harvest categories reflect the migratory path and, therefore, the harvest range of Yakima River salmon. Note that the harvest category "Tribal Ceremonial and Subsistence," found in the Columbia River zone 6 area and the

Yakima River, includes ceremonial harvest, which is typically not included in BCAs, since attempting to economically value ceremonial harvest would be akin to valuing Tribal spiritual beliefs. Since study team biologists had no information for separating subsistence harvest from ceremonial harvest, the decision was made to value the total ceremonial and subsistence harvest using the subsistence harvest value under the assumption that the ceremonial harvest is likely to be a fairly minor portion of the total. As a result, assuming the values per fish are reasonably accurate, total fishery use value benefits representing commercial, sport, and subsistence harvests may be overstated to some extent by the inclusion of ceremonial harvest.

Economic values per fish by species (e.g., Coho salmon, spring Chinook salmon, fall Chinook salmon[2]) and harvest category (listed above) were obtained from a detailed analysis of existing economic fishery use values (see Appendix A) and care summarized below in Table 2–50. These values are measured in April 2007 dollars to be consistent with the cost estimates. The following briefly summarizes the basis for the values:

- Commercial values are based on estimates of profitability per fish as obtained from the most recent 5 years of catch and price data
- Sport values were obtained from an extensive literature search, and
- Subsistence values were based on the market price per fish under the assumption that subsistence harvest could have been sold in the marketplace.

Table 2–50. Economics values per fish by species and harvest category

Harvest Category	Coho Salmon	Spring Chinook Salmon	Fall Chinook Salmon
Ocean Commercial	8.07	25.57	25.57
Ocean Sport	118.54	101.49	101.49
Lower Columbia River (zones 1-5) Commercial	5.82	45.53	14.56
Lower Columbia River (zones 1-5) Sport	304.02	304.02	304.02
Columbia River (zone 6) Tribal Commercial	3.11	22.56	8.78
Columbia River (zone 6) Tribal Ceremonial & Subsistence	3.89	28.2	10.97
Yakima River Sport	368.00	461.52	368.00
Yakima River Ceremonial & Subsistence	3.89	28.20	10.97

[2] Note that study team biologists also evaluated impacts to Yakima River steelhead populations, but given their federally listed (threatened) status, the assumption was made that harvest of those species would be precluded.

While the subsistence value is considered a lower bound, the decision was made to value the harvest using a defendable lower bound rather than ignore valuing subsistence harvest altogether. As with other Columbia River Basin studies (e.g., U.S. Army Corps of Engineers, 2002), the per-fish salmon sport fishing values proved significantly higher than the other per-fish values. This is due to the fact that these sport fishing values are related to the per-trip values. The very low catch rates per trip (less than one) imply a single fish equates to the sport fishing value of several trips combined, hence the large value per sport-caught fish.

Harvest estimates by fish species, type of harvest, and alternative were obtained from study team biologists. Estimates of total harvest were developed by applying harvest rates by species to annual estimates of returning adults by species (i.e., catch to escapement ratios). Total harvest was then allocated across the various harvest categories (see Table 2–51). The harvest rates, as provided by Yakama Nation biologists, reflect current fishery management compacts and Environmental Species Act (ESA) restrictions for salmon and steelhead returning to the Yakima basin.

Table 2–51. Percentages used to allocate total harvest by species across the various harvest categories (data from AHA model)

Species	Ocean		Lower Columbia River (Zones 1-5)		Columbia River (Zone 6)		Yakima River	
	Commercial	Sport	Commercial	Sport	Commercial	Ceremonial & Subsistence	Sport	Ceremonial & Subsistence
spring Chinook	0.0408	0.0000	0.0507	0.1164	0.0673	0.2692	0.0867	0.3698
fall Chinook	0.0265	0.0265	0.0805	0.0805	0.5330	0.0281	0.2250	0.0000
coho	0.2411	0.3617	0.1025	0.1537	0.1051	0.0055	0.0305	0.0000

The All H Analyzer (AHA) model (MOBRAND, 2005) was used to calculate the annual number of returning adults for the 100-year study period for spring Chinook, fall Chinook, coho and steelhead, which accounts for fish produced both by the natural environment and those and released from Yakima basin hatcheries. The AHA model was developed by Washington State fishery managers as a tool to facilitate analysis of anadromous salmonid recovery strategies in the Pacific Northwest. The "H" stands for Habitat, Hatcheries, Harvest, and the Hydroelectric system (of the Columbia River). The model allows the user to better understand the relationship between the 4-Hs toward developing viable salmon recovery and enhancement strategies.

Changes in harvest by species were calculated for each of the Joint Alternatives (i.e., Black Rock, Wymer, and Wymer Plus) by subtracting No Action Alternative harvest levels from Joint Alternative harvest levels. Population and harvest estimates were developed on an annual basis for each year of the 100-year study period. Table 2–52 presents summary information on the range (i.e., average, high, and low) of annual incremental total harvest by species and alternative across the 100-year study period. For example, for the Black Rock Alternative, the average annual increase in total spring Chinook harvest over the No Action Alternative was estimated at 580 fish, with a range from 294 to 1,926 fish. These annual estimates of total additional harvest by alternative and fish species were then allocated across the eight harvest categories.

Table 2–52. Annual Increment in Fish Harvest as compared to No Action Alternative

Alternative	Spring Chinook	Fall Chinook	Coho
Black Rock			
Average:	580	7,471	623
High:	1,926	26,513	1,875
Low:	294	3,619	304
Wymer Dam and Reservoir			
Average:	33	396	41
High:	106	1,365	123
Low:	17	195	19
Wymer Dam Plus Yakima River Pump Exchange			
Average:	379	4,262	323
High:	1,273	15,988	947
Low:	191	1,964	150

The economic values per fish by harvest category listed above were applied to the annual estimates of harvest change by species, harvest category, and alternative to obtain annual values by species and alternative. The annual values were then discounted to a present value as of the start of the benefit period. Finally, the discounted values by species, type of harvest, and alternative were aggregated to estimate the total fisheries use value by alternative.

2.3.5.1.2 R esults

Black Rock Alternative

Table 2–53 and Table 2–56 present the results of the fisheries use value analysis for the Black Rock Alternative. Table 2–53 presents the 100-year projection of fish harvest by species for both the No Action and Black Rock Alternatives as provided by study team biologists. The Black Rock and No Action fish

projections are used to calculate the change in annual harvest by fish species. Note that the projection does not show a gradual increase in fish harvest over the study period. This is in part because the fish population and harvest models include an ocean productivity component which occurs cyclically. Table 2–53 also shows the total discounted value for each year of the study period. The values presented in Table 2–56 reflect the present value of the 100-year stream of fishery use values by alternative, fish species, and harvest category. The total present value by species in Table 2–56 agrees with the sum of the annual present values for each species listed towards the bottom of Table 2–53. Table 2–56 shows the detail of present values by harvest category which is not included in Table 2–53. The total present value for the Black Rock Alternative was estimated at $20.9 million. Over 90 percent of that additional fishery use value as compared to the No Action Alternative stemmed from the ocean, lower Columbia River (zones 1-5), and Yakima River sport fisheries.

Wymer Dam and Reservoir Alternative
As shown in Table 2–54 and Table 2–56, the total present value of the 100-year stream of fishery use values for the Wymer Dam and Reservoir Alternative was estimated at $1.1 million.

Wymer Dam Plus Yakima River Pump Exchange Alternative
As shown in Table 2–55 and Table 2–56, the total present value of the 100-year stream of fishery use values for the Wymer Dam Plus Yakima River Pump Exchange Alternative was estimated at $12.2 million. As with the Black Rock Alternative, over 90 percent of that additional fishery use value stemmed from the ocean, lower Columbia River (zones 1-5), and Yakima River sport fisheries.

2.3.5.2 Fish Nonuse Values

The purpose of this section is to discuss nonuse values within the context of the benefit-cost and cost allocation analyses associated with the Storage Study.

2.3.5.2.1 Nonuse Values and the Reclamation Planning Process

Nonuse values, otherwise referred to as passive use, intrinsic, existence, or preservation values, reflect an individual's willingness to pay (WTP) for simply knowing a resource exists even if that individual never intends to use the resource. Aggregating across individuals (or in most cases households) provides an estimate of societal nonuse value. For example, the harvest of threatened and endangered (T&E) species may be prohibited and yet households nationwide may still be willing to pay to ensure the continued existence of the species. The economics literature indicates that nonuse values may be greatest when the resource is scarce or unique, when the magnitude of the resource change is relatively large, when the resource is of national significance, and when adverse impacts are likely to be

irreversible or of long duration. Therefore, a permanent injury to a unique resource of national significance may generate substantial adverse nonuse value impacts (costs), even for those residing far from the site. Conversely, large improvements to a scarce resource of national significance would likely result in significant positive nonuse values (benefits). This is not to imply that less scarce/unique resources, or resources of regional but not national significance, do not generate any nonuse values. Less scarce/unique or regional resources may still provide nonuse values, but likely to a lesser extent than scarce/unique resources of national significance. This is because less scarce/unique resources tend to have lower per-household nonuse values and the aggregation is made over a smaller number of households.

Table 2–53. Annual harvest and total economic value by species for the Black Rock Alternative

Fish Species	Spring Chinook				Fall Chinook				Coho			
Alternative	No Action	Black Rock			No Action	Black Rock			No Action	Black Rock		
Year	Total Harvest	Total Harvest	Change in Total Harvest from No Action Alt	Total Discounted Value	Total Harvest	Total Harvest	Change in Total Harvest from No Action Alt	Total Discounted Value	Total Harvest	Total Harvest	Change in Total Harvest from No Action Alt	Total Discounted Value
1	2,677	3,299	622	58,322	10,366	29,139	10,793	1,197,526	3,426	4,089	663	66,526
2	1,273	1,567	294	26,262	8,749	13,893	5,144	546,247	1,667	1,986	319	29,472
3	1,564	1,921	357	30,414	9,988	16,251	6,263	633,197	2,113	2,589	476	42,600
4	1,923	1,990	375	30,505	10,331	16,937	6,605	637,748	2,104	2,668	489	41,193
5	1,415	1,746	330	26,602	8,931	14,699	5,768	631,062	1,904	2,310	406	33,217
6	1,265	1,605	320	23,642	8,372	13,862	5,490	481,099	1,829	2,250	421	32,015
7	1,478	1,826	348	24,513	8,844	14,715	5,871	491,447	1,969	2,446	477	35,483
8	1,331	1,647	316	21,243	7,863	13,114	5,251	419,111	1,763	2,191	418	29,625
9	3,050	3,777	727	46,542	17,510	29,284	11,774	896,044	4,015	5,039	1,025	69,246
10	6,702	8,341	1,639	100,680	41,232	67,745	26,513	1,923,880	8,646	10,312	1,666	102,314
11	3,451	4,275	824	47,582	22,485	35,501	13,016	900,576	4,143	4,950	807	49,583
12	1,564	1,932	368	20,449	9,575	15,323	5,748	379,224	1,909	2,272	363	21,253
13	1,725	2,132	406	21,505	9,584	15,733	6,149	386,846	2,240	2,672	432	24,110
14	1,841	2,030	389	19,661	8,882	14,735	5,852	351,052	2,118	2,552	433	23,088
15	1,777	2,201	424	20,404	9,470	15,827	6,357	357,890	2,310	2,785	475	24,118
16	1,707	2,116	410	18,802	8,002	14,851	6,969	326,543	2,222	2,659	436	21,120
17	1,293	1,693	399	13,531	6,642	10,952	4,410	229,310	1,670	2,004	335	15,468
18	1,443	1,789	346	14,459	7,058	11,793	4,735	234,766	1,863	2,316	453	19,969
19	2,516	3,116	607	24,139	12,127	20,282	8,155	385,568	3,227	4,016	790	33,155
20	5,680	7,070	1,390	52,726	28,884	47,724	18,840	849,365	7,252	8,642	1,390	56,630
21	2,915	3,491	576	24,446	16,842	26,057	9,216	396,123	3,352	4,008	655	24,987
22	1,560	1,932	372	12,820	6,258	13,096	4,838	198,291	1,907	2,268	361	13,141
23	1,279	1,700	329	10,922	6,754	10,810	4,056	159,520	1,757	2,115	359	12,448
24	1,662	2,060	398	12,479	7,884	12,630	4,746	176,855	2,100	2,606	506	16,743
25	2,121	2,633	512	15,315	10,139	16,289	6,150	218,517	2,696	3,300	604	19,085
26	1,714	2,131	417	11,878	8,427	13,554	5,128	173,737	2,192	2,606	414	12,452
27	1,622	1,992	370	10,053	7,374	11,854	4,480	144,736	1,949	2,343	394	11,299
28	1,318	1,626	308	8,237	6,258	10,020	3,762	116,507	1,671	2,042	371	10,147
29	3,001	3,729	728	18,004	14,101	22,590	8,489	249,351	3,806	4,742	936	24,407
30	6,956	8,660	1,704	40,172	36,430	58,778	21,347	597,899	8,666	10,338	1,673	41,846
31	2,045	2,623	577	16,225	16,106	26,141	8,955	239,154	3,316	3,970	654	15,514
32	1,681	2,069	388	8,311	8,697	13,643	4,946	126,945	1,971	2,346	375	8,881
33	1,429	1,768	341	6,973	6,957	11,094	4,137	100,455	1,902	2,163	261	7,792
34	1,460	1,810	351	6,831	6,881	11,014	4,133	95,687	1,826	2,270	443	9,100
35	1,734	2,153	419	7,785	8,131	13,036	4,905	100,266	2,179	2,715	536	10,490
36	1,736	2,158	422	7,483	8,260	13,264	5,021	105,686	2,175	2,679	504	9,420
37	1,562	1,968	386	6,525	7,571	12,178	4,607	92,462	1,993	2,435	442	7,879
38	1,623	2,020	397	6,390	7,713	12,397	4,684	89,643	2,045	2,518	474	8,040
39	3,020	3,759	740	11,358	14,950	23,088	8,719	159,105	3,808	4,682	875	14,152
40	7,560	9,413	1,853	27,137	38,486	61,676	23,141	402,861	9,518	11,726	1,807	27,913
41	3,757	4,648	891	12,447	21,422	33,181	11,759	195,104	4,393	5,199	806	12,674
42	1,911	2,363	452	6,017	10,339	16,166	5,826	92,172	2,255	2,692	436	6,135
43	1,886	2,299	443	5,619	9,206	14,634	5,428	81,801	2,319	2,749	430	5,763
44	2,026	2,525	499	5,910	9,910	15,723	5,905	84,941	2,561	3,050	497	6,340
45	2,006	2,490	484	5,588	9,700	15,581	5,880	80,650	2,530	3,004	474	5,769
46	1,370	1,702	332	3,650	6,628	10,654	4,026	52,662	1,731	2,055	323	3,754
47	1,584	1,967	383	4,020	7,413	11,888	4,475	55,800	1,995	2,467	472	5,227
48	1,860	2,312	453	4,529	8,733	14,027	5,295	62,956	2,342	2,883	541	5,712
49	2,571	3,200	629	6,000	12,287	19,772	7,484	84,851	3,235	3,926	691	8,959
50	6,019	7,491	1,473	13,397	29,949	48,099	18,150	196,209	7,477	8,912	1,434	13,767
51	3,564	4,415	851	7,385	19,738	30,864	11,126	114,687	4,155	4,976	821	7,517
52	1,954	2,418	464	3,838	10,418	16,368	5,950	58,878	2,313	2,761	448	3,911
53	2,169	2,881	517	4,079	10,888	17,019	6,331	59,333	2,695	3,197	502	4,181
54	1,296	1,608	312	2,343	6,331	10,141	3,809	34,042	1,815	1,919	304	2,409
55	1,342	1,666	323	2,314	6,257	10,012	3,755	31,995	1,682	2,089	406	3,064
56	1,376	1,709	333	2,277	6,359	10,179	3,820	31,036	1,710	2,129	411	2,964
57	1,719	2,137	418	2,726	7,963	12,754	4,791	37,118	2,139	2,697	558	3,907
58	1,698	2,115	417	2,580	8,037	12,918	4,881	36,058	2,107	2,627	520	3,409
59	3,383	4,216	832	4,934	16,098	25,890	9,792	68,970	4,202	5,217	1,015	6,347
60	7,845	9,771	1,926	10,896	40,353	64,483	24,129	162,066	9,553	11,427	1,875	11,179
61	2,728	3,374	646	3,404	15,590	24,079	8,489	54,425	3,132	3,756	624	3,540
62	2,347	2,905	558	2,888	12,229	19,255	7,025	42,898	2,830	3,359	529	2,922
63	2,037	2,524	487	2,306	10,174	16,196	6,022	35,063	2,499	2,970	473	2,443
64	1,939	2,405	466	2,178	9,431	15,102	5,671	31,482	2,421	2,875	454	2,236
65	1,820	2,259	439	1,966	8,750	14,050	5,300	28,067	2,295	2,723	428	2,014
66	1,447	1,798	350	1,486	6,898	11,089	4,191	21,153	1,833	2,185	351	1,575
67	1,291	1,604	313	1,267	6,025	9,670	3,645	17,546	1,621	2,000	378	1,617
68	1,866	2,319	453	1,750	8,609	13,701	5,172	23,730	2,337	2,902	565	2,302
69	3,060	3,810	750	2,763	14,540	23,385	8,845	38,705	3,829	4,687	858	3,335
70	5,298	6,587	1,288	4,589	26,876	43,037	16,161	67,434	6,492	7,756	1,264	4,883
71	3,131	3,880	750	2,511	17,139	26,868	9,730	39,711	3,660	4,383	723	2,553
72	1,826	2,261	435	1,390	9,563	15,075	5,513	20,951	2,179	2,599	420	1,416
73	1,721	2,134	413	1,256	8,389	13,384	4,996	18,073	2,160	2,561	401	1,209
74	1,531	1,900	369	1,071	7,271	11,660	4,389	15,138	1,912	2,315	403	1,235
75	1,388	1,724	336	930	6,494	10,422	3,928	12,919	1,740	2,137	397	1,159
76	1,842	2,289	447	1,180	8,533	13,680	5,147	16,140	2,295	2,877	582	1,620
77	1,830	2,278	448	1,127	8,881	13,985	5,284	15,800	2,292	2,800	507	1,346
78	1,660	2,067	407	976	7,920	12,759	4,830	13,771	2,078	2,528	450	1,139
79	3,090	3,847	757	1,733	14,839	23,543	8,904	24,207	3,884	4,740	856	2,066
80	5,889	7,305	1,436	3,133	29,699	47,664	17,966	46,314	7,173	8,569	1,397	3,215
81	3,467	4,294	827	1,721	19,159	29,937	10,778	26,641	4,028	4,826	798	1,752
82	1,942	2,403	461	915	10,291	16,180	5,889	13,879	2,298	2,743	446	933
83	1,585	1,964	379	717	7,793	12,414	4,621	10,305	1,972	2,340	369	735
84	1,747	2,167	420	768	8,256	13,221	4,966	10,647	2,173	2,588	415	923
85	1,607	1,996	389	669	7,583	12,184	4,601	9,400	2,018	2,443	425	771
86	1,795	2,231	436	716	8,424	13,537	5,113	9,961	2,239	2,759	517	894
87	1,566	1,974	387	605	7,518	12,097	4,579	8,506	1,997	2,418	421	694
88	1,934	2,406	472	704	9,097	14,623	5,526	9,709	2,416	2,979	563	885
89	2,894	3,604	709	1,008	13,844	22,285	8,441	14,258	3,566	4,389	823	1,084
90	6,927	8,620	1,693	2,296	34,844	56,052	21,207	33,832	8,492	10,131	1,639	2,344
91	3,306	4,091	785	1,015	18,549	28,837	10,288	15,798	3,812	4,571	759	1,035
92	1,873	2,317	444	548	9,916	15,583	5,668	8,084	2,219	2,649	430	569
93	1,522	1,886	364	420	7,451	11,869	4,419	6,169	1,901	2,255	354	429
94	1,280	1,588	308	345	6,020	9,639	3,619	4,816	1,589	1,957	368	435
95	1,763	2,177	413	452	8,073	12,911	4,838	6,142	2,186	2,710	524	591
96	1,500	1,865	366	372	7,054	11,337	4,283	5,184	1,862	2,302	440	473
97	1,843	2,293	450	437	8,621	13,845	5,223	6,024	2,280	2,864	585	696
98	1,553	1,935	381	353	7,393	11,898	4,504	4,957	1,945	2,373	429	519
99	2,329	2,901	571	505	10,969	17,630	6,661	6,980	2,895	3,602	707	859
100	4,802	5,983	1,182	996	23,473	37,762	14,289	14,297	6,015	7,179	1,164	1,034
				1,075,145				10,537,392				1,261,454
Average	2,402	2,982	580		12,966	19,837	7,471		2,986	3,608	625	
Maximum	7,845	9,771	1,926		41,232	67,745	26,513		9,553	11,427	1,875	
Minimum	1,273	1,567	294		6,020	9,639	3,619		1,589	1,919	304	

Table 2–54. Annual harvest and total economic value by species for the Wymer Dam and Reservoir Alternative

Fish Species:	Spring Chinook				Fall Chinook				Coho			
Alternative:	No Action	Wymer Dam and Reservoir			No Action	Wymer Dam and Reservoir			No Action	Wymer Dam and Reservoir		
Year	Total Harvest	Total Harvest	Change in Total Harvest from No Action Alt.	Total Discounted Value	Total Harvest	Total Harvest	Change in Total Harvest from No Action Alt.	Total Discounted Value	Total Harvest	Total Harvest	Change in Total Harvest from No Action Alt.	Total Discounted Value
1	2,677	2,727	50	4,709	18,386	18,951	565	52,919	3,426	3,472	46	4,543
2	1,273	1,293	20	1,758	8,749	9,016	267	26,356	1,657	1,678	21	1,978
3	1,564	1,586	22	1,877	9,998	10,324	327	33,084	2,113	2,143	29	2,637
4	1,623	1,645	22	1,812	10,331	10,676	344	33,247	2,184	2,216	31	2,692
5	1,415	1,434	19	1,485	8,931	9,231	300	27,602	1,904	1,933	30	2,414
6	1,365	1,384	18	1,350	8,372	8,657	285	25,038	1,829	1,857	27	2,130
7	1,478	1,498	20	1,385	8,844	9,149	305	25,546	1,969	1,999	30	2,218
8	1,331	1,348	18	1,191	7,863	8,135	272	21,707	1,763	1,790	27	1,921
9	3,050	3,091	41	2,601	17,510	18,119	609	46,371	4,015	4,075	61	4,120
10	6,702	6,792	89	5,461	41,232	42,597	1,365	99,049	8,646	8,756	110	7,078
11	3,451	3,496	46	2,656	22,485	23,145	660	45,690	4,143	4,198	54	3,340
12	1,564	1,585	21	1,152	9,575	9,866	292	19,237	1,909	1,933	24	1,390
13	1,725	1,748	23	1,215	9,584	9,899	315	19,818	2,240	2,271	31	1,747
14	1,641	1,663	22	1,107	8,882	9,182	300	17,983	2,118	2,148	30	1,606
15	1,777	1,801	24	1,143	9,370	9,690	320	18,328	2,310	2,345	35	1,790
16	1,707	1,729	23	1,047	8,882	9,187	305	16,647	2,222	2,257	35	1,672
17	1,283	1,301	17	752	6,542	6,767	225	11,715	1,670	1,696	26	1,217
18	1,443	1,462	19	808	7,058	7,302	243	12,073	1,863	1,890	27	1,210
19	2,510	2,543	34	1,338	12,127	12,547	420	19,851	3,227	3,276	50	2,081
20	5,680	5,757	76	2,892	28,884	29,840	956	43,102	7,252	7,342	90	3,622
21	2,815	2,852	37	1,354	15,842	16,316	475	20,412	3,352	3,396	44	1,668
22	1,560	1,581	21	721	8,258	8,512	254	10,403	1,907	1,930	23	848
23	1,379	1,398	19	612	6,754	6,970	216	8,450	1,757	1,781	25	856
24	1,662	1,684	22	702	7,884	8,140	256	9,549	2,100	2,129	29	951
25	2,121	2,149	29	855	10,139	10,471	332	11,782	2,696	2,737	41	1,295
26	1,714	1,737	23	659	8,427	8,702	275	9,321	2,192	2,219	27	804
27	1,522	1,543	21	559	7,374	7,614	241	7,785	1,949	1,980	31	678
28	1,308	1,326	18	469	6,238	6,443	205	6,301	1,671	1,694	24	646
29	3,001	3,042	41	1,005	14,101	14,563	462	13,569	3,806	3,863	57	1,480
30	6,956	7,049	94	2,208	35,430	36,574	1,143	32,018	8,656	8,766	110	2,732
31	2,845	2,883	38	852	16,166	16,636	470	12,556	3,316	3,360	44	1,038
32	1,631	1,653	22	471	8,597	8,858	261	6,649	1,971	1,995	24	545
33	1,428	1,448	19	395	6,957	7,179	222	5,381	1,802	1,827	25	549
34	1,460	1,479	20	385	6,881	7,104	224	5,179	1,828	1,853	25	520
35	1,734	1,758	24	437	8,131	8,397	266	5,876	2,179	2,211	32	633
36	1,736	1,759	24	418	8,263	8,534	271	5,710	2,175	2,209	34	632
37	1,582	1,603	21	363	7,571	7,820	248	4,982	1,993	2,025	32	566
38	1,623	1,645	22	355	7,713	7,966	253	4,842	2,045	2,077	32	545
39	3,020	3,061	41	630	14,350	14,820	470	8,584	3,808	3,869	61	980
40	7,560	7,662	102	1,497	38,436	39,671	1,236	21,501	9,318	9,436	118	1,825
41	3,757	3,807	50	700	21,422	22,037	616	10,219	4,339	4,396	58	848
42	1,911	1,937	26	342	10,339	10,645	306	4,838	2,255	2,283	28	398
43	1,856	1,881	25	319	9,206	9,495	289	4,360	2,319	2,346	27	363
44	2,036	2,063	28	335	9,818	10,134	316	4,545	2,561	2,599	37	478
45	2,006	2,033	27	314	9,700	10,015	315	4,320	2,530	2,560	30	371
46	1,370	1,389	19	205	6,628	6,844	216	2,825	1,731	1,752	21	239
47	1,584	1,605	22	226	7,413	7,655	242	3,020	1,995	2,023	27	304
48	1,860	1,885	25	253	8,733	9,019	287	3,411	2,342	2,375	33	351
49	2,571	2,606	35	333	12,287	12,690	403	4,566	3,235	3,286	51	513
50	6,019	6,100	82	742	29,949	30,920	971	10,492	7,477	7,571	93	894
51	3,564	3,612	48	414	19,738	20,324	586	6,038	4,155	4,209	55	499
52	1,954	1,980	26	218	10,418	10,732	313	3,080	2,313	2,342	29	253
53	2,163	2,193	29	232	10,688	11,025	337	3,161	2,695	2,727	32	264
54	1,296	1,314	18	132	6,331	6,534	203	1,817	1,815	1,834	19	153
55	1,342	1,360	18	131	6,257	6,460	203	1,729	1,682	1,705	23	173
56	1,376	1,395	19	128	6,359	6,566	207	1,685	1,718	1,742	24	171
57	1,719	1,742	23	153	7,963	8,224	261	2,018	2,129	2,160	31	215
58	1,698	1,721	23	144	8,037	8,301	264	1,950	2,107	2,140	33	214
59	3,383	3,429	46	273	16,098	16,626	528	3,721	4,202	4,269	67	419
60	7,845	7,951	106	600	40,353	41,640	1,287	8,642	9,553	9,675	123	731
61	2,728	2,764	36	196	15,580	16,025	444	2,846	3,132	3,174	42	237
62	2,347	2,378	32	163	12,229	12,600	371	2,263	2,820	2,855	34	187
63	2,037	2,064	28	135	10,174	10,494	320	1,863	2,498	2,528	30	155
64	1,939	1,965	26	123	9,431	9,734	303	1,680	2,421	2,450	29	142
65	1,820	1,845	25	110	8,750	9,034	284	1,505	2,295	2,322	27	128
66	1,447	1,467	20	84	6,898	7,123	225	1,136	1,833	1,860	27	120
67	1,291	1,308	18	71	6,025	6,222	197	950	1,621	1,644	23	97
68	1,866	1,891	25	98	8,609	8,890	282	1,292	2,337	2,371	34	138
69	3,060	3,102	42	154	14,540	15,017	477	2,085	3,829	3,890	61	236
70	5,299	5,370	72	252	26,876	27,739	862	3,599	6,492	6,574	82	306
71	3,131	3,173	42	141	17,138	17,651	513	2,041	3,660	3,708	48	168
72	1,826	1,851	25	79	9,553	9,845	292	1,108	2,179	2,206	27	91
73	1,721	1,744	23	71	8,388	8,655	267	966	2,160	2,185	25	81
74	1,531	1,552	21	61	7,271	7,507	236	813	1,912	1,940	28	85
75	1,388	1,407	19	52	6,494	6,706	212	698	1,740	1,765	25	72
76	1,842	1,867	25	66	8,533	8,813	279	876	2,295	2,329	34	94
77	1,830	1,855	25	63	8,681	8,966	285	851	2,292	2,329	36	96
78	1,660	1,683	23	54	7,928	8,188	260	742	2,078	2,112	34	85
79	3,090	3,132	42	96	14,639	15,118	480	1,305	3,884	3,946	62	149
80	5,869	5,948	80	174	29,699	30,652	953	2,471	7,173	7,264	91	210
81	3,467	3,514	46	97	19,159	19,726	567	1,402	4,028	4,081	53	116
82	1,942	1,968	26	52	10,291	10,602	310	732	2,298	2,326	29	60
83	1,585	1,606	22	41	7,793	8,039	246	563	1,972	1,995	23	46
84	1,747	1,771	24	43	8,255	8,523	268	574	2,173	2,204	31	59
85	1,607	1,629	22	38	7,583	7,831	248	506	2,018	2,047	29	53
86	1,795	1,819	24	40	8,424	8,700	276	538	2,239	2,273	34	59
87	1,586	1,608	22	34	7,518	7,765	247	458	1,997	2,029	31	51
88	1,934	1,960	26	39	9,097	9,395	298	528	2,416	2,454	38	59
89	2,894	2,934	39	56	13,844	14,298	455	768	3,666	3,726	60	90
90	6,927	7,021	94	127	34,844	35,966	1,121	1,806	8,492	8,599	107	153
91	3,306	3,350	44	57	18,549	19,089	540	829	3,812	3,863	50	69
92	1,873	1,898	25	31	9,905	10,203	298	436	2,219	2,247	28	36
93	1,522	1,543	21	24	7,451	7,686	235	329	1,901	1,923	22	28
94	1,280	1,298	17	20	6,020	6,215	195	260	1,589	1,612	22	26
95	1,753	1,777	24	26	8,073	8,336	263	334	2,186	2,215	30	34
96	1,500	1,520	20	21	7,054	7,286	231	280	1,862	1,891	29	31
97	1,843	1,868	25	24	8,621	8,904	283	327	2,282	2,316	34	35
98	1,553	1,574	21	20	7,393	7,636	243	267	1,945	1,977	32	31
99	2,329	2,361	32	28	10,969	11,329	360	378	2,895	2,940	45	42
100	4,802	4,867	65	55	23,473	24,240	766	767	6,015	6,090	75	67
				61,988				967,810				83,273
Average:	2,402	2,435	33		12,386	12,762	396		2,986	3,027	41	
Maximum:	7,845	7,951	106		41,232	42,597	1,365		9,553	9,675	123	
Minimum:	1,273	1,293	17		6,020	6,215	195		1,589	1,612	19	

