Puntledge River Habitat Restoration
Powerhouse Side-Channel Improvements
2004 – 2005

04Pu.02

Prepared for:
BC Hydro Bridge Coastal Fish and Wildlife Restoration Program

Prepared by:

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on behalf of:

Fisheries and Oceans Canada
Puntledge Hatchery

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Executive Summary

Location:	Located on the south side of the Puntledge River , 0.5 km upstream of the BC Hydro Powerhouse. Access to the site is off the BC Hydro R.O.W. at the end of Powerhouse Road.		
Watershed Code:	92055320094-4200		
Map References:	92 F-11		
UTM Co-ordinates:	Zone 10.	5,506,324m N; 352,990 m E	(NAD83)
Construction Drawings:	PH-SK-10		
Cost Summary:	Total 2004/05 costs		**$ 22,260.52**
	BC Hydro		**$ 17,497.52**
	In Kind (DFO, Volunteers)		**$ 4,763.00**

The Powerhouse side-channel was constructed in 1990 through a joint partnership with BC Hydro, Weldwood of Canada Ltd., Fisheries and Oceans Canada, Ministry of Water, Land and Air protection and the Steelhead Society of B.C (Comox Valley Chapter). The main purpose of the channel is to provide stable summer and overwintering habitat for juvenile coho salmon and trout and limited spawning habitat for pink and coho salmon.

During the instream fisheries work window in 2004, a new wing intake and pipeline were installed to replace the open channel inlet to the side-channel. This inlet was prone to in-filling with sediment from the Puntledge River, causing reduced flows into the side-channel and threatening spawning, egg incubation and juvenile rearing habitat.

These measures will improve water flow through the channel, thereby improving spawning and incubation success, and increasing the productivity and survival of summer rearing and overwintering juvenile salmonids. The Powerhouse Side-channel Improvement Project addresses the interruption of gravel and wood recruitment and the reduction in spawning and rearing habitat below the diversion dam, as outlined in the BCRP Strategic Plan Volume 2, Chapter 3 (Puntledge River), by improving stable off-channel spawning, summer rearing and overwintering habitat and ensuring its integrity over the long term.

Table of Contents

List of Figures

List of Appendices

1 Introduction

1.1 Background

The Powerhouse side-channel was constructed in 1990 through a joint partnership with BC Hydro, Weldwood of Canada Ltd., Fisheries and Oceans Canada, Ministry of Water, Land and Air protection and the Steelhead Society of B.C (Comox Valley Chapter). The main purpose of the side-channel is to provide stable summer and overwintering habitat for juvenile coho salmon and trout and limited spawning habitat for pink and coho salmon.

1.2 Need Statement

Spawning habitat in the Puntledge mainstem below Comox Lake is presently limited to the lower-most reach (reach 1), and small pockets in the upper section of reach 3. The spawning grounds in reach 1 were cited as being impacted from accentuated fall-winter freshets following the expansion of the hydro facilities in 1955, and the lack of gravel inputs leading to declines in the fall-run chinook stock (Marshall, 1971).

Gravel sources and gravel recruitment to the lower Puntledge River reflect geologic processes that took place in south-western British Columbia since the last (Fraser) glaciation, 15,000 years ago. Events during and after the retreat of the glaciers resulted in deposition of gravel mainly around the present 150 m (500 ft) contour. The information suggests that a large proportion of gravel deposits (post-glacial deltaic gravel and sand sediments) in the Puntledge River became unavailable for transport by the construction of the diversion dam at elevation 130 m (430 ft) asl downstream of Comox Lake. Historically, the lake would have settled much of these gravel deposits, therefore gravel recruitment downstream of the lake would have been limited. Supply Creek, the main tributary between the two dams probably once provided moderate contributions as evidenced by the formation of gravel bars at the confluence of this tributary with the Puntledge mainstem (Bengeyfield and McLaren, 1994). Since 1912 gravel contributions from sources above the diversion dam have been eliminated by the dam and are now restricted to the deltaic and fluvial terrace sediments downstream. The falls reach likely never supported much spawning but was mainly a transport reach and gravel recruitment from this reach is limited to the scouring of the thin alluvial deposits along the banks (Bengeyfield and McLaren, 1994).

Not only has hydro-electric development in the watershed interrupted gravel recruitment to the lower river from dam construction, but the regulation of flow downstream of the dam has resulted in frequent rapid fluctuations in discharge and occasional excessive flow events which have scoured existing gravel. The reduction in good quality spawning gravel in the lower reaches is further complicated by the repeated utilization of the same spawning habitat by different species, mainly pink and chum salmon (MacKinnon *et al.*, 1979).

