Draft Yakima River Basin Water Enhancement Project (YRBWEP) Workgroup
Agreement to Support Final Integrated Water Resource Management Plan and Related Future Activities

1.0 Action

The Workgroup supports an Integrated Water Resource Management Plan for the Yakima Basin. The Integrated Plan includes the seven elements: reservoir fish passage, structural/operational changes, surface storage, groundwater storage, fish habitat enhancements, enhanced water conservation, and market based reallocation of water resources and the actions described below.

By approving this decision document the Workgroup also supports Integrated Plan implementation. Non-federal organizations represented on the Workgroup will collaboratively work together to support the Integrated Plan as it moves forward through legislative processes. The entire Workgroup will support National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA) reviews, permitting and mitigation for actions in the Integrated Plan.

To support, the Workgroup will organize an Implementing Subcommittee comprised of tribal, state, and local entity representatives to oversee efforts to seek authorization and funding. The Implementing Subcommittee will report progress back to the Workgroup. The Workgroup will meet periodically to review progress on plan implementation.

2.0 Background

The Yakima River Basin Water Enhancement Project (YRBWEP) Workgroup has been working for nearly 18 months on a Yakima Basin Integrated Water Resource Management Plan (Integrated Plan) to restore fisheries and improve water supply in the Yakima basin.

The Workgroup, convened in June 2009 by the Bureau of Reclamation (Reclamation) and Washington State Department of Ecology (Ecology), developed a preliminary Integrated Plan (December 2009) comprised of seven elements and agreed to move these forward for further evaluation in 2010. These seven elements were identified in the 2009 Ecology Final Environmental Impact Statement for the Yakima River Basin Integrated Water Resource Management Plan.

Actions within these seven elements have been evaluated and characterized in greater detail in 2010 through the Yakima River Basin Study. Summary results from the basin study are

provided in this document, including the elements and actions the Workgroup is approving for inclusion in the Final Integrated Plan. More detailed information will be provided in the Integrated Plan. Workgroup members will have the opportunity to review and comment on the draft Integrated Plan in early 2011.

The Workgroup identified the following key concepts for promoting the Integrated Plan:

- Include benefits for all involved interests.
- Be composed of a package of complementary projects drawn from all seven elements, that in combination provide water supply, flow and habitat benefits.
- Be adaptable and flexible to accommodate anticipated trends, such as increasing drought, climate change and population growth, as well as unanticipated events.
- Maximize benefits from in-basin supply opportunities first, and seek out of basin supply if triggered by rolling needs review.

3.0 Integrated Plan Elements and Actions

The YRBWEP Workgroup finds that the elements and actions listed below should be included in the Final Integrated Water Resource Management Plan.

3.1 Fish Passage

Restore anadromous salmonid access to habitat above the five existing large storage reservoirs and provide upstream and downstream passage for bull trout and other resident fish. For Clear Lake dam and Box Canyon Creek provide upstream passage for bull trout. For Cle Elum and Bumping, install upstream and downstream fish passage. Install upstream and downstream fish passage at Tieton, Keechelus, and Kachess dams based upon evaluation studies. Passage would be constrained by the following:

- There would be no changes to current operations (i.e., quantity and timing of flow releases), but the flow pathway(s) could change to accommodate operation of the new fish passage facilities
- There would be in "total water supply available" (TWSA)

Providing for unimpeded fish migration past the existing storage dams in the Yakima basin would increase species distribution, allow for the reintroduction of extirpated sockeye runs, and allow expanded migrations and genetic interchange for listed bull trout and other native fish.

3.2 Structural and Operational Changes

3.2.1 Cle Elum Dam (Pool Raise)

The proposed Cle Elum Pool Raise project (Pool Raise) consists of raising the maximum water level of Cle Elum Lake 3 feet from a current maximum elevation of 2,240 feet to 2,243 feet. The Pool Raise would increase the volume of available storage in Cle Elum Lake by approximately 14,600 acre-feet. Modifications would include shoreline protection, radial gate improvements, and mitigation of upstream inundation and recreation.

