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Case Study: Ice Harbor Irrigation

In the 1960's and 1970's, the U.S. Army Corps of Engineers built four dams on the Lower Snake River in Southeastern Washington. Only one, Ice Harbor Dam, provides irrigation water to the surrounding basin. According to the Corps 2002 Lower Snake River Feasibility Report (LSRFR), the Ice Harbor reservoir provides irrigation to an estimated 37,000 acres of farmland.[1]

To gain a regional perspective, there are approximately 14.7 million acres of agricultural lands in Washington.[2] These lands are separated into three main groups: Irrigated, non-irrigated, and pasture, rangeland, and other grazing. Just under 2 million acres are classified as irrigated, 6 million non-irrigated, with the remaining classified as pasture, rangeland, and other grazing. In Franklin and Walla Walla Counties, there are a total of 300,000 acres of irrigated land combined (see Figure 1).[3] The other three Lower Snake River dams do not provide irrigation.[4]

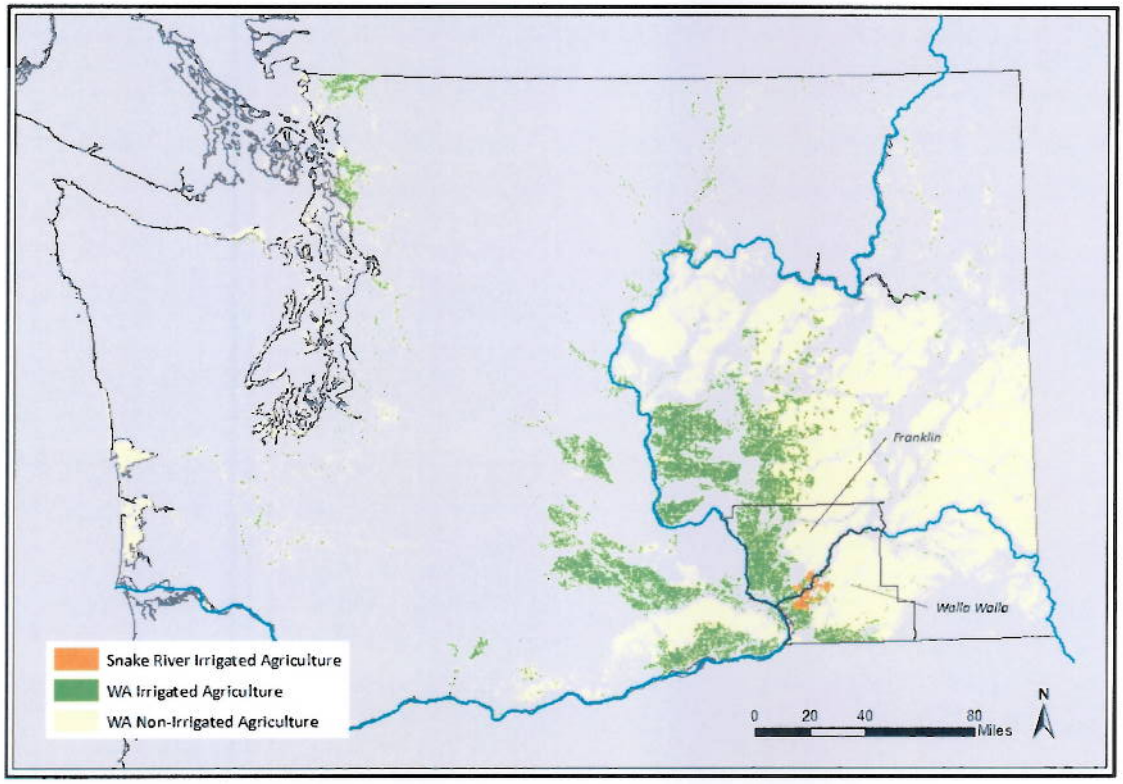

Figure 1. Irrigated and Non-Irrigated Agriculture in Washington State

The 2002 LSRFR evaluated the economic benefit of water supply from the Ice Harbor reservoir. The Corps analysis concluded that the economic effect associated with the loss of 37,000 acres of irrigated farmland would be $195 million (2015 USD; $134 million in 1998 dollars).[5] This case study will review the 2002 LSRFR and provide an estimate of the current benefits provided by the Ice Harbor reservoir.

