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Rev. 0

River Corridor
Closure Contract

Field Summary Report for Remedial Investigation of Hanford Site Releases to the Columbia River, Hanford Site, Washington

Collection of Fish Tissue Samples

September 2010

For Public Release

Washington Closure Hanford

Prepared for the U.S. Department of Energy, Richland Operations Office
Office of Assistant Manager for River Corridor

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ACRONYMS

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
GPS	global positioning system
HEIS	Hanford Environmental Information System
NOAA	National Oceanographic and Atmospheric Administration
PCB	polychlorinated biphenyl
PIT	Passive Integrated Transponder
RI	remedial investigation
RM	river mile
SAI	sampling and analysis instruction
SAP	sampling and analysis plan
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCH	Washington Closure Hanford
WDFW	Washington Department of Fish and Wildlife

1.0 INTRODUCTION

Between 1943 and 1989, releases of contamination to the Columbia River occurred during the Hanford Site weapons production mission. In addition, waste disposal practices at the Hanford Site also resulted in release of contaminants to the upland soil. Some of the contaminants have moved from the soil into groundwater beneath the Hanford Site. The contaminants then moved via the groundwater into the Columbia River where the groundwater percolates up through the river bottom and mixes with river water and riverine sediments.

Cleanup of contaminated upland soil and groundwater at the Hanford Site is currently under way. Through this cleanup, the U.S. Department of Energy (DOE) is attempting to prevent additional contaminants from reaching the Columbia River. As a part of the remedial investigation (RI), it is important to understand what contaminants are present, the concentrations of these contaminants, and current contaminant locations because the contamination may have undesirable effects on humans, animals, and plants that use or live in the Columbia River.

1.1 PURPOSE

This report has been prepared in support of the RI of Hanford Site releases to the Columbia River and describes the 2009 to 2010 fish collection efforts. This report documents field activity associated with the collection, preparation, and shipment of fish samples. The purpose of the report is to describe the sampling locations, identify samples collected, and describe any modifications and additions made to the sampling and analysis plan (SAP), which is Appendix A to DOE/RL-2008-11, *Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River* (hereafter referred to as the "Work Plan"). Resulting data from the RI sampling efforts will be used by DOE to evaluate the nature and extent of past releases of Hanford Site contaminants to the Columbia River. Results from the sampling efforts will be combined with previously collected environmental data and used to complete a baseline human health and ecological risk assessment prepared in accordance with *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) guidance. The risk assessment will address current environmental conditions in the Columbia River. The information gained from sampling efforts described in this field summary report and the risk assessment to follow will help regulators make final decisions for cleaning up Hanford Site contamination that exists in and along the Columbia River.

1.2 SCOPE

The fish tissue sample collection program for the RI was developed by the DOE, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology), collectively referred to as the "Tri-Parties." The scope of the sampling program was based on the outcome of the data quality objectives process (WCH-265, *DQO Summary Report for the Remedial Investigation of Hanford Site Releases to the Columbia River*) to address the data needs. The rationale for the sampling approach and strategy are detailed in the Work Plan, and the resulting RI sampling activities are detailed in the SAP. Requirements for sampling methods, sample handling and custody, and analytical methods are detailed in WCH-286, *Sampling and Analysis Instructions for the Remedial Investigation of Hanford Site*

Releases to the Columbia River (SAI). The Work Plan, SAP, and SAI directed the sample collection methods and locations described in this field summary report.

Fish were targeted for sampling to characterize the nature and extent of Hanford Site-related contaminants that have come to be located within the Columbia River and assess the current risk to ecological and human health receptors that is posed by those Hanford Site-related contaminants. Contaminant concentrations in biotic media are to be compared to endpoint criteria specified by Washington State regulations, EPA technical guidance, DOE technical guidance, or as supported by the scientific literature.

As shown in Figure 1-1, the primary sample collection area on the Columbia River extended from just above Wanapum Dam (river mile [RM] 420) to McNary Dam (RM 292). The lateral limits extended from shore to shore. As shown in Figure 1-1, the fish collection project area was divided into the following sub-areas based on proximity to the Hanford Site:

- Upriver Sub-Area (RM 420 to RM 388)
- 100 Area Sub-Area (RM 388 to RM 365)
- 300 Area Sub-Area (RM 365 to RM 339)
- Lake Wallula Sub-Area (RM 339 to RM 292).

The goals of the tissue sampling were to support performance of a CERCLA-compliant remedial investigation that:

- Characterizes the nature and extent of Hanford Site-related contaminants that have come to be located within the Columbia River

- Assesses the current risk to ecological and human receptors posed by Hanford Site-related contaminants.

To accomplish these goals, fish tissue sampling efforts were carried out within the Hanford Reach of the Columbia River and downstream to McNary Dam, due to historical releases of contaminants from the Hanford Site into the river and the potential accumulation of contaminants in resident fish. The objective of this fish sampling project is to obtain tissue samples for analysis of contaminants that have been identified as originating from the Hanford Site. The primary use of the fish sampling data is to determine the potential health risk to nearby residents who consume these fish as a part of their diet. However, fish tissue data will also be used to support the evaluation of fish in the ecological risk assessment.

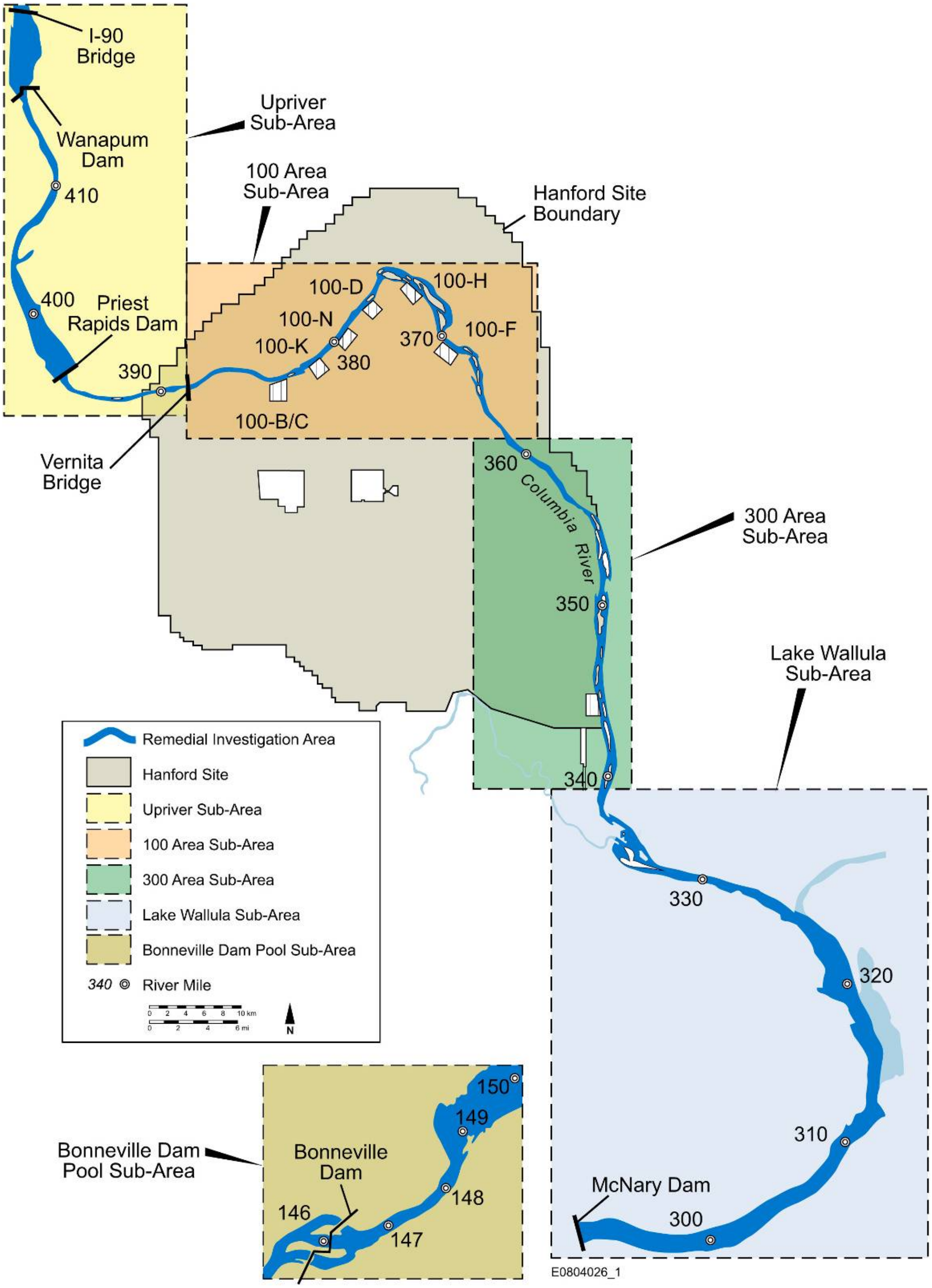
In addition to the main objective of obtaining samples in support of conducting the human health risk assessment, the following goals were also identified for the project:

- Characterize concentrations of analytes in each target fish species

- Characterize the distribution of Hanford Site-related contaminants in different parts of fish

- Confirm detections of target analytes in fish samples collected and analyzed during previous investigations

Figure 1-1. Columbia River Remedial Investigation Project Area.



- Establish background concentrations of contaminants in fish collected from areas of the river not impacted by activities associated with the Hanford Site
- Estimate which areas of the river contain fish with the highest concentrations of Hanford Site-related contaminants
- Evaluate and summarize the variability of concentrations of Hanford Site-related contaminants within each fish species and between different species
- Provide data for current and future evaluations of ecological risk.

2.0 METHODS

2.1 COLLECTION PERIODS

Table 4-14 of the SAP (DOE/RL-2008-11, Appendix A) proposed collection periods of fish for this study. However, collection periods were altered for bass, walleye, and whitefish with agreement from the Tri-Parties (Table 2-1). Whitefish collection was changed to mid-winter due to project and contracting logistics. Without this change, the whitefish collection that occurred in early 2009 would have been delayed until fall 2009. Bass and walleye collection were altered to allow for fishing work to occur during the more productive harvest times.

Table 2-1. Proposed Sample Periods for Fish Collection Activities.

Target Fish Species	Proposed Sampling Period	Actual Sampling Period
Carp	Fall	Fall
Bass	Fall	Summer
Sturgeon	Summer	Summer
Suckers	Fall	Fall
Walleye	Fall	Summer
Whitefish	Fall	Winter

Whitefish were collected in January and February 2009. All other species were collected between June and December 2009, with the exception of walleye from the upriver and Lake Wallula sub-areas that were collected in June 2010. Sampling periods were established to occur during recreational fishing seasons for each target species but after spawning season to minimize the impact on spawning fish. Another consideration was to set sampling times during periods of elevated water temperatures and reduced river flows; both conditions serving to facilitate the capture of fish and maximize the potential contaminant exposure.

2.2 ADDITIONAL APPROVED STURGEON SAMPLING AND DATA COLLECTION

A workshop on the sturgeon sampling portion of the project was held with the Tri-Parties, stakeholders, and sturgeon subject matter experts on February 26, 2009, to discuss and finalize the components of the sturgeon sampling portion of this project. As a result of this meeting, the following additional sampling and data collection activities beyond those included in DOE/RL-2008-11 were approved by the Tri-Parties.

1. The study sample size was increased from 20 to 30 sturgeon. Of this number, 25 fish were distributed among the 100 Area, 300 Area, and Lake Wallula sub-areas. Fish were collected from as many different locations as possible within these three sub-areas. The remaining five fish were obtained from the upriver sub-area.

2. Fork length and total length measurements were obtained and recorded for all sturgeon that were captured during field work. Both over- and under-sized fish were measured before release.

3. All captured sturgeon were scanned for Passive Integrated Transponder (PIT) tags. All PIT tag information was recorded and submitted to the Washington Department of Fish and Wildlife (WDFW) after the collection effort was completed.

4. All sturgeon captured during fishing operations were inspected for physical abnormalities with particular attention paid to the lateral scute pattern. Any anomalies were recorded and submitted to WDFW after the collection effort was completed.

5. Pectoral fins samples from the 30 sturgeon were collected and submitted to WDFW for age dating.

6. Gill, gonad, kidney, and liver tissue samples were collected for histological examination onboard the fishing vessel immediately after capture of sturgeon. The euthanasia method was changed from immediately stunning and pithing the fish to severing the spinal cord. This sample collection is discussed in Section 2.5.2.

7. During dissection and sample processing, the color of fat (either yellow or white) found in each sturgeon was recorded.

8. Measurement and determination of the percentage of sediment within stomachs of the sturgeon caught for this study was performed. A method for measuring the various components of the stomachs was developed and reviewed by the sturgeon subject matter experts. The method was then used to measure the components of the stomach contents and determine the percentage of sediment. Discussion of this sample collection is presented in Section 2.6.2.4.

9. Liver and kidney samples from each fish were prepared and analyzed as separate samples rather than combined into one sample, as originally prescribed in DOE/RL- 2008-11.

10. Additional analysis for methyl mercury on a subset of sturgeon samples (tissues from six individual fish) was performed.

11. Additional analysis for hexavalent chromium on all tissues (as available based on mass) was performed.

12. Analysis of viscera samples from a subset of the sturgeon samples (tissues from six individual fish) was performed.

13. The Confederated Tribes of the Umatilla Indian Reservation requested that sturgeon otoliths (earbones) be collected for possible age dating.

14. A commercially caught sturgeon was purchased and used for “practice” on the various sampling and data collection requirements prior to work on any fish caught specifically for this study.

The following additional sample requests were approved after the sturgeon workshop.

1. Researchers at the U.S. Geological Survey (USGS) Portland office were conducting a nonrelated sturgeon study developing methods and quantification of emerging contaminants, such as endocrine disruptors, for Columbia River white sturgeon. The USGS requested brain, gonad, kidney, and liver tissue samples from all specimens. These samples are discussed in Section 2.6.2.3.

2. After sturgeon collection had begun, a request for collection of blood samples from the yet uncollected sturgeon was made by DOE. Blood samples from the last 14 sturgeon specimens were collected. The procedure for blood collection and storage is discussed in Section 2.5.2.

2.3 FISH SIZE AND SAMPLE NUMBER

The species of fish that were collected for the study included white sturgeon (*Acipenser transmontanus*), common carp (*Cyprinus carpio*), largescale sucker (*Catostomus macrocheilus*), mountain whitefish (*Prosopium williamsoni*), smallmouth bass (*Micropterus dolomieui*), and walleye (*Sander vitreus, n*ee *Stizostedion vitreum*). For all fish other than sturgeon, a total of 100 fish/species were to be collected for the study (DOE/RL-2008-11). The total number of sturgeon was initially set at 20 individuals but was increased to 30 as described in Section 2.2. Of the 30 fish, 25 were to be obtained from various locations with the three study sub-areas (100 Area, 300 Area, and Lake Wallula). The remaining five sturgeon were to be obtained in the upriver control sub-area. Table 2-2 shows the legal sizes of fish and final target sample counts.

Table 2-2. Target Fish Sizes and Sample Numbers. (2 Pages)

	Whitefish	Suckers	Carp	Bass	Walleye	Sturgeon
Target size	>10 in.	>12 in.	>18 in.	<14 in.	>11 in. [a]	43 to 54 in. [b]
Number composite sample/sub-area	5	5	5	5	5	NA
Anticipated number individuals/composite	5	5	5	5	5	1
Number sturgeon samples from 100 Area, 300 Area, and Lake Wallula sub-areas.	NA	NA	NA	NA	NA	25
Number sturgeon from upriver (control) sub-area	NA	NA	NA	NA	NA	5
Total target number individuals	100	100	100	100	100	30 [c]

Table 2-2. Target Fish Sizes and Sample Numbers. (2 Pages)

	Whitefish	Suckers	Carp	Bass	Walleye	Sturgeon
Total number composite samples	20	20	20	20	20	NA

[a] Minimum size for walleye was originally set at 18 in. but later reduced to enhance collection rate. See Section 3.7.1 for discussion.
[b] Sturgeon lengths based on fork length, not total length as with the other species.
[c] The sampling and analysis plan (DOE/RL-2008-11, Appendix A) had specified that a total of 20 sturgeon were to be collected. The Tri-Parties increased this number to 30 (Section 2.2).

NA = not applicable

DOE/RL-2008-11, 2008, *Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2.4 SAMPLE COLLECTION METHODS

All collection activities were conducted under WDFW Scientific Collection Permits 08-272 (Phase 1) and 09-280 (Phase 2) and National Oceanographic and Atmospheric Administration (NOAA) Fisheries Section 10 Authorization for Incidental Take of Endangered Species Permit 14283. NOAA Fisheries is responsible for implementation of the *Endangered Species Act of 1973* (ESA) for anadromous salmon and steelhead while the USFWS is responsible for authorizing incidental take of ESA listed bull trout (*Salvelinus confluentus*). The USFWS provided ESA Section 7 informal consultation regarding the potential incidental take of bull trout during this project and issued a letter authorizing the work. Consistent with permit requirements, all electrofishing was conducted in accordance with NOAA Fisheries Electrofishing Guidelines. Specimens were collected following the American Veterinary Medical Associate guidelines on euthanasia (AVMA 2007). A total of five different boats were used throughout the project to collect whitefish, bass, walleye, sturgeon, suckers, and carp.

The coordinates of each capture location were determined using a hand-held global positioning system (GPS) and documented in Washington State Plane coordinates. Fish collection was conducted from boats equipped with first aid kits; spill kits; and all U.S. Coast Guard-required lighting, floatation, and emergency equipment. Only legal-sized fish of target species were collected. Nontarget species that were incidentally captured were immediately released in the least invasive means possible at the sample location from which they were taken.

Methods used to capture specimens included the following:

- Electrofishing (whitefish, suckers, carp)
- Hook and line (bass, walleye, sturgeon, suckers, carp)
- Long-line (sturgeon).

2.4.1 Electrofishing

Electrofishing is an efficient and relatively safe method of fish collection when properly conducted by trained personnel. The electrofisher unit generates an electrical current in the water that runs from the anode to the cathode, creating a high-voltage potential. The electrode and cathodes are located on either of two current-generating arrays extended from maneuverable lifts on the front of the vessel (Figure 2-1). When a fish encounters a large potential gradient such as that resulting from a pulsed DC current, it experiences galvanotaxis or an uncontrolled muscular convulsion that results in the fish swimming involuntarily toward the anode. The fish is then momentarily stunned or otherwise rendered incapacitated (electronarcosis) and can be easily netted and sampled.

Figure 2-1. Electrofishing for Whitefish.

Within the range of the electrical field, electrofishing is a nonselective sampling method in that both target and nontarget species are affected. However, nontarget species can be identified and tallied without being netted and immediately released from the electrical field. Electrofishing is an effective method of capture to maximum depths of 10 to 15 ft, depending upon the water clarity and velocity.

Boats were equipped with all necessary equipment, including certified electrician safety gloves, a long-handled net, specimen bags and 5-gal bucket, fish-handling gloves, decontamination solutions, length board, and ice chest. A GPS unit was used to mark locations of captured fish and starting and ending points of sample transects.

The target species for the electrofishing collection method were whitefish, carp, and suckers. The other target species (walleye, bass, and sturgeon) reside in depths beyond that which can be effectively sampled via electrofishing and were therefore collected using other means (see Sections 2.4.2 and 2.4.3). All electrofishing was conducted from a jet propulsion boat equipped with a generator and the electrofishing unit. Electrofishing techniques used were consistent with state and federal scientific collection permit conditions and the Hanford Site Salmonid Management Plan (DOE/RL-2000-27, *Threatened and Endangered Species Management Plan – Salmon and Steelhead*).

2.4.2 Hook and Line

Hook and line were used to collect all walleye and bass (Figure 2-2) and as a supplemental technique to collect sturgeon, carp, and suckers. This method is most often used by recreational anglers to catch fish and is an effective tool used by fisheries biologists to sample and assess fish populations. Hook and line is advantageous as it can be used to access deeper areas of the river where electrofishing is ineffective. Depending upon the target species, artificial lures or baited hooks are the selective means of capture. Although less effective than electrofishing, hook and line was used incidentally to collect carp and suckers during walleye collection activities.

Figure 2-2. Bass Collected Using Hook and Line.

Artificial lures were used primarily to collect walleye and bass. Sportfishing gear specifically designed for these target species was used to minimize the likelihood of take of nontarget species, especially ESA-listed salmonids. Although infrequent, both juvenile and adult salmonids (e.g., ESA-listed salmon and steelhead) can be incidentally hooked when fishing for bass and walleye. Artificial lures generally hook fish superficially allowing nontarget species to be released with minimal harm, and therefore artificial lures were used to the maximum extent to minimize the potential impact on nontarget species. Bait was used only when artificial lures alone were found to be ineffective.

Hook-and-line techniques were also used to collect sturgeon. Unlike walleye and bass, sturgeon are generally not captured using artificial lures. Therefore baited, barbless circle hooks in sizes of 9/0 or larger were used to capture sturgeon. Sturgeon are the largest species of fish inhabiting the Columbia Basin, and large hook sizes and baits were used to target on sturgeon of legal size (43-in. to 54-in. fork length). The larger sized bait, such as chad and pickled squid, and hook sizes used to capture white sturgeon virtually eliminated the possibility of capturing most other nontarget species, including ESA-listed salmonids. Barbless hooks were used so that over- or under-sized sturgeon could be easily released with minimal damage to the fish. In all cases, fish that were not retained as specimens were released using the least invasive means.

2.4.3 Long-Lines (Sturgeon Only)

Long-line techniques are used to capture large numbers of sturgeons in commercial fisheries and were used for this project in accordance with the SAP (DOE/RL-2008-11, Appendix A) (Figure 2-3). Long-lines are an efficient collection method, with minimal impacts to other fish species, and the ability to free nontarget or under/oversized fish without mortalities. Large circle hooks (described in Section 2.4.2) were also used for long-line fishing to minimize the capture of nontarget species and facilitate the release of captured sturgeon not suitable for this study.

Figure 2-3. Long-Line Sturgeon Collection.

For this study, a long-line configuration was used similar to that developed by the Oregon Department of Fish and Wildlife and the WDFW to capture sturgeon in the lower Columbia River (Rien et al. 1997). Setlines consisted of 2 buoys, 2 anchors, and approximately 200 ft to 300 ft rope set with 6 to 12 leaders. Circle hooks were attached to the leader lines at approximately 15-ft intervals in between the anchored buoys. Additional weights were attached at several points along the ground line to help keep all the baited hooks on, or near, the riverbed. Setline hooks were baited as appropriate using shad or commercially available pickled squid.

Setlines were deployed from a boat and set either parallel to the shore in faster flowing water or perpendicular to the shore in calmer water. Prior to each line setting event, water depth was determined and used to select a float line of appropriate length. Float lines in fluctuating water zones were at least 15 to 20 ft longer than the actual water depth. An anchor and float line were also attached to one end of the mainline.

Long lines were retrieved within 12 hours of setting to reduce mortality to target and incidental captures. Sturgeon setlines were retrieved by hand or using a davit, depending on size and number of fish on the setline. All nontarget sturgeon were released after fish-specific data were recorded. The floats used were clearly labeled with the scientific permit number and the name and address of the point of contact.

2.5 FIELD SAMPLE HANDLING

2.5.1 Nonsturgeon Sample Handling

For all target fish other than sturgeon, fish were dip-netted from the river (Figure 2-4) and then euthanized by a blow to the head and pithed. Great care was taken to ensure that each specimen did not come in direct contact with the interior of the boat after being netted. Samplers wore nitrile gloves while handling the fish. The dip-net was rinsed in the river and the pithing tools were decontaminated after each use. Sampled fish were individually bagged and measured (total length) using a measuring board (Figure 2-5). Each sample bag was labeled (sample number, location, date, length, WDFW permit number, sampler's initials) then placed on ice. At the end of the collection day, the bagged samples were taken to the onshore sample processing facility where they were stored in calibrated temperature-controlled (approximately -16 °C), locked storage until sufficient samples were collected for processing.

High capture rates for suckers during electrofishing necessitated a change in the sampling sequence as more than one specimen was stunned at any given time. Up to five fish were collected at a time and placed in a single large poly-lined container. After five fish had been captured, the fish were euthanized, measured, and bagged together to comprise a single composite sample.

2.5.2 Sturgeon Sample Handling

As discussed in Section 2.2, additional sturgeon sample and data collection in the field had been approved by the Tri-Parties. Physical information was recorded for all sturgeon, including fish that were released. At the request of the WDFW, each sturgeon was scanned for PIT tags, measured for total and fork length, and examined for anomalies in the lateral scute pattern. The presence of a PIT tag indicated the sturgeon had been previously captured and fitted with a small transponder. Information on the date, location, and individual were recorded when the PIT tag was implanted. Collection and tracking of these PIT tags aids fish management agencies in understanding the life cycle of the sturgeon.

Figure 2-4. Carp Specimen Collected with Hook and Line.

Figure 2-5. Bagged Walleye Specimen on Measuring Board.

Each sturgeon was visually examined for physical anomalies, with particular attention to the scute pattern. Anomalies in the scute pattern are an indication that the fish had been previously captured and possibly PIT tagged. Sturgeon that were outside the target size range were not brought on board the boat but were measured and examined alongside the boat and then carefully released (Figure 2-6).

Figure 2-6. Measuring the Length of a Sub-Legal-Size Sturgeon.

The legal-size sturgeon retained for this study were not dip netted, but instead brought onto the boat by hand and immediately weighed. As requested by the Tri-Parties, additional histology samples were then attained from each of the 30 sturgeon caught for this study.

2.5.2.1 Histology Sample Collection. After weighing, sturgeon were euthanized by severing the spinal cord, thus allowing collection of nontraumatized gill tissue for histological examination. The fish were also pithed in cases where severing of the spinal cord did not cause immediate death. In addition to the gill tissue, samples of gonad, liver, and kidney were also collected for histology at this time. Powder-free nitrile gloves (CT International, Correct Touch clean room, class 100) were worn by samplers handling histological sample tissues. Tissue samples (approximately 5 g per tissue type) were collected and immediately placed into Davidson's fixative for 24 to 72 hours. After fixing, tissues were removed from solution, rinsed with deionized water, and stored in ethanol until processing.

Davidson's fixative:

95% Ethanol (denatured)	600 mL
Acetic acid	200 mL
Formalin	400 mL
Deionized water	600 mL

2.5.2.2 Blood Sample Collection. After the sturgeon field sampling was under way, a request was made by DOE to collect samples of blood from sturgeon caught for this study. For the last 14 sturgeon collected, blood samples were collected prior to euthanasia and all other sampling. Sturgeon were brought on the boat and secured in a fish inspection trough. Fish were irrigated with river water at a rate of 1 to 2 gal/min prior to and during blood sample collection. Blood samples were obtained using an 18-gauge hypodermic needle connected to a BD Vacutainer® with a 6-mL plastic tube (BD Vacutainer SPC Plus with BD Hemogard™, Becton Dickenson product number 368381). Whole blood samples were immediately placed on ice and put into freezer storage at the end of the day. Two to five milliliters were collected in each vial and six to eight vials were collected per fish.

2.6 LABORATORY SAMPLE PROCESSING

Fish were examined for general health metrics (e.g., length, weight, description of fatty tissues). Any abnormalities in the fish collected were recorded.

2.6.1 Bass, Carp, Suckers, Walleye, and Whitefish

The procedure described below was used to dissect, composite, and process whitefish, bass, carp, walleye, and suckers.

Prior to sample processing, the individual fish that were to make up each sample composite were determined. For each of the four sub-areas, five composite samples composed of at least five fish each were to be prepared. Fish of each species were grouped into composites of five or more individuals based on geographic proximity within each sub-area with secondary consideration given to consistency of fish size within and among the composites, as discussed in Section 2.4.4.3 of the SAP (DOE/RL-2008-11, Appendix A). The geographic location of each fish sample was identified based on the GPS coordinates that were taken at the time of collection. Maps showing the collection locations of each fish are presented in Appendix A.

2.6.1.1 Dissection. Specimens were kept frozen at approximately -16 °C until processing. Fish were placed on absorbent towels, and excess slime/sediment was removed from the exterior of fish specimens with forceps, scalpel, and/or absorbent towels. Individual fish specimens were weighed (to the nearest 5 g for smaller fish, nearest 30 g for larger fish), measured (total length and fork length to the nearest centimeter) and the sex determined (when possible). The external condition of each fish was also inspected before dissection and any gross abnormalities were noted.

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™ BD Hemogard is a trademark of Becton, Dickinson and Company.

Clean nitrile gloves were worn by laboratory staff during dissection. The internal organs were removed from each fish, and the liver and kidneys were separated from the rest of the entrails (Figure 2-7). Obvious abnormalities on the internal tissues were recorded. The fillet (muscles, skin, and scales), liver, kidney, remaining entrails, stomach content, and all remaining carcass tissues (head, bones, and fins) were weighed (to the nearest gram) separately in pre-cleaned, tared, aluminum weighing trays. Once all desired tissues were separated and weighed, the individual tissues were wrapped in aluminum foil, bagged, labeled, and refrozen until the final sample homogenization steps.

Figure 2-7. Carp Dissection in the Laboratory.

2.6.1.2 Sample Compositing/Preparation. The fillets for each composite sample were combined and homogenized in a commercial-grade food grinder (Figure 2-8). Sample bottles were filled by taking a number of systematic sub-samples across the composited sample material. Samples were weighed and frozen for at least 24 hours prior to shipment. Carcass composite samples were processed using the same method as fillet composite samples.

Organ samples were homogenized in a laboratory-grade blender to create the composite samples. Carp and suckers do not have a distinct liver as the liver and pancreas are conjoined (hepatopancreas). For these fish, as much of the liver as possible was removed without including the pancreas in the tissue sample.

For bass, suckers, walleye, and whitefish, livers and kidneys were combined and homogenized. For these species, all of the kidney and liver tissues from each fish within the composite group were combined and used to create a single homogenized composite.

Figure 2-8. Fish Tissue Homogenization Using Commercial Grade Food Grinder.

For carp, the kidney and liver tissues were not combined but were instead processed as separate samples. For each carp composite set, kidneys and livers were homogenized separately in the laboratory blender to create the two homogenized composite samples.

For all samples, the homogenized tissues were placed in sample containers, weighed, and immediately frozen for at least 24 hours prior to shipment. The hard-frozen, processed samples were then shipped to various analytical laboratories in temperature-controlled packaging.

All remaining entrails, stomach content, and excess fillet and carcass were then wrapped tightly in aluminum foil, cataloged, and returned to the freezer. The tissue samples and their corresponding analyses are shown in Table 2-3.

The tissue mass attained from composited liver and kidney samples was insufficient to complete the entire sample analyte list of the SAP. For these samples, the analytical priorities were determined based on the SAP guidance in Section 2.4.5. Priority was given to metals and radionuclides, followed by polychlorinated biphenyls (PCBs) (PCB congener in the case of fish samples) and pesticides. However, the sample mass needed to adequately complete the PCB congener analysis was in some cases greater than that available from the entire organ composite sample. Given there was insufficient mass from the composite samples to complete the PCB congener analysis, this analysis was not performed on organ tissue.

To maximize the amount of data obtained from each composite sample, organ samples were first shipped for radionuclide analyses, after which the samples were trans-shipped to a second laboratory for metals and pesticide analyses. Not all organ samples were analyzed for pesticides as the time required for trans-shipping between laboratories led to analytical hold-time exceedances.

Table 2-3. Analyses for Fish Samples Except Sturgeon.

Tissue	Sample Analyses													
	Gamma Spectroscopy	Carbon-14	Tritium	Strontium 89/90	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Technetium-99	Metals	Mercury	Total Inorganic Arsenic	Pesticides	Percent Lipids	PCB Congeners
Fillet	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Carcass	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Liver/kidney [a, b]	X	X	X	X	X	X	X	X	X	X		X [c]		

[a] For organ samples, insufficient mass was available to conduct all analyses. The analytical priority stated in DOE/RL-2008-11 (Appendix A, Section 2.4.5) was followed with deference given to maximizing the mass available for metals and radionuclides. The stated priority was metals and radionuclides, then PCBs (congeners) and pesticides. For the low-mass organ samples, analyses that required higher mass (PCB congeners) or required a separate sample (inorganic arsenic) were not performed.
[b] The liver and kidney samples for carp were processed and analyzed as separate samples.
[c] Because of the logistics of trans-shipping samples to maximize the number of analyses attainable with the limited mass of the organ samples, the short hold time (14 days) for pesticide analysis was not met. Because of this problem, pesticide analysis was not requested for all samples.

PCB = polychlorinated biphenyl

DOE/RL-2008-11, 2008, *Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2.6.2 Sturgeon

2.6.2.1 Processing Procedure. The procedure described in Section 2.4.1 to process bass, carp, suckers, walleye, and whitefish was used to process sturgeon samples with exceptions described below. Sturgeon specimens were removed from the freezer and allowed to thaw for approximately 10 hours prior to dissection. Timing of this step was important to minimize loss of fluids from target (and nontarget) tissues and to ensure target organs were completely separated from the rest of viscera.

Unlike the other fish species, sturgeon specimens were processed as individual samples rather than composited. The liver, kidney, stomach, entrails (internal organs less stomach, liver, and kidney), fillets (muscle tissue including dark tissue, skin removed), and remaining carcass (all remaining portions including skin, head, fins, and bones) were weighed separately and recorded for each sturgeon specimen. In contrast to the nonsturgeon samples, the fillet samples for the sturgeon did not include the skin. The skin was instead included as part of the carcass samples.

For all specimens, the entire sturgeon carcass was homogenized and all excess tissue remaining after sample processing was labeled, cataloged, and stored at approximately -16 °C. The sturgeon tissue samples and their corresponding analyses are shown in Table 2-4.

Table 2-4. Analyses for Sturgeon Samples.

Tissue	Sample Analyses [a]																
	Gamma Spectroscopy	Carbon-14	Tritium	Strontium 89/90	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Technetium-99	Metals	Mercury	Total Inorganic Arsenic	Pesticides	Percent Lipids	PCB Congeners	Hexavalent Chromium	Methyl Mercury [b]	Percentage Sediment
Fillet	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Carcass	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Liver	X	X	X	X	X	X	X	X	X	X		X	X	X			
Kidney [c]	X	X	X	X	X	X	X	X	X	X		X	X	X			
Stomach																	X
Viscera [d]	X	X	X	X	X	X	X	X	X	X		X	X	X	X		

[a] For organ samples, insufficient mass was available to conduct all analyses. The analytical priority stated in DOE/RL-2008-11 (Appendix A, Section 2.4.5) was followed with deference given to the maximizing the mass available for metals and radionuclides. The stated priority was metals and radionuclides, then PCBs (congeners) and pesticides. For the low-mass organ samples, analyses that required higher mass (PCB congeners) or required a separate sample (inorganic arsenic) were not performed.
[b] Methyl mercury was performed on a subset of samples (six sturgeon) only.
[c] Kidney mass obtained from sturgeon was not sufficient to obtain PCB congener analysis. Radiological and metal analyses were the priority for the organ samples.
[d] For sturgeon samples, viscera consisted of visceral organ material minus kidney, liver, and the contents of the stomach. A total of six viscera samples were analyzed.

PCB = polychlorinated biphenyl

DOE/RL-2008-11, 2008, *Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2.6.2.2 Histological Samples. Gill, gonad, liver, and kidney tissues were collected and preserved onboard the fishing vessel after each sturgeon was caught (Section 2.5.2) for subsequent histological analysis. While on the fishing boat, the tissues were immediately placed in a formaldehyde-based fixative solution (Davidson's formula). Samples were transferred to the laboratory at the end of the work day. After the samples had spent 24 to 72 hours in the fixative solution, they were removed and rinsed with de-ionized water. After rinsing, the samples were saturated with denatured ethanol in their final sample containers for shipment to the offsite laboratory conducting the histological analysis.

2.6.2.3 Additional Sturgeon Laboratory Data Collection and Offsite Study Support. Additional tissues from sturgeon were prepared and shipped to USGS to support their current study developing methods and quantification of emerging contaminants such as endocrine disruptors for Columbia River white sturgeon. Samples of approximately 10 to 20 g or more (as available) of brain and gonad tissues from all specimens, plus liver tissues when sufficient mass was available, were collected during the laboratory dissection and sample processing of the sturgeon. Samples were wrapped in aluminum foil, frozen, and shipped to the USGS. Given the low mass of the sturgeon kidney tissue, and the priority to complete analyses described in DOE/RL-2008-11, samples from this tissue were not able to be provided.

As discussed in Section 2.2, the color of fat (white or yellow) found in muscle tissue was recorded. Per the WDFW request, a portion of the pectoral fin was removed from each sturgeon, cataloged, frozen, and later dried. Pectoral fin samples were later sent to the WDFW for age determination. Per the request from the Confederated Tribes of the Umatilla Indian Reservation, otoliths, which are the ear bones of sturgeon, were removed, cataloged, and frozen for possible use in age determination. Eggs were not present in any of the female sturgeon that were collected, and therefore no egg samples were taken.

2.6.2.4 Stomach Sediment Determination. A laboratory procedure was created with input from sturgeon subject matter experts to quantify the amount of sediment in sturgeon stomach samples relative to other stomach contents. The stomach tissue from each sturgeon had been removed and frozen during the initial dissection of the fish. The amount of sediment in sturgeon stomachs was determined as a percentage of the entire stomach content (shells, pebbles, fauna, etc.).

Each stomach was removed from freezer storage and allowed to thaw for approximately one hour. The stomach lining was dissected and all contents were emptied into a pre-cleaned aluminum weigh boat and weighed to the nearest ± 0.01 g. The stomach lining was then flushed with de-ionized water to ensure all stomach contents were removed. Denatured ethanol at a quantity of 5 to 10 times the volume of gut contents was added to the stomach contents to expedite sieving of material. All organic content and/or sediment within shells were removed using a pre-cleaned scoopula. Shells were rinsed to ensure all organic content and sediment was removed.

The stomach contents were then sieved through a 2-mm pre-cleaned sieve and thoroughly rinsed. All gut contents and rinsate that passed through the sieve were collected and filtered under vacuum using a Buchner funnel and pre-tared Whatman filter paper (grade 54, hardened, ashless filter, 22 µm, 122 mm diameter). Gut contents greater than 2 mm in size were transferred to a labeled, pre-cleaned aluminum tray and dried in an oven at 105 °C until a constant dry weight was obtained. The filter and any remaining unfiltered material were also transferred to a labeled, pre-cleaned aluminum tray and dried at 105 °C until a constant dry weight was obtained. When dried, each set of gut contents was weighed to the nearest 0.01 g. All pebbles and identifiable taxa were weighed separately in order to calculate the proportion of each food item. Pebbles (greater than 2 mm) were discarded and discernable macro-invertebrate shells (less than 2 mm) were set aside after having been weighed. All organic content and/or sediment was removed from shells and returned to dried gut contents. Foregut contents that were less than 2 mm were transferred to the muffle furnace and ashed at 550 °C for no less than 5 hours, cooled, and then transferred to a dessicator. A final weight was recorded (± 0.01 g) within 1 hour of removal from the dessicator.

3.0 COLLECTION RESULTS

In total, sufficient fish to create 20 composite samples (consisting of at least 5 fish per sample) of whitefish, bass, sucker, and walleye were successfully collected from the four sub-areas. The required 30 sturgeon were also successfully collected. For carp, sufficient fish to create a total of 19 samples were collected as 1 composite of 5 fish was unable to be collected. The results of field and laboratory sample collection and processing are detailed in the following sections with further details provided in Appendix A (maps of fish collection locations), Appendix B (laboratory record data), and Appendix C (analytical sample identification).

3.1 COLLECTION LOCATIONS

Attempts to collect fish from the popular recreational fishing areas identified in DOE/RL-2008-11 were performed for each species. Exceptions to this were as follows:

- Habitat for, and therefore specimens of, a given target species was absent
- Sampling the area would likely result in the take of an ESA-listed salmonid
- Sampling via electro-shocking was not allowed under the NOAA permit.

A summary of the recreational fishing areas successfully fished for each of the target species is presented in Table 3-1.

Table 3-1. Recreational Fishing Locations Sampled for Target Fish Species. (2 Pages)

Popular Recreational Fishing Location	Species					
	Whitefish	Bass	Suckers	Carp	Walleye	Sturgeon
Upriver						
Wanapum Pool	X	X	X	X	X	X
Priest Rapids Dam Pool	X	X	X	X	X	NA
100 Area						
100-B/C Hole	X	X	X	X	X	X
100-K Hole	X	X	X	X	X	X
100-N Hole	X	X	X	X	X	X
100-D Hole	X	NA	X	X	X	X
White Bluffs Hole 1	X	NA	X	X	X	X
White Bluffs Hole 2	X	NA	X	X	X	X

Table 3-1. Recreational Fishing Locations Sampled for Target Fish Species. (2 Pages)

Popular Recreational Fishing Location	Species					
	Whitefish	Bass	Suckers	Carp	Walleye	Sturgeon
300 Area						
Hanford Townsite Hole 1	X	NA	X	X	X	X
Hanford Townsite Hole 2	X	NA	X	X	X	X
Ringold	NA	X	NA	NA	X	NA
Taylor Flats	X	X	X	X	X	NA
300 Area Hole 1	X	NA	X	X	X	X
Lake Wallula						
Yakima River Delta	X	X	X	X	X	X
Finley Slough	X	NA	NA	NA	X	X
Burbank Slough	X	NA	NA	NA	X	NA
Wallula Gap	NA	NA	NA	NA	X	X

NA = not applicable

3.2 WHITEFISH

Whitefish (*Prosopium williamsoni*) collection via electrofishing was the first fishing campaign for this project and was conducted in January and February 2009. The whitefish collection period prescribed in the SAP (fall) (DOE/RL-2008-11, Appendix A) was changed to winter with Tri-Party concurrence due to logistics of the project. By allowing collection to occur in early 2009, the fish were able to be collected and processed early in the project rather than waiting until the next fall (2009). Electrofishing for whitefish was initially conducted during daylight hours but subsequently changed to nighttime after approximately 2 weeks of fishing because the whitefish were significantly more susceptible to capture after dark.

3.2.1 Specimens and Collection Period

Whitefish were collected from January 27 through February 27, 2009, during 25 outings. A total of 104 whitefish were captured, measured, bagged, labeled, and frozen for laboratory processing. All collection activities were conducted under WDFW Scientific Collection Permit 08-272 and NOAA Authorization 14283.

Records of the incidental catch of other fish species observed to be stunned within the electrical field were also kept. The bi-catch totaled 4,419 fish, of which the vast majority (80.1%) was suckers (*Catostomus* spp.). These incidental fish other than adult whitefish were briefly stunned, identified, and counted but usually not netted and brought aboard the boat. This was done to minimize the potential deleterious effect on nontarget species and to maximize efficiency of capturing operations.

3.2.2 Location

The location of each captured whitefish was mapped, and individual whitefish specimens were grouped into five composite samples of five or more fish based on proximity of capture location within each of the four sub-areas and minimizing the size variation within, and among, composite sample sets as described in Section 2.4.4.3 of the SAP (DOE/RL-2008-11, Appendix A). The majority of whitefish collected in the Lake Wallula sub-area were located near the city of Richland. A number of 300 Area sub-area specimens were obtained immediately in front of the 300 Area (see Appendix A), and near the Hanford townsite. The 100 Area whitefish samples were generally collected between 100-D and 100-F Areas. Whitefish collected from the upriver sub-area were primarily collected within 5 miles downstream of Wanapum Dam. A listing of the general locations from which whitefish were collected is presented in Table 3-1. Specific collection locations from each of the four sub-areas are illustrated in Appendix A.

3.2.3 Composite Summaries

Individual whitefish were grouped by sub-areas (Lake Wallula, 300 Area, 100 Area, upriver), consisting of five samples within each sub-area. The whitefish samples were also grouped by geographic subregions within each of these sub-areas. Each whitefish sample consisted of five individual specimens, with the exception of one sample, which consisted of seven individual fish. Laboratory records detailing field identification and composite numbers, date of capture, location coordinates, size, organ weights, stomach contents, sex, and general condition are included in Appendix B (Tables B-1 and B-2). Sample identification records are included in Appendix C.

Whitefish dissection began on March 18, 2009 and composite sample processing occurred from April 13 to 30, 2009. External lacerations and granulomas in the digestive system were the abnormalities most frequently observed (Appendix B). Stomach contents were classified into general invertebrate taxa (e.g., snails, scuds, caddis fly larvae). Stomach contents were found to be almost entirely scuds.

Whitefish ranged in size from 10.3 in. to 20.0 in. and averaged 15.6 in. (total length) overall (Figure 3-1). The fish size classes within each sample group were found to be consistent with SAP (DOE/RL-2008-11, Appendix A) guidelines in all sub-areas except the upriver sub-area. Fish were fewer in number in the upriver reference sub-area, with a much broader size range relative to the other three sub-areas. Although removing the larger fish from the upriver sub-area would have helped to meet the size class guidelines in the SAP, it would have reduced the total amount of tissue mass required for analyses. Therefore, these two larger specimens were retained in the upriver sub-area composite samples.

Liver/kidney tissues from each of the five specimens combined into a single sample were homogenized using a laboratory-grade blender. Fillets (muscle and skin) and carcass samples were homogenized using a food-grade grinder. The food-grade grinder had been re-tinned immediately prior to this work to ensure no metal contamination would be introduced into the samples. Equipment blanks were prepared for each of the homogenization techniques. Sub-samples of the homogenized tissues were then prepared for each suite of analyses as prescribed in the SAP (sample records reported in Appendix C). All samples were shipped to the analytical laboratories within 1 week of the sample processing date (date of compositing using the grinder or the blender).

Figure 3-1. Whitefish Specimen.

Because of the limited mass available in the composited organ samples, not all analyses were able to be conducted. Analytical priority was given to radionuclides and metals with PCB congeners and pesticides to be analyzed as mass allowed. Because of the mass required for PCB congener analysis, no organ samples underwent the analysis. Consequently, analysis for percent lipids that was conducted with the PCB congener analysis was not obtained for the organ samples. Logistical difficulties in trans-shipping organ tissues from the laboratory performing nondestructive radiological analysis to a separate laboratory for pesticide analysis led to exceedances of hold-time. Inorganic arsenic was not performed on organ samples due to limited mass.

3.3 BASS

Artificial lures specifically designed for the bass were used to collect bass (*Micropterus dolomieui*) via hook and line in all sub-areas. Sample specimens ranged from 9 to 14 in. (total length) and averaged 10.5 in.

3.3.1 Specimens and Collection Period

Collection of bass began June 29 and was completed July 21, 2009. A total of 100 bass (25 fish per sub-area) were collected, grouped by geographic proximity into five fish composites, processed, and shipped for analysis.

3.3.2 Location

Bass from the Lake Wallula sub-area were collected primarily in the vicinity of Chiawana, Howard Amon, and Leslie Grove Parks, and near Columbia Point Marina (Figure A-20). Bass were collected in the vicinity of the 300 Area facility downstream to the Leslie Groves boat launch in the 300 Area sub-area. Collections from the 100 Area sub-area were from the vicinity of Coyote Rapids (near 100-K), 100-B/C and 100-N Reactors, and 100-F slough. Bass were collected just downstream of Wanapum Dam to the vicinity of the Desert Aire boat launch in the upriver sub-area (Figures A-12 and A-13). None were caught upstream of Wanapum Dam. A listing of the general locations from which bass were collected is presented in Table 3-1. Specific collection locations from each of the four sub-areas are illustrated in Appendix A.

3.3.3 Composite Summaries

The processing of bass tissues into analytical samples was the same as described for whitefish (Section 3.2.3). The locations from which bass were collected are presented in Table 3-1. Laboratory records detailing field identification and composite numbers, date of capture, location coordinates, size, organ weights, stomach contents, sex, and general condition are included in Appendix B (Tables B-3 and B-4). The only visible tissue abnormality observed (discolored gonads) was seen in a fish from the upriver sub-area (UR Bass 6). The average stomach contents were 39% miscellaneous invertebrates, 31% crawfish, and 19% fish. Sample identification records are included in Appendix C.

3.4 STURGEON

3.4.1 Specimens and Collection Period

Sturgeon samples were collected between July 16 and September 15, 2009. The 30 sturgeon collected and used for this study ranged in size from 43 in. to 53 in. and averaged 47 in. in fork length.

A total of 166 sturgeon were caught during fishing operations. Of these, 31 were of legal size, 124 were smaller than 43 in., and 11 were larger than 54 in. (fork length). One legal-size sturgeon escaped during initial handling and was subsequently replaced. Overall, sturgeon ranged in size from 18 in. to 88 in. (fork length).

3.4.2 Locations

Specific collection locations for all sturgeon specimens are included in Appendix A. Sturgeon collection by sub-area and the rate of legal-size fish relative to all captured fish per area is shown in Table 3-2.

All captured sturgeon were visually checked for the occurrence of abnormalities such as fin deformities and tumors. Although the number of fish sampled by sub-area varied considerably, the observed abnormality rate was fairly consistent as seen in Table 3-2.

Table 3-2. Sturgeon Collection By Sub-Area.

Study Sub-Area	Number of Sturgeon Retained for Study	Total Number of Sturgeon Captured	Rate of Legal Size Sturgeon Captured (%)	Rate of Observed Anomalies (%)
Upriver	5	10	50	10
100 Area	9	92	10	12
300 Area	10	51	20	12
Lake Wallula	6	13	54	8

Legal-size sturgeon were relatively scarce in some of the project sampling locations. Because of the relatively small population of sturgeon inhabiting the upriver sub-area, all sturgeon from the control area were collected upriver of Wanapum Dam. The upriver sub-area boundary was extended upstream from RM 420 to RM 441 to allow for the collection of sturgeon in areas of known sturgeon habitat. Information from local fishing experts and agencies indicated that the most likely areas to catch legal-size sturgeon upriver of Wanapum Dam were upriver of the SAP boundary. Expanding the upper boundary of the study area from RM 420 to RM 441 allowed fish to be captured from locations more likely to be used by fishermen and, therefore, was appropriate to include for the human health risk assessment.

3.4.3 Sample Summary

Sturgeon sample processing began in July following DOE/RL-2008-11 and WCH-286. As detailed in Section 2.2, additional samples and data were collected during laboratory processing.

1. Pectoral fins samples from the 30 sturgeon were collected and submitted to the WDFW for possible age dating.

2. During dissection and sample processing, the color of fat found in each sturgeon (yellow or white fat) was recorded.

3. Measurement and determination of the percentage of sediment within stomachs of the sturgeon caught for this study was performed. A method by which the various components of the stomachs were measured was developed and reviewed by sturgeon subject matter experts. The method was used to measure the components of the stomach contents and determine the percentage of sediment.

4. Liver and kidney samples from each fish were processed and analyzed as separate samples rather than combined into one sample.

5. Additional analysis for methyl mercury on a subset of sturgeon samples (tissues from six individual fish) was performed.

6. Additional analysis for hexavalent chromium on all tissues (as available) was performed.

7. Analysis of viscera samples from a subset of the sturgeon samples (tissues from six individual fish) was performed.

8. Sturgeon otoliths (earbones) were collected for possible age dating, as requested by the Confederated Tribes of the Umatilla Indian Reservation.

9. A commercially caught sturgeon was purchased and used for “practice” on the various sampling and data collection requirements prior to work on any fish caught specifically for this study.

10. Samples of brain, gonad, and liver tissue and a subsample of the final fillet sample were collected from all specimens per USGS request.

11. Samples of blood were collected immediately prior to euthanasia for the last 14 fish and were processed and stored at approximately -16 °C.

A single practice specimen was obtained prior to processing of field samples, allowing laboratory technicians to become familiar with sturgeon dissecting and tissue processing procedures. A commercially caught Columbia River sturgeon was purchased in Dallesport, Washington, for this purpose.

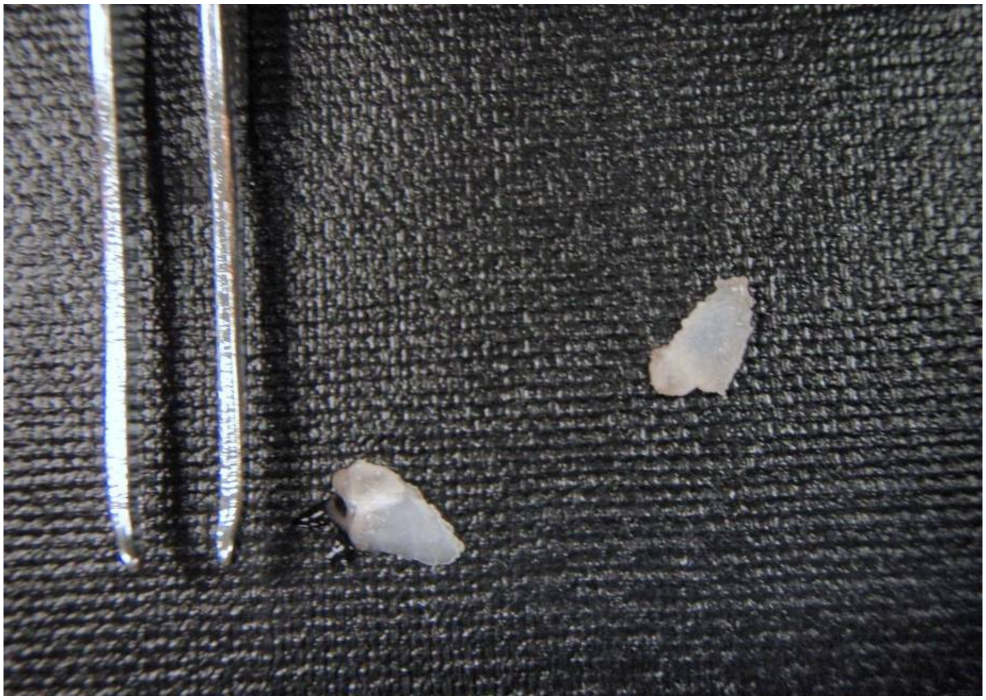
Requests from agencies resulted in modifying sturgeon tissue sample preparation protocols. The USGS requested tissue samples of brain, gonad, and, if available, liver and kidney. A subsample of the processed fillet sample from each sturgeon was also requested. Because of the limited mass available for sturgeon kidney tissues, no kidney samples were prepared for the USGS. A protocol was developed to ensure adequate tissue mass was obtained to meet SAP analytical requirements and provide the USGS with selected tissues when possible.

The Confederated Tribes of the Umatilla Indian Reservation requested that sturgeon otoliths be collected for possible age dating. Laboratory staff were unable to locate the otoliths of the first four sturgeon, but other otoliths were successfully collected. A photograph of the otoliths from a sturgeon with laboratory tweezers for scale is presented in Figure 3-2.

Pectoral fin ray sections were collected from all fish during laboratory processing and stored at approximately -16 °C. After sample processing was completed, the sections were air dried for approximately 4 days and shipped to the WDFW for age determination. Appendix D contains the results of that age determination.

Records detailing field identification and sample numbers, date of capture, location coordinates, size, organ weights, stomach contents, fat color, general condition, and histology sample identification are presented in Appendix B (Table B-11). Histology samples were collected from every sturgeon. These samples included kidney, liver, gonad, and gill tissues and were sent to the USFW Bozeman Fish Health Center for analysis. Sample identification records are presented in Appendix C. Results from the histological sample analyses are presented in Appendix E.

Figure 3-2. Sturgeon Otoliths.



3.4.4 Sturgeon Stomach Percent Sediment Determination

As requested by the Tri-Parties, measurement and determination of the percentage of sediment within stomachs of the sturgeon caught for this study was performed. A method by which the various components of the stomachs were measured was developed. The method was reviewed by sturgeon subject matter experts. This method was used to measure the components of the various stomach contents and determine the relative percentage of sediment.

One sturgeon stomach was misplaced, and therefore stomach sediment determination was performed on only 29 samples. Ashing of stomach contents was conducted for the percent sediment determination. During the trial run of the process, it was found that the ashless filters had more ash content than anticipated after burning. To arrive at a correction factor for the ashed sample mass, filters were subsequently burned in multiple trials and the residue weighed so that correction factors could be calculated to account for the additional ash. The procedure used is found in Appendix F. Complete results from the processing are presented in Appendix G. A photograph of a filtered sturgeon sediment sample on an ashless filter is shown in Figure 3-3.

Figure 3-3. Ashless Filter with Sturgeon Sediment Sample Prior to Ashing.

3.4.5 Laboratory Observations

Twelve sturgeon were observed to have anatomical abnormalities. These abnormalities included duplicate fins, lesions, and discolored gonads. Seventeen of thirty sturgeon had yellow fat and thirteen had white fat (Appendix B).

One sturgeon stomach was misplaced, and therefore stomach contents were not recorded. Of the remaining 29 samples, snails were found most frequently in stomach contents, followed by crawfish, fish, clams, and algae/vegetation (Table 3-3).

Table 3-3. Observed Contents of Sturgeon Stomachs.

Stomach Content	Percentage of Samples with Content (%)
Snails	59
Crawfish	45
Fish	41
Clams	38
Algae/vegetation	28

Sturgeon tissue samples prepared for laboratory analysis are summarized in Table 3-4.

Table 3-4. Summary of Sturgeon Samples Per Fish.

Sturgeon Identification	Tissue Samples Submitted for Offsite Analysis					Samples Collected Onsite for other Agencies		Samples Processed Onsite
	Fillet	Carcass	Liver	Kidney	Entrails	Otoliths	Pectoral Fin	Stomach Sediment
HS01	X	X	X	X	NA	NA	X	X
HS02	X	X	X	X	NA	NA	X	X
HS03	X	X	X	X	NA	NA	X	X
HS04	X	X	X	X	NA	NA	X	NA
HS05	X	X	X	X	NA	X	X	X
HS06	X	X	X	X	NA	X	X	X
HS07	X	X	X	X	NA	X	X	X
HS08	X	X	X	X	NA	X	X	X
HS09	X	X	X	X	NA	X	X	X
HS10	X	X	X	X	NA	X	X	X
HS11	X	X	X	X	NA	X	X	X
HS12	X	X	X	X	NA	X	X	X
HS13	X	X	X	X	NA	X	X	X
HS14	X	X	X	X	NA	X	X	X
HS15	X	X	X	X	NA	X	X	X
HS16	X	X	X	X	NA	X	X	X
HS17	X	X	X	X	X	X	X	X
HS18	X	X	X	X	X	X	X	X
HS19	X	X	X	X	X	X	X	X
HS20	X	X	X	X	X	X	X	X
HS21	X	X	X	X	NA	X	X	X
HS22	X	X	X	X	NA	X	X	X
HS23	X	X	X	X	NA	X	X	X
HS24	X	X	X	X	NA	X	X	X
HS25	X	X	X	X	NA	X	X	X
URS26	X	X	X	X	NA	X	X	X
URS27	X	X	X	X	X	X	X	X
URS28	X	X	X	X	X	X	X	X
URS29	X	X	X	X	NA	X	X	X
URS30	X	X	X	X	NA	X	X	X

HS = Hanford sturgeon
NA = not applicable
URS = upriver sub-area

3.5 SUCKERS

Suckers were collected primarily via electrofishing. Five fish were caught with hook and line shortly before the start of electrofishing and were included in a sample composite (Figure 3-4). All suckers collected and composited were largescale sucker (*Catostomus macrocheilus*) and ranged in size from 17 in. to 25 in. and averaged 21 in. in total length. A listing of the general locations from which suckers were collected is presented in Table 3-1. Specific collection locations from each of the four sub-areas are illustrated in Appendix A.

