

# **INITIAL STUDY REPORT DOCUMENT VOLUME 1: SECTIONS 1-4**

**INTRODUCTION  
EVALUATION OF GOALS AND OBJECTIVES  
SUMMARIES OF STUDY RESULTS  
INITIAL STUDY REPORT MEETING**

**WELLS HYDROELECTRIC PROJECT  
FERC PROJECT NO. 2149-131  
SECURITY LEVEL: PUBLIC**



Prepared by:  
Public Utility District No. 1 of Douglas County  
1151 Valley Mall Parkway  
East Wenatchee, WA 98802  
[www.douglaspud.org/relicensing](http://www.douglaspud.org/relicensing)

October 15, 2008

For copies of this Initial Study Report Document, contact:

Public Utility District No. 1 of Douglas County

Attention: Relicensing

1151 Valley Mall Parkway

East Wenatchee, WA 98802-4497

Phone: (509) 884-7191

E-Mail: [relicensing@dcpud.org](mailto:relicensing@dcpud.org)

**Table of Contents**

---

**1.0 INTRODUCTION.....1**

**2.0 EVALUATION OF GOALS AND OBJECTIVES.....3**

2.1 Cultural Resources Investigation .....4

2.2 Public Access Study.....5

2.3 Recreational Needs Analysis .....6

2.4 Piscivorous Wildlife Control Study .....7

2.5 Transmission Line Wildlife and Botanical Study .....8

2.6 Juvenile Lamprey Study .....10

2.7 Adult Lamprey Passage Study .....11

2.8 Total Dissolved Gas Investigation .....12

2.9 Water Temperature Study .....13

2.10 Okanogan Toxins Study.....14

2.11 DO, pH and Turbidity Study (Not Required by FERC) .....15

2.12 Lamprey Spawning Assessment (Not Required by FERC).....16

**3.0 SUMMARIES OF STUDY RESULTS .....17**

3.1 Cultural Resources Investigation .....17

3.2 Public Access Study.....18

3.3 Recreational Needs Analysis .....18

3.4 Piscivorous Wildlife Control Study .....19

3.5 Transmission Line Wildlife and Botanical Study .....20

3.6 Juvenile Lamprey Study .....21

3.7 Adult Lamprey Passage Study .....22

3.8 Total Dissolved Gas Investigation .....23

3.9 Water Temperature Study .....24

3.10 Okanogan Toxins Study.....24

3.11 DO, pH and Turbidity Study (Not Required by FERC) .....26

3.12 Lamprey Spawning Assessment (Not Required by FERC).....28

**4.0 INITIAL STUDY REPORT MEETING .....29**

## List of Tables

---

Table 2.1-1	Cultural Resources Investigation -----	4
Table 2.2-1	Public Access Study-----	5
Table 2.3-1	Recreational Needs Analysis-----	6
Table 2.4-1	Piscivorous Wildlife Control Study -----	7
Table 2.5-1	Transmission Line Wildlife and Botanical Study -----	8
Table 2.6-1	Juvenile Lamprey Study -----	10
Table 2.7-1	Adult Lamprey Passage Study -----	11
Table 2.8-1	Total Dissolved Gas Investigation-----	12
Table 2.9-1	Water Temperature Study -----	13
Table 2.10-1	Okanogan Toxins Study -----	14
Table 2.11-1	DO, pH and Turbidity Study (Not Required by FERC) -----	15
Table 2.12-1	Lamprey Spawning Assessment (Not Required by FERC) -----	16

## 1.0 INTRODUCTION

Public Utility District No. 1 of Douglas County (Douglas PUD) is the owner, operator and licensee of the 774.3 megawatt Wells Hydroelectric Project (Wells Project), located on the Columbia River in central Washington. Douglas PUD's current Federal Energy Regulatory Commission (FERC) license expires on May 31, 2012. Douglas PUD is seeking a new 50-year FERC license to continue to operate the Wells Project.

In August 2005, Douglas PUD initiated a series of meetings with stakeholders regarding the upcoming relicensing of the Wells Project. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to identify resource issues and to develop preliminary study plans prior to filing the Notice of Intent (NOI) and Pre-Application Document (PAD).

Douglas PUD initiated this voluntary process by hosting an introductory workshop regarding the Integrated Licensing Process (ILP) on October 18, 2005. The intent of the workshop was to introduce stakeholders to the ILP, provide stakeholders with information about the Wells Project and provide an overview of the relicensing schedule. At the conclusion of the workshop, stakeholders were encouraged to participate in the following four resource work groups or RWGs: Aquatic/Water Quality, Terrestrial, Cultural, and Recreation. A series of RWG meetings and site tours began in November 2005 and meetings have continued throughout the ILP.

The primary goals of the RWGs were to identify issues and potential study needs. This process provided stakeholders and Douglas PUD an opportunity to have open dialogue about issues in advance of the rigorous timeline that began once the NOI and PAD were filed. Through 35 meetings, each RWG cooperatively developed a list of Issue Statements, Issue Determination Statements and Agreed-Upon Study Plans. An Issue Statement is an agreed-upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects each RWG's efforts to apply FERC's seven study criteria to mutually determine the applicability of each individual Issue Statement. An Agreed-Upon Study Plans is a detailed study plan that has been developed, reviewed and agreed to by all of the members of the applicable RWG.

Douglas PUD submitted the NOI and PAD to FERC on December 1, 2006. The PAD included the 12 Agreed-Upon Study Plans. The filing of these documents initiated the relicensing process for the Wells Project under FERC's regulations governing the ILP.

On May 16, 2007, Douglas PUD submitted a Proposed Study Plan (PSP) Document. The PSP Document consists of the Applicant's Proposed Study Plans, Responses to Stakeholder Study Requests and a schedule for conducting the Study Plan Meeting. The ILP required Study Plan Meeting was conducted on June 14, 2007. The purpose of the Study Plan Meeting was to provide stakeholders with an opportunity to review and comment on Douglas PUD's PSP Document, to review and answer questions related to stakeholder study requests and to attempt to resolve any outstanding issues with respect to the PSP Document.

On September 14, 2007, Douglas PUD submitted a Revised Study Plan (RSP) Document. The RSP Document consists of a summary of each of Douglas PUD's revised study plans and a response to stakeholder PSP Document comments.

On October 11, 2007, FERC issued its Study Plan Determination based on its review of the RSP Document and comments from stakeholders. FERC's Study Plan Determination required Douglas PUD to complete 10 of the 12 studies included in its RSP Document. Douglas PUD has opted to complete all 12 studies to better prepare for the 401 Water Quality Certification process and to fulfill its commitment to the RWG participants.

This Initial Study Report (ISR) Document has been developed in accordance with 18 CFR § 5.15(c) and is separated into two volumes. Volume 1 includes an Introduction (Section 1), Evaluation of Goals and Objectives (Section 2), Summaries of Study Results (Section 3) and information related to the Initial Study Report Meeting, scheduled for October 30, 2008 (Section 4). The full version of the 12 study reports can be found in Volume 2, Appendices A-D. The Summary of Consultation can be found in Appendix E.

In accordance with the ILP regulations and as described in the FERC-approved Process Plan and Schedule for the Wells Project, the Initial Study Report Document is being filed with FERC and simultaneously distributed to federal and state resource agencies, local governments, affected Indian tribes, members of the public and other interested parties.

## 2.0 EVALUATION OF GOALS AND OBJECTIVES

Each of the 12 Agreed-Upon Study Plans that were developed by the RWGs and submitted to FERC in the RSP Document includes a section for study goals and objectives. Pursuant to the requirements for the ISR Document found in *18 CFR § 5.15(c)*, Douglas PUD is required to:

*. . . file with the Commission an initial study report describing its overall progress in implementing the study plan and schedule and the data collected, including an explanation of any variance from the study plan and schedule. The report must also include any modifications to ongoing studies or new studies proposed by the potential applicant.*

Douglas PUD is on schedule with implementation of studies and has only encountered minor variances associated with individual studies. Douglas PUD is not proposing any additional studies beyond those already covered in the ISR Document.