Table 2–55. Annual harvest and total economic value by species for the Wymer Dam Plus Yakima River Pump Exchange Alternative

Fish Species	Spring Chinook				Fall Chinook				Coho			
Alternative	No Action	Wymer Dam + Yakima River Pump Exchange			No Action	Wymer Dam + Yakima River Pump Exchange			No Action	Wymer Dam + Yakima River Pump Exchange		
Year	Total Harvest	Total Harvest	Change in Total Harvest from No Action Alt.	Total Discounted Value	Total Harvest	Total Harvest	Change in Total Harvest from No Action Alt.	Total Discounted Value	Total Harvest	Total Harvest	Change in Total Harvest from No Action Alt.	Total Discounted Value
1	2,677	3,086	410	38,387	18,386	24,872	6,486	722,352	3,426	3,762	336	33,225
2	1,273	1,466	191	17,104	8,749	11,916	3,167	336,296	1,657	1,813	156	14,749
3	1,564	1,792	228	19,396	9,998	13,671	3,673	371,960	2,113	2,368	255	22,951
4	1,623	1,863	240	19,538	10,331	14,198	3,867	373,359	2,184	2,450	266	22,763
5	1,415	1,628	213	16,467	8,931	12,316	3,384	311,583	1,904	2,129	226	18,457
6	1,365	1,571	205	15,172	8,372	11,558	3,186	279,710	1,829	2,074	244	19,051
7	1,478	1,701	223	15,723	8,844	12,220	3,376	282,609	1,969	2,224	255	18,971
8	1,331	1,534	204	13,688	7,863	10,882	3,019	240,971	1,763	2,009	246	17,449
9	3,050	3,518	467	29,932	17,510	24,207	6,697	609,676	4,015	4,553	538	36,363
10	6,702	7,785	1,083	66,133	41,232	57,220	15,988	1,160,162	8,646	9,482	836	53,876
11	3,451	3,997	546	31,817	22,485	30,859	8,375	579,442	4,143	4,553	409	25,157
12	1,564	1,805	241	13,392	9,575	13,196	3,621	238,927	1,909	2,091	182	10,638
13	1,725	1,987	262	13,859	9,584	13,238	3,654	229,885	2,240	2,463	223	12,477
14	1,641	1,892	251	12,692	8,882	12,299	3,417	204,971	2,118	2,352	233	12,436
15	1,777	2,051	274	13,176	9,370	12,976	3,606	206,269	2,310	2,567	257	13,047
16	1,707	1,972	266	12,190	8,882	12,314	3,432	187,188	2,222	2,450	227	11,001
17	1,283	1,484	201	8,778	6,542	9,059	2,517	130,871	1,670	1,847	177	8,187
18	1,443	1,666	223	9,300	7,058	9,685	2,626	130,231	1,863	2,090	227	10,003
19	2,510	2,901	391	15,576	12,127	16,613	4,486	212,104	3,227	3,632	405	17,007
20	5,680	6,593	913	34,641	28,884	39,498	10,614	478,489	7,252	7,944	692	27,687
21	2,815	3,262	447	16,178	15,842	21,383	5,541	238,207	3,352	3,683	331	12,638
22	1,560	1,803	243	8,387	8,258	11,114	2,856	117,070	1,907	2,086	180	6,538
23	1,379	1,592	212	6,988	6,754	9,016	2,263	88,432	1,757	1,950	193	6,690
24	1,662	1,918	256	8,020	7,884	10,448	2,564	95,549	2,100	2,349	249	8,244
25	2,121	2,452	331	9,907	10,139	13,457	3,318	117,892	2,696	3,035	339	10,695
26	1,714	1,986	272	7,755	8,427	11,252	2,825	95,720	2,192	2,398	206	6,202
27	1,522	1,763	240	6,539	7,374	9,825	2,451	79,195	1,949	2,158	208	5,978
28	1,308	1,514	206	5,338	6,238	8,279	2,041	62,883	1,671	1,879	208	5,687
29	3,001	3,470	469	11,603	14,101	18,603	4,502	132,250	3,806	4,276	470	12,247
30	6,956	8,078	1,123	26,466	35,430	47,447	12,017	336,570	8,656	9,496	840	20,888
31	2,845	3,293	448	10,060	16,186	21,712	5,526	147,574	3,316	3,648	332	7,870
32	1,631	1,885	253	5,430	8,597	11,548	2,952	75,161	1,971	2,158	187	4,219
33	1,428	1,649	221	4,506	6,957	9,290	2,332	56,635	1,802	1,992	191	4,110
34	1,460	1,685	226	4,396	6,881	9,127	2,246	52,007	1,828	2,048	220	4,523
35	1,734	2,004	270	5,019	8,131	10,757	2,626	57,964	2,179	2,455	275	5,400
36	1,736	2,010	274	4,859	8,263	10,969	2,706	56,966	2,175	2,463	288	5,384
37	1,582	1,833	251	4,247	7,571	10,066	2,494	50,063	1,993	2,242	249	4,432
38	1,623	1,881	258	4,161	7,713	10,236	2,523	48,290	2,045	2,319	274	4,665
39	3,020	3,500	481	7,384	14,350	19,043	4,693	85,651	3,808	4,311	503	8,149
40	7,560	8,782	1,222	17,891	38,436	51,561	13,125	228,387	9,318	10,227	909	14,038
41	3,757	4,345	589	8,218	21,422	28,727	7,305	121,204	4,339	4,775	437	6,496
42	1,911	2,207	296	3,939	10,339	13,889	3,550	56,167	2,255	2,474	219	3,073
43	1,856	2,143	287	3,643	9,206	12,329	3,123	47,116	2,319	2,530	211	2,830
44	2,036	2,353	317	3,835	9,818	13,121	3,303	47,514	2,561	2,815	254	3,238
45	2,006	2,321	315	3,635	9,700	12,974	3,274	44,899	2,530	2,763	234	2,844
46	1,370	1,586	216	2,377	6,628	8,865	2,237	29,250	1,731	1,891	159	1,847
47	1,584	1,831	247	2,593	7,413	9,825	2,412	30,077	1,995	2,238	243	2,686
48	1,860	2,153	293	2,933	8,733	11,574	2,841	33,781	2,342	2,629	287	3,034
49	2,571	2,981	410	3,910	12,287	16,350	4,063	46,059	3,235	3,610	376	3,781
50	6,019	6,986	967	8,802	29,949	40,140	10,190	110,162	7,477	8,193	716	6,868
51	3,564	4,126	562	4,876	19,738	26,521	6,783	69,917	4,155	4,570	416	3,803
52	1,954	2,258	304	2,515	10,418	14,009	3,591	35,292	2,313	2,537	224	1,957
53	2,163	2,499	336	2,648	10,688	14,323	3,635	34,063	2,695	2,942	247	2,055
54	1,296	1,499	203	1,524	6,331	8,486	2,155	19,256	1,615	1,765	150	1,187
55	1,342	1,549	207	1,488	6,257	8,287	2,029	17,293	1,682	1,884	202	1,526
56	1,376	1,590	214	1,464	6,359	8,385	2,026	16,463	1,718	1,920	202	1,455
57	1,719	1,988	270	1,757	7,963	10,489	2,526	19,668	2,129	2,407	279	1,916
58	1,698	1,969	271	1,695	8,037	10,647	2,610	19,283	2,107	2,399	292	1,916
59	3,383	3,926	543	3,216	16,098	21,372	5,275	37,152	4,202	4,799	596	3,730
60	7,845	9,118	1,273	7,196	40,353	54,181	13,828	92,872	9,553	10,500	947	5,646
61	2,726	3,154	427	2,300	15,580	20,886	5,306	33,980	3,132	3,449	317	1,603
62	2,347	2,711	364	1,872	12,229	16,423	4,194	25,607	2,820	3,088	268	1,451
63	2,037	2,354	317	1,553	10,174	13,661	3,487	20,303	2,496	2,731	233	1,207
64	1,939	2,242	303	1,414	9,431	12,637	3,206	17,796	2,421	2,644	223	1,100
65	1,820	2,106	285	1,271	8,750	11,703	2,953	15,634	2,295	2,505	210	969
66	1,447	1,675	228	967	6,898	9,208	2,309	11,656	1,833	2,010	177	793
67	1,291	1,493	202	819	6,025	7,989	1,964	9,453	1,621	1,821	199	852
68	1,866	2,158	292	1,126	9,609	11,342	2,733	12,544	2,337	2,616	279	1,137
69	3,060	3,549	489	1,800	14,540	19,303	4,763	20,844	3,829	4,305	476	1,849
70	5,299	6,155	856	3,007	26,876	36,058	9,182	38,313	6,492	7,126	634	2,349
71	3,131	3,626	495	1,657	17,138	23,041	5,903	23,487	3,660	4,025	365	1,289
72	1,826	2,111	285	910	9,553	12,849	3,296	12,505	2,179	2,389	210	706
73	1,721	1,989	268	815	8,388	11,227	2,839	10,271	2,160	2,356	197	632
74	1,531	1,770	239	694	7,271	9,698	2,427	8,370	1,912	2,131	219	670
75	1,388	1,606	217	601	6,494	8,620	2,126	6,993	1,740	1,956	216	632
76	1,842	2,130	288	761	8,533	11,273	2,740	8,592	2,295	2,590	295	820
77	1,830	2,122	292	734	8,681	11,534	2,853	8,531	2,292	2,571	279	740
78	1,660	1,926	266	637	7,928	10,556	2,628	7,494	2,078	2,325	247	626
79	3,090	3,583	493	1,128	14,639	19,464	4,825	13,118	3,884	4,362	478	1,154
80	5,869	6,815	947	2,065	29,699	39,873	10,175	26,375	7,173	7,873	701	1,613
81	3,467	4,013	546	1,135	19,159	25,748	6,589	16,286	4,028	4,432	404	886
82	1,942	2,244	302	599	10,291	13,841	3,549	8,365	2,298	2,521	223	466
83	1,585	1,831	246	465	7,793	10,442	2,650	5,955	1,972	2,163	191	361
84	1,747	2,019	272	490	8,255	10,995	2,740	5,871	2,173	2,447	274	521
85	1,607	1,859	252	434	7,583	10,096	2,512	5,133	2,018	2,248	230	417
86	1,795	2,077	283	463	8,424	11,188	2,764	5,385	2,239	2,537	297	514
87	1,586	1,838	252	394	7,518	10,004	2,486	4,618	1,997	2,225	227	375
88	1,934	2,241	307	457	9,097	12,076	2,979	5,277	2,416	2,742	326	512
89	2,894	3,358	463	658	13,844	18,450	4,607	7,781	3,666	4,037	371	556
90	6,927	8,042	1,115	1,511	34,844	46,784	11,940	19,229	8,492	9,309	817	1,168
91	3,306	3,824	518	670	18,549	24,903	6,354	9,758	3,812	4,197	385	525
92	1,873	2,163	291	358	9,905	13,315	3,410	4,994	2,219	2,434	215	279
93	1,522	1,758	236	277	7,451	9,977	2,526	3,627	1,901	2,074	174	215
94	1,280	1,479	199	223	6,020	8,008	1,988	2,646	1,589	1,787	198	234
95	1,753	2,025	272	290	8,073	10,649	2,575	3,269	2,186	2,443	257	290
96	1,500	1,737	237	242	7,054	9,355	2,301	2,785	1,862	2,114	252	271
97	1,843	2,135	292	283	8,621	11,412	2,790	3,220	2,282	2,590	309	316
98	1,553	1,802	249	230	7,393	9,832	2,439	2,684	1,945	2,181	236	230
99	2,329	2,701	372	328	10,969	14,552	3,582	3,759	2,895	3,311	416	387
100	4,802	5,578	776	663	23,473	31,389	7,915	7,920	6,015	6,599	584	519
				700,631				10,797,221				657,375
Average:	2,402	2,781	379		12,366	16,628	4,262		2,986	3,309	323	
Maximum:	7,845	9,118	1,273		41,232	57,220	15,988		9,553	10,500	947	
Minimum:	1,273	1,465	191		6,020	7,989	1,964		1,589	1,765	150	

Table 2–56. Discounted 100-year stream of fisheries use values by alternative

Alternative	Ocean		Columbia River (zones 1-5)		Columbia River (zone 6)		Yakima River		Total
	Commercial	Sport	Commercial	Sport	Commercial	Ceremonial & Subsistence	Sport	Ceremonial & Subsistence	
Black Rock Alternative									
Spring Chinook:	11,400	0	25,300	386,900	16,600	83,000	437,800	114,100	1,075,100
Fall Chinook:	107,500	426,900	186,000	3,884,200	742,700	48,800	13,141,300	0	18,537,400
Coho:	23,700	521,400	7,300	568,400	4,000	300	136,500	0	1,261,600
Total:	142,600	948,300	218,600	4,839,500	763,300	132,100	13,715,600	114,100	20,874,100
Wymer Dam and Reservoir Alternative									
Spring Chinook:	700	0	1,500	22,300	1,000	4,800	25,200	6,600	62,100
Fall Chinook:	5,600	22,300	9,700	202,800	38,800	2,500	686,100	0	967,800
Coho:	1,600	34,400	500	37,500	300	0	9,000	0	83,300
Total:	7,900	56,700	11,700	262,600	40,100	7,300	720,300	6,600	1,113,200
Wymer Dam Plus Yakima River Pump Exchange Alternative									
Spring Chinook:	7,400	0	16,500	252,100	10,800	54,100	285,300	74,300	700,500
Fall Chinook:	62,600	248,600	108,300	2,262,400	432,600	28,400	7,654,200	0	10,797,100
Coho:	12,300	271,700	3,800	296,200	2,100	100	71,100	0	657,300
Total:	82,300	520,300	128,600	2,810,700	445,500	82,600	8,010,600	74,300	12,154,900

As a resource recovers from a depleted or damaged state, overall nonuse values may diminish and be "replaced" by harvest-based use values–reflecting a transition from nonuse to use values. Note that a resource may provide both nonuse and use values simultaneously, a concept referred to as total values. Total values typically refer to a combination of both nonuse values and recreation use values. While it is possible that other use values (e.g., for fisheries resources-potential commercial or Tribal fishing use values) may be included to some extent in total values, the application of general population surveys tend to reduce the likelihood of including a significant number of respondents with such values within the sample. When conducting surveys of the general population, it is often difficult to separate nonuse values from recreation use values and, as a result, many "nonuse" value studies actually measure total values. In cases where the resource being valued does not provide significant recreational use values (e.g., studies of T&E species), the resulting WTP-value from the survey may reflect a more pure nonuse value. It should be noted that even for T&E species where harvest is not permitted, nonconsumptive use (e.g., for fisheries resources—fish viewing or catch-and-release fishing) of the resource may still occur, although its value may be fairly insignificant compared to the nonuse value component. When total value estimates are used in a study, the analyst should be careful not to double count recreation benefits associated with the resource (e.g., in the case of fisheries, one should avoid including separately estimated ocean and inland sport fishing benefits in addition to the total value estimates).

Most, but not all, economists would probably agree that a fairly strong theoretical case has been made for the concept of nonuse values. Most of those economists who have problems with nonuse values tend to focus on measurement issues. Problematic measurement issues can include determination of the nonuse-value-generating resource as well as the actual nonuse value measurement technique. With regard to the nonuse value resource, there is disagreement within the economics profession over whether only unique, nationally significant resources should be considered for nonuse valuation. For example, some economists would claim that non-T&E regionally significant resources would not be unique enough to generate nonuse values. With regard to measurement techniques, models based from stated preference contingent valuation (CV) or contingent ranking/conjoint analysis (CR) surveys are the only techniques currently available for measuring nonuse values. Both approaches evaluate survey respondent WTP for described changes in resource conditions (e.g., T&E fish populations). The CV approach directly asks valuation questions, whereas the CR approach has respondents rank alternatives. Both approaches provide respondents with information on before- and after-resource conditions, costs, etc., for each of the proposed alternatives. These approaches, especially the early CV approaches, have been criticized from a number of perspectives. As a result, the whole topic area of nonuse value

measurement has become quite controversial. On the positive side, the CV measurement technique has been extensively reviewed and gradually improved over time. The CV approach was included in the *P&Gs* as an acceptable method for recreation valuation. While not directed specifically at nonuse/total values, the P&G endorsement of the CV approach is relevant. In a more direct endorsement, dichotomous choice CV approach was cautiously approved for use in measuring nonuse values in U.S. Department of the Interior damage assessments by a panel of Nobel laureate economists (Arrow et al., 1993).

Many Reclamation studies deal with T&E species or other unique environmental resources which may generate significant nonuse values. Historically, Reclamation has not included nonuse values in benefit-cost analyses (BCA) or cost allocation/repayment (CA/R) analyses. There have been a few Reclamation studies which have attempted to measure nonuse values (e.g., Glen Canyon EIS, Elwha Dam Removal EIS), but to date, no Reclamation studies have actually included nonuse values in a BCA or CA/R analysis. The *P&Gs*, which shape Reclamation's economic BCAs, are silent on the topic of nonuse values. This is most likely due to the fact that nonuse valuation was still a relatively new concept at the time the *P&Gs* were published in 1983. Nevertheless, the *P&Gs* appear to be flexible enough to allow for the inclusion of new benefit measures within Reclamation BCAs. The *P&Gs* allow the analyst to incorporate benefit categories not expressly described in the guidelines within a BCA, assuming the analyst can make a convincing case for their inclusion. As nonuse value measurement techniques have evolved and impacts to nonuse-value-generating resources (e.g., T&E species) have increased, questions have begun to surface as to whether or not nonuse values should be measured within Reclamation studies in lieu of qualitative environmental economic discussions.

Before conducting some sort of nonuse/total value analysis, the need for such an analysis should be demonstrated. Generally speaking, if one is dealing with a unique resource (e.g., T&E species, rare habitat, or landscapes of national significance), the case for nonuse/total values may be reasonable. However, as noted above, less scarce/unique or regionally significant resources may also deserve nonuse value consideration. In addition, the type of project may prove important in determining whether or not to consider nonuse values. If environmental issues are a primary objective or driving force behind a particular project, nonuse values may prove to be a critical component of the BCA. However, given the considerable controversy associated with nonuse valuation, a fairly strict interpretation of the need for nonuse value estimation seems warranted. The stance was taken that a study only be considered for nonuse valuation if T&E species are involved and significantly affected (the significance determination should be made by study team biologists). Since the Storage Study is dealing with salmon and steelhead species, some, but not all, of which are listed

T&E species, there may be a case for estimating nonuse values for this Storage Study. The question then becomes, "should nonuse valuation be pursued for all the salmon and steelhead species or only the listed ones?" Since a significant impact on a T&E species is the criteria for considering nonuse values, it would also seem reasonable to focus the attention of any nonuse valuation exclusively on those same T&E species.

2.3.5.2.2 Nonuse Value Measurement for Storage Study Benefits

From early on in the Storage Study planning process, nonuse values were identified as a potentially significant benefit category. As a result, the concept of nonuse values could be considered fairly well known to the "publics" following these studies. While the best technical solution for measuring nonuse values would have been to conduct a site- and study-specific survey early on, for various legitimate reasons (e.g., cost, time required, lack of necessary fish population estimates at the time to construct the willingness-to-pay questions), the decision was made not to go in that direction for the appraisal-level and Draft PR/EIS analyses.

Instead of pursuing a site-specific nonuse value survey, initial efforts conducted as part of the appraisal level and Draft PR/EIS analyses were directed at attempting to make use of existing CV/CR nonuse value studies through a process referred to as benefits transfer (BT) in order to evaluate the range and possible significance of nonuse values for the Storage Study. Basically, BT involves reapplication of the results of existing studies to the current study under consideration. Three options exist for BT: meta analysis, model transfer, and value transfer. The meta analysis and model transfer approaches both require the estimation and application of statistically based models and are therefore considered superior to the simple value-based transfer.

Before diving into the discussion of the BT-based nonuse value analyses attempted for the Storage Study's appraisal-level BCA, it should be emphasized that while BT has been used for years within the context of recreation use value estimation, the application of BT approaches to nonuse valuation has been infrequent at best. The economics literature on BT from the perspective of recreation use valuation is quite cautious, with little-to-no discussion of the use of BT for nonuse valuation. Most economists, even those comfortable with the nonuse value concept and the approaches used for estimating nonuse values, may actually object or be highly skeptical of the use of BT for measuring nonuse values. As a result, the decision was made to explore the use of BT approaches for measuring nonuse values only for the appraisal-level and Draft PR/EIS analyses. If the BT-based valuation approaches proved successful and the nonuse value estimates proved critical to the analysis (i.e., if the nonuse values affected

the accept/reject decision), then consideration would be given to conducting a full-scale site- and study-specific nonuse value survey to provide a more defendable nonuse value estimate. Only through use of site- and study-specific surveys can nonuse values be measured with any degree of confidence. Reclamation decided that BT approaches do not provide the level of nonuse value estimation accuracy needed for feasibility-level analysis.

Meta Analysis - A literature search was conducted to pull together a list of Pacific Northwest salmon and steelhead nonuse value studies. Five studies were located – Bell, Huppert, and Johnson (2003), Hanemann, Loomis, and Kanninen (1991), Layton, Brown, and Plummer (1999), Loomis (1996), and Olsen, Richards, and Scott (1991). These studies provided a total of eight nonuse valuation estimates for various species of salmon and steelhead across the Pacific Northwest states of Washington, Oregon, Idaho, and California. Following the lead of Loomis (1999), a meta analysis effort was attempted whereby the values from the various salmon and steelhead nonuse value studies, indexed to current dollars, were used to try to develop a statistical nonuse value model estimated as a function of fish populations.

Through direct correspondence with each of the study authors, information was gathered on both the change in fish populations associated with each scenario described in each nonuse value study as well as the starting fish populations at the time of each study (see Table 2–57). It was believed that both the starting fish population and the change in fish population would be relevant in evaluating survey respondent WTP. While the change in fish populations presented in the scenarios described in each study is a rather obvious potential explanatory variable, it was also believed that the starting fish populations at the time of the study could be important. This is because two studies presenting the same numeric change in fish populations may result in different values because of differences in the starting fish population. For example, two studies which attempt to value an additional 100,000 in fish populations could get vastly different WTP values if one study began from a population of 10,000 fish and the other study began from a population of 100,000 fish.[3] A series of statistical models were attempted using different function forms (i.e., linear, log-linear, linear-log, and double log) and the following fish population based explanatory variables: change in fish population; starting fishing population; percentage change in fish population; total fish population; and total fish population squared (quadratic model). Table 2–58 presents the results of four of the more promising

[3] Another related concept which could affect respondent WTP, but which was not evaluated within the meta analysis modeling, was historical fish populations. By the same logic that WTP for scenarios with the same changes in fish populations could vary based on their starting populations, it is also possible that WTP for studies with similar changes in fish population and starting populations could vary depending on historical fish populations within the river system.

statistical models. The models in Table 2–58 were promising from both the standpoint of statistical significance and sign expectations (i.e., the signs of the variables were as anticipated). The overall models proved statistically significant based on the F statistics, and each explanatory variable proved to be statistically significant based on the t-statistics and P-values. The models also produced explanatory variables with the anticipated sign. With all of the models' dependent variables defined as WTP per household per fish, the expected sign for all of the explanatory variables was negative. The resulting nonuse value curve from the statistical analysis was expected to be a downward sloping function of fish populations. In other words, at high fish populations, the value per fish was expected to be low, and at low fish populations, the value per fish was expected to be high. Starting from low fish populations and relatively high values, as one adds additional fish, the value per fish is expected to decline. The higher the starting fish population, the lower the starting value per fish (negative relationship). The greater the increase in fish populations (both in numeric or percentage terms), the further down the curve one moves and the lower the value per fish (negative relationship). For reductions in fish populations, the greater the reduction, the further back up the curve one moves and the higher the value (negative relationship). Unfortunately, every model was estimated based on a dataset of only eight observations obtained from the five studies, which could imply all the results may be questionable due to limited data.

While somewhat promising statistically, each of the models suffered from its own set of problems from a valuation perspective. Using three different function forms, Models #1-#3 included only the change in fish population variable and, therefore, cannot account for different starting fish populations. Model #1 resulted in illogical declining total values as fish populations increased. Based on the above discussion, it is anticipated that values on a per-fish basis would decline as fish populations increased due to diminishing returns (the more fish available, the less value per fish), but total values should continue to increase with additional fish populations (total value continues to grow, but at a declining rate due to diminishing returns). Models #2 and #3 do not suffer from this problem. However, Model #3 may result in illogical negative values when the change in fish populations gets extremely large. Models #1 and #2 cannot be used to measure declines in fish populations given that one cannot take the log of a negative number. Finally, while Model #4 is promising in that both the change in fish population (note this model uses the percentage change in fish population) and the starting fish population variable proved significant, this model suffers from the illogical decline in total value as fish populations increase issue as well as the inability to measure negative changes in fish populations.

Despite the somewhat promising statistical results, given the problems associated with value estimation, the decision was made to abandon the meta analysis effort. Alternatively, the five salmon and steelhead nonuse value studies were then considered from the perspective of the next-best benefits transfer option—that of a possible model transfer.

Table 2–57. Meta analysis full dataset

Authors	Date of Publication	Date of Data	Fish Species	Location	States	Value Type	Original Annual WTP per Household	(Dec 2005 $) Annual WTP per Household	(Dec 2005 $) Annual WTP per Household per add'l Fish	Starting Fish Population	Increase Fish Population	Percent Increase Fish Population	Total Fish Population
Hanemann, Loomis, Kanninen	1990	May 1989	Salmon	San Joaquin Valley, CA	CA	Total	181.00	287.73	0.019310644	100	14,900	14,900.0	15,000
Olsen, Richards, Scott	1991	Dec 1989	salmon and steelhead	Columbia River	WA, OR, ID, west MT	Nonuse primarily	26.52	41.39	1.65555E-05	2,500,000	2,500,000	100.0	5,000,000
Olsen, Richards, Scott	1991	Dec 1989	salmon and steelhead	Columbia River	WA, OR, ID, west MT	Total	50.35	78.58	3.14318E-05	2,500,000	2,500,000	100.0	5,000,000
Loomis	1996	Dec 1994	salmon	Elwha River, WA	WA	Total	73.00	95.97	0.000295286	50,000	325,000	650.0	375,000
Layton, Brown, Plummer	1999	Mar 1998	salmon	Eastern WA & Columbia River	WA	Total	119.04	144.43	0.000144433	2,000,000	1,000,000	50.0	3,000,000
Layton, Brown, Plummer	1999	Mar 1998	salmon	Western WA & Puget Sound	WA	Total	249.96	303.28	0.000121312	5,000,000	2,500,000	50.0	7,500,000
Bell, Huppert, Johnson	2003	Mar 2000	coho salmon	Willapa Bay, WA	Coastal WA and OR	Total	106.09	121.95	0.00190553	64,000	64,000	100.0	128,000
Bell, Huppert, Johnson	2003	Mar 2000	coho salmon	Tillamook Bay, OR	Coastal WA and OR	Nonuse primarily	61.77	71.01	0.000463187	69,000	153,300	222.2	222,300
						Average	108.47	143.04	0.002786048				

Table 2–58. Most promising meta analysis regressions

Model #1: Double Log Regression: Dependent = Ln WTP/HH/Fish, Independent = Increase in Population									
	SUMMARY OUTPUT								
	Regression Statistics								
	Multiple R	0.95869321							
	R Square	0.91909267							
	Adjusted R Square	0.90560811							
	Standard Error	0.69452144							
	Observations	8							
	ANOVA								
		f	*SS*	*MS*	*F*	*Significance F*			
	Regression	1	32.87713551	32.87714	68.15891	0.000170786			
	Residual	6	2.894160171	0.48236					
	Total	7	35.77129568						
		Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
	Intercept[D]	6.34991612	1.774174192	3.579083	0.011656	2.008665094	10.6911672	2.008665094	10.69116716
Change in Population:	X Variable 1	-1.12323343	0.136053178	-8.25584	0.000171	-1.456143808	-0.7903231	-1.45614381	-0.79032305
Model #2: Semi Log (Log-Linear) Regression: Dependent = Ln WTP/HH/Fish, Independent = Ln Increase in Population									
	SUMMARY OUTPUT								
	Regression Statistics								
	Multiple R	0.82063093							
	R Square	0.67343513							
	Adjusted R Square	0.61900765							
	Standard Error	1.39532843							
	Observations	8							
	ANOVA								
		f	*SS*	*MS*	*F*	*Significance F*			
	Regression	1	24.08964707	24.08965	12.37307	0.012555998			
	Residual	6	11.68164861	1.946941					
	Total	7	35.77129568						
		Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
	Intercept[D]	-6.36572662	0.708890422	-8.97985	0.000107	-8.100320267	-4.631133	-8.10032027	-4.63113298
Change in Population:	X Variable 1	-1.5817E-06	4.49654E-07	-3.51754	0.012556	-2.68194E-06	-4.814E-07	-2.6819E-06	-4.8141E-07
Model #3: Semi Log (Linear-Log) Regression: Dependent = WTP/HH/Fish, Independent = Ln Increase in Population									
	SUMMARY OUTPUT								
	Regression Statistics								
	Multiple R	0.74458966							
	R Square	0.55441376							
	Adjusted R Square	0.48014939							
	Standard Error	0.00483493							

Model #3: Semi Log (Linear-Log) Regression: Dependent = WTP/HH/Fish, Independent = Ln Increase in Population (con't)

	Observations	8							
	ANOVA								
	SUMMARY OUTPUT								
	D	*f*	*SS*	*MS*	*F*	*Significance F*			
	Regression	1	0.000174515	0.000175	7.465407	0.034082345			
	Residual	6	0.000140259	2.34E-05					
	Total	7	0.000314774						
		Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
	Intercept	0.03620765	0.01235095	2.931568	0.026234	0.005985939	0.06642935	0.005985939	0.066429354
Change in Population:	X Variable 1	-0.00258785	0.000947137	-2.73229	0.034082	-0.004905415	-0.0002703	-0.00490541	-0.00027029

Model #4: Double Log Regression: Dependent = Ln WTP/HH/Fish, Independent = Ln Starting Population, Ln % Increase in Population

	SUMMARY OUTPUT								
	Regression Statistics								
	Multiple R	0.959090182							
	R Square	0.919853977							
	Adjusted R Square	0.887795568							
	Standard Error	0.757222169							
	Observations	8							
	ANOVA								
		f	*SS*	*MS*	*F*	*Significance F*			
	Regression	2	32.90436861	16.45218	28.69306	0.001818465			
	Residual	5	2.866927069	0.573385					
	Total	7	35.77129568						
		Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
	Intercept *D*	10.57283695	5.081136403	2.080802	0.091968	-2.488618648	23.634293	-2.48861865	23.63429255
% Change in Population:	X Variable 1	-1.03364099	0.437042011	-2.36508	0.064344	-2.157091409	0.0898094	-2.15709141	0.089809432
Starting Population:	X Variable 2	-1.08475033	0.230617682	-4.70367	0.00532	-1.677570989	-0.49193	-1.67757099	-0.49192968

Model Transfer - When the meta analysis effort proved unsuccessful, the various nonuse value studies were individually reviewed to select the most applicable study to the Joint Alternatives. The Layton, Brown, and Plummer (1999) study was selected for use since it applied a state-of-the-art valuation approach (contingent ranking/conjoint analysis); provided a good discussion of past, current, and future baseline or "with project" conditions; and was developed for the same species of fish in the same overall geographic area as the Storage Study. Especially helpful was the fact that the Layton, Brown, and Plummer study estimated a model as a function of fish populations. As a result, varying quantities of fish populations associated with the Joint Alternatives can be inserted into the model to estimate nonuse values across a wide range of fishery improvement conditions. Therefore, the Layton, Brown, and Plummer study was considered to be the most appropriate study for a model-based benefit transfer. The other studies did not allow for reapplication of a model and would require very simplistic value transfers as opposed to the more preferable model transfer. As suggested above, the position was taken that it may be acceptable to employ a model-based transfer within the appraisal-level and Draft PR/EIS analyses, but a simple value transfer would not be sufficient for a benefit category as potentially contentious as nonuse values. To reemphasize the point, while value transfer is a BT method, it was considered inadequate for nonuse valuation even at the appraisal- and Draft PR/EIS-levels.