Figure 3-4. Sucker Collected with Hook and Line.

3.5.1 Specimens and Collection Period

Sucker collection using electrofishing started September 29, 2009, and was completed on November 23, 2009. A total of 103 suckers were collected for this study of which 100 were grouped into 20 composites of 5 fish each.

3.5.2 Locations

Suckers were collected in the upriver sub-area at four locations spread throughout the Priest Rapids Pool. Suckers were not collected from the Wanapum Pool. Collections in the 100 Area sub-area were in close proximity to the 100-B/C, 100-K, 100-N, and 100-D Reactors, and near the White Bluffs boat launch. Sucker collection in the 300 Area sub-area occurred at five general locations (one composite from each) ranging from the Hanford townsite downstream to a close proximity to the 300 Area facility. Lake Wallula sub-area suckers were collected near Columbia Point in Richland, the Yakima River delta, and downstream in the vicinity of Cascade Marina (Figure A-41).

Specific locations where suckers were collected for each of the four sub-areas are illustrated in Appendix A.

3.5.3 Composite Summaries

The processing of sucker tissues into analytical samples was the same as described for whitefish (Section 3.2.3). Laboratory records detailing field identification and composite numbers, date of capture, location coordinates, size, organ weights, stomach contents, sex, and general condition are included in Appendix B (Tables B-5 and B-6). Sample identification records are included in Appendix C. Invertebrates were the only identifiable contents found in the stomachs of suckers. The majority of suckers captured were female (72.1% where sex was discernable). Abnormal tissues were not observed on any of the suckers processed.

3.6 CARP

Carp were collected primarily via electrofishing (Figure 3-5). Two carp were also caught with hook and line prior to the start of electrofishing and were included in the sample composites. Carp collected and composited for this study ranged in size from 20.5 in. to 31.5 in. and averaged 25.8 in. in total length. Nineteen of twenty samples of carp were collected between August and December 2009. A listing of the general locations from which carp were collected is presented in Table 3-1. Specific collection locations from each of the four sub-areas are illustrated in Appendix A.

Figure 3-5. Carp Being Brought Aboard the Electrofishing Boat.

3.6.1 Specimens and Collection Period

Electrofishing for carp was conducted September 28 through December 12, 2009. In all, 96 carp were collected, 94 via electrofishing and 2 via hook and line prior to the start of electrofishing.

3.6.2 Locations

Carp were collected in the upriver sub-area just downstream of Wanapum Dam and at two locations at approximately the mid-point of the Priest Rapids Pool. Carp were not collected upstream of Wanapum Dam. Most of the carp collected from the 100 Area sub-area ranged from the 100-N Reactor intake structure downstream to the vicinity of White Bluffs slough. Carp were collected in the 300 Area sub-area from the Hanford townsite slough downstream to the Leslie Groves boat launch (Richland, Washington) and include specimens from the immediate vicinity of the 300 Area. Carp collections in the Lake Wallula sub-area ranged from Howard Amon Park (Richland, Washington) in the city of Richland downstream to the vicinity of Cascade Marina (Figures A-50 and A-51). Three composites were collected from the Yakima River delta. Specific carp collection locations for each of the four sub-areas are illustrated in Appendix A.

Because of the difficulties in collecting the carp late in the fall of 2009, fish were not able to be collected to complete the fifth composite sample for the upriver sub-area. This was discussed with the Tri-Parties in December 2009. The Tri-Parties agreed that it was acceptable to only have four composite samples of carp from the upriver sub-area.

3.6.3 Composite Summaries

The processing of carp tissues into analytical samples was the same as described for whitefish (Section 3.2.3) with the exception of the organ sample processing. For carp, the liver and kidney were processed into separate composite samples. Laboratory records detailing field identification, composite identification, date of capture, location coordinates, size, organ weights, stomach contents, sex, and general condition are included in Appendix B (Tables B-7 and B-8). Sample identification records are included in Appendix C. Bivalves were the most common identifiable food item found in carp stomachs. Sex was discernable for 99% of the carp processed, and the majority of these (57.6%) were female. Abnormal tissues were not observed on any of the carp processed.

3.7 WALLEYE

All walleye were collected via hook and line (Figure 3-6) and were typically found in water depths of 15 to 20 ft. As discussed in Section 3.7.1, the minimum size for walleye was reduced from 18 in. to 11 in. due to difficulty in obtaining fish of the original size minimum. Because of the difficulty in capturing fish, the walleye collection effort was performed in both 2009 and 2010. Walleye collected and composited for this study ranged in size from 12 in. to 32 in. and averaged 20.5 in. in total length. A listing of the general locations from which walleye were collected is presented in Table 3-1. Specific collection locations from each of the four sub-areas are illustrated in Appendix A.

Figure 3-6. Walleye Collected with Hook and Line.

3.7.1 Specimens and Collection Period

Walleye collection via hook and line began June 8, 2009 and ended September 8, 2009. During this time period, all walleye from the 100 Area and 300 Area, and sufficient fish to complete two of the five composites from the upriver sub-area, were collected. Walleye collection proved difficult in the Lake Wallula and upriver sub-areas and insufficient fish were collected to prepare further composite samples in 2009. A second walleye collection attempt was performed in June 2010, and all remaining walleye from the upriver and Lake Wallula sub-areas were collected. Fish from the 2009 collection were not used for composite samples prepared in 2010. In all, 106 walleye were collected.

The SAP (DOE/RL-2008-11, Appendix A) initially required a minimum size for walleye of 18 in. However, the minimum size for walleye was lowered two times during field work to reflect the collection realities of the sub-areas. The first size reduction was approved by the Tri-Parties in the summer of 2009 and reduced the minimum size to 15 in. The second size reduction was approved in June 2010 to facilitate capture of fish in the Lake Wallula sub-area, which was a particularly difficult fishing ground. The second change reduced the minimum size for walleye to 11 in.

Walleye populations in the study areas were relatively smaller than the populations of the other nonsturgeon fish for which 100 fish/species were collected (whitefish, carp, suckers, and bass). Washington State game fishing regulations for the Columbia River fishing areas covered in DOE/RL-2008-11 specify no minimum size for walleye retention. Of the daily legal limit of 10 fish, only 5 fish greater than 18 in. and 1 fish greater than 22 in. can be retained. Therefore, lowering the minimum size for walleye allowed the collected fish to be more representative of the size range allowed for capture per state regulations in the study areas. Given that the walleye were captured to support a human-health risk assessment and the population of walleye in the study area was more limited than other nonsturgeon fish, including smaller size fish that were within the legal limit was appropriate and does not affect the applicability of the final data for the risk assessment.

3.7.2 Locations

Most of the walleye in the upriver sub-area were collected between the mouth of Crab Creek and Wanapum Dam in the Priest Rapids Pool (Figures A-22 and A-23). Walleye collections in the 100 Area sub-area were primarily in the vicinity of White Bluffs boat launch and the 100-D Reactor. One walleye was collected in close proximity to the 100-B/C Reactor. Walleye were collected in the 300 Area sub-area near the Hanford townsite and in the general proximity of Taylor Flats (Figure A-29). Walleye collection in the Lake Wallula sub-area was divided into two distinct locations: the immediate vicinity of Clover Island and the Port Kelly area located several miles downstream (Figures A-30 and A-31). Specific locations where walleye were collected for each of the four sub-areas are illustrated in Appendix A.

3.7.3 Composite Summaries

Of the 106 walleye that were collected for this project, 102 were combined into 5 fish composites. Walleye 6, collected from the 100 Area sub-area, was processed as an individual walleye sample (100 Area sample 6) due to an external tumor. Although this fish had been placed in freezer storage immediately after capture, tissues from 100 Area sample 6 were preserved and shipped for interpretation to the USFWS Bozeman Fish Health Center.

The processing of walleye tissues into analytical samples was the same as that described for whitefish (Section 3.2.3). Laboratory records detailing field identification and composite numbers, date of capture, location coordinates, size, organ weights, stomach contents, sex, and general condition are included in Appendix B (Tables B-9 and B-10). Sample identification records are included in Appendix C. For walleye specimens, pale liver spotting and worms in the body cavity were occasionally observed and were the only other abnormalities noted. Fish were most commonly found in the stomachs of walleye, followed by invertebrates and bivalves, respectively.

Results from the histopathology analysis of Walleye 6 indicated that the skin tumor contained fat cells, lymphocytes (appeared to be a homogeneous population), and fluid. It was determined that this was most likely a dermal sarcoma, a lymphosarcoma that causes dermal tumors or plagues in adult walleye that typically is resolved in the months after spawning. Several reports found in the literature suggest a retrovirus as the cause of the tumors.

4.0 GENERAL CONCLUSIONS AND DISCUSSION

General discussions of the overall sampling campaign are provided in the following sections.

4.1 ELECTROFISHING FOR WHITEFISH, SUCKER, AND CARP

Electrofishing is a nonselective sampling method that affects all fish caught within the electrical field to water depths of approximately 15 ft. However, although this method is nonselective, it was applied in specific habitat zones during select time periods to minimize the impact on nontarget species, especially salmonids.

Electrofishing for mountain whitefish after dark early in the winter of 2009 compared to during daylight hours proved to be the superior method of capture. Whitefish move to shallower areas of the river after dark during the winter, making them far more susceptible to capture.

During collection of whitefish, areas to be electrofished after dark were surveyed during daylight hours for the presence of navigation hazards, fall Chinook redds, and adult steelhead. Areas where fall Chinook salmon (*Oncorhynchus tshawytscha*) are known to spawn were avoided during electrofishing operations to minimize the potential impact on pre-emergent juvenile salmon. Areas where steelhead fisheries are known to occur (i.e., Ringold Hatchery) were avoided entirely to minimize the likelihood of incidental take of adult steelhead (*Oncorhynchus mykiss)*. Adult steelhead were observed twice during nonshocking operations.

Electrofishing during the fall of 2009 was conducted to target primarily on suckers and carp. The work was originally planned to begin in July or August but in accordance with permit restrictions and NOAA Fisheries Electrofishing Guidelines, electrofishing was delayed until water temperatures fell below 18 °C (64 °F), which occurred on September 28 in the Hanford Slough. Implementation of fall electrofishing was further complicated by the fact that the time period during which water temperatures cooled to below 18 °C corresponded to the peak of the adult salmonid migration within the project area, including that of natural origin summer-run steelhead that are listed under the ESA. The likelihood of incidental take of ESA-listed steelhead was further exacerbated by the fact that the 2009 return of summer-run steelhead to the Columbia Basin was the largest on record. Precautions were taken to minimize the possibility of encountering adult steelhead or other salmonids during electrofishing operations. The precautions included the following:

- The sample transects were visually surveyed for Chinook redds or adult salmonids prior to electrofishing
- Electrofishing directly within or along the river thalweg (migratory corridor) was avoided to the extent possible
- Popular steelhead and Chinook public fishing areas where salmonid sport fisheries were known to be occurring (i.e., Ringold) were avoided
- Areas of known fall Chinook spawning were avoided.

Suckers are cold water species indigenous to the Columbia River and are generally abundant in shallow water habitat year round where they are highly susceptible to capture via electrofishing. Suckers are the dominant fish taxa inhabiting the Hanford Reach, and the collection goal of 100 fish for all four sub-areas was easily reached.

A number of obstacles were encountered during the carp collection efforts. In contrast to suckers, common carp are a nonindigenous warm water species, which inhabit heavily vegetated warm shallow backwater areas during the summer months, but migrate to deeper water zones as the shallows cool in the fall. Initially, carp were found to be fairly abundant in slough-type habitat. However, as the season progressed and the water continued to cool, carp abandoned the backwater shallows and relocated in heavily vegetated cover along the river thalweg often to areas immediately adjacent to the migration corridor for anadromous salmonids. Eventually, as the winter cold water period continued to set in, carp became progressively less available to collection via electrofishing as the fish moved to over-wintering depths beyond the effective range of the electro-shocker. No carp were collected after December 12, 2009.

During the late fall, carp were found to be present only in the heaviest vegetation cover available. Operation of the inboard/outboard jet=propelled electrofisher boat in such cover was accomplished but presented special problems associated with weeds clogging the jet intake system. Control measures implemented to remedy this included the following:

- Operating the boat on the outside edge of the weeds to avoid sucking weeds into the intake
- Shutting down the main propulsion system when the intake was near heavy weed cover and poling through the weeds to capture stunned fish
- Tapping lightly on the electrofisher foot pedal to draw stunned fish from heavy weed cover close enough to the anode to be netted
- Locating heavy weed beds that were submerged deep enough such that the electrofishing boat could be operated over them without drawing weeds into the intake. This was found to be the most successful carp sampling technique in the fall, although such habitat was not always readily available and was only temporarily inhabited by carp prior to their migrating to deep water areas to over winter.

Because of the difficulties in obtaining the final carp specimens, the fish to complete the fifth composite sample from the upriver sub-area were not collected. This was discussed with the Tri-Parties in December 2009 and it was agreed that four composite samples of carp from the upriver sub-area was acceptable.

4.2 HOOK-AND-LINE COLLECTION FOR WALLEYE AND BASS

A total of 50 walleye (10 samples) were collected from the 300 Area and 100 Area sub-areas via hook and line during 2009. Even though the minimum size had been reduced from 18- to 15 in., walleye capture success was poor in the upriver and Lake Wallula sub-areas from June through September 2009. Walleye fishing resumed in June 2010 in the upriver and Lake Wallula sub-areas. Collection success was higher in the upriver sub-area but continued to be difficult in the Lake Wallula sub-area. A population of smaller fish was discovered in the vicinity of Clover

Island in mid-June. Consequently, the minimum retention size for the walleye collection was reduced from 15-in to 11-in to allow the collection of these fish. The WDFW sportfishing regulations list no minimum size limit for walleye in the Lake Wallula sub-area. Therefore, these smaller fish (11 to 15 in.) are available for harvest and consumption by the general public.

Collection of required number of bass from the four sub-areas was conducted between June 29 and July 21, 2009. The hook and line method was an effective and efficient means for collection of these fish.

4.3 NONSTURGEON SAMPLE PROCESSING

The prescribed number of whitefish, bass, sucker, and walleye samples were collected and processed for laboratory analysis as outlined in the SAP (DOE/RL-2008-11, Appendix A). As discussed, only 19 of the 20 carp samples were processed as the fish for one composite were not obtained.

As described in the SAP, samples of fillet, carcass, and organs (liver and kidney) were prepared by combining tissues from five individual fish. In the case of carp only, the liver and kidney tissues were processed as separate samples. Homogenization and preparation of the tissues for shipment to offsite laboratories was performed in accordance with the availability of tissues. While there was sufficient mass to prepare samples to meet the analytes prescribed in the SAP for fillet and carcass tissues, there was not enough organ mass available. Analytical priority was given to radionuclides and metals with PCB congeners and pesticides to be analyzed as mass allowed. Because of the mass required for PCB congener analysis, no organ samples underwent the analysis. Logistical difficulties in trans-shipping organ tissues from the laboratory performing nondestructive radiological analysis to a separate laboratory for pesticide analysis led to exceedances of hold-time. Because of these problems, not all organ samples underwent pesticide analysis. Inorganic arsenic was not able to be performed on organ samples due to limited mass.

4.4 STURGEON COLLECTION AND SAMPLE PROCESSING

The project sample total was increased from 20 to 30 sturgeon as an outcome of a February 2009 meeting between the Tri-Parties, stakeholders, and sturgeon subject matter experts. Additional sample and data collection activities for the sturgeon work were identified during this meeting as described in Section 2.2.

A total of 166 sturgeon were captured during the course of field work (July 16 to September 15, 2009). Of the sturgeon in the 100 Area and 300 Area sub-areas, the percentage of fish captured that were of legal size was significantly lower than in the upriver and Lake Wallula sub-areas (Table 3-2). Of the nonlegal-size fish total, the majority (124 fish) were under the 43- to 53-in. fork length size criteria rather than over the size range (11 fish). Sturgeon were most scarce in the upriver sub-area relative to the other three sub-areas.

The additional analytes and samples added as a result of the February 2009 meeting were processed and sent to contract laboratories for analysis. As with the nonsturgeon fish, not all analyses could be conducted on organ samples due to mass limitations. Samples of blood from the last 14 sturgeon were collected and stored.

A method for stomach content analysis was developed and reviewed by sturgeon subject matter experts. The stomach content analyses were performed after other sample processing was complete. The various stomach contents for 29 specimens were reported and quantified. The percentage of sediment relative to other stomach contents was also determined and reported.

The project was able to support nonrelated, current USGS research by the supplying various sample tissues from 30 sturgeon. Other information and samples requested by the WDFW were obtained or collected and transmitted to the agency for further analysis.

4.5 COMPLIANCE WITH PERMIT REQUIREMENTS

As previously described, special precautions were implemented to minimize the likelihood of incidental capture of salmonids during fish collection activities. However, in spite of these precautions four juvenile and seven adult salmonids were captured and released, six during electrofishing operations and five via hook-and-line sampling for walleye. No salmonids were captured during long-lining for sturgeon or hook and line capture of bass. These occurrences constituted the only reportable take incurred by the program. Notifications were made to NOAA staff as required by the permit in place for these activities.

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APPENDIX A

FISH COLLECTION LOCATION MAPS

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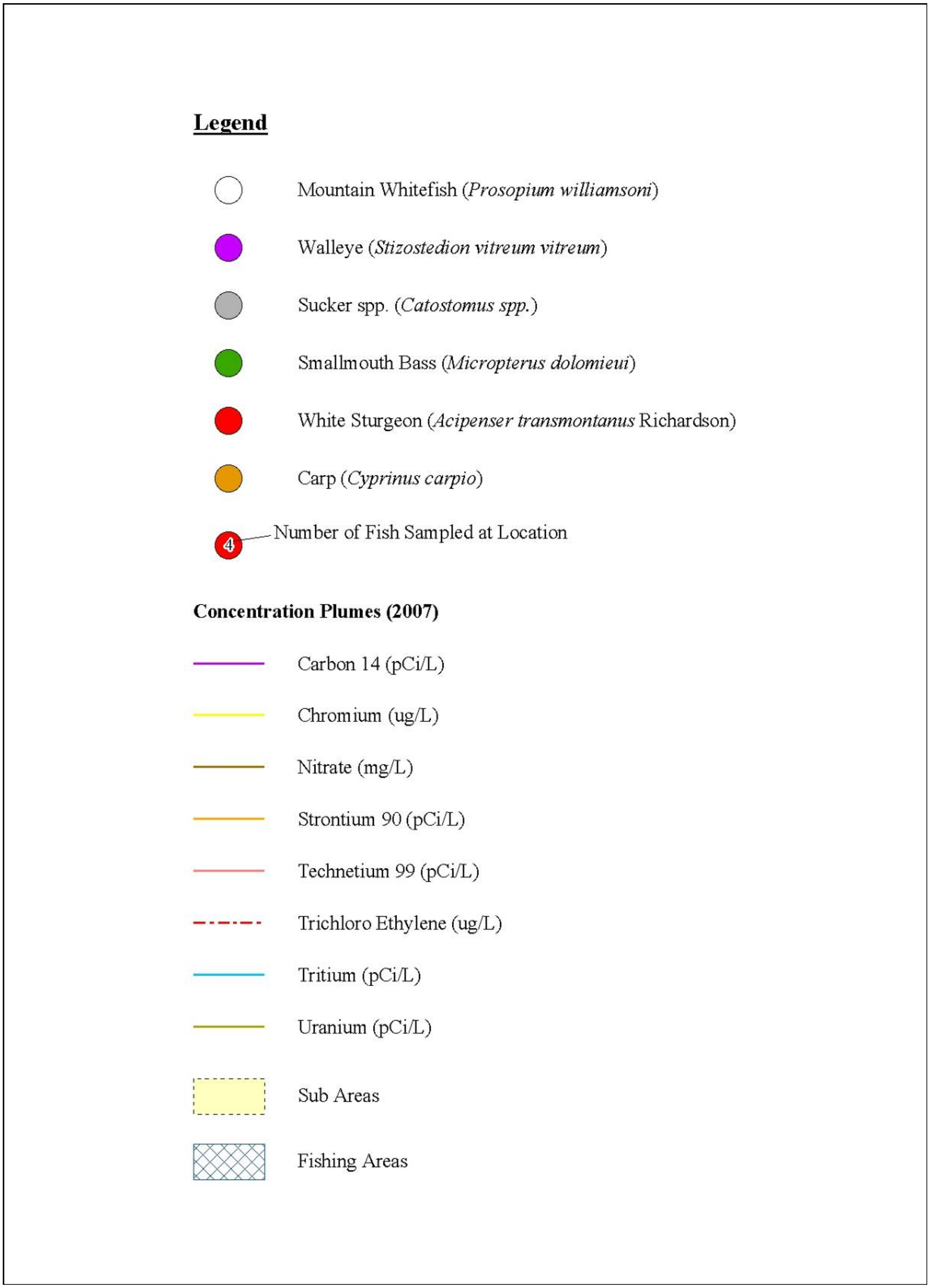


Figure A-2. Fish Capture General Location Map.

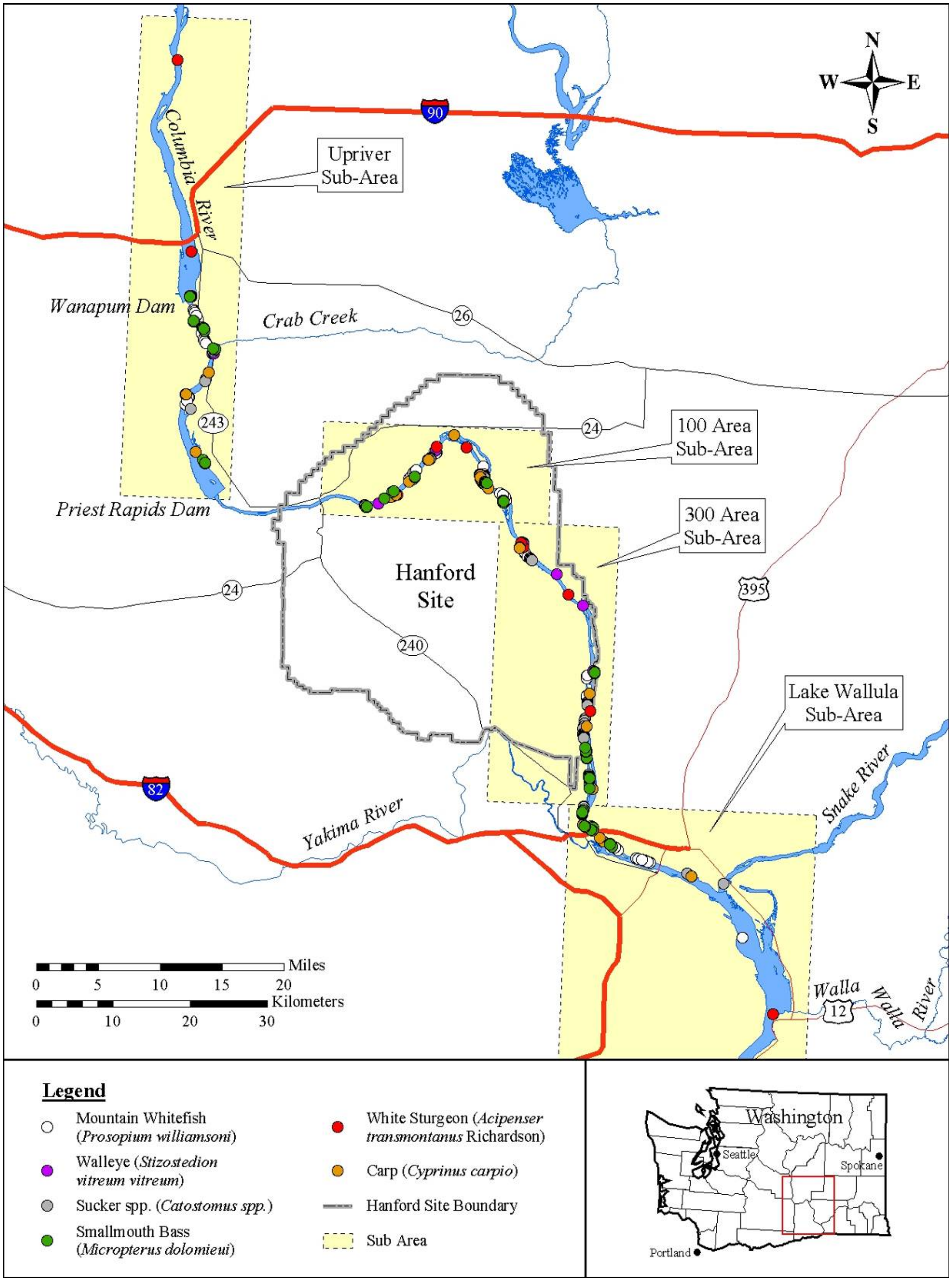
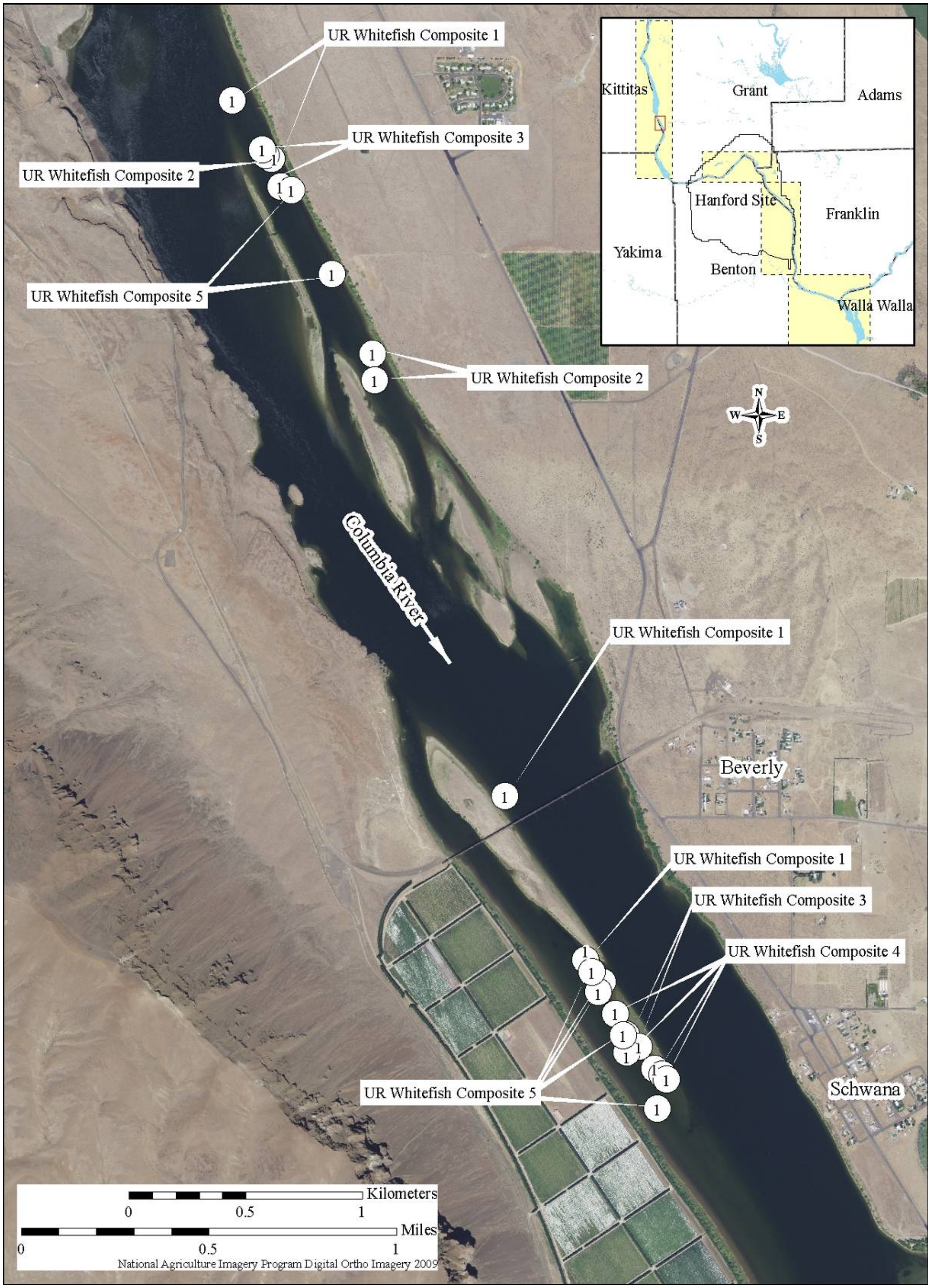


Figure A-3. Whitefish Capture Location Maps (Sheet 1 of 9).



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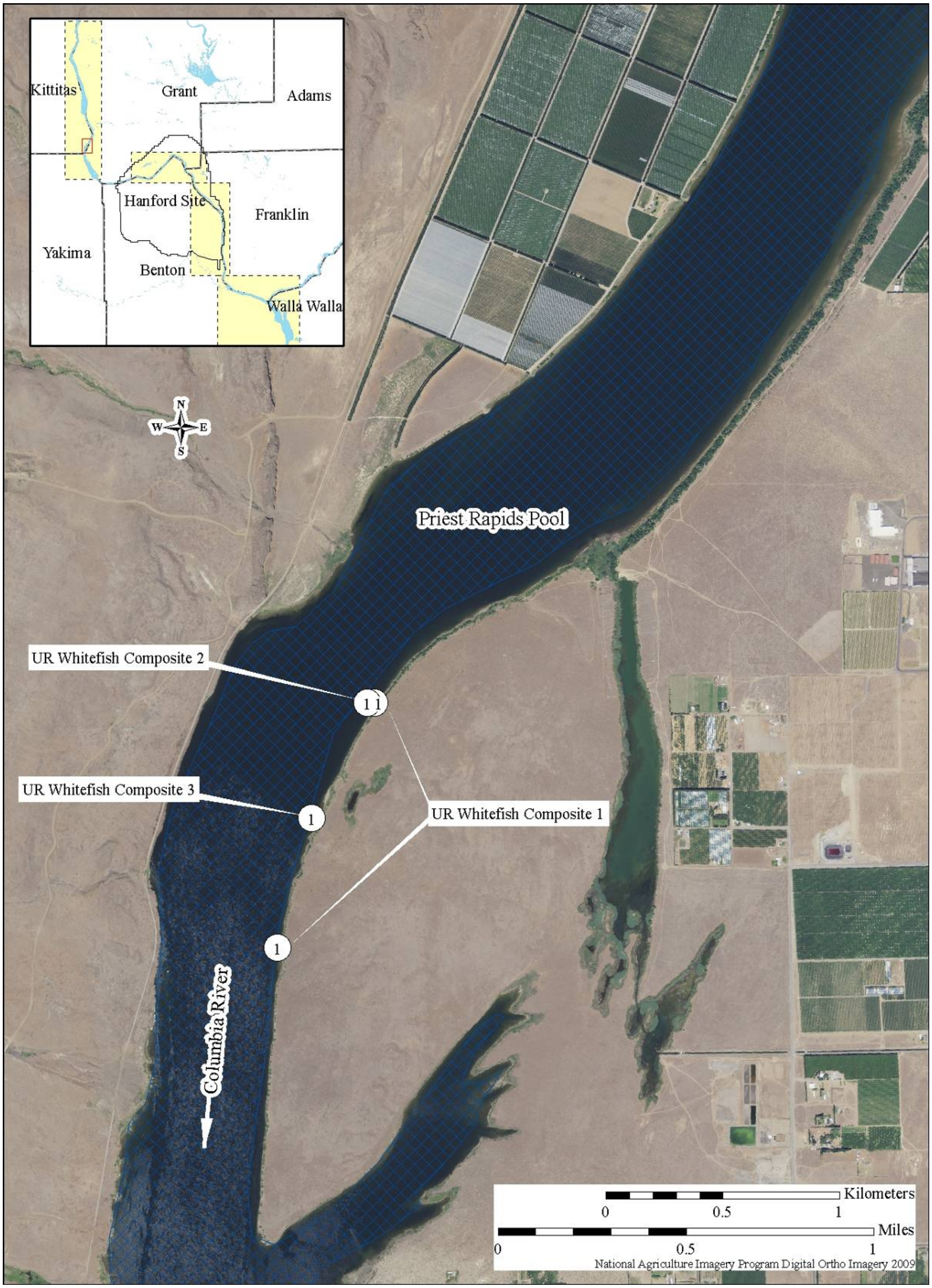
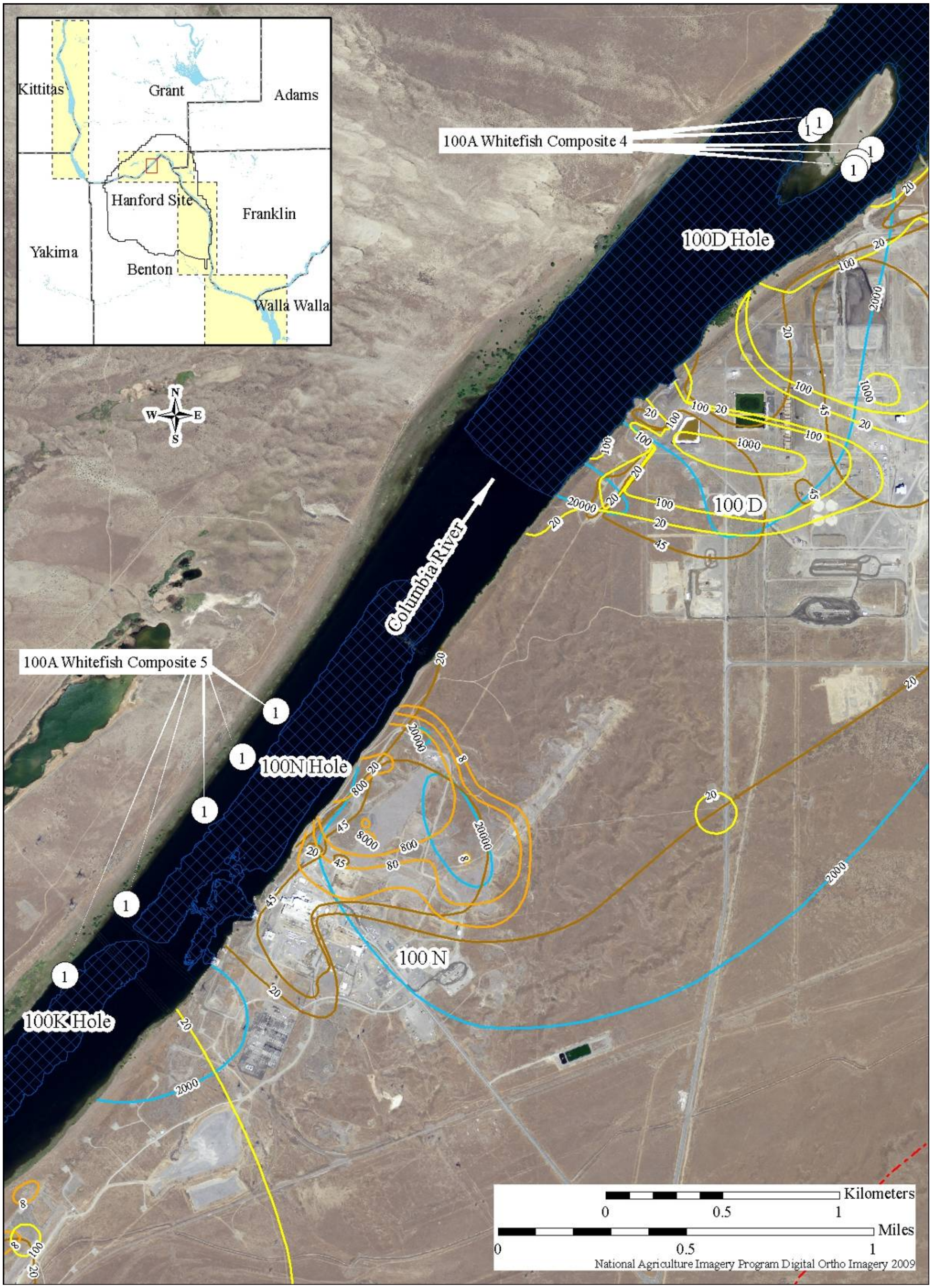


Figure A-5. Whitefish Capture Location Maps (Sheet 3 of 9).



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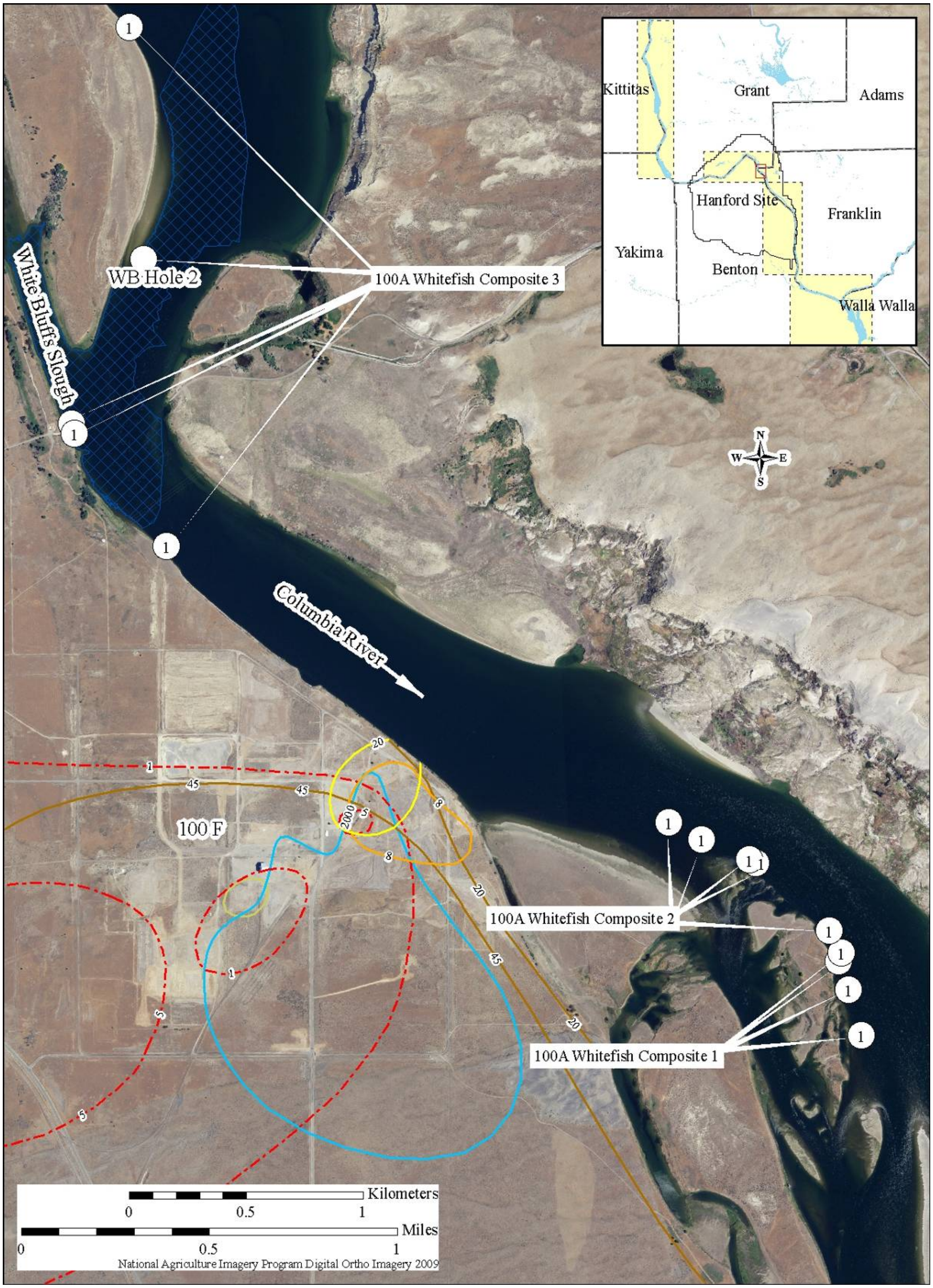


Figure A-7. Whitefish Capture Location Maps (Sheet 5 of 9).

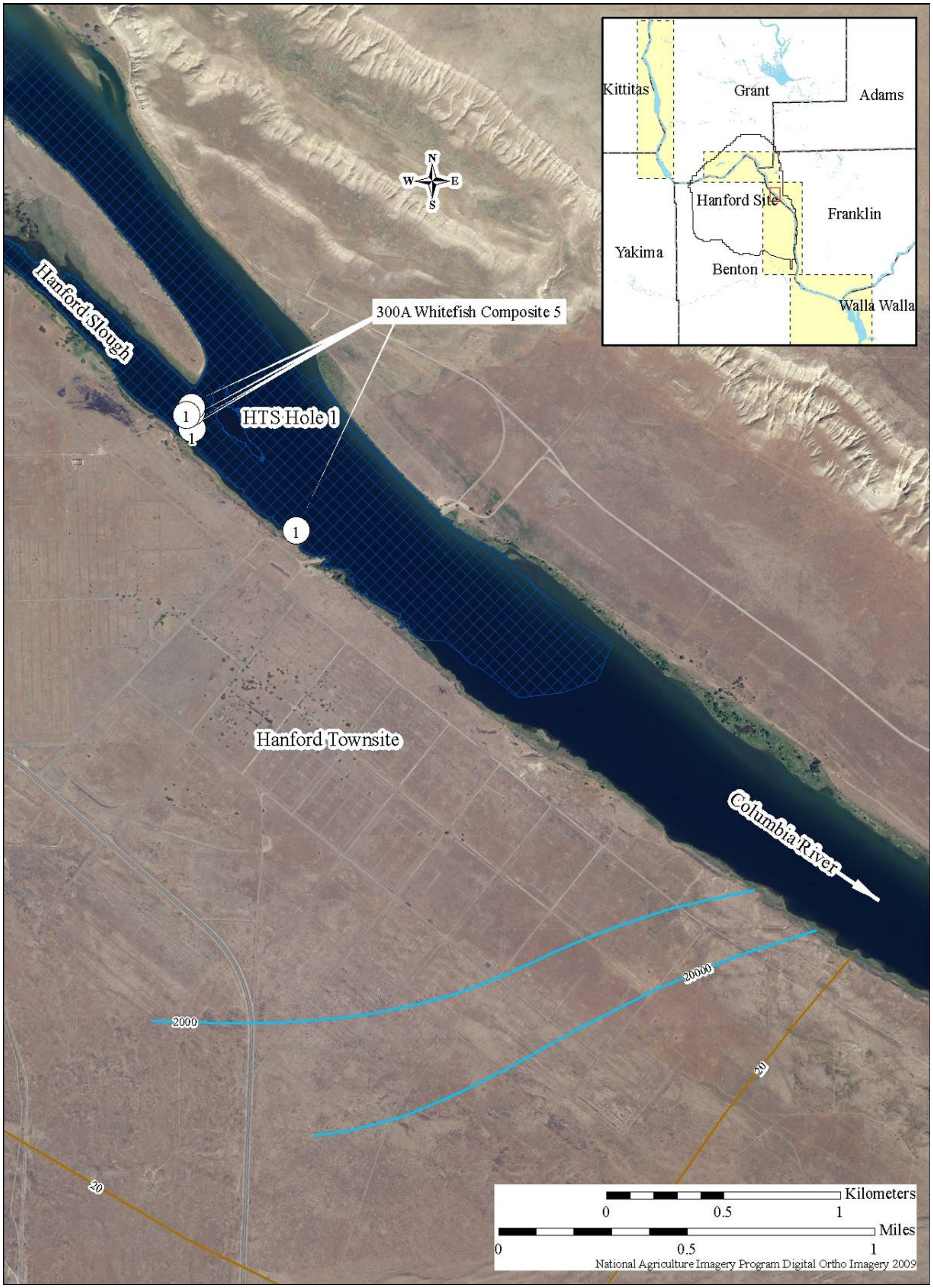
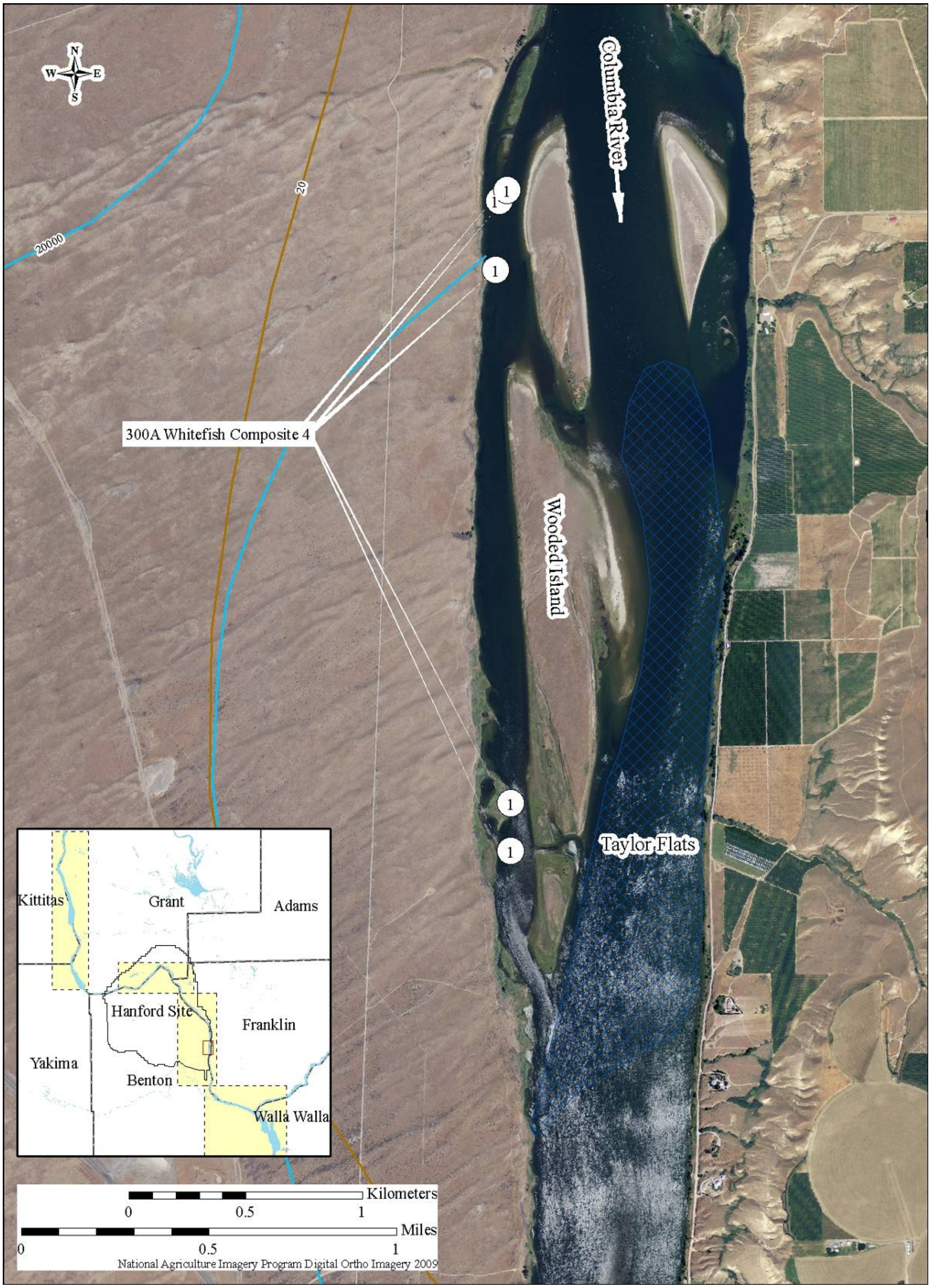


Figure A-8. Whitefish Capture Location Maps (Sheet 6 of 9).



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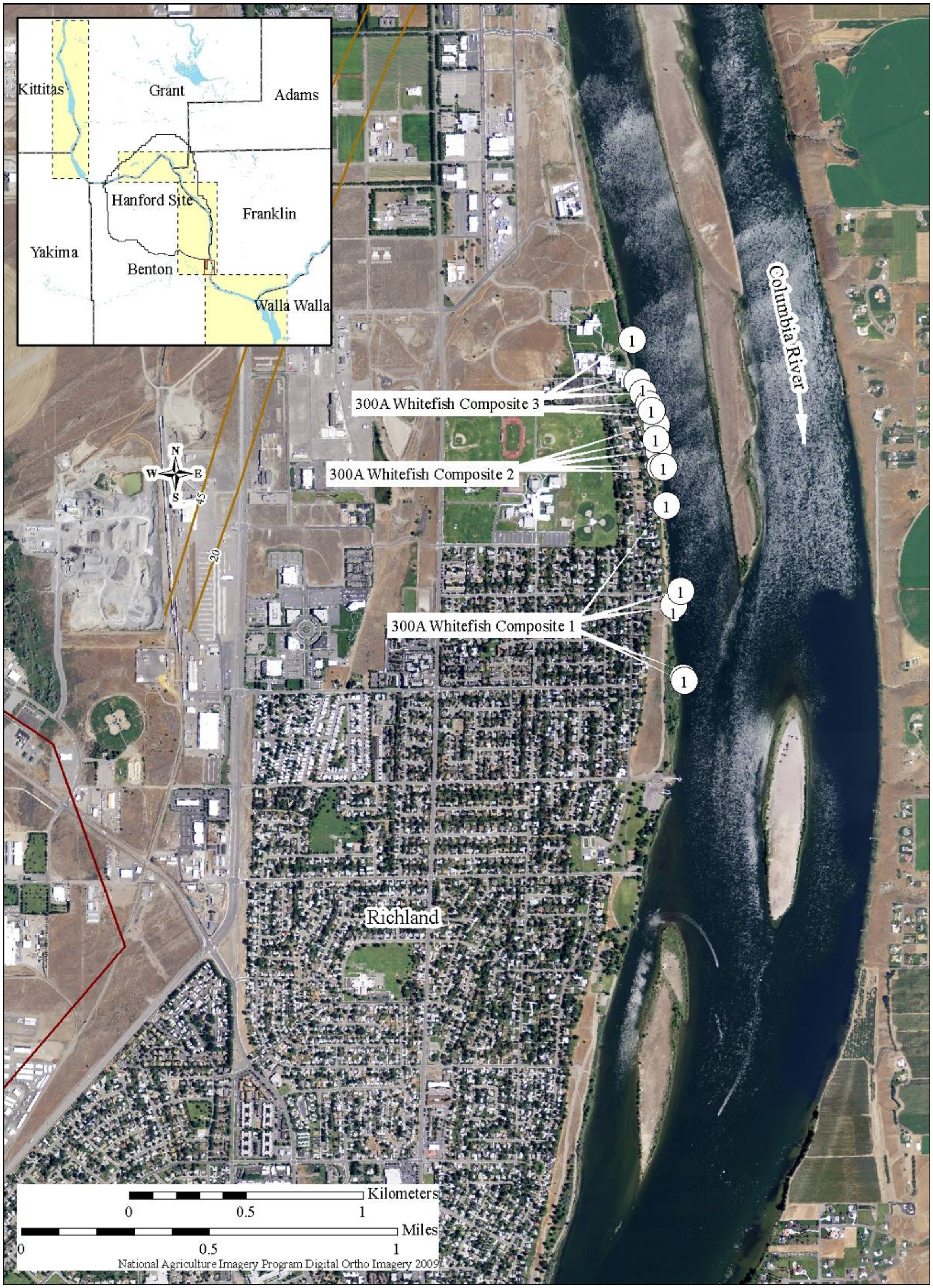

Figure A-10. Whitefish Capture Location Maps (Sheet 8 of 9).