3.2.2 Kittitas Reclamation District (KRD) Canal Modifications

The proposed KRD Main Canal and South Branch Canal Modifications project (KRD Modifications) would improve KRD laterals along those canals designed to reduce seepage losses, [redacted] would be used to enhance instream flows in tributaries to the Yakima River, including Taneum Creek, Manastash Creek, Big Creek, and Little Creek. Specific actions would include:

- Piping of irrigation laterals along the KRD Main Canal and South Branch Canal
- Construction of a re-regulation reservoir to capture KRD operational spills at Manastash Creek
- Construction of a pump station on the Yakima River to deliver flows to Manastash Creek water users

3.2.3 Keechelus to Kachess (K to K) pipeline

Convey water from Lake Keechelus to Lake Kachess to reduce flows and habitat conditions during peak flow events below Keechelus, and provide more water storage in Lake Kachess for downstream needs.

This project would include modifying the existing Lake Keechelus outlet tunnel, installing nearly five miles of large-diameter pipe, and installing a new control structure and outfall into Lake Kachess, and evaluation of a new power generation facility at the outfall.

3.2.4 Power Subordination

Further subordinate water diversions for power generation at Roza Dam and Chandler Power Plant to support outmigration of [redacted], spring Chinook, sockeye and coho juveniles, recognizing power is already greatly subordinated above what originally occurred when the dams were built. [redacted]

3.2.5 Wapatox Improvements

This project includes piping and/or replacing the lining along portions of the existing Wapatox Canal. It would include installation of new canal lining from the fish screen to the Wenas Grade Pump Station and replacement of the existing canal with a pipeline downstream of the pump station, or replacement of the entire existing canal downstream of the fish screen with a pipeline. This project would consolidate diversions into the Wapatox Canal diversion and provide

sufficient conveyance and pumping capacity for deliveries to Wapatox Ditch Company users, Naches Selah Irrigation District, the City of Yakima Water Treatment Plant, and the Gleed Ditch. It would reduce or eliminate the carriage water diverted to the Wapatox Canal and then spilled back to the Naches River at the downstream end of the canal, and also reduce or eliminate other canal losses.

3.3 Surface Water Storage

Pursue additional water supply development through the following ——— storage projects. Storage enhancements should provide supply for instream flow needs and out-of-stream needs, including municipal and domestic uses. Congress should authorize Reclamation to provide water for municipal and domestic uses, in addition to current authorities. With each of these projects, evaluate and implement feasible additional power generation opportunities.

3.3.1 Wymer Dam

Wymer Dam would be located as an off-channel storage facility on Lmuma Creek, approximately 8 miles upstream of Roza Diversion Dam. The dam would 162,500 acre-feet storage capacity. Water would be pumped into the reservoir from the Yakima River during winter, spring and potentially summer, during high flow periods from upstream reservoir releases.

Two pump station options are being considered. Option 1 would include a new pump station at Thorp. This option would include a new transmission main from the pump station to an upgraded Kittitas Reclamation District (KRD) North Branch Canal system and new tunnel to deliver water to Wymer. Option 2 would be a 400 cfs pump station on the Yakima River just upstream of Lmuma Creek and convey water through a new transmission main to Wymer.

Wymer Reservoir releases would pass through tunnels, a siphon, and a hydroelectric powerhouse to the Roza Canal at the existing Roza Canal intake structure. The downstream conveyance alignment provides for connection with future potential storage sites within the Burbank and Selah drainages.

3.3.2 Kachess Reservoir (Inactive Storage up to 200KAF)

The Lake Kachess Inactive Storage project is located just east of Interstate 90 (I-90) near Easton, WA. The project involves a lake tap in Lake Kachess that would allow the lake to be drawn down approximately 80’ lower than current outlet. This lake tap would provide the ability to withdraw another 200,000 acre-feet (AF) of water from the lake when needed for downstream uses.

Water would be conveyed either through a pump station and outlet just downstream of the Lake Kachess Dam or a tunnel outlet to the Yakima River approximately 4.8 miles southeast of the Lake Kachess Dam.

3.3.3 Enlarged Bumping Reservoir (190 KAF)

The proposed damsite is about 40 miles northwest of Yakima, Washington, on the Bumping River about 4,500 feet downstream of the existing Bumping Lake Dam.

