Executive Summary

Introduction

The U.S. Army Corps of Engineers is conducting the Lower Snake River Juvenile Migration Study in response to concerns about the propagation of the Snake River salmon and steelhead. Populations of these anadromous fish continue to decline to the point that one run is listed as endangered and others are listed as threatened under the Endangered Species Acts. One measure for improving juvenile migration is to provide flow augmentation water from the Snake River upstream of Lower Granite Lake to improve streamflows and move juveniles salmon and steelhead more rapidly toward the ocean.

In 1995, Reclamation agreed to provide 427,000 acre-feet of flow augmentation water and has been doing so every year since. The Corps requested that the Bureau of Reclamation analyze the effects of providing a flow augmentation at a level 1,000,000 acre-feet greater than the current level of 427,000 acre-feet. Reclamation developed and analyzed the following scenarios:

- Base Case: Provide 427,000 acre-feet of flow augmentation water each year (existing condition since 1993).

- No Augmentation: Provide no water for flow augmentation (condition prior to 1991).

- 1427i: Provide up to 1,427,000 acre-feet of flow augmentation water to meet deficits in flow targets at Lower Granite Dam. Irrigation shortages would be minimized by using large drawdowns of Reclamation reservoirs.

- 1427r: Provide up to 1,427,000 acre-feet of flow augmentation water to meet deficits in flow targets at Lower Granite Dam. Reservoir elevations would be maintained at or near the Base Case levels with shortages assumed by irrigation.

All larger reservoirs in the Snake River basin upstream of Lower Granite Lake, with the exception of those owned by Idaho Power Company, are owned by Reclamation and operated as part of Federal Reclamation projects. These reservoirs have a total combined capacity of about 7.9 million acre-feet of which 7 million acre-feet are in active space, capable of storing water for irrigation, flood control, and other uses. The remaining capacity is mostly in inactive space needed for reservoir operations. Of the total amount of active space, 6.3 million acre-feet have been contracted to users primarily for irrigation water supply. All active space not under contract, about 690,000 acre-feet, has been assigned to a variety of purposes, primarily related to environmental quality improvement; this amount includes about 159,000 acre-feet of space now assigned to flow augmentation.

Reclamation evaluated other potential water supplies and identified about 293,640 acre-feet in natural flows now used to irrigate about 221,500 acres in five areas in Wyoming, Nevada, Idaho, and Oregon for this analysis. In addition, Reclamation would continue to use the 17,650 acre-feet of natural flows purchased in 1997 as part of the Base Case program of obtaining water supplies for flow augmentation. The total amount of natural flow used in this hydrologic analysis was 311,290 acre-feet. Reclamation did not evaluate the potential for use of storage in non-Reclamation reservoirs, use of groundwater, or development of new storage.

In this analysis the Bureau of Reclamation has attempted to estimate the environmental, economic, social, cultural and recreational effects of acquiring natural flow rights and storage space to provide up to 1,427,000 acre-feet of water for flow augmentation. Due to a limited timeframe, the study does not attempt to address all possible impacts nor does it represent specific outcomes.

Flow Augmentation Scenarios

The 1,427,000-acre-foot scenarios for this analysis are conceptual only. Selection of water sources for flow augmentation has a direct bearing on the type, location, and degree of potential impact on economies, natural resources, and communities. For this analysis, larger blocks of water were identified for acquisition based primarily on water rights, refill of reservoirs, and reduction of potential adverse impacts. Acquisition of water to implement a 1,427,000 acre-foot scenario would likely result in an entirely different mix of water sources based at least in part on economics, Federal-state negotiations, and other factors including the method of acquisition. The effect of such factors on the acquisition of water for flow augmentation is speculative at present. As a result, the reader is cautioned that although potential effects, especially economic effects, have been identified in some detail, the analysis remains conceptual.

Base Case

For this analysis, Reclamation assumed that the pattern of water acquisition for the Base Case would remain unchanged. Water acquisition consists of a small amount of natural flow rights and storage space, reassignment of Reclamation storage space, and annual purchase of rental water. Delivery of the 427,000 acre-feet relies heavily on the annual purchase of water from rental pools in good and normal water years and the use of water in Reclamation inactive space (powerhead space) in drought years. In the past, water from rental pools has made up about 60 percent of the total amount of water delivered for flow augmentation.

No Augmentation

The No Augmentation Scenario assumes operations as they existed before 1991 when no water was released downstream for flow augmentation.

1427i and 1427r Scenarios

The 1427i and 1427r scenarios are identical in goal—to provide up to 1,427,000 acre-feet to help meet target flows at Lower Granite Dam as identified in the 1995 Biological Opinion of the National Marine Fisheries Service on the Federal Columbia River Power System. Both scenarios would include the same amount of water acquired from natural flow rights, but much different amounts of water acquired from Reclamation storage. The two scenarios represent two ends of a possible continuum of ways to reach the flow augmentation goal using Reclamation storage. Under the 1427i scenario, water shortages to users of water from Reclamation reservoirs would be minimized to the extent possible by large drawdown of reservoirs. Under the 1427r scenario, Reclamation reservoirs would be maintained near current water levels but water users who have contracted for Reclamation storage would suffer more serious shortages.

The water supply for the 1427i and 1427r scenario was assumed to include Base Case water supply minus rental pool acquisitions. It is anticipated there would be little or no water consigned to water rental pools due to large purchase of water for the 1427i and 1427r scenarios and resultant water shortages for irrigators.

Natural flow rights were assumed to be available in every year. However, most of the water for flow augmentation would come from acquisition of storage space and reassignment of storage in Reclamation reservoirs. Water that accumulates in this space would vary from year to year.

The amount of water needed for the 1427r scenario would be much larger than the amount needed for the 1427i scenario. Under the 1427i scenario, storage space reassigned or purchased for flow augmentation would be released as needed without concern for reservoir levels. Under the 1427r scenario, maintaining reservoir levels equivalent to the Base Case would require reassignment and purchase of much larger amounts of storage space.

Tables S-1 and S-2 summarize the sources and volumes of water used in the hydrologic analysis. All of the Reclamation water sources consist of storage space in reservoirs located (1) on the main stem of the Snake River, (2) in the Boise River basin, (3) in the Payette River Basin, and (4) on the Owyhee River. As can be seen in tables S-1 and S-2, the largest water source for either scenario is Reclamation storage space. Total storage space needs to be much larger than the volume provided each year because the storage space is not filled each year and about 313,000 acre-feet of space is inactive storage that is used only in emergencies. (Inactive storage space is space needed for operational purposes and is not part of the storage available for contract.)