The following tables describe the overall progress in implementing the 12 Agreed-Upon Study Plans included in the RSP Document. Each of the subsection headings in Section 2 (Evaluation of Goals and Objectives) corresponds with the subsection headings in Section 3 (Summaries of Study Results). As an example, the table in Section 2.1 and the summary in Section 3.1 pertain to the Cultural Resources Investigation.

## 2.1 Cultural Resources Investigation

<b>Table 2.1-1 Cultural Resources Investigation</b>			
<b>Goal:</b> The goal of this study is to establish sound baseline information about cultural resources within the Wells Project boundary for the development of the Historic Properties Management Plan (HPMP).			
<b>Status: Completed.</b> The Cultural Resources Investigation is final and the Cultural RWG has determined that the study results, along with the Traditional Cultural Properties (TCP) study <sup>1</sup> , will provide sufficient information for developing the HPMP and that no further ILP studies are needed to address cultural resources.	<b>Objective Achieved (Y/N)</b>	<b>Variance (Y/N)</b>	
	<b>Objectives:</b>		
	• Update the current location and condition of all known cultural resource locations within the Area of Potential Effects (APE).	Y	N
	• Update site forms for all sites identified within the APE.	Y	N
	• Conduct archaeological survey within high priority portions of the APE.	Y	N
	• Develop a list of priority sites for Determinations of Eligibility (DOE).	Y	N
	• Complete DOEs for priority sites.	N	Y
• Evaluate the Wells Project’s effects on historic properties identified within the APE.	Y	N	
<b>Methodology:</b> The methodology specified in the approved study plan was followed with one minor modification (see Study Variance below). No changes to the study methodology were needed to meet the study goals and objectives.			
<b>Study Variance:</b> Variances in the FERC-approved study plan for the Cultural Resources Investigation include the following:			
<ul style="list-style-type: none"> <li>On September 3, 2008, the Cultural RWG determined that the report for the Cultural Resources Investigation, along with the TCP study results, provided sufficient information for developing the HPMP, and that no further ILP studies are needed to address cultural resources. Douglas PUD and the Cultural RWG have agreed to pursue DOE recommendations as part of the ongoing Section 106 process and/or as part of the HPMP rather than as part of the Cultural Resources Investigation (see ISR Document, Appendix E – Summary of Consultation, pages 407-408). The HPMP will be developed by the Cultural RWG and filed with FERC along with the final license application in May 2010.</li> </ul>			

<sup>1</sup> A TCP study was initiated prior to development of the RSP Document in 2007. The TCP study was conducted by the Confederated Tribes of the Colville Reservation.



## 2.2 Public Access Study

<b>Table 2.2-1 Public Access Study</b>		
<b>Goal:</b> The goal of this study is to evaluate whether Wells Project recreation facilities (public access facilities) such as docks, boat launches and swimming areas, can be reasonably utilized under various reservoir operating scenarios and conditions.		
<b>Status:</b> <b>Completed.</b> <a href="#">The report describing the Public Access Study is final.</a>		
<b>Objectives:</b>	<b>Objective Achieved (Y/N)</b>	<b>Variance (Y/N)</b>
<ul style="list-style-type: none"> <li>Evaluate accessibility to boat docks and launches during low reservoir elevations.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Evaluate how reservoir elevations affect on-water boating experiences.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Evaluate the effect of aquatic plant growth on accessibility to boat docks, launches and designated swimming areas within the Wells Project (reservoir and tailrace).</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Evaluate whether river substrate is restricting access to boat docks, boat launches and designated swimming areas within the Wells Project (reservoir and tailrace).</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Develop a map showing general types of aquatic plants and where they occur.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Develop a map showing areas of the reservoir that may be inaccessible during low reservoir elevations.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Identify measures to improve boat docks and launches and swimming areas as they relate to reservoir fluctuations, aquatic plants and substrate buildup.</li> </ul>	Y	N
<b>Methodology:</b> The methodology specified in the approved study plan was followed and remains appropriate. No changes to the study methodology were needed to meet the study goals and objectives.		
<b>Study Variance:</b> There were no variances from the FERC-approved study plan for the Public Access Study.		

## 2.3 Recreational Needs Analysis

<b>Table 2.3-1 Recreational Needs Analysis</b>		
<b>Goal:</b> The goal of this study is to research, describe, and quantify recreation and access needs in the Wells Project that should be addressed over the term of the next 50-year FERC license.		
<b>Status:</b> <a href="#">Completed. The report describing the Recreational Needs Analysis is final.</a>		
<b>Objectives:</b>	<b>Objective Achieved (Y/N)</b>	<b>Variance (Y/N)</b>
<ul style="list-style-type: none"> <li>Summarize study findings to evaluate recreational use and demand within the Wells Project. This summary will be based on results of the 2005 Wells Project Recreation Visitor Use Assessment and existing information from the FERC Form 80 documents for the Wells Project, Interagency Committee for Outdoor Recreation outdoor recreation participation survey, Washington Department of Fish and Wildlife (WDFW) fisherman surveys, WDFW hunter surveys, City of Bridgeport's Marina Park information and other relevant recreational survey information.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Assess the needs of Hispanic use of recreational facilities and resource areas.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Assess the adequacy of existing Wells Project recreation facilities to accommodate current and future recreation demand.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Assess the adequacy of public access and safety at Wells Project recreation facilities.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Assess the adequacy of operations and maintenance at Wells Project recreation facilities.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Develop a prioritized list of potential actions to address Wells Project recreation issues. The list should include criteria such as demand, effectiveness, feasibility and cost.</li> </ul>	Y	N
<b>Methodology:</b> The methodology specified in the approved study plan was followed and remains appropriate. No changes to the study methodology were needed to meet the study goals and objectives.		
<b>Study Variance:</b> There were no variances from the FERC-approved study plan for the Recreational Needs Analysis.		

## 2.4 Piscivorous Wildlife Control Study

<b>Table 2.4-1 Piscivorous Wildlife Control Study</b>		
<b>Goal:</b> The goal of the predator control program is to reduce the number of juvenile salmon and steelhead that are consumed by predators.		
<b>Status:</b> Completed. The report describing the Piscivorous Wildlife Control Study is final.		
<b>Objectives:</b>	<b>Objective Achieved (Y/N)</b>	<b>Variance (Y/N)</b>
<ul style="list-style-type: none"> <li>Identify and count the current and historic number and species of birds and mammals feeding on fish at the Wells Project hatcheries and in the Wells tailrace.</li> </ul>	Y	Y
<ul style="list-style-type: none"> <li>Assess the potential impacts of mortality caused by piscivorous birds and mammals to Endangered Species Act (ESA) listed, sensitive and recreationally important species.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Describe each of the existing piscivorous wildlife control measures, including species targeted, reason for control, frequency of control and effectiveness of the control method.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Evaluate alternatives, including the costs and benefit of each measure recommended. The study will provide alternative methods of preventing predation of fish at the Wells Project and in hatchery rearing ponds.</li> </ul>	Y	Y
<b>Methodology:</b> The methodology specified in the approved study plan was followed with minor modifications (see Study Variance below).		
<b>Study Variance:</b> Variances in the FERC-approved study plan for the Piscivorous Wildlife Control Study include the following:		
<ul style="list-style-type: none"> <li>No bird counts were collected for the Wells tailrace. Activity in the tailrace was very low for most of the study and so study resources were focused on predation at the Methow and Wells fish hatcheries.</li> <li>No cost estimates were developed for the measures recommended. The effectiveness of the current hazing program can be increased without additional cost.</li> </ul>		