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Review of the Lower Snake River Feasibility Report

The LSRFR made several assertions when calculating the value of irrigated farmland. First, the total acreage of irrigated farmland was not defined in the LSRFR. The LSRFR assumes there are 37,000 acres of irrigated farmland supported by the Ice Harbor reservoir. Second, the per acre value of irrigated farmland in the Ice Harbor project area is much greater than the Washington State per acre value. Finally, the report makes a bold assumption that all irrigated farmland converted to non-irrigated land would converted to pasture and only be used for grazing, providing little value.[6]

The LSRFR estimates that there were 37,000 acres of agricultural land irrigated using water withdrawn from the Ice Harbor reservoir, but notes the value may be as low as 34,000 acres and as high as 50,000 acres. This estimate is based on a survey of farms in the area stating they are presently withdrawing water from the reservoir. Earth Economics reevaluation has concluded that the maximum possible acreage irrigated by the Ice Harbor reservoir is 35,155 acres.

The average per acre value of irrigated land in the study area is estimated to be $4,100 (1998 USD) which is 20% greater than the Washington State per acre value of $3,400 per acre.[7] It is plausible that per acre values for this region are higher than the State average, but the value of $4,100 is based off the opinion of a local appraiser providing a "reasonable average value".[8] Further analysis should be conducted on the per acre value of irrigated farmland in the project area. For instance, a review of cash rents paid by farmers in Walla Walla County ($270/acre) are lower than the State average ($340/acre), while cash rents in Franklin County ($433/acre) are much higher.[9] This difference may be due to the availability of irrigated land in each of the counties, but should be investigated further.

Finally, the assumption that all land irrigated with water from Ice Harbor reservoir is not suitable for growing non-irrigated crops is inaccurate. Although a GIS dataset for agricultural lands in 1998 was not obtained, there are currently significant amounts of non-irrigated crops being grown adjacent to irrigated farms in the project area. Assuming that the land would only be valued at $100 per acre significantly props up the value of irrigated lands over non-irrigated lands.

Reevaluation of Agricultural Lands Irrigated from the Ice Harbor Reservoir

The 2002 LSRFR evaluated the economic benefit of water supply from the Ice Harbor reservoir. The Corps analysis concluded that the economic effect associated with the loss of 37,000 acres of irrigated farmland would be $195 million (2015 USD; $134 million in 1998 dollars).[5] This section of the report will reevaluate the acreages currently being irrigated by the reservoir and the value of irrigated, non-irrigated, and pasture agricultural lands.

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Agricultural Lands Irrigated from the Ice Harbor Reservoir

Earth Economics collected spatial data from the Franklin/Walla Walla County Assessor's office and WA Department of Agriculture (WSDA) to determine croplands irrigated from the Ice Harbor reservoir. First, parcels with active water rights to pump from the reservoir were identified. Not all acreage within a given parcel is irrigated, some remains non-irrigated or non-agricultural land. To identify only the irrigated acreage within these parcels, crop data from WSDA (2015) was overlaid on the parcel areas. WSDA provides field level data with both crop types and irrigation methods. Through this analysis, Earth Economics identified 19,095 acres of row crops, 5,241 acres of orchards, 2,209 acres of vineyards, and 8,610 acres of poplars for a maximum total irrigated acreage of 35,155.

Eliminating non-irrigated and non-agriculture lands within the parcels left a total of 35,155 irrigated acres with water rights to pump from the Snake River. This value can be considered the maximum number of acres irrigated by the Ice Harbor reservoir. The loss of all 35,155 acres is considered in *Scenario A* in Table 1.

Of the 35,155 acres, 6,345 acres are contained in parcels also allocated groundwater rights (). While the proportion of use by source is unknown, it can be assumed that some of the 6,345 acres are (or could be) irrigated with groundwater as opposed to Snake River surface water. Without surface water from Ice Harbor reservoir, some or all of these 6,345 acres may remain irrigated cropland, dependent on crop needs and irrigation efficiencies. The loss of 28,810 irrigated acres (35,155 acres – 6345 acres =28,810 acres) is modeled in *Scenario B* in Table 1.

