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March 11, 2014

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
Mail Code: DHAC, PJ-12
888 First Street, N.E.
Washington, D.C. 20426

RE: Priest Rapids Hydroelectric Project No. 2114 License Compliance Filing – Article 401(a)(11) – 2013 White Sturgeon Management Plan Annual Report

Dear Secretary Bose,

Please find enclosed the 2013 White Sturgeon Management Plan (WSMP) Annual and Biological Objectives Status Report consistent with the requirements of Article 401(a)(11) and the Washington Department of Ecology (WDOE) 401 Water Quality Water Quality Certification Condition (Reporting Section of Appendix C) for the Priest Rapids Project (Project).

This report summarizes annual activities for year 2013. The planning process was initiated in winter 2012, in consultation with the Priest Rapids Fish Forum (PRFF) with implementation planned for the spring of 2013. This report contains current information regarding the white sturgeon supplementation programs that are being implemented in the mid- and upper Columbia River regions (Kootenai and Upper Columbia White Sturgeon Recovery Initiative). Both of these programs were established for the upper Columbia River and have experienced various degrees of success. The Yakama Nation is also in development of a white sturgeon supplementation program to serve the mid-Columbia River. Public Utility District No. 2 of Grant County, Washington (Grant PUD) is currently coordinating with the Yakama Nation's efforts to satisfy supplementation program requirements for the Project in 2012 and beyond.

On February 4, 2014, Grant PUD prepared and disseminated the draft 2013 WSMP Annual Report for a thirty day comment period to members of the PRFF including the WDOE, U.S. Fish & Wildlife Service (USFWS), Washington Department of Fish & Wildlife (WDFW), Colville Confederated Tribes, Yakama Nation, the Columbia River Inter-Tribal Fish Commission, Bureau of Indian Affairs, and the Confederated Tribes of the Umatilla Indian Reservation. A request for comments on the draft plan was also distributed to the Wanapum Indians, and other participating stakeholders. No written comments related to the annual report were received. On February 20, 2014, WDOE approved the 2013 WSMP Annual Report (Appendix D). A comment/comment response summary table showing WDOE's comment and Grant PUD's response is attached to the report as Appendix E.

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Federal Energy Regulatory Commission staff with any questions should contact Tom Dresser at 509-754-5088, ext. 2312, or at tdresse@gcpud.org.

Sincerely,

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Priest Rapids Fish Forum

2013
White Sturgeon Management Plan
Annual Data Report

Priest Rapids Hydroelectric Project (FERC No. 2114)

Prepared for:

Public Utility District No.2 of Grant County
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Prepared by:

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March 2014

Golder Associates would like to acknowledge and thank our partners in this research project as follow:

Lucia Ferreira	LGL Environmental Ltd.
Jason McLellan	Colville Confederate Tribes
Matt Howell	Colville Confederate Tribes
Stuart Hurd	Hurd's Guide Services
Jim Powell	Freshwater Fisheries Society of British Columbia

List of Abbreviations

401 Certification	Washington Department of Ecology Section 401 Water Quality Certification for the Priest Rapids Project
BY	Brood Year
CPUE	Catch-Per-Unit-Effort
CRITFC	Columbia River Intertribal Fisheries Commission
FERC	Federal Energy Regulatory Commission
FL	Fork Length
Grant PUD	Public Utility District No. 2 of Grant County, Washington
CBH	Columbia Basin Hatchery
MDH	Marion Drain Hatchery
M&E	Monitoring and Evaluation
PIT	Passive Integrated Transponder
Project	Priest Rapids Project
PRFF	Priest Rapids Fish Forum
PRPA	Priest Rapids Project Area
RM	River Mile
UCWSRI	Upper Columbia White Sturgeon Recovery Initiative
UTM	Universal Transverse Mercator
WSMP	White Sturgeon Management Plan

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1.0 Introduction

On April 17, 2008, the Federal Energy Regulatory Commission (FERC) issued Public Utility District No. 2 of Grant County, Washington (Grant PUD) a 44-year license to operate the Priest Rapids Hydroelectric Project (FERC No. 2114) located in the mid-Columbia River (Figure 1). Article 401 of the FERC license, consistent with the provisions of the Washington Department of Ecology Section 401 Water Quality Certification for the Priest Rapids Project (401 Certification) requires that Grant PUD develop a White Sturgeon Management Plan (WSMP) and conduct an on-going Monitoring and Evaluation (M&E) program to evaluate the effects of the Project on white sturgeon (*Acipenser transmontanus*) populations within the Project area. The 2013 M&E program was developed in context with Grant PUD WSMP, with the overall goal to restore populations of white sturgeon in the Project area to levels commensurate with the carrying capacity of available habitats. In 2013, the following tasks were completed under the M&E program:

- Develop and implement a tagging, marking and release plan for the 2012 Brood Year juvenile White Sturgeon (2012BY) based in part on the genetic diversity for the broodstock adults, fish health, and the annual release target objectives as determined by the Priest Rapids Fish Forum (PRFF) co-managers.
- Conduct broodstock sampling using set lines and guide-assisted angling for 14 days in June 2013. Use a combination of specialty bait and salmon to increase the probability of capturing larger brood candidate and reduce capture of smaller fish. Transport viable broodstock candidates to the Yakima Nation's Marion Drain Hatchery (MDH).
- Assess and confirm the continued occurrence of natural spawning below Rock Island Dam, a known, high intensity, spawning location of adult White Sturgeon in the Project area.
- Monitor dispersal of the 2012BY juvenile White Sturgeon, based on the movement of acoustic-tagged fish within each release group and determine the extent of outmigration from the Wanapum and Priest Rapids reservoirs.

In 2013, as part of the assessment of natural spawning and reproduction in the Project area, Grant PUD requested Golder Associates (Golder) to implement a pilot study to determine whether sufficient numbers of wild spawned White Sturgeon eggs can be collected and incubated *in situ*, with the intention that the resulting free embryos and larvae reared *in situ* will be transferred to an hatchery and used to supplement the juveniles produced from the broodstock program. Several genetic benefits were identified if hatchery-reared wild spawned larvae can be used to supplement the annual release of hatchery juvenile White Sturgeon into the project area. These benefits included greater representation of locally adapted alleles and reduced risk of genetic swamping [i.e., over representation of a specific genotype(s) within a population]. Production of wild spawned juveniles also eliminates the requirement and associated risks of capturing, handling, and transporting adult broodstock to and from a hatchery. Furthermore, adult spawners that are not removed for broodstock have the opportunity to supplement wild spawning, collection and incubation of wild-spawned eggs or larvae does not impact the success of annual natural recruitment. The following sections of this report summarize the methods used and the results obtained for each of these tasks completed in 2013.

1.1 Consultation

On February 4, 2014, Grant PUD prepared and disseminated for comment a draft 2013 WSMP Annual Report to members of the PRFF including the WDOE, U.S. Fish & Wildlife Service (USFWS), Washington Department of Fish & Wildlife (WDFW), Colville Confederated Tribes, Yakama Nation, the Columbia River Inter-Tribal Fish Commission, Bureau of Indian Affairs, and the Confederated Tribes of the Umatilla Indian Reservation. A request for comments on the draft plan was also distributed to the Wanapum Indians, and other participating stakeholders. Comments were requested by March 6. 2014; no comments were received from the PRFF or participating stakeholders. A letter was received from WDOE on February 20, 2014 approving the draft 2013 WSMP Annual Report.

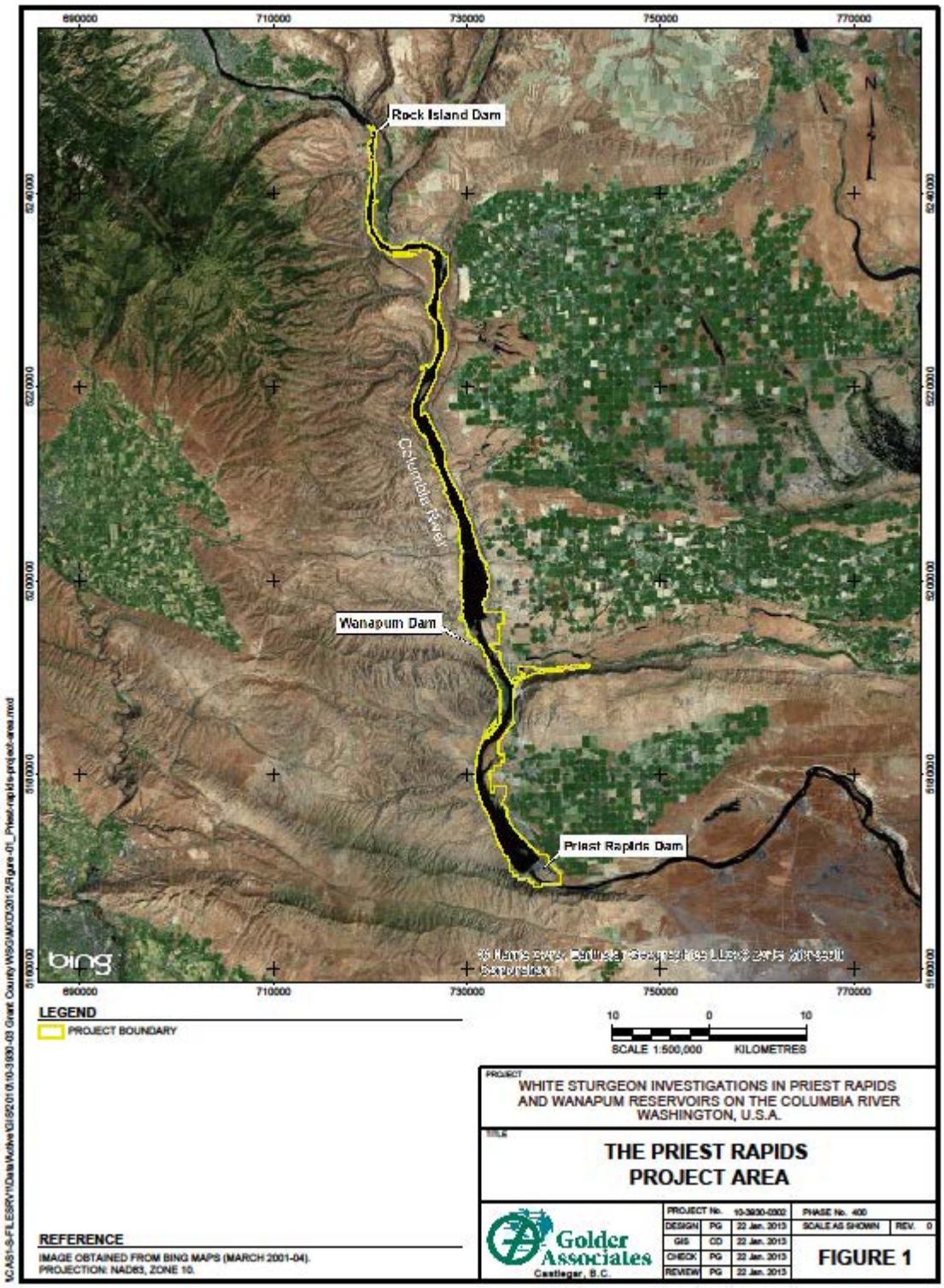

Figure 1 The Priest Rapids Project area.

2.0 Methods

For the most part, the methods used in the present study closely followed those used in previous studies conducted in the PRPA and described in detail in Golder (2013). The following sections provide general descriptions of methods used and more detail provided for methods that were not used or were modified from the previous studies.

2.1 Environmental Variables

2.1.1 Discharge and Temperature

Total river discharge and water temperature are environmental variables that have a substantial effect on many aspects White Sturgeon life history. Discharge and temperature data recorded at Rock Island Dam were used to represent these environmental variables within the Project area, as most of the studies in 2013 were conducted downstream of Rock Island Dam between the dam (RM453.4) and Columbia Heights Eddy (RM442.0). Mean daily total discharge and water temperature from Rock Island Dam from January 1 to December 13, 2013 were obtained from the Columbia River Data Access in Real Time webpage (University of Washington Columbia Basin Research; www.cbr.washington.edu/dart/river.html).

2.2 2012BY Marking and Release

Combined 2012 broodstock capture efforts by Grant PUD and Public Utility District No. 1 of Chelan County, Washington (Chelan PUD) resulted in one family group of four half-sib crosses and one family group of three half-sib crosses (Golder 2013). The seven half-sib cross were partially mixed and held in eight rearing pens at MDH. In consultation with the PRFF, the number of 2012BY juveniles to be released was reduced from the annual WSMP target of 6,500 juveniles (i.e., based on the contributions of nine families from a 3x3 cross) to approximately 4,000 juveniles, with 2/3 of these released in Wanapum Reservoir and the remainder released in Priest Rapids Reservoir. The decision by the PRFF to release fewer fish than annual release target was based in part on concerns of potential future genetic issues if large numbers of genetically related offspring are released in the same year.

Under the direction of Golder, LGL biologists supervised the scute marking and PIT tagging of approximately 3,300 hatchery White Sturgeon progeny raised at MDH. LGL responsibilities included coordinating the tagging effort with MDH staff, organizing tagging and data recording equipment, assisting with the tagging and marking process, and surgically implanting acoustic tags in approximately 33 individuals or 1% of the juvenile release group. All acoustic tags were either V9 coded pingers that indicated position; or V9P acoustic tags also transmitted depth data.

Approximately 700 of the 4000 fish to be released were held at Columbia Basin Hatchery (CBH) as a contingency in the event fish held at MDH became diseased or unavailable. Hatchery staff at CBH were responsible for tagging and data recording of fish at their facility.

Golder staff, with assistance from Grant PUD, Chelan PUD, and Confederated Tribes of the Colville Reservation (CCT) staff, was responsible for transporting and releasing the tagged fish at designated release locations in Wanapum and Priest Rapids reservoirs.

2.2.1 Juvenile Release Experiment

In 2011, the Columbia Siding location (RM450.6) was used as the 2010BY release location and the fish were released by backing the transport trailer into the river's edge and releasing the fish into the nearshore portion of a large eddy at a depth of approximately 2 m. After release,

numerous fish could still be seen holding on the river bottom at the site. PIT tag detection surveys subsequently conducted by Chelan PUD at a known bird colony located in the forebay of Rock Island Dam, recorded numerous PIT tags from the 2010BY juveniles released in Wanapum Reservoir (Golder 2013). The eddy at Columbia Siding is relatively large and shallow; conditions that could expose the released juveniles to avian predations such as cormorants and could explain the relatively high incidence of PIT tags at the bird colony.