The dam height will impound an enlarged reservoir of 198,300 acre-feet at elevation 3490 (top of active conservation capacity) with a surface area of 4,120 acres. The existing dam would be breached following construction to allow full use of the existing pool. The dam and reservoir will provide carryover storage against possible shortages of irrigation water for federally-served irrigable lands, and will also provide instream flow and incidental flood control benefits.

3.3.4 Columbia River Pump Exchange with Yakima Storage

In order to insure that the objectives of the integrated plan are realized, it is important that the integrated plan evaluate water availability of Columbia River water as a supplement to or substitute for other water supply elements of the plan should any of those elements fail at any time to be fully implemented. Study of various physical configurations for pumping, routing and storing Columbia River water in the Yakima Basin should be authorized. Potential storage locations discussed include Wymer, and Selah and Burbank Creek drainages. Columbia River water availability analysis, including analysis of design and construction, should consider constraints of the Federal Columbia River Power System Biological Opinion target flows, effects on salmonids (migration, spawning and rearing), and cumulative impacts taking other water withdrawal proposals (e.g. Odessa) into account. The Columbia River supply evaluation should also include evaluation of substituting Columbia River supply for Yakima River supply for the Roza diversion and removal of the Roza diversion dam on the Yakima River.

The Washington State Department of Ecology has current statutory authority, under RCW 90.90.050, to proceed with the evaluation and study of these projects so as to support construction cost estimates sufficient for Congressional authorization. In order to avoid unreasonable delay of the Columbia River and Roza Alternate Supply projects, they should be fully authorized through construction together with other elements of the water supply/storage component of the Integrated Plan.

3.4 Groundwater Storage

3.4.1 Shallow Aquifer Recharge

The objective of groundwater infiltration is to divert water prior to storage control into designed infiltration systems (ponds, canals, or spreading areas), and allow withdrawal of the infiltrated water during storage control in lieu of reservoir releases.

There are two phases to the groundwater infiltration program: pilot scale infiltration testing in two study areas, followed by full scale implementation. Initially, a limited pilot study would be conducted to verify the feasibility and general design features of groundwater infiltration systems. Pilot testing would take place in two study areas: the Kittitas Reclamation District (KRD) and the Wapato Irrigation Project (WIP). In each study area, two pilot scale infiltration systems would be constructed. Each system would be between one and two acres in size. The pilot tests would result in recommendations for implementation.

At full scale implementation, it is anticipated that between 160 and 500 acres of infiltration area will be necessary to achieve a total infiltration capacity of at least 100,000 acre feet. Total infiltration volumes may vary from year to year depending on snowpack conditions and reservoir

re-fill requirements. Full scale infiltration on the KRD system will be dependent on construction of the Thorp Pump Station (See Wymer Dam – Section 3.3.1).

3.4.2 Aquifer Storage and Recovery

Aquifer Storage and Recovery (ASR) involves diverting surface waters during high-flow periods and storing the water in underground aquifers for use during low-flow periods. The City of Yakima would divert water from the Naches River and treat it at the City's existing water treatment plant. It would then be injected through wells and later pumped out for use by the City's residents and businesses. ASR may also be viable for other cities in the Yakima basin.

3.5 Fish Habitat Enhancement

Implement an approximate $470 million habitat enhancement program addressing reach-level floodplain restoration priorities and restoring access to key tributaries through flow restoration, removing fish barriers, screening diversions. It will significantly improve prospects for recovering fish populations to levels that are resilient to catastrophic events and the potential impacts of climate change by accelerating ongoing efforts to protect existing high-value habitats, improve fish passage, enhance flows, improve habitat complexity, and reconnect side channels and off-channel habitat to stream channels.

It will help create improved spawning/incubation, rearing, and migration conditions for all salmonid species in the Yakima basin, implement key strategies described in the Yakima Subbasin Plan, and complete most of the actions described in the Yakima Steelhead Recovery Plan.

3.6 Enhanced Water Conservation

3.6.1 Agricultural Conservation

Implement an approximate $423 million agricultural water conservation program designed to conserve up to 170,000 acre-feet of water in good water years. The agricultural water conservation program includes measures beyond those likely to be implemented in the existing YRBWEP Phase II conservation program.

