

# *Umatilla Basin Watershed Council*



## **Dillon Dam Removal Feasibility Study Final Summary of Findings**

This study was completed through  
funding and partnerships with:

Oregon Watershed Enhancement Board (212-6033)  
Oregon Water Resources Department (GC 0041 13)  
Confederated Tribes of the Umatilla Indian Reservation  
Oregon Department of Fish and Wildlife  
Dillon Irrigation Company  
Westland Irrigation District and  
Umatilla County



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## **Executive Summary**

The Umatilla Basin Watershed Council began researching this project in February of 2011 after the Dillon Irrigation Company reported a failing irrigation diversion structure and stream gravel movement that seasonally blocked their irrigation headgate. This movement required a large amount of instream dredging to maintain the diversion. A public meeting was organized by the UBWC that identified questions that must be answered through professional consultation with irrigation and environmental engineering firms. The Oregon Watershed Enhancement Board and Oregon Water Resources Department provided financial backing along with multiple agencies, tribal staff, landowners and members of the public contributing to the results of this feasibility study.

Work completed included contracting professional engineers from River Design Group (RDG) and IRZ Consulting (IRZ) for topographical survey, sediment/geomorphic evaluation, detailed construction estimates for removal of the Dillon Dam, and evaluation of irrigation systems. The UBWC coordinated publically held stakeholder meetings, temperature monitoring, contract management and administration.

River Design Group determined, through HEC/RAS modeling, the sheer stress and velocity change within the Umatilla River would be very small and insignificant if the Dillon Diversion Dam were to be removed. Upon RDGs determination that removal of the dam would lead to insignificant impacts, IRZ Consulting assisted with cost estimates of alternative irrigation practices and conducted multiple evaluations of potential opportunities. We were able to conclude that moving the Point of Diversion to the already existing Westland Diversion Dam was the only feasible option for the future removal of the Dillon Dam.

Final conclusion by the Umatilla Basin Watershed Council was that the Dillon Irrigation Company water rights should be transferred to the Westland Canal, a pipeline down Andrews Road should be constructed after which the dam could be removed. A Point of Diversion Transfer application is currently pending within the Oregon Water Resources Department along with a pending grant application through OWEB for engineering and design of the proposed alternate conveyance of water rights.

The Dillon Irrigation Company has been very engaged with the process of removing the dam. The UBWC understands that financial resources are limited and that if progress towards dam removal is not forth-coming, the Company will be placed in a difficult position to either 1) continue to operate an undesirable diversion system in hopes the alternative plans are funded or 2) improve the effectiveness of the diversion structure. Should the effectiveness of the diversion structure be improved, it would exhaust their limited resources budgeted to participate in the dam removal project.