Table S-1 Water Sources Used for the 1427i Scenario

Location	Volume (Acre-Feet)		
	Base Case	Additional	Total
Natural Flow Rights[1]			
Wyoming	0	27,640	27,640
Nevada	0	21,900	21,900
Idaho (Salmon River basin)	0	87,470	87,470
Idaho (Snake River)	0	134,950	134,950
Oregon	17,650	21,680	39,330
Total	17,650	293,640	311,290
Storage Space in Reclamation Reservoirs[2]			
Upstream of Milner Dam	[3]294,896	821,191	1,116,087
Boise/Payette River basins	[4]176,932	425,000	601,932
Owyhee River basin	0	200,000	200,000
Total storage space	471,828	1,446,191	1,918,019

[1]This amount of water is assumed to be available each year.
[2]The volume of storage space. The amount of water available to that storage space varies from year to year and was determined by hydrologic runs using the 62-year historical period of 1928-1989.
[3]Includes 272,000 acre-feet of inactive space.
[4]Includes 41,000 acre-feet of inactive space.

Table S-2 Water Sources Used for the 1427r Scenario			
Location	Volume (Acre-Feet)		
	Base Case	Additional	Total
Natural Flow Rights[1]			
Wyoming	0	27,640	27,640
Nevada	0	21,900	21,900
Idaho (Salmon River basin)	0	87,470	87,470
Idaho (Snake River)	0	134,950	134,950
Oregon	17,650	21,680	39,330
Total	17,650	293,640	311,290
Storage Space in Reclamation Reservoirs[2]			
Upstream of Milner Dam	[3]294,896	1,818,224	2,113,120
Boise/Payette River basins	[4]176,932	984,000	1,160,932
Owyhee River basin	0	200,000	200,000
Total storage space	471,828	3,002,224	3,474,052

[1]This amount of water is assumed to be available each year.
[2]The volume of storage space. The amount of water available to that storage space varies from year to year and was determined by hydrologic runs using the 62-year historical period of 1928-1989.
[3]Includes 272,000 acre-feet of inactive space.
[4]Includes 41,000 acre-feet of inactive space.

Hydrologic Analysis

Hydrologic analysis for this study is based on computer simulation using MODSIM. MODSIM is a river basin network flow model in which water is allocated consistent with hydrological, physical, and institutional aspects of a river basin. The model includes direct flow rights, instream flow rights, reservoir storage rights, reservoir system operational requirements, and water exchanges and operational priorities. The simulation attempts to work within the parameters of the real operating system.

Hydrologic data provided by the simulation included tables and graphs of end of month contents of reservoirs and average monthly flows for key river reaches over a 62-year period of analysis. The model uses the historical water supply for the period of 1928-1989 as input to determine the effect of the scenarios. Also included in the model are the current system of reservoirs, the 1991 acreage of irrigation, and the current system operation for flood control and refill of reservoirs.

Hydrologic data, primarily in the form of tables of reservoir end of month content and average monthly streamflows, were provided to the technical experts in fields of economics, fish and wildlife, water quality, and recreation.

Flow Augmentation Goals

Based on the hydrologic analysis, the flow augmentation goals would be met to the following extent:

- Base Case 82 percent of years
- 1427i 97 percent of years
- 1427r 100 percent of years

Table S-3 shows that the Base Case would deliver a minimum of 179,000 acre-feet in any year but would deliver 427,000 acre-feet in 51 of 62 years.

Table S-3 Base Case Future Delivery of Augmentation Flows

Volume Delivered	Percentage of Years Met	Number of Years Met
427,000 acre-feet	82	51 of 62
300,000 acre-feet	92	57 of 62
250,000 acre-feet	95	59 of 62
179,000 acre-feet	100	62 of 62

Table S-4 shows that the 1427i scenario would deliver 1,427,000 acre-feet in 38 of 40 years when the deficit at Lower Granite Dam exceeds 1,427,000 acre-feet and would deliver the deficit amount in every year when the deficit was less than 1,427,000 acre-feet.

Table S-4 1427i Future Delivery of Augmentation Flows

Volume Delivered	Percentage of Years Met	Number of Years Met
Lower Granite Dam Flow Deficit exceeds 1,427,000 acre-feet		
1,427,000 acre-feet	95 percent	38 of 40 years
1,200,000 acre-feet	98 percent	39 of 40 years
1,100,000 acre-feet	100 percent	40 of 40 years
Lower Granite Dam Flow Deficit less than 1,427,000 acre-feet		
Amount varies each year	100 percent	22 of 22 years

Table S-5 shows that the 1427r Scenario would deliver 1,427,000 acre-feet in every year that the deficit at Lower Granite Dam would exceed 1,427,000 acre-feet and would deliver the deficit amount in every year when the deficit was less than 1,427,000 acre-feet.

Table S-5 1427r Future Delivery of Augmentation Flows		
Volume Delivered	Percentage of Years Met	Number of Years Met
Lower Granite Dam Flow Deficit exceed 1,427,000 acre-feet		
1,427,000 acre-feet	100 percent	40 of 40 years
Lower Granite Dam Target less than 1,427,000 acre-feet		
Amount varies each year	100 percent	22 of 22 years

Irrigation Shortages

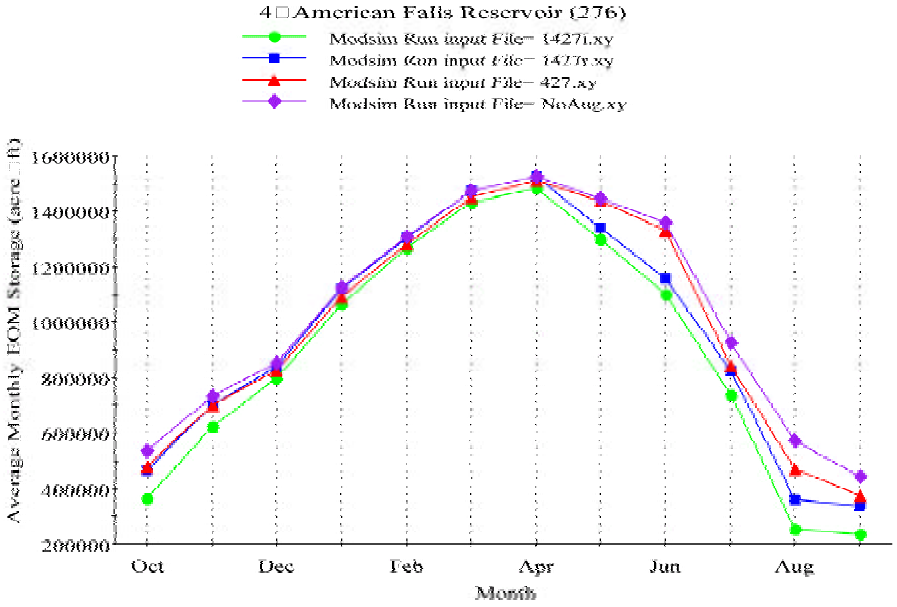
Flow augmentation would reduce the amount of water available for irrigation of lands in Reclamation projects. Based on the hydrologic analysis, tables of irrigation shortages for the average, a dry year, and a wet year were developed. Irrigation shortage is considered to be the difference between the demand for irrigation water and the amount of water available from Reclamation storage. The Base Case and No Augmentation Scenario do not differ significantly and there are shortages even in wet years. Table S-6 summarizes the data.