To assess the effects of release location on subsequent juvenile survival, an experimental release program was developed for the 2012BYjuveniles destined for Wanapum Reservoir. This experiment included the release of half the fish at Columbia Siding, the same site used for the 2010BY releases and half at Columbia Cliffs Eddy (RM442.0), a deep water area with documented high use by adult and older juvenile sturgeon. A total of 2,224 juvenile White Sturgeon were provided by MDH. These fish were released in two equal groups of approximately 1,112 fish at each release location to assess the effect of release location on survival and dispersal. Fish were released into the Columbia Siding area in the same manner as in 2011. Fish released at Columbia Cliffs Eddy were dip netted into a holding tank onboard a boat, transported to the site, and released at the surface in an area with a maximum depth of approximately 40 m. Post-release observations indicated fish descended rapidly to depth after release.

2.3 Broodstock Capture

Broodstock capture was conducted from June 1 to 14, 2013 and was limited to the 5 km section of river below Rock Island Dam in Wanapum Reservoir. In an attempt to supplement set line sampling capture efforts, guide assisted angling was conducted concurrently with set line sampling over the entire 2013 broodstock capture effort.

2.3.1 Set Lines

Combinations of short, medium, and long set lines were deployed at known or suspected White Sturgeon holding and staging areas. The number of hooks and the lengths of set lines deployed depended on the flow characteristics of the area sampled. In fast flowing water or in small back eddies, short and medium length set lines, between 20 and 50 m long, were used and set with between 4 and 12 hooks. In very fast flowing or turbulent locations where set line deployment was not feasible, jug sets (a weighted single hook with a float retrieval line) were used. Long set lines with up 30 hooks were deployed in large back eddies and locations with slower water velocity. On all set lines, large circle hooks (20/0) to reduce capture of the CRITFC juveniles and increase capture of large wild White Sturgeon. Up to 60 hooks per day were baited with large pieces of specialty bait in an additional effort to further reduce the capture of immature fish and increase capture of larger broodstock candidates. Whereas previous brood capture efforts used barbless hooks to reduce hook damage and facilitate fish release, in 2013, a combination of barbless and barbed hooks were used to improve bait retention and reduce the loss of hooked fish. All set lines were tied to shore, anchored, and equipped with a buoy retrieval line.

2.3.2 Angling

Angling was conducted daily by a White Sturgeon fishing guide (Hurd’s Guide Services) to supplement set line catches of White Sturgeon for the broodstock program. On average, four anglers fished from the guide boat each day. Grant PUD also provided a secondary boat and up to four additional anglers for the duration of the capture program. On average, eight rods were fished each sample day and each sample day was approximately 8-hours long. Hatchery

Columbia River Intertribal Fish Commission (CRITFC) origin fish caught by angling were scanned and implanted with a PIT-tag by the fishing guide. Once the PIT-tag number was confirmed, fork length and girth was recorded and the fish released at the capture location. Angled large wild White Sturgeon that were potential broodstock candidates were held in the water until Golder staff arrived at the capture location and transferred the fish to the Golder research boat. If a large fish was angled late in the day and too late to allow processing and surgical examination, the fish was held overnight in a deep pool, secured to shore with either a tail noose or in a vented fish transport bag.

2.3.3 Fish Handling, Processing and Transport

Fish were handled and processed in a similar manner as during the 2012 broodstock capture program (Golder 2013). A canopy installed over the rear half of the Golder research boat protected both fish and crew from direct sunlight; this reduced overall thermal stress and exposure to UV radiation during processing.

In addition to recording morphometric data (e.g., fork length, weight, etc.), sex and maturity of broodstock candidates were assessed by surgical examination and visual inspection of the gonads with an otoscope. The assessment of the sex and maturity adhered to the methods used in the upper Columbia River White Sturgeon recovery program (Table 1; UCWSRI 2006). All field data were entered directly into the Golder's White Sturgeon capture database.

Table 1 Sexual maturity codes for White Sturgeon (adapted from Bruch, et al. 2001)

Sex	Code	Developmental State Description
Male	Mv	**Virgin male juvenile**; Testes are ribbon-like in appearance with lateral creases or folds , dark grey to cream colored attached to a strip of adipose fat tissue.
	M1	**Developing male**; Testes are tubular to lobed, light to dark grey, and embedded in substantial amounts of fat. Testes moderately to deeply lobed have distinct lateral folds.
	M2	**Fully developed male**; Testes large, cream to whitish in color, deeply lobed and filling most of the abdominal cavity. If captured during active spawning, may release sperm if stroked posteriorly along the abdomen.
	M3	**Spent/recovering male**; Testes size are much reduced, with very distinct lobes and whitish to cream color.
	M0	**Male based on previous capture**; general unknown maturity
Female	Fv	**Virgin female juvenile**; small feathery looking, beige ovarian tissue attached to a thin strip of adipose fat tissue.
	F1	**Early developing female**; pinkish/beige ovarian tissue with brain-like folds and smooth to rough surface, imbedded in heavy strip of fat tissue. The visible whitish eggs are <0.5 mm in diameter. Ovarian tissue of F1 females that have previously spawned is often ragged in appearance.
	F2	**Early "yellow egg" female**; Yellowish/beige ovarian tissue with deep "brain-like folds embedded in extensive fat tissue giving it a bright yellow appearance. Eggs, 1 to 2 mm in diameter with no apparent grayish pigmentation.
	F3	**Late "yellow egg" female**; large yellowish ovaries with deep lateral folds and reduced associated fat. Yellow/greenish to grey eggs 2.5 mm in diameter. May indicate next year spawning.
	F4	**"Black egg" female**; Large dark ovaries filling much of the abdominal cavity. Exhibiting a distinct "bulls-eye". Very little fat, Eggs are still tight in the ovary, dark grey to black, shiny and large, >3 mm in diameter.
	F5	**Spawning female**; Loose flocculent-like ovarian tissue with eggs free in body cavity shed in layers from deep ovarian folds. Eggs large, from grey to black, similar to F4.
	F6	**Post spawn female**; ovaries immediately after spawning are folded with a mushy pinkish and flaccid appearance, with little or no associated fat. Post spawn females display a characteristic abdominal mid-line depression. Large dark degeneration eggs buried amongst small oocytes.
	F0	**Female based on previous capture**; general unknown maturity
Unknown	97	adult based on size, (i.e., 1.5 m FL or greater) no surgical examination
	98	juvenile/sub-adult based on size, (i.e., no surgical examination
	99	gonad undifferentiated or not visible during surgical examination

All broodstock transfers from the research boat transport trailer were conducted at the Columbia Siding launch (RM 450.6). Located in the vicinity of the primary broodstock collection area, use of Columbia Siding allowed efficient transport and transfer of broodstock between from river to MDH.

2.4 Spawning

2.4.1 Egg Collection Mats

From June 14 to July 15 2013, egg collection mats were deployed below Rock Island Dam to capture wild-spawned White Sturgeon eggs and determine the timing and number of spawn events. Previous studies have identified the left downstream bank below Rock Island Dam as a high-use White Sturgeon spawning and egg incubation area (Golder 2003; Golder 2011). Metal framed egg collection mats were deployed at locations where White Sturgeon were known or suspected to spawn in previous years (i.e., where eggs were collected or mature adults were detected); the design and deployment method of egg collection mats used in 2013 was identical to the method used during the 2010 spawning assessment (Golder 2003).

Sampling efforts in 2013 were conducted using paired mats deployed at 10 shore locations and a single mat at a mid-channel location along the left downstream riprap bank between the Rock Island Dam boat hazard sign and upstream of Haystack Eddy (Figure 2). Paired mats were also set a single location below the hazard sign on the right downstream bank. The locations sampled and numbers of mats deployed were determined by channel configuration, water elevation, and flow hazards. Site names and UTM locations are provided in Table 2.

Table 2 Locations of egg collection mats deployed below Rock Island Dam, 2013.

SiteName	UTMZone	UTMEasting	UTMNorthing
RI1	10T	720088	5247190
RI2	10T	720184	5247089
RI3	10T	720273	5246953
RI4	10T	720327	5246859
RI4a	10T	720365	5246780
RI4b	10T	720393	5246722
RI5	10T	720413	5246656
RI6	10T	720445	5246499
RI6a	10T	720441	5246575
RI7	10T	720475	5246343
RI8	10T	719933	5246947
RI-M1	10T	720026	5247206

Paired mats were deployed at locations RI3 and RI4 on June 14 at the end of the broodstock capture program and later retrieved on July 4 at the start of the spawn monitoring program; from July 4 to July 15, egg collection mats were inspected daily. All egg collection mats were visually inspected for White Sturgeon eggs. If eggs were observed, eggs found on the mats were first enumerated and a sub-sample (1 in every 5 eggs up to a maximum of 30 eggs) preserved in Prefer® for developmental stage identification. Preserved White Sturgeon eggs were staged at the end of the day or on days when eggs were not captured. Egg staging was conducted using a microscope and was based on developmental stages as identified in Beer (1981).

The remainder of the captured eggs was used in a pilot *in situ* incubation study (see Section 2.4.3).

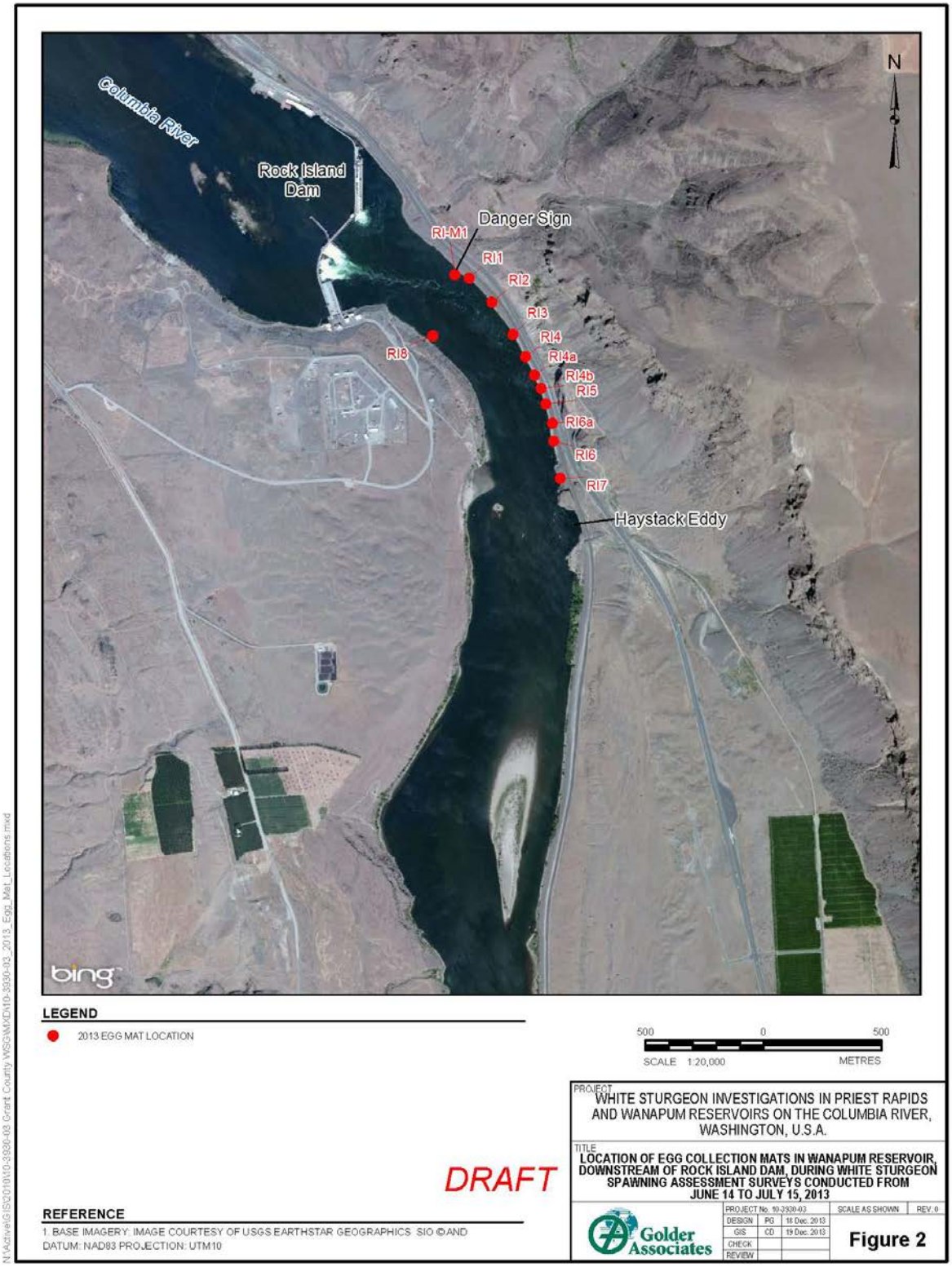

Figure 2 **Location of egg collection mats in the Wanapum Reservoir downstream of Rock Island Dam during the White Sturgeon spawning assessment surveys conducted from June 14 to July 15, 2013.**

2.4.2 Spawning Events

The number and timing of discrete sturgeon spawning events in Wanapum Reservoir were inferred based on the spatial distribution of egg captures, examination of developmental stages and back calculation from the time of egg collection to spawning date based on developmental rates at the measured water temperature (calculated based on Wang et al. 1985; Parsley et al. 2004).

2.4.3 Egg Incubation

A portable floating *in situ* incubation was fabricated as part of a pilot study to determine if sufficient numbers of wild spawned White Sturgeon eggs can be captured and incubated *in situ* to produce larvae for subsequent rearing in the hatchery. The incubator consisted of a square 76 cm wide floating chamber 120 cm deep, designed to allow eggs to develop and hatch on the mat material within the incubator.

If an egg collection mat captured only a few eggs, these eggs were carefully removed from the mat using tweezers and kept in a water-filled cooler until transferred to the incubator. If a mat captured a large number of eggs (e.g., > 30 eggs), the mat frame was dismantled and the mat fibre removed and transferred to the incubator to reduce handling of eggs. Individual fiber sheets of egg-laden mat material were vertically suspended in the incubator, eliminating the need to manually remove eggs from the mat fiber (Figure 3). This approach to *in situ* incubation greatly reduced handling time and the exposure of the eggs to desiccation, high temperature, UV radiation, and mechanical damage from handling.