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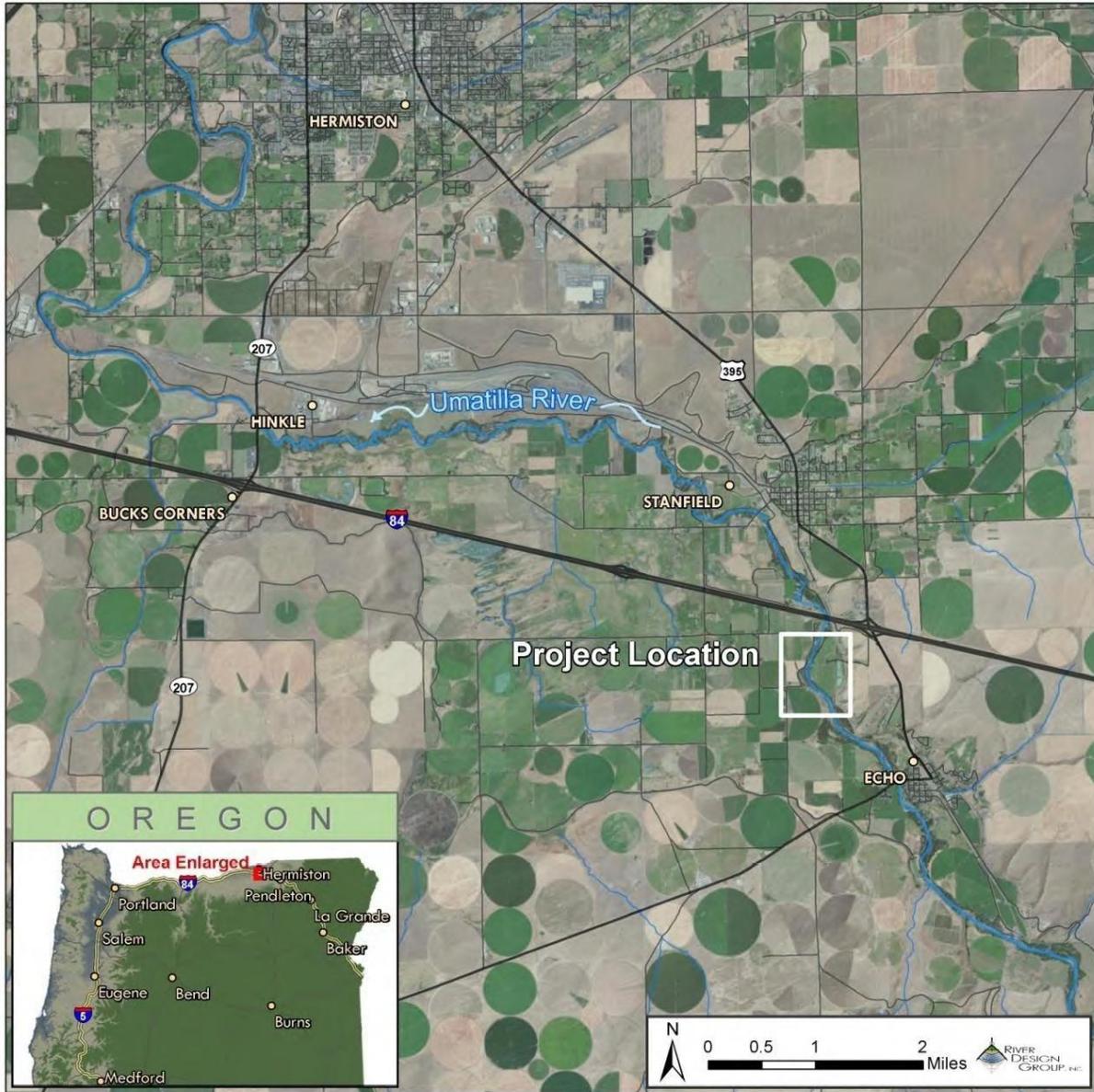
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## **Background**

Historically, the Dillon Irrigation Company (DIC) has diverted water at river mile 25.2 on the Umatilla River. The Dillon Dam, a diversion dam, is utilized to divert water into the Dillon Irrigation Ditch. The dam serves no other purpose. The DIC holds water rights that entitle them to divert instantaneous flows of 22.9 cubic feet per second (cfs) and for the irrigation of 1,821 acres. The Dillon Dam was re-constructed in 1976 and has now exceeded its useful life expectancy. It currently consists, in part, of broken and dilapidated stanchions that hold flash boards to raise water levels behind the dam that help divert stream water into the Dillon Ditch. The Umatilla Basin Watershed Council undertook the project in 2011 to determine the feasibility of dam removal to eliminate a fish passage obstacle and improve irrigation efficiency through decreased operation and maintenance expenses within the lower Umatilla River Basin.

Work proposed for the Dillon Dam Feasibility Study included a Geomorphic Survey, Sediment Transport Modeling, HECRAS Modeling, Alternative Irrigation Analysis, Temperature Monitoring and Environmental Conditions Evaluation, Detailed Construction Cost Estimates and, if found feasible, a point of diversion transfer application.