## 2.5 Transmission Line Wildlife and Botanical Study

<b>Table 2.5-1 Transmission Line Wildlife and Botanical Study</b>		
<b>Goal:</b> The overall goal of the wildlife and botanical surveys along the Wells Project transmission lines is to provide information needed to guide land management decisions, avoid damage to valuable habitat during future transmission corridor management activities and minimize the spread of invasive weeds.		
<b>Status: Interim.</b> The report describing the Transmission Line Wildlife and Botanical Study is an interim report. Additional surveys are being conducted to address the remaining objectives of this study. The final report containing all of the information collected during the study will be available in early 2009.	<b>Objective Achieved (Y/N)</b>	<b>Variance (Y/N)</b>
<b>Objectives:</b>		
<b>Botanical Resources</b>		
<ul style="list-style-type: none"> <li>Identify and document the location of Rare, Threatened and Endangered (RTE) plant species that occur within the transmission line corridor.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Identify and classify the specific vegetation cover types in the study area.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Generate detailed information on the species composition and classification of these plant communities and their structures.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Create a detailed Geographic Information System (GIS) cover type map of the study area showing the locations of these plant communities, their distribution, areas of coverage (acres), and note locations of habitats of special concern or unique areas observed.</li> </ul>	N	N
<ul style="list-style-type: none"> <li>Identify any invasive plant species in the transmission corridor. For this transmission line corridor study, invasive species are Washington State Class A and B-designate noxious weeds.</li> </ul>	Y	N
<b>Wildlife Resources</b>		
<i>Avian</i>		
<ul style="list-style-type: none"> <li>Identify and document the location of any federal and state RTE avian species that use the study area.</li> </ul>	N	N
<ul style="list-style-type: none"> <li>Describe the habitat features used by RTE avian species observed within the corridor.</li> </ul>	N	N
<ul style="list-style-type: none"> <li>Document the presence of other avian species and provide relative abundance for birds using the study area.</li> </ul>	N	N
<ul style="list-style-type: none"> <li>Document raptor and corvid nesting and sharp-tailed and sage grouse use within the study area.</li> </ul>	N	N

<ul style="list-style-type: none"> <li>• Document any evidence under the transmission line of avian collisions.</li> </ul>	N	N
<i>Mammal</i>		
<ul style="list-style-type: none"> <li>• Identify and document the location of federal and state RTE mammal species that use the study area.</li> </ul>	N	N
<ul style="list-style-type: none"> <li>• Describe the habitat features used by RTE mammals observed within the corridor.</li> </ul>	N	N
<ul style="list-style-type: none"> <li>• Document the presence of other mammal species in the study area.</li> </ul>	N	N
<i>Reptile</i>		
<ul style="list-style-type: none"> <li>• Identify and document the location of federal and state RTE reptile species that use the study area.</li> </ul>	N	N
<ul style="list-style-type: none"> <li>• Describe the habitat features used by RTE reptiles observed within the corridor.</li> </ul>	N	N
<ul style="list-style-type: none"> <li>• Document the presence of other reptile species in the study area.</li> </ul>	N	N
<p><b>Methodology:</b> The methodology specified in the approved study plan was followed and remains appropriate. No changes to the study methodology were needed to meet the study goals and objectives.</p>		
<p><b>Study Variance:</b> There were no variances in the FERC-approved study plan for the Transmission Line Wildlife and Botanical Study.</p>		

## 2.6 Juvenile Lamprey Study

<b>Table 2.6-1 Juvenile Lamprey Study</b>		
<p><b>Goal:</b> The goals of this study were to collect current information on the survival and predation of juvenile Pacific lamprey macrophthalmia migrating through Columbia River hydroelectric projects and to collect site and species-specific information on juvenile lamprey predation in the waters immediately upstream and downstream of Wells Dam. This information will be used to inform predator control program decisions regarding predation on juvenile lamprey macrophthalmia.</p>		
<p><b>Status:</b> <b>Completed.</b> <a href="#">The report describing the Juvenile Lamprey Study is final.</a></p>		
<b>Objectives:</b>	<b>Objective Achieved (Y/N)</b>	<b>Variance (Y/N)</b>
<ul style="list-style-type: none"> <li>Conduct a literature review on juvenile lamprey macrophthalmia survival and predation studies conducted at Columbia River hydroelectric projects.</li> </ul>	Y	N
<ul style="list-style-type: none"> <li>Conduct an analysis on the stomach contents of predatory fish and birds (if feasible) to assess the location (only applicable to fish) and level of predation that may be occurring on juvenile Pacific lamprey macrophthalmia in the Wells forebay and tailrace.</li> </ul>	Y	Y
<p><b>Methodology:</b> The methodology specified in the approved study plan was followed with minor modifications (see Study Variance below).</p>		
<p><b>Study Variance:</b> Variances in the FERC-approved study plan for the Juvenile Lamprey Study include the following:</p> <ul style="list-style-type: none"> <li>The definition of the forebay for this study was originally stated as “1,000 feet above Wells Dam.” This sampling area was extended to include forebay waters upstream to the confluence of the Methow River. This extension was made to ensure that the proposed sample size of 500 pikeminnow was achieved as pikeminnow catches immediately above Wells Dam were low during the sampling period.</li> <li>The original proposed sampling period (May-July) was adjusted to one month earlier (April-June) based on analyses subsequent to the development of the study plan indicating that an earlier time frame was more consistent with the juvenile lamprey outmigration in the Wells Project.</li> </ul>		

## 2.7 Adult Lamprey Passage Study

<b>Table 2.7-1 Adult Lamprey Passage Study</b>			
<b>Goal:</b> The goal of this study is to evaluate the effect of the Wells Project and its operations on adult Pacific lamprey upstream migration and behavior as it relates to fishway passage, timing, and downstream passage events (drop back) through the dam. This information will be used to help identify potential areas of passage impediment within the Wells fishways.			
<b>Status:</b> 2007 Study Completed; 2008 Study in Progress. The report describing the 2007 Adult Lamprey Passage Study is final. Douglas PUD is voluntarily conducting a second year of study.		<b>Objective Achieved (Y/N)</b>	<b>Variance (Y/N)</b>
<b>Objectives:</b>			
<ul style="list-style-type: none"> <li>Conduct a literature review of existing adult Pacific lamprey passage studies at Columbia and Snake river dams.</li> </ul>	Y	N	
<ul style="list-style-type: none"> <li>Identify methods for capturing adult Pacific lamprey at Wells Dam.</li> </ul>	Y	N	
<ul style="list-style-type: none"> <li>Document the timing and abundance of radio-tagged lamprey passage through Wells Dam.</li> </ul>	Y	N	
<ul style="list-style-type: none"> <li>Determine whether adult lamprey are bypassing the adult counting windows at Wells Dam.</li> </ul>	Y	N	
<ul style="list-style-type: none"> <li>Where sample size is adequate, estimate passage metrics including fishway passage times and efficiencies, residence time between detection zones, and downstream passage events (drop back).</li> </ul>	Y	Y	
<ul style="list-style-type: none"> <li>If necessary, identify potential areas of improvement to existing upstream fish passage facilities for the protection and enhancement of adult lamprey at the Wells Project.</li> </ul>	Y	N	
<b>Methodology:</b> The methodology specified in the approved study plan was adjusted, in coordination with the Aquatic RWG, to allow additional lamprey to be collected at Rocky Reach Dam. This change was made in an attempt to reach the desired sample size specified in the FERC-approved study plan.			
<b>Study Variance:</b> Variances in the FERC-approved study plan for the Adult Lamprey Passage Study include the following:			
<ul style="list-style-type: none"> <li>The proposed sample size for tagged lamprey was not met in 2007. Only 19 of the 40 allocated radio tags were deployed due to the small number of lamprey observed at Wells Dam in 2007 (n = 35).</li> <li>In an effort to achieve sample sizes, Douglas PUD received concurrence from the Aquatic RWG to collect adult lamprey from Rocky Reach Dam and to tag and release them at Wells Dam (see ISR Document, Appendix E – Summary of Consultation, pages 30-39).</li> </ul>			

## 2.8 Total Dissolved Gas Investigation

<b>Table 2.8-1 Total Dissolved Gas Investigation</b>		
<p><b>Goal:</b> The goal of this study is to develop a numerical model capable of predicting the hydrodynamics and Total Dissolved Gas (TDG) concentrations in the tailrace of the Wells Project. The purpose of the model is to assist in the understanding of the underlying phenomena leading to TDG supersaturation allowing the evaluation of the effectiveness of spill type and plant operations in reducing TDG production at Wells Dam.</p>		
<p><b>Status:</b> <b>Interim.</b> The report describing the Total Dissolved Gas Investigation is an interim report. The final report containing all of the information collected during the 2008 study will be available in early 2009.</p>	<p><b>Goal Achieved (Y/N)</b></p>	<p><b>Variance (Y/N)</b></p>
<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>Develop a numerical model capable of predicting the hydrodynamics and TDG concentrations in the tailrace of the Wells Project.</li> </ul>		
	<p>Y</p>	<p>N</p>
<p><b>Methodology:</b> The methodology specified in the approved study plan was followed and remains appropriate. No changes to the study methodology were needed to meet the study goals and objectives.</p>		
<p><b>Study Variance:</b> There were no variances from the FERC-approved study plan for the Total Dissolved Gas Investigation.</p>		



