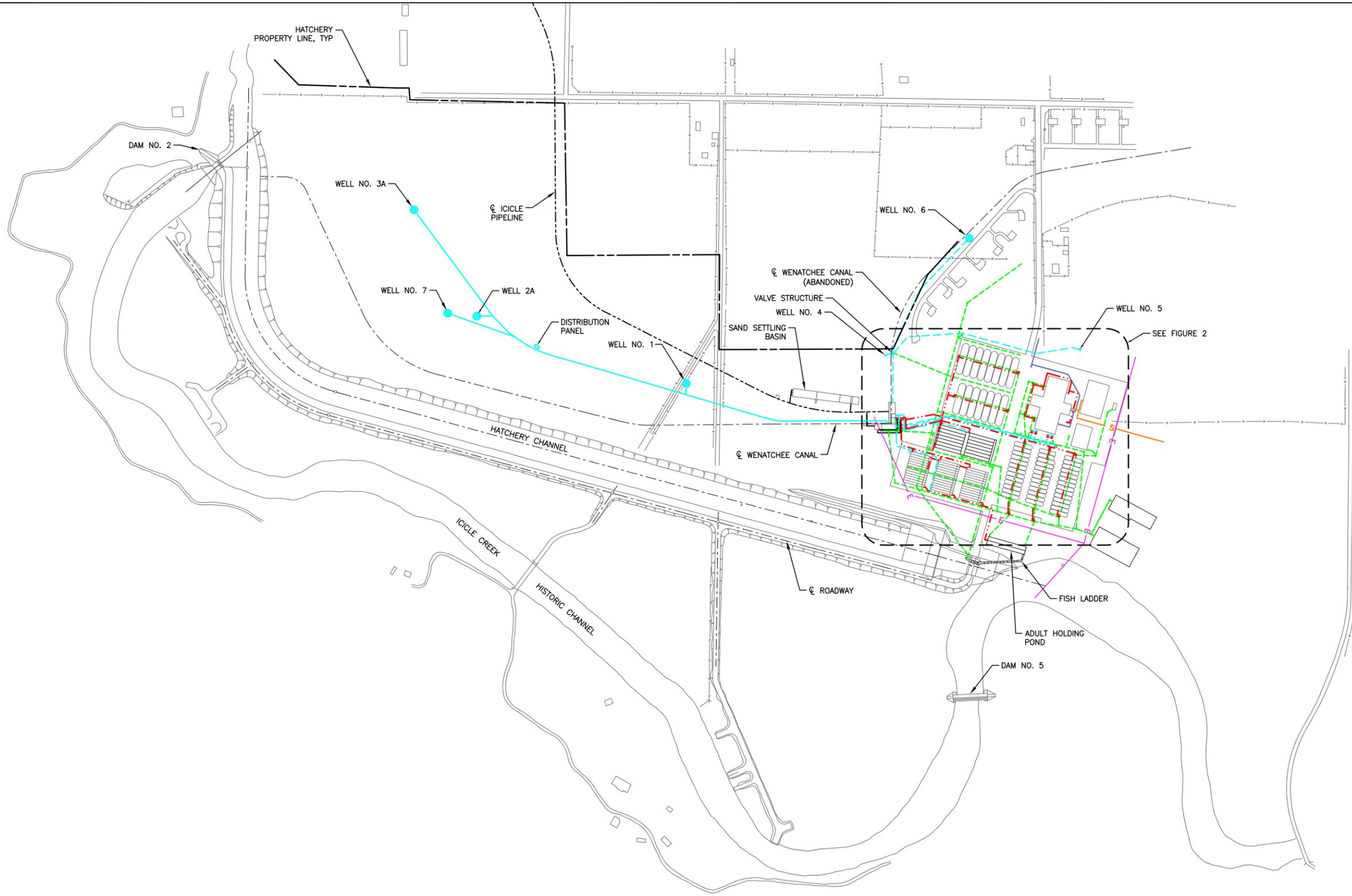


APPENDIX A
FACILITY SCHEMATIC DIAGRAMS



LEGEND

	WELL WATER
	BLENDED WATER
	DOMESTIC WATER
	DRAIN LINE
	SANITARY SEWER
	ELECTRICAL

ABBREVIATIONS

BO	- BLOW OFF
BV	- BUTTERFLY VALVE
D	- DRAIN
D ₂	- COLLECTING DRAIN #2
FH	- FIRE HYDRANT
GD ₃	- GROUND DRAIN #3
GS	- GALVANIZED STEEL PIPE
GV	- GATE VALVE
M ₁	- WATER MAIN #1
SW	- STREET WASHER
TB	- TRAP BOX

SITE PLAN
NOT TO SCALE

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PIPING SCHEMATIC

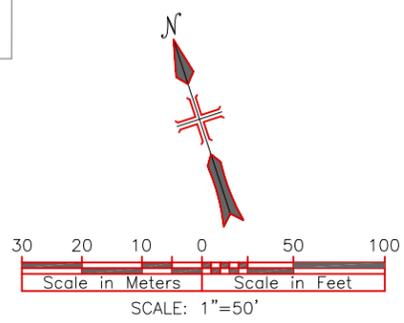
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	DCJ		11/3/14	

FIGURE 1



- LEGEND**
- WELL WATER
 - .-.- BLENDED WATER
 - DOMESTIC WATER
 - DRAIN LINE
 - SANITARY SEWER
 - ELECTRICAL
 - ▶ FLOW DIRECTION
 - ✕ BUTTERFLY VALVE

- ABBREVIATIONS**
- BO - BLOW OFF
 - BV - BUTTERFLY VALVE
 - D - DRAIN
 - D₂ - COLLECTING DRAIN #2
 - FH - FIRE HYDRANT
 - GD₃ - GROUND DRAIN #3
 - GS - GALVANIZED STEEL PIPE
 - GV - GATE VALVE
 - M₁ - WATER MAIN #1
 - SW - STREET WASHER
 - TB - TRAP BOX



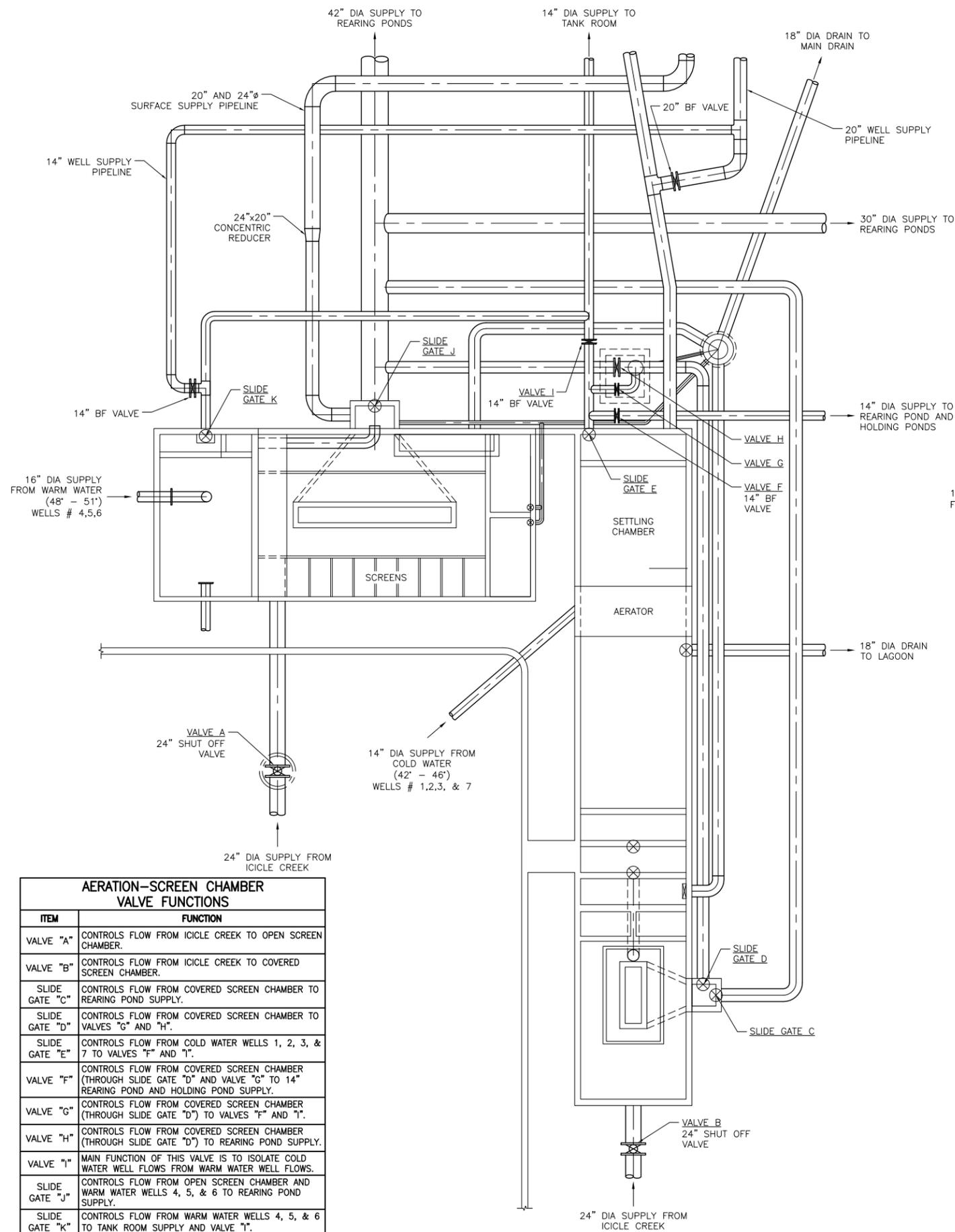
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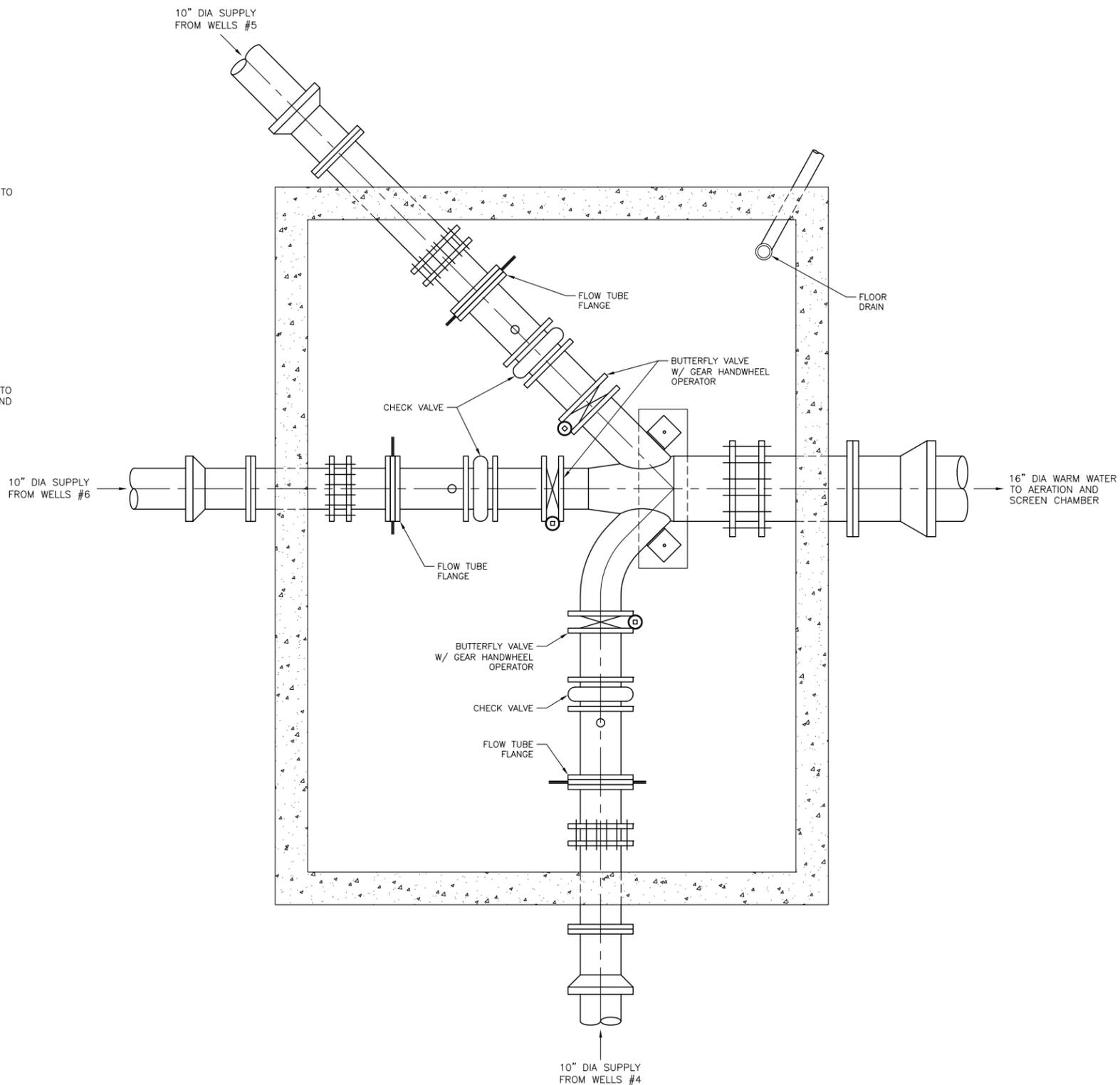
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FIGURE 2



AERATION-SCREEN CHAMBER VALVE FUNCTIONS	
ITEM	FUNCTION
VALVE "A"	CONTROLS FLOW FROM ICICLE CREEK TO OPEN SCREEN CHAMBER.
VALVE "B"	CONTROLS FLOW FROM ICICLE CREEK TO COVERED SCREEN CHAMBER.
SLIDE GATE "C"	CONTROLS FLOW FROM COVERED SCREEN CHAMBER TO REARING POND SUPPLY.
SLIDE GATE "D"	CONTROLS FLOW FROM COVERED SCREEN CHAMBER TO VALVES "G" AND "H".
SLIDE GATE "E"	CONTROLS FLOW FROM COLD WATER WELLS 1, 2, 3, & 7 TO VALVES "F" AND "I".
VALVE "F"	CONTROLS FLOW FROM COVERED SCREEN CHAMBER (THROUGH SLIDE GATE "D" AND VALVE "G" TO 14" REARING POND AND HOLDING POND SUPPLY.
VALVE "G"	CONTROLS FLOW FROM COVERED SCREEN CHAMBER (THROUGH SLIDE GATE "D") TO VALVES "F" AND "I".
VALVE "H"	CONTROLS FLOW FROM COVERED SCREEN CHAMBER (THROUGH SLIDE GATE "D") TO REARING POND SUPPLY.
VALVE "I"	MAIN FUNCTION OF THIS VALVE IS TO ISOLATE COLD WATER WELL FLOWS FROM WARM WATER WELL FLOWS.
SLIDE GATE "J"	CONTROLS FLOW FROM OPEN SCREEN CHAMBER AND WARM WATER WELLS 4, 5, & 6 TO REARING POND SUPPLY.
SLIDE GATE "K"	CONTROLS FLOW FROM WARM WATER WELLS 4, 5, & 6 TO TANK ROOM SUPPLY AND VALVE "I".

DETAIL - SCREEN CHAMBER 1
SCALE: NTS



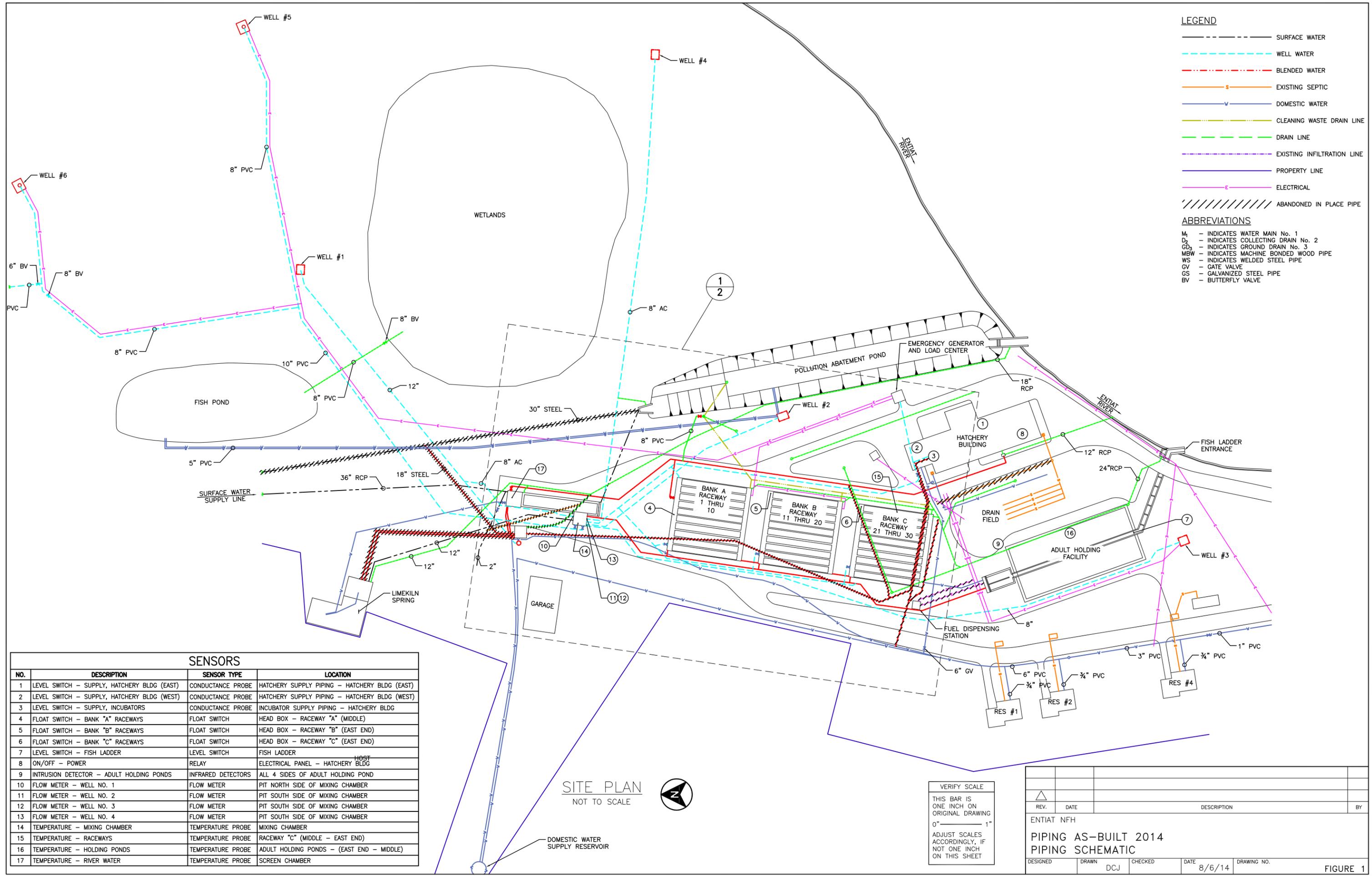
DETAIL - VALVE CHAMBER 1
SCALE: NTS

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PIPING SCHEMATIC

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SENSORS			
NO.	DESCRIPTION	SENSOR TYPE	LOCATION
1	LEVEL SWITCH - SUPPLY, HATCHERY BLDG (EAST)	CONDUCTANCE PROBE	HATCHERY SUPPLY PIPING - HATCHERY BLDG (EAST)
2	LEVEL SWITCH - SUPPLY, HATCHERY BLDG (WEST)	CONDUCTANCE PROBE	HATCHERY SUPPLY PIPING - HATCHERY BLDG (WEST)
3	LEVEL SWITCH - SUPPLY, INCUBATORS	CONDUCTANCE PROBE	INCUBATOR SUPPLY PIPING - HATCHERY BLDG
4	FLOAT SWITCH - BANK "A" RACEWAYS	FLOAT SWITCH	HEAD BOX - RACEWAY "A" (MIDDLE)
5	FLOAT SWITCH - BANK "B" RACEWAYS	FLOAT SWITCH	HEAD BOX - RACEWAY "B" (EAST END)
6	FLOAT SWITCH - BANK "C" RACEWAYS	FLOAT SWITCH	HEAD BOX - RACEWAY "C" (EAST END)
7	LEVEL SWITCH - FISH LADDER	LEVEL SWITCH	FISH LADDER
8	ON/OFF - POWER	RELAY	ELECTRICAL PANEL - HATCHERY BLDG
9	INTRUSION DETECTOR - ADULT HOLDING PONDS	INFRARED DETECTORS	ALL 4 SIDES OF ADULT HOLDING POND
10	FLOW METER - WELL NO. 1	FLOW METER	PIT NORTH SIDE OF MIXING CHAMBER
11	FLOW METER - WELL NO. 2	FLOW METER	PIT SOUTH SIDE OF MIXING CHAMBER
12	FLOW METER - WELL NO. 3	FLOW METER	PIT SOUTH SIDE OF MIXING CHAMBER
13	FLOW METER - WELL NO. 4	FLOW METER	PIT SOUTH SIDE OF MIXING CHAMBER
14	TEMPERATURE - MIXING CHAMBER	TEMPERATURE PROBE	MIXING CHAMBER
15	TEMPERATURE - RACEWAYS	TEMPERATURE PROBE	RACEWAY "C" (MIDDLE - EAST END)
16	TEMPERATURE - HOLDING PONDS	TEMPERATURE PROBE	ADULT HOLDING PONDS - (EAST END - MIDDLE)
17	TEMPERATURE - RIVER WATER	TEMPERATURE PROBE	SCREEN CHAMBER

SITE PLAN
NOT TO SCALE



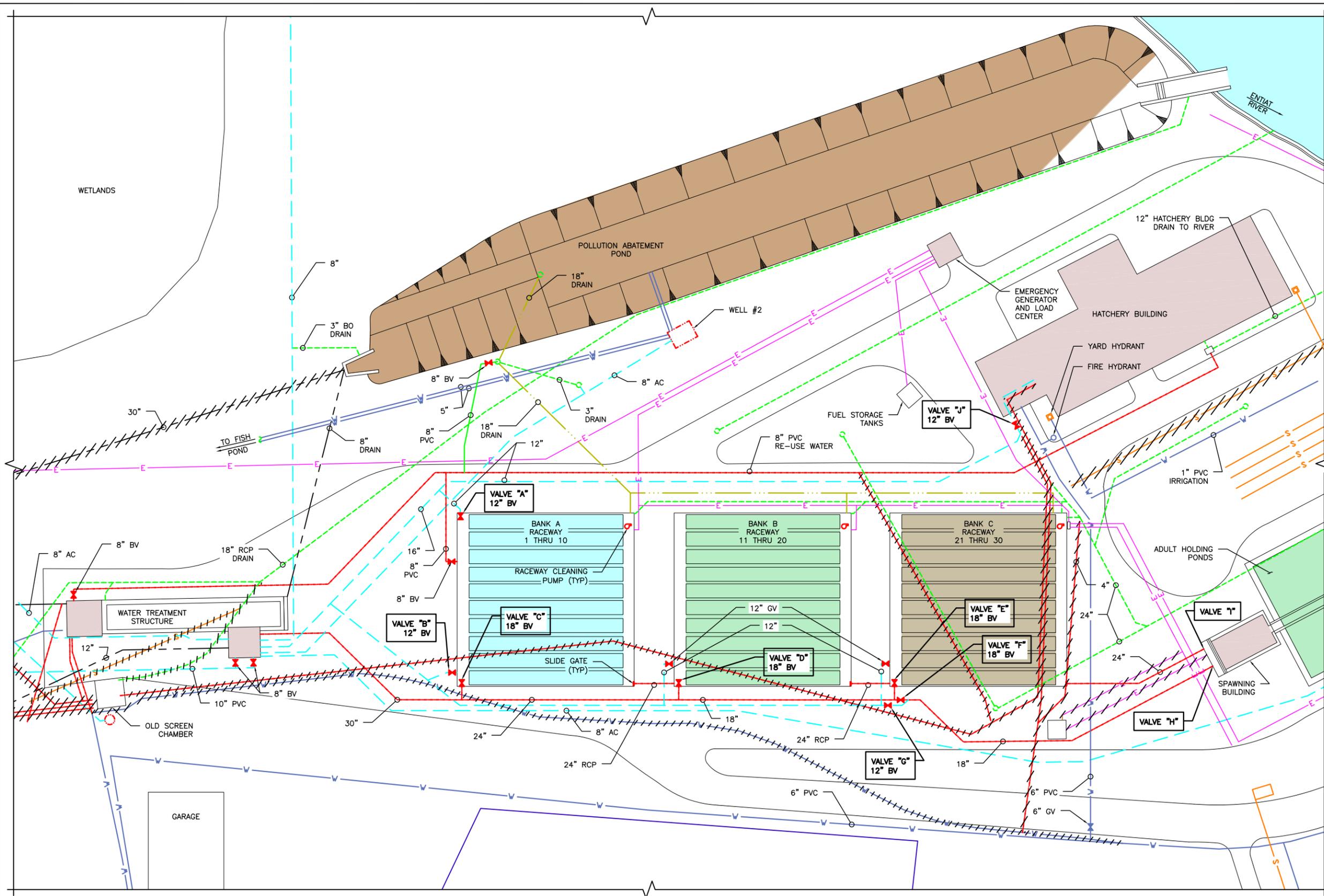
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PIPING SCHEMATIC

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FIGURE 1



- LEGEND**
- SURFACE WATER
 - - - - - WELL WATER
 - . - . - BLENDED WATER
 - S — EXISTING SEPTIC
 - V — DOMESTIC WATER
 - W — CLEANING WASTE DRAIN LINE
 - D — DRAIN LINE
 - I — EXISTING INFILTRATION LINE
 - P — PROPERTY LINE
 - E — ELECTRICAL
 - ////// ABANDONED IN PLACE PIPE
- ABBREVIATIONS**
- GV - GATE VALVE
 - BV - BUTTERFLY VALVE

VALVES	
ITEM NO.	DESCRIPTION
VALVE "A"	CONTROLS FLOW FROM MAIN AERATED SUPPLY LINE TO E ½ OF UPPER BANK OF PONDS.
VALVE "B"	CONTROLS FLOW FROM MAIN AERATED SUPPLY LINE TO W ½ OF UPPER BANK OF PONDS.
VALVE "C"	CONTROLS FLOW FROM MAIN POND SUPPLY LINE TO UPPER BANK OF PONDS (1-10).
VALVE "D"	CONTROLS FLOW FROM MAIN POND SUPPLY LINE TO MIDDLE BANK OF PONDS (11-20).
VALVE "E"	CONTROLS FLOW FROM MAIN POND SUPPLY LINE TO LOWER BANK OF PONDS (21-30).
VALVE "F"	CONTROLS FLOW FROM MAIN POND SUPPLY LINE TO WORK POND HEADBOX.
VALVE "G"	CONTROLS FLOW FROM MAIN AERATED SUPPLY LINE TO WORK POND HEADBOX.
VALVE "H"	ALLOWS THE SUPPLEMENTATION OF REUSE WATER WITH THE FRESH WATER (WELL AND RIVER) THROUGH TO UPWELL.
VALVE "I"	CONTROLS THE FLOW FROM WORK POND HEADBOX TO HOLDING POND UPWELL.
VALVE "J"	MAIN HATCHERY BUILDING WATER SUPPLY SHUTOFF.