While the Layton, Brown, and Plummer study had a number of advantages, it also has its disadvantages. As with any study within a benefits transfer context, there are certain aspects of the Layton, Brown, and Plummer study which were deemed to be either inconsistent with the Storage Study or simply inadequately described. The following list presents some of the more difficult to address issues. Two of the study's authors (i.e., Mark Plummer and David Layton) were contacted to try to get some resolution to these issues, but, in some cases, even the authors did not agree.

1) Fish populations—The survey used to gather data for development of the willingness-to-pay model asked respondents to rank fisheries improvement scenarios based on cost and migratory fish (salmon and steelhead) populations in 20 years. While there is always a tradeoff between providing too much versus too little information within a survey, several problems arose from this definition of the growth in fish populations.

    a. Which fish population—In subsequently trying to apply the model derived from the survey, the question arose as to which fish populations to apply—spawners, adults, or some other measure of

fish populations? Based on discussions with the authors, there is disagreement (one author interprets fish populations as adults whereas the other author interprets them as spawners). The definition of fish populations in the survey also said nothing about reflecting only T&E fish so, presumably, fish populations represent both T&E and non-T&E fish.

b. Fish population growth before year 20—The survey was silent on the growth of fish populations from year 0 to year 20. As a result, it cannot be distinguished which alternative has most of its growth in the first few years of the 20-year period versus an alternative which has most of it growth in the last few years.

c. Fish population growth after year 20—One of the authors suggested that the model estimates long-term average values compressed into a 20-year time period. Given the survey says nothing about the fish population growth after year 20, it appears to be a stretch to make this claim. If there is no way to tell what fish populations are expected to do after year 20, the model again would not be able to distinguish between alternatives with different growth patterns after year 20.

d. Year 20 fish populations or fish populations over 20 years—While the authors and Ecology seem to concur that the fish populations presented in the survey clearly reflect fish populations in year 20, others may not be so sure. In reviewing the survey, there is enough ambiguity in the wording of some of the questions that a respondent might interpret the fish population estimate as the total over 20 years. This uncertainty may result in variation in the value estimates.

2) Values—Without a clear definition of fish populations, it becomes difficult to determine what types of values are being obtained. As noted above, one author interprets migratory fish populations as salmon and steelhead spawners. Since spawners survive to produce future generations of fish, they obviously are not harvested (although they could be "nonconsumptively used" via catch-and-release fishing, fish viewing etc.) and, as a result, the values obtained could be considered primarily nonuse values. Even if one assumed fish populations to mean spawners, by not defining fish populations as T&E, some economists might argue that nonuse values might not be applicable (i.e., are non-T&E species unique enough to justify a nonuse value estimate?). Conversely, the other contacted author

interprets fish populations as adults which may or may not be harvested, implying the potential for both nonuse and harvest (use) values. This total value concept is typically assumed to refer to both nonuse values and recreational use values (as opposed to Tribal and commercial use values). If the Layton, Brown, and Plummer model results in total values, then one would not want to separately estimate ocean and in-river recreational fishing values for fear of double counting the benefit. If the model estimates primarily nonuse values, little-to-no double counting would occur and recreational fishing values should be separately estimated.

3) Human population for aggregation of values—The survey only gathered information from households across the State of Washington. So while use and nonuse values would undoubtedly accrue to households outside of Washington (at the very least, for households in the State of Oregon, which borders the Columbia River), from a technical perspective, one could question the use of households outside of Washington in the aggregation process.

It should be noted that there are really no right or wrong answers to the above issues since they are a matter of interpretation. Different people (including the study authors) can interpret the survey results differently. Obviously, the problem is that the interpretation is not clear, implying that survey respondents could have been valuing different scenarios based on their interpretations of the survey questions. Ideally, one should not have to make an educated guess as to what the survey questions and, ultimately, the survey results mean. However, as noted above, survey researchers often have to make tradeoffs between providing too much information (resulting in longer survey instruments and reduced response rates) versus providing not enough information (resulting in ambiguous questions and valuation interpretation problems).

Despite the apparent inconsistency between the interpretations of the study authors, for the preliminary nonuse valuations developed for the Storage Study appraisal-level BCA, the approach suggested by the Layton, Brown, and Plummer study's lead author was used (i.e., use spawner estimates in the model and assume the valuation results reflect nonuse values only). This is also the position taken by Ecology, who funded the Layton, Brown, and Plummer study and has been interpreting the Layton, Brown, and Plummer model in this way since the study was completed in 1999.

The actual BT-based nonuse value results associated with the range of preliminary fish population estimates by alternative evaluated in the Storage Study appraisal-level BCA are not presented. However, given the best-case

scenario, that high-end benefit-cost ratios for the appraisal-level benefit-cost analyses were calculated at approximately .3 to 1, inclusion of the nonuse value estimates did not critically affect the benefit-cost result. This implies that even the high-end benefit estimates, inclusive of BT-based nonuse values plus all other benefit categories (i.e., agriculture, fisheries, recreation, municipal, and hydropower), only covered about 30 percent of the estimated project costs in the appraisal-level BCA. It should be noted that the BT-based nonuse value estimates developed for the appraisal-level BCA may also have been somewhat optimistic in that all additional spawner populations (not simply the additional T&E spawner populations) were used in the calculation. With the controversy over nonuse values in general and nonuse value estimation approaches in particular, questions about the applicability of nonuse values to the range of fishery resources associated with the Storage Study, and the apparent insensitivity of the appraisal-level benefit-cost result to the inclusion of nonuse values, the decision was made to forego pursuing a site- and study-specific nonuse value survey and simply exclude quantification of nonuse values from the feasibility-level BCA. Instead, a qualitative discussion of nonuse values is included in the Final PR/EIS.

Chapter 3. REGIONAL ECONOMIC DEVELOPMENT ECONOMIC IMPACT ANALYSIS

This section describes the methodology and results of the regional economic development (RED) impact analysis conducted for the Storage Study. Regional economic impacts stem from changes in construction expenditures, operation and maintenance expenditures, gross farm income, and recreational expenditures for each alternative as compared to the No Action Alternative. The regional economic impact analysis comprises the RED account. The NED account compares the alternatives from a national perspective, whereas the RED account measures how the alternatives impact the region's local economy.

The RED analysis includes not only the initial or direct impact on the primary affected industries, but also the secondary impacts resulting from those industries providing inputs to the directly affected industries as well. This also includes the changes in economic activity stemming from household spending of income earned by those employed in the sectors of the economy impacted either directly or indirectly. These secondary impacts are often referred to as "multiplier effects."

The NED economic benefits are not used directly in the RED analysis; only the physical changes are carried over from the NED analysis. For example, changes in agricultural water supply may result in a change in crop acreages which subsequently result in a change in gross farm income. The change in gross farm income reflects the direct economic impact in the RED analysis which, after being run through the regional economic model, generates the secondary or multiplier effects. The NED benefits analysis uses net farm income as defined by the *P&Gs* as the estimate of agricultural benefits.

See section 2.8 of the Final PR/EIS, Comparative Evaluation of Alternatives for further explanation on the difference between the NED and RED accounts.

3.1 Methodology and Assumptions

The study area encompasses Kittitas, Yakima, Benton, and Franklin Counties of Washington State. Ellensburg, Yakima, and the Tri-Cities (Richland, Pasco, and Kennewick) are the largest cities located within the study area. The Yakima River basin includes all of these counties except Franklin County. Franklin

County was included because the Tri-Cities are located in both Franklin and Benton Counties.

The common measures of regional economic impacts are output, employment, and labor income. Output is the dollar value of production (sales revenues and gross receipts) from all industries in the region. Labor income is a measure of employee compensation (wages and benefits) plus income for self-employed individuals. Employment is the number of jobs, both full-time and part-time, in a particular sector.

The regional impacts in the analysis of the Joint Alternatives are a result of:

1) Construction expenditures made within the study area

2) Regional operation and maintenance expenditures

3) Changes in gross farm income related to the alternatives, and

4) Regional expenditures related to recreation visitation.

The regional economic impact analysis involves running alternative-specific estimates of expenditures or gross farm income through a regional impact model generated for the study area. IMPLAN (IMpact, Analysis, for PLANning) was selected for this analysis. IMPLAN is an input-output modeling system that estimates the effects of economic changes in a region.

3.2 Construction Costs

The construction-related expenditures associated with each of the alternatives were placed into categories that represent different sectors of production in the economy. The construction expenditures that are made inside the study region were considered in the regional impact analysis. Construction expenditures made outside the four-county area were considered "leakages" and would have no impact on the local economy.

The RED study assumes that the workforce would move to the region and spend their wages inside the area during the construction period. This analysis also assumed that the vast majority of the construction expenditures will be funded from sources outside the four-county study area. Money from outside the region that is spent on goods and services within the region would contribute to regional economic impacts, while money that originates from within the study region is much less likely to generate regional economic impacts. Spending from sources

within the region represents a redistribution of income and output rather than an increase in economic activity.

For the purpose of this study, the total construction costs were used to measure the overall regional impacts. These overall impacts would be spread over the construction period and would vary year-by-year proportionate to actual expenditures.

Table 3–1, Table 3–2, and Table 3–3 summarize the in-region construction costs used in this analysis.

Table 3–3 summarizes the Yakima Pump Exchange costs. These costs were added to the Wymer costs shown in Table 3–2 to estimate the Wymer Plus alternative.

Table 3–1. Black Rock in-region costs and IMPLAN sector (million $)

	Total Cost	In Region costs and sector		
		IMPLAN sector	Non-wages	Wages
Intake - Civil/Structural	$69	Other New Construction	40.21	29.03
Intake – Mechanical	$11	Other New Construction	6.4	4.27
Plant - Civil/Structural	$108	Other New Construction	66.46	41.54
Plant – Mechanical	$44	Other New Construction	28.22	15.79
Plant – Electrical	$2	Other New Construction	1.31	0.87
Switchyard & Transmission Line	$15	Other New Construction	9	6
Discharge 1	$242	Other New Construction	151	91
Central Core Rockfill Dam	$1,155	Other New Construction	696	459
River Outlet Works	$89	Other New Construction	50	39
Main Seepage Collection	$85	Other New Construction	51	34
Outflow Conveyance	284	Other New Construction	178	106
Plant	$34	Other New Construction	19.5	14.6
Electrical	1.21	Other New Construction	.73	.49
Switchyard	.30	Other New Construction	0.18	0.12
Sunnyside Delivery System: Civil and Structural Subtotal	12	Other New Construction	7	5
Sunnyside Delivery System: Electrical Subtotal	4.33	Other New Construction	2.6	1.73
Sunnyside Delivery System: Switchyard Subtotal	0.49	Water Sewer and Pipeline Construction	0.29	0.20
Highway and Utility Relocations	$109.68	Highway, Street, Bridge, and Tunnel Construction	65.81	43.87
Mechanical	24.12	Water Sewer and Pipeline Construction	14.61	9.52

Table 3–2. Wymer in-region construction costs and IMPLAN sector (million $)

	Total Costs	In Region Costs and Sector		
		IMPLAN Sector	Non-Wages	Wages
Yakima River -- Wymer Pumping Plant Intake	9.6	Other New Construction	5.3	4.3
Pumping Plant	25.6	Other New Construction	15	10.6
Switchyard & Transmission Line	1.7	Other New Construction	1.0	0.7
Dam & Dike	309.5	Other New Construction	184.9	124.6
Spillway & Outlet Works	34	Other New Construction	19	15
Diversion & Care	3.5	Other New Construction	2.2	1.3
Road & Creek Improvements	3.4	Highway, Street, Bridge, and Tunnel Construct.	2.0	1.4
Discharge Pipeline	33	Water Sewer and Pipeline Construction	20	13

Table 3–3. Wymer Pump Exchange (Wymer dam not included) in-region construction costs and IMPLAN sector

	Total Cost	In Region Costs and Sector		
		IMPLAN Sector	Non-Wages	Wages
Pumping Plant #1	41	Other New Construction	24.54	16.48
Pumping Plant #2	69.3	Other New Construction	41.17	28.14
Pumping Plant #3 -- Plan 2	29	Other New Construction	17.41	11.61
Pumping Plant Intake	13	Water Sewer and Pipeline Construction	7.60	5.59
Discharge Pipelines	621.8	Water Sewer and Pipeline Construction	373.13	248.75
Deliveries	0.45	Water Sewer and Pipeline Construction	0.27	0.18

3.2.1 Results

Regional economic impacts related to construction expenditures, incremental to the No Action Alternative, for each Joint Alternative, are presented in Table 3–4. The employment, output, and income generated from each alternative's expenditures are compared to the overall regional economy. The estimated impacts are representative of the entire construction period. These impacts would not occur each year; they vary year-by-year proportionate to annual expenditures. The majority of the employment, output, and income impacts are due to the expenditures of the wages earned by the workforce involved in the construction project and the construction activities.

Table 3–4. Summary of regional economic impacts stemming from construction expenditures

	Black Rock			Wymer			Wymer Plus		
	Labor Income (million $)	Employment (jobs)	Output (million $)	Labor Income (million $)	Employment (jobs)	Output (million $)	Labor Income (million $)	Employment (jobs)	Output (million $)
Ag, Forestry, Fish, and Hunting	5.9	276.8	21.9	1.1	51.2	4.1	3.0	140.0	11.0
Mining	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Utilities	1.7	21.3	10.2	0.3	3.9	1.9	0.9	11.0	5.2
Construction	651.9	14,248.00	1,405.1	116.8	2,554.5	251.6	313.3	6,829.0	718.8
Manufacturing	14.1	309.8	77.6	2.6	56.8	14.1	6.5	144.0	36.4
Wholesale Trade	32.6	764.9	86.7	6.0	140.7	15.9	17.2	404.0	45.8
Transportation and Warehousing	20.5	509.5	46.8	3.7	92.2	8.4	11.5	285.0	26.9
Retail trade	84.3	3,380.30	207.9	15.6	623.8	38.4	42.5	1,700.0	104.6
Information	10.5	230.8	48.4	1.9	42.5	8.9	5.3	116.0	24.3
Finance and insurance	24.6	544.5	89.7	4.5	100.4	16.5	12.7	282.0	46.5
Real estate and rental	15.9	597.4	81.9	2.9	109.8	15.0	8.3	308.0	42.8
Professional-scientific and technical services	80.9	1,283.70	144.5	14.8	235.6	26.5	40.1	641.0	71.8
Management of companies	4.2	62.7	9.6	0.8	11.5	1.8	2.1	32.0	4.9
Administrative and waste services	19.6	837.7	37.2	3.6	154.2	6.9	9.1	388.0	17.5
Educational services	6.4	343.7	13.7	1.2	63.6	2.5	3.3	176.0	7.0
Health and social services	126.8	3,270.20	236.8	23.5	604.7	43.8	64.7	1,667.0	120.8
Arts-entertainment and recreation	7.2	448.3	20.2	1.3	82.9	3.7	3.7	229.0	10.3
Accommodation and food services	34.4	2,218.90	104.0	6.4	410.6	19.2	17.6	1,134.0	53.2
Other services	35.7	1,769.30	88.5	6.6	326.5	16.3	18.3	902.0	45.6
Government and non-NAICs	18.5	296.3	272.9	3.4	54.6	50.5	9.4	150.0	139.3
Institutions	0.0	0	376.0	0.0	0.0	71.0	0.0	0.0	199.1
Total	1195.8	31,414.40	3,379.8	217.0	5,720.1	617.1	589.4	15,538.0	1,731.7

The total number of jobs for the Black Rock Alternative during the approximate 10-year construction period, 31,414, includes 14,145 direct construction jobs. Thus, assuming a 10-year construction period, an average of about 1,415 of the 3,140 average annual jobs would be directly related to construction and include onsite and offsite labor. The 14,145 direct construction jobs would be about 6 percent of the regional 2004 employment, while the total number of jobs, 31,414, would be about 8 percent. The average annual direct and average annual total number of jobs, 1,415 and 14,145, respectively, would be about 1 percent of the regional 2004 employment.

The total number of jobs for the Wymer Dam and Reservoir Alternative during the approximate 10-year construction period, 5,700, includes 2,535 direct construction jobs. Thus, assuming a 10-year construction period, an average of about 255 of the 570 average annual jobs would be directly related to construction and include onsite and offsite labor. The 2,535 direct construction jobs would be about 1 percent of the regional 2004 employment, while the total number of jobs, 5,700, would be about 2 percent. The average annual direct and average annual total number of jobs, 255 and 570, respectively, would be less than three-tenths of 1 percent of the regional 2004 employment.

The total number of jobs for the Wymer Dam Plus Yakima River Pump Exchange Alternative during the approximate 10-year construction period, 15,539, includes 6,776 direct construction jobs. Thus, assuming a 10-year construction period, an average of about 680 of the 1,550 average annual jobs, would be directly related to construction and include onsite and offsite labor. The 6,776 direct construction jobs would be slightly less than 3 percent of the regional 2004 employment, while the total jobs, 15,539, would be about 6 percent. The average annual direct and average annual total number of jobs, 680 and 1,550, respectively, would be less than 1 percent of the regional 2004 employment.

3.3 Operation, Maintenance, and Replacement

Expenditures that are made inside the study region related to OM&R will also generate a positive economic output to the regional economy. Estimating regional impacts resulting from OM&R expenditures is difficult because they occur during different periods of time. For example, expenditures related to operations and maintenance occur annually, whereas replacement expenditures occur periodically based on the replacement schedule.

This analysis quantifies annual impacts resulting from annual costs related to operation and maintenance. The analysis does not quantify the positive impacts resulting from replacement costs since they are spread out over the entire study period. Like the construction-related expenditures, O&M expenditures made inside the study area associated with each alternative were placed into categories related to the each sector of the economy and run through IMPLAN to estimate impacts to the regional economy. Table 3–5 summarizes the in-region expenditures used in this analysis.

Table 3–5. In region O&M costs and IMPLAN sector

O&M	Total	In-region Labor	IMPLAN sector	In-region Nonlabor	IMPLAN sector
Black Rock	$10,170,000	$2,441,098	Medium Household Income	$626,860	Other New Construction
Wymer	$1,080,000	$566,251	Medium Household Income	$234,015	Other New Construction
Wymer Plus Pump Exchange	$18,198,000	$883,771	Medium Household Income	$6,682,695	Other New Construction

3.3.1 Results

Regional economic impacts related to O&M expenditures incremental to the No Action Alternative for each alternative are shown in Table 3–6. The employment, output, and income generated from each alternative's O&M are compared back to the overall economy. These impacts are assumed to occur on an annual basis. Like the construction impacts, the majority of the O&M impacts are due to the expenditures of the wages earned by the workforce involved O&M-related activities.

Table 3–6. Regional economic impacts stemming from annual O&M expenditures

	Black Rock			Wymer			Wymer Plus		
	Labor Income ($)	Employment (jobs)	Output ($)	Labor Income ($)	Employment (jobs)	Output ($)	Labor Income ($)	Employment (jobs)	Output ($)
Ag, Forestry, Fish, and Hunting	9,783	0.5	36,431	2,447	0.1	9,098	16,495	0.7	60,372
Mining	6	0	76	2	0	20	19	0	172
Utilities	2,813	0	16,895	703	0	4,219	4,690	0.1	28,001
Construction	298,478	6.5	643,422	110,601	2.4	238,230	3,121,910	68.3	6,715,981
Manufacturing	16,919	0.4	99,250	4,522	0.1	26,121	49,680	1.1	261,657
Wholesale Trade	47,650	1.1	126,762	12,195	0.3	32,442	100,438	2.4	267,193
Transportation and Warehousing	26,604	0.7	61,281	6,952	0.2	15,978	66,537	1.6	150,655
Retail trade	134,228	5.3	329,262	33,795	1.3	82,980	242,328	9.8	600,264
Information	15,516	0.3	71,281	3,966	0.1	18,225	32,363	0.7	148,946
Finance and insurance	39,092	0.9	143,750	9,840	0.2	36,130	70,379	1.6	254,979
Real estate and rental	21,705	0.9	112,354	5,636	0.2	29,134	51,674	1.8	264,445
Professional-scientific and technical services	57,648	1.1	108,430	18,054	0.3	33,348	361,959	5.4	636,457
Management of companies	6,006	0.1	13,899	1,541	0	3,566	12,927	0.2	29,915
Administrative and waste services	22,086	0.9	44,544	6,019	0.3	11,949	73,283	3.1	133,896
Educational services	11,456	0.6	24,463	2,823	0.2	6,027	16,187	0.9	34,566
Health and social services	221,596	5.70	413,323	54,819	1.4	102,270	329,145	8.5	615,473
Arts--entertainment and recreation	12,484	0.8	35,042	3,093	0.2	8,680	18,879	1.2	52,867
Accommodation and food services	60,965	3.9	184,439	15,043	1	45,504	87,739	5.6	265,012
Other services	55,539	2.9	136,294	14,043	0.7	34,509	104,574	4.9	260,141
Government and non-NAICs	30,075	0.5	485,755	7,541	0.1	119,776	52,061	0.8	692,971
Institutions	0	0	1,012,788	0	0	234,932	0	0	366,668
Total	1,090,649	33	4,099,741	313,635	9	1,093,138	4,813,267	119	11,840,631

3.4 Irrigated Agriculture

Regional economic impacts are realized only in drought years when the proration level is below 70 percent. Table 2–23 in section 2.3.1 of this document summarizes the proration levels for the 6 years where the proration levels dropped below 70 percent. During these years, positive regional impacts are attributable to the Joint Alternatives. During these 6 dry years, the alternatives increase the water supply available to irrigated agriculture.

The YAI model discussed earlier was used to estimate the changes in gross onfarm income incremental to the No Action Alternative. The crops modeled in the YAI model were aggregated into the IMPLAN sectors and summarized in Table 3–7. Table 3–8 summarizes the gross onfarm income which was run through IMPLAN to estimate regional impacts.

It should be noted that this analysis measures the impacts stemming from production agriculture. Industries that rely on irrigated crops as part of their production process, for example, food processing or livestock industries, will also be positively impacted by the alternatives.

Table 3–7. Representative crop table

IMPLAN sector	Crops included
Vegetables	Asparagus, Sweet Corn, Potato
Fruits	Cherries, Pears, Apples
Other	Mint, Hops, Concord Grapes, Wine Grapes, Timothy Hay, Alfalfa, Silage
Grains	Wheat

Table 3–8. Gross onfarm income summary

Alternative	Year	Grains ($)	Other ($)	Fruits ($)	Vegetables ($)
Black Rock	1987	556,579	17,232,110	16,043,770	1,129,626
	1992	428,138	13,255,040	12,347,810	868,943
	1993	685,021	21,206,100	19,804,730	1,393,283
	1994	1,840,993	55,196,340	88,008,910	4,932,981
	2001	1,113,159	34,101,480	43,542,390	2,964,663
	2005	1,070,345	32,796,050	41,392,080	2,821,306
Wymer and Wymer Plus	1987	171,255	5,302,016	4,939,123	347,577
	1992	256,883	7,953,024	7,408,685	521,366
	1993	470,952	14,578,580	13,630,830	958,812
	1994	85,628	2,086,366	6,944,756	32,920
	2001	642,207	19,520,940	29,959,800	2,008,826
	2005	171,255	5,221,744	8,601,246	573,428

3.4.1 Results

Table 3–9 and Table 3–10 show the regional economic impacts for the years where the proration level fell below 70 percent for Black Rock and Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives, respectively. These results are shown on an annual basis because dry years do not occur each year in the period of record.

Table 3–9. Regional economics impacts stemming from changes in gross onfarm production for the Black Rock Alternative.

	1987			1992			1993			1994			2001			2005		
	Labor Income ($)	Employment (jobs)	Output ($)	Labor Income ($)	Employment (jobs)	Output ($)	Labor Income ($)	Employment (jobs)	Output($)	Labor Income ($)	Employment (jobs)	Output($)	Labor Income ($)	Employment (jobs)	Output($)	Labor Income ($)	Employment (jobs)	Output($)
Ag, Forestry, Fish, and Hunting	13,866,143	439.4	38,678,232	10,669,217	338.1	29,759,350	17,094,462	541.7	47,670,852	62,528,400	1,978	166,979,776	33,397,480	1,055.90	90,741,160	31,874,860	1,007.80	86,685,752
Mining	86	0	1,309	66	0	1,007	106	0	1,612	338	0	5,156	191	0	2,907	182	0	2,783
Utilities	20,618	0.3	119,290	15,864	0.2	91,784	25,414	0.4	147,035	90,246	1	521,803	48,758	0.7	281,990	46,566	0.6	269,314
Construction	63,363	1.4	146,134	48,752	1.1	112,438	78,098	1.7	180,117	275,497	6	635,416	149,217	3.3	344,153	142,528	3.1	328,727
Manufacturing	250,904	4.9	2,272,304	193,051	3.8	1,748,338	309,268	6.1	2,800,618	1,101,938	22	9,828,431	594,180	11.9	5,329,431	567,433	11.4	5,091,297
Wholesale trade	447,860	10.5	1,191,427	344,600	8.1	916,727	552,094	13	1,468,715	1,998,437	47	5,316,373	1,071,152	25.2	2,849,548	1,022,572	24	2,720,313
Transportation and warehousing	277,962	7.1	666,160	213,870	5.4	512,555	342,622	8.7	821,092	1,220,739	31	2,906,881	658,663	16.8	1,572,443	628,999	16	1,501,834
Retail trade	566,840	22.5	1,389,958	436,149	17.3	1,069,490	698,793	27.7	1,713,523	2,545,441	101	6,241,482	1,361,665	54	3,338,882	1,299,707	51.5	3,186,960
Information	82,608	1.8	374,299	63,561	1.4	288,000	101,836	2.2	461,425	369,892	8	1,677,153	198,083	4.4	897,898	189,082	4.2	857,084
Finance and insurance	229,885	5.1	850,312	176,879	3.9	654,250	283,365	6.3	1,048,121	1,012,330	22	3,740,087	545,524	12.1	2,016,374	520,929	11.5	1,925,513
Real estate and rental	230,399	9.4	1,259,919	177,267	7.3	969,370	283,933	11.6	1,552,635	974,986	40	5,315,061	533,903	21.9	2,914,195	510,271	20.9	2,785,394
Professional-scientific and technical services	266,094	5.5	523,895	204,745	4.3	403,108	328,047	6.8	645,866	1,201,562	25	2,362,849	640,979	13.3	1,261,103	611,753	12.7	1,203,633
Management of companies	41,239	0.6	95,436	31,731	0.5	73,432	50,835	0.8	117,643	182,829	3	423,107	98,238	1.5	227,345	93,796	1.4	217,065
Administrative and waste services	119,513	4.7	255,544	91,956	3.6	196,621	147,315	5.7	314,987	525,706	21	1,121,169	283,455	11.1	605,141	270,681	10.6	577,901
Educational services	49,180	2.6	104,889	37,841	2	80,706	60,629	3.2	129,307	221,009	12	471,349	118,195	6.3	252,078	112,815	6	240,604
Health and social services	1,035,076	27.00	1,937,083	796,430	20.8	1,490,472	1,276,037	33.3	2,388,027	4,652,286	121	8,706,460	2,487,882	64.9	4,655,918	2,374,632	61.9	4,443,976
Arts-entertainment and recreation	59,282	3.7	166,382	45,614	2.8	128,022	73,083	4.5	205,116	266,568	16	748,193	142,520	8.8	400,013	136,031	8.4	381,801
Accommodation and food services	260,814	16.8	788,065	200,681	12.9	606,369	321,529	20.7	971,516	1,170,971	75	3,538,230	626,439	40.3	1,892,846	597,938	38.5	1,806,727
Other services	283,118	13.9	694,735	217,841	10.7	534,554	349,014	17.1	856,427	1,265,081	62	3,099,853	678,037	33.3	1,662,294	647,255	31.8	1,586,880
Government and non-NAICs	221,980	3.5	2,355,202	170,796	2.7	1,812,175	273,618	4.3	2,903,344	975,744	15	10,504,348	526,309	8.3	5,634,098	502,595	7.9	5,378,534
Institutions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	18,372,964	581	53,870,575	14,136,911	447	41,448,768	22,650,098	716	66,397,978	82,580,000	2,608	234,143,177	44,160,870	1,394	126,879,816	42,150,625	1,330	121,192,089

Table 3–10. Regional economic impacts Stemming from changes in gross onfarm production for the Wymer Dam and Wymer Dam Plus Yakima River Pump Exchange Alternatives

	1987			1992			1993			1994			2001			2005		
	Labor Income ($)	Employment (jobs)	Output ($)	Labor Income ($)	Employment (jobs)	Output ($)	Labor Income ($)	Employment (jobs)	Output($)	Labor Income ($)	Employment (jobs)	Output($)	Labor Income ($)	Employment (jobs)	Output ($)	Labor Income ($)	Employment (jobs)	Output ($)
Ag, Forestry, Fish, and Hunting	4,267,687	135.2	11,903,739	6,401,530	202.9	17,855,610	11,759,857	372.7	32,791,184	4,039,308	129	10,274,031	21,661,356	683.90	58,005,916	6,090,542	192.20	16,221,795
Mining	26	0	403	40	0	604	73	0	1,109	19	0	284	118	0	1,800	33	0	497
Utilities	6,346	0.1	36,713	9,518	0.1	55,070	17,482	0.2	101,143	5,654	0	32,672	31,308	0.4	181,028	8,770	0.1	50,707
Construction	19,501	0.4	44,975	29,251	0.6	67,463	53,721	1.2	123,898	17,156	0	39,568	95,589	2.1	220,472	26,754	0.6	61,707
Manufacturing	77,221	1.5	699,335	115,831	2.3	1,049,003	212,743	4.2	1,926,449	69,660	2	613,034	381,824	7.7	3,406,260	106,990	2.2	952,544
Wholesale trade	137,840	3.2	366,691	206,760	4.9	550,036	379,794	8.9	1,010,352	128,265	3	341,220	692,092	16.3	1,841,149	194,321	4.6	516,946
Transportation and warehousing	85,548	2.2	205,022	128,322	3.3	307,533	235,687	6	564,814	76,780	2	181,517	423,406	10.8	1,008,632	118,657	3	282,437
Retail trade	174,460	6.9	427,796	261,690	10.4	641,694	480,719	19.1	1,178,778	163,819	7	401,675	881,901	35	2,162,445	247,834	9.8	607,693
Information	25,425	0.6	115,200	38,137	0.8	172,800	70,055	1.5	317,425	23,743	1	107,735	128,165	2.8	581,098	36,004	0.8	163,256
Finance and insurance	70,752	1.6	261,700	106,127	2.4	392,550	194,926	4.3	720,996	63,960	1	236,011	350,957	7.8	1,296,700	98,383	2.2	363,448
Real estate and rental	70,907	2.9	387,748	106,360	4.4	581,622	195,299	8	1,067,951	58,778	2	319,231	338,909	13.9	1,847,890	94,529	3.9	515,209
Professional-scientific and technical services	81,898	1.7	161,243	122,847	2.6	241,865	225,675	4.7	444,312	78,159	2	153,465	415,759	8.7	817,684	116,901	2.4	229,881
Management of companies	12,692	0.2	29,373	19,038	0.3	44,059	34,970	0.5	80,927	11,659	0	26,980	63,335	1	146,571	17,768	0.3	41,120
Administrative and waste services	36,782	1.4	78,648	55,174	2.2	117,973	101,337	4	216,676	33,138	1	70,472	182,304	7.1	388,858	51,099	2	108,961
Educational services	15,136	0.8	32,282	22,705	1.2	48,424	41,708	2.2	88,954	14,233	1	30,355	76,570	4.1	163,302	21,520	1.2	45,896
Health and social services	318,572	8.30	596,189	477,858	12.5	894,283	877,822	22.9	1,642,791	299,651	8	560,776	1,611,810	42	3,016,401	453,007	11.8	847,773
Arts-entertainment and recreation	18,246	1.1	51,209	27,368	1.7	76,813	50,276	3.1	141,105	17,184	1	48,233	92,345	5.7	259,190	25,955	1.6	72,850
Accommodation and food services	80,272	5.2	242,548	120,409	7.7	363,822	221,188	14.2	668,332	75,357	5	227,705	405,689	26.1	1,225,840	114,005	7.3	344,480
Other services	87,137	4.3	213,821	130,705	6.4	320,732	240,093	11.8	589,151	81,009	4	198,240	438,412	21.5	1,074,285	123,128	6.1	301,658
Government and non-NAICs	68,318	1.1	724,870	102,478	1.6	1,087,305	188,220	3	1,997,257	61,412	1	671,255	338,433	5.3	3,640,708	94,855	1.5	1,022,263
Institutions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	5,654,766	179	16,579,505	8,482,148	268	24,869,261	15,581,645	493	45,673,604	5,318,944	169	14,534,459	28,610,282	902	81,286,229	8,041,055	254	22,751,121

3.5 Recreation

Regional economic effects stemming from changes in recreation activity develop from in-region recreational expenditures for such items as hotels and motels, restaurants, groceries, gasoline, etc. Changes in regional recreation expenditures can result in gains or losses in regional output, income, and employment.