Agricultural water conservation measures that could be implemented under this program include:

- Lining or piping existing canals or laterals
- Constructing reregulation reservoirs on irrigation canals
- Installing gates and automation on irrigation canals
- Improving water measurement and accounting systems
- Installing higher efficiency sprinkler systems
- Implementing irrigation water management practices and other measures to reduce seepage, evaporation and operational spills

Although a list of specific projects was reviewed in developing this element, this recommendation does not identify specific projects for implementation. Projects to be implemented will be selected through detailed feasibility studies and evaluation by the existing Conservation Advisory Group (CAG).

3.6.2 Municipal and Domestic[1] Conservation program

Create a $30 million fund to promote water use efficiency basin-wide using voluntary, incentive-based programs. Focus on outdoor uses as top priority.

[1] **Municipal and domestic water usage includes** water delivered by public water systems regulated by the State Department of Health, water used by individual homeowners served by "exempt" wells; water used by commercial or industrial facilities, and water delivered by irrigation entities for purposes of outdoor landscape irrigation. ~~in developed areas of the Yakima Basin~~. It includes residential, commercial, industrial and urban recreational uses of water such as parks, ballfields, and golf courses

Convene a locally-based advisory committee on municipal and domestic water conservation to organize outreach to local elected officials and provide liaison with Reclamation, WDOE and WDOH. The advisory committee would focus particular attention on:

- Education, incentives and other measures to encourage residential and commercial users to improve efficiency of landscape irrigation, where the source of supply is agricultural irrigation canals or ditches.
- Improving the efficiency of consumptive uses.
- Establish standards for access to the new supply developed through the Integrated Plan and dedicated to municipal use and municipal/domestic mitigation.
- Determining appropriate conditions for accessing the new supply that would apply to homeowners, ~~or~~ developers or water for .

3.7 Market Reallocation

The Market Reallocation Element proposes to reallocate water resources through a water market and/or water bank to improve water supply in the Yakima River basin. This element consists of recommendations for legislative changes and funding requests to improve the efficiency and flexibility of water transfers. The proposal includes two phases—a short-term option that builds on the existing water market programs and a long-term option that requires more substantial changes to existing laws and policies.

The short-term option would continue existing water marketing and banking programs in the basin, but take additional steps to reduce barriers to water transfers.
The long-term option would focus on facilitating water transfers from irrigation districts. It would allow an irrigation district to fallow land within the district and lease water rights for that land outside the district. The proposal is similar to the "Super Ditch" project in southeast Colorado.

Attachment 1 - Water Needs

Out of Stream Needs

Needs are described for federally supplied agriculture, and for municipal and domestic water uses. Process for updating needs is also characterized. Review needs every five years and update, as necessary, as part of an ongoing review conducted by the State. Adaptive management measures will be implemented to address changes in water needs.

Federally-Supplied Agriculture

The need to be met for single and multi-year droughts, based on recent hydrologic conditions, is 70% of the water right entitlement each year for Kittitas Reclamation District, Roza Irrigation District and Wapato Irrigation Project. These are the districts that have proratable water rights and are seeking drought relief through the Integrated Plan. In severe drought conditions, this need could be as high as ~~300,000 to~~ 400,000 AF.

With potential climate change impacts, the estimated need would increase an additional 95,000 AF. This additional amount reflects the potential need for all Districts supplied water by Reclamation, based on the increased consumptive use for crops in the Yakima Project.

Municipal and Domestic Water Uses

For non-drought conditions, projected additional need by 2060, adjusted for water conservation and land conversion ranges from 41,000 (200 gpcd) to 49,000 AF (234 gpcd) annually. During drought conditions, local curtailment policies can reduce these quantities. Needs are distributed across all three counties of the Yakima River Basin and enhanced supplies should be allocated, in part, on a geographic basis reflecting expected growth trends in the three counties.

Groundwater Depletion

Recent studies conducted by the USGS conclude that the surface and groundwater systems of the basin are interconnected. Areas within the basin, especially the deep basalt aquifer, are seeing significant declines in groundwater levels, which in turn are affecting stream flow and water supply available for irrigation. Improvement in drought-year surface water irrigation supply will offset a portion of the existing groundwater demand. Meeting future Municipal and Domestic needs through implementation of the Integrated Plan is targeted to reduce future

impacts to instream flows and federally supplied agricultural water demands. The USGS groundwater study early estimate of deep basalt aquifer depletion is around 30,000 AF annually.