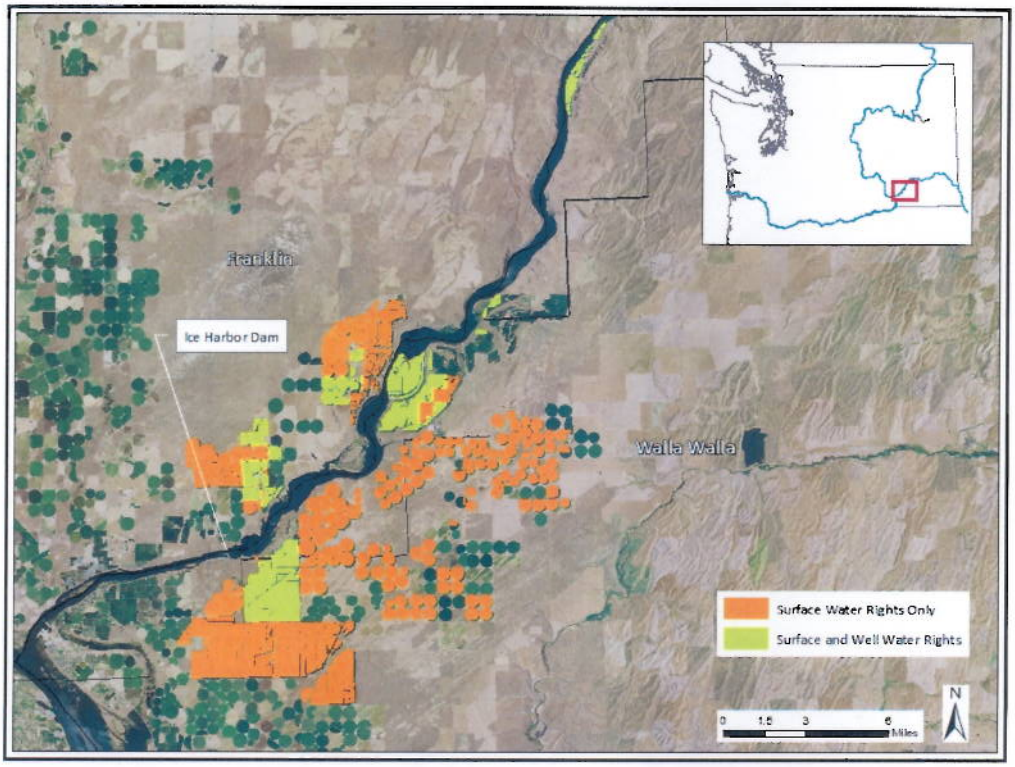

Figure 2.Snake River Irrigation with Both Surface and Well Water Rights

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In the event of decreased surface water availability (dam breaching), irrigated agricultural lands would retain some value through conversion to non-irrigated agriculture or pasture land. Earth Economics evaluated potential land-use change based on current uses adjacent to irrigated acreage. This proximity analysis conservatively identified 6,180 acres of irrigated row crops directly adjacent to non-irrigated plots greater than 50 acres. Based on the assumptions that ground conditions necessary for irrigated agriculture are sufficient for non-irrigated agriculture and climatic variation is insignificant across adjacent plots, these 6,180 acres would convert to non-irrigated agriculture.

If all 35,155 acres are to be converted to non-irrigated or pasture (i.e. ground water rights do not provide sufficient irrigation), then 6,180 acres would be transitioned to non-irrigated agriculture and 28,975 acres to pasture, modeled as *Scenario C* in Table 1.Assuming that ground water rights are viable for continued irrigated agriculture, of the 35,155 acres, 6,345 acres would remain irrigated, 5,865 acres would be converted to non-irrigated, and 22,945 acres would be converted to pasture. This scenario is modeled as *Scenario D* in Table 1.In all scenarios modeled, the 8,610 acres of poplar farms are not suitable for non-irrigated farming and converted to pasture.