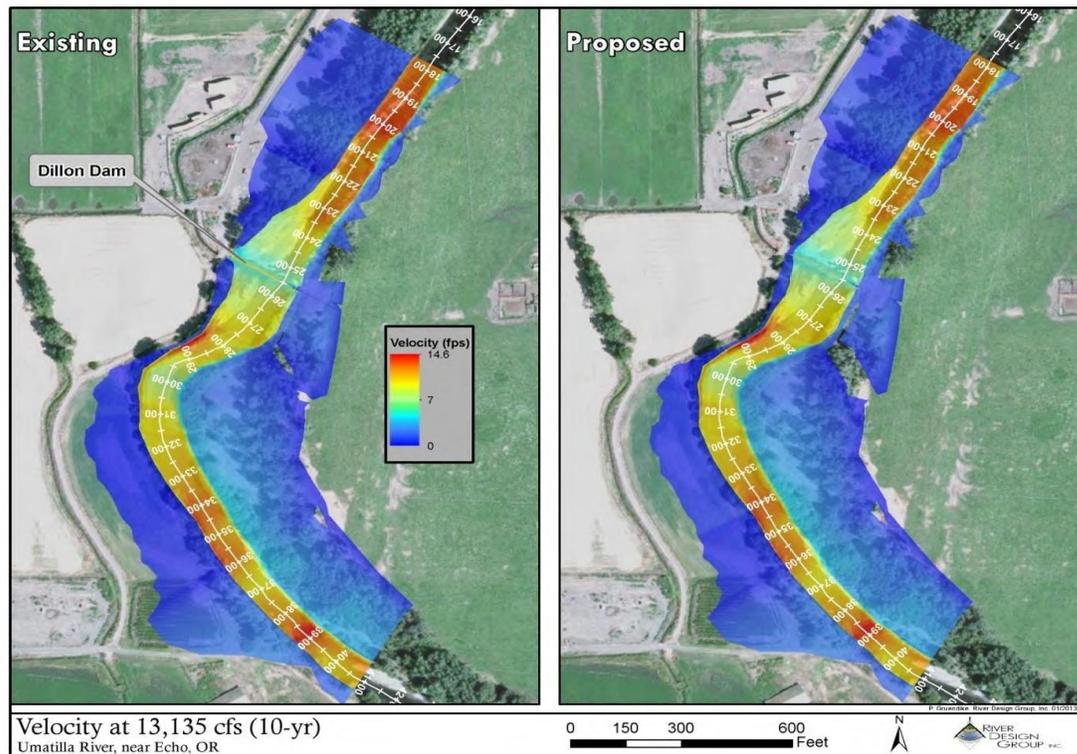


**Figure 1: Dillon Dam Project Location**

## Description and Results of Work Completed

### Geomorphic Survey / Sediment Transport Modeling / HECRAS Modeling

A HEC/RAS model was completed by River Design Group, Inc. (RDG) of Corvallis, Oregon to determine feasibility of dam removal. A report was provided December 2013, entitled “Dillon Dam Scoping Report” that included a survey of current stream conditions projects and forecast future conditions if the dam was removed. Figure 2 shows that velocity changes are nearly indistinguishable due to the small influence Dillon Dam has at high flow conditions.



**Figure 2: Velocity plots for existing and proposed (no dam) conditions based on the removal of Dillon Dam.**

### Alternative Irrigation Analysis

IRZ Consulting, Inc (IRZ) was contracted to complete “Alternative Irrigation Analysis” through review of conceptual designs completed in 1998 and evaluation of new ideas. Alternatives evaluated were movement of the point of diversion (POD) downstream and movement of the POD upstream. The results of this work are included in a report dated February 2013.

Regarding the movement of the POD downstream, IRZ concluded that movement downstream would not be a realistic choice due to lateral migration of the active flood plain and stream channel. The cost of a pump station to divert water from the river was estimated at \$625,000 with an annual operating cost of \$25,000. This alternative would also require a new structure in

the river to create a large enough pool from which to pump water. Due to the previously mentioned lateral migration, this would increase the amount of instream work to insure the channel stayed within operating capacity of the new structure. Furthermore, this alternative was deemed unacceptable by the DIC due to the operating costs and increased maintenance. To conclude, movement of the POD downstream was rejected early on in the feasibility study for the previously mentioned reasons. It would be inefficient, both environmentally and economically, to develop this structure and would be better to reconstruct the existing Dillon Dam than implement this alternative.

Moving the POD upstream was evaluated by IRZ and concluded to be the better alternative. Two options were proposed; both involved diverting water at the existing Westland Irrigation District (WID) diversion dam. Option A, developed in 1998, was reviewed and concluded to be the better option for easement opportunities and direct delivery to the DIC ground. Option B, proposed by IRZ had a slightly shorter pipeline but involved multiple landowners and that would require expensive easements and affect high profile agriculture land.

Keeping the existing structure was evaluated briefly. It was determined that “No Action” would directly cause an “Action” by the DIC. The dilapidated stanchions that hold the flashboards in place have exceeded their life expectancy and are in need of replacement if the dam is not removed. “No Action” would cause the DIC to rebuild the dam to be bigger and more efficient. If the dam was repaired, it would remove the incentive for the Dillon Irrigation Company to participate in the alternate point of diversion that would lead to removal of the aquatic species barrier.

### **POD Transfer Application**

An “Additional Point of Diversion Transfer Application” was prepared by the Umatilla Basin Watershed Council with assistance from IRZ Consulting and the Oregon Water Resources Department. IRZ recommended an “Additional POD Transfer” to the WID diversion dam. This would allow the landowner the opportunity to utilize the existing DIC POD during high flow events.

Upon initial OWRD Watermaster Review, Watermaster Mr. Tony Justus determined that moving the POD upstream would injure an in-stream water right established for fish protection. To overcome the injury, ODFW would need to conclude the injury was mitigated by an environmental benefit. For ODFW to accept the injury to the instream water right, the dam must be removed. The existing POD would be unusable if the dam was removed. The UBWC agreed that the proposal would be amended to remove the existing POD from the transfer application and remove any ability to use the diversion structure at the existing location.