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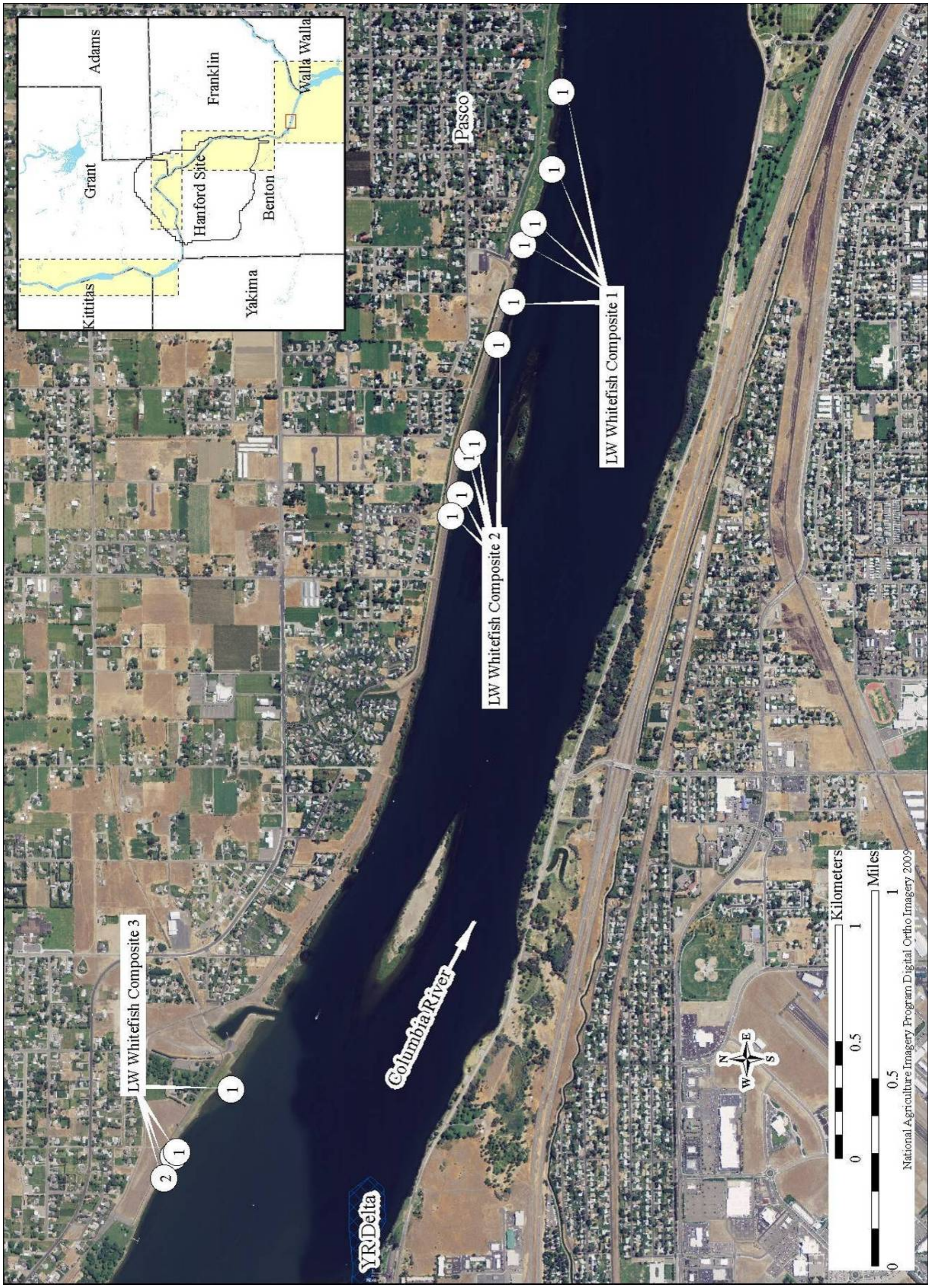

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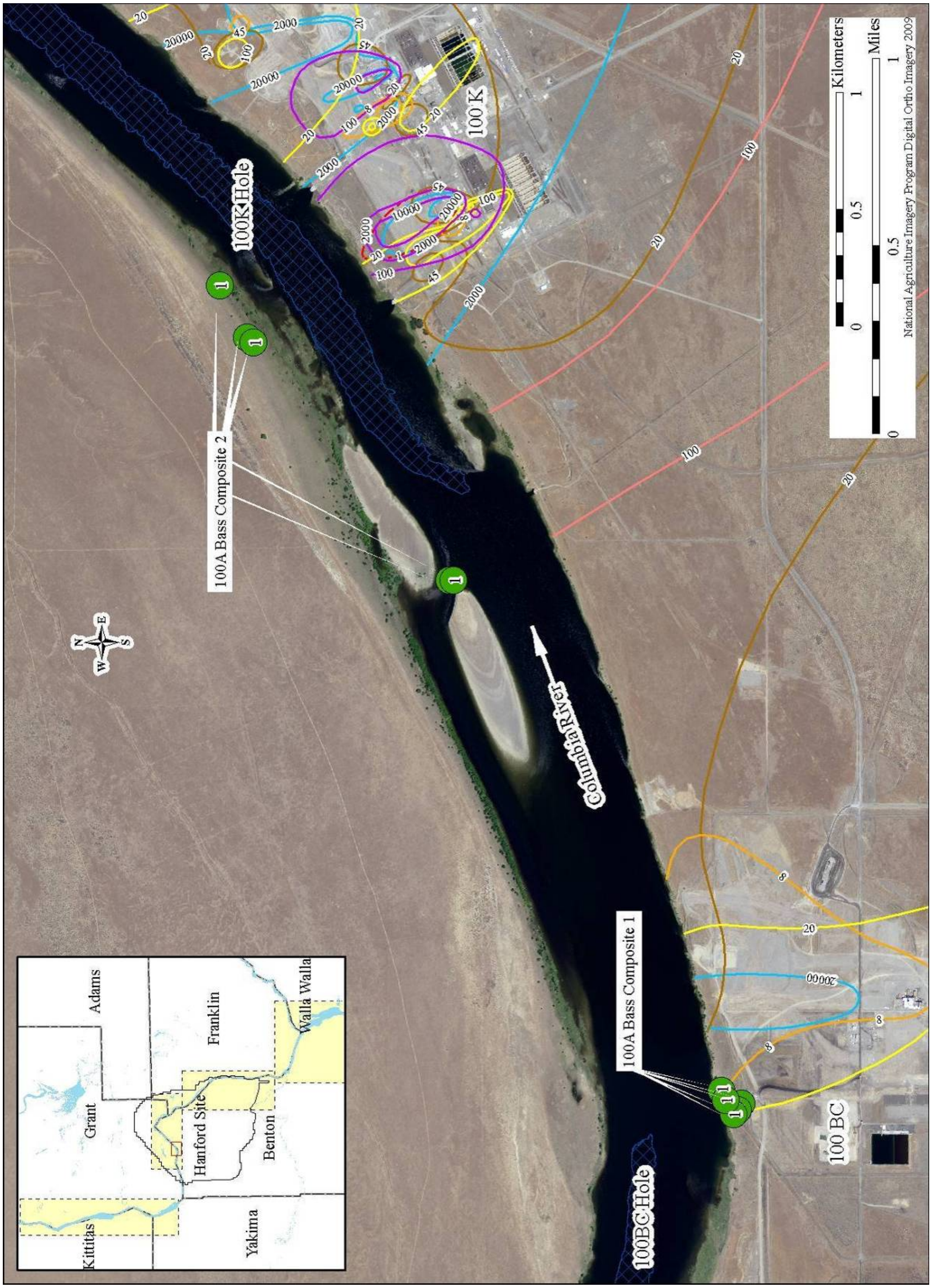

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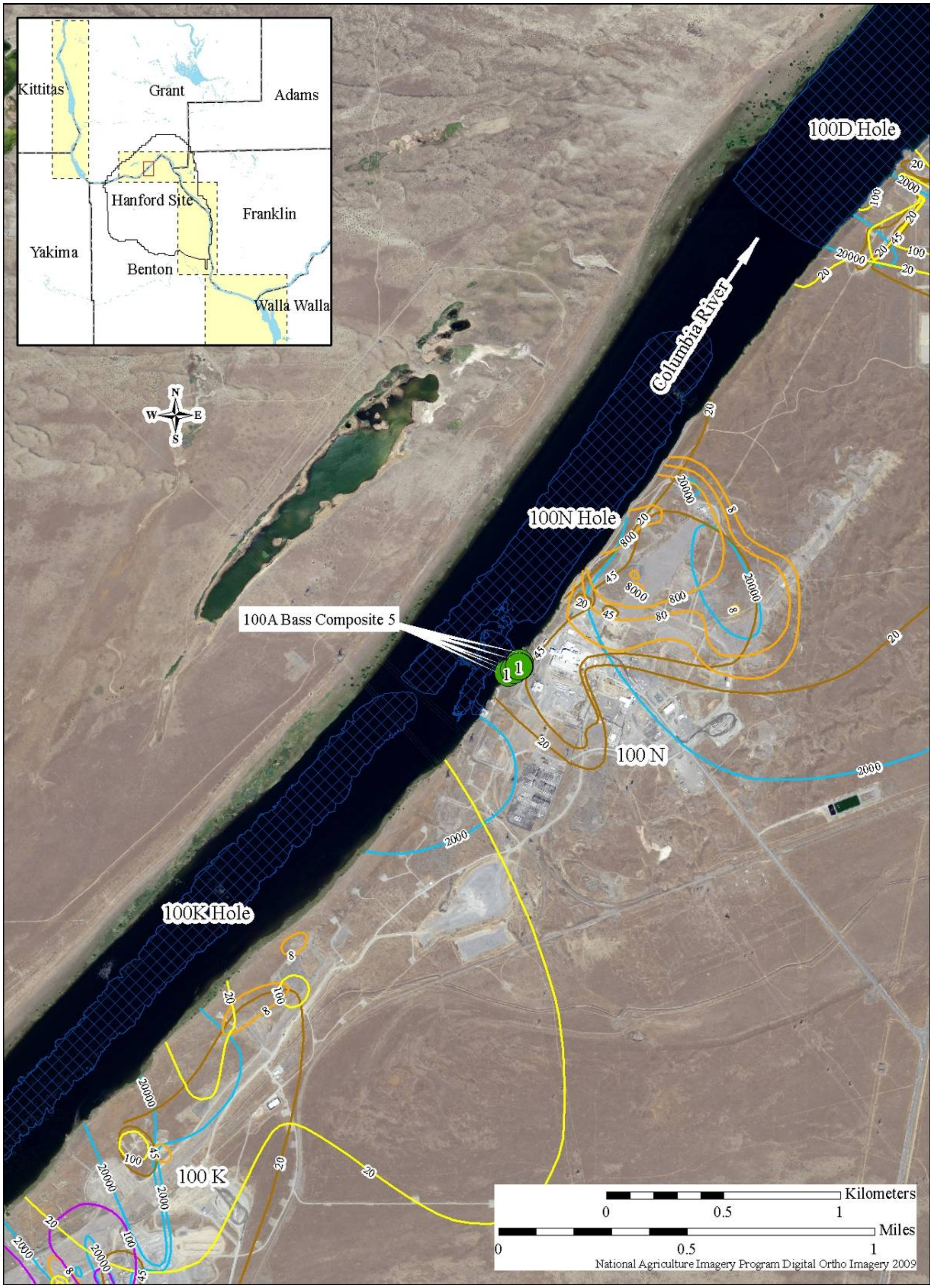

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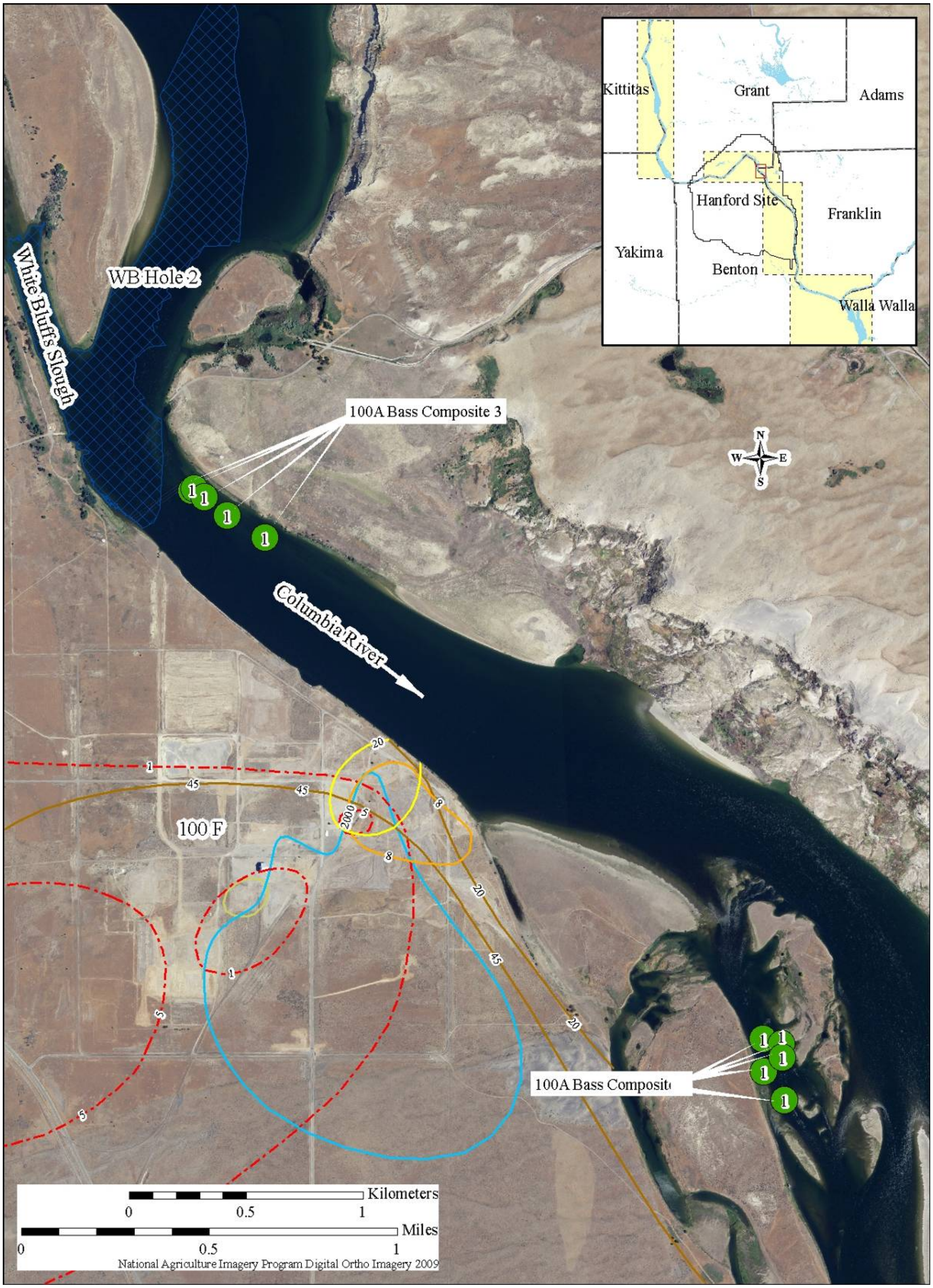

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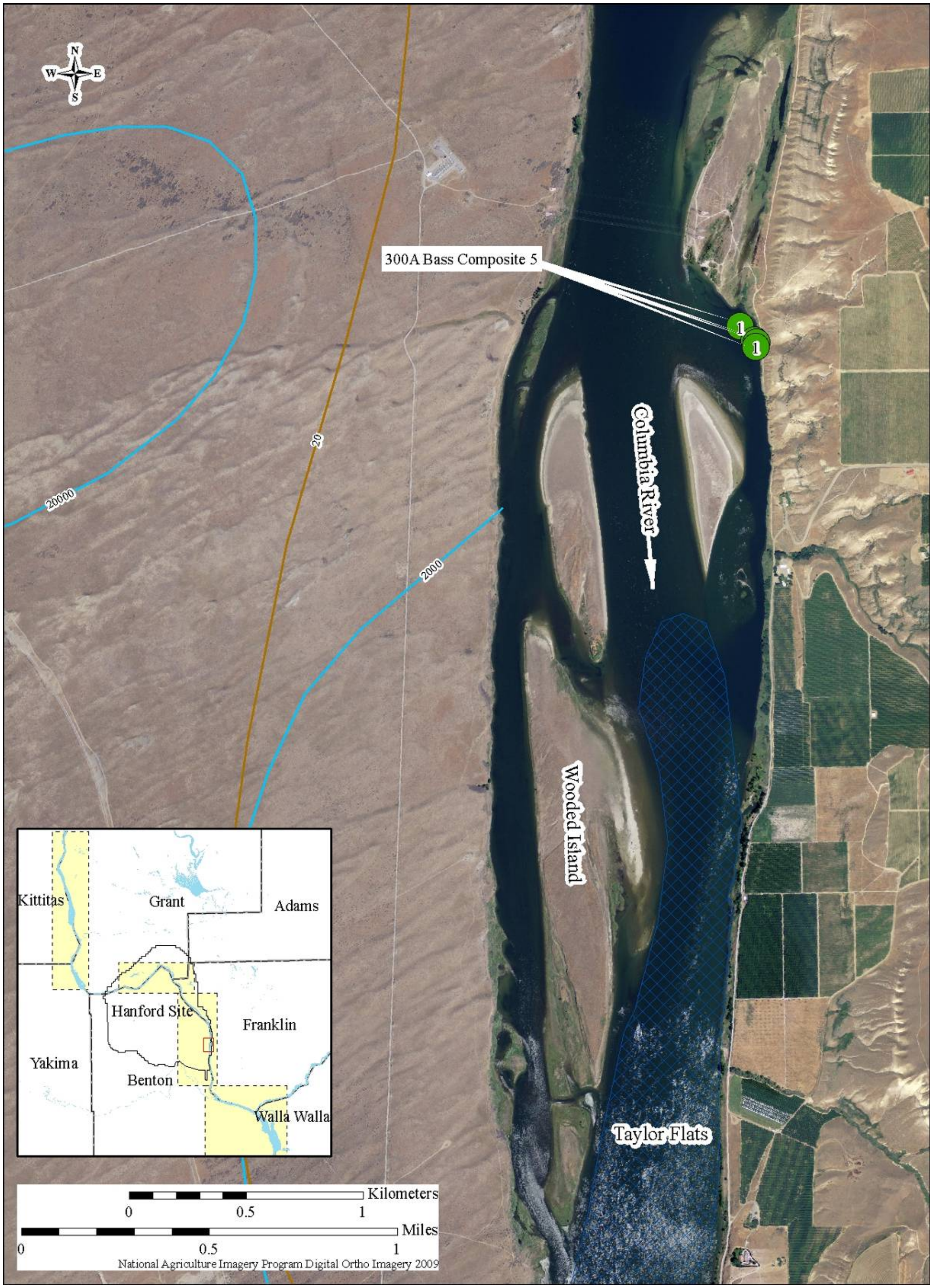

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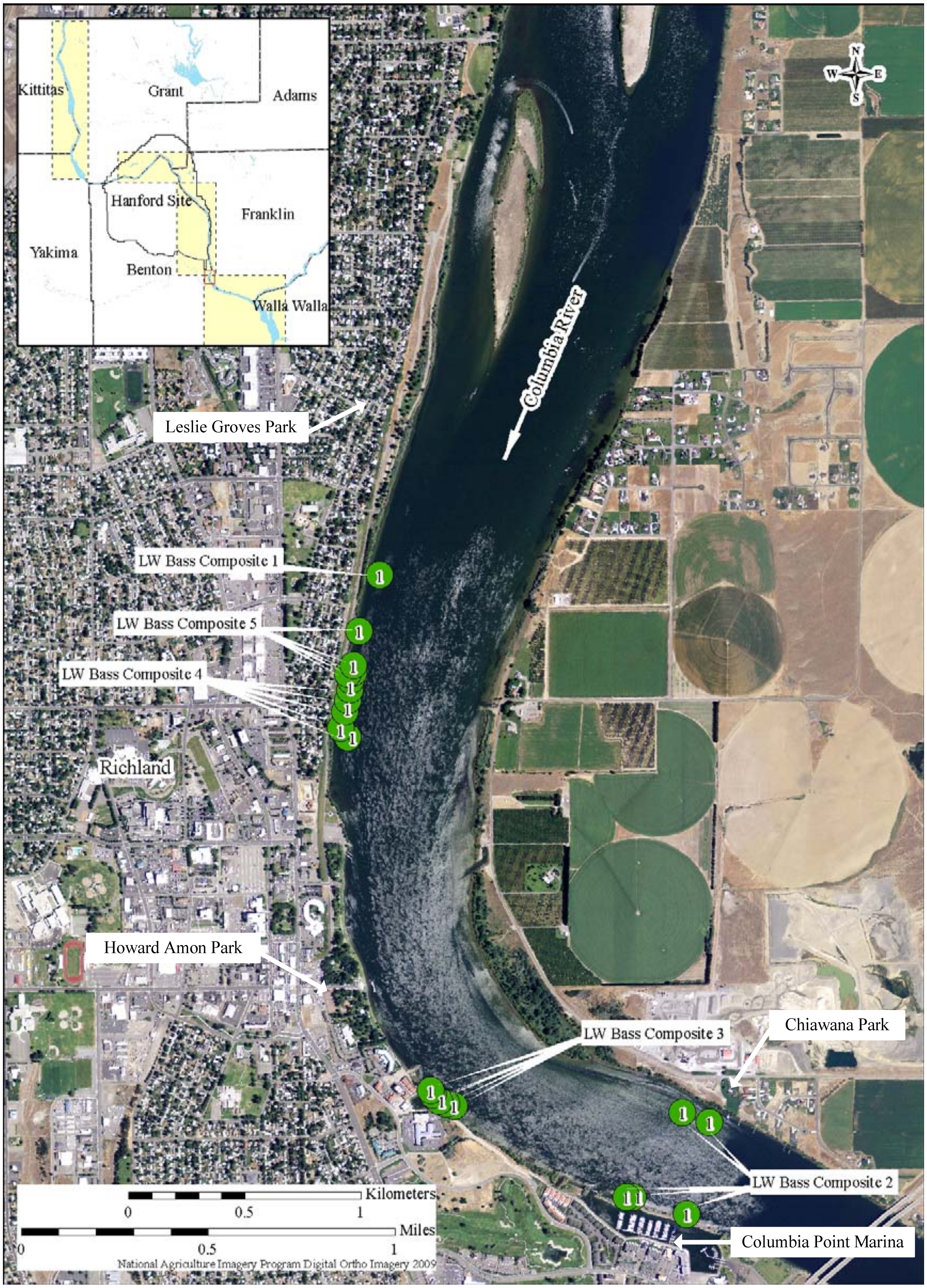

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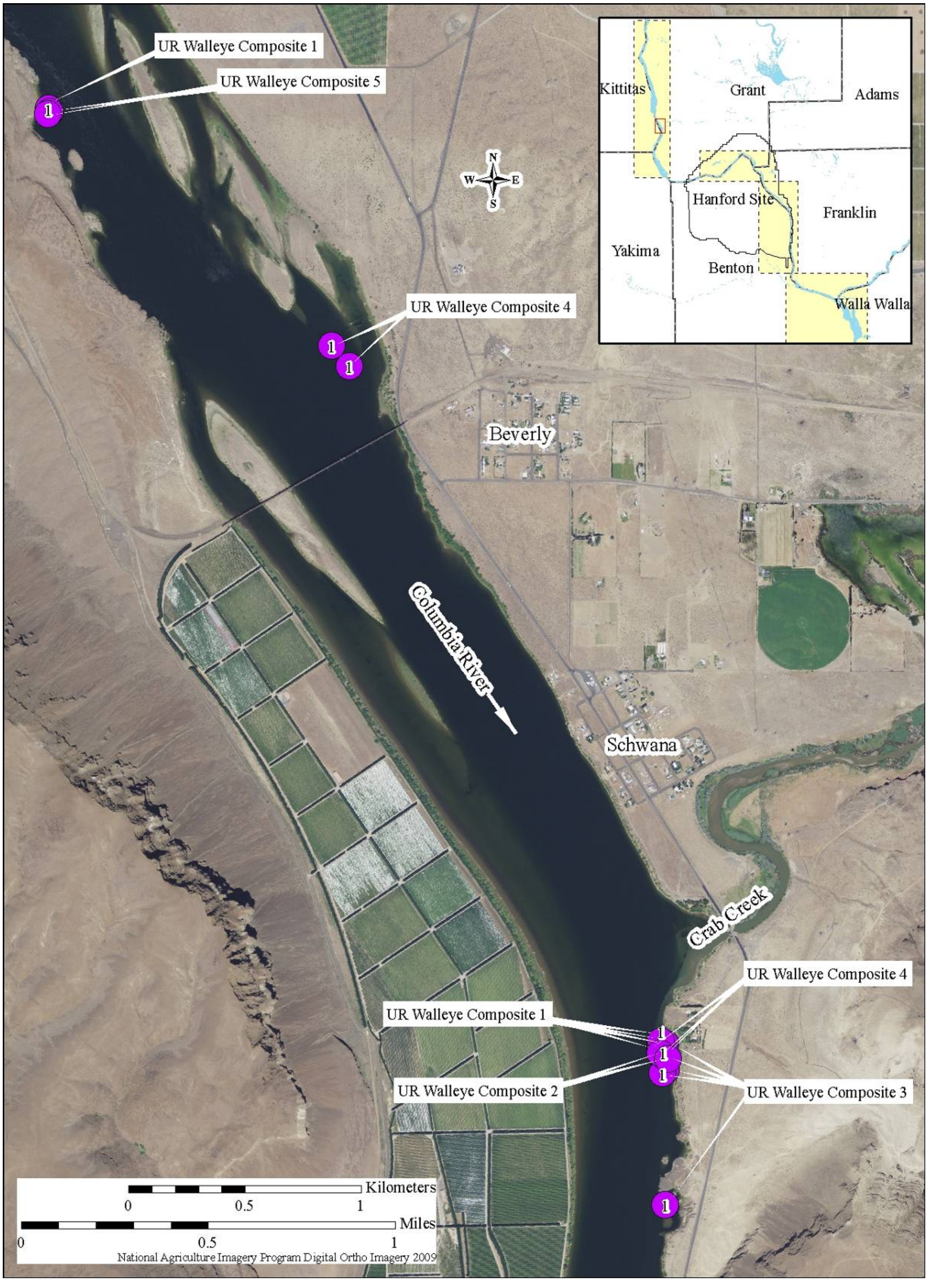

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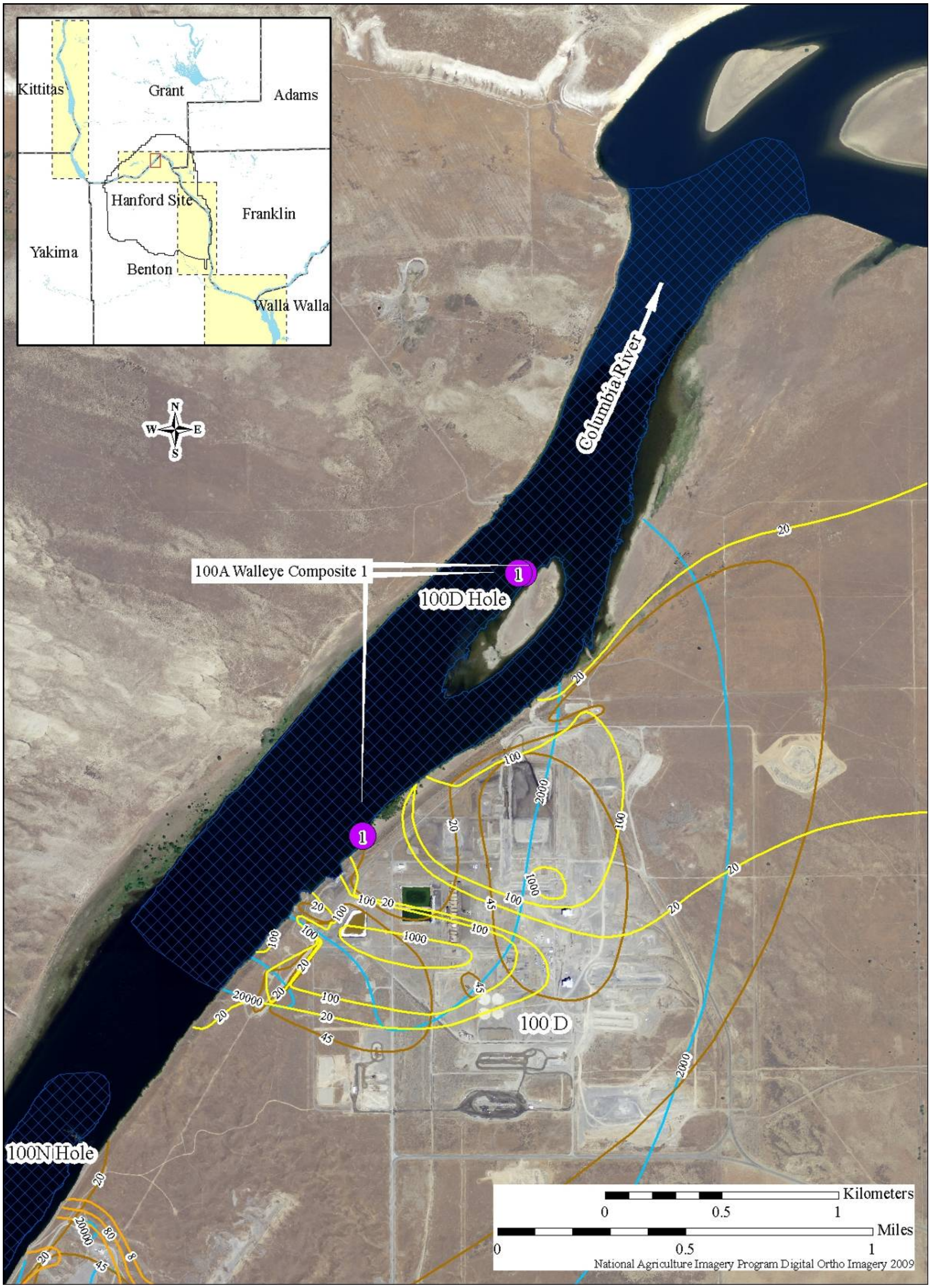

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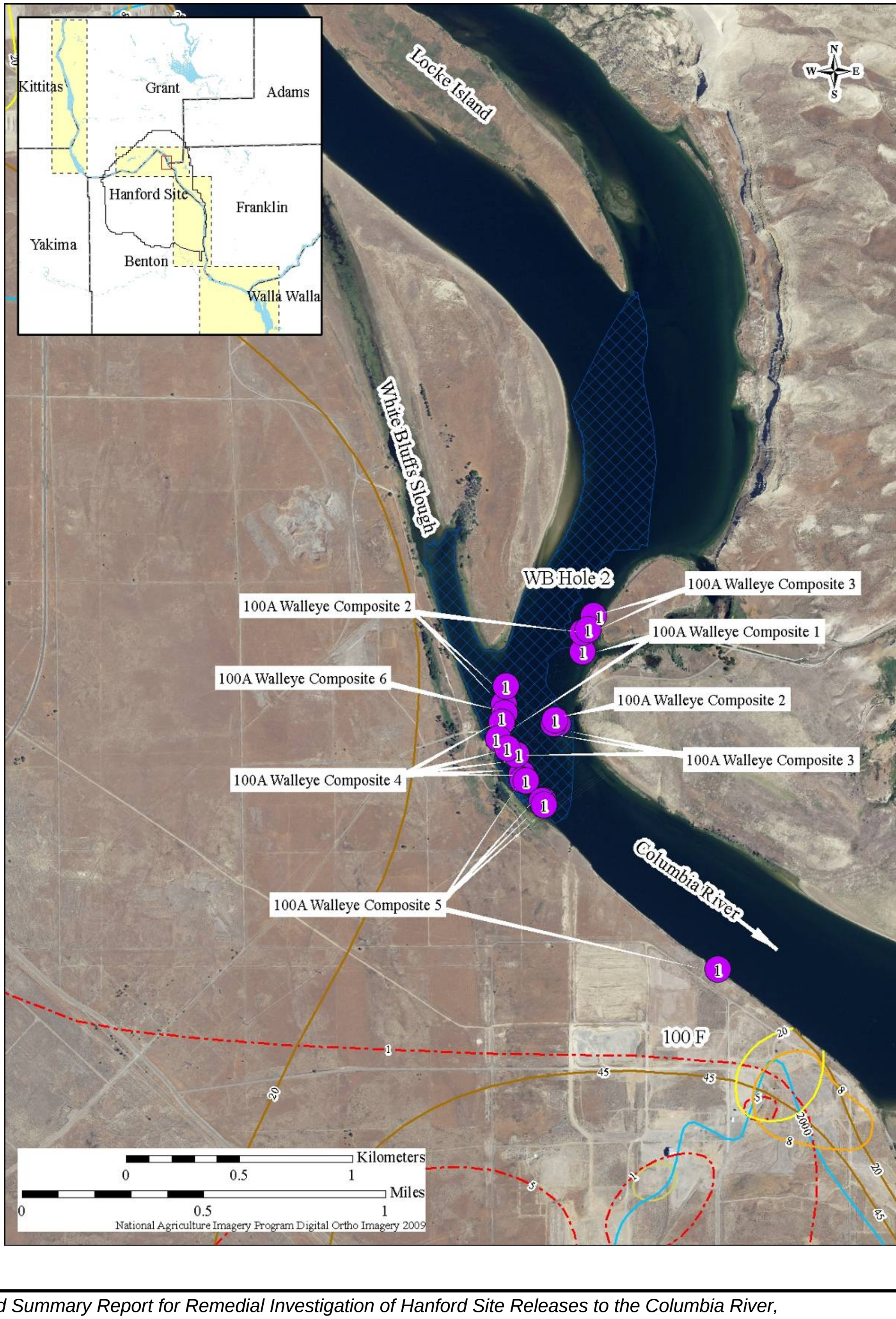

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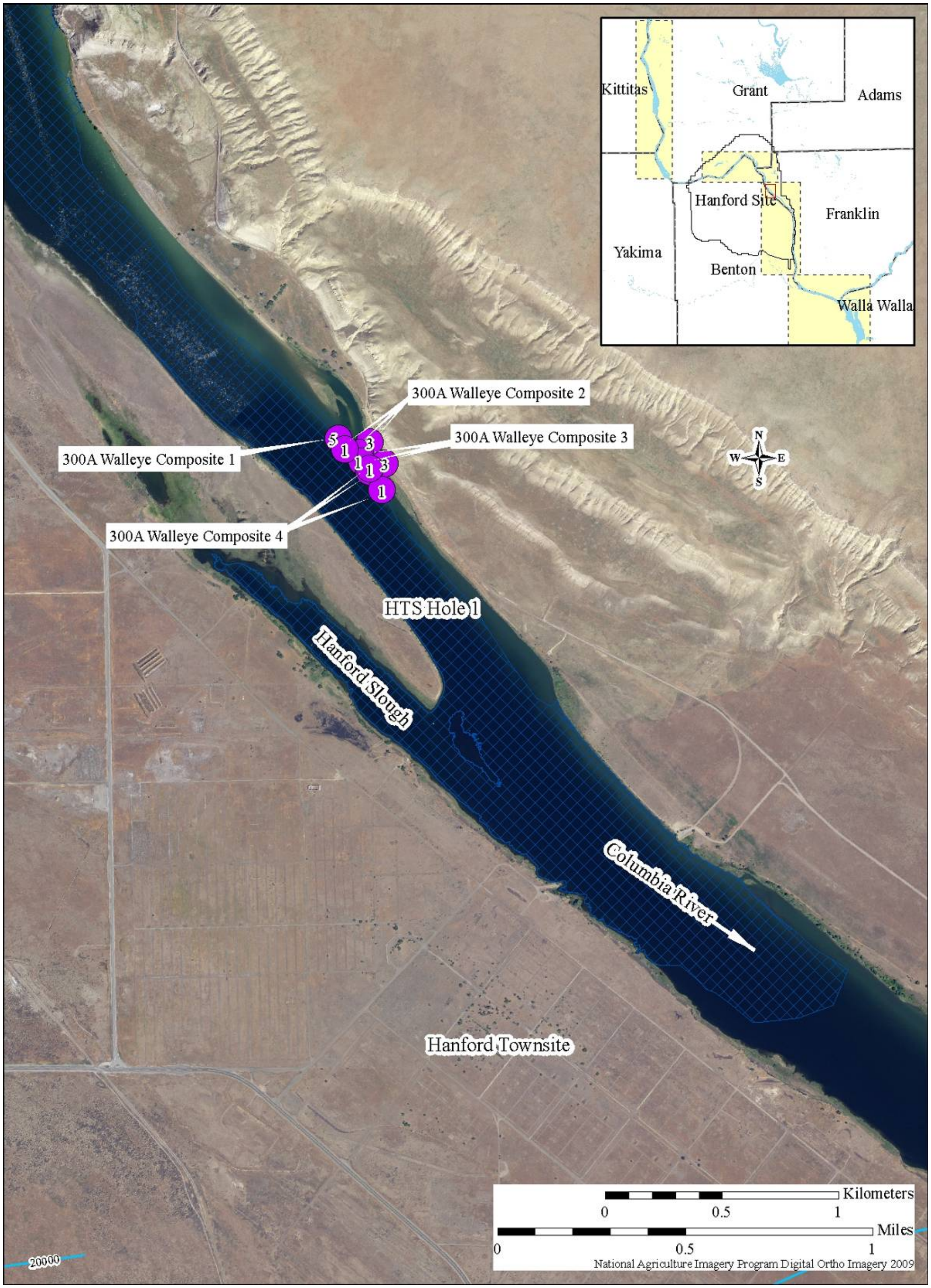

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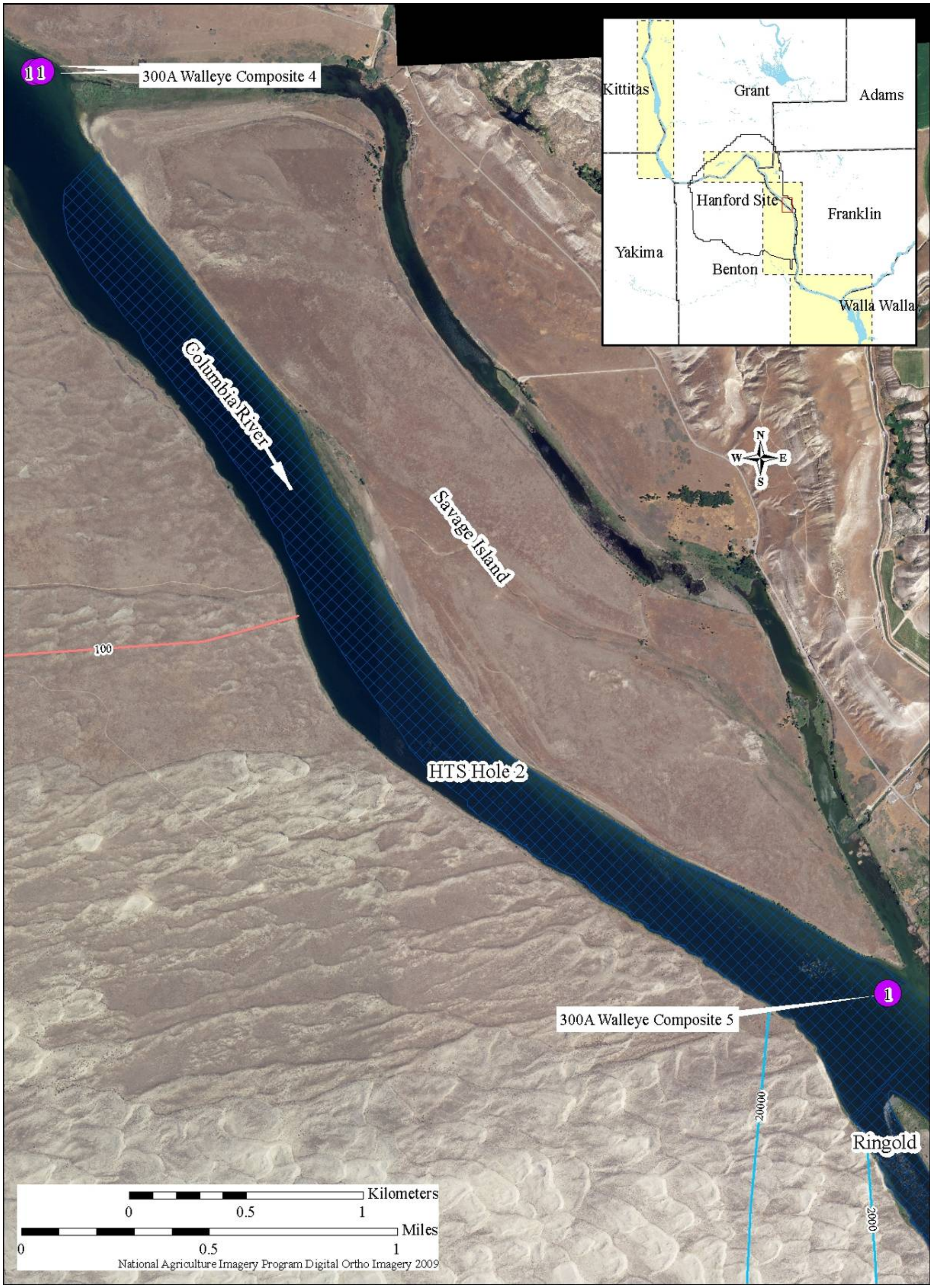

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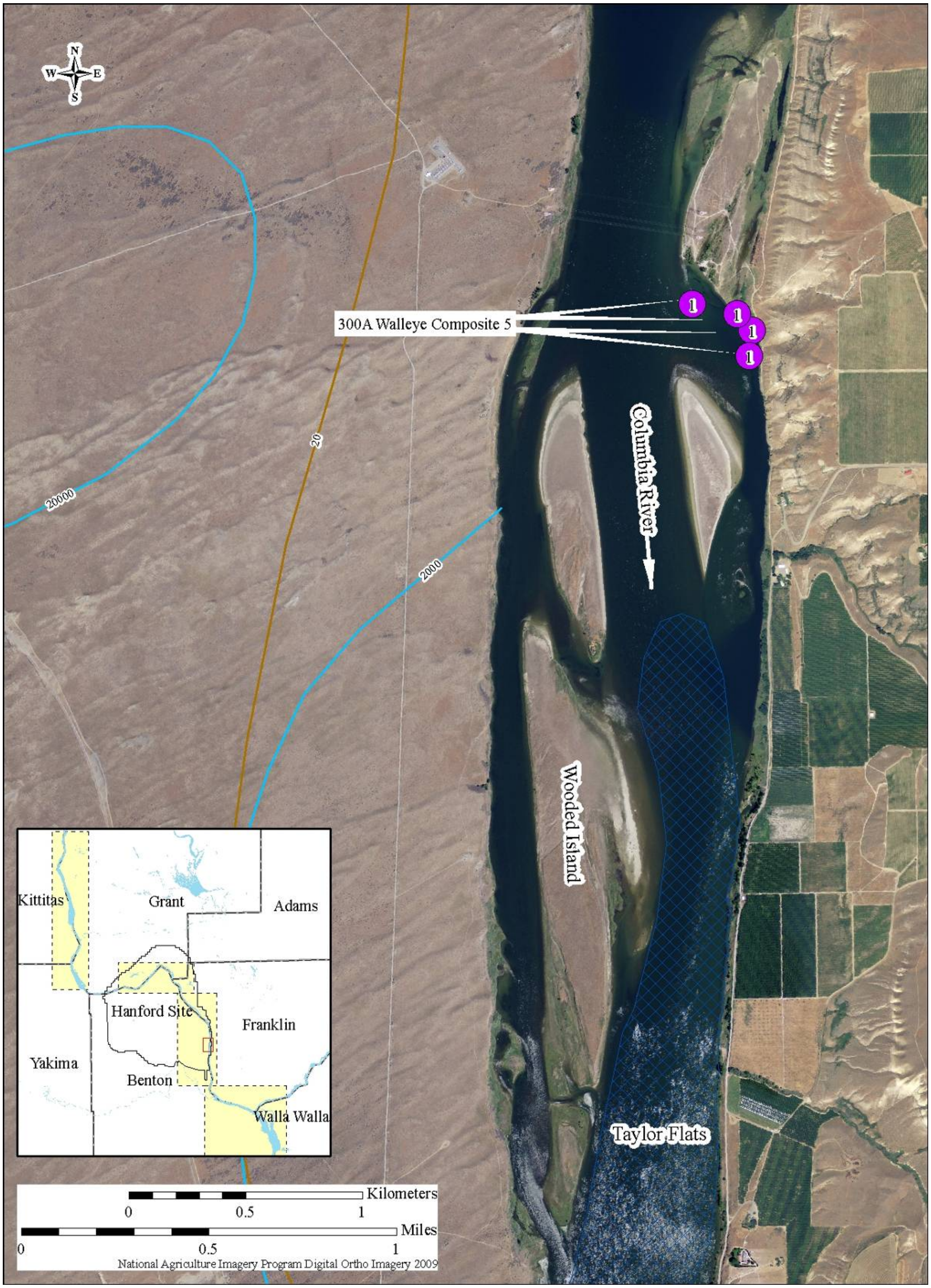

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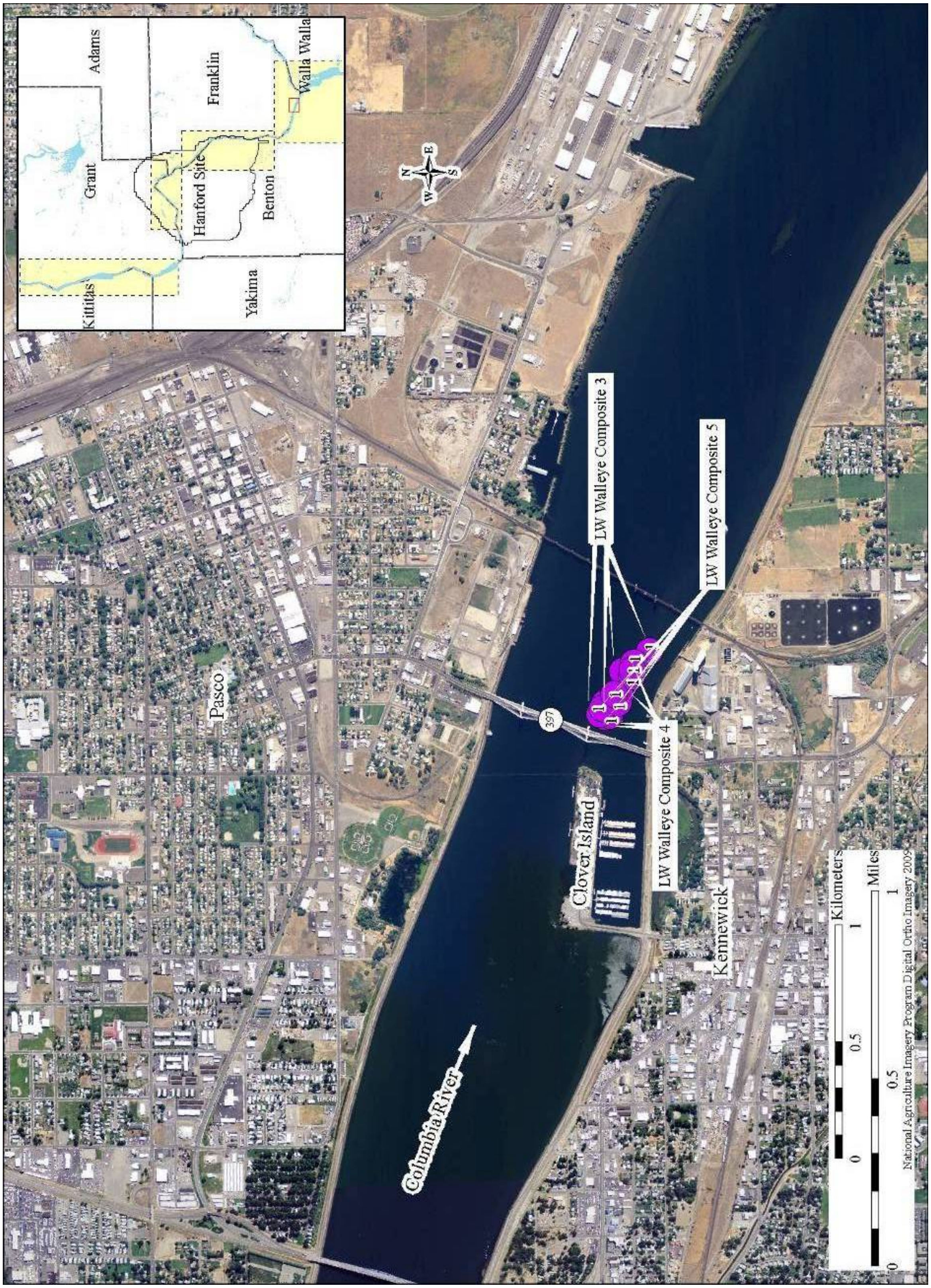

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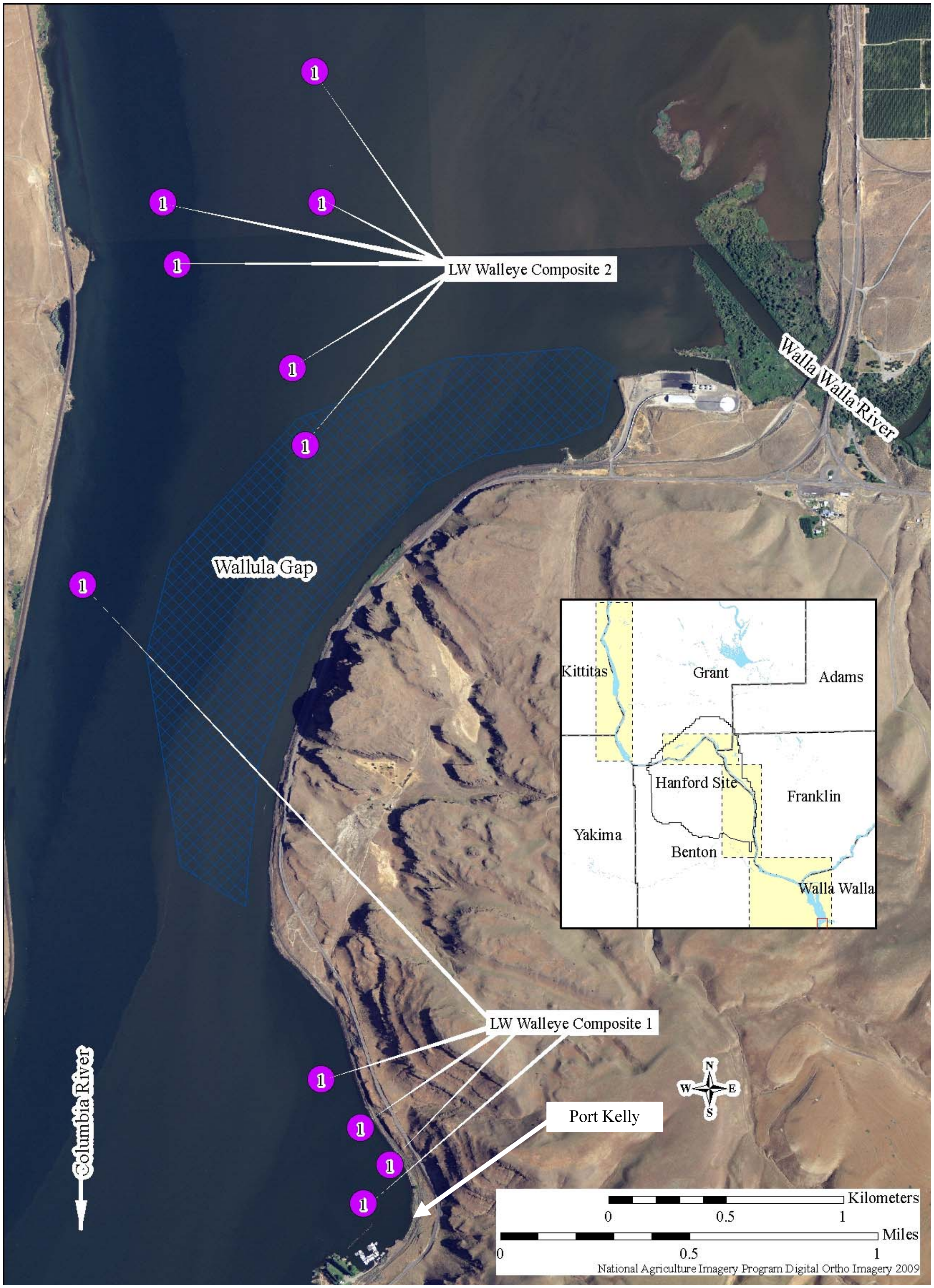

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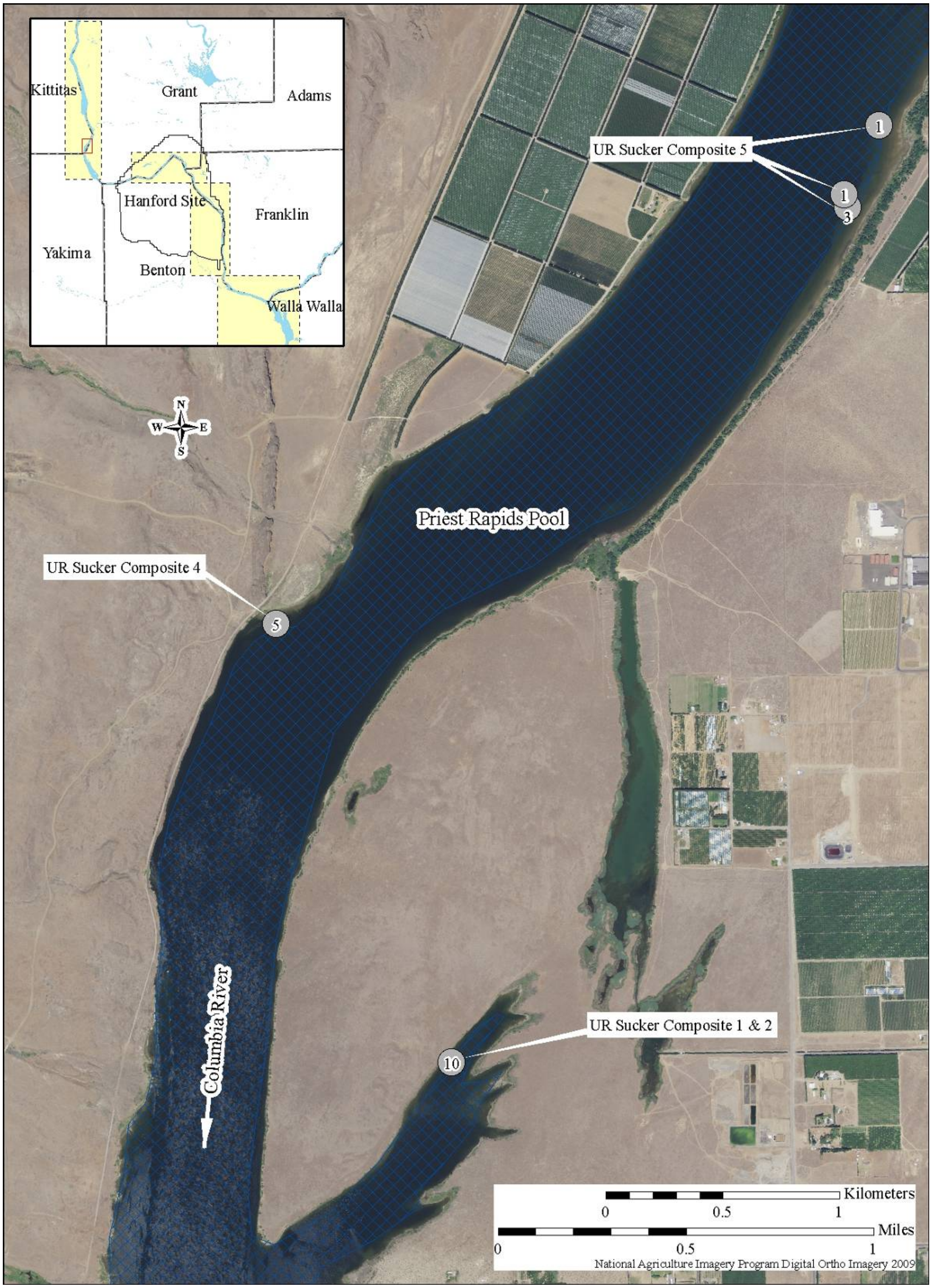

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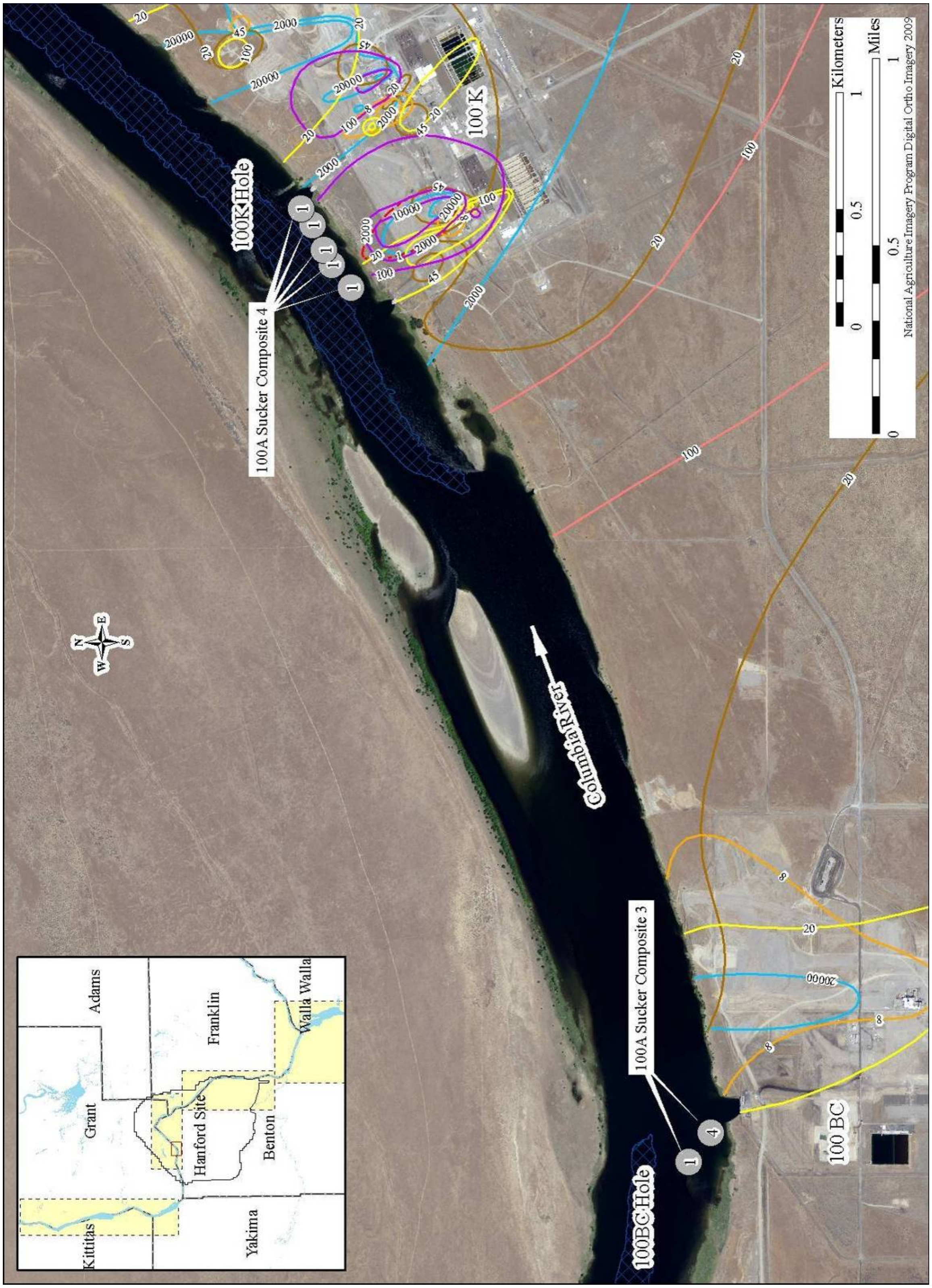

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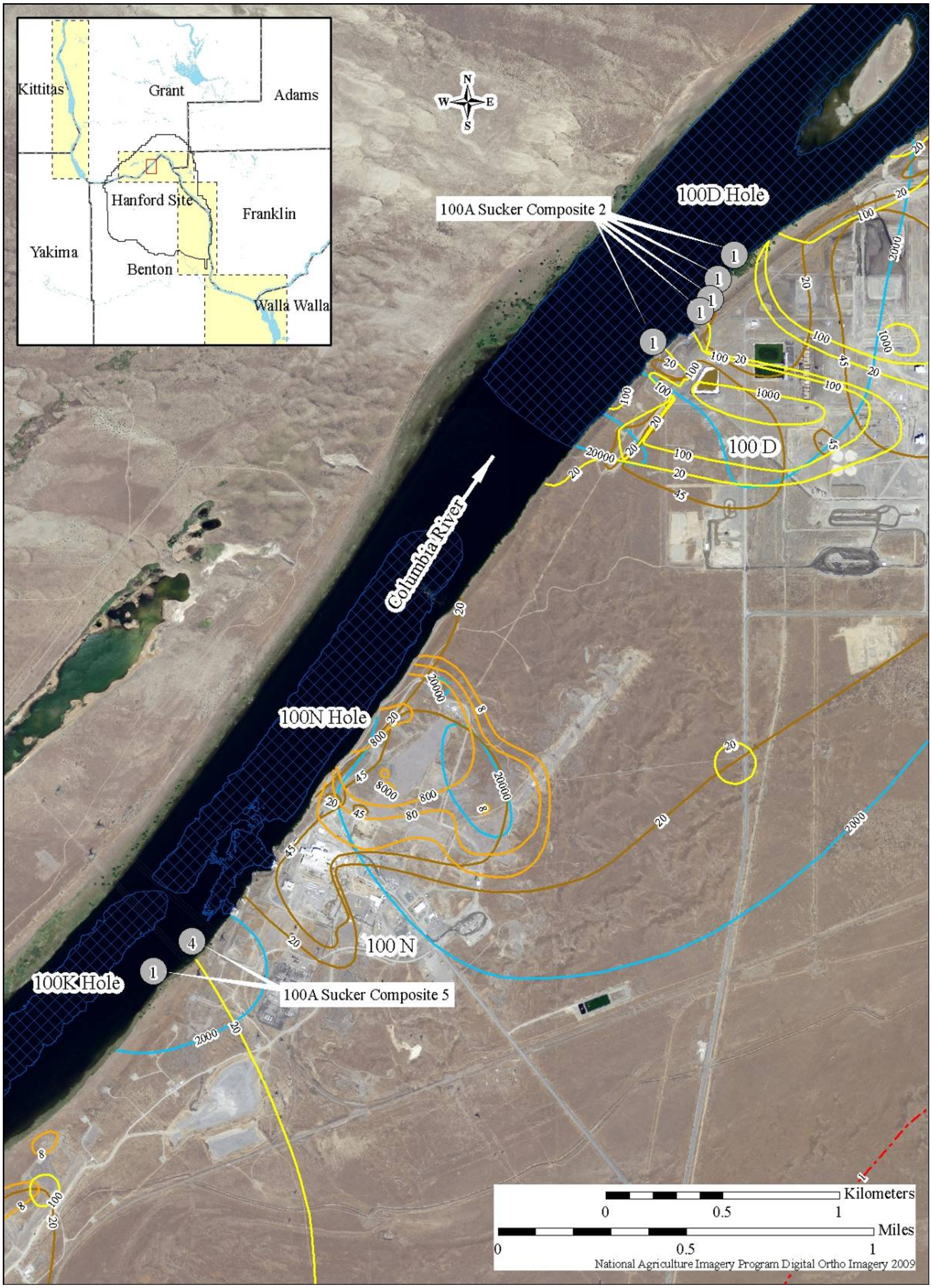

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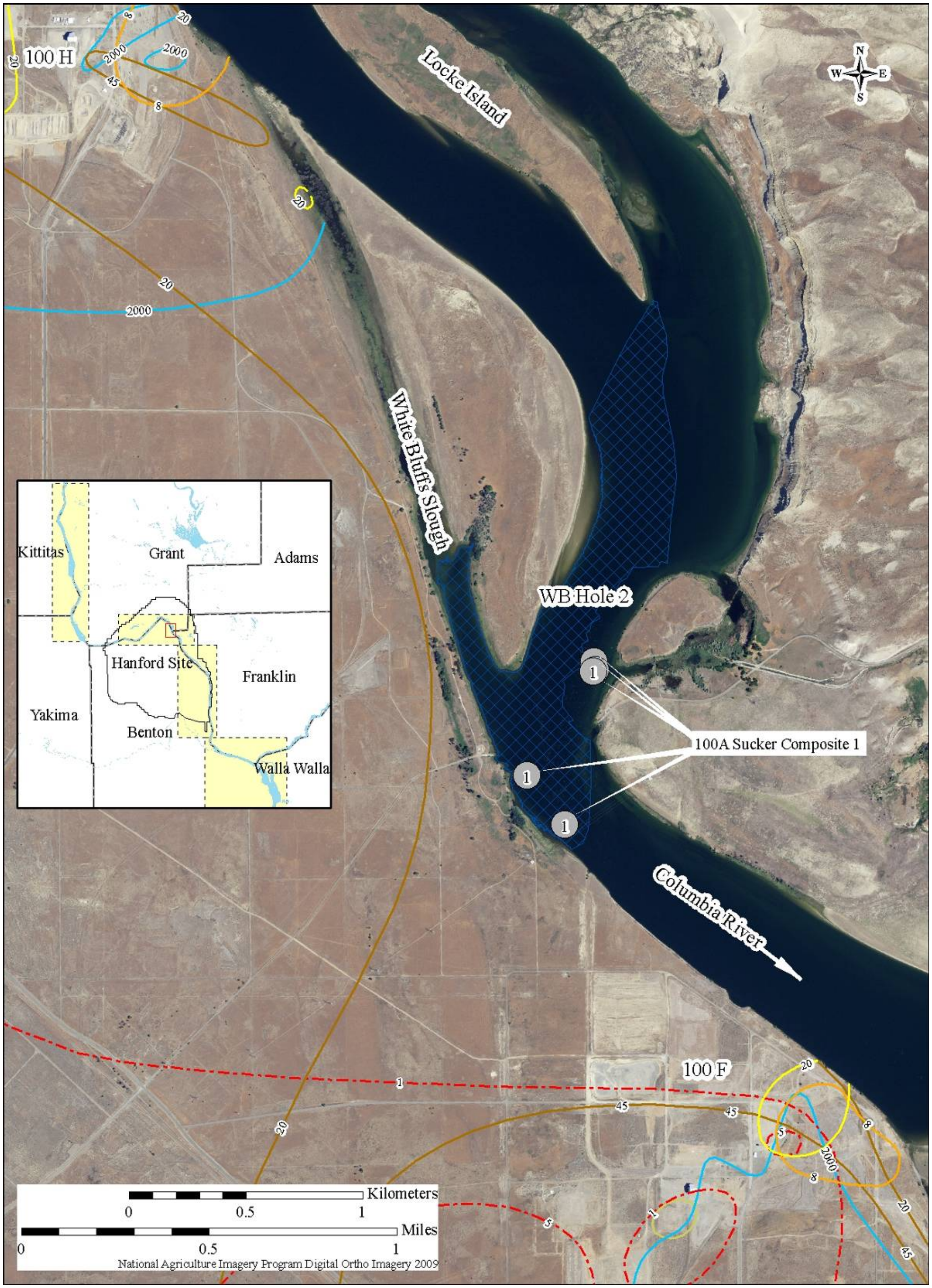

Figure A-37. Sucker Capture Location Maps (Sheet 6 of 10).