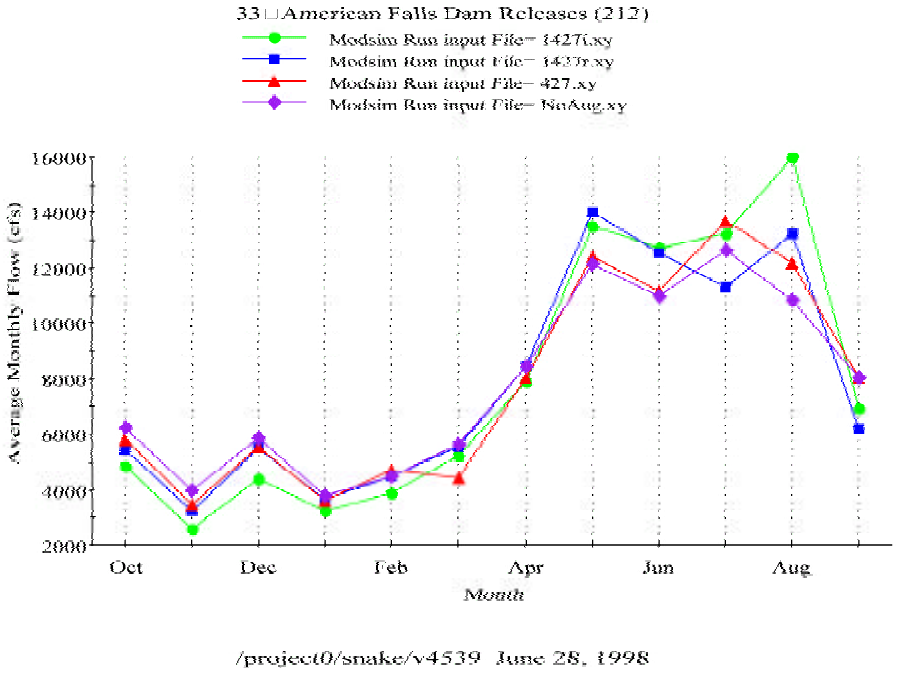
Table S-6 Irrigation Shortages for All Scenarios (Acre-Feet)				
Period	Base Case	No Augmentation	1427i	1427r
Average (1928-1989)	72,216	72,964	187,743	770,746
Dry year (1977)	335,634	444,607	1,043,335	2,201,459
Wet year (l983)	2,261	2,261	3,593	132,633
Average annual diversion is 11,779,498 acre-feet under the Base Case				

Reservoir and Streamflow Effects

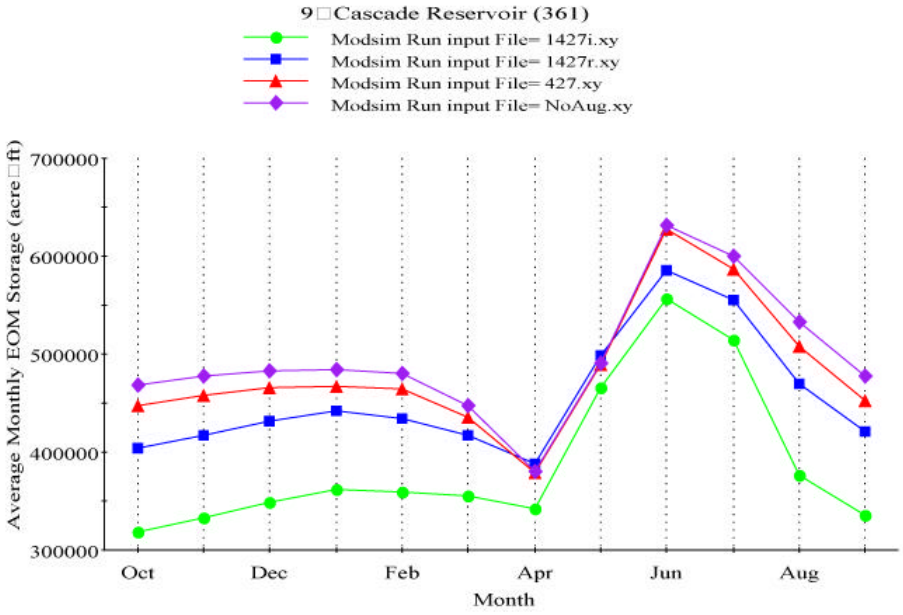
Graphs of the average end-of-month content and average monthly outflow for American Falls and Cascade Reservoirs illustrate the effects of the scenarios. These sites show extreme differences among the scenarios. Other sites show smaller differences among scenarios and some sites show negligible differences when averaged over the 62-year period of analysis. Most reservoirs in some years would be drawn down much further under the 1427i scenario than under the Base Case or the 1427r scenario.

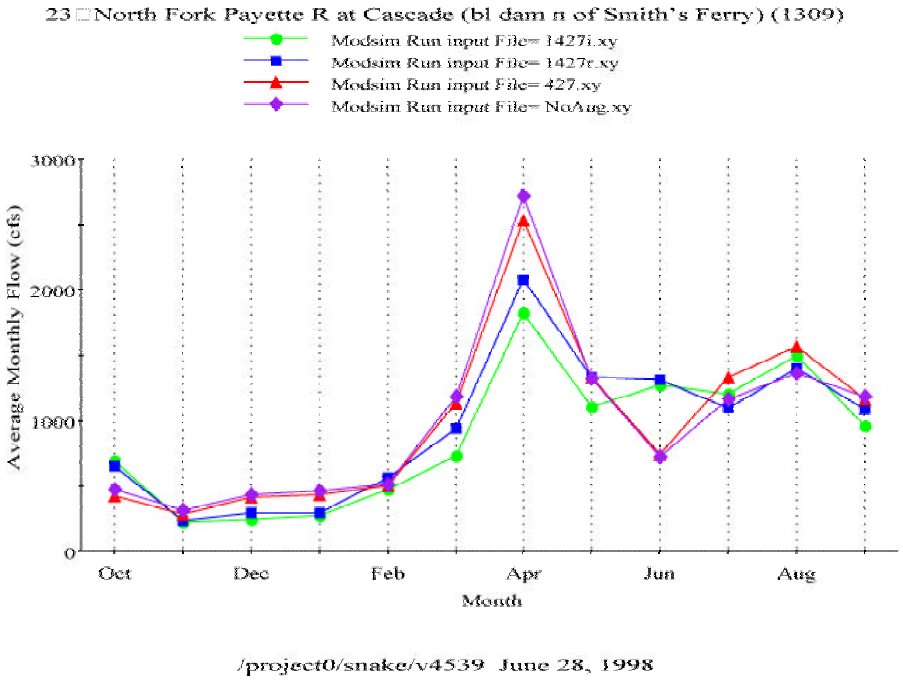
Table 2-7 shows some differences that could be expected with respect to reservoir minimum pools and minimum outflows of selected reservoirs. Target minimum pools at some reservoirs would be maintained about an equal percentage of the years under all scenarios.