At the time this final report was prepared, ODFW was undergoing review of habitat conditions and is expected to require that the additional point of diversion transfer application be amended and “Additional” be removed from the proposal.

### Temperature Monitoring / Environmental Conditions Evaluation

The Umatilla Basin Watershed Council conducted stream temperature monitoring at 13 sites during the summer of 2012 and 2013. The UBWC also worked with the Oregon Department of Environmental Quality (ODEQ) to conduct stream temperature modeling in this reach. Figure 3 shows the results of this monitoring effort for 2012; Figure 4 shows the results for 2013. For 2013, the spike in water temperature at the “Dillon Ladder” occurred when the thermister cable became entangled in floating plant debris, which caused a surfing effect and began reading air temperature. The decline in 2013 at the “below Dillon” site occurred due to isolation of the thermister outside of the thalweg and in an isolated pool from the main stream flow as stream flows reduced. The temperature decrease is believed to be caused by the shaded area and ground water return in the isolated pool. Both thermisters were placed in the thalweg once the discoveries were made.

ODEQ ran a Heat Source model of the Umatilla River to estimate what the temperature effects would be under varying ranges of stream flow if the POD were moved upstream to the WID diversion. Results from ODEQ modeling showed that the stream temperature could increase by up to 0.3 degrees Celsius in the modeled reach when stream flow was reduced from 60 cfs down to 50 cfs. The river temperature increase, however, would go to zero after 10 kilometers.