In the hatchery, newly hatched White Sturgeon yolk sac larvae, referred to as free-embryos, typically swim to the bottom of the incubation apparatus and seek cover (R. Ek, FFSBC, pers. comm.). To provide a refuge for larval hiding, a capture chamber was incorporated into the base of the incubator; this chamber contained “biospheres” to simulate the cover provided by natural substrate on a river bed. The capture chamber was sealed and could be retrieved from the top of the incubator to allow collection of free-embryos as they accumulated. The free embryos were then transferred to an adjacent floating incubator until they absorbed their yolk sac and developed into exogenously feeding larvae. Both the incubator and rearing chamber were moored in a eddy approximately 3.5 km downstream of Rock Island Dam, near RM451 (Figure 4).

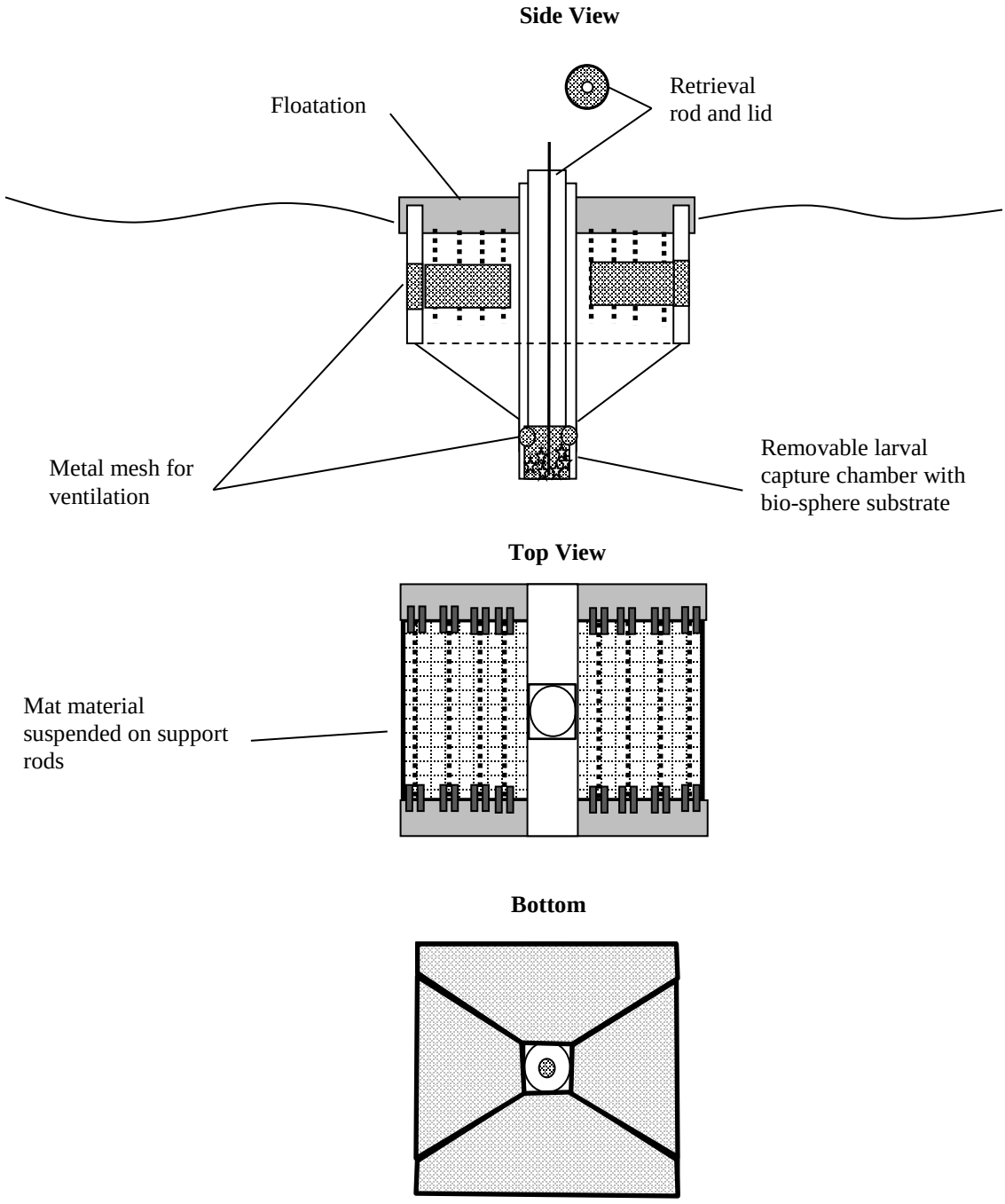

Figure 3 **Design of the prototype in situ White Sturgeon egg incubator used to incubate White Sturgeon eggs captures in Wanapum Reservoir below Rock Island Dam, July 2013.**

Figure 4 Egg incubator (right) and rearing chamber (left) deployed in Wanapum Reservoir near RM 451, July 2013.

2.5 VR2W Telemetry Array Download and Maintenance

In 2013, a total of 12 VR2W stationary telemetry receivers (model VR2W, Vemco-Amirix Systems Inc., Halifax, NS) were used to monitor movements of acoustic-tagged White Sturgeon within the PRPA at locations throughout both reservoirs and in the tailwater of Priest Rapids Dam (Table 3). Receivers were downloaded and serviced in a manner identical to the methodology applied during the 2012 study (Golder 2013). In 2013, monitors were downloaded and serviced during three inspection periods: May 22 to 23, July 16 to 17, and October 28 to 29.

High flows and debris load during the 2013 freshet resulted in displacement of station VRRM452.4 approximately 50 m downstream. Although still functional at this new location, high water velocity and deep water prevented retrieval and re-positioning of this station until lower flow conditions in October. Similarly, the higher reservoir levels for most of the year prevented retrieval of station VRRM416.1 in the Wanapum Dam forebay. This station was assumed lost and was only relocated in late October after reservoir levels decreased.

Table 3 Acoustic receiver station locations, deployment dates, and status in the PRPA as of October, 2013.

		UTM					
Station Name	**River Mile**	**Zone**	**Easting**	**Northing**	**Reservoir**	**Deployment Date**	**Station Status**
VRRM392.0	392.0	11	284680	5167847	McNary	18-May-12	Active
VRRM398.1	398.1	11	276897	5170976	Priest Rapids	22-Jun-10	Active
VRRM404.0	404.0	11	272861	5180011	Priest Rapids	22-Jun-10	Active
VRRM410.5	410.5	11	276868	5188281	Priest Rapids	23-Jun-10	Active
VRRM413.5	413.5	11	274586	5192162	Priest Rapids	23-Jun-10	Active
VRRM415.5	415.5	11	274044	5195579	Priest Rapids	19-Sep-10	Active
VRRM416.1	416.1	11	273719	5196719	Wanapum	7-Oct-10	Active
VRRM426.5	426.5	10	727309	5211953	Wanapum	23-Jun-10	Active
VRRM437.1	437.1	10	726171	5227514	Wanapum	17-May-12	Active
VRRM442.0	442.0	10	725506	5234769	Wanapum	21-Jun-10	Active
VRRM446.9	446.9	10	719589	5237495	Wanapum	29-Jun-11	Active
VRRM452.4	452.4	10	720484	5246202	Wanapum	20-Sep-10	Active

2.6 Juvenile Movements

Telemetry data from acoustic tagged 2012BY juveniles released in 2013 were screened for errors. Spurious detections, defined as sonic tag IDs that were detected only once during a 24 h or longer period, were removed from the dataset prior to analysis.

The screened data were analyzed as presence/absence data. If a fish was detected at a receiver more than once in a day (i.e., the detection was defined as non-spurious), it was considered to be present near that receiver on that day. This approach allowed the examination of temporal patterns of presence/absence rather than simply reporting the numbers of detections recorded at each VR2W station. Daily presence/absence data were then used to estimate 1) a weekly estimate of fish numbers at each station and 2) a weekly residency ratio, calculated as the number of days an individual fish was present at each receiver station out of the available number of days in that week. During the week of fish release, the weekly residency ratio was adjusted to account for the date of release; i.e., the ratio of residency was estimated as:

days present/(days in week - date of release+1)

Individual residency ratios were then used to calculate mean weekly residency ratios across fish from the same release site.

All data analyses were performed in the statistical environment R, v. 3.0.1 (R Development Core Team 2013). Plots were created in R using the package ggplot2 (Wickham 2009).

2.7 Data Analysis

Custom task-specific field databases were designed and used to record field data. Within these databases, queries were used to extract and process White Sturgeon capture, spawning, and telemetry data, as well as screen for data entry errors. Broodstock and egg capture CPUE calculations, summary tables, and simple figures were produced in Excel® using pivot tables and data filters, or in SigmaPlot®. More complicated figures were created in R using the package

ggplot2 (Wickham 2009). Customized datasheets and manifests were used to record information during the juvenile release, broodstock transport, VR2W download and servicing, and mobile telemetry tracking.

3.0 Results

3.1 Discharge and Temperature

Discharge in 2013 exhibited high sustained flows from early spring to mid-summer. Peak mean daily discharge from Rock Island Dam ranged from a high of 6511 m³/s on June 30 to a low of 1149 m^3/s on March 10 (Figure 5). Mean daily water temperature in the tailrace of Rock Island Dam ranged between 2.6 C on February 4 and 20.6 C on September 15. Discharge and water temperature during specific study components will be discussed in context with sampling results within specific sections within this report.

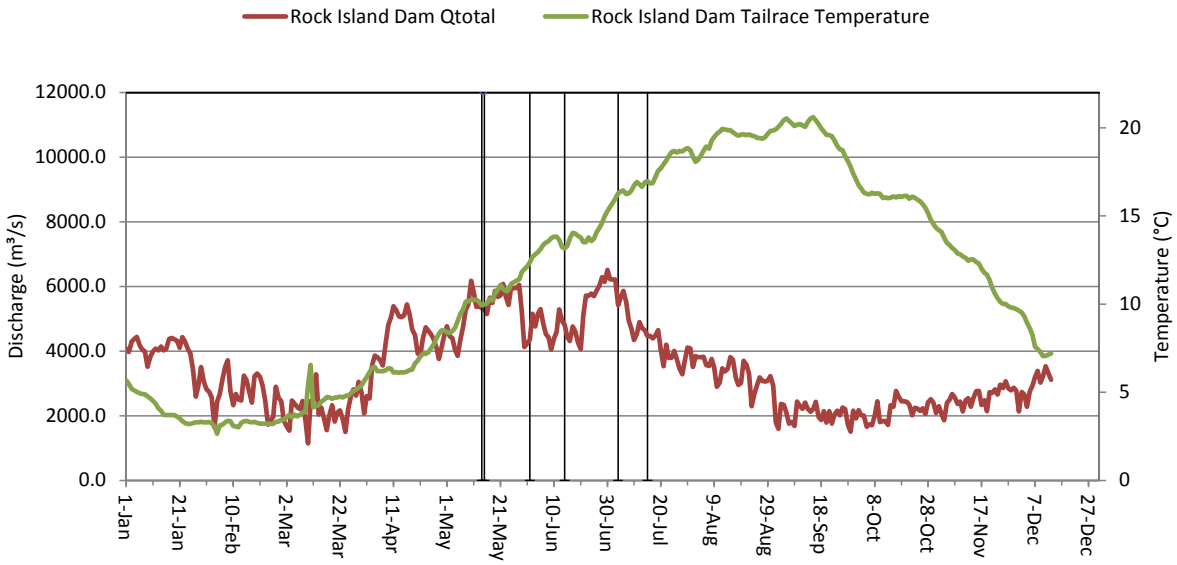

Figure 5 Mean daily discharge (Qtotal) and water temperature, as measured below Rock Island Dam in the Priest Rapids Project area, 2013. Vertical bars denote monitoring periods for the main monitoring programs.

3.2 2012BY Juvenile Marking and Release

In total, 3983 juvenile White Sturgeon (2012BY) were released in the PRPA from May 14 to 15 (Table 4). In Wanapum Reservoir, 1,135 fish were released at the Columbia Siding Launch (RM450.6) and 1129 fish were released by boat at Columbia Cliffs Eddy (RM442.0) to assess dispersal and survival differences of fish released at these two locations. Acoustic telemetry tags (16 model V9 and 8 model V9P tags, Vemco-Amirix Systems Inc., Halifax, NS) were implanted in 24 of the fish released in Wanapum Reservoir, split approximately evenly between the two release groups.

In Priest Rapids Reservoir, 1,719 2012BY were released in the Wanapum Dam tailrace (RM415.6). The fish released were provided by both MDH (1,019 fish) and CBH (700 fish). Six acoustic tagged fish from MDH were part of this release.

Table 4 Number and mean FL of 2012BY juvenile White Sturgeon released in the PRPA, May 14 and 15, 2013.

Release Location Reservoir (River Mile)	No. of Fish (No. Acoustic Tags)	Mean FL in mm (+/- SD)
Wanapum (442.0)	1129 (11)	298 (26)
Wanapum (450.6)	1135 (13)	293 (27)
Priest Rapids (415.6)	1719 (6)	285 (25)
Total	**3983** (30)	291 (26)

3.3 Broodstock Capture

All broodstock collection efforts in 2013 were conducted below Rock Island Dam from June 1 to June 14. Mean daily discharge from Rock Island Dam during the broodstock collection period ranged between 4,044 m^3/s on June 9 and 5,300 m^3/s on June 5; mean daily water temperature over this period ranged between 12.4 C and 13.8 C (Figure 5).

3.3.1 Set line Sampling

In 2013, three to six set lines were deployed daily. In total, 1,569 hooks baited with either salmon or squid were set overnight for a total sample effort of 32,710 hook-hours.

Set lines captured 20 CRITFC hatchery fish (19 fish and 1 recapture) and 18 wild White Sturgeon. Overall catch-per-unit-effort (CPUE) for hatchery and wild White Sturgeon was 0.12 fish/100 hook-hours. This was the lowest set line CPUE recorded during any of the broodstock capture programs conducted since 2010 (Table 5). However, the 2013 catch rate of wild fish (i.e., 0.06 fish/100 hook-hours) was comparable to previous years. A summary of capture, life history, and tagging information for all White Sturgeon caught by set line in 2013 is provided in Appendix A, Table A1.