American Falls Reservoir Average End of Month Content and Average Monthly Release





Cacades Reservoir Average End of Month Content and Average Monthly Release

Table S-7 Maintenance of Reservoir Target Minimum Pools and Target Minimum Releases (Percent of years over a 62-year period of analysis)				
Reservoir	Base Case	No Augmentation	1427i	1427r
American Falls Reservoir 100,000 acre-feet minimum (in September)	58	66	34	56
Cascade Reservoir 300,000 acre-feet minimum (year-round)	95	95	70	100
American Falls release 300 cfs minimum release at Neeley (November-March)	85	87	82	88
Lucky Peak 80 cfs minimum release (November-February)	80	80	72	85
Owyhee Dam 10 cfs minimum release (October-March)	15	15	10	10

If end-of-month contents are compared over all months for the entire 62-year period of analysis, most reservoirs show a lower average content under the 1427i scenario compared to the Base Case. Average end-of-month content of most reservoirs under the 1427r and No Augmentation scenarios would not be significantly different from the Base Case. Table S-8 summarizes reservoir average content as a percent of the Base Case reservoir content.

Table S-8 Average End-of-Month Reservoir Content Over the 62-year Analysis Period (Percent of the Base Case)				
Reservoir	Base Case	No Augmentation	1427i	1427r
Jackson Lake	100	99	92	98
Palisades Reservoir	100	103	89	102
Island Park Reservoir	100	100	101	101
American Falls Reservoir	100	107	86	97
Lake Walcott	100	100	100	100
Anderson Ranch Reservoir	100	101	88	96
Arrowrock Reservoir	100	102	66	121
Lucky Peak Lake	100	100	87	105
Deadwood Reservoir	100	100	100	100
Cascade Reservoir	100	103	80	96
Owyhee Reservoir	100	98	90	103

Under the 1427i and 1427r scenarios, streamflows downstream of most reservoirs would generally be greater from April through September and less during the fall and winter compared to the Base Case. These effects would be particularly significant immediately downstream from reservoirs that provide a large amount of the flow augmentation water. Streamflows with the No Augmentation scenario would not be significantly different from the Base Case except in the reach immediately downstream from Milner Dam. In this reach, flows would be significantly reduced during the April through September period.

Economic Analysis

National and Regional Perspectives

Changes in agricultural production, hydropower generation, and recreation due to the flow augmentation scenarios would have national and regional economic impacts. National economic impacts were identified for agriculture, hydropower, and recreation; regional impacts were identified only for agriculture and recreation. In general, the No Augmentation scenario was found to be indistinguishable from the Base Case.

The economic analyses measure impacts of the scenarios from (1) the national view which considers the net effects to the nation and (2) the regional perspective which identifies economic gains and losses to specific functional economic regions in the Snake River basin.

Under the national perspective only those gains or losses at the national level are identified. Generally, national effects represent the initial or primary response of a specific resource category (e.g., irrigation, hydropower, recreation) to a change. For example, a scenario showing less water being available to irrigation, may reduce irrigated farm income. This is a negative effect to the national economy. Potential changes in the value of the output of goods and services were estimated for irrigation, hydropower, and recreation.

Under the regional perspective the potential economic consequences of the 1427i and 1427r scenarios on sales, employment, and income for four identified functional economic regions were estimated. These regional impacts represent the change in the economy of a region resulting from a change in the operation of the Snake River basin water supply. For example, a change in the irrigation water supply, in addition to the direct impact to irrigated farming, may also potentially affect those industries or sectors supplying inputs to irrigated farming located within the particular region. Regional impacts also reflect the succeeding rounds of spending by related businesses and households. Because of the nature of what is being measured, regional impacts are not directly additive to the impacts measured from the national perspective. Regional impacts were developed by preparing a regional input-output model (IMPLAN) constructed for four functional economic regions in the Snake River basin.

Results of the economic analysis are summarized in table S-11.

Water Acquisition Costs

In order to meet the flow and volume targets at Lower Granite Dam additional water would be required from the Snake River basin. The analysis assumes that water would be acquired from willing sellers. Accordingly, a comparison of impacts is not complete without acknowledging the budgetary requirements for water acquisition and related transaction costs.

Different methods of estimating the cost are addressed. A low to medium estimate is to base water acquisition cost on recent purchases by Reclamation in the Snake River basin. An escalation component is added using correlative relationships from other water basins in the West, recognizing the relative influence on the market for purchases of this size. Using this method, the annual water acquisition cost could range from $10.4 million to $31.2 million for the 1427i scenario and from $31.1 million to $87.2 million for the 1427r scenario. Using these figures, the lump sum costs (capitalized values) would be $151.3 million to $453.8 million for the 1427i scenario and $452.2 million to $1.3 billion for the 1427r scenario.

In addition to the water acquisition cost, which is income paid to the seller, there are other potential costs associated with implementation, that may be borne by Federal and State governments, and by other entities. These transaction costs may include, but are not limited to: water right identification, contract negotiation costs, legal costs, monitoring, revegetation costs for lands taken out of production, in lieu O&M costs to irrigation districts and property taxes, weed and erosion control, environmental compliance costs, and potential mitigation costs.

Transaction costs were estimated as annual costs and are projected to range from $2.4 million to $4.8 million for the 1427i scenario and from $7.3 million to $14.7 million for the 1427r scenario.

Resource Analysis

Water Quality

Water quality changes overall would not be dramatic. However, the 1427i scenario would adversely affect water quality in American Falls Reservoir and Cascade Reservoir. Riverflows downstream of reservoirs that provide flow augmentation water would increase during the summer flow augmentation period but would decrease relative to the Base Case during the winter. The latter is particularly true with the 1427i scenario. Water quality of reservoirs is closely linked to content. In general, the higher the content, the better the water quality and the less chance of sluicing sediments downstream (see table S-8).

Fish

Releases of flow augmentation water would decrease reservoir carryover and reduce annual minimum pools in some years. Reduced pools could lead to increased fish emigration at American Falls and Palisades Reservoirs. Reduced pools and increased fluctuations would reduce total available habitat and fish productivity in affected reservoirs. The effect of the 1427i and 1427r scenarios compared to the Base Case would vary from stream reach to stream reach and from reservoir to reservoir. In general, the 1427i scenario would result in adverse conditions for most reservoirs and river reaches compared to the Base Case and the 1427r scenario. In contrast, the 1427r scenario would result in improved conditions in some reaches or in some reaches at some times compared to the Base Case. Whether these changes would result in any significant change in fish populations is unclear.

Wildlife and Vegetation, Including Wetlands and Riparian Habitat

The No Augmentation scenario would have little effect on the wildlife, vegetation, or wetland communities of the affected area as compared to the Base Case. The 1427i and 1427r scenarios may result in improved streamside wetland and riparian habitat vigor due to improved downstream flows. Both scenarios would result in significant reductions of irrigated crops and increase in fallow lands and/or dry land crops and vegetation, with 1427r having the greatest effect--especially in the middle Snake River area. There would be significant reductions in reservoir levels and carryover under the 1427i scenario,

adversely affecting reservoir shoreline wetlands and riparian communities. More mudflats, used as feeding habitat by some animals, would be exposed.