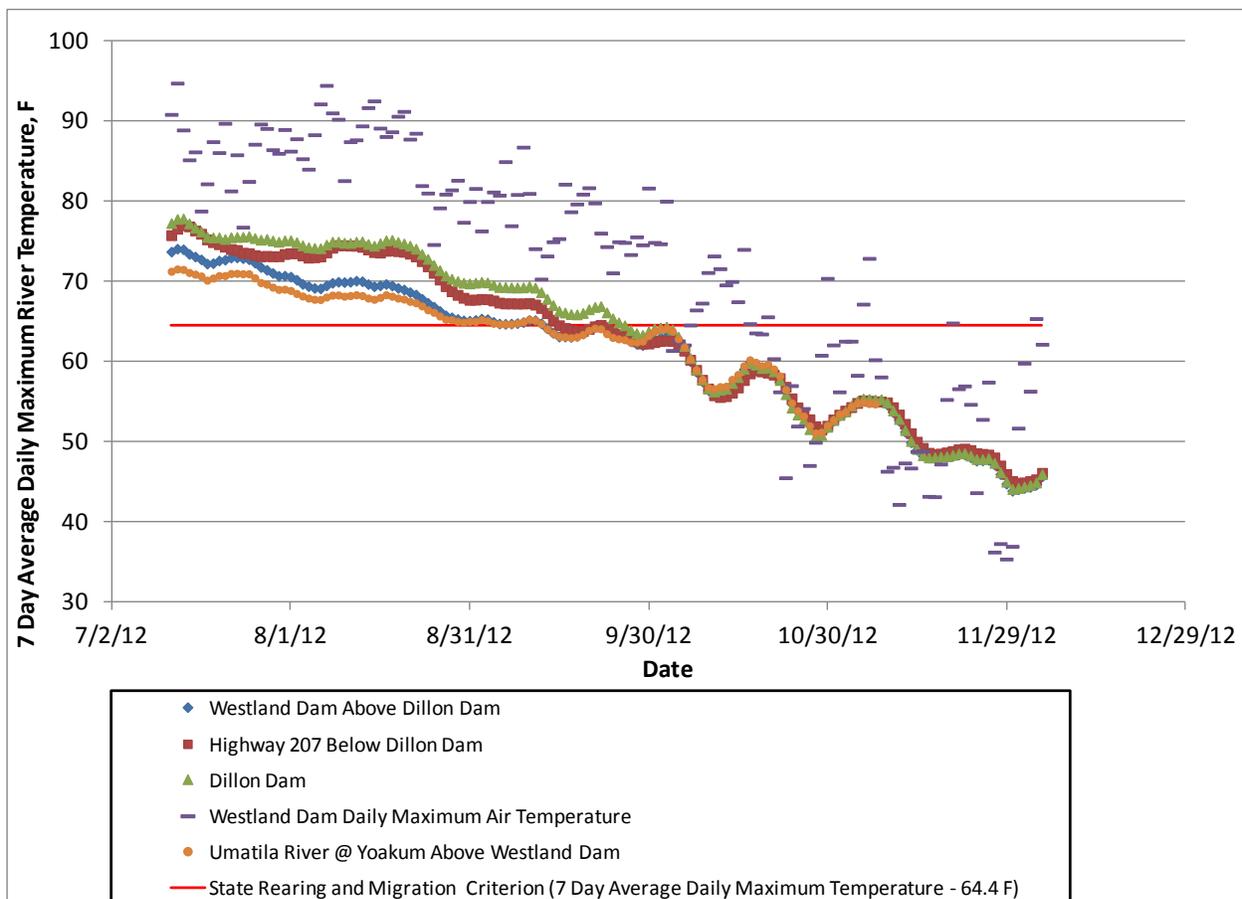
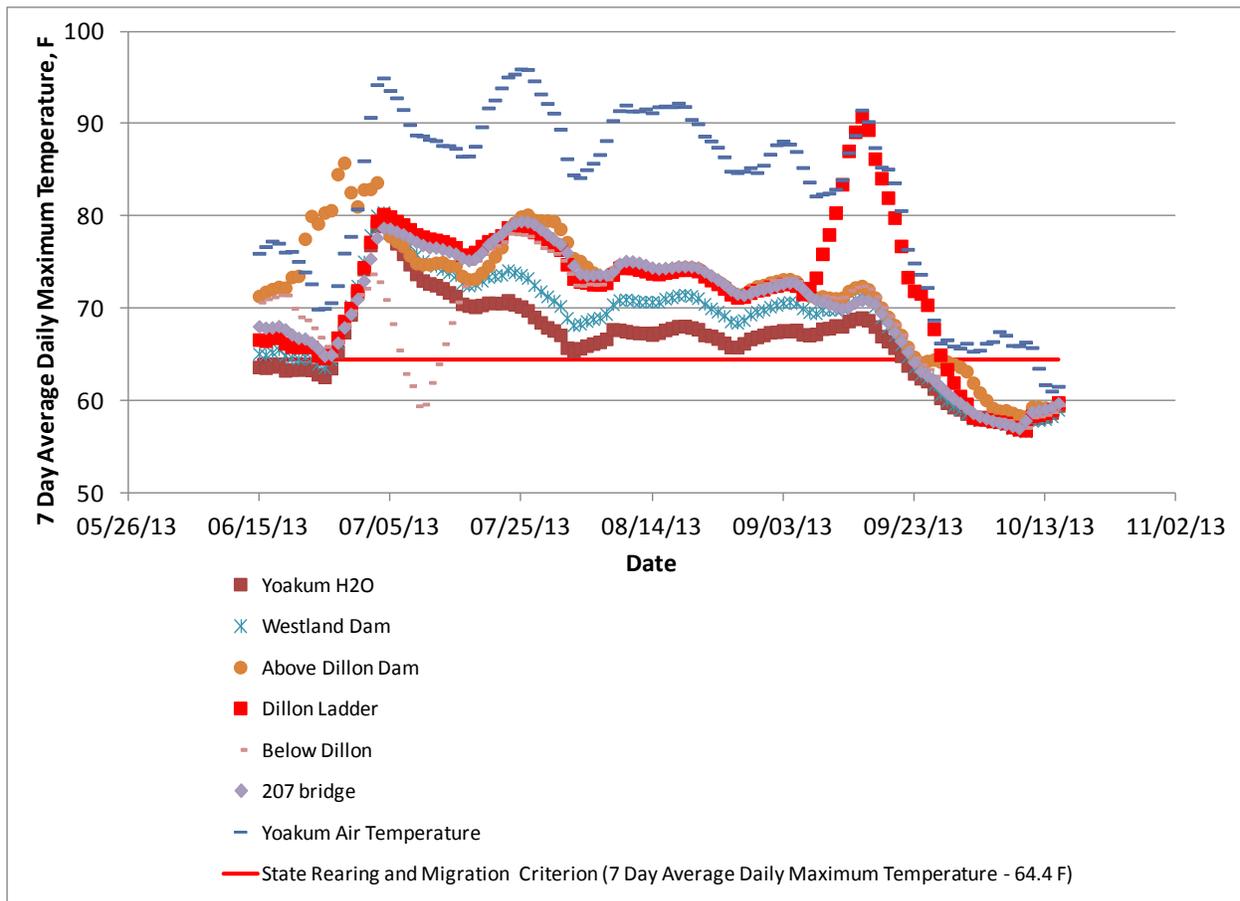


Figure 3: 7 Day Average Daily Maximum River Temperature for Umatilla River Above and Below Dillon Dam, 2012



**Figure 4; 7 Day Average Daily Maximum Temperature for Umatilla River Above and Below Dillon Dam, , 2013**

### **LiDAR Mapping, FLIR and Orthoimagery**

In addition to the project funded under this grant, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) conducted LiDAR Mapping, Thermal Imagery and Ortho Imagery of the Dillon Dam Project area. LiDAR data and orthoimagery was given to RDG engineers to enhance their portion of the project. In addition, the Option A pipeline route was also flown down Andrews Road in an attempt to save on future surveying and engineering costs of the pipeline.