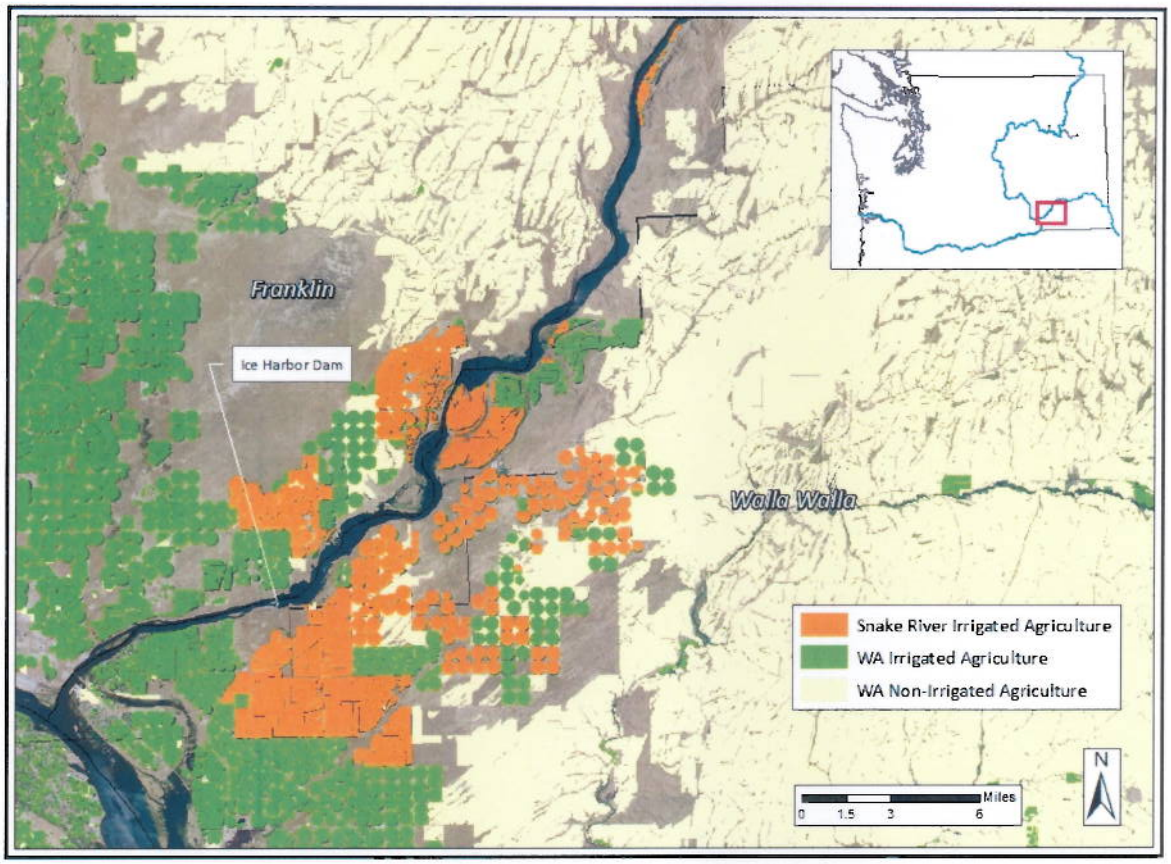

Figure 3. Irrigated and Non-Irrigated Agriculture in the Snake River Study Area

Value of Agricultural Lands

The value of irrigated, non-irrigated, and pastureland in the study area have also been reevaluated. As stated in the previous section, the LSRFR assumes a value of $4,100 per acre (1998 USD) for 28,400 acres of agricultural lands irrigated from the Ice Harbor reservoir.[10] The LSRFR also estimates the value of 8,600 acres of poplar trees irrigated by the reservoir to be $2,500 per acre.[11] The value of non-irrigated lands is estimated to be $100, assigned to 37,000 acres of land converted from irrigated to non-irrigated.[121] Per acre values are defined as '2002 LSRFR' in Table 1.

The calculation of the economic value of agricultural land irrigated by the Ice Harbor reservoir is as follows:

($4,100 * 28,400 acres) + ($2,500 * 8,600 acres) – ($100 * 37,000 acres) = $116,440,000 + $21,500,000 – $3,700,000 = $134,240,000.

The average per acre value of agricultural lands in Washington have increased significantly since the 2002 LSRFR. In 1998, the average per acre value for irrigated land was $3,400. The 2015 per acre value was $7,850, an increase of 130% over this period.[7] The value of non-irrigated farmland in Washington has increased from $840 per acre in 1998 to $1,240 per acre in 2015.[7] The value of pasture has increased from $550 per acre to $820 per acre.[7] These values are defined as *Value Set 1* in Table X. An argument can be made that the value of pasture in the study area is 2.6% the value of irrigated lands, or $208 per acre, defined as *Value Set 2*.[2]

Assuming that the per acre value for irrigated lands in the project area is indeed more valuable then state averages and has increased at the same rate as all irrigated lands in Washington (130%), the 2015 value of irrigated lands in the project area is estimated to be $9,466 per acre. This estimate is not unrealistic, but is assumed to be an upper estimate. The value for non-irrigated farmland is estimated to be consistent with the Washington State average of $1,280 per acre. The value of pasture in the study area is estimated to be 2.6% the value of irrigated land, or $152.38 per acre. These estimates can be found in *Value Set 3* in Table 1.