Instream Needs

The flow objectives and the associated prioritization framework identified in Attachment 1, Table 1 are the approximate instream flow needs/benefits to be met through the combination of actions in the Integrated Plan. It is difficult to quantify the instream water needs because each reach has a different flow need, which could be met either through operational changes or increased water supply.

Table 1 – Yakima River Basin Instream Flow Needs By Reach		
River Reach	**Flow Objective**	**Priority**
Keechelus Dam to Lake Easton	Improve summer rearing by reducing flows down to 450-550 cfs. Increase winter flow to 120 cfs (connection to side channels at that flow). Provide pulses in winter.	High
	High late summer flows reduced below 800 cfs 99.7 % of the time, as opposed to 54.7 % of the time under FWIP. In the winter, 120 cfs is exceeded 99.6 % of the time under the Integrated Plan as compared to 20.2 % of the time under the FWIP. Spring pulse flows of 7000 AF are released each year. Additional pulse flows will be available in most years as system carryover storage is increased by 160 kAF on average.	
Kachess River	No change proposed – lesser priority for improving river flow because of other objectives	
Easton Reach	Provide spring pulse of 1000 cfs for 48 hours during dry years, augment spring Q for channel maintenance occasionally (5-yr for riparian recruitment – bank full during wet years)	Medium
	Currently 180 cfs, start spawning flow at 220 cfs, increase to 250-300 cfs in winter, 250 cfs provides connection to side channels. Spawning flows at 220 cfs.	High
	Spring pulse flows provided in 18 out of 26 years under Integrated Plan; Average fall/winter flows increased from 407 to 462 cfs.	
Cle Elum River	Reduce flow, modify flip flop to give more gentle change in hydrograph. In wet years, spill earlier but hold water back in August to reduce flow (reduce by 1000 cfs). Also desire to bridge peaks between spring and summer to improve cottonwood establishment.	High
	Increase to 500 cfs September through March. Side channels are thought to be activated around 500 cfs, and one was recently modified to activate at 200 cfs, provide pulse flows.	High
	Average summer flows have decreased from 2779 to 2280 cfs. Average fall/winter flows have increased to 436 from 325 cfs. Spring pulse flows are provided in non-drought years. Additional pulse flows or flow variability will be available in most years as system carryover storage is increased by 160 kAF on average.	
Cle Elum to Teanaway River	Reduce flows from 4000 cfs to 1000 cfs by late August. Ok to have high flow in July, as mimics unregulated hydrograph.	High
	Provide channel shaping flows every 5 years or so.	Medium
	Provide flow variability, see Cle Elum River.	Medium
	Average flow on August 31st has been reduced to 2174 from 3142 cfs. Pulse flows are provided from upstream reservoirs. Additional system carryover storage in Keechelus and Cle Elum reservoirs will allow additional pulse flow or increase in flow variability.	

Table 1 – Yakima River Basin Instream Flow Needs By Reach		
River Reach	**Flow Objective**	**Priority**
Teanaway to Roza Dam	Reduce summer flows	High
	Provide channel shaping flows every 5 years or so	Medium
	Provide flow variability, time pulses to match natural events.	Medium
	Average summer flows have been reduced from 3204 to 2471 cfs. Pulse flows are provided from upstream reservoirs. Additional system carryover storage in Keechelus and Cle Elum reservoirs will allow additional pulse flow or increase in flow variability.	
Roza-Naches	Increase flow to about 1400 cfs for high and average water years from March through May[1] .	High
	Increase to 1000-1400 cfs (use IFTAG flows). Link flows to habitat needs. Compare to 2-D habitat model for reach above Roza Dam.	High
	Provide flow variability	Low to medium
	The average spring flow has increased to 1385 from 1299 cfs. In the fall/winter the average flow is 926, as opposed to the FWIP average of 952 cfs. However, subordination was not modeled so additional flow would be provided if subordination of Roza Power plant flows is adopted.	
Bumping Dam—Lower Naches	Reduce flows by 70-100 cfs from August through October	Medium
	Average daily flow from August through October has decreased to 165 from 189 cfs. Spring pulse flows are provided every year and can be timed by biologists. A gradual reduction in the flow hydrograph is provided from July to September.	
Tieton River	Maintain minimum 125 cfs flow during winter months	High
	Reduce September flows as much as possible.	Medium
	Average winter flows have increased from 195 to 290 cfs. Average flow in September has decreased to 1166 from 1534 cfs.	
Lower Naches River	Change ramping rate from spring to summer. Increase summer low flow. Check habitat needs vs flow.	High
	Reduce September flows as much as possible. Look at releasing more in summer and reducing flip flop.	High