This section describes the methodology for estimating regional economic impacts for recreation as well as the results of the analyses.

3.5.1 Methodology

Economic impacts associated with changes in recreation activity within the region were estimated for both the proposed reservoirs and existing reservoirs and rivers. As noted in the recreation benefit section, changes in existing reservoir water levels and river instream flows occur as a result of the operation of the proposed Black Rock and Wymer reservoirs. These changes in hydrologic water level and instream flow conditions generate changes in recreation visitation at each site for each Joint Alternative (i.e., Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives) as compared to the No Action Alternative. Estimates of changes in visitation by site were obtained from the recreation analysis. Since the potential Black Rock and Wymer reservoirs are obviously not a part of the No Action Alternative, the estimates of visitation for these potential reservoirs reflect the full change in visitation as compared to the No Action Alternative.

In regional economic impact analyses of recreation, the assumption is typically made that the majority of impacts are generated by expenditures from recreators residing outside the region, since their expenditures reflect an undeniable positive inflow to the local economy. Within-region or local recreators are generally assumed to spend the majority of their money within the region regardless of the alternatives under consideration, implying they would generate little by way of additional regional economic activity. Stated differently, if the proposed alternatives were not pursued, local recreators would still be expected to spend the majority of their money within the region anyway. The visitation estimates were assumed to reflect changes in visitation at each site compared to the No Action Alternative. A gain in visitation for local recreators would imply a shift in within-region spending from No Action Alternative expenditures for nonrecreational goods and services to recreation expenditures under the Joint Alternatives. While it is possible that somewhat different levels of regional economic impacts could result from the same level of spending across different expenditure categories

(i.e., nonrecreational to recreational), this variation in regional economic impacts was assumed to be relatively minor. As a result, the analysis focuses on in-region expenditures by nonlocal recreators.

Potential Economic Development Around Black Rock Reservoir: Assuming Black Rock Reservoir is constructed, certain local interests plan on pursuing the idea of a recreational resort as well as residential and commercial developments around the reservoir. While no developers have come forward thus far, some basic conceptual plans have been proposed (YBSA, 2007). The plans call for significant levels of resort, residential, and commercial development resulting in sizable increases in property values compared to current conditions. Conversely, other local interests see the proposed development concepts as pure speculation. They claim that such proposed developments are unlikely given the significant degree of annual reservoir drawdown expected at Black Rock, the less than pristine natural setting compared to mountain reservoirs in the region, and the fact that development around other reservoirs in similar settings in the general vicinity of the proposed Black Rock Reservoir have not materialized (e.g., Desert Aire at Priest Rapids Lake).

The assumption was made in the economic benefit-cost analysis that if Black Rock was not constructed, potential developers would invest in developments elsewhere in the nation, resulting in little change from a national perspective. As a result, any potential development would not constitute a benefit to the Nation, since the investment could be considered part of the No Action Alternative and therefore would be made regardless of the alternative selected in this study. Despite failing to reflect a national benefit, any development around Black Rock reservoir would represent a positive economic impact to the region's local economy.

3.5.1.1 Changes in Visitation by Nonlocal Recreators

Initial or current condition estimates of changes in visitation as compared to the No Action Alternative were obtained for each site and Joint Alternative from the *Yakima River Basin Reservoir and River Recreation Survey Report of Findings* (Reclamation, 2008a). As discussed above under section 2.3.3, Recreation Benefits, the initial changes in visitation estimates were used as the starting point in a series of visitation projections by site and alternative over the 100-year benefits period. The average annual change in visitation by alternative across the 100-year benefits period was used in this RED analysis (see tables Table 2–30 and Table 2–31 for the proposed Black Rock and Wymer reservoirs; and Table 2-37 through Table 2–48 for the existing Kachess Lake, Cle Elum Lake, Yakima River, and Tieton River sites under the Black Rock, Wymer Dam and Reservoir, Wymer Dam Plus Yakima River Pump Exchange Alternatives). Since

these average annual changes in visitation obviously include both local and nonlocal recreators, estimates of the nonlocal portion of the visitation change had to be developed. For the existing reservoir and river sites, the nonlocal visitation percentage was estimated based on the results of the recreation survey. For the proposed reservoirs, the nonlocal visitation percentage was estimated by activity based on professional judgment (see percentages listed below). Applying the nonlocal visitation percentages by site to the estimates of the average annual change in visitation by alternative and site provides an estimate of the nonlocal change in visitation by site and alternative.

Nonlocal Visitation Percentages by Site:

Existing Sites:

1) Yakima River: 50% (from recreation survey)
2) Tieton River: 78% (from recreation survey)
3) Kachess Lake: 86% (from recreation survey)
4) Cle Elum Lake: 66.3% (from recreation survey)

Proposed New Sites:

5) Black Rock Reservoir: 28% (see Table 3–11 below)
6) Wymer Reservoir: 0% (Recreation analysis assumed that visitation was entirely comprised of local area residents)

Table 3–11. Nonlocal visitation percentage for the Black Rock Alternative

Activity	Total # annual visits (1,000)	% Local	% Nonlocal	# Local visits (1,000)	# Nonlocal visits (1,000)
Boat Fishing	100	0.5	0.5	50	50
Shoreline Fishing [1]	40	0.8	0.2	32	8
Swimming [1]	60	0.8	0.2	48	12
Picnicking [1]	60	0.8	0.2	48	12
Water & Jet Ski	100	0.7	0.3	70	30
Walking	12	1	0	12	0
Wildlife Viewing	12	1	0	12	0
Horseback Riding	8	1	0	8	0
ORV Riding	8	1	0	8	0
Total visits	400	72	28	288	112

[1] Shoreline fishing, swimming, and picnicking activities were assumed to be "predominantly local" by the recreation analysis. With water and jet skiing assumed at 70% local by the recreation analysis, we assumed "predominantly local" reflected an even higher percentage. For this analysis, "predominantly local" was considered as 80% local. *Source: Yakima River Basin Reservoir and River Recreation Survey Report of Findgs* (Reclamation, 2008a)

In addition, these estimates of the nonlocal change in visitation by site and alternative were measured in terms of visitor days. Given the expenditures per visit (as discussed in the next section) are measured in terms of trips and not visitor days, a conversion had to be made between visitor days and trips. The average number of days per trip, as obtained from the recreation survey (i.e., Kachess Lake = 5.3, Cle Elum Lake = 5.0, Yakima River = 3.7, and Tieton River = 3.58), were divided into the change in nonlocal visitor days to estimate the change in nonlocal trips by site and alternative. For the proposed Black Rock reservoir, the days-per-trip estimate from Cle Elum Lake was applied based on a comparison of the sites. (As noted above, RED impacts were not estimated for Wymer reservoir since visitation was assumed to be comprised of local residents.)

3.5.1.2 Recreation Expenditures per Visit by Site

The estimates of the average annual change in visits or trips[4] as compared to the No Action Alternative by site and alternative for nonlocal recreators were multiplied by estimates of nonlocal recreator, in-region expenditures per visit by site to calculate the change in average annual nonlocal recreator in-region expenditures by site and alternative. Changes in alternative-specific, in-region recreational expenditures were aggregated across the existing sites. The expenditures associated with the proposed Black Rock reservoir were kept separate. These estimates of the changes in alternative-specific average annual in-region recreational expenditures by nonlocal residents were then run through the IMPLAN model to estimate the alternative-specific regional economic impacts in terms of output, income, and employment within the four-county region associated with the estimated changes in recreation activity. Separate regional economic impact estimates were developed for the existing recreation sites versus the proposed Black Rock reservoir.

This section presents information on the nonlocal-recreator, in-region expenditures per visit as obtained from the recreation survey. Given that nonlocal-recreator, in-region expenditures per visit vary by site, the survey was conducted across all the existing reservoirs and rivers within the region. Survey questions asked recreators to estimate their total expenditures for the current visit, the portion of those expenditures incurred within the local region, and the breakdown of expenditures into various expenditure categories (e.g., lodging, food, gas, etc.). This later piece of information was necessary to help subdivide the expenditures across the 500+ economic sectors included in the IMPLAN model.

[4] Note that visits and trips are equivalent terms.

Table 3–12 presents the results of the total-expenditures-per-trip question by site for nonlocal recreators. Note that the data is only presented for the four existing sites expected to be impacted by the alternatives under consideration (i.e., Kachess Lake, Cle Elum Lake, Yakima River, and Tieton River). The information on average total expenditures per trip was obtained by recreation activity from the survey. In the final analysis, a weighted, average expenditure per trip was estimated for each site by weighing the expenditure-per-trip estimates by activity by their frequencies of occurrence within the overall survey. The estimates of weighted average expenditures per trip were as follows: Kachess Lake = $128.06, Cle Elum Lake = $195.16, Tieton River = $207.00, and the Yakima River = $176.35. Nonlocal recreator, expenditure-per-trip information was also needed for the proposed Black Rock reservoir (note that Wymer would not generate much in terms of additional regional economic activity, since 100 percent of visitation was assumed to reflect local recreators). A comparison was made between the breakdown of anticipated recreation activities at Black Rock and the current recreational activities at Kachess Lake and Cle Elum Lake. The breakdown of activities at Cle Elum Lake proved to be a better fit than those at Kachess Lake. As a result, the expenditures per trip at Cle Elum Lake were used for Black Rock reservoir as well.

Table 3–12. Average total expenditures per trip to each reservoir and river by primary activity - nonlocal respondents

Primary Recreation Activity	Kachess Lake			Cle Elum Lake			Tieton River			Yakima River		
	Average $ spent per trip	Frequency	Weighted Average Expenditures Across All Activities	Average $ spent per trip	Frequency	Weighted Average Expenditures Across All Activities	Average $ spent per trip	Frequency	Weighted Average Expenditures Across All Activities	Average $ spent per trip	Frequency	Weighted Average Expenditures Across All Activities
Motorboating	$75.36	14	1,055.04	$247.08	12	2,964.96	**			**		
Boat fishing (guided)	**			**			**			**		
Boat fishing (private)	$63.00	10	630.00	$117.50	4	470.00	**			$187.27	11	2,059.97
Bank fishing/ Shoreline fishing	$37.22	9	334.98	$45.00	4	180.00	$100.00	4	400.00	$105.00	4	420.00
Kayaking/Canoeing	$167.22	9	1,504.98	$100.00	3	300.00	$153.61	18	2,764.98	$110.83	6	664.98
Water-skiing	$137.50	4	550.00	$307.50	6	1,845.00	**			**		
PWC/Jet-skiing	**			$286.36	11	3,149.96	**			**		
Swimming	$56.43	7	395.01	$181.43	7	1,270.01	**			**		
Camping	$184.18	59	10,866.62	$177.62	26	4,618.12	$214.75	26	5,583.50	$141.96	23	3,265.08
Sightseeing	$52.00	5	260.00	**			**			$86.67	3	260.01
Wildlife viewing	**			$55.00	3	165.00	**			**		
Picnicking/Day use	$23.33	3	69.99	$169.00	5	845.00	$75.00	3	225.00	$95.00	6	570.00
Rafting (guided)	**			**			$170.00	7	1,190.00	**		
Rafting (private)	**			**			$260.17	30	7,805.10	$369.38	16	5,910.08
Wade fishing	**			**			$110.00	6	660.00	$130.83	6	784.98
Trail use	**			**			**			$93.60	5	468.00
Tubing	**			**			**			$102.50	4	410.00
Other	$28.33	3	84.99	**			$483.33	3	1,449.99	**		
Total		123	15,751.61		81	15,808.05		97	20,078.57		84	14,813.10
Weighted Averages:			$128.06			$195.16			$207.00			$176.35

** Denotes that there were not sufficient responses or activity not applicable

Table 3–13, Table 3–14, Table 3–15, and Table 3–16 provide cost-category details for Kachess Lake, Cle Elum Lake, Yakima River, and the Tieton River. The weighted, nonlocal-recreator, average total expenditures (per trip by site) estimate from Table 3–12 was first multiplied by the percentage of nonlocal recreator expenditures per trip incurred within the region so as to focus on only in-region expenditures. The in-region percentage was estimated at each site by dividing the weighted in-region expenditures across all activities by the weighted total expenditures across all activities. These percentages were calculated as follows: Kachess Lake = 38.3%, Cle Elum Lake = 68.2%, Yakima River = 50.2%, and the Tieton River = 41.2%. The resulting nonlocal recreator, in-region average total expenditures per trip by site (i.e., Kachess Lake = $49.02, Cle Elum Lake = $133.09, Tieton River = $85.24, and the Yakima River = $88.47) were then multiplied by the site-specific percent of total expenditures for each expenditure category (calculated from the in-region weighted totals). This provides an estimate of nonlocal-recreator, in-region expenditures per trip by expenditure category for each site. These expenditures per trip by expenditure category were then multiplied by the estimate of the change in nonlocal visitation by site and alternative to measure the total change in nonlocal-recreator, in-region expenditures by expenditure category, site, and alternative. The total expenditure information by expenditure category, site, and alternative was then aggregated across sites to provide an estimate of the total expenditures by category and alternative. It was this alternative's specific expenditure information by expenditure category that was fed into the IMPLAN model to estimate the regional impacts of recreation for each alternative.

Table 3–13. Average total and within local area trip expenditures by expenditure category - nonlocal respondents

Kachess Lake											
Expenditure Category:	Total Expenditures					In-Region Expenditures					Weighted Average In-Region Expenditures per Trip by Nonlocals Across All Activities
	Frequency	Average total $ spent	% of total $ spent based on Straight Total	Weighted Totals	% of total $ spent based on Weighted Total	Frequency	Average local $ spent	% of local $ spent based on Straight Total	Weighted Totals	% of local $ spent based on Weighted Total	
										Weighted Average Total Expenditures per Trip:	$128.06
										In-Region Percentage:	0.383
										Weighted Average In-Region Expenditures per Trip:	$49.02
Camping fees	64	$71.66	0.185	4586.24	0.273	29	$71.34	0.182	2,068.86	0.322	$15.80
Day use fees	12	$15.33	0.040	183.96	0.011	4	$19.00	0.049	76.00	0.012	$0.58
Hotels/motels and other lodging		**					**				
Restaurants	10	$51.50	0.133	515.00	0.031	8	$60.63	0.155	485.04	0.076	$3.70
Groceries and liquor	54	$121.95	0.315	6585.30	0.393	29	$74.79	0.191	2,168.91	0.338	$16.56
Gas and oil for auto and boat	48	$73.02	0.189	3504.96	0.209	15	$82.33	0.211	1,234.95	0.192	$9.43
Recreation supplies	26	$53.69	0.139	1395.94	0.083	6	$45.83	0.117	274.98	0.043	$2.10
Recreation equipment rentals		**					**				
Guide services		**					**				
Souvenirs/gifts		**					**				
Other		**				3	$37.00	0.095	111.00	0.017	$0.85
Totals:	214	$387.15		$16,771.40		94	$390.92	101.0	$6,419.74	38.3	$49.02

** Denotes that there were not sufficient responses

Table 3–14. Average total and within local area trip expenditures by expenditure category - nonlocal respondents

Cle Elum Lake											
Expenditure Category:	Total Expenditures					In-Region Expenditures					Weighted Average In-Region Expenditures per Trip by Nonlocals Across All Activities
	Frequency	Average total $ spent	% of total $ spent based on Straight Total	Weighted Totals	% of total $ spent based on Weighted Total	Frequency	Average local $ spent	% of local $ spent based on Straight Total	Weighted Totals	% of local $ spent based on Weighted Total	
										Weighted Average Total Expenditures per Trip:	$195.16
										In-Region Percentage:	0.682
										Weighted Average In-Region Expenditures per Trip:	$133.09
Camping fees	29	$55.45	0.045	1,608.05	0.078	19	$70.53	0.055	1,340.07	0.095	$12.71
Day use fees	10	$11.90	0.010	119.00	0.006	2	$15.00	0.012	30.00	0.002	$0.28
Hotels/motels and other lodging	5	$360.00	0.292	1,800.00	0.087	4	$375.00	0.291	1,500.00	0.107	$14.22
Restaurants	19	$128.47	0.104	2,440.93	0.119	15	$145.67	0.113	2,185.05	0.156	$20.72
Groceries and liquor	42	$159.52	0.129	6,699.84	0.326	30	$144.73	0.112	4,341.90	0.309	$41.17
Gas and oil for auto and boat	39	$110.90	0.090	4,325.10	0.210	23	$112.61	0.087	2,590.03	0.185	$24.56
Recreation supplies	21	$82.86	0.067	1,740.06	0.085	14	$70.00	0.054	980.00	0.070	$9.29
Recreation equipment rentals	6	$275.00	0.223	1,650.00	0.080	3	$316.67	0.245	950.01	0.068	$9.01
Guide services		**					**				
Souvenirs/gifts	4	$50.00	0.041	200.00	0.010	3	$40.00	0.031	120.00	0.009	$1.14
Other		**					**				
Totals:	175	$1,234.10		$20,582.98		113	$1,290.21	104.5	$14,037.06	68.2	$133.09

** Denotes that there were not sufficient responses

Table 3–15. Average total and within local area trip expenditures by expenditure category - nonlocal respondents

Yakima River											
Expenditure Category:	Total Expenditures					In-Region Expenditures					Weighted Average In-Region Expenditures per Trip by Nonlocals Across All Activities
	Frequency	Average total $ spent	% of total $ spent based on Straight Total	Weighted Totals	% of total $ spent based on Weighted Total	Frequency	Average local $ spent	% of local $ spent based on Straight Total	Weighted Totals	% of local $ spent based on Weighted Total	
										Weighted Average Total Expenditures per Trip:	$176.35
										In-Region Percentage:	0.502
										Weighted Average In-Region Expenditures per Trip:	$88.47
Camping fees	31	$31.45	0.054	974.95	0.073	21	$39.76	0.091	834.96	0.124	$11.01
Day use fees		**					**				
Hotels/motels and other lodging	6	$128.33	0.220	769.98	0.058	4	$121.25	0.277	485.00	0.072	$6.39
Restaurants	17	$90.12	0.154	1,532.04	0.115	13	$94.77	0.217	1,232.01	0.184	$16.24
Groceries and liquor	50	$92.24	0.158	4,612.00	0.345	23	$77.96	0.178	1,793.08	0.267	$23.64
Gas and oil for auto and boat	53	$71.19	0.122	3,773.07	0.282	30	$62.37	0.143	1,871.10	0.279	$24.67
Recreation supplies	23	$60.09	0.103	1,382.07	0.103	12	$41.25	0.094	495.00	0.074	$6.53
Recreation equipment rentals		**					**				
Guide services		**					**				
Souvenirs/gifts		**					**				
Other	3	$111.00	0.190	333.00	0.025		**				
Totals:	183	$584.42		13,377.11		103	$437.36	74.8	6,711.15	50.2	$88.47

** Denotes that there were not sufficient responses

Table 3–16. Average total and within-local-area trip expenditures by expenditure category - nonlocal respondents

Tieton River											
Expenditure Category:	Total Expenditures					In-Region Expenditures					
	Frequency	Average total $ spent	% of total $ spent based on Straight Total	Weighted Totals	% of total $ spent based on Weighted Total	Frequency	Average local $ spent	% of local $ spent based on Straight Total	Weighted Totals	% of local $ spent based on Weighted Total	Weighted Average In-region expenditures per trip by nonlocals across all activities
										Weighted Average Total Expenditures per Trip:	$207.00
										In-Region Percentage:	0.412
										Weighted Average In-Region Expenditures per Trip:	$85.24
Camping fees	30	$67.28	0.107	2,018.40	0.111	16	$66.56	0.209	1,064.96	0.142	$12.07
Day use fees		**					**				
Hotels/motels and other lodging							**				
Restaurants	32	$51.47	0.082	1,647.04	0.090	25	$51.28	0.161	1,282.00	0.171	$14.54
Groceries and liquor	57**	$91.96	0.147	5,241.72	0.287	38	$68.07	0.214	2,586.66	0.344	$29.33
Gas and oil for auto and boat	52	$87.98	0.140	4,574.96	0.251	26	$83.65	0.263	2,174.90	0.289	$24.66
Recreation supplies	20	$202.75	0.323	4,055.00	0.222	10	$23.00	0.072	230.00	0.031	$2.61
Recreation equipment rentals		**					**				
Guide services	4	$82.50	0.132	330.00	0.018		**				
Souvenirs/gifts	9	$43.33	0.069	389.97	0.021	7	$25.71	0.081	179.97	0.024	$2.04
Other		**					**				
Totals:	204	$627.27		18,257.09		122	$318.27	50.7	7,518.49	41.2	$85.24

** Denotes that there were not sufficient responses

3.5.1.3 Change in Expenditures by Site and Alternative

Applying the nonlocal-visitor percentages for each site to the estimates of changes in visitation by site and alternative provided estimates of changes in nonlocal visitation by site and alternative. Dividing the changes in nonlocal visitation (measured in visitor days) by site and alternative by the average number of days per visit by site resulted in an estimate of the average annual change in nonlocal visits/trips by site and alternative. Multiplying this result by the estimates of nonlocal-recreator expenditures by category per trip and site resulted in estimates of changes in nonlocal-recreator expenditures by category, site, and alternative. These changes in nonlocal expenditures by category, site, and alternative were then run through the IMPLAN model to estimate the regional economic impacts associated with the changes in recreational activity for each alternative.

For the proposed Black Rock reservoir,[5] average annual nonlocal visitation estimates were derived by multiplying the nonlocal visitation percentage (.28) by the straight average of total visitation estimates over the 100-year study period. As shown in Table 3–17, average recreation visits by nonlocals were estimated at 36,600 annually, which converts to an increase in recreational expenditures of approximately $4.9 million annually.

For the existing reservoirs and rivers, the nonlocal-visitation percentages (86% Kachess Lake, 66.3% Cle Elum Lake, 50% Yakima River, and 78% Tieton River) were applied to the straight average of total visitation estimates over the 100-year study period for each site. As shown in Table 3–17, the average annual change in recreation expenditures across all four sites was estimated at $124,500, $41,700, and $107,700 for the Black Rock, Wymer Dam and Reservoir, and Wymer Dam Plus Yakima River Pump Exchange Alternatives, respectively. Table 3–18 also shows the change in average annual recreation expenditures by alternative at each site (i.e., Kachess Lake, Cle Elum Lake, Yakima River, and the Tieton River).

[5] Recall that the Wymer Reservoir is not expected to generate regional economic impacts because visitation was estimated to be almost exclusively from local residents.

Table 3–17. Nonlocal recreator visitation and expenditure analysis for the Black Rock reservoir ($)

Activity/ Percent	Boat fishing 0.25	Shoreline fishing 0.1	Swimming 0.15	Picnicking 0.15	Water ski, wakeboard, jet ski 0.25	Walking, hiking 0.03	Wildlife viewing 0.03	Horseback riding 0.02	Off-road vehicle riding 0.02	Total visits
Average Annual Visitor Days	163,247	65,300	97,948	97,948	163,247	19,589	19,589	13,060	13,060	652,986
Nonlocal %	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Average Annual Nonlocal Visitor Days	45,709	18,284	27,425	27,425	45,709	5,485	5,485	3,657	3,657	182,836
Average Days per Visit (*)	5	5	5	5	5	5	5	5	5	5
Average Annual Nonlocal Trips	9,142	3,657	5,485	5,485	9,142	1,097	1,097	731	731	36,567
Average Annual Change in Expenditures by Category ($)										
Total nonlocal visits	**Camping fees 12.71**	**Day use fees 0.28**	**Lodging 14.22**	**Restaurants 20.72**	**Groceries & liquor 41.17**	**Gas & oil 24.56**	**Recreation supplies 9.29**	**Recreation equipment rentals 9.01**	**Souvenirs/ gifts 1.14**	**Total 133.10**
36,567	464,767	10,239	519,983	757,668	1,505,463	898,086	339,707	329,469	41,686	4,867,068

* Average days per visit and expenditures by category for nonlocal visitors were based on those estimates developed for Cle Elum Lake. Of the available expenditure data from the recreation survey, Cle Elum appeared to be the most similar to Black Rock based on the types of activities and percentages of visitation by activity.

Table 3–18. Change in expenditures from the No Action Alternative at existing sites by alternative

I. Kachess Lake																
Alternatives	In-region expenditures on a per-trip basis					Average annual change in expenditures by category ($)										
	Average Annual Change in Visitor Days	Average # of days per visit (from survey)	Average Annual Change in visits	Nonlocal percent (from survey)	Change in Average annual nonlocal visits	Camping fees 15.8	Day use fees 0.58	Lodging 0	Restaurants 3.7	Groceries & liquor 16.56	Gas & oil 9.43	Recreation supplies 2.1	Recreation equipment & rentals 0	Souvenirs & gifts 0	Other 0.85	Total 49.02
Black Rock:	10,971	5.3	2,070	0.86	1,780	28,127	1,033	0	6,587	29,480	16,787	3,738	0	0	1,513	87,266
Wymer Only	0	5.3	0	0.86	0	0	0	0	0	0	0	0	0	0	0	0
Wymer Plus	6,302	5.3	1,189	0.86	1,023	16,156	593	0	3,783	16,933	9,642	2,147	0	0	869	50,123
II. Cle Elum Lake																
Alternatives	In-region expenditures on a per-trip basis					Average annual change in expenditures by category ($)										
	Average Annual Change in Visitor Days	Average # of days per visit (from survey)	Average Annual Change in visits	Nonlocal percent (from survey)	Change in Average annual nonlocal visits	Camping fees 12.71	Day use fees 0.28	Lodging 14.22	Restaurants 20.72	Groceries & liquor 41.17	Gas & oil 24.56	Recreation supplies 9.29	Recreation equipment & rentals 9.01	Souvenirs & gifts 1.14	Other 0	Total 133.10
Black Rock:	3,916	5	783	0.663	519	6,599	145	7,383	10,758	21,376	12,752	4,823	4,678	592	0	69,106
Wymer Only	1,147	5	229	0.663	152	1,933	43	2,162	3,151	6,261	3,735	1,413	1,370	173	0	20,240
Wymer Plus	2,043	5	409	0.663	271	3,444	76	3,853	5,614	11,156	6,655	2,517	2,441	309	0	36,066
III. Yakima River																
Alternatives	In-region expenditures on a per-trip basis					Average annual change in expenditures by category ($)										
	Average Annual Change in Visitor Days	Average # of days per visit (from survey)	Average Annual Change in visits	Nonlocal percent (from survey)	Change in Average annual nonlocal visits	Camping fees 11.01	Day use fees 0	Lodging 6.39	Restaurants 16.24	Groceries & liquor 23.64	Gas & oil 24.67	Recreation supplies 6.53	Recreation equipment & rentals 0	Souvenirs & gifts 0	Other 0	Total 88.48
Black Rock:	2,532	3.7	684	0.5	342	3,767	0	2,186	5,557	8,089	8,441	2,234	0	0	0	30,274
Wymer Only	1,795	3.7	485	0.5	243	2,671	0	1,550	3,940	5,735	5,985	1,584	0	0	0	21,464
Wymer Plus	1,795	3.7	485	0.5	243	2,671	0	1,550	3,940	5,735	5,985	1,584	0	0	0	21,464
IV. Tieton River																
Alternatives	In-region expenditures on a per-trip basis					Average annual change in expenditures by category ($)										
	Average Annual Change in Visitor Days	Average # of days per visit (from survey)	Average Annual Change in visits	Nonlocal percent (from survey)	Change in Average annual nonlocal visits	Camping fees 12.07	Day use fees 0	Lodging 0	Restaurants 14.54	Groceries & liquor 29.33	Gas & oil 24.66	Recreation supplies 2.61	Recreation equipment & rentals 0	Souvenirs & gifts 2.04	Other 0	Total 85.25
Black Rock	-3,346	3.58	-935	0.78	-729	-8,799	0	0	-10,599	-21,381	-17,977	-1,903	0	-1,487	0	-62,146
Wymer Only	0	3.58	0	0.78	0	0	0	0	0	0	0	0	0	0	0	0
Wymer Plus	0	3.58	0	0.78	0	0	0	0	0	0	0	0	0	0	0	0

V. Combined across all four existing sites																
Alternatives	In-region expenditures on a per-trip basis					Average annual change in expenditures by category ($)										
	Average Annual Change in Visitor Days	Average # of days per visit (from survey)	Average Annual Change in visits	Nonlocal percent (from survey)	Change in Average annual nonlocal visits	Camping fees	Day use fees	Lodging	Restaurants	Groceries & liquor	Gas & oil	Recreation supplies	Recreation equipment & rentals	Souvenirs & gifts	Other	Total
Black Rock	14,073		2,602			29,695	1,178	9,570	12,302	37,564	20,004	8,894	4,678	-895	1,513	124,501
Wymer Only	2,942		714		395	4,604	43	3,713	7,091	11,995	9,719	2,997	1,370	173	0	41,705
Wymer Plus	10,140		2,083	1,913		22,271	669	5,403	13,337	33,823	22,282	6,249	2,441	309	869	107,653

1,536

3.5.2 Results

Recreation expenditures (the expenditures used in IMPLAN were incremental to the No-Action) related to the proposed Black Rock reservoir stimulate $4.7 million of output, $1.9 million in labor income, and 72 jobs annually. Recreation expenditures at existing recreation sites generate a small amount of regional economic impacts ($0.118 million of output, $0.056 million of labor income, and 1 job). The majority of the regional impacts stemming from expenditures at the proposed reservoir and existing sites occur in the Accommodation and Food Service and the Retail Trade sectors. Table 3-19 summarizes these results.