Economic Value Provided by the Ice Harbor Reservoir for Agriculture

The reevaluation of the economic value of agricultural land irrigated by the Ice Harbor reservoir is presented in Table 1. The estimates provided in this table illustrate the scenarios and value sets discussed in this reevaluation. Although values range from $182 million to $312 million, it is safe to

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[1] The LSRFR associated this value with non-irrigated farmland, but is technically considered pasture as it would have been used for grazing, as opposed to non-irrigated crop production.

[2] The value of pasture being 2.6% of irrigated land is derived from an analysis of cash rents for pasture and irrigated farmland.

assume irrigated parcels adjacent to land where there is non-irrigated farming occurring will be converted to non-irrigated farmland, while the remainder is converted to pasture suitable for grazing (Scenarios C and D). This can be considered a conservative estimate, with a maximum economic value of $289 million. Additionally, it can be argued that land with dual water rights (ground water and surface water) will remain productive (Scenarios B and C). It was identified that 6,345 acres of farmland held dual water rights, and therefore could be excluded from these calculations. If one were to assume these acres remain productive and that the value of the agricultural land in the study area is valued at 20% higher than the state average, the maximum value of agricultural lands in the study area decreases to $230 million. Using Washington State average farm values with this assumption brings the economic value of the agricultural lands to $182 million.

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Table 1. Economic Value of Agriculture Irrigated from the Ice Harbor Reservoir

Per Acre Value Assumptions			Acreage Assumptions									
			2002 LSRFR		Scenario A		Scenario B		Scenario C		Scenario D	
			With Reservoir	Dam Breaching	With Reservoir	Dam Breaching	With Reservoir	Dam Breaching	With Reservoir	Dam Breaching	With Reservoir	Dam Breaching
		Irrigated Acres	28,400	-	26,546	-	26,546	6,345	26,546		26,546	6,345
		Non-irrigated Acres	-	-	-	-	-	-	-	6,180	-	5,865
		Pasture Acres	-	37,000	-	35,155	-	28,810	-	28,975	-	22,945
		Poplar Acres	8,600	-	8,610	-	8,610	-	8,610	-	8,610	-
		Total Acres	**37,000**	**37,000**	**35,155**	**35,155**	**35,155**	**35,155**	**35,155**	**35,155**	**35,156**	**35,155**
2002 LSRFR (1998 USD)	Irrigated	$4,100	$116,440,000	$0	$108,836,685	$0	$108,836,685	$26,016,062	$108,836,685	$0	$108,836,685	$26,016,062
	Non-irrigated	$100	$0	$0	$0	$0	$0	$0	$0	$617,990	$0	$586,512
	Pasture	$100	$0	$3,700,000	$0	$3,515,530	$0	$2,880,991	$0	$2,897,540	$0	$2,294,480
	Poplar	$2,500	$21,500,000	$0	$21,524,406	$0	$21,524,406	$0	$21,524,406	$0	$21,525,000	$0
	Total Value		$137,940,000	$3,700,000	$130,361,092	$3,515,530	$130,361,092	$28,897,054	$130,361,092	$3,515,530	$130,361,685	$28,897,054
	Net Value		**$134,240,000**		$126,845,562		**$101,464,038**		**$126,845,562**		**$101,464,632**	
Value Set 1	Irrigated	$7,850	$222,940,000	$0	$208,382,434	$0	**$208,382,434**	**$49,811,241**	**$208,382,434**	$0	**$208,382,434**	**$49,811,241**
	Non-irrigated	$1,280	$0	$0	$0	$0	**$0**	**$0**	**$0**	**$7,910,269**	**$0**	**$7,507,347**
	Pasture	$820	$0	$30,340,000	$0	$28,827,342	**$0**	**$23,624,130**	**$0**	**$23,759,826**	**$0**	**$18,814,735**
	Poplar	$5,772	$49,639,706	$0	$49,696,056	$0	**$49,696,056**	**$0**	**$49,696,056**	**$0**	**$49,697,426**	**$0**
	Total Value		$272,579,706	$30,340,000	$258,078,490	$28,827,342	**$258,078,490**	**$73,435,371**	**$258,078,490**	**$31,670,095**	**$258,079,861**	**$76,133,324**
	Net Value		**$242,239,706**		**$229,251,147**		**$184,643,119**		**$226,408,394**		**$181,946,537**	
Value Set 2	Irrigated	$7,850	$222,940,000	$0	$208,382,434	$0	$208,382,434	$49,811,241	$208,382,434	$0	$208,382,434	$49,811,241
	Non-irrigated	$1,280	$0	$0	$0	$0	$0	$0	$0	$7,910,269	$0	$7,507,347
	Pasture	$208	$0	$7,688,230	$0	$7,304,919	$0	$5,986,412	$0	$6,020,798	$0	$4,767,700
	Poplar	$5,772	$49,639,706	$0	$49,696,056	$0	$49,696,056	$0	$49,696,056	$0	$49,697,426	$0
	Total Value		$272,579,706	$7,688,230	$258,078,490	$7,304,919	$258,078,490	$55,797,653	$258,078,490	$13,931,067	$258,079,861	$62,086,288
	Net Value		**$264,891,476**		**$250,773,571**		**$202,280,837**		**$244,147,422**		**$195,993,572**	
Value Set 3	Irrigated	$9,466	$268,839,412	$0	$251,284,700	$0	$251,284,700	$60,066,496	$251,284,700	$0	$251,284,700	$60,066,496
	Non-irrigated	$1,280	$0	$0	$0	$0	$0	$0	$0	$7,910,269	$0	$7,507,347
	Pasture	$152	$0	$5,638,060	$0	$5,356,964	$0	$4,390,055	$0	$4,415,271	$0	$3,496,329
	Poplar	$5,772	$49,639,706	$0	$49,696,056	$0	$49,696,056	$0	$49,696,056	$0	$49,697,426	$0
	Total Value		$318,479,118	$5,638,060	$300,980,756	$5,356,964	$300,980,756	$64,456,551	$300,980,756	$12,325,541	$300,982,126	$71,070,172
	Net Value		**$312,841,058**		**$295,623,792**		**$236,524,204**		**$288,655,215**		**$229,911,954**	