SITE PLAN
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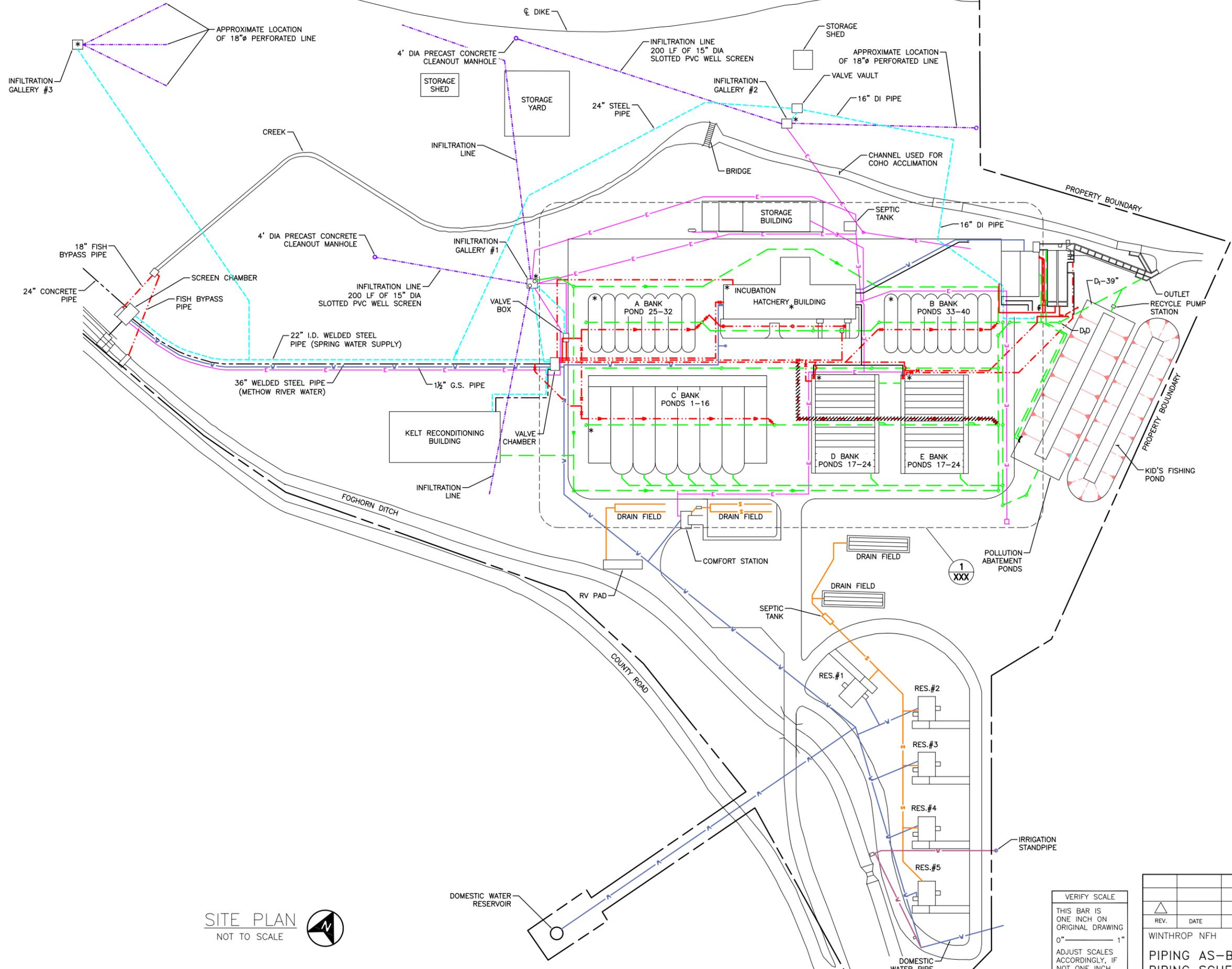
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FIGURE 2



- LEGEND**
- SURFACE WATER
 - - - - - WELL WATER
 - . - . - . BLENDED WATER
 - - - - - EXISTING SEPTIC
 - - - - - DOMESTIC WATER
 - - - - - DITCH WATER
 - - - - - DRAIN LINE
 - - - - - EXISTING INFILTRATION LINE
 - - - - - ELECTRICAL

- ABBREVIATIONS**
- D₂ - INDICATES COLLECTING DRAIN No. 2
 - GV - GALVANIZED STEEL PIPE
 - * - ALARM POINTS

SITE PLAN
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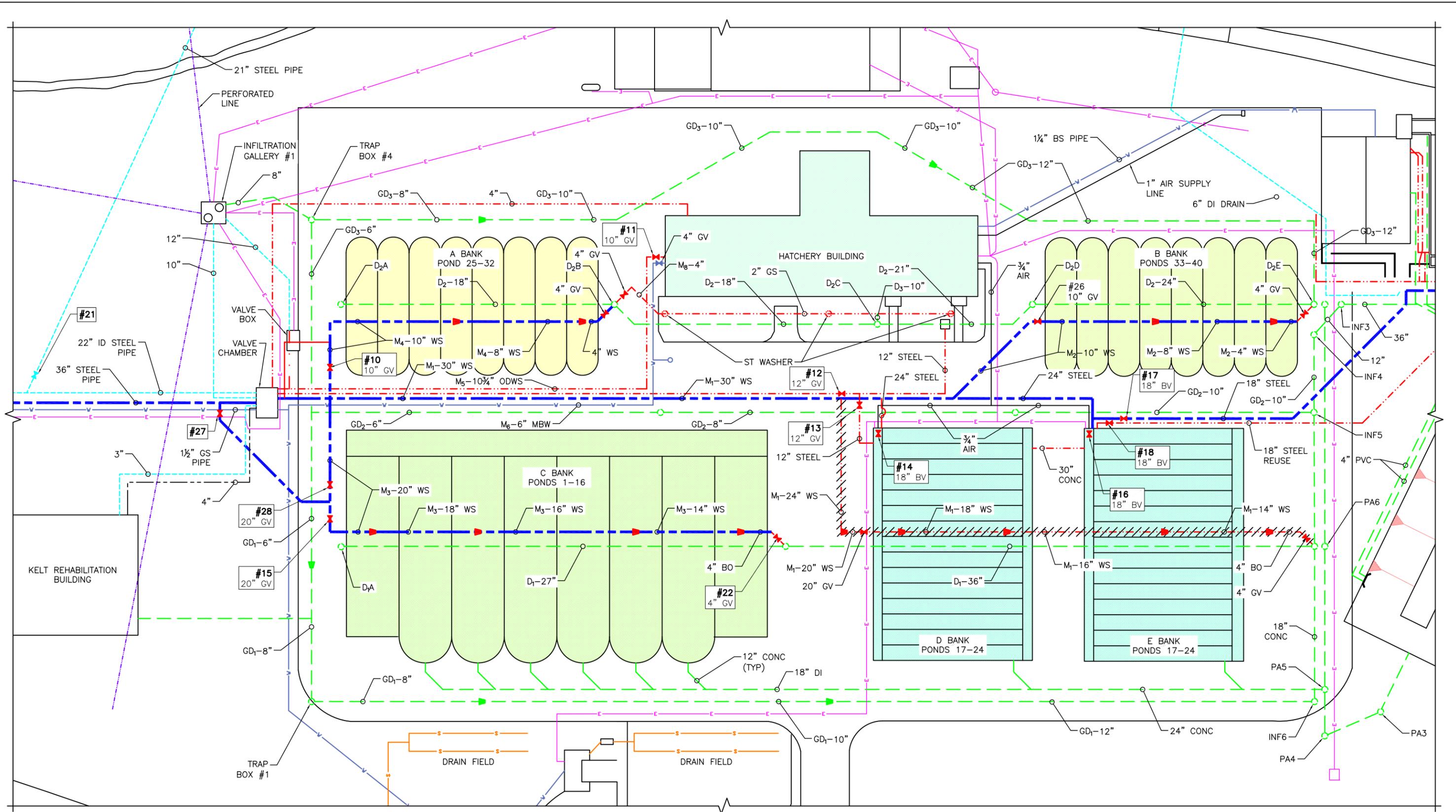


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PIPING SCHEMATIC

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LEGEND

- MAIN SUPPLY LINES
- - - - - SURFACE WATER
- - - - - WELL WATER
- - - - - BLENDED WATER
- - - - - EXISTING SEPTIC
- - - - - DOMESTIC WATER
- - - - - DRAIN LINE
- - - - - EXISTING INFILTRATION LINE
- AIR LINE
- ELECTRICAL
- / / / / / ABANDONED IN PLACE PIPE

DETAIL

SCALE: NTS

1
XXX



ABBREVIATIONS

- M₁ - INDICATES WATER MAIN No. 1
- D₂ - INDICATES COLLECTING DRAIN No. 2
- GD₃ - INDICATES GROUND DRAIN No. 3
- MBW - INDICATES MACHINE BONDED WOOD PIPE
- WS - INDICATES WELDED STEEL PIPE
- GV - GATE VALVE
- GS - GALVANIZED STEEL PIPE
- BO - BLOW OFF
- BV - BUTTERFLY VALVE

VERIFY SCALE

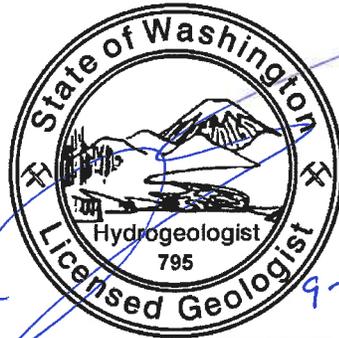
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DRAWING NO.			FIGURE 2

APPENDIX B
WATER SUPPLY REPORTS

September 26, 2014

To: Mark Reiser, McMillen, LLC



Joseph N. Morrice

From: Joseph N. Morrice, LHG
Associate HydrogeologistTimothy J. Flynn, LHG, CGWP
Principal Hydrogeologist

Re: Leavenworth National Fish Hatchery Water Source Assessment

This memorandum presents an assessment of groundwater supplies at the Leavenworth National Fish Hatchery in Chelan County, Washington. Aspect Consulting, LLC (Aspect) performed this work in support of the Leavenworth Hatchery Complex Alternatives Analysis for the Entiat, Winthrop, and Leavenworth fish hatcheries. Similar assessments for the Winthrop and Entiat hatcheries are provided separately.

Information provided in this memorandum is based on documents and data provided by the United States Fish and Wildlife Service (USFWS), the United States Bureau of Reclamation (USBR), and a June 23, 2014 site visit to locate and identify active and inactive production and observations wells at the hatchery. A bibliography of reports and documents received from USFWS and USBR is included as Attachment 1.

The following sections summarize existing water supply, including water right authorizations, water supply sources and capacities, water quality, and condition of groundwater source infrastructure; known existing constraints on water supply; and recommendations to address water supply constraints.

Summary of Existing Supply

The following provides a description of existing water supply, including state water right authorizations, a summary of sources and capacities based on data provided by hatchery staff and the field visit, available information on water quality, and the condition of groundwater source infrastructure.

Water Rights

The USFWS holds four water right certificates and two water right claims to supply the hatchery for fish propagation purposes. These rights include a combination of groundwater and surface water rights. Attributes of these water rights, including instantaneous (Q_i) and annual (Q_a) limits on diversions/withdrawals as currently certificated, are summarized in Table 1. This summary is based

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on information provided in *Groundwater Conditions at the Leavenworth National Fish Hatchery, Leavenworth, Washington* (Bureau of Reclamation, 2010) and an initial review of Department of Ecology's (Ecology) water right files; a detailed, independent review of the water rights was not performed by Aspect. The combined instantaneous (Qi) and annual (Qa) authorized withdrawals for the groundwater rights are 6,700 gallons per minute (gpm) and 7,677 acre-feet per year (afy), respectively.

Table 1 – Leavenworth National Fish Hatchery Water Rights

Water Right	Source(s)	Priority Date	Authorized Withdrawals/Diversions			
			Instantaneous (Qi)	Units ¹	Annual (Qa)	Units
Certificate 1824	Icicle Creek	3/26/1942	42	cfs	---	afy
Certificate 1825 (Storage)	Snow and Nadal Lakes	3/26/1942	---	---	16,000	afy
Certificate 3103-A	Well No. 1	10/16/1957	1,200	gpm	1,120	afy
Claim 016378	Well No. 3	June 1940	700	gpm	570	afy
Claim 016379	Well No. 2	August 1939	900	gpm	730	afy
Certificate G4-27115C	Well Nos. 4 through 7	10/20/1980	3,900	gpm	5,257	afy

¹ cfs = cubic feet per second. gpm = gallons per minute. afy = acre-feet per year.

Sources and Capacities

A site visit was performed with hatchery staff to locate and identify all active and inactive water supply and monitoring wells at the hatchery. A total of 18 water supply type wells have been constructed at the hatchery since the 1940s, although not all were put into production; seven wells are currently active. The status of these wells (active or inactive), as confirmed during the site visit and reported by USFWS, is summarized in Table 2. The last comprehensive evaluation of well production capacity was completed in 1995 (GeoEngineers, 1995), which found that the seven active production wells were capable of providing a combined, simultaneous withdrawal of about 6,700 gpm, with the sum of the pumping capacity of individual wells on the order of 7,000 gpm.

The well pumps were recently equipped with variable frequency drives (VFDs) to allow the pumps to be operated at lower flow rates to maintain sufficient water levels within the wells. Prior to addition of the VFDs the pumps were operated at full capacity, with a low-level shut off, which significantly constrained the pumping capacity particularly of wells affected by drawdown interference associated with pumping multiple wells simultaneously.

The wells all tap unconsolidated alluvial and glacial deposits in hydraulic continuity with Icicle Creek and, when hydrated, the hatchery channel. The 1995 hydrogeologic evaluation (GeoEngineers, 1995) developed a conceptual model of site hydrogeologic conditions, describing a shallow, unconfined aquifer present beneath the southern half of the site with a more localized deep, confined aquifer underlying a silt and clay unit in the northern portion of the site near Well Nos. 5 and 6. Depth to bedrock ranges from about 200 to 330 feet.

Based on our review of site well and boring logs, the glacial and alluvial materials at the site are highly variable over relatively short distances, and the aquifers are likely laterally discontinuous. This variability has complicated efforts to successfully site wells and develop groundwater supply at the facility.

September 26, 2014

Water Quality

No water quality concerns were raised by hatchery staff. However, the hatchery has a preference for groundwater supply primarily due to the more constant temperature of the groundwater sources, particularly the deep aquifer. Groundwater used to supplement and cool surface water supplies in the summer, and to regulate temperature in the winter. Groundwater temperatures in the shallow aquifer range from about 43 to 53 degrees Fahrenheit, and water temperature in the deep aquifer (measured at Well No. 6) average about 53 degrees Fahrenheit.

Condition of Source Infrastructure

Since development of the hatchery in the 1940s, 18 water supply or test wells have been constructed, although not all have been put into production. Table 2 summarizes the well construction history. A number of replacement wells (e.g., Well Nos. 2A and 3A) and test wells (TW-1 through TW-3) were constructed in efforts to maximize the available groundwater supply and fully utilize the hatchery's groundwater rights. Other wells (Well Nos. 5A, 5B, and 9) were damaged during the pumping tests when first installed or produced excessive sand. Well No. 10 was installed in 1995 but never tested for yield or equipped with a pump.

The pumps in the active wells appear to be in reasonable operating condition; however, the available data suggest a decline in well efficiency over time in many of the wells contributing to reduced pumping capacity. No major maintenance issues were reported by hatchery staff or documented in the files reviewed. As mentioned above, VFDs were installed at the active wells, allowing the hatchery to control flow rather than operate at full capacity with a low level shut-off.

Known Existing Water System Constraints

The primary constraint is sufficient groundwater supply from the existing wells. The groundwater supply issues are exacerbated by changes in hatchery operations starting in 2006 to improve fish passage and habitat in the natural (historical) Icicle Creek channel; these operational changes have reduced groundwater recharge from the constructed Hatchery channel to the shallow aquifer tapped by wells west of the channel.

Prior to 2006, most creek flows were diverted into the Hatchery Channel, limiting flow into the natural creek channel. The Hatchery channel is about 5 feet higher than the natural channel of Icicle Creek and parallels the natural channel for about 1 mile, before rejoining the creek. Since 2006, the control structure (Structure 2) on Icicle Creek that diverts flow to the Hatchery Channel is left open most of the year in order to maintain higher flows in the natural creek channel, but leaving the Hatchery channel largely dry. Limited diversion to the hatchery channel is allowed every 2 weeks, which helps recharge the shallow aquifer immediately adjacent to many of the hatchery water supply wells; however, the duration of this recharge benefit is limited due to the highly transmissive nature of the shallow alluvium. Results of a recent groundwater modeling evaluation by the USBR, in collaboration with a data collection effort by the USFW at the hatchery, indicate that both the natural (historical) creek and Hatchery channels contribute recharge to the groundwater system. Changes in channel operations and corresponding effect on pumping levels is still being evaluated, however additional measures are needed to improve and maintain groundwater supply.

Recommendations

Results of the review of existing information summarized above and recommendations for actions to improve groundwater supply to allow full use of the hatchery's water rights were presented to the Icicle Workgroup (IWG) Groundwater Technical Committee in July 2014. Final recommendations

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Project No.: 140162-01

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include additional investigation to identify potential targets for groundwater supply development; assessing the condition and testing existing Well No. 10; and, if suitable targets for groundwater development are identified, constructing and testing a new production/test well. In addition to the investigation and construction work to improve supply, consolidation of water rights is recommended to give more flexibility in operation of water sources and minimize potential relinquishment risks. Details on these recommendations are summarized below.

A geophysical survey, using time-domain electromagnetic (TEM) methods would be performed along up to three transects to identify potential target aquifers for groundwater supply. One transect is recommended for Hatchery Island, located between the hatchery channel and the natural Icicle Creek channel. A second transect is recommended for Chelan County-owned property immediately northwest of the hatchery property and deep Well No. 5. A third transect, if performed, would be located based on initial results of the first two transects. Results of the geophysical evaluation would be used to determine if installation of a test/production well is warranted.

If results of a geophysical survey indicate suitable aquifer(s) for groundwater development, then drilling of a test well is recommended, either on Hatchery Island or on County property northwest Well No. 5. This well would be a 12-inch-diameter, with estimated completion to a depth of up to 200 feet. This diameter is recommended because of the anticipated cobbly nature of the alluvium and also would allow use of the test well as a production well if yield is sufficient. After well construction and development, step-rate and 24-hour aquifer tests would be performed to assess well yield, the effect of hydraulic boundaries (e.g., bedrock and surface waters), and potential interference with other wells.

The final investigation and construction recommendation is to assess and test Well No. 10. This well was constructed in 1995, but apparently never tested or brought on-line. A down-hole video would be performed to assess current condition of the well. A temporary submersible pump would then be set in the well and step-rate and 24-hour aquifer tests performed to evaluate yield and interference with other wells.

Results of the geophysical survey, well construction, well video, and aquifer tests would be documented in a memorandum for the IWG and will inform recommendations for additional groundwater supply development in the Action Plan, including whether to bring Well No. 10 online and potential locations for additional groundwater supply development.

In addition to the investigation and construction recommendations, water right permitting to consolidate the groundwater rights is warranted to give more flexibility in managing supplies and minimize any relinquishment concerns. Three of the groundwater rights currently authorize withdrawal from one well each, and the fourth groundwater right authorizes withdrawals from four wells. As indicated in Table 1, each of the individual water rights include limits on the maximum Q_i and Q_a that can be exercised from the specified well(s) which can constrain optimal use of the collective groundwater supply. Under this recommendation, each active well and any new or replacement wells would be added as points of withdrawal to each of the groundwater rights, allowing the hatchery to manage them as a single well field with a maximum combined withdrawal of 6,700 gpm.

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Project No.: 140162-01

September 26, 2014

Limitations

Work for this project was performed for McMillen, LLC (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Attachments

Table 1 – Leavenworth National Fish Hatchery Water Rights (In Text)

Table 2 – Well Construction Summary

Attachment 1 – References

W:\140162 McMillen Hatcheries\Deliverables\Leavenworth Water Source Memo\Leavenworth Water Supply Memo.docx

Table 2 - Well Construction Summary

Leavenworth National Fish Hatchery

Well ID	Date Drilled	Drilled Depth (feet)	Completion Depth (feet)	Diameter (inches)	Perforated Casing or Screened Depth (feet)	Source Aquifer	Status
1	(04/58)?	80	80	12	40-80	Shallow	Active
2	1940	94	94	12.5	20-90	Shallow	Replaced by 2A
2A	Jul-91	206	203	20	70-90	Shallow	Active
3	--	103	103	12	20-92	Shallow	Replaced by 3A
3A	Jun-91	120	98	16	63-98	Shallow	Active
4	Oct-76	324	237	16	60-69 and 95-225	Shallow	Active
4A	8-Oct	333	105	16	64-94	Shallow	Active
5	Jul-79	290	279	14	249-279	Deep	Active
5A	Feb-78	300	300	14	250-300	Deep	Collapsed during pumping test
5B	Oct-76	286	280	16	--	Deep	Pumped excessive sand during pumping test
6	Dec-76	195	170	14	102-112 and 150-170	Shallow and Deep	Active
7	Nov-76	192	110	14	72-82 and 92-110	Shallow	Active
8	Oct-76	278	2788	1.5	--	--	Obser. Well
9	Nov-76	213	205	16	80-105, 115-136, and 180-200	Shallow	Collapsed during pumping test, used as obser. well
10	Feb-95	110	104	12	75-100	Shallow	Not Pumped
11	Feb-95	278	278	16	--	Shallow	Decommissioned
TW-1	Sep-94	276	--	--	--	--	Abandoned
TW-2	Nov-94	150	--	--	--	Shallow	Used as obser. well
TW-3	Jan-95	145	--	--	--	Shallow	Cased well near Well 10

From USBR, 2010 and confirmed during the June 23, 2014 site visit.

Attachment 1

References

- ENSR Consulting & Engineering, 2000, US FWS Hydraulic and Hydrologic Analysis of Icicle Creek Fish Passage Restoration Alternatives, Leavenworth National Fish Hatchery, Leavenworth, Washington, Prepared for Sverdrup Civil, Inc., April 2000.
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- GEI Consultants, Inc., 2002, Field Investigation Data Report for the Conceptual Design of Modification to Nada and Snow Dams, Leavenworth National Fish Hatchery, Chelan County, WA, Submitted to US FWS, Division of Engineering, Dam Safety Branch, June 2002.
- Geocal, Inc., 2008a, By Pass Water Control Str Bridge - Bridge Inspection and Appraisal Report, Leavenworth National Fish Hatchery, Chelan County, Washington, Submitted to USFWS, Division of Engineering, Bridge Safety Branch, August 29, 2008.
- Geocal, Inc., 2008b, Canal Bridge – Bridge Inspection and Appraisal Report, Leavenworth National Fish Hatchery, Chelan County, Washington, Submitted to USFWS, Division of Engineering, Bridge Safety Branch, August 29, 2008.
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MEMORANDUM

Project No.: 140162-01

October 6, 2014

To: Mark Reiser, McMillen, LLC



Joseph N. Morrice

A handwritten signature in black ink, appearing to read "Timothy J. Flynn".

From: Joseph N. Morrice, LHG
Associate Hydrogeologist

Timothy J. Flynn, LHG, CGWP
Principal Hydrogeologist

Re: Entiat National Fish Hatchery Water Source Assessment

This memorandum presents an assessment of groundwater and spring water supplies at the Entiat National Fish Hatchery in Chelan County, Washington. Aspect Consulting, LLC (Aspect) performed this work under contract to McMillen, LLC in support of the Leavenworth Hatchery Complex Alternatives Analysis for the Entiat, Winthrop, and Leavenworth fish hatcheries. Similar assessments for the Winthrop and Leavenworth hatcheries are provided separately.

Information provided in this memorandum is based on documents and data provided by the United States Fish and Wildlife Service (USFWS) staff who operate the hatchery, well log, and water right files retrieved from the Washington State Department of Ecology (Ecology), and a June 4, 2014 site visit to interview hatchery staff and observe existing infrastructure.

The following sections summarize existing water supply, including water right authorizations, water supply sources and capacities, water quality, and condition of groundwater source infrastructure; known existing constraints on water supply; and recommendations to address water supply constraints.

Summary of Existing Supply

The following provides a description of the existing water supply, including state water right authorizations, a summary of sources and capacities based on data provided by hatchery staff, available information on water quality, and the condition of groundwater source infrastructure.

Water Rights

The USFWS holds four water right certificates to supply the hatchery for fish propagation purposes. These rights include a combination of groundwater and surface water rights. Attributes of these water rights, including instantaneous (Q_i) and annual (Q_a) limits on diversions/withdrawals as currently certificated, are summarized in Table 1.

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Certificate 3058 originally authorized diversion only from the Entiat River. In 1996, Ecology approved a change to this water right, adding the six wells as additional points of withdrawal. Certificate 3059 authorizes use of Limekiln (also known as Packwood) Spring, and Certificates 4584-A and G4-25874C authorize use of Well No. 1 and Well Nos. 2, 3, and 4, respectively.

Table 1 – Entiat National Fish Hatchery Water Rights

Water Right	Source(s)	Priority Date	Authorized Withdrawals/Diversions			
			Instantaneous (Qi)	Units ¹	Annual (Qa)	Units
Certificate 3058	Entiat River and Well Nos. 1 through 6	6/4/1943	22.5	cfs	---	afy
Certificate 3059	Limekiln (Packwood) Spring	6/4/1943	7	cfs	---	afy
Certificate 4584-A	Well No. 1	8/25/1960	800	gpm	800	afy
Certificate G4-25874C	Well Nos. 2, 3, and 4	4/19/1978	1,300	gpm	699	afy

¹ cfs = cubic feet per second. gpm = gallons per minute.

Sources and Capacities

The hatchery operates six water supply wells and two surface water diversions authorized under the water rights. The wells all tap sand, gravel, and cobble alluvial deposits. Based on the geologic conditions and location near the river, the wells all tap the same body of groundwater and are in hydraulic continuity with the river, as reflected in the addition of the wells as points of withdrawal to the Entiat River surface water right.

Annual water production by source over the past 5 years, based on water use data provided by hatchery staff, is summarized in Table 2. Average yield by source, when operating, is summarized in Table 3. Over this period, the wells have sustained an average withdrawal of about 1,300 gallons per minute (gpm). This supply is supplemented with water from Limekiln Spring and seasonally from the Entiat River.

Water from Limekiln Spring is used year-round, with the quantity dependent on seasonal variability in flow. Peak flows of up to 2,000 gpm (about 4.5 cubic feet per second [cfs]) typically occur in May or June and low flows on the order of 200 to 400 gpm occur from early September through March. The Entiat River source is generally not used from mid-April through October due to concerns about exposing hatchery fish to *Myxobolus* parasites and other pathogens from spawning adult fish present in surface water above the intake. Over the past two winters this diversion was active starting in September or November through mid-April.

Table 2 – Summary of Annual Water Production by Source

Year	Water Source and Annual Production in Acre-Feet								Total
	Entiat River	Limekiln Spring	Well No. 1	Well No. 2	Well No. 3	Well No. 4	Well No. 5	Well No. 6	
2009	0	940	182	394	213	364	286	0	2,379
2010	0	868	466	204	182	386	224	0	2,329¹
2011	0	1,442	521	244	339	238	47	140	2,973¹
2012	649	827	575	293	220	336	302	139	3,341
2013	5,665	867	710	555	273	339	235	152	8,796

¹ Values may not total correctly due to rounding.

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Table 3 – Summary of Average Yield by Source

Year	Water Source and Average Production when Operating in gpm							
	Entiat River	Limekiln Spring	Well No. 1	Well No. 2	Well No. 3	Well No. 4	Well No. 5	Well No. 6
2009	0	560	312	295	250	246	186	0
2010	0	536	292	226	208	243	141	100
2011	0	782	332	212	204	276	110	156
2012	5,072	555	427	215	191	207	250	128
2013	5,760	532	444	207	193	207	168	119

Based on water use records provided by the hatchery staff, during 2013/2104 winter operations Entiat River surface diversions approached the maximum Qi authorized under the water rights, reaching about 22 cfs in December 2013 and January 2014. Maximum total use from all sources was 26 cfs during this period, with a consistent 1,300 gpm (3 cfs) withdrawn from the wells, about 1 cfs diverted from Limekiln Spring, and 22 cfs from the Entiat River.

Water Quality

No recent water quality data for the hatchery sources were identified. However, the hatchery has a preference for groundwater supply primarily due to the more constant temperature of the groundwater sources and the lower risk of pathogens compared to the Entiat River surface water source. Hatchery staff also identified problems with algal growth at the facility, which is suspected to be related to mineralized water from Limekiln Spring, which discharges from a marble outcrop northwest of the hatchery facilities.

Condition of Source Infrastructure

The hatchery operates six water wells that were constructed between 1961 and 1994 using cable tool drilling methods. All wells are completed in sand, gravel, and cobble alluvium of the Entiat River, which overlies non-productive gneiss bedrock present between about 70 and 120 feet below ground surface (bgs). Well No. 1 was completed with perforated casing, and the other wells were completed with stainless steel screens. At time of drilling, depths to water in the wells were approximately 10 feet bgs, similar to water levels in the adjacent river. Other well construction details are summarized in Table 4.

Comparing the yields when the wells were first installed to recent average yields when the wells are operating (Table 3), it appears that the sustainable yields have declined by about 50 percent or more. The suboptimal well yields may be due to a combination of well screen fouling and/or water level drawdown interference between pumping wells. The relatively limited available drawdown (water column) above the well screens likely further limits the productivity of these wells. To address screen fouling, the hatchery hires a contractor to rehabilitate one well per year using the Aqua Freed CO₂ method. Hatchery staff report rehabilitation efforts typically result in a temporary increase in yield on order of 100 gpm, which remains well below the original capacity.

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Table 4 – Well Construction Summary

Well ID	Year Constructed	Screened/Perforated Interval (feet bgs)	Screen Diameter (inches)	Yield when Installed (gpm)
1	1961	30 to 73	20	880
2	1977	45 to 65	14	500
3	1977	57 to 82	14	450
4	1977 ¹	50 to 65 and 75 to 115	14	390
5	1994	55 to 70 and 103 to 116	16	500
6	1994	82 to 94 and 99 to 115	16	260

¹ Reconditioned in 1995 to address sand production.

Known Existing Water System Constraints

The primary constraint is lack of sufficient groundwater supply due to limited well production. Hatchery staff indicated that they have space to expand operations from 400,000 to 600,000 summer Chinook smolts if sufficient groundwater supply were available. Maximizing groundwater supply is also desirable for the hatchery because of its more consistent temperature and lower risk of pathogens compared to the Entiat River surface water supply and as a backup supply for winter use when the river diversion ices over. Finally, replacing supply from Limekiln Spring with groundwater from the alluvium may help address algal growth problems at the hatchery.

Use of the surface water diversion is constrained in the winter due to ice formation on the intake and fish screens. Groundwater is currently used to de-ice the intake and screens when this happens. The river also occasionally freezes to the point where there is no divertible flow, further reducing reliability of the surface source.

