Section 3 - Mainstem Construction (SCT) Five-Year Work Plan

Table of Contents

3. Mainstem Construction (SCT) Five-Year Work Plan....3
3.1 Description of Work Plan....3
3.2 General Mainstem Passage Objectives....7
3.3 Summary and Comparison of Strategies Associated with Three Major Salmon Recovery Plans - - Capital Construction Activities in Mainstem Snake and Columbia Rivers....9
3.4 Mainstem Construction Categories....18
3.5 Federal/Council and CRITFC Future System Configuration Paths....98
3.6 Identification of Key Issues....105

List of Figures

Figure 3- 1 Federal/Council approach: Capital construction funding by major category.... 5
Figure 3- 2 CRITFC/Shoshone-Bannock approach: Capital construction funding by major category.. 6
Figure 3- 3 Hydrosystem configuration decision framework.... 22
Figure 3- 4 CRFMP costs: Studies vs. implementation federal/Council perspective.... 61
Figure 3- 5 CRFMP costs: Studies vs. implemetation Shoshone-Bannock perspective.... 62
Figure 3- 6 Tribal capital construction priorities by project.... 93
Figure 3- 7 Construction cost breakdown among major categories, FY 1995 - 2007.... 99

List of Tables

Table 3- 1 Comparison of tribal and federal plans by capital construction categories.... 5
Table 3- 2 Mainstem construction/system configuration: SCT's comparison matrix of three major salmon recovery plans.... 10
Table 3- 3 Current research, monitoring and evaluation activities for mainstem construction and system configuration categories.... 53
Table 3- 4 Federal/Council approach draft Columbia River fish mitigation program.... 58
Table 3- 5 Tribal capital construction priorities by project.... 92
Table 3- 6 Bonneville Dam capital construction tasks, CRITFC plan.... 93
Table 3- 7 The Dalles capital construction tasks, CRITFC plan.... 94
Table 3- 8 John Day capital construction tasks, CRITFC plan.... 95
Table 3- 9 McNary Dam capital construction costs, CRITFC plan.... 95
Table 3- 10 Ice Harbor Dam capital construction costs, CRITFC plan.... 96
Table 3- 11 Lower Monumental Dam capital construction costs, CRITFC plan.... 96
Table 3- 12 Little Goose capital construction costs, CRITFC plan.... 97
Table 3- 13 Lower Granite capital construction costs, CRITFC plan.... 97

Table 3- 14 Dworshak capital construction costs, CRITFC plan 97
Table 3- 15 Total appropriations needed to carry out plan 103
Table 3- 16 Plant in-service totals for BPA 103
Table 3- 17 Interest and depreciation payment by BPA 104

3. Mainstem Construction (SCT) Five-Year Work Plan

3.1 Description of Work Plan

This section contains two different plans for mainstem construction. The first was prepared by federal and council representatives on the System Configuration Team (SCT), based on the NMFS Biological Opinion and the Council Fish and Wildlife Program. The second approach was prepared by CRITFC and the Shoshone-Bannock Tribes. The two approaches are very different. Regional policy makers need to resolve these differences as soon as possible.

Section 3.1 provides a description of the work plan development, outlines the structure of the remaining sections, and briefly identifies the major issue that affects this area of salmon recovery.

The biological and performance objectives listed in Section 3.2 of this plan were taken directly from three sources: 1) *Wy-Kan-Ush-Mi Wa-Kish-Wit -- Spirit of the Salmon:* The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes; 2) the Northwest Power Planning Council's 1994 Columbia River Basin Fish and Wildlife Program; and 3) the National Marine Fisheries Service's 1995 Biological Opinion. Section 3.3 is a comparison of the three plans in both matrix and narrative form.

Section 3.4 is the heart of the work plan and reflects two fundamental approaches described below. It contains material from a number of planning and program documents, as well as from interviews with agency and tribal staffs. Most of the SCT activities listed are the responsibility of the U.S. Army Corps of Engineers, and the Corps provided plans of study, design memorandums, program descriptions, decision documents, and other information for development of this document. In addition, staff in both the Corps' Portland and Walla Walla district offices were interviewed to obtain up-to-date budget and schedule information. Summary level of detail for tasks and activity descriptions is provided in this work plan. Additional detail can be obtained from the references and points of contact identified for each measure. The tribal work plan approach was constructed by CRITFC staff in cooperation with staff of the Shoshone-Bannock Tribes.

The Federal Energy Regulatory Commission (FERC) agreements, Mid-Columbia proceedings, and the developing Mid-Columbia Habitat Conservation Plan are the sources of information for capital construction projects at the five mid-Columbia River public utility district dams. This information was also updated with staff interviews.

Section 3.5 describes three future alternatives for mainstem system configuration that will largely be addressed with capital expenditures after the end of the MOA period in 2001: 1) drawdowns of the lower Snake and John Day projects; 2) inriver passage using juvenile fish bypass system improvements and spill; and 3) transportation. As this section indicates, the direction of future system configuration activities depends upon the resolution of a major policy issue and collection of key information. The

work plan concludes with Section 3.6, which reiterates the key policy issues that remain to be resolved concerning mainstem system configuration.

3.1.1 Two Different Approaches to Mainstem Construction Activities

The mainstem capital construction work plan involves two fundamentally different approaches to address prioritization of spending roughly $600 million allocated to the Corps' General Construction Fund between 1997 and 2001 as provided for under the regional Memorandum of Agreement. The first is called the federal/Council approach. The other is termed the CRITFC/Shoshone-Bannock approach. Neither of these approaches is inconsistent with the NMFS 1995 Biological Opinion concerning drawdown implementation. The Biological Opinion calls for interim evaluation of three mainstem system configuration alternatives (surface bypass, transportation, and drawdowns) between the years 1995 and 1999, in order to choose a single alternative in 1999 to be implemented by the year 2000, unless the Corps and NMFS decide otherwise.

Federal/Council Approach: The approach of the federal agencies and the Council would fund juvenile fish screening and bypass systems and associated facilities, transportation barges and associated improvements, and would gather necessary information from engineering feasibility and/or prototype studies related to implementation of drawdowns, dissolved gas abatement structures and surface bypass systems. Under this approach, the information gained from these efforts will be used to determine the future implementation path for mainstem capital construction activities. One of the major differences between salmon recovery plans is that both the Council's 1994 Fish and Wildlife Program and the 1995 Spirit of the Salmon plan call for a phased implementation of drawdown actions in the Snake River over the next five years, whereas the 1995 NMFS Biological Opinion calls for the Corps to complete all necessary feasibility and engineering design work to allow preparations for implementing drawdown of Snake River reservoirs to begin by the year 2000, unless the NMFS and the Corps agree on a different course of action.

Table 3-1 shows the funding requirements for fiscal year 1996-2001 for the federal/Council approach and the CRITFC/Shoshone-Bannock approach. Figure 3-1 is a pie chart showing the distribution of funding over the next five years ($610 million for fiscal years 1996 through 2000+) broken out by eight major categories used in the federal/Council approach. This total does not include $216 million already expended on mainstem fish passage facilities through FY 1995, nor does it include the capital construction costs of full implementation of drawdown, surface bypass or gas abatement measures (prototype development and evaluation costs are included only). Figure 3-1 illustrates that, if the SCT implements the federal/Council approach over the next five years as outlined in this work plan, 90 percent of the funding requirements will be spent in three categories: 1) juvenile fish bypass system improvements; 2) development of surface bypass technology; and 3) dissolved gas abatement structures. The remaining five categories -- Snake River and John Day reservoir drawdown feasibility studies, juvenile fish transportation improvements, adult fish passage improvements and miscellaneous projects -- make up the remaining ten percent of this approach's five-year funding requirements.

Table 3- 1 Comparison of tribal and federal plans by capital construction categories

Category	Tribal Plan	Federal Plan
Surface Bypass and Spill Efficiency	$ 86	$ 149
Gas Abatement and Temperature Control	$ 109	$ 60
Snake River Drawdowns	$ 351	$ 16
John Day Drawdown	$ 22	$ 12
Adult Passage	$ 44	$ 6
Juvenile Screen Bypass Improvements and Transportation	$ -	$ 363
Other (studies, monitoring)	$ 23	$ 6
Totals	**$ 635**	**$ 611**
All figures in millions of dollars		

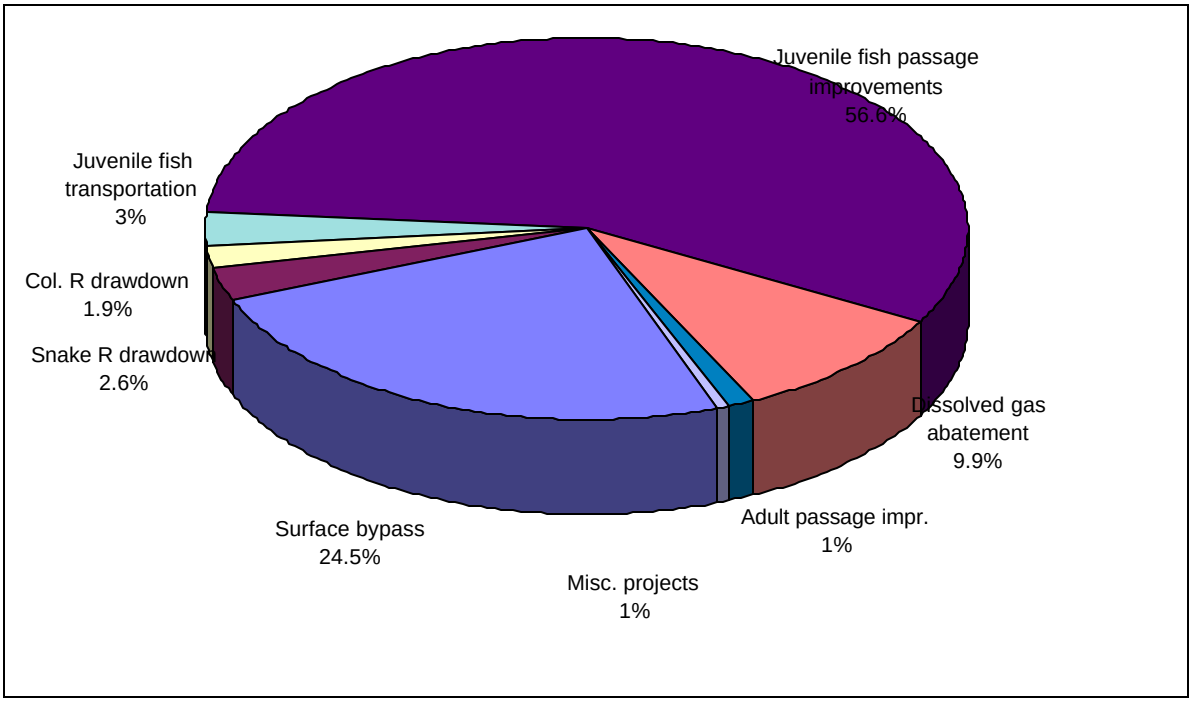

Figure 3- 1 Federal/Council approach: Capital construction funding by major category

CRITFC/Shoshone-Bannock Tribes' Approach: In contrast, the CRITFC and Shoshone-Bannock Tribes conclude that existing evaluations have provided ample information to decide now on major system configuration modifications. Their approach focuses funds on early implementation of natural river drawdowns of the four Snake River reservoirs by the year 2002 and drawdown of John Day Reservoir to near spillway crest elevation by 2004. In addition, the tribes would also direct funds toward: a) implementation of structural actions to abate or reduce high gas levels, such as raised stilling basins, which will reduce total dissolved gas levels caused by spill and elevated temperatures to water quality standards under the Clean Water Act; b) development and implementation of surface bypass systems; and c) significant improvements to adult fish passage facilities. While the federal agencies' and Council's approach directs significant capital investments on interim projects related to juvenile fish bypass improvements at the four lower Snake River and John Day dams (approximately $207 million, or 34 percent of the total expected expenditures over the next five years), the CRITFC/Shoshone-Bannock Tribes' approach calls for a majority of expenditures to be focused on fish bypass improvements at the lower Columbia River dams. Moreover, the tribes' approach directs capital expenditures for the lower Snake River dams to early implementation of a permanent natural river drawdown.

Figure 3-2 is a pie chart showing the distribution of funding ($635 million) broken out by major categories for the CRITFC/Shoshone-Bannock Tribes' proposed capital construction program over the next five years. Note that Figure 3-2 uses a different set of categories for mainstem construction activities. The six principal funding categories for the CRITFC/Shoshone-Bannock approach include: 1) Snake River and John Day drawdowns; 2) spill efficiency and surface bypass; 3) temperature control and gas abatement; 4) fish screen systems and transportation; 5) adult passage; and 6) other miscellaneous measures.

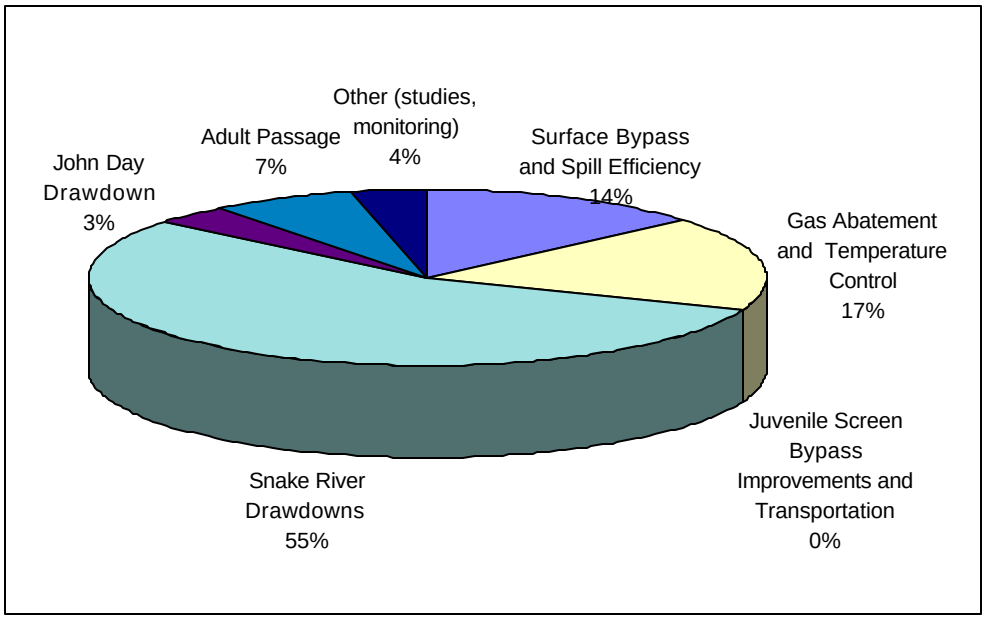

Figure 3- 2 CRITFC/Shoshone-Bannock approach: Capital construction funding by major category

In general, the accounting used in the CRITFC/Shoshone-Bannock approach combines Snake River drawdowns with Columbia River (John Day Reservoir) drawdown, and combines juvenile fish transportation with juvenile fish screening and bypass system improvements. The former are combined into a Drawdown category, while the latter are combined into a category called Screen Systems and Transportation. However, several activities in the Screen Systems and Transportation category were included in the Other category in the CRITFC/Shoshone-Bannock approach, which is similar in definition to the Miscellaneous category used in Figure 3-1 under the federal/Council approach.

It is critical that the region's policy makers address and resolve, as soon as possible, which of these two approaches, or an alternative to them, should be pursued. The state fish and wildlife agencies generally concur with the approach proposed by the federal agencies and the Council, but there are clear differences in funding priorities for projects proposed during the 1997-2001 time frame. The federal/Council approach is currently being implemented. Because of the timing and sequencing of capital construction projects, the CRITFC/Shoshone-Bannock Tribes believe their approach is being seriously compromised, and millions of dollars will be spent on fish bypass improvements that will become obsolete should drawdowns be implemented in the future. Regardless of the approach that is finally selected by the region, fish passage improvements installed at dams where drawdowns may be implemented in the future may provide interim fish survival benefits until drawdown occurs. In addition, the two approaches propose different expenditures associated with implementation and study measures. This issue is addressed in more detail in Section 3.4.2.5.

A possible compromise proposed by the CRITFC/Shoshone-Bannock Tribes between these two approaches is to begin by funding only those mainstem capital construction activities that are common to the Spirit of the Salmon plan, the Council's 1994 Fish and Wildlife Program, and the NMFS 1995 Biological Opinion. The measures common to all three salmon recovery plans are identified in Table 3-2 (Section 3.3). This approach has not been developed in the draft work plan.

Further discussion of this policy issue is contained in Section 3.6.

3.2 General Mainstem Passage Objectives

3.2.1 Ecological Objectives

1. The Spirit of the Salmon plan states its objectives in Section 5 on page 5B-2:

> Within seven years, halt the declining trends for all anadromous fish (salmon, sturgeon and lamprey); within 25 years, increase the annual escapement above Bonneville Dam from existing 0.5 million to 4 million adult salmon; within 25 years, increase lamprey and sturgeon populations to permit sustainable levels of tribal harvest; and restore anadromous fishes to historical abundance in perpetuity.

2. The Fish and Wildlife Program outlines its mainstem Columbia and Snake River passage actions in Section 5.6A. The biological objective is stated as follows:

To minimize delays at dams and minimize the passage of juvenile fish through turbines by providing high survival alternative passage routes.

3. The NMFS 1995 Biological Opinion outlines a general goal for mainstem passage:

Implement all reasonable measures for operation and configuration of the Federal Columbia River Power System that will reduce mortalities of listed fish (juveniles and adults).

An overall goal stated in the Biological Opinion is that operation of the Federal Columbia River Power System (FCRPS), in addition to environmental baseline and cumulative effects, must result in survival with an adequate potential for recovery of listed Snake River species.

The Biological Opinion also identifies a mainstem biological objective in Reasonable and Prudent Action 15, which states:

Make improvements in fish passage at mainstem dams to support salmon smolt-to-adult survival ratios that foster long-term population growth.

3.2.2 Performance or Operational Objectives

1. Spirit of the Salmon plan states its operational objectives in Section 5 on pages 5B-27 to 5B-30:

> Implement passage measures which will result in a three to five-fold increase in the survival of stocks originating above eight or more dams; implement a program of controlled spill to achieve an 80 to 90 percent fish passage efficiency[1] (FPE) over the short term (3 to 5 years), and at least a 90 percent FPE over the long term; and maximize spill efficiency through use of hydroacoustic monitoring across the entire dam, and implementation of full-flow surface bypass systems, gas abatement measures, and previously evaluated spill patterns.

2. The 1994 Fish and Wildlife Program outlines its mainstem Columbia and Snake River passage actions in Section 5.6A. The operational objective is stated as:

> To achieve 80 percent fish passage efficiency at each Snake River project from April 15 to July 31 and at each Columbia River project from May 1 to August 31, while keeping dissolved gas levels within the limits of federal and state water quality standards and ensuring a high degree of adult passage success; ensure a 98 percent or greater salmon survival rate in all bypass and collection facilities (from deflector screens or surface bypass entrances to the end of the bypass system outfall); and increase smolt survival in area below bypass system outfall.

[1] Fish passage efficiency is defined as juvenile fish passage via non-turbine routes, i.e., through a bypass system, sluiceway or spillway.

3. The NMFS 1995 Biological Opinion outlines its mainstem performance objective in Reasonable and Prudent Action 15, which states:

> The interim performance objective for these juvenile bypass improvements is an 80 percent fish passage efficiency and a 95 percent survival rate for fish passing at each dam, without exceeding a 115/120 percent total dissolved gas saturation standard. The adult performance criterion is to maintain adult fish facilities within criteria identified in the Corps' Fish Passage Plan.

3.3 Summary and Comparison of Strategies Associated with Three Major Salmon Recovery Plans -- Capital Construction Activities in Mainstem Snake and Columbia Rivers

The purpose of this section is to compare and contrast the fish passage strategies associated with the three major salmon recovery plans as they relate to construction activities in the mainstem Columbia and Snake rivers. The three plans, the NMFS 1995 Biological Opinion (Biological Opinion), the Council's 1994 Fish and Wildlife Program, and the Spirit of the Salmon plan of the Nez Perce, Umatilla, Warm Springs, and Yakama tribes, are compared by the seven major categories of actions. In addition, differences among the plans are identified. Table 3-2 provides a detailed matrix comparing mainstem construction and/or system configuration actions in each of the major categories.

Fish passage construction activities at the FERC mid-Columbia hydropower projects are specified in the Rock Island Dam settlement agreement, the Wells Dam settlement agreement, the FERC stipulations, the Mid Columbia FERC Proceedings, and the developing Mid-Columbia River Habitat Conservation Plan. These agreements and plans are not represented in Table 3-2; however, specific information concerning capital fish passage improvements for each of the FERC mid-Columbia hydropower projects are included in Section 3.4.2.

3.3.1 Surface Bypass

Both NMFS' and the Council's salmon recovery plans place a high priority on research and development to determine the effectiveness of surface-oriented fish bypass systems at mainstem hydroelectric projects. The Spirit of the Salmon plan calls for implementation of structural surface bypass measures as a top priority at the lower Columbia River dams.

The NMFS Biological Opinion calls on the Corps to investigate the application of surface bypass technology at certain lower Snake and Columbia river hydropower dams. Testing of the surface bypass concept began at Ice Harbor and The Dalles dams in 1995. Prototype surface bypass systems are to be designed and tested at Lower Granite and possibly The Dalles dams beginning in 1996. Testing is to include evaluations of surface bypass at both powerhouses and spillways to determine the effectiveness and safety of passing juvenile salmon. If preliminary testing indicates surface bypass is effective at conventional powerhouses, the NMFS Biological Opinion calls on the Corps to begin prototype testing at John Day Dam in 1997 or as soon as possible.

The Council's program directs the Corps and other parties, including the mid-Columbia PUDs, to explore promising new approaches to fish bypass technologies, including development and prototype

testing of surface bypass systems, surface-oriented spill systems, and behavioral guidance devices, such as the use of sound to help guide juvenile salmon. Prototype testing of surface flow juvenile bypass systems is to be conducted at Lower Granite, The Dalles, John Day, Bonneville, and Ice Harbor dams, and completed by 1998. If the results of this research indicate high efficiency at costs less than conventional screening or other bypass system modifications

Table 3- 2 Mainstem construction/system configuration: SCT's comparison matrix of three major salmon recovery plans

Major Areas in Mainstem Construction and/or System Configuration[a]	NPPC's 1994 F& W Program	NMFS 1995[b] Biological Opinion	CRITFC's 1996 Spirit of the Salmon
Surface Bypass:			
Test prototype at Lower Granite Dam	5.6A.7 (by '98)	RPA 11 (by '96)	
Test prototype at The Dalles Dam	5.6A.7 (by '98)	RPA 11 (by '95)	p. 5B-29
Test prototype at John Day Dam	5.6A.9 (by '98)	RPA 11 (by '97)	p. 5B-29
Test prototype at Bonneville Dam	5.6A.6 (by '98)		p. 5B-29
Test prototype at Ice Harbor Dam	5.6A.11 (by '98)	RPA 11 (by '95)	p. 5B-29
Test prototype at Rocky Reach Dam	5.6B.3 (by '95)		p. 5B-29
Test prototype at Wanapum/Priest Rapids	5.6B.10 (by '96)		p. 5B-29
Mainstem Reservoir Drawdown			
Snake River Drawdowns:[c]			
Interim evaluation report on Snake River drawdown alternatives	5.3B.4 (by 1996)	RPA 10 (by mid-'96)	
Complete engineering and design work on Snake River drawdowns	5.3B.8 (by 12/97)	RPA 10 (by 1998)	
Feasibility studies of Snake River drawdown alternatives	5.3B.8 (by 12/97)	RPA 10 (by 1999)	p.5B-29
Implement drawdown of Lower Granite Dam	5.3A.1 (interim by '95) 5.3B.2 (by '96)	RPA 10 (by 2000)	p. 5B-29 (by '97)
Implement drawdown at Little Goose Dam	5.3B.2 (by '99)	RPA 10 (by 2000)	p. 5B-30
Implement drawdown at Lower Monumental Dam	5.3B.9 (by 2002)	RPA 10 (by 2000)	p. 5B-30
Implement drawdown at Ice Harbor Dam	5.3B.9 (by 2002)	RPA 10 (by 2000)	p. 5B-30
Implement cultural resource protection plan			p. 5B-29
Columbia River Drawdowns:			

Major Areas in Mainstem Construction and/or System Configuration[a]	NPPC's 1994 F& W Program	NMFS 1995[b] Biological Opinion	CRITFC's 1996 Spirit of the Salmon
Implement permanent drawdown at John Day to MOP[d]	5.4C.1 (by '96)	RPA 5 (by '96)	p. 5B-29 (by '97)
Feasibility studies for deep drawdown of John Day Reservoir	5.4C.5 (by 2002)	RPA 5	p. 5B-30
Drawdown to spillway crest at JDA			p. 5B-30
Implement permanent DD at Rocky Reach Dam			p. 5B-30
Implement permanent DD at Wanapum Dam			p. 5B-30
Juvenile Fish Transportation:			
Construct add'l. barges for direct fish loading	5.8A.5	RPA 25 (by '97-99)	
Make improvements in fish transport facilities:			
-Barge exit modifications	5.8A.6	RPA 9 (by '97)	
-Improvements to LWG collection facilities		RPA 20 (by '97)	
Discontinue juvenile fish transportation			p. 5B-25,26
Juvenile Fish Screen/Bypass Improvements:			
Install extended-length screens at LWG/LGS	5.6A.4 (by '96)	RPA 19 (by '96)	
Develop plan for improvements to LWG JBS		RPA 20 (by '95)	
Implement improvements to LWG JBS		RPA 20 (by '97)	
Test & install extended-length screens at LMN	5.6A.4	RPA 19	
Test/install extended-length screens at IHR	5.6A.4	RPA 19	
Hydroacoustic monitoring of passage at IHR	5.6E.2 (by 1997)	ITS 10 (by 1995)	
Install extended-length screens at MCN	5.6A.4 (by '95)	RPA 19 (by '97)	
Eval./improve dewatering screen cleaning @ MCN		ITS 5 (ASAP)	
Install permanent shading over raceways @ MCN	5.8A.6 (ASAP)	ITS 5 (by 1995)	
Install extended-length screens at JDA	5.6A.4 (by '98)	RPA 21 (by '98)	
Eval. & improve juvenile spill patterns at JDA	5.6E.2	ITS 2 (by 1996)	
Install screen/bypass system at TDA	5.6A.2 (by 2000)	RPA 24 (by '99)	
Hydroacoustic monitoring of passage at TDA	5.6E.2 (by 1997)	ITS 10 (by 1996)	
Relocate bypass outfalls at Bonneville Dam	5.6A.3 (by '98)	RPA 23 (by '99)	p. 5B-29[e]
Improve FGE at Bonneville First Powerhouse	5.6A.6	RPA 12	
Provide indep. station service at BON Dam	5.6A.6 (by 1998)	ITS 3 (by 1998)	

Major Areas in Mainstem Construction and/or System Configuration[a]	NPPC's 1994 F& W Program	NMFS 1995[b] Biological Opinion	CRITFC's 1996 Spirit of the Salmon
Install PIT-tag detectors at JDA and BON	5.0F.10 (by '96)	RPA 22 (by '97/'99)	
Juvenile bypass system improvemts. at BON	5.6A.6	ITS 6 (by 2000)	
Evaluate benefits of dispersed release sites	5.6A.3	ITS 8	
Install screens/bypass system at PRD	5.6B.8 (by '97)		
Install screens/bypass system at WAN	5.6B.7 (by '98)		
Install screens/bypass system at RIS	5.6B.4		
Re-evaluate existing smolt bypass systems	5.6A.10, 12	RPA 15	
Explore new fish bypass technologies	5.6A.13	RPA 15	
Develop improved smolt counting methods	5.0F.9	RPA 15	
Eval. improvemts. in turbine passage survival, incl. design and prototype testing of new turbine blades and wicket gate.	5.6A.14 (by 2001)	CR 5	p. 5B-30
Complete turbine index testing of all units at all mainstem hydro dams	5.6D.1		p. 5B-29
Implement powerhouse optimize. program to improve operating efficiency			p. 5B-29
Develop/construct a regional fish passage engineering research facility	5.6A.8 (by 1996)	CR 6 (by 1998)	
Evaluate and remedy water pollution problems in gatewells		ITS 12	
Maximize fish spill efficiency			p. 5B-29
Hydroacoustic spill monitoring at all dams			p. 5B-29
Dissolved Gas Abatement:			
Complete feasibility evaluation (Phase 2) of gas abatement alternatives	5.6E.2 (by '97)	RPA 18	
Install spillway deflectors at IHR and JDA	5.6E.2 (by '97)	RPA 18 (ASAP)	p. 5B-29
Install spillway deflectors at other 6 fed'l dams	5.6E.2 (by '97)		p. 5B-29 (BON)
Prototype test spillway/stilling basin mod'ns.	5.6E.2	RPA 18	
Implement a gas abatement program at all dams.		RPA 18	
Evaluate & implement operational methods to reduce TDG	5.6E.3	RPA 18	
Install spillway deflectors at WAN and RRC			p. 5B-29

Major Areas in Mainstem Construction and/or System Configuration[a]	NPPC's 1994 F& W Program	NMFS 1995[b] Biological Opinion	CRITFC's 1996 Spirit of the Salmon
Adult Fish Passage:			
Maintain adult fish facilities within FPP/DFOP operating criteria	6.1A.1	RPA 7	p. 5B-35[f]
Refinement of adult spill patterns	6.1A.1/6.1B.4	CR 1	p. 5B-35
Upgrade/improve adult fish passage facilities	6.1A.4	RPA 7	p. 5B-35
-O&M and repair of pumps, gear boxes, etc.	6.1A.2	RPA 7	p. 5B-35
-Procure critical spare parts for fishways	6.1A.2	ITS 15	p. 5B-35
-Automate fishway control systems	6.1A.4	RPA 7	p. 5B-35
-Evaluate placement of staff gages	6.1A.4	RPA 7	p. 5B-35
-Install velocity meters where necessary	6.1A.4	RPA 7	p. 5B-35
-Construct add'l. ladders at LWG and LGS	6.1A.4 (by '99)	CR 2	p. 5B-35
-Provide improved attraction water at entrans.	6.1A.4 (by '97)	CR 2	p. 5B-35
-Construct ladder exten. at LWG & LGS	6.1A.4 (by '98)	CR 2	p. 5B-35
-Complete adult fishway mod'ns. at BON	6.1A.4 (by '97)		p. 5B-35
-Modify ladder exits to reduce fallback			p. 5B-35
-Investigate covering existing ladders	6.1A.4		p. 5B-35
-Implement hydraulic evals. of all fishways			p.5B-36
Evaluate installing adult PIT-tag detectors	6.1B.6	ITS 14	
Implement measures to reduce adult fallback	6.1A.3	RPA 8	p. 5B-35
Evaluate alternative fish ladder water temp. control measures & prototype test remedy	6.1A.1	ITS 18 (by '98)	p. 5B-35
Emergency Auxiliary Water Supply (general)	6.1A.4	ITS 16	p. 5B-35
-TDA emergency auxiliary water supply	6.1A.4	ITS 16 (ASAP)	p. 5B-35
-Engineering study of L. Columbia R. dams		ITS 16 (by '95)	p. 5B-35
-Eval. of capabilities at L. Snake R. projects		ITS 16 (by '96)	p. 5B-35
-Develop schedule for design and installation		ITS 16 (by '96)	p. 5B-35
Continue PIES program modifications		CR 1	p. 5B-35
Eval./correct pollution problems in fishways		ITS 12	p. 5B-35
Implement 24-hr counting at IHR & LWG		ITS 13 (by '95)	p. 5B-36
Implement 24-hr video counting at all dams			p. 5B-36
Provide report on adult fish counting program		ITS 13	p. 5B-35
Provide indep. fishway inspection/monitoring	6.1A.5		p. 5B-35[g]
Evaluate feasibility/benefits of video or automatic counting	6.1B.5		
Investigate and implement better and more effective fishway designs			p.5B-35-6
Eval. effects of shad on salmon passage; implement structural remedies, if necess.	6.1B.1		p. 5B-35
Eval. entrance attraction flows and fishway hydraulics; implement improvements	6.1A.2		p. 5B-36

Abbreviation Key
RPA Reasonable and prudent alternative
ITS Incidental take statement
CR Conservation recommendation

Notes
a Not included are research, monitoring and evaluation actions associated with many of the measures listed above.
a Several 1995 NMFS Biological opinion schedules are under revision through the RPA 26/ System Configuration Team process.
a NPPC/CRITFC dates are implementation dates or date of effective operation; NMFS dates are the beginning of implementation or construction.
a JDA drawdown to MOP is contingent on implementation of mitigation measures.
a The tribal plan calls for evaluating the benefits of changing the juvenile fish bypass outfall location at Bonneville Dam prior to relocating the outfall.
a Only the tribal plan calls for using the criteria contained in the fishery agencies' and tribes' 1994 Detailed Fishery Operating Plan (DFOP). The criteria in this plan are more rigorous and protective of adult salmon than those contained in the Corps' annual Fish Passage Plan (FPP).
a Only the tribal plan calls for frequent monitoring of fishways by fishery agency and tribal personnel, to be funded by the Corps of Engineers.

and show no reason to preclude use of this new technology, such surface bypass systems are to be proposed to the Council for incorporation into the program's bypass strategies.