It is assumed that recreators at the proposed Wymer reservoir are residents of the regional study area so their recreational expenditures do not create regional economic impacts to the region. The Wymer Dam and Reservoir Alternative generates a small amount of recreation expenditures at existing sites as shown in Table 3-19. Regional economic impacts stemming from recreational expenditures at existing sites stimulates $0.038 million in output, $0.016 million in labor income, and .5 job. Like the Black Rock Alternative, most of the regional impacts occur in the Accommodation and Food Services and Retail Trade sectors of the economy.

Like the Wymer Dam and Reservoir Alternative, regional economic impacts related to the Wymer Dam Plus Yakima River Exchange Alternative are related to recreational expenditures at existing recreational sites. Regional economic impacts related to recreational expenditures are small ($0.1 million output, $0.047 million in labor income, and 1.5 jobs). These results are summarized in Table 3-19.

Table 3-19. Regional economic impacts stemming from recreation visitation expenditures

	Impacts of alternatives to existing reservoirs									Impacts to potential Black Rock reservoir		
	Black Rock Alternative			Wymer Dam and Reservoir Alternative			Wymer Plus Pump Exchange Alternative			Potential Black Rock reservoir		
	Labor Income ($)	Employment (jobs)	Output ($)	Labor Income ($)	Employment (jobs)	Output ($)	Labor Income ($)	Employment (jobs)	Output ($)	Labor Income ($)	Employment (jobs)	Output ($)
Ag, Forestry, Fish, and Hunting	232	0.0	1,000	83	0.0	373	201	0.0	879	9,129	0.5	40,353.2
Mining	0	0.0	2	0	0.0	1	0	0.0	1	4	0.0	63.2
Utilities	61	0.0	359	20	0.0	120	52	0.0	304	2,507	0.0	14,747.6
Construction	219	0.0	506	78	0.0	180	187	0.0	430	10,358	0.2	23,801.6
Manufacturing	395	0.0	2,510	142	0.0	927	343	0.0	2,195	16,437	0.4	103,726.2
Wholesale Trade	839	0.0	2,231	279	0.0	742	718	0.0	1,911	32,069	0.8	85,310.8
Transportation and warehousing	704	0.0	1,545	238	0.0	522	600	0.0	1,319	30,433	0.9	65,833.0
Retail trade	11,654	0.5	29,327	3,895	0.2	9,910	10,112	0.5	25,430	463,454	21.8	1,145,690.2
Information	531	0.0	2,172	182	0.0	740	453	0.0	1,849	24,920	0.6	100,633.2
Finance and insurance	661	0.0	2,341	207	0.0	727	555	0.0	1,967	27,171	0.6	94,839.4
Real estate and rental	822	0.0	4,240	248	0.0	1,294	653	0.0	3,385	92,696	2.2	454,984.4
Professional-scientific and technical services	717	0.0	1,513	240	0.0	507	605	0.0	1,278	33,090	0.8	70,925.8
Management of companies	371	0.0	859	128	0.0	295	317	0.0	734	15,675	0.2	36,274.4
Administrative waste services	583	0.0	1,244	200	0.0	435	490	0.0	1,044	28,700	1.2	62,116.8
Educational services	153	0.0	327	44	0.0	94	128	0.0	273	5,215	0.3	11,158.2
Health and social services	3,149	0.1	5,893	898	0.0	1,682	2,626	0.1	4,913	105,503	2.8	197,441.6
Arts-entertainment and recreation	191	0.0	530	56	0.0	156	161	0.0	443	6,984	0.5	19,224.8
Accommodation and food services	8,642	0.5	25,532	3,834	0.2	11,312	7,596	0.5	22,498	465,754	27.4	1,360,683.4
Other services	858	0.1	2,129	260	0.0	643	717	0.0	1,781	33,403	1.6	82,567.0
Government and non-NAICs	25,108	0.5	33,717	4,912	0.1	7,247	20,091	0.5	27,216	469,121	9.4	737,203.0
Institutions	0	0.0	340	0	0.0	156	0	0.0	315	0	0.0	15,711.8
Total	55,888	1.6	118,315	15,945	0.5	38,062	46,603	1.5	100,165	1,872,624	72.1	4,723,289.6

REFERENCES

Arrow, K., R. Solow, P. Portney, E. Leamer, R. Radner, and H. Schuman. 1993. "Report to the NOAA Panel on Contingent Valuation." *Federal Register* 58(10): 4602-4614.

Bell, K., D. Huppert, and R. Johnson. 2003. "Willingness to pay for local Coho Salmon enhancement in coastal communities." *Marine Resource Economics*, 18: 15-31

Crutchfield, J., S. Langdon, O. Mathisen, and P. Poe. *The biological, economic, and social values of a sockeye salmon stream in Bristol Bay, Alaska*. University of Washington, College of Fisheries, Fisheries Research Institute. October 1982.

Gallo, D. 2003. *The economic benefits to freshwater anglers of achieving the Anadromous Fish Restoration Program fish population goals for the Sacramento River System*. College of Behavioral and Social Sciences, California State University-Chico, California.

Hanemann, M., J. Loomis, and B. Kanninen. 1991. "Statistical efficiency of double-bounded dichotomous choice contingent valuation." *American Journal of Agricultural Economics*, November 1991: 1255-1263

Jones and Stokes Associates, Inc. 1987. *Juneau area sport fishing economic study*. Prepared for: Alaska Department of Fish and Game. Juneau AK. November 1987.

Kaval, P. and J. Loomis. 2003. *Updated Outdoor Recreation Use Values with Emphasis on National Park Recreation*. Report submitted to the National Park Service, Ft. Collins, Colorado.

Layton, D., G. Brown, and M. Plummer. 1999. *Valuing multiple programs to improve fish populations*. Prepared for: Washington State Department of Ecology, April 1999.

Loomis, J. 1996. "Measuring the economic benefits of removing dams and restoring the Elwha River: Results of a contingent valuation survey." *Water Resources Research*, 32(2): 441-447.

Loomis, J. 1999. *Recreation and Passive Use Values from Removing the Dams on the Lower Snake River to Increase Salmon*. Unpublished paper included into Lower Snake River EIS. March 1999. (U.S. Army Corps of Engineers website: www.usace.army.mil/lsr/REPORTS/rec_passive/pass_rec.htm).

Minnesota IMPLAN Group, Inc. June 2000. *IMPLAN Professional Version 2.0: User's Guide, Analysis Guide, and Data Guide.*

MOBRAND—Jones & Stokes. 2005. *All H Analyzer (AHA) User Guide – Draft*. Prepared by MOBRAND—Jones & Stokes. August 17, 2005.

Olsen, D. and J. Richards. 1992. *Summary Report: Rogue River Summer Steelhead and Fall Chinook sport fisheries – Economic valuation study*. The Pacific Northwest Project. Lake Oswego, Oregon.

Olsen, D., J. Richards, and R. Scott. 1991. "Existence and sport values for doubling the size of Columbia River Basin salmon and steelhead runs." *Rivers*, 2(1): 44-56.

Platt, J. 2008. *Measuring the influence of water management practices on the economic benefits of commercial fishing*. Technical memorandum EC-2008-1. U.S. Department of the Interior. Bureau of Reclamation. Technical Service Center. Denver, Colorado.

Reclamation. 2002. *Interim Comprehensive Basin Operating Plan.* Yakima Project, Washington. U.S. Department of the Interior, Bureau of Reclamation, Pacific Northwest Region, Upper Columbia Area Office, Yakima, Washington.

Reclamation, 2004. Summary Report, Appraisal Assessment of the Black Rock Alternative, Technical Series No. TS-YSS-7. U.S. Department of the Interior, Bureau of Reclamation, Pacific Northwest Region. December 2004.

Reclamation. 2006. *2006 M&I Water Rate Survey Data*. U.S. Bureau of Reclamation, Office of Program and Policy Services, Contract Services Office. Denver, Colorado.

Reclamation. 2007. *Wymer Dam and Reservoir Appraisal Report for the Yakima River Basin Storage Study*. Technical Series No. TS-YSS-16. September 2007. U.S. Department of the Interior, Bureau of Reclamation, Pacific Northwest Region.

Reclamation. 2008a. *Yakima River Basin Reservoir and River Recreation Survey Report of Findings*. Technical Series No. TS-YSS-15, Prepared by Aukerman, Haas, and Associates, LLC, for the Bureau of Reclamation. January 2008.

Reclamation. 2008b. *Cost-Risk Analysis for Black and Wymer Alternatives*. Technical Series No. TS-YSS-26. U.S. Department of the Interior, Bureau of Reclamation, Technical Service Center. Denver, Colorado. December 2008.

Reclamation. 2008c. *Yakima River Basin Water Storage Feasibility Study Final Planning Report/Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Reclamation, Pacific Northwest Region. Yakima, Washington. December 2008.

Reclamation. 2008d. *Yakima River Basin Water Storage Feasibility Study Draft Planning Report/Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Reclamation, Pacific Northwest Region. Yakima, Washington. January 2008.

U.S. Army Corps of Engineers. 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement, Appendix I – Economics. Walla Walla District. February 2002.

U.S. Department of Commerce, National Marine Fisheries Service, Northwest Regional Office and Alaska Department of Fish and Game. November 2003. *Final Programmatic Environmental Impact Statement for Pacific Salmon Fisheries Management Off The Coasts Of Southeast Alaska, Washington, Oregon, and California and in the Columbia River Basin. Appendix D: Economics Technical Appendix*.

U.S. Water Resources Council. 1983. *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. U.S. Government Printing Office. March 1983. Washington DC.

YBSA. 2007. *Recreation and Economic Development Analysis of Lands Around Black Rock Reservoir*. Prepared for the Yakima Basin Storage Alliance by the Mitchell Nelson Group, LLC. January 12, 2007.

Yakima River Basin Watershed Planning Unit and Tri-County Water Resources Agency. 2003. *Watershed Management Plan – Yakima River Basin*. Prepared by: Economic and Engineering Services, Inc., in association with Montgomery Water Group, Inc., R.C. Bain and Associates, and McKenzie Consulting. Funded by grant # G0900288 and G0200298 provided by Washington State Department of Ecology. January 2003.

APPENDIX A - ESTIMATING FISHERY ECONOMIC USE VALUES

Appendix A - Contents

SUMMARY AND CONCLUSIONS

This paper presents information on the estimation of economic harvest or use values per fish for salmon based on existing data. A case study involving various proposed Yakima River projects was used to define and develop the economic value estimation methodology. Although the values were oriented toward Yakima River salmon, the approaches presented could be generalized to other river systems and fish species.

Given the Yakima River is a tributary of the Columbia River, migratory anadromous salmon stemming from the Yakima River can be caught not only in the Yakima River, but also in the Columbia River and the Pacific Ocean. To estimate fishery economic harvest benefits associated with fishery improvements within the Yakima River Basin, one needs both estimates of the increase harvest by geographic area (i.e., Yakima River, Columbia River, Pacific Ocean) as well as economic values per fish within each geographic area. In addition, each geographic area allows different types of fish harvest – commercial, sport, and tribal ceremonial and subsistence. This report focuses on the estimation of the economic values per salmon by harvest type in each geographic area.

The foundation of the commercial fishing value estimation is the existing harvest (pounds and number of fish) and market price data gathered and maintained by the PFMC and the ADFG. This data allowed for the estimation of commercial revenue per fish by state (CA, OR, WA, and AK) from which profitability estimates were derived. To develop a weighted average value across all Pacific Coast states for the ocean commercial analysis, coded wire tag data from the PSMFC was used to calculate the percentage of Yakima River fish caught in the ocean areas of each state.

The basis for the sport fishing values was a comprehensive literature search of existing sport fishing economic studies. While the sheer number of existing studies is quite large, only a small portion the studies could actually be used within a benefits transfer context. After selecting and averaging indexed values from the most applicable studies, an additional step was required to convert sport fishing values from a per trip/day basis to a per fish basis.

Finally, tribal subsistence values were estimated using commercial revenues per fish (i.e., market price multiplied by average weight per fish). This food based value assumes the subsistence harvest could have been sold within existing markets and therefore reflects the opportunity cost of the subsistence harvest. Given subsistence harvest also includes a cultural/spiritual value associated with

the harvest activity, the exclusively food based value should be considered a defendable lower bound.

In conclusion, there appears to be sufficient existing data to allow for the estimation of commercial, sport, and subsistence values associated with the harvest of Yakima River salmon. While the approaches described in this report can be extended to other species and river systems, the actual value estimation will be contingent upon the existence of adequate data related to the fish species or river system in question.

Chapter 1.0 INTRODUCTION

Federal water management agencies, such as the Bureau of Reclamation, often impact fish populations through the construction and operation of their projects. As a result, estimating the fishery economic effects of a proposed project or of a change in operations at an already existing project is often required in order to evaluate the proposed action.

This technical memorandum provides analytical information on the application of existing information to estimate fishery economic use value benefits applicable to Reclamation benefit-cost analyses. Fishery use values refer to the economic benefits fishery resource users (e.g., fishermen) experience when "using" the fishery resource. Typically, fishery use value stems from the harvest and consumption of fish. This form of fishery use value is therefore often referred to as "consumptive use" value. Commercial, recreational, and tribal subsistence harvests reflect the most common forms of consumptive fishery use value. A less commonly measured form of fishery use value is referred to as "nonconsumptive use" value and includes non-harvest oriented fishery activities such as recreational catch and release fishing and fish viewing. These consumptive and nonconsumptive use values differ from "nonuse" values which can be held by both resource users and nonusers related to the existence or preservation of a resource even if the individual never intends to make use of the resource.

The methods and values presented in this document focus on commercial, recreational or sport, and Tribal subsistence consumptive use values. The example used throughout the report strives to measure consumptive use values associated with Yakima River salmon populations. The Yakima River basin is found in south-central Washington State. The primary salmon species harvested within the Yakima River are Chinook and coho. Salmon are an anadromous species, meaning they migrate to the ocean before ultimately returning to their river of origin to spawn. As a result, Yakima River salmon stocks are harvested not only in the Yakima River, but also in the Columbia River into which it flows, and the Pacific Ocean. While the information presented in this paper focuses on consumptive fishery use values related to Yakima River salmon populations, the approaches can be generalized to many other fish species.

1.1 National Economic Development Benefit-Cost Analysis

To provide some perspective on the need for fishery use values related to the Yakima River Basin, national economic development (NED) oriented benefit-cost analyses (BCA) are being developed for the various Yakima River planning and environmental studies currently underway. To be consistent with Federal water management agency economic guidelines—*Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies,* also referred to as the "P&Gs" (U. S. Water Resources Council, 1983)—these BCAs will attempt to quantify not only the benefits to fisheries (ocean and in-river commercial, recreational, and Tribal), but also any relevant benefits to agriculture, municipal and industrial (M&I) water supply, recreation (reservoir and river), hydropower, etc. Cost categories covered include construction costs, interest during construction, and annual operating, maintenance, replacement, and energy (OMR&E) costs. The annual stream of benefits projected over the period of analysis for each study will be discounted to a present value before being aggregated and compared to the aggregated present value of the costs in order to calculate net benefits for each study alternative. If an alternative's benefits exceed its costs, a positive net benefit results, and the alternative is considered economically justified. This document focuses only on the estimation of fishery economic use values necessary for the BCA fishery benefit analysis. While fisheries benefits are but one piece of the overall BCA puzzle, they tend to be a very important component in many Reclamation studies. This is because many Reclamation studies, especially within the last 20 to 30 years, have been initiated with the objective of improving habitat conditions to aid in the recovery of diminished fish populations.

Chapter 2.0 FISHERIES USE VALUE ESTIMATION

The fisheries use value benefit estimation process discussed below focuses on harvest oriented consumptive use values measured on a per fish basis. Given the migratory range of Yakima River salmon, these harvest oriented fishery use values include commercial, sport, and tribal fisheries in the ocean, lower Columbia River (zones 1-5), Columbia River (zone 6), and Yakima River. The values per fish developed in this report are to be subsequently applied to annual estimates of fish harvest developed by project alternative, harvest area, and species to calculate annual fishery economic benefits. The annual fishery benefits are then discounted to a present value as of the start of the benefits period and aggregated into an estimate of total fishery consumptive use value benefits. As a result, this report focuses on one component of the fishery use value benefit estimation process – the critical estimate of economic values per fish.

2.1 Ocean Commercial

The basic objective of a Reclamation ocean commercial fishing economic benefit analysis, as described in the P&Gs, is to estimate the change in commercial fishing profitability stemming from changes in ocean commercial harvest associated with each of the proposed "action" alternatives as compared to the baseline No Action Alternative. This section describes how estimates of ocean commercial profitability per fish by species were developed for subsequent application to projections of the species specific incremental harvest for each of the action alternatives being considered in the Yakima River planning studies.

The ocean commercial benefit estimation procedure makes use of the most recent annual data on commercial ex-vessel (harvest level) prices per pound by state (CA, OR, WA, AK) and species (Chinook and coho salmon) in conjunction with average weights per fish by species to calculate values per fish by state and species. Table 1-Ocean Commercial Fishing #1 presents data obtained from the Pacific Fishery Management Council's (PFMC) *Review of Ocean Salmon Fisheries* and the Alaska Department of Fish and Game (ADFG). The *Review of Ocean Salmon Fisheries* is published annually by PFMC and includes a comprehensive discussion of salmon ocean commercial and sport fishing activity off the coasts of CA, OR, and WA over the past year. This report also includes a substantial amount of historical data. ADFG also maintains databases with both

TABLE 1.—OCEAN COMMERCIAL FISHING #1: Ocean Commercial Values per Fish by Species and State

Sources: 1) CA, OR, WA Data: 2006 Review of Ocean Salmon Fisheries (2006 Salmon SAFE Document, published 2/2007), Socioeconomic Chapter, Table IV-2, 3, 4, 5, 6, 7, 8
2) Alaska Data: Dept of Fish & Game, Division of Commercial Fisheries, Commercial Salmon Harvests and Exvessel Values
3) GDP Implicit Price Deflator Annual and Quarterly Values: U. S. Bureau of Economics Analysis website (www.bea.gov/national/nipaweb/TablePrint.asp)

Bureau of Economic Analysis — **Insert Target Quarter:** 1st Qrtr 2007 — **Insert IPD Value:** Annual GDP Implicit Price Deflator (IPD): 118.041

Chinook

Insert Profit %: 0.8

GDP Annual Index Value	State/ Year	Nominal Value (**) (K$)	**1st Qrtr 2007** Real Value (K$)	Dressed Pounds Landed (Thousands)	# Fish Harvested (Thousands)	Nominal Price/lb. (Dressed)	**1st Qrtr 2007** Real Price/lb. (Dressed)	Pounds per Fish	Nominal Revenue per Fish	Real 1st Qrtr 2007 Revenue per Fish
	I. CALIFORNIA:	Table IV-2	Table IV-2 (Calculated)	Table IV-6	A-3	Table IV-2 (Calculated)	Table IV-2 (Calculated)			
0.808	1997	7,288	9,016	5,248	487	1.39	1.72	10.77		
0.817	1998	3,060	3,744	1,847	227	1.66	2.03	8.14		
0.829	1999	7,429	8,960	3,846	264	1.93	2.33	14.54		
0.847	2000	10,304	12,163	5,131	480	2.01	2.37	10.68		
0.867	2001	4,773	5,502	2,409	193	1.98	2.28	12.48		
0.883	2002	7,776	8,810	5,008	392	1.55	1.76	12.79		
0.901	2003	12,181	13,513	6,392	492	1.91	2.11	12.99		
0.927	2004	17,895	19,304	6,230	502	2.87	3.10	12.41		
0.955	2005	12,913	13,521	4,347	341	2.97	3.11	12.75		
0.983	2006 (*)	5,261	5,352	1,030	69	5.11	5.20	14.97		
	5 Year Sum:	56,026	60,499	23,007	1,795					
	10 Year Sum:	88,880	99,885	41,488	3,448					
	1) REVENUE:									
	5 Year Straight Avg:	11,205	12,100			2.88	3.06	13.18	37.99	40.28
	5 Year Weighted Avg:					2.44	2.63	12.81	31.21	33.70
	10 Year Straight Avg:	8,888	9,988			2.34	2.60		28.64	31.86
	10 Year Weighted Avg:					2.14	2.41	12.03	25.78	28.97
								12.25		
	2) PROFIT:									
	5 Year Straight Avg:								30.39	32.22
	5 Year Weighted Avg:								24.97	26.96
	10 Year Straight Avg:								22.91	25.49
	10 Year Weighted Avg:								20.62	23.18

TABLE 1.—OCEAN COMMERCIAL FISHING #1: Ocean Commercial Values per Fish by Species and State (continued)

II. OREGON:

	Table IV-3	Table IV-3 (Calculated)	Table IV-7	A-8	Table IV-3 (Calculated)	Table IV-3 (Calculated)	
1997	2,469	3,055	1,542	150	1.60	1.98	10.30
1998	2,297	2,811	1,398	124	1.64	2.01	11.26
1999	1,400	1,689	721	63	1.94	2.34	11.53
2000	2,988	3,527	1,481	136	2.02	2.38	10.90
2001	4,680	5,395	2,897	275	1.62	1.86	10.54
2002	5,383	6,099	3,488	304	1.54	1.75	11.47
2003	7,186	7,972	3,639	330	1.97	2.19	11.04
2004	9,832	10,606	2,850	253	3.45	3.72	11.28
2005	8,466	8,864	2,671	251	3.17	3.32	10.63
2006 (*)	2,663	2,709	486	35	5.48	5.57	13.90
5 Year Sum:	33,530	36,250	13,134	1,173			
10 Year Sum:	47,364	52,726	21,173	1,920			
1) REVENUE:							
5 Year Straight Avg:	6,706	7,250	2,627		3.12	3.31	11.66	36.43	38.61
5 Year Weighted Avg:					2.55	2.76	11.20	28.59	30.91
10 Year Straight Avg:	4,736	5,273	2,117		2.44	2.71	11.28	27.57	30.61
10 Year Weighted Avg:					2.24	2.49	11.03	24.67	27.46
2) PROFIT:									
5 Year Straight Avg:								29.14	30.89
5 Year Weighted Avg:								22.87	24.73
10 Year Straight Avg:								22.06	24.49
10 Year Weighted Avg:								19.73	21.97

TABLE 1.—OCEAN COMMERCIAL FISHING #1: Ocean Commercial Values per Fish by Species and State (continued)

III. WASHINGTON:

A. Non-Indian:

	Table IV-4	Table IV-4 (Calculated)	Table IV-8	A-13	Table IV-4 (Calculated)	Table IV-4 (Calculated)		
1997	125	155	80	6	1.56	1.93	12.46	
1998	123	151	82	6	1.50	1.84	13.83	
1999	377	455	198	17	1.90	2.30	11.34	
2000	224	264	131	10	1.71	2.02	12.76	
2001	349	402	241	21	1.45	1.67	11.35	
2002	756	857	678	54	1.12	1.26	12.60	
2003	951	1,055	821	56	1.16	1.29	14.61	
2004	1,079	1,164	504	35	2.14	2.31	14.25	
2005	1,273	1,333	471	35	2.70	2.83	13.43	
2006 (*)	1,029	1,047	222	17	4.64	4.71	13.24	
5 Year Sum:	5,088	5,455	2,696	197				
10 Year Sum:	6,286	6,882	3,428	259				
1) REVENUE:								
5 Year Straight Avg:	1,018	1,091	539		2.35	2.48	13.62	32.02	33.80
5 Year Weighted Avg:					1.89	2.02	13.67	25.80	27.66
10 Year Straight Avg:	629	688	343			2.22	12.99	25.81	28.77
10 Year Weighted Avg:					1.83	2.01	13.26	24.31	26.62
2) PROFIT:									
5 Year Straight Avg:								25.62	27.04
5 Year Weighted Avg:								20.64	22.13
10 Year Straight Avg:				1.99				20.65	23.02
10 Year Weighted Avg:								19.45	21.29

TABLE 1.—OCEAN COMMERCIAL FISHING #1: Ocean Commercial Values per Fish by Species and State (continued)

B. Indian:

1) REVENUE:				
5 Year Straight Avg:	- Due to lack of data, used the non-Indian values per fish times	11.53	27.11	28.61
5 Year Weighted Avg:	Treaty Indian pounds per fish.	11.53	21.76	23.33
10 Year Straight Avg:		10.27	20.41	22.74
10 Year Weighted Avg:		10.27	18.82	20.61
2) PROFIT:				
5 Year Straight Avg:			21.68	22.88
5 Year Weighted Avg:			17.41	18.67
10 Year Straight Avg:			16.32	18.20
10 Year Weighted Avg:			15.06	16.49

Notes: (*) Preliminary data.

(**) Value refers to revenue.

TABLE 1.—OCEAN COMMERCIAL FISHING #1: Ocean Commercial Values per Fish by Species and State (continued)

IV. ALASKA: Southeast Only

1997	8,420	10,417	5,170	300	1.63	2.01	17.23
1998	4,130	5,053	4,050	240	1.02	1.25	16.88
1999	4,910	5,922	2,950	190	1.66	2.01	15.53
2000	5,750	6,787	3,780	230	1.52	1.80	16.43
2001	7,030	8,104	4,160	244	1.69	1.95	17.05
2002	7,527	8,528	6,661	417	1.13	1.28	15.97
2003	7,939	8,807	6,616	431	1.20	1.33	15.35
2004	15,359	16,568	7,413	497	2.07	2.24	14.92
2005	16,491	17,267	6,518	462	2.53	2.65	14.11
2006 (*)	18,121	18,433	5,377	355	3.37	3.43	15.15
5 Year Sum:	65,437	69,603	32,585	2,162			
10 Year Sum:	95,677	105,887	52,695	3,366			

1) REVENUE:

5 Year Straight Avg:	13,087	13,921	6,517	2.06	2.18	15.10	31.11	32.99
5 Year Weighted Avg:				2.01	2.14	15.07	30.27	32.19
10 Year Straight Avg:	9,568	10,589	5,270	1.78	1.99	15.86	28.27	31.62
10 Year Weighted Avg:				1.82	2.01	15.66	28.42	31.46

2) PROFIT:

5 Year Straight Avg:	24.89	26.39
5 Year Weighted Avg:	24.21	25.76
10 Year Straight Avg:	22.62	25.30
10 Year Weighted Avg:	22.74	25.17

TABLE 1.—OCEAN COMMERCIAL FISHING #1: Ocean Commercial Values per Fish by Species and State (continued)

State/ Year	Coho Nominal Value (**) (K$)	Coho 1st Qrtr 2007 Real Value (K$)	Coho Dressed Pounds Landed (Thousands)	Coho # Fish Harvested (Thousands)	Coho Nominal Price/lb. (Dressed)	Coho 1st Qrtr 2007 Real Price/lb. (Dressed)	Profit %: 0.8 Pounds per Fish	Nominal Revenue per Fish	Real 1st Qrtr 2007 Revenue per Fish
I. CALIFORNIA:	No ocean commercial Coho fishery in California from 1997-2006.								
II. OREGON:									
	Table IV-3	Table IV-3 (Calculated)	Table IV-7	A-8	Table IV-3 (Calculated)	Table IV-3 (Calculated)			
1997	0	0	0	0					
1998	0	0	0	0					
1999	1	1	1	0	1.00	1.21			
2000	75	89	71	12	1.06	1.25	5.79		
2001	41	47	52	9	0.79	0.91	5.57		
2002	8	9	11	2	0.73	0.82	7.26		
2003	36	40	43	6	0.84	0.93	6.68		
2004	86	93	70	9	1.23	1.33	7.92		
2005	37	39	20	3	1.85	1.94	7.64		
2006 (*)	38	39	13	1	2.92	2.97	9.19		
5 Year Sum:	205	219	157	21					
10 Year Sum:	322	356	281	42					
1) REVENUE:									
5 Year Straight Avg:	41	44	31		1.51	1.60	7.74	11.71	12.36
5 Year Weighted Avg:					1.31	1.40	7.54	9.84	10.52
10 Year Straight Avg:	32	36	28			1.42	7.15	9.31	10.15
10 Year Weighted Avg:					1.15	1.27	6.62	7.59	8.40
2) PROFIT:									
5 Year Straight Avg:								9.37	9.89
5 Year Weighted Avg:								7.87	8.42
10 Year Straight Avg:								7.44	8.12
10 Year Weighted Avg:								6.07	6.72

1.30

TABLE 1.—OCEAN COMMERCIAL FISHING #1: Ocean Commercial Values per Fish by Species and State (continued)

III. WASHINGTON:

A. Non-Indian:

	Table IV-4	Table IV-4 (Calculated)	Table IV-8	A-13	Table IV-4 (Calculated)	Table IV-4 (Calculated)			
1997		0							
1998		0							
1999	19	23	21	4	0.90	1.09	5.45		
2000	34	40	31	5	1.10	1.29	5.89		
2001	34	39	49	8	0.69	0.80	6.04		
2002	2	2	1	0	1.58	1.76	5.56		
2003	40	44	54	9	0.74	0.82	6.03		
2004	106	114	91	13	1.16	1.26	6.85		
2005	16	17	10	1	1.60	1.68	6.93		
2006 (*)	16	16	10	1	1.60	1.63	7.91		
5 Year Sum:	180	194	166	25					
10 Year Sum:	267	296	267	42					
1) REVENUE:									
5 Year Straight Avg:	36	39	33		1.34	1.43	6.65	8.90	9.50
5 Year Weighted Avg:					1.08	1.17	6.60	7.16	7.72
10 Year Straight Avg:	33	30	33			1.29	6.33	7.42	8.17
10 Year Weighted Avg:					1.00	1.11	6.30	6.30	6.99
2) PROFIT:									
5 Year Straight Avg:								7.12	7.60
5 Year Weighted Avg:								5.73	6.17
10 Year Straight Avg:								5.94	6.54
10 Year Weighted Avg:								5.04	5.59

1.17

B. Indian:

1) REVENUE:				
5 Year Straight Avg:	- Due to lack of data, used the non-Indian values per fish times	6.01	8.04	8.59
5 Year Weighted Avg:	Treaty Indian pounds per fish.	6.01	6.52	7.03
10 Year Straight Avg:		5.47	6.41	7.06
10 Year Weighted Avg:		5.47	5.47	6.06
2) PROFIT:				
5 Year Straight Avg:			6.43	6.87
5 Year Weighted Avg:			5.22	5.62
10 Year Straight Avg:			5.13	5.64
10 Year Weighted Avg:			4.37	4.85

Notes: (*) Preliminary Data
(**) Value refers to revenue.