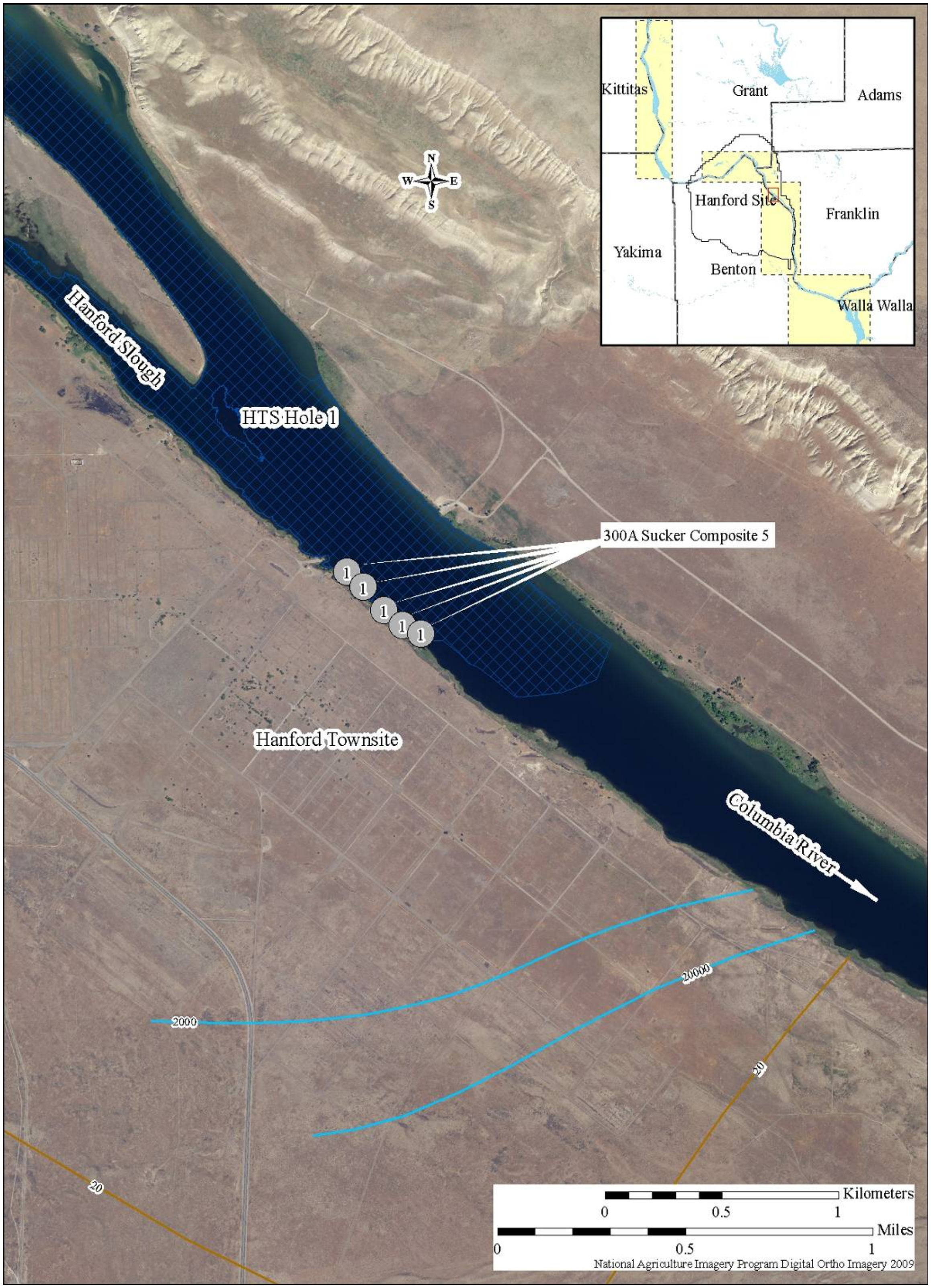

Figure A-38. Sucker Capture Location Maps (Sheet 7 of 10).

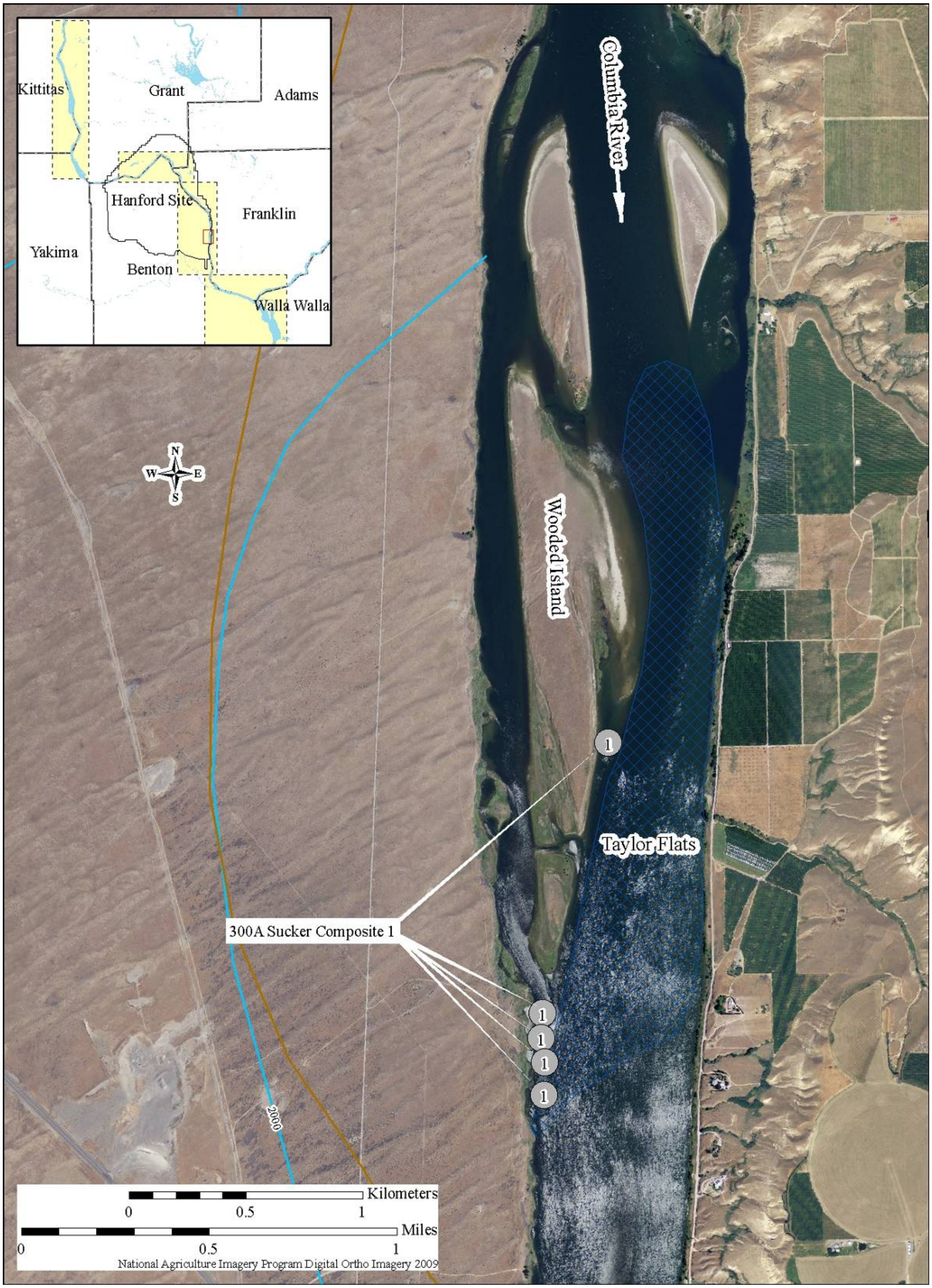

Figure A-39. Sucker Capture Location Maps (Sheet 8 of 10).

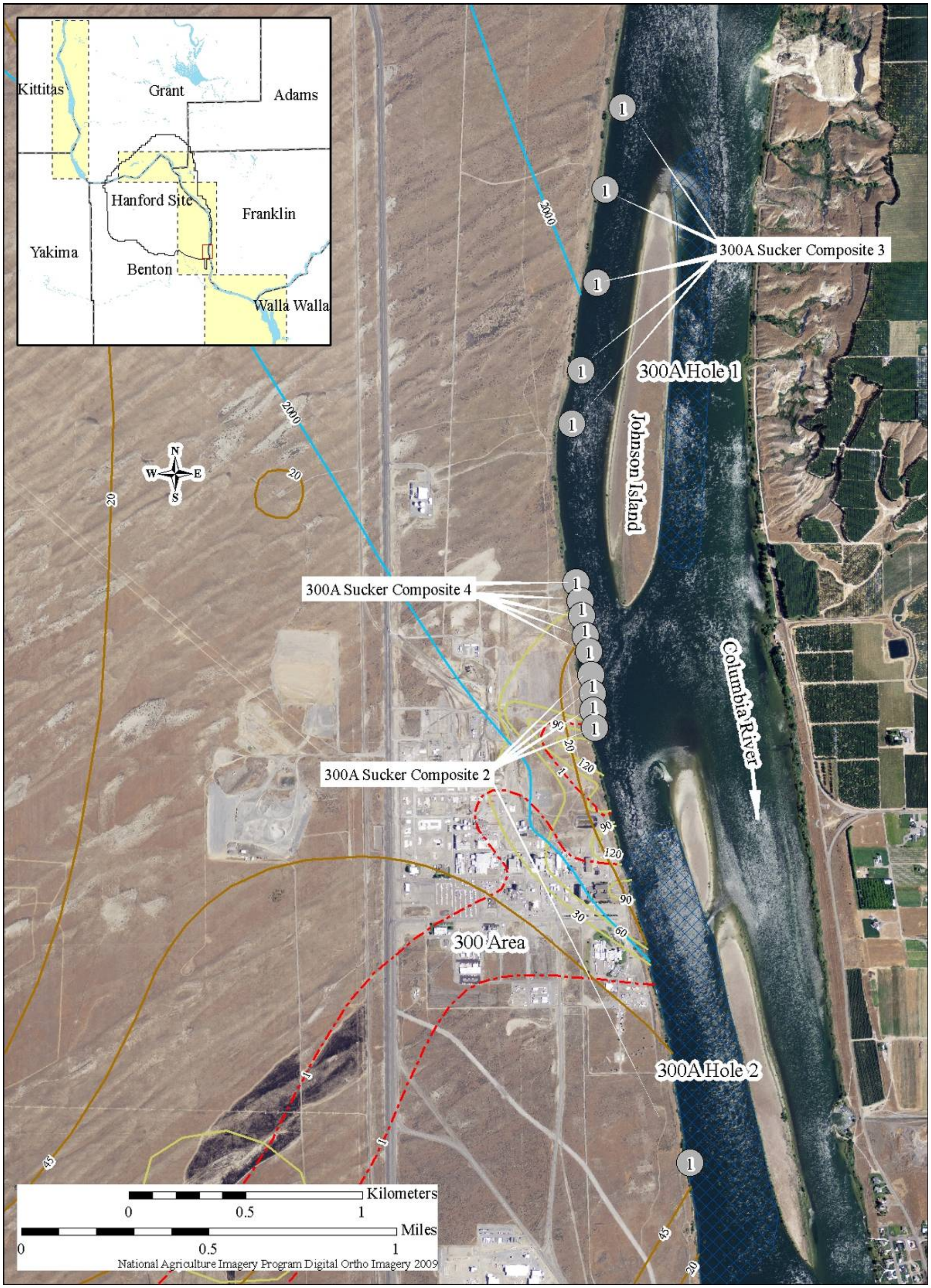

Figure A-40. Sucker Capture Location Maps (Sheet 9 of 10).

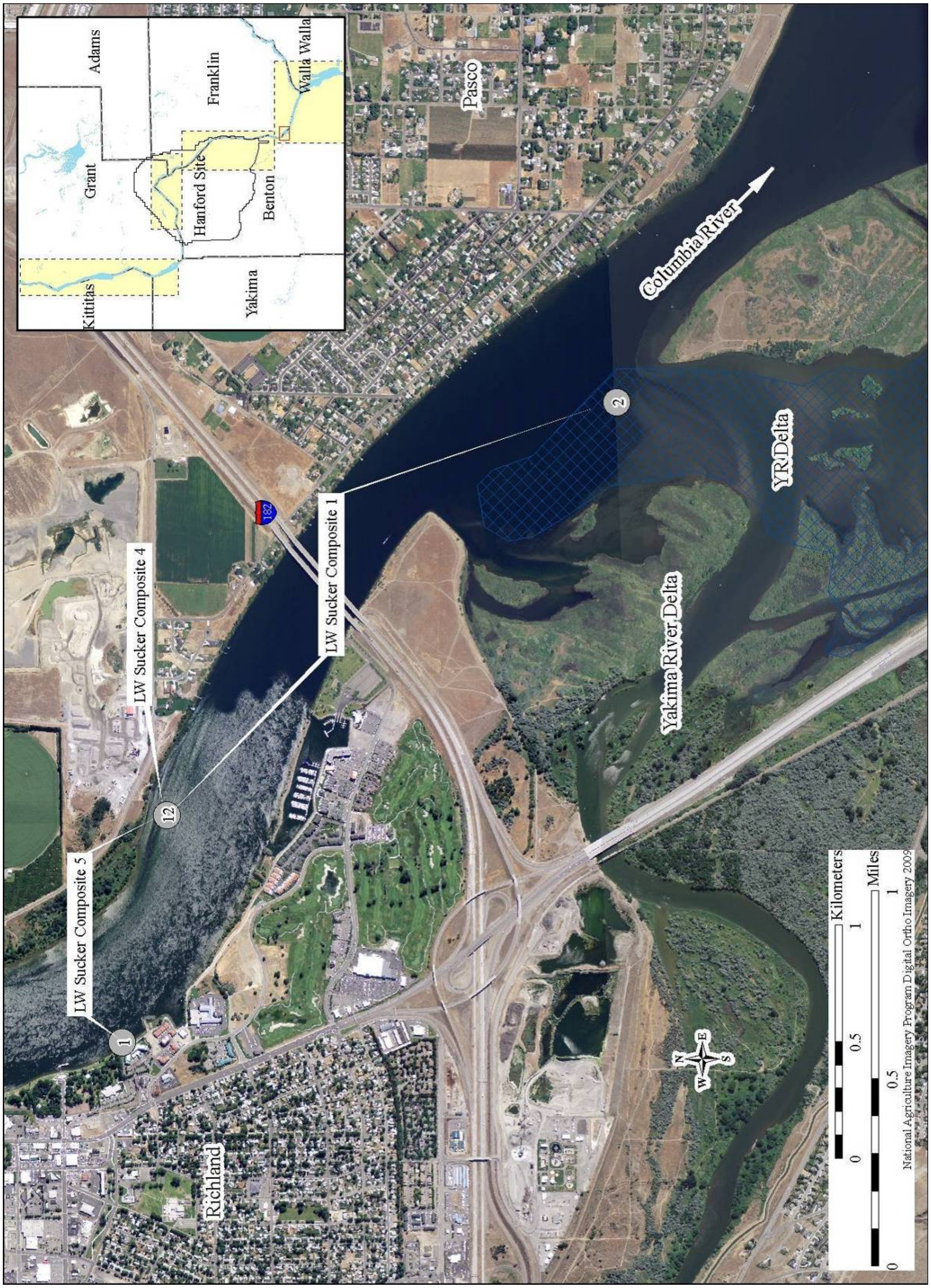

Figure A-41. Sucker Capture Location Maps (Sheet 10 of 10).

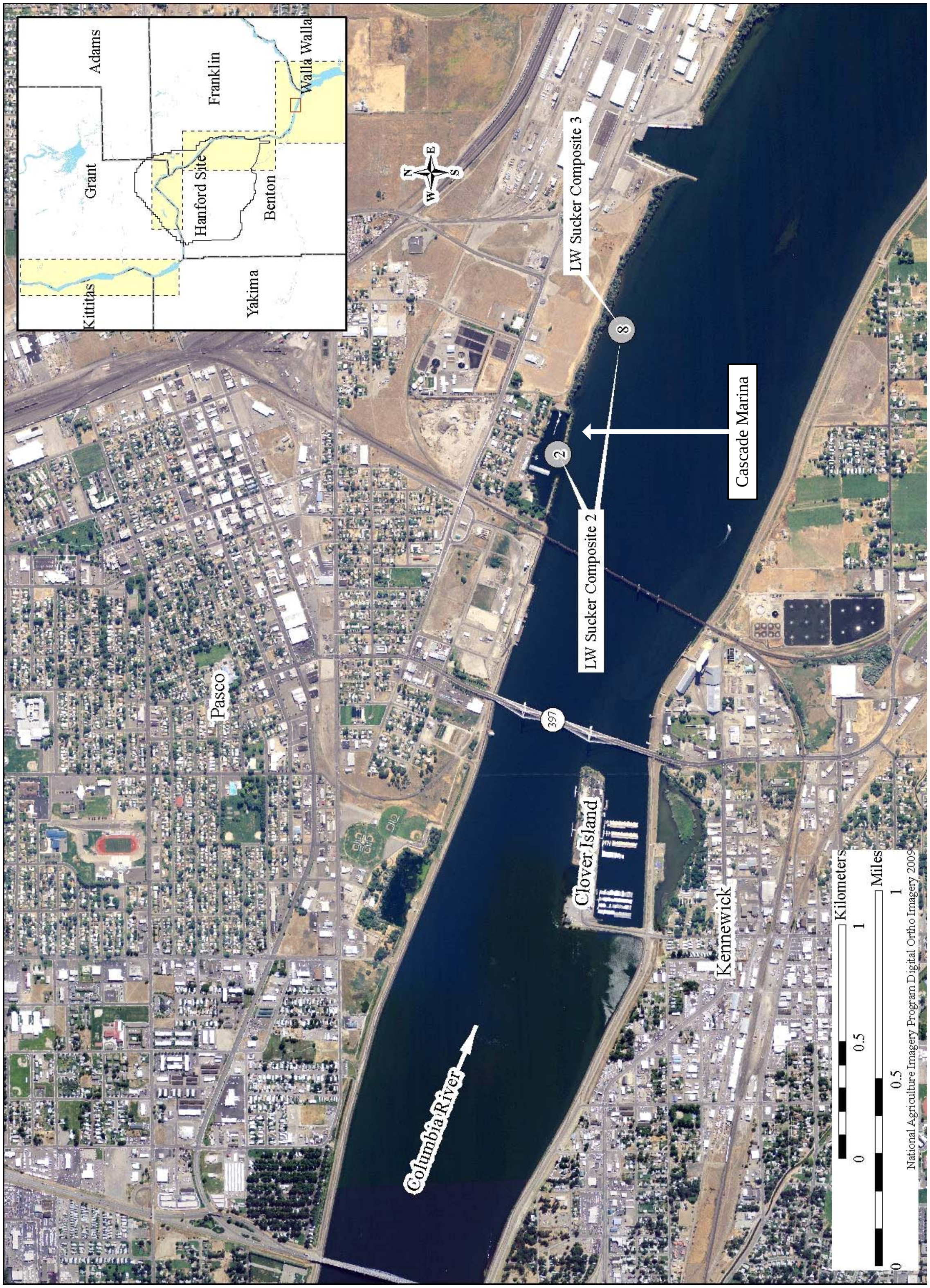

Figure A-42. Carp Capture Location Maps (Sheet 1 of 10).

Figure A-43. Carp Capture Location Maps (Sheet 2 of 10).

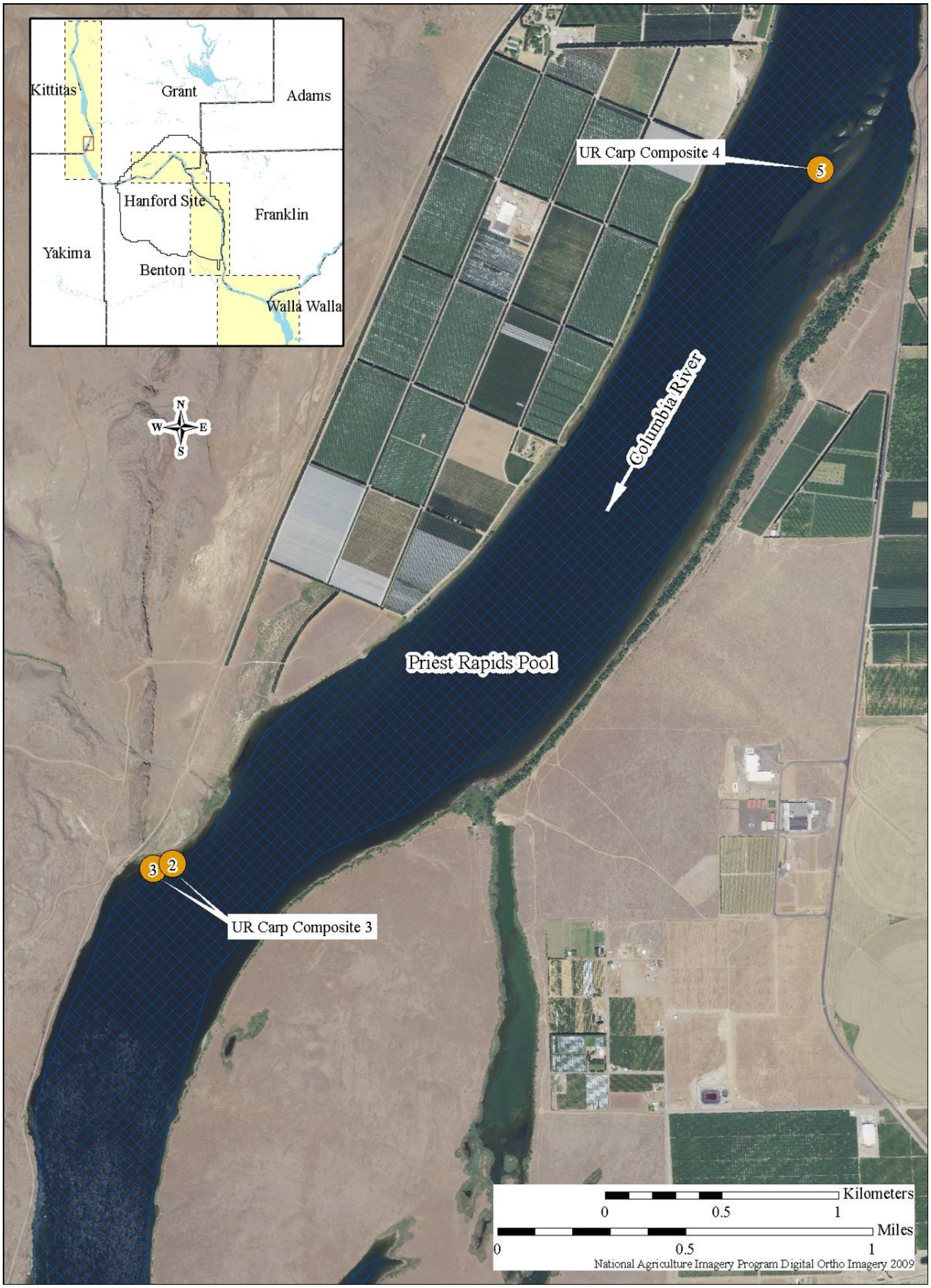

Figure A-44. Carp Capture Location Maps (Sheet 3 of 10).

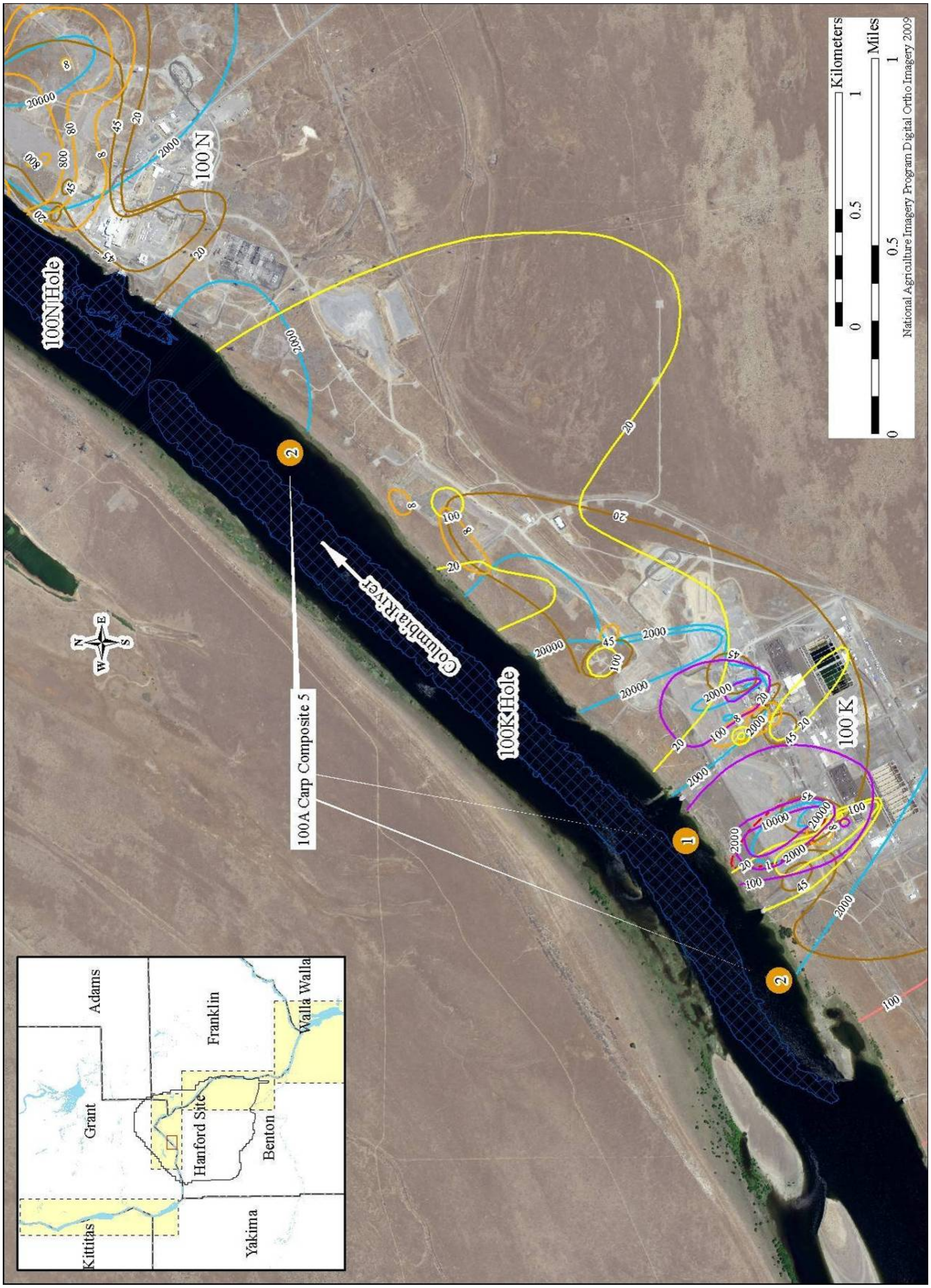

Figure A-45. Carp Capture Location Maps (Sheet 4 of 10).

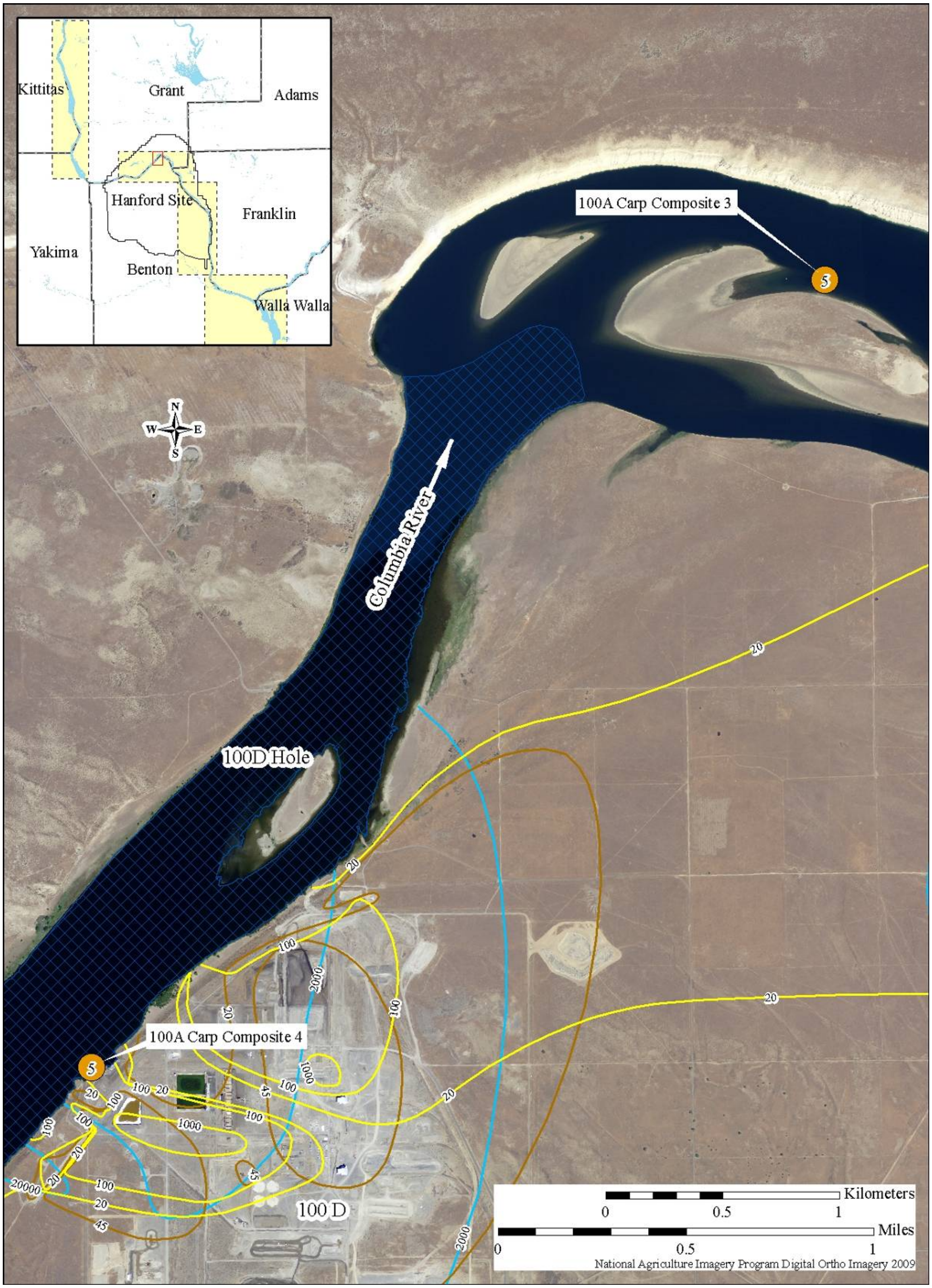

Figure A-46. Carp Capture Location Maps (Sheet 5 of 10).

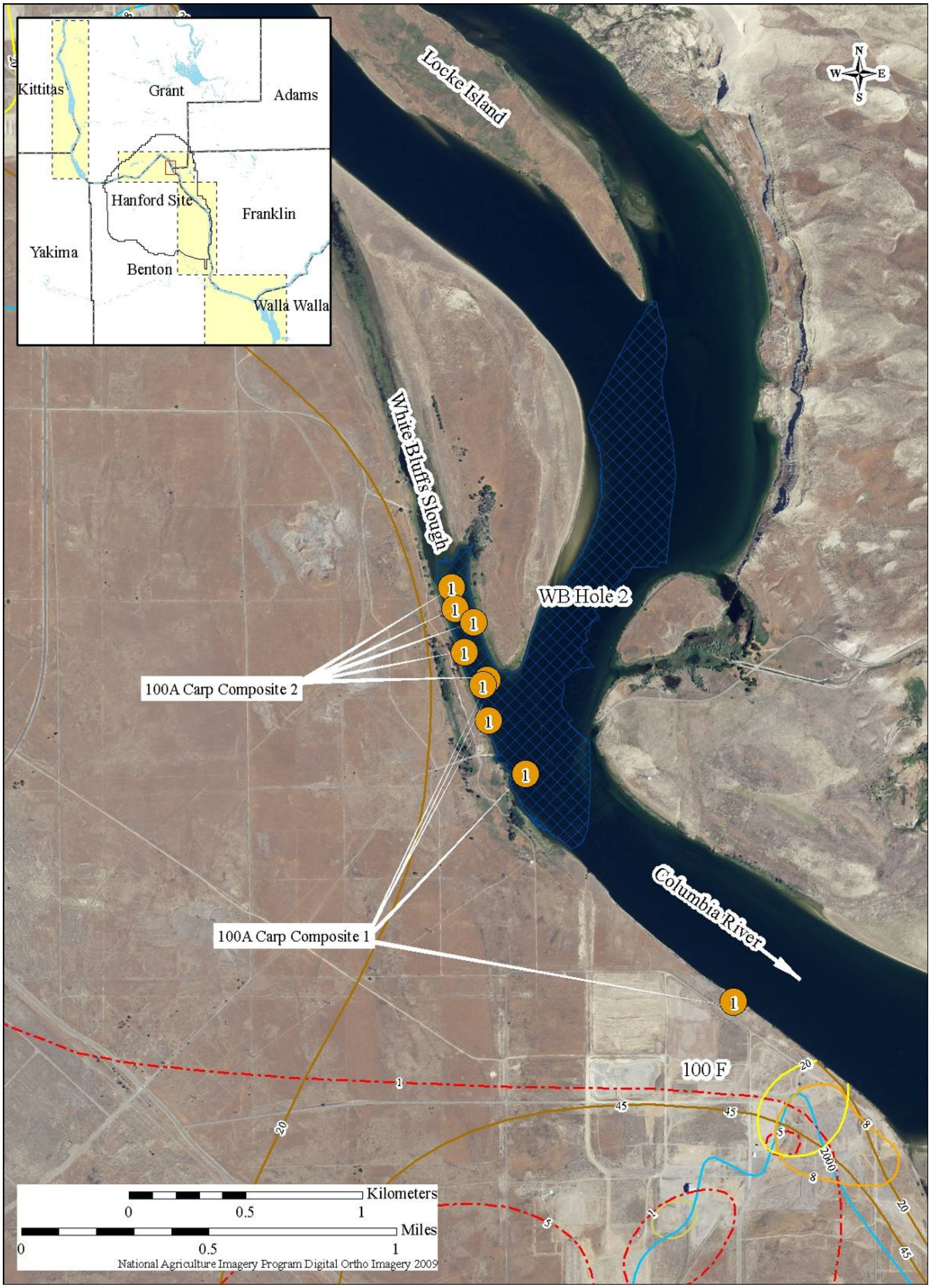

Figure A-47. Carp Capture Location Maps (Sheet 6 of 10).

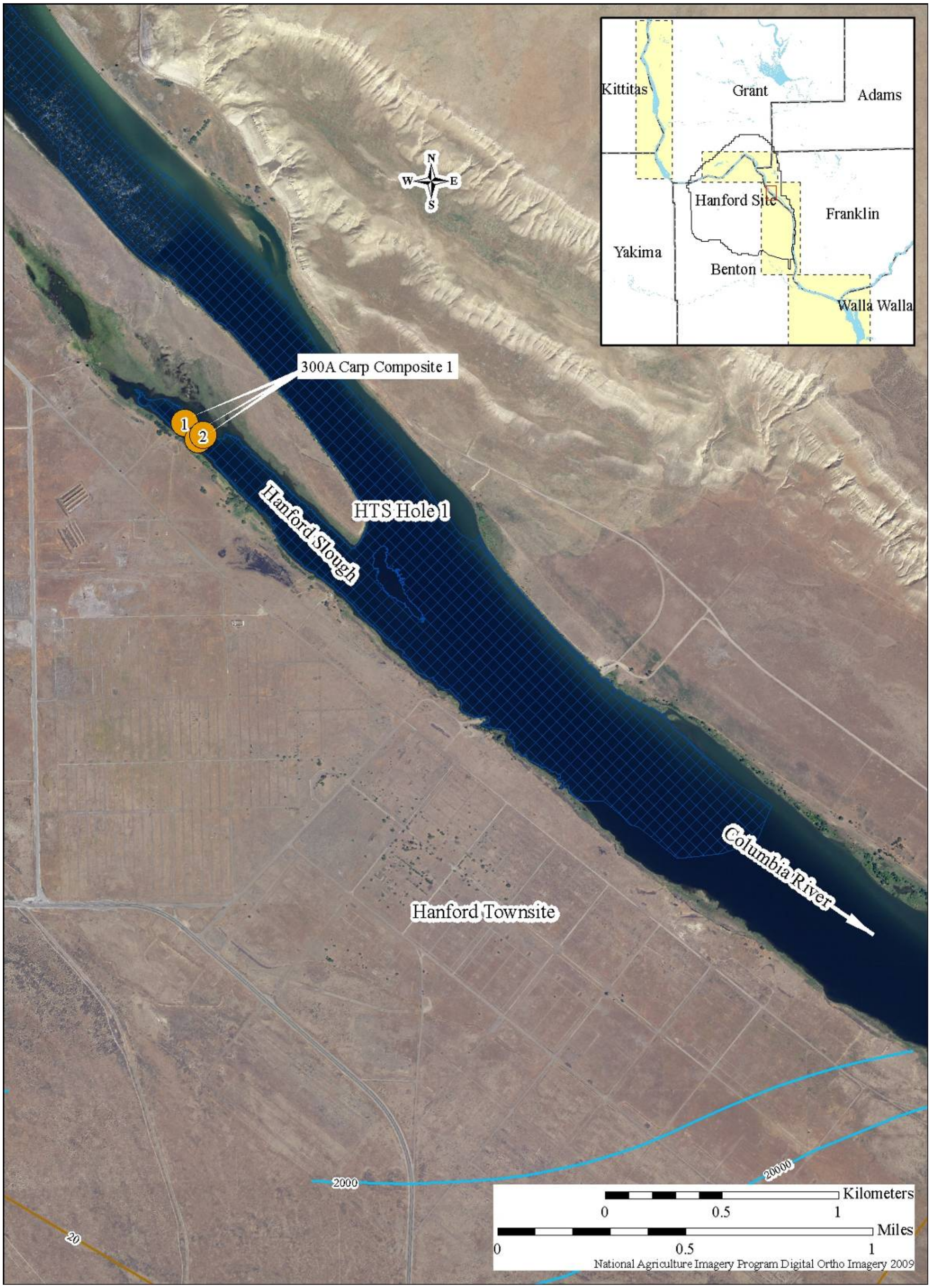

Figure A-48. Carp Capture Location Maps (Sheet 7 of 10).

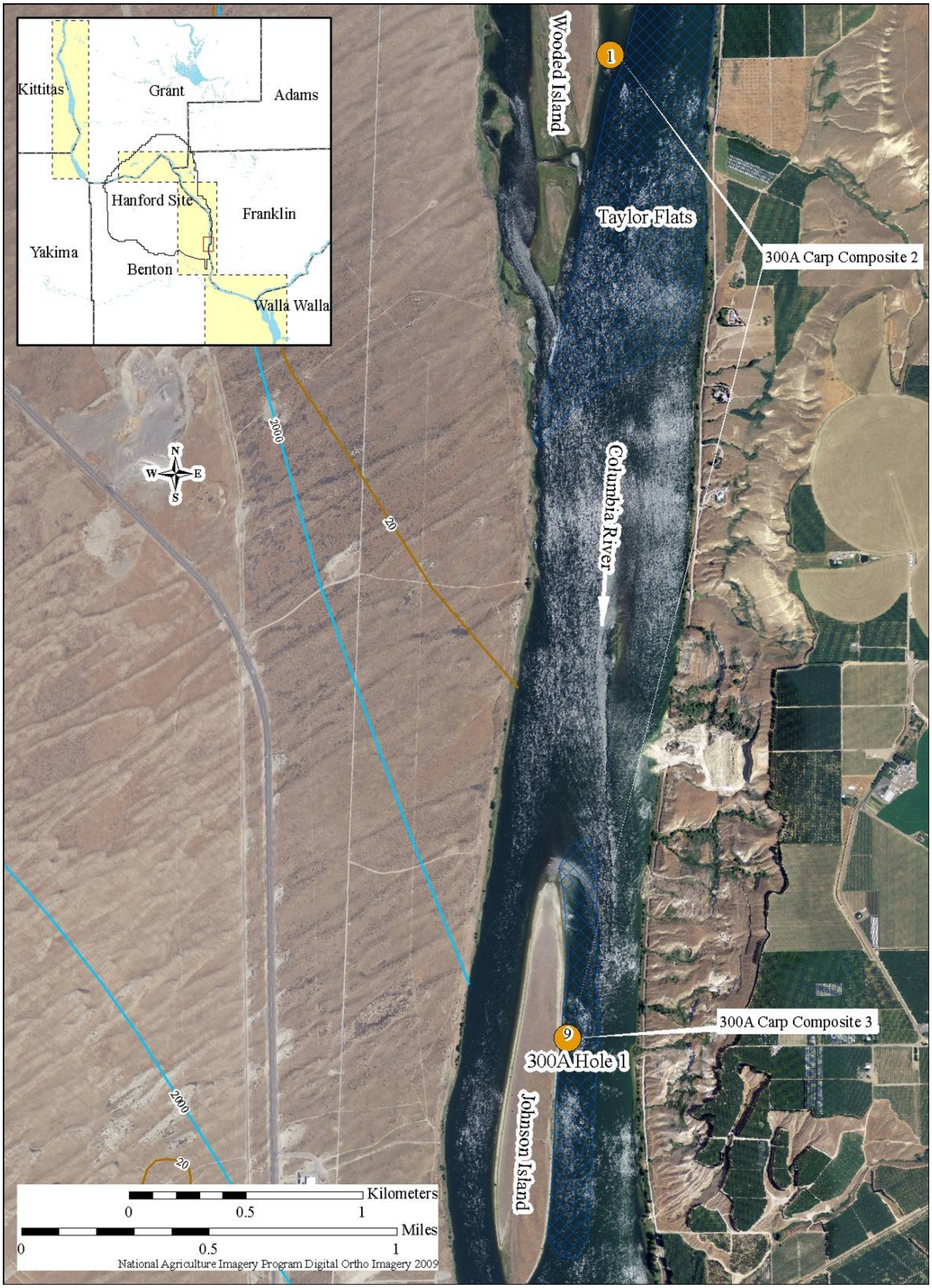

Figure A-49. Carp Capture Location Maps (Sheet 8 of 10).

Figure A-50. Carp Capture Location Maps (Sheet 9 of 10).

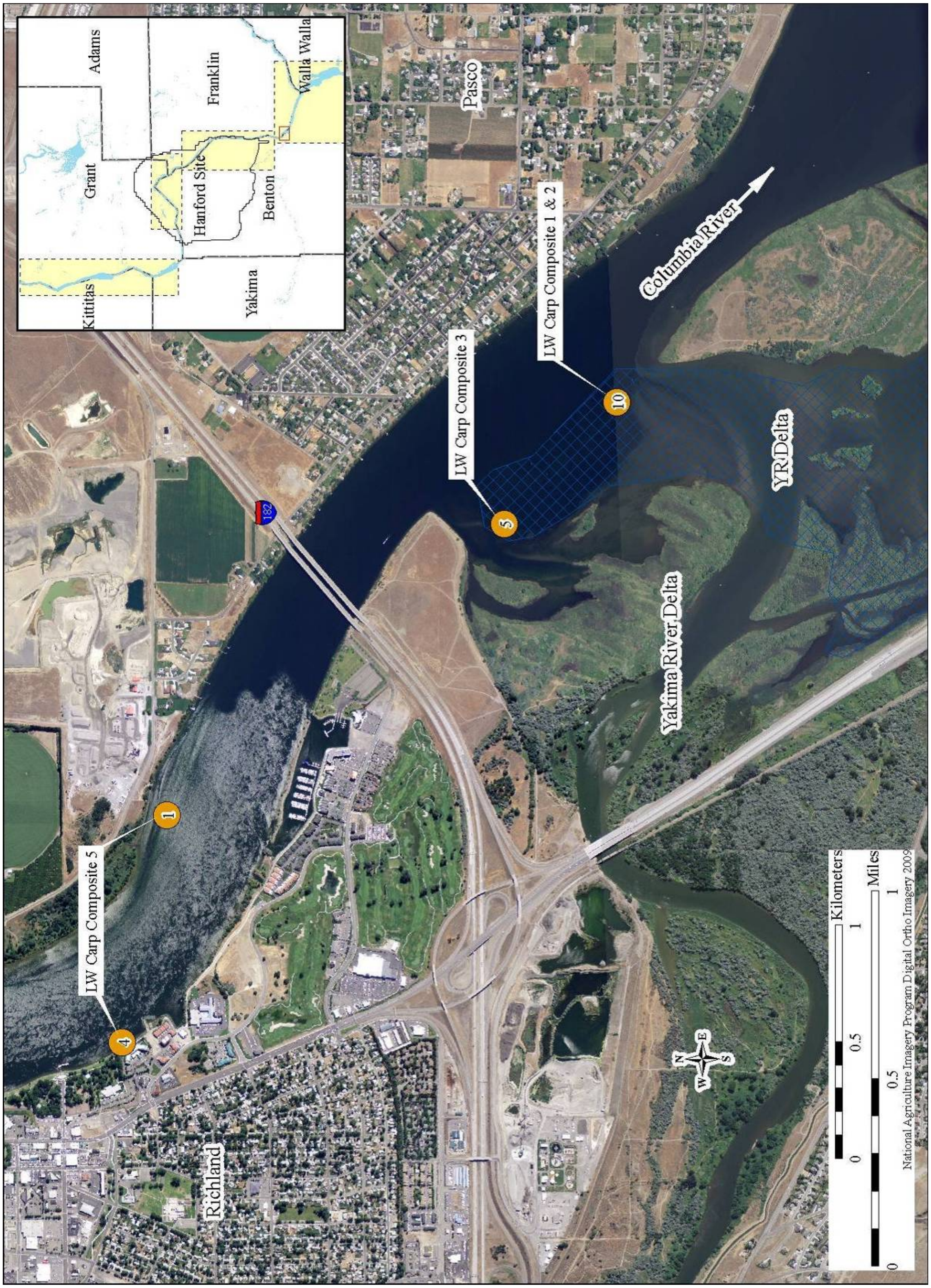

Figure A-51. Carp Capture Location Maps (Sheet 10 of 10).

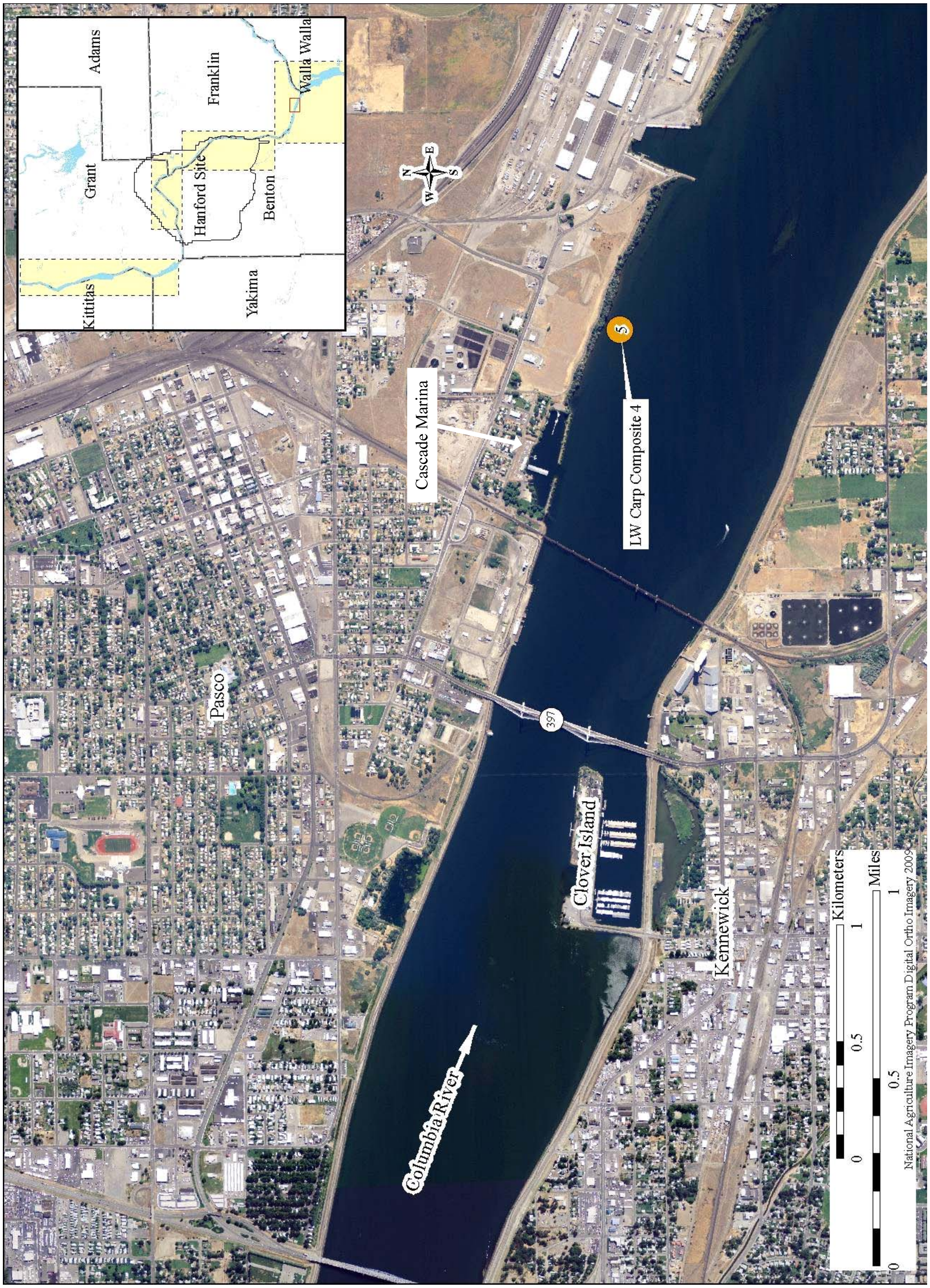

Figure A-52. Sturgeon Capture Location Maps (Sheet 1 of 8).

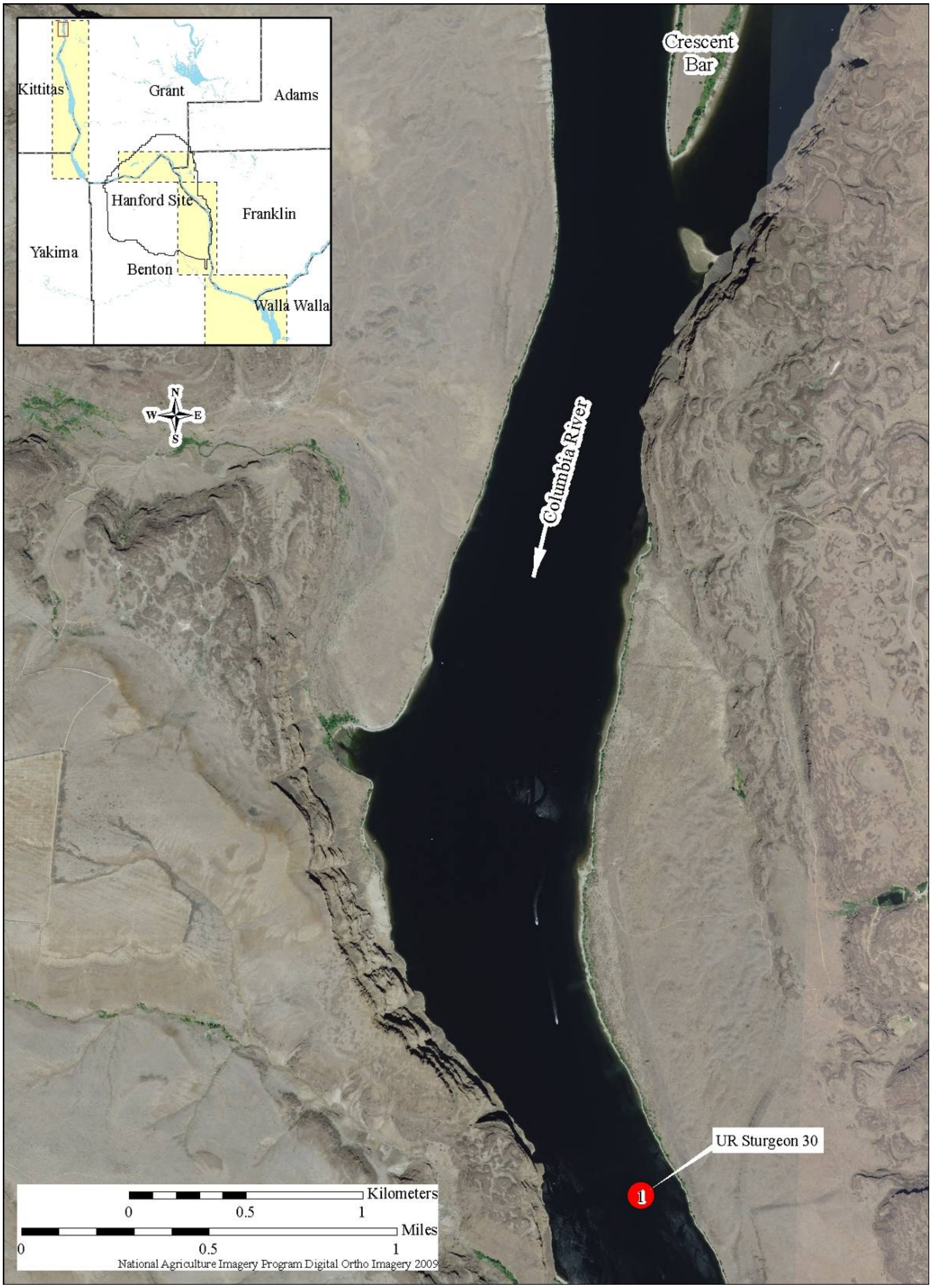

Figure A-53. Sturgeon Capture Location Maps (Sheet 2 of 8).

Figure A-54. Sturgeon Capture Location Maps (Sheet 3 of 8).

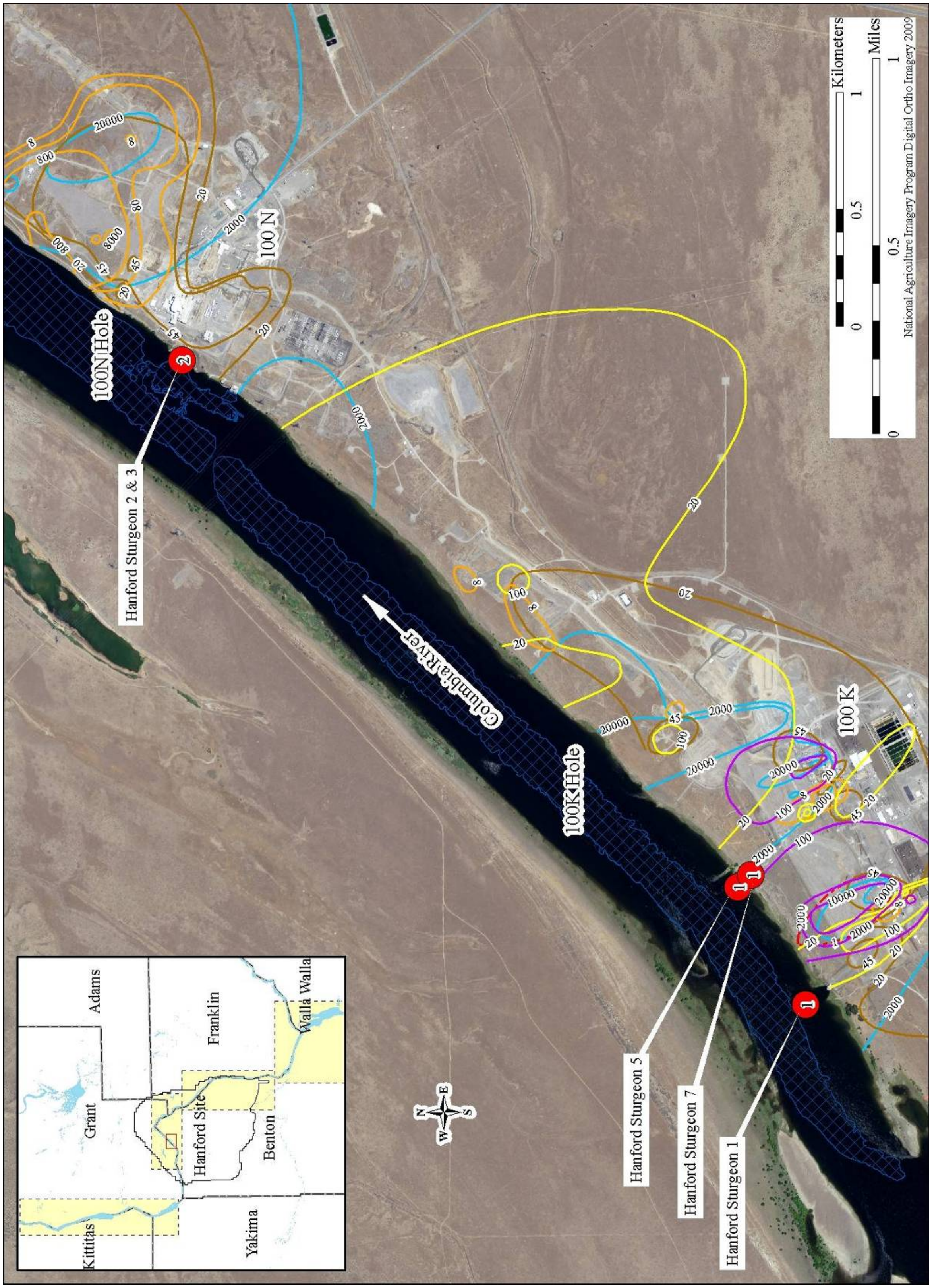

Figure A-55. Sturgeon Capture Location Maps (Sheet 4 of 8).