The Spirit of the Salmon plan states that current structural screening and bypass features at mainstem dams are inadequate for juvenile salmon passage. The tribes recommend further development and implementation of surface-oriented fish bypass systems. In the near term, the tribes call for expedited prototype development of surface flow bypass systems, particularly to address passage problems at Bonneville, John Day, The Dalles, Ice Harbor, Rocky Reach, Priest Rapids, and Wanapum dams.

The Shoshone-Bannock Tribes are opposed to the further development of surface or conventional screening and bypass systems at the four lower Snake River dams. Instead, the tribes' approach is to focus future efforts toward early implementation of natural river drawdowns in the lower Snake River and improvements in adult passage.

3.3.2 Snake River Drawdowns

One of the major differences between salmon recovery plans is that both the Council's 1994 Fish and Wildlife Program and the Spirit of the Salmon plan call for a phased implementation of drawdown actions in the Snake River over the next five years, whereas the 1995 NMFS Biological Opinion calls for the Corps to complete all necessary feasibility, design, and engineering work to allow preparations for implementing drawdown of Snake River reservoirs to begin by the year 2000, unless the NMFS and the Corps agree on a different course of action. NMFS calls on the Corps to complete an interim evaluation report related to various drawdown actions and surface bypass by mid-1996. The Interim Status Report for the Lower Snake River Juvenile Salmon Migration Feasibility Study of lower Snake River drawdown options was released by the Corps for public and regional review on December 9, 1996. The Interim Status Report was prepared under Phase II of the Corps' System Configuration

Study. Using information from this Interim Status Report, the region is to decide which drawdown option for the Snake River to carry forward to the engineering and design stage through 1998. A regional decision is presently scheduled to be made in 1999 as to whether to implement drawdown of mainstem Snake River reservoirs. This decision is largely dependent on ongoing evaluations designed to determine if improvements in mainstem survival can be made by improving inriver or transportation survival.

The Council's Fish and Wildlife Program outlines an adaptive management approach that specifies that, contingent on needed fish passage modifications and development of a mitigation plan, Lower Granite pool was to have been lowered to elevation 710 feet for 60 days during spring 1995, then drawn down further to near spillway crest (elevation 690 feet) beginning in spring 1996, with Little Goose lowered a similar amount beginning in spring 1999. The Council program maintains that a properly designed drawdown of Lower Granite and Little Goose pools would produce essential biological information needed before a long-term commitment to drawdown of all four lower Snake projects is decided.

The tribal plan also calls for structural measures to be implemented to lower the surface elevation of Snake River reservoirs in an adaptive management framework that includes biological, economic, and cultural studies, and mitigation measures. In the near term, Lower Granite pool is to be lowered to elevation 710 feet beginning in spring 1997. In the long term, the tribes' preferred alternative would require structural modifications at all four lower Snake River dams to allow for a permanent drawdown to natural river levels. Drawdown to natural river level is intended to restore flow velocities at the water surface elevations that existed in the Snake River prior to impoundment. An alternative structural means of achieving natural river elevations is to include evaluating installation of low-level water outlets at the dams, excavation of the non-overflow sections of the dams, and excavation of the spillway sections of the dams.

The formal policy and work plan of the Shoshone-Bannock Tribes is to finalize the feasibility, NEPA, and Congressional authorization requirements, and implement restoration of a natural river condition, or the ecosystem components that most closely resemble a natural river condition and associated healthy riparian ecosystem, in the lower Snake River as soon as possible.

3.3.3 Columbia River Drawdowns

All three salmon restoration plans call for John Day reservoir to be lowered permanently to near its minimum operating pool level (elevation 257 feet) beginning in 1996, contingent upon development of a mitigation plan. In addition, all three plans specify further evaluation as to the costs and feasibility of operating John Day reservoir near its spillway crest or lower elevation, e.g., a deep drawdown operation. The Spirit of the Salmon plan identifies John Day Dam drawdown to spillway crest elevation as a high priority. The Council program calls for the Corps to complete by May 1, 1996, all design, engineering, and environmental review of facility and operational changes necessary to operate John Day Dam at near spillway crest elevation by the year 2002.

The feasibility studies of a deep lowering of the John Day reservoir have not been accomplished to date because of 1995 Congressional report language requiring the Corps not to request funding for further

studies of John Day drawdown alternatives pending additional scientific justification. In order to move forward with feasibility studies of a deep drawdown of John Day pool, NMFS prepared a letter in the fall of 1996 with documentation containing the necessary scientific justification and will be submitting it to the Corps shortly. The Corps is expected to expedite submission of the justification letter to Congress for its approval.

On the Mid-Columbia Reach, the Spirit of the Salmon plan calls for implementation of drawdowns at both Wanapum and Rocky Reach dams. While the tribal plan calls for drawdowns at Rocky Reach and Wanapum dams, the mid-Columbia public utility districts that operate these dams do not support drawdowns as a restoration strategy, and drawdowns are not included in the draft habitat conservation plan for the mid-Columbia River. The Spirit of the Salmon plan includes drawdown of these projects to re-establish substantial spawning areas for fall and summer chinook salmon, as well as reducing dam passage and reservoir mortalities.

3.3.4 Juvenile Fish Transportation

Another major difference between the three plans is that both the Council's Fish and Wildlife Program and the NMFS Biological Opinion include a number of capital construction measures to improve the smolt transportation program, whereas the tribes call for stopping the practice of mass barging and trucking of juvenile salmon. The tribes contend that alternative fish passage measures should be tested first and that alternative passage methods have a proven historical basis throughout rivers worldwide.

Among the capital improvements to upgrade the transportation program cited by the Council or NMFS are direct loading of fish without holding them in raceways after collection (this would necessitate building additional transport barges); enlarging transport barge exits; minimizing fish densities; reducing stress in holding areas through shading or other means; developing smolt release strategies, including dispersing fish to minimize predation and using net pens and/or mid-river release strategies to reduce mortality associated with bypass outfall areas; and reducing noise levels in the barges and collection facilities. The Council's program also calls for an evaluation of the feasibility of constructing and operating acclimation facilities below Bonneville Dam and/or evaluating alternative release sites downriver.

3.3.5 Juvenile Fish Passage Improvements

Both the Council's Fish and Wildlife Program and the NMFS Biological Opinion include a number of capital construction measures to improve juvenile fish passage at the mainstem Snake and Columbia river dams. These include installation of standard or extended-length screens and improvements in fish bypass and collection facilities. The tribal plan calls for emphasis on the modification of existing spill passage systems incorporating gas abatement and spill efficiency technology to safely pass all stocks of juvenile salmon and lamprey past hydroelectric dams. The tribes note that mechanical screen bypass systems are only partially effective and select against certain juvenile salmon stocks and life histories, such as fall chinook and sockeye, and also can be damaging to lamprey.

All three plans, however, place a high priority on research and prototype development to determine the effectiveness of surface-oriented bypass system concepts, except that the Shoshone-Bannock Tribes

call for an immediate halt to any studies and/or prototype testing of these types of improvements at the four lower Snake River dams. Each of the plans calls for prototype surface bypass systems to be designed and tested on an expedited basis at selected mainstem Columbia river hydropower projects (see Section 3.3.1 above).

3.3.6 Dissolved Gas Abatement

All three salmon restoration plans call for development of a systemwide gas abatement program, including evaluation and modification, if necessary, of various technologies at mainstem dams to reduce total dissolved gas levels during both voluntary and forced spill operations and to increase spill efficiency. Gas abatement measures under construction or evaluation include installation of spillway deflectors at John Day and Ice Harbor dams, and at end spillbays at other dams without fliplips; design and prototype testing of spillway and stilling basin modifications; and design and prototype testing of structural means, as well as fish behavioral methods, to increase passage efficiency at spillways, including use of slotted spillgates. While the NMFS and Council approach is directed toward feasibility and prototype studies, the tribal approach is directed more toward implementation of structural modifications at the dams. In addition, the tribal approach calls for specific improvements at Bonneville and John Day dams where elevated dissolved gas levels limit fish passage through spill and where involuntary spill routinely violates Clean Water Act standards.

3.3.7 Adult Fish Passage Improvements

Both the Council's Fish and Wildlife Program and the NMFS Biological Opinion include a number of measures to improve survival of adult fish at mainstem Snake and Columbia river dams, including adherence to all spill and operating criteria at adult fish passage facilities and implementation of needed structural improvements. Both plans call on the Corps to leave juvenile fish screens installed for a longer period during the year to provide protection for adult salmon that fall back through the powerhouse. The major measures called for in all three plans include: installation of automated fishway control systems; adult fishway modifications and improvements at McNary, The Dalles and Bonneville dams; evaluation of covering existing fish ladders, or alternative means to reduce fish ladder water temperatures; and improving the effectiveness of entrance attraction flows and fishway hydraulics, including improvements (and emergency back-up capability) in auxiliary water supply systems.

The tribal plan recommends that the Corps and Mid-Columbia PUDs, with fishery agency and tribal approval, finish structural assessments of all mainstem fishways and take necessary corrective actions, including improving attraction flows; installing additional pumps, gravity flow systems, automated systems, and additional fish ladders; and modifying ladder exits to reduce adult fallback. In addition, the tribal plan calls for identification and implementation of structural remedies to reduce the incidence of adult shad in the fishways and to evaluate and implement new fishway designs that emphasize modifications to weirs, baffles, and pools. These modifications should be based upon maximizing adult bioenergetic capacities by stimulating leaping, which is thought by tribal biologists to be more efficient than swimming in gaining elevation.

3.3.8 Water Temperature Control Measures

Both EPA and CRITFC have identified the need for structural water temperature control measures at mainstem Snake and Columbia river hydroelectric dams. While the Council's Fish and Wildlife Program and the NMFS Biological Opinion call for an evaluation of the need for structural measures to help reduce summer water temperatures in mainstem fish ladders, the tribal salmon restoration plan calls for implementation of measures to reduce water temperatures in adult fishways, including pumping cooler water at depth from dam forebays into fish ladders. In addition, the tribal plan calls for installation of low-level regulating outlets to affect water temperature at mainstem storage projects such as those of the Hells Canyon hydroelectric complex operated by Idaho Power Company. For a more detailed discussion of the need for water temperature control measures, see issues Section 3.6.

3.4 Mainstem Construction Categories

3.4.1 Introduction

This section of the work plan presents in detail the capital construction projects that are underway or will be undertaken over the next five years at federal and PUD-owned dams on the mainstem Columbia and Snake rivers under both the federal/Council and CRITFC/Shoshone-Bannock approaches. Each approach includes various subsections, including: a) an overview with scope and decision process; b) information related to tasks, work activities, schedules and costs in each of the major categories; c) research, monitoring, and evaluation activities; d) a summary table of capital construction activities with cost estimates for fiscal years 1996 through 2000+, organized by dam and by measures that have systemwide application; and e) a figure illustrating how much money is being spent in each fiscal year on implementation (construction) actions versus how much is being spent on studies or research.

3.4.2 Federal/Council Approach

3.4.2.1 Overview of Work Plan and Decision Process

Scope: A major issue facing the region is whether or not sufficient scientific and/or biological information already exists to make a system configuration decision and, if not, can it be obtained according to the schedule called for in the NMFS Biological Opinion?

This section of the work plan describes the federal/Council approach to capital construction projects that are underway or will be undertaken over the next five years at federal and PUD-owned dams on the mainstem Columbia and lower Snake rivers. These projects will implement measures called for in the region's three major salmon recovery plans and other regional directives. They generally fall into six categories: surface bypass, drawdowns, juvenile fish transportation, juvenile passage improvements, dissolved gas abatement and adult fish passage improvements. The projects involve either implementing a construction measure or developing and evaluating potential physical modifications to the dams so a decision can be made. In this context, the plans reflect an adaptive management approach: specific work activities for many measures will evolve and be refined as a result of prototype design and biological testing.

The SCT has not reached agreement on all work priorities for FY 1997 and beyond. This plan may change, based on the results of monitoring and evaluation and potential resolution of the differences between the federal/Council and CRITFC/Shoshone-Bannock approaches.

The information presented on tasks, activities, schedules, costs, and issues is based on work underway and/or proposed by the Corps, NMFS, the Council, and the other federal, state, and tribal fishery agencies for the lower Snake River and lower Columbia River federal dams, and by the mid-Columbia PUDs for their projects. For Corps projects, all of the work plan information was developed under the framework of the NMFS Biological Opinion (reasonable and prudent alternative measures, incidental take statement, and conservation measures). The plans have been developed, discussed and refined through existing regional forums for coordination and decisionmaking. These forums include the Biological Opinion implementation organization, which consists of executive (Executive Committee), policy (Implementation Team) and coordination/oversight (System Configuration Team) groups. Technical review and coordination takes place within the Fish Facility Design Review Work Groups (FFDRWG) of the Portland and Walla Walla Districts and Scientific Review Groups (SRG) of the Corps' Anadromous Fish Evaluation Program. Details of work plans and review of research are largely accomplished in the FFDRWG and SRG processes.

The tribes and state fishery agencies have had significant disputes within all these federal processes and many times consensus on work activities has not been reached. The specific work plan for the CRITFC/Shoshone-Bannock approach is based on the Spirit of the Salmon, and is incorporated in Section 3.4.3. The Shoshone-Bannock Tribes' policy is to halt all further studies and prototype testing of fish bypass improvements and immediately implement permanent year-round drawdown of the four lower Snake River dams to natural river level.

Funding and Repayment: The funding for planning and implementation of the projects comes from a limited number of sources, including Congressional appropriations for the Corps of Engineers and separately, the PUD budgets. Corps appropriations are provided annually and allow for installation of facilities or the performance of other activities as is described in this work plan.

Once facilities are completed and considered to be in service (plant-in-service), a portion of the actual costs and interest during the construction period are transferred as new debt to the Federal Columbia River Power System. BPA takes on the obligation to repay the U. S. Treasury for this new debt. It is limited to the power share of the total construction costs, which is determined according to the allocation of original project benefits. The non-power share is covered by federal taxpayers. BPA generally capitalizes new costs to the Federal Columbia River Power System and accounts for the resulting interest and depreciation expenses on an annual basis. Approximately 81 percent of Corps' costs are allocated to hydropower and reimbursed by BPA.

BPA's power rates include repayment estimates, and these are reflected in the recently signed Memorandum of Agreement (MOA) concerning BPA's fish and wildlife costs. The MOA addresses federal expenditures allocated to hydropower for fish and wildlife activities, including projects for

salmon recovery. In the MOA, the federal agencies committed themselves to work closely with state and tribal fishery agencies and the Council in planning and allocating available funds.

Current Schedules and Decision Points: NMFS 1995 Biological Opinion identifies immediate, intermediate, and long-term actions for the operation and configuration of the hydropower system that will reduce mortality of ESA-listed fish. Immediate survival actions include improved bypasses, increased spills and spring/summer flows, reduced fish handling, and better transportation techniques. Intermediate actions identified in the Biological Opinion to improve salmon survival include gas abatement measures, installation of extended-length screens at some dams, Bonneville bypass outfall relocation, and acquisition of new fish barges. Immediate research activities include evaluation of alternative long-term strategies, in particular, major structural modifications such as installation of surface bypass systems, and drawdowns.

There are several decision points along the path to determining the benefits of various structural modifications. The Biological Opinion states that the first preliminary decisions regarding drawdown of the four Lower Snake dams and installing surface bypass systems should be possible by mid-1996. NMFS calls on the Corps to complete an interim evaluation of these measures by mid-1996 and to proceed with the engineering and design work for a preferred drawdown alternative and development of surface bypass systems, unless NMFS and the Corps agree on a different course. Engineering and design work and the NEPA process are to be completed by December 1999, and Congressional authorization is to be pursued. NMFS goal is to ensure that construction of drawdown or surface bypass systems in the Snake River could begin in 2000. To meet this time frame, Congressional authorization, if needed, and necessary Corps funding to implement such actions would need to be accomplished in 1998.

Under the MOA, NMFS, the Corps, and other federal agencies recognize the significant roles and functions that state and tribal fish and wildlife managers perform related to capital investments in fish and wildlife. The multi-year work plan provisions set forth in the Annex to the MOA call for regional input to mainstem construction schedules and budgets. MOA section VI.b.3.A. states that the regional offices of the Corps of Engineers and the Bureau of Reclamation, when submitting annual Congressional budget requests, will act in a manner consistent with the capital construction multi-year work plan.

While a deliberate decision point has been established for lower Snake River configuration alternatives, similar decision dates have not been established for system configuration alternatives related to capital construction activities on the mid- and lower Columbia River. The work plan activities for these reaches reflect milestones based on the amount of time needed to accomplish engineering and prototype development and to obtain the biological information necessary to support fish bypass and/or system configuration decisions.

Decision Framework: The term decision framework is intended to mean the process through which future capital improvements, system configuration changes, and hydrosystem operation are determined. The decision framework or process includes:

- Biological recovery goals
- Procedures for resolving technical/biological issues
- Identification of project activities that are currently under way
- Criteria used in decisionmaking
- Interactions among the areas of activity
- Algorithms for applying decision criteria to arrive at a specific configuration to meet recovery goals, which are not yet defined

An attempt at a decisionmaking process for lower Snake River configuration changes was outlined in NMFS 1995 Biological Opinion, but it does not incorporate measures from other regional plans, such as the Council's Fish and Wildlife Program, Spirit of the Salmon plan, independent scientific reports, etc. Furthermore, the Biological Opinion measures address only those salmon stocks listed under the Endangered Species Act.

Figure 3-3 illustrates a decision framework with the NMFS Biological Opinion remaining as the driving force. The framework has been developed to achieve a specific goal: to define a system configuration and hydrosystem operation that recovers listed stocks in the Snake River Basin. The framework does not necessarily have to be limited to the NMFS Biological Opinion.

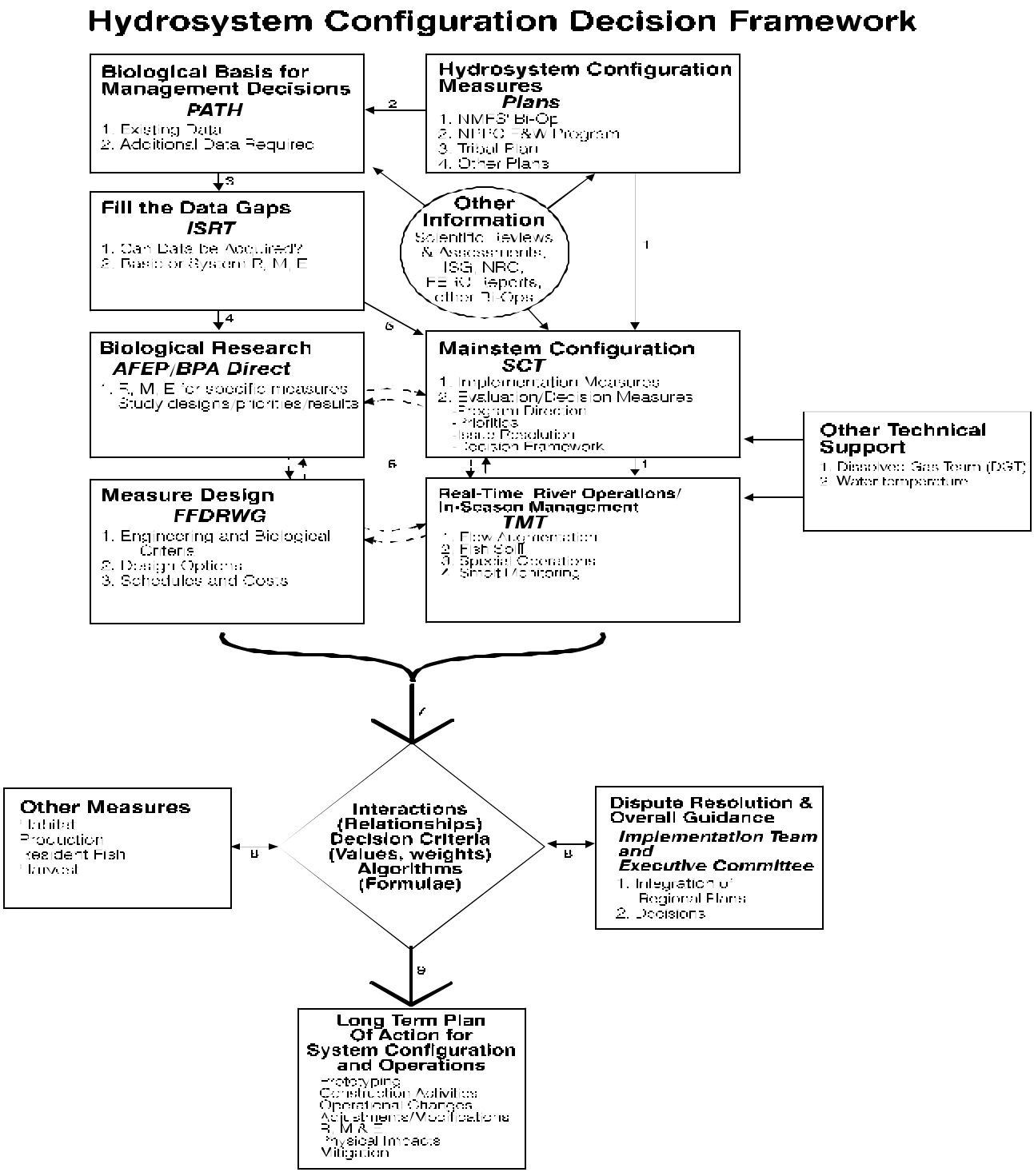

Figure 3- 3 Hydrosystem configuration decision framework

Decision Framework Interactions: A proposed process by which regional decisions on system configuration and operations could occur is illustrated by the graphic above. The process involves a number of interactions or linkages. These interactions represent the interface of both technical groups and specific issues through which effective decisions are reached. They are briefly described below.

1. Overall program direction or guidance is received by SCT and the Technical Management Team (TMT) (and other groups) from the various regional and tribal recovery plans. The plans recommend specific operational requirements and identify needed system configuration, research, monitoring, and evaluation activities.

2. The second interaction provides the biological basis for managers to select the most appropriate future direction. The PATH process is looking at existing biological data and performing a retrospective analysis, then relating that information to proposed alternative management decisions and identifying the biological questions that should be answered by prospective biological research and analysis.

3. The next interaction identifies biological information needed to support future decisions and requested of regional researchers. The intent is to create a biological performance basis for making such future decisions. This linkage also identifies whether such information can be obtained at all or in time to make a decision.

4. This interaction continues the development of biological information by focusing on specific biological studies identified by regional scientific groups. This research takes place in the context of an overall research program.

5. This interaction shows how basic research, e.g., reach survival and transport survival, and specific project-related research, can affect program direction and the priorities for specific measures.

6. The next interaction represents the collaboration and tradeoffs required among configuration measures, the design of these measures, the research needed to understand or predict biological success, and their effect on real-time operations.

7. This interaction represents the two-way exchange that influences or determines the value and weights of decision criteria, which in turn affects the long-term decision on system configuration and operation. It assumes that there is sufficient policy guidance to guide the technical work and to ensure that course corrections can be made on the technical level. Such course corrections should in turn influence the ultimate policy direction.

8. This interaction attempts to provide a forum for resolution of policy and technical disputes and allows for integration among hydropower, habitat, harvest, and hatchery issues.

9. The last interaction represents the end product of the decisionmaking process and provides policy and technical direction for system configuration and hydrosystem operation.

Decision Criteria: In rational decisionmaking, several criteria or factors are identified and weighed together. The following criteria represent one list used by SCT during the process for establishing FY 1997 capital construction activities. Other criteria could be identified and incorporated in this list.

- Short-term survival for listed and unlisted stocks
- Long-term survival for unlisted stocks
- Recovery of listed stocks
- Cost: current and future
- Revenue impacts
- Policy consistency
- Key knowledge
- Ongoing activity
- Longevity/persistence

Decisionmaking Algorithm: A decision algorithm is the process by which a single plan for system configuration and operation is established while taking into account all of the above information. Different assumptions can be made about the weights assigned to the above criteria.

Differing weights applied to biology, finance, economics, and policy can yield different configurations, operations, and the resulting schedules or timelines necessary to get there. A major issue facing the region is whether the science or biological information needed can be obtained according to the schedule outlined in the NMFS Biological Opinion.

3.4.2.2 Mainstem Construction Projects by Major Category

Although many of the following capital construction projects show work activities extending beyond 1997, the System Configuration Team has not reached agreement on all projects for FY 1997 and beyond. There are some outstanding issues related to the future path or direction of the capital construction program that require further discussion and resolution (see Section 3.6 for a complete listing of issues). For example, the state fish and wildlife agency and tribal representatives of SCT have not supported acquisition of two new fish barges for 1998. Neither have these parties supported implementation of Phase I of the turbine passage survival program, nor testing of a guidance curtain at Lower Granite Dam. Those projects are recommended in this work plan by NMFS based on its 1995 Biological Opinion and/or supported by other federal agencies pending further discussion by the salmon managers. Moreover, the Shoshone-Bannock Tribes do not support any further investment in juvenile or adult fish passage facility improvements at lower Snake River dams. Instead, the Shoshone-Bannock Tribes support expediting all biological, economic and engineering evaluations associated with implementation of a permanent natural river drawdown in the Snake River (see Section 3.4.3).

3.4.2.2.1 Surface Bypass

Purpose/Objectives: The Corps of Engineers and operators of PUD-owned mid-Columbia dams have developed testing/implementation programs for surface bypass and collection systems aimed at improving survival of juvenile salmon migrating past hydroelectric projects on the lower Snake and Columbia rivers. Surface bypass systems aim to benefit fish by reducing forebay delay, decreasing the

need for fish to "sound" to access existing mechanical guidance systems, reducing stress, injury, and mortality associated with the existing passage systems, and reducing the proportion of fish passing through turbines.

The NMFS 1995 Biological Opinion states that surface collection technology should be evaluated over the next five years to determine its effectiveness in reducing mortality of ESA-listed fish. The Biological Opinion states that all work should be done to ensure that implementation of measures such as drawdowns, surface collectors, recommended existing system improvements (dissolved gas control measures, juvenile fish facility improvements, adult fish facility improvements, etc.), or combinations of measures can begin in the lower Snake and Columbia rivers by 2000.

Both the Council's Fish and Wildlife Program and the tribal plan call for the Corps and other parties, such as mid-Columbia PUDs, to explore promising new approaches to fish bypass technologies. These include development and prototype testing of surface bypass systems, surface spill, and such behavioral guidance devices as the use of sound to guide fish. These new passage technologies, if proven feasible and effective, will be considered and may be incorporated into the Council's program during the upcoming amendment process. The Shoshone-Bannock Tribes believe that tests of these systems in the lower Snake River will not provide any more information than currently exists, and are concerned that these funds will be wasted if the decision is made to implement a natural river drawdown in 1999. The Shoshone-Bannock Tribes object to further development of surface bypass technologies and testing in the lower Snake River.

CORPS PROJECTS

Scope: The Corps of Engineers' Walla Walla and Portland Districts have developed a program for research and development of surface bypass and collection prototypes. The program is on a fast-track to design, construct, and test these systems, with a goal of providing the information necessary to make an informed decision on whether to begin implementing full-scale systems within four years.

The Corps is designing surface collector and bypass prototypes based on project-specific fish behavior and hydraulic characteristics at the dams and forebays. Options are being evaluated for passing fish directly to the tailrace (for in-river migration) as well as to conventional holding and loading facilities (transport).

The Corps has surface bypass activities under way at Lower Granite, Ice Harbor (1995), John Day, The Dalles, and Bonneville dams. The total cost of the Corps' prototype development program (1995-1999) is estimated to be $152 million. Grant County PUD has a prototype surface bypass project ongoing at Wanapum Dam, and Chelan County PUD has a project at Rocky Reach Dam.

Tasks and Activities:

1. Surface Bypass Prototype at Lower Granite Dam. Development and testing of a surface bypass prototype at Lower Granite is considered a priority because it is the first Corps dam on the lower

Snake, where a large number of juvenile salmon must pass, and because of concern for ESA-listed stocks. Developing a prototype surface bypass, and possibly collection, system for Lower Granite Dam (with potential application for other mainstem dams) is the first objective for the lower Snake River.

Current plans identify the following options as main components of the Lower Granite surface bypass system: a fish bypass channel, with surface-oriented entrances; connection of the channel to the existing juvenile facility; direct fish and water bypass to the tailrace; a large-scale dewatering system; and provisions for handling the excess water. It should be noted that plans change, based on current test results.

Schedule/Milestones:

1996 Initial prototype tested. Evaluated fish acceptance of various configurations and flows.

1997 Modifications to the 1996 structure, including repairs to the vertical slot gates, removal of flotation from above the center slot, as well as other structural modifications to make the facility safer for personnel. Investigations will focus on unresolved questions from 1996 studies.

1998 Additional modifications to the existing structure. A guidance device (curtain) may be incorporated into the structure, as an alternative to constructing a full powerhouse prototype. Other options evaluated may include a Wells Dam-type surface intake design and construction of a full powerhouse prototype surface bypass system.

1999 Testing of a dewatering system and connection to the existing juvenile bypass system is planned, depending upon previous years' test results.

Costs: Total preliminary cost for prototype surface bypass development at Lower Granite Dam is estimated at $51,505,000.

Research, Monitoring and Evaluation**:** During 1995-99, the Corps will evaluate the effectiveness of the prototype surface bypass system using radio telemetry and hydroacoustic techniques to assess response to the surface bypass collection, its efficiency and effectiveness relative to other passage routes, and accompanying studies to determine the condition and survival of juvenile fish passing through the prototype system, adult and predator fish response to the system, and infrasound tests to attempt to redistribute smolts for development of an acceptable dewatering structure (Table 3-3 in Section 3.4.2.3).

Reference: Lower Snake and Columbia Rivers, Surface Bypass and Collection Systems Prototype Development Program, August 1995. Personal communication with Mike Mason, COE; Steve Fink, COE.

2. Surface Bypass Studies at John Day Dam. Surface bypass studies at John Day Dam will begin in 1997.

The four skeleton bays (bays without turbines) at John Day make this powerhouse different and unique among the lower Columbia River dams. The plan at John Day Dam calls for : a) evaluating whether the skeleton bays can be used to pass a high volume of fish attraction flow; b) determining whether the

skeleton bays can be used as a route for a surface bypass channel; and c) testing baffled slots at the spillway to assess the potential for low-cost, high efficiency juvenile passage.

Schedule/Milestones:

The prototype system is to be developed and tested over a period of four years, 1997-2000.

1997-8	Test baffles in three spillbays
2000	Prototype test surface bypass in one skeleton bay

Costs: The cost for the testing in 1997 is estimated at $3.1 million. Total preliminary costs for activities related to prototype surface bypass development at John Day Dam are estimated at $30,523,000.

Research, Monitoring and Evaluation**:** During 1996-2000, the Corps will evaluate the effectiveness of the prototype surface bypass system at John Day Dam using hydroacoustic and radio telemetry evaluations of juvenile fish passage patterns at the project (Table 3-3 in Section 3.4.2.3).