Table 5 Comparisons of set line sampling effort and catch per unit-effort (CPUE) CRITFC hatchery and wild White Sturgeon captured in Wanapum Reservoir during broodstock capture programs in 2010, 2011, 2012, and 2013.

Year	Sample Effort (hook-hours)	Catch (No. of fish)			CPUE (fish/100 hook-hours)		
		Hatchery	Wild	Total	Hatchery	Wild	Hatchery & Wild
2013	**32,710**	**20**	**18**	**38**	**0.06**	**0.06**	**0.12**
2012	*23,447*	*27*	*20*	*47*	*0.12*	*0.09*	*0.20*
2011	*30,364*	*57*	*10*	*67*	*0.19*	*0.03*	*0.22*
2010	*33,421*	*108*	*18*	*126*	*0.32*	*0.05*	*0.38*

3.3.2 Angling

During the 2013 broodstock capture program, total angling effort was estimated at 896 hook-hours (4 hooks deployed for 8 hours per day, 2 boats, for 14 days). In total, 43 White Sturgeon were captured by angling, with the catch comprised of 18 CRITFC hatchery fish and 25 wild fish. Overall, angling CPUE was 4.8 fish/100 hook-hours. The life history data from fish captured by angling are provided in Appendix A, Table A2.

3.4 Broodstock Catch Size Distribution and Frequency

The combined average length of hatchery White Sturgeon captured by set line and angling during the 2013 broodstock program below Rock Island Dam (n = 37) was 106.2 cm FL (range from 57.0 cm to 141.0 cm FL). The average length of wild White Sturgeon (n = 43) captured was 188.1 cm FL (range from 107.5 cm to 247.0 cm FL). The length-frequency distributions of hatchery and wild White Sturgeon captured are presented in Figure 6. The largest single day capture of CRITFC fish (n = 7) was on June 6 (Figure 7). The greatest single day capture of wild fish (n = 8) was on June 4.

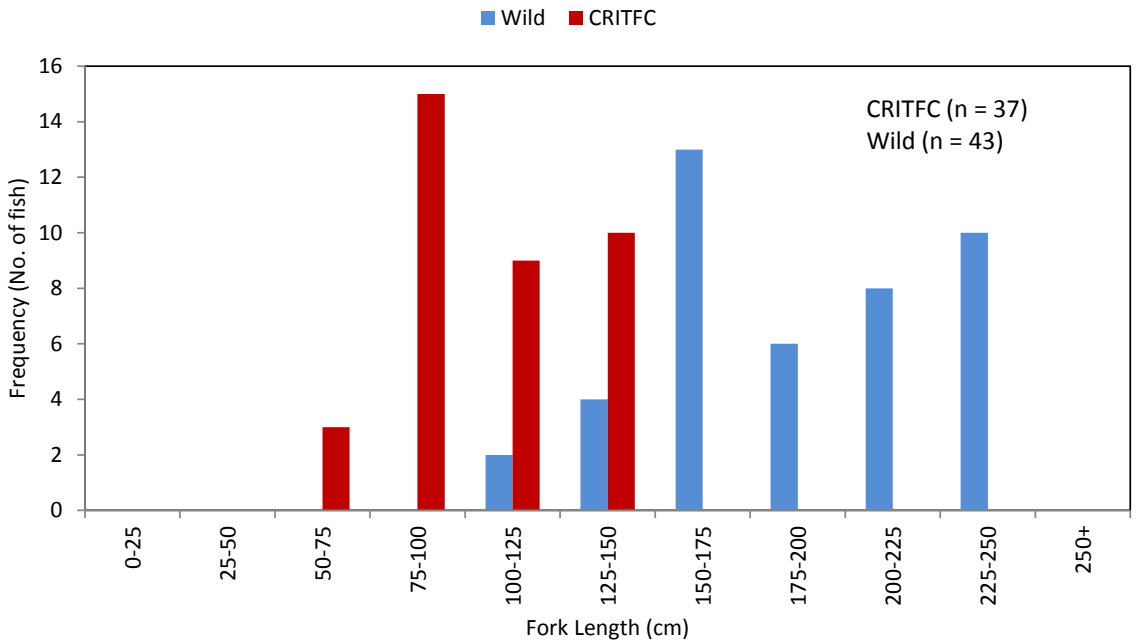

Figure 6 Length –frequency of CRITFC hatchery and wild White Sturgeon captured in Wanapum Reservoir during the broodstock capture program, June 1 to June 14, 2013.

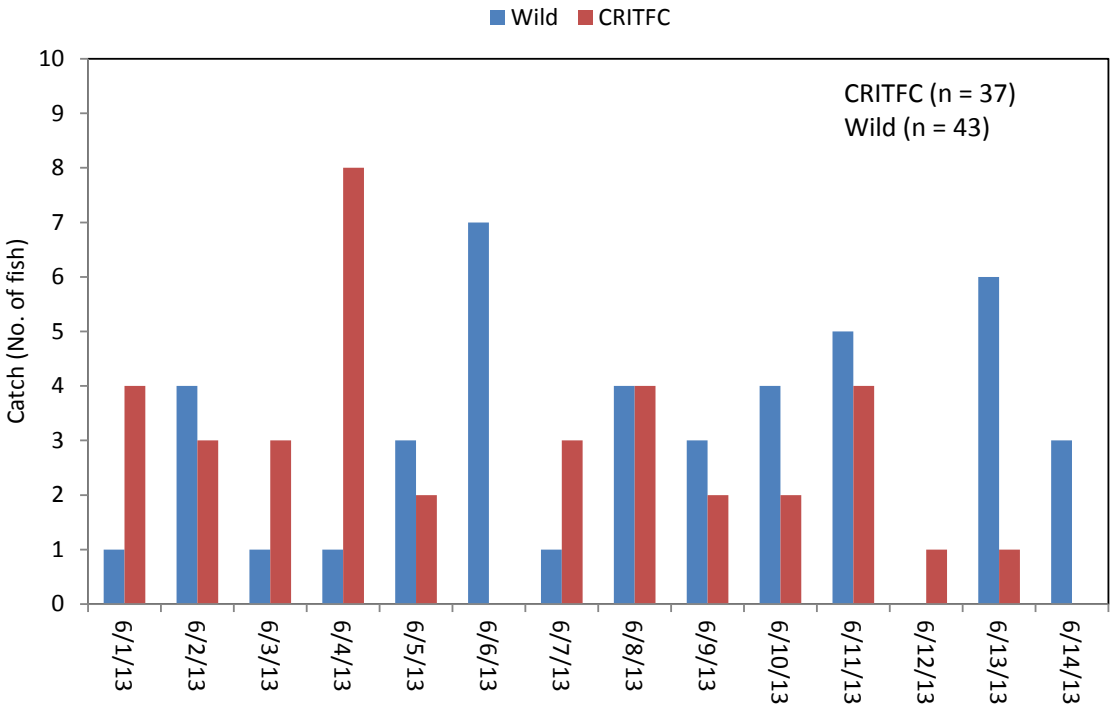

Figure 7 **Daily capture frequency of CRITFC hatchery and wild White Sturgeon in Wanapum Reservoir during the broodstock capture program, June 1 to June 14, 2013.**

3.5 Broodstock Transportation

In 2013, only 3 of the 43 wild fish captured in Wanapum Reservoir were identified as candidate broodstock and transported to MDH (Table 6). One of the three fish captured was a pre-spawning female (i.e., F5) based on egg size and egg color. The two other fish capture were males with mature gonads; however, these fish were not expressing milt at the time of capture. Fish were transported to the MDH in the Grant PUD sturgeon transport trailer following the protocol established in 2011 (Golder 2012). At the hatchery, transport crews assisted MDH hatchery staff in weighing and moving the fish from the transport trailer into a holding pen. At the hatchery, milt was subsequently obtained from only one of the two males transported. Hatchery staff were also unable to successfully spawn the female. Hatchery personnel eventually returned all broodstock to Wanapum Reservoir in late June at the Columbia Siding launch.

Table 6 **Information from candidate broodstock captured in Wanapum Reservoir below Rock Island Dam and transported to Marion Drain Hatchery, 2013.**

Capture Date	PIT-tag Number	Fork Length (cm)	Weight (kg)	Sex/Maturity[1]
3-Jun-13	985121028969911	192.5	75.3	M2
4-Jun-13	985121028967938	239.0	148.0	F5
9-Jun-13	985121029006977	187.5	72.6	M2

[1] See Table 1 for definitions of Sex / Maturity codes.

3.6 Acoustic Telemetry Tagging

In 2013, 10 adult wild White Sturgeon captured during the broodstock collection program were tagged with acoustic telemetry transmitters before being released. Similar to previous adult tagging efforts conducted during previous broodstock capture programs, these fish included candidate broodstock that were transported to MDH, as well as potential future broodstock candidates that, based on maturity and size, may spawn in the next two years.

3.7 2012BY Juvenile White Sturgeon Movement

Acoustic telemetry positional data from the 2012BY juveniles recorded from May 14 to October 30 were analyzed to determine the post-release dispersal of the juvenile White Sturgeon from the release locations in each reservoir. In Wanapum Reservoir, 8 of the 13 acoustic-tagged fish released at Columbia Siding (RM450.6) have since been detected, and of these, 6 moved upstream and were detected at the monitoring station below Rock Island Dam near RM452.4 (Figure 8).

Of the fish released Wanapum Reservoir near Columbia Cliffs Eddy (RM442.0), all of the 11 acoustic-tagged fish released have since been detected. Ten of these fish demonstrated some upstream movement and were detected at upstream monitoring stations (Figure 8). Of the 10 fish that were detected upstream, 6 were detected at the monitoring station below Rock Island Dam and had moved more than 16 km upstream from their release location.

Upstream movement of the 2012BY juveniles after release was supported by the recovery 2012BY juvenile White Sturgeon from a draft tube during maintenance of a generation unit at Rock Island Dam (Lance Keller, Chelan PUD, November 8, 2013, personal communication). Of the 17 2012BY juveniles salvaged from the draft tube, 10 had been released at Columbia Siding and 7 at Columbia Cliffs Eddy.

Changes in the weekly detection ratios suggested that some of the fish moved initially upstream from both release locations to a position near Rock Island Dam (Figure 8). By mid-summer, fish had disbursed and were found upstream and downstream of their original release locations, but movement of significant quantity was only detected for a few fish. The absence of detections at Columbia Cliffs Eddy suggest that the over wintering area may not be heavily used during the summer. By late fall, juveniles were again detected at the overwinter site near Columbia Cliffs Eddy and juvenile fish were generally evenly dispersed throughout the upper third of the reservoir, with the similar densities and residency ratios recorded at monitoring locations between RM452.4 and RM437.1. Due to the large number of tagged fish near RM442.0 overwintering area, especially adult fish with the high power V16 tags, detection efficiency of the lower power V9 tags may be low, resulting in lower detections and underestimate of the density of acoustic-tagged fish at the overwintering area (Figure 8).

Depth data were recorded from six of the eight 2012BY juveniles that were implanted with depth sensor acoustic tags and released in equal numbers at the Columbia Siding and Columbia Cliffs Eddy release locations in Wanapum Reservoir. The mean depth recorded from the six fish was 19.6 m (SD +/- 6.4 m; n = 2350 readings).

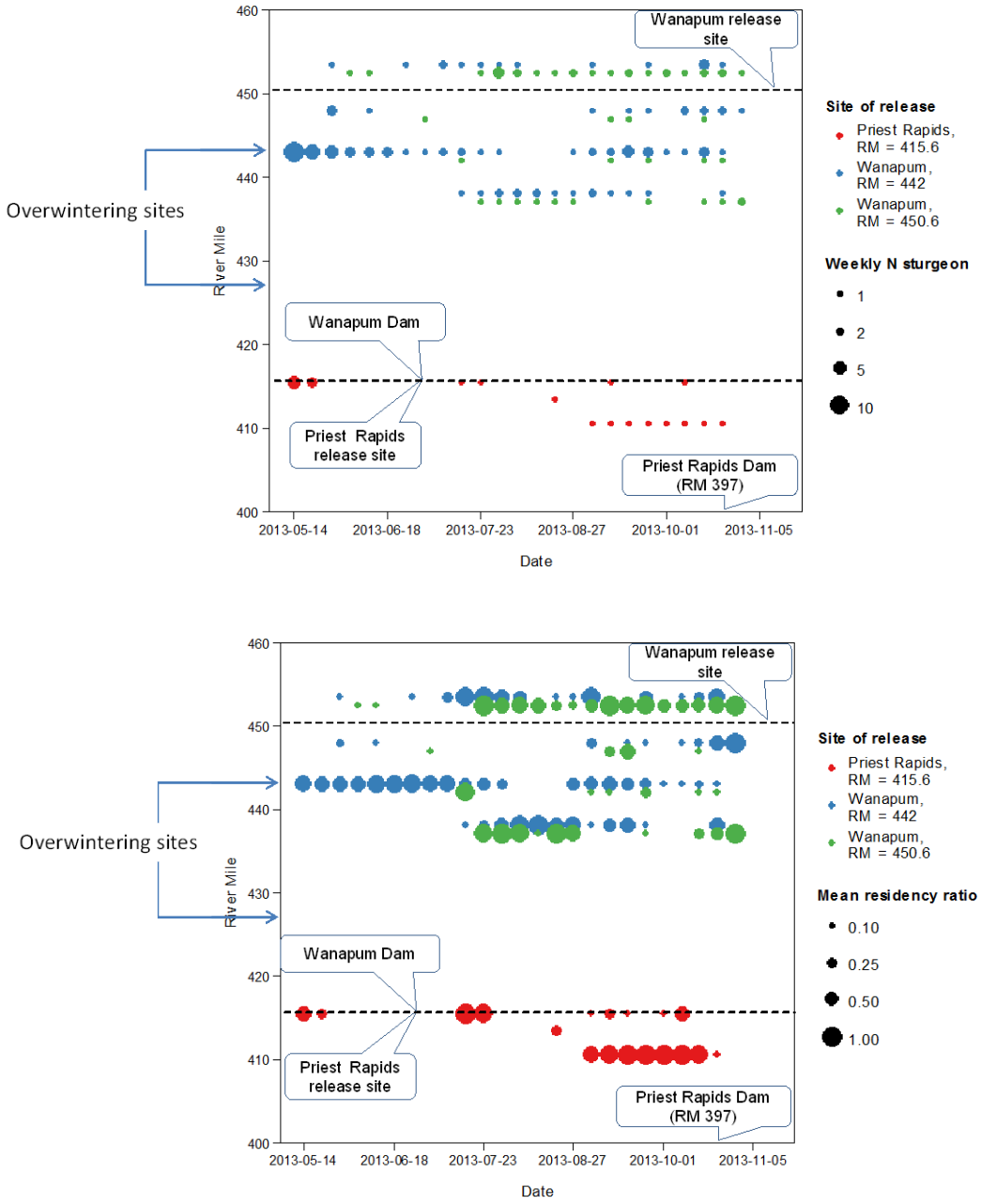

Figure 8 **Weekly density (top graph) and residency ratio (bottom graph) of 2012BY juvenile White Sturgeon throughout the PRPA, averaged across fish from the release site. Dot sizes represent the magnitude of densities and residency ratios. Dot colors corresponds to release locations at RM450.6 (green) RM442.0 (blue), and RM415.6 (red).**

In Priest Rapids Reservoir, fish were released in the Wanapum tailrace (RM415.6); these fish have the option to either remain in the tailrace area or move downstream into the reservoir. The highest densities of juveniles and highest residency ratios were recorded in the Wanapum tailrace near the release site immediately after release on May 14. In total, five of six acoustic-tagged fish released were detected in the Wanapum tailrace. Of these five fish, one moved downstream and was detected downstream near RM410.5. Acoustic-tagged fish were not detected further downstream in the reservoir or downstream of Priest Rapids Dam.