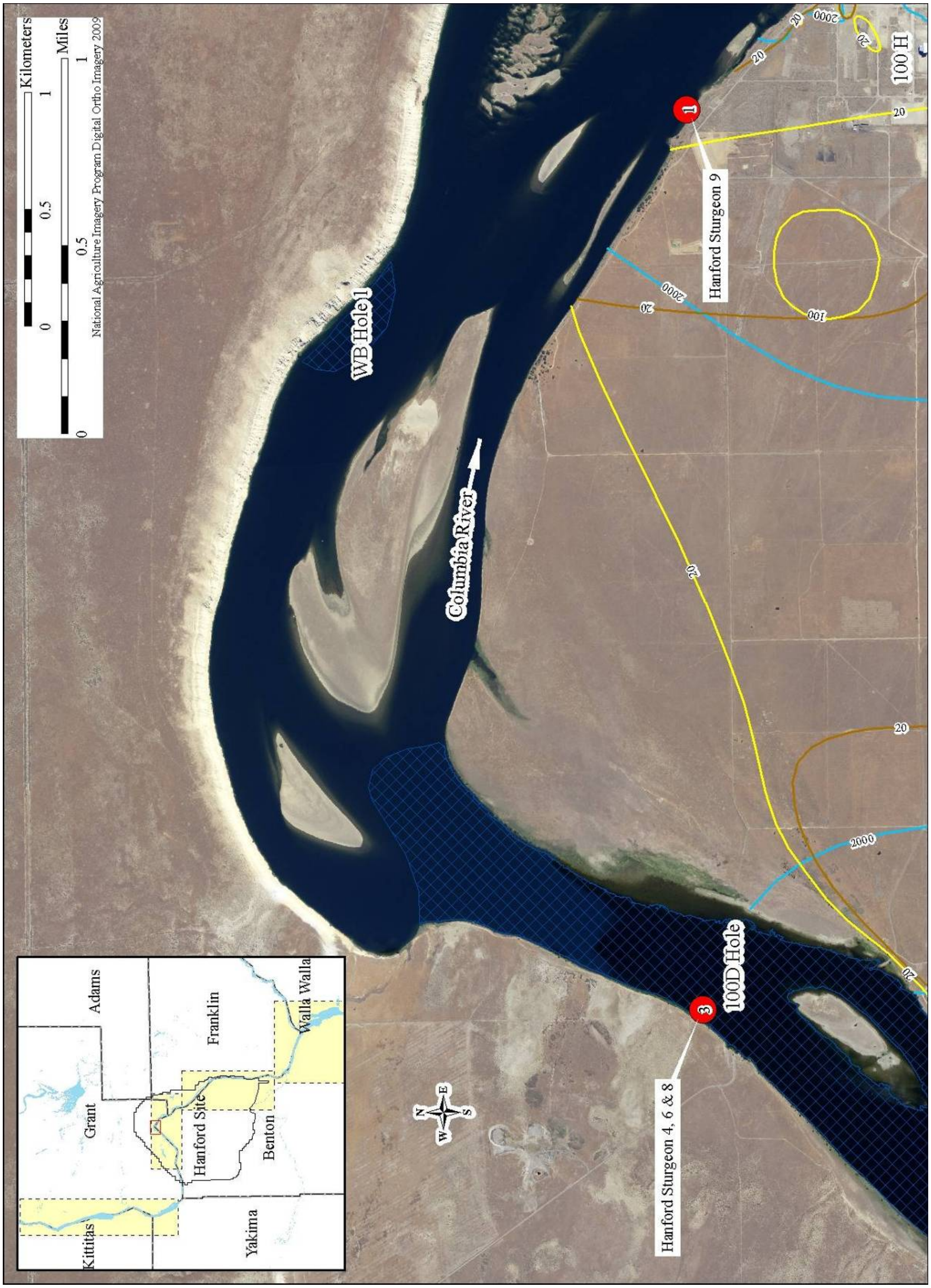

Figure A-56. Sturgeon Capture Location Maps (Sheet 5 of 8).

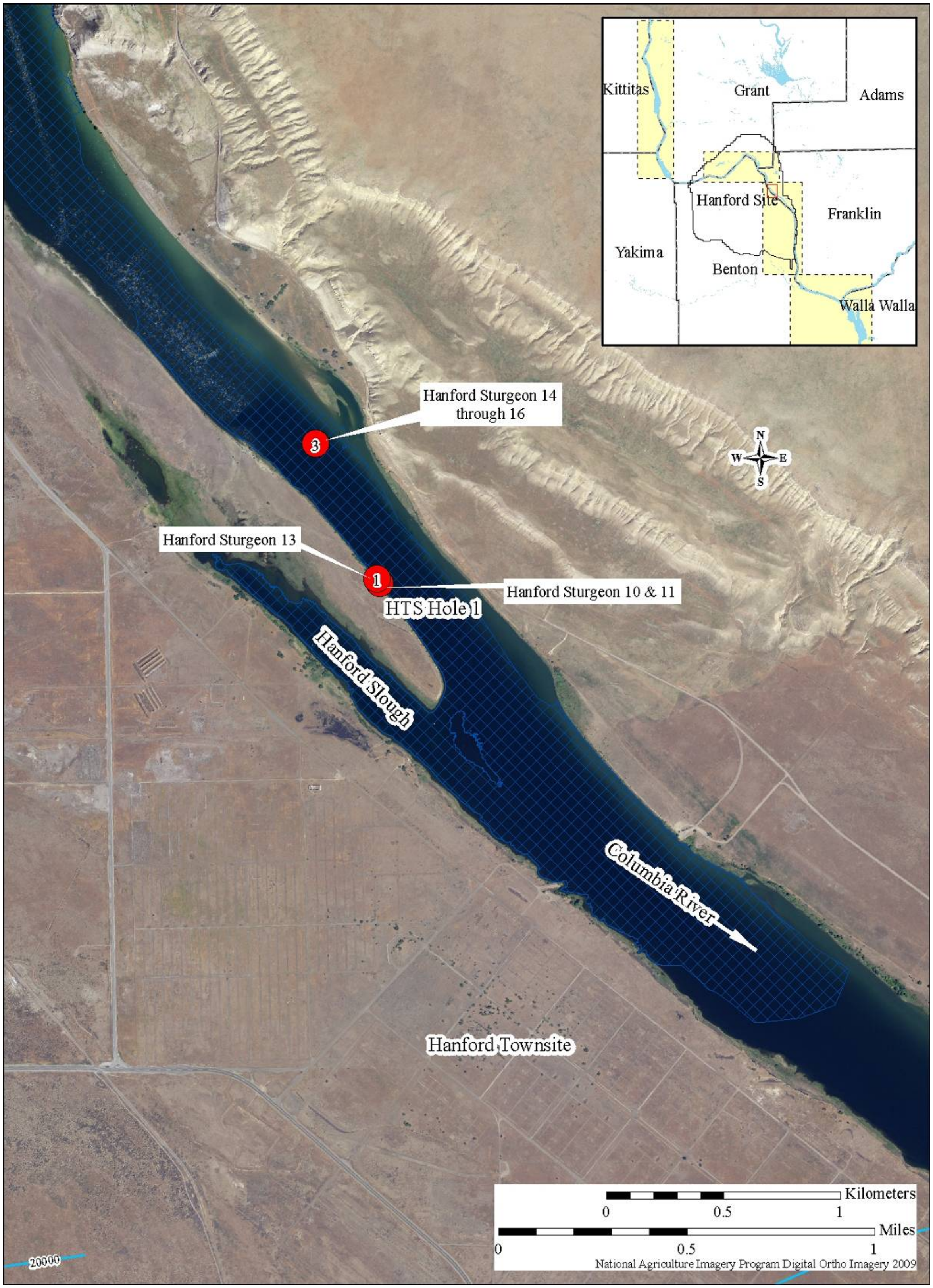

Figure A-57. Sturgeon Capture Location Maps (Sheet 6 of 8).

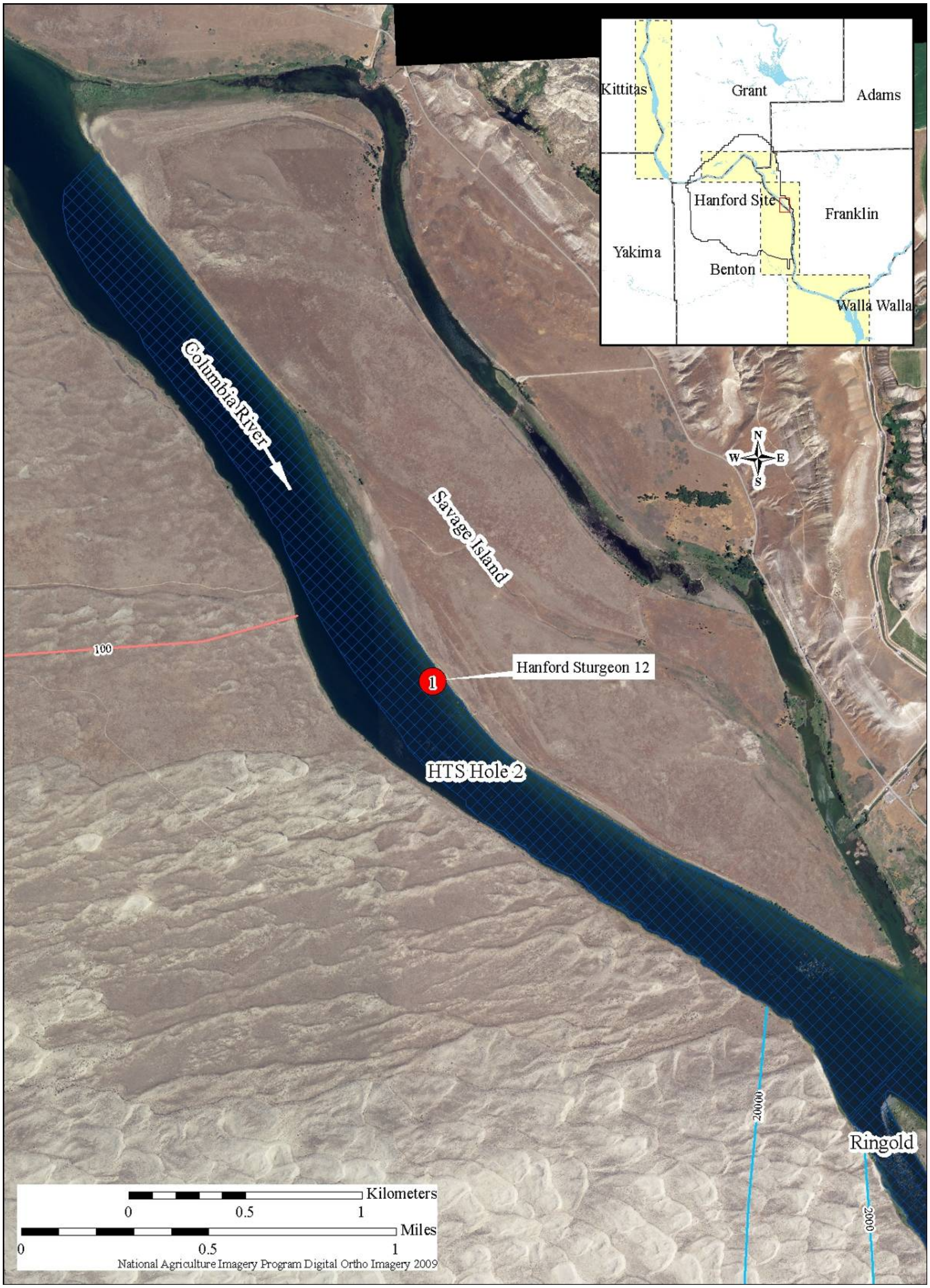

Figure A-58. Sturgeon Capture Location Maps (Sheet 7 of 8).

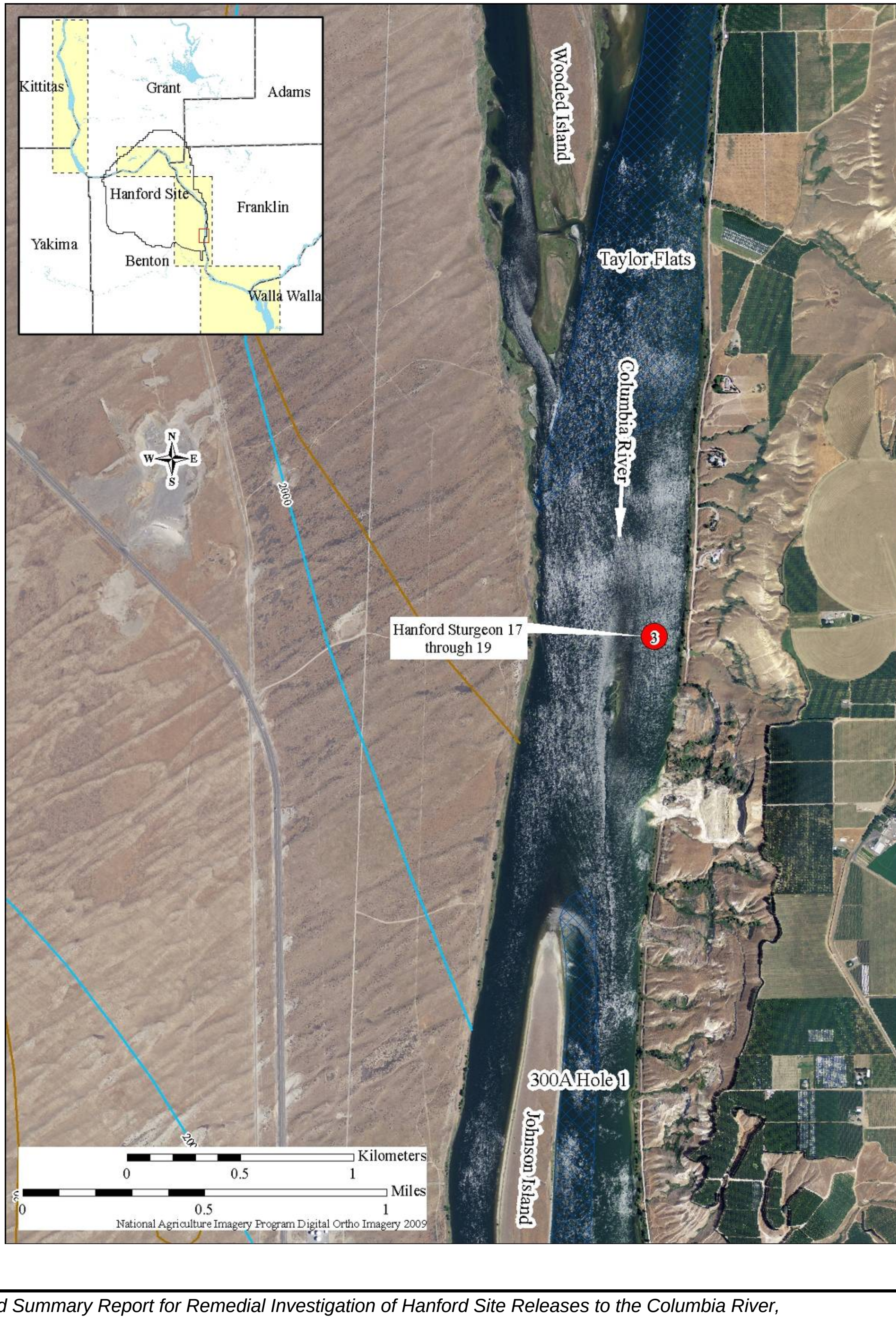

Figure A-59. Sturgeon Capture Location Maps (Sheet 8 of 8).

APPENDIX B

LABORATORY PROCESSING RECORDS BY FISH SPECIES AND LOCATION

ACRONYMS

LW	Lake Wallula
NA	not applicable
PR	Priest Rapids
UR	upriver
WB	White Bluffs
WSU	Washington State University

Table B-1. Laboratory Processing Records: Upriver and 100 Area Sub-Areas Whitefish.

			State Plane South 4602		Field Record	Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record
Field ID	Composite	Date	Northing	Easting	General Collection Area	Total Length (in)	Total Length (cm)	Fork Length (cm)	Total Body Wt. (g)	Liver Wt. (g)	Kidney Wt. (g)	Stomach Contents	Sex (M/F) If Known	General Condition
UR Whitefish 2	1	2/17/2009	158562.833	541073.393	Desert Aire	15.5	37.5	36.0	500	4.63	3.18	Inverts. (Scuds)	F	EN
UR Whitefish 3	1	2/17/2009	157514.129	540656.717	Desert Aire	14.0	35.0	33.5	380	2.37	1.86	NA		EN
UR Whitefish 13	1	2/23/2009	166229.369	542655.930	PR2	18.5	45.5	44.0	800	10.43	8.59	NA	F	EN
UR Whitefish 22	1	2/26/2009	169659.287	541309.871	PR3	15.0	38.0	35.0	500	3.50	4.61	Inverts. (Scuds)		EN
UR Whitefish 23	1	2/27/2009	169909.778	541143.320	PR3	17.0	42.5	40.0	620	5.06	4.09	Inverts. (Scuds)		EN
UR Whitefish 1	2	2/17/2009	158562.299	541040.104	Desert Aire	14.0	34.0	32.0	320	2.60	2.75	Inverts. (Scuds)		EN
UR Whitefish 16	2	2/24/2009	166931.886	542309.107	PR3	14.0	36.5	33.5	420	3.32	2.47	Inverts. (Scuds)		EN
UR Whitefish 20	2	2/25/2009	168823.852	541743.712	PR3	14.0	35.5	33.0	400	2.67	2.59	Inverts. (Scuds)		EN
UR Whitefish 25	2	2/27/2009	169673.491	541286.701	PR3	13.75	34.0	33.0	300	2.04	1.49	Inverts. (Scuds)		EN
UR Whitefish 26	2	2/27/2009	168712.118	541751.795	PR3	13.5	34.0	32.0	320	3.18	3.14	Inverts. (Scuds)		EN
UR Whitefish 4	3	2/17/2009	158068.565	540802.835	Desert Aire	12.5	29.0	27.0	200	1.73	1.21	NA		EN
UR Whitefish 7	3	2/20/2009	165911.962	542827.399	PR2	13.0	32.0	30.0	240	1.37	1.17	Inverts. (Scuds)		EN
UR Whitefish 8	3	2/20/2009	165858.614	542883.822	PR2	12.25	30.5	28.5	240	1.25	1.89	NA		EN
UR Whitefish 24	3	2/27/2009	169700.680	541271.512	PR3	13.0	32.0	30.5	280	1.80	2.28	Inverts. (Scuds)		EN
UR Whitefish 27	3	2/27/2009	169540.683	541350.724	PR3	13.0	32.5	30.0	280	2.25	1.66	Inverts. (Scuds)		EN
UR Whitefish 9	4	2/20/2009	165764.670	542950.978	PR2	12.0	29.0	27.0	220	1.12	1.33	Inverts. (Scuds)		EN
UR Whitefish 10	4	2/20/2009	165739.157	542983.071	PR2	12.0	30.0	27.5	200	1.62	1.49	Inverts. (Scuds)		EN
UR Whitefish 11	4	2/20/2009	166000.167	542781.625	PR2	12.25	30.0	29.0	200	1.35	1.90	Inverts. (Scuds)		EN
UR Whitefish 12	4	2/21/2009	165719.543	543001.587	PR2	12.0	30.5	29.0	240	1.44	2.14	Inverts. (Scuds)		EN
UR Whitefish 18	4	2/24/2009	165833.016	542832.036	PR2	12.0	29.0	27.0	200	1.20	1.34	Inverts. (Scuds)		EN
UR Whitefish 5	5	2/20/2009	166136.448	542728.574	PR2	11.0	27.5	26.0	160	0.99	0.93	NA		EN
UR Whitefish 6	5	2/20/2009	166095.062	542710.785	PR2	12.0	29.5	28.5	240	1.44	1.54	NA		EN
UR Whitefish 14	5	2/23/2009	166180.160	542683.151	PR2	10.25	26.5	24.5	120	0.72	0.45	Inverts. (Scuds)		EN
UR Whitefish 15	5	2/23/2009	165909.114	542815.900	PR2	12.0	30.0	28.5	240	1.60	1.11	Inverts. (Scuds)		EN
UR Whitefish 17	5	2/24/2009	165594.495	542963.398	PR2	11.5	31.0	29.0	220	1.59	1.77	NA		EN
UR Whitefish 19	5	2/25/2009	169526.982	541396.688	PR3	11.75	29.0	27.0	220	1.35	1.30	Inverts. (Scuds)		EN
UR Whitefish 21	5	2/25/2009	169165.913	541569.966	PR3	12.0	30.0	27.5	220	1.99	1.62	Inverts. (Scuds)		EN
100A Whitefish 4	1	2/6/2009	147199.378	582891.937	100F	18.5	44.0	42.5	1040	10.65	8.50	Inverts. (Scuds)		granulomas on stomach
100A Whitefish 5	1	2/6/2009	147199.378	582891.937	100F	17.5	44.5	42.0	820	8.47	4.97	Inverts. (Scuds)		granulomas on stomach
100A Whitefish 8	1	2/6/2009	147235.383	582902.704	100F	17.5	43.0	40.0	780	6.41	6.75	Inverts. (Scuds)		puncture mark on left side
100A Whitefish 9	1	2/6/2009	147076.068	582934.569	100F	18.0	44.0	41.5	770	9.33	3.86	Empty	F	EN
100A Whitefish 10	1	2/6/2009	146881.512	582987.465	100F	18.75	47.0	43.5	920	9.05	7.14	Inverts. (Scuds)	F	granulomas on intestine
100A Whitefish 1	2	2/6/2009	147719.841	582305.214	100F	16.0	40.0	37.0	620	5.72	4.02	Inverts. (Scuds)		EN
100A Whitefish 2	2	2/6/2009	147619.300	582537.224	100F	18.0	46.0	42.5	880	9.62	5.24	Inverts. (Scuds)		granulomas on stomach
100A Whitefish 3	2	2/6/2009	147329.048	582850.470	100F	17.0	42.0	41.0	620	4.86	3.37	Inverts. (Scuds)		EN
100A Whitefish 6	2	2/6/2009	147793.190	582165.773	100F	15.0	39.0	36.5	480	4.08	3.09	Inverts. (Scuds)		EN
100A Whitefish 7	2	2/6/2009	147633.296	582511.654	100F	18.5	44.0	42.0	860	8.19	6.09	NA		granulomas on stomach
100A Whitefish 14	3	2/7/2009	149498.571	579615.978	White Bluffs Launch	16.0	39.0	35.5	480	3.84	3.62	Inverts. (Scuds)	F	EN
100A Whitefish 15	3	2/7/2009	149458.133	579626.343	White Bluffs Launch	16.0	40.5	37.5	580	6.55	5.34	Empty		EN
100A Whitefish 16	3	2/8/2009	148976.677	580020.761	White Bluffs Launch	16.0	40.0	36.5	620	6.51	4.44	Inverts. (Scuds)		pale colored liver
100A Whitefish 19	3	2/8/2009	151196.618	579861.170	White Bluffs Launch	18.0	46.0	43.0	1000	11.53	8.08	Inverts. (Scuds)	F	laceration on left side
100A Whitefish 20	3	2/8/2009	150203.563	579923.192	White Bluffs Launch	14.0	35.0	33.0	360	3.53	2.04	Inverts. (Scuds)		EN
100A Whitefish 11	4	2/7/2009	152742.614	573644.016	100D	18.5	45.5	43.0	780	6.14	4.08	Inverts. (Scuds)		EN
100A Whitefish 12	4	2/7/2009	152689.791	573585.892	100D	16.0	38.0	35.8	640	5.64	4.50	Inverts. (Scuds)		EN
100A Whitefish 13	4	2/7/2009	152831.266	573387.745	100D	15.0	38.0	35.5	480	3.90	3.32	NA		EN
100A Whitefish 17	4	2/8/2009	152865.718	573424.276	100D	17.0	40.5	37.5	620	7.71	3.57	NA		EN
100A Whitefish 18	4	2/8/2009	152660.563	573568.837	100D	18.0	44.5	41.5	840	6.07	5.26	Inverts. (Scuds)		EN
100A Whitefish 21	5	2/9/2009	149207.681	570196.436	100-N	15.0	37.5	34.5	440	3.36	2.52	Inverts. (Scuds)		EN
100A Whitefish 22	5	2/9/2009	149513.442	570458.749	100-N	17.5	46.0	42.5	840	10.53	6.21	Empty		several lacerations
100A Whitefish 23	5	2/9/2009	149915.407	570794.549	100-N	16.0	42.0	39.5	580	5.46	3.70	Inverts. (Scuds)		EN
100A Whitefish 24	5	2/9/2009	150144.327	570954.338	100-N	15.0	38.5	35.5	500	4.23	3.19	Inverts. (Scuds)		EN
100A Whitefish 25	5	2/9/2009	150339.755	571096.499	100-N	16.0	39.0	36.0	640	6.14	6.38	Inverts. (Scuds)		EN

Table B-2. Laboratory Processing Records: 300 Area and Lake Wallula Sub-Areas Whitefish.

			State Plane South 4602		Field Record	Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record
Field ID	Composite	Date	Northing	Easting	General Collection Area	Total Length (in)	Total Length (cm)	Fork Length (cm)	Total Body Wt. (g)	Liver Wt. (g)	Kidney Wt. (g)	Stomach Contents	Sex (M/F) If Known	General Condition
300A Whitefish 13	1	2/2/2009	110585.969	595502.745	WSU	15.0	39.0	36.0	580	4.45	2.25	Inverts. (Scuds)		EN
300A Whitefish 14	1	2/2/2009	110277.814	595542.058	WSU	20.0	51.5	49.0	1220	12.93	9.13	Snails		granulomas on intestine
300A Whitefish 10	1	2/2/2009	110264.339	595548.965	WSU	17.0	40.0	36.5	560	7.74	5.86	Inverts. (Scuds)		laceration on right side
300A Whitefish 16	1	2/3/2009	111013.592	595471.348	WSU	17.0	43.0	40.5	620	4.59	3.88	Inverts. (Scuds)		EN
300A Whitefish 17	1	2/3/2009	110648.411	595533.508	WSU	15.0	38.5	36.5	500	4.50	2.75	Inverts. (Scuds)		EN
300A Whitefish 5	2	1/27/2009	111248.959	595438.682	WSU	15.0	38.0	36.0	520	5.08	6.56	Inverts. (Scuds)	F	deep scar near dorsal
300A Whitefish 9	2	2/2/2009	111179.089	595444.037	WSU	17.0	42.5	39.5	720	5.87	6.53	Snails		granulomas on intestine
300A Whitefish 18	2	2/4/2009	111360.055	595428.479	WSU	18.0	45.0	43.5	820	7.77	6.80	Inverts. (Scuds)		EN
300A Whitefish 19	2	2/4/2009	111298.702	595425.008	WSU	16.0	38.5	37.0	560	4.73	4.06	Inverts. (Scuds)		EN
300A Whitefish 20	2	2/4/2009	111177.471	595458.892	WSU	17.0	42.0	39.5	660	5.40	2.99	Inverts. (Scuds)		EN
300A Whitefish 1	3	1/27/2009	111724.606	595326.923	WSU	14.5	38.5	35.5	550	3.20	2.20	Inverts. (Scuds)		EN
300A Whitefish 2	3	1/27/2009	111543.642	595348.401	WSU	15.0	40.0	38.5	680	6.60	3.91	Inverts. (Scuds)		granulomas on intestine
300A Whitefish 3	3	1/27/2009	111495.520	595371.730	WSU	18.0	45.5	43.0	920	6.40	4.18	Inverts. (Scuds)		EN
300A Whitefish 4	3	1/27/2009	111447.399	595395.063	WSU	14.0	37.0	35.0	520	6.05	3.34	Inverts. (Scuds)		EN
300A Whitefish 11	3	2/2/2009	111418.657	595408.912	WSU	16.0	41.0	38.0	680	6.29	3.38	Inverts. (Scuds)		EN
300A Whitefish 6	4	2/1/2009	121737.592	594599.282	Wooded Island	18.0	45.0	42.0	900	8.62	6.52	Inverts. (Scuds)		EN
300A Whitefish 7	4	2/1/2009	121941.727	594599.069	Wooded Island	17.0	42.0	39.5	640	5.62	4.34	Inverts. (Scuds)		granulomas on intestine
300A Whitefish 8	4	2/1/2009	124522.415	594552.539	Wooded Island	16.0	40.5	37.5	580	7.76	4.78	Empty		EN
300A Whitefish 26	4	2/22/2009	124226.502	594535.447	Wooded Island	18.0	45.5	42.5	740	7.67	5.47	Inverts. (Scuds)		EN
300A Whitefish 27	4	2/22/2009	124566.377	594584.441	Wooded Island	15.75	38.0	35.0	480	2.73	2.49	Inverts. (Scuds)		EN
300A Whitefish 21	5	2/5/2009	140181.953	585720.259	Townsite	16.0	38.5	36.5	620	5.09	3.52	Inverts. (Scuds)		granulomas on stomach
300A Whitefish 22	5	2/5/2009	140250.713	585717.629	Townsite	13.5	34.5	32.5	380	2.12	2.03	Inverts. (Scuds)		EN
300A Whitefish 23	5	2/5/2009	140272.273	585716.534	Townsite	14.5	36.0	33.5	380	1.98	2.42	NA		EN
300A Whitefish 24	5	2/5/2009	140237.841	585694.959	Townsite	12.0	30.0	29.0	280	1.51	2.24	NA		EN
300A Whitefish 25	5	2/5/2009	139743.459	586165.482	Townsite	14.0	35.5	34.0	400	3.61	2.67	Inverts. (Scuds)		granulomas on intestine
LW Whitefish 9	1	2/10/2009	100829.027	602951.833	Pasco	17.0	42.0	40.5	860	8.46	7.18	Inverts. (Scuds)	F	EN
LW Whitefish 10	1	2/10/2009	100785.362	603196.538	Pasco	18.75	46.5	43.5	860	12.79	7.53	Inverts. (Scuds)		EN
LW Whitefish 11	1	2/10/2009	100618.087	603852.072	Pasco	17.5	41.5	39.0	700	6.68	3.76	Inverts. (Scuds)		EN
LW Whitefish 15	1	2/10/2009	100738.821	603286.741	Pasco	16.0	40.0	38.0	640	5.63	4.24	Inverts. (Scuds)	F	EN
LW Whitefish 16	1	2/10/2009	100657.546	603520.057	Pasco	17.0	43.0	40.5	660	5.98	3.60	Inverts. (Scuds)	F	EN
LW Whitefish 8	2	2/10/2009	101053.206	602125.290	Pasco	16.0	38.5	36.5	600	6.37	3.23	Inverts. (Scuds)	F	EN
LW Whitefish 12	2	2/10/2009	101090.748	602035.893	Pasco	17.0	41.5	38.5	760	7.25	3.71	Inverts. (Scuds)		EN
LW Whitefish 13	2	2/10/2009	101021.847	602285.162	Pasco	18.0	43.5	40.0	840	11.22	5.50	Inverts. (Scuds)		EN
LW Whitefish 14	2	2/10/2009	100998.120	602345.521	Pasco	17.0	41.0	38.5	660	4.92	3.43	Inverts. (Scuds)		granulomas on intestine
LW Whitefish 17	2	2/10/2009	100894.088	602768.476	Pasco	17.5	42.5	40.0	760	8.31	3.95	Inverts. (Scuds)		EN
LW Whitefish 22	3	2/11/2009	102281.532	599294.583	Pasco	16.5	42.0	39.5	680	6.11	3.82	Inverts. (Scuds)		granulomas on stomach
LW Whitefish 23	3	2/11/2009	102263.900	599313.220	Pasco	15.5	39.5	37.0	600	5.84	2.53	Inverts. (Scuds)	F	EN
LW Whitefish 24	3	2/11/2009	102034.369	599581.932	Pasco	16.0	42.0	39.5	620	5.58	4.64	Inverts. (Scuds)		granulomas on stomach
LW Whitefish 25	3	2/11/2009	102320.313	599198.660	Pasco	17.0	42.5	40.0	660	5.85	3.00	Inverts. (Scuds)		EN
LW Whitefish 26	3	2/11/2009	102320.313	599198.660	Pasco	17.5	43.5	42.0	780	8.26	5.70	Inverts. (Scuds)		EN
LW Whitefish 3	4	2/4/2009	107312.337	594880.034	Richland	16.0	38.0	36.5	520	4.05	5.65	Inverts. (Scuds)		EN
LW Whitefish 4	4	2/4/2009	106988.497	594786.963	Richland	16.0	45.0	42.5	760	6.80	4.05	Inverts. (Scuds)	F	EN
LW Whitefish 7	4	2/4/2009	106986.016	594794.213	Richland	17.0	41.5	40.0	760	5.63	4.87	Inverts. (Scuds)	F	EN
LW Whitefish 19	4	2/11/2009	107006.910	594785.276	Richland	18.0	42.5	41.0	720	6.89	4.52	Inverts. (Scuds)		EN
LW Whitefish 20	4	2/11/2009	106961.424	594773.132	Richland	17.0	41.5	38.5	660	6.10	3.38	Inverts. (Scuds)		EN
LW Whitefish 2	5	2/4/2009	107437.364	594918.910	Richland	17.0	42.0	39.5	680	11.79	8.89	Inverts. (Scuds)	F	2 lacaration/1 sub eq
LW Whitefish 5	5	2/4/2009	107484.000	594911.422	Richland	17.0	42.0	40.5	660	10.31	4.29	Inverts. (Scuds)		EN
LW Whitefish 6	5	2/4/2009	107379.795	594896.013	Richland	17.0	42.0	40.0	600	4.62	3.95	Inverts. (Scuds)		granulomas on intestine
LW Whitefish 18	5	2/11/2009	107395.581	594882.450	Richland	16.5	41.5	40.0	660	5.15	4.10	Inverts. (Scuds)		EN
LW Whitefish 21	5	2/11/2009	107388.027	594883.479	Richland	18.0	46.0	43.5	960	11.85	6.15	Inverts. (Scuds)		EN

Table B-3. Laboratory Processing Records: Upriver and 100 Area Sub-Areas Bass.

			State Plane South 4602			Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record
Field ID	Composite	Date	Northing	Easting	Location	Total Length (in)	Total Length (cm)	Fork Length (cm)	Total Weight (g)	liver wt (g)	kidney wt(g)	Stomach Contents	Sex (M/F) If Known	General Condition
UR Bass 1	1	07/15/09	164935.63	544173.58	Lake Wanapum	9.0	23.0	22.0	160	1.33	0.37	Craw dads		Normal
UR Bass 2	1	07/15/09	164940.88	544130.29	Lake Wanapum	12.0	30.5	29.5	420	4.53	1.03	Craw dads	F	Normal
UR Bass 3	1	07/15/09	164809.04	544090.56	Lake Wanapum	12.0	30.0	29.0	380	8.54	1.22	Invertebrates	F	Normal
UR Bass 4	1	07/15/09	164891.59	544231.14	Lake Wanapum	11.0	28.0	27.0	296	3.51	0.87	Sculpin	F	Normal
UR Bass 5	1	07/15/09	164982.46	543990.09	Lake Wanapum	9.0	23.0	21.0	164	2.29	0.33	Invertebrates		Normal
UR Bass 6	2	07/15/09	167402.12	542708.66	Lake Wanapum	12.0	31.0	30.0	400	8.16	1.54	Invertebrates	F	Yel/org gonads
UR Bass 7	2	07/15/09	167638.68	542626.89	Lake Wanapum	11.5	29.0	28.5	320	3.15	1.38	Invertebrates		Normal
UR Bass 18	2	07/20/09	167283.47	542698.06	Lake Wanapum	9.0	22.5	21.0	154	2.20	0.64	Invertebrates		Normal
UR Bass 19	2	07/20/09	167647.36	542544.20	Lake Wanapum	10.0	25.0	23.5	218	1.54	0.41	Invertebrates		Normal
UR Bass 20	2	07/20/09	167553.66	542655.47	Lake Wanapum	10.0	26.0	25.0	244	3.36	0.63	Invertebrates		Normal
UR Bass 13	3	07/16/09	171703.72	540785.16	Wanapum dam	9.0	21.5	20.5	140	1.09	0.57	Unidentified		Normal
UR Bass 14	3	07/16/09	171692.01	540697.58	Wanapum dam	13.3	35.0	33.0	560	3.25	1.28	Craw dads		Normal
UR Bass 15	3	07/16/09	171656.05	540584.75	Wanapum dam	11.0	28.5	26.5	340	3.89	0.76	Craw dad & Inverts		Normal
UR Bass 16	3	07/20/09	171665.86	540665.99	Wanapum dam	10.5	27.0	26.5	320	2.85	1.28	Fish & Invertebrates		Normal
UR Bass 17	3	07/20/09	171622.94	540620.55	Wanapum dam	10.0	27.0	26.0	340	4.34	1.74	Fish		Normal
UR Bass 8	4	07/16/09	150299.13	543346.44	Desert aire	11.5	36.5	35.5	740	17.95	5.27	Invertebrates	F	Normal
UR Bass 9	4	07/16/09	150068.62	543494.72	Desert aire	9.0	23.0	22.5	180	1.48	0.67	Invertebrates		Normal
UR Bass 10	4	07/16/09	150429.84	543230.75	Desert aire	12.0	33.0	31.5	520	9.10	5.36	Craw dad		Normal
UR Bass 11	4	07/16/09	150011.88	543590.76	Desert aire	13.0	35.0	34.0	580	16.30	4.57	Craw dad & Inverts		Normal
UR Bass 12	4	07/16/09	150068.94	543539.34	Desert aire	11.0	28.0	27.5	360	5.01	2.42	Invertebrates		Normal
UR Bass 21	5	07/20/09	168414.72	541262.54	Lake Wanapum	9.0	23.0	22.0	120	1.58	0.63	Unidentified		Normal
UR Bass 22	5	07/20/09	168364.59	541247.63	Lake Wanapum	13.5	34.0	33.0	560	11.71	4.57	Invertebrates	F	Normal
UR Bass 23	5	07/20/09	168529.52	541252.86	Lake Wanapum	10.0	26.0	25.5	240	2.71	0.92	Craw dad Claw		Normal
UR Bass 24	5	07/20/09	168518.40	541252.93	Lake Wanapum	10.5	26.5	26.0	300	4.98	1.51	Craw dad & Inverts		Normal
UR Bass 25	5	07/20/09	168488.91	541274.74	Lake Wanapum	12.0	31.0	30.5	380	3.60	2.42	Empty		Normal
100A Bass 1	1	07/08/09	145239.51	564843.96	100 BC	9.0	23.0	22.0	160	1.12	1.16	Unidentified		Normal
100A Bass 2	1	07/08/09	145254.05	564818.28	100 BC	9.5	25.0	24.0	260	2.78	1.55	Craw dad		Normal
100A Bass 3	1	07/08/09	145270.52	564798.96	100 BC	9.0	23.0	22.0	160	1.32	0.89	Empty		Normal
100A Bass 13	1	07/20/09	145323.50	564901.76	100 BC	9.0	23.0	22.0	180	1.30	1.19	Craw dad		Normal
100A Bass 14	1	07/20/09	145306.37	564859.83	100 BC	9.5	29.0	28.0	340	4.38	2.04	Craw dad		Normal
100A Bass 4	2	07/08/09	147352.52	568126.57	Coyote Rapids	10.0	26.0	25.0	240	2.72	1.88	Empty		Normal
100A Bass 5	2	07/08/09	147324.49	568105.21	Coyote Rapids	9.0	23.0	22.5	160	1.42	1.20	Empty	F	Normal
100A Bass 6	2	07/08/09	147469.89	568348.49	Coyote Rapids	10.0	26.0	25.0	240	2.87	2.32	Unidentified		Normal
100A Bass 15	2	07/20/09	146486.78	567086.30	Coyote Rapids	9.0	23.5	22.5	180	2.00	1.01	Craw dad & Fish		Normal
100A Bass 16	2	07/20/09	146468.25	567086.51	Coyote Rapids	9.5	24.5	24.0	220	1.83	2.19	Invertebrates		Normal
100A Bass 7	3	07/14/09	149213.68	580128.13	100 F	10.5	27.5	26.5	320	3.17	1.58	Bivalve		Normal
100A Bass 8	3	07/14/09	149221.25	580139.51	100 F	9.0	23.5	23.0	220	2.18	1.23	Invertebrates		Normal
100A Bass 9	3	07/14/09	149186.59	580180.78	100 F	14.0	37.0	35.5	700	11.36	6.79	Craw dad;Fish;Inverts		Normal
100A Bass 10	3	07/14/09	149106.37	580278.78	100 F	10.5	25.5	25.0	240	1.20	0.63	Invertebrates		Normal
100A Bass 11	3	07/14/09	149012.19	580440.73	100 F	10.0	24.5	24.0	240	2.20	0.55	Invertebrates		Normal
100A Bass 12	4	07/14/09	146865.80	582569.42	100 F slough	9.5	24.0	22.5	220	2.04	1.62	Fish		Normal
100A Bass 17	4	07/20/09	146726.86	582570.05	100 F slough	9.0	23.0	22.0	140	1.10	0.47	Invertebrates		Normal
100A Bass 18	4	07/20/09	146603.97	582661.04	100 F slough	9.5	24.0	23.0	180	1.47	1.14	Craw dad		Normal
100A Bass 19	4	07/20/09	146844.66	582648.82	100 F slough	13.0	32.0	31.0	600	12.02	4.79	Craw dad;Fish;Inverts	F	Normal
100A Bass 20	4	07/20/09	146787.23	582649.61	100 F slough	10.5	27.0	26.0	340	4.85	2.72	Rocks & Inverts	F	Normal
100A Bass 21	5	07/20/09	149437.75	570941.77	100 N	14.0	36.0	35.5	660	6.17	4.64	Invertebrates		Normal
100A Bass 22	5	07/20/09	149451.00	570965.85	100 N	9.0	23.0	22.0	100	0.95	0.90	Craw dad		Normal
100A Bass 23	5	07/20/09	149482.81	570992.26	100 N	10.0	24.0	23.0	160	1.39	0.41	Craw dad		Normal
100A Bass 24	5	07/20/09	149467.99	570992.43	100 N	11.0	28.0	27.0	300	2.67	2.67	Craw dad		Normal
100A Bass 25	5	07/20/09	149466.07	570987.35	100 N	9.0	23.0	22.0	140	1.52	0.99	Craw dad		Normal

Table B-4. Laboratory Processing Records: 300 Area and Lake Wallula Sub-Areas Bass.

			State Plane South 4602			Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record
Field ID	Composite	Date	Northing	Easting	Location	Total Length (in)	Total Length (cm)	Fork Length (cm)	Total Weight (g)	liver wt (g)	kidney wt(g)	Stomach Contents	Sex (M/F) If Known	General Condition
300A Bass 4	1	07/06/09	109907.47	595537.29	Leslie Groves	13.0	33.0	32.0	440	6.88	4.51	Unidentified		Normal
300A Bass 15	1	07/13/09	113789.29	594970.76	300A	9.0	23.0	22.0	180	1.56	1.06	Craw dad		Normal
300A Bass 23	1	07/21/09	111310.09	595426.67	300A	10.0	26.0	25.0	280	2.54	2.14	Fish		Normal
300A Bass 24	1	07/21/09	111350.72	595418.33	300A	13.0	34.0	33.0	620	1.81	3.12	Fish	F	Normal
300A Bass 25	1	07/21/09	111262.09	595437.69	300A	10.0	27.0	26.0	320	4.13	2.80	Invertebrates		Normal
300A Bass 8	2	07/07/09	114516.03	594882.42	300A	11.0	28.0	27.0	300	2.12	1.88	Unidentified	F	Normal
300A Bass 9	2	07/07/09	114421.80	594899.29	300A	11.0	29.0	28.0	320	2.35	1.18	Craw dad		Normal
300A Bass 10	2	07/07/09	113924.48	594967.36	300A	9.3	25.0	24.0	180	0.82	0.63	Invertebrates		Normal
300A Bass 2	2	06/30/09	113867.28	594982.36	Port of Benton	10.3	26.0	25.0	240	2.96	2.11	Invertebrates		Normal
300A Bass 3	2	06/30/09	113822.73	594976.65	Port of Benton	10.0	25.0	24.0	220	4.43	1.91	Empty		Normal
300A Bass 16	3	07/13/09	114734.89	594898.24	300A	9.3	24.0	23.0	220	2.16	0.88	Craw dad	F	Normal
300A Bass 21	3	07/13/09	114702.98	594871.80	300A	11.0	28.0	27.0	300	1.77	1.82	Craw dad		Normal
300A Bass 22	3	07/13/09	114687.89	594854.07	300A	9.0	23.0	22.0	160	1.81	0.63	Unidentified		Normal
300A Bass 6	3	07/07/09	114643.67	594870.16	300A	10.0	27.0	26.0	280	2.46	2.94	Craw dad		Normal
300A Bass 7	3	07/07/09	114580.97	594889.10	300A	11.0	28.0	27.0	280	2.77	2.78	Craw dad & Inverts		Normal
300A Bass 5	4	07/07/09	114771.34	594859.19	300A	9.0	23.0	22.0	360	3.25	1.85	Empty	F	Normal
300A Bass 1	4	06/30/09	114992.85	594806.98	300A	10.0	26.0	25.0	700	2.91	1.22	Empty		Normal
300A Bass 17	4	07/13/09	115109.04	594773.10	300A	10.0	26.0	25.0	320	1.95	0.59	Unidentified		Normal
300A Bass 19	4	07/13/09	115072.10	594780.09	300A	10.0	28.0	27.0	170	4.10	1.53	Craw dad		Normal
300A Bass 20	4	07/13/09	114754.31	594836.37	300A	14.0	36.0	35.0	220	4.74	5.83	Fish	F	Normal
300A Bass 11	5	07/07/09	125064.23	595510.18	300A	11.0	28.0	27.0	320	4.96	3.38	Empty		Normal
300A Bass 12	5	07/07/09	125005.90	595571.30	300A	12.0	31.5	30.5	460	4.84	2.82	Empty	F	Normal
300A Bass 13	5	07/07/09	124994.91	595579.15	300A	9.3	28.0	27.0	320	4.83	2.79	Invertebrates	F	Normal
300A Bass 14	5	07/07/09	124976.35	595576.88	300A	11.0	24.0	23.0	220	2.91	1.26	Invertebrates & Fish		Normal
300A Bass 18	5	07/13/09	115175.60	594764.37	300A	12.5	32.0	31.0	500	6.32	4.73	Invertebrates		Normal
LW Bass 20	1	07/21/09	102434.43	598833.51	Chiaw ana Park	13.0	33.0	32.0	560	8.33	3.66	Invertebrates	F	Normal
LW Bass 22	1	07/21/09	107147.45	594861.47	How ard Amon	9.8	25.0	24.5	220	2.74	1.68	Invertebrates		Normal
LW Bass 23	1	07/21/09	102779.02	598489.88	Chiaw ana Park	9.5	23.5	23.0	180	1.43	0.83	Unidentified		Normal
LW Bass 24	1	07/21/09	102735.36	598539.43	Chiaw ana Park	10.0	25.0	24.5	220	2.50	1.08	Craw dad		Normal
LW Bass 25	1	07/21/09	102728.18	598553.68	Chiaw ana Park	10.5	26.5	25.5	360	3.06	2.17	Craw dad		Normal
LW Bass 1	2	06/29/09	104846.48	596164.23	Columbia point	11.0	28.0	27.0	400	7.87	5.29	Invertebrates		Normal
LW Bass 2	2	06/29/09	104803.86	596280.54	Columbia point	10.0	26.0	25.0	240	1.72	1.13	Craw dad		Normal
LW Bass 3	2	06/29/09	104411.40	596183.97	Columbia point	9.5	23.0	22.0	180	1.78	1.12	Invertebrates		Normal
LW Bass 4	2	06/29/09	104485.55	595951.51	Columbia point	10.5	26.0	25.0	220	4.00	1.53	Empty		Normal
LW Bass 5	2	06/29/09	104485.12	595924.53	Columbia point	10.5	26.0	25.0	260	3.32	1.47	Fish		Normal
LW Bass 6	3	06/29/09	104875.51	595183.45	How ard Amon	9.0	23.5	22.5	160	1.55	0.57	Invertebrates		Normal
LW Bass 7	3	06/29/09	104884.23	595148.63	How ard Amon	11.0	26.0	25.5	280	4.23	1.85	Empty	F	Normal
LW Bass 8	3	06/29/09	104896.71	595117.60	How ard Amon	9.5	24.0	22.5	200	2.39	1.09	Fish		Normal
LW Bass 9	3	06/29/09	104922.24	595091.50	How ard Amon	10.0	26.5	25.5	280	4.35	1.59	Invertebrates	F	Normal
LW Bass 10	3	06/29/09	104940.60	595080.93	How ard Amon	14.0	37.0	35.5	640	8.13	3.46	Craw dad	F	Normal
LW Bass 11	4	06/29/09	106454.26	594724.57	Leslie Groves	10.0	25.5	25.0	240	3.00	1.50	Invertebrates		Normal
LW Bass 12	4	06/29/09	106492.71	594695.72	Leslie Groves	11.5	27.0	26.0	280	3.83	2.69	Fish		Normal
LW Bass 13	4	06/29/09	106563.40	594713.89	Leslie Groves	10.0	25.0	24.0	200	2.64	1.51	Bivalve & Invertebrates		Normal
LW Bass 14	4	06/29/09	106613.61	594725.94	Leslie Groves	10.0	25.0	24.0	200	3.01	1.67	Fish		Normal
LW Bass 15	4	06/29/09	106658.21	594734.24	Leslie Groves	9.8	24.0	23.0	200	3.49	1.69	Invertebrates & Fish		Normal
LW Bass 16	5	06/29/09	106699.02	594737.46	Leslie Groves	10.0	24.0	23.5	200	2.48	0.94	Unidentified		Normal
LW Bass 17	5	06/29/09	106730.68	594748.52	Leslie Groves	10.0	24.5	23.5	200	3.02	1.65	Fish		Normal
LW Bass 18	5	06/29/09	106724.77	594725.50	Leslie Groves	10.5	26.5	25.5	240	2.99	1.90	Empty		Normal
LW Bass 19	5	07/13/09	106908.96	594775.28	Leslie Groves	9.0	24.0	23.0	180	1.41	0.65	Craw dad Claw		Normal
LW Bass 21	5	07/21/09	106760.36	594750.63	Leslie Groves	11.0	28.0	27.0	340	3.35	2.68	Fish		Normal

Table B-5. Laboratory Processing Records: Upriver and 300 Area Sub-Areas Suckers.

			State Plane South 4602		Field Record	Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record
Field ID	Composite	Date	Northing	Easting	General Collection Area	Total Length (in)	Total Length (cm)	Fork Length (cm)	Total Body Wt. (g)	Liver Wt. (g)	Kidney Wt. (g)	Stomach Contents	Sex (M/F) If Known	Condition Observations
Upriver Sucker 2	1	9/29/09	157023.20	541401.67	Upper Slough	21.0	52.0	50.0	1820	6.27	9.74	Invertebrates	F	Normal
Upriver Sucker 3	1	9/29/09	157023.20	541401.67	Upper Slough	19.0	47.0	44.0	1260	9.90	18.33	empty	NA	Normal
Upriver Sucker 4	1	9/29/09	157023.20	541401.67	Upper Slough	22.0	56.0	54.0	1860	11.33	9.52	unidentified	F	Normal
Upriver Sucker 5	1	9/29/09	157023.20	541401.67	Upper Slough	22.0	54.0	52.0	1660	12.81	16.73	unidentified	F	Normal
Upriver Sucker 6	1	9/29/09	157023.20	541401.67	Upper Slough	18.5	46.0	44.5	1060	6.98	9.69	empty	M	Normal
Upriver Sucker 7	2	9/29/09	157023.20	541401.67	Upper Slough	21.5	56.0	55.0	1740	12.34	18.57	unidentified	F	Normal
Upriver Sucker 8	2	9/29/09	157023.20	541401.67	Upper Slough	22.0	57.5	55.5	1960	10.98	14.96	unidentified	F	Normal
Upriver Sucker 9	2	9/29/09	157023.20	541401.67	Upper Slough	19.5	50.0	49.0	1340	10.31	20.12	unidentified	M	Normal
Upriver Sucker 10	2	9/29/09	157023.20	541401.67	Upper Slough	18.5	47.0	46.0	1100	9.07	13.98	invertebrates	NA	Normal
Upriver Sucker 11	2	9/29/09	157023.20	541401.67	Upper Slough	17.0	43.0	41.0	900	4.36	9.96	invertebrates	NA	Normal
Upriver Sucker 12	3	10/1/09	167682.81	542369.63	Beverly Slough	22.0	56.0	53.0	1840	5.32	14.02	empty	F	Normal
Upriver Sucker 13	3	10/1/09	167682.81	542369.63	Beverly Slough	22.0	56.0	54.0	1200	6.08	14.08	empty	NA	Normal
Upriver Sucker 14	3	10/1/09	167682.81	542369.63	Beverly Slough	21.0	54.0	52.5	1320	6.41	10.22	unidentified	F	Normal
Upriver Sucker 15	3	10/1/09	167682.81	542369.63	Beverly Slough	20.0	51.0	48.0	1440	16.35	16.21	unidentified	M	Normal
Upriver Sucker 16	3	10/1/09	167483.37	542658.58	Beverly Slough	20.0	46.0	43.0	1020	6.38	5.90	empty	NA	Normal
Upriver Sucker 17	4	11/23/09	158899.98	540650.62	Mid Lake	21.5	54.5	51.5	1640	21.48	14.10	unidentified	F	Normal
Upriver Sucker 18	4	11/23/09	158899.98	540650.62	Mid Lake	22.0	53.0	51.0	1560	22.75	15.97	unidentified	F	Normal
Upriver Sucker 19	4	11/23/09	158899.98	540650.62	Mid Lake	20.0	50.0	48.0	1110	9.13	10.15	empty	NA	Normal
Upriver Sucker 20	4	11/23/09	158899.98	540650.62	Mid Lake	19.0	50.0	47.5	1080	12.15	11.82	unidentified	M	Normal
Upriver Sucker 21	4	11/23/09	158899.98	540650.62	Mid Lake	21.5	55.0	52.0	1680	18.18	31.48	unidentified	F	Normal
Upriver Sucker 22	5	11/23/09	160684.26	543095.97	Mid Lake East	22.0	56.0	53.5	1640	14.57	10.09	unidentified	F	Normal
Upriver Sucker 23	5	11/23/09	160684.26	543095.97	Mid Lake East	21.0	53.5	51.0	1680	27.13	16.86	empty	F	Normal
Upriver Sucker 24	5	11/23/09	160684.26	543095.97	Mid Lake East	22.0	56.0	52.5	1560	25.50	10.86	unidentified	F	Normal
Upriver Sucker 25	5	11/23/09	161033.45	543229.90	Mid Lake East	19.5	46.0	44.0	1260	10.34	23.12	unidentified	M	Normal
Upriver Sucker 26	5	11/23/09	160738.15	543081.17	Mid Lake East	21.0	55.0	51.0	1560	18.20	16.29	unidentified	F	Normal
300 A Sucker 1	1	10/7/2009	122200.35	595016.36	Wooded Island	19.5	48.5	47.5	1260	5.16	8.44	unidentified	NA	Normal
300 A Sucker 3	1	11/16/09	121041.95	594734.33	Wooded Island	22.5	54.5	53.0	2220	27.75	20.14	unidentified	F	Normal
300 A Sucker 4	1	11/16/09	120935.29	594727.36	Wooded Island	21.0	54.5	52.5	1940	34.33	7.52	empty	F	Normal
300 A Sucker 5	1	11/16/09	120833.52	594745.06	Wooded Island	19.0	50.0	48.0	1320	13.03	12.42	unidentified	NA	Normal
300 A Sucker 6	1	11/16/09	120692.92	594741.11	Wooded Island	20.0	50.5	48.0	1440	19.09	12.72	unidentified	F	Normal
300 A Sucker 2	2	10/25/2009	114506.49	594878.59	300 Area (lower)	23.0	61.0	58.0	2300	36.15	27.55	unidentified	F	Normal
300 A Sucker 17	2	11/16/09	116595.65	594455.36	300 Area (lower)	20.0	51.0	49.0	1680	18.11	28.62	unidentified	NA	Normal
300 A Sucker 18	2	11/16/09	116515.37	594462.34	300 Area (lower)	21.0	48.0	46.0	1620	23.63	9.72	unidentified	F	Normal
300 A Sucker 19	2	11/16/09	116442.07	594465.83	300 Area (lower)	20.0	49.0	47.0	1360	12.37	6.27	unidentified	M	Normal
300 A Sucker 20	2	11/16/09	116368.25	594470.01	300 Area (lower)	24.5	59.5	57.5	2460	42.05	24.99	empty	F	Normal
300 A Sucker 7	3	11/16/09	119025.54	594589.32	Johnson Island	21.5	53.0	51.5	1460	20.30	14.49	unidentified	F	Normal
300 A Sucker 8	3	11/16/09	118674.45	594516.98	Johnson Island	21.5	54.0	51.0	1620	21.97	18.04	unidentified	F	Normal
300 A Sucker 9	3	11/16/09	118272.81	594478.73	Johnson Island	19.5	51.5	48.5	1220	19.89	8.21	unidentified	F	Normal
300 A Sucker 10	3	11/16/09	117899.85	594411.79	Johnson Island	22.5	58.5	56.0	2220	21.07	12.44	unidentified	F	Normal
300 A Sucker 11	3	11/16/09	117669.45	594371.90	Johnson Island	21.0	56.0	53.0	1540	20.64	16.81	empty	F	Normal
300 A Sucker 12	4	11/16/09	116991.12	594390.28	300 Area (upper)	18.0	46.0	43.5	1040	20.09	13.41	unidentified	NA	Normal
300 A Sucker 13	4	11/16/09	116913.27	594409.98	300 Area (upper)	22.0	55.0	52.5	1720	23.84	15.82	unidentified	F	Normal
300 A Sucker 14	4	11/16/09	116846.95	594416.96	300 Area (upper)	23.5	62.0	59.0	2480	31.96	16.44	unidentified	F	Normal
300 A Sucker 15	4	11/16/09	116763.18	594430.93	300 Area (upper)	23.0	57.0	55.0	1640	11.57	15.05	empty	F	Normal
300 A Sucker 16	4	11/16/09	116696.87	594444.89	300 Area (upper)	22.0	54.0	51.5	1820	18.58	17.32	unidentified	F	Normal
300 A Sucker 21	5	11/17/2009	139568.48	586385.24	Hanford Townsite	20.5	53.0	51.0	1500	19.13	17.47	unidentified	F	Normal
300 A Sucker 22	5	11/17/2009	139502.87	586454.12	Hanford Townsite	19.5	49.5	48.0	1340	20.95	16.13	unidentified	NA	Normal
300 A Sucker 23	5	11/17/2009	139404.46	586542.69	Hanford Townsite	21.0	55.0	52.0	1560	12.14	25.31	empty	F	Normal
300 A Sucker 24	5	11/17/2009	139338.86	586621.42	Hanford Townsite	23.0	58.0	56.0	2100	21.59	22.73	unidentified	F	Normal
300 A Sucker 25	5	11/17/2009	139304.48	586702.38	Hanford Townsite	22.0	54.0	51.5	1540	16.99	12.64	unidentified	F	Normal

Table B-6. Laboratory Processing Records: 100 Area and Lake Wallula Sub-Areas Suckers.