References: Lower Snake and Columbia Rivers, Surface Bypass and Collection Systems Prototype Development Program, August 1995. Personal communication with John Kranda, COE; Stuart Stanger, COE.

3. Surface Bypass Studies at The Dalles Dam. Fish behavior around The Dalles powerhouse suggests that surface bypass at this location could be highly effective. Initial surface bypass studies were conducted in 1995 and 1996. However, because spill is efficient at this project in meeting fish passage efficiency requirements and other funding priorities, future activities over the next few years at The Dalles Dam will be limited to spillway survival studies and sluiceway outfall relocation feasibility studies.

Schedule/Milestones: The Corps conducted initial biological and hydraulic research and testing for a surface bypass system at The Dalles in 1995 and 1996. Future activities over the next few years at The Dalles Dam will be limited to spillway survival studies and sluiceway outfall relocation feasibility studies.

1997-2001	Conduct spillway and sluiceway survival studies.

Costs: The total preliminary costs for activities related to spillway and sluiceway survival studies at The Dalles Dam (FY 1995-2001) are estimated at $5,000,000.

Research, Monitoring and Evaluation**:** During 1997-2001, the Corps will conduct a survival study of juvenile fish passage through the spillway (Table 3-3 in Section 3.4.2.3).

(a) Spillway Survival Study at The Dalles Dam. In 1997, the Corps will be conducting a survival study of juvenile fish passage through the spillway at The Dalles Dam. During in-season spill operations, spills of 64 percent of total project discharge are provided to meet minimum fish passage efficiency goals. The study will evaluate juvenile fish survival during similar spill operations. The annual cost of the study is $1 million; it is currently scheduled to continue through 2001, if necessary.

(b) Sluiceway Outfall Relocation Study at The Dalles Dam. The Corps is also planning to conduct an outfall relocation study at The Dalles in 1997. The current outfall for the ice/trash sluiceway deposits juvenile fish in a high predation area. The Corps will investigate the feasibility of relocating the outfall. The study will be conducted in 1997 at an estimated cost of $200,000.

4. Surface Bypass Prototype at Bonneville Dam. The region has given Bonneville Dam priority because of the complexity of juvenile fish passage issues and the lack of adequate fish passage protection at the dam after a decade of intensive research and monitoring. If higher levels of non-turbine passage are to be achieved at Bonneville Dam, new fish passage technologies will have to be developed.

As part of the research at Bonneville Dam, new scale models of both powerhouse forebays are being constructed to evaluate the potential of surface bypass alternatives at both Powerhouse 1 and Powerhouse 2.

Schedule/Milestones:

1996	Initial biological and hydraulic research and testing conducted for a surface bypass system at both powerhouses at Bonneville Dam.
1998	Surface collection prototype to be installed and tested at Powerhouse 1.
2000	Second prototype installed and tested at Powerhouse 1.
2001	Complete surface bypass evaluations.

Note: The schedule for prototype testing at Powerhouse 2 has been deferred because of limited funds and inability to monitor the trash chute in 1996. The Corps plans an evaluation of Bonneville Powerhouse 2 sluice chute as an initial indicator of the potential for smaller-scale surface bypass options. Modeling biological and engineering work will continue at Powerhouse 2.

Costs: The total preliminary costs for prototype development activities at Bonneville are estimated at $54,000,000.

Research, Monitoring, and Evaluation**:** During 1996-99, the Corps will evaluate the potential for development of a prototype surface bypass system at Bonneville Dam using hydroacoustic and radio telemetry evaluations of juvenile fish passage patterns at the project, as well as a proposed evaluation of the distribution and behavior of northern squawfish, a known salmon predator, in the Bonneville forebay (Table 3-2).

Reference: Lower Snake and Columbia Rivers, Surface Bypass and Collection Systems Prototype Development Program, August 1995. Personal communication with Doug Clarke, COE.

Overall Costs of the Corps Surface Bypass Program: The total costs for development of the prototype surface bypass and collections systems during FY 1995 through 1999 are estimated at $152 million.

Reference: Lower Snake and Columbia Rivers, Surface Bypass and Collection Systems Prototype Development Program, August 1995.

MID-COLUMBIA SURFACE COLLECTION PROJECTS

1. Wanapum and Priest Rapids Dams (Grant County PUD).

(a) Surface Bypass Prototype at Wanapum. In 1997, Grant County PUD will test a complete surface bypass system prototype at Wanapum Dam. Depending upon the outcome of the tests, fully operational surface collectors will be installed at both Priest Rapids and Wanapum dams by the spring outmigration in 2000.

Costs: The estimated cost of a surface bypass system at Wanapum Dam is in the range of $30,219,000 to $70,791,000, depending upon what type of system is to be installed. For Priest Rapids, the estimate is $51,949,000 to $68,816,000.

(b) Top-Spill at Wanapum. Grant PUD tested a prototype top-spill gate in 1996 at Wanapum Dam as a method for improving the effectiveness of spill in bypassing juvenile migrants. The results of the tests were promising, and the PUD is considering whether to incorporate top-spill into the long-term juvenile passage system.

Costs: The estimated cost of modifying the spillgates at Wanapum to accommodate top-spill is $24,185,000.

Research, Monitoring, and Evaluation: The bypass systems at both Wanapum and Priest Rapids will have passive integrated transponder (PIT-tag) detection systems. They will also incorporate facilities for fish sampling and inspection for injuries. The PUD will use PIT-tag studies to evaluate fish collection and guidance efficiencies and injury rates.

Reference: Mid-Columbia Mainstem Conservation Plan, Priest Rapids Hydroelectric Project, May 1996 (Draft).

2. Rocky Reach Dam and Rock Island Dams (Chelan County PUD).

(a) Surface Bypass Prototype at Rocky Reach. The PUD installed a prototype surface bypass system in 1995 in the powerhouse forebay at Rocky Reach Dam. The system was modified in 1996 to improve its effectiveness. However, tests in 1996 indicated that the modification, consisting of an external floor in front of the powerhouse and collector entrance, did not improve collection efficiency. A turbine intake screen collection system is also in place in the intakes of Turbine Unit 1. The turbine screen system, prior to installation of the prototype surface collector, had failed to produce adequate fish guidance efficiencies (FGE). Collection of fish from the screen intakes in 1995 and 1996 suggests that there were improvements in guidance efficiency. Initial results with the surface bypass system have been positive, and the focus at Rocky Reach is now on surface bypass. Since the fish collection

numbers from Unit 1 intakes were also high, Chelan PUD is presently planning to include some level of intake screening as part of a hybrid system.

The 1996 in-season testing resulted in a decision by Chelan PUD to retest the 1996 prototype design in 1997, with the external floor removed and some internal modifications. At the same time, the PUD will investigate outfall alternatives for the bypass system at Rocky Reach. If indicated, the PUD will continue installing additional phases of the juvenile bypass system in 1998.

Costs: The PUD estimates the cost of a permanent surface collection bypass system, including a relocated outfall, at $40,000,000.

Research, Monitoring, and Evaluation: In 1997, Chelan PUD plans to retest its 1996 prototype surface bypass design at Rocky Reach Dam, with the external floor removed and with some internal modifications.

(b) Surface Bypass Prototype at Rock Island. The PUD is also developing a surface bypass system at Rock Island Dam. During 1996, spill gates were modified to include top-spill in order to improve spill efficiency. In 1997, the PUD will modify additional spillgates to accommodate top-spill to further increase spill efficiency. The PUD will determine in 1998, based on spillway entrance tests, whether a surface bypass at the powerhouses will be investigated as a long-term bypass measure at the dam.

Costs: Chelan PUD estimates the cost of a permanent surface collection bypass system at $30,000,000.

Research, Monitoring, and Evaluation: During 1997, Chelan PUD will continue to evaluate the prototype surface collectors and surface spill using video counting, sampling bypassed juvenile fish for injury and species composition, evaluating PIT-tag data, and evaluating fish behavior using radio telemetry and hydroacoustic technology. If a permanent bypass system is constructed and evaluated in 1998 and if passage efficiencies are acceptable, the PUD will do follow-up studies every five years.

Reference: Mid-Columbia Mainstem Conservation Plan, Rocky Reach Hydroelectric Project, Public Utility District No. 1 of Chelan County, May 1996 (Draft).

3.4.2.2.2 Snake River Drawdowns (Corps of Engineers)

Purpose/Objectives: The NMFS 1995 Biological Opinion calls for evaluating the feasibility of drawdown at the four federal dams on the lower Snake River as a means of improving juvenile survival. The Corps' Juvenile Salmon Migration Feasibility Study for the Lower Snake River will provide the evaluation, and will also satisfy the NEPA compliance requirements, for any system configuration modifications necessitated by a 1999 decision. Drawdown is aimed at reducing mortality by increasing velocity and improving dam passage.

Scope: The first step toward drawdown in the lower Snake is to conduct a feasibility study. The study, due to be completed and sent to Congress in 1999 (interim evaluation report in 1996), will consist of a

comprehensive analysis of alternatives, which include bypass improvements, as well as drawdowns. The geographic area included in the study extends from the upper end of the Lower Granite reservoir (above Lewiston, Idaho) to below Ice Harbor Dam. The four lower Snake River dams are: Lower Granite, Little Goose, Lower Monumental and Ice Harbor.

Tasks and Activities: The feasibility study requires a number of analyses, including engineering, biological, social and cultural, environmental, economic and cost effectiveness, risk and uncertainty, and institutional. The specific studies are described briefly below.

1. Hydrologic Studies. These studies will cover basin hydrology and the results of modeling. Topics include transfers of flood control space, water travel time, flow target estimates and sediment studies.

2. Engineering Appendix -- Lower Snake River Drawdown. The appendix will provide concept designs for several drawdown alternatives. The product will include conceptual and detailed engineering evaluations, hydraulic analysis, field investigations, and detailed design and layout.

3. Engineering Appendix -- Surface Bypass Systems. A separate appendix will be prepared for the engineering evaluation of the surface bypass systems. This activity will include conceptual engineering evaluations of a powerhouse collector system, spillway slot system, and floating guidance curtain and slot system. The detailed engineering evaluation will include the following design requirements: hydraulic analysis, physical model studies, structural design, mechanical design, electrical design, preparation of drawings, and report preparation.

4. Socio-Economic Studies and Report. These include an economic evaluation of alternatives, and an analysis of impacts on system uses such as power generation, recreation, navigation, irrigation, flood control, and anadromous fish. It will also include an analysis to determine the effects on local communities and cost-effectiveness calculations.

5. Real Estate Studies. A real estate analysis will include a gross appraisal report and will describe any acreage and easements to be acquired.

6. Environmental Compliance. Requirements for compliance with environmental laws will be identified, and appropriate NEPA documents, including an environmental impact statement, will be prepared.

7. Biological Analysis. A comprehensive analysis of the potential biological benefits and impacts on anadromous fish, reservoir ecology, water quality and limnology, wildlife, and riparian and wetland ecology will be undertaken.

8. Public Involvement. A plan to involve the public and fulfill the requirements for environmental compliance will be prepared and carried out. Activities include those required by NEPA, such as public meetings for scoping and comment on a draft report, as well as a newsletter and news releases.

9. Plan Formulation and Evaluation. Plan formulation begins with scoping and includes defining and evaluating alternatives, ultimately leading to the development of the preferred plan. At least five alternatives will be evaluated in the feasibility study: seasonal drawdown to spillway crest; seasonal drawdown to near natural river; permanent drawdown to near natural river; surface bypass; and "without project drawdown conditions" (the base case or no action).

10. Feasibility Report Preparation. This activity includes coordinating information and preparing study reports.

Schedule/Milestones: The feasibility study, which was initiated in 1995, is a five-year effort. Milestones in the schedule include:

December 1996	Initial plan formulation, including an interim report
December 1998	Detailed analysis activities complete; preliminary draft report
February 1999	Draft feasibility study report
June 1999	Final feasibility study report
November 1999	Record of Decision
December 1999	Report to Congress

Products:

- Final interim report, December 1996.
- Final feasibility report, June 1999.

Costs: The total cost of the lower Snake River feasibility study is $16.3 million. The breakdown of activity is as follows:

Hydrologic Studies		$ 272,000
Engineering Appendix (Drawdown)		$ 2,210,000
Engineering Appendix (Bypass)	$ 1,954,000	
Socio-Economic Studies		$ 627,000
Real Estate Analysis		$ 140,000
Environmental Compliance		$ 1,296,000
Biological Investigations		$ 7,990,000
Cost Estimates		$ 268,000
Plan Formulation & Evaluation	$ 504,000	
Feasibility Report Preparation		$ 989,000
TOTAL		$ 16,250,000

Research, Monitoring, and Evaluation: The feasibility study includes a number of research and evaluation projects (see hydrologic, socio-economic and biological studies sections above).

References: Columbia River Salmon Mitigation Analysis, System Configuration Study--Phase II: Juvenile Salmon Migration Feasibility Study Lower Snake River, Project Study Plan, August 1995; Juvenile Salmon Migration Feasibility Study Lower Snake River, Interim Evaluation Report, November 1996 (Draft). Personal communication with Pete Poolman, COE.

3.4.2.2.3 Columbia River Drawdowns (Corps of Engineers)

Purpose/Objective: John Day Reservoir is currently being operated at minimum irrigation pool (between elevation 263 to 265 feet) from May 1 to August 31 to increase water velocity conditions for migrating juvenile salmonids. Both the NMFS Biological Opinion and the Council's Fish and Wildlife Program call on the Corps to evaluate the feasibility of drawing down the reservoir to near spillway crest elevation. The purpose would be to further increase water velocity through the reservoir to improve juvenile salmon survival and to restore salmon spawning, feeding, and rearing habitat.

Scope: Three possible operations for John Day reservoir have been proposed. One proposal is to operate year round at or near minimum operating pool (MOP), which is eleven feet lower than the full pool elevation of 268 feet. A second possibility is a drawdown to near spillway crest (elevation 210 feet). A third option is a drawdown to natural river level.

Tasks and Activities: The Corps had completed some advanced planning and design work for the mitigation associated with operating John Day near MOP (e.g., modifying irrigation and water supply intakes, modifying hatchery and recreation facilities) when work was halted in October 1995. There has not been an evaluation of operating the reservoir at spillway crest or below.

Further evaluation of these operations was put on hold in response to 1996 Congressional appropriations bill language, which required that any future funding requests for study of John Day drawdown be accompanied by scientific justification. NMFS is currently developing that information. The Corps is prepared to immediately initiate further study of deep drawdowns (below MOP) should the appropriations committee agree to reprogram FY 1997 funds to this activity, or if it is included in an appropriation in 1998.

Schedule: There is no schedule for further studies at this time, although $3 million has been earmarked for such studies in FY 1997 pending scientific justification and Congressional response.

Products: A feasibility study would be completed for proposed alternative drawdown modifications and operations.

Costs: The cost of mitigation for operation near MOP was estimated at $180 million. A preliminary estimate to complete a spillway crest or lower drawdown feasibility study is $8 million to $12 million; a preliminary estimate of the costs to implement a drawdown to near spillway crest is $1 billion; no estimate has been made for a natural river operation.

Research, Monitoring and Evaluation**:** Beginning in 1994, the Corps initiated a number of habitat and limnological studies to evaluate the potential biological benefits and impacts of a John Day drawdown operation. All biological studies in the John Day reservoir have been deferred since late 1995 in

response to the 1996 Congressional appropriations bill language mentioned above (Table 3-3 in Section 3.4.2.3 below).

References: Corps of Engineers System Configuration Study, Phase I, Appendix B; Review of Reservoir Drawdown, Harza and Associates, April 1994. Personal communication with Stuart Stanger, COE.

3.4.2.2.4 Juvenile Fish Transportation (Corps of Engineers)

Purpose/Objective: The purpose of the Juvenile Fish Transportation Program is to increase the survival rate of juvenile salmon that migrate from the Snake and Columbia rivers to the Pacific Ocean. The program aims to reduce migration time, eliminate the problems smolts encounter in passing dams, and decrease reservoir mortality. Both CRITFC and the Shoshone-Bannock Tribes object to transportation of juvenile salmon as a recovery tool, and support transportation only as a temporary technique to be used only in extreme emergency situations. Therefore, the tribes do not support further expenditures on juvenile fish transportation at any of the four lower Snake River dams.

Scope: The Corps has been developing plans to provide direct loading of juvenile salmon at the four collector dams (Lower Granite, Little Goose, Lower Monumental, and McNary) to reduce stress on the transported fish. Direct loading at all four dams would require acquisition of new barges and expansion of support facilities. Existing barges are currently being modified to speed the release of fish from the barges when they reach their destination below Bonneville Dam.

Tasks and Activities:

1. Barge Loading Facilities Modification. An additional barge mooring dolphin (concrete pier) is being constructed at Lower Monumental Dam. The dolphin will correct a safety problem at the barge loading facility and will allow spill during barge loading.

Schedule/Milestones:

October 1996	Contract Awarded
March 1997	Work Complete

Costs: The total project cost (FY 1996 and 1997) is $944,000.

References: System Configuration Study Additional Juvenile Fish Transportation Barges, Design Memorandum (Prefinal), June 1996. Personal communication with Mike Mason, COE; Dave Hurson, COE.

2. Additional Barges and Appurtenances; Replacement Barges. Fish collected for transport are often held in raceways until a barge is available. Crowding and the process of transferring the fish from raceways into the barges causes stress, which may contribute to juvenile mortality. To alleviate this problem, the Corps is seeking to provide for direct loading of fish at the lower Snake River collection

sites: Lower Granite, Little Goose and Lower Monumental. This would require adding to the barge fleet and constructing additional facilities, such as moorages and fueling stations.

a. Lower Granite/Little Goose. The first phase of the Corps' plan is to provide for direct-loading of juvenile fish at Lower Granite and Little Goose dams. To accomplish this, the Corps plans to acquire two new 75,000-lb. barges, with an option for a third. It is estimated that three new fish barges will be required to provide direct loading capability at both Lower Granite and Little Goose dams. The Corps also plans to expand the moorage and maintenance facilities at Lower Granite Dam, if more than three new barges are brought online. Subject to available funding, this work is scheduled to be initiated in FY 1997, with two new barges on line in March 1998.

b. Lower Monumental. The second phase of the plan is to provide direct-loading capability at Lower Monumental, if necessary. This phase would require four new 50,000-lb. barges and a new daily barge-mooring and fueling facilities at Lower Monumental Dam. (NOTE: This phase is subject to change based upon data collected on the effectiveness of surface collection bypass systems and whether reservoir drawdown is pursued.) The current schedule for having barges on line is post-1999, pending additional decisions.

c. Replacement Barges. The third phase of the plan calls for potentially replacing the two 23,000-lb. capacity barges currently in service. The replacements would be 50,000-lb. capacity vessels. The current schedule for having replacement barges on line is post-1999, pending additional decisions.

Costs: The fully funded cost-estimate for all phases of the barge program is $17,737,000.

References: System Configuration Study Additional Juvenile Fish Transportation Barges, Design Memorandum (Prefinal), June 1996. Personal communication with Mike Mason, COE.

3. Barge Exit Modifications. Juvenile fish are released through exit openings in the bottom of a barge. These openings are being enlarged in all six barges in order to reduce the unloading time. Work is complete on the two 50,000-lb. vessels; construction is in progress on the remaining barges and will be complete by spring 1997.

Costs: The total construction cost is $894,000.

Research, Monitoring, and Evaluation: The Corps has a number of evaluations ongoing, continuing or planned from 1992-2004 related to transportation. Chief among these studies is research to evaluate the effectiveness of transporting spring/summer chinook salmon compared with inriver migration in the Snake River; this research began in 1995 and will continue with collection of adult return information through 2003. Similar transport effectiveness research is being conducted in the Columbia River with subyearling salmon at McNary Dam from 1995-2004. Other biological evaluations are under way to address procedures to improve collection/handling/transportation techniques to minimize fish stress and

injury. And more study is being conducted to evaluate the efficacy of transporting juvenile fish further downstream, i.e., below the normal release location at Skamania light buoy. That study is expected to continue until 1999 (Table 3-3 in Section 3.4.2.3).

References: System Configuration Study Additional Juvenile Fish Transportation Barges, Design Memorandum (Prefinal), June 1996. Personal communication with Steve Fink, COE.

3.4.2.2.5 Juvenile Fish Passage Improvements (Other than Surface Bypass) at Federal Dams

Purpose/Objectives: Juvenile fish passage systems at Columbia and Snake river dams provide a way for migrants to safely bypass the dams as they move downstream to the Pacific Ocean. The purpose of the following improvement projects is to increase the likelihood of safe passage and survival through the system. The Shoshone-Bannock Tribes support the immediate implementation of permanent drawdowns of the four lower Snake River dams to natural river levels, and therefore oppose all further expenditures on juvenile fish passage improvements at these dams that are inconsistent with this objective.

Scope: Improvements to fish passage facilities include a wide range of activities. There are both systemwide projects, such as a study of "fish friendly" turbine designs, as well as a number of project-specific measures, such as installing screens and other fish guidance devices. The Corps has projects planned for seven Corps dams over the next five years. The mid-Columbia PUDs are focusing on surface bypass, but there are efforts such as the replacement of turbine blades at Rocky Reach Dam that will reduce injury and improve survival of juvenile fish.

Tasks and Activities:

Corps of Engineers

1. Turbine Fish Passage Survival Program. The purpose of the program is to develop short-term solutions to improve survival and conditions as unguided fish pass through the existing turbines, to establish a biological basis for design of "fish-friendly" turbine modifications, and to develop new turbine designs or modifications for implementation over the long term.

Schedule/Milestones: A draft study plan was completed in September 1996. Regional review of the draft study plan is scheduled for November 1996. Tasks and milestones identified here are subject to this review. Testing and evaluation is proposed over the next five years.

October 1997	Begin Prototype and Modification Testing
October 1997	Begin Biological and Engineering Testing
November 1997	Begin Turbine Hydraulic and Performance Modeling
February 1998	Begin Numerical Modeling
April 1999	Engineering Report
October 1999	Numerical Modeling Report

Costs: The estimated cost for Phase I (1997-2000) is $10,300,000.

Research, Monitoring, and Evaluation**:** The Corps has proposed three research projects for developing more fish-friendly turbine designs, beginning in 1997, with completion by 1999: They are: 1) a base case survival and injury study to evaluate the causal mechanisms of mortality and injury in a turbine environment; 2) development of methodology and equipment for use in fish distribution studies within a turbine environment; and 3) a study of the effects of pressure changes on juvenile salmonids within the turbine environment (Table 3-3 in Section 3.4.2.3).

References: Columbia River Fish Mitigation Program, System Configuration Study Phase II, Turbine Fish Passage Survival Program, Project Study Plan, September 17, 1996 (Draft). Personal communication with John Kranda, COE.

2. Acoustic Technology Evaluation. The Corps is conducting research into the potential use of sound-based fish guidance and deterrence systems. The research will be conducted in three phases, the first of which is to prepare a background and development report. This includes an inventory of existing knowledge about the technology and identifying uncertainties in its application. The second phase would be a demonstration project, and the third phase would involve full prototype testing (Table 3-3 in Section 3.4.2.3).

Schedule: The study will be conducted over five years, 1996-2000.

Costs: The estimated cost of the study is $5.2 million.

Research, Monitoring and Evaluation**:** Several studies are either ongoing or planned to be conducted through the year 2000 to evaluate the efficacy of using very low-frequency sound fields to modify fish behavior and help guide or deter juvenile salmonids or other fish species. One project is funded by BPA, and the other is being funded by the Corps; the agencies are coordinating the two projects (Table 3-3 in Section 3.4.2.3).

Reference: Lower Snake and Columbia Rivers, Surface Bypass and Collection Systems Prototype Development Program, August 1995.

3. Juvenile Fish Facility Improvements.

a. Lower Granite Dam. (1) Construction and installation of extended-length bar screens was completed at Lower Granite in 1996. Post-construction activities and evaluation of the new extended-length screens will be conducted in 1997 (Table 3-3 in Section 3.4.2.3). Final modifications to the powerhouse deck to accommodate screen handling will be complete in 1998.

Costs: The total project cost is $8,800,000; the FY 1997 and 1998 expenditures are expected to be $2.7 million.

(2) The juvenile fish facilities at Lower Granite Dam are the oldest on the Snake River. The Corps plans to make major improvements and additions to the facilities that include a new modified collection channel; a transportation channel linking the collection channel and the primary dewatering structure; a primary dewatering channel; a corrugated fish transport flume and pipe system; and modified juvenile fish holding, loading, and bypass facilities, including a new separator.

Schedules/Milestones:

April 1999	Reinitiate Detailed Design
April 2000	Design and Contract Documents Complete
July 2000	Three-year Construction Phase Begins
2003	Construction Complete

Costs: The new facilities are estimated to cost $16,250,000 (1996 price level).

References: 1) Lower Granite Dam, Snake River, Washington and Idaho, Feature Design Memorandum (FDM) No. 43, Juvenile Bypass/Holding and Loading Facilities, March 1996. 2) Supplement No. 1 to FDM No. 43. 3) Personal communication with Mike Mason, COE.

(3) The Corps plans to develop, construct and test an evaluation fish separator at one of the Snake River dams for design development that can be applied at Lower Granite and possibly other dams. This activity includes developing proposed separator modifications, model testing of concepts at the Waterways Experiment Station; constructing a prototype evaluation separator; and biological testing of prototype designs.

Schedules/Milestones:

December 1996	Scoping Document Complete
January 1997	Detailed Design Begins
August 1997	Construction Contract Award
March 1998	Construction Complete and Testing Begins
April 1998	Biological Testing Begins

Costs: The preliminary estimated cost of the evaluation, including construction of a prototype separator, is $3,000,000. (The Corps' scoping document will include a more refined cost estimate.)

References: 1) Lower Granite Dam, Snake River, Washington and Idaho, Feature Design Memorandum (FDM) No. 43, Juvenile Bypass/Holding and Loading Facilities, March 1996. 2) Supplement No. 1 to FDM No. 43. Personal communication with Rick Emmert, COE.

b. Little Goose Dam. (1) The Corps awarded a contract in October 1996 to relocate the juvenile bypass system outfall pipe at Little Goose Dam to reduce salmon predation and improve survival of bypassed fish. Work is to be completed in March 1997.

Costs: The total project cost is $1,306,000.

(2) The Corps will complete the installation of extended-length bar screens at Little Goose in January 1997, and post-construction evaluations of the new screens will be conducted in spring 1997 and 1998 (Table 3-3 in Section 3.4.2.3). Deck screen modifications are scheduled for 1998.

Costs: The total project cost is $7,941,000. The FY 1997 and FY 1998 expenditures are estimated to be $2,480,000.

c. Lower Monumental Dam. (1) The Corps is conducting an Alternative Intake Gate Closure Study at both Lower Monumental and McNary dams. The final phase of the study is to be complete in 1996.

Costs: The total remaining cost of the study is estimated to be $355,000 and will be funded under the McNary project.

(2) The Corps is planning to purchase a new gantry crane for Lower Monumental to handle the operating gates when they are in a raised position and to handle the new screens. The purchase is scheduled to take place in 1998

Costs: The total cost is estimated at $490,000.

Reference: Personal communication with Mike Mason, COE.

d. Ice Harbor Dam. The Corps will be conducting post-construction activities on the bypass facility at Ice Harbor in 1997. A post-construction evaluation of the new juvenile fish bypass system was completed in 1996 (Table 3-3 in Section 3.4.2.3).

Costs: The estimated cost to complete all remaining work is $1.5 million.

Reference: Personal communication with Mike Mason, COE.

e. McNary Dam. (1) The Corps has completed construction of the juvenile fish bypass, sampling and holding/loading facilities at McNary Dam, and will be conducting post-construction and evaluation activities on the new bypass facilities to correct any design problems (Table 3-3 in Section 3.4.2.3). Work will also involve adding an emergency water supply system.

Costs: The remaining expenses in FY 1997 are estimated to be $1,016,000.

(2) The Corps is conducting an Alternative Intake Gate Closure Study at both McNary and Lower Monumental dams. The study will be completed this year. No cost estimate beyond 1997 can be made pending study completion.

Costs: See section 3.c. above for cost information.

(3) The Corps is installing a new extended-length screen system at McNary Dam. The work is expected to be completed in March 1997. Post-construction evaluation of the new screens is scheduled to begin in 1997 and be completed in 1999 (Table 3-3 in Section 3.4.2.3). In addition, the Corps is planning to construct a Screen Rehabilitation Facility for maintaining the extended-length submersible bar screens and related components of the fish guidance system at the dam. That facility is to be constructed during 1998 and completed in the first quarter of 1999.

Schedules/Milestones: Facility design began in October 1996. The project is expected to continue according to the following schedule:

June 1997	Design Complete
October 1997	Construction Contract Award
July 1998	Construction Complete

Costs: The fully funded project estimate is $6,748,000.

References: McNary Lock and Dam Lake Wallula, Oregon and Washington: Turbine Intake Screening Systems Screen Rehabilitation Facility, Feature Design Memorandum No. 34, December 1995. Personal communication with Mike Mason, COE.

f. John Day Dam. (1) The Corps is currently installing a smolt monitoring facility, including PIT-tag detection, at John Day Dam. The facility is nearing completion and will be operational by March 1998. Post-construction evaluation of the new juvenile fish monitoring facilities is scheduled to be conducted in 1998 and 1999 (Table 3-3 in Section 3.4.2.3). Data collected at the smolt monitoring facility at John Day will enable the region to gather smolt survival information from the head of the Lower Granite pool down to McNary Dam, as well as smolt travel time information through the John Day reservoir.

Costs: The total project cost is $27.1 million, which includes $6 million direct-funded by BPA.

(2) The Corps is planning to design and install extended-length bar screens to replace the existing standard-length screens on the John Day bypass system. Prototype testing took place in 1996; mechanical structure testing of the screens will occur in 1997. Installation of extended-length screens may begin in 1998. Post-construction evaluation of the new screens will occur after installation.

Costs: The Corps plans to expend $1 million on the extended screens in 1997. Total cost for constructing and installing the extended-length screens is estimated at $35 million.

Reference: Personal communication with Stuart Stanger, COE.

g. The Dalles Dam. Currently the only method to bypass juvenile fish at The Dalles is via the ice and trash sluiceway. The Corps has estimated that installation of a standard screened bypass system would increase FGE significantly, based on the results of research on a prototype screen system conducted in 1994 and 1995. However, because of other funding priorities, installation of a mechanical screen bypass system has been delayed in favor of continued fish spill and surface bypass studies. Current plans call for continued monitoring of smolt survival at the spillway and through the sluiceway at The Dalles Dam, beginning in 1997 and completed by the year 2000.

Reference: Personal communication with Norm Tolonen, COE.

h. Bonneville Dam. Several improvements are planned for the bypass system at Bonneville Dam. (1) Powerhouse 1: Downstream Migrant and Monitoring Facilities and Outfall Relocation. Studies estimate that fish released in the current bypass system are less likely to survive than fish released below the dam in the tailrace; most of this mortality has been attributed to predation at the outfall location. The Corps has evaluated alternative sites and will relocate the outfall by 2001. In addition, the Corps plans to improve concurrently the orifice and dewatering facilities at Powerhouse 1, and construct downstream monitoring facilities.

Schedule/Milestones:

August 1998	Complete Design Memo and Decision Document
August 1999	Complete Plans and Specifications
October 1999	Construction Contract Award
August 2001	Construction Complete

Costs: The estimated cost is $42,400,000.

(2) Powerhouse 2: Downstream Migrant and Monitoring Facilities and Outfall Relocation. These improvements include modifications to orifices, collection channel, control weir and dewatering screens. This activity also includes a combined Powerhouse 1 and 2 outfall and monitoring facility.

Schedule/Milestones:

August 1997	Complete Plans and Specifications
October 1997	Construction Contract Award
April 1999	Facility Operational
August 1999	Construction Complete

Costs: The estimated cost is $41,700,000.

(3) 1st Powerhouse: FGE Improvements. The Bonneville Powerhouse 1 has the poorest juvenile fish guidance on the river. Improvements to the existing screen bypass system will be evaluated in addition to surface bypass. The Corp plans to identify and evaluate alternatives, including the potential for combining a surface collection and extended-length screen system.

Schedule/Milestones: The Corps will run hydraulic model tests, conduct fish behavioral studies, and develop and test prototypes. The schedule calls for testing prototype screens in 1998 and completing the evaluations in 1999 to 2000.