### **Aquatic Species Migration and Blockage**

The UBWC and RDG worked jointly to compile Umatilla River data regarding aquatic species migration and blockage. Much of the published data was from the CTUIR fish habitat program. RDG graphed these data and related them to seasonal use of the Umatilla River. It showed a worst case scenario of stream flow influences and correlated it to the presence of aquatic species.

The findings showed that, when water levels are at their lowest point, the presence of native aquatic species, at best, is limited due to migration patterns. In addition it showed a lack of use in the lower river during the summer. All information was passed on to ODF&W to support their findings of environmental impacts of the project. See Dillon Dam Scoping Report published by River Design Group for full report.

Aaron Jackson, Lamprey Passage Specialist with the CTUIR and Dr. Mary L Moser, NOAA-NMFS Research Fish Biologist, have been completing lamprey research on the Umatilla since 2006. They have concluded that “the Dillon Diversion Dam obstructs upstream passage of Pacific Lamprey spawning migration. The few lamprey that are able to pass Dillon Diversion Dam experienced an average migration delay of one week. Dillon Diversion Dam limits access to lamprey spawning habitats and recovery of this imperiled species.” Aaron Jackson (CTUIR) Presentation prepared for Dillon Dam Public meeting, February 2013.

### Estimated Costs for Construction of a Pipeline

IRZ Consulting completed preliminary estimates for three alternatives for delivering water from the new POD to the current place of use (POU). These cost estimates were based from their extensive knowledge in irrigation pipeline construction. Due to limited funds and uncertainty of the POD transfer location during the study, it was not reasonable for the UBWC to ask them to design and engineer multiple pipeline locations for a detailed cost estimate. A very generic cost estimate was created with the intent that technical assistance, specific to pipeline design and engineering, would be sought specific to the OWRD and ODFW approved POD alternative. This was believed to be the most responsible use of limited financial resources.

River Design Group was able to complete a detailed construction cost estimate for removal of the dam. This was easily attainable given extensive knowledge of dam removals and construction costs for other projects. The engineering survey data collected for the sediment transport and HECRAS modeling allowed them to easily calculate costs for removal. Figures in Table 1 are believed to be reasonable, detailed, estimates for removal of the dam structure.

**Table 1: Projected Estimated Costs of Alternative Points of Diversion and Dam Removal**

Dam Removal Construction		Pipeline Options	
Planning and Outreach	\$20,000	Alternative 1A Pipeline - Andrews Road 21"	\$540,000
Design and Studies	\$50,000	Alternative 1B Pipeline - Andrews Road 30"	\$940,000
Permits/Reports/Assessments	\$46,000	Alternative 2 - Echo Meadows Route 30" Pipe	\$730,000
Floodplain CLOMR-LOMR	\$30,000	Alternative 3 - Pump Station (+\$25K annual power)	\$680,000
Dam Removal Construction	\$250,000		
Restoration and Monitoring	\$30,000		
Total	\$426,000		

The feasibility study found that Alternative 1A Pipeline, a 21” pipe, would deliver 10cfs of the Dillon Irrigation Company. This was as small of a diameter as the DIC was willing to negotiate since 12.9 cfs could be delivered through existing infrastructure in the Westland System. Ideally, a 30” pipe that could hold the full 22.9cfs would be constructed, but the ability to raise the additional \$400,000 for the project is believed to be challenging.

Estimated project costs for pipeline and dam removal total \$966,000. This is estimated in 2013 dollars and does not include any contingencies. To complete the project, it is recommended the project be completed in phases. The phases identified and if all goes well timelines:

Phase I – Engineering, design and detailed alternative point of diversion designs.  
Currently pending an Oregon Watershed Enhancement Board Technical Assistance Grant

Phase II – Construction of alternative point of diversion delivery system.  
To be applied for to OWEB and other potential funding sources in April 2014. Begin Construction in Fall 2014/Winter 2015.

Phase III – Engineering, Design and Permitting for Dam Removal  
Begin Summer of 2015.

Phase VI – Dam Removal Construction and Restoration  
Begin Summer of 2016.

