Yakima River Basin Water Enhancement Project (YRBWEP) Workgroup
Integrated Water Resource Management Plan
Summary Support Document

1.0 Action

The Yakima River Basin Water Enhancement Project (YRBWEP) Workgroup was convened to identify solutions to address a variety of water resource problems that impact agriculture, fish, and municipal and domestic water supplies in the Yakima River Basin. The Integrated Water Resource Management Plan (Integrated Plan) Summary Support Document outlines the elements and actions proposed by the Workgroup.

The Workgroup's proposal is intended for further consideration by Reclamation and Ecology as they proceed with preparing a planning report and programmatic environmental impact statement which will comply with the National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA).

The Workgroup supports the proposed Integrated Plan to improve water supply reliability during drought years to 70 percent proratable supply for participating irrigation districts, enhance instream flows and habitat conditions and provide for fish passage at existing reservoirs. The Integrated Plan includes seven elements: 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 contained within these elements, as described below.

By approving this summary document the Workgroup members support working together to develop a strategy and agreement for advancing the Integrated Plan. The entire Workgroup will support administrative review of the Integrated Plan including preparing a final planning report and programmatic National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and State Environmental Policy Act (SEPA) reviews, including incorporating results from land conservation discussions and advance mitigation currently underway. Depending upon the outcomes of these reviews (i.e., no fatal flaws), the non-federal organizations represented on the Workgroup will support legislative authorization and appropriations for the Integrated Plan. All Workgroup members will support permitting and mitigation for actions in the Integrated Plan.

The Workgroup will organize an Implementing Subcommittee comprised of tribal, state, and local government representatives, and one representative representing environmental interests to oversee efforts to seek authorization and funding. Implementing Subcommittee members will be drawn from the existing Workgroup participants. The Implementing Subcommittee will report progress back to the Workgroup. The Workgroup will meet periodically to review plan implementation progress.

It should be noted that by supporting this document, no Federal, State, local or Tribal agency with representatives participating on the YRBWEP Workgroup believes their statutory and other legal obligations are, or can be, met through the proposed plan. Support of the proposed plan shall not be construed to limit any agency with jurisdiction related to one or more actions in the proposed Integrated Plan from complying with its obligations under applicable laws and regulation or from considering public comments received in any environmental review or regulatory process related the actions in the Integrated Plan. Support of this proposal should not be interpreted to predetermine the outcome of any NEPA or SEPA environmental review process or any permit process.

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. A group of natural resource conservation community stakeholders are developing a proposal for land conservation and broadly structured advance mitigation program to further the plan's instream flow and ecosystem protection and restoration goals. This program would be incorporated into the administrative review process described in Section 1.

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 evaluate other surface water storage or pump exchange supply projects 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. Procedures for adjusting the plan if necessary during the implementation stage are described in Section 4.

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. At Clear Lake dam, replace the existing upstream passage facilities. At Box Canyon Creek (Kachess Lake tributary), ensure effective passage for pre-spawn adult bull trout. For Cle Elum dam, install downstream juvenile passage facilities and fish ladder and collection facility for capture and upstream transport by tanker truck. For Bumping dam, install upstream and downstream fish passage as part of the proposed Bumping Lake enlargement, or at the existing dam if the enlargement is not authorized. Install upstream and downstream fish passage at Tieton, Keechelus, and Kachess dams, subject to further evaluation of alternatives to determine the most feasible approach for providing passage at each dam.

Passage would be constrained by the following:

- Fish passage facilities would be designed and operated within existing operational considerations and constraints outlined in the Interim Comprehensive Basin Operating Plan (Reclamation 2002).
- Operations would continue to serve existing Reclamation contracts.
- Potential operational changes would be considered that might enhance passage without adversely impacting existing contracts or irrigation water supply.

Providing unimpeded fish migration past the existing storage dams in the Yakima Basin would increase species distribution; allow reintroduction of sockeye runs and expanded migrations, and provide for genetic interchange for listed bull trout and other native fish. This also provides a strategy for coping with potential future climate change impacts, should they occur, by allowing fish to access high-quality habitat at higher elevations if lower elevation habitat is no longer suitable for supporting fish life stages at certain times of year.