Costs: The estimated cost is $11,100,000.

(4) 2nd Powerhouse: FGE Improvements. The Bonneville Powerhouse 2 also has poor turbine intake screen guidance efficiency. Both the NMFS Biological Opinion and the Council's Fish and Wildlife Program call on the Corps to improve fish passage efficiency at the second powerhouse.

(5) Flat-Plate PIT-tag Detector. The Corps is working with NMFS to test a new type of PIT-tag detector at both Bonneville Dam powerhouses. Testing began in 1996 and will continue in 1997.

Costs: The total project cost is $230,000.

(6) Dispersed Release. If evaluation of the outfall relocation at Bonneville Dam indicates it is warranted, the Corps plans to study dispersed release of juveniles from barges in conjunction with the post-construction monitoring of the relocated outfall . No activities were scheduled and no funding is available for the dispersed release study in 1997. Evaluation activities are planned for FY 1998, 1999 and beyond, at a total cost of $5 million.

Reference: Personal communication with Doug Clarke, COE.

Research, Monitoring, and Evaluation**:** In addition to the acoustic technology studies, there is one other research project with systemwide application: an evaluation of the effects of descaling on the short-term survival of migrating juvenile salmonids. This is an ongoing study that is expected to be completed in 1997 (Table 3-3 in Section 3.4.2.3).

3.4.2.2.6 Mid-Columbia Juvenile Fish Passage Improvements

Mid-Columbia Dams Turbine Replacement and Evaluation. Chelan PUD is replacing turbine runners at Rocky Reach Dam over the next five years and is attempting to include designs that reduce

strike and abrasion of fish that pass through the turbines. The PUD has also designed a study to evaluate juvenile injury and survival at Rock Island Dam Powerhouse 1. This study will be conducted in 1997 and results will be used as the PUD evaluates its options for replacing turbines at Rock Island, which could occur beginning in 2000.

Chelan PUD estimates it will cost $5 million to modify the turbine runner design to reduce adverse impacts to fish at Rocky Reach. The cost of fish-related measures in the turbine redesign, manufacture, and installation at Rock Island is also estimated at $5 million.

Grant PUD also plans to incorporate the latest technological improvements into the design and replacement of turbines at Wanapum Dam. The cost of turbine design modifications to reduce adverse impacts on fish is estimated at $15.8 million.

Reference: Mid-Columbia Mainstem Habitat Conservation Plan, Rock Island Hydroelectric Project, May 1996 (Draft).

3.4.2.2.7 Dissolved Gas Abatement (Corps of Engineers)

Purpose/Objectives: The purpose of the dissolved gas abatement plan is to reduce the total dissolved gas (TDG) supersaturation in the lower Snake and Columbia rivers to meet federal and state standards during spill operations, including involuntary spill and voluntary spill for juvenile fish passage. The current water quality standards specify that TDG supersaturation should not exceed 110 percent for discharges below the 10-year, 7-day average peak flood event. Waivers were obtained to allow operators to go up to 120 percent TDG in 1996.

There are two primary efforts over the next five years that will address the issue of dissolved gas: installing flow deflectors at Ice Harbor and John Day dams, and conducting the second phase of a systemwide dissolved gas abatement study.

Scope: Construction of flow deflectors at Ice Harbor and John Day has been fast-tracked to 1996/97 to reduce TDG during voluntary spill at those projects. Work is expected to be completed over the next two years.

Phase II of the Corps' Dissolved Gas Abatement Study is to recommend structural and operational measures that could be implemented to reduce TDG supersaturation in the lower Snake and Columbia rivers. This phase of the study entails a detailed evaluation of the alternatives recommended in Phase I. The Technical Report from the Gas Abatement Study Phase II will include implementation schedules for those projects which require structural modifications to reduce dissolved gas.

Based on the recommendations in Phase I, the study will continue to evaluate four potential modifications: 1) raised stilling basin; 2) spillway deflectors; 3) raised tailrace; and 4) submerged outlets and flow deflectors. Additional structural alternatives may also be evaluated if research leads to new

ideas. The study will be at a feasibility level, and it will focus on biological and engineering aspects. Each alternative will be analyzed in sufficient detail to proceed to a feature level design.

All eight federal hydro projects will be included in the study: Bonneville, The Dalles, John Day, McNary, Ice Harbor, Lower Monumental, Little Goose and Lower Granite dams.

Tasks and Activities:

1. Flow Deflectors. Flow deflectors are considered only a partial gas abatement measure. They are relatively low cost, will provide some benefit in all years, but have limited effectiveness relative to other alternatives. Flow deflectors will be installed at Ice Harbor and John Day during 1996, 1997, and perhaps 1998.

a. Ice Harbor: Detailed design was completed and a construction contract awarded in FY 1996. Construction of eight bays of deflectors will be completed during the late fall-winter work window in FY 1997, if flow conditions remain acceptable for in-water work.

The Corps is currently considering whether to add two more bays of deflectors to the project; further model testing is needed, and the results will be reported in a letter supplement to the September 1996 design memorandum for the spillway deflectors at Ice Harbor.

Schedules/Milestones: The letter report supplement is scheduled to be completed in January 1997, with construction of deflectors in an additional 2 spill bays to be finished by March 31, 1998, assuming construction funds are available. Construction costs for installing additional deflectors and other modifications will be identified in the letter report supplement.

Costs: The estimated construction cost of installing deflectors on the center eight spill bays is $2.7 million. Preparing the letter report supplement is estimated at $300,000.

Reference: Corps of Engineers, Ice Harbor Lock and Dam, Feature Design Memorandum No. 34, Spillway Deflectors, September 1996. Personal communication with Rick Emmert, COE.

b. John Day: Detailed design was completed in 1996, and construction was begun in October 1996. Contract award has been delayed due to a procurement dispute among the bidders.

Schedule/Milestones: The plan is to complete the installation of at least four to six spillway bays prior to spring 1997, with the balance of all deflectors to be completed by spring 1998.

Costs: The estimated project cost is $12.6 million.

Research, Monitoring, and Evaluation: The flow deflectors will be evaluated after construction is completed; evaluations are scheduled to begin in 1997 and be completed in 1999 (Table 3-3 in Section 3.4.2.3). The Corps will collect dissolved gas data after installation of the deflectors at the two projects as part of its field data collection program and compare it with data from the original structures. The

decision about whether to add two additional bays of deflectors at Ice Harbor depends upon the outcome of additional research and modeling.

2. Dissolved Gas Abatement Study, Phase II. The study has been broken out into the following tasks and subtasks:

Task 1: Alternative Analysis. The alternative analysis activity includes an engineering evaluation, physical model construction, physical model studies, biological evaluation, and a cost analysis.

Task 2: Prototype Testing. Prototype testing (of one of the four potential modifications listed above in the Scope section) will be required to confirm estimates of improvement in TDG levels and biological conditions resulting from construction of the selected gas abatement alternative. This activity includes preparation of feature design memorandum, plans and specifications, contract advertisement and award, construction, testing, and biological evaluation.

Task 3: Numerical Model Development. A numerical model will be developed to predict the potential system-wide gas reduction and associated biological benefits of the gas abatement alternative. There are several components to the model: one-dimensional, unsteady-flow transport model; project specific gas-production model; two-dimensional unsteady-flow overlay model with lateral mixing; a biological (fish survival) component of model; and integration of all components into a system-wide model.

Task 4: Field Data Collection. Field data, both physical and biological, is necessary to support, calibrate and validate the numerical models. This will include field studies to determine TDG transport, spillway performance tests, fixed monitor system analysis, temporary fixed monitors, database development and management, and project operation data collection.

Task 5: Biological Field and Laboratory Studies. The Corps' study plan calls for biological tests to evaluate the complex relationships between TDG and risk to salmonids. A number of studies are planned, including: hydroacoustics with physical capture; floating net pen study; PIT-tag reach survival; radio tracking; dynamic exposure; various gas bubble trauma detection studies on both juvenile and adult salmon; spillway efficiency determination; deflector survival; spill pattern evaluation; and stilling basin survival. As of November 1996, there are ongoing regional discussions concerning the need for, and use in decisionmaking of, some of the biological information planned to be acquired in several of the field and laboratory studies. Pending resolution of this issue, the study plan and cost estimates indicated for biological studies are subject to revision.

Task 6: Systemwide Biological Benefit Analysis. Use new numerical model to assess effects of reducing the gas contribution at specific projects and estimate the systemwide fish survival benefits. This task is also subject to revision pending resolution of scope of future biological studies.

Task 7: Develop a schedule to implement the recommended operational and structural modifications to reach gas abatement goals.

Research, Monitoring, and Evaluation: Part of the Dissolved Gas Abatement Study Phase II is a research activity, and specific tasks within the study are geared toward monitoring and evaluation, specifically, tasks 5 and 6 (Table 3-3 in Section 3.4.2.3).

Schedule/Milestones: The study will run into the year 2000. The numerical model will be complete, and prototype testing will begin about March 1, 1999. A detailed schedule is attached.

Products: A Dissolved Gas Abatement Study Phase I report was released in August 1996. Three additional reports and a final report will be prepared.

October 1, 1997	30% Report recommends best alternative and project for prototype construction
January 1, 1998	60% Report summarizes alternative analysis and field data collection
August 1, 1999	90% Report summarizes system-wide analysis using the numerical model
September 1, 2000	Final Phase II Study Report

Costs: The total five-year cost for the Dissolved Gas Abatement Study is $38,462,000; the most costly component is construction of a prototype test structure. The breakdown by task is as follows:

Alternative Analysis	$ 6,190,000
Prototype Test Structure	$ 17,235,000
Numerical Model Development	$ 2,005,000
Field Data Collection	$ 3,522,000
Biological Field Data Collection[2]	$ 8,025,000
System-wide Biological Benefit Analysis[3]	$ 360,000
Implementation Schedule Development	$ 105,000
Report Preparation	$ 555,000
Coordination	$ 465,000
TOTAL	$ 38,462,000

References: Dissolved Gas Abatement Study, Phase II, Plan of Study, Updated August 1996.

3.4.2.2.8 Adult Fish Passage Improvements

Purpose/Objectives: The purpose of this plan is to modify and improve upstream passage conditions for adult anadromous fish.

[2] Cost subject to change per discussion under Task 5 above.

[3] Cost subject to change per discussion under Task 6 above.

Scope: The improvements fall into two general areas: emergency auxiliary water supplies for adult fishways and fish ladder water temperature control investigations. Adult fish passage improvement projects are planned at Lower Granite, Little Goose, McNary and The Dalles dams over the next five years. In addition, the Corps is currently investigating adult fish passage improvement requirements for Bonneville and John Day dams. Additional investigations will continue at The Dalles Dam.

Corps of Engineers Projects to Improve Adult Passage

1. Fish Ladder Exit Modifications. The Corps is modifying the fish ladder exits at McNary Dam. Tilting weirs will be replaced with fixed vertical slot control weirs. Planning and design of the modifications can be initiated as soon as funds are made available. Construction costs and schedules are currently unknown.

Schedule/Costs: The work will take place in 1997 and 1998, with $340,000 budgeted for each year.

2. McNary Adult Fishway Emergency Auxiliary Water Supply. A technical report on McNary adult fishway emergency auxiliary water supply was completed in May 1995. The report recommended rebuilding existing fishway pumps to improve reliability. The existing system currently has adequate backup (emergency auxiliary water) capacity. Design and construction of the rehabilitation of the existing pumps can proceed as soon as operation and maintenance funds are made available. The estimated cost for the rehabilitation work is $5.5 million.

3. Adult Fish Ladder Emergency Auxiliary Water Supply for Lower Snake River Dams. In November 1995, the Corps completed Phase I of a study of alternatives for improving the reliability of the existing auxiliary water supply or providing additional emergency back-up water supply to adult fishways at the four lower Snake River dams. The report identified several potential alternatives for each of the dams. Further study (Phase II report) is necessary to evaluate the feasibility of the alternatives and select a preferred alternative for each dam. The Phase II study will begin as soon as funds are made available.

Schedule/Costs: Further study is scheduled for 1997; a report detailing the alternatives and costs will be completed in 1997. The preliminary estimated cost for the Phase II study is $340,000.

Reference: Lower Snake River Adult Ladder Systems Emergency Auxiliary Water Supply, Final Report, November 1, 1995. Personal communication with Mike Mason, COE.

4. The Dalles Dam Auxiliary Water Supply. The Corps in currently evaluating a way to provide backup auxiliary water supply to the adult fishways at The Dalles Dam. Forced outages of the attraction-water units at the Dalles could have a severe impact on adult migrants. The evaluation, which was put on hold in 1996, will resume in 1997.

Schedule/Costs: During 1997, the Corps will identify alternatives to augment the system, with a design memorandum to be complete early in FY 1998. The cost of the evaluation is estimated at $750,000.

5. The Dalles Dam Adult Channel Dewatering. The Corps is evaluating the feasibility of improving the dewatering capability in the adult channel at The Dalles Dam. This is a one-year effort, and future actions will depend upon the results of the evaluation.

Schedule/Costs: The study is taking place in 1997, at a cost of $100,000.

6. Fish Ladder Water Temperature Control. The Corps has completed a plan of study to evaluate the temperature differentials and resulting biological behavior at fish ladders at McNary and the four lower Snake River dams. During FY 1996, temperature data only was collected at Ice Harbor and Lower Granite dams and during FY 1997, both temperature and biological behavior data will be collected at these projects. If the data indicate an adult passage problem, an engineering study will be initiated to identify alternatives for temperature control measures. A preferred alternative for each dam will be selected and design/construction costs and schedules will be developed. It may be necessary to collect additional data at other Snake River dams and McNary Dam (Table 3-3 in Section 3.4.2.3). The Corps also conducted evaluations in 1994-96 monitoring water temperatures in the fish ladders at John Day, The Dalles and Bonneville dams. The Corps plans to continue this temperature monitoring program in FY 1997.

Schedule/Costs: A final report on McNary and the lower Snake River fish ladders is scheduled for completion in 1998. The total cost of the study is estimated at $680,000.

7. Adult Passage Improvements - Lower Snake. The Corps will install picketed lead fences in the adult channel entrances at Lower Granite and Little Goose dams in 1997.

Cost: The total cost is $166,000.

Reference: Personal communication with Mike Mason, COE.

8. Adult Passage Improvements -- Lower Columbia. A program to evaluate problem areas and alternative remedial measures for adult passage facilities will be initiated by the Corps in FY 1997. Areas to be investigated include auxiliary water supplies, adult ladder entrance and passageway conditions. No specific plan of study or implementation has been proposed at this time.

Research, Monitoring, and Evaluation. The Corps plans to continue radio telemetry studies to investigate adult migration and the need for improvements to adult fishways in the lower Columbia River through the year 2000. The purpose of the evaluation is to identify sources of adult delay, injury, and stress associated with specific passage locations, and propose necessary adult passage improvements. There currently is no plan of action or schedule for this study beyond 1997 (Table 3-3 in Section 3.4.2.3).

Mid-Columbia Projects to Improve Adult Passage

1. Radio Telemetry Studies at Priest Rapids and Wanapum Dams. Grant County PUD plans to implement improvements to adult fishways at its dams. Measures under consideration are guidance fences and improved attraction flows. The PUD is using radio telemetry technology to identify adult passage problems. In 1996, radio telemetry was used to evaluate spring chinook use of the fishways at Priest Rapids Dam. In 1997, radio-telemetry will be used to evaluate adult sockeye passage.

3.4.2.2.9 Miscellaneous Projects

1. John Day Mitigation for Salmon at Ringold Springs, WA. The development of a hatchery at Ringold Springs is part of the mitigation plan for fall chinook salmon losses due to the construction of John Day Dam. The Corps is constructing a test facility at Ringold Springs to receive returning adults and to test rearing and acclimation at the location.

Schedule/Costs: Construction began in 1996 and is to be completed in 1997. The 1996-97 construction cost is $1,862,315.

Reference: Personal communication with George Miller, COE.

2. Power Distribution at Bonneville Dam. The Corps is procuring and installing equipment at Bonneville Dam to allow independent operation of Powerhouse 2. The purpose of the project is to improve tailrace conditions for juvenile migrants.

Schedule/Costs: Begun in 1996, the project will be complete in 1998. The total cost is $700,000.

Reference: Personal communication with Doug Clarke, COE.

3. Bio-Engineering Test Facility. Both the NMFS Biological Opinion and the Council's program call for the Corps to consider development of a bio-engineering test facility to improve the implementation efficiency and biological effectiveness of new or potential fish bypass structures. This development involves gathering new information on fish behavior and injury caused by different types of fish passage structures. Research is to be conducted in a laboratory environment off river and prior to final design and full-scale implementation, which will provide more accurate data and a broader range of results than is currently possible during full-scale prototype testing. In addition, experimentation can be more closely controlled and monitored, and the test season can be expanded. Information obtained is intended to reduce the amount of prototype testing needed, saving time and money, as well as reducing the risks to listed species. Bio-engineering facilities could be in place to begin answering fish passage questions about site-specific designs and implementation after 1999. No cost estimate for a test facility is available at this time.

4. Dworshak Hatchery Water Supply Improvements. Cold water releases from Dworshak Dam into the North Fork Clearwater River during the summer months to provide water temperature control

for the lower Snake River have impacted the production of steelhead at Dworshak National Fish Hatchery near Orofino, Idaho. Rearing water, which is pumped from the North Fork Clearwater River, is too cold for adequate growth of steelhead during the critical summer growth period. As a result, constraints have been placed on cold water releases from Dworshak Dam. Modifications to Dworshak National Fish Hatchery facilities would allow for faster growth of steelhead during the indoor nursery rearing stage to compensate for slower growth later in the year during outdoor rearing when Dworshak Dam releases colder water. Modifications at the hatchery and accelerated steelhead growth could accommodate a wide range of operations at Dworshak Dam.

The U.S. Fish and Wildlife Service has requested, and the NMFS Implementation Team has supported, the following facility modifications at Dworshak National Fish Hatchery:

1) Upgrade the boilers that supply water to the nursery building;
2) Rehabilitate the System 1 water reuse system; and
3) Extend the two Dworshak Reservoir water pipelines to provide for separate control of rearing and incubation water in the nursery building.

Schedule/Costs: If funding can be allocated, this work could be completed in 1997. The estimated cost to upgrade the boilers and extend the two water pipelines to supply the nursery building is $739,290. The estimated cost to rehabilitate the System 1 water reuse system is $429,400.

Note to Steering Committee: This project should also be included in the Habitat and Production work plan, and possibly the Mainstem Operations work plan.

5. Willamette River Temperature Control, OR. The purpose of this project is to provide facilities at the Corps' existing Cougar and Blue River projects that will enable selective withdrawal of water from various levels in the reservoirs which, when released downstream, will result in more desirable water temperatures in the McKenzie River to benefit fish resources and habitat. The goal is to restore downstream water temperatures in the McKenzie River to pre-project conditions to benefit anadromous and resident fish species, especially Willamette spring chinook salmon, which are proposed for listing under the Endangered Species Act, and bull trout, a candidate species for listing.

Schedule/Costs: The first construction contract (Cougar) is scheduled to be awarded in March 1998. FY 1997 funds are being used to complete the feature design memorandum (FDM) and to develop plans and specifications for Cougar Dam. The total project cost (Cougar and Blue River dams) is estimated to be between $45 million and $55 million.

6. Middle Fork Willamette Fishery Restoration, OR. Congress requested the Corps to evaluate the potential for providing passage for anadromous fish around the dams in the Middle Fork Willamette subbasin. The reconnaissance study is scheduled to be completed by January 1997. During the study, spring chinook salmon were identified as the only indigenous species satisfying the study objectives. Several alternatives were identified that would establish a self-sustaining run of as many as 1,800 fish to reach spawning habitat in the upper reaches of the subbasin. It is anticipated that the potential sponsor,

Oregon Department of Fish and Wildlife, will request that the study be deferred until it can identify a funding source to finance the cost-shared portion of the feasibility study.

7. South Santiam Fishery Restoration, Or. The fish passage facilities originally constructed at the Corps' Green Peter project on the South Santiam River do not provide effective juvenile and adult passage for native winter steelhead trout and spring chinook salmon to access their natural habitat upstream of the project. These anadromous fish species are currently petitioned for listing under the Endangered Species Act. State and federal fishery agencies believe inadequate fish passage at Green Peter Dam was responsible for elimination of these species in the South Santiam subbasin.

The project would restore fish passage by using floating juvenile surface collectors in the upper arms of the reservoir (Quartzville Creek and the Middle Santiam River) and by correcting the water temperature in the adult fish ladder. A two-phased study approach will be needed. Phase 1 of the study would design and construct one floating juvenile collector and test/evaluate the collector to determine collection efficiency and degree of passage success. Phase 1 is estimated to take 24 months to complete at an estimated cost of $2,150,000. Phase 2 would design and construct the second floating juvenile collector, a permanent barge transport system, and correct the water temperature in the adult ladder. Phase 2 is estimated to take 24 to 30 months to complete at an estimated cost of $5,875,000.

3.4.2.2.10 Operation and Maintenance of Existing Fish Passage Facilities

The following information provides annual cost estimates for present, ongoing operation and maintenance of existing fish passage facilities including adult and juvenile fish passage systems, juvenile fish transportation, and research, monitoring and evaluation associated with these operation and maintenance activities. Total operation and maintenance costs for FY 1996 is $14.3 million, and this cost represents the hydropower share (approximately 81 percent). These costs are included in the reimbursable category of the Memorandum of Agreement concerning Bonneville Power Administration's Financial Commitment for Columbia River Basin Fish and Wildlife Costs.

Incremental changes in O&M costs for new facilities or other physical modifications being considered in the mainstem construction five year work plan will be addressed in the evaluation/decision process for implementing new passage facilities or modifications. Pending decisions about which new passage facilities or system configuration modifications will be implemented by the year 2001, the Corps estimates the annual operation and maintenance of mainstem passage facilities could increase by $2-3 million.

The Memorandum of Agreement budget allocations, however, do not currently provide for an increase in operation and maintenance costs in the reimbursable cost category. Reallocations of funds among categories to cover such funding shortfalls is a potential cross-cutting policy issue.

Breakdown of O&M Costs: Operation of adult and juvenile fish passage systems at the Corps' eight mainstem dams costs $10 million annually. This involves both operation and maintenance of existing fish

passage facilities (traveling fish screens, fish barrier screens, fish ladders, fish collection facilities, fish bypass facilities, fish water pumps, etc.) and all related equipment for collecting and safe passage of fish.

Operation of the Corps' juvenile fish transportation program costs $2.3 million annually. This primarily represents the cost of tow boat contracts and operation and maintenance of holding and loading facilities at the four collector dams.

Research, monitoring, and evaluation costs related to operation of fish passage facilities and transportation are approximately $2.0 million annually. This includes various studies for research evaluation of completed facilities as determined through regional priorities identified in the Corps' Anadromous Fish Evaluation Program. It also includes evaluation associated with the transportation program.

3.4.2.3 Research, Monitoring, and Evaluation Projects

Table 3-3 shows all the research, monitoring and evaluation projects grouped by major mainstem construction category. Both Corps of Engineers' Anadromous Fish Evaluation Program (AFEP) projects and Bonneville's Fish and Wildlife Program direct-funded projects are identified in Table 3-3, along with each project number, and start and end dates. Note: The SCT will include cost estimates for each research, monitoring, and evaluation project in the final draft of the work plan, as well as all research, monitoring, and evaluation activities associated with the lower Snake River drawdown feasibility study.

Table 3- 3 Current research, monitoring and evaluation activities for mainstem construction and system configuration categories

SURFACE BYPASS

Project No.	Project Title	Start Date	Stop Date
SBC-96-1	Radio telemetry of juveniles at LWG in support of SBC prototype structure	1995	1999
SBC-96-3	Hydroacoustic evaluation of fish passage at LWG associated with the prototype SBC	1995	1999
SBC-96-4	Fish passage at LWG associated with the prototype SBC-balloon tag-fish condition	1995	1996
SBC-96-5	Test effectiveness of floating curtain as fish guidance device at IHR Dam	1995	1996
SBC-96-6	LWG prototype SBC-infrasound method to redistribute smolts in dewatering structure	1996	1999
SCB-97(3)	Surface bypass collection evaluation: distribution and behavior of northern squawfish in Bonneville forebay	1997	1999
SCB-97(3)-1	Hydroacoustic evaluations of fish passage at Bonneville Dam	1996	1999
SCB-97(3)-2	Radio telemetry for fine scale behavioral information of juvenile salmonids at BON Dam	1996	1998
SCD-97(2)-1	Laboratory analysis of salmonid behavior and reaction/response to flow/field gradients*	1997	1999
SCD-97(2)-2	Direct capture evaluations of fish passage at The Dalles ice and trash sluiceways*	1998	1999
SCD-97(3)-3	Hydroacoustic evaluations of fish passage at The Dalles Dam	1995	1999
SCD-97(3)-4	Radio telemetry for fine scale behavioral information of juvenile salmonids	1996	1998
SCJ-97(3)-1	Surface collection - Hydroacoustic evaluations of fish passage at John Day Dam*	1997	2000
SCJ-97(3)-2	Radio telemetry for fine scale behavioral information of juvenile salmonids at John Day	1996	1998

COLUMBIA RIVER DRAWDOWNS

Project No.	Project Title	Start Date	Stop Date
JDD-94(3)-1	Shallow water habitat studies at JDA reservoir	1994	1996
SCS Phase 1-2	Hard substrate benthic invertebrates	1994	1996
SCS Phase 1-3	Limnology of shallow water reservoir areas	1994	1996
SCS Phase 1-4	Pelagic reservoir limnology and productivity	1994	1996

JUVENILE FISH TRANSPORTATION

Project No.	Project Title	Start Date	Stop Date
MPE-92-1	Evaluate transportation of juvenile fish downstream of Skamania light buoy	1992	1999
MPE-95-1	Evaluation of transported fish compared to inriver migrating fish	1995	2003
MPE-95-3	Evaluation of procedures for collection, transportation, and downstream passage of outmigrating salmonids	1995	1999
MPE-96-14	A study to compare the adult recoveries of inriver migrating vs. transported subyearling chinook from MCN Dam	1995	2004
MPE-96-4a	Development of design criteria to improve wet separator efficiency and reduce fish delay	1992	1997
MPE-96-4b	Development of design criteria to reduce delay of fish in areas of accelerating flows	1996	1999
MPE-96-5	Evaluate improved collection/handling/transportation techniques	1987	1996

JUVENILE PASSAGE IMPROVEMENTS

Project No.	Project Title	Start Date	Stop Date
9104000	Bonneville Dam juvenile fish sampling facility	1992	1998
9207100	Assess tech to improve measurement capabilities and passage survival	1992	2000
9207101	Application of sound to modify the behavior of fish	1995	------
ILC-97(4)-1	Acoustic technology: Modifying fish behavior using sound fields*	1997	2000
JDE-96(3)-1	Evaluation of extended length bar screens, OPE, and incidence of descaling	1996	1996
JFB-90-LGO-1	Post-construction evaluation of the permanent juvenile fish collection facilities at LGS	1990	1991
JFB-91-BN-1	Evaluate juvenile passage facilities at BON First Powerhouse	1991	1992
JFB-91-MN-1	Evaluate extended-length screens to improve juvenile chinook FGE at MCN	1991	1995
JFB-92-LM-1	Post-construction evaluation of the new juvenile fish bypass system at LMN	1992	1994
JFB-93-LGO-1	Pre-construction evaluation of improved juvenile fish guidance system at LGS	1993	1995
JFB-93-TD-1	Evaluation of prototype juvenile bypass system at TDA	1994	1995

JFB-94-LM-1	Post-construction evaluation of the new juvenile fish bypass outfall at LMN	1994	1995
JFB-94-MN-1	Evaluation of the new juvenile collection, bypass, and sampling facility at McNary Dam	1993	1994
MPE-94-1	Evaluation of the effects of descaling on short-term survival of migrating juvenile salmonids	1994	1997
MPE-96-2	Post-construction evaluation of the new juvenile fish bypass system at Ice Harbor Dam	1996	1996
MPE-96-3	Post-construction evaluation of extended screens at LWG*	1997	1997
MPE-97(2)-1	Post-construction evaluation of new juvenile fish monitoring facilities at JDA	1998	1999
MPE-97-2	Evaluate project survival of juvenile salmonids passing LGS Dam*	1997	1999
MPE-97-3	Post-construction evaluation of extended screens at MCN Dam*	1997	1999
MPE-97-5	Post-construction evaluation of extended screens at LGS*	1997	1998
TDB-96-1	TDA Free-Flow Orifice test	1995	1997
TUR-97(1)-3	Turbine: Study effects of pressure changes within the turbine environment on juvenile salmonids*	1997	1997
TUR-97(2)-2	Turbine: Develop methodology/equipment for use in fish distribution studies within the turbine environment*	1997	1998
TUR-97(3)-1	Turbine: Base case survival/injury studies - causal mechanisms*	1997	1999

DISSOLVED GAS ABATEMENT

Project No.	**Project Title**	**Start Date**	**Stop Date**
DGAS-96-8	Spill passage survival of low vs. raised stilling basins	1999	2000
DGAS-97-5	LGS smolt survival of flow deflector spillbay vs. non-deflector spillbay passage*	1997	1999
MPE-97-1	Post-construction evaluation of the IHR Dam deflectors*	1997	1999
TDAS-97(4)-1	Evaluation of the relative spillway survival of juvenile salmonids as they pass through TDA tailrace*	1997	2001
TDGAP	COE Dissolved Gas Abatement Program	1995	2000

ADULT FISH PASSAGE

Project No.	Project Title	Start Date	Stop Date
9204101	Evaluate adult migration in lower Columbia River and tributaries	1992	2000
ADLT-96(3)-2	JDA Dam South Ladder modification - evaluate modifications for impacts to jumping and holding of salmonids in flow control section and diffuser pool*	1997	1997
ADLT-96(4)-1	Evaluation of adult salmon and steelhead migration past dams through reservoirs in the lower Columbia and into tributaries	1995	2001
LSRF-96-16	Snake River water temperature control monitoring	------	------
MPE-96-1	Evaluate facility modifications to adult fishway in Snake River projects and evaluate water temperature in fish ladders and forebays at LWG and IHR	1992	1997
N/A-	Coltemp upgrade and recalibration	1991	1994
SBC-96-2	Evaluation of adult salmon and steelhead passage and squawfish behavior in relation to SBC	1995	1999

* Research, monitoring or evaluation project proposed and under consideration for implementation in FY 1997.

3.4.2.4 Construction/System Configuration Project Detail

Table 3-4 summarizes the Corps' Columbia River Fish Mitigation Program activities described in detail in Section 3.4.2.2, organized by dam and by measures that have systemwide application. The table includes brief descriptions of each activity, as well as cost estimates for fiscal years 1996 through 2000+. The table shows (footnote 3) expenditures of $216 million incurred through FY 1995. The table does not include full implementation costs for some measures, such as drawdown, surface bypass, and gas abatement (development and evaluation expenditures only). The system category includes activities that involve multiple dams. It also includes evaluations of problems that have not yet been associated with specific locations. In addition, the last section in Table 3-4 identifies the state fish and wildlife agencies' lowest-priority activities. Note that Table 3-4 simply reflects the plan as developed by the Corps of Engineers to implement the NMFS Biological Opinion in future years.

Using the project-specific information contained in Table 3-4, the bar graph shown in Figure 3-4 illustrates how much money is being spent in each fiscal year on implementation (construction) "I" actions versus studies or research "S" measures. Figure 3-4 illustrates that most funding will be expended on studies through FY 1999. Beyond FY 1999, it shows more funding will be applied to implementation measures than studies.

There are several caveats associated with Table 3-4. First, as a committee, the SCT has not reached full agreement on funding priorities for FY 1997. Second, funding priorities for FY 1998-2001 have not yet been prioritized by the SCT. The SCT is just now beginning to discuss funding priorities for FY 1998. Finally, the Shoshone-Bannock Tribes have an issue with activities or projects identified as implementation items "I" in the table for the lower Snake River dams. Since the Shoshone-Bannock Tribes recommend immediate implementation of natural river drawdown in the Snake River, they maintain that all activities listed for the lower Snake River dams should be identified in Table 3-4 as studies "S" only, and not implementation (construction) "I" actions. Figure 3-5 illustrates the proportion of funding for studies or implementation if the activities are categorized according to the Shoshone-Bannock perspective. See Section 3.4.3.4 for more information about the Shoshone-Bannock Tribes' perspective concerning study versus implementation expenditures.