Threatened and Endangered Species

The area for this analysis of flow augmentation options is the home or within the migration pattern of a wide variety of species listed under the Endangered Species Act. Species that could potentially be affected by one or more of the flow augmentation scenarios were identified and considered for evaluation. These species are listed in table S-9.

Table S-9 Endangered Species Act Federally Listed Species Found Within the Area and Considered in this Analysis

Common Name[1]	Scientific Name	Major Streams and Reservoirs Where Present
Federally Listed Endangered Species		
1 - American peregrine falcon	*Falco peregrinus anatum* and *Falco peregrinus tundrius*	Main stem and Henrys Fork including associated reservoirs, Lake Owyhee and downstream, Boise River and Payette Rivers including associated reservoirs.
2 - Snake River sockeye salmon	*Oncorhynchus nerka*	Lower Snake River downstream of Hells Canyon Dam; critical habitat designation, Salmon River
3 - Idaho springsnail	*Pyrgulopsis idahoensis*	Middle Snake River (Bancroft Springs to downstream of C.J. Strike Dam)
3 - Snake River physa	*Physa natricina*	Upper Snake River and middle Snake River (Jackson Bridge to Bancroft Springs)
3 - Utah valvata snail	*Valvata utahensis*	Upper Snake River and middle Snake River (from American Falls Dam to upstream of Lower Salmon Falls Dam)
Federally Listed Threatened Species		
1 - Bald Eagle	*Haliaeetus leucocephalus*	Main stem and Henrys Fork to Brownlee Dam including associated reservoirs; Ririe Lake/Willow Creek; Boise and Payette Rivers and associated reservoirs.
2 - Snake River spring/summer chinook salmon	*Oncorhynchus tshawytscha*	Lower Snake River (downstream of Hells Canyon Dam); critical habitat designation; Grande Ronde River, Salmon River
2 - Snake River fall chinook salmon	*Oncorhynchus tshawytscha*	Lower Snake River (downstream of Hells Canyon Dam); critical habitat designation, Clearwater River
2 - Snake River steelhead trout	*Oncorhynchus mykiss*	Lower Snake River (downstream of Hells Canyon Dam); Sweetwater Creek, Clearwater River
3 - Bliss Rapids snail	*Taylorconcha serpenticola*	Middle Snake River (Thousand Springs to King Hill/Clover Creek)
4 - Ute ladies' tresses	*Spiranthes diluvialis*	South Fork Snake River
2 - Bull trout	*Salvelinus confluentus*	Boise River; Payette River; Malheur River

[1] The numerical designations indicate: 1 - Birds; 2 - Fish; 3 - Invertebrates; 4 - Plants

Salmon and steelhead species were not evaluated as hydrologic modeling did not include modeling the basin downstream of Hells Canyon Dam where these species are located. In addition, overall analysis of effects on salmon and steelhead is within the purview of the Corps analysis. Nonetheless, the Base Case and No Augmentation would have no effect on the flows of the Grande Ronde and Salmon Rivers. The 1427i and 1427r scenarios would likely increase spring and summer flows and improve habitat for salmon and steelhead in those streams.

The 1427i and 1427r scenarios are not likely to affect or adversely affect any of the species listed in table S-9 with the exception of aquatic snails. Aquatic snails would not be affected or adversely affected upstream of Hagerman. Downstream of Hagerman, flows during August under the 1427i and 1427r scenarios would be rated as somewhat adverse for snails because the increase in flows under these scenarios would create temporary habitat which would later be dewatered possibly stranding snails. Flows downstream of C.J. Strike Dam would likely be adverse to snails under the 1427i and 1427r scenarios during the month of August due to oscillations in flow releases.

Cultural Resources

Cultural resources is a broad term that includes prehistoric, historic, architectural, and traditional cultural properties. It includes such things as archaeological sites, districts, buildings, structures, and objects; standing historic structures or objects; locations of important historic events; and places or resources that are important to the cultural practices and beliefs of a living community. The National Register lists Traditional Cultural Property that is associated with cultural practices or beliefs of a living community that are rooted in that community's history and are important to maintaining the continued cultural and traditional religious identity of that community. Some archaeological sites qualify as traditional cultural properties. Indian Trust Assets are also included in cultural resources but are discussed separately in the Indian Trust Assets section.

Cultural resources at reservoirs are currently affected by changing water levels which cause wave action, inundation, and possible exposure of archeological deposits. These effects tend to be cumulative, may occur under the Base Case, and would tend to increase under the 1427i and 1427r scenarios. Under the 1427i scenario reservoirs would be drawn down more often and for longer periods and would also negatively affect Traditional Cultural Properties by desiccating wetland plants for longer period and reducing the availability of these resources. These effects under the 1427i scenario would be greater than under the Base Case. In contrast, the effects of the 1427r scenario on Traditional Cultural Properties at reservoirs would not be significantly different from the Base Case.

Increased flow velocities downstream of reservoirs that provide flow augmentation water for the 1427i and 1427r scenarios may affect cultural resources but the effect would likely be negligible.

Indian Trust Assets

The United States, with the Secretary of the Interior as the trustee, holds many assets in trust for Indian tribes and individuals and has a responsibility to protect and maintain rights reserved or granted by treaties, statutes, and executive orders. This trust responsibility requires that all Federal agencies, including Reclamation, take all actions reasonably necessary to protect trust assets.

The Department of the Interior defines Indian trust assets as legal interests in property held in trust by the United States for Indian tribes or individuals. Examples of trust assets are lands, minerals, hunting and fishing rights, and water rights. Reclamation operations can affect these trust assets in river corridors and reservoirs. Effects can extend beyond the river corridor to Federal lands where some tribes hold off-reservation treaty rights.

The Snake River basin upstream of Lower Granite Lake includes aboriginal areas of the following:

- Nez Perce Tribe (the Nez Perce Indian Reservation is in the Clearwater drainage which is not included in this analysis).
- Confederated Tribes of the Umatilla Reservation of Oregon (the Umatilla Indian Reservation is in the Umatilla River Drainage which is not included in this analysis).
- Shoshone-Bannock Tribes of the Fort Hall Indian Reservation in eastern Idaho.
- Northwestern Band of the Shoshoni Indians of Utah (there is no reservation to be included).
- Shoshone-Paiute Tribes of the Duck Valley Indian Reservation in southern Idaho and northern Nevada.
- Burns-Paiute Tribes (the Burns-Paiute Indian Reservation near Burns, Oregon is not in the Snake River drainage and not included in this analysis)

Salmon and steelhead populations, a portion of which are Indian trust assets, are not addressed in this analysis. Identifying overall effects on these resources is within the purview of the overall Corps study and will be addressed by the Corps.

In the Snake River basin upstream of Milner Dam, there could be some beneficial and some adverse effects on resident fish, wildlife, and vegetation due to the 1427i and 1427r scenarios. Overall, it is projected that there would be no net effect. The 1427i and 1427r scenarios are not likely to affect Indian trust assets downstream of Milner Dam.