3.8 Avian Mortality of 2012BY

Avian predation on juvenile White Sturgeon was assessed based on PIT tag recovery data from a known bird colony on an island located in the forebay of Rock Island Dam (Lance Keller, Chelan PUD, November 13, 2013, personal communication). In total, 45 PIT tag identification codes detected on the island were from the 2012BY released in Wanapum Reservoir. These 45 PIT tags represent approximately 2% (45 of 2264 fish) of the total number of PIT-tagged fish released in Wanapum Reservoir. Out of the 45 PIT tags detected at the bird colony, 32 (71%) of the tags were in fish released at Columbia Siding and the remaining 13 (29%) in fish released at Columbia Cliffs Eddy.

3.9 Spawning Investigations

3.9.1 Egg and Larval Collection

In total, 455 White Sturgeon eggs were captured during 5,927 mat-hours of sample effort in Wanapum reservoir below Rock Island Dam (Table 7).

Water temperatures reached 14.0 C on June 26 and exceed 16.0 C on July 3. Previous spawning assessments in the Project and elsewhere have identified that this temperature window typically corresponds with initiation of White Sturgeon spawning in the Middle and Upper Columbia (Golder 2011).

3.9.2 Wanapum Reservoir

White Sturgeon spawning activity was monitored below Rock Island Dam from June 14 to July 4 at RI3 and RI4, with paired egg mats deployed once at the start and end on the monitoring period. From July 4 to July 15, up to 12 sites were assessed daily. Overall CPUE was 1.8 eggs/24 mat-hours and eggs were captured at 11of 12 sample sites. All eggs were captured on the left downstream bank below Rock Island Dam from July 4 to July 14. Water temperature in the tailrace of Rock Island Dam during egg mat sampling ranged from 13.1 C to 17.0 C and discharge ranged from 4064 m^3/s to 6511 m^3/s.

3.9.3 Egg Development Staging and Spawning Events

A total of 98 eggs were preserved during the study their developmental stage determined based on stage descriptions provided in Beer (1981). For each egg capture event, the number of eggs preserved, capture location, and the egg developmental stage are provided in Appendix B, Table B1. A single spawning event was assumed to represent one or more females releasing their entire egg mass within a 24-hour period.

Table 7 The total White Sturgeon egg capture effort, number of eggs captured, and catch-per-unit-effort at each capture location in the Wanapum Reservoir, 2013.

Station	Total Effort (mat-hours)	Total Egg Catch	CPUE/24 mat-hours
RI1	521.6	8	0.4
RI2	521.6	61	2.8
RI3[a]	1475.7	98	1.6
RI4	513.8	84	3.9
RI4a	368.4	65	4.2
RI4b	418.4	14	0.8
RI5	524.2	33	1.5
RI6	97.9	19	4.7
RI6a	428.3	43	2.4
RI7	525.0	25	1.1
RI8	100.2	0	0.0
RI-M1	431.6	5	0.3
Total	**5926.6**	**455**	**1.8**

[a] Paired egg collections mats were deployed at RI3 and RI4 on June 14 and retrieved on July 4; egg collection mats were only recovered at RI3.

The number of White Sturgeon spawning events and approximate date of each event was estimated based on the distribution of egg captures from below Rock Island Dam, the development stages of the egg, and water temperature. On this basis, six discrete spawning events were detected below Rock Island Dam in 2013. The back-calculated spawn times for each event are provided in Table 8**.** These spawning events likely occurred on June 29, July 4, July 5, July 7, July 8, and July 10. Water temperatures during all of the estimated spawning events were within the optimal temperature range for White Sturgeon egg development (14 C to 16 C; Wang et al. 1985).

Table 8 Estimated White Sturgeon spawning events below Rock Island Dam in Wanapum Reservoir based on egg collection, developmental staging and back-calculation based on daily average water temperature and discharge as recorded at Rock Island Dam.

Spawning event	Egg collection date/time	Water temp. at egg collection (°C)	Egg stage at capture	Estimated spawning date/time	Water temp. at spawning	Daily Average Discharge at spawning
1	4-Jul-13 12:00	16.3	27	29/Jun/13 3:00	15.0	6141
2	4-Jul-13 12:00	16.3	16	04/Jul/13 1:00	16.3	5421
3	6-Jul-13 12:00	16.4	18	05/Jul/13 18:00	16.4	5659
4	8-Jul-13 12:00	16.3	19	07/Jul/13 15:00	16.2	5527
5	9-Jul-13 12:00	16.4	18	08/Jul/13 18:00	16.3	4936
6	10-Jul-13 12:00	16.7	12	10/Jul/13 12:00	16.7	4343

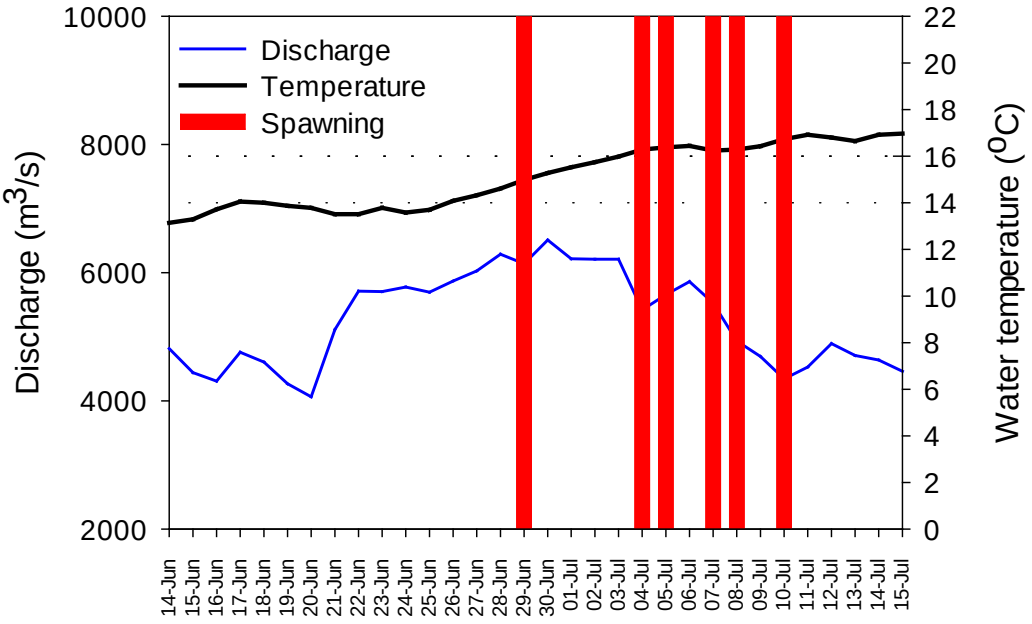

Figure 9 **Mean daily water temperature and discharge of the Columbia River below Rock Island Dam from June 14 to July 15 in 2013. Vertical red bars indicate estimated dates of spawning events. Horizontal lines represent the optimal egg incubation temperature range for White Sturgeon egg development (14-16 C).**

3.9.4 White Sturgeon Egg Incubation

Of the 455 eggs captured, an estimated 357 eggs were deployed in the *in situ* incubator and incubated a sufficient amount of time to allow all eggs to hatch and develop into free-swimming, exogenously feeding larvae. Out of the 357 eggs, approximately 293 eggs were adhered to the egg collection mats and were not physically handled. These eggs were deployed in the incubator on the egg collection mats, with the mats suspended inside the incubator. Up to 29 eggs manually removed from the mats were placed in an incubation pouch made of mat material. This pouch was suspended inside the incubator. As a second trial method to incubate un-adhered eggs, approximately 35 loose eggs were placed in one of the rearing chambers. Biospheres were added to both the incubator's removable capture chamber cup and the bottom of the floating rearing chamber.

Initially, the incubator capture chamber was checked daily for free-embryos, under the assumption the free- embryo would swim down and seek cover within the biospheres. However, free-embryos were not recovered from the capture chamber. Furthermore, the incubator was found to have containment issues that allowed the majority of free-embryos to escape the incubator, likely when waves created by passing boats breached the incubator seal. Due to the fragile nature of free-embryos, daily inspection of the incubator was stopped and the incubator was not inspected again until July 24 to allow sufficient time for all free-embryos to develop in exogenously feeding larvae. These larvae were robust and more suitable for hatchery rearing than free-embryos.

In total, four larvae were recovered from the incubator from eggs that had adhered to the egg collection mats; two additional larvae were observed but escaped during transfer. Hatch success and survival of loose eggs placed in the mat material incubator pouch was poor (i.e., 0 out of 29 eggs) due to fungus infection. However, hatch success of eggs placed in the rearing chamber was much higher and 25 live larvae from 35 eggs were recovered. In total, 29 live larvae were transferred to Wells Hatchery on July 24 for rearing.

4.0 Summary

The following is a brief summary of Year 6 of the WSMP tasks completed in 2013 and the results. A 2014 WSMP study plan, that outlines the proposed study components, methodologies, and schedules, is provided in Appendix C:

Discharge and Water Temperature

- In 2013, peak mean daily discharge from Rock Island Dam was 6,511 m^3/s recorded on June 30.
- Mean daily water temperature in the tailrace of Rock Island Dam ranged between 2.6 C on February 4 and 20.6 C on September 15.

Juvenile White Sturgeon Release (2012BY)

- In Project area, 3,983 PIT-tagged fish were released on May 14 and 15; 30 of these fish were implanted with acoustic telemetry tags. In total, 3,283 fish were provided by MDH and 700 fish provided by CBH. Approximately 2/3 of fish were released in Wanapum Reservoir with the remainder released in Priest Rapids Reservoir.
- Fish released in Wanapum Reservoir were released in equal numbers at Columbia Siding (RM450.6) and Columbia Cliffs Eddy (RM442.0) as part of an experimental release program to examine effects of release location on avian predation rates.

Broodstock Capture and Transport

- Broodstock set line sampling was conducted daily from June 1 to June 14. Sampling efforts in Wanapum Reservoir was 32,710 hook-hours. Angling effort in Wanapum Reservoir was 896 hook-hours.
- In total, 38 hatchery and 43 wild White Sturgeon were captured by combined set line and angling efforts. Only three of the wild White Sturgeon captured were suitable broodstock candidates and transferred to the MDH.
- Acoustic telemetry transmitters were implanted in ten mature White Sturgeon that may spawn within two or three years. Movement of these fish will be monitored to identify seasonal movements related to spawning behavior and to location spawning locations.

Juvenile White Sturgeon Movement

- After release, up to 84% of 2012BY acoustic-tagged juvenile White Sturgeon detected (16 out of 19 fish detected) exhibited some upstream movement. This upstream movement was supported by incidental recovery of PIT-tagged 2012BY fish trapped in a draft tube at Rock Island Dam. Based on the acoustic telemetry data and PIT tag detection, fish released at both Columbia Siding (RM450.6) and Columbia Cliffs Eddy (RM442.0) exhibited upstream movements.

- Upstream dispersal of 2012BY fish was also confirmed by PIT tag detections at a known cormorant colony in the Rock Island Dam forebay. Out of 45 detected PIT tags from 2012BY fish, 32 tags were from fish released at Columbia Siding and 13 were from fish released at Columbia Cliffs Eddy.
- In a comparison of the attributes of the Columbia Cliffs Eddy and Columbia Siding release sites, fish released at Columbia Cliff Eddy were likely subjected to less avian predation due to greater water depth at the release location (i.e., 40 m deep versus 2 m deep) and the greater distance from the cormorant colonies in the Rock Island Dam forebay (i.e., 18.0 km versus 4.5 km).
- Avian predation resulted in the mortality of a minimum of 2% (i.e., 45 of 2264 fish) of the 2012BY released in Wanapum Reservoir.
- Acoustic-tagged 2012BY released in Wanapum and Priest Rapids Reservoir were detected in the upper third of each reservoir; downstream emigration or entrainment through either Wanapum Dam or Priest Rapids Dam was not detected.
- Pending receipt of more data and a more detailed analysis, a preliminary inspection of the depth preferences of juvenile White Sturgeon suggests that depth selection and residency within the first week after release maybe be highly variable for an individual fish (e.g., between 1 and 40 m), but that variably decreases with time as fish eventually select and reside in deeper water habitat for longer periods.

Spawning Assessment

- Natural spawning was monitored downstream of Rock Island Dam from June 14 to July 15.
- In total, 455 White Sturgeon eggs were collected, of which 98 eggs were preserved for developmental staging and 357 eggs were incubated *in situ* within a prototype floating incubator.
- Based on developmental staging results, six discrete spawning events were detected in Wanapum Reservoir downstream of Rock Island Dam in 2013.