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 three 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, and allow greater flexibility in KRD supply management. The water saved or transferred 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.

Tributary flow improvements will be coordinated with habitat enhancement actions (Section 3.5) targeting improving fish passage at KRD canal crossings[1].

3.2.3 Keechelus to Kachess (K to K) pipeline

Convey water from Lake Keechelus to Lake Kachess to reduce flows and improve habitat conditions during high flow releases 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. Also included, is an evaluation of a new power generation facility at the outfall.

Every effort will be made to coordinate construction of the K to K pipeline with ongoing construction of I-90, particularly on the Lake Keechelus end of the pipeline.

[1] The updated Habitat Enhancement program description presented to the Workgroup at the October 2010 meeting identifies improving four canal/creek crossings within the entire KRD system.

3.2.4 Power Subordination

Further subordinate water diversions for power generation at Roza Dam and Chandler power plant to support outmigration of steelhead, Chinook, sockeye and coho juveniles, recognizing power is already greatly subordinated above what originally occurred when the dams were built. Subordination will be pursued subject to the condition that acceptable mitigation is agreed upon and approved by Reclamation, Bonneville Power Administration and either Roza or Kennewick Irrigation District as applicable.

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 midway down the canal and replacement of the existing canal downstream from that point with a pipeline, or replacement of the entire length of existing canal downstream of the fish screen with a pipeline. The purpose of the project is to reduce or eliminate the carriage water diverted into the canal for Wapatox Ditch Company water users. This project could consolidate other diversions into the Wapatox Canal such as the Naches Selah Irrigation District, the City of Yakima Water Treatment Plant and the Gleed Ditch. However the benefits of consolidating those diversions may not be sufficient compared to the cost and those water users may choose to not participate in the project.

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. With each of these projects, evaluate and implement feasible additional power generation opportunities.

The first three surface water storage projects listed below (Wymer Dam, Kachess Inactive Storage, and Bumping Lake Enlargement) reflect the Workgroup's intent to focus on in-basin solutions to address water supply and aquatic resource problems in the Yakima River Basin. Collectively, these projects represent just over 450,000 acre-feet of additional water supply for instream and out-of-stream uses in the basin. Should, after concerted effort by the Workgroup to advance these projects, one or more of the three projects fail to receive necessary permits and approvals for implementation, the Workgroup will select a replacement project (or projects) that will supply at least an equivalent quantity of water.

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 storage capacity of the reservoir would be approximately 162,500 acre-feet. 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, which has the potential to mitigate for artificially high summer flows.

Two pump station options are being considered. Option 1 includes a new pump station at Thorp, including a new water transmission main from the pump station to an upgraded Kittitas Reclamation District (KRD) North Branch Canal system, and a 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 with water conveyance through a new water transmission main that would deliver water 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. Evaluate Roza dam removal feasibility as part of implementing the Wymer project. 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 200 KAF)

The Lake Kachess Inactive Storage project is located just east of Interstate 90 (I-90) near Easton, Washington. The project involves a lake tap in Lake Kachess that would allow the lake to be drawn down approximately 80 feet lower than the 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 during drought conditions.

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 dam site 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 would impound approximately 198,300 acre-feet at elevation 3,490 (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 would provide carryover storage against possible shortages of irrigation water for federally-served irrigable lands, and would also provide instream flow and incidental flood control benefits.

3.3.4 Columbia River Pump Exchange with Yakima Storage

As implementation of the three surface storage projects described above proceeds, appraisal and feasibility level work would commence on other water supply enhancements, including the potential for an inter-basin transfer from the Columbia River. As in-basin actions are developed and implemented, supply improvements will be measured at least every five years as part of a rolling needs assessment against the identified 70 percent proratable supply need for irrigation and other out of stream needs, and instream flow objectives. Need for additional water supply enhancements will depend on the effectiveness of projects that are implemented as part of the Integrated Plan, how the Basin economy develops over time, as well as the timing of and manner in which climate change affects water supply availability.

The feasibility study for a Columbia River to Yakima Basin transfer would be conducted in two steps.