[1] Yakima Joint Board of Control is planning to conduct a study below Roza to improve the biological basis for flow enhancements in this reach. Results are expected in 12 -18 months.

Table 1 – Yakima River Basin Instream Flow Needs By Reach

River Reach	Flow Objective	Priority
	When compared to FWIP, the average summer flow has decreased by approximately 215 cfs, resulting in an average flow of 1029 cfs. Lower Naches was not targeted by reservoir operation rules. However, additional carryover storage of 190,000 AF on average is available for use on the Naches arm.	
Yakima River Naches River to Parker	Reduce high summer flows as much as possible	Low
	When compared to FWIP, the average summer flow has decreased by approximately 215 cfs, resulting in an average flow of 3185 cfs.	
Yakima River from Parker to Toppenish Creek (Wapato reach)	15,000 – 20,000 acre-feet to use specifically for smolt outmigration in dry years. See SOAC recommendations for pulse flows. Evaluate early and late pulse and opportunities to improve Sockeye passage also. Change ramping rate at end of high flows that occur in June-July in average-wet years.	High
	link to habitat needs	No priority assigned[2]
	Average summer flow under the integrated plan is 2683 cfs, as compared to an average flow of 2564 cfs under the FWIP. Additional pulse flows or flow variability will be available in most years as system carryover storage is increased by 160 kAF on average.	
Yakima River: Toppenish Creek to Prosser Dam	See Wapato Reach	See Wapato Reach
	Average spring flow has increased to 3578 from 3377 cfs, an increase of 201 cfs under the Integrated Plan.	
Yakima River—Chandler Reach	Need greater than 1000 cfs in September	Low
	Although some subordination occurs to provide 1000 cfs, need more flow	Low
	Average flow in July has increased from 682 cfs to 758 cfs under the Integrated Plan. Average September flow has decreased from 650 cfs to 492 cfs under the Integrated Plan. Average spring flows have increased by 188 cfs, resulting in an average spring flow of 2490 cfs. Subordination of Chandler Power plant was not modeled. Additional flow and survival benefits would occur if subordination is adopted.	
Lower Yakima River (Chandler	see Wapato Reach	Low
	link to habitat needs	Low

[2] This reach needs to better understanding of existing conditions. Design and implement research, monitoring and evaluation (RM&E) program to better understand improvements needed. Develop flow objectives from RM&E results.

Table 1 – Yakima River Basin Instream Flow Needs By Reach		
River Reach	**Flow Objective**	**Priority**
Powerplant to mouth)	Under the integrated plan, the average spring flow has increased by 196 cfs, resulting in an average flow of 3668 cfs.	
Tributaries		
Manastash, Taneum, Cowiche	Increase summer and early fall flows.	High
Big, Little	Increase summer and early fall flows.	Medium
Ahtanum	Increase summer and early fall flows.	High
Wenas	Increase summer and early fall flows.	Lower
North Side Kittitas Valley Tributaries	Improve passage	Lower
	The KRD south branch project will improve instream flow in Manastash Creek and Big and Little Ahtanum and Taneum.	

Attachment 2 - Water Supply Benefits

The Integrated Plan (comprised of the actions describe above) will provide the benefits outlined in the following table below for average water years, and single (2001, 2005) and multi-year (1993, 1994) drought conditions.