Due to loss of free-embryos that escaped from the incubator, an accurate assessment of hatch success was not possible. In total, 29 live larvae were successfully reared *in situ* and transferred to Wells Hatchery. Future refinements to the incubator may allow a more accurate assessment of the feasibility of *in situ* incubation of captured wild-spawned eggs as a method for providing additional wild progeny fish for hatchery rearing.

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Appendix A
Additional data from White Sturgeon broodstock collection in Priest Rapids and Wanapum reservoirs, 2013

Table A1 Summary of capture, life history and tagging information for all White Sturgeon caught by set line during broodstock capture in 2013. Origin was wild (W) or hatchery (H). See Table 1 for definitions of Sex/Maturity codes.

Reservoir	Site	Date	Origin	Fork Length (cm)	Weight (kg)	Sex / Maturity	PIT-tag#
Wanapum	BS451.7R	02-Jun-13	W	226.5	117.5	F2	985120017790841
Wanapum	BS451.8R	02-Jun-13	H	99.0	6.8	98	985120019712460
Wanapum	BS452.3M	07-Jun-13	H	112.5	10.7	98	985120019690355
Wanapum	BS451.8R	07-Jun-13	H	103.8	9.8	98	985120030516191
Wanapum	BS451.8R	07-Jun-13	H	137.7	0.0	98	985121021134961
Wanapum	BS451.7R	08-Jun-13	H	128.5	25.4	98	985120019450101
Wanapum	BS453.1R	08-Jun-13	H	137.0	0.0	98	985121029026870
Wanapum	BS453.1R	08-Jun-13	H	141.0	26.8	98	985120019396423
Wanapum	BS453.1R	08-Jun-13	W	125.5	20.0	98	985120021829482
Wanapum	BS453.1R	08-Jun-13	W	224.5	106.6	F2	985121029030531
Wanapum	BS453.1R	08-Jun-13	W	197.0	70.8	M1	985121028992433
Wanapum	BS451.6R	09-Jun-13	H	75.0	2.5	98	985120019382977
Wanapum	BS453.1R	09-Jun-13	W	175.0	59.4	F1	985121029002947
Wanapum	BS451.0R	10-Jun-13	H	113.0	13.2	98	985120019357846
Wanapum	BS451.6R	10-Jun-13	H	97.5	8.8	98	985120019510330
Wanapum	BS452.4M	02-Jun-13	W	107.5	8.6	98	985121028985573
Wanapum	BS452.7R	02-Jun-13	W	173.5	47.2	M0	985120017240035
Wanapum	BS451.7R	03-Jun-13	H	83.5	3.9	98	985121029030588
Wanapum	BS451.7R	03-Jun-13	H	135.0	30.8	97	985121029034051
Wanapum	BS452.4M	03-Jun-13	H	97.0	6.0	98	985121029514819
Wanapum	BS451.0R	04-Jun-13	H	100.0	8.1	98	985121029006911
Wanapum	BS452.4M	04-Jun-13	H	93.5	14.1	98	985120019425335
Wanapum	BS452.4M	04-Jun-13	H	119.0	12.2	98	985120019348911
Wanapum	BS452.7R	04-Jun-13	W	239.0	0.0	F5	985121028967938
Wanapum	BS451.7R	06-Jun-13	W	162.5	44.9	Fv	985121029035985
Wanapum	BS451.7R	06-Jun-13	W	190.5	54.9	97	985121022020981
Wanapum	BS451.7R	06-Jun-13	W	131.5	25.4	98	985120025325019
Wanapum	BS452.3M	06-Jun-13	W	188.5	75.3	30	985121028962153
Wanapum	BS453.1R	10-Jun-13	W	175.0	52.6	M1	985120021722647
Wanapum	BS452.4M	11-Jun-13	H	86.5	0.0	98	985121029030588
Wanapum	BS452.4M	11-Jun-13	H	118.0	12.4	98	985120019405075
Wanapum	BS453.3R	11-Jun-13	W	147.0	27.7	F0	985120017816961
Wanapum	BS452.4M	12-Jun-13	H	88.0	5.3	98	985120021594794
Wanapum	BS452.4M	13-Jun-13	W	0.0	0.0	97	985120017634361
Wanapum	BS452.4M	13-Jun-13	W	118.0	12.9	M1	985121029002987
Wanapum	BS452.4M	13-Jun-13	W	128.5	13.6	M1	985121028962440
Wanapum	BS453.3R	14-Jun-13	W	152.0	36.7	M1	985121028966979
Wanapum	BS452.4M	14-Jun-13	W	229.5	136.5	F3	985121029009404

Table A2 Summary of capture, life-history and tagging information for all White Sturgeon caught by angling during broodstock capture in 2013. Origin was wild (W) or hatchery (H). See Table 1 for definitions of Sex / Maturity codes.

Reservoir	Site	Date	Origin	Fork Length (cm)	Weight (kg)	Sex / Maturity	PIT-tag#
Wanapum	AB451.2M	10-Jun-13	W	224.0	113.4	F3	985121029038309
Wanapum	AB452.4	10-Jun-13	W	237.0	127.5	F2	985121029009113
Wanapum	AB451.2M	11-Jun-13	W	225.5	94.8	F1	985121021142811
Wanapum	BS452.4M	11-Jun-13	W	204.5	72.1	M1	985121028965858
Wanapum	AB453.0	11-Jun-13	W	203.0	73.0	F1	985121029407623
Wanapum	AB453.0	11-Jun-13	W	156.5	39.0	M1	985121029002864
Wanapum	AB453.0	11-Jun-13	H	128.0	16.6	98	985120019504380
Wanapum	AB451.2M	13-Jun-13	W	207.0	86.6	F4	985121028980358
Wanapum	AB452.4	13-Jun-13	W	247.5	125.2	F1	985120021740441
Wanapum	AB452.4	14-Jun-13	W	227.0	132.0	F2	985121028961026
Wanapum	AB452.5	01-Jun-13	H	106.0	0.0	98	985120019377523
Wanapum	AB452.5	01-Jun-13	H	57.0	0.0	98	985120019379425
Wanapum	AB452.5	01-Jun-13	H	76.0	0.0	98	985120019418963
Wanapum	AB452.5	01-Jun-13	H	109.0	0.0	98	985120019475080
Wanapum	AB452.5	02-Jun-13	H	85.0	0.0	98	985120019398667
Wanapum	AB452.5	02-Jun-13	H	112.0	0.0	98	985120019461018
Wanapum	AB452.5	04-Jun-13	H	70.0	0.0	98	985120019462209
Wanapum	AB452.5	04-Jun-13	H	99.0	0.0	98	985120021814210
Wanapum	AB452.5	04-Jun-13	H	86.0	0.0	98	985121020795906
Wanapum	AB452.5	04-Jun-13	H	87.0	0.0	98	985121020817985
Wanapum	AB452.5	04-Jun-13	H	90.0	0.0	98	985121022010282
Wanapum	AB452.5	05-Jun-13	H	127.0	0.0	98	985120021784951
Wanapum	AB452.5	05-Jun-13	H	122.0	0.0	98	985121022039742
Wanapum	AB452.5	08-Jun-13	H	140.0	0.0	98	985120019443334
Wanapum	AB452.5	09-Jun-13	H	98.0	0.0	98	985120019441791
Wanapum	AB452.5	11-Jun-13	H	140.0	0.0	98	985121020829541
Wanapum	AB452.5	13-Jun-13	H	132.0	0.0	98	985121022011227
Wanapum	AB452.5	13-Jun-13	W	161.0	0.0	98	4110600E10
Wanapum	AB452.5	13-Jun-13	W	230.0	0.0	98	42034B1647
Wanapum	AB450.1L	01-Jun-13	W	199.0	78.5	F1	985121029009124
Wanapum	AB440.8	02-Jun-13	W	219.0	103.4	M1	985121029005755
Wanapum	AB451.2M	03-Jun-13	W	192.5	75.3	M2	985121028969911
Wanapum	BS453.3R	05-Jun-13	W	230.0	114.8	F1	985121029020939
Wanapum	AB452.4	05-Jun-13	W	167.5	44.9	97	985121029012534
Wanapum	AB452.4	05-Jun-13	W	204.0	94.8	F4	985121029033675
Wanapum	AB451.2M	06-Jun-13	W	158.0	39.0	98	985121028977372
Wanapum	AB452	06-Jun-13	W	153.0	36.7	F0	985120021819353
Wanapum	SLRM451.1L	06-Jun-13	W	223.0	0.0	F0	985120017185588
Wanapum	AB451.2M	07-Jun-13	W	171.0	58.5	30	985120025201012
Wanapum	AB450.1L	08-Jun-13	W	174.5	44.5	M1	985121029030547
Wanapum	AB451.2M	09-Jun-13	W	187.5	72.6	M2	985121029006977
Wanapum	AB450.1L	09-Jun-13	W	161.5	42.2	M1	985121029026768
Wanapum	AB451.2M	10-Jun-13	W	236.5	122.0	F3	985121029033369

Appendix B
2013 Spawning Assessment Development Staging

Table B1 **Developmental stages of white sturgeon eggs collected during the 2013 spawn monitoring program in Wanapum pool, downstream of Rock Island Dam.**

Date	Site Number	1st Stager's Initials	2nd Stager's Initials	No. Eggs Pres.[b]	Egg Developmental Category (Stage)[b,c]															
					No. Unfert. or Fung.[b]	Post Fert	1st Cleav	2nd Cleav	3rd Cleav	4th - 6th Cleav	Late Cleav	Early Epi-thelial	Late Epi-thelial	Early Gastru-lation	Early Yolk Plug	Late Yolk Plug	Early Neur-alation	Closure of Neural Tube	Elongation of Pro-nephros	Heart	Pre- hatch
					12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
4-Jul-13[d]	RI-3	PG	JW	3	1					1										1
5-Jul-13	RI-1	PG	JW	2							2									
5-Jul-13	RI-2	PG	JW	2						1	1									
5-Jul-13	RI-3	PG	JW	1								1								
5-Jul-13	RI-4	PG	JW	1									1							
5-Jul-13	RI-5	PG	JW	1										1						
6-Jul-13	RI-1	PG	JW	1												1				
6-Jul-13	RI-2	PG	JW	2	2															
6-Jul-13	RI-3	PG	JW	4	1							1	1			1				
6-Jul-13	RI-4	PG	JW	3									3							
6-Jul-13	RI-5	PG	JW	1									1							
7-Jul-13	RI-3	PG	JW	2												1	1			
7-Jul-13	RI-4	PG	JW	3	1											2				
7-Jul-13	RI-5	PG	JW	3	1											2				
7-Jul-13	RI-6	PG	JW	1													1			
8-Jul-13	RI-M1	PG	JW	2									2							
8-Jul-13	RI-1	PG	JW	1									1							
8-Jul-13	RI-2	PG	JW	2													1		1	
8-Jul-13	RI-3	PG	JW	2										2						
8-Jul-13	RI-5	PG	JW	1															1	
9-Jul-13	RI-M1	PG	JW	2												2				
9-Jul-13	RI-1	PG	JW	1												1				
9-Jul-13	RI-3	PG	JW	1							1									
9-Jul-13	RI-4	PG	JW	3							3									
9-Jul-13	RI-4a	PG	JW	5							4	1								
9-Jul-13	RI-4b	PG	JW	2								2								
9-Jul-13	RI-6	PG	JW	3								3								
9-Jul-13	RI-7	PG	JW	2								2								
10-Jul-13	RI-2	PG	JW	1																1
10-Jul-13	RI-3	PG	JW	1											1					
10-Jul-13	RI-4a	PG	JW	3		1								1	1					
10-Jul-13	RI-4b	PG	JW	2		2														
10-Jul-13	RI-5	PG	JW	2		1									1					
10-Jul-13	RI-6a	PG	JW	5		5														
10-Jul-13	RI-7	PG	JW	2		1						1								
11-Jul-13	RI-1	PG	JW	1																1
11-Jul-13	RI-3	PG	JW	3	1						1			1						
11-Jul-13	RI-4a	PG	JW	3								3								

11-Jul-13	RI-4	PG	JW	3								1	2							
Date	**Site Number**	**1st Stager's Initials**	**2nd Stager's Initials**	**No. Eggs Pres.[b]**	**Egg Developmental Category (Stage)[b,c]**															
					No. Unfert. or Fung.[b]	**Post Fert**	**1st Cleav**	**2nd Cleav**	**3rd Cleav**	**4th - 6th Cleav**	**Late Cleav**	**Early Epi-thelial**	**Late Epi-thelial**	**Early Gastru-lation**	**Early Yolk Plug**	**Late Yolk Plug**	**Early Neur-alation**	**Closure of Neural Tube**	**Elongation of Pro-nephros**	**Heart**	**Pre- hatch**
11-Jul-13	RI-7	PG	JW	2										2						
12-Jul-13	RI-all	PG	JW	5												5				
13-Jul-13	RI-all	PG	JW	2												1	1			
14-Jul-13	RI-all	PG	JW	1													1			
				98	7	10	0	0	0	2	3	12	28	5	2	16	7	1	0	2	3

[a] See Figure 1 for site locations.

[b] Pres. = preserved; Unfert. = unfertilized; Fung. = fungused; Cleav = cleavage.

[c] Developmental stages based on Beer (1981).

[d] Stations RI3 and RI4 were deployed at the end of broodstock on June 14 and retrieved on July 4; RI4 was lost, RI3 was recovered

Appendix C
2014 WSMP Study Plan and Schedule

INTRODUCTION

The following study plan and schedule for Monitoring and Evaluation (M&E) activities in 2014 are consistent with those outline in Grant PUD's White Sturgeon Management Plan (WSMP). The specific objectives and tasks were developed for the three years of the current study (2012 to 2014) to meet the overall study objectives of the WSMP and address the specific M&E tasks described in the Grant PUD RFP No. 11-31(Table 1).

Study components associated with: 1) adult broodstock collection; 2) production, marking, and release of juvenile white sturgeon; 3) assessment of adult and juvenile seasonal movements; 4) database management; and, 5) reporting, will be conducted each study year.

Table 1: 2014 WSMP M&E program task objectives by study year.