## **Community Public Relations**

In additional to all reports and data available on the Umatilla Basin Watershed Council website, the following presentations and updates were given:

River Restoration Northwest Symposium – Skamania, Washington - 1/30/2012

“Introduction to Stream Project: Decision Analysis and Design Guidance for Stream Restoration”. Presented by Dr. Peter Wilcock, Dr. Daniel Baker, and Greg Silbernagel

International Fish Passage Conference – Corvallis, Oregon 6/25/2013

Session A: Dam Removal III – Titled “Dillon Diversion Dam Removal Feasibility Study”  
Presented by Greg Silbernagel

National Water Quality Monitoring Summit – Portland, Oregon 5/13/2012

Session 6: “Dam Removal and Associated Water Quality Impacts”  
“Dillon Dam: Evaluation of a Umatilla River Diversion Structure”  
Presented by Greg Silbernagel

Umatilla River Operations Meetings – Updates provided monthly since April 2011.

Umatilla Basin Watershed Council Meetings – Updates provided monthly since March 2011.

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Oregon Department of Fish and Wildlife – Restoration and Enhancement Board  
Presentation and discussion of Dillon Dam – Presented by Greg Silbernagel.  
1/31/2013 - Salem, Oregon  
4/26/2013 - Medford, Oregon  
7/26/2013 - Lakeview, Oregon  
11/15/2013 - Coos Bay, Oregon

Hermiston Chamber of Commerce –  
Leadership Hermiston Class on Agriculture Awareness Day - 10/8/2013

Pendleton Chapter of Rotary International - Presentation given on 5/13/2013  
Umatilla Basin Watershed Council Activities presented by Greg Silbernagel

Umatilla Basin Restoration Team Meetings – Updates provided at quarterly meetings

Umatilla Basin Technical Team Meetings – Updates provided at quarterly meetings

City of Echo Newsletter: “The Echo” - September 2013 Publication  
Voluntary newsletter insert informing local citizens of plans for removal and notification  
of irrigation point of diversion transfer application.

East Oregonian Newspaper  
“Dam on Umatilla may be on way out” 11/17/2011  
“New Study Shows Dam Removal a Possibility” 2/22/2013

Oregon Public Broadcasting  
“Dam on Umatilla may be on way out” 11/17/2011  
“New Study Shows Dam Removal a Possibility” 2/22/2013

Hermiston Herald  
“Removal of Dillon Dam could benefit fish, farms” 2/22/2013

Dillon Dam Public Meeting –  
Blue Mountain Community College - Hermiston, Oregon 11/15/2011  
Blue Mountain Community College - Hermiston, Oregon 2/21/2013

Umatilla County Commissioners Meeting – Pendleton, Oregon  
February 20<sup>th</sup>, 2013 – Dillon Project presented to Umatilla County Commissioners  
September 18<sup>th</sup>, 2013 – Proposal to Umatilla County Commissioners seeking easement  
down Andrews Road. Easement was granted, signed and approved.

Oregon Department of Environmental Quality – Pendleton, Oregon 11/13/2013  
Northeast Oregon Water Quality Monitoring Summit -  
“Results of temperature monitoring on low head dams in the lower Umatilla River.”  
Presented by Dick Nichols and Greg Silbernagel

## Water Savings Evaluation and Fish Bypass Evaluation

Although the purpose of the project is the feasibility of removing the dam as a barrier to fish passage, a water savings estimate was conducted by IRZ Consulting and results were found to be inconclusive.

“On October 11, 2012 an attempt to measure the flows in the Ditch at three locations was undertaken. The condition of the canal, along with the relatively low volume flowing through it, was not conducive to stream gauging. The canal was overgrown with grasses, aquatic weeds, and had a soft silty bottom. An attempt to reduce these impacts was made with mixed results. The volume flowing in the canal was also such that flow depths were not large enough to get optimum flow velocity readings with the equipment utilized.” IRZ Consulting, February 2013

An evaluation of DIC water usage was then conducted through data collected by the OWRD gage station, #14031000 - DILLON CN NR STANFIELD, OR. OWRD operates this gage station on the Dillon Canal where the water is considered owned by the DIC after this point. Any water loss that occurs prior to this point, between the headgate and the gage station, is believed to return immediately back to the Umatilla River through the operation of the fish screen return.

The fish screen bypass return is typically shut off during the summer months with the judgment that the fish are doomed whether in the canal or in the nearly dry slough the return pipe delivers the stranded fish to. The nearly dry slough runs 600 feet before returning to the Umatilla River. Predatory wildlife such as Blue Herons, Black Capped Night Herons, King Fishers, Mergansers and evidence of raccoons are frequently seen feeding in and around this slough. See Figures 5 and 6 below.