			State Plane South 4602		Field Record	Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record
Field ID	Composite	Date	Northing	Easting	General Collection Area	Total Length (in)	Total Length (cm)	Fork Length (cm)	Total Body Wt. (g)	Liver Wt. (g)	Kidney Wt. (g)	Stomach Contents	Sex (M/F) If Known	General Condition
100 Sucker 1	1	8/13/2009	149368.48	579729.71	WB Hole 2	20.0	50.0	48.0	1240	11.02	7.93	unidentified	F	Normal
100 Sucker 2	1	9/1/2009	149859.16	580014.74	WB Hole 2	22.0	54.0	52.5	1600	11.38	13.88	empty	M	Normal
100 Sucker 4	1	9/1/2009	149158.26	579888.59	WB Hole 2	22.5	56.0	53.0	1900	18.85	12.22	empty	M	Normal
100 Sucker 5	1	9/3/2009	149822.54	580019.82	WB Hole 2	22.0	53.0	51.0	1700	10.09	16.15	empty	F	Normal
100 Sucker 6	1	9/8/2009	149815.77	580012.26	WB Hole 2	21.5	51.0	49.5	1500	24.85	13.78	empty	F	Normal
100 Sucker 7	2	11/19/2009	152081.31	572976.79	100 D	20.5	53.0	51.0	1640	14.34	19.75	empty	F	Normal
100 Sucker 8	2	11/19/2009	151975.60	572905.68	100 D	24.0	59.0	57.5	2360	32.06	22.06	unidentified	F	Normal
100 Sucker 9	2	11/19/2009	151708.68	572627.43	100 D	24.0	59.5	57.0	1980	20.19	13.48	empty	M	Normal
100 Sucker 10	2	11/19/2009	151890.25	572871.54	100 D	23.5	58.0	55.0	2420	24.34	20.34	unidentified	M	Normal
100 Sucker 11	2	11/19/2009	151839.03	572828.86	100 D	19.5	49.0	47.0	1220	27.11	14.72	empty	F	Normal
100 Sucker 12	3	11/19/2009	145464.30	564594.00	100 BC	22.0	57.5	54.5	1740	24.54	7.87	unidentified	F	Normal
100 Sucker 13	3	11/19/2009	145367.91	564720.43	100 BC	22.5	58.0	54.0	2020	22.33	18.94	unidentified	F	Normal
100 Sucker 14	3	11/19/2009	145367.91	564720.43	100 BC	20.5	53.5	52.0	1560	15.59	13.33	unidentified	F	Normal
100 Sucker 15	3	11/19/2009	145367.91	564720.43	100 BC	21.0	52.0	49.5	1660	17.39	15.06	unidentified	F	Normal
100 Sucker 16	3	11/19/2009	145367.91	564720.43	100 BC	23.5	58.0	54.0	2080	28.28	15.81	unidentified	F	Normal
100 Sucker 17	4	11/19/2009	146908.75	568339.67	100 K	22.0	58.0	54.0	1840	25.24	14.91	empty	F	Normal
100 Sucker 18	4	11/19/2009	146991.19	568437.35	100 K	22.0	54.5	53.0	1600	16.45	9.35	unidentified	F	Normal
100 Sucker 19	4	11/19/2009	147022.91	568500.79	100 K	20.5	51.0	49.0	1480	9.08	14.46	empty	F	Normal
100 Sucker 20	4	11/19/2009	147071.81	568607.46	100 K	19.0	49.0	46.0	1100	10.24	11.20	unidentified	NA	Normal
100 Sucker 21	4	11/19/2009	147121.73	568677.08	100 K	22.0	57.5	55.5	1660	15.05	11.79	unidentified	F	Normal
100 Sucker 22	5	11/19/2009	149014.41	570493.13	100 N	19.5	48.0	46.0	1260	12.43	7.76	empty	M	Normal
100 Sucker 23	5	11/19/2009	149140.24	570656.90	100 N	21.5	52.5	50.0	1740	18.45	11.45	unidentified	M	Normal
100 Sucker 24	5	11/19/2009	149140.24	570656.90	100 N	20.5	55.0	52.0	1520	19.15	15.65	empty	F	Normal
100 Sucker 25	5	11/19/2009	149140.24	570656.90	100 N	19.0	47.0	45.5	1120	15.62	10.65	unidentified	M	Normal
100 Sucker 26	5	11/19/2009	149140.24	570656.90	100 N	19.0	50.0	46.5	1240	9.52	11.10	unidentified	F	Normal
LW Sucker 2	1	10/6/2009	103016.15	597672.99	Yakima Delta 1	19.0	48.0	45.0	1060	8.99	11.28	unidentified	M	Normal
LW Sucker 3	1	10/6/2009	103016.15	597672.99	Yakima Delta 1	23.0	58.5	55.0	2100	13.49	16.92	unidentified	F	Normal
LW Sucker 14	1	10/22/2009	104942.25	595906.35	Columbia Pt (East)	25.0	63.0	60.0	3020	31.76	18.96	unidentified	M	Normal
LW Sucker 15	1	10/22/2009	104942.25	595906.35	Columbia Pt (East)	20.5	53.0	51.0	1600	13.62	12.63	empty	M	Normal
LW Sucker 16	1	10/22/2009	104942.25	595906.35	Columbia Pt (East)	23.0	55.5	53.0	1920	19.37	11.56	unidentified	F	Normal
LW Sucker 4	2	10/21/2009	99321.52	608782.62	Cascade Marina	19.5	49.5	48.5	1580	20.43	11.81	unidentified	M	Normal
LW Sucker 5	2	10/21/2009	99321.52	608782.62	Cascade Marina	19.5	47.0	45.0	1340	21.41	11.00	unidentified	F	Normal
LW Sucker 6	2	10/21/2009	99049.80	609314.55	Cascade Marina	20.5	52.0	49.5	1620	20.94	8.82	unidentified	M	Normal
LW Sucker 7	2	10/21/2009	99049.80	609314.55	Cascade Marina	19.5	49.0	48.0	1660	26.72	15.51	unidentified	M	Normal
LW Sucker 8	2	10/21/2009	99049.80	609314.55	Cascade Marina	20.0	50.5	49.0	1440	12.97	8.95	unidentified	NA	Normal
LW Sucker 9	3	10/21/2009	99049.80	609314.55	Cascade Marina	18.0	44.0	41.0	1160	14.64	6.71	unidentified	NA	Normal
LW Sucker 10	3	10/21/2009	99049.80	609314.55	Cascade Marina	20.5	51.0	48.0	1600	22.59	16.3	unidentified	F	Normal
LW Sucker 11	3	10/21/2009	99049.80	609314.55	Cascade Marina	20.0	51.0	49.0	1580	17.49	13.73	unidentified	M	Normal
LW Sucker 12	3	10/21/2009	99049.80	609314.55	Cascade Marina	22.0	53.0	50.0	2080	26.81	15.1	unidentified	F	Normal
LW Sucker 13	3	10/21/2009	99049.80	609314.55	Cascade Marina	23.0	58.0	56.0	2080	27.15	15.28	unidentified	F	Normal
LW Sucker 17	4	10/22/2009	104942.25	595906.35	Columbia Pt (East)	22.0	56.0	53.0	1840	23.02	23.25	empty	F	Normal
LW Sucker 18	4	10/22/2009	104942.25	595906.35	Columbia Pt (East)	22.0	50.0	49.0	1320	10.44	15.34	unidentified	F	Normal
LW Sucker 19	4	10/22/2009	104942.25	595906.35	Columbia Pt (East)	20.0	51.0	48.0	1260	14.77	10.18	unidentified	M	Normal
LW Sucker 20	4	10/22/2009	104942.25	595906.35	Columbia Pt (East)	23.0	59.0	56.0	2080	20.17	26.13	unidentified	F	Normal
LW Sucker 21	4	10/22/2009	104942.25	595906.35	Columbia Pt (East)	21.0	55.0	54.0	1960	22.43	15.06	unidentified	F	Normal
LW Sucker 22	5	10/22/2009	105131.60	594933.88	Howard Amon	20.0	47.5	46.0	1340	10.88	12.36	empty	M	Normal
LW Sucker 23	5	10/22/2009	104942.25	595906.35	Columbia Pt (East)	22.0	55.0	53.0	1800	12.07	11.35	unidentified	F	Normal
LW Sucker 24	5	10/22/2009	104942.25	595906.35	Columbia Pt (East)	20.5	52.0	50.5	1360	9.66	8.53	unidentified	M	Normal
LW Sucker 25	5	10/22/2009	104942.25	595906.35	Columbia Pt (East)	20.0	49.5	47.0	1440	18.92	14.01	unidentified	F	Normal
LW Sucker 26	5	10/22/2009	104942.25	595906.35	Columbia Pt (East)	20.5	53.5	51.0	1560	25.81	8.27	unidentified	M	Normal

Table B-7. Laboratory Processing Records: Lake Wallula and 300 Area Sub-Areas Carp.

			State Plane South 4602			Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Other	Lab Record
Field ID	Composite	Date	Northing	Easting	General Collection Area	Total Length (in)	Total Length (cm)	Fork Length (cm)	Total Body Wt. (g)	Liver Wt. (g)	Kidney Wt. (g)	Stomach Contents	Sex M/F If Known	General Condition
LW Carp 1	1	10/6/09	103016.15	597672.99	Yakima Delta 1	25.0	61.5	57.0	3240	19.97	13.58	NA	male	Normal
LW Carp 2	1	10/6/09	103016.15	597672.99	Yakima Delta 1	25.5	66.0	60.5	3540	40.44	26.97	NA	male	Normal
LW Carp 3	1	10/6/09	103016.15	597672.99	Yakima Delta 1	26.0	66.0	60.0	3460	36.33	16.58	unidentified	male	Normal
LW Carp 4	1	10/6/09	103016.15	597672.99	Yakima Delta 1	25.0	66.0	59.5	3760	46.26	25.04	NA	male	Normal
LW Carp 5	1	10/6/09	103016.15	597672.99	Yakima Delta 1	28.5	74.0	68.0	5640	43.88	26.32	NA	female	Normal
LW Carp 6	2	10/6/09	103016.15	597672.99	Yakima Delta 1	26.5	67.0	62.0	4160	55.62	18.77	NA	male	Normal
LW Carp 7	2	10/6/09	103016.15	597672.99	Yakima Delta 1	24.0	64.0	62.0	2880	46.86	41.80	NA	male	Normal
LW Carp 8	2	10/6/09	103016.15	597672.99	Yakima Delta 1	24.5	63.0	58.0	3240	58.62	24.43	95% clams	female	Normal
LW Carp 9	2	10/6/09	103016.15	597672.99	Yakima Delta 1	26.0	69.5	64.5	4080	27.65	37.41	unidentified	female	Normal
LW Carp 10	2	10/6/09	103016.15	597672.99	Yakima Delta 1	27.0	69.5	65.5	4260	76.59	40.68	NA	male	Normal
LW Carp 11	3	10/6/09	103497.56	597151.26	Yakima Delta 2	25.0	65.0	59.0	3400	39.04	17.11	unidentified	female	Normal
LW Carp 12	3	10/6/09	103497.56	597151.26	Yakima Delta 2	25.0	64.0	59.0	3600	77.86	51.94	unidentified	male	Normal
LW Carp 13	3	10/6/09	103497.56	597151.26	Yakima Delta 2	29.0	72.0	67.0	5800	125.16	43.20	80% clams	female	Normal
LW Carp 14	3	10/6/09	103497.56	597151.26	Yakima Delta 2	25.5	66.5	61.5	3540	45.08	48.52	unidentified	male	Normal
LW Carp 15	3	10/6/09	103497.56	597151.26	Yakima Delta 2	23.5	62.0	57.0	2940	30.07	12.60	unidentified	female	Normal
LW Carp 16	4	10/21/09	99049.68	609314.63	Cascade Marina	25.0	62.0	59.0	3660	91.80	39.88	unidentified	male	Normal
LW Carp 17	4	10/21/09	99049.68	609314.63	Cascade Marina	30.0	77.0	72.0	8300	126.57	73.66	50% clams	female	Normal
LW Carp 18	4	10/21/09	99049.68	609314.63	Cascade Marina	25.5	66.0	61.0	3960	113.57	27.90	unidentified	male	Normal
LW Carp 19	4	10/21/09	99049.68	609314.63	Cascade Marina	28.0	72.0	67.0	6000	76.61	34.32	unidentified	female	Normal
LW Carp 20	4	10/21/09	99049.68	609314.63	Cascade Marina	25.0	63.5	59.5	3520	116.21	30.30	unidentified	male	Normal
LW Carp 21	5	10/22/09	104942.25	595906.35	Columbia Pt East	28.0	71.5	67.0	6480	122.29	36.10	unidentified	female	Normal
LW Carp 22	5	10/22/09	105131.60	594933.88	Howard Amon	25.5	63.0	58.0	4160	72.71	30.18	unidentified	female	Normal
LW Carp 23	5	10/22/09	105131.60	594933.88	Howard Amon	28.0	70.0	65.0	5260	88.23	31.68	5% clams	female	Normal
LW Carp 24	5	10/22/09	105131.60	594933.88	Howard Amon	25.0	61.0	57.5	4400	67.95	24.46	unidentified	female	Normal
LW Carp 25	5	10/22/09	105131.60	594933.88	Howard Amon	26.0	62.0	58.0	3140	84.41	16.85	unidentified	male	Normal
300A Carp 1	1	9/28/09	140893.74	585003.87	Hanford Slough	25.0	65.0	61.0	3680	49.83	13.79	unidentified	female	Normal
300A Carp 2	1	9/28/09	140842.12	585080.27	Hanford Slough	25.0	63.0	59.0	4460	71.17	18.34	5% clams	female	Normal
300A Carp 3	1	9/28/09	140822.75	585061.16	Hanford Slough	20.5	53.0	48.5	1740	16.11	6.99	unidentified	male	Normal
300A Carp 4	1	9/28/09	140822.75	585061.16	Hanford Slough	21.5	58.0	54.5	2980	58.39	16.94	50% clams	female	Normal
300A Carp 5	1	9/28/09	140842.12	585080.27	Hanford Slough	25.0	63.0	58.5	4540	96.11	30.62	85% clams	female	Normal
300A Carp 6	2	10/7/2009	122200.35	595016.36	Wooded Island	21.5	54.5	50.5	1820	30.63	31.20	unidentified	male	Normal
300A Carp 7	2	10/7/2009	117991.32	594833.05	Johnson Island	26.5	66.0	62.5	4660	64.12	52.85	90% clams	male	Normal
300A Carp 8	2	10/7/2009	117991.32	594833.05	Johnson Island	28.0	70.0	66.0	5180	126.05	18.54	90% clams	male	Normal
300A Carp 9	2	10/7/2009	117991.32	594833.05	Johnson Island	27.5	72.0	67.0	5300	64.88	33.96	unidentified	female	Normal
300A Carp 10	2	10/7/2009	117991.32	594833.05	Johnson Island	26.0	53.0	49.0	4140	50.15	29.60	unidentified	male	Normal
300A Carp 11	3	10/7/2009	117991.32	594833.05	Johnson Island	22.0	54.0	51.0	1950	24.81	15.87	NA	female	Normal
300A Carp 12	3	10/7/2009	117991.32	594833.05	Johnson Island	25.0	64.0	59.0	4100	67.45	39.37	90% clams	male	Normal
300A Carp 13	3	10/7/2009	117991.32	594833.05	Johnson Island	24.5	61.0	57.0	3400	27.23	29.41	90% clams	female	Normal
300A Carp 14	3	10/7/2009	117991.32	594833.05	Johnson Island	25.0	64.0	61.0	4100	69.83	46.60	10% clams	male	Normal
300A Carp 15	3	10/7/2009	117991.32	594833.05	Johnson Island	27.5	66.0	61.0	5240	60.86	31.10	unidentified	female	Normal
300A Carp 16	4	10/25/2009	114506.49	594878.59	300 Area	25.0	65.0	61.0	4140	95.29	28.31	unidentified	male	Normal
300A Carp 17	4	10/25/2009	114562.44	594866.36	300 Area	26.0	68.0	63.0	4600	98.67	17.13	unidentified	female	Normal
300A Carp 18	4	10/25/2009	114617.2	594862.04	300 Area	27.0	71.0	66.0	5520	114.15	9.37	unidentified	female	Normal
300A Carp 19	4	10/25/2009	114654.67	594859.16	300 Area	25.0	63.0	57.0	3120	59.65	14.87	unidentified	male	Normal
300A Carp 20	4	10/25/2009	114699.54	594850.89	300 Area	31.0	80.0	73.0	8540	207.18	40.33	unidentified	female	Normal
300A Carp 21	5	11/17/2009	109821.75	595878.73	Leslie Groves	30.0	80.5	76.5	8320	146.08	17.85	empty	female	Normal
300A Carp 22	5	11/17/2009	109821.75	595878.73	Leslie Groves	25.0	63.5	58.5	3520	99.13	22.92	unidentified	male	Normal
300A Carp 23	5	11/17/2009	109821.75	595878.73	Leslie Groves	27.0	70.0	66.0	4700	75.03	47.67	unidentified	female	Normal
300A Carp 24	5	11/17/2009	109821.75	595878.73	Leslie Groves	27.0	68.5	64.5	5620	117.69	41.16	empty	female	Normal
300A Carp 25	5	11/17/2009	109821.75	595878.73	Leslie Groves	26.0	67.0	61.0	4300	134.48	33.49	unidentified	male	Normal

Table B-8. Laboratory Processing Records: Upriver and 100 Area Sub-Areas Carp.

			State Plane South 4602			Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Other	Lab Record
Field ID	Composite	Date	Northing	Easting	General Collection Area	Total Length (in)	Total Length (cm)	Fork Length (cm)	Total Body Wt. (g)	Liver Wt. (g)	Kidney Wt. (g)	Stomach Contents	Sex M/F If Known	General Condition
UR Carp 1	1	10/1/2009	167483.37	542658.58	Beverly Slough	24.0	60.0	56.0	4200	78.41	16.32	unidentified	female	Normal
UR Carp 2	1	10/1/2009	167483.37	542658.58	Beverly Slough	28.5	78.0	71.0	7520	117.78	60.09	5% snail,15% clams	male	Normal
UR Carp 3	1	10/1/2009	167483.37	542658.58	Beverly Slough	28.5	71.0	67.0	4740	65.61	58.62	unidentified	male	Normal
UR Carp 4	1	10/1/2009	167483.37	542658.58	Beverly Slough	27.0	64.0	61.0	4260	58.81	56.04	unidentified	male	Normal
UR Carp 5	1	10/1/2009	167483.37	542658.58	Beverly Slough	29.5	74.0	70.0	6840	175.02	90.62	NA	male	Normal
UR Carp 6	2	10/1/2009	167483.37	542658.58	Beverly Slough	27.0	68.0	66.0	6300	106.30	30.04	unidentified	female	Normal
UR Carp 7	2	10/1/2009	167483.37	542658.58	Beverly Slough	26.0	66.0	61.0	4320	75.76	56.18	unidentified	male	Normal
UR Carp 8	2	10/1/2009	167483.37	542658.58	Beverly Slough	24.5	65.0	61.0	5020	53.54	23.95	unidentified	female	Normal
UR Carp 9	2	10/1/2009	167483.37	542658.58	Beverly Slough	28.0	72.0	67.0	6660	123.87	28.41	unidentified	female	Normal
UR Carp 10	2	10/1/2009	167483.37	542658.58	Beverly Slough	27.0	67.0	62.0	4500	34.65	20.02	75% clams	male	Normal
UR Carp 11	3	11/23/2009	158899.98	540650.62	Midlake	28.0	69.0	64.0	6840	117.53	50.95	unidentified	female	Normal
UR Carp 12	3	11/23/2009	158899.98	540650.62	Midlake	26.0	68.0	62.0	5820	134.77	40.28	unidentified	female	Normal
UR Carp 13	3	11/23/2009	158899.98	540650.62	Midlake	28.5	73.5	67.5	7660	155.90	42.01	unidentified	female	Normal
UR Carp 14	3	11/23/2009	158922.56	540733.42	Midlake	28.5	74.0	69.0	6180	117.98	27.33	unidentified	male	Normal
UR Carp 15	3	11/23/2009	158922.56	540733.42	Midlake	21.5	56.0	52.5	3140	75.31	20.84	unidentified	female	Normal
UR Carp 17	4	12/2/2009	161892.76	543507.86	Mid Lake 2	24.0	61.5	58.0	3980	101.47	32.88	unidentified	male	Normal
UR Carp 18	4	12/2/2009	161892.76	543507.86	Mid Lake 2	27.0	72.5	63.0	6420	71.20	32.41	unidentified	female	Normal
UR Carp 19	4	12/2/2009	161892.76	543507.86	Mid Lake 2	26.5	69.0	65.0	5480	49.13	28.51	empty	female	Normal
UR Carp 20	4	12/2/2009	161892.76	543507.86	Mid Lake 2	31.5	85.0	74.5	10720	98.34	53.20	unidentified	female	Normal
UR Carp 21	4	12/2/2009	161892.76	543507.86	Mid Lake 2	25.5	66.0	54.0	4320	101.19	15.89	unidentified	male	Normal
100A Carp 1	1	8/18/2009	149377.3041	579724.2337	WB Hole 2	23.0	58.0	54.0	2760	37.93	10.14	unidentified	NA	Normal
100A Carp 2	1	9/1/2009	148399.7802	580615.738	WB	29.0	74.0	67.0	5900	57.88	59.48	75%clams, 25% craw dad	female	Normal
100A Carp 3	2	9/30/2009	150174.14	579408.87	WB Hole 2	21.0	54.0	51.0	2460	28.67	13.87	unidentified	male	Normal
100A Carp 4	2	9/30/2009	150083.52	579423.9	WB Hole 2	24.0	62.0	56.0	3960	64.06	31.27	unidentified	female	Normal
100A Carp 5	2	9/30/2009	149897.7	579461.8	WB Hole 2	22.0	58.0	53.0	3180	33.93	25.25	unidentified	female	Normal
100A Carp 6	2	9/30/2009	150024.15	579502.69	WB Hole 2	26.0	68.5	64.5	4460	60.01	30.57	NA	female	Normal
100A Carp 7	2	9/30/2009	149777.18	579560.35	WB Hole 2	23.0	58.5	53.5	3100	77.02	18.37	unidentified	male	Normal
100A Carp 8	1	9/30/2009	149777.18	579560.35	WB Hole 2	21.0	54.0	50.0	2200	33.53	21.59	unidentified	male	Normal
100A Carp 9	1	10/8/2009	149603.75	579568.11	WB Slough	27.0	68.0	64.0	5080	97.99	21.71	unidentified	male	Normal
100A Carp 10	1	10/8/2009	149755.62	579542.87	WB Slough	27.0	71.0	68.0	4980	96.38	35.99	unidentified	female	Normal
100A Carp 11	3	10/8/2009	155102.68	575834.72	Island 3	24.0	62.0	59.0	4040	62.16	22.09	unidentified	female	Normal
100A Carp 12	3	10/8/2009	155102.68	575834.72	Island 3	25.0	66.0	61.0	4260	67.73	27.42	5% clams	male	Normal
100A Carp 13	3	10/8/2009	155102.68	575834.72	Island 3	23.5	58.0	54.0	3460	43.10	18.64	unidentified	female	Normal
100A Carp 14	3	10/8/2009	155102.68	575834.72	Island 3	24.5	64.0	60.0	3740	81.14	22.29	unidentified	male	Normal
100A Carp 15	3	10/8/2009	155102.68	575834.72	Island 3	22.0	57.5	53.5	2600	44.47	19.19	60% clams	female	Normal
100A Carp 16	4	10/8/2009	151730.89	572699.27	100 D Intake	25.0	63.0	58.0	3740	56.85	26.00	unidentified	male	Normal
100A Carp 17	4	10/8/2009	151730.89	572699.27	100 D Intake	28.0	75.0	68.0	6040	70.85	35.92	NA	female	Normal
100A Carp 18	4	10/8/2009	151730.89	572699.27	100 D Intake	28.5	71.0	61.0	5200	77.77	24.79	unidentified	female	Normal
100A Carp 19	4	10/8/2009	151730.89	572699.27	100 D Intake	28.5	72.0	67.0	6800	63.03	49.27	unidentified	female	Normal
100A Carp 20	4	10/8/2009	151730.89	572699.27	100 D Intake	27.0	70.0	62.0	4320	83.82	22.83	unidentified	male	Normal
100A Carp 21	5	11/19/2009	146656.49	567979.2	100 K-100 N	25.0	65.0	61.0	4320	95.42	24.61	unidentified	female	Normal
100A Carp 22	5	11/19/2009	146656.49	567979.2	100 K-100 N	24.5	60.0	56.0	3220	122.11	24.52	unidentified	male	Normal
100A Carp 23	5	11/19/2009	147054.5	568576.51	100 K-100 N	25.5	66.0	61.5	4460	106.47	22.75	unidentified	female	Normal
100A Carp 24	5	11/19/2009	148750.38	570238.56	100 K-100 N	25.5	65.0	61.5	4740	90.52	22.97	unidentified	female	Normal
100A Carp 25	5	11/19/2009	148750.38	570238.56	100 K-100 N	25.0	63.0	58.0	4320	122.11	29.79	unidentified	female	Normal

Table B-9. Laboratory Processing Records: 100 Area and 300 Area Sub-Areas Walleye. (2 Pages)

Field Identification	Composite	Date	NAD 1983 Washington State Plane South 4,602 (m)		Field Record		Lab Record							Other
			Northing	Easting	General Collection Area	Total Length (in.)	Total Length (cm)	Fork Length (cm)	Total Body Weight (g)	Liver Weight (g)	Kidney Weight (g)	Stomach Contents	General Condition Observations	Gender (If Known)
100A Walleye 15	1	8/28/09	153043.29	573583.26	100 D Area	22.0	57.0	54.0	2,040	18.59	19.23	NA	Normal	NA
100A Walleye 20	1	8/29/09	149426.62	579670.78	WB Hole 2	25.0	63.0	60.5	2,700	26.39	12.73	Unidentified	Normal	NA
100A Walleye 25	1	9/8/09	153044.14	573561.07	100 D Area	29.0	73.0	71.0	4,040	39.20	12.82	Unidentified	Normal	NA
100A Walleye 4	1	6/15/09	151917.74	572894.86	100 D area	30.5	74.0	72.5	4,560	44.73	4.32	Unidentified	Normal	NA
100A Walleye 8	1	8/13/09	149811.73	580042.91	WB Hole 2	24.0	57.5	56.5	2,260	22.55	14.27	Fish, invertebrates	Normal	NA
100A Walleye 2	2	6/10/09	149494.31	579913.98	Wahluke	30.5	76.5	74.5	5,020	60.29	41.92	Unidentified	Normal	NA
100A Walleye 24	2	9/8/09	149908.74	580065.35	WB Hole 2	31.5	80.0	77.5	5,020	47.77	16.47	Unidentified	Normal	NA
100A Walleye 26	2	9/3/09	145767.82	566405.24	100 B/C Area	23.0	58.0	56.5	2,000	25.43	12.65	Unidentified	Normal	NA
100A Walleye 3	2	6/10/09	149580.33	579693.49	Wahluke	28.0	71.0	69.5	3,160	21.36	12.04	NA	Normal	NA
100A Walleye 5	2	6/17/09	149658.28	579703.94	Wahluke	28.0	69.5	65.5	2,580	23.13	18.72	NA	Normal	NA
100A Walleye 1	3	6/10/09	149496.42	579933.09	Wahluke	17.0	43.0	42.0	880	7.35	4.79	Unidentified	Normal	NA
100A Walleye 18	3	8/29/09	149896.19	580041.03	WB Hole 2	19.0	47.5	46.0	1,100	12.35	5.21	Unidentified	Normal	NA
100A Walleye 23	3	9/3/09	149969.13	580092.09	WB Hole 2	18.0	46.0	44.5	960	11.87	2.91	Invertebrates	Normal	NA
100A Walleye 7	3	6/17/09	149509.22	579920.16	Wahluke	18.0	47.0	46.0	920	5.81	2.87	Unidentified	Normal	NA
100A Walleye 9	3	8/13/09	149357.61	579748.22	WB Hole 2	19.0	48.0	46.0	1,100	7.94	1	Fish parts	Normal	NA
100A Walleye 10	4	8/18/09	149271.24	579773.84	WB Hole 2	22.0	53.5	51.0	1,940	21.67	9.87	NA	Normal	NA
100A Walleye 11	4	8/18/09	149357.61	579748.22	WB Hole 2	24.0	61.0	58.0	1,980	29.83	11.51	Fish parts, invertebrates	Normal	NA
100A Walleye 12	4	8/18/09	149501.28	579684.34	WB Hole 2	23.5	59.5	57.5	2,160	16.39	9.61	Unidentified	Normal	NA
100A Walleye 13	4	8/28/09	149244.61	579777.26	WB Hole 2	21.0	52.0	51.0	1,520	10.62	8.19	Unidentified	Normal	NA
100A Walleye 21	4	9/1/09	149386.02	579711.11	WB Hole 2	23.0	57.0	55.5	2,190	27.31	10.76	Fish, invertebrates	Normal	NA
100A Walleye 14	5	8/28/09	148408.99	580639.34	WB Hole 2	29.5	73.5	70.0	4,800	45.99	32.9	Fish, invertebrates	Normal	NA
100A Walleye 16	5	8/29/09	149241.48	579792.60	WB Hole 2	19.0	48.0	46.5	1,100	7.33	8.87	NA	Normal	NA
100A Walleye 17	5	8/29/09	149156.87	579867.95	WB Hole 2	17.0	43.0	41.0	780	6.25	2.85	NA	Normal	NA
100A Walleye 19	5	8/29/09	149152.35	579861.89	WB Hole 2	18.0	47.0	46.0	860	8.55	3.97	Fish parts	Normal	NA
100A Walleye 22	5	9/1/09	149135.80	579871.29	WB Hole 2	22.5	56.0	54.0	2,150	27.27	17.22	Unidentified	Normal	NA
100A Walleye 6	6	6/17/09	149539.64	579699.13	Wahluke	29.0	73.0	70.0	4,220	16.94	47.27	Worms, invertebrates	Tumor under gill (EL-1638)	NA
300 A Walleye 10	1	07/31/09	141529.75	585333.00	HTS Hole 1	23.0	56.5	54.0	1,280	12.53	7.26	Unidentified	Normal	NA
300 A Walleye 11	1	08/04/09	141529.75	585333.00	HTS Hole 1	21.0	58.5	57.0	1,760	10.84	2.27	NA	Normal	NA
300 A Walleye 7	1	07/31/09	141529.75	585333.00	HTS Hole 1	22.0	54.0	52.5	1,940	13.25	5.26	Unidentified	Normal	NA
300 A Walleye 8	1	07/31/09	141529.75	585333.00	HTS Hole 1	21.5	51.0	50.0	1,040	7.84	2.86	Unidentified	Normal	NA
300 A Walleye 9	1	07/31/09	141529.75	585333.00	HTS Hole 1	19.0	46.0	45.0	1,620	9.96	1.96	Unidentified	Normal	NA
300 A Walleye 14	2	08/06/09	141500.00	585380.00	HTS Hole 1	19.0	48.0	46.5	1,080	8.00	3.82	Unidentified	Normal	NA
300 A Walleye 15	2	08/06/09	141500.00	585380.00	HTS Hole 1	18.5	46.0	45.0	1,020	6.67	5.74	Fish parts, invertebrates	Normal	NA
300 A Walleye 16	2	08/12/09	141500.00	585380.00	HTS Hole 1	20.0	51.5	50.0	1,440	11.48	7.53	Unidentified	Normal	NA
300 A Walleye 19	2	08/20/09	141469.20	585425.87	HTS Hole 1	18.0	46.0	44.5	1,120	10.37	6.43	Unidentified	Normal	NA
300 A Walleye 23	2	09/08/09	141484.94	585359.75	HTS Hole 1	19.0	45.5	44.0	1,020	8.61	2.42	NA	Normal	NA
300 A Walleye 12	3	08/04/09	141408.00	585443.40	HTS Hole 1	24.0	63.0	61.5	2,480	16.96	5.65	fish	Normal	NA
300 A Walleye 13	3	08/04/09	141408.00	585443.40	HTS Hole 1	22.5	55.0	53.5	2,000	21.10	9.17	Unidentified	Normal	NA
300 A Walleye 17	3	08/12/09	141408.00	585443.40	HTS Hole 1	19.0	49.0	47.5	1,060	9.30	4.41	Fish parts, invertebrates	Normal	NA
300 A Walleye 20	3	08/20/09	141415.06	585449.62	HTS Hole 1	18.5	48.0	47.0	960	6.70	5.52	Unidentified	Normal	NA
300 A Walleye 21	3	08/20/09	141432.62	585433.28	HTS Hole 1	21.0	52.5	51.0	1,680	16.19	7.97	Unidentified	Normal	NA
300 A Walleye 22	4	09/08/09	141388.61	585465.32	HTS Hole 1	19.0	48.5	46.5	1,120	7.84	2.14	Unidentified	Normal	NA
300 A Walleye 25	4	09/08/09	141400.88	585468.21	HTS Hole 1	19.5	50.0	48.5	1,420	14.41	6.65	Unidentified	Normal	NA
300 A Walleye 4	4	06/24/09	137621.00	589993.67	Savage Island	21.0	53.0	51.0	1,800	11.26	16.9	Invertebrates	Normal	NA
300 A Walleye 5	4	06/24/09	137623.23	590019.19	Savage Island	27.0	73.0	71.5	3,680	34.57	32.35	Invertebrates	Normal	NA
300 A Walleye24	4	09/08/09	141309.32	585518.54	HTS Hole 1	19.5	49.0	47.0	1,100	8.11	2.44	Unidentified	Normal	NA
300 A Walleye 1	5	06/08/09	125048.46	595568.06	Taylor Flats	19.0	48.0	47.0	980	18.13	6.66	Unidentified	Normal	NA
300 A Walleye 18	5	08/14/09	133676.94	593637.13	Ringold	26.0	63.0	61.0	3,020	23.62	18.86	Fish	Normal	NA
300 A Walleye 2	5	06/08/09	125117.88	595505.50	Taylor Flats	17.5	38.0	36.5	460	2.10	1.07	Bivalve	Normal	NA
300 A Walleye 3	5	06/08/09	125161.16	595312.73	Taylor Flats	23.0	59.0	56.5	1,920	20.72	13.07	NA	Normal	NA

Table B-9. Laboratory Processing Records: 100 Area and 300 Area Sub-Areas Walleye. (2 Pages)

Field Identification	Composite	Date	NAD 1983 Washington State Plane South 4,602 (m)		Field Record		Lab Record							Other
			Northing	Easting	General Collection Area	Total Length (in.)	Total Length (cm)	Fork Length (cm)	Total Body Weight (g)	Liver Weight (g)	Kidney Weight (g)	Stomach Contents	General Condition Observations	Gender (If Known)
300 A Walleye 6	5	07/07/09	124937.10	595555.73	Taylor Flats	15.0	42.0	41.0	680	13.34	1.27	Unidentified	Normal	NA

HTS = Hanford townsite
NA = not available

Table B-10. Laboratory Processing Records: Upriver Sub-Area Walleye.

			WA State Plane South 4602 (Meters)		Field Record	Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Other	Lab Record
Field ID	Composite	Date	Northing	Easting	General Collection Area	Total Length (in)	Total Length (cm)	Fork Length (cm)	Total Body Wt. (g)	Liver Wt. (g)	Kidney Wt. (g)	Stomach Contents	Gender (if known)	General Condition Observations
Upriver Walleye 2	1	6/16/2009	168440.52	541296.43	Schwana	28	69.5	66.5	2880	23.16	10.01	50% sculpin, 35% flat worms,1% bivalve	NA	Worms inside body cavity
Upriver Walleye 3	1	6/16/2009	164415.07	543925.8	Crab Creek	20	51	49.5	1400	7.3	2.22	Unidentified	M	NORMAL
Upriver Walleye 4	1	6/16/2009	164379.5	543926.82	Crab Creek	23.5	59.5	57.5	2000	20.98	12.2	50% sculpin	NA	NORMAL
Upriver Walleye 5	1	6/16/2009	164417.44	543945.62	Crab Creek	20.5	53.5	51.5	1500	8.07	3.61	Unidentified	M	NORMAL
Upriver Walleye 6	1	6/16/2009	164389.5	543925.98	Crab Creek	20	51	48.5	1200	6.68	2.06	Unidentified	M	NORMAL
Upriver Walleye 1	2	6/16/2009	171720.08	540683.16	Wanapum	23	59.5	58	2060	14.11	11.15	Unidentified	NA	NORMAL
Upriver Walleye 7	2	6/16/2009	164378.46	543935.99	Crab Creek	20	46	44	940	5.99	2.71	Empty	M	NORMAL
Upriver Walleye 8	2	6/23/2009	171656.37	540631.76	Wanapum (Tail Race)	20.5	56	52.5	1500	10.9	3.72	Unidentifed	F	NORMAL
Upriver Walleye 10	2	8/5/2009	164334.00	543952.00	Crab Creek	24	60	58	2620	24.88	7.12	80% sculpin,5%flat worm	M	NORMAL
Upriver Walleye 13	3	6/3/2010	164346.25	543939.27	Crab Creek	23	56	54	1940	19.51	7.94	95% fish	M	NORMAL
Upriver Walleye 14	3	6/3/2010	164301.85	543948.76	Crab Creek	21	53	50	1380	16.67	8.16	Fish bones	M	NORMAL
Upriver Walleye 15	3	6/3/2010	164388.51	543942.02	Crab Creek	20	52	48	1480	15.45	12.04	Whole fish	M	Focalized yellow spotting on liver
Upriver Walleye 18	3	6/6/2010	163724.91	543947.62	Crab Creek	22	55	53	1520	21.83	16.61	5% worms; 95% unidentified	M	NORMAL
Upriver Walleye 19	3	6/6/2010	164289.51	543932.82	Crab Creek	22	55	53	1880	41.71	12.23	Empty	M	NORMAL
Upriver Walleye 12	4	6/3/2010	164367.37	543939.12	Crab Creek	24	59	57	2260	22.14	10.57	Unidentified	M	NORMAL
Upriver Walleye 16	4	6/3/2010	164426.19	543926.48	Crab Creek	23	56	54	1920	27.09	9.91	80% fish parts	F	NORMAL
Upriver Walleye 17	4	6/5/2010	167333.46	542588.63	Beverly Slough	23	57	55	1740	27.35	11.73	Unidentified	M	NORMAL
Upriver Walleye 20	4	6/6/2010	167420.74	542512.49	Beverly Slough	23	58	56	2120	36.37	11.46	Empty	M	Focalized yellow spotting on liver
Upriver Walleye 26	4	6/3/2010	164377.27	543925.31	Crab Creek	28	66	63	3080	52.81	19.28	Unidentified	F	NORMAL
Upriver Walleye 21	5	6/6/2010	168426.12	541304.16	Rob's Hole #1	23	57	55	1980	25.34	16.53	5 fish (whole)	F	Normal
Upriver Walleye 22	5	6/11/2010	171733.31	540667.82	PRDP (Wanapum Dam)	29	72.5	70.5	3800	60.4	27.52	85% fish bone	F	Worms inside body cavity;pale colored liver
Upriver Walleye 23	5	6/11/2010	168417.16	541295.06	PRDP (Rob #1)	32	80	77	4600	57.39	28.11	95% fish	F	Normal
Upriver Walleye 24	5	6/11/2010	171700.93	540645.94	PRDP (Wanapum Dam)	26	66.5	64.5	3400	65.12	24.34	Unidentified	F	Focalized yellow spotting on liver
Upriver Walleye 25	5	6/13/2010	171700.93	540645.94	PRDP (Wanapum)	25	49.5	46.5	1180	18.78	11.83	Unidentified	M	Normal

Table B-11. Laboratory Processing Records: Lake Wallula Sub-Area Walleye.

			WA State Plane South 4602 (Meters)		Field Record	Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Other	Lab Record
Field ID	Composite	Date	Northing	Easting	General Collection Area	Total Length (in)	Total Length (cm)	Fork Length (cm)	Total Body Wt. (g)	Liver Wt. (g)	Kidney Wt. (g)	Stomach Contents	Gender (if known)	General Condition Observations
Lake Wallula Walleye 12	1	6/21/2010	81181.11	619858.32	Lake Wallula	30.0	79.0	75.0	5160	47.08	27.64	Unidentified	F	Normal
Lake Wallula Walleye 21	1	6/24/2010	78540.01	621055.45	Lake Wallula	14.0	42.0	41.0	600	4.05	4.97	Unidentified	M	Normal
Lake Wallula Walleye 22	1	6/24/2010	78864.36	621042.05	Lake Wallula	16.0	40.0	38.0	580	4.08	4.88	Unidentified	M	Normal
Lake Wallula Walleye 23	1	6/24/2010	78704.52	621166.79	Lake Wallula	15.5	36.5	34.0	460	2.22	3.13	Empty	M	Normal
Lake Wallula Walleye 24	1	6/24/2010	79071.13	620873.80	Lake Wallula	14.0	36.5	35.5	420	3.00	3.33	20% fish; 80%unknown	M	Normal
Lake Wallula Walleye 1	2	6/16/2010	82545.31	620261.78	Lake Wallula	15.0	35.0	33.0	400	7.31	4.02	Unidentified	F	Focalized yellow spotting on liver
Lake Wallula Walleye 13	2	6/22/2010	83367.33	620848.32	Lake Wallula	17.0	43.5	42.0	780	4.16	5.49	Unidentified	M	Normal
Lake Wallula Walleye 14	2	6/22/2010	82809.82	620201.63	Lake Wallula	17.0	43.5	41.5	800	10.58	6.89	Unidentified	M	Normal
Lake Wallula Walleye 15	2	6/22/2010	82810.92	620876.36	Lake Wallula	16.0	42.5	40.5	600	5.04	5.12	50% fish parts; 50% unidentified	M	Normal
Lake Wallula Walleye 18	2	6/23/2010	82102.52	620751.10	Lake Wallula	13.5	35.5	33.5	360	3.50	2.82	Empty	M	Normal
Lake Wallula Walleye 19	2	6/23/2010	81774.56	620807.12	Lake Wallula	16.0	41.0	39.0	560	4.45	4.93	Empty	F	Normal
Lake Wallula Walleye 4	3	6/18/2010	99131.67	607670.94	Clover Island	12.0	31.0	29.5	220	5.51	2.52	Empty	M	Normal
Lake Wallula Walleye 6	3	6/19/2010	99034.82	607851.69	Clover Island	12.5	32.0	30.0	320	5.42	1.83	95% Fish	M	Normal
Lake Wallula Walleye 10	3	6/21/2010	99105.85	607656.74	Clover Island	12.0	31.0	29.0	280	6.47	2.55	95% fish	M	Pale colored liver
Lake Wallula Walleye 11	3	6/21/2010	99110.24	607716.85	Clover Island	12.0	31.0	30.0	300	5.99	3.98	Empty	M	Normal
Lake Wallula Walleye 25	3	6/25/2010	98919.65	607939.39	Clover Island	17.5	46.0	44.0	880	11.69	6.79	60% fish; 5% worms	M	Normal
Lake Wallula Walleye 2	4	6/17/2010	99041.94	607752.02	Clover Island	17.5	45.5	44.0	920	9.64	4.17	Empty	F	Normal
Lake Wallula Walleye 7	4	6/19/2010	99092.01	607691.71	Clover Island	13.0	34.0	32.0	360	4.71	3.11	Empty	M	Normal
Lake Wallula Walleye 17	4	6/23/2010	98985.46	607889.61	Clover Island	13.0	33.5	31.0	340	4.95	3.11	95% fish	M	Normal
Lake Wallula Walleye 20	4	6/24/2010	99074.53	607709.00	Clover Island	12.0	30.0	29.0	300	4.72	2.77	75% fish	M	Normal
Lake Wallula Walleye 26	4	6/25/2010	99090.40	607663.19	Clover Island	13.0	33.0	31.5	380	4.78	3.71	Empty	M	Focalized pale spotting on liver
Lake Wallula Walleye 3	5	6/18/2010	98995.57	607832.32	Clover Island	17.0	43.0	41.0	760	9.45	4.39	Fish	M	Normal
Lake Wallula Walleye 5	5	6/18/2010	99131.67	607670.94	Clover Island	12.5	31.0	30.0	280	3.12	2.47	Empty	F	Normal
Lake Wallula Walleye 8	5	6/19/2010	98990.46	607857.88	Clover Island	12.5	31.0	29.0	300	6.25	2.37	Unidentified	M	Normal
Lake Wallula Walleye 9	5	6/21/2010	99120.95	607693.51	Clover Island	12.0	30.0	28.0	260	3.97	2.63	Fish	M	Normal
Lake Wallula Walleye 27	5	6/25/2010	99052.46	607717.87	Clover Island	13.0	33.0	31.5	380	6.98	2.24	60% fish; 5% worms	M	Normal
Lake Wallula Walleye 16	5	6/23/2010	99072.02	607755.34	Clover Island	12.0	29.0	28.0	260	2.93	1.02	90% fish	M	Normal

Table B-12. Laboratory Processing Records: Sturgeon.

		NAD 1983 Washington State Plane South 4602 (Meters)		Field Record	Field Record	Field Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Lab Record	Other	Lab Record	Lab Record
Field ID	Date	Northing	Easting	General Collection Area	Total Length (CM)	Weight (lbs)	Total Length (cm)	Fork Length (cm)	Total Body Wt. (g)	Liver Wt. (g)	Kidney Wt. (g)	Fat Color	General Condition Observations	Histology Sample ID	Stomach Contents	% Sediment
Hanford Sturgeon 1	7/16/09	146826.15	568207.28	100KW Hole	132	not recorded	124	112	11260	134.1	9	white	Normal	6	snails; fish; crawdad; pickled squid	1.8
Hanford Sturgeon 2	7/17/09	149492.49	570965.36	100N Hole	135	28	126.5	107.5	12440	126.93	23.43	Yellow	Internal lesions present	7	fish; crawdad; pickled squid; algae	0.3
Hanford Sturgeon 3	7/17/09	149492.49	570965.36	100N Hole	140	29	132.5	112	12780	296	53.77	Yellow	Double pectoral fin on right side	8	snails; unidentified	0
Hanford Sturgeon 4	7/22/09	153475.63	573666.69	100D Hole	130	25	125	109	8710	112.38	28.03	white	Normal	9	NA	NA
Hanford Sturgeon 5	7/22/09	147114.19	568708.46	100KE Hole	126	22	128	109	9000	111.1	35.52	Yellow	2 anal fins. One much smaller.	10	snails; fish; crawdad	0.22
Hanford Sturgeon 6	7/23/09	153475.63	573666.69	100D Hole	122	20	130	110	9340	104.18	36	Yellow	Normal	11	crawdad; fish; worms; snails	0.03
Hanford Sturgeon 7	7/28/09	147058.08	568759.61	100KE Hole	142	22	133	117	13840	166.96	38.08	Yellow	Normal	12	rocks; clams; snails	7.07
Hanford Sturgeon 8	7/29/09	153475.63	573666.69	100D Hole	124	12	124	112	8610	107.98	22.19	white	Normal	13	crawdad; worms	0
Hanford Sturgeon 9	7/29/09	153545.05	577519.70	WB Hole 1	128	14	128	112	9520	85.8	41.62	white	Normal	14	snails	100
Hanford Sturgeon 10	8/3/09	140912.32	585508.07	HTS	140	27	123	116	11980	103.4	37.48	yellow	Normal	15	crawdad; snails; fish; vegetation	0
Hanford Sturgeon 11	8/3/09	140912.32	585508.07	HTS	150	not recorded	136	126	15800	171.8	51.7	white	Normal	16	crawdad; clams	3.8
Hanford Sturgeon 12	8/3/09	135011.28	591700.35	HTS	156	40	135	127	20340	211.84	99.92	Yellow	Normal	17	snails; clams	0
Hanford Sturgeon 13	8/4/09	140929.91	585494.79	HTS	125	19	117.5	110	8360	82.06	34.18	white	Normal	18	crawdad; fish; pickled squid	0.2
Hanford Sturgeon 14	8/11/09	141507.60	585232.24	HTS Hole 1	130	16	128	117	12400	240	53.9	white	blue/blk mottling on gonads(yellow fat in places)	19	crawdad; snails; algae	23.51
Hanford Sturgeon 15	8/12/09	141507.60	585232.24	HTS Hole 1	134	22	120	111	10124	134.42	27.45	yellow	Normal	20	worms; fish; crawdad; snails	0.72
Hanford Sturgeon 16	8/12/09	141507.60	585232.24	HTS Hole 1	142	30	130	119	13099	138.95	54.09	Yellow	of sturgeon. Lrg (~10cm) lesion on left side. Sml (~1-3cm) on	21	rock; crawdad; clam; snail; pickled squid	0
Hanford Sturgeon 17	8/26/09	119963.81	595215.07	300A Hole 1	127	21	116	107	10640	125.9	30.42	white	Normal	22	clams; snails	6.25
Hanford Sturgeon 18	8/26/09	119963.81	595215.07	300A Hole 1	139	27	128.5	111.5	12320	255.82	47.73	white	Normal	23	algae; fish; snails; pickled squid	0.73
Hanford Sturgeon 19	8/27/09	119963.81	595215.07	300A Hole 1	150	38	138.5	124	16400	164.34	66.1	Yellow	mottled blk gonads with blk edges	24	fish	0
Hanford Sturgeon 20	9/2/09	81522.70	620775.73	Wallula Gap	130	29	not recorded	not recorded	11985	165.05	53.41	Yellow	blk mottled gonads	25	pebble; clams	26.37
Hanford Sturgeon 21	9/2/09	81522.70	620775.73	Wallula Gap	150	39	130.5	110.5	20160	178.23	37.78	white	Normal	26	NA	0
Hanford Sturgeon 22	9/2/09	81522.70	620775.73	Wallula Gap	142	48	127	114	17900	248.5	54.9	Yellow	focalized blk color on gonads	27	invertebrates; snail; clam	21.83
Hanford Sturgeon 23	9/2/09	81522.70	620775.73	Wallula Gap	155	39	135	122	19110	265.93	64.66	Yellow	focalized blk coloring on one side of gonad.	28	fish; invertebrates; clam	4
Hanford Sturgeon 24	9/2/09	81522.70	620775.73	Wallula Gap	159	48	140	127	18020	227.79	57.38	Yellow	Normal	29	crawdad	18.44
Hanford Sturgeon 25	9/9/09	81522.70	620775.73	Wallula Gap	135	not recorded	124.5	109.5	12010	183.15	27.86	Yellow	mottled blk coloring on gonads	30	crawdad; snails; invertebrates; clam	6.86
UR Sturgeon 26	9/4/09	177476.12	540517.03	Wanapum Pool	132	not recorded	123.5	107.5	10020	103.41	32.1	white	possible egg follicles on gonads	1	fish; algae; snails; unidentified	8.89
UR Sturgeon 27	9/10/09	177476.12	540517.03	Wanapum Pool	128	26	113.5	107.5	12797	237.96	47.4	Yellow	Normal	2	vegetation; worms	26.5
UR Sturgeon 28	9/10/09	177476.12	540517.03	Wanapum Pool	130	19	117.5	101.5	9634	94.29	30.25	white	Normal	3	fish; pickled squid	0
UR Sturgeon 29	9/10/09	177476.12	540517.03	Wanapum Pool	140	not recorded	131	115.5	15320	230.97	51.47	Yellow	focalized blk spots on gonads	4	clams; vegetation	13.76
UR Sturgeon 30	9/15/09	202328.15	537680.64	Crescent Bar	133	22	122.5	110.5	9560	148.19	35.84	white	Normal	5	vegetation; clams; snails; worms	26.78

APPENDIX C

SAMPLE NUMBER ASSIGNMENT BY FISH SPECIES

ACRONYMS

100 SA	100 study area
300 SA	300 study area
As	arsenic
BMS	Battelle Memorial Sequim
EB	Eberline
ID	identification
LMA	land management area
LVL	Lionville
LWSA	Lake Wallula study area
MeHg	methyl mercury
PCB	polychlorinated biphenyl
SA	study area
TA	Test America
URSA	upriver study area
WF	whitefish

Table C-1. Whitefish.

Fish	Sub-area	LMA	Tissue	Rad/metals sample ID (LVL/EB)	PCB/Lipids Sample ID (TA)	Arsenic sample ID (BMS)
Whitefish	Upriver	URSA-WF1	fillet	J18J06	J18J11	J18J16
Whitefish	Upriver	URSA-WF2	fillet	J18J07	J18J12	J18J17
Whitefish	Upriver	URSA-WF3	fillet	J18J08	J18J13	J18J18
Whitefish	Upriver	URSA-WF4	fillet	J18J09	J18J14	J18J19
Whitefish	Upriver	URSA-WF5	fillet	J18J10	J18J15	J18J20
Whitefish	Upriver	URSA-WF1	liver/kidney	J18J59		
Whitefish	Upriver	URSA-WF2	liver/kidney	J18J60		
Whitefish	Upriver	URSA-WF3	liver/kidney	J18J61		
Whitefish	Upriver	URSA-WF4	liver/kidney	J18J62		
Whitefish	Upriver	URSA-WF5	liver/kidney	J18J63		
Whitefish	Upriver	URSA-WF1	carcass	J18J69	J18J74	J18J79
Whitefish	Upriver	URSA-WF2	carcass	J18J70	J18J75	J18J80
Whitefish	Upriver	URSA-WF3	carcass	J18J71	J18J76	J18J81
Whitefish	Upriver	URSA-WF4	carcass	J18J72	J18J77	J18J82
Whitefish	Upriver	URSA-WF5	carcass	J18J73	J18J78	J18J83
Whitefish	100 Area	100SA-WF1	fillet	J18J84	J18J89	J18J94
Whitefish	100 Area	100SA-WF2	fillet	J18J85	J18J90	J18J95
Whitefish	100 Area	100SA-WF3	fillet	J18J86	J18J91	J18J96
Whitefish	100 Area	100SA-WF4	fillet	J18J87	J18J92	J18J97
Whitefish	100 Area	100SA-WF5	fillet	J18J88	J18J93	J18J98
Whitefish	100 Area	100SA-WF1	liver/kidney	J18K11		
Whitefish	100 Area	100SA-WF2	liver/kidney	J18K12		
Whitefish	100 Area	100SA-WF3	liver/kidney	J18K13		
Whitefish	100 Area	100SA-WF4	liver/kidney	J18K14		
Whitefish	100 Area	100SA-WF5	liver/kidney	J18K15		
Whitefish	100 Area	100SA-WF1	carcass	J18K21	J18K26	J18K31
Whitefish	100 Area	100SA-WF2	carcass	J18K22	J18K27	J18K32
Whitefish	100 Area	100SA-WF3	carcass	J18K23	J18K28	J18K33
Whitefish	100 Area	100SA-WF4	carcass	J18K24	J18K29	J18K34
Whitefish	100 Area	100SA-WF5	carcass	J18K25	J18K30	J18K35
Whitefish	300 Area	300SA-WF-1	fillet	J18K36	J18K41	J18K46
Whitefish	300 Area	300SA-WF-2	fillet	J18K37	J18K42	J18K47
Whitefish	300 Area	300SA-WF-3	fillet	J18K38	J18K43	J18K48
Whitefish	300 Area	300SA-WF-4	fillet	J18K39	J18K44	J18K49
Whitefish	300 Area	300SA-WF-5	fillet	J18K40	J18K45	J18K50
Whitefish	300 Area	300SA-WF-1	liver/kidney	J18K52		
Whitefish	300 Area	300SA-WF-2	liver/kidney	J18K53		
Whitefish	300 Area	300SA-WF-3	liver/kidney	J18K54		
Whitefish	300 Area	300SA-WF-4	liver/kidney	J18K55		
Whitefish	300 Area	300SA-WF-5	liver/kidney	J18K56		
Whitefish	300 Area	300SA-WF-1	carcass	J18K63	J18K68	J18K73
Whitefish	300 Area	300SA-WF-2	carcass	J18K64	J18K69	J18K74
Whitefish	300 Area	300SA-WF-3	carcass	J18K65	J18K70	J18K75
Whitefish	300 Area	300SA-WF-4	carcass	J18K66	J18K71	J18K76
Whitefish	300 Area	300SA-WF-5	carcass	J18K67	J18K72	J18K77
Whitefish	Lake Wallula	LWSA-WF1	fillet	J18K78	J18K83	J18K88
Whitefish	Lake Wallula	LWSA-WF2	fillet	J18K79	J18K84	J18K89
Whitefish	Lake Wallula	LWSA-WF3	fillet	J18K80	J18K85	J18K90
Whitefish	Lake Wallula	LWSA-WF4	fillet	J18K81	J18K86	J18K91
Whitefish	Lake Wallula	LWSA-WF5	fillet	J18K82	J18K87	J18K92
Whitefish	Lake Wallula	LWSA-WF1	liver/kidney	J18KD3		
Whitefish	Lake Wallula	LWSA-WF2	liver/kidney	J18KD4		
Whitefish	Lake Wallula	LWSA-WF3	liver/kidney	J18KD5		
Whitefish	Lake Wallula	LWSA-WF4	liver/kidney	J18KD6		
Whitefish	Lake Wallula	LWSA-WF5	liver/kidney	J18KD7		
Whitefish	Lake Wallula	LWSA-WF1	carcass	J18KD8	J18KF3	J18KF8
Whitefish	Lake Wallula	LWSA-WF2	carcass	J18KD9	J18KF4	J18KF9
Whitefish	Lake Wallula	LWSA-WF3	carcass	J18KF0	J18KF5	J18KH0
Whitefish	Lake Wallula	LWSA-WF4	carcass	J18KF1	J18KF6	J18KH1
Whitefish	Lake Wallula	LWSA-WF5	carcass	J18KF2	J18KF7	J18KH2
	Grinder-Equip Blank		water	J18KH3		
	Blender-Equip Blank		water	J18KH4		

Table C-2. Bass.