Objective	Task No.	Task	Year
			2014
1	1	Broodstock Collection[1]	x
1	2	PRFF Support	x
1	3.1	Juvenile Marking	x
1	3.2	Juvenile Transport	x
2	1	Juvenile Movement Assessment	x
2	2.1	Juvenile Indexing	x
2	2.2	Habitat Assessment (Juvenile)	
2	3	Adult Indexing	
4	1	Evaluation of Existing Spawning Use	
4	3	Conservation Aquaculture Database Requirements	x
4	4	Annual WSMP Report [2]	x

[1] Includes a pilot study to assess diet composition of CRITF hatchery White Sturgeon based on stomach content analysis.

[2] Includes Objective 4 Task 2 to assess reproduction and stocking rates.

The following sections provide details on the timing and methods that will be used in the 2014 study program to achieve the M&E objectives shown in Table 1.

Objective 1 Task 1 - Broodstock Collection

In anticipation of a low 2014 flow year due to below average snowpack, broodstock collection has been tentatively scheduled from May 25 to June 7, prior to the start of white sturgeon spawning activity, which can occur as early as mid-June in a low flow year as water temperature increase and flows decline. Previous studies have found that White Sturgeon spawning in the study area is usually initiated when water temperatures exceed 14 °C and during the descending limb of the spring freshet (Golder 2003, 2011). As part of the Grant PUD broodstock program, resources and information will be shared and coordinated with the Chelan PUD broodstock program. Coordination between both programs and the Marion Drain Hatchery (MDH) is a key objective in 2014 so that potential broodstock captured during both programs arrive at MDH within a similar time frame to increase the possibility of crossbreeding between fish captured by both broodstock collection programs.

The 2014 broodstock capture program methodology will differ from previous Grant PUD broodstock programs in that only angling will be conducted to capture broodstock. In previous broodstock capture programs conducted below Rock Island Dam, even though set line sampling has result in the capture viable broodstock, setline sampling CPUE has been consistently much lower when compared to angling. This difference is due in part to the limited number of locations where setlines can be effective deployed during high flow condition, whereas angling can be conducted under most flow condition and at most locations. Furthermore, unlike passive setline sampling, angling crews can quickly change sampling locations and allocate more effort at locations where high densities of fish are discovered.

Broodstock capture efforts will be focussed in the three to five kilometre section of river/reservoir habitat below Rock Island Dam in Wanapum Reservoir. Wanapum Reservoir has the highest known number of potential candidate broodstock and therefore, represents the sample area with the highest probability of capture success. Acoustic telemetry tracking with a VR100 receiver will be conducted prior to and during the sample program to locate previously captured and tagged adult fish, which based on gonad maturity at capture, could potentially spawn in 2014.

Sampling will be conducted for 14 consecutive days by up to three boat-based crews, each with four anglers. All three boats will angle at locations where 2013 crews had previous success catching adult fish. Angling will be conducted primarily with salmon bait and specially-brined large squid. Two of the boat crews will be dedicated to angling and will transfer fish to the processing crew on the third boat. The third boat will be equipped with a davit system to allow fish to be brought on board for examination. A Golder biologist and a technician will process the fish and assess maturity. If candidate broodstock are captured late in the day and cannot be processed in a timely manner, these fish will be held overnight in a portable fish transfer bag for processing the following morning. Due to a really risk of gear tampering and fish poaching by the public, fish will only be held at safe locations along the right downstream bank, which is less accessible and more secure.

Each fish captured will be processed following methods outlined in the WSMP. PIT-tags will be applied during the broodstock assessment to increase the total number of marked individuals at-large in the White Sturgeon population within the Project area. After the sex and maturity of fish have been determined, selected fish will be implanted with a 10-year Vemco V16-6H 69 kHz coded acoustic tag. Up to 10 acoustic tags will be deployed during the 2013 broodstock collection study. All candidate broodstock transported to the hatchery will have a V16 tagged applied during processing. When possible, milt will be extracted from flowing male White Sturgeon following methodologies provided by MDH and Kootenay Trout Hatchery (KTH) hatchery staff. A sample of eggs from ripe females will be preserved in Ringers Solution and provided to the MDH hatchery staff to allow calculation of a PI index. Broodstock will be transferred to the MDH by one Golder crew and a second person using the Grant PUD transport trailer pulled by either a Golder or Grant PUD truck.

Given that the amount of time broodstock will remain at MDH cannot be accurately determined, return of the fish to their reservoir of origin will be conducted by MDH hatchery staff, with assistance from Golder personnel if required. With the addition of a fish-lifting system and hydraulic boom arm to the MDH fish transport trailer, MDH staff can efficiently and safely transport fish. Wanapum Reservoir broodstock will be released back at the Columbia Siding launch.

White Sturgeon Diet Analysis

Up to 20 CRITFC hatchery White Sturgeon captured during the 2014 broodstock program will be sampled for the purpose of diet composition analysis. The overall objective of this analysis is to determine whether salmon smolts make up a portion of diet of hatchery White Sturgeon, and if so, calculate a coarse estimate of the proportion salmon smolts in relation to other food types (i.e., native vs. invasive clams, resident fish, etc.). Released in 2004, the average fork length of the CRITFC hatchery fish in 2013 now exceeds 100 cm (106 +/- 22 cm; n = 37) based on hatchery captured during the 2013 broodstock collection program. As diet of fish of a similar size class will likely be the same, 20 fish over 90 cm fork length will be selected as a representative sample of the local population of hatchery fish. Ideally , 5 fish will be selected from each of the 90-100 cm, 101-110 cm, 111-120 cm, 121-130 cm, and >131 cm FL size bins.

Hatchery fish will be processed normally with the fish alive to obtain PIT tag information, fork length, weight, and scute mark patterns. Once this information is obtained, the decision whether or not to sacrifice the fish will be determine based on the numbers of fish needed to meet the size allocation targets, number of sampling days left, catch rate, and if wild fish require processing and transport to the hatchery. Processing and transport of wild fish will have priority. Also, no more than 2-3 CRITFC hatchery fish will be processed per day so that samples are obtained over the entire monitoring period.

The fish will be sacrificed by first anesthetizing the fish, head down in a 30 cm diameter cylindrical plastic tube partially filled with a concentration of 250 mg/L buffered MS-222,t the recommended concentration for euthanization of fish with anesthetic. After removal from the tube, the anesthetized fish will receive a blow to the head to sever the spinal cord from the brain and ensure the fish is dead prior to removal of its stomach and gut content. The body cavity of the fish will be opened with a mid-line longitudinal scalpel incision along the ventral surface. Prior to removal of any organs, the viscera will be photographed and

the sex and maturity of the fish recorded. The stomach and hind gut will be opened using a scalpel and scissors and the contents place in a white examination tray, where it will be photographed. The dominant diet components of the gut contents will be identify to class (e.g., bivalves, ray-finned fish, etc). If species are intact and undigested, identification to genus or species may be possible for some samples. The contents of the tray will them be transferred into sealed mason jar and preserved in 70% isopropyl alcohol at a volume ratio of 2:1 alcohol to sample. The samples will be archived for a more detail analysis if required. The fish carcass will be disposed of in a deep portion of the river channel after perforation of the swimbladder to ensure the fish sinks. In the way, biomass is not removed from the environment and the carcass of the dead sturgeon will contribute to the overall reservoir productivity.

Assumptions: Objective 1 Task 1 White Sturgeon Broodstock Collection

Key assumptions of our proposed approach are:

1) Sample effort will concentrate in the Rock Island tail water area in upper Wanapum Reservoir.

2) Fish will be transported using Grant PUD's fish transport trailer equipped with a water pump and hoses, an oxygen regulation system, a portable YSI oxygen and temperature meter, and maintenance equipment.

3) Golder and its subconsultants will operate under Grant PUD's 2014 state and federal fish transport and collection permits

4) Golder will deliver broodstock to Marion Drain Hatchery (MDH) during the broodstock collection program. A sample of milt will be provided with male fish (if expressing milt); a sample of egg preserved in Ringer's Solution with be provide with female fish.

Objective 1 Task 1 Broodstock Collection Schedule

Date	Task
May 24	Travel
May 25 to June 7	Broodstock capture
June 8	Travel

Objective 1 Task 2 – PRFF Support

Senior biologists from Golder, Colville Confederated Tribes (CCT) and the Freshwater Fisheries Society of British Columbia (FFSBC) will assist Grant PUD Resource Managers and members of the PRFF in the development and implementation of cost effective strategies to fulfill Grant PUD FERC license obligations in 2014. They will also participate in an advisory role as requested by Grant PUD to provide input and expertise into the white sturgeon aquaculture component of the WSMP through participation at regional workgroups, the PRFF, and in support of aquaculture activities undertaken at the Yakama Nation, Marion Drain Hatchery facility in Toppenish, WA. The majority of involvement will entail attendance at PRFF meetings (via teleconference), review of documents, and technical and professional communications.

Assumptions: Objective 1 Task 2 Conservation Aquaculture

Key assumptions of our proposed approach are:

1) Senior or intermediate staff will participate in the majority of monthly PRFF meetings primarily via teleconferencing.

2) Physically attendance at PRFF meetings will be limited to once per year for senior staff (Larry Hildebrand, Paul Grutter, Jason McLellan, Matt Howell, and/or Dr. Jim Powell).

Objective 1 Task 3.1 – 2013BY Marking and Tagging

At present, we have planned for the release of up to 4300 (2013BY) juveniles reared at MDH into the Priest Rapids Project area in 2014; however, the final release numbers will be determined by the PRFF (are currently under review). The date when the 2013BY will be tagged will depend on growth rate and average size. Out of the 4300 juveniles planned for release in the Project area, 77% (3311 fish) will be released in Wanapum Reservoir, with the remaining 23% (989 fish) released in Priest Rapids Reservoir. A total of 65 Vemco V9 acoustic tags were purchased for implantation of 2013BY juveniles in 2014. The V9 tags weigh 4.7 g in air and will be implanted in fish that weigh 235 g (or more) to ensure that the tag weight does not contribute more than 2% to total weight of the tagged fish. Up to 43 acoustic tags will be distributed in the Project area in the same proportion used to determine the total fish released in each of the two reservoirs, with 33 acoustic tags (i.e., 77%) deployed in Wanapum Reservoir and the remaining 10 tags (i.e., 23%) deployed in Priest Rapids Reservoir.
The specific release plan is provided below.

Tagging Procedures

A LGL biologist, supported by a Golder technician, will supervise the marking and tagging of hatchery White Sturgeon progeny raised at MDH. LGL's responsibilities will include coordinating the tagging effort with MDH staff, directing the Golder technician in organizing tagging and data recording equipment, assisting with the tagging and marking process, and surgically implanting acoustic tags.
During rearing, the 11 half-sib crosses were kept in nine circular pens and segregated by the maternal parent (e.g., pens 1 and 2 contain progeny from the first female spawned, pens 3 and 4 contain the progeny from the second female, etc.). A mix of progeny from all crosses was kept in a tenth pen. The pens were assigned the specific identification numbers by the MDH hatchery staff based on pen number and the chronological spawn order of the female parent of the progeny (Table 2).

Table 2: MDH rearing pen and genetic stock identification of 2013BY juvenile White Sturgeon

Rearing Pen/Genetic Stock ID
1- WF1xM1, WF1 xM2
2- WF1xM3, WF1 xM4
3- WF2xM1, WF1 xM2
4- WF2xM3, WF1 xM4
5- WF3xM1, WF1 xM2
6- WF3xM3, WF1 xM4

Rearing Pen/Genetic Stock ID
7- CF1xM1, CF1 xM2
8- CF1xM3, CF1 xM4
9 - all crosses
10 – all crosses

All 4300 fish will receive a 12.5 mm 134 kHz ISO PIT tag. Three left lateral scutes below the dorsal fin will also be removed to mark all fish. Due to a manufacturers recall related to depth sensor tags, only V9-2L coded pingers will be implanted in 2014. Specifications of the V9-2L tag are provided in Table 3.

Table 3: Vemco V9-2L coded pinger tag specifications.

Vemco V9 Tag Specifications	V9-2L
Output (dB/m)	145
Weight in air (g)	4.7
Tag length (mm)	29
Tag diameter (mm)	9
Tag life at 170-310s burst interval (days)	821

The LGL biologist will implant hatchery White Sturgeon progeny raised at MDH with PIT-tags, using an appropriate applicator, with the tag inserted on the left side at the base of the 4th dorsal scute, with the tag oriented in line with body axis towards the head of the fish. LGL will assist MDH staff with PIT-tagging, scute-marking, and conduct the surgical implantation of acoustic tags using standard procedures first developed by Kootenay Trout Hatchery. A copy of these procedures will be provided to LGL by Golder for reference.

For each fish, the LGL biologist will record the data fields identified in Table 4. All fish processing data will be recorded in a manner similar to the methods LGL applied in 2011 during processing of the 2010BY release. Data will be recorded electronically into the P3 data processing program to limited errors associated with manual data entry. The LGL biologist will be responsible for implementing appropriate quality control/quality assurance measures during fish processing and data recording.

Table 4: 2013BY release data to be recorded by LGL.

Data Field	Description
Rec #	Sequential record number
Hatchery (Rearing)	Marion Drain Hatchery (MDH)
Proponent	Grant PUD
Tagging Date &Time (mm/dd/yyyy hh:mm)	Date and time when each fish is tagged
PIT-Tag Code	in HEX or DEC,
Species	White Sturgeon
Fork Length (mm)*	Measure for all fish; tip of snout to tail fork (nearest 1 mm)
Weight (g)	Measure for all fish (nearest 1 g)

Acoustic ID code	Vemco V9 5 digit code
Acoustic Serial #	Vemco 7 digit serial number
Acoustic Tag Model	V9-2L
Brood Year Cross	2013
Rearing Pen-Stock Id	Either Wanapum or Priest Rapids Pools
Release Pen #	Release Pen RM442.0-X or RM415.6-X
Scute removal	3 left lateral scute below dorsal, see work instructions provided
PIT-tag placement	left lateral, behind head
Notes	Record deformities and if fish are in poor health

Wanapum Reservoir Release

Equal numbers of fish from each genetic family will be included as part of the total release of 3311 fish into Wanapum Reservoir. This equates to approximately 301 fish from each of the 11 families. Once tagged, the 3311 fish destined for Wanapum Reservoir will be placed in one or two release pens, in approximately equal numbers, and tagging treatment information and release pen designation recorded. In past studies, PIT tags from the 2012BY release group were recorded on a bird colony in Rock Island Reservoir which suggested avian predation was a factor in the survival of those releases. To assess the effect of release location on survival an experimental release was conducted in 2013. Thedata from that experiment suggested that fish released further downstream (i.e., near RM442) are subject to less avian predator than fish release further upstream near Rock Island Dam (i.e., RM450.6). Although insufficient data has been collected to statistically verify the release effect on survival, qualitatively the data warrants that all fish be released downstream near RM442 to maximize survival.