TABLE 1.—OCEAN COMMERCIAL FISHING #1: Ocean Commercial Values per Fish by Species and State (continued)

V. ALASKA: Southeast Only

1997	14,270	17,654	14,410	1,970	0.99	1.23	7.31		
1998	13,990	17,118	23,310	2,990	0.60	0.73	7.80		
1999	21,080	25,425	21,510	3,580	0.98	1.18	6.01		
2000	9,690	11,438	13,800	1,950	0.70	0.83	7.08		
2001	13,950	16,081	22,140	3,300	0.63	0.73	6.71		
2002	10,255	11,619	24,417	3,242	0.42	0.48	7.53		
2003	11,417	12,666	17,564	2,498	0.65	0.72	7.03		
2004	20,089	21,671	21,743	3,085	0.92	1.00	7.05		
2005	17,451	18,272	18,369	3,003	0.95	0.99	6.12		
2006 (*)	19,765	20,105	14,018	2,054	1.41	1.43	6.82		
5 Year Sum:	78,977	84,332	96,111	13,882					
10 Year Sum:	151,957	172,048	191,281	27,672					
1) REVENUE:									
5 Year Straight Avg:	15,795	16,866	19,222		0.87	0.92	6.91	6.02	6.39
5 Year Weighted Avg:					0.82	0.88	6.92	5.69	6.07
10 Year Straight Avg:	15,196	17,205	19,128		0.83	0.93	6.95	5.73	6.47
10 Year Weighted Avg:					0.79	0.90	6.91	5.49	6.22
2) PROFIT:									
5 Year Straight Avg:								4.81	5.11
5 Year Weighted Avg:								4.55	4.86
10 Year Straight Avg:								4.59	5.18
10 Year Weighted Avg:								4.39	4.97

current and historical data. All of this revenue and landings (harvest) information can be found on the PFMC and ADFG websites.[1]

The most recent 10 years (1997-2006) of annual data on revenue, dressed pounds landed (i.e., partially processed harvest which may include the removal of internal organs, gills, fins, and head), and number of fish harvested, was gathered by species and state. To be consistent with PFMC procedures, original year (nominal) revenue data was converted to "current" (real) dollars using the U.S. Bureau of Economic Analysis Annual Gross Domestic Product Implicit Price Deflator (IPD).[2] The intent was to present fishing values measured in current (1st quarter 2007) dollars to be consistent with the cost estimates used in the Yakima River planning studies.

Total dressed pounds landed was divided into total nominal and real revenues on an annual basis to calculate annual nominal and real prices per pound by state and species. Five- and 10-year straight and weighted averages of both nominal and real prices per pound were calculated. The weighted averages were developed by summing the total revenue over the 5- or 10-year period and dividing it by the total dressed pounds landed over the same time period. Five- and 10-year straight and weighted average estimates of dressed weight per fish by state were also calculated and applied to the estimates of price per pound to estimate 5- and 10-year straight and weighted average nominal and real commercial revenues per fish by state. Note that the assumption was made that the additional harvest generated by the alternatives under consideration in the Yakima River studies is not expected to be large enough to generate a change in salmon prices, as a result, the plan was to make use of relatively recent salmon prices within the commercial fishing analysis.

Five- and 10-year straight and weighted average nominal and real profitability per fish by species and state was then estimated by applying a marginal or incremental profitability percentage of 80% (.8) to the estimated revenue per fish. A literature review of a series of salmon ocean commercial fishing studies (U.S. Department of Commerce, National Marine Fisheries Service, and Alaska Department of Fish & Game, 2003) indicated a range of profitability percentages from .43 to .99. As discussed in Platt (2007), excess harvest capacity within the ocean salmon commercial fishing industry leads to the potential of harvesting

---

[1] PFMC Salmon Stock Assessment and Fishery Evaluation (SAFE) Report Website: Historic data and annual Reviews of Ocean Salmon Fisheries can be found at http://www.pcouncil.org/salmon/salsafe.html . ADFG Division of Commercial Fisheries – Salmon Catch, Effort, and Value: Annual data by species and area can be found at http://www.cf.adfg.state.ak.us/geninfo/finfish/salmon/salmcatch.php .

[2] U.S. Bureau of Economic Analysis Annual and Quarterly Gross Domestic Product Implicit Price Deflator data can be found at: www.bea.gov/national/nipaweb/TablePrint.asp .

additional fish with relatively little additional cost. As a result, the additional profitability associated with the incremental harvest revenue is likely to be high, implying the use of a high profitability percentage. Ultimately, the 5-year weighted average of real profitability per fish by state and species was applied in the Yakima River ocean commercial fishing economic benefit analyses, since this estimate is based on the most recent data (years 2002-2006), accounts for landings differences between years (weighting), and converts dollars to a common year (real dollars).

Since the ocean commercial profitability values per Chinook and coho salmon vary by state, to apply them to estimate changes in commercial fishing benefits would require estimates of ocean commercial harvest by state stemming from the increases in Yakima River fish stocks. The biological population and harvest modeling effort provided estimates of total ocean commercial harvest, but not ocean harvest broken down by state. To estimate the portion of Chinook and coho commercial ocean harvest by state stemming from the Yakima River, data was gathered from hatchery fish coded wire tag recoveries as obtained from the Pacific States Marine Fisheries Commission (PSMFC) Regional Mark Processing Center (RMPC).[3] With the assistance of RMPC personnel, the database of wire tag recoveries was searched for Chinook and coho ocean commercial recoveries stemming from the Yakima River. Table 2-Ocean Commercial Fishing #2 presents the results of the coded wire tag database queries. The data from the database was used to calculate the percentage of Yakima River ocean commercial recoveries by species and state. Note that while the information within the database only reflects a small portion of the total ocean commercial harvest by state and species, it does provide an indication of the potential percentage allocation of harvest by species and state.

Since Alaskan ocean commercial fishing economic data is broken down into four subregions, a further query of the PSMFC coded wire tag recovery database was needed to separate the Alaskan harvest stemming from the Yakima River by subregion (see Table 3-Ocean Commercial Fishing #3). This additional database query was only conducted for Chinook, since no coded wire tag recoveries in Alaska stemming from the Yakima River were reported for Coho. Since 95 percent of the Alaskan Chinook ocean commercial tag recoveries stemming from the Yakima River occurred in Alaska's Southeast Region, the Alaskan ocean commercial economic data used in the Yakima River analysis focused exclusively on Southeast Region data. So while the percentage of ocean commercial harvest by species and state (including Alaska) was obtained from Table 2-Ocean Commercial Fishing #2, the data from Table 3-Ocean Commercial Fishing #3 was

[3] PSMFC Regional Mark Processing Center (RMPC) website: http://www.rmpc.org/index.php .

needed to make the decision to use of southeast Alaska economic data as reflective of Alaskan Chinook harvest for the benefit estimation process.

The focus of the BCAs is on national economic development; therefore, harvest and associated benefits occurring in Canada would be irrelevant. The 29.9% and 6.7% of ocean commercial Chinook and coho harvest, respectively, stemming from the Yakima River, which was expected to be caught in Canada, should therefore be excluded from the ocean commercial fishery benefit analysis.

The coded wire tag based percentages of ocean commercial harvest by species and state stemming from Yakima River stocks were applied to the state-by-state ocean commercial profitability estimates to calculate a weighted average ocean commercial profitability estimate per fish by species.[4] Since the coded wire tag data included Canada, the state-by-state percentages by species needed to be recalculated without Canada in order to total 100 percent. For coho, there has not been an ocean commercial fishery in California over the past ten years, as a result, both the California and Canada harvest percentages were eliminated, and the value per fish was based on only Oregon and Washington data (notice that the Alaskan percentage was zero for coho). If the percentages had not been recalculated, the United States-only weighted average profitability per fish would have been understated since the unadjusted state percentages total only to 70.1 percent (100 percent - 29.9 percent Canadian) for Chinook and 93.3 percent (100 percent - 6.7 percent Canadian) for coho. To calculate nationally oriented ocean commercial fishing benefits, either the ocean commercial harvest estimates provided by the biologists will need to focus exclusively on the U.S. harvest or the Canadian harvest percentages will need to be applied to the total (U.S. and Canada) ocean harvest by species so that Canadian harvest could be deducted from total harvest to estimate U.S.-only harvest. Table 4-Ocean Commercial Fishing #4 presents the weighted average U.S. ocean commercial revenue and profitability estimates per fish by species. In the Yakima River BCAs, the 5-year weighted average profitability values per fish by species ($25.57 for Chinook and $8.07 for coho in 1st quarter 2007 dollars) were applied to the annual estimates of U.S. ocean commercial harvest by species for each alternative. The annual profitability estimates were discounted to the present and aggregated to provide an ocean commercial fishing benefit estimate.

[4] Another option would have been to apply the percentages by state from the coded wire tag data to the overall ocean commercial harvest estimates developed by study team biologists and then apply the profitability values per fish from each state to the state specific harvest estimates. This approach would require the analyst to keep track of many more value estimates – one for each species, state, harvest type, and harvest area.

TABLE 2.—OCEAN COMMERCIAL FISHING #2: Percentage of Yakima River Ocean Commercial Harvest by Species and State (Hatchery coded wire tag data)

Source: PSMFC Regional Mark Processing Center' Coded Wire Tag Recovery Database

Species	Harvest Type	Recovery Year	Hatchery Salmon Coded Wire Tag Recovery Data by Species and Area Stemming From Yakima River: Alaska	AK%	Canada	Canada%	Washington	WA%	Oregon	OR%	California	CA%	Total
Chinook	Commercial	1984		0.000	2	1.000		0.000		0.000		0.000	2
		1985	2	0.250	6	0.750		0.000					8
		1986	5	0.250	14	0.700		0.000	1	0.050		0.000	20
		1987	18	0.367	25	0.510	3	0.061	3	0.061		0.000	49
		1988	18	0.514	15	0.429	1	0.029	0.000	0.000	0.000 1	0.029	35
		1989	11	0.297	22	0.595	2	0.054	1	0.027	1	0.027	37
		1990	51	0.560	39	0.429		0.000	1	0.011		0.000	91
		1991	23	0.418	30	0.545	1	0.018	1	0.018		0.000	55
		1992	9	0.474	7	0.368	3	0.158					19
		1993	28	0.571	18	0.367		0.000	3	0.061		0.000	49
		1994	32	0.640	18	0.360		0.000					50
		1995	3	0.231	7	0.538	1	0.077	0.000	2	0.154	0.000	0.000 13
		1996	18	0.947	1	0.053		0.000					19
		1997	41	0.612	24	0.358	1	0.015	0.000	1	0.015	0.000	0.000 67
		1998	68	0.701	25	0.258	1	0.010		3	0.031		0.000 97
		1999	133	0.619	68	0.316	13	0.060	0.000		0.000	0.000 1	0.005 215
		2000	114	0.891	9	0.070	4	0.031		1	0.008		0.000 128
		2001	39	0.780	5	0.100	2	0.040		4	0.080		0.000 50
		2002	87	0.837	12	0.115	3	0.029		2	0.019		0.000 104
		2003	80	0.909	6	0.068	2	0.023					88
		2004	20	0.645	8	0.258	3	0.097					31
		2005	17	0.500	16	0.471	1	0.029					34
		2006	6	0.750	2	0.250		0.000	0.000		0.000	0.000	0.000 8
1984-2006 Totals:			823	0.649	379	0.299	41	0.032	0.000	23	0.018	0.000 3	0.002 1269
									0.000			0.000	

Direction of Migration from the mouth of the Columbia River	
% North	% South
0.980	0.020

TABLE 2.—OCEAN COMMERCIAL FISHING #2: Percentage of Yakima River Ocean Commercial Harvest by Species and State (Hatchery coded wire tag data) (continued)

Source: PSMFC Regional Mark Processing Center's Coded Wire Tag Recovery Database

	Harvest	Recovery	Hatchery Salmon Coded Wire Tag Recovery Data by Species and Area Stemming From Yakima River:										
Species	Type	Year	Alaska	AK%	Canada	Canada%	Washington	WA%	Oregon	OR%	California	CA%	Total
Coho	Commercial	1981		0.000		0.000	1	0.071	12	0.857	1	0.071	14
		1982		-		-		-		-		-	0
		1983		-		-		-		-		-	0
		1984		-		-		-		-		-	0
		1985		-		-		-		-		-	0
		1986		-		-		-		-		-	0
		1987		-		-		-		-		-	0
		1988		0.000	1	1.000		0.000		0.000		0.000	1
		1989		0.000	10	0.123	5	0.062	64	0.790	2	0.025	81
		1990		0.000	2	0.040	9	0.180	26	0.520	13	0.260	50
		1991		0.000	2	0.024	3	0.036	63	0.750	16	0.190	84
		1992		0.000	1	0.143	1	0.143	5	0.714		0.000	7
		1993		0.000		0.000	1	1.000		0.000		0.000	1
		1994		-		-		-		-		-	0
		1995		0.000	1	0.500	1	0.500		0.000		0.000	2
		1996		-		-		-		-		-	0
		1997		-		-		-		-		-	0
		1998		-		-		-		-		-	0
		1999		0.000		0.000	2	1.000		0.000		0.000	2
		2000		0.000		0.000	1	0.500	1	0.500		0.000	2
		2001		0.000		0.000	3	0.750	1	0.250		0.000	4
		2002		0.000		0.000	1	1.000		0.000		0.000	1
		2003		0.000		0.000	1	1.000		0.000		0.000	1
		2004		0.000		0.000	3	1.000		0.000		0.000	3
		2005		-		-		-		-		-	0
		2006		-		-		-		-		-	0
1981-2006 Totals:			0	0.000	17	0.067	32	0.126	172	0.680	32	0.126	253

Direction of Migration from the mouth of the Columbia River	
% North	% South
0.194	0.806

TABLE 3.—OCEAN COMMERCIAL FISHING #3: Alaskan Ocean Chinook Coded Wire Tag Recoveries by Area

SPECIES_TYPE	RC_STATE	RC_RMPC_REGION *	FISHERY_TYPE	RECOVERY_DATE_YEAR	SUM(RC_TOTAL)	Percent By Area
Chinook	Alaska	CNAK	Commercial	1986	1	0.122
Chinook	Alaska	SEAK	Commercial	2006	6	
Chinook	Alaska	SEAK	Commercial	2005	15	
Chinook	Alaska	SEAK	Commercial	2004	20	
Chinook	Alaska	SEAK	Commercial	2003	80	
Chinook	Alaska	SEAK	Commercial	2002	87	
Chinook	Alaska	SEAK	Commercial	2001	38	
Chinook	Alaska	SEAK	Commercial	2000	112	
Chinook	Alaska	SEAK	Commercial	1999	129	
Chinook	Alaska	SEAK	Commercial	1998	62	
Chinook	Alaska	SEAK	Commercial	1997	38	
Chinook	Alaska	SEAK	Commercial	1996	17	
Chinook	Alaska	SEAK	Commercial	1995	3	
Chinook	Alaska	SEAK	Commercial	1994	31	
Chinook	Alaska	SEAK	Commercial	1993	26	
Chinook	Alaska	SEAK	Commercial	1992	9	
Chinook	Alaska	SEAK	Commercial	1991	21	
Chinook	Alaska	SEAK	Commercial	1990	43	
Chinook	Alaska	SEAK	Commercial	1989	8	
Chinook	Alaska	SEAK	Commercial	1988	17	
Chinook	Alaska	SEAK	Commercial	1987	15	
Chinook	Alaska	SEAK	Commercial	1986	4	
Chinook	Alaska	SEAK	Commercial	1985	2	
				Total:	783	95.140
Chinook	Alaska	WEAK	Commercial	2005	2	
Chinook	Alaska	WEAK	Commercial	2001	1	
Chinook	Alaska	WEAK	Commercial	2000	2	
Chinook	Alaska	WEAK	Commercial	1999	4	
Chinook	Alaska	WEAK	Commercial	1998	6	
Chinook	Alaska	WEAK	Commercial	1997	3	
Chinook	Alaska	WEAK	Commercial	1996	1	
Chinook	Alaska	WEAK	Commercial	1994	1	
Chinook	Alaska	WEAK	Commercial	1993	2	
Chinook	Alaska	WEAK	Commercial	1991	2	
Chinook	Alaska	WEAK	Commercial	1990	8	
Chinook	Alaska	WEAK	Commercial	1989	3	
Chinook	Alaska	WEAK	Commercial	1988	1	
Chinook	Alaska	WEAK	Commercial	1987	3	
				Total:	39	4.739
				Overall Total:	823	100

Note: * Alaskan ocean commercial data is broken down into 4 subregions: 1) southeast (SEAK), 2) central (CNAK), 3) Artic-Yukon-Kuskokwim (AYK), and 4) westward (WEAK)

TABLE 4.—OCEAN COMMERCIAL FISHING #4: Weighted Average Revenue and Profitability per Fish by Species

	Chinook						Coho					
	CA	OR	WA	AK	CANADA (**)	TOTAL	CA	OR	WA	AK	CANADA (**)	TOTAL
% Harvest by State/Country:	0.0024	0.0181	0.0323	0.6485	**0.2987**	1.0000	0.1265	0.6798	0.1265	0.0000	**0.0672**	1.0000
% Harvest by States Only:	0.0034	0.0258	0.0461	0.9247		1.0000	n/a (***)	0.8431	0.1569	0.0000		1.0000
1) REVENUE:												
5 Year Straight Avg:	0.14	1.00	1.56	30.50		33.19	n/a	10.42	1.49	0.00		11.91
5 Year Weighted Avg:	0.11	0.80	1.27	29.77		31.96	n/a	8.87	1.21	0.00		10.08
10 Year Straight Avg:	0.11	0.79	1.33	29.24		31.47	n/a	8.55	1.28	0.00		9.84
10 Year Weighted Avg:	0.10	0.71	1.23	29.09		31.12	n/a	7.08	1.10	0.00		8.18
2) PROFIT:												
5 Year Straight Avg:	0.11	0.80	1.25	24.40		26.56	n/a	8.34	1.19	0.00		9.53
5 Year Weighted Avg:	0.09	0.64	1.02	23.82		25.57	n/a	7.10	0.97	0.00		8.07
10 Year Straight Avg:	0.09	0.63	1.06	23.39		25.17	n/a	6.84	1.03	0.00		7.87
10 Year Weighted Avg:	0.08	0.57	0.98	23.27		24.90	n/a	5.66	0.88	0.00		6.54

** Will need to reduce ocean harvest by Canada harvest percentage (29.87%) to account for only U.S. harvest.
*** Despite the historical data on coded wire tag recoveries (early 1990s), there was not an ocean commercial Coho fishery in California during the 1997-2006 period.

2.2 Ocean Sport

Unlike commercial fishing, recreational or sport fishing activities typically do not take place within a market setting (with the exception of for-hire sector trips – charterboat, partyboat, guideboat activities). As a result, market price information is generally unavailable and nonmarket valuation techniques are typically employed.

The most common nonmarket valuation techniques used in valuing sport fishing and other outdoor recreation activities are the travel cost method (TCM) and contingent valuation method (CVM). Both of these approaches have been recommended for use in valuing outdoor recreation activities within the P&Gs. The travel cost method makes use of data on observed recreator behavior to develop a sport fishing statistical demand model where visitation is estimated as a function of travel costs to the site, site quality (e.g., fish harvest), and other socioeconomic/demographic factors. The area under the demand curve provides a measure of recreator willingness-to-pay (WTP). Subtracting from WTP the cost of accessing the site (e.g., travel cost) provides a measure of the net WTP or economic value attributable to the associated level of recreation visitation, a standard recreation valuation measure otherwise referred to as consumer surplus. Contingent valuation utilizes surveys to directly ask recreators about their WTP for different recreationally oriented scenarios. As with TCM, CVM also provides a measure of consumer surplus. One of the advantages as well as difficulties with CVM is that it involves the posing of hypothetical questions within the survey. As a result, the CVM technique can be used to estimate values for scenarios prior to their implementation. Due to the hypothetical nature of some of the CVM questions, some economists prefer using TCM since it is based on actual observed behavior. A disadvantage of a standard TCM is that it cannot address issues beyond the range of historical observation.

To estimate values per recreationally caught fish for use in the Yakima River studies sport fishing benefit estimation analyses, a detailed literature search was conducted of salmon and steelhead economic sport fishing studies. This approach of using the valuation results from existing studies, a procedure referred to as benefits transfer, is common practice for recreational economic analyses. Virtually all of the reviewed studies providing original value estimates made use of either the TCM or CVM approach. Over 80 studies were gathered and reviewed for their applicability to the Yakima River sport fisheries economic analyses. An annotated bibliography was developed of the various reviewed studies, with those studies providing value estimates included in an Excel spreadsheet for further data analysis. Since various runs of salmon are

recreationally caught both in rivers and in the ocean, with different values associated with river versus ocean sport fishing, the Excel worksheet was separated into salmon ocean versus salmon in-river sections. Note that there were not enough salmon studies differentiated by species (e.g., fall Chinook, spring Chinook, coho, etc.) to allow for separate value estimates by salmon species; therefore, all salmon sport fishing trips/days were assigned the same value within the same general geographic area (i.e., ocean versus river). However, a separate section was developed for steelhead given the number of available steelhead studies (note that steelhead are recreationally caught only within Pacific Northwest rivers and not in the ocean). Of the 80+ salmon and steelhead studies reviewed, only 59 provided original value estimates (17 for ocean salmon, 18 for river salmon, and 24 for river steelhead), the other studies either did not provide value estimates or made use of estimates from another existing study.

A complication with the use of these studies had to do with the type of value estimate(s) provided in each study. Many of the studies provided value estimates for a specific change in fishery conditions (e.g., a certain percentage change in fish populations/harvest or for the marginal/next fish harvested). The specific changes in fishery conditions therefore varied widely across the "change in conditions" studies, suggesting that the valuation results also reflected a wide range of different scenarios. Unfortunately, such studies would likely have little relevance to the Yakima studies since the change in fishery conditions evaluated in each reviewed study would be significantly different from that being evaluated in the Yakima studies. Given this situation, the decision was made to focus only on those studies that provided value estimates for "current" conditions at the time of the study. While conditions at the time of the study may vary from those seen today, it is often the case that fishery conditions tend to change rather slowly, implying those current condition value estimates would likely be more relevant to the Yakima studies. In addition, the studies were grouped and the values averaged within the spreadsheets across the following time intervals: since 2005; since 2000; since 1995; since 1990; and since 1985, with the intent on focusing on the more recently completed studies. With more recent studies, it is more likely that advanced forms of the TCM and CVM approaches would have been employed and fishery conditions would be less likely to have changed significantly as compared to current conditions. Unfortunately, it appears the majority of salmon and steelhead studies were conducted from the late 1970s to the late 1980s, so many (but not all) of the studies may be getting somewhat dated. Also note that the values from the various studies were indexed up to current (April 2007) dollars based on the consumer price index to be consistent with the Yakima River studies cost estimates. To the extent possible, we also tried to make use of the more recent studies so as to minimize the duration of the indexing period. In addition, despite the fact that the studies reflect a range of

different river and ocean locations, most of these studies were conducted in the Pacific Northwest states of California, Oregon, Washington, and Idaho (with several from Alaska). Furthermore, by grouping the studies by species (salmon versus steelhead) and geographic setting (ocean versus river), we tried to lump similar studies together. By averaging valuation results over similar species, geographic areas, and time periods, the intent was to obtain the most relevant values possible.

Another issue pertains to the units of measure of the sport fishing effort estimates. Sport fishing effort is typically measured in terms of recreation days by federal and state fisheries agencies (see Table 5-Ocean Sport Fishing #1). One needs to be careful in utilizing fishery agency effort data because in some cases, the estimates referred to as "trips" actually reflect "days" from an economics perspective (e.g., PFMC data). From an economist's point of view, a recreation trip reflects a single visit to a recreation site from one's primary residence even if the visit involves multiple days. Conversely, estimates of recreation days reflect the actual number of days spent on-site where a recreation day can involve recreating for any portion of a calendar day. As a result, a recreation trip can be comprised of more than one recreation day. Economists tend to focus on trips as the preferred visitation and valuation measure since many of the travel cost components are incurred on a per-trip basis as opposed to a per-day basis (e.g., costs of traveling to the region). For local residents, recreation trips tend to equal the number of recreation days (i.e. locals typically take single day trips). On the other hand, nonlocals tend to stay overnight in the region, implying multiple day trips. If a site experiences a significant amount of visitation from nonlocals, the number of days could significantly exceed the number of trips. Given that the Federal and state agency fishing effort estimates are generally measured in days, the valuation estimates would also need to be measured in days. Unfortunately, the majority of the reviewed studies measured values on a per-trip basis and did not provide estimates of the average number of days per trip to allow for conversion of per-trip to per-day values. To the extent that per-trip values exceed per-day values, the use of per-trip estimates would overstate sport fishing benefits.

The need to develop a value per-day estimate eliminated the available studies that only provided estimates of values on a per-trip basis. For ocean benefit estimation, only two studies conducted since 1985 were located that provided current condition value estimates on a per-day basis: 1) Olsen, Richards, and Scott (1991) and 2) Jones and Stokes (1987). Olsen et al. (1991) conducted a contingent valuation survey in 1989 to estimate use and nonuse values associated with current ocean and Columbia River conditions as well as a doubling of the size of the salmon and steelhead runs on the Columbia River. This is perhaps the most frequently referenced study of Columbia River salmon values found in the

literature. Jones and Stokes (1987) conducted a survey in 1986-7 of Juneau, Alaska, area anglers (with analysis conducted by Michael Hanemann (UC-Berkeley) and Richard Carson (UC-San Diego) using sophisticated random utility travel cost models. The average across the four values -ay estimates (two from each study), indexed to April 2007 dollars, was $115.28.

A final aspect of the ocean sport fishing analysis has to do with the conversion of value estimates from a per-day basis to a per-fish basis. The biological models used in the Yakima River studies estimated changes in fish populations for each alternative from which harvest estimates were developed. Since the sport fishing economic studies employed report values on a per-day basis, those values have to be converted to a per-fish basis before being applied to the harvest estimates. A standard procedure for conversion is to multiply the values per day by the number of ocean sport fishing days per fish harvested. Federal and state fisheries agencies generally collect data on ocean sport harvest and effort from which harvest per day estimates can be derived. Whereas harvest is estimated by species, number of days fished may not be species-specific, since many anglers do not target specific species. In others words, ocean sport trips may target certain general types of fish (e.g., salmon), but those trips may not be species-specific (e.g., fall Chinook trips). PFMC visitation data is available by species group (e.g., salmon), but not by individual species. As a result, it is often necessary to combine individual species (e.g., fall Chinook, spring Chinook, coho) into similar species groups (e.g., salmon) based on the level of detail available for the effort (trips/days) data. Harvest per day estimates can be calculated for general species types using the Federal/state agency catch and effort data. The inverse of harvest per day is the days per fish harvested factor needed to convert value per day to value per fish.

Similar to the ocean commercial analysis, ocean sport data on days per fish harvested varied by state. To estimate a weighted average days per Chinook and coho salmon harvested across the various states, coded wire tag data (as obtained from the PSMFC Regional Mark Processing Center) was again used, this time to estimate the percentage of ocean sport harvest by state stemming from the Yakima River (see Table 6-Ocean Sport Fishing #2). Note that while the days per fish harvested had to be combined for Chinook and coho due to lack of detail on fishing effort (salmon trips, not Chinook salmon trips), the coded wire tag data was salmon species specific. Multiplying the generic salmon days per harvested fish by state by the species-specific (Chinook and coho) percentages by state stemming from the Yakima River allows for the estimation of weighted average species-specific estimates of days per ocean sport harvested Chinook and coho salmon. While this estimate would be more accurate if species-specific visitation estimates could be developed and therefore species specific days per harvested fish estimates were available, nevertheless this estimate does allow for differentiation between fish species.

A complication with the estimation of the weighted average days per Chinook and coho stemmed from the lack of certain data from the State of Alaska. While Alaska gathers data on ocean sport Chinook and coho harvest, their effort (days fished) data is not species- or species-group-specific. The estimates of ocean sport fishing days in Alaska include all species. Therefore, it would not be reasonable to develop a "days per Chinook or Coho harvested" estimate since the fishing day estimate includes days where salmon are not being targeted. Since salmon days per fish harvested could not be estimated for Alaska, another option would be to see if the available Alaskan ocean sport salmon valuation studies provided estimates of values on a per-fish basis. If so, no conversion would need to be made between values per day and values per fish. Unfortunately, none of the Alaskan studies reported values on a per-fish basis or provided harvest per-day information to allow for such a conversion. As a result, a weighted average days per Chinook and coho harvested were estimated, based only on data from the states of California, Oregon, and Washington. The percentages by state for California, Oregon and Washington were re-weighted to sum to 100 percent (see Table 7-Ocean Sport Fishing #3). For coho, this data shortage was not a problem since no coded wire tags were recovered in Alaska, but for Chinook, this exclusion proved problematic since nearly 38 percent of the coded wire tags were recovered in Alaska. By excluding Alaska, we are assuming that the ocean sport fishing value per fish in Alaska is analogous to the weighted average across California, Oregon, and Washington. The decision was made that this was not an unrealistic assumption.

Table 7-Ocean Sport Fishing #3 presents the results of applying the re-weighted percentages by state to the 5-year weighted average days per fish harvested by state to estimate an overall weighted average days per ocean sport fish harvested for Chinook (.880) and coho (1.028). Multiplying these estimates of overall ocean sport days per harvested fish by the $115.28 value per day provides the necessary estimates of values per fish for Chinook ($101.49) and coho ($118.54). While both species utilized the same estimates of value per day and days per fish harvested by state, the difference in value per fish is driven by the harvest percentages by state obtained from the coded wire tag data. As with the ocean commercial analysis, the percentage of ocean sport Chinook harvest stemming from the Yakima River expected to be taken in Canada (31.5%) would need to be excluded from the analysis (note the percentage of coho harvested in Canada was essentially zero [0.3 percent]). To calculate nationally oriented ocean sport fishing benefits, either the ocean sport harvest estimates provided by the biologists will need to focus exclusively on U.S. harvest, or the Canadian harvest percentages will need to be applied to the total (U.S. and Canada) ocean harvest by species so that Canadian harvest could be deducted from total harvest to estimate U.S. harvest.