Integrated Plan Results for Benefits Evaluation

11/5/2010

Resource indicator (measurement)	Future without Integrated Plan	Integrated Plan	Change from FWIP
WATER RESOURCES			
Average for water years 1981–2005 (maf)			
Water supply			
April 1 total water supply available (TWSA)	2.79	3.00	0.22
Water distribution			
April–September Parker flow volume	0.64	0.60	-0.04
April–September diversion	1.61	1.69	0.09
September 30 reservoir contents	0.23	0.58	0.34
Irrigation proration level	80%	92%	12%
1993 dry-year (maf)			
Water supply			
April 1 total water supply available (TWSA)	2.06	2.24	0.18
Water distribution			
April–September Parker flow volume	0.36	0.30	-0.06
April–September diversion	1.42	1.57	0.15
September 30 reservoir contents	0.05	0.26	0.21
Irrigation proration level	44%	70%	26%
1994 dry-year (maf)			
Water supply			
April 1 total water supply available (TWSA)	1.74	2.22	0.48
Water distribution			
April–September Parker flow volume	0.31	0.25	-0.07
April–September diversion	1.23	1.52	0.29
September 30 reservoir contents	0.05	-0.06	-0.11
Irrigation proration level	21%	70%	49%
2001 dry-year (maf)			
Water supply			
April 1 total water supply available (TWSA)	1.76	2.45	0.69
Water distribution			
April–September Parker flow volume	0.25	0.20	-0.05
April–September diversion	1.29	1.55	0.27
September 30 reservoir contents	0.06	0.22	0.16
Irrigation proration level	32%	70%	38%
2005 dry-year (maf)			
Water supply			
April 1 total water supply available (TWSA)	1.71	2.32	0.61
Water distribution			
April–September Parker flow volume	0.25	0.18	-0.06
April–September diversion	1.25	1.53	0.28
September 30 reservoir contents	0.08	0.13	0.05
Irrigation proration level	28%	70%	42%

Attachment 3 - Fisheries Benefits

Fisheries benefits were estimated using existing fisheries models developed for the Basin, including Ecosystem Diagnosis and Treatment (EDT), All H's (hydropower, harvest, hatcheries and habitat) Analyzer (AHA) and spawning per hectare (Sockeye only) models. The benefits of the Integrated Plan to spring Chinook, steelhead, coho fall Chinook, summer Chinook, and sockeye are significant. The models reflect the habitat restoration actions and fish passage included in the Integrated Plan. These improvements would likely result in a range of total adult salmon recruitment between 235,0000 during low survival years and more than 800,000 adults in years of high survival. Harvest would be three or more times greater than the future without the Integrated Plan. The number of fish reaching the spawning grounds would grow from a maximum return of 91,000 adults if the plan were not implemented to 273,000 if this Integrated Plan is implemented.

Annual Adult Salmon Run Size	**Future without Plan**			**Integrated Plan**		
	Min	**to**	**Max**	**Min**	**to**	**Max**
Recruitment	18,581	to	131,343	236,404	to	836,060
Harvest	5,148	to	37,260	23,635	to	108,470
Yakima R. Mouth	15,103	to	106,619	71,392	to	324,336
Total Escapement	**12,139**	**to**	**91,228**	**59,618**	**to**	**273,354**

Bull trout would also benefit from the g identifies the Yakima Basin h iability with Integrated Plan i

opulation	Plan
um	+
Creek	++
Fork Tieton	+++
Fork Tieton	+++
can	+
Creek	+
nake Creek	+
Creek	-
ng River	-
s River	-
nyon Creek	-
reek	+++
Cle Elum/Waptus	+
Upper Yakima	++
Teanaway	+

0 = Neutral, dependant on level of local recovery efforts

+ = Some benefit from habitat actions or Bull Trout Task Force

++ = Additional benefit, either re-connectivity as dam passage is addressed, or another project that addresses a specific limiting factor for a population (e.g. SF Tieton falls, Gold Creek Hydrological Assessment).

+++ = Multiple passage or population specific projects

Attachment 4 - Plan Costs

Costs were determined in accordance with the Reclamation Cost Estimating Handbook. Based on 10% engineering design or less, the material and quantities; mobilization and demobilization; site preparation; and labor required to build the project were estimated. All costs were estimated at an appraisal level and within -20% and +40% of the estimate. Design and permit costs were assumed to be 30% of the construction costs. Annual O&M Costs includes anticipated staff, electrical and routine maintenance.