Step 1 - The first step would involve the following: 1) a detailed analysis of the physical and legal availability of water for diversion from the Columbia River, 2) a description of alternatives for configuration of pumping, routing and storing Columbia River water in the Yakima Basin as well as options for instream and out-of-stream uses of that water, 3) estimates of capital and O&M costs for each alternative, and 4) an evaluation of allocation of costs for each alternative. The Columbia River water availability analysis should consider constraints for the Federal Columbia River Power System Biological Opinion target flows, effects on salmonids (migration, spawning and rearing), and cumulative impacts of other water withdrawal proposals (e.g., Odessa).

Step 2 - The Workgroup would consider the results of the initial stage of the study in deciding whether to pursue the second step involving more detailed, site-specific analyses of alternatives. In the feasibility study, depending upon the outcome of the Wymer project described above, serving the Roza diversion through Columbia River supply could also be evaluated.

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. The timing and scale of surface water diversions will be designed to allow continuation of natural high flow events that provide biologic and geomorphic benefits.

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 would 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 would be dependent on construction of the Thorp Pump Station (See Wymer Dam – Section 3.3.1). During the pilot phase, policy and legal protocols will be developed to ensure water stored through infiltration is not captured by unauthorized users.

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 timing and scale of surface water diversions will be designed to allow continuation of natural high flow events that provide biologic and geomorphic benefits.

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 Habitat Protection and Enhancement

3.5.1 Targeted Watershed Protections and Enhancements

The watershed, water supply, and ecological restoration goals of the Integrated Plan would be furthered through the protection and restoration of key landscapes. The primary lands that enhance other components of the Integrated Plan are large tracts in the Yakima/Naches watershed that provide high potential for ecosystem and species conservation and restoration both within and outside of the immediate riparian corridor.

The targeted acquisitions include:

- 46,000 acre tract in the middle and lower Teanaway River Basin comprised of mid to high elevation mixed conifer forest, lower elevation grand fir and ponderosa pine.
- 15,000 acre tract in the Yakima River canyon, including the valley bottom and eastern slopes, from the Yakima River to I-82.
- 10,000 acres at the headwaters of the Little Naches River and lands surrounding the headwaters of Taneum and Manastash Creeks.

If these preferred sites cannot be acquired, a combination of alternative sites of equivalent conservation value may be selected as long as alternatives collectively meet the following targets:

- Conservation Target for High Elevation Watershed Enhancement: 45,000 acres
- Conservation Target for Shrub-Steppe Habitat Enhancement: 15,000 acres
- Conservation Target for Forest Habitat Enhancement: 10,000 acres

Additional lands are eligible and/ or have already been recommended for federal Wilderness and Wild and Scenic River designation through other processes. In addition to the conservation targets provided above, protection of the following lands is consistent with values and objectives of the Integrated Plan:

- Wilderness designation should be pursued for the land around Bumping Lake that is not consumed by the reservoir expansion.

- Wilderness or other appropriate designation should also be sought for roadless areas in the Teanaway, in the area between Kachess and Cle Elum Lakes, and in the upper reaches of Manastash and Tanuem Creeks in order to protect headwaters streams, snow pack, and forests.

- Wild and Scenic River designation should be sought for the American, upper Cle Elum, and Waptus rivers. Other rivers determined eligible and recommended for designation in future forest plans should also be considered.

All of these areas are eligible and have already been recommended for these designations through other processes.

3.5.2 Fish Habitat Enhancement

Implement an approximate $460 million habitat enhancement program addressing reach-level floodplain restoration priorities and restoring access to key tributaries through flow restoration, removing fish barriers, and screening diversions. These actions would 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.

Fish habitat enhancement actions would 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. Early mainstem floodplain improvements could include channel and habitat restoration in the Yakima River near Ellensburg and between Selah and Union Gap, and on the Naches River. Tributary program early actions could include completing screening and passage at diversions in the middle and upper Yakima basin, bull trout habitat improvements and management actions, and implementing the Toppenish Creek Corridor program.

The implementation approach will be tailored to utilize existing organizations, review processes and plans, as applicable. Reclamation and Ecology may establish an advisory group similar to the YRBWEP Conservation Advisory Group (CAG) (see Section 3.6.1) to help in developing a more detailed approach for how and when projects would be funded.