Figure 5: Dillon Ditch Fish Screen 7/11/2013



Figure 6: Dillon Ditch Fish Screen Return 7/11/2013

This feasibility study found water savings measurements undetectable. Through OWRD gage station data the DIC must divert more than their water right at the headgate to meet their water right at the gage station location. However, the additional water diverted is intended to operate the fish screen and is returned back to the river over the course of 1200 feet and before the OWRD gage station data is collected. This additional water diverted is done so under an OWRD exempt water use statute defined under ORS 537.141(d). This exemption allows DIC to divert extra water at the headgate as long as it used to operate the fish screen bypass back to the river. This concludes that any “water savings” would equal each other out when the Dillon Dam and Ditch is decommissioned since this additional water would no longer need to be diverted to operate the fish screen.

### **County Road and State Highway easements**

Option A pipeline would require easements from Spike Ranches, Umatilla County, Double M Ranch, Oregon Department of Transportation, and Courtney Irrigation District. Approval has been granted from Umatilla County, Double M Ranch, Courtney Irrigation District and Oregon Department of Transportation. Signed documents are available at the Umatilla Basin Watershed Council office upon request. Umatilla County easement has been granted subject to approval of future designs. Oregon Department of Transportation easement has been granted under condition of updating their state records after the project is complete. Copies of easements are available and on file at the Umatilla Basin Watershed Council office. Negotiations are currently taking place with Spike Ranches for an easement to shorten the pipeline. Additional Umatilla County road easement is a secondary plan if Spike Ranch easement is unattainable.

### **Cultural Resources Evaluation**

A cultural resources survey was completed by Historical Research Associates, Inc (HRA). The document entitled “Archaeological Investigations of Twenty-eight Oregon Department of Fish and Wildlife Fish Screen and Passage Projects in Grant and Umatilla Counties, Oregon” September 2013. Due to confidential findings at other passage locations, the report is protected to preserve historical artifacts from theft. The report at the time of this publication was being reviewed by the State Historical Preservation Office for Section 106 compliance. However, HRA has recommended that Dillon Dam, Dillon Headgate and Dillon Ditch do not meet eligibility for the Historic Register and may be removed upon SHPO concurrence. This survey was funded through Oregon Department of Fish and Wildlife.

### **Preliminary determination of the effects or unintended consequences to downstream Umatilla River water users.**

Umatilla District Watermaster, Tony Justus, made a preliminary determination that there would be injury to three downstream water users. 1) Certificate 53515 in the name of D.W. Bowman, currently serving property owned by Mike Yunkers. There are 50.9 acres associated with this right at a rate of .63cfs. 2) Certificate D2577 in the name of J.H. Koontz, currently serving

property owned by Tim Smith. There are 4 acres associated with this right at the rate of .05cfs. and 3) Instream Water Right Certificate #59837 held by the Oregon Water Resources Department with the purpose to support aquatic life would be injured. This is a unique water right in that it covers the entire river and not a specific point. The injury would occur if the POD was moved upstream to the Westland Diversion Dam, thus reducing flow in the Umatilla River for 2.6 miles. This is currently undergoing an evaluation of mitigation by the Oregon Department of Fish and Wildlife through the Point of Diversion Application process. The UBWC is working with ODFW and OWRD on this matter.

## **Description and explanation of changes to original proposal**

There were a few changes to the original grant proposal due to lack of a third successful funding proposal. This proposal by NOAA American Rivers, ranked high for the Northwest region but was not funded due to a legislative decision that all funding in 2011 would go towards construction-ready projects. This was out of our control. The more expensive deliverables in the grant that could be completed at later stages were removed from this project. Portions of the project with the highest priority were completed until funds were depleted.

Examples of budget line items removed were “Development of a highly detailed cost estimate and engineering of the proposed pipeline system”. This was removed because of the lengthy process associated with the Point of diversion transfer. We did not want to spend funding designing and estimating a project that could change or be useless if the POD transfer was not approved. Rough estimates were made by IRZ but detail is lacking due to the need of an engineer to design portions. To be sure, an increased level of design will produce a more accurate cost estimate.

A component of the survey was to determine if the Westland Irrigation District (WID) could carry the additional water. We were able to cut costs in this regard by working with WID, who is highly knowledgeable of their system and who provided a letter supporting the project. This letter confirmed that the WID system had capability to carry the additional water. Places of flow capacity shortfalls in the WID system are well down stream of the proposed Dillon outlet. There was no need to spend limited funds to hire a surveyor and engineer to confirm this.

Research was conducted with the Allen, Courtney and Pioneer irrigation ditches. It was determined early, however, that a large, mega pipeline, that included all irrigation companies would involve many landowners with differing needs that could not be realistically met in a cost effective manner. It would be cheaper to pipe them all individually than route a large pipeline that would meet all landowner needs.