## 2.9 Water Temperature Study

<b>Table 2.9-1 Water Temperature Study</b>		
<b>Goal:</b> The goal of the study is to develop two temperature models (using CE-QUAL-W2) to assess the effects of Wells Project operations on water temperatures at Wells Dam and within the Wells Reservoir as they relate to compliance with the Washington State Water Quality Standards and Section 401 of the Clean Water Act certification process.		
<b>Status: Completed.</b> The report describing the Water Temperature Study is final.	<b>Objective Achieved (Y/N)</b>	<b>Variance (Y/N)</b>
<b>Objectives:</b>		
<ul style="list-style-type: none"> <li>Develop two temperature models (using CE-QUAL-W2) to assess the effects of Wells Project operations on water temperatures at Wells Dam and within the Wells Reservoir.</li> </ul>	Y	N
<b>Methodology:</b> The methodology specified in the approved study plan was followed and remains appropriate. No changes to the study methodology were needed to meet the study goals and objectives.		
<b>Study Variance:</b> There were no variances from the FERC-approved study plan for the Water Temperature Study.		

## 2.10 Okanogan Toxins Study

<b>Table 2.10-1 Okanogan Toxins Study</b>		
<b>Goal:</b> The objective of the study is to determine the concentration of the insecticide 1,1,1-trichloro-2,2-bis[p-chlorophenyl]ethane (DDT) and polychlorinated biphenyls (PCBs) in recreational fish species and in swimming areas of the lower Okanogan River, up to River Mile (RM) 15.5, within the Wells Project boundary.		
<b>Status:</b> <b>Completed.</b> The report describing the Okanogan Toxins Study is final.		
<b>Objectives:</b>	<b>Objective Achieved (Y/N)</b>	<b>Variance (Y/N)</b>
<ul style="list-style-type: none"> <li>Collect and analyze sediment samples for DDT and PCBs from specific recreational sites (i.e., swimming areas and boat launches) in the lower Okanogan River up to RM 15.5.</li> </ul>	Y	Y
<ul style="list-style-type: none"> <li>Collect and analyze fish tissue for DDT and PCBs from recreational fish species of interest consumed by tribal and recreational anglers.</li> </ul>	Y	Y
<b>Methodology:</b> The methodology specified in the approved study plan was followed with several minor modifications (see Study Variance below).		
<b>Study Variance:</b> Variances from the FERC-approved study plan for the Okanogan Toxins Study include the following:		
<ul style="list-style-type: none"> <li>In order to properly characterize the surface sediments most likely to be encountered by recreational river uses, grab samples were collected from only the upper 10 cm of the sediment as opposed to the 32 cm depth sediment cores for the Okanogan River TMDL Technical Assessment.</li> <li>The Okanogan River in May was near flood stage and could not safely be accessed. All sediment samples were collected on July 8, 2008, after spring snowmelt flows had receded. Also, due to high flows in May 2008, fish collection was conducted during late June and all of the month of July.</li> <li>This study included a much higher level of fish collection effort than what was proposed in the study plan. In total, over 60 staff days were consumed trying to meet the sample size levels for carp, whitefish and smallmouth bass.</li> <li>Due to recent ESA listings, electrofishing was not an approved collection method in the scientific collection permit. Instead, in an effort to meet sample sizes for the study, several other collection methods were utilized including beach seines, trot lines, archery and recreational angling gear. All smallmouth bass were collected by angling and all carp were collected using archery equipment. Unfortunately, even with the additional effort expended toward fish collection, the crews were unsuccessful in capturing whitefish from the lower Okanogan River.</li> </ul>		

## 2.11 DO, pH and Turbidity Study (Not Required by FERC)

<b>Table 2.11-1 DO, pH and Turbidity Study (Not Required by FERC)</b>		
<b>Goal:</b> The goal of this study is to continue monitoring dissolved oxygen (DO), pH, and turbidity in the Wells Dam forebay and lower Okanogan River, both above and within the Wells Project boundary.		
<b>Status: Interim.</b> The report describing the voluntary DO, pH and Turbidity Study is an interim report. Additional data will be collected during the fall of 2008 as requested by the Washington State Department of Ecology (Ecology). The final report containing all of the information collected during the 2008 study will be available in early 2009.	<b>Objective Achieved (Y/N)</b>	<b>Variance (Y/N)</b>
<b>Objectives:</b>		
<ul style="list-style-type: none"> <li>Monitor DO, pH, and turbidity in the Wells Dam forebay and lower Okanogan River.</li> </ul>	Y	Y
<b>Methodology:</b> The methodology specified in the study plan was followed with minor modifications (see Study Variance below).		
<p><b>Study Variance:</b> This study was not required by FERC as part of the October 11, 2007 Study Plan Determination. This study was voluntarily conducted by Douglas PUD at the request of Ecology in support of the 401 water quality certification for the Wells Project. Variances associated with the voluntarily conducted study for DO, pH, and Turbidity include the following:</p> <ul style="list-style-type: none"> <li>The upper sampling station location was changed from the Wells Project boundary (RM 15.5) to the Malott Bridge (RM 17.0). No suitable structure could be found at RM 15.5. As a result, the instrument housing was installed on the Malott Bridge.</li> <li>The study plan specified that DO monitoring would occur between mid-July and mid-September when the probability of exceedances is highest. In order to access the river prior to the peak of the spring hydrograph, the monitoring equipment was deployed several weeks earlier than required in the study plan. Equipment was deployed on May 5 and 6 at the Okanogan River locations and May 30 at the Wells forebay. The equipment is also expected to continue collecting data through October 30 which is over a month longer than required by the study plan.</li> <li>The study plan required that data be collected on an hourly basis. Due to battery failure and instrument inaccessibility during high flow and debris load periods, several significant gaps in the hourly database now exist. Data gaps occurred from May 6 to June 18 at the Malott Bridge, from July 3 to July 9 and July 11 to 24 at the Monse Bridge and from July 19 to 24 at the Highway 97 Bridge.</li> <li>All turbidity results for the Wells Dam forebay location were judged to be unreliable and rejected as unusable. The self-cleaning mechanism on the water quality probe was not functioning properly and became fouled frequently during the study.</li> </ul>		

## 2.12 Lamprey Spawning Assessment (Not Required by FERC)

<b>Table 2.12-1 Lamprey Spawning Assessment (Not Required by FERC)</b>		
<b>Goal:</b> The goal of this study is to assess the level of spawning activity by adult Pacific lamprey in the Wells Project and whether Wells Dam operations are affecting this activity.		
<b>Status:</b> Completed. The report describing the Lamprey Spawning Assessment is final.		<b>Objective Achieved (Y/N)</b>
<b>Objectives:</b>		<b>Variance (Y/N)</b>
<ul style="list-style-type: none"> <li>Identify areas within the Wells Project where suitable spawning habitat may exist for adult Pacific lamprey.</li> </ul>		Y
<ul style="list-style-type: none"> <li>Survey these areas of spawning habitat for use by Pacific lamprey to confirm suitability.</li> </ul>		Y
<ul style="list-style-type: none"> <li>If spawning is observed, assess whether the operations of the Wells Project are having adverse effects on these spawning areas (i.e., dewatering, flow alterations, scour, etc.).</li> </ul>		Y
<p><b>Methodology:</b> The methodology specified in the study plan was followed and remains appropriate. No changes to the study methodology were needed to meet the study goals and objectives.</p>		
<p><b>Study Variance:</b> This study was not required by FERC as part of the October 11, 2007 Study Plan Determination. This study was voluntarily conducted by Douglas PUD based upon the agreed-upon study plan filed with FERC in the RSP Document. There were no variances from the study plan.</p>		

## **3.0 SUMMARIES OF STUDY RESULTS**

### **3.1 Cultural Resources Investigation**

In accordance with applicable FERC regulations, 18 C.F.R. § 5.2(c) (2008), the report describing the results from the Cultural Resources Investigation is not being distributed to the general public due to the confidential nature of information regarding archaeological and historic resources.