Water right authority is not the limiting factor on hatchery supply. Under the existing water rights, the hatchery is authorized to withdraw 800 gpm from Well No. 1, 1,300 gpm from Well Nos. 2 through 4, and up to an additional 22.5 cfs (about 10,100 gpm) from all of the wells plus the Entiat River. Based on the well yields when first installed, the wells were originally capable of supporting the instantaneous quantities authorized under the groundwater rights (i.e., 800 gpm at Well No. 1 and a combined 1,300 gpm at Well Nos. 2, 3, and 4), but are now only capable of sustaining a combined 1,300 gpm. The decline in groundwater source capacity does pose a potential non-use concern with regards to exercise of the groundwater rights in recent years, however, there are a number of exemptions under the water right statute Chapter 90.14.140 RCW that may apply.

Recommendations

We understand hatchery staff are planning to proceed with construction of groundwater collector system with lateral collector lines near Well No. 4. If the first collector is successful, the hatchery may pursue a second system. The goal is to develop up to 4,500 gpm of additional groundwater supply. If sufficient groundwater supply can be developed, we understand the hatchery may discontinue use of Limekiln Spring to reduce algal growth. Spring discharge would instead be routed through a wetlands area.

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The Well No. 4 area is a reasonable location for development of a groundwater collector system, with a relatively large open space for installation of collector laterals. The driller's log for Well No. 4 indicates boulders, gravel, and sand with a depth to water of 10 feet bgs.

Siting of a second collector system or additional vertical well(s) is constrained by existing hatchery buildings and facilities, but possible locations include north of the trout pond and Well No. 6 or a wedge of USFWS-owned land adjacent to the river and south of Roaring Creek Road. The area north of the trout pond is open and presents good access, but based on bedrock outcrops and steep slopes to the west, it is uncertain how thick or extensive the water-bearing alluvium is in this area. No geologic information is available for the area south of Roaring Creek Road, and construction or drill rig access may be challenging down steep slopes from the road. However, if sufficient alluvium is present in this location it would offer the advantage of minimizing the potential for drawdown interference with other hatchery wells.

The hatchery's continued efforts to develop and maximize groundwater supply, through development of a collector system and periodic rehabilitation of existing wells, are important for protecting the groundwater rights from partial relinquishment due to non-use. As mentioned above, the wells were originally able to produce the combined instantaneous withdrawals permitted in the groundwater rights of 2,100 gpm, but with declining yield currently sustain about 1,300 gpm. Lack of availability of water, such as with declining well yield, is one statutory exemption to relinquishment, but requires that the hatchery demonstrate due diligence in trying to address supply constraints. The hatchery typically rehabilitates one well per year to improve yield. It is uncertain if reduced well yield is the result of well interference or well screen fouling, but the incremental increase in yield appears to be worth the cost. Further, this helps demonstrate due diligence in improving supply until sufficient additional groundwater capacity is developed.

If the hatchery does develop additional groundwater supply and discontinues the current rearing use of water from Limekiln Spring, efforts should be made to preserve the spring source water right. Supplying the trout ponds at the hatchery likely still qualifies as a fish propagation purpose of use and should not require a water right change; however, this change in how water is used should be documented internally to demonstrate that the hatchery is still beneficially using the water. Alternatively, if the spring use is discontinued entirely, the hatchery should place the spring source water right into the state Trust water Right Program. This would protect the right from relinquishment and would allow the hatchery to use the right as mitigation for new groundwater or surface water rights, if needed.

Limitations

Work for this project was performed for McMillen, LLC (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

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To: Mark Reiser, McMillen, LLC



Joseph N. Morrice

A handwritten signature in black ink, appearing to read "Timothy J. Flynn".

From: Joseph N. Morrice, LHG
Associate Hydrogeologist

Timothy J. Flynn, LHG, CGWP
Principal Hydrogeologist

Re: Winthrop National Fish Hatchery Water Source Assessment

This memorandum presents an assessment of groundwater and spring water supplies at the Winthrop National Fish Hatchery in Okanogan County, Washington. Aspect Consulting, LLC (Aspect) performed this work under contract to McMillen, LLC in support of the Leavenworth Hatchery Complex Alternatives Analysis for the Entiat, Winthrop, and Leavenworth fish hatcheries. Similar assessments for the Entiat and Leavenworth hatcheries are provided separately.

Information provided in this memorandum is based on documents and data provided by the United States Fish and Wildlife Service (USFWS) staff who operate the hatchery, well log, and water right files retrieved from the Washington State Department of Ecology (Ecology), and a site visit to interview hatchery staff and observe existing infrastructure performed on June 3, 2014.

The following sections summarize existing water supply, including water right authorizations, water supply sources and capacities, water quality, and condition of groundwater source infrastructure; known existing constraints on water supply; and recommendations to address water supply constraints.

Summary of Existing Supply

The following provides a description of existing water supply, including state water right authorizations, a summary of sources and capacities based on observations and discussion with hatchery staff during the site visit, available information on water quality, and the condition of groundwater source infrastructure.

Water Rights

The USFWS holds four active water right certificates to supply the hatchery for fish propagation purposes. These rights include a combination of groundwater and surface water rights. Attributes of these water rights, including instantaneous (Q_i) and annual (Q_a) limits on diversions/withdrawals as currently certificated, are summarized in Table 1.

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Certificate 848 originally authorized diversion only from the Methow River. This right has been subject to several changes since first issued in 1922. In 1989, Ecology approved a change authorizing the nearby Washington Department of Fish and Wildlife (WDFW) State fish hatchery to divert up to 7 cubic feet per second (cfs) of this water right in the event of an emergency water shortage. In 2005, Ecology approved a second change to this water right, adding groundwater Infiltration Gallery 3 as a point of withdrawal, with a maximum withdrawal rate of 10 cfs. A change application was also recently filed with Ecology in 2013 requesting to add Infiltration Gallery 1 and Infiltration Gallery 2 as additional points of withdrawal to this water right. A decision by Ecology on this change application is still pending.

Change Certificate S4-CV1P206 authorizes use of an unnamed spring (Spring Branch Spring). One other water right certificate for Spring Branch Spring (Certificate 3203), issued in 1943, was relinquished for non-use in 2005 following Ecology's review of the change to Certificate 848.

Certificate 7209 was issued for Infiltration Gallery 1. Previous planning documents from the USFWS for the Methow Hatchery (e.g., the 2006 Comprehensive Hatchery Management Plan) indicate that Certificate 7590 was issued for Infiltration Gallery 2; however based on review of the water rights files, Certificate 7590 appears to have been issued as an additive right to Certificate 7209 authorizing increased withdrawals from Infiltration Gallery 1. No water right file information was identified indicating that this right was later changed to authorize withdrawals from Infiltration Gallery 2, and it does not appear that this source is currently authorized under any of the water rights.

Table 1 – Winthrop National Fish Hatchery Water Rights

Water Right	Source(s)	Priority Date	Authorized Withdrawals/Diversions			
			Instantaneous (Qi)	Units ¹	Annual (Qa)	Units
Certificate 848	Methow River and Infiltration Gallery 3	1/10/1922	50	cfs	---	afy
S4-CV1P206	Unnamed Spring	1/10/1922	10	cfs	---	afy
Certificate 7209	Infiltration Gallery 1	4/6/1967	1,500	gpm	2,420	afy
Certificate 7590	Infiltration Gallery 1	2/17/1971	1,500	gpm	2,400	afy

¹ cfs = cubic feet per second. gpm = gallons per minute. afy = acre-feet per year.

Sources and Capacities

The hatchery operates three infiltration galleries or groundwater collector systems and two surface water diversions authorized under the water rights. Throughout the year the hatchery uses different proportions of surface water and groundwater, depending on active operations and desired water temperatures. Groundwater from the infiltration galleries is about 46 to 48 degrees Fahrenheit year round, while the river water shows a much greater temperature range, approaching 70 degrees Fahrenheit in late summer.

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The infiltration galleries were completed with either one or two laterals, consisting of perforated pipe draining to a sump from which water is pumped. The laterals were completed generally less than 12 feet deep in shallow sand and gravel alluvium in hydraulic continuity with river. There were no reported issues with the laterals fouling or clogging and requiring maintenance.

Hatchery staff indicated that operation of Infiltration Gallery 3 results in water level drawdown interference at Infiltration Gallery 1, located about 900 feet east. Hatchery staff monitor water levels in Infiltration Gallery 1 and adjust withdrawals when needed to avoid pump cavitation. This condition also has the potential to result in gas bubble disease issues in the raceways if not monitored closely.

The hatchery maintains and operates the Foghorn Dam surface water diversion on the Methow River located about 1 mile upstream of the hatchery facility. The diversion routes water into the Foghorn Ditch, which also conveys water for irrigators located downstream of the hatchery and the WDFW fish hatchery located upstream. Spring Branch Spring flows into and comingles with the Foghorn Ditch water. Hatchery staff estimated that the spring contributes on the order of 1 cfs to flows in the ditch.

Instantaneous and annual water production data were not available, but hatchery staff provided estimates of use and source meter readings of instantaneous withdrawals were observed during the site visit. The surface diversions were not active during the site visit, but hatchery staff estimated typical surface water use of about 1,000 to 7,000 gallons per minute (gpm) (about 2.2 to 15.6 cfs). Hatchery staff estimated that the typical infiltration gallery production is about 1,100 gpm at Gallery 1, 1,800 to 3,000 gpm at Gallery 2, and about 1,200 gpm at Gallery 3, or roughly 9 to 12 cfs combined. At the time of the site visit, Gallery 1 was producing 1,260 gpm, Gallery 2 was producing 2,500 gpm, and Gallery 3 was producing 1,800 gpm.

Water Quality

No recent water quality data for the hatchery sources were identified. However, the hatchery has a preference for groundwater supply for incubation, early rearing and adult holding, primarily due to the more constant temperature of the groundwater sources and the lower risk of pathogens compared to the surface water sources. Surface water is preferred for final rearing to imprint fish and reduce straying. The main quality concern with groundwater supply is excessive drawdown at Infiltration Gallery 1 creating conditions favorable for gas bubble disease if not monitored closely. Hatchery staff did not identify other water quality concerns, other than source selection based on temperature differences.

Condition of Source Infrastructure

There were no reports from hatchery staff of significant maintenance or performance issues with the infiltration galleries, with the exception of drawdown related impacts at Infiltration Gallery 1, while Infiltration Gallery 3 is operating, causing cavitation and water quality concerns. The pump at Infiltration Gallery 3 is equipped with a variable frequency drive, allowing the flow and associated drawdown to be controlled; staff indicated that this pump is not operated at more than 80 percent of full speed. Staff also described a problem with backflow of groundwater pumped from Infiltration Gallery 3 to waste at the surface water screen chamber overflow due to a lack of proper valving.

Known Existing Water System Constraints

The primary water system constraint is lack of sufficient groundwater supply due to limited well production. Maximizing groundwater supply is desirable for the hatchery because of its more

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consistent temperature and lower risk of pathogens compared to the Methow River and Spring Branch Spring surface water sources.

Water right authority does not appear to be the limiting factor on hatchery supply, although as discussed in the Recommendations section there may be some permitting changes with Ecology required to bring the water right authorizations in line with actual use—i.e., current instantaneous withdrawals from the infiltration galleries appear to exceed the water right authorizations. Under the existing water rights, the hatchery is authorized to withdraw 3,000 gpm (6.7 cfs) from Infiltration Gallery 1 and up to 50 cfs from Infiltration Gallery 3 and the Methow River. The hatchery also holds a right to divert up to 10 cfs from Spring Branch Spring. Based on estimated water use provided by hatchery staff on the order of 28 cfs may be in use during peak withdrawals and diversion. **It is important to note that reliable metering data were not available to support this estimate and that additional evaluation and data collection would be required to accurately quantify hatchery water use.**

Recommendations

We understand a water right change has been filed on Certificate 848 to add Infiltration Galleries 1 and 2 to this right. As discussed above, Infiltration Gallery 2 does not appear to be associated with any of the hatchery water rights; this change would help bring the water right authorization in line with actual water use and give the hatchery more flexibility in managing their supply sources.

In addition to proceeding with the change to Certificate 848, we recommend that Infiltration Gallery 2 be added to Certificates 7209 and 7590, which apparently currently only authorize use of Infiltration Gallery 1. This could likely be completed through what is termed a Showing of Compliance with RCW 90.44.100(3). Under this approach, the USFWS can add Infiltration Gallery 2 as a point of withdrawal to either or both of the existing groundwater rights, as long as the added point of withdrawal is located within the legal description of the locations advertised in the public notice when the original water rights were permitted. Other requirements include tapping the same body of groundwater as the original source, not impairing other existing water rights, and the added point of withdrawal must comply with current State of Washington well construction standards.

We expect Infiltration Gallery 2 will meet all of these criteria, although we have not evaluated the surface completion of the gallery sump to ensure it meets well construction standards. Infiltration Gallery 2 is located in the NE1/4SE1/4 of Section 3, Township 34 North, Range 21 East Willamette Meridian, the same area as was published in the public notices for Certificates 7209 and 7590. Infiltration Gallery 2 also taps the same body of public groundwater, alluvial deposits in hydraulic continuity with the Methow River, as Infiltration Gallery 1. Finally, this gallery has been operating for decades without indications of impairment.

The Showing of Compliance process is to file a one page form with Ecology certifying that the necessary requirements are met. Advantages to this approach are that it would not trigger Ecology review of the hatchery's water use history and would not open the rights to a possible tentative determination (review of extent and validity relative to potential relinquishment) from Ecology. Further, unlike a water right change, there is no requirement to publish a public notice inviting public comments. Finally, other than a nominal fee for filing the Showing of Compliance form, this approach would not incur the costs of processing a water right change and could be completed in a timeline of weeks rather than months or longer.

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A Showing of Compliance could not be used to add Infiltration Gallery 3 to Certificates 7209 and 7590, as Infiltration Gallery 3 appears to be located in a different quarter-quarter section than was published in the public notice for those water rights.

Options for increasing groundwater supply, if desired, beyond what the current infrastructure can physically support are likely limited to installation of traditional vertical wells, rather than an additional infiltration gallery. Given the existing drawdown interference between Infiltration Galleries 1 and 3 installation of a new infiltration gallery near the river would likely increase drawdown interference and exacerbate an existing constraint. Installing an infiltration gallery further inland from the river also does not appear feasible. During the site visit, hatchery staff indicated that several test borings were drilled during design of Infiltration Gallery 3 and that shallow groundwater was not encountered at significant distances inland from the river, presumably due to higher ground surface elevations. Because a trench must be excavated to install the infiltration gallery laterals, they require relatively shallow depth to groundwater to be cost effective.

Any vertical well that was constructed would likely need to tap the same alluvial aquifer in hydraulic continuity with the river as the existing infiltration galleries in order to be added to the existing water rights. However, a vertical well could potentially be located further inland, reducing the potential for drawdown interference when pumping.

Limitations

Work for this project was performed for McMillen, LLC (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

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MEMORANDUM

Project No.: 140162-02

January 30, 2015

To: Mark Reiser, McMillen Jacobs Associates

cc: Steve Croci, USFWS

From: Joseph Morrice, LHG, Associate Hydrogeologist
Tim Flynn, LHG, Principal Hydrogeologist

Re: **LNFH Geophysical Survey Results and Recommendations**

This memorandum provides results of a geophysical survey performed at the Leavenworth National Fish Hatchery (LNFH) in Chelan County, Washington. The purpose of the survey was to identify potential areas for groundwater development to supplement existing hatchery water supply. The survey was performed by Zonge, International (Zonge) of Reno, Nevada under contract to Aspect Consulting, LLC (Aspect).

The survey was completed by Zonge between December 2 and 4, 2014 using time-domain electromagnetic (TEM) survey methods. TEM is used to estimate electrical resistivity of soils and rock, which are used to infer soil characteristics (e.g., fines content) and identify lateral and vertical changes in soil properties. Zonge's reported results are provided as Attachment 1. Survey lines were completed in three areas:

- Hatchery Island, consisting of lines 1 and 2;
- A Chelan County-owned parcel north of the LNFH (West Area), consisting of line 3; and
- An area south of the LNFH between wells PW-1 and PW-2 (South Area), consisting of lines 4 and 5.

The survey areas and the orientations of the survey lines are shown on Figures 1 through 4 of the Zonge report. Interpreted subsurface resistivity measurements are provided on Figures 5 through 7. To aid in interpretation, color contours of resistivity measurements and inferred soil characteristics are provided on these figures. Soils with resistivity measurements between 200 and 800 ohm-meters are expected to have little clay content, with the higher resistivity measurements generally indicating less clay. Soils interpreted to have low clay content are shown in order of decreasing clay content as green, yellow, and orange contours. The approximate bedrock contact is also shown in pink.

The following sections discuss geophysical survey results for each of the surveyed areas, followed by our recommendations for next steps for assessing supply options and developing additional groundwater supply at the LNFH.

January 30, 2015

Geophysical Survey Results

Hatchery Island (Lines 1 and 2)

Figure 2 of the attached report shows the orientation of survey lines 1 and 2 at Hatchery Island, and Figure 5 shows cross sections of the interpreted results. There is an apparent coarser grained layer (orange and yellow) extending from ground surface down to about 60 feet below ground surface (bgs). This unit overlies deposits with higher fine-grained content (green) to the top of bedrock at a depth of about 200 feet bgs. This is generally consistent with the log for well PW-9.

Immediately north and south of well PW-9 there is little lateral variation in the geophysics results, indicating no significant change in soil conditions. East, west, and further south of this well the soils between depths of 60 and 200 feet bgs grade into what appears to be more fine-grained deposits (blue shading on the sections), while the shallower soils show little variation. There are a few limited areas just above bedrock with higher resistivity readings where the interpretation is unclear. These could be localized coarse-grained deposits, or local variation in the bedrock elevation; in either event there does not appear to be a laterally extensive deeper sand and gravel unit to tap at the island.

Well PW-9 provides some information about expected groundwater yield if wells were completed on Hatchery Island. PW-9 was screened between depths of 80 and 200 feet, corresponding to the green shaded intervals on the survey cross sections. The screen interval is below the more coarse grained materials inferred from the geophysical results. This well was reportedly tested at a rate of 400 gallons per minute (gpm) with 50 feet of drawdown before collapsing. That yield and drawdown are marginal for meeting LNFH water demands. As an initial estimate--assuming PW-9 is representative of what a new well on the island would yield, and allowing for some loss in production due to drawdown interference between wells--a well field with 3 or 4 wells may be able to sustain a yield on the order of 1,000 gpm. Well locations would be limited to area north of PW-9, based on the apparent finer-grained deposits at depth to the east, west, and south.

Alternatively, developing the shallower deposits on Hatchery Island with a groundwater collector system, similar to the systems at Winthrop and planned for Entiat, is more likely to achieve the desired higher yields, assuming the presence of coarse sands and gravels is confirmed. Non-pumping depth to water at PW-9 was 12 feet in November 1979. Assuming depth to water of about 20 feet during summer low water conditions and that the coarse deposits extend to a depth of about 60 feet, there is about 40 feet of available drawdown to operate a collector system. Additional field investigation would be required to confirm soil conditions, water levels, and potential yield to support design of a collector system. Although vertical well PW-9 collapsed during testing, a shallower collector system would not experience the same lateral forces as the deeper well. With proper design a groundwater collection system should not be at risk of collapse.

West Area/County Parcel (Line 3)

The geophysics survey for this area indicates relatively high fines content (blue) in the upper 100 feet bgs, overlying moderately coarse material (green) to near the top of bedrock. Because of surface interferences from power lines and fences the top of bedrock could not be accurately imaged, and the interpreted location is approximate. The higher resistivity readings near the top of bedrock may indicate gradation to a coarse grained layer immediately above the bedrock surface, but is not definitive. If present, the coarser materials appear to be only a thin unit.

January 30, 2015

South Area (Lines 4 and 5)

Survey lines 4 and 5 are located south of the LNFH near several existing LNFH production wells. The geophysics results indicate moderately coarse material, similar to what is inferred on Hatchery Island below depths of 60 feet. As was the case with the west area, the top of bedrock could not be accurately imaged, and there may be some gradation to coarser grained materials above the bedrock contact. The log for well PW-2 located near the south end of Line 5 describes cobbles with clay at the bedrock contact, while nearby well PW-7 describes alternating layers of clay and cobbles above bedrock; these wells currently produce about 600 and 300 gpm, respectively. The geophysical survey did not indicate any target area that would be significantly different than what is already tapped by nearby LNFH wells, and any additional wells in this area would be expected to have similar yields.

Recommendations

Based on the geophysical survey, the most promising target for groundwater development is the shallower deposits on Hatchery Island, which could be developed with a groundwater collector system. It is anticipated that the use of vertical wells would require deeper completion intervals, into the finer grained materials similar to well PW-9, to afford sufficient available drawdown. Consequently, new vertical wells completed on Hatchery Island or in the South survey area would be expected to have moderate yield, similar to existing wells, on the order of 300 to 500 gpm. Suitable locations for new wells are limited, either due to potential drawdown interference from existing wells (e.g., in the South survey area) or unfavorable soil conditions (e.g., Hatchery Island south, east, and west of well PW-9).

The potential yield from a shallower groundwater collection system on Hatchery Island requires further evaluation, and would depend on the length of collector laterals, depth of installation and available drawdown, hydraulic properties of the shallower soils, and degree of hydraulic continuity with surface water. Despite the uncertainty, we expect a groundwater collection system would have a better likelihood of achieving the desired yields on the order of 2,000 to 3,000 gpm than a series of additional vertical wells. Based on these considerations we recommend completing additional field investigation to verify the presence and thickness of shallow, coarse-grained deposits on Hatchery Island to support siting and design of a groundwater collector system.

Prior to the geophysical survey, our recommended scope of work for completing an assessment of water supply improvements at LNFH included:

- Assess yield and condition of existing well PW-10 with downhole video and a constant rate aquifer test;
- Construct a test/production well at a location selected based on geophysics and complete a constant rate aquifer test; and
- Prepare Action Plan for implementing water supply improvements.

We recommend retaining the assessment of well PW-10 and development of the action plan, but replacing the test well task with a focused investigation on Hatchery Island to support design and construction of groundwater collection system. The scope of work would include completing shallow borings or test pits along a potential groundwater collector system alignment to confirm the presence and depth of the coarse-grained layer, assess depth to groundwater, and collect

MEMORANDUM

Project No.: 140162-02

January 30, 2015

geotechnical and grain size data to support collector design. Short-term (e.g., 1 to 2 hours) pumping tests would be completed in selected boring or trench explorations to assess potential yield. We also recommend reconvening the Icicle Work Group (IWG) Groundwater Technical Committee to get stakeholder concurrence on the approach for assessing development potential at Hatchery Island and improving water supply.

Limitations

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Attachments

Attachment A – Zonge International Geophysical Survey Report

W:\140162 McMillen Hatcheries\Deliverables\Leavenworth Geophysics Memo\LNPH Geophysics Results Memo_Jan302015.docx

ATTACHMENT A

Zonge International Geophysical Survey Report



***GEOPHYSICAL INVESTIGATION
NATIOAL FISH HATCHERY
LEAVENWORTH, WASHINGTON***



Photo from Zonge International

Prepared for:

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Submitted by:

Zonge International, Inc.
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Reno, NV 89521
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Zonge Ref: 14093

January 29, 2015

GEOPHYSICAL INVESTIGATION
NATIOAL FISH HATCHERY
LEAVENWORTH, WASHINGTON

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1.0 INTRODUCTION

This report conveys the results of a geophysical investigation undertaken by Zonge International, Inc. (Zonge) at the National Fish Hatchery in Leavenworth, Washington. Zonge performed nanoTEM soundings on five lines (Figure 1) as part of a groundwater study being undertaken by Aspect Consulting.

The objective of the geophysical investigation was to better estimate depth to bedrock and to characterize the sediments above bedrock. There are numerous boreholes across the site. These include groundwater production wells for the hatchery, abandoned groundwater wells and groundwater monitoring wells.

1.1 East Area

The East Area (Figure 2) lies on an island east of the main Hatchery operations. It is bounded by Icicle Creek on the east and a channel of the Creek on the west. Data were acquired on two crossed lines, north-south (Line 1) and east-west (Line 2). The lines intersect near the borehole PW9. In the southern portion of the site, Line 2 is broken by an underground utility.

PW9 was drilled in 1976 and collapsed during testing/construction. The drillers log reports sand and gravel with bedrock (“*Granite hard Quartzite*”) at 207 feet.

1.2 West Area

The West Area (Figure 3) is in a county owned gravel quarry east of Icicle Road and south of E. Leavenworth Road. Loop size was restricted to 20m loops by a discontinuous barb wire fence to the east of the property and numerous aggregate stockpiles on the property. The nanoTEM survey was conducted on the floor of the quarry, some 20-30 feet below the ground level to the west.

1.3 South Area

The South Area (Figure 4) sits in the middle of an active water production well field, with PW1 to the north and PW2, PW7, & PW3A to the south. The area is crisscrossed by unmarked underground power lines and pipelines. We consulted with Hatchery maintenance personnel prior to selecting line locations but could not be assured that any site would be clear of interference. The larger 40m loops were not deployed in this Area as they require a much larger lateral clearance from buried utilities.

2.0 METHODOLOGY - NANOTEM

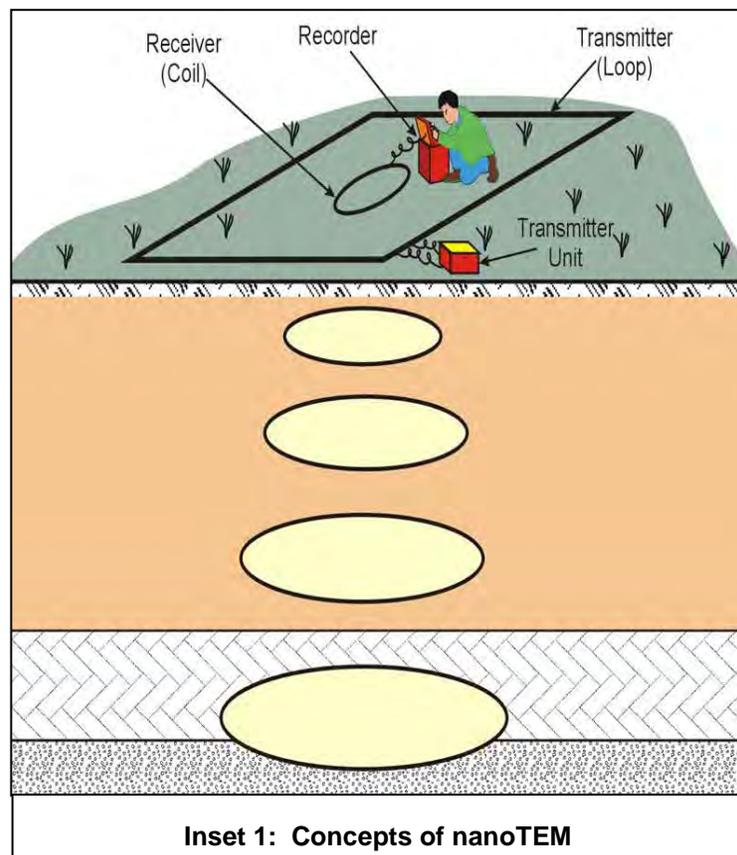
The time-domain electromagnetic (TEM) methods apply a square-wave current into a transmitting antenna, typically a large square loop. A current is abruptly turned off thereby causing a rapid change in the magnetic field generated by the transmitter. The rapidly changing magnetic field induces eddy-currents to flow in nearby conductors. Those eddy currents in turn produce small secondary magnetic fields which are measured by observing induced voltages in receiver loops. The NanoTEM transmitter and receiver configuration is a very fast turnoff and sampling TEM system that allows for the use of smaller transmitter loops (20m and 40m square loops were used for most of this investigation).

Depth of investigation can be tailored to specific target objectives by varying the size of the transmitter loop. Induced currents in poor conductors (moderate resistivity) decay quickly, currents in good conductors (very low resistivity) decay slowly, and very poor conductors (e.g., crystalline rocks), will not sustain any measurable induced currents.

Sounding data, collected using the Zonge nanoTEM system, are numerically inverted to arrive at an interpreted variation of soil resistivity as a function of depth. This allows us to characterize the subsurface in terms of geologic properties as discussed in Section 5.3 below.

The smooth-model inversion program is a robust method for converting observed measurements to profiles of resistivity versus depth. Observed decay time window magnitude data for each station are used to determine the parameters of a layered-earth model.

Layer thicknesses are fixed by calculating source-field penetration depths for each window time. Layered resistivities are then adjusted iteratively until the model TEM



response is as close as possible to the observed data consistent with smoothness constraints. The smoothness constraints limit resistivity variation from layer to layer. The result of the smooth-model inversion is a set of estimated resistivities that vary smoothly with depth giving the gradational result seen in the interpreted nanoTEM models. The smooth-model inversion does not require any *a priori* estimates of model parameters, thus the results are unaffected by any data processor's bias.

3.0 FIELD DATA ACQUISITION

Field data acquisition was conducted between December 3 and 5, 2014. There were 1-2 inches of snow at the site at the time of the survey. The field crew included a Senior Geophysicist and a geophysical technician from Zonge, one Zonge field assistant.