Fish	Sub-area	LMA	Tissue	Rad/metals sample ID (LVL/EB)	PCB/Lipids Sample ID (TA)	Arsenic sample ID (BMS)
Bass	Upriver	URSA-Bass1	fillet	J19029	J19034	J19039
Bass	Upriver	URSA-Bass2	fillet	J19030	J19035	J19040
Bass	Upriver	URSA-Bass3	fillet	J19031	J19036	J19041
Bass	Upriver	URSA-Bass4	fillet	J19032	J19037	J19042
Bass	Upriver	URSA-Bass5	fillet	J19033	J19038	J19043
Bass	Upriver	URSA-Bass1	liver/kidney	J19047		
Bass	Upriver	URSA-Bass2	liver/kidney	J19048		
Bass	Upriver	URSA-Bass3	liver/kidney	J19049		
Bass	Upriver	URSA-Bass4	liver/kidney	J19050		
Bass	Upriver	URSA-Bass5	liver/kidney	J19051		
Bass	Upriver	URSA-Bass1	carcass	J19052	J19057	J19062
Bass	Upriver	URSA-Bass2	carcass	J19053	J19058	J19063
Bass	Upriver	URSA-Bass3	carcass	J19054	J19059	J19064
Bass	Upriver	URSA-Bass4	carcass	J19055	J19060	J19065
Bass	Upriver	URSA-Bass5	carcass	J19056	J19061	J19066
Bass	100 Area	100SA-Bass1	fillet	J19067	J19072	J19077
Bass	100 Area	100SA-Bass2	fillet	J19068	J19073	J19078
Bass	100 Area	100SA-Bass3	fillet	J19069	J19074	J19079
Bass	100 Area	100SA-Bass4	fillet	J19070	J19075	J19080
Bass	100 Area	100SA-Bass5	fillet	J19071	J19076	J19081
Bass	100 Area	100SA-Bass1	liver/kidney	J190D0		
Bass	100 Area	100SA-Bass2	liver/kidney	J190D1		
Bass	100 Area	100SA-Bass3	liver/kidney	J190D2		
Bass	100 Area	100SA-Bass4	liver/kidney	J190D3		
Bass	100 Area	100SA-Bass5	liver/kidney	J190D4		
Bass	100 Area	100SA-Bass1	carcass	J190D5	J190F0	J190F5
Bass	100 Area	100SA-Bass2	carcass	J190D6	J190F1	J190F6
Bass	100 Area	100SA-Bass3	carcass	J190D7	J190F2	J190F7
Bass	100 Area	100SA-Bass4	carcass	J190D8	J190F3	J190F8
Bass	100 Area	100SA-Bass5	carcass	J190D9	J190F4	J190F9
Bass	300 Area	300SA-Bass1	fillet	J190H0	J190H5	J190J0
Bass	300 Area	300SA-Bass2	fillet	J190H1	J190H6	J190J1
Bass	300 Area	300SA-Bass3	fillet	J190H2	J190H7	J190J2
Bass	300 Area	300SA-Bass4	fillet	J190H3	J190H8	J190J3
Bass	300 Area	300SA-Bass5	fillet	J190H4	J190H9	J190J4
Bass	300 Area	300SA-Bass1	liver/kidney	J190J5		
Bass	300 Area	300SA-Bass2	liver/kidney	J190J6		
Bass	300 Area	300SA-Bass3	liver/kidney	J190J7		
Bass	300 Area	300SA-Bass4	liver/kidney	J190J8		
Bass	300 Area	300SA-Bass5	liver/kidney	J190J9		
Bass	300 Area	300SA-Bass1	carcass	J190K0	J190K5	J190L0
Bass	300 Area	300SA-Bass2	carcass	J190K1	J190K6	J190L1
Bass	300 Area	300SA-Bass3	carcass	J190K2	J190K7	J190L2
Bass	300 Area	300SA-Bass4	carcass	J190K3	J190K8	J190L3
Bass	300 Area	300SA-Bass5	carcass	J190K4	J190K9	J190L4
Bass	Lake Wallula	LWSA-Bass1	fillet	J190L6	J190M1	J190M6
Bass	Lake Wallula	LWSA-Bass2	fillet	J190L7	J190M2	J190M7
Bass	Lake Wallula	LWSA-Bass3	fillet	J190L8	J190M3	J190M8
Bass	Lake Wallula	LWSA-Bass4	fillet	J190L9	J190M4	J190M9
Bass	Lake Wallula	LWSA-Bass5	fillet	J190M0	J190M5	J190N0
Bass	Lake Wallula	LWSA-Bass1	liver/kidney	J190N1		
Bass	Lake Wallula	LWSA-Bass2	liver/kidney	J190N2		
Bass	Lake Wallula	LWSA-Bass3	liver/kidney	J190N3		
Bass	Lake Wallula	LWSA-Bass4	liver/kidney	J190N4		
Bass	Lake Wallula	LWSA-Bass5	liver/kidney	J190N5		
Bass	Lake Wallula	LWSA-Bass1	carcass	J190N6	J190P1	J190P6
Bass	Lake Wallula	LWSA-Bass2	carcass	J190N7	J190P2	J190P7
Bass	Lake Wallula	LWSA-Bass3	carcass	J190N8	J190P3	J190P8
Bass	Lake Wallula	LWSA-Bass4	carcass	J190N9	J190P4	J190P9
Bass	Lake Wallula	LWSA-Bass5	carcass	J190P0	J190P5	J190R0

Table C-3. Suckers.

Fish	Sub-area	LMA	Tissue	Rad/metals sample ID (LVL/EB)	PCB/Lipids Sample ID (TA)	Arsenic sample ID (BMS)
Sucker	Upriver	URSA Sucker 1	fillet	J190R1	J190R6	J190T1
Sucker	Upriver	URSA Sucker 2	fillet	J190R2	J190R7	J190T2
Sucker	Upriver	URSA Sucker 3	fillet	J190R3	J190R8	J190T3
Sucker	Upriver	URSA Sucker 4	fillet	J190R4	J190R9	J190T4
Sucker	Upriver	URSA Sucker 5	fillet	J190R5	J190T0	J190T5
Sucker	Upriver	URSA Sucker 1	liver/kidney	J190T7		
Sucker	Upriver	URSA Sucker 2	liver/kidney	J190T8		
Sucker	Upriver	URSA Sucker 3	liver/kidney	J190T9		
Sucker	Upriver	URSA Sucker 4	liver/kidney	J190V0		
Sucker	Upriver	URSA Sucker 5	liver/kidney	J190V1		
Sucker	Upriver	URSA Sucker 1	carcass	J190V2	J190V7	J190W2
Sucker	Upriver	URSA Sucker 2	carcass	J190V3	J190V8	J190W3
Sucker	Upriver	URSA Sucker 3	carcass	J190V4	J190V9	J190W4
Sucker	Upriver	URSA Sucker 4	carcass	J190V5	J190W0	J190W5
Sucker	Upriver	URSA Sucker 5	carcass	J190V6	J190W1	J190W6
Sucker	100 Area	100SA Sucker 1	fillet	J191H3	J191H8	J191J3
Sucker	100 Area	100SA Sucker 2	fillet	J191H4	J191H9	J191J4
Sucker	100 Area	100SA Sucker 3	fillet	J191H5	J191J0	J191J5
Sucker	100 Area	100SA Sucker 4	fillet	J191H6	J191J1	J191J6
Sucker	100 Area	100SA Sucker 5	fillet	J191H7	J191J2	J191J7
Sucker	100 Area	100SA Sucker 1	liver/kidney	J191N4		
Sucker	100 Area	100SA Sucker 2	liver/kidney	J191N5		
Sucker	100 Area	100SA Sucker 3	liver/kidney	J191N6		
Sucker	100 Area	100SA Sucker 4	liver/kidney	J191N7		
Sucker	100 Area	100SA Sucker 5	liver/kidney	J191N8		
Sucker	100 Area	100SA Sucker 1	carcass	J191N9	J191P4	J191P9
Sucker	100 Area	100SA Sucker 2	carcass	J191P0	J191P5	J191R0
Sucker	100 Area	100SA Sucker 3	carcass	J191P1	J191P6	J191R1
Sucker	100 Area	100SA Sucker 4	carcass	J191P2	J191P7	J191R2
Sucker	100 Area	100SA Sucker 5	carcass	J191P3	J191P8	J191R3
Sucker	300 Area	300SA Sucker 1	fillet	J191R4	J191R9	J191T4
Sucker	300 Area	300SA Sucker 2	fillet	J191R5	J191T0	J191T5
Sucker	300 Area	300SA Sucker 3	fillet	J191R6	J191T1	J191T6
Sucker	300 Area	300SA Sucker 4	fillet	J191R7	J191T2	J191T7
Sucker	300 Area	300SA Sucker 5	fillet	J191R8	J191T3	J191T8
Sucker	300 Area	300SA Sucker 1	liver/kidney	J191V0		
Sucker	300 Area	300SA Sucker 2	liver/kidney	J191V1		
Sucker	300 Area	300SA Sucker 3	liver/kidney	J191V2		
Sucker	300 Area	300SA Sucker 4	liver/kidney	J191V3		
Sucker	300 Area	300SA Sucker 5	liver/kidney	J191V4		
Sucker	300 Area	300SA Sucker 1	carcass	J191V5	J191W0	J191W5
Sucker	300 Area	300SA Sucker 2	carcass	J191V6	J191W1	J191W6
Sucker	300 Area	300SA Sucker 3	carcass	J191V7	J191W2	J191W7
Sucker	300 Area	300SA Sucker 4	carcass	J191V8	J191W3	J191W8
Sucker	300 Area	300SA Sucker 5	carcass	J191V9	J191W4	J191W9
Sucker	Lake Wallula	LWSA Sucker 1	fillet	J191X0	J191X5	J191Y0
Sucker	Lake Wallula	LWSA Sucker 2	fillet	J191X1	J191X6	J191Y1
Sucker	Lake Wallula	LWSA Sucker 3	fillet	J191X2	J191X7	J191Y2
Sucker	Lake Wallula	LWSA Sucker 4	fillet	J191X3	J191X8	J191Y3
Sucker	Lake Wallula	LWSA Sucker 5	fillet	J191X4	J191X9	J191Y4
Sucker	Lake Wallula	LWSA Sucker 1	liver/kidney	J191Y5		
Sucker	Lake Wallula	LWSA Sucker 2	liver/kidney	J191Y6		
Sucker	Lake Wallula	LWSA Sucker 3	liver/kidney	J191Y7		
Sucker	Lake Wallula	LWSA Sucker 4	liver/kidney	J191Y8		
Sucker	Lake Wallula	LWSA Sucker 5	liver/kidney	J191Y9		
Sucker	Lake Wallula	LWSA Sucker 1	carcass	J19220	J19225	J19230
Sucker	Lake Wallula	LWSA Sucker 2	carcass	J19221	J19226	J19231
Sucker	Lake Wallula	LWSA Sucker 3	carcass	J19222	J19227	J19232
Sucker	Lake Wallula	LWSA Sucker 4	carcass	J19223	J19228	J19233
Sucker	Lake Wallula	LWSA Sucker 5	carcass	J19224	J19229	J19234

Table C-4. Walleye.

Fish	Sub-area	LMA	Tissue	Rad/Metals Sample ID (LVL/EB)	PCB/Lipids Sample ID (TA)	Arsenic Sample ID (BMS)
Walleye	Upriver	Upriver SA Wall 1	fillet	J18WV4	J18WV9	J18WW4
Walleye	Upriver	Upriver SA Wall 2	fillet	J18WV5	J18WW0	J18WW5
Walleye	Upriver	Upriver SA Wall 3	fillet	J18WV6	J18WW1	J18WW6
Walleye	Upriver	Upriver SA Wall 4	fillet	J18WV7	J18WW2	J18WW7
Walleye	Upriver	Upriver SA Wall 5	fillet	J18WV8	J18WW3	J18WW8
Walleye	Upriver	Upriver SA Wall 1	liver/kidney	J18WW9		
Walleye	Upriver	Upriver SA Wall 2	liver/kidney	J18WX0		
Walleye	Upriver	Upriver SA Wall 3	liver/kidney	J18WX1		
Walleye	Upriver	Upriver SA Wall 4	liver/kidney	J18WX2		
Walleye	Upriver	Upriver SA Wall 5	liver/kidney	J18WX3		
Walleye	Upriver	Upriver SA Wall 1	carcass	J18WX5	J18WY0	J18WY5
Walleye	Upriver	Upriver SA Wall 2	carcass	J18WX6	J18WY1	J18WY6
Walleye	Upriver	Upriver SA Wall 3	carcass	J18WX7	J18WY2	J18WY7
Walleye	Upriver	Upriver SA Wall 4	carcass	J18WX8	J18WY3	J18WY8
Walleye	Upriver	Upriver SA Wall 5	carcass	J18WX9	J18WY4	J18WY9
Walleye	100 Area	100 SA Walleye 1	fillet	J18X86	J18X91	J18X96
Walleye	100 Area	100 SA Walleye 2	fillet	J18X87	J18X92	J18X97
Walleye	100 Area	100 SA Walleye 3	fillet	J18X88	J18X93	J18X98
Walleye	100 Area	100 SA Walleye 4	fillet	J18X89	J18X94	J18X99
Walleye	100 Area	100 SA Walleye 5	fillet	J18X90	J18X95	J18XB0
Walleye	100 Area	100 SA Walleye 6	fillet	J19746	J19749	J19751
Walleye	100 Area	100 SA Walleye 1	liver/kidney	J18XB1		
Walleye	100 Area	100 SA Walleye 2	liver/kidney	J18XB2		
Walleye	100 Area	100 SA Walleye 3	liver/kidney	J18XB3		
Walleye	100 Area	100 SA Walleye 4	liver/kidney	J18XB4		
Walleye	100 Area	100 SA Walleye 5	liver/kidney	J18XB5		
Walleye	100 Area	100 SA Walleye 6	liver/kidney	J19747		
Walleye	100 Area	100 SA Walleye 1	carcass	J18XB6	J18XC1	J18XC6
Walleye	100 Area	100 SA Walleye 2	carcass	J18XB7	J18XC2	J18XC7
Walleye	100 Area	100 SA Walleye 3	carcass	J18XB8	J18XC3	J18XC8
Walleye	100 Area	100 SA Walleye 4	carcass	J18XB9	J18XC4	J18XC9
Walleye	100 Area	100 SA Walleye 5	carcass	J18XC0	J18XC5	J18XD0
Walleye	100 Area	100 SA Walleye 6	carcass	J19748	J19750	J19752
Walleye	300 Area	300 SA Walleye 1	fillet	J18XD1	J18XD6	J18XF1
Walleye	300 Area	300 SA Walleye 2	fillet	J18XD2	J18XD7	J18XF2
Walleye	300 Area	300 SA Walleye 3	fillet	J18XD3	J18XD8	J18XF3
Walleye	300 Area	300 SA Walleye 4	fillet	J18XD4	J18XD9	J18XF4
Walleye	300 Area	300 SA Walleye 5	fillet	J18XD5	J18XF0	J18XF5
Walleye	300 Area	300 SA Walleye 1	liver/kidney	J18XF6		
Walleye	300 Area	300 SA Walleye 2	liver/kidney	J18XF7		
Walleye	300 Area	300 SA Walleye 3	liver/kidney	J18XF8		
Walleye	300 Area	300 SA Walleye 4	liver/kidney	J18XF9		
Walleye	300 Area	300 SA Walleye 5	liver/kidney	J18XH0		
Walleye	300 Area	300 SA Walleye 1	carcass	J18XH1	J18XH6	J18XJ1
Walleye	300 Area	300 SA Walleye 2	carcass	J18XH2	J18XH7	J18XJ2
Walleye	300 Area	300 SA Walleye 3	carcass	J18XH3	J18XH8	J18XJ3
Walleye	300 Area	300 SA Walleye 4	carcass	J18XH4	J18XH9	J18XJ4
Walleye	300 Area	300 SA Walleye 5	carcass	J18XH5	J18XJ0	J18XJ5
Walleye	Lake Wallula	LW SA Walleye 1	fillet	J18XJ6	J18XK1	J19XK6
Walleye	Lake Wallula	LW SA Walleye 2	fillet	J18XJ7	J18XK2	J19XK7
Walleye	Lake Wallula	LW SA Walleye 3	fillet	J18XJ8	J18XK3	J19XK8
Walleye	Lake Wallula	LW SA Walleye 4	fillet	J18XJ9	J18XK4	J19XK9
Walleye	Lake Wallula	LW SA Walleye 5	fillet	J18XK0	J18XK5	J19XL0
Walleye	Lake Wallula	LW SA Walleye 1	liver/kidney	J18XL1		
Walleye	Lake Wallula	LW SA Walleye 2	liver/kidney	J18XL2		
Walleye	Lake Wallula	LW SA Walleye 3	liver/kidney	J18XL3		
Walleye	Lake Wallula	LW SA Walleye 4	liver/kidney	J18XL4		
Walleye	Lake Wallula	LW SA Walleye 5	liver/kidney	J18XL5		
Walleye	Lake Wallula	LW SA Walleye 1	carcass	J18XL6	J18XM1	J18XM6
Walleye	Lake Wallula	LW SA Walleye 2	carcass	J18XL7	J18XM2	J18XM7
Walleye	Lake Wallula	LW SA Walleye 3	carcass	J18XL8	J18XM3	J18XM8
Walleye	Lake Wallula	LW SA Walleye 4	carcass	J18XL9	J18XM4	J18XM9
Walleye	Lake Wallula	LW SA Walleye 5	carcass	J18XM0	J18XM5	J18XN0

Table C-5. Carp.

Fish	Sub-area	LMA	Tissue	Rad/metals sample ID (LVL/EB)	PCB/Lipids Sample ID (TA)	Arsenic sample ID (BMS)
Carp	Upriver	URSA-Carp 1	fillet	J19236	J19241	J19246
Carp	Upriver	URSA-Carp 2	fillet	J19237	J19242	J19247
Carp	Upriver	URSA-Carp 3	fillet	J19238	J19243	J19248
Carp	Upriver	URSA-Carp 4	fillet	J19239	J19244	J19249
~~Carp~~	~~Upriver~~	~~URSA-Carp 5~~	~~fillet~~		not collected	
Carp	Upriver	URSA-Carp 1	liver	J19251		
Carp	Upriver	URSA-Carp 2	liver	J19252		
Carp	Upriver	URSA-Carp 3	liver	J19253		
Carp	Upriver	URSA-Carp 4	liver	J19254		
~~Carp~~	~~Upriver~~	~~URSA-Carp 5~~	~~liver~~	not collected		
Carp	Upriver	URSA-Carp 1	kidney	J19256		
Carp	Upriver	URSA-Carp 2	kidney	J19257		
Carp	Upriver	URSA-Carp 3	kidney	J19258		
Carp	Upriver	URSA-Carp 4	kidney	J19259		
~~Carp~~	~~Upriver~~	~~URSA-Carp 5~~	~~kidney~~	not collected		
Carp	Upriver	URSA-Carp 1	carcass	J19667	J19672	J19677
Carp	Upriver	URSA-Carp 2	carcass	J19668	J19673	J19678
Carp	Upriver	URSA-Carp 3	carcass	J19669	J19674	J19679
Carp	Upriver	URSA-Carp 4	carcass	J19670	J19675	J19680
~~Carp~~	~~Upriver~~	~~URSA-Carp 5~~	~~carcass~~		not collected	
Carp	100 Area	100SA-Carp 1	fillet	J19682	J19687	J19692
Carp	100 Area	100SA-Carp 2	fillet	J19683	J19688	J19693
Carp	100 Area	100SA-Carp 3	fillet	J19684	J19689	J19694
Carp	100 Area	100SA-Carp 4	fillet	J19685	J19690	J19695
Carp	100 Area	100SA-Carp 5	fillet	J19686	J19691	J19696
Carp	100 Area	100SA-Carp 1	liver	J196B0		
Carp	100 Area	100SA-Carp 2	liver	J196B1		
Carp	100 Area	100SA-Carp 3	liver	J196B2		
Carp	100 Area	100SA-Carp 4	liver	J196B3		
Carp	100 Area	100SA-Carp 5	liver	J196B4		
Carp	100 Area	100SA-Carp 1	kidney	J196B5		
Carp	100 Area	100SA-Carp 2	kidney	J196B6		
Carp	100 Area	100SA-Carp 3	kidney	J196B7		
Carp	100 Area	100SA-Carp 4	kidney	J196B8		
Carp	100 Area	100SA-Carp 5	kidney	J196B9		
Carp	100 Area	100SA-Carp 1	carcass	J196C0	J196C5	J196D0
Carp	100 Area	100SA-Carp 2	carcass	J196C1	J196C6	J196D1
Carp	100 Area	100SA-Carp 3	carcass	J196C2	J196C7	J196D2
Carp	100 Area	100SA-Carp 4	carcass	J196C3	J196C8	J196D3
Carp	100 Area	100SA-Carp 5	carcass	J196C4	J196C9	J196D4
Carp	300 Area	300SA-Carp 1	fillet	J196D5	J196F0	J196F5
Carp	300 Area	300SA-Carp 2	fillet	J196D6	J196F1	J196F6
Carp	300 Area	300SA-Carp 3	fillet	J196D7	J196F2	J196F7
Carp	300 Area	300SA-Carp 4	fillet	J196D8	J196F3	J196F8
Carp	300 Area	300SA-Carp 5	fillet	J196D9	J196F4	J196F9
Carp	300 Area	300SA-Carp 1	liver	J196H0		
Carp	300 Area	300SA-Carp 2	liver	J196H1		
Carp	300 Area	300SA-Carp 3	liver	J196H2		
Carp	300 Area	300SA-Carp 4	liver	J196H3		
Carp	300 Area	300SA-Carp 5	liver	J196H4		
Carp	300 Area	300SA-Carp 1	kidney	J196H5		
Carp	300 Area	300SA-Carp 2	kidney	J196H6		
Carp	300 Area	300SA-Carp 3	kidney	J196H7		
Carp	300 Area	300SA-Carp 4	kidney	J196H8		
Carp	300 Area	300SA-Carp 5	kidney	J196H9		
Carp	300 Area	300SA-Carp 1	carcass	J196J0	J196J5	J196K0
Carp	300 Area	300SA-Carp 2	carcass	J196J1	J196J6	J196K1
Carp	300 Area	300SA-Carp 3	carcass	J196J2	J196J7	J196K2
Carp	300 Area	300SA-Carp 4	carcass	J196J3	J196J8	J196K3
Carp	300 Area	300SA-Carp 5	carcass	J196J4	J196J9	J196K4
Carp	Lake Wallula	LWSA-Carp 1	fillet	J196K5	J196L0	J196L5
Carp	Lake Wallula	LWSA-Carp 2	fillet	J196K6	J196L1	J196L6
Carp	Lake Wallula	LWSA-Carp 3	fillet	J196K7	J196L2	J196L7
Carp	Lake Wallula	LWSA-Carp 4	fillet	J196K8	J196L3	J196L8
Carp	Lake Wallula	LWSA-Carp 5	fillet	J196K9	J196L4	J196L9
Carp	Lake Wallula	LWSA-Carp 1	liver	J196W7		
Carp	Lake Wallula	LWSA-Carp 2	liver	J196W8		
Carp	Lake Wallula	LWSA-Carp 3	liver	J196W9		
Carp	Lake Wallula	LWSA-Carp 4	liver	J196X0		
Carp	Lake Wallula	LWSA-Carp 5	liver	J196X1		
Carp	Lake Wallula	LWSA-Carp 1	kidney	J196X2		
Carp	Lake Wallula	LWSA-Carp 2	kidney	J196X3		
Carp	Lake Wallula	LWSA-Carp 3	kidney	J196X4		
Carp	Lake Wallula	LWSA-Carp 4	kidney	J196X5		
Carp	Lake Wallula	LWSA-Carp 5	kidney	J196X6		
Carp	Lake Wallula	LWSA-Carp 1	carcass	J196X8	J196Y3	J196Y8
Carp	Lake Wallula	LWSA-Carp 2	carcass	J196X9	J196Y4	J196Y9
Carp	Lake Wallula	LWSA-Carp 3	carcass	J196Y0	J196Y5	J19700
Carp	Lake Wallula	LWSA-Carp 4	carcass	J196Y1	J196Y6	J19701
Carp	Lake Wallula	LWSA-Carp 5	carcass	J196Y2	J196Y7	J19702

Table C-6. Sturgeon. (2 Pages)

LMA	Tissue	Rad/metals sample ID (LVL/EB)	PCB/Lipids Sample ID (TA)	As sample ID (BMS)	MeHg sample ID (BMS)
Sturgeon 1	fillet	J19025	J19261	J19265	
Sturgeon 1	carcass	J19026	J19262	J19266	
Sturgeon 1	liver	J19027	J19263		
Sturgeon 1	kidney	J19028	J19264		
Sturgeon 2	fillet	J19272	J19276	J19267	
Sturgeon 2	carcass	J19273	J19277	J19268	
Sturgeon 2	liver	J19274	J19278		
Sturgeon 2	kidney	J19275	J19279		
Sturgeon 3	fillet	J19283	J19287	J19291	
Sturgeon 3	carcass	J19284	J19288	J19292	
Sturgeon 3	liver	J19285	J19289		
Sturgeon 3	kidney	J19286	J19290		
Sturgeon 4	fillet	J19293	J19297	J192B1	
Sturgeon 4	carcass	J19294	J19298	J192B2	
Sturgeon 4	liver	J19295	J19299		
Sturgeon 4	kidney	J19296	J192B0		
Sturgeon 5	fillet	J192B3	J192B7	J192C1	
Sturgeon 5	carcass	J192B4	J192B8	J192C2	
Sturgeon 5	liver	J192B5	J192B9		
Sturgeon 5	kidney	J192B6	J192C0		
Sturgeon 6	fillet	J192D3	J192D7	J192F1	
Sturgeon 6	carcass	J192D4	J192D8	J192F2	
Sturgeon 6	liver	J192D5	J192D9		
Sturgeon 6	kidney	J192D6	J192F0		
Sturgeon 7	fillet	J192F4	J192F8	J192H2	
Sturgeon 7	carcass	J192F5	J192F9	J192H3	
Sturgeon 7	liver	J192F6	J192H0		
Sturgeon 7	kidney	J192F7	J192H1		
Sturgeon 8	fillet	J192Y6	J19300	J19304	
Sturgeon 8	carcass	J192Y7	J19301	J19305	
Sturgeon 8	liver	J192Y8	J19302		
Sturgeon 8	kidney	J192Y9	J19303		
Sturgeon 9	fillet	J19306	J19310	J19314	
Sturgeon 9	carcass	J19307	J19311	J19315	
Sturgeon 9	liver	J19308	J19312		
Sturgeon 9	kidney	J19309	J19313		
Sturgeon 10	fillet	J19317	J19321	J19325	
Sturgeon 10	carcass	J19318	J19322	J19326	
Sturgeon 10	liver	J19319	J19323		
Sturgeon 10	kidney	J19320	J19324		
Sturgeon 11	fillet	J193K4	J193K8	J193L2	
Sturgeon 11	carcass	J193K5	J193K9	J193L3	
Sturgeon 11	liver	J193K6	J193L0		
Sturgeon 11	kidney	J193K7	J193L1		
Sturgeon 12	fillet	J193L4	J193L8	J193M2	
Sturgeon 12	carcass	J193L5	J193L9	J193M3	
Sturgeon 12	liver	J193L6	J193M0		
Sturgeon 12	kidney	J193L7	J193M1		
Sturgeon 13	fillet	J193M6	J193N0	J193N4	
Sturgeon 13	carcass	J193M7	J193N1	J193N5	
Sturgeon 13	liver	J193M8	J193N2		
Sturgeon 13	kidney	J193M9	J193N3		
Sturgeon 14	fillet	J19438	J19442	J19446	
Sturgeon 14	carcass	J19439	J19443	J19447	
Sturgeon 14	liver	J19440	J19444		
Sturgeon 14	kidney	J19441	J19445		
Sturgeon 15	fillet	J19448	J19452	J19456	
Sturgeon 15	carcass	J19449	J19453	J19457	
Sturgeon 15	liver	J19450	J19454		
Sturgeon 15	kidney	J19451	J19455		
Sturgeon 16	fillet	J19458	J19462	J19466	
Sturgeon 16	carcass	J19459	J19463	J19467	
Sturgeon 16	liver	J19460	J19464		
Sturgeon 16	kidney	J19461	J19465		

Table C-6. Sturgeon (2 Pages).

LMA	Tissue	Rad/metals sample ID (LVL/EB)	PCB/Lipids Sample ID (TA)	As sample ID (BMS)	MeHg sample ID (BMS)
Sturgeon 17	fillet	J19468	J19472	J19476	J195T9
Sturgeon 17	carcass	J19469	J19473	J19477	J195V0
Sturgeon 17	liver	J19470	J19474		
Sturgeon 17	kidney	J19471	J19475		
Sturgeon 17	viscera	J195V7	J195W1	J195W5	
Sturgeon 18	fillet	J19478	J19482	J19486	J195V1
Sturgeon 18	carcass	J19479	J19483	J19487	J195V2
Sturgeon 18	liver	J19480	J19484		
Sturgeon 18	kidney	J19481	J19485		
Sturgeon 18	viscera	J195V8	J195W2	J195W6	
Sturgeon 19	fillet	J19488	J19492	J19496	J195V3
Sturgeon 19	carcass	J19489	J19493	J19497	J195V4
Sturgeon 19	liver	J19490	J19494		
Sturgeon 19	kidney	J19491	J19495		
Sturgeon 19	viscera	J195V9	J195W3	J195W7	
Sturgeon 20	fillet	J19499	J194B3	J194B7	J195V5
Sturgeon 20	carcass	J194B0	J194B4	J194B8	J195V6
Sturgeon 20	liver	J194B1	J194B5		
Sturgeon 20	kidney	J194B2	J194B6		
Sturgeon 20	viscera	J195W0	J195W4	J195W8	
Sturgeon 21	fillet	J194C0	J194C4	J194C8	
Sturgeon 21	carcass	J194C1	J194C5	J194C9	
Sturgeon 21	liver	J194C2	J194C6		
Sturgeon 21	kidney	J194C3	J194C7		
Sturgeon 22	fillet	J194Y5	J194Y9	J19503	
Sturgeon 22	carcass	J194Y6	J19500	J19504	
Sturgeon 22	liver	J194Y7	J19501		
Sturgeon 22	kidney	J194Y8	J19502		
Sturgeon 23	fillet	J195P2	J195P6	J195R0	
Sturgeon 23	carcass	J195P3	J195P7	J195R1	
Sturgeon 23	liver	J195P4	J195P8		
Sturgeon 23	kidney	J195P5	J195P9		
Sturgeon 24	fillet	J195R4	J195R8	J195T2	
Sturgeon 24	carcass	J195R5	J195R9	J195T3	
Sturgeon 24	liver	J195R6	J195T0		
Sturgeon 24	kidney	J195R7	J195T1		
Sturgeon 25	fillet	J195X1	J195X5	J195X9	
Sturgeon 25	carcass	J195X2	J195X6	J195Y0	
Sturgeon 25	liver	J195X3	J195X7		
Sturgeon 25	kidney	J195X4	J195X8		
Sturgeon 26	fillet	J19601	J19605	J19609	
Sturgeon 26	carcass	J19602	J19606	J19610	
Sturgeon 26	liver	J19603	J19607		
Sturgeon 26	kidney	J19604	J19608		
Sturgeon 27	fillet	J19620	J19624	J19628	J19628*
Sturgeon 27	carcass	J19621	J19625	J19629	J19629*
Sturgeon 27	liver	J19622	J19626		
Sturgeon 27	kidney	J19623	J19627		
Sturgeon 27	viscera	J19662	J19664	J19666	
Sturgeon 28	fillet	J19631	J19635	J19639	J19698
Sturgeon 28	carcass	J19632	J19636	J19640	J19699
Sturgeon 28	liver	J19633	J19637		
Sturgeon 28	kidney	J19634	J19638		
Sturgeon 28	viscera	J19661	J19663	J19665	
Sturgeon 29	fillet	J19641	J19645	J19649	
Sturgeon 29	carcass	J19642	J19646	J19650	
Sturgeon 29	liver	J19643	J19647		
Sturgeon 29	kidney	J19644	J19648		
Sturgeon 30	fillet	J19651	J19655	J19659	
Sturgeon 30	carcass	J19652	J19656	J19660	
Sturgeon 30	liver	J19653	J19657		
Sturgeon 30	kidney	J19654	J19658		

Sturgeon 27 has 1 sample and HEIS # for both the arsenic and methyl mercury

APPENDIX D

STURGEON AGE DETERMINATION

APPENDIX D

STURGEON AGE DETERMINATION

The table that follows contains the field records of 166 sturgeon that were captured as part of this study. Records include the total and fork length (in inches) of each fish, the date and general area in which the fish was caught, any markings (scute pattern, PIT tag number), and anomalies noted as described in Section 2.5.2 of the report. This information was provided to the Washington State Department of Fish and Wildlife as a condition of the fish collection permit approved for this study. In addition, the assigned identification numbers (HS1 – 30) for the sturgeon kept for this study have also been included.

As described in Section 3.4.3 of the report, during sample processing pectoral fin ray sections from each sturgeon were collected, stored, and later shipped to the Washington State Department of Fish and Wildlife for age determination. Results from that determination are provided in the last column of the following table.

Table D-1. Hanford 2009 Sturgeon Field Records With Age Assignments. (5 Pages)

Field Identification Number	Total Length (in.)	Fork Length (in.)	Date	Collection Sub-Area	Collection Point	Collection Technique	Previous Marks (See Notes at Bottom of Table)			Anatomical Anomaly (If Present)	Target Fish Identification (HS = Hanford Sturgeon, URS = Upriver Sturgeon) Target Size = (43-54"Fork Length)	Age Assignment	
							Absence of Scute Yes (Y)/No (N)	Scan Identification/Passive Integrated Transponder Tag (If Present)	Marking Study			Age	Comments
1	38	33	7/14/2009	100 Area	100 D Hole	Hook and line	N	NA		NA			
2	NA	NA	7/14/2009	100 Area	100 D Hole	Hook and line	N	NA		NA			
3	46	39	7/14/2009	100 Area	100 D Hole	Set-lines	3rd L	NA	2003 RI stocking? (missing 10R?)	NA			
4	35.5	31.5	7/14/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
5	28.5	24	7/14/2009	100 Area	100 D Hole	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
6	41	36	7/15/2009	100 Area	100 D Hole	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
7	31	26	7/15/2009	100 Area	100 D Hole	Set-lines	3rd L	NA	2003 RI stocking? (missing 10R?)	NA			
8	46	40.5	7/15/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
9	45.25	39.75	7/16/2009	100 Area	100 D Hole	Set-lines	N	NA		Forked barble			
10	30.5	26	7/16/2009	100 Area	100 D Hole	Set-lines	N	NA		Gill plates 40% normal			
11	42	36.75	7/16/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
12	45.5	40	7/16/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
13	38	33	7/16/2009	100 Area	100 D Hole	Set-lines	7th L	NA	1995 McNary assessment	NA			
14	41	36	7/16/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
15	33	29	7/16/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
16	63.25	56	7/16/2009	100 Area	100 B/C Hole	Set-lines	4th L	NA	2003 RI stocking? (3L?, missing 10R?)	Lower coddle 80%			
17	52	45.5	7/16/2009	100 Area	100 KW Hole	Set-lines	N	NA		NA	**HS01**	**13**	
18	30	20	7/16/2009	100 Area	100 D Hole	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
19	40	35	7/17/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
20	43	38	7/17/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
21	43	38	7/17/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
22	44	39	7/17/2009	100 Area	100 N Hole	Set-lines	N	NA		Tumor on R dorsal			
23	41	37	7/17/2009	100 Area	100 N Hole	Set-lines	N	132061009	1995 McNary assessment	NA			
24	39	33.5	7/17/2009	100 Area	100 N Hole	Set-lines	3rd and 4th L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
25	53	47	7/17/2009	100 Area	100 N Hole	Set-lines	N	NA		Lower coddle 80% of norm	**HS02**	**Unreadable**	**Stacked annuli**
26	55	48	7/17/2009	100 Area	100 N Hole	Set-lines	N	NA		2 pec fins	**HS03**	**20**	
27	35	30	7/17/2009	100 Area	100 KE Hole	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
28	64	59	7/17/2009	100 Area	100 KE Hole	Set-lines	N	NA		NA			
29	46	41	7/17/2009	100 Area	100 KW Hole	Set-lines	3rd L	NA	2003 RI stocking? (missing 10R?)	NA			
30	41	36	7/17/2009	100 Area	100 KW Hole	Set-lines	N	NA		NA			
31	44	39	7/21/2009	300 Area	300 A Hole 2	Set-lines	N	NA		1st L gill arch separated			
32	36	31.75	7/21/2009	100 Area	100 KW Hole	Hook and line	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
33	47	42	7/21/2009	100 Area	100 KW Hole	Hook and line	N	NA		Bumps			
34	51.5	46.5	7/22/2009	100 Area	100 D Hole	Set-lines	N	NA		NA	**HS04**	**21-23**	**Damage**
35	37	33	7/22/2009	100 Area	100 D Hole	Set-lines	N	NA		Curved dorsal fin			
36	38	33	7/22/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
37	36	31	7/22/2009	100 Area	100 D Hole	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
38	46	39.5	7/22/2009	100 Area	100 N Hole	Set-lines	N	NA		NA			
39	43.5	38	7/22/2009	100 Area	100 N Hole	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	Stunted L pec 60% of norm			
40	37	34.5	7/22/2009	100 Area	100 N Hole	Set-lines	N	NA		NA			

Table D-1. Hanford 2009 Sturgeon Field Records With Age Assignments. (5 Pages)

Field Identification Number	Total Length (in.)	Fork Length (in.)	Date	Collection Sub-Area	Collection Point	Collection Technique	Previous Marks (See Notes at Bottom of Table)			Anatomical Anomaly (If Present)	Target Fish Identification (HS = Hanford Sturgeon, URS = Upriver Sturgeon) Target Size = (43-54"Fork Length)	Age Assignment	
							Absence of Scute Yes (Y)/No (N)	Scan Identification/Passive Integrated Transponder Tag (If Present)	Marking Study			Age	Comments
41	37	32.5	7/22/2009	100 Area	100 N Hole	Set-lines	N	NA		NA			
42	72	67	7/22/2009	100 Area	100 N Hole	Set-lines	N	NA		NA			
43	44	38	7/22/2009	100 Area	100 KE Hole	Set-lines	3rd L	NA	2003 RI stocking? (missing 10R?)	NA			
44	32	27	7/22/2009	100 Area	100 KE Hole	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
45	33.5	28.5	7/22/2009	100 Area	100 KE Hole	Set-lines	N	NA		NA			
46	50	45	7/22/2009	100Area	100 KE Hole	Set-lines	N	NA		NA	**HS05**	**14**	
47	97	86	7/22/2009	100 Area	100 B/C Hole	Set-lines	N	NA		NA			
48	24	18	7/22/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
49	46	41	7/22/2009	100 Area	100 B/C Hole	Set-lines	N	NA		NA			
50	66	60	7/22/2009	100 Area	100 KW Hole	Set-lines	N	NA		NA			
51	61	55	7/22/2009	100 Area	100 KE Hole	Set-lines	N	NA		NA			
52	48	43.5	7/23/2009	100 Area	100 D Hole	Set-lines	N	NA		NA	**HS06**	**21**	
53	45	39	7/23/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
54	29	25	7/23/2009	100 Area	100 D Hole	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
55	42	36	7/23/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
56	46.5	39	7/23/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
57	39.5	34	7/23/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
58	45	40	7/23/2009	100 Area	100 N Hole	Set-lines	N	NA		NA			
59	31	27	7/23/2009	100 Area	100 B/C Hole	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
60	36.5	31.5	7/24/2009	UR	King Hole	Set-lines	N	NA		NA			
61	96	86	7/27/2009	100 Area	100 N Hole	Hook and line	N	NA		NA			
62	29	25	7/27/2009	100 Area	100 N Hole	Hook and line	3rd L	NA	2003 RI stocking? (missing 10R?)	NA			
63	31	27	7/27/2009	100 Area	100 N Hole	Hook and line	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
64	44	40	7/28/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
65	27	23	7/28/2009	100 Area	100 KE Hole	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
66	56	48	7/28/2009	100 Area	100 KE Hole	Set-lines	N	NA		NA	**HS07**	**13**	
67	28	24	7/28/2009	100 Area	100 KE Hole	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
68	46	40.5	7/28/2009	100 Area	100 KW Hole	Set-lines	N	NA		NA			
69	82	75	7/28/2009	100 Area	100 KW Hole	Set-lines	N	NA		NA			
70	28	25	7/29/2009	100 Area	100 KW Hole	Set-lines	3rd L	NA	2003 RI stocking? (missing 10R?)	NA			
71	78	69	7/29/2009	100 Area	100 KE Hole	Set-lines	N	NA		NA			
72	23	20	7/29/2009	100 Area	100 KE Hole	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
73	38	33	7/29/2009	100 Area	100 N Hole	Set-lines	N	NA		NA			
74	40	35	7/29/2009	100 Area	100 N Hole	Set-lines	N	NA		NA			
75	44	39	7/29/2009	100 Area	100 N Hole	Set-lines	N	NA		Tumor on R dorsal			
76	34	31	7/29/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
77	46	40	7/29/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
78	41	35	7/29/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
79	45	40	7/29/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
80	44	39	7/29/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
81	49	44	7/29/2009	100 Area	100 D Hole	Set-lines	N	NA		NA	**HS08**	**14**	
82	50.5	44	7/29/2009	100 Area	WB Hole 1	Set-lines	N	NA		NA	**HS09**	**20**	
83	42	37	7/29/2009	100 Area	WB Hole 1	Set-lines	N	NA		NA			

Table D-1. Hanford 2009 Sturgeon Field Records With Age Assignments. (5 Pages)

Field Identification Number	Total Length (in.)	Fork Length (in.)	Date	Collection Sub-Area	Collection Point	Collection Technique	Previous Marks (See Notes at Bottom of Table)			Anatomical Anomaly (If Present)	Target Fish Identification (HS = Hanford Sturgeon, URS = Upriver Sturgeon) Target Size = (43-54"Fork Length)	Age Assignment	
							Absence of Scute Yes (Y)/No (N)	Scan Identification/Passive Integrated Transponder Tag (If Present)	Marking Study			Age	Comments
84	44	39	7/29/2009	100 Area	WB Hole 1	Set-lines	N	NA		NA			
85	97	88	7/30/2009	100 Area	100 D Hole	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
86	42	37	7/30/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
87	39	34	7/30/2009	100 Area	100 D Hole	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
88	23	20	7/30/2009	100 Area	100 D Hole	Set-lines	N	NA		Tumor on lower ventral side 5mm round			
89	27	24	7/30/2009	100 Area	100 D Hole	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
90	43	37	7/30/2009	100 Area	100 D Hole	Set-lines	N	NA		NA			
91	42	38	7/30/2009	100 Area	WB Hole	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
92	37	33	7/30/2009	100 Area	WB Hole	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
93	34	29	7/30/2009	100 Area	WB Hole	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
94	33	29	7/30/2009	100 Area	WB Hole	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
95	38	33	8/3/2009	300 Area	HTS	Set-lines	N	NA		NA			
96	55	47	8/3/2009	300 Area	HTS	Set-lines	N	NA		NA	**HS10**	**17**	
97	59	52	8/3/2009	300 Area	HTS	Set-lines	N	NA		Dorsal fin curved	**HS11**	**25**	**stacked annuli**
98	43	39	8/3/2009	300 Area	HTS	Set-lines	N	NA		NA			
99	31	26	8/3/2009	300 Area	HTS	Set-lines	N	NA		NA			
100	42	36	8/3/2009	300 Area	HTS	Set-lines	N	NA		NA			
101	44	39	8/3/2009	300 Area	HTS	Set-lines	N	NA		NA			
102	44	39	8/3/2009	300 Area	HTS	Set-lines	N	NA		NA			
103	61	53	8/3/2009	300 Area	HTS	Set-lines	N	NA		NA	**HS12**	**24**	
104	38	34	8/3/2009	300 Area	HTS	Set-lines	N	NA		NA			
105	27	23	8/3/2009	300 Area	HTS	Set-lines	N	NA		NA			
106	28	25	8/3/2009	300 Area	HTS	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
107	39	34	8/4/2009	300 Area	HTS	Set-lines	N	NA		NA			
108	49	43	8/4/2009	300 Area	HTS	Set-lines	N	NA		NA	**HS13**	**15**	
109	29	25	8/4/2009	300 Area	HTS	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
110	29	23	8/4/2009	300 Area	HTS	Set-lines	N	NA		NA			
111	28	24	8/4/2009	300 Area	HTS	Set-lines	2nd and 4th L	985120014577358	Rock Island stocking (3L?, missing 10L)	NA			
112	36	31	8/4/2009	300 Area	HTS	Set-lines	N	NA		NA			
113	42	37	8/4/2009	300 Area	HTS	Set-lines	N	NA		NA			
114	32	28	8/4/2009	300 Area	HTS	Set-lines	2nd and 10th L	NA	2001 Wanapum assessment?	NA			
115	42	38	8/5/2009	300 Area	HTS	Set-lines	N	NA		NA			
116	29	25	8/5/2009	300 Area	HTS	Set-lines	2nd and 4th L	985120019382918	Rock Island stocking (3L?, missing 10L)	NA			
117	28	24	8/5/2009	300 Area	HTS	Set-lines	2nd and 10th L	985120019471571	Rock Island stocking (missing 3L)	NA			
118	45	40	8/11/2009	300 Area	HTS	Set-lines	N	NA		NA			
119	45	40	8/11/2009	300 Area	HTS	Set-lines	N	NA		Lower coddle small			
120	39	34	8/11/2009	300 Area	HTS	Set-lines	N	NA		NA			

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Field Identification Number	Total Length (in.)	Fork Length (in.)	Date	Collection Sub-Area	Collection Point	Collection Technique	Previous Marks (See Notes at Bottom of Table)			Anatomical Anomaly (If Present)	Target Fish Identification (HS = Hanford Sturgeon, URS = Upriver Sturgeon) Target Size = (43-54"Fork Length)	Age Assignment	
							Absence of Scute Yes (Y)/No (N)	Scan Identification/Passive Integrated Transponder Tag (If Present)	Marking Study			Age	Comments
121	51	44	8/11/2009	300 Area	HTS	Set-lines	N	NA		R pec 80% of normal	**HS14**	**14**	**damage**
122	34	31	8/11/2009	300 Area	HTS	Set-lines	N	NA		NA			
123	36	32	8/11/2009	300 Area	HTS	Set-lines	N	NA		NA			
124	Undersize	Undersize	8/11/2009	300 Area	HTS	Set-lines	N	NA		NA			
125	50	42.5	8/11/2009	300 Area	HTS	Set-lines	N	NA		NA			
126	44	38	8/12/2009	300 Area	HTS Hole 1	Set-lines	3rd L	NA	2003 RI stocking? (missing 10R?)	NA			
127	53	45	8/12/2009	300 Area	HTS Hole 1	Set-lines	N	NA		R pec fin curled 60% norm	**HS15**	**15**	**damage**
128	56	49	8/12/2009	300 Area	HTS Hole 1	Set-lines	N	NA		NA	**HS16**	**unreadable**	**stacked annuli**
129	37	32	8/26/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA			
130	40	34	8/26/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA			
131	37	32	8/26/2009	300 Area	300 A Hole 1	Set-lines	2nd L	NA	2003 RI stocking? (3L & 10R missing?)	NA			
132	50	44	8/26/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA	**HS17**	**15**	
133	50	42	8/26/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA			
134	55	46.5	8/26/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA	**HS18**	**15**	
135	31	26	8/26/2009	300 Area	300 A Hole 2	Set-lines	2nd L 11th R	NA	Either 2003 RI stocking or 2002 Rocky Reach assessment	NA			
136	42	37	8/26/2009	300 Area	300 A Hole 2	Set-lines	N	NA		NA			
137	NA	NA	8/27/2009	300 Area	300 A Hole 1	Set-lines	3rd and 10th L	985120014377604	Rock Island stocking (missing 2L?)	L pec 50%			
138	59	52	8/27/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA	**HS19**	**16**	
139	42	36	9/1/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA			
140	44	38	9/1/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA			
141	47	40	9/1/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA			
142	40	35	9/1/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA			
143	41	36	9/1/2009	300 Area	300 A Hole 1	Set-lines	4th and 5th L	985120019433361	Rock Island stocking (2,3 off?, missing 10L?)	Missing L pec fin			
144	46	40	9/1/2009	300 Area	300 A Hole 1	Set-lines	N	NA		NA			
145	37	32	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	2, 3, 10 L	985120014364966	2003 Rock Island stocking	NA			
146	44	38	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	2, 3, 9 L	Missing PIT tag? (BJ)	Likely 2003 Rock Island stocking	NA			
147	36	30	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	N	NA		Small tumors on body surface			
148	51	45	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	N	NA		NA	**HS20**	**14**	
149	45	39	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	3rd L	NA	2003 RI stocking? (missing 10R?)	NA			
150	59	51	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	N	NA		NA	**HS21**	**15**	
151	62	52	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	N	NA		NA			
152	56	50	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	N	NA		NA	**HS22**	**14**	
153	61	52	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	N	NA		NA	**HS23**	**12**	
154	42	36	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	2nd and 3rd L	Missing PIT tag? (BJ)	2003 RI stocking? (missing 10L?)	NA			
155	63	52	9/2/2009	Lake Wallula	Wallula Gap	Set-lines	N	NA		NA	**HS24**	**16**	
156	52	44	9/4/2009	Wanapum	Wanapum Pool	Set-lines	3rd L	NA	2003 RI stocking? (missing 10R?)	NA	**URS26**	**9**	
157	53	46	9/9/2009	Lake Wallula	Wallula Gap	Set-lines	N	NA		NA	**HS25**	**17**	
158	82	73	9/9/2009	Lake Wallula	Wallula Gap	Set-lines	N	NA		NA			

Table D-1. Hanford 2009 Sturgeon Field Records With Age Assignments. (5 Pages)

Field Identification Number	Total Length (in.)	Fork Length (in.)	Date	Collection Sub-Area	Collection Point	Collection Technique	Previous Marks (See Notes at Bottom of Table)			Anatomical Anomaly (If Present)	Target Fish Identification (HS = Hanford Sturgeon, URS = Upriver Sturgeon) Target Size = (43-54"Fork Length)	Age Assignment	
							Absence of Scute Yes (Y)/No (N)	Scan Identification/Passive Integrated Transponder Tag (If Present)	Marking Study			Age	Comments
159	36	31	9/10/2009	Wanapum	Wanapum Pool	Set-lines	2nd and 9th L	NA	2001 Wanapum assessment	Leading pec ray curled right pec fin			
160	50	44.5	9/10/2009	Wanapum	Wanapum Pool	Set-Lines	2, 3, 10 L	Missing PIT tag? (BJ)	2003 Rock Island stocking	NA	**URS27**	**7**	
161	47	41	9/10/2009	Wanapum	Wanapum Pool	Set-Lines	3rd L 10th R	NA	2003 Rock Island stocking	NA			
162	51	43	9/10/2009	Wanapum	Wanapum Pool	Set-Lines	2, 3, 10 L	Missing PIT tag? (BJ)	2003 Rock Island stocking	NA	**URS28**	**7**	
163	41	36	9/10/2009	Wanapum	Wanapum Pool	Set-Lines	2nd L and 10th R	NA	2002 Rocky Reach (maybe 2003 RI stocking)	NA			
164	55	50	9/10/2009	Wanapum	Wanapum Pool	Set-Lines	2, 3, 8, 10 L	Missing PIT tag? (BJ)	Likely 2003 Rock Island stocking	NA	**URS29**	**6**	
165	39	34	9/15/2009	Wanapum	Cresent Bar	Hook and line	2, 3, 4 L	NA	No match for scute	NA			
166	52	46	9/15/2009	Wanapum	Cresent Bar	Hook and line	N	NA		NA	**URS30**	**12**	

NOTES:

Scute Mark	Study
5R	1993 McNary (none PIT tagged)
6L or 2L,6L	1995 McNary (most PIT tagged)
2L,7L	1996 Ice Harbor (all PIT tagged)
2L,7R	1997 Lower Monumental (all PIT tagged)
2L,7R	1997 Little Goose (all PIT tagged)
2L,9R	2000 Wanapum & Priest Rapids (all PIT tagged)
2L,9L	2001 Wanapum & Priest Rapids (all PIT tagged)
2L,9L	2001 Rocky Reach (all PIT tagged)
2L,10R	2002 Rocky Reach (all PIT tagged)
2L,3L,10L	2003 Rock Island (all PIT tagged)
3L,10R	2003 Rock Island (none PIT tagged)

NA = not available
PIT = Passive Integrated Transponder

APPENDIX E

STURGEON HISTOLOGICAL SAMPLE ANALYSIS

152423

May 12, 2010

Mr. Larry Hulstrom
Washington Closure Hanford, LLC.
2620 Fermi Avenue
Richland, WA 99354

Re: Histology Report on Columbia River White Sturgeon from the Hanford Reach Area

Dear Larry:

Kidney, liver, gill and gonad tissues from 30 white sturgeon collected from the Columbia River were submitted to the Bozeman Fish Health Center for histological evaluation. Additional tissue samples were submitted from four of these fish that were found to have gross lesions or abnormalities.

Methods

To insure adequate processing, large tissue samples were further dissected. All tissue pieces (2 gill arches, 2 kidney, 2-3 gonad, and 3-5 liver per fish) were processed using standard histological techniques. Two 5 um tissue sections were taken at different depths from each block and slides were stained with hematoxylin & eosin (H&E). Additional sections were cut from some tissues and stained with Giemsa to demonstrate the presence of any bacteria or parasites. A total of 12-18 tissue sections were evaluated for each fish.

Severity of histological changes was scored on a scale of 0-5: 0 = no change; 1 = minimal; 2 = mild; 3 = moderate; 4 = moderately severe; 5 = severe and may be further defined for specific conditions. In general, histological scores of 1 and 2 should be considered normal or cellular changes of no significance; 3 is transitional or intermediary, moderate cellular changes that may or may not be within the normal range depending on species, age, and sex of the fish; 4 and 5 are indicative of pathological lesions (e.g. normal tissue is replaced by the lesion). A summary of the scores assigned is found in Table 1.

Results

Gill (Figures 1-3).

Histological changes (described below) in gill tissue were consistent from fish to fish and severity scores ranged from mild (+2) to moderate (+3). Only one fish showed moderately severe (+4) changes. Parasites or bacteria were not found in gills of any fish. No significant degeneration or necrosis of squamous epithelium covering lamellae (secondary lamellae) was observed.

Widespread infiltration of inflammatory cells, primarily lymphocytes, similar to the other tissues examined was the primary gill lesion. Thickening of lamellae, mostly at tips, and basal spaces between lamellae was caused by infiltrate of inflammatory cells not proliferation of gill epithelium. External irritants (e.g. bacteria, sediment, toxicant) typically induce a proliferative response in gill tissue. The only proliferative response observed was a mild to moderate increase in numbers of mucus cells mostly at ends of filaments (primary lamellae) but occasionally along lamellae seen in one third of the fish examined.

Kidney (Figures 4-7).

Histological changes in kidney tissue were consistent among the 30 fish examined. The most remarkable changes in kidney occurred in interstitial tissue (proliferation of hematopoietic tissue and inflammatory cell infiltrate) resulting in replacement of nephrons.

Nephron – Minimal to moderate scattered degeneration and necrosis of tubule epithelium, hypertrophy of tubule epithelium, accumulation of protein in tubule lumen and proliferation of mesangial cells in glomeruli were seen in kidney tissue sections. A few fish showed scattered, small foci of hydropic degeneration in tubules.

Interstitium – moderate to severe hematopoietic hyperplasia and inflammatory infiltlrate (primarily lymphocytic cells but macrophages and eosinophilic granular cells also present) more concentrated in area surrounding glomeruli. Nephron replacement was seen in 23 fish with severity scores of +4 or higher (only one fish had +5). Melanomacrophages (+2 to +3) were seen in kidney tissue only when moderately severe numbers (+4) were found in liver tissue.

Liver (Figures 8- 11).

Histological changes in liver tissue were consistent among the 30 fish examined. All fish showed widespread inflammation of blood vessels (vasculits) throughout liver tissue sections. The most intense inflammation was associated with larger blood vessels. Lymphocytes were the predominant cell type but macrophages and eosinophilic granular cells were also observed in the lesion. Moderately severe (+4) vasculitis was seen in 26 of 30 fish examined. Two of those fish had focal areas that scored +5. Vasculitis was moderate (+3) in 4 of 30 fish. Melanomacrophage aggregates were commonly associated with vascular lesions and found in all fish. Four fish had moderate numbers and 26 were scored moderately severe (+4). Active Kupfer cells in liver sinusoids were seen in one fish and granulomatous inflammation was seen in another fish.

Fat vacuolation (energy storage) in hepatcytes was highly variable among fish. Most (12) had moderate (considered healthy) levels, seven were +2, one +1 and the remaining 10 showed zonal variation; areas with no fat (0) to areas of excessive fat (+4). Mild to moderate diffusely scattered hepatocyte pleomorphism, necrosis or megahepatocytes were seen in 12 fish.

Intrahepatic pancreatic tissue was present in some tissue sections. Vasculitis and moderate cytoplasmic vacuolation of acinar pancreatic cells were common.

152423

Gonad (Figures 12-16).
Ovarian tissue showed various stages of developing ooocytes. Atresia, if present, was mild. Inflammation (primarily lymphocytic) ranged from minimal (+1) to moderately severe (+4). Five fish with +4 scores showed oocytes replaced by inflammation. In general, testicular tissue was very immature and showed less inflammation than females. Fully developed spermatoza were present in testis from one fish. Tissue was normal and no inflammation was evident in this fish.

Amounts of fat interspersed among developing gametes was also scored. Four females with scores of +4 showed isolated oocytes completely surrounded by fat cells, possibly precluding development to maturation and/or release. Often, but not always increased amounts of fat correlated with increased inflammation in the same fish.

Additional Tissues: Gastrointestinal (GI) (Figures 17-19).
Nematode worms were found encysted in musculature of gastrointestinal tissue of all 3 fish submitted. There was a localized granulomatous host response to these parasites.

Tissue in sample container of one fish collected on 9/2/09, possibly associated with GI but found separate (not attached or within any tissue) was a large adult tapeworm. Typical of cestodes, both male and female reproductive organs (hermaphroditic) were found in the individual worm (Figure 19).

Summary
There was remarkable consistency in findings among all 30 fish examined. Similar (but more severe) to histological changes observed in white sturgeon from Lake Roosevelt, these fish showed widespread vasculitis in gill, kidney, liver and gonad tissues. The inflammation was characterized by a lymphocytic infiltrate. However, the presence of a mixed population of inflammatory cells indicates that this is a normal proliferative response to insult not neoplasia. Overall, degeneration and necrosis was minimal compared to inflammation. No parasites or bacteria were found in liver, kidney or gill tissues.

Vasculitis was the predominant lesion observed in all tissues examined. This type of response is not surprising since sturgeon, in contrast to salmonids, appear to have a very developed lymphatic system. Well defined lymph nodes are visible in tissue sections of several organs (i.e. heart). I have routinely observed vasculitis, especially in liver tissue, in wild and hatchery reared pallid, shovelnose, and white sturgeon of variable ages. However, in my experience it is less common in young hatchery fish.