The Cultural Resource Investigation identified and revisited all previously recorded archaeological resources within the study area in order to better define their location and condition. New site forms were created for each site, documenting the current condition, ongoing impacts, and recommendations for eligibility for the National Register of Historic Places. Some segments of the study area required new survey, including the 230 kV transmission corridor and the Okanogan River portion of the reservoir. The study was conducted by the Confederated Tribes of the Colville Reservation.

The goal of the study was to establish sound baseline information about cultural resources within the Wells Project for the development of the HPMP. Specific objectives were to:

- Update the current location and condition of all known cultural resource locations within the study area;
- Update site forms for all sites identified within the study area;
- Conduct archaeological surveys within high priority areas;
- Develop a list of priority sites for DOEs;
- Complete DOEs for priority sites; and
- Evaluate the Wells Project's effects on historic properties identified within the APE.

No changes in the proposed study plan or schedule were required. On September 3, 2008, the Cultural RWG determined that the study results, along with the TCP study, will provide sufficient information for developing the HPMP, and that no further ILP studies are needed to address cultural resources. Douglas PUD and the Cultural RWG will further pursue DOE recommendations as part of the ongoing Section 106 process and/or as part of the HPMP which will be filed with FERC along with the final license application in May 2010.

Note: A TCP study was initiated prior to development of the Revised Study Plan in 2007. The TCP study was conducted by the Confederated Tribes of the Colville Reservation, and finalized in July 2008.

### **3.2 Public Access Study**

The Public Access Study evaluated whether Wells Project recreation facilities (public access facilities) such as docks, boat launches and swimming areas, can be reasonably utilized under various reservoir operating scenarios and conditions.

Public access to, and use of, the Wells Reservoir can be affected by reservoir fluctuations and the growth of aquatic plants. Reservoir fluctuations, influenced by operational changes at Wells Dam and the amount of inflow from upstream dams and tributaries to the Wells Reservoir, can affect the ability to both utilize public access sites as well as general navigation of the reservoir. The degree of impact is dependent on the configuration, location, and usage of each recreation site. Access restrictions are more pronounced at lower than normal forebay elevations (El.) at Wells Dam, generally below El. 777 feet. Since the Wells Dam forebay is above El. 777 approximately 98 percent of the time, the occurrence of events that limit access due to reservoir fluctuations are limited in frequency and duration during normal Wells Project operations.

The buildup of sediment can also reduce public access to the Wells Reservoir, particularly in locations subject to upstream bed load movement within the inundated tributaries. Two sites appear affected by sediment buildup: Monse and Methow River boat launches. In these areas, sediment buildup is pronounced and can reduce access for larger motorized boats.

Aquatic plants can be a seasonal impediment to public access, including limiting the use of shoreline areas and several boat launches during the later parts of summer. Several swimming areas can also be affected depending upon the time of year and elevation of the reservoir. Aesthetics and safety within the swimming areas can also be impacted by excessive aquatic plant growth. The swimming area located within Marina Park is the one swimming area most affected by aquatic plant growth. The Methow Boat Launch and Starr Boat Launch are both moderately affected by plant growth.

### **3.3 Recreational Needs Analysis**

The Recreational Needs Analysis researched, described, and quantified recreation use information toward identifying current and future recreation needs to be addressed over the term of the next license for the Wells Project. Through the needs analysis, potential measures were identified to address current and likely future recreation resource demands.

Generally, visitors were satisfied with facilities and the provision of recreational opportunities in the Wells Project. Maintenance of facilities was identified as good overall, with a future need to upgrade restroom and access sites to meet Americans with Disabilities Act (ADA) standards. Future recreational measures may include assisting in the development of a water trail, which has a set of guidelines for effective access and recreational activity enhancement. Additional measures may include safety and informational signage in Spanish, ADA related improvements, near-shore tent camping (water trail enhancement) and providing education about the Wells Project (including natural and social resources).

### 3.4 Piscivorous Wildlife Control Study

The Piscivorous Wildlife Control Study evaluated existing practices and alternatives to inform future management decisions related to piscivorous wildlife control measures at the Wells Project and associated hatchery rearing facilities.

From November 2007 through April 2008, the number and species of birds attempting to use (forage and/or loaf) the Wells Hatchery and their response to non-lethal hazing efforts during daylight hours on weekdays were recorded. Additionally, the number and species of birds using the same facility during periods when hazing did not occur (weekends, evenings, and pre-dawn mornings) were recorded from November 2007 through May 2008. A total of 2,274 bird dispersals from the Wells Hatchery resulted from 810 hazing events (324 vehicle and 486 pyrotechnics), with a mean of 2.8 birds dispersed per event. Only 14 bird occurrences, mainly American coot (*Fulica americana*), did not respond to hazing events by dispersing. The three most frequently observed species during hazing were common merganser (*Mergus merganser*), bufflehead (*Bucephala albeola*), and great blue heron (*Ardea herodias*); while the three most abundant species observed during hazing were common merganser, bufflehead, and mallard (*Anas platyrhynchos*). In the absence of hazing, the three most frequently observed species were great blue heron, mallard, and common goldeneye (*Bucephala clangula*); while the three most abundant species overall were mallard, American coot, and lesser scaup (*Aythya affinis*).

Observations of birds during non-hazing periods documented 782 foraging attempts by 11 species of birds, including 67 fish captures and 436 unknown captures. Great blue herons made 67 percent of the foraging attempts, capturing 16 fish and 329 unknown prey during the index counting period. Osprey were the most efficient avian predator observed, capturing 26 fish in 27 foraging attempts during the index counting period. Over half (51 percent) of all observed foraging attempts were made in the four hatchery dirt ponds resulting in an index take of 65 fish and 183 unknown captures.

The significance of bird predation could not be assessed for Ponds 1 and 2, where only estimates of the number of fish released into the Columbia River were available. However, estimated bird predation loss was compared to total fish (steelhead smolt) loss for Pond 3 and 4. Total fish loss was calculated by hatchery personnel by a water displacement method (pounds of water displaced multiplied by the number of fish per pound) when the fish are loaded into transport trucks. Estimated consumption of fish in Pond 3 accounted for only 26 percent of the total fish loss estimated by hatchery personnel. However, estimated consumption of fish by birds in Pond 4 was 4.5 times greater than the total loss calculated when fish were released from the pond. In both instances the rates of total fish loss did not correspond to the observed level of bird related losses recorded for each pond.

Mammalian predators may have also contributed to losses of some fish at Wells Hatchery; however, their impacts appear to be negligible. Observations of 1-4 raccoons (*Procyon lotor*) were recorded 15 times during focal observations but none were observed catching fish. River otter (*Lutra canadensis*) were observed four times during evening focal observations and were documented capturing fish on two occasions. A nuisance wildlife control specialist contracted to trap furbearers at Wells Hatchery removed three raccoons during this study period.

From November 2007 through March 2008, the number and species of birds attempting to use the Methow Hatchery also were recorded. Passive measures such as pond covers, bird wires, fencing and overhead netting were effective at reducing predation by birds as most bird observations were outside ponds and raceways. Only birds that entered ponds through open doors were observed foraging (one kingfisher and one great blue heron). Mink tracks were observed outside fencing, although no mammals were documented in ponds or raceways.

The current combination of active and passive non-lethal control measures implemented at Wells Hatchery appear to effectively deter potential avian and mammalian predators during daylight hours. Adding additional hazing during the evening or later at night should further deter avian and mammalian predators. Passive control measures also are effectively deterring predators at the Methow Hatchery. Because increasing gull presence at the Wells Hatchery coincides with the release of fish to the main hatchery channel, consideration should be given to extend active control measures until all fish are removed from the hatchery.

### **3.5 Transmission Line Wildlife and Botanical Study**

The Transmission Line Wildlife and Botanical Study has provided baseline data on plants and animals found within or adjacent to the Wells Project transmission line corridor and information on the presence and habitat associations of RTE plant and animal species in the corridor.