The proposed project addresses the interruption of gravel and wood recruitment and the reduction in spawning and rearing habitat below the diversion dam, as outlined in the BCRP Strategic Plan Volume 2, Chapter 3 (Puntledge River), by improving stable off-channel spawning, summer rearing and overwintering habitat and ensuring its integrity over the long term.

1.3 Objectives

The objectives of the Powerhouse Side-channel Improvement Project are to improve the spawning success of adult salmon and trout, incubation survival of eggs, and summer and overwinter rearing of juvenile salmonids by improving water flow delivery to the side-channel.

2 Study Area

The Powerhouse side-channel is located on the south side of the Puntledge River in Reach 3, also called the diversion reach, upstream of the BC Hydro powerhouse (Figure 1). The channel is fed directly from the Puntledge River mainstem by a small inlet channel, and consists of gravel beds, rearing pools and flooded riparian forest. The channel is approximately 350 m in length with over 1,700 m^2 of spawning and rearing habitat.

3 Methods

The wing intake and bank intake were designed by Fisheries and Oceans Canada and fabricated by Les Colville Welding and Fabrication Ltd. in Courtenay, BC (Appendix IV). They were delivered to the site on the day of installation.

The worksite was isolated, thus cutting flow into the existing side-channel. A portable pump from Puntledge Hatchery was used to pump water from Puntledge River into the channel downstream of the worksite to maintain flow to the channel. Boulders and coarse gravel were removed to the designed grade for the pipeline. The pipe and intake were assembled together prior to being placed in the river. The complete unit was then lifted with the excavator and placed in the river and immediately armoured with riprap. Once the pipeline and river intake were secured, flow to the channel was allowed through the intake.

The bank intake was 6 “ too tall and had to be returned to the fabricator to be modified prior to installation. Since it was being fastened to an existing footbridge, it was easier to modify the intake rather than the bridge.

4 Results

Between August 2004 and March 2005 the following construction and monitoring activities were completed in the Powerhouse side-channel:

- Installation of a 10” wing intake and pipeline
- Installation of a screened bank intake.
- Visual surveys of salmon spawning activity in the channel (pink and coho) and sediment deposition following high flows.
- Installation of a sign adjacent the channel to raise public awareness about the importance of the fish habitat structures and channel improvements, and the overall value of this channel in the ecologic health of the Puntledge River watershed.

5 Discussion

The former inlet into the Powerhouse side-channel was protected and maintained by large boulders and deflector logs. However, sand and gravel was continually transported into the side-channel, particularly during high flows. Most of this sediment was immediately deposited at the upper end of the channel due to the low gradient. The sediment was mainly composed of shale which easily breaks down into smaller angular fragments. Over time, this infilling significantly reduced the amount of flow delivered into the side-channel, jeopardizing incubating eggs and juvenile rearing habitat. Puntledge Hatchery staff had to frequently excavate the inlet channel by hand during the fall/winter in order to maintain some flow through the side-channel. Unfortunately, these stop-gap measures have been inadequate for restoring optimum flows.

The new intake is designed to reduce or eliminate sediment transport into the channel thus reducing the high maintenance requirement by hatchery staff. This structure consists of a wing intake with trash rack and vortex plate that rests approximately 0.5 m above the river bed (Appendix IV). This allows sediments to travel along the river bottom during high flows and not be intercepted by the intake. A gate valve was included to allow full control of flow into the side-channel. Therefore if sediment transport is found to be a problem at high flows, the intake can be shut off while the slotted screen bank intake would still provide flow into the channel. This intake design has been used for various side-channel restoration projects on Vancouver Island and the lower Mainland.

6 Recommendations

Operation of the new river and bank intake will be closely monitored during the first season of high flows after installation. The channel will be inspected to identify quantity of sediment transport and areas of deposition. A maintenance schedule will be developed with Puntledge Hatchery staff to determine the necessity of closing the valve during flood events to reduce sediment transport into the channel.

7 Acknowledgements

This project was made possible through the financial support of BC Hydro Bridge Coastal Fish and Wildlife Restoration Program and the technical and supervisory support of Fisheries and Oceans Canada Pacific Region Habitat and Enhancement Branch (Nanaimo).