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Endnotes

[1] USACE 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report / Environmental Impact Statement, Appendix I: Economics, p I3-125. Available at: www.nww.usace.army.mil/Library/2002LSRStudy.aspx

[2] USDA NASS, 2012. Census of Agriculture, Table 8. Farms, Land in Farms, Value of Land and Buildings, and Land Use: 2012 and 2007. Available at https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_US_State_Level/st99_2_008_008.pdf

[3] USDA NASS, 2012. Census of Agriculture, Table 10. Irrigation: 2012 and 2007. Available at https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_County_Level/Washington/

[4] USACE 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report / Environmental Impact Statement, Appendix I: Economics, p I3-134. Available at: www.nww.usace.army.mil/Library/2002LSRStudy.aspx

[5] USACE 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report / Environmental Impact Statement, Appendix I: Economics, p I3-138. Available at: www.nww.usace.army.mil/Library/2002LSRStudy.aspx

[6] USACE 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report / Environmental Impact Statement, Appendix I: Economics, p I3-136. Available at: www.nww.usace.army.mil/Library/2002LSRStudy.aspx

[7] USDA ESMIS, 2016. Agricultural Land Values 1997-2015. Available at http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1446

[8] USACE 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report / Environmental Impact Statement, Appendix I: Economics, p I3-135. Available at: www.nww.usace.army.mil/Library/2002LSRStudy.aspx

[9] USDA NASS, 2016. Cash Rents. Available at https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_County_Level/Washington/

[10] USACE 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report / Environmental Impact Statement, Appendix I: Economics, p I3-137. Available at: www.nww.usace.army.mil/Library/2002LSRStudy.aspx

[11] USACE 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report / Environmental Impact Statement, Appendix I: Economics, p I3-135. Available at: www.nww.usace.army.mil/Library/2002LSRStudy.aspx

[12] USACE 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report / Environmental Impact Statement, Appendix I: Economics, p I3-136. Available at: www.nww.usace.army.mil/Library/2002LSRStudy.aspx