Surveys in the transmission line corridor targeted RTE plants, invasive plant species, birds, mammals, and reptiles. Field surveys were also conducted to identify and classify the specific vegetation cover types in the transmission line corridor. Additional data were collected to document (1) nesting by raptors and corvids, (2) use by sharp-tailed grouse (*Tympanuchus phasianellus*) and greater sage-grouse (*Centrocercus urophasianus*), and (3) evidence of avian collisions with the transmission line and associated structures in the study area.

One occurrence of an RTE plant species [Thompson's clover (*Trifolium thompsonii*), a State-listed threatened species] was observed and mapped within the transmission line corridor during botanical field surveys. Invasive plant surveys mapped and documented 48 potential occurrences of two Class B Designate weed species, Dalmatian toadflax (*Linaria dalmatica* ssp. *dalmatica*) and spotted knapweed (*Centaurea stoebe*). This result (48 occurrences) is based on lumping spotted knapweed (Class B Designate) and diffuse knapweed (*Centaurea diffusa*) (Class B Non-Designate). During early surveys, differentiation of knapweed species was difficult due to similarities in early life forms for both species. Occurrences will be revisited during the final botanical survey to identify to species. The number of invasive plants is expected to decrease in subsequent drafts of this report, following late summer botanical surveys once spotted knapweed and diffuse knapweed are differentiated. Furthermore, since Dalmatian toadflax is only a Class B Designate in Douglas County south of Township 25N and west of Range 25E, occurrences north of Township 25N will be excluded from the total for the final report. Occurrences of two Class C weed species, field bindweed (*Convolvulus arvensis*) and Canada thistle (*Cirsium arvense*), were also noted, but not mapped.

Cover types were grouped into 11 mapping categories based on previously mapped GIS data and field observations. Descriptions, abundance, and distribution for each of these cover type



categories and information on associated species will be discussed in subsequent drafts of this report, following data collection during the late summer surveys in early September 2008.

Surveys documented the presence of 91 bird species in the study area. Based on an analysis of relative abundance (number of birds observed per 5-minute visit within 115 feet of the 50 point count stations), the most common species in the study area was the Brewer's sparrow (*Spizella breweri*). Other commonly detected species (in descending order of relative abundance) were spotted towhee (*Pipilo maculatus*), vesper sparrow (*Pooecetes gramineus*), mountain chickadee (*Poecile gambeli*), and lazuli bunting (*Passerina amoena*). The greatest number of species was detected where the dominant cover type was open conifer, closely followed by riparian and then shrub-steppe (which was the most common cover type in the study area, and in which the greatest survey effort occurred). One RTE bird species [sage thrasher (*Oreoscoptes montanus*), a State candidate] was documented in the study area.

Eleven nests of raptors or corvids were detected within or adjacent to the study area, including four on Douglas PUD transmission towers. No evidence of avian mortality due to collisions with the transmission lines or towers was documented.

Reptile species observed included pygmy short-horned lizard (*Phrynosoma douglasii*), western skink (*Eumeces skiltonianus*), racer (*Coluber constrictor*), western terrestrial garter snake (*Thamnophis elegans*), and western rattlesnake (*Crotalus viridis*). Mammals that were documented through sign or direct observation included mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), bobcat (*Felis rufus*), cougar (*Felis concolor*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), America badger (*Taxidea taxus*), porcupine (*Erethizon dorsatum*), northern pocket gopher (*Thomomys talpoides*), bushy-tailed woodrat (*Neotoma cinerea*), and yellow-bellied marmot (*Marmota flaviventris*). Additional observations indicated the presence of chipmunks (*Tamias* spp., yellow-pine or least) and voles (species unknown).

### **3.6 Juvenile Lamprey Study**

The Juvenile Lamprey Study collected current information on the survival and predation of juvenile Pacific lamprey macrophthalmia migrating through Columbia River hydroelectric projects and to collect site and species-specific information on juvenile lamprey predation in the waters immediately upstream and downstream of Wells Dam. This information will be used to inform predator control program decisions regarding predation on juvenile lamprey macrophthalmia.

The literature review confirmed that information on the juvenile Pacific lamprey outmigration in the Columbia River is scarce and the lack of conclusive data is largely due to the absence of technology to meet research needs. In other words, no studies currently document the level of survival attributed to a project's operations, nor does an accepted technology currently exist that would achieve this level of assessment for juvenile lamprey. The relevant literature also suggests that there are three areas of concern for juvenile lamprey passing through Columbia River hydroelectric dams, including survival through turbines, impingement on turbine intake screens, and increased predation related to passage through dams.

The field study collected over one thousand piscivorous fishes in the forebay and tailrace of Wells Dam for stomach analysis during spring and early summer of 2008. Eleven birds provided by the United States Department of Agriculture were also examined. Seven lamprey were collected from five predators, including three northern pikeminnow (*Ptychocheilus oregonensis*) of 1,022 sampled; one double-crested cormorant (*Phalacrocorax auritus*) of five sampled; and one ring-billed gull (*Larus delawarensis*) of three sampled. No lamprey were collected from smallmouth bass (*Micropterus dolomieu*), walleye (*Stizostedion vitreum*), Caspian tern (*Hydroprogne caspia*) or California gull (*Larus californicus*).

These results suggest that:

- Predation of juvenile lamprey by northern pikeminnow in the study area is likely not substantial at this time;
- A difference in predation rates of juvenile lamprey between the Wells forebay and Wells tailrace is not detectable based on these results;
- Predation of juvenile lamprey by walleye and smallmouth bass in the study area is likely not substantial at this time given the relatively small numbers of bass and walleye present during the peak of the macrophthalmia outmigration and the absence of juvenile lamprey within the stomachs of the fish sampled;
- Avian predation of juvenile lamprey in the study area was larger than that observed for predatory fish, though these conclusions are based upon limited sample sizes for the avian predators; and
- The lack of the monitoring, trapping, and tagging technology required to produce reliable survival estimates will continue to limit the ability to measure the impact of hydroelectric operations on lamprey populations in the Columbia River.

### **3.7 Adult Lamprey Passage Study**

The Adult Lamprey Passage Study evaluated the effect of the Wells Project and its operations on adult Pacific lamprey upstream migration and behavior as it related to fishway passage, timing, and downstream passage events (drop back) through the dam. This information will be used to help identify potential areas of passage impediment within the Wells fishways. Specific objectives of the study include: 1) conducting a literature review of existing adult Pacific lamprey passage studies at Columbia and Snake river dams; 2) identifying and implementing methods for capturing adult Pacific lamprey at Wells Dam; 3) documenting the timing and abundance of radio-tagged lamprey passage through Wells Dam; 4) determining whether adult lamprey are bypassing the adult counting windows at Wells Dam; 5) where sample size is adequate, estimating passage metrics including fishway passage times and efficiencies, residence time between detection zones, and downstream passage events (drop back); and 6) if necessary, identifying potential areas of improvement to the existing upstream fish passage facilities for the protection and enhancement of adult lamprey at the Wells Project.

A review of past adult lamprey passage studies indicated commonalities among lamprey behavior at hydroelectric projects and trapping methodologies were developed to capture adult lamprey at Wells Dam. During the 2007 study, 21 lamprey were captured, surgically radio-

tagged and released. Of these fish, 10 were released into the tailrace and 11 were released into the fishway between mid-August and early October. One tailrace-released fish was recaptured. Ten of the twelve (83 percent) lamprey released into the middle fishway successfully ascended, with a median upper fishway passage time of 7.9 hours. Seven of the ten (70 percent) lamprey released into the tailrace were detected at the outside of a fishway entrance. Only one of these seven (14 percent) lamprey entered into the collection gallery and ascended the fishway with a lower fishway passage time of 6.1 hours and upper fishway passage time of 5.9 hours. Including one tailrace-released fish, 6 of 11 (55 percent) tagged lamprey that ascended the upper fishway were detected inside the video bypass area. Three of the eleven (27 percent) fish that exited the ladder passed through the upper fish ladder without being observed at the counting window. No drop backs were detected by fish that exited the fishway.