Extensive necrosis (associated with acute toxicity) or proliferation (indicating chronic toxicity exposure) of filament and lamellar epithelium were not seen in these fish. Histological changes observed in gill and other tissues were indicative of an internal, not external, insult (e.g. an ingested toxicant not waterborne). Widespread vasculitis suggests transport of a toxicant or pathogen via blood, subsequent absorption into surrounding tissue, and injury to the endothelial lining of blood vessels eliciting a strong immune response. The most intense lymphocytic response was associated with large blood vessels and kidney glomeruli (intitial site of blood filtration). The blood vessel inflammation, considered a non-specific response, is indicative of chronic insult not the result of transient events (i.e. handling, single acute contaminant exposure, etc.). I would characterize the immune response in these fish as active and chronic. The integrity of some blood vessel walls was compromised in fish with moderately severe widespread vasculitis which could have a negative impact on vascular function.

Macrophage aggregates (MA or melanomacrophage centers) are widely used as a biomarker for exposure to environmental stressors (i.e. contaminants) but their utility needs to account for fish age. The majority of these fish had high numbers of MA in liver tissue sections but to suggest a contaminant etiology need to be compared to fish of similar ages from an uncontaminated site. There are other specific liver lesions used as biomarkers of contaminant induced effects but studies (conducted on teleosts) have shown that relationships between contaminant exposure and lesion risk were often species-specific.

Lesions described in ovarian tissue may be of little importance to survival of the individual but in fish with moderately severe (+4) inflammation and amounts of fat this may have a negative impact on reproductive health and subsequently negative population effects.

Sincerely,

Elizabeth MacConnell

Beth MacConnell
Headwaters Fish Pathology LLC
headwatersfp@gmail.com

Site: Columbia River
Received @ BFHC: 10/1/2009
Reference case # **10-05**
Number of fish: 30

Enclosures

Table 1. Summary of Histology Scores Assigned to Columbia River White Sturgeon from the Hanford Reach Area (Sheet 1 of 2)

Fish #	Study Sub-Area	Histology Sample #	Liver Vasc	Liver MMC	Liver FV	KidH Inflm/P	KidH MMC	Gonad Dev	Gonad Inflm	Gonad Fat	Gill Inflm	Other Tissue
Sturgeon 1	100 Area	6	4	4	3	4	2	F	2	4	2	
Sturgeon 2	100 Area	7	3	4	2	4	2	IM posM	2	0	3	
Sturgeon 3	100 Area	8	4	4	3	4	2	IM posM	2	0	3	
Sturgeon 4	100 Area	9	4*	4	2	3	3	F	1	1	2	
Sturgeon 5	100 Area	10	4	4	3	3	2	F	2	3	3	
Sturgeon 6	100 Area	11	4	4	2	4	2	IM posM	1	0	3	
Sturgeon 7	100 Area	12	4	4	Z	3	2	IM posM	0	0	2	
Sturgeon 8	100 Area	13	4	4	Z	3	2	IM posM	2	0	2	GI muscle - encysted nematodes
Sturgeon 9	100 Area	14	4	4	Z	3	2	F	2	2	3	GI muscle - encysted nematodes
Sturgeon 10	300 Area	15	4	4	2	4	3	IM posM	3	0	3	
Sturgeon 11	300 Area	16	4	4	Z	4	2	F	1	2	2	GI muscle - encysted nematodes
Sturgeon 12	300 Area	17	4	4	2	4	2	IM	2	2	2	
Sturgeon 13	300 Area	18	3	4	Z	4	2	F	2	0	2	
Sturgeon 14	300 Area	19	3	3	3	4	0	IM	2	0	3	
Sturgeon 15	300 Area	20	4	4	Z	4	2	F	2	2	2	
Sturgeon 16	300 Area	21	4	4	Z	4	2	IM	1	0	3	
Sturgeon 17	300 Area	22	4	3	3	4	0	F	2	4	3	
Sturgeon 18	300 Area	23	3	3	3	4	0	F	3	2	3	
Sturgeon 19	300 Area	24	4	4	2	4	2	F	2	3	3	
Sturgeon 20	Lake Wallula	25	4	4	1	4	2	F	4	3	3	cestode worm

5

Table 1. Summary of Histology Scores Assigned to Columbia River White Sturgeon from the Hanford Reach Area (Sheet 2 of 2)

Fish #	Study Sub-Area	Histology Sample #	Liver Vasc	Liver MMC	Liver FV	KidH Inflm/P	KidH MMC	Gonad Dev	Gonad Inflm	Gonad Fat	Gill Inflm	Other Tissue
Sturgeon 21	Lake Wallula	26	4	4	Z	4	2	F	3	3	3	
Sturgeon 22	Lake Wallula	27	4	4	3	3	2	F	4	4	3	
Sturgeon 23	Lake Wallula	28	4	4	3	4	2	M	0	0	2	
Sturgeon 24	Lake Wallula	29	4*	4	Z	4	2	IM	3	0	3	
Sturgeon 25	Lake Wallula	30	4	4	2	5	3	IM	3	0	4	
Sturgeon 26	Upriver	1	4	4	2	3	2	F	4	2	3	
Sturgeon 27	Upriver	2	4	3	3	4	0	IM	2	0	3	
Sturgeon 28	Upriver	3	4	4	Z	4	2	F	4	3	3	
Sturgeon 29	Upriver	4	4	4	3	4	3	F	4	4	3	
Sturgeon 30	Upriver	5	4	4	3	4	2	F	4	4	3	

Notes:
Vasc = vasculitis
MMC = melanomacrophages
D/N = degeneration/necrosis
Z = zonal
FV = fat vacuolation
KidT = kidney tubule
Inflam = inflammation
P = proliferation
KidH = kidney interstitium
IM = immature
*foci of +5

Histology Figures of Columbia River White Sturgeon from the Hanford Reach Area

GILL

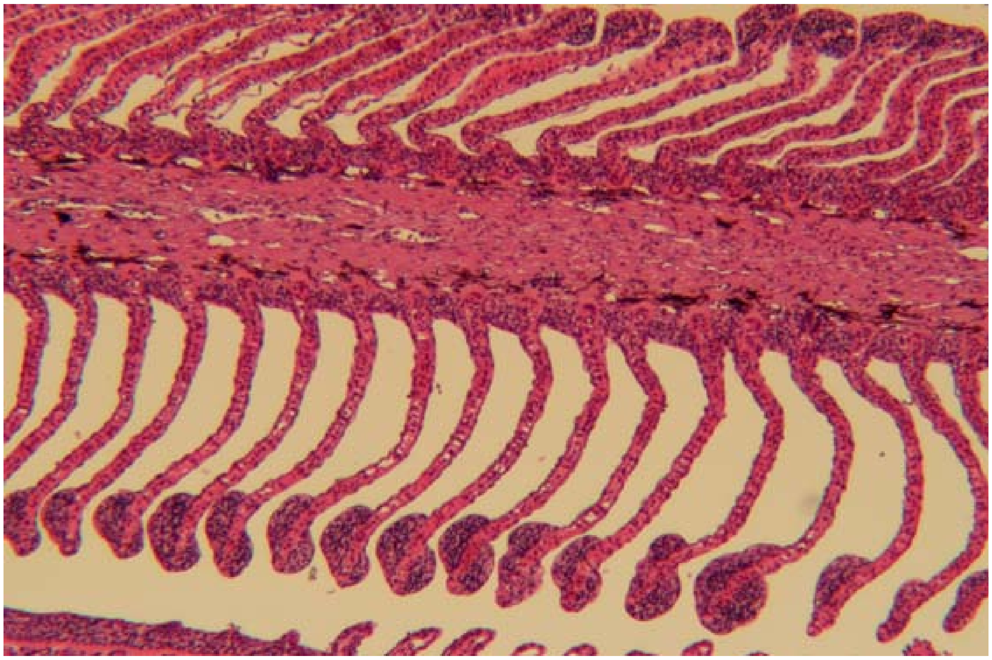

Figure 1a. Enlarged tips of gill lamellae.

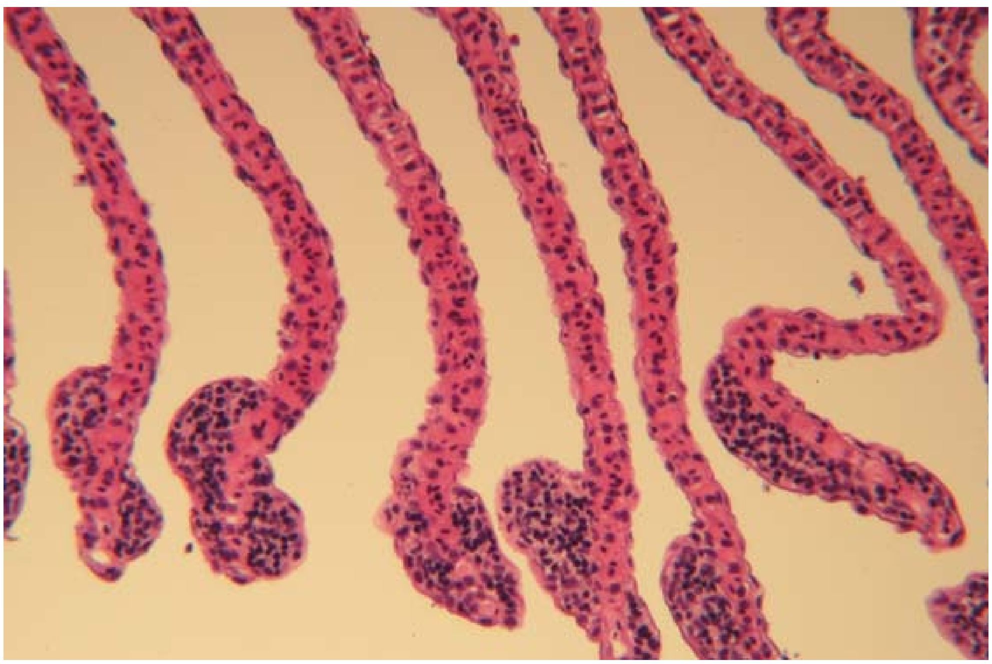

Figure 1b. Higher magnification showing lymphocytes (dark blue cells) accumulating between blood capillaries and squamous epithelium.

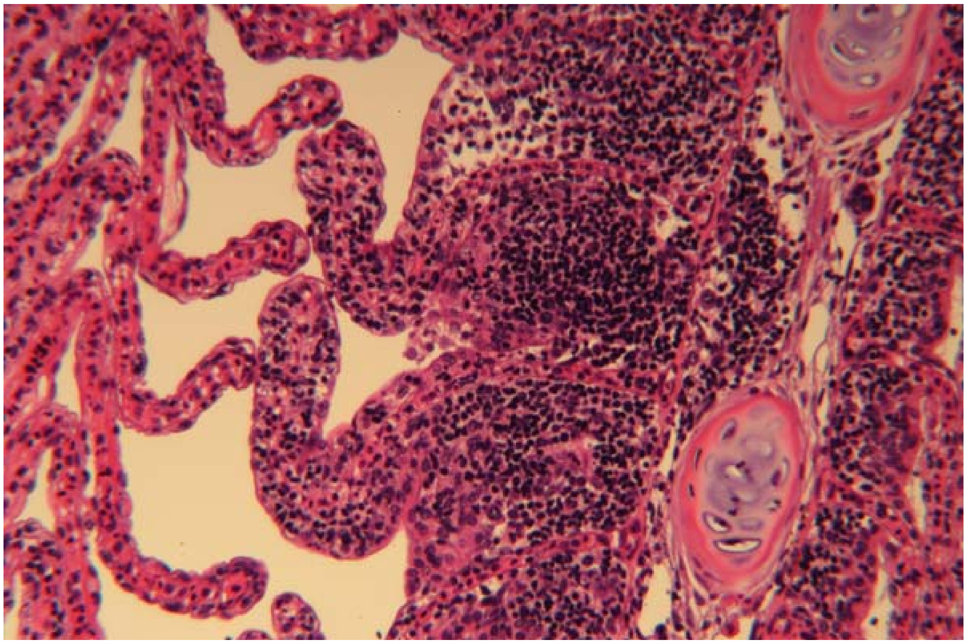

Figure 2. Lymphocytic infiltrate gill lamellae (including basal areas) and filament.

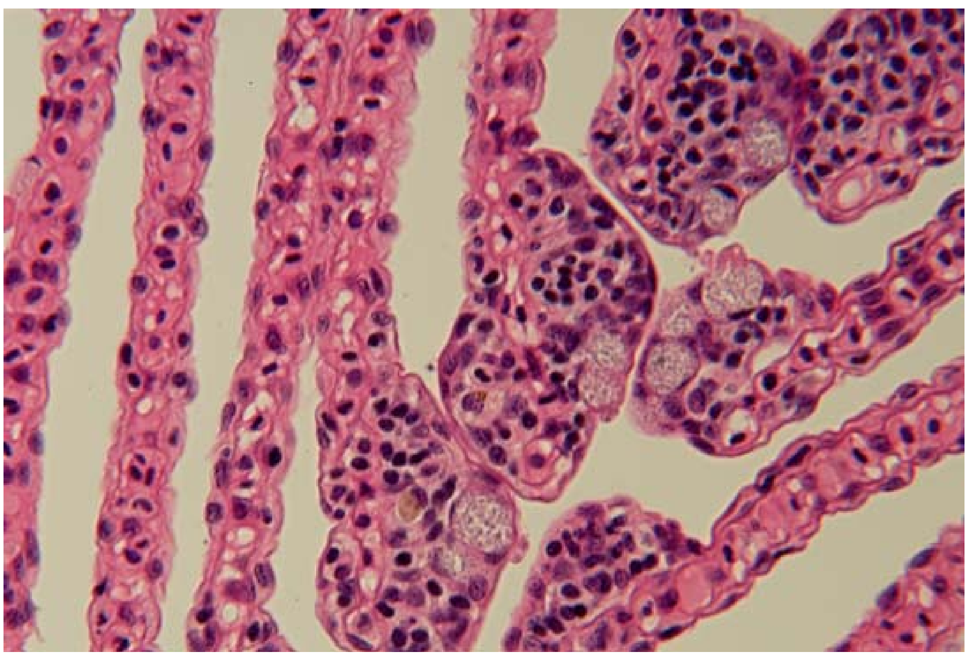

Figure 3. Increased number of mucus cells on tips of gill lamellae.

KIDNEY

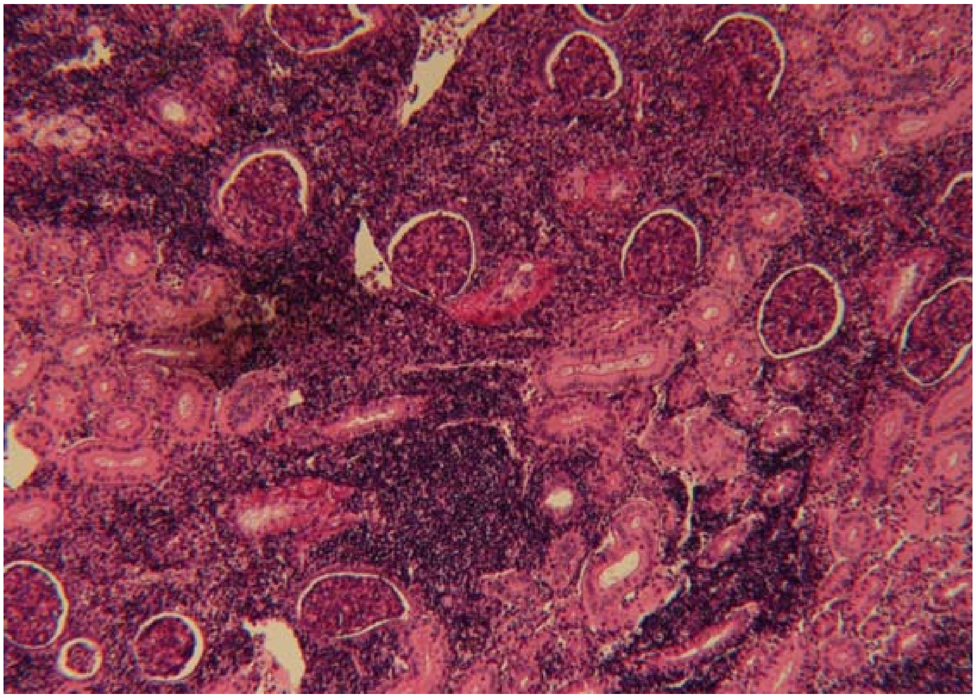

Figure 4. Widespread inflammation, melanomacrophages and replacement of normal kidney tissue.

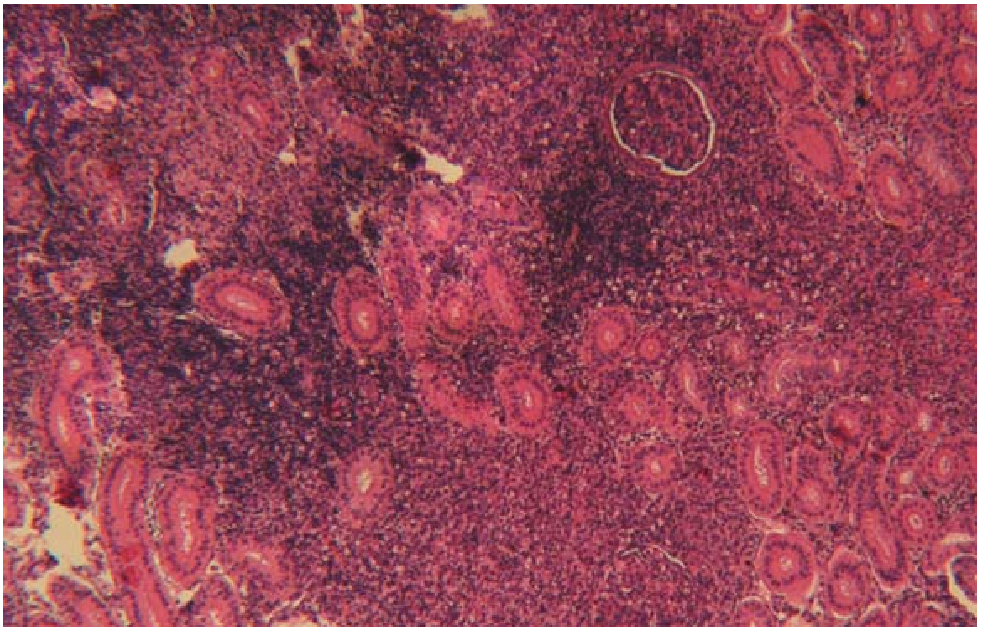

Figure 5. Inflammation (lymphoctes, macrophages and eosinophilic granular cells) and replacement of kidney nephrons.

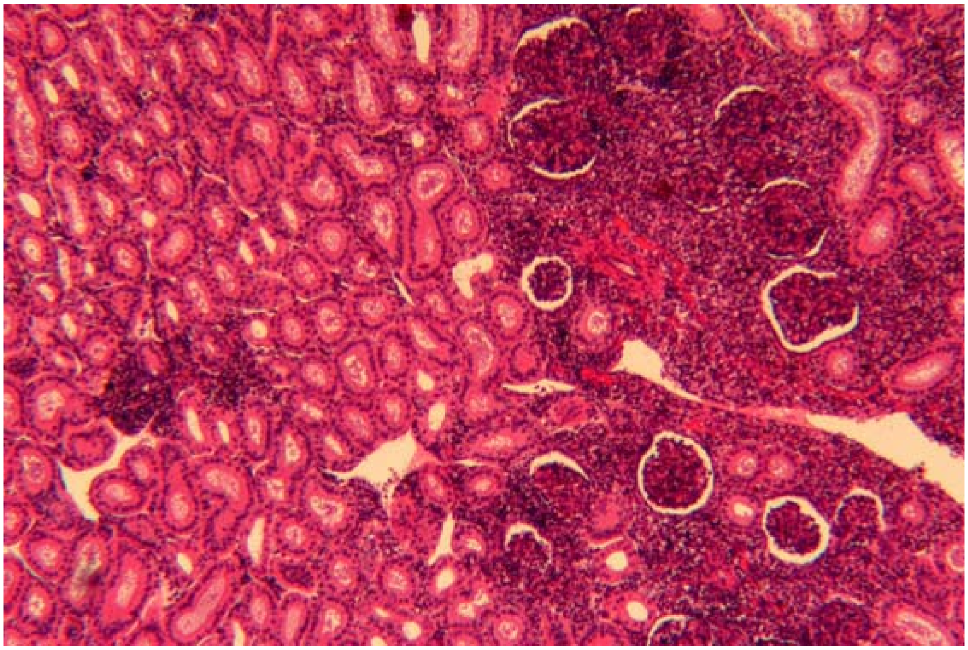

Figure 6. Diffuse inflammation in area of glomeruli (right side) and small foci of inflammation associated with tubules (left).

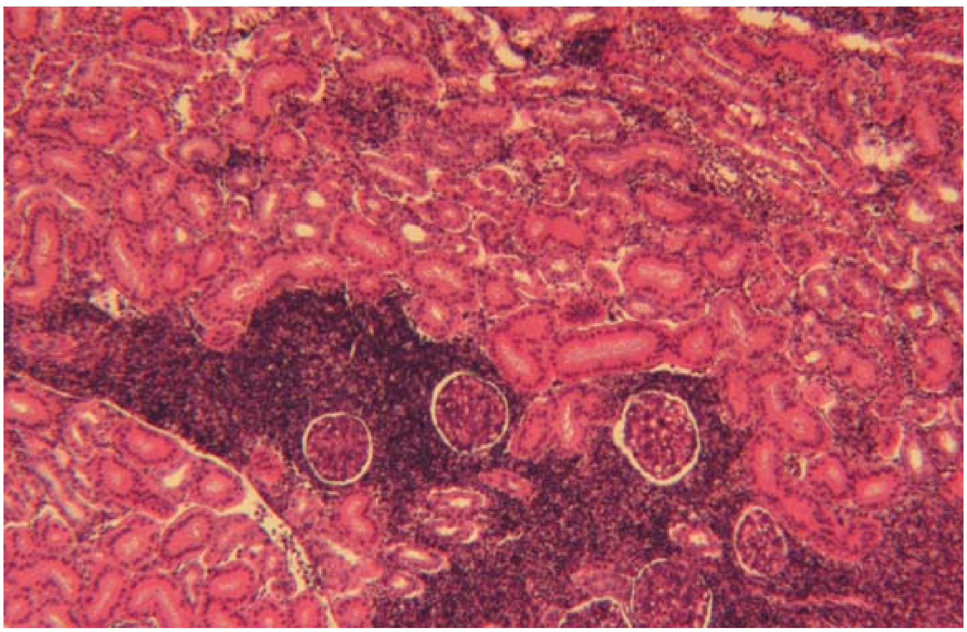

Figure 7. Inflammation (primarily lymphocytes) surrounding kidney glomeruli.

LIVER

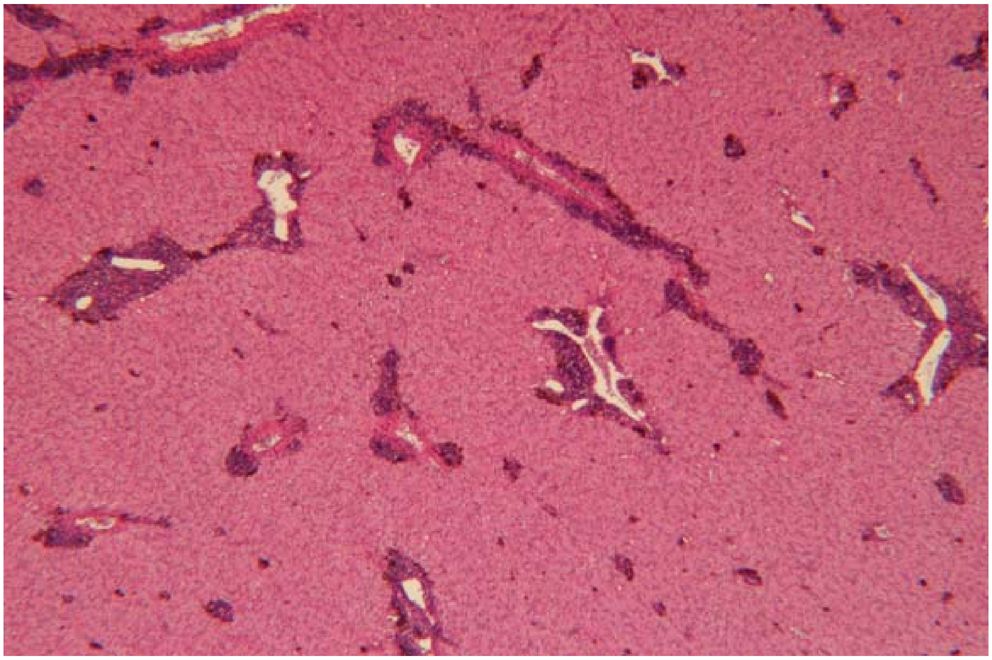

Figure 8. Low power magnification showing inflammation (dark blue areas) associated with blood vessels (vasculitis) in liver tissue.

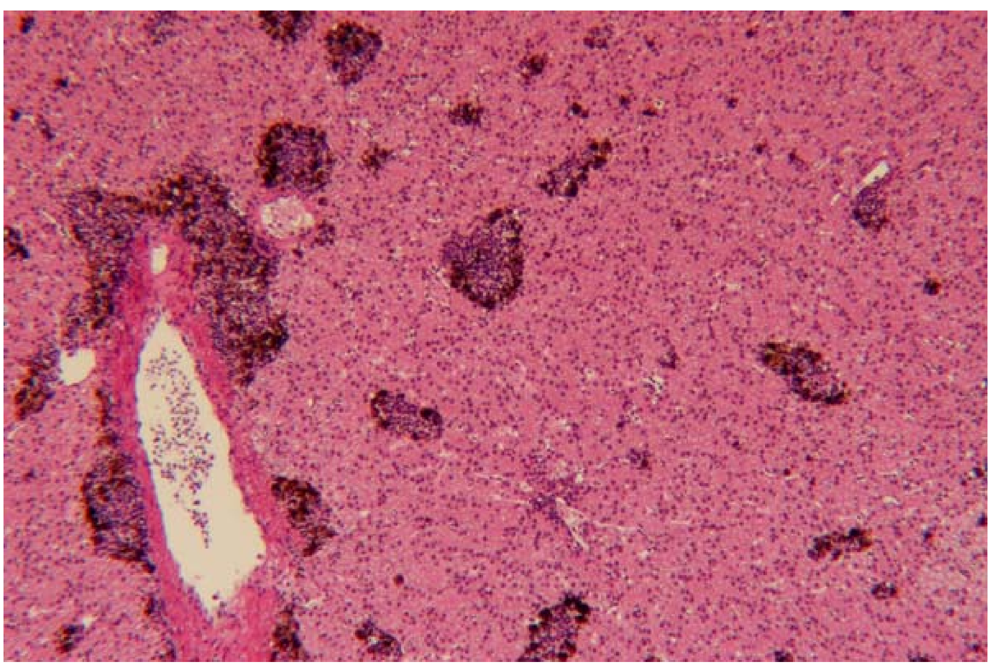

Figure 9. Vasculitis and melanonmacrophages (dark brown) in liver.

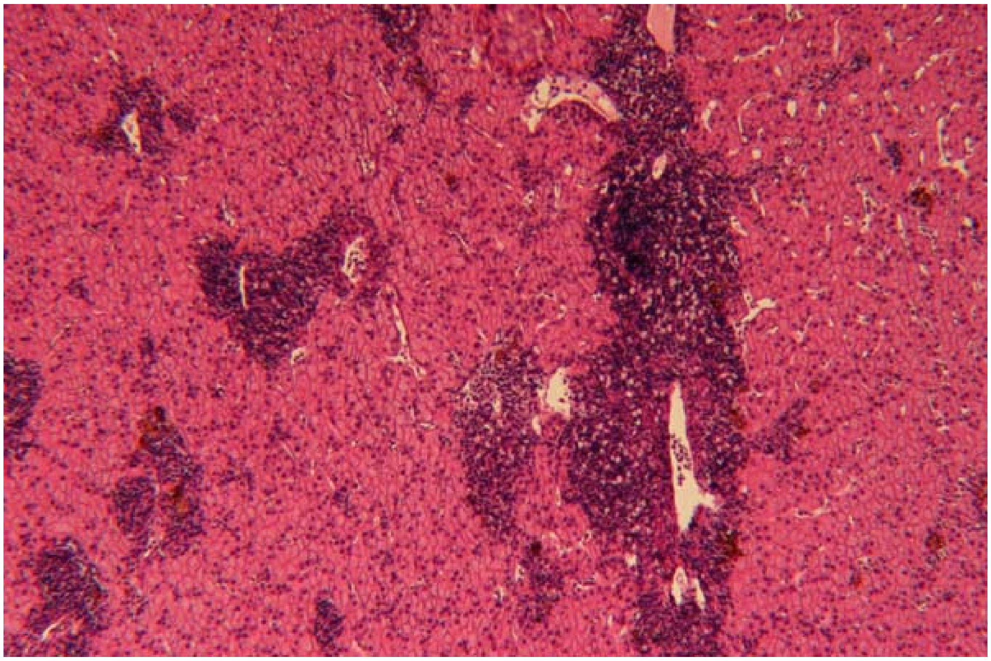

Figure 10. Widespread vasculitis and liver cells (hepatocytes) with mild (+2) amounts of fat vacuolation.

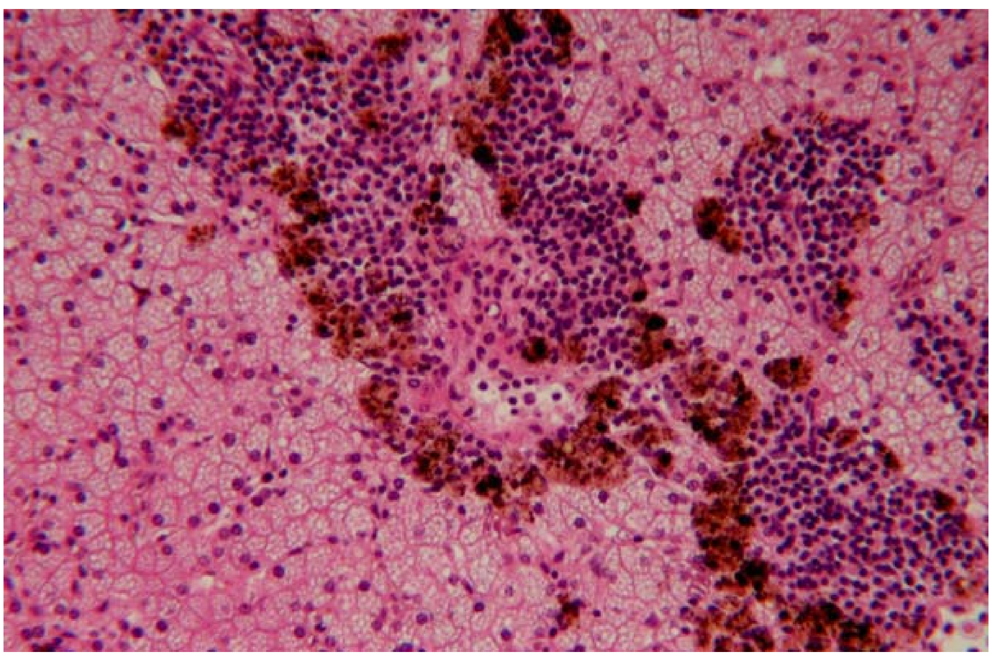

Figure 11. Vasculitis and melanomacrophges. Hepatocytes with moderate fat vacuolation appear light pink.

GONAD

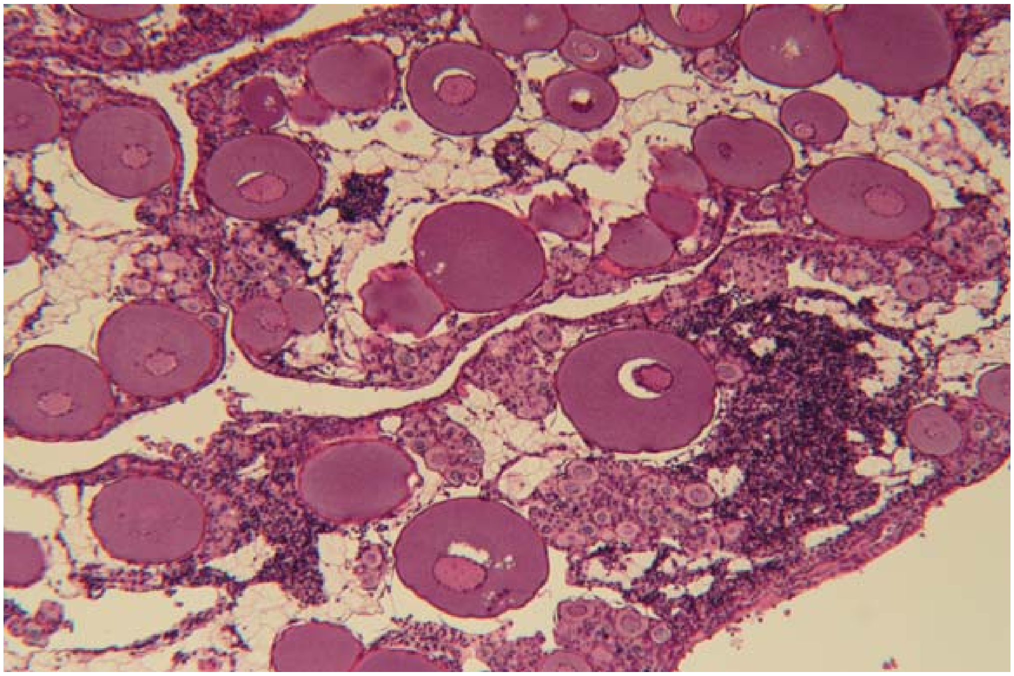

Figure 12. Various stages of developing oocytes and foci of inflammation.

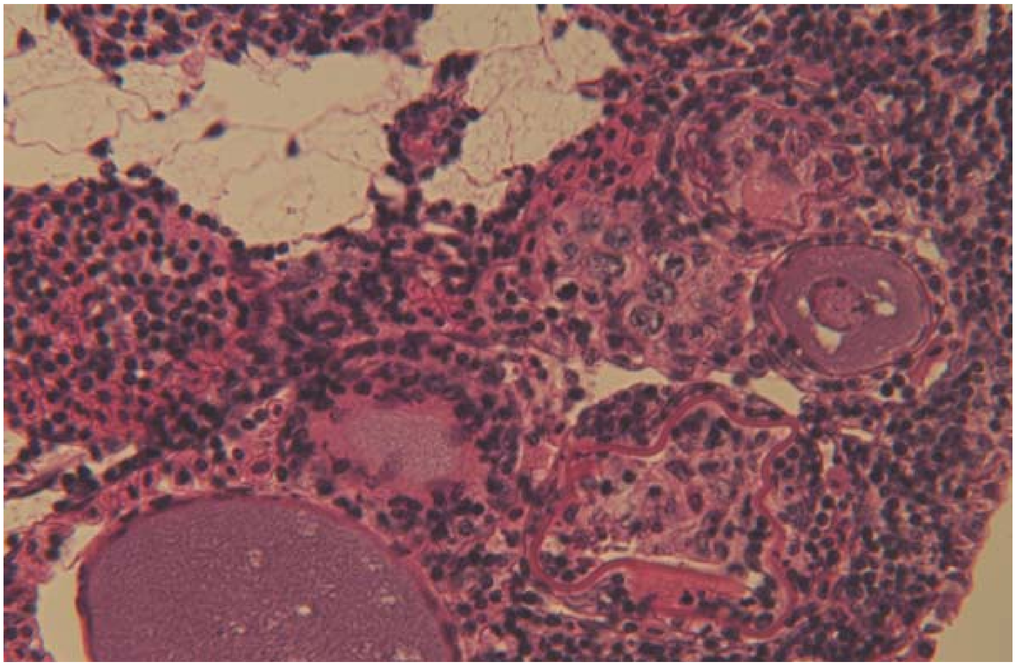

Figure 13. Inflammation, degeneration and necrosis of developing oocytes.

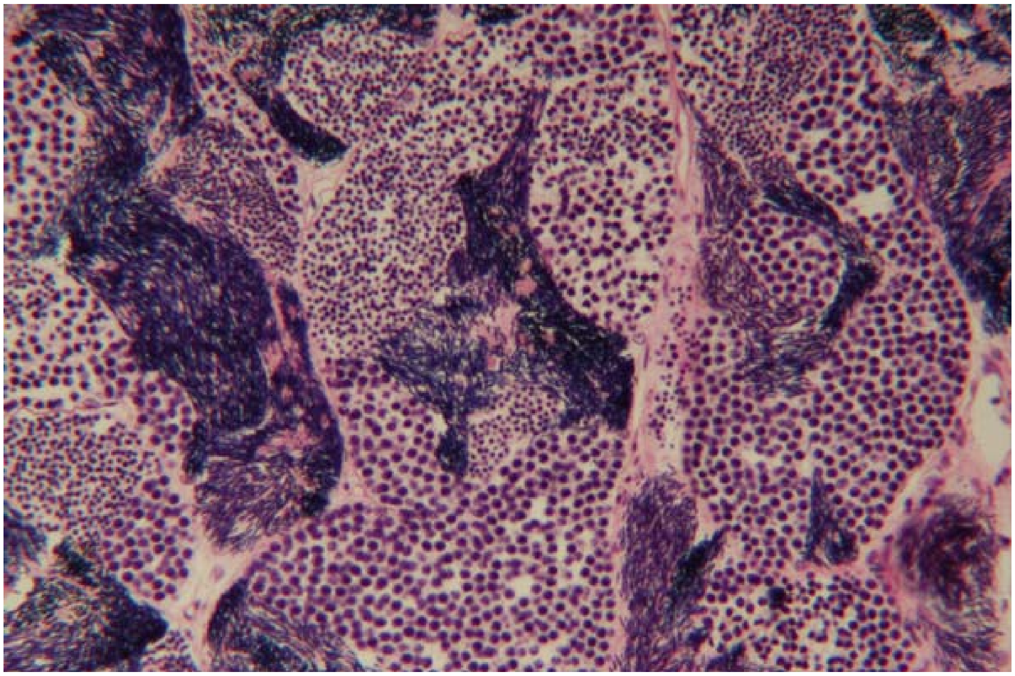

Figure 14. Testis with mature spermatoza.

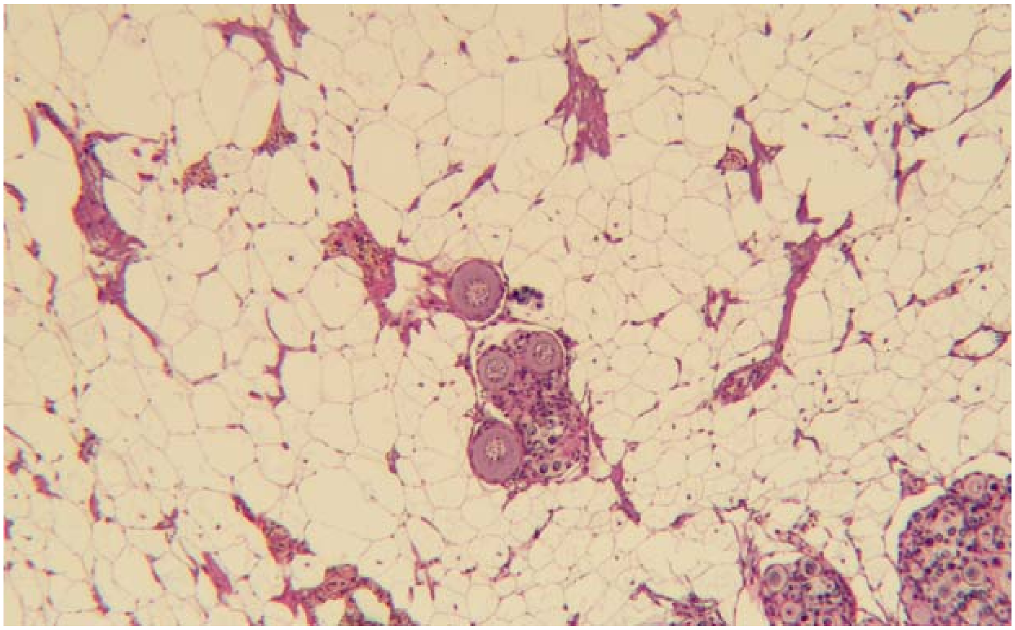

Figure 15. Numerous fat cells surrounding developing oocytes.

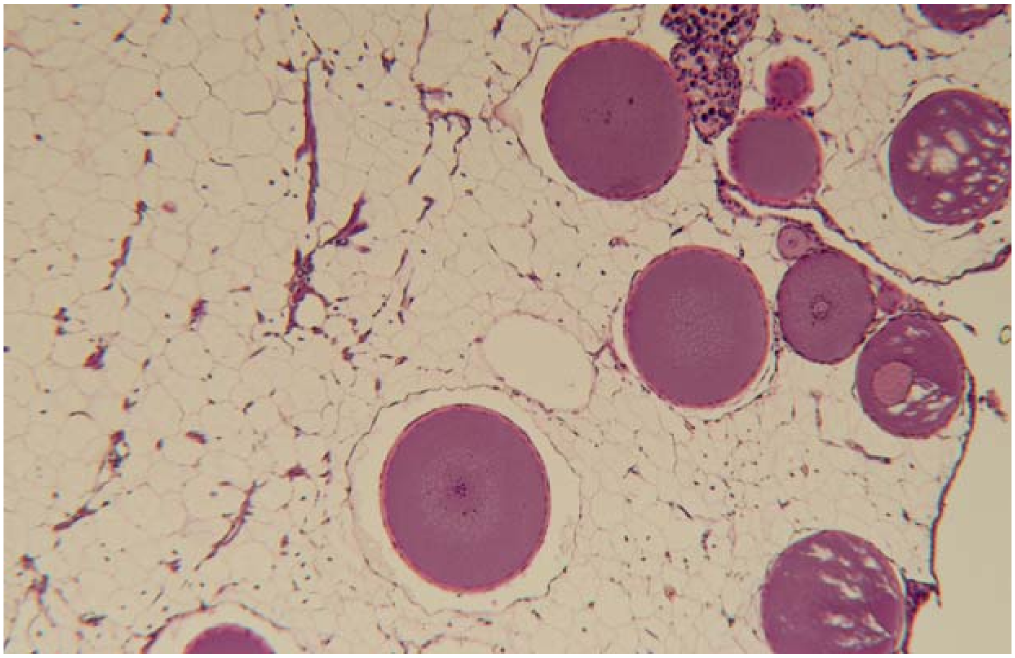

Figure 16. Oocyte surrounded by fat.

GASTROINTESTINAL

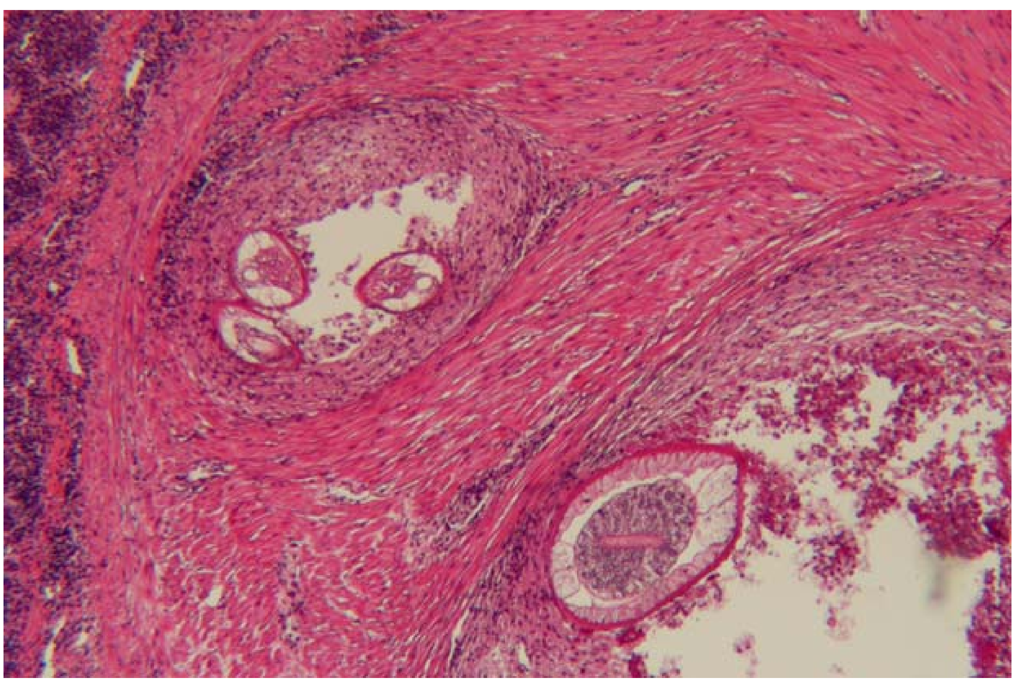

Figure 17. Parasitic worms (nematodes) and localized inflammation in muscle wall of GI.

Figure 18. Granulomatous inflammatory response associated with nematode in muscle tissue.

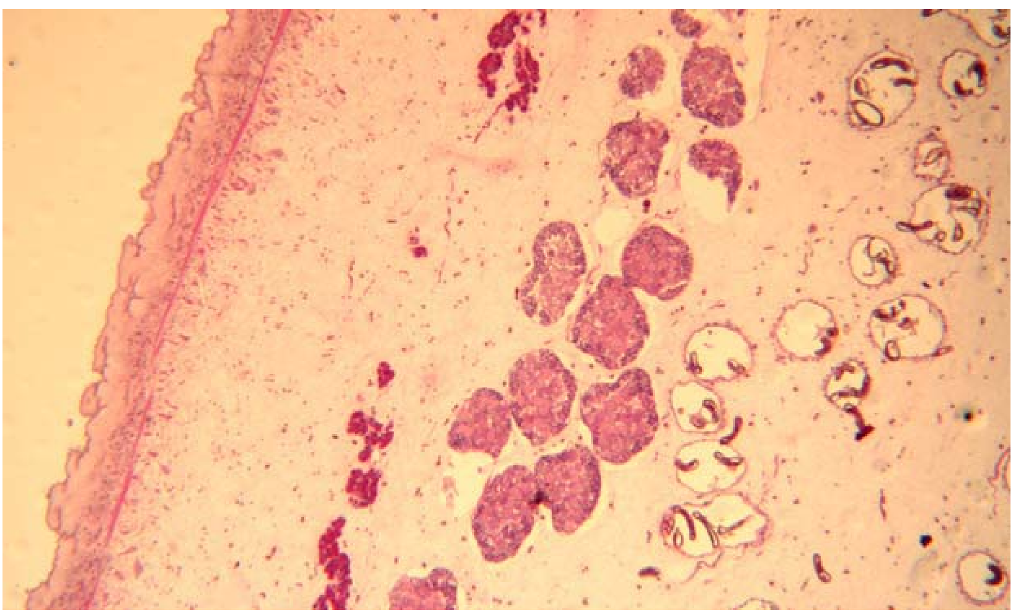

Figure 19. Section of large worm showing body wall, male and female reproductive organs.

APPENDIX F

PROCEDURE FOR STURGEON STOMACH PERCENT SEDIMENT DETERMINATION

APPENDIX F

PROCEDURE FOR STURGEON STOMACH PERCENT SEDIMENT DETERMINATION

The following procedure is a revision the original version found in Section 3.1.3.7 of the *Sampling and Analysis Instructions for the Remedial Investigation of Hanford Site Releases to the Columbia River* (WCH-286, Rev. 3). This revised procedure was used for all sturgeon stomach sample processing.

The purpose of determining the amount of sediment in the foregut of sturgeon was to ascertain the amount of biologically available contaminant the fish were ingesting. Foregut contents were sieved, dried, and ashed (less than 2 mm fraction only) at a high temperature to determine the amount of sediment. The percentage of sediment relative to the total foregut content was then determined. The sediment samples may be analyzed for radionuclides at a later date.

The following is a list of sturgeon stomach content processing equipment.

- Latex or nitrile gloves
- Dissecting tray
- Stainless steel scalpel or filet knife
- Stainless steel scissors
- 2 mm stainless steel sieve
- Büchner filter
- Büchner flask
- Vacuum pump and hose
- Whatman filter paper (grade 54, hardened, ashless filter, 22 µm, 122 mm diameter)
- Aluminum weighing tray
- Calibrated balances (the most sensitive to be ± 0.01g)
- Drying oven
- Ashing furnace
- Desiccator
- Forceps
- Metal tongs
- Spatulas/scoopula
- Liqui-Nox® detergent (1%) in deionized water.

The following are instructions of processing sturgeon stomach contents:

1. Remove stomach from freezer and allow it to thaw until pliable.

2. Don gloves and wash gloves with Liqui-Nox® solution and rinse with deionized water.

® Liqui-Nox is a registered trademark of Alconox, Inc.

3. Assess gut fullness of stomach. Gut fullness will be based on the following criteria:
   - 0, empty
   - 1, at least some form of gut contents
   - 2, gut less than half full
   - 3, gut half full
   - 4, gut greater than half full
   - 5, gut distended.

4. Make an incision in stomach lining with pre-cleaned scissors and empty all foregut contents into aluminum tray. Scrape as much of the foregut contents as possible from the foregut lining. Weigh all stomach contents to the nearest ± 0.01 g. This is the wet weight of the sturgeon gut contents. Note: the wet weight was not used for final sediment weight calculations.

5. Add reagent grade, denatured ethanol at a quantity of 5 to 10 times the volume of gut contents. Addition of ethanol expedites sieving of material in later steps. Remove all organic content and/or sediment within shells using a pre-cleaned scoopula.

6. Rinse shells with deionized water to ensure all organic content and sediment has been removed and place shells in labeled, pre-cleaned pre-tared aluminum tray. Dry in an oven at 105 °C until constant weight is obtained.

7. Transfer the other contents from aluminum tray into a pre-cleaned 2 mm sieve. Flush foregut lining and aluminum tray with deionized water to ensure all contents are removed.

8. Thoroughly rinse all gut contents in sieve with ethanol and collect everything that passes through (gut contents and rinsate) in pre-cleaned pre-tared aluminum tray.

9. Filter gut contents less than 2 mm in size (i.e., gut content that rinsed through sieve) and rinsate under vacuum using a Büchner funnel and pre-tared Whatman filter. Transfer unfiltered material (including the Whatman filter) to a labeled, pre-cleaned aluminum tray and dry in an oven at 105 °C until constant weight is obtained.

10. Transfer gut contents greater than 2 mm in size (i.e., gut content that did not rinse through sieve) into a labeled, pre-cleaned aluminum tray and dry in an oven at 105 °C until constant weight is obtained.

11. After drying, separate the various, identifiable components of the greater than 2 mm size material using pre-cleaned tweezers and scoopulas. Weight and record the weights of each component (contents less than 2 mm, pebbles, shells, worms, fish, etc.) to the nearest 0.01 g. Discard pebbles (rocks greater than 2 mm in size. The sum of these weights will be the total dry weight of sturgeon stomach contents. Wrap all gut contents greater than 2 mm tightly in foil and store in freezer.

12. Transfer the tray containing the less than 2 mm foregut contents to muffle furnace and ash sample at 550 °C for no less than 5 hours. After this time has elapsed, turn muffle furnace off and cool for 30 minutes.

13. With tongs, transfer the tray containing ashed gut content to a dessicator and allow it to cool for 1 hour.

14. Record the final actual weight (± 0.01 g) of ashed gut content within 1 hour of removal from dessicator.

15. Place samples of remaining ashed material in labeled sample containers and store at room temperature.

APPENDIX G

RESULTS FOR STURGEON STOMACH PERCENT SEDIMENT DETERMINATION

APPENDIX G

RESULTS FOR STURGEON STOMACH PERCENT SEDIMENT DETERMINATION

As described in Section 3.4.4 of the report and the procedure found in Appendix F, the tables that follow present the results of the determination of the percentage of sediment contained within the stomachs of the sturgeon taken for this study. Table G-1 contains the specific details regarding each of the 30 sturgeon that were analyzed and the resultant percentage of sediment. Table G-2 provides a summary of what else (greater than 2 mm) was identified within the foregut of each sturgeon as an indication of the diet consumed by each sturgeon.

Table G-1. Determination of Sediment Content in Sturgeon Foregut.

Variable	Measure	Sturgeon Identification																													
		HS01	HS02	HS03	HS04	HS05	HS06	HS07	HS08	HS09	HS10	HS11	HS12	HS13	HS14	HS15	HS16	HS17	HS18	HS19	HS20	HS21	HS22	HS23	HS24	HS25	URS26	URS27	URS28	URS29	URS30
NA	Gut fullness (relative scale 0 - 5)	4	5	1	Not Analyzed	4	5	4	2	1	2	4	1	3	3	5	5	ND [a]	ND [a]	ND [a]	ND [a]	0	1	2	1	1	3	ND [a]	ND [a]	2	3
A	Weight of tray and foregut contents after ashing (less than 2 mm fraction) (g)	8.494	8.176	8.247		8.251	8.191	10.238	8.201	8.601	8.259	8.867	8.418	8.516	9.245	8.400	8.250	8.762	7.954	7.912	47.889	8.109	8.416	8.227	8.052	11.287	8.468	11.201	8.227	8.394	10.817
B	Weight of emptied tray (g)	8.153	8.148	8.211		8.220	8.134	8.126	8.122	8.170	8.220	8.288	8.343	8.403	8.269	8.259	8.230	8.284	7.898	7.905	8.135	8.104	8.160	8.160	7.887	11.212	8.137	8.209	8.219	8.125	8.195
C	Number of filters used	8	1	5		1	3	5	6	1	8	9	6	6	2	4	2	1	3	1	12	2	4	2	3	1	4	3	1	1	10
D	Average ashed filter weight (g) [b]	0.016	0.016	0.016		0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
NA	Presence of residual ash from filters? (Yes or No)	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
E	Total ash weight of foregut sample attributable to filter(s) (g) (C x D)	0.127	0.016	0.079		0.016	0.047	0.079	0.095	0.016	0.127	0.142	0.095	0.095	0.032	0.063	0.032	0.016	0.047	0.016	0.190	0.032	0.063	0.032	0.047	0.016	0.063	0.047	0.016	0.016	0.158
F	Weight of sediment (g) (A -B-E)	0.214	0.012	-0.043		0.015	0.010	2.033	-0.016	0.415	-0.088	0.437	-0.020	0.018	0.944	0.078	-0.012	0.462	0.009	-0.009	39.564	-0.027	0.193	0.035	0.118	0.059	0.268	2.945	-0.008	0.253	2.464
G	Total weight of dried foregut content (g) (greater than 2 mm fraction)	11.685	37.293	0.070		6.756	28.352	26.738	5.281	0	2.311	11.048	0.286	9.021	3.073	10.756	35.257	6.937	1.159	3.247	110.444	0.620	0.690	0.848	0.520	0.803	2.744	8.167	1.632	1.587	6.736
H	Total weight of all foregut contents (g) (F+G)	11.899	37.305	0.027		6.771	28.362	28.771	5.265	0.415	2.223	11.485	0.266	9.039	4.017	10.834	35.245	7.399	1.168	3.238	150.008	0.593	0.883	0.883	0.638	0.862	3.012	11.112	1.624	1.840	9.200
NA	Percentage of sediment ([F ÷ H] x 100)	1.80%	0.03%	-160.34%	NA	0.22%	0.03%	7.07%	-0.30%	100.00%	-3.94%	3.80%	-7.49%	0.20%	23.51%	0.72%	-0.03%	6.25%	0.73%	-0.27%	26.37%	-4.49%	21.83%	4.00%	18.44%	6.86%	8.89%	26.50%	-0.48%	13.76%	26.78%

[a] Not determined. The foregut contents had been previously removed from the foregut tissues during preparation of the viscera sample.
[b] The average weight of ashed filters was measured. Of four filters successfully tested, the average ashed weight was 0.016 g with a standard deviation of 0.0009 g.

NA = not applicable
HS = Hanford sturgeon
URS = upriver sturgeon

Table G-2. Dry Weights of Foregut Contents Greater Than 2 mm (g).

Description	Sturgeon Identification																													
	HS01	HS02	HS03	HS04	HS05	HS06	HS07	HS08	HS09	HS10	HS11	HS12	HS13	HS14	HS15	HS16	HS17	HS18	HS19	HS20	HS21	HS22	HS23	HS24	HS25	URS26	URS27	URS28	URS29	URS30
Total weight of dried foregut content (greater than 2 mm fraction)	11.685	37.293	0.070	Not Analyzed	6.756	28.352	26.738	5.281	0	2.311	11.048	0.286	9.021	3.073	10.756	35.257	6.937	1.159	3.247	110.444	0.620	0.690	0.848	0.520	0.803	2.744	8.167	1.632	1.587	6.736
Snails	4.002	NA	0.040		0.034	0	5.721	NA	NA	0.218	NA	NA	NA	0.074	0.050	0.010	0.500	0.070	NA	NA	NA	0.010	NA	NA	0.004	0.060	NA	NA	NA	0.030
Fish	1.680	35.601	NA		4.489	22.983	NA	NA	NA	0.921	NA	NA	3.155	NA	3.842	NA	NA	0.070	2.130	NA	NA	NA	0.265	NA	NA	2.144	NA	1.336	NA	NA
Crayfish	3.572	0.544	NA		2.023	2.885	NA	4.598	NA	1.172	11.037	NA	5.504	1.751	6.000	1.268	NA	NA	NA	NA	NA	NA	NA	0.030	0.118	NA	NA	NA	NA	NA
Pebbles	NA	NA	NA		NA	NA	8.936	NA	NA	NA	NA	NA	NA	NA	NA	32.100	NA	NA	NA	0.036	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Worms-chironomid larvae	NA	NA	NA		NA	0.024	NA	0.121	NA	NA	NA	NA	NA	NA	0.014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.105	NA	NA	0.038
Clams	NA	NA	NA		NA	NA	9.832	NA	NA	NA	NA	0.286	NA	NA	NA	0.347	5.930	NA	NA	68.374	NA	0.130	0.393	NA	0.351	NA	NA	NA	0.045	0.107
Other 1 (see description)	2.431	1.148	0.030		NA	0.365	NA	NA	NA	NA	NA	NA	0.362	0.136	NA	1.382	NA	0.580	NA	NA	NA	0.020	0.010	NA	0.040	0.111	3.942	0.296	1.139	2.119
Other 1 Description	Pickled squid	Pickled squid	Unidentified		NA	Unidentified	NA	NA	NA	NA	NA	NA	Pickled squid	Algae	NA	Pickled squid	NA	Pickled squid	NA	NA	NA	Invertebrates	Invertebrates	NA	Invertebrates	Unidentified	Vegetation	Pickled squid	Vegetation	Vegetation
Other 2 (see description)	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other 2 Description	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Algae	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA = not applicable
HS = Hanford sturgeon
UR = upriver sturgeon

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