TABLE 5.—OCEAN SPORT FISHING #1: Days per Chinook & Salmon Harvested

Source: Pacific Fishery Management Council (PFMC), Salmon SAFE Report website, 2005 SAFE Report Socioeconomic Chapter

Year/Area	Charterboat Ocean Sport Salmon Days (Thousands)	Private Boat Ocean Sport Salmon Days (Thousands)	Total Ocean Sport Salmon Days (Thousands)	Charterboat Chinook Ocean Landings (Thousands of Fish)	Private Boat Chinook Ocean Landings (Thousands of Fish)	Total Chinook Ocean Landings (Thousands of Fish)	Charterboat Coho Ocean Landings (Thousands of Fish)	Private Boat Coho Ocean Landings (Thousands of Fish)	Total Coho Ocean Landings (Thousands of Fish)	Total Chinook & Coho Ocean Landings (Thousands of Fish)	Total Chinook & Coho Harvest Rate per Day	Total Chinook & Coho Days per Fish Harvested
CALIFORNIA:												
1997	102.6	131.7	234.3	122.3	106.6	228.9	0.0	0.5	0.5	229.4	0.979	1.021
1998	67.0	85.0	152.0	59.7	62.3	122.0	0.0	0.1	0.1	122.1	0.803	1.245
1999	62.6	84.4	147.0	40.5	47.4	87.9	0.0	0.6	0.6	88.5	0.602	1.661
2000	94.0	120.4	214.4	91.9	94.0	185.9	0.0	0.4	0.4	186.3	0.869	1.151
2001	69.9	95.2	165.1	43.2	55.6	98.8	0.1	1.2	1.3	100.1	0.606	1.649
2002	86.6	123.4	210.0	85.1	96.9	182.0	0.0	0.8	0.8	182.8	0.870	1.149
2003	59.4	75.3	134.7	48.3	46.4	94.7	0.1	0.6	0.7	95.4	0.708	1.412
2004	97.7	121.0	218.7	124.7	96.5	221.2	0.0	1.4	1.4	222.6	1.018	0.982
2005	69.1	103.9	173.0	61.3	81.9	143.2	0.0	0.7	0.7	143.9	0.832	1.202
2006	43.3	77.0	120.3	34.7	54.8	89.5	0.0	1.4	1.4	90.9	0.756	1.323
5 Year Straight Avg:	71.2	100.1	171.3	70.8	75.3	146.1	0.0	1.0	1.0	147.1	0.837	1.214
5 Year Weighted Avg:											0.859	1.165
10 Year Straight Avg:	75.2	101.7	177.0	71.2	74.2	145.4	0.0	0.8	0.8	146.2	0.804	1.280
10 Year Weighted Avg:											0.826	1.210

TABLE 5.—OCEAN SPORT FISHING #1: Days per Chinook & Salmon Harvested (continued)

OREGON:

1997	3.9	26.4	30.3	1.5	6.2	7.7	2.4	3.6	6.0	13.7	0.452	2.212
1998	1.8	24.2	26.0	0.5	3.6	4.1	0.5	1.8	2.3	6.4	0.246	4.063
1999	5.5	43.9	49.4	0.9	6.9	7.8	3.4	10.3	13.7	21.5	0.435	2.298
2000	9.8	68.7	78.5	3.6	21.8	25.4	7.5	25.7	33.2	58.6	0.746	1.340
2001	18.2	102.3	120.5	6.4	20.8	27.2	19.3	75	94.3	121.5	1.008	0.992
2002	15.7	91.9	107.6	7.9	39.5	47.4	9	27.5	36.5	83.9	0.780	1.282
2003	23.4	121.1	144.5	8.8	31.8	40.6	23.7	90	113.7	154.3	1.068	0.936
2004	21.1	124.6	145.7	14.6	41.8	56.4	13.1	58.8	71.9	128.3	0.881	1.136
2005	9.9	66.1	76.0	4.5	23.4	27.9	3.1	10.6	13.7	41.6	0.547	1.827
2006	8.0	54.3	62.3	1.5	11.6	13.1	3.6	12	15.6	28.7	0.461	2.171
5 Year Straight Avg:	15.6	91.6	107.2	7.5	29.6	37.1	10.5	39.8	50.3	87.4	0.747	1.470
5 Year Weighted Avg:											0.815	1.227
10 Year Straight Avg:	11.7	72.4	84.1	5.0	20.7	25.8	8.6	31.5	40.1	65.9	0.662	1.826
10 Year Weighted Avg:											0.783	1.277

WASHINGTON:

1997	12.5	15.1	27.6	1.7	2.3	4.0	12.5	12.8	25.3	29.3	1.062	0.942
1998	5.5	6.8	12.3	1.1	0.9	2.0	5.6	7.1	12.7	14.7	1.195	0.837
1999	17.5	29.9	47.4	5.7	4.1	9.8	16.3	23.7	40.0	49.8	1.051	0.952
2000	17.1	27.9	45.0	5.1	3.4	8.5	27.9	35.8	63.7	72.2	1.604	0.623
2001	41.2	72.4	113.6	11.9	10.8	22.7	66.2	98.2	164.4	187.1	1.647	0.607
2002	37	57.4	94.4	30.9	27	57.9	30.4	43.7	74.1	132.0	1.398	0.715
2003	44.5	75.5	120.0	16	18.1	34.1	53.4	84.9	138.3	172.4	1.437	0.696
2004	36.5	73.1	109.6	10.3	14.6	24.9	37.6	75.1	112.7	137.6	1.255	0.797
2005	31.7	58.9	90.6	15.9	20.4	36.3	19.2	32.6	51.8	88.1	0.972	1.028
2006	24.5	39.1	63.6	4	6.7	10.7	16.2	19.9	36.1	46.8	0.736	1.359
5 Year Straight Avg:	34.8	60.8	95.6	15.4	17.4	32.8	31.4	51.2	82.6	115.4	1.160	0.919
5 Year Weighted Avg:											1.206	0.829
10 Year Straight Avg:	26.8	45.6	72.4	10.3	10.8	21.1	28.5	43.4	71.9	93.0	1.236	0.856
10 Year Weighted Avg:											1.284	0.779

TABLE 6.—OCEAN SPORT FISHING #2: Percentage of Yakima River Ocean Sport Harvest by Species and State (Hatchery coded wire tag data)

Source: PSMFC Regional Mark Processing Center's Coded Wire Tag Recovery Database

Species	Harvest Type	Recovery Year	Hatchery Salmon Coded Wire Tag Recovery Data by Species and Area Stemming From Yakima River: Alaska	AK%	Canada	Canada%	Washington	WA%	Oregon	OR%	California	CA%	Total
Chinook	Sport	1983		0.000		0.000		0.000	1	1.000		0.000	1
		1984		-		-		-		-		-	0
		1985			1	1.000		0.000		0.000		0.000	1
		1986			2	1.000		0.000		0.000		0.000	2
		1987			2	0.500	2	0.500		0.000		0.000	4
		1988			1	1.000		0.000		0.000		0.000	1
		1989			2	0.250	5	0.625		0.000	1	0.125	8
		1990	0.000	3 0.600	1	0.200	1	0.200		0.000		0.000	5
		1991	0.000			0.000	2	1.000		0.000		0.000	2
		1992	0.000	-		-		-		-		-	0
		1993	0.000			0.000	3	1.000		0.000		0.000	3
		1994	0.000	1 1.000		0.000		0.000		0.000		0.000	1
		1995				0.000		0.000		0.000	1	1.000	1
		1996	0.000	1 1.000		0.000		0.000		0.000		0.000	1
		1997		3 0.500		0.000	3	0.500		0.000		0.000	6
		1998	0.000	1 0.091	3	0.273	7	0.636		0.000		0.000	11
		1999		10 0.303	13	0.394	9	0.273	1	0.030		0.000	33
		2000	0.000	21 0.700	8	0.267	1	0.033		0.000		0.000	30
		2001		0.000	2	0.500	1	0.250	1	0.250		0.000	4
		2002		6 0.400	6	0.400	3	0.200		0.000		0.000	15
		2003		6 1.000		0.000		0.000		0.000		0.000	6
		2004		0.000	3	0.600	1	0.200	1	0.200		0.000	5
		2005		1 0.500	1	0.500		0.000		0.000		0.000	2
		2006		1 1.000		0.000		0.000		0.000		0.000	1
		1983-2006 Totals:		54 0.378	45	0.315	38	0.266	4	0.028	2	0.014	143

Of Columbia River	
% North	% South
0.958	0.042

TABLE 6.—OCEAN SPORT FISHING #2: Percentage of Yakima River Ocean Sport Harvest by Species and State (Hatchery coded wire tag data) (continued)

Coho	Sport	1981			0.000		0.000	2	0.500	1	0.250	1	0.250	4		
		1982			-		-		-		-		-	0		
		1983			-		-		-		-		-	0		
		1984			-		-		-		-		-	0		
		1985			-		-		-		-		-	0		
		1986			-		-		-		-		-	0		
		1987			-		-		-		-		-	0		
		1988			-		-		-		-		-	0		
		1989			0.000	1	0.006	69	0.445	77	0.497	8	0.052	155		
		1990			0.000		0.000	59	0.381	82	0.529	14	0.090	155		
		1991			0.000		0.000	78	0.377	85	0.411	44	0.213	207		
		1992			0.000		0.000	10	0.385	16	0.615		0.000	26		
		1993			0.000		0.000	7	0.350	10	0.500	3	0.150	20		
		1994					0.000	1	1.000		0.000		0.000	1		
		1995			0.000		0.000	17	0.773	5	0.227		0.000	22		
		1996					0.000	5	0.833		0.000	1	0.167	6		
		1997			0.000		0.000	17	0.944	1	0.056		0.000	18		
		1998			0.000		0.000	13	0.867	2	0.133		0.000	15		
		1999	0.000		0.000		0.000	25	0.676	12	0.324		0.000	37		
		2000			0.000		0.000	25	0.500	25	0.500		0.000	50		
		2001	0.000		0.000	1	0.019	36	0.692	15	0.288		0.000	52		
		2002			-		-		-		-		-	0		
		2003			0.000		0.000	6	0.857	1	0.143		0.000	7		
		2004					0.000	6	1.000		0.000		0.000	6		
		2005					0.000	4	1.000		0.000		0.000	4	Of Columbia River	
		2006			-		-		-		-		-	0	% North	% South
		1981-2006 Totals:		0	0.000	2	0.003	380	0.484	332	0.423	71	0.090	785	0.487	0.513
			0.000													
			0.000													

TABLE 7.—OCEAN SPORT FISHING #3: Values per Fish

State	5 & 10 Year Wtd. Average Chinook & Coho Days/Fish Harvested	% Chinook Harvest by State	Re-Weighted % Chinook Harvest By State	% Coho Harvest by State	Re-Weighted % Coho Harvest by State
California:	1.165	0.014	0.045	0.090	0.091
Oregon:	1.227	0.028	0.091	0.423	0.424
Washington:	0.829	0.266	0.864	0.484	0.485
Alaska:	not available	0.378	-	0.000	-
Canada:	not applicable	0.315	-	0.003	-
			1.000		1.000
5 Year CA/OR/WA Wtd Average Days/Fish Harvested:			0.880		1.028
Value per Day (April 2007 $):			$ 115.28		$ 115.28
Value per Fish (April 2007 $):			$ 101.49		$ 118.54
California:	1.210	0.014	0.045	0.090	0.091
Oregon:	1.277	0.028	0.091	0.423	0.424
Washington:	0.779	0.266	0.864	0.484	0.485
Alaska:	not available	0.378	-	0.000	-
Canada:	not applicable	0.315	-	0.003	-
					1.000
10 Year CA/OR/WA Wtd Average Days/Fish Harvested:			0.844		1.029
Value per Day (April 2007 $):			$ 115.28		$ 115.28
Value per Fish (April 2007 $):			$ 97.24		$ 118.62

2.3 Lower Columbia River (Zones 1-5) Non-Indian Commercial

The Lower Columbia River non-Indian commercial fishing analysis applies a similar methodology as the ocean commercial fishing analysis. Zones 1-5 basically extend from the mouth of the Columbia River 140 miles upriver to Bonneville Dam. Zones 1-5 are open to non-Indian commercial fishermen and sport fishermen. Ten years of revenue and round pounds landed (entire fish as opposed to a partially processed dressed fish) data were again obtained from the PFMC nnual *Review of Ocean Salmon Fisheries*. Data from both Oregon and Washington were combined to estimate total Lower Columbia River values. As with the ocean commercial fishing analysis, nominal revenues were obtained from the report and real revenues were estimated using the GDP Implicit Price Deflator. Five- and 10-year straight and weighted averages of nominal and real prices per pound by species were multiplied by average round pounds per fish to estimate revenues per fish by species as presented in Table 8-Lower Columbia River Non-Indian Commercial Fishing #1. Round pounds per fish by species data, shown in Table 9-Lower Columbia River Non-Indian Commercial Fishing #2, was obtained from the Oregon Department of Fish and Wildlife (ODFW) website[5] and from Doug Case, ODFW staff. Again, an estimated profitability percentage of 80 percent was used to calculate profitability per fish by species. Since the biological harvest model estimated non-Indian commercial in-river harvest for this stretch of the Columbia River (zones 1-5), there is no need to use hatchery-coded wire tag recovery data to try and allocate harvest within the Columbia River Basin. The 5-year weighted average profitability value per fish by species ($45.53 for Spring Chinook, $14.56 for Fall Chinook, and $5.82 for Coho in 1st quarter 2007 dollars) presented in Table 8-Lower Columbia River Non-Indian Commercial Fishing #1 was applied directly to the annual estimates of Lower Columbia River commercial harvest. The annual profitability estimates were discounted to the present and aggregated into a total Lower Columbia River commercial fishing benefit estimate.

[5] Oregon Department of Fish and Wildlife (ODFW) website: www.dfw.state.or.us/ .

TABLE 8.—LOWER COLUMBIA RIVER NON-INDIAN COMMERCIAL FISHING #1: Non-Indian Commercial Values per Fish by Species and State

Sources: OR, WA Data: 2006 Review of Ocean Salmon Fisheries (2006 Salmon SAFE Document, published 2/2007), Socioeconomic Chapter, Table IV-9

Bureau of Economic Analysis — **Insert Target Quarter:** 1st Qrtr 2007 — **Insert IPD Value:** Annual GDP 118.041

Non-Indian — Spring Chinook — **1st Qrtr 2007** — Round — **1st Qrtr 2007**

Insert Profit %: 0.8

Year	Implicit Price Deflator (IPD)	GDP Annual Value	Nominal Value Data Year	Applied GDP Index Value	State/ Year	Nominal Value (2) (K$)	Real Value (3) (K$)	Pounds Landed (Thousands)	# Fish Harvested (Thousands)	Nominal Price/lb. (Round)	Real Price/lb. (Round)	Round Pounds per Fish	Nominal Revenue per Fish	Real 1st Qtr 2007 Revenue per Fish
					I. OREGON:	Table IV-9	Table IV-9 (Calculated)	Table IV-9	?*	Table IV-9 (Calculated)	Table IV-9 (Calculated)			
1997	95.414	0.808	2000	0.847	1997	69	81	26	?	2.65	3.13			
1998	96.472	0.817	2000	0.847	1998	94	111	35	?	2.69	3.17			
1999	97.868	0.829	2000	0.847	1999	81	96	28	?	2.89	3.41			
2000	100	0.847	2000	0.847	2000	229	270	85	?	2.69	3.18			
2001	102.399	0.867	2001	0.867	2001	586	676	222	?	2.64	3.04			
2002	104.187	0.883	2002	0.883	2002	932	1,056	316	?	2.95	3.34			
2003	106.404	0.901	2003	0.901	2003	378	419	147	?	2.57	2.85			
2004	109.426	0.927	2004	0.927	2004 (1)	1,027	1,108	276	?	3.72	4.01			
2005	112.737	0.955	2005	0.955	2005 (1)	314	329	92	?	3.41	3.57			
2006	116.043	0.983	2006	0.983	2006 (1)	614	625	131	?	4.69	4.77			
					5 Year Sum:	3,265	3,536	962						
					10 Year Sum:	4,324	4,770	1,358						
					1) REVENUE:									
					5 Year Straight Avg:	653	707			3.47	3.71	15.21	52.74	56.41
					5 Year Weighted Avg:					3.39	3.68	15.03	51.02	55.26
					10 Year Straight Avg:	432	477			3.09	3.45	14.86	45.93	51.25
					10 Year Weighted Avg:					3.18	3.51	15.00	47.77	52.70
					2) PROFIT:									
					5 Year Straight Avg:								42.19	45.13
					5 Year Weighted Avg:								40.82	44.21
					10 Year Straight Avg:								36.74	41.00
					10 Year Weighted Avg:								38.22	42.16

* ? = no data available

TABLE 8.—LOWER COLUMBIA RIVER NON-INDIAN COMMERCIAL FISHING #1: Non-Indian Commercial Values per Fish by Species and State (continued)

II. WASHINGTON:

1997				?*		
1998				?		
1999				?		
2000	15	18	3	?	5.00	5.90
2001	134	154	35	?	3.83	4.41
2002	295	334	70	?	4.21	4.77
2003	80	89	20	?	4.00	4.44
2004 (1)	272	293	69	?	3.94	4.25
2005 (1)	220	230	62	?	3.55	3.72
2006 (1)	320	326	87	?	3.68	3.74
5 Year Sum:	1,187	1,272	308			
10 Year Sum:	1,336	1,444	346			

1) REVENUE:

5 Year Straight Avg:	237	254	3.88	4.18	15.21	58.95	63.63
5 Year Weighted Avg:			3.85	4.13	15.03	57.93	62.09
10 Year Straight Avg:	191	206	4.03	4.46	14.86	59.89	66.31
10 Year Weighted Avg:			3.86	4.17	15.00	57.93	62.63

2) PROFIT:

5 Year Straight Avg:	47.16	50.90
5 Year Weighted Avg:	46.35	49.68
10 Year Straight Avg:	47.91	53.05
10 Year Weighted Avg:	46.34	50.11

* ? = no data available

TABLE 8.—LOWER COLUMBIA RIVER NON-INDIAN COMMERCIAL FISHING #1: Non-Indian Commercial Values per Fish by Species and State (continued)

III. OR & WA COMBINED:

1997	69	81	26	?*	2.65		3.13
1998	94	111	35	?	2.69		3.17
1999	81	96	28	?	2.89		3.41
2000	244	288	88	?	2.77		3.27
2001	720	830	257	?	2.80		3.23
2002	1,227	1,390	386	?	3.18		3.60
2003	458	508	167	?	2.74		3.04
2004 (1)	1,299	1,401	345	?	3.77		4.06
2005 (1)	534	559	154	?	3.47		3.63
2006 (1)	934	950	218	?	4.28		4.36
5 Year Sum:	4,452	4,809	1,270				
10 Year Sum:	5,660	6,215	1,704				
1) REVENUE:							
5 Year Straight Avg:	890	962		3.49	3.74	15.21	53.03	56.85
5 Year Weighted Avg:				3.51	3.79	15.03	52.70	56.92
10 Year Straight Avg:	566	621		3.12	3.49	14.86	46.43	51.88
10 Year Weighted Avg:				3.32	3.65	15.00	49.83	54.72
2) PROFIT:								
5 Year Straight Avg:							42.43	45.48
5 Year Weighted Avg:							42.16	45.53
10 Year Straight Avg:							37.14	41.51
10 Year Weighted Avg:							39.87	43.77

Notes:

1) Preliminary Data
2) Nominal value was obtained from Table IV-9. Since real value and nominal values equate in the current year, nominal values were obtained by referring to the real values for the current year in each annual report. The annual report was not available for years 1997-1999, so those nominal values were expressed in real year 2000 $ (obtained from the year 200 report). As a result, the 10 year nominal value estimates are incorrect, but the 10 year real values are correct.
3) Real values were calculated from the nominal values using the GDP index. The calculated real values in this spreadsheet vary somewhat from those presented in Table IV-9 given we used end of year GDP Implicit Price Deflator values.

* ? = no data available

TABLE 8.—LOWER COLUMBIA RIVER NON-INDIAN COMMERCIAL FISHING #1: (Fall Chinook) (continued)

Insert Profit %: 0.8

State/ Year	Non-Indian Fall Chinook - Brights & Tules (4) Nominal Value (2) (K$)	**1st Qrtr 2007** Real Value (3) (K$)	Round Pounds Landed (Thousands)	# Fish Harvested (Thousands)	Nominal Price/lb. (Round)	**1st Qrtr 2007** Real Price/lb. (Round)	Round Pounds per Fish	Nominal Revenue per Fish	Real 1st Qtr 2007 Revenue per Fish
I. OREGON:	Table IV-9	Table IV-9 (Calculated)	Table IV-9	?*	Table IV-9 (Calculated)	Table IV-9 (Calculated)			
1997	73	86	143	?	0.51	0.60			
1998	36	42	53	?	0.68	0.80			
1999	92	109	89	?	1.03	1.22			
2000	111	131	116	?	0.96	1.13			
2001	130	150	273	?	0.48	0.55			
2002	217	246	604	?	0.36	0.41			
2003	419	465	748	?	0.56	0.62			
2004 (1)	610	658	633	?	0.96	1.04			
2005 (1)	476	498	405	?	1.18	1.23			
2006 (1)	655	666	363	?	1.80	1.84			
5 Year Sum:	2,377	2,533	2,753						
10 Year Sum:	2,819	3,052	3,427						
1) REVENUE:									
5 Year Straight Avg:	475	507			0.97	1.03	18.44	17.93	18.93
5 Year Weighted Avg:					0.86	0.92	18.38	15.87	16.91
10 Year Straight Avg:	282	305			0.85	0.94	17.70	15.08	16.71
10 Year Weighted Avg:					0.82	0.89	18.06	14.85	16.08
2) PROFIT:									
5 Year Straight Avg:								14.34	15.14
5 Year Weighted Avg:								12.70	13.53
10 Year Straight Avg:								12.07	13.37
10 Year Weighted Avg:								11.88	12.86

* ? = no data available

TABLE 8.—LOWER COLUMBIA RIVER NON-INDIAN COMMERCIAL FISHING #1: (Fall Chinook) (continued)

II. WASHINGTON:

1997	9	11	9	?*	1.00	1.18
1998	29	34	27	?	1.07	1.27
1999	86	102	82	?	1.05	1.24
2000	131	155	138	?	0.95	1.12
2001	67	77	122	?	0.55	0.63
2002	99	112	215	?	0.46	0.52
2003	258	286	448	?	0.58	0.64
2004 (1)	431	465	338	?	1.28	1.38
2005 (1)	327	342	235	?	1.39	1.46
2006 (1)	420	427	218	?	1.93	1.96
5 Year Sum:	1,535	1,633	1,454			
10 Year Sum:	1,857	2,011	1,832			

1) REVENUE:

5 Year Straight Avg:	307	327		1.13	1.19	18.44	20.76	21.95
5 Year Weighted Avg:				1.06	1.12	18.38	19.40	20.64
10 Year Straight Avg:	186	201		1.03	1.14	17.70	18.15	20.17
10 Year Weighted Avg:				1.01	1.10	18.06	18.30	19.82

2) PROFIT:

5 Year Straight Avg:	16.61	17.56
5 Year Weighted Avg:	15.52	16.51
10 Year Straight Avg:	14.52	16.14
10 Year Weighted Avg:	14.64	15.86

* ? = no data available

TABLE 8.—LOWER COLUMBIA RIVER NON-INDIAN COMMERCIAL FISHING #1: (Fall Chinook) (continued)

III. OR & WA COMBINED:

1997	82	97	152	?*	0.54	0.64	
1998	65	77	80	?	0.81	0.96	
1999	178	210	171	?	1.04	1.23	
2000	242	286	254	?	0.95	1.12	
2001	197	227	395	?	0.50	0.57	
2002	316	358	819	?	0.39	0.44	
2003	677	751	1,196	?	0.57	0.63	
2004 (1)	1,041	1,123	971	?	1.07	1.16	
2005 (1)	803	841	640	?	1.25	1.31	
2006 (1)	1,075	1,094	581	?	1.85	1.88	
5 Year Sum:	3,912	4,166	4,207				
10 Year Sum:	4,676	5,063	5,259				

1) REVENUE:

5 Year Straight Avg:	782	833	1.03	1.08	18.44	18.91	19.98
5 Year Weighted Avg:			0.93	0.99	18.38	17.09	18.20
10 Year Straight Avg:	468	506	0.90	0.99	17.70	15.89	17.60
10 Year Weighted Avg:			0.89	0.96	18.06	16.06	17.38

2) PROFIT:

5 Year Straight Avg:						15.13	15.98
5 Year Weighted Avg:						13.67	14.56
10 Year Straight Avg:						12.71	14.08
10 Year Weighted Avg:						12.84	13.91

Notes:

1) Preliminary Data
2) Nominal value was obtained from Table IV-9. Since real value and nominal values equate in the current year, nominal values were obtained by referring to the real values for the current year in each annual report. The annual report was not available for years 1997-1999, so those nominal values were expressed in real year 2000 $ (obtained from the year 200 report). As a result, the 10 year nominal value estimates are incorrect, but the 10 year real values are correct.
3) Real values were calculated from the nominal values using the GDP index. The calculated real values in this spreadsheet vary somewhat from those presented in Table IV-9 given we used end of year GDP Implicit Price Deflator values.
4) “Tules” (to-lee) are fall Chinook that are ready to spawn and are therefore less commercially valuable than fall “brights.” Fall brights spawn later and further upstream (Hanford Reach or Snake River). These values include both tules and fall brights combined.

* ? = no data available

TABLE 8.—LOWER COLUMBIA RIVER NON-INDIAN COMMERCIAL FISHING #1: (Coho) (continued)

State/ Year	Non-Indian Coho Nominal Value (2) (K$)	1st Qrtr 2007 Real Value (3) (K$)	Round Pounds Landed (Thousands)	# Fish Harvested (Thousands)	Nominal Price/lb. (Round)	1st Qrtr 2007 Real Price/lb. (Round)	Round Pounds per Fish	Nominal Revenue per Fish	Real 1st Qtr 2007 Revenue per Fish
I. OREGON:	Table IV-9	Table IV-9 (Calculated)	Table IV-9	?*	Table IV-9 (Calculated)	Table IV-9 (Calculated)			
1997	115	136	149	?	0.77	0.91			
1998	131	155	193	?	0.68	0.80			
1999	400	472	469	?	0.85	1.01			
2000	506	597	949	?	0.53	0.63			
2001	374	431	1323	?	0.28	0.33			
2002	373	423	1148	?	0.32	0.37			
2003	776	861	1522	?	0.51	0.57			
2004 (1)	679	732	755	?	0.90	0.97			
2005 (1)	845	885	789	?	1.07	1.12			
2006 (1)	627	638	478	?	1.31	1.33			
5 Year Sum:	3,300	3,538	4,692						
10 Year Sum:	4,826	5,329	7,775						
1) REVENUE:									
5 Year Straight Avg:	660	708			0.82	0.87	9.98	8.21	8.70
5 Year Weighted Avg:					0.70	0.75	9.77	6.87	7.37
10 Year Straight Avg:	483	533			0.72	0.80	9.22	6.67	7.41
10 Year Weighted Avg:					0.62	0.69	9.34	5.80	6.40
2) PROFIT:									
5 Year Straight Avg:								6.57	6.96
5 Year Weighted Avg:								5.50	5.90
10 Year Straight Avg:								5.34	5.92
10 Year Weighted Avg:								4.64	5.12

Insert Profit %: 0.8

* ? = no data available

TABLE 8.—LOWER COLUMBIA RIVER NON-INDIAN COMMERCIAL FISHING #1: (Coho) (continued)

II. WASHINGTON:

1997	2	2	3	?*	0.67	0.79
1998				?		
1999	183	216	215	?	0.85	1.00
2000	256	302	504	?	0.51	0.60
2001	247	285	934	?	0.26	0.30
2002	176	199	538	?	0.33	0.37
2003	449	498	799	?	0.56	0.62
2004 (1)	314	339	370	?	0.85	0.92
2005 (1)	196	205	191	?	1.03	1.07
2006 (1)	276	281	207	?	1.33	1.36
5 Year Sum:	1,411	1,522	2,105			
10 Year Sum:	2,099	2,327	3,761			

1) REVENUE:

5 Year Straight Avg:	282	304		0.82	0.87	9.98	8.17	8.66
5 Year Weighted Avg:				0.67	0.72	9.77	6.55	7.07
10 Year Straight Avg:	233	259		0.71	0.78	9.22	6.54	7.21
10 Year Weighted Avg:				0.56	0.62	9.34	5.21	5.78

2) PROFIT:

5 Year Straight Avg:	6.54	6.93
5 Year Weighted Avg:	5.24	5.65
10 Year Straight Avg:	5.23	5.77
10 Year Weighted Avg:	4.17	4.62

* ? = no data available

TABLE 8.—LOWER COLUMBIA RIVER NON-INDIAN COMMERCIAL FISHING #1: (Coho) (continued)

III. OR & WA COMBINED:

1997	117	138	152	?*	0.77	0.91	
1998	131	155	193	?	0.68	0.80	
1999	583	688	684	?	0.85	1.01	
2000	762	899	1,453	?	0.52	0.62	
2001	621	716	2,257	?	0.28	0.32	
2002	549	622	1,686	?	0.33	0.37	
2003	1,225	1,359	2,321	?	0.53	0.59	
2004 (1)	993	1,071	1,125	?	0.88	0.95	
2005 (1)	1,041	1,090	980	?	1.06	1.11	
2006 (1)	903	919	685	?	1.32	1.34	
5 Year Sum:	4,711	5,061	6,797				
10 Year Sum:	6,925	7,657	11,536				

1) REVENUE:

5 Year Straight Avg:	942	1,012	0.82	0.87	9.98	8.21	8.70
5 Year Weighted Avg:			0.69	0.74	9.77	6.77	7.28
10 Year Straight Avg:	693	766	0.72	0.80	9.22	6.65	7.39
10 Year Weighted Avg:			0.60	0.66	9.34	5.60	6.20

2) PROFIT:

5 Year Straight Avg:	6.57	6.96
5 Year Weighted Avg:	5.42	5.82
10 Year Straight Avg:	5.32	5.91
10 Year Weighted Avg:	4.48	4.96

Notes:

1) Preliminary Data
2) Nominal value was obtained from Table IV-9. Since real value and nominal values equate in the current year, nominal values were obtained by referring to the real values for the current year in each annual report. The annual report was not available for years 1997-1999, so those nominal values were expressed in real year 2000 $ (obtained from the year 200 report). As a result, the 10 year nominal value estimates are incorrect, but the 10 year real values are correct.
3) Real values were calculated from the nominal values using the GDP index. The calculated real values in this spreadsheet vary somewhat from those presented in Table IV-9 given we used end of year GDP Implicit Price Deflator values.

* ? = no data available

TABLE 9.—LOWER COLUMBIA RIVER NON-INDIAN COMMERCIAL FISHING #2: Average Weights per Fish by Species for Non-Indian Commercial Harvest

Source: ODFW website (Fish Division, Ocean Salmon & Columbia River Program, Columbia River Fisheries & Management, Commercial Fishing Landings) and personal communications with Doug Case, ODFW staff

			Non-Indian Winter/Spring/Summer Chinook			Non-Indian Fall Chinook			Non-Indian Coho		
Year	Season	Location	# Fish	# Pounds	Lbs/Fish	# Fish	# Pounds	Lbs/Fish	# Fish	# Pounds	Lbs/Fish
1997	Combined	Mainstem & Non-Mainstem	1,913	26,211	13.7	8,609	151,696	17.6	19,477	152,855	7.8
1998	Combined	Mainstem & Non-Mainstem	2,231	35,476	15.9	4,339	78,143	18.0	23,801	194,226	8.2
1999	Combined	Mainstem & Non-Mainstem	1,971	28,310	14.4	8,055	116,994	14.5	80,533	683,934	8.5
2000	Combined	Mainstem & Non-Mainstem	6,988	88,077	12.6	13,196	246,583	18.7	173,888	1,548,562	8.9
2001	Combined	Mainstem & Non-Mainstem	15,955	255,295	16.0	24,636	394,516	16.0	253,495	2,257,359	8.9
2002	Combined	Mainstem & Non-Mainstem	26,083	388,461	14.9	43,523	816,528	18.8	164,152	1,687,089	10.3
2003	Combined	Mainstem & Non-Mainstem	10,962	172,739	15.8		1,222,859	18.1	262,450	2,402,880	9.2
2004	Combined	Mainstem & Non-Mainstem	24,329	351,589	14.5	67,601	987,165	18.4	118,466	1,138,396	9.6
2005	Combined	Mainstem & Non-Mainstem	10,557	166,560	15.8	53,706	646,856	17.9		1,001,927	10.2
2006	Combined	Mainstem & Non-Mainstem	16,453	249,269	15.2	36,232	583,787	19.1	98,175	701,722	10.6
		5 Year Sum:	88,384	1,328,618		30,288	4,257,195		709,268	6,932,014	
		10 Year Sum:	117,442	1,761,987		290,465	5,245,127		66,025 1,260,462	11,768,950	
		5 Year Straight Average:			15.2			18.4			10.0
		5 Year Weighted Average:			15.0			18.4			9.8
		10 Year Straight Average:			14.9			17.7			9.2
		10 Year Weighted Average:			15.0			18.1			9.3

Note: Years 2003-2006 from ODFW website. Years 1997-2002 from Doug Case (ODFW).