These results suggest that, similar to observations at other Columbia River dams, lamprey are having difficulty negotiating the fishway entrances and appear to be largely bypassing the adult counting windows. Unlike other dams, lamprey at Wells are passing the upper fishway at high rates, in a reasonable amount of time, and with negligible drop back within the ladder.

### **3.8 Total Dissolved Gas Investigation**

Douglas PUD is required to obtain a water quality certificate pursuant to Section 401 of the Clean Water Act. As part of the 401 certification process, Ecology must determine whether the Wells Project is in compliance with state water quality standards, including the numeric standards, for TDG.

The Total Dissolved Gas Investigation examined TDG production dynamics at the Wells Project to comply with State water quality standards. As part of the relicensing of the Wells Project, Douglas PUD has initiated a series of assessments aimed at gaining a better understanding of the effect of spill operations on the production, transport and mixing of TDG in the Wells tailrace.

The primary goal of this study was to develop an unsteady three-dimensional, two-phase flow computational fluid dynamics tool to predict the hydrodynamics and TDG distribution within the Wells tailrace. Two models were used in the study; a volume of fluid (VOF) model and a rigid-lid two-phase flow model.

The VOF model predicts the flow regime and the free-surface characteristics, recognizing that a spillway jet may plunge to depth in the tailrace or remain closer to the surface depending upon the geometry of the outlet and the tailwater elevation. The VOF model boundary extended approximately 1,700 feet downstream of the dam.

The rigid-lid model included 16,500 feet of the Wells tailrace, from Wells Dam downstream to the TDG compliance monitoring station. This two-phase flow model characterizes the hydrodynamics and three-dimensional distribution of gas volume fraction, bubble size and TDG in the Wells tailrace. This model assumes that the free surface can be modeled using a rigid-lid non-flat boundary condition. The free-surface shape for the first 1,000 feet downstream of the dam was extracted from VOF computations and slopes derived from HEC-RAS simulations were used for the downstream region. The upstream velocity profiles derived from the VOF model

were input into the rigid-lid model. The gas volume fraction and bubble diameter at the spillbays are the external parameters of the model.

The model was calibrated and validated using field data collected in 2006 during a TDG production dynamics study. The model was then calibrated using data collected during spill tests conducted on June 4 and June 5, 2006. The spillway flow was spread across spillbays on June 4 and concentrated through a single spillbay on June 5. Agreement was attained between the depth-averaged velocity data collected in the field and those generated by the model. A gas volume fraction of 3 percent and bubble diameter of 0.5 mm in the spillbays produced TDG values that bracketed the 2006 field observations.

Once calibrated, the predictive ability of the model was validated by running the model for three different operational conditions tested in 2006. The model captured the lateral TDG distribution and the reduction of TDG longitudinally as observed in the field. The numerical results demonstrate that the model provides a reliable predictor of tailrace TDG and therefore can be used as a tool to identify Wells Project operations that can minimize TDG concentrations downstream of Wells Dam.

### **3.9 Water Temperature Study**

The Water Temperature Study developed two two-dimensional laterally-averaged temperature models (using CE-QUAL-W2) that represent existing (or “with Project”) conditions and “without Project” conditions of the Wells Project. These models include the Columbia River from the Chief Joseph Dam tailrace to Wells Dam, the lowest 15.5 miles of the Okanogan River, and the lowest 1.5 miles of the Methow River. The results were processed to develop daily values of the seven-day average of the daily maximum temperatures (7-DADMax) and then compared for the two conditions.

The model analyses demonstrated that “with Project” temperatures in the Columbia, Okanogan and Methow rivers do not increase more than 0.3°C compared to ambient (“without Project”) conditions anywhere in the reservoir, and that the Wells Project complies with state water quality standards for temperature. The analyses also show that backwater from the Wells Project can reduce the very high summer temperatures observed in the lower Okanogan and Methow rivers. The intrusion of Columbia River water into the lowest 1-2 miles of the Okanogan River and lowest 1.5 miles of the Methow River can significantly decrease the temperature of warm summer inflows from upstream, and can also moderate the cold winter temperatures by 1-3°C, reducing the extent and length of freezing.

### **3.10 Okanogan Toxins Study**

The Okanogan Toxins Study determined the concentration of the persistent bioaccumulative pollutants 1,1,1-trichloro-2,2-bis[*p*-chlorophenyl]ethane (DDT) and polychlorinated biphenyls (PCBs) in recreational fish species and in swimming area sediments of the lower Okanogan River (up to RM 15.5) within the Wells Project boundary. This study augments previous information collected by Ecology during the development of the Lower Okanogan River Basin DDT and PCBs TMDL report, and will help document DDT and PCBs concentrations in the

sediment and fish tissues in the Okanogan River. In addition, the information collected during this study may be used to inform the development of an appropriate information and education program to address the human health risks related to recreational use by the public in the lower Okanogan River.

Fish species targeted for analyses were common carp (*Cyprinus carpio*), mountain whitefish (*Prosopium williamsoni*) and smallmouth bass (*Micropterus dolomieu*). These are three common resident fish species in the Okanogan River and represent different feeding behaviors and habitat uses. Fish collected during the study were weighed, measured, and filet samples collected and delivered to Analytical Resources, Incorporated in Seattle, Washington, for analyses of DDT and PCBs concentrations.

Sediment sampling locations were selected during a site reconnaissance targeting accessible recreation sites along the lower Okanogan River within the Wells Project boundary (RM 15.5 to RM 0.0). To characterize the surface sediments most likely to be encountered by recreational river users, three grab samples were collected from the upper 10 cm of the sediments at each site with a vanVeen or Ekman grab sampler. At each site, an aliquot of sediment from each grab sample was analyzed for total organic carbon, grain size, total solids, PCBs (Aroclors), and DDT analogs.

PCBs were undetected in all sediment samples at the 3.9 to 4.0  $\mu\text{g}/\text{kg}$  reporting limits. Results were more than one order of magnitude below the 60  $\mu\text{g}/\text{kg}$  sediment quality standard value proposed by Michelsen (2003). DDT analogs were not detected in samples from the SED4 and SED5 sampling sites. Total DDT results were similar to the range of 8.3 to 23  $\mu\text{g}/\text{kg}$  detected in the upper 32 cm of a 2001 sediment core collected for the TMDL study, where total concentrations were 8.8  $\mu\text{g}/\text{kg}$  in the upper 2 cm and increased to 23  $\mu\text{g}/\text{kg}$  in sediments from 30 to 32 cm deep. Sample concentrations from both studies were below the lowest apparent effects thresholds for aquatic life (DDD 96  $\mu\text{g}/\text{kg}$ , DDE 21  $\mu\text{g}/\text{kg}$ , and DDT 19  $\mu\text{g}/\text{kg}$ ).

The lipids content of lower Okanogan River carp collected for this study were greater than in carp collected for the TMDL technical assessment. The carp sampled in this study were also larger and presumably older than fish sampled for the TMDL. The larger and older fish used in this study had correspondingly higher concentrations of DDT than reported in the TMDL assessment. Total DDT ranged from 120 to 25,726  $\mu\text{g}/\text{kg}$  in carp from the current study compared to 236 to 434  $\mu\text{g}/\text{kg}$  in carp from the TMDL study. The higher concentrations exceed levels that have led the Washington Department of Health to issue fish consumption advisories for the Yakima River.

Similar results for DDT were observed for smallmouth bass. Larger fish with higher lipids levels were captured during this study compared to the TMDL study. On average, these larger fish also had higher DDT concentrations than the fish analyzed during the TMDL study. Total DDT ranged from 79 to 2,553  $\mu\text{g}/\text{kg}$  in smallmouth bass from the current study compared to 28 to 288  $\mu\text{g}/\text{kg}$  in smallmouth bass from the TMDL study.

The differences between DDT concentrations in fish tissues collected in the two studies may be attributable to differences in age, as indicated by size, and to differences in lipids content. The

larger fish not only contained more lipids, where organic chemicals bioaccumulate, but they also have had additional years to bioaccumulate DDT.