8 References

Bengeyfield, W. and W. A. McLaren. 1994. Puntledge River gravel placement feasibility study. Global Fisheries Consultants Ltd. White Rock, B.C. and McLaren Hydrotechnical Engineering, Coquitlam, B.C. for: Environmental Resources, B.C. Hydro, Burnaby 43 p.

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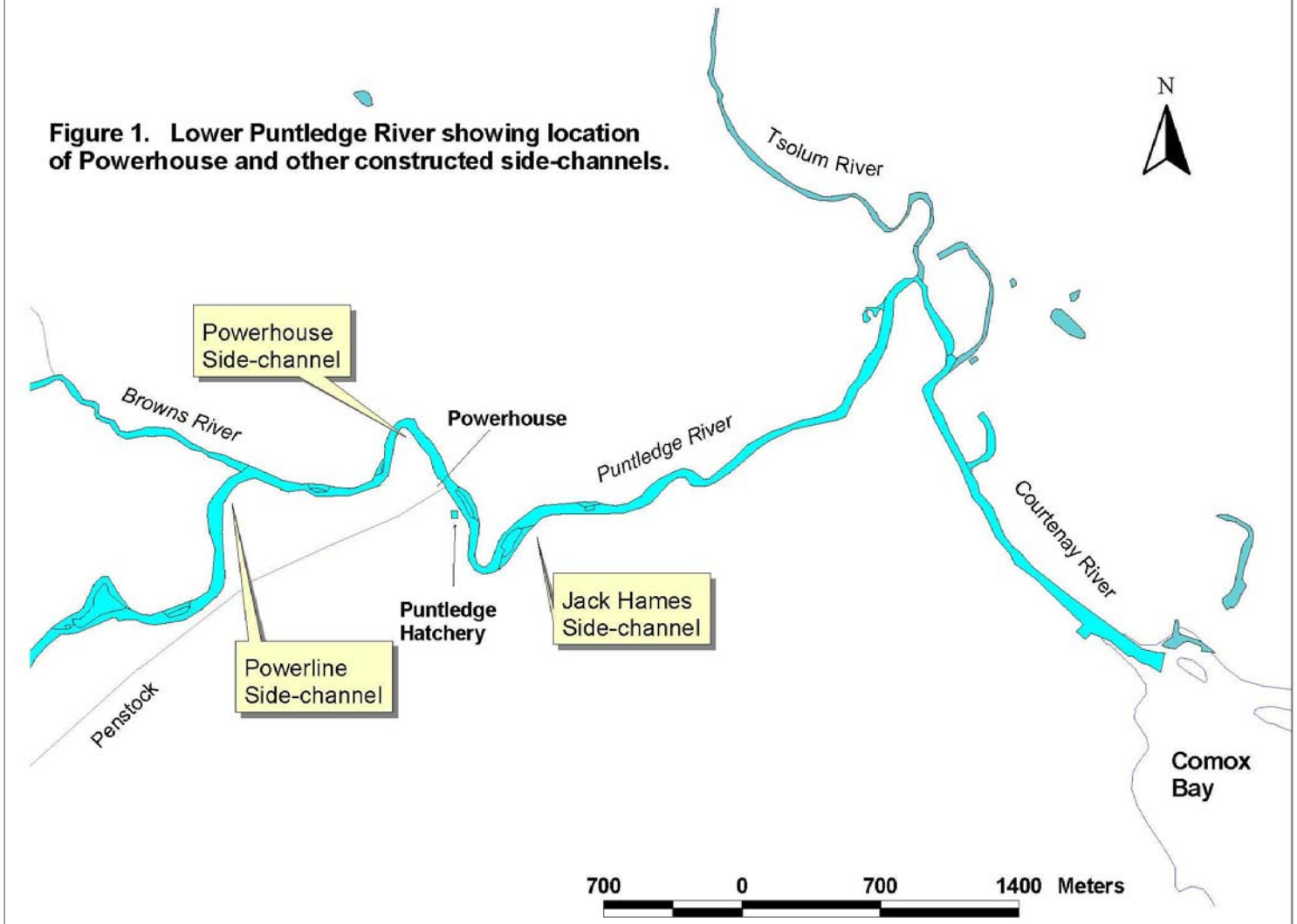
MacKinnon, C.N., H. Genoe and D.C. Sinclair. 1979. Puntledge River Project 1972 - 1977. Fish. and Mar. Serv. Tech. Rep. No. 842, Enhancement Services Branch, Vancouver, 126 p.