Project	Construction Cost	Range		Construction w/Design & Permit	Range		Annual O & M
		Lower	Upper		Lower	Upper	
Keechelus to Kachess Pipeline	$146,669,278	$117,335,422	$205,336,989	$190,670,061	$152,536,049	$266,938,086	$90,000
Bumping Lake Dam Enlargement	$309,613,882	$247,691,106	$433,459,435	$402,498,047	$321,998,437	$563,497,265	$210,000
KRD Canal South Branch Modifications	$27,621,368	$22,097,094	$38,669,915	$35,907,778	$28,726,223	$50,270,890	$25,000
Kachess Inactive Storage Alt 1 - Tunnel	$195,243,377	$156,194,702	$273,340,728	$253,816,390	$203,053,112	$355,342,946	$270,000
Kachess Inactive Storage Alt 2 - Pump Station	$173,619,609	$138,895,687	$243,067,453	$225,705,492	$180,564,393	$315,987,688	$590,000
Cle Elum Improvements - 3' Pool Raise	$12,956,605	$10,365,284	$18,139,247	$16,843,587	$13,474,869	$23,581,021	$500,000
Wymer Reservoir, Pump Station and Powerplant	$1,007,490,102	$805,992,082	$1,410,486,143	$1,309,737,133	$1,047,789,706	$1,833,631,986	$3,980,000
Wapatox Canal Option 1	$45,638,595	$36,510,876	$63,894,033	$59,330,174	$47,464,139	$83,062,243	$210,000
Wapatox Canal Option 2	$63,178,672	$50,542,938	$88,450,141	$82,132,274	$65,705,819	$114,985,183	$210,000
Thorp, KRD Canal, Siphon and Tunnel/Pipeline	$416,338,052	$333,070,442	$582,873,273	$541,239,468	$432,991,574	$757,735,255	$3,390,000
Fish Passage Cle Elum	$74,185,375	$59,348,300	$103,859,525	$96,440,988	$77,152,790	$135,017,383	$500,000
Fish Passage Bumping	$20,473,111	$16,378,489	$28,662,355	$26,615,044	$21,292,035	$37,261,062	$500,000
Fish Passage Clear Lake	$2,302,732	$1,842,186	$3,223,825	$2,993,552	$2,394,841	$4,190,972	$70,000
Fish Passage Box Canyon	$2,500,000	$2,000,000	$3,500,000	$3,250,000	$2,600,000	$4,550,000	$70,000
Fish Passage (Tieton, Kachess, Keechelus)	$150,000,000	$120,000,000	$210,000,000	$195,000,000	$156,000,000	$273,000,000	$1,500,000
Columbia River Pump Station Study	$3,800,000	$3,040,000	$5,320,000	$3,800,000	$3,040,000	$5,320,000	$0
Enhanced Agriculture Conservation	$423,000,000	$338,400,000	$592,200,000	$549,900,000	$439,920,000	$769,860,000	$0
Groundwater Infiltration (Pilot study : 2 areas)	$1,338,000	$1,070,400	$1,873,200	$1,739,400	$1,391,520	$2,435,160	$600,000
Groundwater Infiltration (Full scale :160-500	$56,100,000	$44,880,000	$78,540,000	$72,930,000	$58,344,000	$102,102,000	$2,145,000
Municipal Conservation	$0	$0	$0	$0	$0	$0	$1,000,000
Tributary Habitat				$180,000,000	$144,000,000	$252,000,000	$0
Mainstem Habitat				$279,700,000	$223,760,000	$391,580,000	$0
Total	***$2,893,228,632***	***$2,298,917,367***	***$4,077,934,776***	***$4,219,757,221***	***$3,355,440,577***	***$5,943,299,208***	***$15,220,000***

Attachment 5 - Timing, Sequence and Triggers

The graphic below shows the proposed implementation schedule. Colors are used in the graphic to show four stages of activity: 1.) Authorization; 2.) Studies; 3.) Project Environmental Review, Permitting and Design; and 4.) Project Construction or Program Activation.

Timing, Triggers and Sequence, Yakima Basin Integrated Plan

(Note: This draft shows all projects listed in 2009 Preliminary IWRNMP. Any Projects eliminated from final IWRMP will be removed from the schedule.)