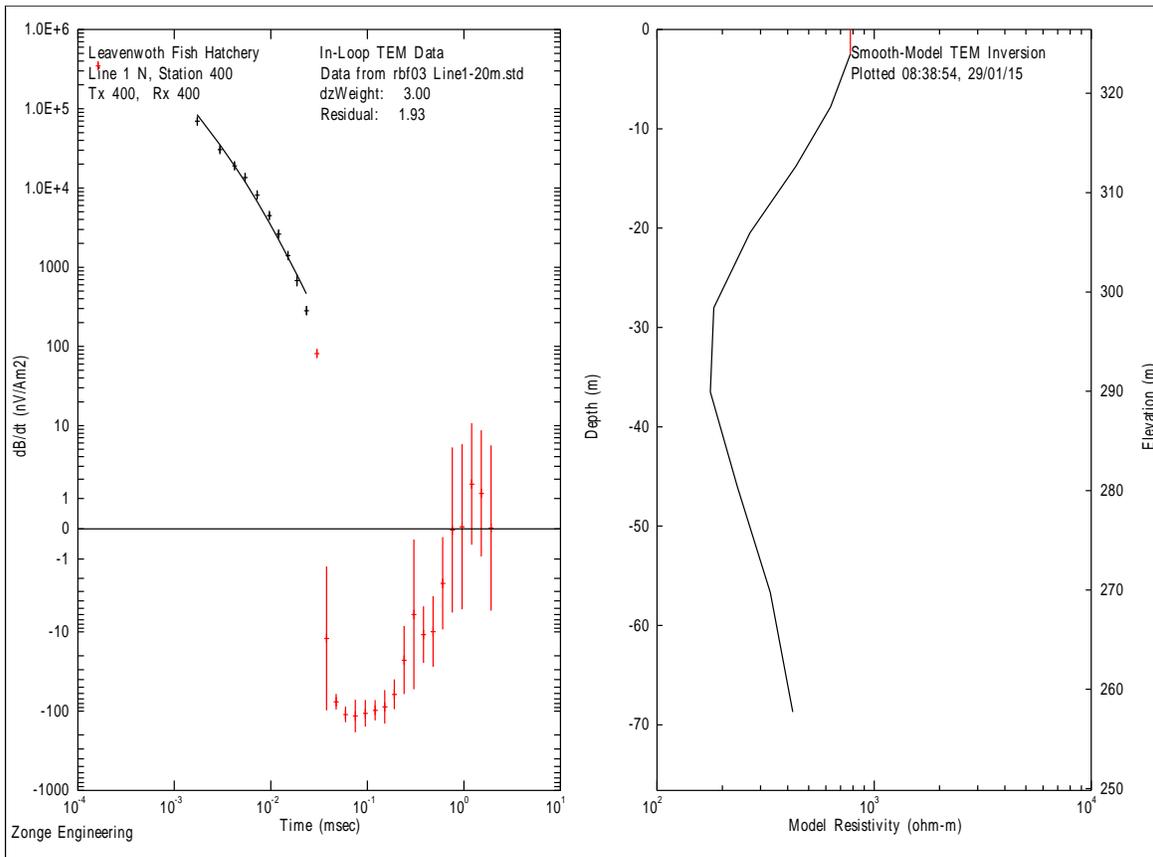
NanoTEM data were acquired using a Zonge GDP-32 receiver equipped with the nanoTEM option and a Zonge NT-20 transmitter. In the east area data were acquired using both 20m and 40m square transmitter loops with one turn of wire. Central loop receiver coils were used with one turn square coils 5m and 10m on a side for the 20m and 40m transmitters respectively. In the West and South Areas only 20m loops were used due to space constraints.

The space constraints arise from fences, buried and overhead utilities near the nanoTEM lines. Generally the TEM soundings should be 2 times the loop size from any of those long linear conductors to avoid interference from currents which the TEM transmitter will induce in the linear conductors. This is often termed *cultural interference* in the geophysical jargon.

4.0 DATA PROCESSING

Data were processed using the software TEMAVGW and STEMINV both developed and marketed by Zonge International. TEMAVGW was used to reformat the raw data and average the repeat soundings from each station while allowing the interpreter to discard bad or noisy data points.

Data were then modelled using STEMINV (v.3.30g) software. That software inverts the TEM data to create a resistivity vs. depth model for each station. Inset 2 on the next page shows an example data plot from the STEMINV software. On the left are sounding data points with a log-log plot of normalized field strength (dB/dt in nanoVolts/Ampere-meter²) for each time gate in milliseconds. Red data points are not used in the inversion. The solid line is the calculated response from the inverted model shown on the right. The model is displayed as resistivity (ohm-meters) versus depth (meters).



Inset 2: STEMINV modeled data

Data from adjacent soundings were concatenated using Geosoft Oasis mapping software to create the pseudo 2D geoelectric sections shown in the Interpreted Model plates.

Layered earth models were also generated for all lines using the TEM module of the IX1D (version 3.36) from Interpex Ltd. Inversions were run to obtain best fit 3-layer models. These were most useful with the 40m loop data where the depth of investigation allowed better resolution of the third layer (crystalline bedrock). We have not presented the layered earth models from the 20m loops in this report.

5.0 RESULTS AND INTERPRETATION

Figures 5-7 present interpreted resistivity profiles for the five lines of soundings acquired in the three areas at the Hatchery. The color contour plots show the interpreted (modeled) 20m loop sounding results. Data were collected on all lines using 20m loops. Data were also collected using 40m loops in the East Area where there were fewer constraints from cultural interference (power lines, fences, & buried utilities). The 40m loops have a greater depth of investigation than the 20m loops but have reduced resolution,

5.1 Earth Resistivity Values

There is considerable range in the resistivity of earth materials. Hence, any observed resistivity will not uniquely identify a soil or rock type. Nonetheless we offer a range of resistivities which might be expected for the general soil and rock types we would expect on this site, based on the borehole data.

TABLE 1: Resistivities of Earth Materials

Material	Resistivity (ohm-meters)	Comments
Granitic Bedrock	400-4000	Fracturing and weathering will decrease resistivity
Sand & Gravel	100-800	Increasing clay content will decrease resistivity
Clay	20-100	

We have annotated the resistivity color bar to indicate that the more prospective areas for water production. Sands & gravels with little clay content will be areas with resistivities of 200-800 ohm-meters; the higher resistivity sediments generally have less clay content.

Where borehole “ground truth” data are available we can often assign resistivities to geologic units encountered in the boreholes. Using those resistivities we can extrapolate away from the borings to identify changes in depth and/or thickness of given units.

5.2 East Area

The Site Plan for the East Area is shown in Figure 2. Interpreted resistivity profiles for the East Area, Lines 1 & 2, are shown in Figure 5.

Data on both lines in the East Area were collected using both 20m and 40m loops. The 20m loops have a better resolution of the section down to 100-150 feet but did not image bedrock (at 200 feet) very well. Hence we have included the interpreted bedrock surface from the 40m loops, using a three layer model. We have not included details of those 3 layer models as they do not resolve anything above bedrock.

We offer three points from these sections:

1. The interpreted bedrock surface was relatively flat across the entire sections and did not rise steeply to the east as suggested from your limited cross sections.
2. The nanoTEM did not reveal any strong lateral changes in the sections. While model resolution was less than hoped, we believe major changes would have been observed in the interpretation.
3. The nanoTEM loop sizes employed typically do not model the near surface well. With 20m loops, the first 5m (15-20 feet) of the model is unreliable.

5.3 West Area

The Site Plan for the West Area is shown in Figure 3. The interpreted resistivity profile for Line 3 in the East Area is shown in Figure 6.

NanoTEM data were collected on the floor or a gravel quarry to the west of the Fish Hatchery and east of Icicle Road. Sounding locations, shown in Figure # were constrained by a barbed wire fence to the east, the quarry wall to the west, several material stockpiles, and a power line coming in from the west.

Data were acquired on one north-south line, Line 3. The interpreted profile is shown in Figure #.

We offer two comments on the interpretation:

1. Resistivities in the upper 100 feet are lower than in the East Area, suggesting more silt and clay in that section. Some lateral changes were noted in the section but no clear trends were observed.
2. The bedrock surface, at a depth greater than 100 feet, was not clearly resolved with the 20m loops. We have indicated an estimated depth on the figure. This estimate is based on the 400 ohm-meter contour. The three layer models would suggest a shallower bedrock surface. We stress that with the 20m loops resolution & reliability beyond a depth of 30m-40m (100-130 feet) is very limited.

3. There is a zone of gradational resistivities which may indicate the presence of a resistive sand & gravel unit above the bedrock surface.

5.4 South Area

The Site Plan for the South Area is shown in Figure 4. Interpreted resistivity profiles for the South Area, Lines 4 & 5, are shown in Figure 7.

As noted in Section 1, the South Area sits in the middle of an active water production well field. The larger 40m loops were not deployed in this Area as they require a much larger lateral clearance from buried utilities.

Data from the southern portion of Line 4 displayed a character indicative of cultural interference. For that reason we have not included data from stations 40-80 in the interpretation. Data from Line 5, to the east of the well field and along the river channel, showed no outward appearance of interference.

We offer these comments on the interpretation:

1. Resistivities in the upper 100 – 120 feet were 200-300 ohm-meters, intermediate between the east and west areas. Sediments with these resistivities can often produce a reasonable amount of groundwater.
2. Again, the bedrock surface, at a depth greater than 100 feet, was not clearly resolved with the 20m loops. We have indicated an estimated depth on the figure. The comments from the West Area bedrock interpretation apply here equally:
“The depth to bedrock estimate shown is based on the 400 ohm-meter contour. The three layer models would suggest a shallower bedrock surface. We stress that with the 20m loops resolution & reliability beyond a depth of 30m-40m (100-130 feet) is very limited.”
3. The transition to higher resistivities is less gradational than on Line 3 in the West Area. However, there is still a gradational zone which may indicate the presence of a thin layer of resistive sand & gravel above the bedrock surface.

6.0 CLOSURE

Zonge International, Inc. has performed this work in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No warranty, express or implied, beyond exercise of reasonable care and professional diligence, is made. This report is intended for use only in accordance with the purposes of the study described within.

We appreciate the opportunity to perform this geophysical investigation. Should you require further information concerning the field investigation, or this report, please contact us at your convenience.

Respectfully Submitted,

Zonge International, Inc.



Rowland B. French, Ph.D., L.G.
Senior Geophysicist

FILE: Leavenworth nanoTEM rpt01.docx
PROJECT: 14093

REVISION: A-26-JAN-15

DATE: DECEMBER 2014

FILE: Overview 10K.mxd

ZONGE PROJECT: 14093

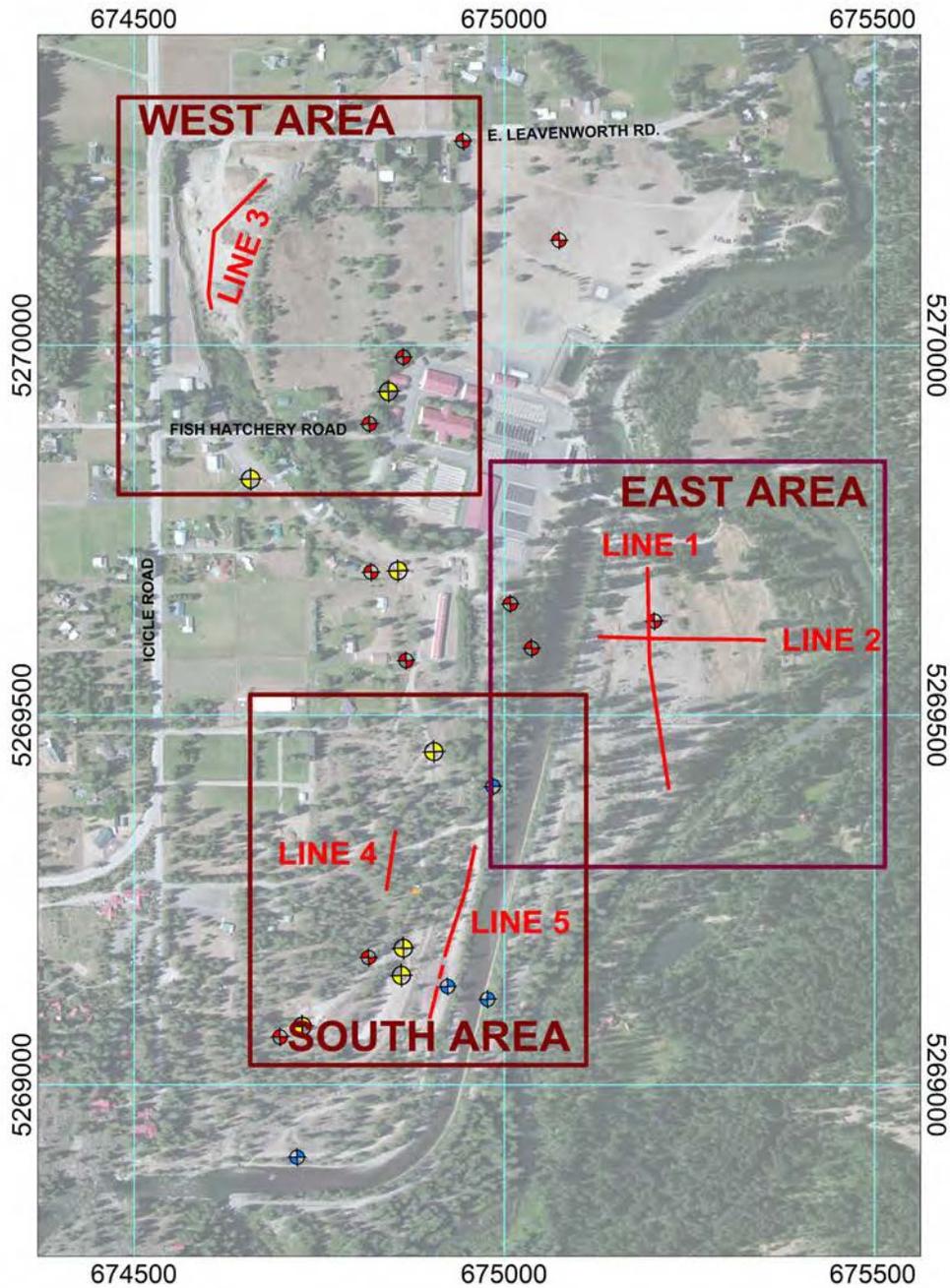


IMAGE FROM BING MAPS

Scale 1:10000
 100 0 100 200
 (meters)
 WGS 84 / UTM zone 10N

500 0 500 1000
 (feet)

LEGEND

-  nanoTEM PROFILE
-  ACTIVE PRODUCTION WELL
-  ABANDONED or INACTIVE WELL
-  OBSERVATION WELL

FIGURE 1

Prepared By:



Prepared For:

Aspect Consulting

PROJECT OVERVIEW

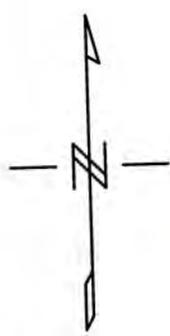
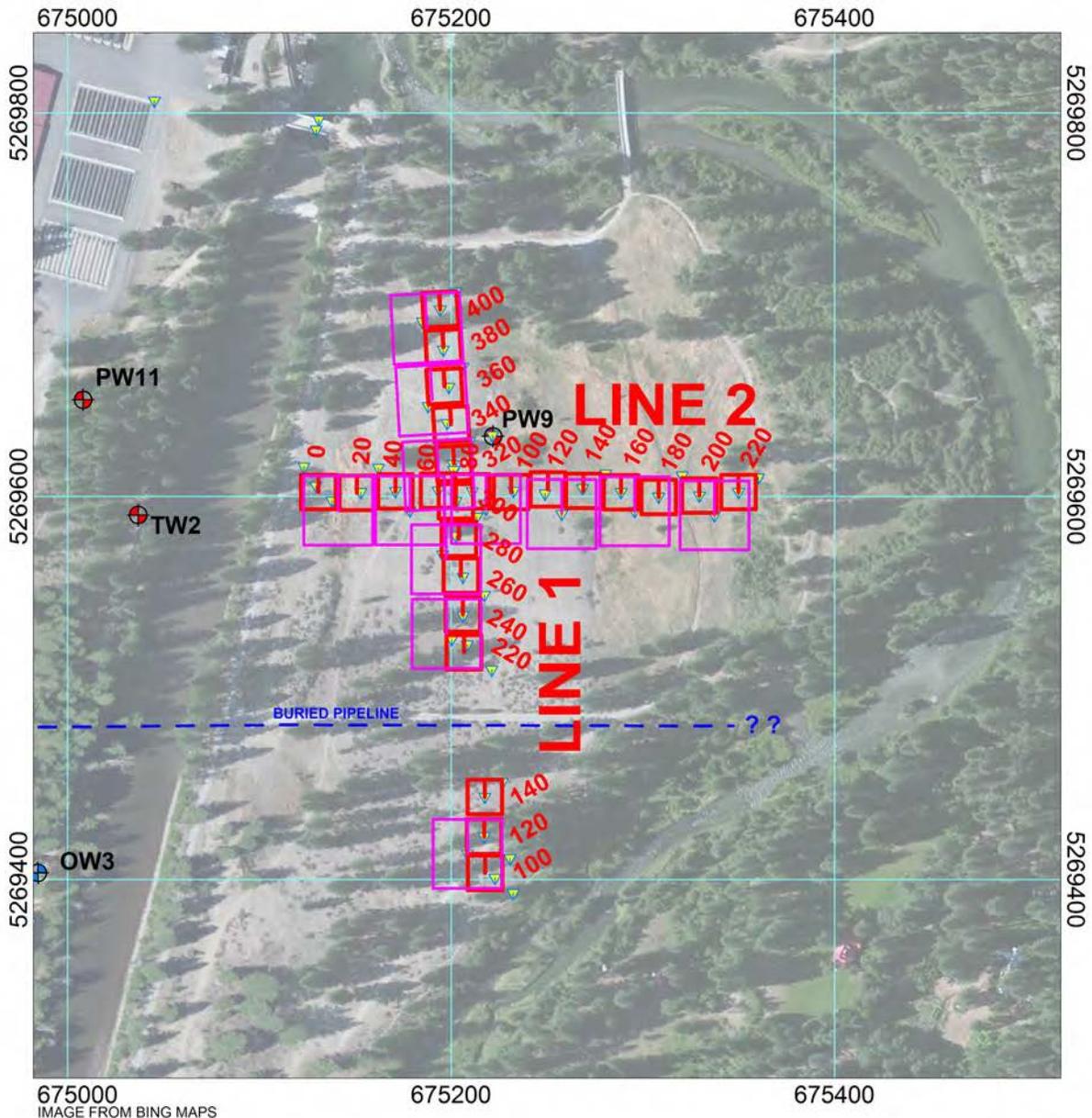
Geophysical Investigation
 National Fish Hatchery
 Leavenworth, Washington

REVISION: A-26-JAN-15

DATE: DECEMBER 2014

FILE: Island 30K map

ZONGE PROJECT: 14093



LEGEND

nanoTEM SOUNDING

 20m TRANSMITTER LOOP

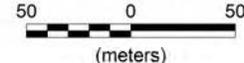
 40m TRANSMITTER LOOP

 ACTIVE PRODUCTION WELL

 ABANDONED or INACTIVE WELL

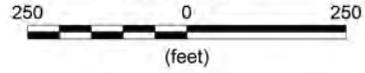
 OBSERVATION WELL

Scale 1:3600



(meters)

WGS 84 / UTM zone 10N



(feet)

FIGURE 2

**SITE PLAN DETAIL
EAST AREA**

Geophysical Investigation
National Fish Hatchery
Leavenworth, Washington

Prepared By:



Prepared For:

Aspect Consulting

REVISION: A-28-JAN-15

DATE: DECEMBER 2014

FILE: West 36k.map

ZONGE PROJECT: 14093

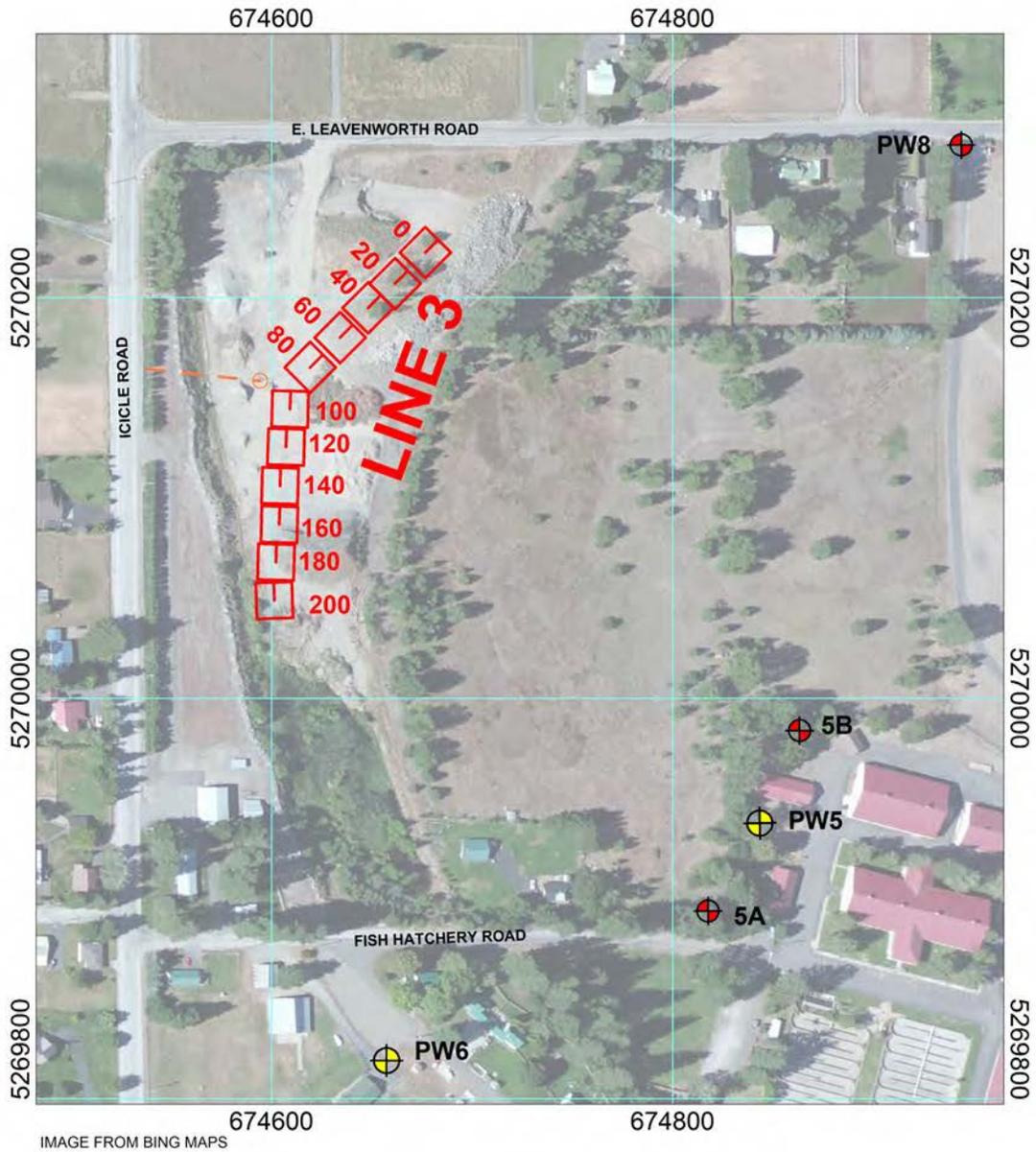


IMAGE FROM BING MAPS

LEGEND

-  nanoTEM SOUNDING 20m LOOP
-  ACTIVE PRODUCTION WELL
-  ABANDONED or INACTIVE WELL
-  OBSERVATION WELL
-  OVERHEAD POWER LINE

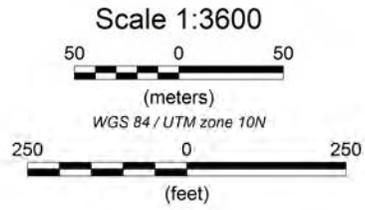


FIGURE 3

Prepared By:

 TRUSTED GEOPHYSICS.

Prepared For:
 Aspect Consulting

SITE PLAN DETAIL WEST AREA

Geophysical Investigation
 National Fish Hatchery
 Leavenworth, Washington

REVISION: A-26-JAN-15

DATE: DECEMBER 2014

FILE: South 36K map

ZONGE PROJECT: 14093

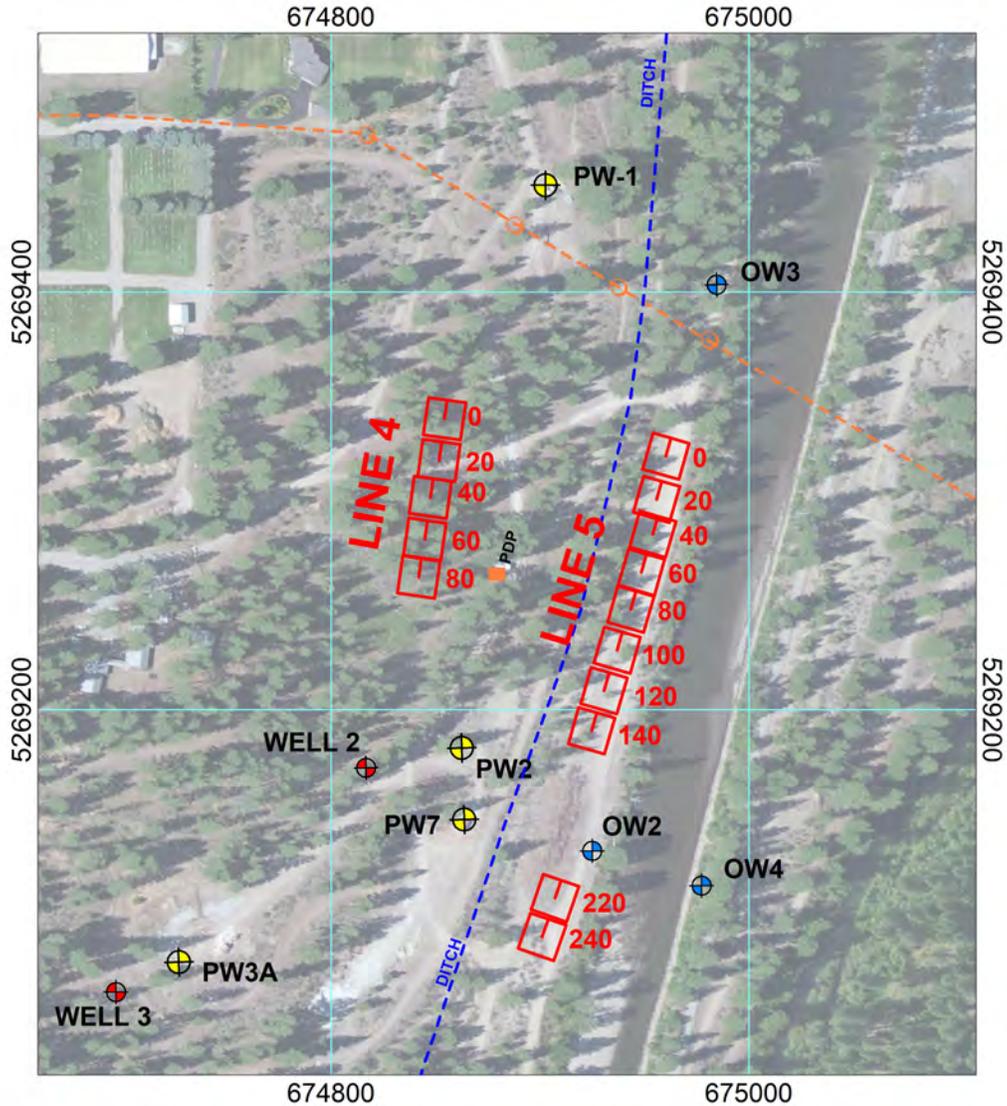


IMAGE FROM BING MAPS

LEGEND

-  nanoTEM SOUNDING 20m LOOP
-  ACTIVE PRODUCTION WELL
-  ABANDONED or INACTIVE WELL
-  OBSERVATION WELL
-  PDP POWER DISTRIBUTION PANEL
-  OVERHEAD POWER LINE

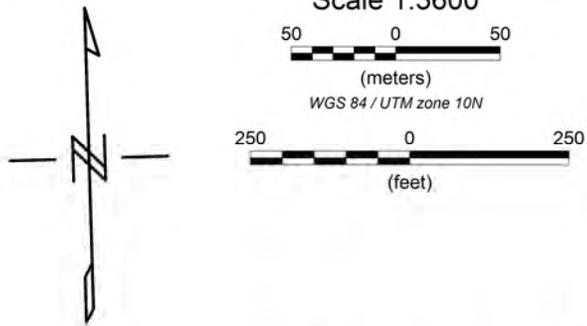


FIGURE 4

Prepared By:



Prepared For:

Aspect Consulting

SITE PLAN DETAIL SOUTH AREA

Geophysical Investigation
National Fish Hatchery
Leavenworth, Washington

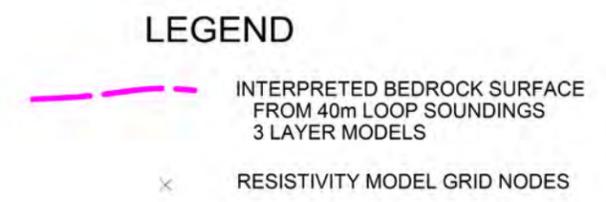
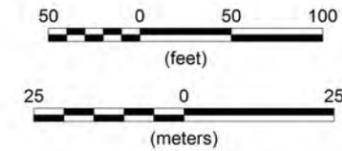
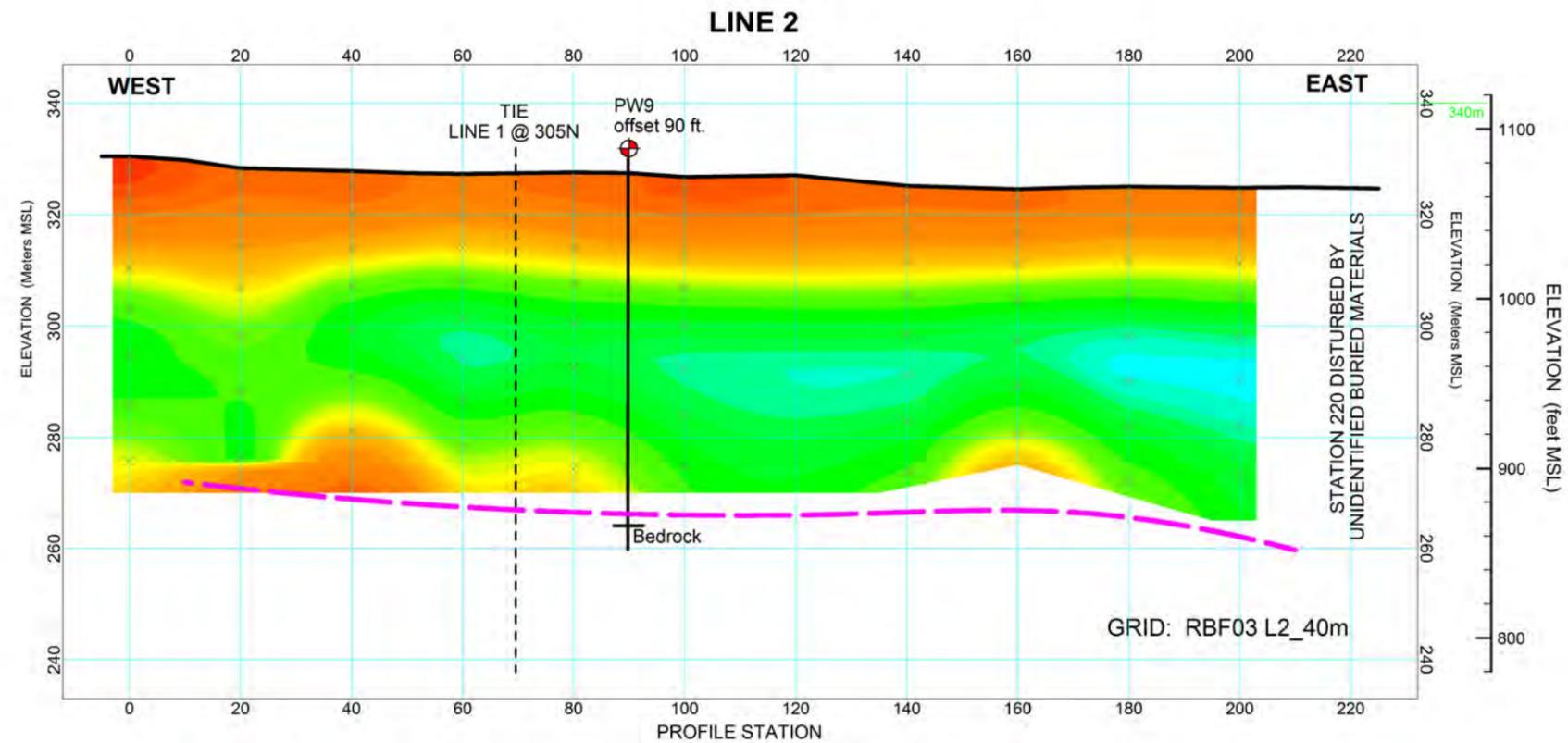
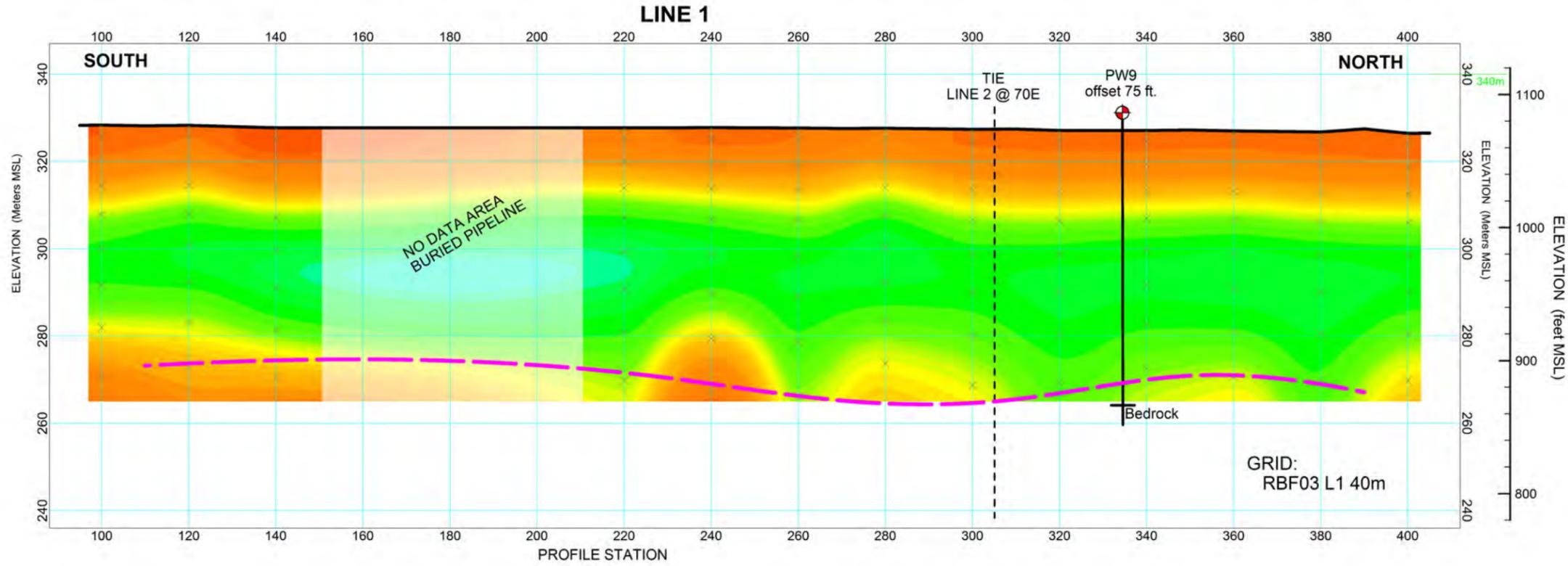
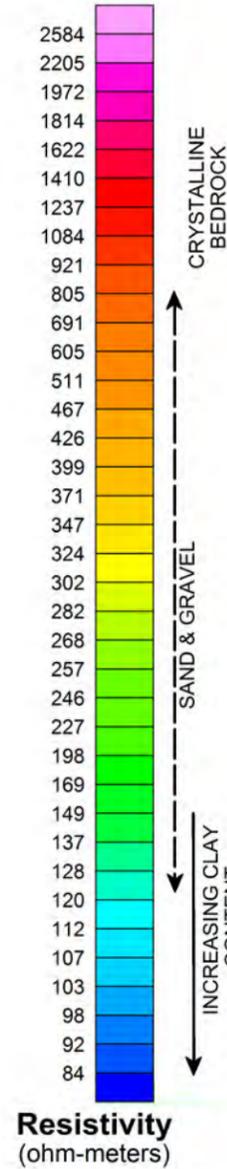
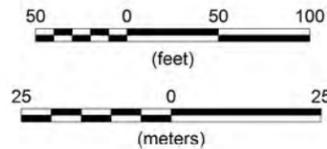
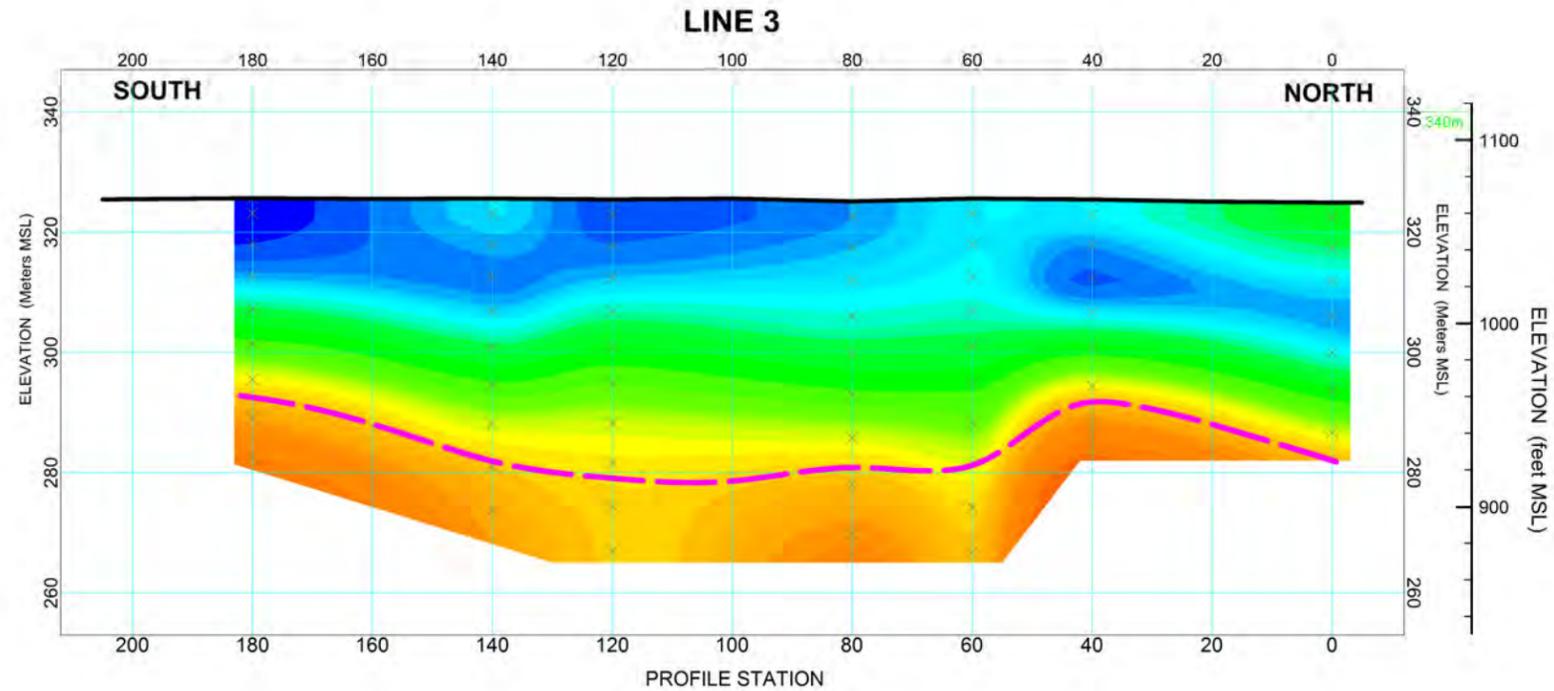
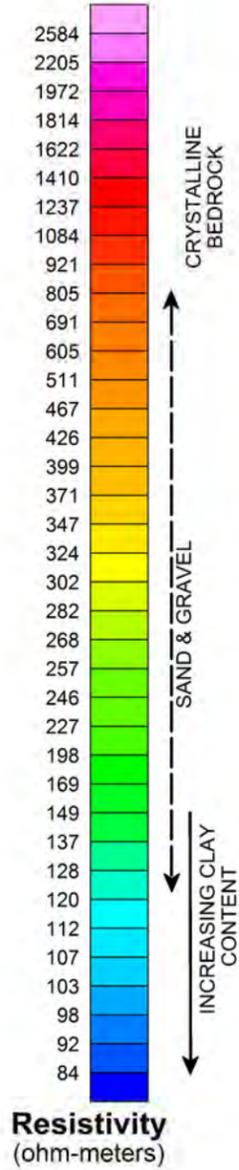


FIGURE 5

RESISTIVITY INTERPRETATION EAST AREA

Geophysical Investigation
National Fish Hatchery
Leavenworth, Washington



LEGEND

- ESTIMATED BEDROCK SURFACE
DEPTH ESTIMATE BASED ON
400 ohm-m CONTOUR OF 20m DATA
- RESISTIVITY MODEL GRID NODES

NOTES

GRID: RBF03

DISTURBED DATA:
STNS 20, 160 & 200
NOT INCLUDED

BAD INVERSION:
STN 100

NO 40m LOOP DATA
DUE TO SPACE CONSTRAINTS

FIGURE 6

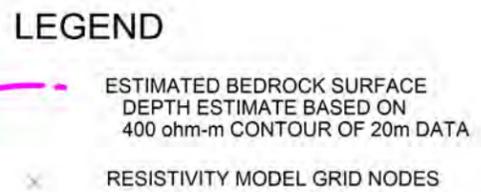
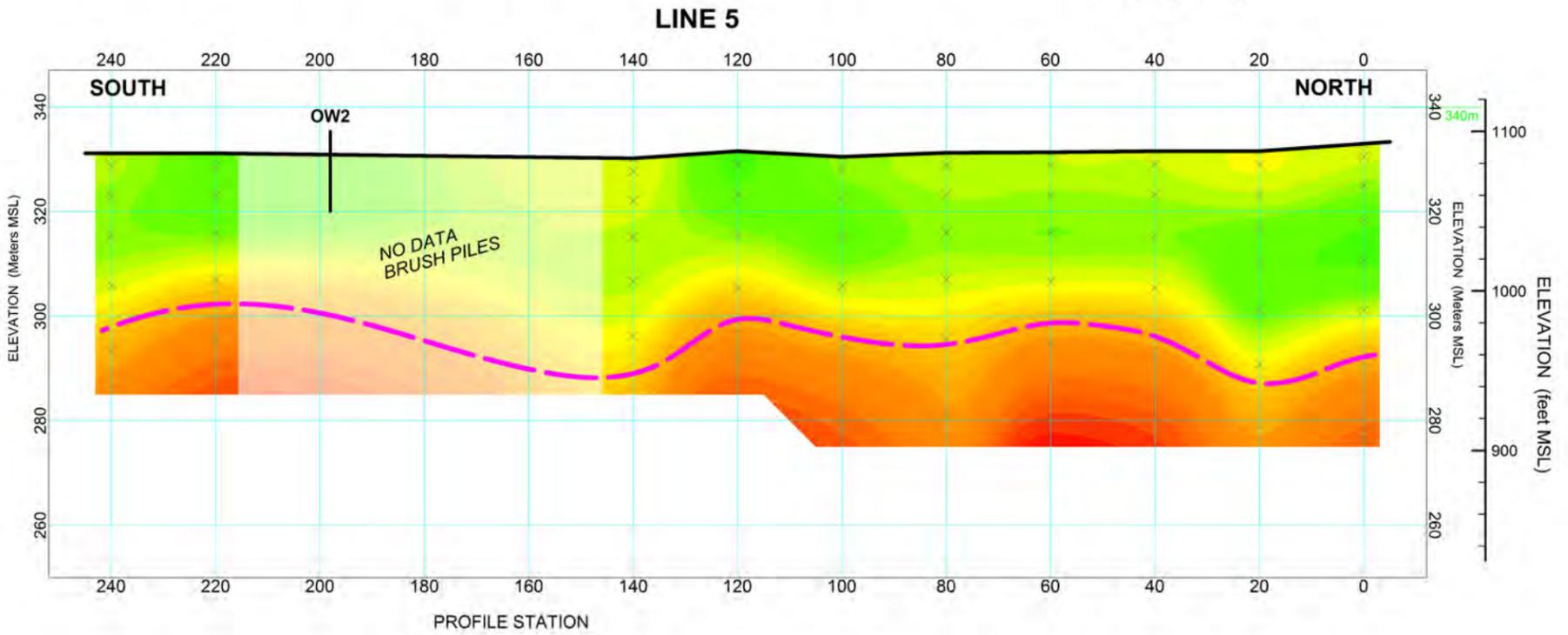
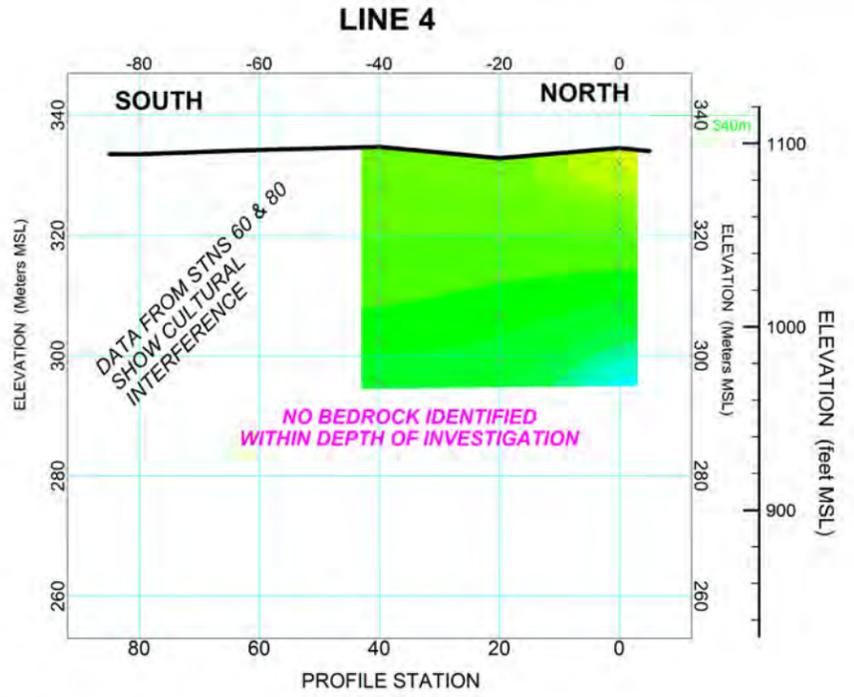
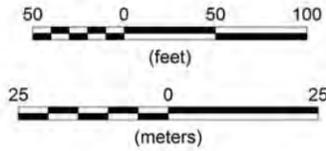
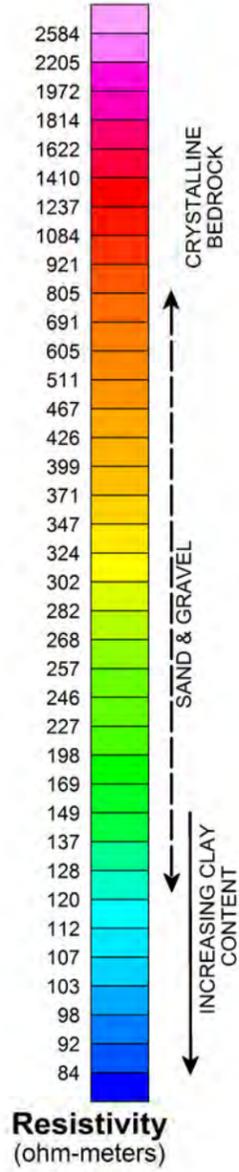


FIGURE 7

RESISTIVITY INTERPRETATION SOUTH AREA

Geophysical Investigation
National Fish Hatchery
Leavenworth, Washington

MEMORANDUM

Project No.: 140162

October 7, 2015

To: Steve Croci, Leavenworth National Fish Hatchery

cc: Mark Reiser, McMillen Jacobs Associates

From: Joe Morrice, LHG Associate Hydrogeologist
Aaron Pruitt, Senior Staff Hydrogeologist

Re: **Leavenworth National Fish Hatchery Groundwater Supply Investigations**

This memorandum provides results and analysis of groundwater supply investigations completed at the Leavenworth National Fish Hatchery (LNFH) in Chelan County, Washington. The purpose of the investigations was to assess the viability of increasing groundwater supply capacity by up to 3,000 gallons per minute (gpm), or approximately 6.7 cubic feet per second (cfs) to support LNFH operations.

This work was performed by Aspect Consulting, LLC (Aspect) under contract to McMillen Jacobs Associates.

Summary of Investigations and Results

A geophysical investigation of the LNFH property and an adjacent Chelan County-owned parcel was completed in December 2014 as an initial step to identify areas for potential groundwater supply development (Aspect, 2015). Results of that investigation identified shallow, apparently coarse-grained deposits underlying Hatchery Island as the most promising target for groundwater supply development using a horizontal collector system. The geophysical survey indicated that deeper soils at Hatchery Island and other areas of the facility are relatively finer-grained and less likely to produce the desired yields.

Based on the geophysical survey results and review of previous investigations and well construction efforts at LNFH, Aspect developed and completed the following scope of work to further assess groundwater supply options:

- Assess condition and yield of existing well PW-10, which is currently not in service, with downhole video and a constant rate aquifer test;
- Excavate test pits along potential groundwater collector laterals on Hatchery Island to confirm groundwater and soil conditions inferred from geophysical data;
- Install a shallow observation well near the potential groundwater collector to monitor seasonal changes in shallow water levels and provide a monitoring point during aquifer tests; and
- Excavate additional test pits and perform a short-term pumping test on each to assess groundwater inflow.

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A summary of the results of the investigations and recommendations are provided in the following sections. The remainder of this memorandum provides additional details on the investigations, observations, and analyses and results.

Well PW-10 Results and Recommendations

A downhole video at well PW-10 was completed followed by a constant rate pumping test using a temporary submersible pump. The video showed some incrustation and fouling of the well screen. Limited brushing of the well screen was performed prior to setting the test pump. The constant rate test results indicate that this well could sustain a maximum of about 200 gpm. This well is likely subject to drawdown interference from existing wells PW-1 and PW-4A, which will reduce yields during periods of high demand on groundwater supply at the hatchery. Under best case conditions, this is a relatively small portion of the desired approximately 3,000 gpm increase in supply capacity. Given the limited expected increased yield, we do not recommend equipping this well with a pump and tying it into the distribution system.

Hatchery Island Results and Recommendations

A total of nine test pits (TP-1 through TP-9) were excavated on Hatchery Island in May and August 2015 to observe depth to groundwater and confirm the presence of shallow, coarse-grained soils inferred from the geophysical survey. The test pits were located along potential groundwater collector lateral alignments, as shown on Figure 1. A shallow observation well (ASP-MW-1) was constructed in May 2015, and equipped with a pressure transducer and data recorder to monitor seasonal changes in groundwater elevations. Short-term pumping tests were performed at two test pits excavated in August, during low water levels, to assess groundwater inflow and support estimates of groundwater collector yields. Logs of soil and groundwater observations from the test pits and observation well are provided in Appendix A.

The test-pit investigations confirm the presence of saturated coarse-grained sand, gravel, and cobbles starting at depths of about 10 to 12 feet below ground surface (bgs) and extending to the maximum excavation depth of 20 feet bgs. The coarse-layer is overlain by finer-grained sand and sandy silt. Depth to water in the excavations was about 6 to 8 feet bgs, rising above the contact between the finer sand and silt and the coarse sand and gravel.

Water level monitoring at the observation well showed groundwater elevations decreasing over the spring and summer, with depth to water in the well falling from about 5.1 feet bgs in early May to about 11 feet bgs in early August. Hatchery Channel was kept hydrated in June, helping to maintain higher water levels beneath Hatchery Island; once the channel was drained water levels began to drop more rapidly in July. The influence of the effluent pump back test at the Hatchery Channel can also be seen in the increase in water levels by about 3 feet starting in early August.

The short-term pumping tests at the test pits sustained inflows of about 50 to 75 gpm with water level drawdown of about 2 feet from initial conditions. Extrapolating these results to a collector system consisting of three 200-foot-long laterals indicates potential yields on the order of 1 to 5 cfs. The range of estimated yields depends largely on the amount of drawdown allowed around the laterals, and by extension, the depth to which the laterals are installed. This estimate is based on analytical evaluation of the two sets of test-pit inflow data, and does not account for potential drawdown interference between collector laterals or seasonality in yields due to changes in nearby surface water elevations.

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A MODFLOW numerical groundwater flow model developed by the U.S. Bureau of Reclamation (USBR) for the LNFH was acquired from USBR and configured to further assess potential groundwater collector yields, including accounting for drawdown interference between laterals and the effects of seasonal changes in surface water levels. MODFLOW Drain cells were added to the model to represent the collector laterals; no other changes to the USBR model were performed. Two collector lateral completion depths were evaluated with the model. The first assumed collectors would be installed to about 12 to 13 feet bgs, or about 2 feet below the seasonal low water table. This model scenario indicated flows to the collector system of about 3 to 4 cfs during periods of high surface water and groundwater levels (e.g., during the spring freshet), with flows decreasing to as little as 0.5 cfs during summer through winter low water periods.

The second model scenario assumed collectors would be installed to depths of about 17 to 18 feet bgs, or about 7 feet below the seasonal low water table. This model produced peak flows to the collector system of up to 5.5 cfs during the spring freshet, with minimum flows of about 2 cfs during the lower water periods.

There is considerable uncertainty in the capacity of a groundwater collector system, due to the influence of seasonally variable surface water and groundwater elevations on yield. However, based on the observed hydrogeologic conditions, including the shallow depth to groundwater, coarse sand and gravel, and presence of groundwater recharge sources from Icicle Creek and (periodically) Hatchery Channel, a collector system on Hatchery Island is the most viable approach (versus completion of additional vertical wells) for significantly increasing the quantity of groundwater supply for the hatchery.

We recommend including a collector system as part of the Water Supply Action Plan for LNFH, and proceeding to design and permitting. The proposed collector would be completed to a depth of about 18 to 20 feet bgs with estimated, seasonally varying yields of about 2 to 5.5 cfs. The estimated yields represent a significant portion of groundwater supply shortfalls at the hatchery. Figure 13 (discussed below in the Hatchery Island Investigation section) compares estimated yields for the deeper collector with shortfalls in groundwater supply based on existing water supply well production and estimated monthly groundwater supply needs for Spring Chinook and Coho rearing. A collector appears likely to address groundwater supply shortfalls over the winter months and through early summer, but depending on flows and water levels in Icicle Creek and Hatchery Channel may only provide about half the desired water in July and August when hatchery water supply demands are high and yields may be in decline.

Well PW-10 Investigation

This section documents the field investigation and analysis of the well PW-10 pumping test and video survey. A video survey was completed first to identify any obstructions that could hinder pump placement and confirm conditions of the well. Step-rate and constant-rate pumping tests were then performed to assess well yield and water level drawdown.

Well PW-10 was installed in 1995 but never tested or brought online. The well was drilled to a total depth of 110 feet bgs, and completed with a 12-inch-diameter steel casing and 10-inch-diameter stainless-steel screen. The screened interval extends from about 75 to 100 feet bgs, tapping fine to medium sand. A copy of the driller's log for well PW-10 is included in Appendix A.

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Well Video Survey

A video survey of well PW-10 was completed by Clark Underground Survey on April 22, 2015. A CD copy of the video log is included as Appendix B.

The video survey showed the well to be intact, and the upper 12-inch diameter casing to be in good condition. The video showed some sediment accumulation in the bottom of the well. The video survey also showed portions of the screen to be encrusted with a hard material, particularly at the top and bottom of the screen interval. A screen shot example is given below.



Screen capture of video log show encrustation on well screen. Depth given is approximate depth below ground surface.

Well Testing

Pumping tests were completed by Holt Services, Inc. (Holt) in April 2015. Prior to setting a temporary test pump, Holt performed a partial rehabilitation of the well screen. The screened interval was first surged and brushed with a tight-fitting wire brush attached to a surge block. After surging and brushing for 15 minutes, the well was bailed to remove sediment from the bottom of the well. This process of scrubbing/surging was repeated once more and the well was bailed until the well was producing little sand or hard encrusted material. Following this limited screen rehabilitation, Holt installed and operated a temporary submersible pump for the pumping tests.

Step-rate Test

Aspect oversaw a step-rate pumping test of the well on April 29, 2015. Depth to water prior to the test was about 28 feet bgs, or about 47 feet above the well screen. The pump was set to flow rates

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of about 101, 195, and 250 gpm for approximately 20 minutes each, and drawdown was measured in the well with a pressure transducer and a water level indicator. The water level measurements from the well are shown on Figure 2. The 101 gpm pumping rate produced approximately 14 feet of drawdown, the 195 gpm rate produced approximately 23 feet of drawdown, and the 250 gpm rate produced approximately 32 feet of drawdown.

Constant-Rate Test

After water levels had recovered from the step-rate pumping test, a constant-rate pumping test was started. A constant pumping rate of 200 gpm was targeted based on the step-rate test results as the maximum that could be sustained without drawing down water levels far enough to dewater the pump or the screen. Well PW-10 was pumped for approximately 22 hours. After pumping ceased, water level recovery was measured for approximately two hours. Water level measurements during the constant-rate test are provided in Figure 3.

Pumping Test Analyses

Results from the step-rate and constant-rate pumping tests were analyzed to assess well efficiency and estimate transmissivity of the aquifer and predict drawdown assuming long-term pumping of well PW-10.

Well Efficiency

Results of the step-rate test were reviewed to assess well efficiency and the degree to which head losses (drawdown) at the well are associated with turbulent flow across the screen. Plotting the specific capacities (pumping rate divided by drawdown) measured at the end of each pumping step against the pumping rate for each step did not reveal any indications of increasingly turbulent flow. Instead, head losses appear to be associated with laminar flow in the aquifer approaching the well, which are typically unaffected by additional well development or rehabilitation.