Recreation

The Snake River basin contains some of the most important and highly valued recreation resources in the Pacific Northwest; some of these resources have national prominence. Some river reaches and reservoirs are located within or near national parks, national forests, state parks, and local parks. Recreation resources afford a wide spectrum of recreation opportunities which have added to the quality of life and formed an important component of the regional economy. In addition, there are specially designated recreation areas, wildlife refuges, and trophy fisheries. Water resources are a recreation magnet in this arid region.

Time constraints of this analysis made it necessary to limit the analysis to 11 representative Reclamation reservoirs and river reaches downstream of those reservoirs. Other reservoirs and river reaches affected by flow augmentation operations could be expected to experience similar effects. C.J. Strike and Brownlee Reservoirs are important sites for recreation on the main stem Snake River but were not evaluated due to a lack of readily available data. It can be assumed that recreation at these reservoirs would be affected by flow augmentation but neither a quantitative nor qualitative analysis was possible without additional data.

The analysis of possible effects on recreation focused on visitation as the marker of changes in recreation. Furthermore, it was assumed that most recreation occurs during the 5-month period of May through September and that most visits at reservoirs are water-dependent or water-related. Major water related activities include boating, fishing, camping, viewing, and day use including picnicking and swimming. Boat ramp access and the ability to boat and fish were major factors used in determining potential changes in recreation visitation at reservoirs and stream reaches.

The hydrologic model of the No Augmentation scenario indicates minimal differences in storage at a few reservoirs in the basin from the Base Case scenario. Therefore, recreation visitation at these reservoirs would not likely change from the Base Case scenario; an analysis of the No Augmentation scenario was not made.

Loss of recreation would be far more widespread and greater in depth with the 1427i scenario than with the 1427r scenario. Recreation losses would be greater for the Boise River reach below Boise River Diversion Dam than for any other site. Other sites with a loss greater than 20 percent include American Falls Reservoir, Cascade Reservoir, and Lucky Peak Lake. Overall, recreation loss would be greater with the 1427i scenario than with the 1427r scenario at all but two sites. Table S-10 summarizes the percent of recreation use projected with the 1427i and 1427r scenario compared to the Base Case

Table S-10 Summary of Potential Summer Recreation Visitation (Percent Compared to Base Case)

Area	1427i	1427r
Jackson Lake	99	100
Palisades Reservoir	89	100
American Falls Reservoir	77	92
Lucky Peak Lake	80	100
Cascade Reservoir	75	93
Lake Owyhee	89	92
Snake River downstream of Jackson Lake Dam	86	94
Snake River downstream of Palisades Dam	94	100
Boise River downstream of Boise River Diversion Dam	25	18
NF Payette River downstream of Cascade Dam	96	99
Payette River downstream of Banks	100	100

Wild and Scenic Rivers

There are numerous river reaches listed under the Wild and Scenic Rivers Act of 1968 that could potentially be affected by the flow augmentation scenarios. These include two reaches of the Snake River main stem, several stream reaches in the Owyhee River basin, several stream reaches in the Salmon River basin and several segments of the Grande Ronde River.

In addition to listed reaches there are numerous other reaches of the Snake, Bruneau, and Owyhee River that have been identified for potential addition to the National Wild and Scenic Rivers system.

The flow augmentation scenarios would increase flows during the summer months and decrease flows during the winter months. The No Augmentation scenario would have the opposite effect but would generally not be significantly different from the Base Case. Although a definitive analysis was not made, it is clear that the flow augmentation scenarios would have little or no effect on the status of river segments currently included in the National Wild and Scenic Rivers system.

Social Analysis

The focus of the social analysis was potential irrigation and recreation related impacts on (1) those who live in irrigation service areas and (2) those who use reservoirs and rivers for recreation purposes.

Eight irrigation service areas were identified based on irrigation water supplies that could be impacted by one or more of the flow augmentation scenarios. Three of the irrigation service areas receive water from Reclamation reservoirs and five irrigation service areas use natural streamflows for irrigation.
Loss of storage water in the three Reclamation irrigation service areas would result in a varying amount of irrigated acreage from year to year depending on the annual runoff. In the five natural flow irrigation service areas, a specific acreage of irrigation would be eliminated in each and every year. As a result, the effects would be different for communities associated with the Reclamation service areas as compared to communities associated with the natural flow areas.

As indicated earlier, Reclamation identified 11 reservoirs and river reaches for the analysis of potential effects of the flow augmentation scenarios on recreation.

Given the magnitude of the Snake River basin and the conceptual level of the scenarios, case studies were made of two irrigation service areas and two recreation areas. Under this approach, hydrology, economic, and other data were collected on the 1427i and 1427r scenarios and used in discussions with a limited number of knowledgeable persons in the case study areas. These discussions helped identify potential impacts to communities, families, and individuals. Discussions were also held with a few individuals in each irrigation service area to help identify unique conditions and impacts that might be potentially more significant to specific irrigation service areas.

There would be no difference between the 1427i and 1427r scenarios in the natural flow service areas because the curtailment of irrigation would be the same under both scenarios. The effects on communities, families, and individuals could be significant in these natural flow areas because many of the communities are isolated, rural or highly dependent on irrigated agriculture (low economic diversity). Loss of jobs, income, and sales would not easily be absorbed by these communities. Overall social well being of these communities would decline.

In contrast, the Reclamation Service areas would be adversely affect much more by the 1427r scenario compared to the 1427i scenario. Rural communities associated with the Reclamation Service areas and those with low economic diversity would be adversely affected by the 1427i and 1427r scenarios. Communities with little rural character and considerable economic diversity would be least affected.

Implementation Concerns and Issues

The possibility of acquiring sufficient natural flow rights and storage space to provide an additional 1 million acre-feet from the upper Snake River basin to augment flows for salmon migration creates a number of concerns for the residents of the area, the states, tribes, and the Federal Government. The current augmentation program, which provides only 427,000 acre-feet, has not been without its share of problems or controversy.

Irrigators, hydropower producers and consumers, reservoir boaters, river floaters, reservoir and river anglers, campers, and others compete for a limited resource, and each group desires water for their specific objectives. Population growth in a number of communities in or near the basin has resulted in additional demands on the limited water supply. It follows that any operational change of the river and reservoir system that may reallocate water downstream would unite local interests in strong opposition.

It would be impossible to provide an additional 1 million acre-feet for flow augmentation without significant impact to natural resources, recreation, and economic sectors. The Federal Government does not have exclusive control over such a vast amount of storage space in the Snake River basin as would be needed to provide the additional water. Therefore, any program that requires the acquisition of large amounts of water would necessitate the reallocation of existing water rights and/or contract entitlements held by irrigation entities in Idaho and Oregon and, possibly, in Wyoming and Nevada.

Each state has laws that regulate the acquisition and utilization of water and the issuance of water rights. These laws vary from state to state, but generally limit the use of water according to their individual definition of beneficial use. Under state law, any variance in water use from the terms identified in the water right generally requires authorization by the state through an approval of a transfer of water right.