Marshall, D. E. 1971. 1970 Puntledge River biological program. Memo to L. Edgeworth and D. MacKinnon. Dept. of Fish. & Forestry, Pac. Reg. Memo. 31-3-P1, 16 p. + app.

Figure 1. Lower Puntledge River showing location of Powerhouse and other constructed side-channels.



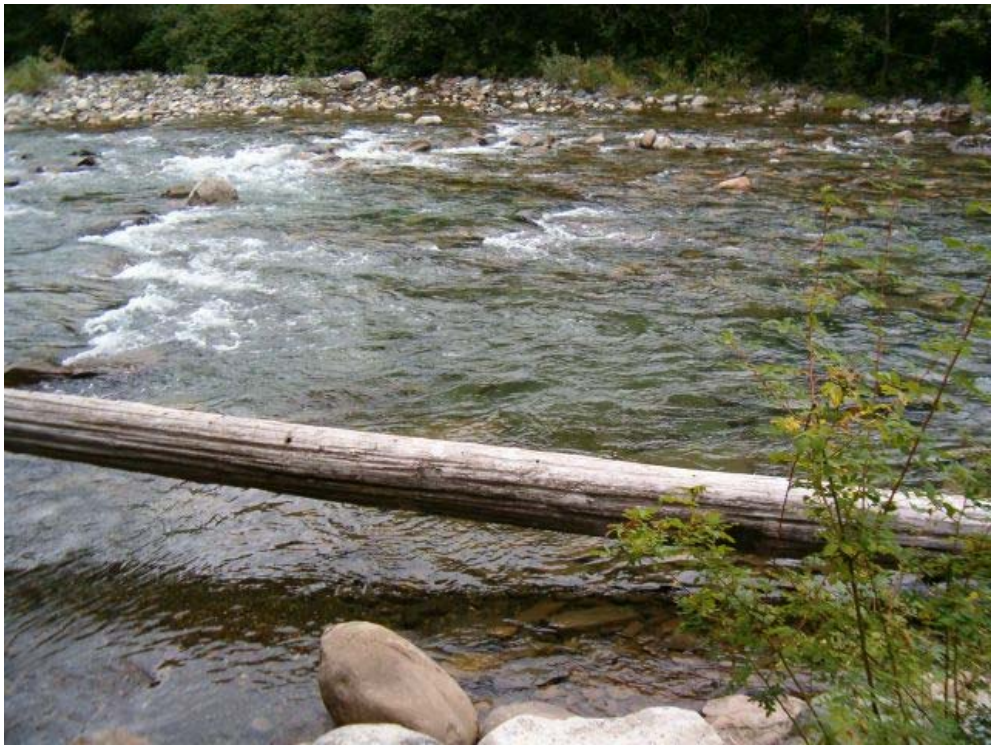


Figure 2. Location of the wing intake in the Puntledge River (before installation) for the Powerhouse side-channel.

Figure 3. Inlet channel and footbridge providing flow control to the Powerhouse side-channel before installation of pipeline.

Figure 4. Replacement of inlet channel with pipeline (seen in centre of photo).

Figure 5. Powerhouse side-channel footbridge with screened bank intake in place.

Appendix I

Project # 04.Pu.02

Financial Statement Form

	BUDGET		ACTUAL	
	BCRP	**Other**	**BCRP**	**Other**
INCOME				
Total Income by Source	19,591.00	5,054.00	21,041.00	4,763.00
Grand Total Income (BCRP + other)		24,645.00		25,804.00
EXPENSES				
Project Personnel				
Wages		3,500.00		3,150.00
Consultant Fees	1,400.00		3,000.00	
(List others as required) Technician	2,000.00		121.00	
Materials & Equipment				
Equipment Rental	4,891.00	150.00	3,110.00	200.00
Materials Purchased	9,500.00		10,009.00	
Travel Expenses	600.00	230.00	202.52	353.00
Permits				
(List others as required) signage	1,200.00		1,055.00	
Administration				
Office Supplies				
Photocopies & printing				
Postage				
(List others as required) 5% Admin fees		1,174.00		1,060.00
Total Expenses	19,591.00	5,054.00	17,497.52	4,763.00
Grand Total Expenses (BCRP + other)		24,645.00		22,260.52
BALANCE (Grand Total Income – Grand Total Expenses)	*The budget balance should equal $0*	0.00	*The actual balance might not equal $0**	3,543.48