Table 3- 4 Federal/Council approach draft Columbia River fish mitigation program

Activity Type	Activity/Description	96 Cost	97 Cost	97 Cuml Cost	98 Cost	99 Cost	00+Cost	Total
	LOWER GRANITE							
I	**Extended Length Screens** - Installation completed in March 1996. FY97 work will be completing the post construction eval. FY98 work includes modifications to the deck screens including hand railing and other modifications to facilitate screen handling.	5,460	1,492		1,203			8,155
I	**Juvenile Bypass Facility -** Complete design and initiate construction of the new facility in FY99, which includes a new flume, holding & loading facility, and channel modifications. Phase I construction completed in 2001. Phase II completion in 2002.	800	170		600	600	14,080	16,250
I	**Picketed Lead Fences -** New fences will be installed in the adult channel entrances. This will significantly reduce the rate of fallout from the channel. Work will also continue on adult passage evaluations.		88					88
S	**Surface Bypass Program -** The comprehensive evaluation of surface collection continues. At Lower Granite activities will depend on the final results of the previous years tests.	14,030	8,345		10,850	13,530		46,755
I	**Fish Ladder Temperature Control -** Implementation of identified corrective action.		10		450			460
	LITTLE GOOSE							
I	**Extended Length Screens** - Screen installation will be completed in January 1997. Post construction evaluations will be completed in spring 1997. Deck screen modifications scheduled for 1998.	5,290	1,435		1,046	170		7,941
I	**Outfall Pipe** - Construction of a new outfall pipe will begin in late FY 96, with completion scheduled for March 1997. Post construction evaluations will be conducted and completed in 1998..	140	1,166		0			1,306
I	**Picketed Lead Fences -** New fences will be installed in the adult channel entrances, replacing the test structure. This will significantly reduce the rate of fallout from the channel. Work will also continue on adult passage evaluations.		78					78
I	**Fish Ladder Temperature Control-** See Lower Granite		10		50	460		520
	LOWER MONUMENTAL							
I	**Barge Loading Facilities Modification -** An additional barge mooring dolphin will be constructed on the upstream end of the barge loading facility. This additional dolphin is required to address a safety problem with the existing facility.	40	944					984
I	**Gate Raise Modifications** - The Alternative Intake Gate Closure Study will be completed in 1996. Implementation of the alternative selected in that report could begin in FY97.	260	0		410			670
I	**Gantry Crane -** A new gantry crane will be procured. A new crane is required to handle the operating gates when in a raised position as well as handling of the new screens.		40		450			490
I	**Fish Ladder Temperature Control**- See Lower Granite				60	400		460
	ICE HARBOR							0
I	**Juvenile Bypass Facility -** Construction of the new JBS was completed in March 1996. FY97 work is limited to post construction evaluations of the new facility.	3,930	747		751			5,428
I	**Flip Lips** - Detailed design was completed and a construction contract awarded in FY96. Construction of a full complement of deflectors will be completed during the work window in FY97 if flow conditions revain acceptable for in-water work.	1,260	2,418		3,292	0		6,970
S	**Surface Collection -** Currently no plans for further work on guidance curtain at Ice Harbor. Assumed part of Lower Granite surface bypass development.	1,030	0		0			1,030
	McNARY							
I	**Extended Length Screens -** Completion of installation of new screens is scheduled for 1997. Additional work includes post construction evaluations and design of a new screen maintenance facility which will be constructed in 1998-99.	15,093	3,550		630	10		19,283
I	**Maintenance Facility** - Construction in 1998-99 of structure required for screen maintenance.	227	450		4,512	600		5,789
I	**Juvenile Fish Facility Completion -** This will complete the Juvenile Bypass Facility. Work includes miscellaneous contracts to correct design deficiencies, complete O&M manuals and add an emergency water supply system to the JBS.	520	1,016					1,536

I	**Fish Ladder Exit Mods.** - To simplify and improve the fish ladder exits, the existing tilting weirs will be replaced with fixed vertical-slot control weirs.		340	340			680
I	**Gate Raise Modifications -** The Alternative Intake Gate Closure Study will be completed in 1996. Implementation of the alternative selected in that report could begin in FY97.		322	2,100	2,200		4,622
	JOHN DAY						
I	**Monitoring Facility -** Operational summer 1997. Complete construction in FY 98. Costs do not include $6 million BPA funds.	5,100	11,800	2,100			19,000
I	**Flip Lips -** Design in FY 96. Start construction September 96. Complete 4-6 bays prior to spring '97. Complete all bays by spring '98.	600	5,600	5,530			11,730
S	**Surface Bypass -** Conduct biological baseline and hydraulic model studies. Develop and design PH (skeleton bay) prototype for testing in 2000. Test spillway overflow weir for skeleton bay concept.	100	3,100	3,000	19,000	9,000	34,200
S	**Spillway Crest Drawdown Study - A**ctivity pending scientific justification as requested by Congress (current study cost estimate: $8-12 million). NPP developing study plan.		3,000	5,000	4,000	1,000	13,000
S	**John Day Mitigation Relocation Evaluation (Ringold) -** Complete test facilities in FY97. Continue collection and evaluation of permanent relocation. (incl. marking, tagging, transporting)	1,000	1,460	280	200	200	3,140
	THE DALLES						
S	**Emergency Auxiliary H2O Supply -** Evaluate alternatives and develop recommendations.		600	120			720
S	**Adult Channel Dewatering -** Evaluate feasibility of improving dewatering capability.		100				100
S	**Spillway and Sluiceway Survival Study** - Costs previously included in The Dalles SBC study.		1,000	1,000	1,000	2,000	5,000
	BONNEVILLE						
I	**Power Distribution -** Initiate procurement and installation of equipment to allow independent powerhouse operations	300	330	70			700
I	**PH2 DSM, Monitoring and Outfall Relocation -** Continue and complete FDM and P&S for FY 98 construction start. Evaluate combined PH1/PH2 monitoring facility.	1,850	2,640	19,530	17,240	1,160	42,420
I	**PH1 DSM, Monitoring and Outfall Relocation -** Restart designs in FY97, FDM and P&S for FY 99 construction start: completion 2001.		1,430	2,040	6,310	32,610	42,390
S	**Surface Bypass -** Finish PH 2 forebay model. Cont. biological and hydraulic evaluations. Design and initiate construction for PH 1 prototype test in 98. Potential follow-up trash chute tests. Prepare designs for PH2 and spill prototypes.	3,850	9,240	12,500	9,100	13,600	48,290
S	**PH1 FGE -** Continue model and biological evaluations. Prepare designs for FY 98 extended screen prototype tests. Evaluate alt. measures for possible FY 99 tests.	450	2,740	3,800	3,310	820	11,120
S	**Flat Plate PIT Tag Detector -** Testing and development of technology in 1996. Follow-on testing in FY 97.	200	30				230
	SYSTEM						
S	**Gas Abatement Study -** Complete alternative evaluations. Determine design and location for prototype test in F99. Initiate construction in FY98. Physical and bio. data collection and processing for numerical model development. ($ include both NPP and NPW)	3,650	8,400	12,000	15,800	1,400	41,250
							0
S	**Turbine Passage Survival -** Evaluate operational issues (1% efficiency) and potential new turbine runner designs to improve turbine environment. Complete detailed plan of study for long term program. (placeholder $)	100	1,000	1,000	1,000	1,000	4,100
S	**Acoustic Technology -** Research use of sound guidance technology for use w/ surface bypass or existing passage systems. Emphasis on development of potential for limited range applications.	50	550	1,500	2,000		4,100
S	**Adult Passage Improvements L. Col -** Scope and initiate evaluations of passage improvement measures in response to several BIOP requirements. (Placeholder $)		400	200	200	400	1,200
S	**Lower Snake River Feasibility Study -** Scope dependent on outcome of interim report. FY97 activities will likely include gathering additional biol. information, detailed eng. studies on selected DD alternative as well as econ. eval. Complete in 1999.	1,600	8,520	3,555	2,000	140	15,815

S	**Turbine Model Study -** The Lower Granite turbine model will be completed in 1988.	660	600		400			1,660
S	**Aux. Water Supply in Fishladders/Snake River Projects -** Detailed evaluations. A final report with recommendation on solution to water supply problems will be identified for each Snake River Project where required.	10	340					350
S	**Lower Snake Fish Ladder Entrance Modifications** - Potential future "placeholder".							
S	**Fish Ladder Temperature Control Evaluations -** Additional ladder temp. info will be gathered. Problems in specific ladders will be identified and a final report with recommendation for a prototype at one of the SR Projects in '98 will be identified. Outyear costs include implementation estimates at L. Snake and McNary projects.	60	120		500			680
S	**Separator Evaluation** - Design, construction and testing of an evaluation separator.	115	850	86,471	2,000	100		3,065
	STATES' LOWER PRIORITY ACTIVITIES (see Note 1)							
S	**John Day Extended Length Screens Tests -** Conduct 2nd year of prototype tests. Complete FDM in FY98.	3,450	700	87,171	250			4,400
I	**John Day Extended Length Screens Implementation -** Initiate and complete P&S for implementation of full installation. Defer construction pending test results/other alternatives.		300	87,471	0	0	29,930	30,230
S	**The Dalles Surface Bypass -** Continue studies including biological behavioral studies, additional trashrack and spillway baffle tests. Study sluiceway outfall relocation.	1,900	1,150	88,621	6,000	4,100	500	13,650
I	**The Dalles Juvenile Bypass System -** Defer P&S preparation. Reinitiate design and P&S for conventional screened bypass pending surface bypass/spill survival evaluations.	460	50	88,671	0	0	104,420	104,930
I	**Barge Exit Modifications** - Modifications began in FY96. Remaining barges will be completed in FY97. Post construction evaluations will be conducted in the spring of 1997 ($90k).	730	577	89,248	30			1,337
I	**Additional Barges -** construct new barges - Two new 75k barges completed in 1998. Mooring facilities completed in 1999.	50	2,810	92,058	1,500	2,037	9,930	16,327
S	**Dispersed Release (Short haul Barging) -** Evaluation of feasibility of dispersed released strategy. Investigate vessel and test loading facility designs. No funds proposed for FY 97.		0	92,058	370	380	4,300	5,050
I	**John Day MOP Mitigation Design and Construction -** No activity proposed.	300	0	92,058				300
	TOTAL		92,058		111,019	105,747	226,490	609,979

Notes: 1. Reference 29 April 96 letter from 3 states
2. FY 96 does not reflect BPA funded $6m
3. $216m expended thru FY 95

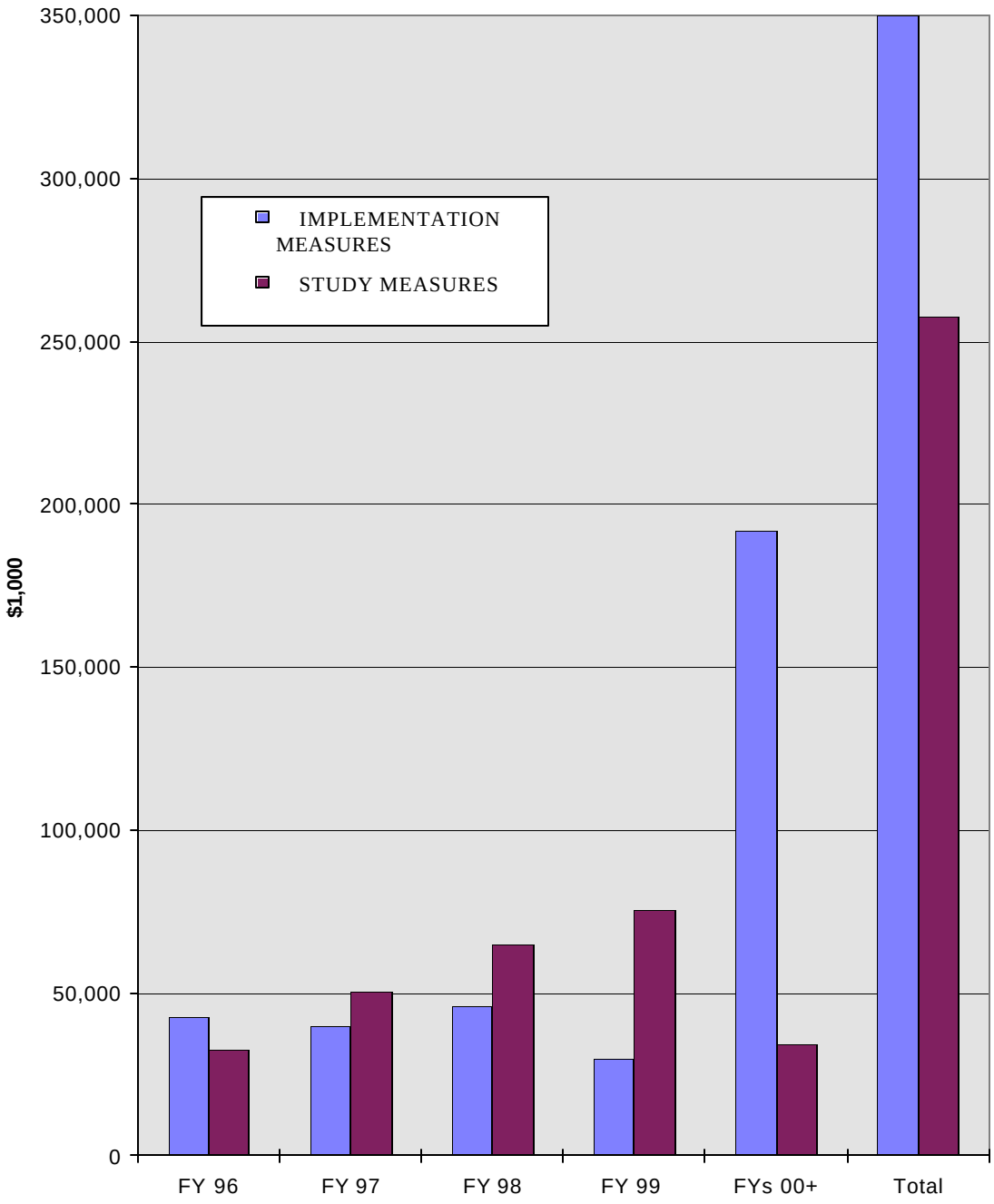

Figure 3- 4 CRFMP costs: Studies vs. implementation federal/Council perspective

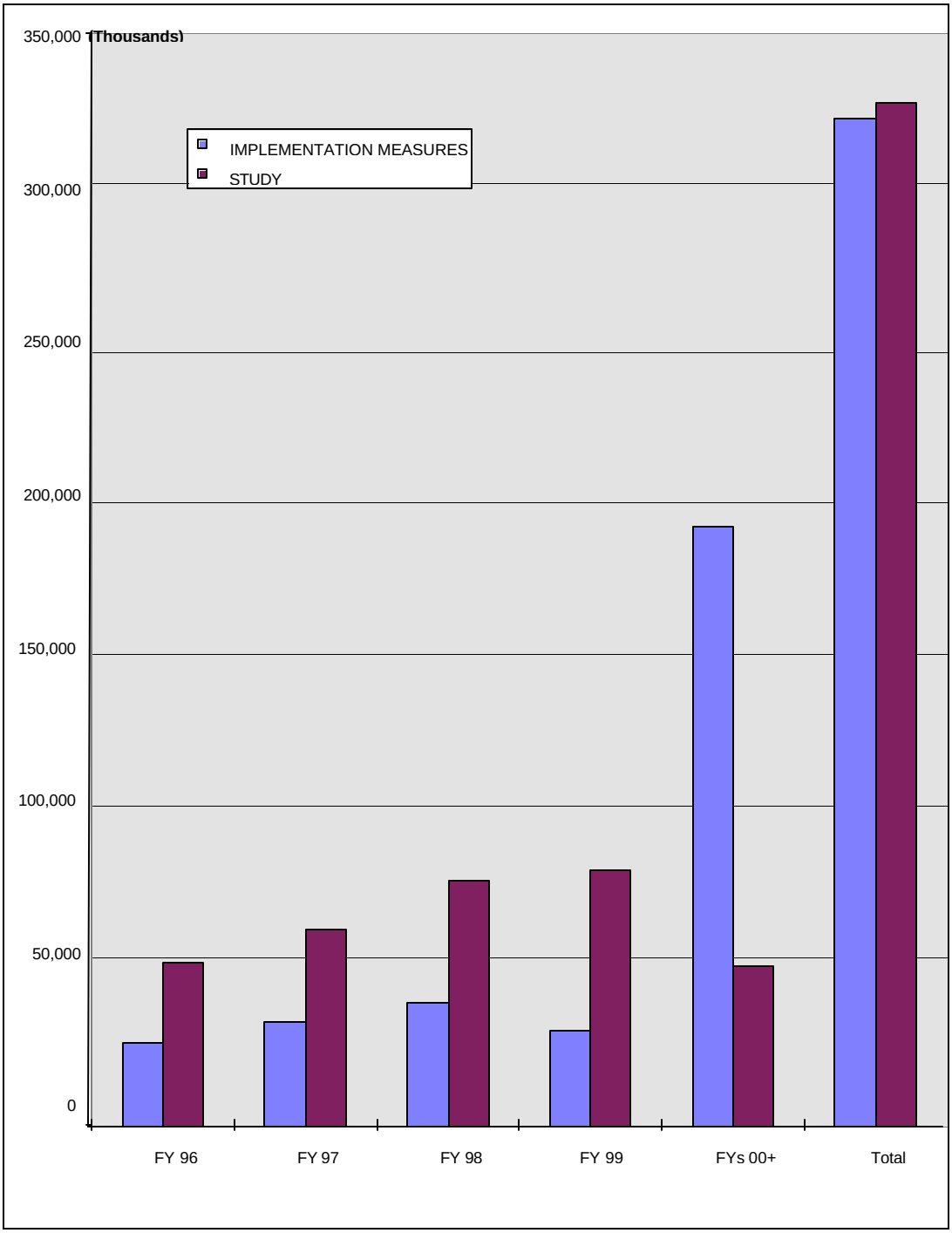

Figure 3- 5 CRFMP costs: Studies vs. implemetation Shoshone-Bannock perspective

3.4.3 Columbia River Inter-Tribal Fish Commission and Shoshone-Bannock Tribal Work Plan for Federal Capital Construction Projects under the 1997-2001 Memorandum of Agreement

Executive Summary

The following work plan represents the Columbia River Inter-Tribal Fish Commission and Shoshone-Bannock capital construction objectives and tasks at federal hydroprojects critical for recovery of anadromous fish stocks in the Columbia and Snake River basins. While the principal focus is applied to tasks during the federal Memorandum of Agreement (MOA) term (1997-2001), some provisions for outyear capital construction projects have been included. The tribal approach is closely linked to achieving the ecological and passage performance objectives previously outlined in Section 3.2 by the end of the MOA term.

To achieve these objectives, the tribal work plan considers the issues of uncertainty and irreversibility of capital construction expenditures and prioritizes three primary capital construction tasks: 1) immediate natural river drawdowns of the four lower Snake River hydroprojects by 2002; 2) preparation for John Day spillway crest drawdown by 2004-5 and; 3) bringing the lower Columbia River hydroprojects to compliance with ecological and passage performance standards by 2001. The tribal plan also considers capital construction measures likely to be required at upper Columbia federal hydroprojects to protect both anadromous and resident fish.

The MOA marks an overdue and momentous opportunity for tribes basinwide to influence the direction of federal expenditures toward both anadromous recovery and the protection of resident fish. Tribal policy makers must take this opportunity now, because of the likely irreversibility of capital construction actions during the MOA in terms of extinction of anadromous stocks and the profound uncertainty that exists with future federal funding for fish and wildlife in the coming era of energy deregulation.

3.4.3.1 Work Plan Overview and Implementation Decision

Work Plan Overview

The following work plan is organized in five sections. Section 3.4.3.1 outlines the work plan overview, decision criteria, justification for capital construction implementation decisions, general objectives, and general tasks. Section 3.4.3.2 contains the heart of the work plan with detailed tables and textual descriptions of tasks necessary at each stage to meet the tribal plan objectives. Section 3.4.3.3 contains a description of research, monitoring, and evaluation tasks necessary to provide a "report card" on the efficacy of plan tasks. Section 3.4.3.4 provides a brief comparison between the priority of studies versus implementation of structural measures in the tribal plan.

Work Plan Setting

In September 1996 the Department of Energy, the Department of the Army, the Department of the Interior, and the Department of Commerce jointly signed a Memorandum of Agreement (MOA) that generally limits the total federal expeditures for fish and wildlife recovery and mitigation in the Columbia River basin from 1997 to 2001. While this agreement limits federal fish and wildlife expenditures, it also obligates these agencies and their regional subordinates to conduct meaningful consultation with the Columbia Basin tribes with respect to these expeditures. A key component of the MOA directs the federal agencies to involve tribal sovereigns at the policy level in the prioritization and spending of the Corps of Engineers construction general and annual operations and maintenance (O&M) budgets. These budgets are annually appropriated by Congress and average about $100 million and $20 million per year respectively. To guide these efforts, the MOA specifies that a five-year implementation plan will be jointly prepared by the region's tribal, state and federal sovereigns. The objective of the five-year implementation plan is to prioritize capital construction and operations and maintenance tasks to best realize basinwide anadromous fish restoration.

In the 1995 NMFS Biological Opinion for the Federal Columbia River Power System (FCRPS), NMFS and the other federal agencies did not recognize that the NWPPC (Council) and individual tribal sovereigns should be consulted at the policy level with respect to capital investments for fish and wildlife. However, the multi-year plan provisions set forth in the Annex to the MOA call for regional input to mainstem construction schedules and budgets. Further, the MOA section IV.a.3A. states that the regional offices of the Corps of Engineers and the Bureau of Reclamation, when submitting annual Congressional budget requests, will act in a manner consistent with the final capital construction work plan.

The MOA marks a significant improvement with respect to tribal involvement and influence in directing principal expeditures to modify federal hydroprojects that seriously diminish treaty trust resources[4]. Before the MOA, tribal recommendations to the federal agencies with respect to structural modifications to dams and reservoirs were largely ignored. For example, despite several requests from the CRITFC, the North Pacific Division of the Corps of Engineers has yet to provide comments to the detailed and comprehensive recommendations for important structural modifications at federal hydroprojects contained in the CRITFC tribes' Spirit of the Salmon anadromous fish restoration plan.

Tribal Work Plan Justification and General Tasks

The tribal approach for prioritization of capital expenditures for drawdowns over the term of the MOA is founded upon the scientific principles presented in the Spirit of the Salmon. Further, this approach is supported by other scientific evidence in riverbasins worldwide (Dodge 1989) and by the review in the Independent Science Group's comprehensive report, *Return to the River* (ISG 1996). The tribal plan focuses upon structural changes that will restore key ecological functions and promote life history diversity (Lichatowich et al. 1995). These changes are necessary for increasing anadromous fish production and end many of the capital construction "technofixes" being currently employed at mainstem

[4] In 1986, CRITFC determined that the FCRPS had resulted in a cumulative loss of between 175-350 million adult salmon from 1933 to 1985 (CRITFC 1986). Since 1986, the hydrosystem has caused the loss of tens of millions of additional adult and juvenile fish basinwide.

dams, which are of uncertain value at best and injurious to stocks at worse. If the tribal plan is implemented, we expect significant improvement of key water quality parameters such as turbidity, temperature, nutrient cycling, and total dissolved gas, critical for fish production. The cumulative outcome of these measures should result in restored anadromous fish habitat and should allow for the connectivity of this habitat with existing fragmented habitats in the mainstem and major tributaries. Lichatowich and Mobrand (1995) and the ISG (1996) both emphasize the importance of reconnecting fragmented habitats basinwide as fundamental to salmon recovery.

A chief difference between the NMFS Biological Opinion and the tribal Spirit of the Salmon is that the former only addresses structural measures for listed species under the Endangered Species Act, while the latter addresses restoration of all of the basin's anadromous fish stocks. The opinion and federal capital construction plan place the highest juvenile passage priority on continuing the development of screen systems and transportation, which dewater, descale, crowd, and stress juveniles and provide predators with a point source of prey. Further, these systems likely act to reduce genetic diversity by causing high mortalities to subyearling and fry life histories (Mundy et al. 1994; CRITFC et al. 1994).

In contrast, the tribal approach calls for safeguarding all life histories by returning the river to a riverine ecosystem, or in the case of the lower Columbia dams, passing juveniles over the dams in large volumes of water to reduce the risk of delays, high temperatures disease, and predation. For adult passage, while the opinion and federal plan call for more studies for years to identify problems, the tribal approach emphasizes immediate implementation of proven structural measures to alleviate known problems such as fallback and delay in collection channels. Further, the tribal plan calls for development and implementation of new fishway designs to reduce adult expenditures of limited energy reserves. These reserves are critical for adults to migrate upstream without delay and successfully spawn.

The foundation of the tribal work plan is defined by the ecological objectives in Section 3.2.1 and by the passage performance objectives in Section 3.2.2. The work plan is comprised of four major priorities or tasks that are linked to the foregoing objectives. These tasks include:

1. **Natural river drawdowns of three lower Snake River dams by 2002 and complete drawdown of the fourth by 2003.**

2. **Prepare for implementing John Day drawdown to spillway crest in 2004-5.**

3. **Achieve juvenile passage performance standards of 80% fish passage efficiency (FPE) and 95% per-project survival by 2001.**

4. **Reduce adult salmon delays and interdam mortalities by 50% by 2001.**

General Project Criteria

1. Management applicability

   a. Projects must stress adaptive management by pushing existing Federal Columbia River Power System operations to immediately protect stocks while concurrent structural changes are brought online.
   b. Evaluation designs and methods must stress monitoring and evaluation protocols.
   c. Projects must be consistent with hypothesis testing identified by PATH group.

2. Historical and ecological perspective

   a. Projects must move toward re-establishment of historical physical and biological habitat characteristics that contributed to abundant and diverse basin fish stocks.
   b. Projects should be consistent with relevant historical studies and literature from both inside and outside the region.

3. Life history diversity

   a. Projects should emphasize re-establishment of life history diversity and stock fitness. That is, increase stock variability at age of maturity.
   b. Projects should not select against one life stage, life history, or stock in an attempt to mitigate for another. The most sensitive stock is the lowest common denominator with respect to protection.

4. Protection of all Columbia River Basin anadromous fish stocks

   a. Projects that protect the greatest number of stocks should receive the highest priority.
   b. Projects with the poorest protection performance should receive the lowest priority.
   c. Achieve a minimum of 80 percent fish passage efficiency over the shortterm and a 90 percent fish passage efficiency over the long term. Establish project-specific scope and schedules to attain these performance objectives (see also Section 3.22).
   d. Achieve a minimum of 95 percent per project survival rate over the short term and 98 percent per project survival rate in the long term.

Monitoring and Evaluation Criteria

1. Prioritize methods that combine measurement and correlation of physical habitat parameters with biological parameters, including life history studies (e.g., flow and temperature parameters correlated with growth and migration timing parameters). Adult return information is essential.

2. Prioritize passive methods of monitoring and evaluation, such as scale analysis and careful documentation of migration behavior (e.g., timing and distribution of spawning). Reliance on massive fish tagging experiments lowers adult returns and introduces study bias through handling and tagging impacts.

3. Prioritize methods that are statistically sensitive to detect small changes in stock performance (e.g., time and size of juveniles at saltwater entry; precise enumeration of adults at dams, spawner distribution, and adult bioenergetic studies). Evaluation methods should emphasize timely exploration of relationships while including analysis of all life history stages.

4. Combine and coordinate mainstem monitoring and evaluation programs with tributary and ocean research programs. Avoid duplication of effort.

Policy Criteria

Highest priority should be given to those projects that are common to all three salmon recovery plans; the Council's 1994 Fish and Wildlife Program, the tribes' Spirit of the Salmon anadromous fish restoration plan, and the NMFS 1995 Biological Opinion.

Decision Criteria

Lower Snake River Dams

As stated previously, the fundamental regional decision for the direction of salmon recovery is under serious dispute. This decision is critical from the perspective of uncertainty and irreversibility. If the region waits for yet more specific scientific evidence to reduce uncertainty regarding appropriate measures for salmon recovery at the dams, there is a significant risk that such delays will lead to the irreversible consequences of extirpation, or the extinction of local stocks.

In Section 3.4.2 of the Five-Year Implementation Plan, the federal and Council approach tries to resolve the many uncertainties surrounding appropriate structural changes at the dams and reservoirs during the interim period from 1997 to 1999. Thus, many different pathways for structural changes would be pursued in parallel, in the hope that one of them may work.

With respect to the lower Snake River dams, the current federal and Council plan follows the Biological Opinion. The opinion states that unless the Corps and NMFS agree otherwise, a decision will be made in late 1999 either to proceed with major drawdowns of Snake River dams or to continue the status quo configuration of attempting to transport more juvenile salmon by installing more screen bypass systems and converting experimental surface bypass systems for transportation. In the interim, the federal plan calls for more marking and tagging studies of juvenile salmon to attempt to resolve smolt-to-adult survival ratios of transported and in-river migrants to determine whether transportation alone will achieve a high enough smolt-to-adult survival rate to meet recovery standards called for by the opinion. At the same time, the federal plan calls for interim development of screen and surface bypass systems at the four Snake River dams at an approximate cost of $100-$120 million. [5] As a related issue, the

[5] These estimates reflect only the approximate structual costs of the interim measures. When the salaries, support, and travel of state, federal and tribal participants to develop and implement these measures are considered, these measures are likely to cost tens of millions more.

Corps is pursuing significant and necessary powerhouse rehabilitation programs at the lower Snake River dams. For example, the Ice Harbor rehabilitation program is scheduled to begin in 2000 with an estimated cost between $200-300 million. While these substantial costs are not directly a part of the MOA, they will have to be reimbursed by BPA in the future. Thus, they could impact future funding of fish and wildlife mitigation.

In contrast, the tribal plan accepts the risk of existing uncertainties and directs capital construction tasks toward avoiding the risk of the irreversible consequences of extirpation. These risks are twofold. First, the extremely low populations of many stocks, combined with the loss of stock fitness and diversity, has likely placed these fish in the extinction spiral. Second, serious limitations of capital construction and O & M budgets during the MOA period and uncertainty with respect to future funds demand that a single direction be pursued that is supported by the weight of available scientific evidence. The tribal plan is founded upon the concept that enough scientific information already exists[6] to immediately proceed with drawdowns of the four Snake River dams and drawdown of John Day to spillway crest or natural river. The Spirit of the Salmon plan views these actions as essential to prevent the extirpation of Snake River salmon stocks and to increase production of non-listed salmon stocks throughout the Columbia Basin. In addition, the tribes maintain that such a path will save the $100-$120 million now dedicated by the federal government to development of interim juvenile bypass systems at Snake River dams and that, as noted by Harza (1996) and the Corps (1996), immediate implementation of drawdowns will be much cheaper and more certain of fostering listed stock recovery than waiting until 1999.

In November, 1996, a group of senior level policy and technical representatives from state, federal, and tribal entities met informally to discuss the future direction of drawdowns. Key members of the Plan for Analyzing and Testing Hypothesis (PATH) group related that their analyses for Snake River yearling chinook indicated that interim structural measures to increase in-river passage other than drawdowns will not likely recover ESA listed stocks. This is consistent with the conclusions of the *Salmon Decision Analysis Lower Snake River Feasibility Study* (Harza 1996) and the December 10, 1996, PATH report, *Conclusions of FY96 Retropective Analyses* (PATH 1996). In response to the PATH's report conclusion whether modifications other than drawdown compensate for the effect of hydrosystem impacts upon yearling juvenile Snake River spring and summer chinook salmon during their downstream migration the report states:

> *"Improvements to the current system may increase survival rates, but such improvements are not likely to increase survival rates sufficiently to meet the full range of the passage goal."*

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[6] The tribes note the failure of transportation to recover the stocks over many years of implementation (Mundy et al. 1994), recommendations from the Independent Science Group's (1996) report to the Council, and analyses of riverbasins worldwide (Dodge 1989) that support restoring riverine ecology for anadromous salmon production as sufficient evidence to immediately proceed with drawdowns. The tribes also note that past dam removals in the Clearwater River, Idaho restored anadromy to areas that were previously blocked (Winter 1990).