In Idaho, transfers involving more than 50 cfs or more than 5,000 acre-feet must be explicitly approved by the state legislature. Reclamation's effort to secure the present flow augmentation amount of 427,000 acre-feet has been a difficult, and often arduous, undertaking.

Discussions with governmental and water user interests in Idaho, Nevada, and Wyoming indicate that a call for 1,427,000 acre-feet would not be acceptable under any circumstances and would be vehemently opposed. Oregon water officials have never expressed an opinion.

There are two possible actions that could be used to carry out a flow augmentation program, administrative action and legislative action. Typically, administrative action involves utilizing existing authority to appropriate water for flow augmentation. Conversely, legislative action would require the Congress to clarify, authorize, and fund a water acquisition effort.

The acquisition of storage space sufficient to provide 1,427,000 acre-feet of water for flow augmentation would impose significant impacts on Reclamation projects; financial impacts to the local area, and Federal budget impacts. The magnitude of the potential impacts argues, for pragmatic if not legal reasons, that a legislative approach that includes Congressional authorization would be necessary.

The legislative approach used in the analysis is the willing buyer/willing seller option. Other possible choices include prior or superior claims and taking. However, these choice appear to carry a high social and political price. The options are discussed below.

Prior or Superior Claims

This option would invoke the "prior or superior claims" provisions of Reclamation repayment contracts and reallocate stored water for flow augmentation with no reimbursement to project beneficiaries for their loss of stored water. Most, if not all, water user repayment contracts in the basin contain a clause that exempts the United States from liability in the event of a shortage of water. One of the causes of shortage is listed as "prior or superior claims." If the prior or superior claims clause were invoked, and sustained by the courts in the inevitable legal challenges that would arise, water would be released from Reclamation project reservoirs on the basis that the Endangered Species Act need constitutes a superior claim. Using this approach, the United States would not be liable for monetary damages associated with the water released.

Although this option could be implemented relatively quickly, the actual release of water could be delayed an indefinite period of time due to probable litigation. This option would have severe political implications. If flow augmentation were attempted through this approach, affected water users would likely fight the release of water by every legal means possible. The extreme degree of contention that would result from this approach is difficult to describe.

Taking

Under this option, Reclamation would release stored water on the basis that it constitutes a taking, for which compensation (lost income) must be paid. Congress might direct Reclamation to release contracted water for flow augmentation, subject to claims for damages. The water users would seek to enjoin Reclamation from releasing water until the matter was resolved.

Like the prior or superior claims option, this approach could be implemented relatively quickly. Also similarly, this approach could generate unfavorable political fallout and would likely become involved in the courts.

Willing Buyer/Willing Seller

Under this option a willing buyer/willing seller program would be instituted. The current flow augmentation program acquires water through the willing buyer/willing seller approach.

Though local opposition may occur, this option appears to be the most benign from a social/political perspective. Other advantages include the possibility of targeting certain water supplies (i.e., natural flows, non-Federal storage, diversions in the salmon corridor, etc.).

However, disadvantages to the willing buyer/willing seller approach have been identified. The amount of time necessary to purchase the required water rights and ultimately implement this option would be extreme. It would take several years to obtain the natural flow rights and storage space sufficient to provide an additional volume of water as large as 1,000,000 acre-feet. In addition, experience has demonstrated that when massive volumes of a resource are sought in the open market, the prices rise rapidly and dramatically.

Moreover, no long-term, willing-seller water acquisition has occurred in the Western States at a magnitude comparable to what is being examined in this study. The logistics and cost of negotiating acquisition contracts at this scale would have to be addressed prior to implementation.

It is apparent that the 1427i and 1427r scenarios, if implemented, could require an extensive amount of time, labor, and funding. In addition, each option appears to have a number of factors that could detract from its overall effectiveness in providing flow augmentation. Consequently, any option selected would likely require considerable monitoring and oversight.

Conclusions

It is important to recognize that the 1,427,000 acre-foot scenarios for this analysis are only conceptual, and therefore, the analysis is conceptual. In some cases, due to a lack of empirical data, estimations and assumptions were used in developing modeling simulations. The model results cannot precisely depict all future operations and circumstances. The implementation of an additional 1 million acre-feet of flow augmentation would, most certainly, have an affect that reaches far beyond the scope of this theoretical analysis.

However, it should be noted that this analysis did reveal some fundamental certainties:

- There are no new undiscovered or unallocated sources of water available to provide an additional 1 million acre-feet of flow augmentation.
- Reclamation does not have sufficient storage space to provide a large amount of water for flow augmentation without significant impacts to natural resources, recreation, and economic sectors.
- The acquisition of additional water to provide a total of 1,427,000 acre-feet would require the reallocation of existing water rights and/or contract entitlements.
- Reclamation could not meet present obligations to project beneficiaries if it were required to provide an additional 1 million acre-feet for flow augmentation.
- It would take several years to obtain the necessary water using the willing buyer/willing seller method.
- Any water acquired upstream would need protection from hostile diversion in all states through which the water passes.
- Affected water users would strenuously oppose and resist a call for 1,427,000 acre-feet of flow augmentation.
- Reclamation could not guarantee that 1,427,000 acre-feet would be provided for flow augmentation every year.
- The cost of acquiring natural flow rights and storage space to provide 1,427,000 acre-feet of flow augmentation would be substantial and would have substantial budget effects for the implementing agency.

Table S-11 summarizes the findings of the flow augmentation analysis.

Table S-11 Summary of Findings on Flow Augmentation

Item	Base Case	No Augmentation	1427i	1427r
Water Sources				
Natural flow purchases (acre-feet)	17,650	0	311,290	311,290
Annual rental pool purchases -- average (acre-feet)	250,000	0	0	0
Reservoir reassigned space (acre-feet)	98,554	0	323,554	323,554
Reservoir purchased space (acre-feet)	60,274	0	1,260,274	3,260,274
Inactive space (powerhead) (acre-feet)	313,000	0	313,000	313,000
Goal Achievement				
Years achieved (years of 62-year period of analysis)	51 of 62 (82 percent)	Not applicable	60 of 62 (97 percent)	62 of 62 (100 percent)
Reservoirs				
Average end-of-month content (62-year period)	No change	Negligible change	Would vary from 66 percent to 101 percent of the Base Case	Would vary from 96 percent to 105 percent of Base Case
Maintain or exceed recommended minimum content	No change	Negligible change	Less often maintained at most reservoirs	Negligible change
Streamflows				
April-September	No change	Negligible change except a significant decrease downstream of Milner Dam	Increased flows in most reaches downstream of reservoirs that provide flow augmentation water	Increased flows in most reaches downstream of reservoirs that provide flow augmentation water
October-March	No change	Negligible change	Decreased flows	Decreased flows
National Economic Effects--Agriculture				