* Any unspent BCRP financial contribution to be returned to: BC Hydro, BCRP
6911 Southpoint Drive (E14)
Burnaby, B.C. V3N 4X8
ATTENTION: JANICE DOANE

Appendix II

Project # 04.Pu.02

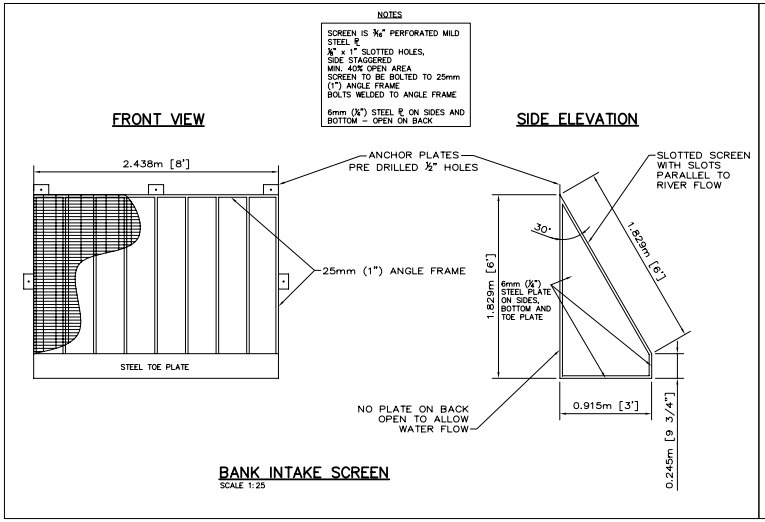
Performance Measures

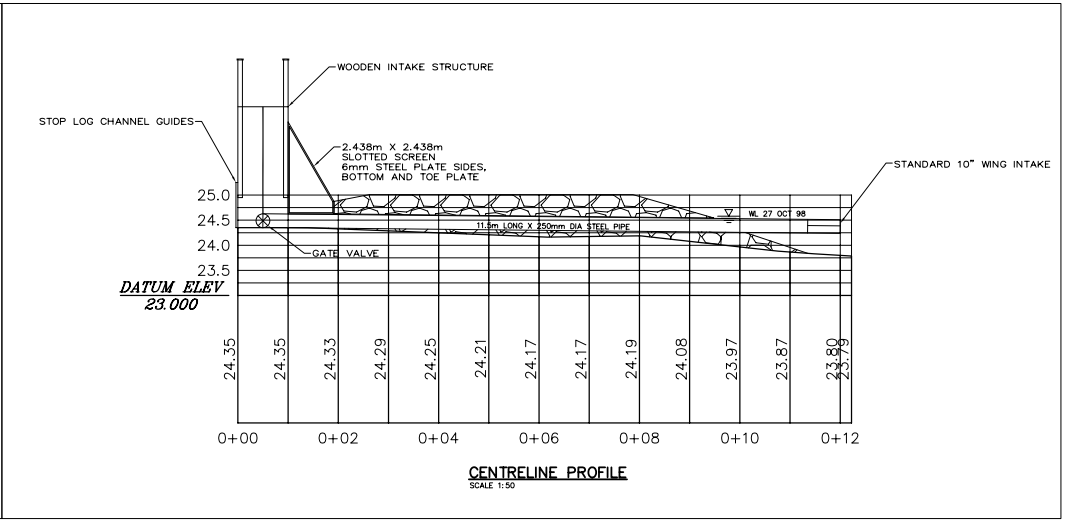
Using the performance measures applicable to your project, please indicate the amount of habitat actually restored/enhanced for each of the specified areas (e.g. riparian, tributary, mainstream).