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 would be selected through detailed feasibility studies and evaluation by the existing YRBWEP Conservation Advisory Group (CAG). Irrigation districts eligible for project funding include both federally and non-federally served irrigation districts, private irrigation entities and individual land-owners.

3.6.2 Municipal and Domestic[2] 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.

Convene a multi-stakeholder advisory committee, including local and environmental stakeholders 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 best practice standards for accessing the new supply developed through the Integrated Plan and dedicated to municipal use and municipal/domestic mitigation. The standards will be based on review of evolving practices in similar communities and similar climate zones of the western United States.

[2] **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

- Determining appropriate conditions for accessing the new supply that would apply to homeowners or developers seeking mitigation water for homes supplied by individual household wells.

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 near-term effort to build on the existing water market programs, and a longer-term effort that requires more substantial changes to existing laws and policies.

The near-term program would continue existing water marketing and banking programs in the basin, but take additional steps to reduce barriers to water transfers.

The long-term program would focus on facilitating water transfers between irrigation districts. This would allow an irrigation district to fallow land within the district and lease water rights for that land outside the district.

To facilitate this process, Agricultural Conservation program funding (See Section 3.6.1) would also be made available to non-federal irrigation entities to upgrade conveyance infrastructure in a manner that improves these entities' operational flexibility and ability to lease water to other irrigation districts, including federally-served Districts.

4.0 Rolling Review and Future Plan Adjustments

The Integrated Plan has seven Elements and some of these include multiple projects. Implementation is expected to extend at least over a 20 year period. While the Yakima Basin Study has addressed many questions regarding the Plan, there are still uncertainties around whether the State Legislature, U.S. Congress and local participants will authorize and/or fully fund the program; whether all of the recommended projects will receive the necessary permits and regulatory approvals; and whether project outcomes achieve the goals predicted using available models. In addition, while the Workgroup supports all seven elements and actions identified in the Integrated Plan, the stakeholders involved in the YRBWEP Workgroup have differing levels of support, authorizations and priorities attached to implementation and outcomes of the various elements and projects.

These factors point to a need for periodic review of the Integrated Plan's success, both in terms of implementation and outcomes. In the event projects cannot be implemented as recommended; or if project benefits are different than expected, adjustments may need to be made over time. Guidelines for review and adjustments to the IP are presented below.

4.1 Rolling Review

It is recommended that Reclamation and Ecology, in cooperation with the YRBWEP Workgroup Implementing subcommittee, jointly review and summarize progress on implementing the Integrated Plan annually for the next five years (2011-2015); and at least every 5 years thereafter until the plan is deemed fully implemented. Develop an adaptive management plan prior to the 2015 rolling review to further refine metrics, triggers and adaptive management measures for potential plan adjustments through time. The Integrated Plan review will include:

- Status of securing funding for implementation.
- Progress in setting up programmatic elements (e.g. water marketing, water conservation, habitat restoration; floodplain restoration).
- Progress in constructing identified infrastructure improvements.
- Assessment of outcomes for water supply and fish production, compared with the goals and metrics.
- Effectiveness of revised Yakima Project operating rules[3] based upon identified goals for meeting instream and out of stream needs.
- Significant changes, if any, in the underlying drivers for the IP, such as listing status of aquatic species; changes in the Basin's population and economy; changes in climate, snowpack and hydrology; major shifts in cropping patterns or irrigation practices; and changes in water needs.
- If necessary, any recommendations for adjustments to the IP or implementation schedule, with a clear explanation of the basis for each recommendation.

The Rolling Review will be submitted to the YRBWEP Workgroup or its successor organizations. If the YRBWEP Workgroup no longer exists, then the review will be submitted to each of the local, state, federal and tribal agencies that were represented on the Workgroup in 2010.

4.2 Adjustments to the Integrated Plan Over Time

If the review described above indicates a need for significant changes to the Integrated Plan, then the following principles should be applied:

- In making changes, every effort should be made to advance both water supply improvements and fisheries enhancements, consistent with the balanced nature of the Integrated Plan.

[3] Yakima Project operating rules should be revised as projects are implemented to meet in and out of stream needs identified in the plan.

- In the event that particular projects or programs encounter insurmountable obstacles to implementation or are found unable to deliver the expected benefits, then substitutes for those projects should be developed to achieve comparable outcomes.