2.4 Lower Columbia River (Zones 1-5) Sport

The Lower Columbia River sport fishing benefits analysis follows the same general procedure as outlined under the ocean sport fishery. Zones 1-5 basically extend from the mouth of the Columbia River (including the Buoy 10 sport fishery) 140 miles upriver to Bonneville Dam.

The value per day was pulled from the river oriented salmon literature search described under the ocean sport fishing section. Four value estimates obtained from three river oriented salmon studies conducted with data gathered since 1985 averaged $68.72 per day in April 2007 dollars. In addition to the Olsen et al. (1991) study discussed in the ocean sport fishing section, another Olsen study was included (Olsen and Richards, 1992) as well as a study by Gallo (2003). The Olsen and Richards (1992) study reported current condition and doubling of salmon population results from a contingent valuation survey conducted on the Rogue River in Oregon in 1992. The Gallo (2003) study used a zonal travel cost model to estimate values associated with current and salmon doubling scenarios on the Sacramento River in California based on a 1999 survey.

As also described under the ocean sport fishing section, value per salmon sport fishing day needs to be converted to a value per fish before being applied to the Lower Columbia River sport fish harvest estimates provided by Yakima River study team biologists. Ten years of Lower Columbia River sport salmon and steelhead harvest and effort (days fished) data, as obtained from an ODFW report *The 2005 Lower Columbia River and Buoy 10 Recreational Fisheries* with 2006 data provided by James Watts (ODFW), is presented in Table 10-Lower Columbia River Sport Fishing #1. The data was used to calculate the conversion factor of Lower Columbia River salmon sport fishing days per fish harvested. Using the 5-year weighted average estimate of salmon sport fishing days per salmon harvested for the Lower Columbia River (4.424), the $68.72 per-day value converts to $304.02 per fish. This value would be applicable to all species of salmon.

TABLE 10.—LOWER COLUMBIA RIVER SPORT FISHING #1: Days per Fish Harvested

Source: Watts, J. and H. Takata. December 2006. "The 2005 Lower Columbia River and Buoy 10 Recreational Fisheries." Oregon Department of Fish and Wildlife, Fish Division.

Year	Salmon and Steelhead Effort (Days)	Salmon and Steelhead Harvest	Harvest per Day	Days per Fish Harvested
1997	146,734	50,808	0.346	2.888
1998	132,164	29,265	0.221	4.516
1999	149,838	36,738	0.245	4.079
2000	197,354	51,105	0.259	3.862
2001	433,036	197,547	0.456	2.192
2002	430,196	86,738	0.202	4.960
2003	415,740	28,693	0.310	3.230
2004	360,074	86,101	0.239	4.182
2005	304,977	55,916	0.183	5.454
2006	260,532	42,946	0.165	6.067
5 Year Sum:	1,771,519	400,394		
10 Year Sum:	2,830,645	765,857		
5 Year Straight Average:			0.220	4.779
5 Year Weighted Average:			0.226	4.424
10 Year Straight Average:			0.263	4.143
10 Year Weighted Average:			0.271	3.696

2.5 Columbia River (Zone 6) Indian Commercial

The Columbia River Indian commercial fishing analysis applies basically the same methodology as the ocean and non-Indian Lower Columbia River commercial fishing analyses. Zone 6 of the Columbia River extends from Bonneville Dam, approximately 140 miles upriver to McNary Dam. While zones 1-5 are assigned to non-Indian fisheries, zone 6 is purely a Tribal fishery. Ten years of revenue and round (full fish) pounds landed data were again

obtained from the PFMC annual *Review of Ocean Salmon Fisheries*. Data from both Oregon and Washington were combined to estimate total zone 6 Columbia River values. Nominal revenues were obtained from the report and real revenues were estimated using the GDP Implicit Price Deflator. Five- and 10-year straight and weighted averages of nominal and real prices per pound by species were multiplied by average pounds per fish to estimate revenues per fish by species as presented in Table 11-Columbia River Indian Commercial Fishing #1. Round pounds per fish by species data, shown in Table 12-Columbia River Indian Commercial Fishing #2, was obtained from the Oregon Department of Fish and Wildlife website and from Doug Case, ODFW biologist. Again, an estimated profitability percentage of 80 percent was used to calculate profitability per fish by species. Since the biological harvest model estimated Indian commercial in-river harvest for this stretch of the Columbia River (zone 6), there is no need to use hatchery-coded wire tag recovery data to try and allocate harvest within the Columbia River. The 5-year weighted average profitability per fish by species ($22.56 for spring Chinook, $8.78 for fall Chinook, and $3.11 for coho in 1st quarter 2007 dollars as presented in Table 11-Columbia River Indian Commercial Fishing #1) was applied directly to the annual estimates of zone 6 Columbia River commercial harvest. The annual profitability estimates were discounted to the present and aggregated into a total zone 6 Columbia River commercial fishing benefit estimate.

TABLE 11.—COLUMBIA RIVER INDIAN COMMERCIAL FISHING #1: Columbia River Zone 6 Indian Commercial Values per Fish by Species and State

Sources: OR, WA Data: 2006 Review of Ocean Salmon Fisheries (2006 Salmon SAFE Document, published 2/2007), Socioeconomic Chapter, Table IV-9

Bureau of Economic Analysis — **Insert Target Quarter:** 1st Qrtr 2007 — **Insert IPD Value:** Annual GDP 118.041 — Indian — Spring Chinook — **Insert Profit %:** 0.8

Year	Implicit Price Deflator (IPD)	GDP Annual Value	Nominal Value Data Year	Applied GDP Index Value	State/ Year	Nominal Value (2) (K$)	Real Value (3) (K$) **1st Qrtr 2007**	Pounds Landed (Thousands) Round	# Fish Harvested (Thousands)	Nominal Price/lb. (Round)	Real Price/lb. **1st Qrtr 2007**	Round Pounds per Fish	Nominal Revenue per Fish	Real 1st Qtr 2007 Revenue per Fish
					I. OREGON:	Table IV-9	Table IV-9 (Calculated)	Table IV-9	?*	Table IV-9 (Calculated)	Table IV-9 (Calculated)			
1997	95.414	0.808	2000	0.847	1997				?					
1998	96.472	0.817	2000	0.847	1998				?					
1999	97.868	0.829	2000	0.847	1999				?					
2000	100	0.847	2000	0.847	2000	2	2	1	?	2.00	2.36			
2001	102.399	0.867	2001	0.867	2001	33	38	25	?	1.32	1.52			
2002	104.187	0.883	2002	0.883	2002	17	19	14	?	1.21	1.38			
2003	106.404	0.901	2003	0.901	2003	5	6	1	?	5.00	5.55			
2004	109.426	0.927	2004	0.927	2004 (1)	148	160	80	?	1.85	2.00			
2005	112.737	0.955	2005	0.955	2005 (1)				?					
2006	116.043	0.983	2006	0.983	2006 (1)				?					
					5 Year Sum:	170	184	95						
					10 Year Sum:	205	225	121						
					1) REVENUE:									
					5 Year Straight Avg:	57	61			2.69	2.97	16.61	44.64	49.37
					5 Year Weighted Avg:					1.79	1.94	16.38	29.30	31.80
					10 Year Straight Avg:	41	45			2.28	2.56	17.65	40.20	45.20
					10 Year Weighted Avg:					1.69	1.86	15.63	26.49	29.05
					2) PROFIT:									
					5 Year Straight Avg:								35.72	39.50
					5 Year Weighted Avg:								23.44	25.44
					10 Year Straight Avg:								32.16	36.16
					10 Year Weighted Avg:								21.19	23.24

* ? = data not available

TABLE 11.—COLUMBIA RIVER INDIAN COMMERCIAL FISHING #1: Columbia River Zone 6 Indian Commercial Values per Fish by Species and State (continued)

II. WASHINGTON:

1997				?*					
1998				?					
1999				?					
2000	51	60	27	?	1.89	2.23			
2001	280	323	221	?	1.27	1.46			
2002	218	247	185	?	1.18	1.34			
2003	142	158	133	?	1.07	1.18			
2004 (1)	165	178	105	?	1.57	1.70			
2005 (1)	113	118	67	?	1.69	1.77			
2006 (1)	425	432	180	?	2.36	2.40			
5 Year Sum:	1,063	1,133	670						
10 Year Sum:	1,394	1,516	918						
1) REVENUE:									
5 Year Straight Avg:	213	227			1.57	1.68	16.61	26.12	27.84
5 Year Weighted Avg:					1.59	1.69	16.38	25.98	27.70
10 Year Straight Avg:	199	217			1.57	1.72	17.65	27.80	30.45
10 Year Weighted Avg:					1.52	1.65	15.63	23.74	25.82
2) PROFIT:									
5 Year Straight Avg:							20.90		22.27
5 Year Weighted Avg:							20.78		22.16
10 Year Straight Avg:							22.24		24.36
10 Year Weighted Avg:							18.99		20.66

* ? = data not available

TABLE 11.—COLUMBIA RIVER INDIAN COMMERCIAL FISHING #1: Columbia River Zone 6 Indian Commercial Values per Fish by Species and State (continued)

III. OR & WA COMBINED:

1997				?*			
1998				?			
1999				?			
2000	53	63	28	?	1.89		2.23
2001	313	361	246	?	1.27		1.47
2002	235	266	199	?	1.18		1.34
2003	147	163	134	?	1.10		1.22
2004 (1)	313	338	185	?	1.69		1.83
2005 (1)	113	118	67	?	1.69		1.77
2006 (1)	425	432	180	?	2.36		2.40
5 Year Sum:	1,233	1,318	765				
10 Year Sum:	1,599	1,741	1,039				
1) REVENUE:							
5 Year Straight Avg:	247	264		1.60	1.71	16.61	26.63	28.39
5 Year Weighted Avg:				1.61	1.72	16.38	26.39	28.20
10 Year Straight Avg:	228	249		1.60	1.75	17.65	28.20	30.89
10 Year Weighted Avg:				1.54	1.68	15.63	24.06	26.20
2) PROFIT:								
5 Year Straight Avg:							21.30	22.71
5 Year Weighted Avg:							21.11	22.56
10 Year Straight Avg:							22.56	24.71
10 Year Weighted Avg:							19.25	20.96

Notes:

4) Preliminary Data
5) Nominal value was obtained from Table IV-9. Since real value and nominal values equate in the current year, nominal values were obtained by referring to the real values for the current year in each annual report. The annual report was not available for years 1997-1999, so those nominal values were expressed in real year 2000 $ (obtained from the year 200 report). As a result, the 10 year nominal value estimates are incorrect, but the 10 year real values are correct.
6) Real values were calculated from the nominal values using the GDP index. The calculated real values in this spreadsheet vary somewhat from those presented in Table IV-9 given we used end of year GDP Implicit Price Deflator values.
7) “Tules” (to-lee) are fall Chinook that are ready to spawn and are therefore less commercially valuable than fall “brights.” Fall brights spawn later and further upstream (Hanford Reach or Snake River). These values include both tules and fall brights combined.

* ? = data not available

TABLE 11.—COLUMBIA RIVER INDIAN COMMERCIAL FISHING #1: (Fall Chinook) (continued)

Insert Profit %: 0.8

State/ Year	Nominal Value (2) (K$)	1st Qrtr 2007 Real Value (3) (K$)	Round Pounds Landed (Thousands)	# Fish Harvested (Thousands)	Nominal Price/lb. (Round)	1st Qrtr 2007 Real Price/lb. (Round)	Round Pounds per Fish	Nominal Revenue per Fish	Real 1st Qtr 2007 Revenue per Fish
	Indian								
	Fall Chinook - Brights & Tules **								
I. OREGON:	Table IV-9	Table IV-9 (Calculated)	Table IV-9	?*	Table IV-9 (Calculated)	Table IV-9 (Calculated)			
1997	57	67	136	?	0.42	0.49			
1998	44	52	73	?	0.60	0.71			
1999	70	83	127	?	0.55	0.65			
2000	102	120	166	?	0.61	0.73			
2001	8	9	8	?	1.00	1.15			
2002	4	5	6	?	0.67	0.76			
2003	13	14	19	?	0.68	0.76			
2004 (1)	568	613	775	?	0.73	0.79			
2005 (1)	219	229	267	?	0.82	0.86			
2006 (1)	319	324	217	?	1.47	1.50			
5 Year Sum:	1,123	1,185	1,284						
10 Year Sum:	1,404	1,517	1,794						
1) REVENUE:									
5 Year Straight Avg:	225	237			0.87	0.93	19.22	16.81	17.91
5 Year Weighted Avg:					0.87	0.92	19.16	16.76	17.69
10 Year Straight Avg:	140	152			0.76	0.84	18.65	14.10	15.65
10 Year Weighted Avg:					0.78	0.85	18.77	14.69	15.87
2) PROFIT:									
5 Year Straight Avg:								13.45	14.33
5 Year Weighted Avg:								13.41	14.15
10 Year Straight Avg:								11.28	12.52
10 Year Weighted Avg:								11.75	12.69

* ? = data not available

TABLE 11.—COLUMBIA RIVER INDIAN COMMERCIAL FISHING #1: (Fall Chinook) (continued)

II. WASHINGTON:

1997	278	328	633	?*	0.44	0.52			
1998	246	290	508	?	0.48	0.57			
1999	336	397	613	?	0.55	0.65			
2000	297	351	509	?	0.58	0.69			
2001	315	363	1306	?	0.24	0.28			
2002	282	319	1587	?	0.18	0.20			
2003	292	324	1607	?	0.18	0.20			
2004 (1)	443	478	806	?	0.55	0.59			
2005 (1)	716	750	1404	?	0.51	0.53			
2006 (1)	1269	1,291	905	?	1.40	1.43			
5 Year Sum:	3,002	3,162	6,309						
10 Year Sum:	4,474	4,891	9,878						
1) REVENUE:									
5 Year Straight Avg:	600	632			0.56	0.59	19.22	10.84	11.36
5 Year Weighted Avg:					0.48	0.50	19.16	9.12	9.60
10 Year Straight Avg:	447	489			0.51	0.57	18.65	9.54	10.56
10 Year Weighted Avg:					0.45	0.50	18.77	8.50	9.29
2) PROFIT:									
5 Year Straight Avg:								8.68	9.09
5 Year Weighted Avg:								7.29	7.68
10 Year Straight Avg:								7.64	8.44
10 Year Weighted Avg:								6.80	7.43

* ? = data not available

TABLE 11.—COLUMBIA RIVER INDIAN COMMERCIAL FISHING #1: (Fall Chinook) (continued)

III. OR & WA COMBINED:

1997				?*	0.44	0.51				
1998	335	395	769	?	0.50	0.59				
1999	290	342	581	?	0.55	0.65				
2000	406	479	740	?	0.59	0.70				
2001	399	471	675	?	0.25	0.28				
2002	323	372	1,314	?	0.18	0.20				
2003	286	324	1,593	?	0.19	0.21				
2004 (1)	305	338	1,626	?	0.64	0.69				
2005 (1)	1,011	1,091	1,581	?	0.56	0.59				
2006 (1)	935	979	1,671	?	1.42	1.44				
5 Year Sum:	1,588	1,615	1,122							
10 Year Sum:	4,125	4,347	7,593							
	5,878	6,408	11,672							
1) REVENUE:										
5 Year Straight Avg:	825	869			0.60	0.63	19.22	11.46	12.02	
5 Year Weighted Avg:					0.54	0.57	19.16	10.41	10.97	
10 Year Straight Avg:	588	641			0.53	0.59	18.65	9.89	10.93	
10 Year Weighted Avg:					0.50	0.55	18.77	9.45	10.30	
2) PROFIT:										
5 Year Straight Avg:								9.17	9.62	
5 Year Weighted Avg:								8.33	8.78	
10 Year Straight Avg:								7.91	8.74	
10 Year Weighted Avg:								7.56	8.24	

* ? = data not available

TABLE 11.—COLUMBIA RIVER INDIAN COMMERCIAL FISHING #1: (Coho) (continued)

State/ Year	Nominal Value (2) (K$)	1st Qrtr 2007 Real Value (3) (K$)	Round Pounds Landed (Thousands)	# Fish Harvested (Thousands)	Nominal Price/lb. (Round)	1st Qrtr 2007 Real Price/lb. (Round)	Round Pounds per Fish	Nominal Revenue per Fish	Real 1st Qtr 2007 Revenue per Fish
	Indian						Insert Profit %:	0.8	
	Coho								
I. OREGON:	Table IV-9	Table IV-9 (Calculated)	Table IV-9	?*	Table IV-9 (Calculated)	Table IV-9 (Calculated)			
1997				?					
1998				?					
1999	3	4	4	?	0.75	0.89			
2000	5	6	8	?	0.63	0.74			
2001				?					
2002				?					
2003				?					
2004 (1)	17	18	29	?	0.59	0.63			
2005 (1)				?					
2006 (1)	14	14	12	?	1.17	1.19			
5 Year Sum:	31	33	41						
10 Year Sum:	39	42	53						
1) REVENUE:									
5 Year Straight Avg:	16	16			0.88	0.91	9.84	8.62	8.95
5 Year Weighted Avg:					0.76	0.79	10.18	7.70	8.09
10 Year Straight Avg:	10	11			0.78	0.86	8.80	6.88	7.57
10 Year Weighted Avg:					0.74	0.79	9.38	6.90	7.44
2) PROFIT:									
5 Year Straight Avg:								6.90	7.16
5 Year Weighted Avg:								6.16	6.47
10 Year Straight Avg:								5.50	6.06
10 Year Weighted Avg:								5.52	5.95

* ? = data not available

TABLE 11.—COLUMBIA RIVER INDIAN COMMERCIAL FISHING #1: (Coho) (continued)

II. WASHINGTON:

1997	1	1	2	?*	0.50	0.59
1998	1	1	1	?	1.00	1.18
1999	8	9	11	?	0.73	0.86
2000	13	15	30	?	0.43	0.51
2001	7	8	68	?	0.10	0.12
2002	3	3	22	?	0.14	0.15
2003	2	2	23	?	0.09	0.10
2004 (1)	5	5	43	?	0.12	0.13
2005 (1)	10	10	34	?	0.29	0.31
2006 (1)	25	25	45	?	0.56	0.57
5 Year Sum:	45	47	167			
10 Year Sum:	75	82	279			

1) REVENUE:

5 Year Straight Avg:	9	9		0.24	0.25	9.84	2.34	2.46
5 Year Weighted Avg:				0.27	0.28	10.18	2.74	2.86
10 Year Straight Avg:	8	8			0.45	8.80	3.48	3.97
10 Year Weighted Avg:				0.27	0.29	9.38	2.52	2.76

2) PROFIT:

5 Year Straight Avg:							1.87	1.97
5 Year Weighted Avg:							2.19	2.29
10 Year Straight Avg:			0.40				2.78	3.17
10 Year Weighted Avg:							2.02	2.21

* ? = data not available

TABLE 11.—COLUMBIA RIVER INDIAN COMMERCIAL FISHING #1: (Coho) (continued)

III. OR & WA COMBINED:

1997	1	1	2	?*	0.50	0.59			
1998	1	1	1	?	1.00	1.18			
1999	11	13	15	?	0.73	0.87			
2000	18	21	38	?	0.47	0.56			
2001	7	8	68	?	0.10	0.12			
2002	3	3	22	?	0.14	0.15			
2003	2	2	23	?	0.09	0.10			
2004 (1)	22	24	72	?	0.31	0.33			
2005 (1)	10	10	34	?	0.29	0.31			
2006 (1)	39	40	57	?	0.68	0.70			
5 Year Sum:	76	79	208						
10 Year Sum:	114	124	332						
1) REVENUE:									
5 Year Straight Avg:	15	16			0.30	0.32	9.84	2.97	3.12
5 Year Weighted Avg:					0.37	0.38	10.18	3.72	3.89
10 Year Straight Avg:	11	12			0.43	0.49	8.80	3.80	4.31
10 Year Weighted Avg:					0.34	0.37	9.38	3.22	3.51
2) PROFIT:									
5 Year Straight Avg:								2.37	2.49
5 Year Weighted Avg:								2.98	3.11
10 Year Straight Avg:								3.04	3.45
10 Year Weighted Avg:								2.58	2.81

* ? = data not available

TABLE 12.—COLUMBIA RIVER INDIAN COMMERCIAL FISHING #2: Average Weights per Fish by Species for Indian Commercial Harvest

Source: Data based on personal communication with Doug Case (ODFW)

Year	Indian Winter/Spring/Summer Chinook # Fish	# Pounds	Lbs/Fish		Indian Fall Chinook # Fish	# Pounds	Lbs/Fish		Indian Coho # Fish	# Pounds	Lbs/Fish	
1997	14	267	19.1		39,371	733,602	18.6		223	1,635	7.3	
1998	1	18	18.0		31,349	550,084	17.5		230	1,586	6.9	
1999	1	31	31.0		43,780	739,633	16.9		1,650	14,294	8.7	
2000	1,313	15,496	11.8		37,514	737,821	19.7		4,415	36,474	8.3	
2001	16,134	219,958	13.6		73,231	1,292,967	17.7		3,757	28,679	7.6	
2002	13,733	194,107	14.1		81,399	1,549,161	19.0		454	4,223	9.3	
2003	7,936	149,197	18.8	*	94,822	1,926,555	20.3	*	3,052	25,398	8.3	*
2004	11,043	153,435	13.9	*	111,833	2,020,889	18.1	*	6,042	59,342	9.8	*
2005	3,853	66,315	17.2	*	92,437	1,772,975	19.2	*	2,169	21,810	10.1	*
2006	13,609	258,571	19.0	*	59,050	1,151,475	19.5	*	5,577	65,251	11.7	*
5 Year Sum:	50,174	821,625			439,541	8,421,055			17,294	176,024		
10 Year Sum:	67,637	1,057,395			664,786	12,475,162			27,569	258,692		
5 Year Straight Average:	16.6				19.2				9.8			
5 Year Weighted Average:	16.4				19.2				10.2			
10 Year Straight Average:	17.7				18.6				8.8			
10 Year Weighted Average:	15.6				18.8				9.4			

Notes: * reflects preliminary data

2.6 Columbia River (Zone 6) Indian Ceremonial and Subsistence

Economic analyses do not attempt to place a value on Tribal ceremonial or spiritually oriented harvest since that would be akin to placing a value on Tribal culture. However, subsistence harvest in some cases has been valued purely from a food-based perspective. Tribal subsistence harvest provides more than simply a food-based value since such harvests are also inextricably linked to Tribal culture. As a result, any attempt to use a food-based value to measure Tribal subsistence values would significantly understate the true Tribal value of the subsistence fishery resource. Nevertheless, to avoid the situation of not placing any value on the ceremonial and subsistence harvest, the Yakima River study economic analyses looked to use a food-based value as a defendable lower bound. Crutchfield et al. (1982) suggests two possible approaches for estimating food-based subsistence values – opportunity cost and cost of substitute foods. Assuming the opportunity to sell the fish exists, the opportunity cost approach involves using commercial ex-vessel price as the forgone market value when one harvests a fish for subsistence purposes. The cost of substitute foods approach uses the retail price of the closest substitute food item as an indicator of the value of the subsistence harvest. Given the difficultly in selecting a substitute food item, the analysis uses the opportunity cost concept based on the Columbia River (zone 6) Indian 5-year weighted average revenue per fish from the commercial fishing analysis as a lower bound subsistence and ceremonial value ($28.20 for spring Chinook, $10.97 for fall Chinook, and $3.89 for coho in 1st quarter 2007 dollars; see Table 11-Columbia River Indian Commercial Fishing #1). Since the Columbia River zone 6 Indian fishery includes a commercial fishery there is some logic to applying this approach.

2.7 Yakima River Sport

The Yakima River sport fishing benefits analysis follows the same general procedure as outlined under the ocean and Columbia River sport fishery.

It was assumed that the value per day for Yakima River sport fishing would be the same as that used in the Lower Columbia River sport fishing analysis and was pulled from the river oriented salmon literature search described under the ocean sport fishing section. Four salmon value estimates obtained from three river oriented studies conducted with data gathered since 1985 averaged $68.72 per day

in April 2007 dollars (see the Lower Columbia River zones 1-5 Sport Fishing section for details).

As also described under the ocean and Lower Columbia River sport fishing sections, value per salmon sport fishing day needs to be converted to a value per fish before being applied to the Yakima River sport fish harvest estimates provided by study team biologists. Several years of Yakima River sport salmon harvest and effort (days fished) data, as obtained from Jim Cummings and Paul Hoffarth of the Washington Department of Fish and Wildlife (WDFW), is presented in Table 13-Yakima River Sport Fishing #1. Note that while the fall Chinook sport fishery has been ongoing, the spring Chinook sport fishery has been sporadic (Yakima River coho sport harvest is negligible). The WDFW data was used to calculate the conversion factors of Yakima River salmon sport fishing days per fish harvested by salmon species. While the river sport fishing value per day is assumed applicable to all salmon species, the different days per fish harvested for spring versus fall Chinook results in a different value per fish. Using the weighted average estimates of salmon sport fishing days per salmon harvested for the Yakima River (6.716 for spring Chinook and 5.355 for fall Chinook and coho), the $68.72 per day salmon value converts to $461.52 per fish for spring Chinook and $368.00 per fish for fall Chinook and coho as measured in April 2007 dollars.

TABLE 13.—YAKIMA RIVER SPORT FISHING #1: Salmon Sport Fishing Days per Fish Harvested

Species		2000	2001	2002	2003	2004	2005	2006	3 Year Straight Average	3 Year Total	3 Year Weighted Average
Spring Chinook	Source: Personal communication, Jim Cummings (WDFW), May 2007										
	Effort (hours):		55068.0	22596.8		25883.8				103548.6	
	Hours/trip: (*)			3.5							
	Effort (Day Trips):		15733.7	6456.2		7395.4				29585.3	
	Catch:		1908	843		1654				4405	
			0.121	0.131		0.224			0.158		0.149
	Trips/Fish:	3.5	8.246	7.659	3.5	4.471			6.792		6.716
Fall Chinook & Coho (Coho minor)	Source:	Years 2000-2005: Table 76, District 4 Fish Management Annual Report 2005 (P. Hoffarth, 3/2006) Year 2006: Personal Communication, P. Hoffarth, 5/9/2007									
Catch/Trip:									5 Year Straight (2002-2006) Average	5 Year (2002-2006) Total	5 Year Weighted (2002-2006) Average
	Effort (hours):	12556.0	13193.0	22796.0	32225.0	23878.0	15195.0	16139.0		110233.0	
	Hours/trip: (*)	3.5	3.5	3.5	3.5	3.5	3.5	3.5			
	Effort (Day Trips):	3587.4	3769.4	6513.1	9207.1	6822.3	4341.4	4611.1		31495.1	
		346	1054	2390	1463	830	733	465		5881.0	
		0.096	0.280	0.367	0.159	0.122	0.169	0.101	0.183		0.187
	Trips/Fish:	10.368	3.576	2.725	6.293	8.220	5.923	9.916	6.615		5.355

Notes:

* Based on Personal communication, Jim Cummings (WDFW), May 2007.

Catch:
Catch/Trip:

2.8 Yakima River Indian Ceremonial and Subsistence

The Yakima River Indian Ceremonial and Subsistence benefit estimation methodology applies the same approaches and values as used in the Columbia River (zone 6) ceremonial and subsistence analysis. Lower bound food-based values per fish of $28.20 were used for spring Chinook, $10.97 for fall Chinook, and $3.89 for coho (as measured in 1st quarter 2007 dollar) were based on Columbia River zone 6 Tribal commercial fishing revenues per fish (see Columbia River (Zone 6) Indian Ceremonial and Subsistence section and Table 11-River Indian Commercial Fishing #1). While it is possible the weights per fish and, therefore, values per fish may be somewhat more or less for subsistence harvest in the Yakima River as compared to the Columbia River, the difference was assumed to be negligible given the general proximity of the upriver sections of zone 6 to the mouth of the Yakima River.

Appendix A - References

Crutchfield, J., S. Langdon, O. Mathisen, and P. Poe. 1982. *The biological, economic, and social values of a sockeye salmon stream in Bristol Bay, Alaska*. University of Washington, College of Fisheries, Fisheries Research Institute. October 1982.

Gallo, D. 2003. *The economic benefits to freshwater anglers of achieving the Anadromous Fish Restoration Program fish population goals for the Sacramento River System*. College of Behavioral and Social Sciences, California State University, Chico CA.

Jones and Stokes Associates, Inc. 1987. *Juneau area sport fishing economic study*. Prepared for: Alaska Department of Fish and Game, Juneau AK. November 1987.

Kaval, P. and J. Loomis. 2003. *Updated Outdoor Recreation Use Values with Emphasis on National Park Recreation*. Report submitted to the National Park Service, Ft. Collins CO.

Loomis, J. 1999. *Recreation and Passive Use Values from Removing the Dams on the Lower Snake River to Increase Salmon*. Unpublished paper included in Lower Snake River EIS (found on COE website: www.usace.army.mil/lsr/REPORTS/rec_passive/pass_rec.htm .

Olsen, D. and J. Richards. 1992. *Summary Report: Rogue River Summer Steelhead and Fall Chinook sport fisheries – Economic valuation study*. The Pacific Northwest Project. Lake Oswego WA.

Olsen, D., J. Richards, and R. Scott. 1991. "Existence and sport values for doubling the size of Columbia River Basin salmon and steelhead runs." *Rivers*, 2(1): 44-56.

Platt, J. 2008. *Measuring the influence of water management practices on the economic benefits of commercial fishing*. Technical memorandum EC-2008-1, U.S. Department of the Interior. Bureau of Reclamation, Technical Service Center. Denver CO.

Reclamation. 2002. *Interim Comprehensive Basin Operating Plan for the Yakima Project Washington*. U.S. Department of the Interior. Bureau of Reclamation. November 2002.

Reclamation. 2006. *2006 M&I Water Rate Survey Data*. Office of Program and Policy Services. U.S. Department of the Interior. Bureau of Reclamation. Denver CO>

Reclamation. 2006. *Appraisal Assessment of the Yakima River Pump Exchange Alternative Delivery System for Roza and Sunnyside Valley Irrigation Districts*. U.S. Bureau of Reclamation. Pacific Northwest Region.

Reclamation. 2007. *Wymer Dam and Reservoir Appraisal Assessment.* U.S. Department of the Interior. Bureau of Reclamation.

U. S. Department of Commerce, National Marine Fisheries Service, Northwest Regional Office and Alaska Department of Fish and Game. 2003. *Final Programmatic Environmental Impact Statement for Pacific Salmon Fisheries Management Off The Coasts Of Southeast Alaska, Washington, Oregon, and California and in the Columbia River Basin*. Appendix D: Economics Technical Appendix. November 2003

U. S. Water Resources Council. 1983. *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. U.S. Government Printing Office. March 1983. Washington D.C.

U.S. Army Corps of Engineers. 2002. *Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement, Appendix I – Economics*. Walla Walla District. February 2002.