While the PATH members continued to dispute the efficacy of transportation to recover yearling stocks, they agreed that natural river drawdown was, with respect to biology, the most certain way to recover all listed stocks. The informal group charged an ad-hoc group of PATH and Implementation Team representatives to further refine the capital construction decision framework with respect to the Lower Snake Dams. At present , the evidence supports moving ahead immediately with drawdowns.

Lower Columbia River Dams

With respect to structural improvements at the Lower Columbia River dams during the 1997-2001 period under the MOA, no formal decision pathway has yet been considered by the region. In the absence of this critical pathway, the federal and Council path has defaulted to the 1995 Biological Opinion, which calls for major funding expenditures for status quo screen bypass systems, but does not call for meeting regional performance standards of 80% juvenile fish passage efficiency (FPE) and 95% per dam survival by 2001. For example, the federal plan calls for nearly $100 million to be spent on more development of the inefficient Bonneville Dam screen bypass system, $100 million to be spent on a new screen bypass system at The Dalles, and over $40 million to be spent on more development of the existing screen bypass system at John Day.

From the tribal perspective, these priorities for the Lower Columbia River dams are seriously misplaced because they will not result in meeting the regional performance standards of 80% FPE and 95% survival per dam and significant progress toward meeting dissolved gas and temperature standards under the Clean Water Act at all federal hydroprojects by 2001. Under the tribal plan, major expenditures to meet these objectives include improving adult passage systems, development of spill and surface bypass systems that are more benign for salmon and other anadromous fish than screen bypass systems, and implementation of structural modifications to bring dam operations in compliance with dissolved gas and temperature standards under the Clean Water Act.

In addition, there is regional concern that structural measures are needed to control dissolved gas from Grand Coulee and possibly Chief Joseph. No federal funds have been appropriated to implement structural modifications to reduce impacts on anadromous and resident fish created by these dams. Overgeneration spill from these dams creates elevated levels of dissolved gas that routinely exceed standards under the Clean Water Act and affect much of the Mid-Columbia reach. The tribal plan calls for resolution of these issues. Because they are largely related to the impacts from Grand Coulee, which are under the jurisdiction of the Bureau of Reclamation, the tribal plan suggests that additional funding from the Department of Interior be appropriated to implement the appropriate structural measures to correct the problems.

Thus, there are significant and fundamental disputes at the regional technical level and there is no consensus within the SCT or other technical groups on which path MOA capital construction and O&M expenditures under the MOA should follow. From the tribal plan perspective, Lower Columbia River decision criteria should be expediently developed by the sovereigns on a dam-by-dam basis using PATH and the Independent Science Advisory Board, and the criteria should be added to this section to complete this portion of the five-year plan. It is vital that the region's sovereigns immediately address this

crucial issue.

Current Schedules and Decision Points

Current Schedules

The Federal and Council Plan: The federal and Council plan assumes that the NMFS 1995-8 Biological Opinion accurately identifies immediate, intermediate, and long-term actions for the operation and configuration of the hydropower system that will reduce mortality of ESA-listed fish. Current actions include more development of juvenile screen bypass systems, which are improvements to increase numbers of transported fish. Intermediate actions identified in the Biological Opinion to improve salmon survival include gas abatement measures, installation of extended-length screens at almost all dams with extant screen systems, Bonneville bypass outfall relocations and acquisition of new fish barges. Current research activities include evaluation of alternative long-term strategies; in particular, major structural modifications such as installation of surface bypass systems and drawdowns.

The Tribal Plan: In contrast, the Spirit of the Salmon plan, supported by the scientific review in the Spirit of the Salmon, found that the NMFS Biological Opinion did not adequately identify the appropriate actions necessary to reduce juvenile and adult mortality and foster restoration. Instead the tribal plan has found that the opinion calls for many actions that will at best not mitigate for current hydrosystem impacts and that, at worst, may actually increase juvenile mortality through additional handling, dewatering, and delays. For example, Harza (1996), through analysis of smolt-to-adult returns of juvenile salmon that were pit-tagged and traveled through screen bypass systems or turbines and spillways, found that juveniles that did not pass through screened bypass systems survived to adulthood at significantly higher rates. Thus, the tribal plan calls for cessation of further development of status quo screen systems and transportation. Instead, the tribal plan calls for immediate implementation of specific structural measures including drawdowns, temperature control, gas abatement, and surface bypass development to be fully implemented over the MOA period, instead of additional screen bypass and transportation development, surface bypass studies, and other research.

Because the Biological Opinion did not include critical structural improvements for adult passage as reasonable and prudent measures, they are not a high priority in the federal and Council plan. In contrast, the tribal plan calls for significant actions to reduce adult passage delay, such as temperature control in fishways, increasing adult attraction flows, and implementation of new fishway designs, as high priority structural actions to be completed during the MOA.

Decision points: According to the NMFS Biological Opinion, there are several decision points along the path to determining the benefits of various structural modifications. The Biological Opinion states that the first preliminary decisions regarding the drawdown of the four Lower Snake dams and decisions to install surface bypass systems should be possible by mid-1996. NMFS calls on the Corps to complete an interim evaluation of these measures by mid-1996 and to proceed with the engineering and design work for a drawdown alternative and development of surface bypass systems, unless NMFS and the

Corps agree on a different course. The opinion calls for engineering and design work and the NEPA process to be completed by December 1999, and subsequently Congressional authorization is to be pursued. In the Biological Opinion there is no provision for reaching consensus with the state and tribal sovereigns on this critical decision.

While the Biological Opinion's goal is to ensure that construction of drawdowns in the Snake River could begin in 2000, under the present federal plan, which calls for the Corps to submit a report to Congress for appropriations by the end of 1999, this is not feasible. This is because of the appropriations process, under which funds are not available until a year after budgets are submitted. For example, even if Congress appropriated funding for drawdowns in 2000, funding would not be available until 2001 because the Corps' 2001 general construction budget would be appropriated by Congress in 2000. In order to start Snake River dam drawdowns in 2000, Congress would have to appropriate funding to the Corps' general construction budget in 1999, which means the Corps would have to submit the drawdown appropriations request to Congress by mid 1998.

The tribal plan calls for sequentially implementing Snake River drawdowns to natural river levels beginning in 1999. This would require Congressional authorization to appropriate funds in 1998 to the Corps' 1999 general construction budget. To fulfill this action, NEPA, the Corps' report on drawdown, and construction general budget would have to be completed and submitted to Congress by the middle of 1998. Thus, in order to implement the tribal plan, the Corps' 1997 and 1998 general construction funds must be directed to complete the NEPA process and the report to Congress. This is a key reason why the region's sovereigns must urge a decision on natural river drawdown of the lower Snake dams as soon as possible.

3.4.3.2 Tribal Work Plan Capital Construction Tasks

Project Prioritization by Major Category

Introduction: The tribal plan calls for the majority of capital construction funding during the MOA period to be applied to major categories that include surface flow bypass systems and spill efficiency, drawdowns, dissolved gas abatement and temperature control, adult passage, and several other measures. While the federal and Council plan emphasizes many approaches at many dams, the tribal plan calls for specific prioritization of appropriate measures and funds toward dams that currently have the poorest ability to meet regional ecological and passage performance standards. Tribal priorities and funding by major category are contrasted with the federal plan in Section 3.1; Figures 3-1 and 3-2.

Drawdowns

The tribal plan's highest priority is to immediately begin preparations for implementing sequential drawdowns of the four lower Snake River reservoirs to natural river levels by 2002, with completion of

three dams to natural river drawdown by the end of the MOA period. The tribal plan calls for all engineering and biological plans, NEPA compliance, and the federal report to Congress to be completed by the middle of 1998 to allow Congressional appropriations for drawdown for fiscal year 1999. The tribal plan allocates $350 million or about 55% of the MOA capital construction budget to this task. In contrast, the federal plan allocates only about $16 million or 2.6 % of the MOA budget to this task.

While specific methods to accomplish drawdown are still being investigated (Corps 1996), the current concept is to install cofferdams at the embankment section of a dam and create a river level outlet. Subsequently the pool behind the dam would be lowered via the spillways and turbines and the navigation lock. In the final stage the pool would be lowered to natural river channel level. It is expected that the complete implementation of natural river drawdown would take about two years per dam. During the deconstruction phase, methods to accommodate adult passage would have to be employed. For example, to protect anadromous stocks during removal of two Elwha River dams, salmon managers have decided that trapping and hauling adults at appropriate places below the dam being deconstructed is an appropriate safeguard. With respect to the possible impacts of deconstruction of the Elwha River dams, state, tribal, and federal fishery managers have determined that even high levels of impacts to migrating year classes are acceptable over the short term to gain full restoration of anadromy for five stocks of anadromous fish over the long term (DOI 1996).

Another key priority of the tribal plan is to complete preparations to implement a spillway crest drawdown of John Day pool by 2004-5. The tribal plan allocates $22 million or about 3.5% of the MOA capital construction budget to this task. A proposed plan to accomplish this task has been presented in a feasibility report by Harza (1994). The John Day pool would be lowered to spillway crest level by opening the spillgates. Modifications to the adult fishway exits at John Day and to the spillway entrances at McNary would be necessary, and some modifications to the powerhouses may be necessary. With the restoration of about 40 miles of river for spawning and rearing habitat and reduction of chronic periods of high water temperatures and water particle travel times, Harza (1994) and the ISG (1996) believed this measure could be among the most beneficial available to restore anadromous fish in the Columbia River Basin.

Solid evidence exists that drawing down impoundments or removing dams to restore natural river systems has substantially increased or enabled anadromous fish production to occur to areas above where the former dams partially or fully blocked anadromy. For example, removals of Harpster Dam on the south fork of the Clearwater River, Idaho, and Lewiston Dam on the north fork of the Clearwater River, Idaho, restored adult chinook passage and increased steelhead passage to upstream areas, which resulted in seeding of available upstream habitat (Winter 1990). Steelhead runs have benefited from removal of Sweasy Dam on the Mad River, California (Winter 1990). Even though conventional passage methods such as screened bypass systems and fish ladders were considered to restore five species of anadromous fish above two dams in the Elwha River, Washington, considerable analysis and review by tribal, state, and federal fishery managers resulted in recommending removal of the two dams as necessary to fully restore all of the river's stocks (DOI 1996). In addition, studies of juvenile chinook passage through the Brownlee Reservoir, Idaho, indicated that substantially more juveniles survived reservoir passage when the reservoir was drawn down (Durkin et al. 1970).

Surface Bypass and Spill Efficiency

The CRITFC tribes' *Wa-Kan-Ush-Mi Wa-Kish-Wit* plan and the Independent Science Group's *Return to the River* report both emphasize the advantages of surface-oriented bypass systems over conventional juvenile screen systems to reduce direct and indirect salmon mortality as well as reducing delays and predation on migrating juveniles. The tribal plan calls for prioritization of surface bypass development using large volumes of flow (8,000-10,000 cfs) at the two dams where screen systems likely cannot achieve the regional passage and survival goals for both listed and unlisted anadromous fish. These dams include both powerhouses at Bonneville and John Day. The tribal plan has allocated $86 million, or about 14% of the overall MOA capital construction budget, to surface bypass and spill efficiency tasks.

Surface bypass studies at Wanapum Dam in the mid-Columbia have indicated that while small numbers of juveniles are committed to pass through the vertical slots of the collection channel, the presence of the forebay channel itself appears to prevent juveniles from sounding into turbine intakes. The tribes believe that this information, as well as the success of the Wells Dam surface bypass system, indicates that these systems should be fully applied at Bonneville and John Day, because the extant juvenile screen bypass systems at these dams are among the most inadequate on the river. These systems achieve only about a 30-50% FPE, and are currently spill-limited because of dissolved gas.

The tribal plan has prioritized funding to increase spill efficiency[7] at all lower Columbia River dams. Installation and operation of hydroacoustic monitoring across all Corps dams is a high priority to increase the efficiency of spill in passing juvenile salmon. This method has been successfully employed at Priest and Wanapum dams to quantify project passage performance standards, reduce dissolved gas, and refine spill patterns and other operational measures to benefit migrating juvenile and adult salmon. In addition, this task will likely increase power generation by avoidance of unnecessary spill. The federal plan does not call for these measures.

Other measures to increase spill efficiency and surface bypass being pursued in the Mid-Columbia include modifying radial spill gates by installing mini-gates inside the radial gates to allow for surface spill. The tribal plan calls for the Corps to pursue these concepts and implement them when they demonstrate prototype success.

The tribal plan calls upon the Corps, the states, and Council to assist in developing and expeditiously implementing full flow surface bypass prototypes, forebay channels, spillgate modifications, and hydroacoustic monitoring, with minimal research expeditures to achieve the tribal plan objectives by the end of the MOA term. In particular, the tribal plan directs the region to focus efforts at Bonneville and John Day, which have among the poorest juvenile passage performance of any existing juvenile bypass systems in the basin.

Gas Abatement and Temperature Control

The tribal plan focuses upon capital construction tasks to bring all dams into compliance with total dissolved gas and temperature standards under the Clean Water Act. In meeting this goal, the plan has addressed many of the technical comments filed by the Environmental Protection Agency (Kelly 1996), which found the draft federal and Council plan seriously deficient in addressing extreme violations of federal and state water quality standards caused by the FCRPS.

The federal plan calls for a $40 million gas abatement program, of which $20 million is directed toward construction of a prototype at an undisclosed site by 1999, and $20 million is directed toward studies. The tribal plan calls for specific measures, which have been proven in the river, to be immediately implemented at the dams that are the most problematic-Bonneville and John Day. Spill to meet regional passage performance standards is seriously restricted at these dams because spill causes elevated levels of dissolved gas. The tribal plan calls for implementation of raised stilling basins or similar fixes at these dams to allow both voluntary and involuntary spill to occur without substantially raising dissolved gas levels over established standards.

[7] Spill efficiency is defined as a ratio of the number of juveniles passed through a dam via surface bypass systems or spillways to the volume of water spilled. At most dam spillways, the ratio is believed to be 1:1, but surface spill studies at Wanapum, Rock Island, and The Dalles indicate that efficiencies of 12:1 or greater are obtainable. Advantages of increasing spill efficiency are threefold: dissolved gas is reduced, better adult passage conditions are realized, and more of the river is available for power generation as spill volumes decrease.

With less than 0.5 % of the MOA budget prioritized for temperature control and most of this applied to studies, the federal and Council plan does not adequately address reduction of temperature at dams or in the river. Temperature is a key limiting factor for anadromous fish (ISG 1996; CRITFC 1996) and serious violations are commonplace during much of the summer months. In contrast, the tribal plan calls for a structural measure to allow cool water releases from Dworshak Reservoir without impacting Dworshak hatchery production and immediate implementation of measures to reduce temperatures in adult fishways.

By prioritizing drawdowns at the lower Snake River and John Day dams, water temperature and total dissolved gas levels will be significantly reduced. The tribal plan has allocated $109 million or about 17% of the overall MOA capital construction budget for tasks to immediately improve the key water quality parameters of total dissolved gas and temperature.

Adult Passage

Serious adult passage problems exist through the FCRPS. For example, the Biological Opinion states that an estimated 39-51% of chinook adults are lost as they migrate through eight dams. State and tribal fishery managers estimate that this loss was approximately 50% on average from 1988 to 1993 (CRITFC 1996). These impacts do not include loss of spawner success from prespawning mortality and failure to consummate spawning. Lichatowich and Cramer (1979), in a review of key life history characteristics of salmon linked to productivity, found that proper timing of adults to the spawning grounds and increasing spawner distribution to the upper tributaries were among the most influential and statistically sensitive parameters.

While the federal plan's foundation for adult passage is keyed to "reasonable and prudent measures" in the Biological Opinion, the opinion specifies few measures. Instead, the most beneficial adult passage measures are limited to the opinion's Conservation Recommendations, which are not binding to the Corps and other federal action agencies. For fall chinook, under the reasonable and prudent measures in the opinion, NMFS expected 39%, or the minimum estimated mortality level before the measures were invoked, to be achievable. The federal capital construction plan calls for about 1% of the MOA budget to be appropriated to achieve improvements in adult passage. Of this amount (by CRITFC estimates $3.3 million), some 42% or $1.39 million is dedicated to studies alone. For example, while the tribal plan identifies over $1 million in direct implementation measures at lower Columbia dams to improve adult passage in 1997, the Corps has placed only $0.4 million in this category and this funding is directed entirely toward studies.

The tribal plan notes that under the federal and Council plan, direct mortality rates and the cumulative and indirect mortality impacts of the FCRPS upon adults are unacceptable and will only lead to extirpation. The tribal objective for adult passage is to reduce adult delay through the FCRPS by 50% by 2001, reduce adult upstream energy expenditures, and increase spawner distribution to upstream habitats. The tribal focus upon drawdowns will reduce, and in the case of natural river drawdowns, largely eliminate direct hydroproject impacts on adult passage. Drawdowns will also create new spawning habitats, both in the mainstem reaches and at the lower portions of tributaries now inundated

by mainstem pools. This will allow expansion of existing spawning areas as described by the ISG (1996).

In the case of the lower Columbia River dams, the tribal plan directs capital expenditures toward solutions of known problems such as fallback through the dams, and calls for increasing adult attraction flow and implementation of new emergency backup systems. With respect to these problems, the tribal plan incorporates the criteria and recommendations of the Detailed Fishery Operating Plan (SFAT 1993), which are much more rigorous than the Corps' Annual Fish Passage Plans adopted in the federal and Council plan. Further, the tribal plan is founded upon recent recommendations from adult passage experts at the Fish Passage Center (Basham, pers. comm. 1996). In addition, the tribal plan calls for development and implementation of new adult passage technologies (CRITFC 1996) that could reduce adult energy expenditures. The tribal plan prioritizes capital construction tasks for adult passage, non-inclusive of drawdowns, at $44 million, which is about 7% of the total MOA expenditures.

Screen Systems and Transportation

From the tribal perspective, further development of screen systems and transportation will only divert limited funds from other measures that are more likely to achieve regional restoration goals. While the federal plan calls for a majority of funds to be applied to this category, or by CRITFC estimates 51% and $309 million of the total MOA budget, the tribal plan does not allocate any capital construction funds to this category.

Screen bypass systems were originally developed as a compromise to avoid power losses through spill and to protect migrating juvenile salmon. There remains no argument among regional salmon managers that spill provides the best passage route for juvenile salmon. Numerous spill mortality studies have been conducted basinwide, and spill passage consistently shows between 0 and 3% mortality (SFAT 1995). While numerous turbine passage studies showed that juveniles suffered about 15% mortality per dam through turbines (SFAT 1995) and politically spill was not an option, basin fishery agencies believed that screen systems were an advantageous alternative. However, upon closer examination, evidence now shows that *screen system passage may be as harmful as turbine passage* (Harza 1996), and causes far greater reductions in smolt-to-adult returns than spill passage (Gilbreath et al. 1993). As previously mentioned, it is likely that screen bypass systems act to cause selective mortality in salmon life histories by impinging fry and subyearlings. The bypass systems also fail to divert most fry and subyearlings from the turbines (Mundy et al. 1994; CRITFC et al. 1994)). The cumulative impact of this selection is the reduction of genetic diversity in basin stocks.

A common misconception is that fish guidance efficiency is equal to fish passage efficiency. Fish guidance efficiency is only the percentage of juveniles diverted by turbine intake screens into gatewells. Of those fish that are diverted into the gatewells, the informal criterion, which is not always met, is that within 24 hours 70% of them must pass into pipes leading to the powerhouse collection channel where more of them are delayed. Further delays occur as fish continue to pass through the maze of additional pipes, dewatering screens, separators, and raceways. A recent radio tag study showed that summer migrants delayed passage and held in the separator for a week (Vendetti and Rondoff 1996).

Despite twenty years of screen system development, these serious problems remain. It is likely that one of the basin's stocks in the most critical condition, listed Snake River sockeye, is especially affected by screen bypass systems. For example, mean sockeye guidance efficiencies at Bonneville Dam are only 21%, while mean descaling has ranged from about 17% to 50% from screen system passage (Monk et al. 1995). Oregon State University studies have shown that descaled juveniles are not likely to survive to the estuary. Further, subjecting juvenile fish to screen bypass systems in the summer months causes them to be held in temperatures that substantially exceed state and federal water quality standards. In addition, there is evidence that extended-length screen systems significantly impinge juvenile lamprey (Dalen et al. 1995), which are an important tribal cultural resource.

The transportation process depends upon the use of screen bypass systems. The past failures and future uncertainties of this process to recover basin stocks are documented in Mundy et al. (1994), CRITFC (1996), and ISG (1996). Given the dire status of many basin stocks, the tribal plan emphasizes that immediately increasing spill efficiency, developing surface bypass systems and reducing dissolved gas are paramount tasks to achieve restoration and cannot wait for the results derived from additional research.

Other or Miscellaneous (studies, monitoring)

The key component of this category includes completion of index testing of all turbine units at all dams and installation of turbine optimization programs to increase unit efficiency as presented in Sheldon and Loupin (1995). This will benefit power production, reduce O & M costs on units, and reduce fish mortality through the turbines. Shelton (1996 pers. comm) noted that installation of these systems saved New England utilities enough in efficiencies in only a few months' time to pay for the cost of the systems. Another component of this category is capital construction funding to upgrade the Ringold Hatchery. The tribal plan allocates $23 million or 4% of the MOA budget to this category. A final component in this category is construction of a regional passage research facility at Bonneville Powerhouse 2. This facility would allow both engineering and biological studies focused on experimental juvenile and adult passage structures to be implemented. Presently there is no such facility on the river and most of the federal dam engineering studies are conducted at the Corps' Waterway Experiment Station in Vicksburg, Mississippi. Construction of a regional research facility would allow for full state, federal, and tribal participation in development of alternatives at substantial cost savings, and it would allow for in-river biological studies with Columbia basin anadromous fish stocks. The tribal plan has directed $3.5 million to construction of this facility, about 0.5% of the overall MOA budget.

Project by Project Capital Construction Tasks

While a comparison of the tribal and federal/Council plans by major category is useful, the following criteria are more critical:

1. **Identify the current status of each dam with respect to meeting regional passage and ecological performance objectives and;**
1. **Prescribe the appropriate tasks that provide the most certainty that each dam will meet the regional performance objectives by 2001.**

CRITFC has prepared the following work plan, addresses capital construction tasks to meet the above criteria for each federal mainstem dam. Table 3-5 and Figure 3-6 describe the dam-by-dam capital construction prioritization under the tribal plan for the term of the MOA. Section 3.4.3.4 contains Tables 3-6 to 3-14, which summarize capital construction tasks for each dam under the tribal plan. CRITFC has estimated capital construction task costs based upon Corps, Mid-Columbia public utility, and Bureau of Reclamation estimates.

The tribal plan calls upon the Corps, the states, and Council to assist in developing and expeditiously implementing drawdowns, temperature and gas abatement control, full flow surface bypass prototypes, forebay channels, spillgate modifications, hydroacoustic monitoring, adult passage, and other improvements with minimal research expeditures to achieve the tribal plan objectives by the end of the MOA term. In particular, the tribal plan directs the region to focus efforts at Bonneville and John Day, which have among the poorest juvenile passage performance of any existing juvenile bypass systems in the basin.

Bonneville Dam (Table 3-6).

Juvenile Passage

Current status: Both powerhouses have screen bypass systems that divert only 10-50% of juvenile migrants. Several years of comprehensive study with millions of tagged salmon showed that smolt-to-adult return rates for juvenile fish passing over the spillway are significantly better than for those passing through screen bypass systems, tailrace, or turbines (Gilbreath et al. 1993). Spill is limited because of the creation of elevated levels of dissolved gas, which exceed water quality standards.

Prescription: Juvenile passage through spill should be increased to meet the 80% FPE and 95% survival standard. Tasks to improve spill efficiency, surface bypass development, and gas abatement measures should be immediately implemented.

Task 1. Install a three-unit, full-flow channel prototype at Powerhouse 1, eventually capable of carrying 8,000-10,000 cfs to the spillway channel by 1998. Configure the outfall to the spillway. Install a full-channel prototype at Powerhouse 1 by 2001.
Cost: $24 million.

Task 2. In 1998, install a curtain in the forebay of Powerhouse 1 to attempt to divert juvenile fish to the spillway channel. If successful, the curtain could divert juveniles away from the existing screen bypass

system and turbines. Cost: $2.3 million.

Task 3. By 1997 passage season, install, monitor, and evaluate juvenile fish passage via hydroacoustic monitoring systems over both the spillway and powerhouses 1 and 2 through the duration of the MOA term. Vary operations, for example, vary total flow to the spillway and powerhouses to achieve regional goals of 80% FPE and 95% survival per project. Cost: $ 6 million.

Task 4. By 1999, install a raised stilling basin or modify the existing ogee crest to reduce total dissolved gas created by spill and approach water quality standards under both voluntary and involuntary spill conditions. Cost: $24 million.

Adult Passage

Current status: There are substantial adult passage problems at Bonneville Dam. Because Bonneville is the first dam that anadromous fish encounter, it is critical that better conditions be expeditiously implemented. At present, juvenile passage objectives cannot be met because spill increases adult salmon fallback through the dam. In addition, temperatures in fishways exceed water quality standards. Also, if the Powerhouse 2 fishway pumps fail there is no backup system to put water into the fishway, except for operating the ice and trash sluiceway, which entrains juvenile fish. The existing fishway pumps must be turned off at night to rake trash in front of them. Trash buildup in front of fishway pumps is a serious problem because fishways cannot meet operating criteria. And the gravity flow system at Powerhouse 1 cannot supply enough water to meet criteria when tailwaters are at low elevation. Accumulation of millions of migrating adult shad clog fishways and likely affect adult salmon passage. Entrance sills to the Powerhouse 1 fishway cannot meet agency and tribal depth criteria.

Prescription: Implement the following tasks to meet the tribal plan adult and juvenile passage goals.

Task 1. By 2001, develop and implement engineering remedies to reduce adult fallback by at least 50% at Bradford Island under spill regimes necessary to meet juvenile passage performance standards, and under conditions of involuntary spill. Cost: $11 million.

Task 2. By 1998, develop and implement automated structural means to reduce or eliminate trash in front of fishway turbine pumps. Cost: $2.5 million.

Task 3. By 1999, modify the existing trashrack in front of the Powerhouse 2 sluiceway or add an additional pump for an emergency backup system. Cost: $3.5 million.

Task 4. By 1998, modify the Powerhouse 2 fishway to allow for tribal shad harvest and to increase the efficiency of the fishway to pass adult salmon. This could be a first task to be addressed by the new research facility at Powerhouse 2. Cost $1.5 million.

Task 5. By 1999, modify the Powerhouse 1 fishway entrance weirs so that entrance criteria can be met under low tailwater conditions. Cost: $5 million.

Task 6. By 1998, install fishway temperature control measures such as pumping water at depth in forebays. Cost: $2 million.

Other

Current conditions: Currently, Powerhouse 2 cannot operate independent of Powerhouse 1. Turbine and powerhouse systems have not been calibrated to operate at the best possible efficiencies. This is wasteful in terms of both juvenile and adult mortality and energy and O&M. There is neither a regional facility nor funding to develop and implement new fishway designs, as suggested by Orsborn (1987), that have the potential of reducing adult energy expenditures through fishways.

Prescription: Perform the following tasks to reduce juvenile and adult mortality, facilitate passage, and develop more efficient adult passage facilities basinwide over the long term.

Task 1. By 1998, complete electrical bussing modifications to allow independent operation of both powerhouses. This will allow flexibility in operations to benefit adult and juvenile passage. Cost: $0.5 million.

Task 2. Complete turbine index testing of all units and install turbine efficiency optimization programs at each powerhouse. Cost: $5 million. (Note: Based upon experience at dams on the east coast, these systems may pay for themselves within a short time after implementation.) Cost: $ 5 million.

Task 3. By the first quarter of 1999, complete construction and have ready for operations a regional research facility at Powerhouse 2. Begin studies of structural modifications at fishways basinwide that have the potential of reducing adult bioenergetic expenditures and delay as they pass through dams. Cost: $3.5 million.

The Dalles (Table 3-7).

Juvenile Passage

Current Status: Spill to meet the regional performance standard of 80% FPE is currently implemented within total dissolved gas standards because the project has a raised stilling basin in the tailrace. Spillway efficiencies are uncertain, and hydroacoustic monitoring should be implemented under different spill patterns to further refine efficiencies. Spill efficiencies may be further enhanced by development of spillway surface bypass systems.

Prescription: Implement a comprehensive spillway efficiency monitoring program by development of spillway surface bypass programs and monitoring of juvenile passage through the entire project. If successful, these modifications could also contribute to abating total dissolved gas levels.

Task 1. By 1999, develop and install prototypes and, if warranted, install surface flow bypass structures in spillway gates and make other spillway modifications. Cost: $7.5 million.

Task 2. By 1997, install and operate a hydroacoustic monitoring network across the entire dam and monitor juvenile passage efficiencies and delay under a variety of flows and spill patterns. Cost: $6 million.

Adult Passage

Current conditions: Temperatures in the fishway exceed water quality standards. There is no emergency backup system for existing fishway turbines. Spill at bays adjacent to fishway entrances leak into the entrances, causing poor adult entry conditions. At the south shore fishway, the exit weir is not capable of rapid adjustments to fluctuating forebay flows; thus the fishway is often out of hydraulic criteria.

Prescription: Implement the following structural measures to meet the tribal plan's adult passage objectives and bring the fishways into line with water temperature standards.

Task 1. By 1998, modify existing fishway water supplies to provide cooler water at depth at forebays. Install additional pumps if needed. Cost: $2 million.

Task 2. By the first quarter of 1999, install an emergency backup system employing additional pumps. This task could be combined with Task 1 to facilitate implementation. Cost: $6 million.

Task 3. By the first quarter of 1999, install bulkheads at the end spillways to prevent side spill from leaking into fishway entrances (which causes poor entrance conditions). Cost: 45 million.

Task 4. By the end of 1998, install structural modifications to allow automated and rapid adjustment of the south shore exit weir to rapidly fluctuating forebay flows. Cost: $1.5 million.

Other

Current condition: As previously discussed for Bonneville Dam, all turbine units are not being index tested, and the powerhouse does not optimize potential efficiencies. This needlessly wastes power-generating potential and inflicts greater juvenile and adult mortality on salmon that pass through turbine units.

Prescription: Implement the following task to decrease mortality of juvenile and adult salmon that pass through turbines.

Task 1. By 1997, complete turbine index testing of all units and install turbine efficiency optimization programs at each powerhouse. Continue to operate these programs over the MOA term. (Note: Based upon experience at dams on the east coast, these systems may pay for themselves within a short time after implementation.) Cost: $4.5 million.

John Day (Table 3-8).

Juvenile Passage

Current conditions: Neither fish passage nor ecological objectives can currently be met at this project. The John Day impoundment is documented as a significant source of juvenile migration delays and mortality because of slack water velocities, extremely high water temperatures, lack of adequate turbidity and lotic nutrient cycling, and significant predation. John Day Dam has a screen bypass system that diverts only about 30% of summer migrants into the system. Because the dam generates elevated levels of dissolved gas in excess of water quality standards, voluntary spill is currently limited, while involuntary spill from excess power on the system or high flows is a significant problem. Turbine mortality is likely excessive because the units are aged and not all of them have been index tested.

Prescription: Preparations for spillway crest drawdown should be immediately implemented to meet the tribal plan ecological and passage objectives. Tasks to accomplish this are compatible with other structural tasks. Surface flow bypass technology, spill efficiency, and gas abatement measures should be developed and implemented to meet the tribal plan passage objectives. The following tasks should be accomplished over the MOA term.

Task 1. By 1998, implement a prototype surface bypass channel on the face of the powerhouse adjacent to the spillway. Cost: $11 million.

Task 2. By 1998, implement prototype radial gate modifications to increase spill efficiency. Cost: $2 million.

Task 3. By 1997 and continuing through the MOA term, implement hydroacoustic monitoring of the entire dam to test spill and operational patterns, improve spill efficiencies, and reduce juvenile forebay delays. Cost: $4.5 million.