- The agencies and organizations represented on the YRBWEP Workgroup will continue to work in good faith throughout the implementation period to secure resources as soon as possible to implement all of the Integrated Plan projects and programs, or to identify reasonable substitutes if one or more of the recommended projects or programs cannot be implemented. This collaborative effort will continue until the entire plan has been implemented, or further implementation is deemed infeasible based on the Rolling Review described above.

Attachment 1 - Water Needs

Out of Stream Needs

Needs to be met through the Integrated Plan are described for federally supplied agriculture, and for municipal and domestic water uses. 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 irrigation need to be met for single and multi-year droughts, based on recent hydrologic conditions, is estimated at 70% of the irrigation 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 directly through the Integrated Plan. In severe drought conditions, this need could be as high as 300,000 to 400,000 AF. Kennewick Irrigation District (KID) also has proratable water rights and partially relies upon return flows to meet supply needs. Supply improvements in the Integrated Plan should improve reliability for KID.

With potential climate change impacts and existing cropping patterns, the estimated need would increase an estimated additional 95,000AF[4] in non-drought years (less in drought years). This additional amount reflects the potential need for all Districts supplied water by Reclamation, based on rough estimates of increased consumptive use for existing crops in the Yakima Project. It does not take into account potential crop changes that could result from climate change response.

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). 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.

Instream Needs

Flow targets, some qualitative and other quantitative, are provided below. Specific numbers aren't always provided because in many instances, scientific understanding of the relationship of flow to fish survival is limited, the objectives will vary with environmental conditions, and because in times of shortage, water that might have been directed to one ecological purpose may be more ecologically valuable elsewhere. This section is intended to explain at a coarse scale how flows within the river system should be managed for fish.

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[4] The consultant team received comments from the University of Washington Climate Impact Group stating their opinion that the increase in water demand would be more likely 3-5 percent, instead of the 7 – 9 percent used to arrived at the 95,000 AF increase (Stockle, C. Email to J. Vano and A. Graham, November 19, 2010). A 5 percent increase is approximately a 53,000 AF increase.

For many years, flow management has focused on protecting spring Chinook salmon redds in the upper watershed and on spring flows from Parker to the mouth. While each of these is important, the Integrated Plan seeks to improve other aspects of flow management as well.

Lower River

Despite the water supply facilities identified in the Integrated Plan, the fisheries managers (federal and state fish and wildlife agencies, and the Yakama Nation) recognize that flow volumes during the spring of the driest years will be largely unchanged from present conditions. It is expected, however that aquifer recharge efforts will improve water quality, particularly summer water temperatures in much of the lower river corridor. Flow targets for the lower river will be met as required in Title XII based on TWSA. In addition, flow pulses will be provided as recommended by the System Operations Advisory Committee (SOAC). The hydrologic modeling performed for the Integrated Plan demonstrated that an additional 15,000 acre-foot block of water can be provided for flow pulses during drought years. That water is provided in addition to the water needed to meet a 70% water supply for proratable water users and the volume required by Title XII. Such flow increases may either be pulsed, episodic (for a subset of the irrigation season), or static (as Title XII flows are presently managed), according to the recommendations of SOAC. In wetter years the modeling indicated there are larger blocks of water available for shaping but no analysis was performed of its use. It may be desirable to shape those larger blocks of water to improve our understanding of flow/survival relationships. As provided in the modeling results presented to the Workgroup, there will be times when unregulated discharge during the smolt migration is reduced relative to present conditions in order to fill new reservoirs. It will be important as part of a future effort to establish minimum flows to which reservoir refill will be subordinate.

Upper River High Summer Flows

Storing water in a network of more broadly distributed “buckets” affords additional operational flexibility. With the increased flexibility that the proposed Wymer Reservoir and a larger Bumping Reservoir could provide, Reclamation, consulting with SOAC, can attenuate unnatural high flows in the Cle Elum, upper Yakima, and Tieton Rivers, to the extent possible, without reducing pro-ratable water supplies below 70% during drought conditions. In addition, the Keechelus to Kachess pipeline would enable substantial reductions to the unnaturally high August flow regime below Keechelus Dam.

