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 percent 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). 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

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.

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 percent of the time, as opposed to 54.7 percent of the time under FWIP. In the winter, 120 cfs is exceeded 99.6 percent of the time under the Integrated Plan as compared to 20.2 percent of the time under the FWIP. Spring pulse flows of 7,000 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 1,000 cfs for 48 hours during dry years; augment spring quantity for channel maintenance occasionally (5-year 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 1,000 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 to provide pulse flows.	High
	Average summer flows have decreased from 2,779 to 2,280 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 4,000 cfs to 1,000 cfs by late August. Okay to have high flow in July, as it mimics the 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 2,174 from 3,142 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 3,204 to 2,471 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 1,400 cfs for high and average water years from March through May[1].	High
	Increase to 1,000-1,400 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 1,385 from 1,299 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

[1] 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**
	Average winter flows have increased from 195 to 290 cfs. Average flow in September has decreased to 1,166 from 1,534 cfs.	
Lower Naches River	Change ramping rate from spring to summer. Increase summer low flow. Check habitat needs versus flow.	High
	Reduce September flows as much as possible. Look at releasing more in summer and reducing flip flop.	High
	When compared to FWIP, the average summer flow has decreased by approximately 215 cfs, resulting in an average flow of 1,029 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 3,185 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. Also, evaluate early and late pulse and opportunities to improve Sockeye passage. 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 2,564 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

[2] This reach needs 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**
	Average spring flow has increased to 3,578 from 3,377 cfs, an increase of 201 cfs under the Integrated Plan.	
Yakima River—Chandler Reach	Need greater than 1,000 cfs in September.	Low
	Although some subordination occurs to provide 1,000 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 2,490 cfs. Subordination of Chandler Power plant was not modeled. Additional flow benefits would occur if subordination is adopted.	
Lower Yakima River (Chandler Powerplant to mouth)	See Wapato Reach.	Low
	Link to habitat needs.	Low
	Under the Integrated Plan, the average spring flow has increased by 196 cfs, resulting in an average flow of 3,668 cfs.	
Tributaries	**Flow Objective**	**Priority**
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 table below 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 with FWIP. Numbers of fish reaching the spawning grounds would grow from a maximum return of 91,000 adults with FWIP to 273,000 with the Integrated Plan.

Annual Adult Salmon Run Size	**Future without Plan (FWIP)**			**Future with 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 River 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 Integrated Plan. Yakima Basin Fisheries Managers identified the following 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	+

- \- = 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 percent 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 percent and (+) 40 percent of the estimate. Design and permit costs were assumed to be 30 percent 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 acre	$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.