Transmissivity

Results from the constant-rate pumping test were analyzed using the Cooper-Jacob straight line method (Cooper and Jacob, 1946), after correcting the drawdown data for unconfined conditions (Jacob, 1944). In the Cooper-Jacob method, drawdown is plotted against time since the start of pumping on a semi-log plot, and a straight line is drawn through the late-time data. This line is used to estimate the transmissivity using the change in drawdown (Δs) over one log cycle.

Transmissivity is estimated to be approximately 48,000 ft² per day (ft²/day). Figure 4 shows the semi-log plot and calculation.

Predicted Drawdown with Long-Term Operation

Observed late-time drawdowns in PW-10 were projected to estimate future drawdown under long-term operating conditions assuming pumping at 200 gpm. As shown on Figure 5 after one week about 29.5 feet of drawdown is expected. After one year, drawdown is only expected to be about 30.5 feet. These drawdown predictions assume that the cone of depression from PW-10 does not intersect with cone(s) of depression from other LNFH pumping well(s), nor does it account for seasonal variations in groundwater levels near Well PW-10. Either of these factors would act to reduce long-term yields from PW-10.

Active production wells PW-1 and PW-4A are located about 500 feet south and north of well PW-10, respectively, and would have the greatest potential to cause drawdown interference. These wells

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are screened in the same shallow sand and gravel aquifer as well PW-10, with similar completion depths. The degree of drawdown interference between wells will depend on pumping schedules and rates, but it is expected that drawdown from wells PW-1 and PW-4A, when in operation, will affect yields from PW-10. We expect a yield of 200 gpm could be sustained when hatchery water demands and pumping from wells PW-1 and PW-4A are low, with lower yields from well PW-10 during periods of higher water demands use of wells PW-1 and PW-4A.

Recommendation for Well PW-10

Yields from well PW-10 are limited by the low available drawdown above the well screen, moderately productive aquifer materials, and potential for drawdown interference with other active production wells. The expected maximum yield of about 200 gpm is only a small portion of the total desired increase in groundwater supply, and would be even less during periods when water demands are highest. It does not appear that additional rehabilitation of this well will improve capacity, as head losses (beyond aquifer drawdown) do not appear to be related to turbulent flow across the well screen. Given the limited expected increased yields, we do not recommend equipping this well with a pump and tying it in to the distribution system.

Hatchery Island Investigation

This section documents the field investigation and analysis of the potential for developing groundwater supply on Hatchery Island using a shallow groundwater collector system. The investigation was completed in two phases: an initial phase, including test-pit investigations to confirm soil and groundwater conditions as well as installation of an observation well; followed by a second phase of test-pit excavations with short-term pumping tests.

Field Investigations

In the initial phase of investigation, seven test pits (TP-1 through TP-7) were excavated along a conceptual groundwater collector alignment. Excavation work was performed on May 4 and 5, 2015, by Pipkin Construction of Wenatchee, Washington, under direction of an Aspect geologist. Test pits were excavated to between about 15 and 20 feet bgs. Test pit locations and the conceptual groundwater collector lateral alignment are shown on Figure 1. Logs of the test pits are provided in Appendix A. Excavated soils were placed back in the test pits at the end of each day and ground surface regraded.

A shallow observation well (ASP-MW-1) was also constructed near the conceptual collector alignment (Figure 1). The well was drilled and constructed by Holt on May 26, 2015, under direction of an Aspect geologist. The well was drilled to a total depth of 35 feet bgs, and completed with 25 feet of 2-inch-diameter schedule 40 PVC screen between 8 and 33 feet bgs and 2-inch-diameter PVC riser from 8 feet bgs to ground surface. The surface completion consists of a flush mount monument set in a concrete pad. A log of the observation well is included in Appendix A. A pressure transducer with data logger was installed in the observation well to monitor changes in water level over the summer and identify the seasonal low water level. A groundwater quality sample was collected from the observation well on August 24, 2015 and submitted to Cascade Analytical, Inc. of Wenatchee, Washington, for analysis of total phosphorous.

Two additional test pits (TP-8 and TP-9) were excavated along the lateral alignments on August 24 and 25, 2015. These test pits were excavated to about 15 to 16 feet bgs, about 8 feet below where

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water was first encountered. A dewatering pump was placed into each test pit and a short-term pumping test performed to assess groundwater inflow rates. The test pits maintained inflow rates of about 50 to 75 gpm with about 2 feet of water level drawdown.

Soil and Groundwater Conditions

The soil profile encountered in the test pits was relatively uniform across the exploration area. Soils consisted of about 8 to 10 feet of silty sand to sandy silt overlying sandy gravel and cobble. The coarse gravel and cobble layer extends to the maximum depth of test pit exploration of about 20 feet.

Depth to water in the test pits was about 6 to 10 feet, fully saturating the sandy gravel and cobble layer at all locations. Depth to water in the observation well was initially about 5 feet bgs at the end of May, but decreased over the summer as shown on Figure 6. The decrease in groundwater levels generally mimics the change in stage in Icicle Creek (measured at the USGS Station 12458000 – Icicle Creek above Snow Creek), with a couple of exceptions. During June, flows in Icicle Creek were partially diverted at Structure 2 to keep the Hatchery Channel hydrated. This appears to have helped maintain higher groundwater elevations despite the decrease in creek stage and flow. Then in August, the effluent pump-back test was performed at Hatchery Channel, resulting in an increase in groundwater elevations of about 3 feet beneath Hatchery Island.

Water Quality Results

Phosphorous was not detected above the detection limit of 0.07 milligrams per liter (mg/L) in the groundwater sample collected from observation well ASP-MW-1. Laboratory results are included in Appendix C.

Pumping Test Results and Analysis

Test pit pumping test data were used to assess inflows to the test pits at different levels of drawdown. The approach was to establish a stage-inflow relationship during recovery of water levels in TP-8 and TP-9, based on the dimensions of the pits and measured change in water level over time. After pumping ceased the change (rise) in water level was measured every 30 seconds and used with the test pit dimensions to calculate the volumetric inflow rate over that period. The instantaneous inflow rates were then plotted against the associated drawdowns to provide a continuous relationship between inflow rates and drawdown, as shown on Figures 7 and 8.

The inflow rates were then normalized to the wetted area of the test pits, to establish a specific discharge or groundwater flux per unit area at a given drawdown. The specific discharge values were then scaled by the dimensions of the collector laterals to estimate total inflows at a given average drawdown. Table 1 provides the test pit and lateral dimensions used in this analysis, and estimated inflow rates assuming average drawdown of 0.5, 1, and 2 feet along the laterals. Estimated inflow rates using this method range from about 1.3 to 2 cfs assuming 0.5 feet of average drawdown to about 2.3 to 5.6 cfs with 2 feet of average drawdown.

Potential groundwater collector yields were further evaluated using a MODFLOW numerical groundwater flow model developed by USBR for the LNFH area. The model was acquired from USBR and configured to include the conceptual collector alignment. Figure 9 provides the model extents, model grid, and boundary conditions, including the lateral locations.

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The collector laterals were represented in the model using drain cells. Two collector lateral completion depths were evaluated. The first assumed collectors would be installed to about 12 to 13 feet bgs, or about 2 feet below the seasonal low water table. Lateral (drain cell) bottom elevations were set to slope downward toward a central sump where the three laterals meet, with a drop in elevation of 1 foot over the 200-foot lateral lengths. Figure 9 provides modeled collector yields over time compared to estimated shortfalls in groundwater supply, and Figures 10 and 11 provide contoured groundwater elevations produced by the model for high and low water level conditions. This model indicated flows to the collector system of about 3 to 4 cfs during periods of high surface water and groundwater levels (e.g., during the spring freshet), with flows decreasing to as little as 0.5 cfs during summer through winter low water periods.

The second model assumed collectors would be installed to depths of about 17 to 18 feet bgs, or about 7 feet below the seasonal low water table. Figure 13 provides modeled collector yields over time compared to estimated shortfalls in groundwater supply, and Figures 14 and 15 provide contoured groundwater elevations produced by the model for high and low water level conditions. This model produced peak flows to the collector system of up to 5.5 cfs during the spring freshet, with minimum flows of about 2 cfs during the lower water periods.

Recommendations

There is uncertainty in the year-round sustained yield that would be produced from a groundwater collector, depending on seasonal groundwater elevations and the depth to which laterals can be installed. Geologic and hydrogeologic conditions are suitable for a groundwater collector – i.e., shallow depth to groundwater, saturated coarse gravel and cobbles, and nearby surface water to recharge and maintain water levels – but are not well suited for construction of vertical wells. Given the magnitude of additional groundwater yields desired at LNFH, installation of a groundwater collector to the maximum depth practicable (approximately 18 to 20 feet bgs) is the most viable option for securing sufficient additional supply.

The estimated yields represent a significant portion of groundwater supply shortfalls at the hatchery, as shown on Figure 13. A collector appears likely to provide sufficient water to address groundwater supply shortfalls over the winter months and through early summer (October/November through June), but depending on flows and water levels in Icicle Creek and Hatchery Channel, it may only provide about half the desired water in July and August when hatchery water supply demands are highest and estimated collector yields are lowest.

We recommend proceeding with design and permitting of a collector system as described above and including the same in the Water Supply Action Plan for LNFH.

Limitations

Work for this project was performed for the McMillen Jacobs Associates (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk

MEMORANDUM

Project No.: 140162

October 7, 2015

of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Attachments:

Table 1 – Groundwater Collector Inflow Analysis

Figure 1 – Groundwater Investigation Site Plan

Figure 2 – Step-Rate Pumping Test, PW-10

Figure 3 – Constant Rate Pumping Test, PW-10

Figure 4 – Cooper-Jacob Analysis, PW-10

Figure 5 – Projected Drawdown, PW-10

Figure 6 – Hydrograph, ASP-MW-1 and Icicle Creek

Figure 7 – Drawdown-Inflow Relationship, TP-8

Figure 8 – Drawdown-Inflow Relationship, TP-9

Figure 9 – MODFLOW Model Grid, Extents, and Boundary Conditions

Figure 10 – Modeled Yield - Shallow Completion

Figure 11 – Modeled Water Levels – High Seasonal Water Level and Shallow Collector

Figure 12 – Modeled Water Levels – Low Seasonal Water Level and Shallow Collector

Figure 13 – Modeled Yield - Deeper Completion

Figure 14 – Modeled Water Levels – High Seasonal Water Level and Deeper Collector

Figure 15 – Modeled Water Levels – Low Seasonal Water Level and Deeper Collector

Appendix A – Test Pit and Water Well Logs

Appendix B – Well PW-10 Video Survey

Appendix C – Laboratory Certificate of Analysis

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TABLES

Table 1 - Groundwater Collector Inflow Analysis

Project 140162 - Leavenworth National Fish Hatchery, Chelan County, WA

Parameter	Units	TP-8 Inflow Analysis	TP-9 Inflow Analysis	Notes:
Test Pit Dimensions				
Depth below Water Table	feet	7	5	Field measurements
Radius	feet	15	12.5	Field measurements
Wetted Area	sq. ft.	861	569	Calculated
Collector Gallery Dimensions and Assumptions				
Trench depth below low water	feet	5	5	Assumed
Trench width	feet	2	2	Assumed
Total lateral length	feet	600	600	Three 200 foot laterals
Inflows to Gallery with 0.5 feet of drawdown				
Saturated depth of trench	feet	4.5	4.5	Depth below water table minus drawdown
Test Pit Inflow	gpm	74	76	From Figures 7 and 8
Specific Discharge to test pit	gpm/ft ²	0.09	0.13	Inflow divided by wetted area
Total lateral trench area	sq. ft.	6600	6600	From lateral lengths and trench dimensions
Estimated yield	gpm	567	887	Trench area times specific discharge
Estimated yield	cfs	1.3	2.0	
Inflows to Gallery with 1 feet of drawdown				
Saturated depth of trench	feet	4	4	Depth below water table minus drawdown
Test Pit Inflow	gpm	111	150	Depth below water table minus drawdown
Specific Discharge to test pit	gpm/ft ²	0.13	0.26	From Figures 7 and 8
Total lateral trench area	sq. ft.	6000	6000	Inflow divided by wetted area
Estimated yield	gpm	771	1576	From lateral lengths and trench dimensions
Estimated yield	cfs	1.7	3.5	Trench area times specific discharge
Inflows to Gallery with 2 feet of drawdown				
Saturated depth of trench	feet	3	3	Depth below water table minus drawdown
Test Pit Inflow	gpm	184	296	Depth below water table minus drawdown
Specific Discharge to test pit	gpm/ft ²	0.21	0.52	From Figures 7 and 8
Total lateral trench area	sq. ft.	4800	4800	Inflow divided by wetted area
Estimated yield	gpm	1025	2494	From lateral lengths and trench dimensions
Estimated yield	cfs	2.3	5.6	Trench area times specific discharge

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10/7/2015

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Table 1

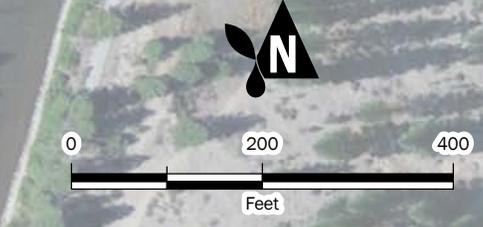
Groundwater Supply Investigations

Page 1 of 1

FIGURES



-  Production Well
-  Monitoring Well
-  Test Pit
-  Water Conveyance and Electrical Power Lines
-  Infiltration Gallery Lateral
-  Area Proposed for Soil and Groundwater Exploration



Groundwater Investigation Site Plan

Hatchery Island Groundwater Investigation Memo
Leavenworth National Fish Hatchery
Leavenworth, Washington

	OCT-2015	BY: JM / EAC	FIGURE NO. 1
	<small>PROJECT NO.</small> 140162-04-002	<small>REVISED BY:</small> RAP/EAC	

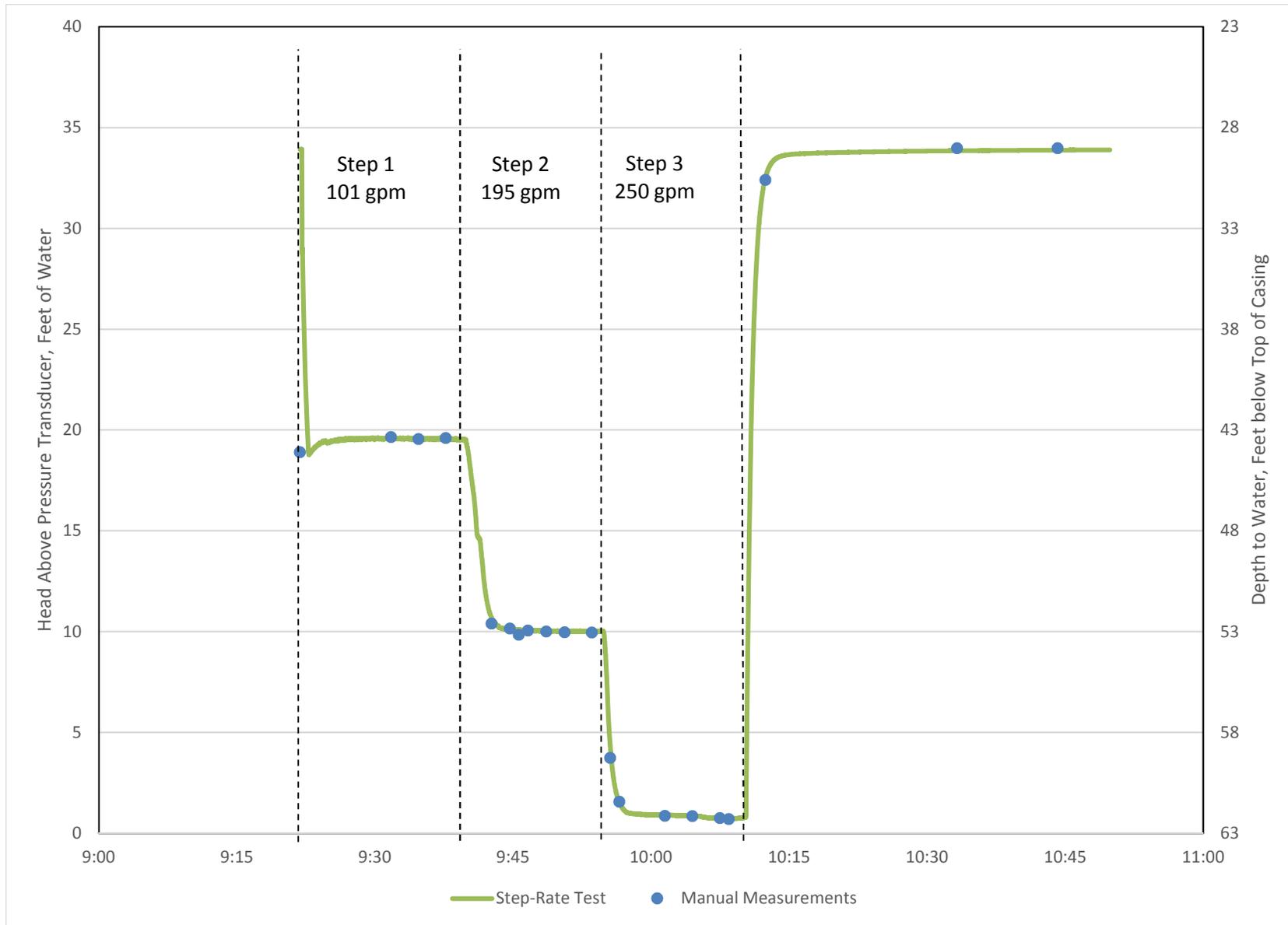


Figure 2

Step-Rate Pumping Test, PW-10

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Groundwater Supply Investigations

Leavenworth National Fish Hatchery, Chelan County, WA

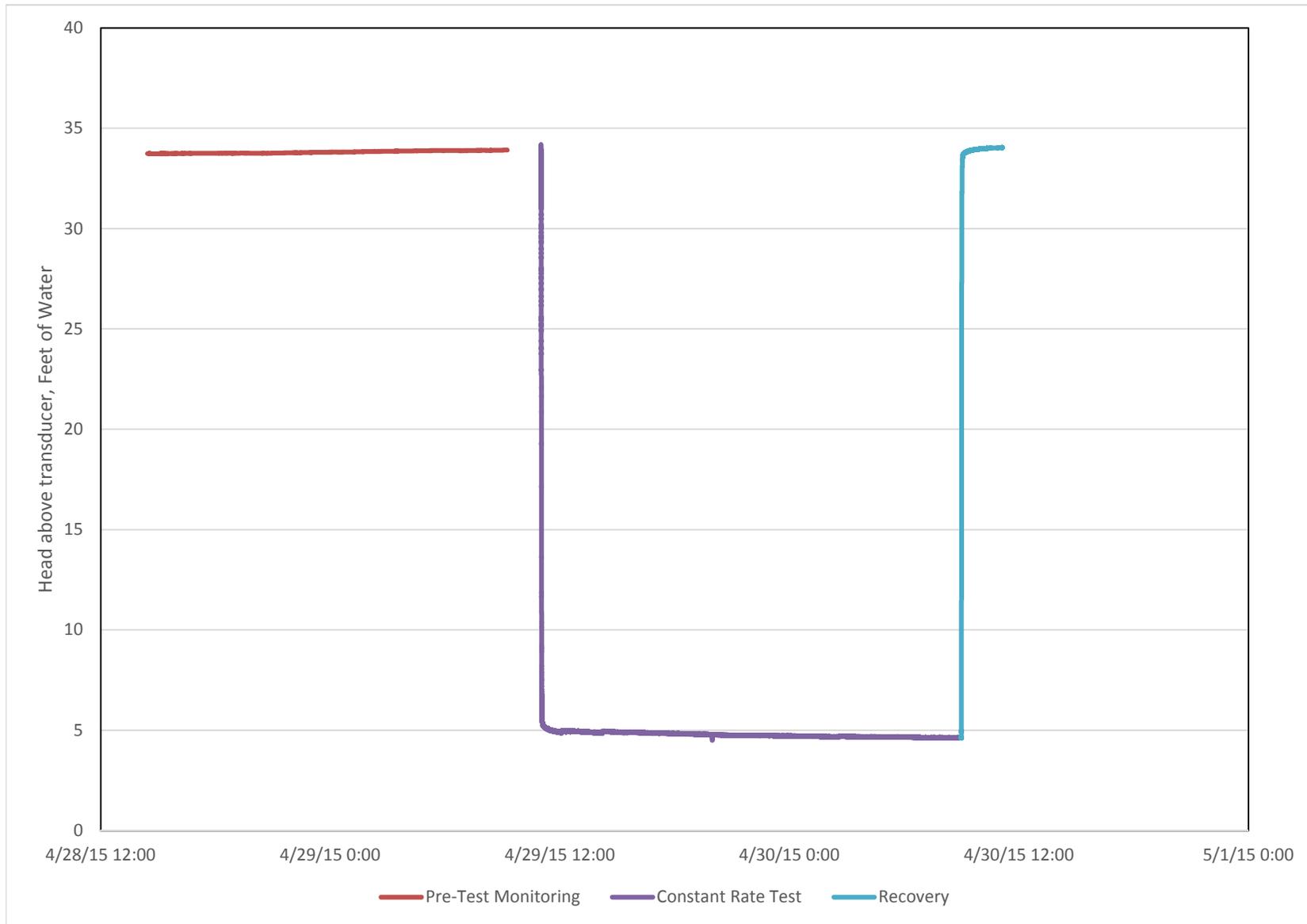


Figure 3

Constant Rate Pumping Test, PW-10

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10/2/2015

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Groundwater Supply Investigations

Leavenworth National Fish Hatchery, Chelan County, WA

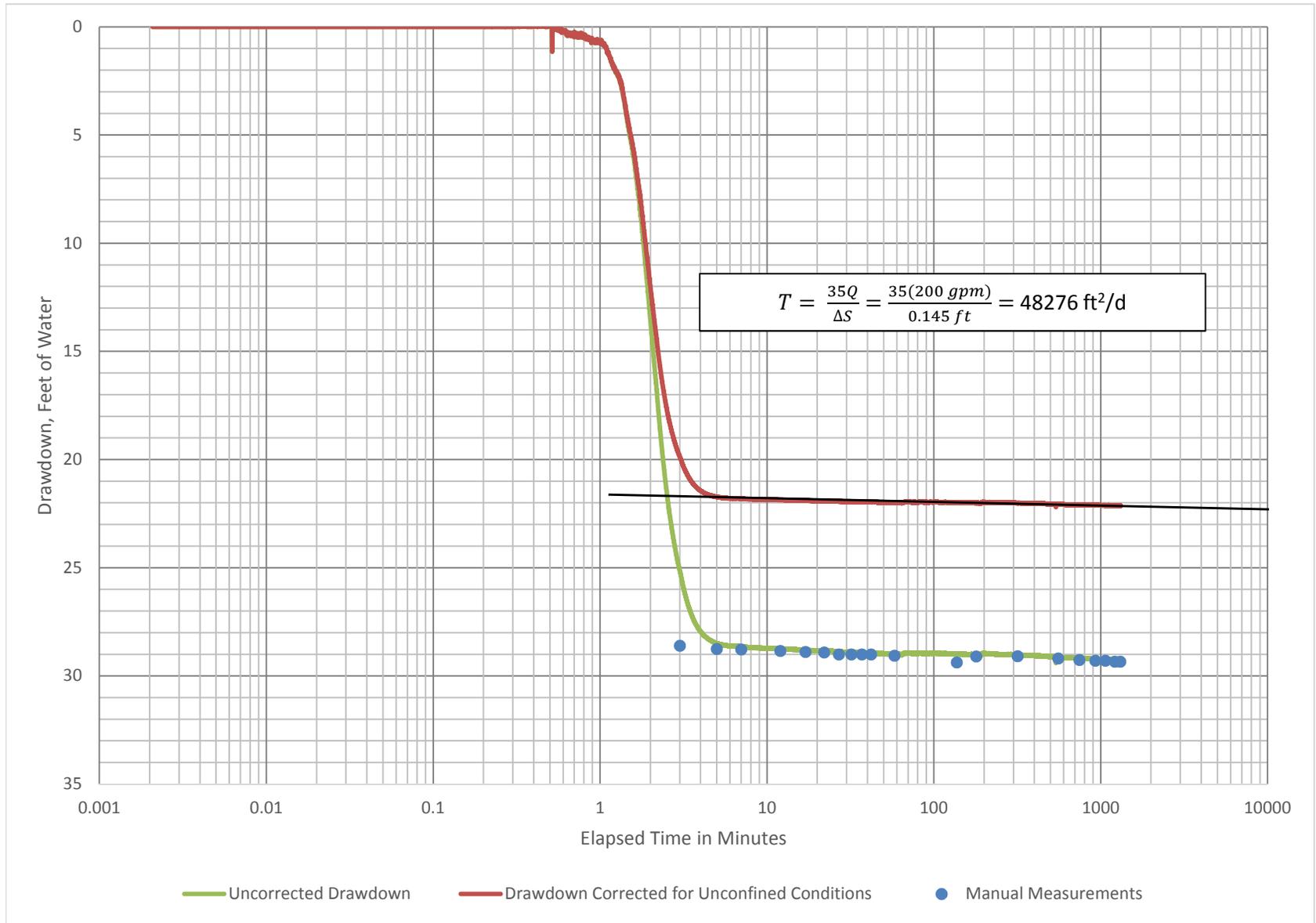


Figure 4

Cooper-Jacob Analysis, PW-10

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10/2/2015

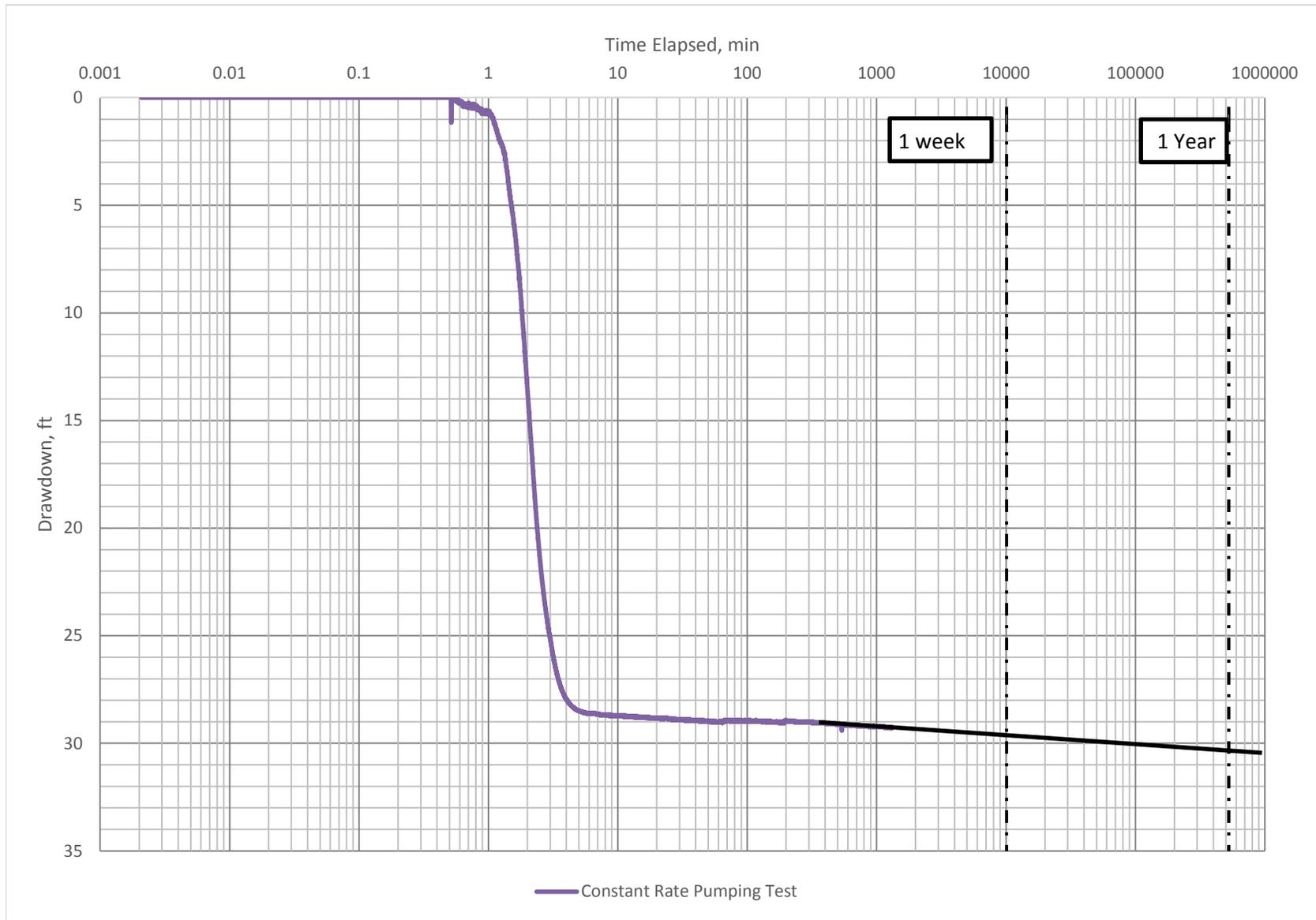


Figure 5

Projected Drawdown, PW-10

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10/2/2015

S:\Chelan County Natural Resources Dept\Project 120045\Leavenworth National Fish Hatchery\Report Drafts\LNFH Groundwater Investigations\Figure 5 - Projected Drawdown, PW-10