Table S-11 Summary of Findings on Flow Augmentation				
Item	**Base Case**	**No Augmentation**	**1427i**	**1427r**
Decrease in irrigated acres in average water-year	[1]0	0	243,000	360,000
Decrease in irrigated acres in dry water-year	([2])	([2])	376,000	643,000
Decrease in value of production in average water-year	[3]0	0	$90,204,000	$136,433,000
Decrease in value of production in dry water-year	([2])	([2])	$141,202,000	$243,737,000
Loss of proprietors income and other property income (annual)	0	0	$46,691,000	$81,357,000
Water acquisition cost (annual) Low estimate High estimate	0	0	 $10,414,000 $31,243,000	 $31,128,000 $87,157,000
[1]Base Case average irrigated acreage is 3,364,000 acres [2]Not estimated [3]Base Case average value of production is $2,019,934,000				
National Economics Effects–Hydropower				
Average annual generation of 20 powerplants (MWh)	4,745,253	4,748,269	4,649,455	4,827,067
Change in annual value (1998 dollars, 7.125 percent discount rate)	0	0	-$2,715,000	$1,876,000
National Economic Effects–Recreation (11 Selected Sites)				
Loss in recreation visitation (annual)	0	0	504,000	212,000
Loss in recreation value (annual)	0	0	$13,664,000	$4,069,000

Table S-11 Summary of Findings on Flow Augmentation

Item	Base Case	No Augmentation	1427i	1427r
Regional Economic Effects–Agriculture				
Employment–jobs lost (annual)	[1]0	0	2,543	3,612
Income lost (annual)	[2]0	0	$44,700,000	$51,976,000
Sales lost (annual)	[3]0	0	$95,200,000	$130,400,000
[1]Base Case regional jobs total 658,543 [2]Base Case regional income totals $23,310,023,000 [3]Base Case regional sales total $46,777,512,000				
Regional Economic Effects–Recreation (11 Selected Sites)				
Visitation lost (annual)	[1]0	0	43,453	14,021
Expenditures lost (annual)	[2]0	0	$1,014,000	$322,000
[1]Base Case visitation is 2,961,640. [2]Base Case expenditures not estimated.				
Water Quality Changes				
Overall basin change	None	None	Slight improvement	Improvement
Jackson Lake to American Falls Reservoir	None	Insignificant improvement	Slightly decrease in quality	No significant change
American Falls Reservoir and downstream	None	Slight improvement	Slight increase in sediment discharge	
Lake Walcott	None	Negligible change	Negligible change	Negligible change
Milner Dam to King Hill	None	Slightly decreased quality during summer	Improved quality in summer, improved flows would tend to move sediment downstream	Improved quality in summer, improved flows would tend to move sediment downstream

Table S-11 Summary of Findings on Flow Augmentation

Item	Base Case	No Augmentation	1427i	1427r
Boise River basin	None	None	Slightly decrease in quality during the winter	Slight improvement in quality
Cascade Reservoir	None	Slight improvement	Decreased quality year-round	Improved quality during the winter, decreased quality at other times
Lake Owyhee	None	None	Slight improvement	
Salmon and Grande Ronde River basins	None	None	Possible improvement	
Fish–Change in Quality or Amount of Habitat				
Snake River and reservoirs upstream of Milner Dam	None	Negligible change to slight improvement	Slightly adverse	Negligible change to slight improvement
Snake River from Milner to Buhl	None	Slight improvement	Slightly adverse	Slight improvement
Boise River basin	None	Negligible change to slight improvement	Slightly adverse	Negligible change to slight improvement
Cascade Reservoir	None	Improvement	Adverse	Slightly adverse
Payette River basin (other than Cascade Reservoir)	None	Negligible change	Negligible change	Negligible change
Grande Ronde and Salmon Rivers	None	None	Slight improvement	Slight improvement
Wildlife and Vegetation Including Wetlands and Riparian Areas				
Streamside	None	None	Improvement	Improvement
Reservoirs	None	None	Adverse	Net effect could be negligible
Irrigated crops areas	None	None	Adverse	Very adverse

Table S-11 Summary of Findings on Flow Augmentation				
Item	**Base Case**	**No Augmentation**	**1427i**	**1427r**
Threatened and Endangered Species–Change in Habitat				
American Peregrine Falcon	No effect			
Salmon and steelhead	Not analyzed, there are no salmon and steelhead upstream of Hells Canyon Dam. Effect in Grande Ronde and Salmon River not analyzed.			
Aquatic Snails				
General	None	Slight improvement	Slightly adverse	
Lake Walcott	None	Negligible change	Negligible change	
Downstream of Milner Dam	None	Slight improvement	None	
At Hagerman	None	Negligible change	Adverse during August, negligible change in other months	
C.J. Strike Dam releases	None	Negligible change	Adverse August-September, negligible change in other months	
Bald Eagle				
Reservoir habitat	None	Slight decrease	Decrease	Slight decrease
River reach habitat	None	None	None	None
Population change	None	None likely	None likely	None likely
Ute Ladies' Tresses	None	None	Slightly adverse near Heise	
Bull Trout	No effect	Negligible effect	Negligible effect to a slight improvement	
Cultural Resources–Change in Condition from Base Case				
Reservoir areas	None	Negligible change	Slightly adverse	Negligible change
Stream areas	None	Negligible change	Negligible change	Negligible change
Indian Trust Assets	No change	Negligible change	Negligible change	Negligible change

Table S-11 Summary of Findings on Flow Augmentation				
Item	**Base Case**	**No Augmentation**	**1427i**	**1427r**
Recreation–Percent Loss of Summertime Visitation – 11 Sites Evaluated				
Jackson Lake	None	None	1	None
Palisades Reservoir	None	None	11	None
American Falls Reservoir	None	None	13	8
Lucky Peak Lake	None	None	20	None
Cascade Reservoir	None	None	25	7
Lake Owyhee	None	None	11	8
Snake River downstream of Jackson Lake Dam	None	None	14	6
Snake River downstream of Palisades Dam	None	None	6	None
Boise River downstream of Boise River Diversion Dam	None	None	75	82
N.F. Payette River downstream of Cascade Dam	None	None	4	1
Payette River downstream of Banks	None	None	None	None

Table S-11 Summary of Findings on Flow Augmentation				
Item	**Base Case**	**No Augmentation**	**1427i**	**1427r**
Wild and Scenic Rivers	No change	No change	No change	No change
Social Effects				
Reclamation irrigation service areas	No change	No change	Changes would be minor	Agricultural businesses would decline, rural communities would become less viable due to changes in tax base and services, demographic changes could be significant as younger population moves away, rural character of communities could change, quality of life would significantly decrease in some areas.
Natural flow irrigation service areas	None	None	A significant number of jobs in local areas would be lost, agricultural businesses would decline and some would close (remote areas would be affect the most), rural communities would become	

Table S-11 Summary of Findings on Flow Augmentation				
Item	**Base Case**	**No Augmentation**	**1427i**	**1427r**
			less viable due to changes in tax base and services, demographic changes would be most areas would lose population, the quality and character of rural communities would be irreversibly changed, family stability, security, and functionality would be adversely affected.	
Social Justice	No change	No change	Minorities and low income populations would be adversely affected the most due to a change in economic conditions. Workers not associated with agriculture or agriculture support industries would not likely be affected.	