Priest Rapids Reservoir Release

Similar to the Wanapum release, equal numbers of fish from each genetic family will be included as part of the 989 fish released into Priest Rapids Reservoir. This equates to approximately 90 fish from each of the 11 families. Once tagged, the 989 fish destined for Priest Rapids Reservoir will be place in one or two release pens, in approximately equal numbers, and tagging treatment information and release pen designation recorded. As in previous years, all fish will be release in the Wanapum Dam tailrace at the boat launch near RM415.6.

Assumptions: Objective 1 Task 3.1 Juvenile Marking

Key assumptions of the 2013BY Juvenile Marking program are:

1) Golder will provide LGL with written tagging procedures and 2013 tagging objectives, as well as a biological technician for field support.

2) Grant PUD will have a separate contract with the Marion Drain hatchery to provide hatchery staff to assist with fish handling and tagging.

3) Grant PUD will provide all tagging equipment and the P3 PIT tag data collection platform, including a programmed computer with the appropriate data field. The P3 data collection platform was re-programmed in 2013 by LGL, so we assume this effort will not have to be repeated.

Objective 1 Task 3.1 Juvenile Marking Schedule

Date	Activity

Date	Activity
April 18 to 22, 2014	Equipment preparation and mobilization, travel to Marion Drain Hatchery by out of state personnel
April 23 to April 30, 2014	LGL to supervise MDH staff to tag and mark 4300 2013BY destined for Project area. Golder to provide a technician for field support

Objective 1 Task 3.2 – Juvenile Transport and Release

In an exchange of services and equipment, Chelan PUD will assist Grant PUD in the release of the 2013BY juvenile white sturgeon. Chelan PUD will provide their large fish transport truck, capability of transporting up to 3500 fish per load. The transport truck has two separate compartments to that fish can be partition by release site if require. The truck operator can monitor and regulate temperature and oxygen of individual compartments.

Golder will coordinate and supervise the release and assist Marion Drain Hatchery staff in the loading of fish into transport truck. In conjunction, use of the Chelan transport truck, Grant PUD fish transport trailer may also be used to transfer up to 1000 fish, pulled by either a Grant PUD truck or Golder DOT registered truck. Transport of 4300 juvenile White Sturgeon may require two trips over two days.

Written specific work instructions will be developed for filling and draining the trailer, monitoring and regulating water oxygen and temperature while in transit, highway transport safety, and fish release procedures. All aspects of each fish transport and release conducted by Golder will be documented using a fish transport and release data collection form.

All fish destined for Wanapum Reservoir will be released at a private boat launch approximately 600 m upstream of Columbia Cliffs Eddy. Fish released at this location are expected to move quickly downstream and into deep water habitat within the eddy. The site of release will be inspected to ensure that fish disperse away from the release location. Avian predation at this release location is expected to be minimal.
The fish destined for Priest Rapids Reservoir will be released in the Wanapum Dam tailrace at the boat launch. This site has been used for all previous releases and the fish released at this location have access to deep water habitat and protection from avian predation provided by both overhead bird deter wires and USDA Wildlife Services crews that actively disperse birds.
If a substantial temperature differential (>8°C) between the hatchery pens and the Columbia River exists, fish will be gradually acclimated (2°C/day) at the hatchery (by hatchery staff) from 16°C, the hatchery ground water temperature, to approximately 8°C, the likely temperature of the Columbia River in mid-May. During the transfer, crews will monitor water temperature and dissolved oxygen (DO) using a portable DO meter and will adjust oxygen and water levels to maintain DO near 8.0 mg/L. A VR2W or VR100 acoustic receiver will be used to ensure all acoustic tags are active upon release.

Assumptions: Objective 1 Task 3.2 Juvenile Transport

Key assumptions of the 2012BY Juvenile Transport component are:

1) Grant PUD will have a separate contract with the Yakima Tribe to provide Marion Drain Hatchery staff to assist with loading of juveniles White Sturgeon

2) Grant PUD will contact Chelan PUD regarding provision of the hatchery transport truck

3) DO meter and complete fish transport tank and trailer (with oxygen tanks and DO meter) will be supplied by Grant PUD.

4) Fish release will be conducted in conjunction with the May VR2W download (Objective 2 Task 1) and prior to the start of broodstock

Objective 1 Task 3.2 Juvenile Transport Schedule

Date	Task
May 20	Travel
May 21	2013BY Release Wanapum Reservoir
May 22	2013BY Release Priest Rapid Reservoir

Objective 2 Task 1 - Juvenile White Sturgeon Movement Assessment

Telemetry data from the VR2W acoustic tag receiver array will be used to monitor juvenile White Sturgeon movement within the Project area to assess post-release juvenile dispersal, seasonal movements, and net out-migration from the Project area. Currently, 12 Vemco VR2W sonic receivers are deployed in the Project area (six in Wanapum Reservoir, five in Priest Rapids Reservoir, and one in the tailwater area of Priest Rapids Dam). When possible, inspection and downloading the VR2W stations will be conducted in conjunction with other field studies (e.g., broodstock assessment or spawn monitoring study components) to reduce study costs. In 2014, the VR2W array will be inspected and serviced in mid-May, concurrent with the 2013BY release work. To maintain the integrity of the array, field crews will have one or more spare VR2W's and the equipment necessary during service visits, to allow immediately deployment of a spare VR2W in the event one of the current VR2W stations is lost. Active tracking with a VR100 will be conducted at each VR2W station to confirm the presence or absence of same day detections at the station. Range testing using a specially programmed test tag will be conducted opportunistically to determine the reception range of each station.

Assumptions: Objective 2 Task 1 Juvenile White Sturgeon Movement Assessment

The key assumption of the white sturgeon movement assessment study component is that Grant PUD would provide the VR2Ws and mooring gear for the stationary array, and a VR100 receiver and hydrophones to conduct the active tracking. The session 1 download in May will be conducted in conjunction with the 2013BY release. The session 2 download will be conducted at the end of the July. The third session will be conducted in October.

Objective 2 Task 1 2013 Juvenile Movement Assessment Schedule

Date	Task
May 17-19	Session 1 VR2W download and station inspection
July 20 and 21	Session 2 VR2W download and station inspection
October 22 and 23	Session 3 VR2W download and station inspection

Objective 2 Task 2-1 – Juvenile White Sturgeon Indexing

Juvenile indexing in the PRPA will be conducted over a three week period from 4 to 22 August, 2014. The main indexing effort will consist of a setline survey. Angling will also be employed opportunistically at locations where set lines cannot be effectively deployed, such as small eddies in riverine areas.

Setlines will be 600ft long and made from ¼" diameter tarred three-strand nylon. Lines will be marked at regular intervals (approximately every 15ft; 40 marks total per line) to facilitate gangion attachment. Gangions will be equipped with small circle hooks (sizes 8/0 and 10/0) and will be baited with pickled squid. Setline sampling will be conducted using two boats each staffed with a three-person crew. Each boat will deploy up to 10 overnight setline sets per day, and total effort expenditure during the survey will be 216 overnight sets. Sampling will be limited to depths greater than approximately 20 feet so as to avoid milfoil beds as well as provide leeway to account for diel fluctuations in reservoir levels.

The setline survey will employ a stratified spatially balanced GRTS sampling approach. Sample sites will be generated using ArcMap10 and the SPSURVEY package in the R statistical program. The PRSA will be stratified by reservoir and the reservoirs will be further divided into three sub-strata of approximately equal lengths by river mile. Broadly speaking, this scheme of stratification delineates riverine, transition zone, and reservoir habitats in each pool.

Sampling effort per unit area will be greatest in the riverine reaches of each pool and be least in the reservoir reaches. This is because telemetry investigations conducted in the PRSA by Golder to date indicate that hatchery juveniles tend to prefer riverine and transition-zone habitats and we wish to maximize catch as far as is possible using a random sampling approach. Preference for riverine and transition zone habitats has also been observed in hatchery origin juveniles released into the Transboundary Reach of the upper Columbia River.

Stratum (habitat type)	RM	Area (ha)	Sampling Week	Sampling Effort (overnight sets)	Sets/100ha
Wanapum Lower Reach ("reservoir")	416-427	2,661	1	53	2.0
Wanapum Middle Reach ("transitional")	428-439	1,179	1 and 2	53	4.5
Wanapum Upper Reach ("riverine")	440-453	773	2	53	6.9
Priest Lower Reach ("reservoir")	397-403	1,369	3	27	2.0
Priest Middle Reach ("transitional")	404-409	356	3	16	4.5
Priest Upper Reach ("riverine")	410-415	203	3	14	6.9

Angling for hatchery juvenile sturgeon will be conducted during the second and third weeks of the survey when field crews will be working in proximity to tailrace areas where opportunities for sampling with setlines are limited. During these weeks, crews will conduct up to two hours of angling each day subsequent to completing setline sampling activities.

Objective 2 Task 2-1 – Juvenile White Sturgeon Indexing Schedule

Date	Task
August 4 to 22	Juvenile Index sampling in the PRPA

Assumptions: Juvenile White Sturgeon Indexing Schedule

1) Grant PUD will purchase bait and circle hooks for the setline survey.

2) Grant PUD will purchase angling gear.

Objective 4 Task 3 – Conservation Aquaculture Database Requirements

Golder will modify and update its existing field and office white sturgeon databases to meet specific 2014 data collection obligations for adult white sturgeon capture, juvenile release tracking, and acoustic telemetry tracking. All indexing databases allow field entry of the following variables:

3) Annual stocking data (fish lengths, weights, deformities, scute marks, PIT tag number);

4) Annual index monitoring results (lengths, weights, deformities, capture location, scute marks, PIT or sonic tag number); and,

5) Annual results obtained from tracking actively tagged juveniles (location records).

In addition to being a repository for the data collected under this Project, the database system will be used to provide data for specific reports to assist with provision of quarterly and annual data summaries, fish movement summaries, and allow upload of release and capture data to external databases (i.e., PTAGIS)

Assumptions: Objective 4 Task 3 Conservation Aquaculture Database Requirements

Key assumptions of our proposed approach are:

1) LGL staff will collect and provide data to Golder from juveniles sampled and marked at the Marion Drain Hatchery and released into the Project area.

2) Golder and its sub consultants will assist Grant PUD in uploading the PIT tag data to PTAGIS.

Objective 4 Task 3 Conservation Aquaculture Database Requirements Schedule

Date	Work Period
2014	Ongoing

Objective 4 Task 4 – 2014 Annual WSMP Report

To facilitate effective management of data from the monitoring programs and support the requirements of the PRFF:

1) Describe the methods used to address the statement of work;

2) present the data and key results of 2014 field investigations;

3) highlight key findings of the investigations; and,

4) provide the proposed study program for the following year.

The general report format will follow that developed for the 2012 report and to comply with Federal and State sampling permit requirements.

Assumptions: Objective 4 Task 4 2014 Annual WSMP Report

Key assumptions of our proposed approach are:

1) Deliverable date for the 2014 annual report will be January 30, 2015.

Objective 4 Task 4 2014 Annual WSMP Report Schedule

Date	Work Period
January 30, 2015	2014 draft report

Appendix D
WDOE Letter Approving the 2013 White Sturgeon Management Plan Annual Report

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
4601 N Monroe Street • Spokane, Washington 99205-1295 • (509)329-3400

February 20, 2014

Mr. Tom Dresser
Manager
Fish, Wildlife and Water Quality
Grant County PUD
PO Box 878
Ephrata, WA 98823

RE: Request for Ecology Review and Approval – *2013White Sturgeon Management Plan Annual Data Report and 2014 WSMP Annual Work Plan.*
Priest Rapids Hydroelectric Project No. 2114

Dear Mr. Dresser:

The Department of Ecology (Ecology) has reviewed the *2013White Sturgeon Management Plan Annual Data Report and 2014 WSMP Annual Work Plan* sent via email to Ecology on January 15, 2014.

Ecology APPROVES the *2013White Sturgeon Management Plan Annual Data Report and 2014 WSMP Annual Work Plan* as submitted. The report fulfills the requirements in:

1. Sections 6.2(5)(c) and 6.2(5)(d) for the White Sturgeon Management Plan
2. White Surgeon implementation measure "**1) Reporting**" requirements in Appendix C "Biological Objectives and Implementation Measures" of the 401 Certification.

Please contact me at (509) 329-3567 or pmcg461@ecy.wa.gov if you have any questions.

Sincerely,

Patrick McGuire
Eastern Region FERC License Coordinator
Water Quality Program

PDM:jb

cc: Ross Hendrick, Grant County PUD
Mike Clement, Grant County PUD

Appendix E
Summary of PRFF Comments on Draft 2013 WSMP Annual Report and Grant PUD Response

Summary of PRFF Comments on 2013 WSMP Annual Report and 2014 WSMP Annual Work Plan and Grant PUD Responses

Submitting Entity	Date Received	Paragraph	Agency Comment	Grant PUD Response
WDOE	20-Feb-2014	1	The Department of Ecology (Ecology) has reviewed the *2013 White Sturgeon Management Plan Annual Data Report and 2014 WSMP Annual Work Plan* sent via email to Ecology on January 15, 2014.	Comment noted.
WDOE	20-Feb-2014	2	Ecology APPROVES the *2013 White Sturgeon Management Plan Annual Data Report and 2014 WSMP Annual Work Plan* as submitted. The report fulfills the requirements in: 1. Section 6.2(5)(c) and 6.2(5)(d) for the White Sturgeon Management Plan. 2. White Sturgeon implementation measure "1) Reporting" requirements in Appendix C "Biological Objectives and Implementation Measures: of the 401 Certification.	Comment noted.
WDOE	20-Feb-2014	3	Please contact me at (509) 329-3567 or pmcg461@ecy.wa.gove if you have any questions.	Comment noted