Groundwater Supply Investigations

Leavenworth National Fish Hatchery, Chelan County, WA

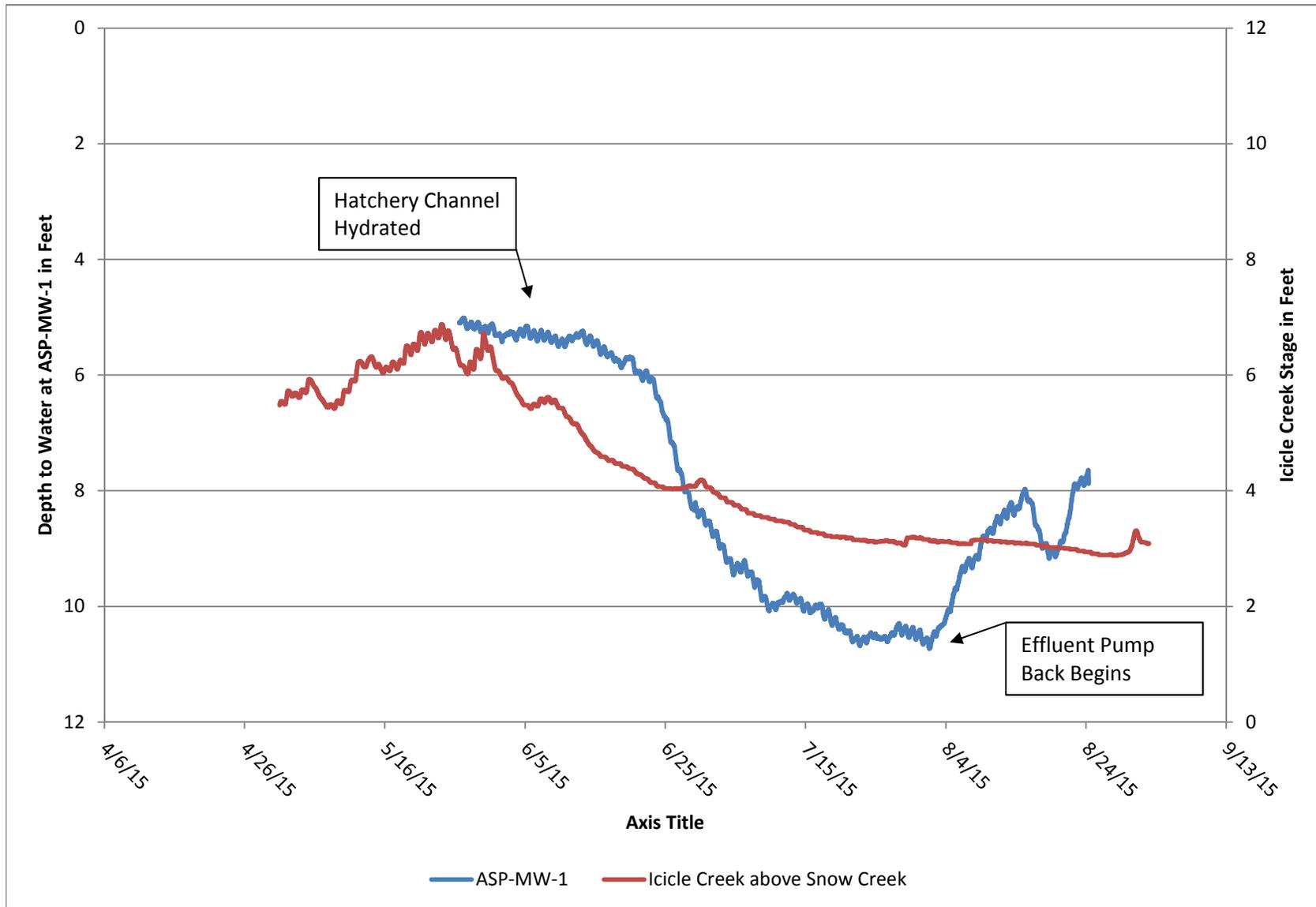


Figure 6

Hydrograph, ASP-MW-1 and Icicle Creek

Aspect Consulting

10/2/2015

W:\140162 McMillen Hatcheries\Deliverables\LNFH Water Supply Memo\DRAFT\Figures and Tables\Figures

Groundwater Supply Investigations

Leavenworth National Fish Hatchery, Chelan County, WA

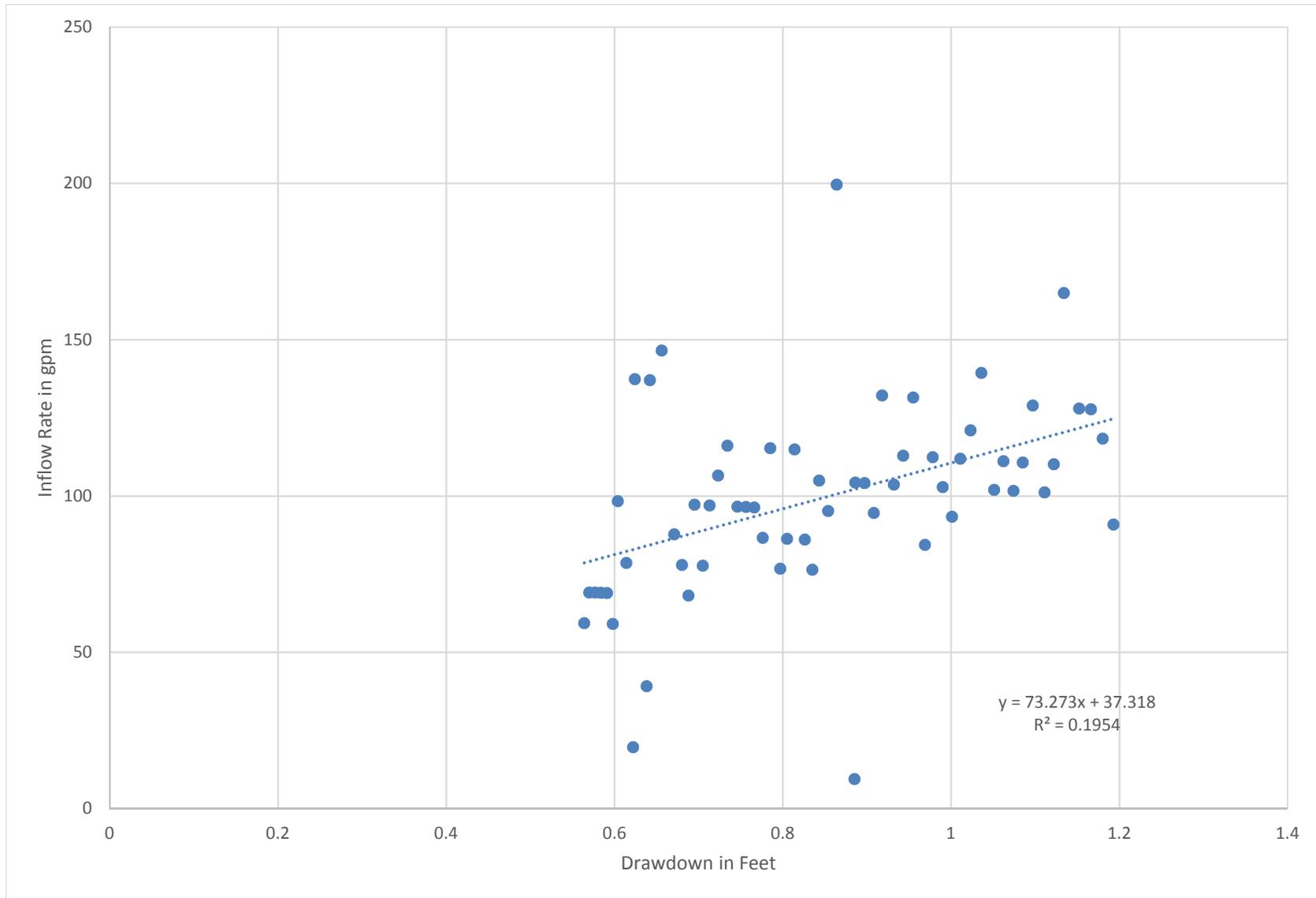


Figure 7

Drawdown-Inflow Relationship, TP-8

Aspect Consulting

10/2/2015

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Groundwater Supply Investigations

Leavenworth National Fish Hatchery, Chelan County, WA

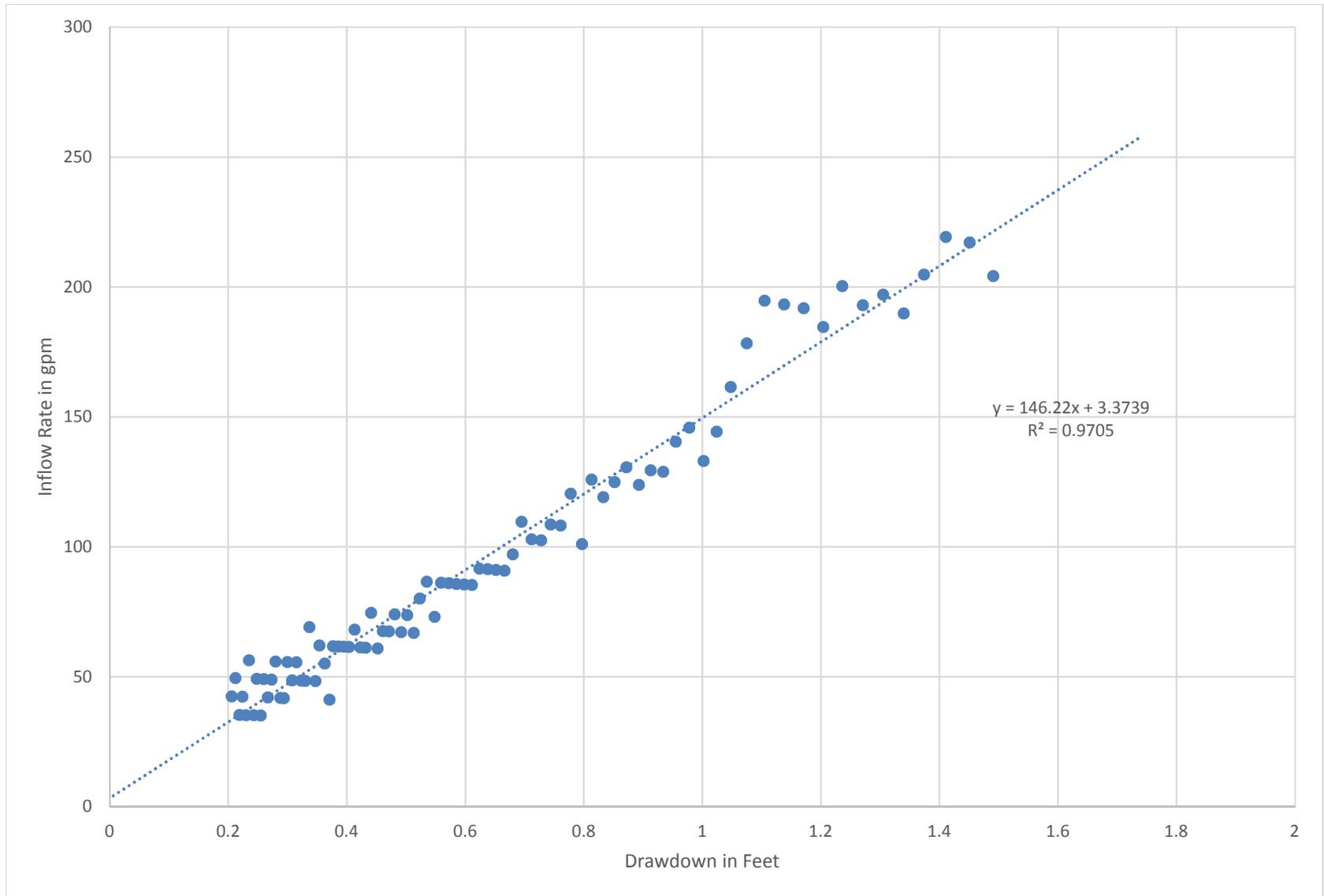


Figure 8

Drawdown-Inflow Relationship, TP-9

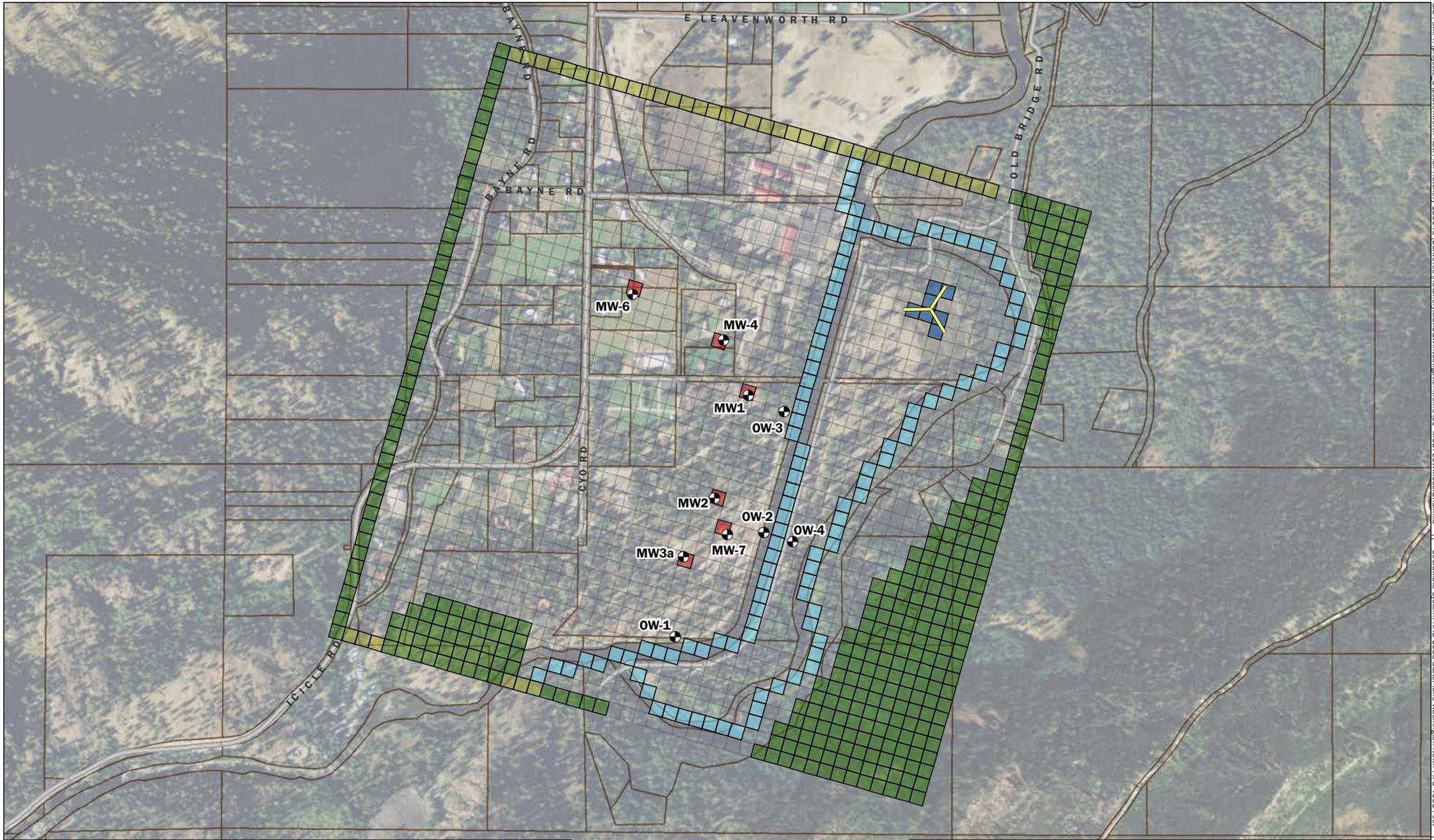
Aspect Consulting

10/2/2015

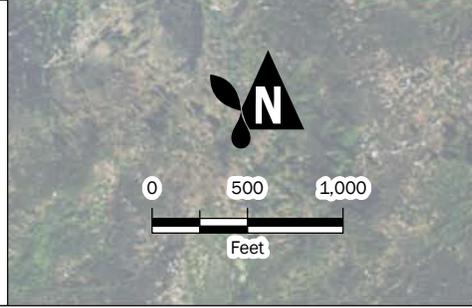
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Groundwater Supply Investigations

Leavenworth National Fish Hatchery, Chelan County, WA



 Target Well	 Active	 River
 Infiltration Gallery Lateral	 Well	 No flow
 Tax Parcel	 Drain	 GHB



**MODFLOW Model Grid, Extents,
and Boundary Conditions**

Hatchery Island Groundwater Investigation Memo
Leavenworth National Fish Hatchery
Leavenworth, Washington

	OCT-2015	BY: AHP / RAP	FIGURE NO. 9
	PROJECT NO. 140162-04-002	REVISED BY: EAC	

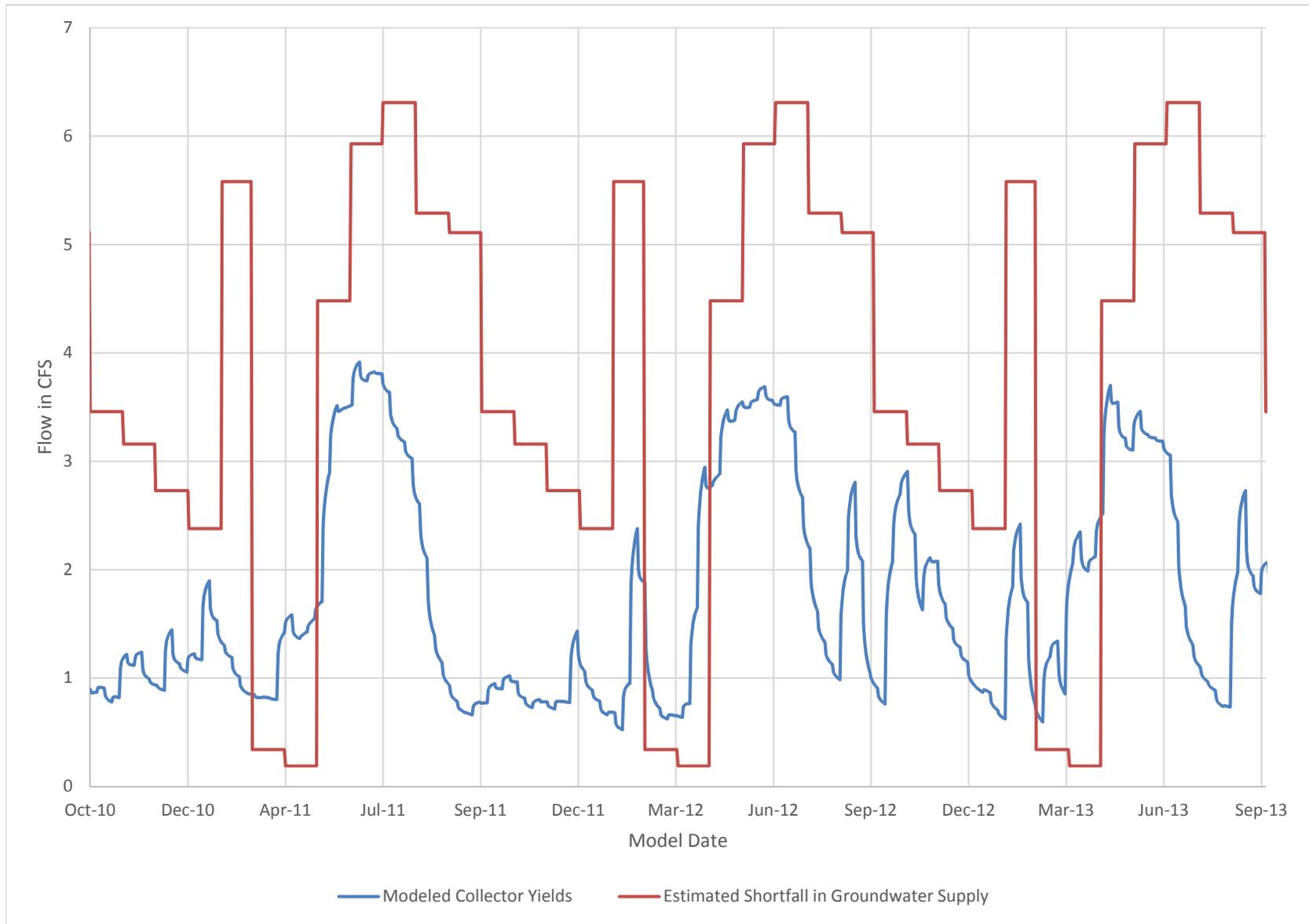


Figure 10

Modeled Yield - Shallow Completion

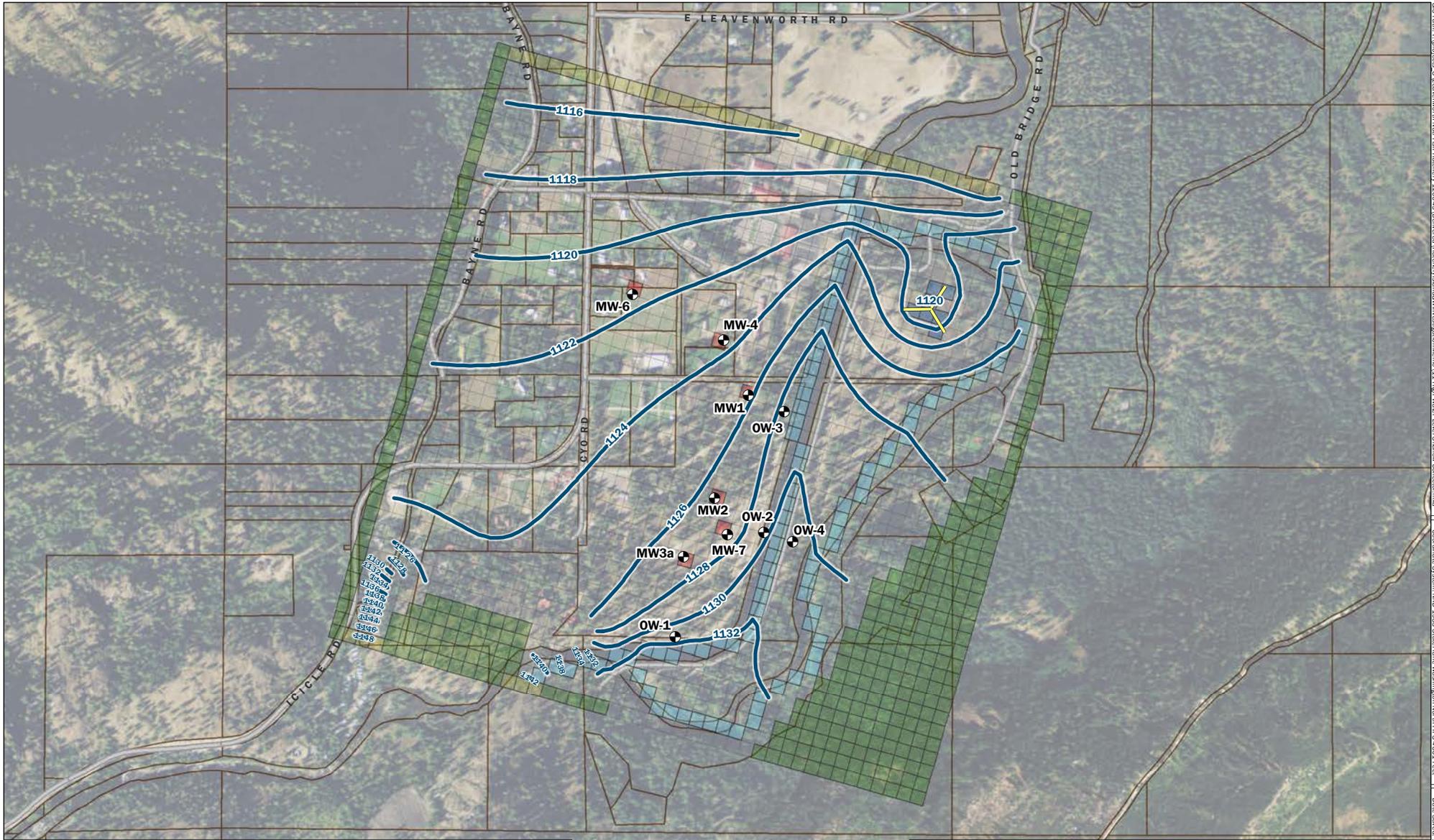
Aspect Consulting

10/2/2015

V:\120045 Chelan County\Deliverables\LNfH GW Investigations\LNfH Water Supply Memo DRAFT\Figures and Tables\Figures

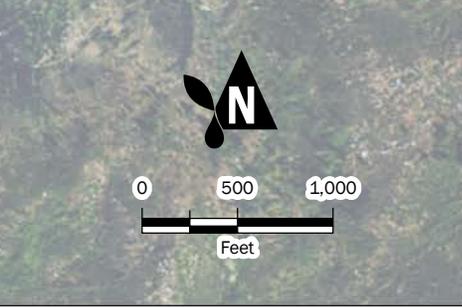
Groundwater Supply Investigations

Leavenworth National Fish Hatchery, Chelan County, WA



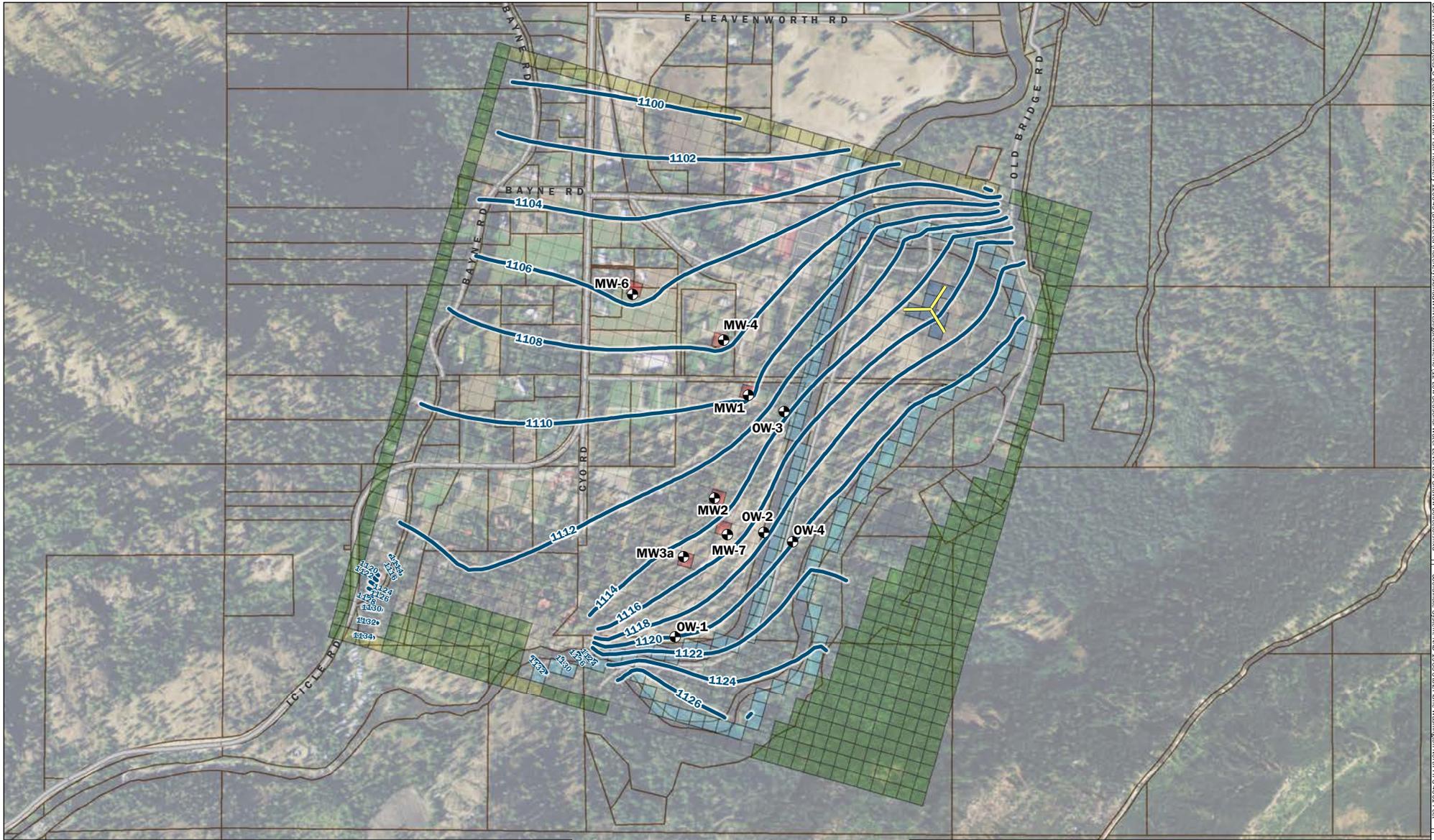
Grid Code

Target Well	Active	River
High Water Level Contours with 10' Deep Drains	Well	No flow
Infiltration Gallery Lateral	Drain	GHB
Tax Parcel		