Winter Flows

Winter flows will be provided below the storage reservoirs as recommended presently (incubation flows for spring Chinook salmon will be maintained at or above spawning flows) or adjusted with better information. If providing higher flows is highly likely to reduce pro-ratable water supply below 70% during drought conditions, they may be reduced in consultation with SOAC.

Spring Flows

When water is available above that needed to provide a water supply of 70% of entitlements to proratable water users during drought conditions, Reclamation in consultation with SOAC may provide freshets to encourage emigration of smolts from heavily regulated reaches below the reservoirs. In addition, it is a high priority to provide high, normative spring migration flows in the reach below Roza Dam.

Tributary Flows

Project facilities will be used where warranted to deliver water either directly to tributary water users or to tributaries to replace tributary diversions.

The flow objectives and the associated prioritization framework identified Table 1 are the approximate instream flow needs/benefits to be met through the combination of Integrated Plan actions.

Other Surface and Groundwater Considerations

The Integrated Plan will make major improvements in water supply and aquatic habitat conditions in the basin. However, some challenges will still remain and need to be addressed through other processes.

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. While this condition is not directly addressed by the Integrated Plan, improvement in drought-year surface water irrigation supply will offset a portion of the existing groundwater demand. Meeting some of the future municipal and domestic needs through implementation of the Integrated Plan would also 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 (http://wa.water.usgs.gov/projects/yakimagw/summary.htm).

Additionally, flows in some tributary streams will not be improved by the Integrated Plan as projects in the plan cannot physically affect all geographic areas where improvements could be made.

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 work 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[5].	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

[5] The Yakima Basin Joint Board has been working with the Bureau of Reclamation and other partners to plan a study below Roza Dam to improve the biological basis for flow enhancements in this reach. Results are expected in 12 to 24 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[6]
	Average spring 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

[6] 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

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

Integrated Plan Results for Benefits Evaluation

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 235,000 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[7]	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 benefit but also could potentially be negatively impacted by actions identified in the Integrated Plan without appropriate mitigation measures. If the effects of moderate climate change to precipitation and water use patterns occur as identified in two of the three future climate change scenarios, conditions in Lake Kachess will have to be managed or modified in a manner to ensure that adult bull trout are able to access and spawn in Box Canyon Creek and the Kachess River.

[7] Recruitment is defined as ocean population at the mouth of the Columbia River, excluding any ocean harvest.

The following identifies the Yakima Basin Fisheries Managers expected changes in bull trout population viability with Integrated Plan implementation.

Population	Plan
Ahtanum	+
Indian Creek	++
South Fork Tieton	+++
North Fork Tieton	+++
American	+
Crow Creek	+
Rattlesnake Creek	+
Deep Creek	-
Bumping River	-
Kachess River	-
Box Canyon Creek	-
Gold Creek	+++
Cle Elum/Waptus	+
Upper Yakima	++
Teanaway	+

- = Negative impact (would require mitigation)
+ = 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.

Benefit/cost analysis still needs to be completed for these projects along with cost allocations. This will occur as part of the Reclamation/Ecology administrative review (final planning report and programmatic NEPA/SEPA/ESA review) discussed in Section 1.0 of the Summary Integrated Plan document.

Project	Construction Cost	Range		Construction w/Design & Permit	Range		Annual O & M
		Lower	Upper		Lower	Upper	
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
Keechelus to Kachess Pipeline	$146,669,278	$117,335,422	$205,336,989	$190,670,061	$152,536,049	$266,938,086	$90,000
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
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
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
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
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
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
Enhanced Agriculture Conservation	$313,333,333	$250,666,666	$438,666,666	$407,333,333	$325,866,666	$570,266,666	$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 acre	$56,100,000	$44,880,000	$78,540,000	$72,930,000	$58,344,000	$102,102,000	$2,145,000
Columbia River Pump Station Study	$3,800,000	$3,040,000	$5,320,000	$3,800,000	$3,040,000	$5,320,000	$0
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	***$2,770,605,360***	***$2,200,818,750***	***$3,906,262,195***	***$4,060,346,967***	***$3,227,912,374***	***$5,720,124,853***	***$14,720,000***

Attachment 5 – Provisional Schedule: Timing, Sequence and Triggers

The graphic below shows the provisional 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.