Task 4. By the first quarter of 1998, complete installation of fliplips at all spillway bays. A Corps contract error that resulted in dispute will limit installation of scheduled fliplips in 1997. The Corps should take all means necessary to ensure as many fliplips are installed by May 1, 1997, as possible, even if this incurs substantial cost overuns. Cost: $11 million.

Task 5. By 2001, install a raised stilling basin or similar structural modification in the John Day tailrace. This will allow for gas abatement at a full range of voluntary and involuntary flows and bring the dam closer to meeting water quality standards. Cost: $55 million.

Task 6. During the MOA period, prepare engineering and biological studies at John Day and McNary to realize a 2004-5 implementation of John Day drawdown to spillway crest levels. This includes modification of the John Day adult fishway exit, the McNary fishway entrance, the McNary tailrace apron, and appropriate mitigation. Cost: $22 million. (Note: additional costs are shown in Table 3-8 that are outyear estimates necessary to continue to implement John Day spillway crest drawdown by 2004-5).

Adult Passage

Current conditions: At the south shore fishway exit adult chinook and steelhead are jumping over the exit, resulting in delays and possible injury. The fishway has a serpentine structure that probably causes delays. No backup system exists, and all three turbine pumps must be operated to meet criteria. Water temperatures are extreme in the fishway and substantially exceed water quality standards.

At the north shore fishway there are six pumps, but only three of them can be operated at a time because the conduit from the pumps to the fishway is not large enough. Additional water is needed in the fishway. Under low flows, fishway entrance gates can maintain only six feet of depth, which is well under established criteria. Pollution could enter the fishway from the navigation lock. Poor passage conditions exist at the counting station, where adults are observed falling back continuously. The fishway has a serpentine structure that probably causes delays. Water temperatures are extreme in the fishway and substantially exceed water quality standards.

Prescription: Numerous structural problems exist at both fishways. Implementation of the following tasks will assist in meeting the tribal adult passage objective by the end of the MOA term.

South Shore Fishway

Task 1. By 1997, implement structural modifications at the fishway exit to prevent adult jumping out of the fishway and delays. Cost: $0.2 million.

Task 2. By 1998, reconfigure the conduit and fishway structures to allow adequate water from all three pumps to be channeled into the fishway. Cost: $1 million.

Task 3. By 1998, install additional pumps to provide an emergency backup system. Cost: $0.8 million.

Task 4. By 1998, modify existing pumps or water entrance conduits to draw water at depth in the forebay for temperature control. It is possible that Task 3 could be combined with Task 4. Cost: $1.5 million.

North Shore fishway

Task 1. By 1999, reconfigure the fishway conduit to modify the existing constriction and adapt other fishway structures to allow water from all six pumps to be placed into the fishway and correct the existing serpentine structure. Cost: $2.0 million.

Task 2. By 1999, modify fishway entrances to met established depth criteria. Cost: $1.5 million.

Task 3. By 1999, make structural modifications at the counting station to reduce adult fallback. Cost: $1 million.

Task 4. By 1998, investigate and, if warranted, implement structural measures to restrain pollution from the navigation lock from entering the fishway. Cost: $0.5 million.

Task 5. By 1998, modify existing pumps or water entrance conduits to draw water at depth in the forebay for temperature control. It is possible that Task 1 could be combined with Task 4. Cost: $1.5 million.

Other

Current condition: As previously discussed for Bonneville Dam, all turbine units are not being index tested, and the powerhouse does not optimize potential efficiencies. This needlessly wastes power-generating potential and inflicts greater juvenile and adult mortality on salmon that pass through turbine units. A related problem is the lack of funding for the Ringold hatchery to assure that some salmon compensation for construction of John Day will finally be realized.

Prescription: Implement the following tasks to decrease mortality of juvenile and adult salmon that pass through turbines and to achieve partial compensation for the construction of the John Day hydroproject.

Task 1. By 1997, complete turbine index testing of all units and install turbine efficiency optimization programs at each powerhouse. Continue to operate these programs throughout the MOA term. (Note: Based upon experience at dams on the east coast, these systems may pay for themselves within a short time after implementation.) Cost: $4.5 million.

Task 2. By 1997 complete testing of rearing and acclimation facilities for fall chinook compensation at Ringold Hatchery. Cost: $1.5 million. By 2001, complete additional capital construction work and/or testing at the hatchery as required. Cost: $0.9 million.

McNary (Table 3-9).

Juvenile Passage

Current conditions: McNary Dam is fully equipped with a full screened bypass system and fliplips to abate dissolved gas and enable juvenile passage performance standards to be met with spill. While involuntary spill can exceed water quality standards, full implementation of river flows through the powerhouse and appropriate spill patterns can lower dissolved gas created by spill. Lower levels of spill at McNary tend to benefit Mid-Columbia stocks more than Snake River stocks because the spillway is located on the Washington shore. In general, while there are some juvenile passage problems at McNary, they are of a magnitude less than John Day and Bonneville. Thus, capital construction projects are of a lower priority at this site during the MOA term.

Prescription: Development of spillgate surface flow bypass and hydroacoustic monitoring across the entire dam could increase spill effectiveness and reduce creation of total dissolved gas. Spillway efficiencies are uncertain, and hydroacoustic monitoring should be implemented under different spill patterns to further refine efficiencies. Spill efficiencies may be further enhanced by development of spillway surface bypass systems to modify existing radial gates.

Task 1. By 2000, develop and install prototypes and, if warranted, install surface flow bypass structures in spillway gates and make other spillway modifications. Cost: $7.5 million.

Task 2. By 1997, install and operate a hydroacoustic monitoring network across the entire dam and monitor juvenile passage efficiencies and delay under a variety of flows and spill patterns. Cost: $4 million.

Adult Passage

Current condition: The north shore fishway is undergoing extensive rehabilitation under a FERC license order to North Wasco PUD. This is expected to be completed by 1998. The north shore fishway has a gravity flow backup system. The south shore fishway could not meet criteria in 1996 because debris caused failure of a water intake screen to the gravity flow system that keeps juvenile fish out of the fishway. Important replacement flow to Umatilla River irrigators for water left in the river is provided by this fishway. Temperatures in the fishway commonly exceed water quality standards in summer months.

Prescription: Testing and monitoring of the north shore fishway after rehabilitation will be necessary to assure the fishway is operating at top efficiencies. Because this is a FERC project, fishery intervenors in the FERC licensing will have to assure that this is realized. Temperature control measures should be implemented at both fishways. An extra screen should be on hand to replace the existing screens if they become damaged.

Task 1. By 1998, modify existing pumps or water entrance conduits to draw water at depth in the forebay for temperature control at both fishways. Cost: $2 million.

Task 2. By 1997 procure an additional intake screen for the south shore fishway to have as a replacement in the event an existing screen fails. Cost: $1.18 million.

Other

Prescription: Implement the following tasks to decrease mortality of juvenile and adult salmon that pass through turbines.

Task 1. By 1997, complete turbine index testing of all units and install turbine efficiency optimization programs at each powerhouse. Continue to operate these programs throughout the MOA term. (Note: Based upon experience at dams on the east coast, these systems may pay for themselves within a short time after implementation.) Cost: $3 million.

Snake River Dams. Note: While the Shoshone-Bannock Tribes do not support interim capital construction expenditures at these dams, they do not oppose them if they will contribute to the tribal plan passage objectives of 80% FPE through spill, and tribal plan ecological objectives such as temperature control. CRITFC supports minor interim capital construction tasks at these dams before natural river drawdowns are implemented as critical to meet both the tribal plan's passage and ecological objectives during the MOA term.

Ice Harbor (Table 3-10).

Juvenile Passage

Current conditions: Fliplips are planned to be installed by April, 1997 on all spillbays. This should allow for the 80% FPE objective through spill to be accomplished. The dam has a full powerhouse screen bypass system. Water temperatures in the juvenile screen bypass system routinely exceed water quality standards. Ecological conditions in the Ice Harbor pool are very poor.

Prescription: Hydroacoustic monitoring across the entire dam is necessary to increase spill efficiencies and reduce dissolved gas. Fliplips should be completed to abate dissolved gas. Natural river drawdown should be implemented to restore critical rearing habitat and improve water quality parameters.

Task 1. Install fliplips by 1997 to abate total dissolved gas and to meet juvenile passage performance standards through spill. Cost: $5.7 million.

Task 2. By 1997, install hydroacoustic monitoring across the entire dam and continue monitoring different operations and spill patterns to benefit juvenile passage and to abate dissolved gas through the MOA term. Cost: $3 million.

Task 3. Complete preparations to implement natural river drawdown by 2002 during the MOA term. Cost: $ 4.5 million.

Adult Passage

Current conditions: Temperatures in both fishways routinely exceed water quality standards. Modifications to existing fishways should be implemented, including installation of fishway pumps to add cool water at depth in the forebay into the fishways. Natural river drawdown should be implemented to create spawning habitat and improve ecological conditions for adults.

Prescription: Implement the following task.

Task 1. By 1997, modify the existing fishways by including installation of fishway pumps to add cool water at depth from the forebay into the fishways. Cost: $1 million.

Other

Prescription: Implement the following tasks to decrease mortality of juvenile and adult salmon that pass through turbines.

Task 1. By 1997, complete turbine index testing of all units and install turbine efficiency optimization programs at each powerhouse. Continue to operate these programs throughout the MOA term. (Note: Based upon experience at dams on the east coast, these systems may pay for themselves within a short time after implementation.) Cost: $1 million.

Lower Monumental (Table 3-11).

Juvenile Passage

The spillway has a complete complement of fliplips installed. This should allow for the 80% FPE objective through spill to be accomplished. The dam has a full powerhouse screen bypass system. Water temperatures in the juvenile screen bypass system routinely exceed water quality standards. Ecological conditions in the Lower Monumental pool are very poor.

Prescription: Hydroacoustic monitoring across the entire dam is necessary to increase spill efficiencies and reduce dissolved gas. Natural river drawdown should be implemented to restore critical rearing habitat and improve water quality parameters.

Task 1. By 1997, install hydroacoustic monitoring across the entire dam and continue monitoring different operations and spill patterns to benefit juvenile passage and abate dissolved gas through the MOA term. Cost: $2.5 million.

Task 2. Complete preparations to implement natural river drawdown by the end of the MOA term. Cost: $ 106 million.
Adult Passage

Current conditions: Temperatures in both fishways routinely exceed water quality standards. Modifications to existing fishways should be implemented, including installation of fishway pumps to add cool water at depth in the forebay into the fishways. Natural river drawdown should be implemented to create spawning habitat and improve ecological conditions for adults.

Prescription: Implement the following task.

Task 1. By 1997, modify the existing fishways by including installation of fishway pumps to add cool water at depth from the forebay into the fishways. Cost: $1 million.

Task 2. Complete preparations to implement natural river drawdown by the end of the MOA term. Cost: $ 106 million.

Other

Prescription: Implement the following tasks to decrease mortality of juvenile and adult salmon that pass through turbines.

Task 1. By 1997, complete turbine index testing of all units and install turbine efficiency optimization programs at each powerhouse. Continue to operate these programs throughout the MOA term. (Note: Based upon experience at dams on the east coast, these systems may pay for themselves within a short time after implementation.) Cost: $1 million.

Little Goose (Table 3-12).

Juvenile Passage

The spillway has a complete complement of fliplips installed. This should allow for the 80% FPE objective through spill to be accomplished. The dam has a full powerhouse screen bypass system. Water temperatures in the juvenile screen bypass system routinely exceed water quality standards. Ecological conditions in the Little Goose pool are very poor.

Prescription: Hydroacoustic monitoring across the entire dam is necessary to increase spill efficiencies and reduce dissolved gas. Natural river drawdown should be implemented to restore critical rearing habitat and improve water quality parameters.

Task 1. By 1997, install hydroacoustic monitoring across the entire dam and continue monitoring different operations and spill patterns to benefit juvenile passage and abate dissolved gas through the MOA term. Cost: $1.5 million.

Task 2. Complete preparations to implement natural river drawdown by the end of 2000. Cost: $ 106 million.

Adult Passage

Current conditions: Temperatures in both fishways routinely exceed water quality standards. Modifications to existing fishways should be implemented, including installation of fishway pumps to add cool water at depth in the forebay into the fishways. Natural river drawdown should be implemented to create spawning habitat and improve ecological conditions for adults.

Prescription: Implement the following task.

Task 1. By 1997, modify the existing fishways by installation of fishway pumps to add cool water at depth from the forebay into the fishways. Cost: $1 million.

Task 2. Complete preparations to implement natural river drawdown by the end of the MOA term. Cost: $ 106 million.

Other

Prescription: Implement the following tasks to decrease mortality of juvenile and adult salmon that pass through turbines.

Task 1. By 1997, complete turbine index testing of all units and install turbine efficiency optimization programs at each powerhouse. Continue to operate these programs throughout the MOA term. (Note: Based upon experience at dams on the east coast, these systems may pay for themselves within a short time after implementation.) Cost: $1 million.

Lower Granite (Table 3-13).

Juvenile Passage

The spillway has a complete complement of fliplips installed. This should allow for the 80% FPE objective through spill to be accomplished. The dam has a full powerhouse screen bypass system. Water temperatures in the juvenile screen bypass system routinely exceed water quality standards. Ecological conditions in the Lower Granite pool are very poor.

Prescription: Hydroacoustic monitoring across the entire dam is necessary to increase spill efficiencies and reduce dissolved gas. Natural river drawdown should be implemented to restore critical rearing habitat and improve water quality parameters.

Task 1. By 1997, install hydroacoustic monitoring across the entire dam and continue monitoring different operations and spill patterns to benefit juvenile passage and abate dissolved gas through the MOA term. Cost: $1.5 million.

Task 2. Complete preparations to implement natural river drawdown by the end of 1999. Cost: $134 million.

Adult Passage

Current conditions: Temperatures in both fishways routinely exceed water quality standards. Modifications to existing fishways should be implemented, including installation of fishway pumps to add cool water at depth in the forebay into the fishways. Natural river drawdown should be implemented to create spawning habitat and improve ecological conditions for adults.

Prescription: Implement the following task.

Task 1. By 1997, modify the existing fishways by including installation of fishway pumps to add cool water at depth from the forebay into the fishways. Cost: $1 million.

Task 2. Complete preparations to implement natural river drawdown by the end of the MOA term. Cost: $ 134 million.

Other

Prescription: Implement the following tasks to decrease mortality of juvenile and adult salmon that pass through turbines.

Task 1. By 1997, complete turbine index testing of all units and install turbine efficiency optimization programs at each powerhouse. Continue to operate these programs throughout the MOA term. (Note: Based upon experience at dams on the east coast, these systems may pay for themselves within a short time after implementation.) Cost: $1 million.

Dworshak (Table 3-14)

Current condition: Cool water augmentation to assist in bringing lower Snake River pools into compliance with water temperature standards affect Dworshak Hatchery steelhead production by retarding growth and causing cool water diseases. This is a conflict which has existed for many years without resolution.

Prescription: The hatchery water supply needs to be upgraded to allow withdrawal from Dworshak pool independent from withdrawal structures used for cool water augmentation releases.

Task 1. By the end of 1997, upgrade the hatchery water supply to make hatchery water sources independent of sources used for cool water releases. Cost: $1.2 million.

Upper Columbia Hydroprojects

Chief Joseph

Current conditions: Release of spill over this project (caused by high flows or lack of power markets) may elevate total dissolved gas levels. Water quality standards may be violated under these conditions. These operating conditions can affect anadromous and resident fish directly through gas bubble trauma, and limit the achievement of juvenile passage and ecological objectives at the Mid-Columbia public utility district hydroprojects.

Prescription and task: By the end of 1997, investigate the problem and identify corrective measures. By 2001, if warranted, implement remediation measures, which could include a raised stilling basin or other structural means of abating elevated levels of dissolved gas from spill. Cost: To be determined. Existing capital construction priorities under the Corps construction general budget may have to be modified to accommodate this task.

Grand Coulee

Current conditions: Release of spill over this project (caused by high flows or lack of power markets) likely elevates total dissolved gas levels. Water quality standards may be violated from these operating conditions. These conditions impact anadromous and resident fish directly through possible gas bubble trauma and limit the achievement of juvenile passage and ecological objectives at the Mid-Columbia public utility district hydroprojects.

Prescription and task: By the end of 1997, investigate the problem and identify corrective measures. By 2001, if warranted, implement remediation measures, which could include a raised stilling basin or other structural means of abating elevated levels of dissolved gas from spill. Cost: To be determined. Because this project is under jurisdiction of the Bureau of Reclamation, funding from the Department of Interior may be required. Existing capital construction priorities under the MOA may have to be modified to accommodate this task.

3.4.3.3 Research, Monitoring, and Evaluation

The federal and Council plan estimates that about 42% of the MOA capital construction funding will be applied to research. In contrast, because recovery tasks are already identified by empirical information and scientific evidence, the tribal plan calls for about 25% of the MOA capital construction funds to be applied to research, while the majority of capital expenditures are to be applied to implementation of structural measures (Figure 3).

There is much dispute between the state and tribal sovereigns and the federal government concerning the needs and priorities of capital construction research. Typically, the Corps accepts comments from

the states and tribes with respect to research needs and priorities and then ignores the comments. With the advent of the MOA, this is no longer the case.

In the federal and Council plan, research, monitoring, and evaluation focus upon reach survival studies that are wrought with many assumptions and uncertainties and require the juvenile migration at large to be subject to screen system and turbine passage. The tribal approach examines impacts of hydrosystem passage on fish from a life history perspective based upon a holistic gathering of data basinwide. Under the tribal plan, smolt-to-adult returns and stock fitness and production (e.g. fecundity, sex ratios) are the true measures of the effectiveness of capital construction measures. Other research, consistent with the approach of Lichatowich and Cramer (1979) and Lichatowich (1980) can provide measurements to monitor the impact of capital construction tasks. These methods rely upon measurements of statistically sensitive life history parameters that affect production, such as the time of saltwater entry, spawner distribution, and timing of spawning. Limited numbers of juvenile and adult salmon should be used for radio telemetry and balloon tag studies; reach survival studies, however, such as those done by NMFS, which require tens of thousands of fish to be tagged and then interrogated at screen bypass systems with pit-tag detectors, provide very uncertain information and come at a high cost to a severely limited resource. Maynard et al. (1989) and CRITFC (1996) have demonstrated that tags increase the risks of predation and can alter age class distributions by causing adults to mature earlier and at smaller sizes.

Recommendation: The tribal plan recommends a new cooperative direction between all of the region's sovereigns to implement necessary research. The need, priority, and study design of research funded by capital construction budgets during the MOA should be agreed upon by all parties before it is implemented. The Corps and other federal agencies must assure that tribes and states have agreed to all research, if necessary by providing funding to allow adequate participation in technical forums.

3.4.3.4 Tables of Tribal Plan Capital Construction Measures: Dam by Dam. References will be provided in the next draft.

Table 3- 5 Tribal capital construction priorities by project

Project	1997	1998	1999	2000	2001	TOTALS
Bonneville	$ 17	$ 37	$ 18	$ 15	$ 5	$ 91
TDA	$ 9	$ 14	$ 7	$ 2	$ 2	$ 33
John Day	$ 28	$ 34	$ 17	$ 26	$ 16	$ 120
McNary	$ 6	$ 3	$ 6	$ 2	$ 1	$ 18
Ice Harbor	$ 9	$ 2	$ 2	$ 2	$ 2	$ 15
Lower Monumental	$ 6	$ 2	$ 2	$ 2	$ 100	$ 111
Little Goose	$ 6	$ 2	$ 1	$ 100	$ 1	$ 110
Lower Granite	$ 6	$ 31	$ 100	$ 1		$ 138
Dworshak	$ 1					$ 1
TOTALS	$ 88	$ 122	$ 152	$ 148	$ 125	$ 635
Grand Total = $635.29 million						

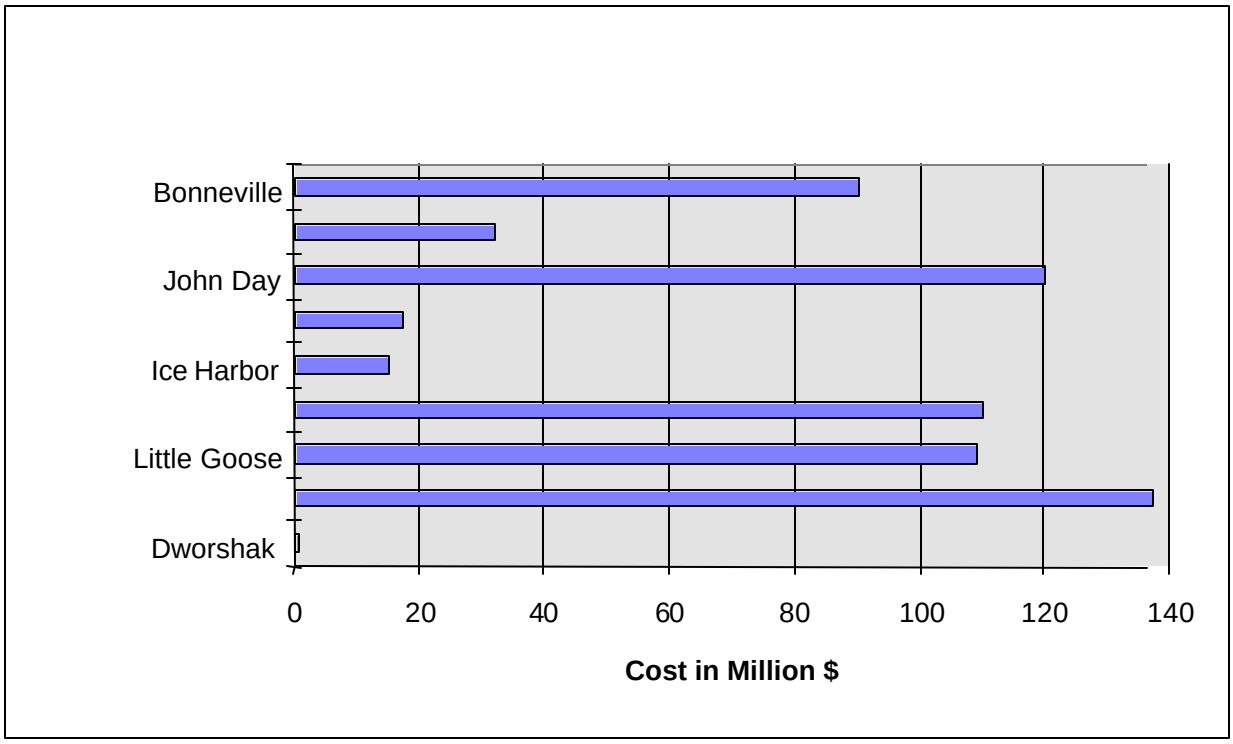

Figure 3- 6 Tribal capital construction priorities by project

Table 3- 6 Bonneville Dam capital construction tasks, CRITFC plan

Bonneville	1997	1998	1999	2000	2001	TOTALS
Surface flow bypass ph1 prototype by 1998 ; ph1 full system by 2001; curtain ph1 forebay	3.3	10	2	10	1	26.3
hydroacoustic spill efficiency monitoring	2	1	1	1	1	6
Gas Abatement raised stilling basin/modified ogee	3	8	10	2	1	24
Fishway temperature control	1	1				2
Adult fishways design/implement structures to reduce adult fallback	1	5	3	1	1	11
structural means to eliminate trash in front of fishway turbines	2	0.5				2.5

Bonneville	1997	1998	1999	2000	2001	TOTALS
modify trashrack or add additional pump at ph2	1	2	0.5			3.5
modify ph2 fishway for shad harvest	0.5	1				1.5
modify ph1 entrance weirs to meet criteria	0.5	4	0.5			5
OTHER						
Electrical bussing	0.4	0.1				0.5
Turbine efficiency optimization	2	1	1	0.5	0.5	5
Research facility at ph2	0.5	3				3.5
TOTALS	17.2	36.6	18	14.5	4.5	90.8

Table 3- 7 The Dalles capital construction tasks, CRITFC plan

The Dalles	1997	1998	1999	2000	2001	TOTALS
Surface flow bypass; gate and spillway modifications	1	1	5	0.5		7.5
spill efficiency monitoring	2	1	1	1	1	6
Fishway temperature control	1	1				2
Adult fishways; emergency backup system	1	5				6
bulkheads to prevent leaking into fishways	1	4				5
S.shore exit weir	0.5	1				1.5
OTHER						
Turbine efficiency optimization	2	1	0.5	0.5	0.5	4.5
TOTALS	8.5	14	6.5	2	1.5	32.5

Table 3- 8 John Day capital construction tasks, CRITFC plan

John Day	1997	1998	1999	2000	2001	TOTALS
Surface flow bypass through existing radial gates and powerhouse channel	6	7				13
spill efficiency monitoring	2	1	0.5	0.5	0.5	4.5
Fishway temperature control	1	2				3
Gas abatement						
fliplips on all bays by 1998	6	5				11
raised stilling basin	5	10	10	20	10	55
Spillway crest drawdown by 2004		5	5	5	5	20
Adult passage						
N.shore fishway/modify entrance weirs and reconfigure conduit; move pump intake	1	3	1			5
S.shore fishway/add emergency backup; reconfigure conduit	2					2
OTHER						
Turbine efficiency optimization	1	0.5	0.5	0.5		2.5
Ringold Hatchery mitigation	1.5	0.3	0.2	0.2	0.2	2.4
TOTALS	25.5	33.8	17.2	26.2	15.7	118.4

Table 3- 9 McNary Dam capital construction costs, CRITFC plan

McNary	1997	1998	1999	2000	2001	TOTALS
Surface flow bypass gate modifications	1	1	5	0.5		7.5
hydroacoustic spill efficiency monitoring	2	0.5	0.5	0.5	0.5	4
fishway temperature control	1	1				2
Adult passage						

McNary	1997	1998	1999	2000	2001	TOTALS
S.shore fishway backup screen; fishway exit modifications	1.18					1.18
OTHER						
turbine efficiency optimization	1	0.5	0.5	0.5	0.5	3
TOTALS	6.18	3	6	1.5	1	17.68

Table 3- 10 Ice Harbor Dam capital construction costs, CRITFC plan

Ice Harbor	1997	1998	1999	2000	2001	TOTALS	2002	2003
Spill efficiency monitoring	1	0.5	0.5	0.5	0.5	3		
Natural river drawdown	0.5	1	1	1	1	4.5	100	1
Gas abatement; fliplips by 1997	5.71					5.71		
Fishway temperature control;pump modifications	1					1		
OTHER								
turbine efficiency optimization	1					1		
TOTALS	9.21	1.5	1.5	1.5	1.5	15.21	100	1

Table 3- 11 Lower Monumental Dam capital construction costs, CRITFC plan

Lower Monumental	1997	1998	1999	2000	2001	TOTALS	2002
Spill efficiency monitoring	1	0.5	0.5	0.5		2.5	
Natural river drawdown	3	1	1	1	100	106	1
Fishway temperature control; pump modifications	1					1	
OTHER							
turbine efficiency	1					1	

Lower Monumental	1997	1998	1999	2000	2001	TOTALS	2002
optimization							
TOTALS	6	1.5	1.5	1.5	100	110.5	1

Table 3- 12 Little Goose capital construction costs, CRITFC plan

Little Goose	1997	1998	1999	2000	2001	TOTALS
Spill efficiency monitoring	1	0.5				1.5
Natural river drawdown	3	1	1	100	1	106
Adult fishways pump modifications for temperature	1					1
OTHER turbine efficiency optimization	1					1

Table 3- 13 Lower Granite capital construction costs, CRITFC plan

Lower Granite	1997	1998	1999	2000	2001	TOTALS
Spill efficiency monitoring	1	0.5				1.5
Natural river drawdown	3	30	100	1		134
Adult fishways pump modifications for temperature	1					1
OTHER turbine efficiency optimization	1					1

Table 3- 14 Dworshak capital construction costs, CRITFC plan

Dworshak	1997	TOTAL
Upgrade hatchery water supply to allow cool water releases	1.2	1.2

3.5 Federal/Council and CRITFC Future System Configuration Paths

Federal/Council and CRITFC technical representatives have considered to some degree capital investments needed after the MOA expires in 2001 to promote basin anadromous fish restoration. Additional work is needed to further develop concepts, specific measures that would be implemented, the schedule for their implementation, and detailed cost estimates. Because, at this time, the key policy decision of whether to implement the federal/Council plan or implement the CRITFC and Shoshone-Bannock plan remains unresolved, it is not possible to further develop outyear scenarios. Nonetheless, the following represents possible scenarios assuming that either the federal/Council or CRITFC and Shoshone-Bannock plan is implemented.

3.5.1 Federal/Council Future System Configuration Paths

The SCT has considered to some degree capital investments needed over the long term or outyears to implement fully the provisions of the three salmon recovery strategies. Significant additional work is needed to define the specific measures that would be implemented, the schedule for their implementation, and detailed cost estimates. In fact, the overall direction for system configuration is uncertain and requires resolution before plans for the outyears can be adequately determined and described. This is a major policy issue.

The SCT has identified, based on the NMFS 1995 Biological Opinion and the Council's Fish and Wildlife Program, three possible future scenarios or alternatives for long-term mainstem system configuration, which depend on the results of ongoing and future drawdown, inriver passage, and transportation evaluations being implemented as part of the PATH process. The three alternatives represent bookend possibilities. They represent the most extreme future scenarios. The selected path could be a combination of measures drawn from one or more of the three scenarios. At present, it is not possible to identify precise capital improvements or system configuration changes at each mainstem dam because such improvements are heavily dependent on ongoing or future biological and engineering studies, as well as availability of adequate funding. The importance of this exercise is to identify the economic ramifications of three different system configuration alternatives, i.e. drawdown, bypass, or transportation.

The drawdown scenario represents a strategy to provide natural river passage of juvenile and adult salmon by lowering reservoirs in the lower Snake and Columbia rivers. Under this scenario, it is assumed that the four Snake and John Day reservoirs are restored to natural river elevation; that spill continues to be the main juvenile fish passage strategy at other dams to achieve the 80 percent fish passage efficiency criterion; and that juvenile fish bypass system and outfall improvements are made at both powerhouses at Bonneville Dam.

The bypass scenario represents a strategy to maximize inriver passage of juvenile salmon by installing surface bypass systems and bypassing fish back to the river at each mainstem dam. Under this scenario, surface bypass facilities would be installed at seven of the eight federal mainstem dams, a juvenile fish

bypass system would be installed at The Dalles Dam, and various gas abatement measures would also be implemented.

The transportation scenario represents a strategy to maximize collection and transportation of juvenile salmon by installing extended-length fish screens and surface bypass/collector systems. This scenario includes installation of juvenile bypass system improvements at Lower Granite Dam and extended-length screens and surface-oriented collection systems at each of the four transport/collector dams (Lower Granite, Little Goose, Lower Monumental dams on the Snake River and McNary Dam on the Columbia River) and at John Day Dam.

There is an important caveat on the potential use of surface collectors under the transportation scenario: there are outstanding technical issues and concerns about the ability to dewater very large volumes of water and fish after collection in a surface bypass system and safely move the fish into collection facilities for transportation. If dewatering technology proves to be infeasible, then conventional screened bypass systems would continue to be used at collector dams.

Figure 3-7 is a breakdown of total costs related to capital construction activities for mainstem fish passage, including ongoing expenditures. It illustrates capital costs that would be incurred beyond the year 2000 that support each of the three alternative future scenarios. The activities included in the general category are not attributable to any one of the three future scenarios, and include such items as adult fish passage improvements/studies, gas abatement measures, and capital costs of the Lower Snake River Compensation Plan.