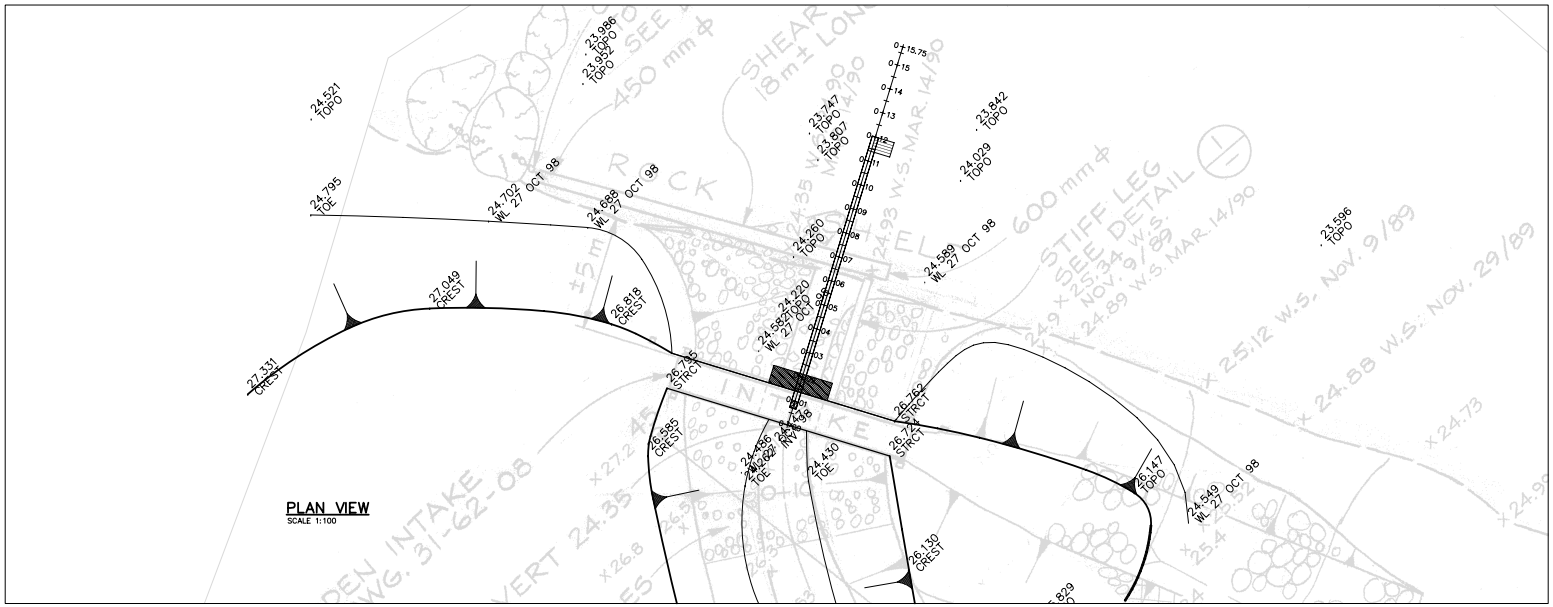
Performance Measures – Target Outcomes													
Project Type	**Primary Habitat Benefit Targeted of Project (m^2)**	**Primary Target Species**	**Habitat (m^2)**										
			Estuarine	In-Stream Habitat – Mainstream	In-stream Habitat – Tributary	Riparian	Reservoir Shoreline Complexes	Riverine	Lowland Deciduous	Lowland Coniferous	Upland	Wetland
Impact Mitigation												
Fish passage technologies	Area of habitat made available to target species											
Drawdown zone revegetation/stabilization	Area turned into productive habitat											
Wildlife migration improvement	Area of habitat made available to target species											
Prevention of drowning of nests, nestlings	Area of wetland habitat created outside expected flood level (1:10 year)											
Habitat Conservation												
Habitat conserved – general	Functional habitat conserved/replaced through acquisition and mgmt											
	Functional habitat conserved by other measures (e.g. riprapping)	pink, coho, trout		1700								
Designated rare/special habitat	Rare/special habitat protected											
Maintain or Restore Habitat forming process												
Artificial gravel recruitment	Area of stream habitat improved by gravel plmt.											
Artificial wood debris recruitment	Area of stream habitat improved by LWD plcmt											
Small-scale complexing in existing habitats	Area increase in functional habitat through complexing											
Prescribed burns or other upland habitat enhancement for wildlife	Functional area of habitat improved											
Habitat Development												
New Habitat created	Functional area created											

Appendix III Confirmation of BCRP recognition.

Signage for the Powerhouse Side-channel Project







FISHERIES AND OCEANS CANADA
OCEANS AND COMMUNITY STEWARDSHIP - SCD

APPENDIX IV

PUNTLEDGE RIVER
POWERHOUSE CHANNEL
INTAKE MODIFICATION
PLAN, PROFILE, SECTIONS

DESIGNED	RN/MS
DRAWN	RN
CHECKED	
RECOMMENDED	
APPROVED	
APPROVED	

SCALE: AS SHOWN
DATE: 28 OCT 03
DRAWING NUMBER: PH-SK-10
REVISION

DWG. NO.	REFERENCE DRAWINGS	NOTES	NO.	DATE	REVISIONS

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