Higher PCBs concentrations were also associated with larger, older-aged carp with higher lipids content. Similar correlations between total PCBs and lipids content, mean weight and mean length were not significant for smallmouth bass tissue samples. Total PCBs concentrations ranged from 8.8 to 246 µg/kg in carp and <4 to 79 µg/kg in smallmouth bass. These concentrations were lower than fish tissue concentrations in carp from the Wenatchee River and in mountain whitefish from the Walla Walla River that have led to fish consumption advisories.

### **3.11 DO, pH and Turbidity Study (Not Required by FERC)**

As part of the 401 certification process previously described in Section 3.8, Ecology must determine whether the Wells Project is in compliance with state water quality standards, including the numeric standards, for DO, pH, and turbidity.

The DO, pH and Turbidity Study augmented established sampling regimes for existing monitoring programs and provide additional information related to DO, pH, and turbidity at the Wells Project. A Quality Assurance Project Plan, revised to incorporate review comments from Ecology, identified the organization, schedule, data quality objectives, sampling design, field and laboratory procedures, quality control, and data management and reporting parameters required to implement the DO, pH, and turbidity study proposed by the Aquatic RWG.

Three Hydrolab Minisonde5 instruments equipped with DO, pH, and turbidity sensors were installed throughout the lower Okanogan River and began recording data at 30-minute intervals on May 5, 2008. Protective instrument housings were attached to pilings at the Malott Bridge (RM 17.0, above the Wells Project boundary), Monse Bridge (RM 5.0) and Highway 97 Bridge (RM 1.3). Similar instrumentation, operating in the Wells Dam forebay at RM 515.6, began recording DO and pH measurements at 1-hour intervals on May 30, 2008, and a Global Water WQ750 sensor began monitoring turbidity at 5-minute intervals on June 3, 2008. These forebay instruments complete the network of four continuous water quality monitoring locations.

Six Okanogan River instrument servicing events were conducted. Each servicing event involved downloading data, calibrating and performing maintenance on the instruments, performing quality control checks (including Winkler's titrations for dissolved oxygen determination), and replacing batteries. High river flows and woody debris accumulations at times precluded access to some of the instruments in the Okanogan River during two of the six servicing events. Battery failures also caused some data gaps. The Wells Dam forebay MiniSonde was serviced bi-monthly without any data gaps. The WQ750 turbidity sensor's self-cleaning mechanism did not function properly and, even with frequent manual cleaning, the data were judged to be unreliable and were rejected as unusable.

Effects of the Wells Project on DO concentrations in the Okanogan River are not evident as incoming DO concentrations closely resemble those within the inundated portions of the Okanogan River. In general, DO measurements in the Okanogan River remained above 9 to 10 mg/L early in the monitoring season and then after July 1, 2008 started to show excursions below

8.0 mg/L at night as snowmelt runoff receded and water temperatures increased. Minimum daily DO concentrations upriver from the Wells Project boundary at Malott have been below the 8.0 mg/L criterion from July 1 through August 5 (monitoring period covered by this interim report). In the lower Okanogan River, within the Wells Project boundary, there has been no pattern of lower DO in the Wells Project compared to upriver at Malott that would suggest Wells Project effects. Minimum daily DO concentrations dropped below 8.0 mg/L at Monse in early July. At the Highway 97 Bridge, daily minimum DO readings began to occasionally drop below 8.0 mg/L on July 1, and stayed below 8.0 mg/L to August 5. Wells forebay DO readings also declined as water temperature increased seasonally, but was continuously within compliance with the water quality standard of a minimum daily DO concentration of 8.0 mg/L.

Most excursions from the water quality criteria for pH (6.5 to 8.5) were recorded upriver from the Wells Project area at Malott. On those few occasions when pH exceeded the criteria at Monse or Highway 97, the variation from pH values at Malott was less than 0.5 units. The Okanogan River pH measurements have ranged from 7.23 to 8.70 at Malott Bridge, 7.07 to 8.68 at Monse Bridge and 7.39 to 8.61 at the Highway 97 Bridge. At the Wells Dam forebay the pH has ranged from 7.09 to 8.07, which is within the water quality criteria. There were only three days in early May when excursions above the water quality pH criteria (6.5 to 8.5) were recorded at Monse, comprising less than six percent of the days with pH records. At no time did the pH at Monse exceed pH upriver from Malott by more than 0.5 units, the criterion for human-caused variation. At Highway 97 there was only one day when pH exceeded the criteria, out of 83 days with pH records, and that daily maximum was only 0.3 units above the Malott pH. One thirteen-day period of daily pH excursions occurred at the Malott Bridge between July 24 and August 5 when diurnal occurrences of higher late afternoon to nighttime pH peaked between 8.58 and 8.70. Because this repeated diurnal excursion occurred above the Wells Project boundary at Malott, these pH excursions were unrelated to Project operations. Since monitoring began in early May, 99.6 percent of recorded pH values in the Project area were within the criteria range of 6.5 to 8.5. When pH at the Highway 97 Bridge or Monse Bridge sampling locations exceeded 8.5, daily maximum values were within 0.26 units of the pH values for water entering the Wells Project (Malott Bridge sampling location).

Turbidity ranged from 0.1 nephelometric turbidity unit (NTU) to 647 NTU at Highway 97, 489 NTU at Monse, and 400 NTU at Malott. Data interpretation was problematic, as the Malott Bridge location instrument failed to collect turbidity data when installed, and was not functional when peak runoff caused maximum turbidity within the Wells Project at the two lower Okanogan River monitoring locations. However, given that high values peaked coincident with annual spring runoff, it is reasonable to attribute those highest values to natural, annual snowmelt and runoff. Due to problems with the self-cleaning mechanism and maintenance of the Wells Dam forebay turbidity sensor, data collected there were judged to be unreliable and were rejected as unusable for the period covered by this interim report.

### **3.12 Lamprey Spawning Assessment (Not Required by FERC)**

The Lamprey Spawning Assessment addressed the level of spawning activity by adult Pacific lamprey in the Wells Project with a goal that if spawning was detected, to determine whether the operations of the Wells Project are affecting this activity. Specific objectives of the study include: 1) identify areas within the Wells Project where suitable spawning habitat may exist for adult Pacific lamprey; 2) survey these areas of spawning habitat for use by lamprey to confirm suitability; and 3) if spawning is observed, assess whether the operations of Wells Dam are having adverse effects on these spawning areas (i.e., dewatering, flow alterations, scour, etc.).

Wells Project bathymetry and high resolution orthophotography were spatially analyzed using a GIS to identify preliminary spawning habitat. Four field surveys were conducted to verify the suitability of preliminary spawning habitat. Criteria for acceptance as suitable spawning habitat during field verification consisted of appropriate substrate (gravel dominant), the presence of water velocity, and a minimum reach length of 10 feet. Four reaches were concluded to have suitable spawning habitat for Pacific lamprey; two in the Columbia River (C1 and C2), one in the Methow River (MR), and one in the Okanogan River (OR).

A total of 14 field visits were conducted between April 25 and August 5, 2008. Sites C1, C2, MR, OR were surveyed 13, 14, 6, and 4 times, respectively. Surveys were conducted over a wide range of water temperatures (8.5°C-21.5°C) and flows (0.001-19.5 kcfs). Tributary sites (MR, OR) were frequently inaccessible during the survey period due to high flows from spring runoff. During the study, no Pacific lamprey or signs of Pacific lamprey spawning (fish, nest construction activity, test digs, or nests) were observed. The evidence indicates that the Wells Project is not an important spawning area for Pacific lamprey.

Review of the scientific literature that describes suitable spawning habitat for Pacific lamprey indicates that the suitable habitat identified within the Wells Project can be described as marginal, at best. This conclusion is supported by extensive spawning ground surveys over the time period and during water quality conditions that typically define the Pacific lamprey spawning period.



#### **4.0 INITIAL STUDY REPORT MEETING**

In accordance with 18 CFR § 5.15(c)(2), Douglas PUD will conduct a meeting to clarify the ISR Document and to discuss the study results. This meeting date will be within the required 15-day ILP timeframe following the filing of the ISR Document and is scheduled as follows:

Thursday, October 30, 2008  
9:00 am – 4:00 pm  
Douglas PUD Auditorium  
1151 Valley Mall Parkway  
East Wenatchee, Washington