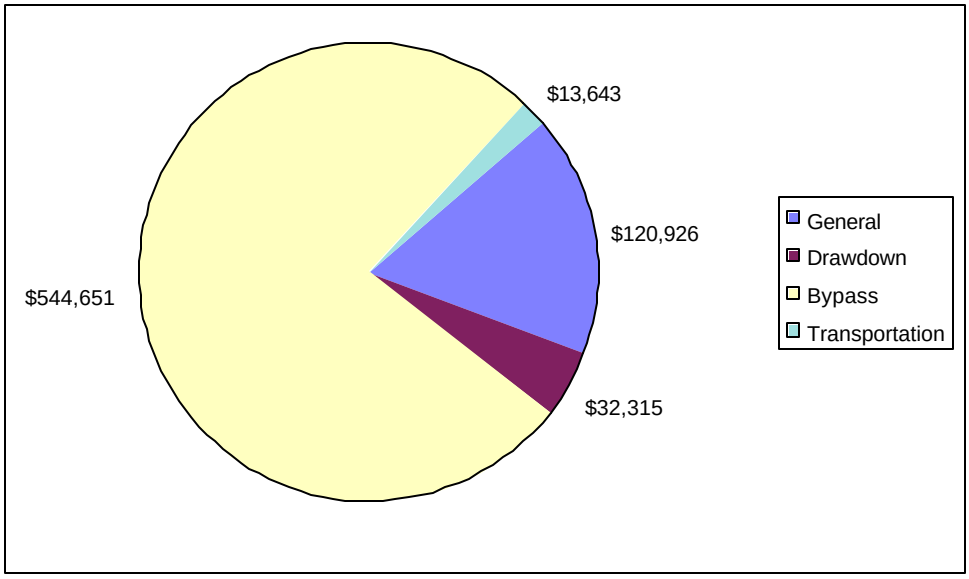

Figure 3- 7 Construction cost breakdown among major categories, FY 1995 - 2007

For each of these future scenarios, the SCT identified specific facilities for each dam that would be needed to satisfy the basic fish passage objectives. Costs were estimated, including annual Corps appropriations and the proportion of these costs that become BPA's responsibility to repay. These

costs were summed to obtain an estimate of the total costs required to pursue one of the three possible future directions.

This chapter of the work plan also describes the current planned investments from which all of the possible future scenarios derive, outlines the major fish passage facilities associated with each future scenario, and provides a summary of the costs for each scenario. Individual dam-by-dam cost estimates are not included in this plan, but are available for those interested in understanding individual facilities costs. An estimate of BPA's interest and depreciation costs for the three scenarios is also summarized below. Based on information from the Corps, an assumption is made that all construction work is completed by no later than 2007 for all three future scenarios.

3.5.1.1 Description of Current Investment and Three Future Scenarios:

a) Current Investment (includes only new investments contemplated under the regional Memorandum of Agreement Plan):

- Lower Granite has extended-length screens, improvements made to the juvenile bypass system, a prototype surface bypass system, picketed lead fences, and fish ladder temperature control.
- Little Goose has extended-length screens, new outfall pipe, picketed lead fences and fish ladder temperature control.
- Lower Monumental has barge facilities modification, gate raise modifications, new gantry crane, and fish ladder temperature control.
- Ice Harbor has complete juvenile bypass facility and flow deflectors.
- McNary has extended-length screens, maintenance facility, juvenile bypass completion, gate raise modifications, and fishway exit modifications.
- John Day has complete juvenile monitoring facility, flow deflectors, extended-length screens, a prototype surface bypass, and drawdown study.
- The Dalles has surface bypass investigations, emergency water supply, adult channel dewatering, and study of spillway/sluiceway survival.
- Bonneville has Powerhouse 1 and 2 downstream migrant monitoring and outfall, development of flat-plate PIT-tag detector, surface bypass investigations, Powerhouse 1 fish guidance evaluation, and independent station service.
- Various studies and investigations occur on a systemwide basis, totaling approximately $150 million, including gas abatement, turbine passage, acoustic technology, barge exit modifications, Lower Snake River feasibility study, new barges, adult passage, dispersed release, separator evaluations, and auxiliary water supply.
- Fish transportation under a "share the risk" strategy is provided.

b) Drawdown Scenario:

- Lower Snake River reservoirs (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor) are drawn down to natural river levels year round; construction and mitigation began in 2000, finished in 2005 (estimated at $180 million per year).
- John Day is drawn down to natural river year round; construction and mitigation began in 2000 and was completed in 2005 (estimated at $1 billion total cost).
- McNary has extended-length bar screens already installed but requires some fish ladder modification because of John Day drawdown (cost is covered under John Day Drawdown), and no further fish transportation occurs.
- The Dalles is spilled to provide sufficient fish passage with no additional investment in facilities (no additional cost).
- Bonneville has a variety of fish passage improvements installed beginning in 1998 through 2005 (total cost of $200 million, $50 million above what is currently planned).

c) In-River and Bypass Scenario:

- Seven out of eight mainstem projects (Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, and Bonneville) have surface bypass systems of some type installed, beginning in 2000 and finished by 2005 or 2007 (estimated at $100 million per dam or $700 million in total). Lower Granite, Little Goose, Lower Monumental, John Day, and Bonneville systems installed by 2005; Ice Harbor and McNary systems installed by 2007.
- The Dalles has a juvenile bypass system installed by 2003 (cost of $105 million).
- Various gas abatement investments are carried out beginning in 2001 through 2005 (total cost of $200 million).

d) Transportation Scenario:

- Lower Granite has juvenile bypass improvements installed by 2001 (total cost of $20 million).
- Lower Monumental has extended-length screens installed by 2001 (cost of $20 million).
- Lower Granite, Little Goose and Lower Monumental have surface collection systems installed, beginning in 2000 and finished by 2005 (estimated at $100 million per dam).
- McNary has a surface collection systems installed, beginning in 2000 and finished by 2005 (estimated at $200 million).
- John Day has various passage improvements (e.g., surface bypass, extended-length screens) totaling $100 million.
- Bonneville has a variety of fish passage improvements installed, beginning in 1998 through 2005 (total cost of $200 million, $50 million beyond what is currently planned).
- Seven additional fish transportation barges are purchased, three in 2001 and four in 2003 (cost of $2 million per barge in 2001 and $2.5 million per barge in 2003).

3.5.1.2 Appropriations Needed, Plant-in-Service Costs and Interest/Depreciation Cost Estimates

In the following tables, the current investment plan is the combination of what is labeled "Base Plan" and "New MOA Investment." The table reflects the distinction that was made in the MOA between different types of investments.

Table 3-15 shows the stream of appropriations required by the Corps to complete the current federal/Council investment plan and each of the three future scenarios. Various totals for selected periods appear just below this table.

Table 3- 15 Total appropriations needed to carry out plan

	Thru 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
BASE PLAN	$136,557	$46,500	$26,593	$35,262	$23,220	$1,960	$200	$0	$0	$0	$0	$0	$0	$270,292
NEW MOA INVESTMENT	$34,509	$45,215	$73,465	$76,957	$82,727	$70,163	$37,813	$12,593	$1,400	$970	$2,490	$2,800	$140	$441,243
DRAWDOWN OPTION	$0	$0	$0	$0	$0	$180,000	$180,000	$200,000	$400,000	$400,000	$380,000	$200,000	$200,000	$2,140,000
BYPASS OPTION	$0	$0	$0	$0	$0	$50,000	$90,000	$151,333	$178,667	$181,666	$181,666	$33,333	$33,333	$900,000
TRANSPORTATION OPTION	$0	$0	$0	$0	$0	$112,812	$112,812	$141,105	$151,105	$120,000	$100,000	$33,333	$33,333	$804,500
(Total of Federal/NPPC and New)	$171,066	$91,715	$100,058	$112,219	$105,947	$72,123	$38,013							$711,535

All figures in thousands of dollars

totals	$133,735
1996	$386,341
thru	$360,000
2001	$140,000
	$225,623

totals	$0	totals	$0
2002	$17,453	2002	$20,393
thru	$1,380,000	thru	$1,780,000
2005	$693,333	2007	$760,000
	$512,210		$578,877

Table 3-16 shows the plant-in-service costs for the various scenarios that would be transferred to BPA for repayment.

Table 3- 16 Plant in-service totals for BPA

	Thru 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
FEDERAL/COUNCIL PLAN		$83,645	$43,422	$26,583	$54,248	$1,189	$49,771	$0	$0	$0	$0	$0	$0	$258,859
NEW MOA INVESTMENT		$9,635	$10,460	$22,915	$3,484	$3,895	$281,107	$35,056	$332	$793	$75	$0	$13,368	$381,119
DRAWDOWN OPTION		$0	$0	$0	$0	$0	$0	$0	$0	$26,663	$1,140,752	$0	$888,023	$2,055,438
BYPASS OPTION		$0	$0	$0	$0	$0	$0	$0	$0	$0	$678,246	$0	$185,803	$864,049
TRANSPORTATION OPTION		$0	$0	$0	$0	$0	$39,197	$0	$91,761	$26,663	$418,629	$0	$188,940	$765,190
(Total of Federal/NPPC and New)		$93,280	$53,882	$49,498	$57,733	$5,084	$330,878	$35,056						$639,978

All figures in thousands of dollars

totals	$258,859
1996	$331,496
thru	$0

totals	$0	totals	$0
2002	$36,255	2002	$49,623
thru	$1,167,4	thru	$2,055,4

2001	$0
	$39,197

	15		38
2005	$678,246	2007	$864,049
	$537,053		$725,993

Table 3-17 shows the BPA interest and depreciation costs that result from the plant-in-service repayment obligation shown just above. These costs include all new capital investments for fish and wildlife, not just those associated with the Corps construction at the mainstem projects. They do not include operation and maintenance costs.

Table 3- 17 Interest and depreciation payment by BPA

	Thru 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
FEDERAL/NPPC (BASE)PLAN		$74,000	$86,300	$95,300	$97,700	$100,900	$111,100	$107,800	$104,800	$101,700	$98,300	$94,700	$91,300	$1,163,900
BASE + NEW MOA INVESTMENT		$74,500	$87,900	$98,700	$102,200	$105,800	$130,900	$143,900	$142,100	$138,400	$134,500	$130,200	$127,000	$1,416,100
BASE, MOA + DRAWDOWN OPTION		$74,500	$87,900	$98,700	$102,200	$105,800	$130,900	$143,900	$142,100	$139,800	$197,000	$251,700	$292,300	$1,766,800
BASE, MOA + BYPASS OPTION		$74,500	$87,900	$98,700	$102,200	$105,800	$130,900	$143,900	$142,100	$138,400	$170,000	$200,800	$205,400	$1,600,600
BASE, MOA + TRANS-PORTATION OPTION		$74,500	$87,900	$98,700	$102,200	$105,800	$133,000	$148,000	$151,000	$153,300	$172,500	$189,600	$195,300	$1,611,800

All figures in thousands of dollars

totals/avgs.	$565,300	$94,217
1996	$600,000	$100,000
thru	$600,000	$100,000
2001	$600,000	$100,000
	$602,100	$100,350

totals	$412,600	totals/avgs.	$598,600	$99,767
2002	$558,900	2002	$816,100	$136,017
thru	$622,800	thru	$1,166,800	$194,467
2005	$594,400	2007	$1,000,600	$166,767
	$624,800		$1,009,700	$168,283

3.5.2 CRITFC Future System Configuration Paths

The CRITFC approach prioritizes post MOA capital construction funding for federal dams in the Columbia River basin toward the following goals in order of priority:

1. Natural river drawdown at Ice Harbor in 2002 at an estimated cost of $ 100 million.
2. Implementation and completion of John Day spillway crest drawdown by 2004-5 at an total estimated cost of $600 million.
3. Meeting a juvenile passage performance standard of 90% fish passage efficiency and 98% survival at remaining run-of-river mainstem dams by at least 2008. Possible measures include further development of surface bypass systems and increasing spill and turbine efficiencies.
4. Continue to reduce adult delay through the hydrosystem to promote successful spawner distribution and success through structural improvements to existing adult fishways and implementation of new fishway engineering designs to reduce adult salmon energy expenditures and fallback through the dams.
5. Under the direction of U.S. and Canadian salmon managers, begin investigation and implementation of the restoration of anadromy to the Canadian portion of the Columbia River basin. Possible measures include drawdown of major storage reservoirs, installation of adult fishways, and installation of surface bypass and/or gas abatement facilities at upper Columbia hydroprojects in the U.S. and Canada.

Time constraints have prevented development of specific work schedules, tasks, and detailed cost estimates to address the above goals. These can be addressed after the region decides upon the key policy issue for capital construction priorities; whether the federal/Council plan or the CRITFC and Shoshone-Bannock plan should be implemented during the MOA period.

3.6 Identification of Key Issues

The key policy issue to resolve in implementing this work plan is: Which approach should be followed in prioritizing roughly $600 million in capital construction funds for mainstem fish passage over the next five years? In other words, which approach should guide the SCT as it pursues mainstem construction activities?

The two options identified in this work plan are:

> 1) The federal agencies' and Council's approach, which continues implementation of fish passage improvements at mainstem dams, including evaluations of existing and alternative system configurations, with a regional decision made in 1999 for the lower Snake River; or
> 2) The CRITFC and Shoshone-Bannock approach, which calls for an immediate regional decision to implement measures leading to drawdown of the four lower Snake River dams to natural river levels by 2002 and a decision to implement measures to achieve drawdown of John Day to spillway crest level by 2004. The CRITFC approach also calls for structural measures at McNary, John Day, The Dalles, and Bonneville to meet a juvenile performance standard of 80% FPE and 95% per dam survival by 2001.

The two approaches differ significantly in the way each would prioritize capital construction funds. The inherent conflict between these two approaches is the key policy issue identified in this work plan. Regional agreement on a single approach is needed, which would then allow priorities and schedules for mainstem passage construction activities to be established by the SCT and then be implemented by the Corps.

Federal/Council Approach

The federal agencies and the Council have largely taken an adaptive management approach to salmon recovery. In this approach, actions evolve, and research, evaluations, and prototype studies are conducted to help determine the next appropriate steps. Improvements to juvenile fish screening and bypass systems, including development and testing of surface bypass technology, are high priorities for funding under this approach. Adaptive management emphasizes a methodical gathering of information from feasibility and/or prototype studies related to implementation of surface bypass systems, dissolved gas abatement structures, and drawdowns. If funds continue to be allocated according to this approach, 90 percent will be spent over the next five years on juvenile fish bypass system improvements, development of surface bypass technology, and dissolved gas abatement structures. These are all various methods to improve bypass methodologies, and hence survival, of juvenile salmon. The remaining 10 percent will be divided among several other activities, including drawdown feasibility studies, juvenile transportation improvements, and adult passage improvements.

Concerns

Adaptive management as described by Hilborn (1987) and Walters and Hilborn (1978) is to implement management actions that focus upon *"… exploratory probing actions that provide information about the true state of nature."* The tribes are concerned that the federal/Council approach does not follow active adaptive management but relies instead upon the status quo hydrosystem fixes, such as screen systems and transportation. Further, the tribes believe that based upon data from Harza (1996), Gilbreath et al. (1993), and CRITFC et al. (1994), there is evidence that screen systems themselves are more harmful to juvenile salmon than spill and perhaps even turbine passage. The tribes believe that Mundy et al. (1994) indicated that screen systems and the transportation process likely select against juvenile salmon life history and stock diversity because certain life histories are more affected by screen passage (i.e., sockeye, subyearling chinook) than others (yearling chinook). Thus, the tribes are concerned that screen systems may reduce genetic diversity necessary for healthy stock production (ISG 1996).

This approach relies heavily on implementation of interim fish passage improvements to the existing hydropower system while evaluations of alternative system configurations are conducted and new passage technologies are tested and developed. It is also likely to be an expensive approach, since considerable funds will be spent on research and testing. Until a policy decision is made about whether to rely on fish transportation in the future, to allow the salmon to migrate inriver, or to implement a drawdown alternative, there is a danger that significant investments will be made over the next five years on improvements to fish passage facilities or other areas that will become prematurely obsolete. In addition, if it is assumed there is a limit to the amount of funding available for future capital construction

activities on the mainstem Snake and Columbia rivers, then the use of existing resources on interim passage improvements and other research, evaluation, and testing activities could preclude or delay implementation of alternative system configurations, such as early implementation of drawdowns.

Further, the tribes are concerned that delay of implementing drawdowns could make the cost of drawdowns over the long term much more expensive, as noted by Harza (1996). The tribes believe that pursuing the federal/Council approach could conceivably incur the following costs:

- Costs to juvenile salmon from additional impacts from increased development of bypass screen systems and transportation

- Stranded investment costs from interim bypass systems as drawdown is implemented

- Additional structural and reimbursement costs of delaying drawdowns to a later date

Finally, interim measures under the federal/Council plan do not have an objective of meeting an 80% FPE, 95% survival per dam performance standard by 2001. This incurs a high risk: many and/or all of the hypothesized paths (i.e., acoustic avoidance technology) called for by the approach could fail, which would result in no measurable progress toward meeting the performance standard necessary to recovery salmon stocks.

Advantages: An advantage of the adaptive management approach is that some believe that additional information, which could be obtained in the interim period, could be useful in making a decision on what system configuration the region should pursue in the future. For example, additional biological, engineering, and economic information will be developed over the next several years and become available to assist regional decisionmakers in 1999. Such additional information may include: a) ongoing research related to the effectiveness of transportation, compared to inriver migration, of juvenile yearling salmon from Snake River dams and subyearling chinook salmon from McNary Dam on the Columbia Rivers; b) ongoing research related to survival of juvenile salmon through the lower Snake River reach to McNary Dam; c) 2-3 years of prototype studies related to development of surface bypass technology at several Snake and Columbia river dams; d) one year of prototype testing of selected gas abatement alternatives; e) improved information on economic costs, engineering feasibility, and biological evaluations related to permanent, natural river drawdown of the four lower Snake reservoirs and deep drawdown of the John Day Reservoir; and f) ongoing research related to both adult and juvenile fish passage improvements. Another advantage is that some believe investments made over the next few years on improvements in fish passage facilities may provide survival benefits in the interim years until a permanent system configuration alternative can be implemented.

The CRITFC and Shoshone-Bannock Approach

The CRITFC and Shoshone-Bannock approach prioritizes MOA funding toward early implementation of the four lower Snake River project drawdowns to natural river levels by 2002 and significant advancement of studies and other processes to implement a John Day pool spillway crest drawdown by 2004-5. To meet a regional juvenile salmon performance standard of 80% FPE and 95% survival by

the end of the MOA period, which is the tribal goal, the tribal focus is upon implementation, rather than conduct of extensive studies as in the federal approach. The tribal approach calls for implementation of structural measures that will bring McNary and lower Columbia Dams into compliance with dissolved gas and temperature standards under the Clean Water Act. These structural measures include surface bypass systems and technologies to increase spill efficiency, gas abatement structures, and temperature control systems such as pumps to introduce cooler water into adult fishways. The tribal approach also prioritizes funding toward structural improvements to existing adult fishways and implementation of new fishway engineering designs to reduce adult salmon energy expenditures and fallback through the dams.

Concerns: It has not been demonstrated that implementation of permanent drawdowns of both the four Snake and John Day reservoirs will, in and of itself, be sufficient to recover endangered or weak salmon stocks. In addition, this approach does not allow for the gathering of additional biological information and determining the engineering feasibility of alternative fish bypass technologies at Snake River and John Day dams. Moreover, this is the most costly approach to salmon recovery. Finally, Congress has directed that no further funding requests be made for drawdown studies of John Day Reservoir until scientific justification is provided.

Advantages: The major advantage of this approach is that making a decision now and focusing all future efforts on implementation of permanent restoration of a natural river in the Snake River and a deep drawdown of John Day pool will reduce costs and save significant funds on future fish passage improvement activities at these projects. For example, the federal/Council approach calls for spending over $200 million, or 34 percent of its total planned expenditures over the next five years, on fish passage improvement projects for the lower Snake River and John Day dams that could become obsolete if the region ends up adopting the tribal measures. The tribes believe that evidence exists that drawing down or removing dams to restore natural river levels has substantially increased anadromous fish production where the former dams had partially or fully obstructed passage. For example, removals of Harpster Dam on the south fork and Lewiston Dam on the north fork of the Clearwater River, Idaho, allowed adult chinook passage and increased adult steelhead passage above these areas, which resulted in seeding of available upstream habitat (Winter 1990). Steelhead runs have benefited from removal of the Sweasy Dam on the Mad River, California (Winter 1990). Even though conventional passage methods such as fish ladders and screens were considered to restore five species of anadromous fish above two dams in the Elwha River, Washington, extensive analysis and review by tribal, state and federal fish agencies resulted in recommending removal of the two dams as necessary to fully restore the river's species (DOI 1996).

Moreover, the tribes believe that implementation of permanent natural river in the Snake and a deep drawdown of John Day Reservoir has several benefits, including the following: a) it will reduce extant estimated juvenile mortalities from about 15% per project to 2-5% in areas where the projects formally existed, and it will reduce adult prespawning mortality from delays and energy expeditures lost through fallback through the project and fishway passage; b) it will significantly reduce serious impacts of poor water quality caused by the dams and reservoirs, such as chronic elevated water temperatures and high levels of dissolved gas, which substantially limit anadromous fish production; c) it is expected to provide the maximum salmon survival benefits; d) it restores a more natural ecosystem, including the addition of

new spawning and rearing habitat; e) it is relatively simple, from an engineering perspective, to design and construct; and f) it can be implemented in about five years once a decision is made. Finally, the Snake River powerhouses, beginning with Ice Harbor Dam, are scheduled for rehabilitation and upgrading beginning about the year 2000. Costs could range from $200 million to 300 million per dam, which could be avoided if a decision is made now to implement drawdown of these reservoirs.

Compromise Approach

Another approach has been suggested that represents a compromise between the competing plans. This approach calls for funding only those capital construction activities that are common to the CRITFC and Shoshone-Bannock plan, the Council's 1994 Fish and Wildlife Program, and the NMFS 1995 Biological Opinion (see Section 3.3 and Table 3-1). For example, capital construction measures called for by all three plans include drawdown feasibility studies, many adult passage improvements, and development of surface bypass and gas abatement systems at John Day and Bonneville dams. This approach has not been outlined in this document, and whether it should be developed further is another aspect of the central policy question.

Why Resolution is Needed Now

It is critical that regional policy makers determine as soon as possible which of these approaches the region should pursue in making decisions about future capital construction activities at federal dams in the Columbia River basin. Until then, the SCT will, for a number of reasons, be unable to reach consensus to prioritize mainstem capital construction improvements necessary to foster recovery of basin anadromous fish stocks. The following policy, procedural, and technical issues are left outstanding in the absence of a policy determination:

- Decision criteria: What are they? What weight should be given to them?
- Timing and schedules for various activities: What guides these determinations? When should particular activities be pursued? Can decisions be made earlier?
- Opportunity costs: Should activities that are currently planned in the near-term be foregone so money will be available later for enormous future capital costs? Should the region take the risk of pursuing uncertain and controversial interim measures that might make it impossible to implement major changes to the system configuration in the future?
- Future obsolescence: Should construction activities be pursued that could have short useful lives?
- Biological data collection: How should biological data weigh in decisions, in terms of both interim and long-term survival benefits? Should the region continue to allocate resources toward development of biological information? What is the link between system configuration activities and research, monitoring, and evaluation activities?
- How should expenditures be balanced among activities and categories of activities? How should the region balance expenditures among research, demonstration, implementation, and immediate survival benefits?
- How much funding should be allocated for outyear projects? How should huge outyear funding requirements be financed? What is the prospect for large future capital investments in mainstem passage beyond what is currently specified in the regional Memorandum of Agreement budgets?

What is the risk to species extirpation and restoration by deferring all implementation decisions for three years? for five years? seven years? ten years?

- Will the Corps' future operation and maintenance funding be adequate to maintain new or improved fish passage facilities and/or system configuration changes under the different future mainstem passage scenarios?
- Is there an appropriate balance of effort among the various categories of activities, such as prototyping new systems, research, monitoring, and evaluation, interim measures for immediate fish benefit, and long-term facilities that will perform for the indefinite future?
- Given the fact that many capital investment decisions have costs and implications that extend well beyond the time limit of the current federal agencies' Memorandum of Agreement, how should these large future capital costs (that is, the "bow wave" effect) be taken into account regarding present policies, directions, and decisions?
- Should mainstem capital construction measures be implemented that may benefit one species and/or life history but select against the survival of other species and life histories? Or should measures be implemented that protect all species and life histories?

If a decision is made soon on the key policy issue, it will enable the region to:

- *Identify* capital construction activities, from now and into the future.
- *Decide* which specific activities to implement and their timing.
- *Resolve* conflicts in prioritizing and implementing specific activities.

Processes Available to Achieve Resolution

There appear to be five regional processes now available that could be used to resolve this policy question:

1. The process created in the NMFS 1995 Biological Opinion for plan integration and dispute resolution (the current "forum" process -- Executive Committee, Implementation Team, System Configuration Team, etc.)
2. Upcoming Council Fish and Wildlife Program amendment process
3. Congressional or administration directives;
4. Legal challenges and judgments or settlements
5. Separate dispute resolution process

Timing of Resolution

If there is no resolution to this major policy issue within the next 3-6 months, then it is most likely the Corps and NMFS will continue a) implementing the federal/Council plan and b) spending large sums of money on each of the major pathways until a regional decision is forthcoming to focus the regional prioritization of mainstem capital construction projects. Within this time frame, SCT will need to make decisions concerning which FY 1998 capital construction activities related to mainstem fish passage to support.

Other Issues

Resolution of the key policy issue as to which direction the region should place upon prioritization of capital construction funds for anadromous fish restoration during the MOA period will likely provide general guidance for setting processes, scope, and specific technical issues directed at the capital construction activities. The two approaches in the workplan identify many of these issues but do not attempt to elaborate upon them because they are linked to the resolution of the key policy issue. However, there remain procedural issues that must be addressed by the region's policy makers. These are critical to guide regional technical representatives, such as those in SCT, in moving forward to resolving disputes at the technical level once the key policy decision is resolved. Because time is of the essence, it is critical that these procedural issues be immediately addressed and resolved by the region's policy makers once the key policy issue has been resolved.

These issues include the following:

1. Should the SCT, which the tribes believe is not fully representative of all of the regional sovereigns, continue to be the primary forum to address technical issues related to prioritization of capital construction activities at federal dams in the Columbia basin? What are the ground rules that should be applied to the conduct of this forum (e.g. dispute resolution)?
2. How is adequate participation in the SCT, which includes the Corps' Anadromous Fish Evaluation Program, ensured for all of the regions' sovereigns to achieve comprehensive involvement and decision making? Should funds from the Corps' construction general budgets be appropriated for this to occur?
3. There is a need to integrate other regional forums under the MOA to comprehensively address all capital construction activities to avoid wasteful and duplicative efforts of valuable time and limited funds. How can a more effective link be made between other forums related to the MOA, such as river operations; research, monitoring and evaluation (e.g. PATH, ISAB); Corps operations and maintenance budgets; and direct funding activities through the Councils' Fish and Wildlife Program?
4. Is it appropriate to identify, resolve, and prioritize all or most capital construction, operations and maintenance, and direct funded activities under the MOA under one process? If so, what forums will be used and how will it be accomplished?
5. Assuming the SCT and Technical Management Team continue to be the forums to address capital construction and river operations expenditures under the MOA, how can activities and jurisdictions be better integrated?
6. Capital construction funds are likely to be needed to correct structural problems at upriver dams such as Grand Coulee, which is maintained by the Bureau of Reclamation. For example, lack of proper structures and spill at Grand Coulee can cause high levels of dissolved gas, which affect resident and anadromous fish downstream. How will these issues be addressed?

Technical Issues

The following are examples of technical issues that the SCT or another appropriate forum will address once the key policy decision sets the framework for anadromous fish restoration. They are related to the interpretation of available science and largely reflect differences between the federal and tribal approaches. While technical forums should be able to resolve these issues, some issues may be

disputed, and then raised to policy levels for discussion and possible resolution. They are presented here to give the region some familiarity with the types of issues that may surface for policy resolution.

General

1. What is the desired timing for other major configuration decisions (similar to the lower Snake decision in 1999)? Are such schedules for future decisions necessary?

2. Are there improvements needed in linking the capital investments to monitoring, since it is through evaluation that the potential biological benefit versus cost is determined?

3. Is it needed and is there a method to ensure that for each program direction, sufficient biological information exists to make long-term decisions?

4. Concerning the major system configuration alternatives, such as drawdowns, surface bypass, and gas abatement measures, is it a worthwhile expenditure of funds to contract for an independent evaluation of the Corps' cost estimates and implementation schedules?

5. Should dams and reservoirs that have the poorest juvenile and adult passage performances be given the highest capital construction priorities?

Surface Bypass

1. Are enough different types of surface bypass/collection systems being explored?

2. Should the pace of concept development be accelerated? Do the complex biological and engineering factors involved in design and operation of new structures make acceleration unreasonable?

3. Scope and cost: Although biological and engineering factors vary at each dam, simultaneous development at multiple sites to address these differences requires substantial investment. Should surface bypass prototypes be developed and tested at each mainstem dam?

4. As applied to the federal/Council approach, is it realistic to believe that sufficient biological information on surface bypass will be available by 1999 to justify pursuing this approach for fish passage?

5. Can surface bypass/collector systems be designed to safely dewater large volumes of water and juvenile fish, as well as function effectively in conjunction with existing juvenile fish bypass systems? This issue is critical as to whether surface bypass systems may be used to increase collection of juvenile fish for transportation.

Snake River Drawdowns

1. As applied to the federal/Council approach, is an appropriate amount and quality of information or knowledge being developed to enable an effective, informed decision on lower Snake River configuration by 1999?

Columbia River Drawdowns

1. What is the appropriate scope, schedule, and cost of engineering feasibility studies and biological evaluation efforts for spillway crest or deeper drawdowns?

Juvenile Fish Transportation

1. When will the region make a decision about the future of the transportation program? This ongoing debate continues to affect whether and when needed capital improvements will be made to this program.

2. As applied to the federal/Council approach, what is the biological need, benefit and timing for bringing additional transport capacity on line?

3. As applied to the federal/Council approach, is it realistic to believe that sufficient biological information on the effectiveness of the transportation program, when compared to inriver migration, will be available by 1999 to justify future reliance on this approach for fish passage?

Adult Passage

1. Are appropriate capital construction funds and structural research efforts being directed at improving adult passage conditions through the dams?

Water Temperature

1. What structural measures should be undertaken at mainstem Snake and Columbia river hydroelectric dams to help reduce elevated summer water temperatures?

Background

A Clean Water Act issue that has been identified by CRITFC and EPA is the need for structural water temperature control measures. EPA states that water temperature control is important in several ways: 1) temperature is a critical parameter for coldwater species such as salmon, and elevated water temperatures alone can have both lethal and nonlethal effects; 2) temperature directly affects other critical water quality parameters, including dissolved oxygen, total dissolved gas, and primary production; and 3) temperature can be a good indicator for many key elements in the overall functioning

of healthy aquatic ecosystems, including flows, ground water/surface water connection, floodplain and riparian conditions, and channel morphology.

Stream temperature alteration leads to a series of biological and chemical changes that can affect salmon fitness, including salmon life history patterns, community structure, trophic structure, inter- and intra-specific competitive success, and reproductive success. Ambient temperature ranges considered by EPA to be "properly functioning," "at risk," and "not properly functioning" include 5-15°C, 15-18°C, and greater than 18°C, respectively.

Mainstem Snake and Columbia river temperatures routinely exceed 24°C during summer months. These temperatures lie outside the properly functioning range of Pacific salmon, and therefore may be limiting to salmon recovery. The water quality standard for temperature is 20°C in the mainstems. Both states of Washington and Oregon have designated most of the relevant portions of the mainstem Snake and Columbia rivers as water-quality limited under Section 303(d) of the Clean Water Act due to temperature standard violations.

It is recognized that water temperature control remedies in the mainstem will be challenging, requiring an adaptive approach to address systemwide temperature disturbances. EPA states that addressing mainstem lethal and sublethal temperatures is critical to the survival of salmonids and other temperature-sensitive species. Within the mainstem, elevated surface water temperatures may delay upstream migration, resulting in energy reserve depletion and ultimately reduced reproductive success. In addition, disease susceptibility, species composition, and competitive success of native species may be affected by sublethal temperatures. Both examples of sublethal effects may have adverse impacts on species persistence. The entirety of EPA's informal comments on the mainstem capital construction multi-year work plan are included as Attachment 1.

The tribal salmon restoration plan calls for expedited measures to reduce water temperatures in adult fishways, including pumping cooler water at depth from dam forebays into fish ladders. In addition, the tribal plan calls for installation of low-level regulating outlets to affect water temperature at mainstem storage projects such as those of the Hells Canyon hydroelectric complex operated by Idaho Power Company.