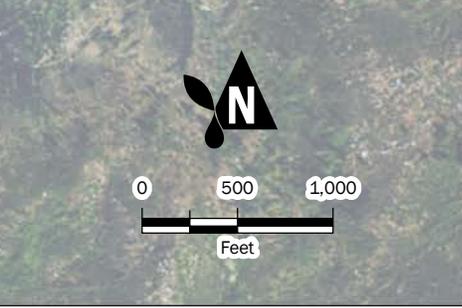


Modeled Water Levels - High Seasonal Water Level and Shallow Collector
 Hatchery Island Groundwater Investigation Memo
 Leavenworth National Fish Hatchery
 Leavenworth, Washington

	OCT-2015	BY: AHP / RAP	FIGURE NO. 11
	PROJECT NO. 140162-04-002	REVISED BY: EAC	



	Target Well		Active		River
	Low Water Level Contours with 10' Deep Drains		Well		No flow
	Infiltration Gallery Lateral		Drain		GHB
	Tax Parcel	Grid Code			



Modeled Water Levels – Low Seasonal Water Level and Shallow Collector

Hatchery Island Groundwater Investigation Memo
Leavenworth National Fish Hatchery
Leavenworth, Washington

	OCT-2015	BY: AHP / RAP	FIGURE NO. 12
	<small>PROJECT NO.</small> 140162-04-002	<small>REVISED BY:</small> EAC	

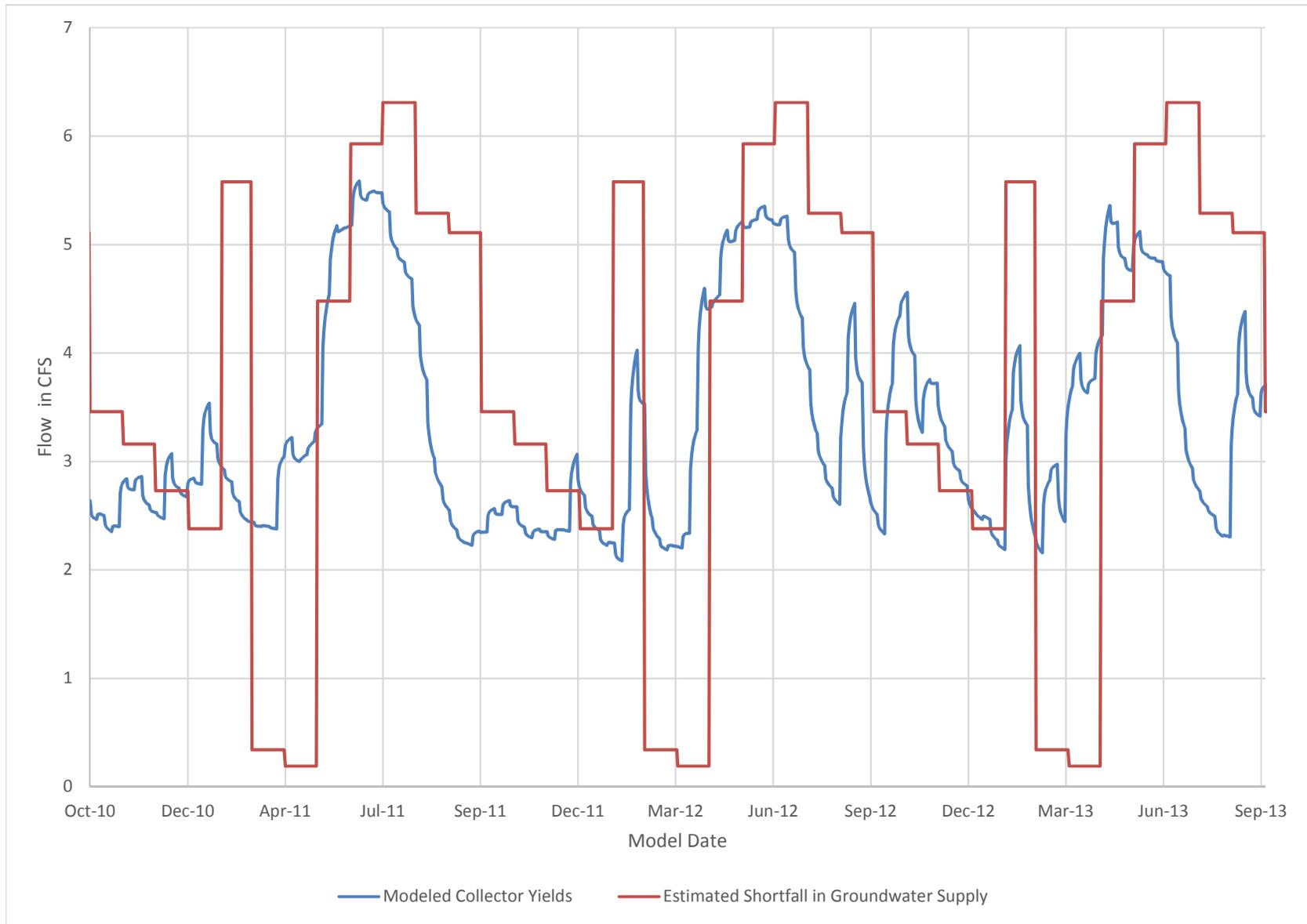


Figure 13

Modeled Yield - Deeper Completion

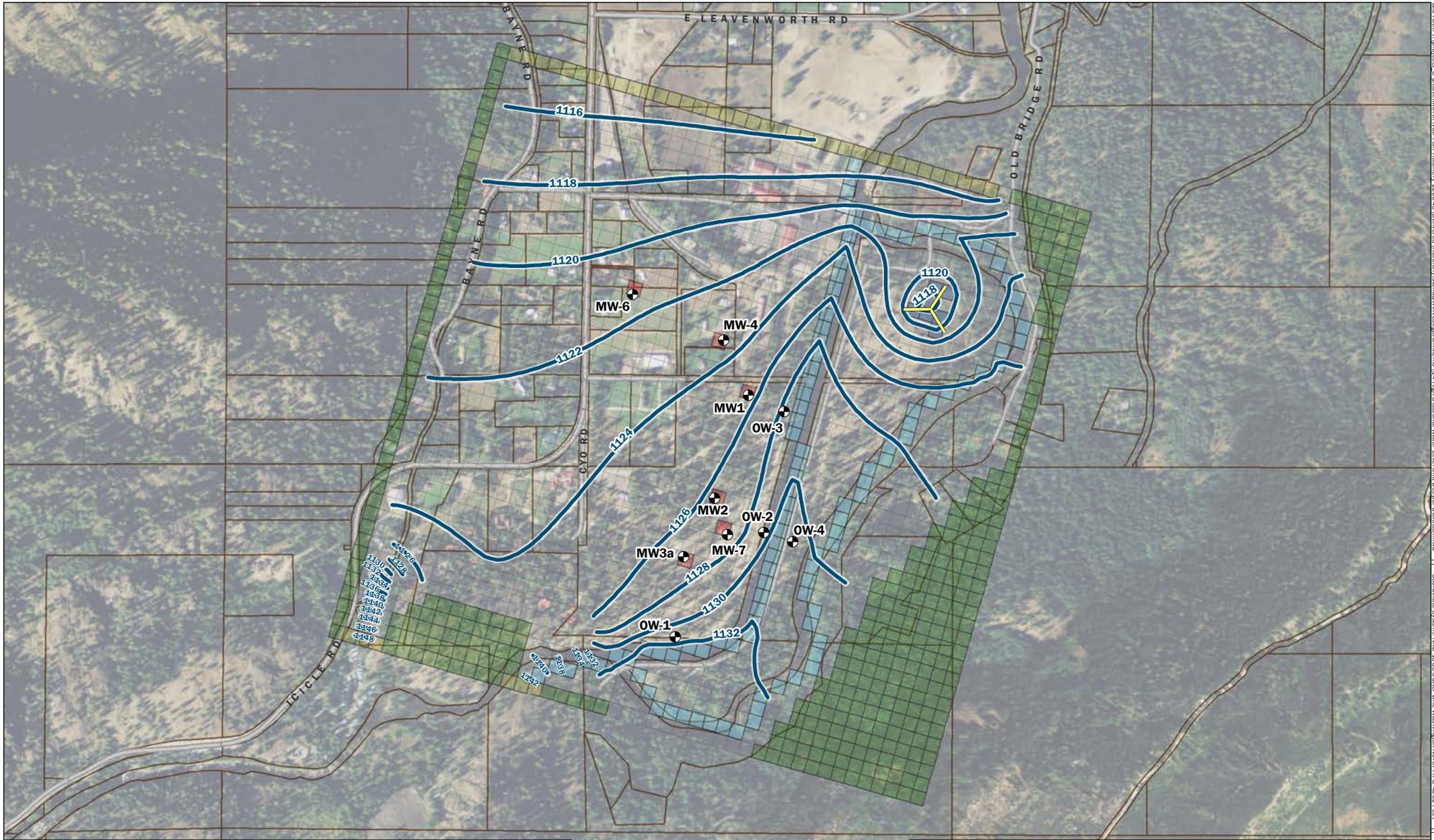
Aspect Consulting

10/2/2015

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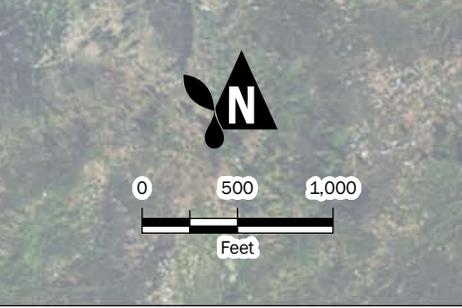
Groundwater Supply Investigations

Leavenworth National Fish Hatchery, Chelan County, WA



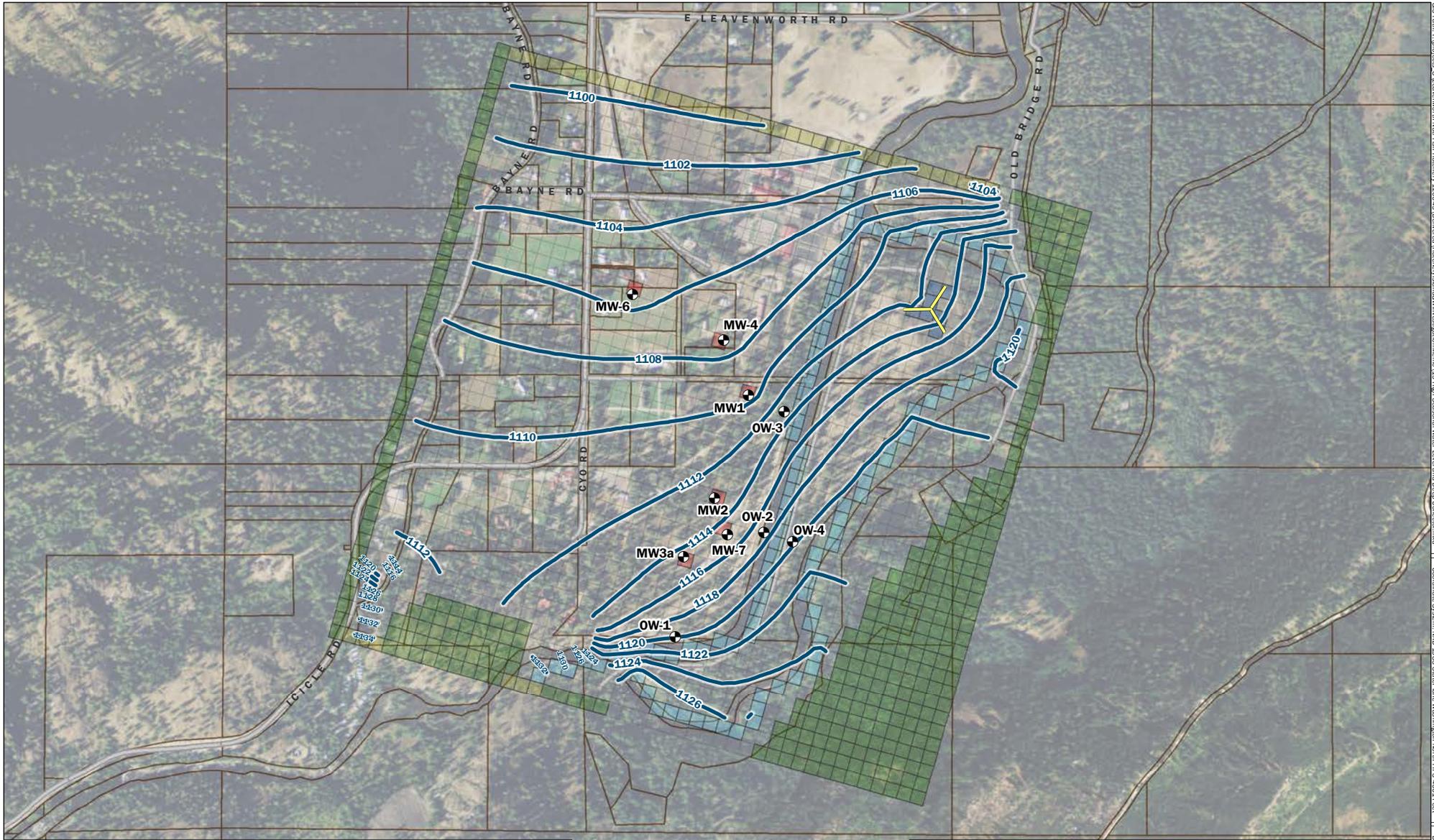
Grid Code

Target Well	Active	River
High Water Level Contours with 15' Deep Drains	Well	No flow
Infiltration Gallery Lateral	Drain	GHB
Tax Parcel		



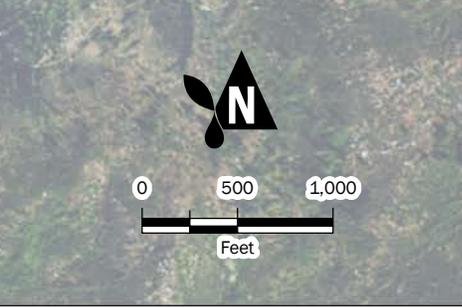
Modeled Water Levels – High Seasonal Water Level and Deeper Collector
 Hatchery Island Groundwater Investigation Memo
 Leavenworth National Fish Hatchery
 Leavenworth, Washington

	OCT-2015	BY: AHP / RAP	FIGURE NO. 14
	PROJECT NO. 140162-04-002	REVISED BY: EAC	



Grid Code

Target Well	Active	River
Low Water Level Contours with 15' Deep Drains	Well	No flow
Infiltration Gallery Lateral	Drain	GHB
Tax Parcel		



Modeled Water Levels – High Seasonal Water Level and Deeper Collector
 Hatchery Island Groundwater Investigation Memo
 Leavenworth National Fish Hatchery
 Leavenworth, Washington

	OCT-2015	BY: AHP / RAP	FIGURE NO. 15
	PROJECT NO. 140162-04-002	REVISED BY: EAC	

GIS Data: Projects & Leavenworth Nat Fish Hatchery 120045; Delivered: HatcheryIslandGroundwaterInvestigationMemo_V15_High_Seasonal_Water_Level_and_Deep_Collector.mxd | Coordinate System: NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet | Date Stamp: 10/9/2015 | User: kcrumbaker | Print Date: 10/9/2015

APPENDIX A

Test Pit and Water Well Logs

Soil Classification		Terms Describing Relative Density and Consistency	
		Density	SPT ⁽²⁾ blows/foot
Coarse-Grained Soils - More than 50% Retained on No. 200 Sieve	Gravels - More than 50% ⁽¹⁾ of Coarse Fraction Retained on No. 4 Sieve	Well-graded gravel and gravel with sand, little to no fines	Very Loose 0 to 4
	GP	Poorly-graded gravel and gravel with sand, little to no fines	Loose 4 to 10
	GM	Silty gravel and silty gravel with sand	Medium Dense 10 to 30
	GC	Clayey gravel and clayey gravel with sand	Dense 30 to 50
	SW	Well-graded sand and sand with gravel, little to no fines	Very Dense >50
	SP	Poorly-graded sand and sand with gravel, little to no fines	
Fine-Grained Soils - 50% ⁽¹⁾ or More of Coarse Fraction Passes No. 4 Sieve	Sands - 50% ⁽¹⁾ or More of Coarse Fraction Passes No. 4 Sieve	Silty sand and silty sand with gravel	
	SM	Clayey sand and clayey sand with gravel	
	SC	Silt, sandy silt, gravelly silt, silt with sand or gravel	
	ML	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay	
	CL	Organic clay or silt of low plasticity	
	OL	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt	
Highly Organic Soils	PT	Peat, muck and other highly organic soils	

Component Definitions	
Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

Estimated Percentage		Moisture Content
Percentage by Weight	Modifier	
<5	Trace	Dry - Absence of moisture, dusty, dry to the touch
5 to 15	Slightly (sandy, silty, clayey, gravelly)	Slightly Moist - Perceptible moisture
15 to 30	Sandy, silty, clayey, gravelly	Moist - Damp but no visible water
30 to 49	Very (sandy, silty, clayey, gravelly)	Very Moist - Water visible but not free draining
		Wet - Visible free water, usually from below water table

Symbols	
Sampler Type	Description
2.0" OD Split-Spoon Sampler (SPT)	Continuous Push
Bulk sample	Non-Standard Sampler
Grab Sample	3.0" OD Thin-Wall Tube Sampler (including Shelby tube)
	Portion not recovered

(1) Percentage by dry weight	(5) Combined USCS symbols used for fines between 5% and 15% as estimated in General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(2) (SPT) Standard Penetration Test (ASTM D-1586)	
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)	
(4) Depth of groundwater	ATD = At time of drilling BGS = below ground surface

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

	<h1>Exploration Log Key</h1>	DATE:	PROJECT NO.
		DESIGNED BY:	
		DRAWN BY:	FIGURE NO.
		REVISED BY:	A-1



Exploration/Test Pit

Project Number
140162

Exploration Number
TP-1

Sheet
1 of 1

Project Name: Leavenworth Fish Hatchery Ground Surface Elev
 Location: Leavenworth, WA
 Contractor/Method: Pipkin Construction / Excavator Depth to Water (ft BGS) 10 ATD
 Sampling Method: Test Pit Start/Finish Date 5/4/2015

Depth / Elevation (feet)	Sample Type/ID	Tests/Remarks	Material Type	Description	Depth (ft)
				Grass	
				Loose, slightly moist, brown, slightly silty SAND (SP); fine to medium sand, subangular, micaceous, trace rounded cobbles	
				Trace roots down to ~5 ft BGS	
5	GRAB	TP1-5			5
10	GRAB	TP1-10		Loose, wet, light brown SAND (SP); medium to coarse micaceous subangular sand	10
				Relatively quick flow in sand above cobbly unit	
				Loose, wet, gray-brown, sandy GRAVEL (GP); coarse subrounded gravel to cobbles	
15	GRAB	TP1-15		Bottom of test pit at 15 ft BGS	15
				15 ft sample may not be representative of grain size. Too much slough in the test pit.	
				Test pit backfilled	

TEST PIT LEAVENWORTH FISH HATCHERY.GPJ September 24, 2015

Sampler Type:

- No Recovery
- Grab Sample

- Static Water Level
- Water Level (ATD)
- Groundwater Seepage (ATD)

Logged by: AHP

Approved by: JNM

Figure No. A - 2



Exploration/Test Pit

Project Number
140162

Exploration Number
TP-2

Sheet
1 of 1

Project Name: Leavenworth Fish Hatchery Ground Surface Elev
 Location: Leavenworth, WA
 Contractor/Method: Pipkin Construction / Excavator Depth to Water (ft BGS) 9 ATD
 Sampling Method: Test Pit Start/Finish Date 5/4/2015

Depth / Elevation (feet)	Sample Type/ID	Tests/Remarks	Material Type	Description	Depth (ft)
				Grass	
				Loose, dry, light brown, silty SAND (SM); fine sand	
				Becomes slightly moist, brown at ~2 ft BGS	
5	GRAB	TP2-3			5
				Loose, moist, light brown, gravelly SAND to sandy GRAVEL (SP-GP); fine to coarse subrounded gravel, medium to coarse subangular sand	
	GRAB	TP2-8			
10				Becomes sandy GRAVEL (GP); coarse gravel to cobbles	10
				Bottom of test pit at 15 ft BGS	
				Water level came up ~9 inches in 15 minutes to top of saturated zone	
				Test pit backfilled	
15	GRAB	TP2-14			15

Sampler Type:

- No Recovery
- Grab Sample

- Static Water Level
- Water Level (ATD)
- Groundwater Seepage (ATD)

Logged by: AHP

Approved by: JNM

Figure No. A - 3

TEST PIT LEAVENWORTH FISH HATCHERY.GPJ September 24, 2015



Exploration/Test Pit

Project Number
140162

Exploration Number
TP-3

Sheet
1 of 1

Project Name: Leavenworth Fish Hatchery

Ground Surface Elev _____

Location: Leavenworth, WA

Contractor/Method: Pipkin Construction / Excavator

Depth to Water (ft BGS) 10 ATD

Sampling Method: Test Pit

Start/Finish Date 5/4/2015

Depth / Elevation (feet)	Sample Type/ID	Tests/Remarks	Material Type	Description	Depth (ft)
				Grass	
				Loose, dry, light brown, silty SAND (SM); fine sand, roots	
				Becomes slightly moist, darker	
5				Becomes moist	5
	GRAB	TP3-7			
10				Becomes wet	10
				Wet, red brown - gray, sandy GRAVEL (GP); coarse gravel, subangular to subrounded cobbles, trace small boulders, predominantly clast supported	
15	GRAB	TP3-15			15
				Bottom of test pit at 16 ft BGS	
				Waterlevel filled in ~8 inches in 10 minutes to top of saturated zone	
				Test pit backfilled	

Sampler Type:

- No Recovery
- Grab Sample

- Static Water Level
- Water Level (ATD)
- Groundwater Seepage (ATD)

Logged by: **AHP**

Approved by: **JNM**

Figure No. **A - 4**

TEST PIT LEAVENWORTH FISH HATCHERY.GPJ September 24, 2015



Exploration/Test Pit

Project Number
140162

Exploration Number
TP-4

Sheet
1 of 1

Project Name: Leavenworth Fish Hatchery

Ground Surface Elev _____

Location: Leavenworth, WA

Contractor/Method: Pipkin Construction / Excavator

Depth to Water (ft BGS) 6 ATD

Sampling Method: Test Pit

Start/Finish Date 5/4/2015

Depth / Elevation (feet)	Sample Type/ID	Tests/Remarks	Material Type	Description	Depth (ft)
				Grass	
				Loose, dry to slightly moist, light brown, silty SAND (SM); fine sand, trace roots down to ~2 ft BGS	
				Becomes slightly moist	
5				Becomes wet	5
	GRAB	TP4-6			
				Loose, wet, gray, sandy GRAVEL (GP); coarse subrounded gravel to cobbles, medium to coarse subangular gravel	
	GRAB	TP4-8			
10				Coarsening downward, more cobbles, clast supported	10
15	GRAB	TP4-15			15
				Bottom of test pit at 16 ft BGS	
				Filled in with water very quickly, as quickly as material was pulled out.	
				Test pit backfilled	

Sampler Type:

- No Recovery
- Grab Sample

- Static Water Level
- Water Level (ATD)
- Groundwater Seepage (ATD)

Logged by: **AHP**

Approved by: **JNM**

Figure No. **A - 5**

TEST PIT LEAVENWORTH FISH HATCHERY.GPJ September 24, 2015



Exploration/Test Pit

Project Number
140162

Exploration Number
TP-5

Sheet
1 of 1

Project Name: Leavenworth Fish Hatchery

Ground Surface Elev _____

Location: Leavenworth, WA

Contractor/Method: Pipkin Construction / Excavator

Depth to Water (ft BGS) _____

8.5 ATD

Sampling Method: Test Pit

Start/Finish Date _____

5/5/2015

Depth / Elevation (feet)	Sample Type/ID	Tests/Remarks	Material Type	Description	Depth (ft)
				Grass	
				Loose, dry, light brown, silty SAND (SM); fine sand, roots down to ~2 ft BGS	
				Becomes slightly moist	
5					5
	GRAB	TP5-7			
				Loose, wet, gray-brown, sandy GRAVEL (GW); fine to coarse subrounded gravel to cobbles, medium to coarse sand	
10					10
				Fining upward - becomes sandy GRAVEL (GP); coarse gravel, cobbles, few boulders, coarse sand, gravel supported	
15					15
				Bottom of test pit at 16 ft BGS	
				Filled in ~8 inches in 10 min to top of saturated zone	
				Test pit backfilled	

Sampler Type:

- No Recovery
- Grab Sample

- Static Water Level
- Water Level (ATD)
- Groundwater Seepage (ATD)

Logged by: **AHP**

Approved by: **JNM**

Figure No. **A - 6**

TEST PIT LEAVENWORTH FISH HATCHERY.GPJ September 24, 2015



Exploration/Test Pit

Project Number
140162

Exploration Number
TP-6

Sheet
1 of 1

Project Name: Leavenworth Fish Hatchery

Ground Surface Elev _____

Location: Leavenworth, WA

Contractor/Method: Pipkin Construction / Excavator

Depth to Water (ft BGS) 9.5 ATD

Sampling Method: Test Pit

Start/Finish Date 5/5/2015

Depth / Elevation (feet)	Sample Type/ID	Tests/Remarks	Material Type	Description	Depth (ft)
				Grass	
				Loose, dry, light brown, silty SAND (SM); fine sand, root to ~2 ft BGS, trash to ~1 ft BGS	
				Becomes slightly moist	
5					5
	GRAB	TP6-6			
	GRAB	TP6-8.5		Loose, slightly moist, light brown, gravelly SAND (SP); fine to coarse gravel, few cobbles	
				Becomes wet	
10				Fining upward - becomes sandy GRAVEL (GP); medium to coarse sand, coarse gravel, cobbles	10
				More cobbles and boulders	
15					15
	GRAB	TP6-16		Bottom of test pit at 16 ft BGS	
				Filled in to top of saturated zone very quickly	
				Test pit backfilled	

Sampler Type:

- No Recovery
- Grab Sample

- Static Water Level
- Water Level (ATD)
- Groundwater Seepage (ATD)

Logged by: **AHP**

Approved by: **JNM**

Figure No. **A - 7**

TEST PIT LEAVENWORTH FISH HATCHERY.GPJ September 24, 2015



Exploration/Test Pit

Project Number
140162

Exploration Number
TP-7

Sheet
1 of 1

Project Name: Leavenworth Fish Hatchery

Ground Surface Elev _____

Location: Leavenworth, WA

Contractor/Method: Pipkin Construction / Excavator

Depth to Water (ft BGS) 10 ATD

Sampling Method: Test Pit

Start/Finish Date 5/5/2015

Depth / Elevation (feet)	Sample Type/ID	Tests/Remarks	Material Type	Description	Depth (ft)
				Grass	
				Loose, dry, light brown, silty SAND (SM); fine sand, roots down to ~1.5 ft BGS, trace cobbles, trash	
5					5
	GRAB	TP7-7		loose, moist, light brown, gravelly sand (SP); medium to coarse sand, fine subrounded gravel	
				~4 inch thick red sand layer 8.5-9.0 ft BGS	
10					10
	GRAB	TP7-11		Loose, wet, brown, sandy GRAVEL (GP); medium to coarse subangular sand, predominantly coarse subrounded gravel and cobbles with some fine gravel	
15					15
	GRAB	TP7-18			
20				Bottom of test pit at 20 ft BGS	20
				Filled in with water ~6 inches to top of saturated zone in ~ 5 minutes	
				Test pit backfilled	

Sampler Type:

- No Recovery
- Grab Sample

- Static Water Level
- Water Level (ATD)
- Groundwater Seepage (ATD)

Logged by: **AHP**

Approved by: **JNM**

Figure No. **A - 8**

TEST PIT LEAVENWORTH FISH HATCHERY.GPJ September 24, 2015



Exploration/Test Pit

Project Number
140162

Exploration Number
TP-8

Sheet
1 of 1

Project Name: Leavenworth Fish Hatchery Ground Surface Elev
 Location: Leavenworth, WA
 Contractor/Method: Pipkin Construction / Excavator Depth to Water (ft BGS) 7.5 ATD
 Sampling Method: Test Pit Start/Finish Date 8/24/2015

Depth / Elevation (feet)	Sample Type/ID	Tests/Remarks	Material Type	Description	Depth (ft)
1			Grass	Loose, dry to slightly moist, brown, slightly sandy SILT (ML); fine sand	1
2					2
3					3
4					4
5					5
6			Loose, slightly moist to moist, brown, silty SAND (SM); F-M sand		6
7					7
8			Loose, wet, brown, sandy GRAVEL (GP); large gravel, cobbles, boulders		8
9					9
10					10
11					11
12					12
13					13
14					14



TEST PIT LEAVENWORTH FISH HATCHERY.GPJ September 24, 2015

Sampler Type:

No Recovery

Static Water Level

Water Level (ATD)

Groundwater Seepage (ATD)

Logged by: AHP

Approved by: JNM

Figure No. A - 9



Exploration/Test Pit

Project Number
140162

Exploration Number
TP-9

Sheet
1 of 1

Project Name: Leavenworth Fish Hatchery

Ground Surface Elev _____

Location: Leavenworth, WA

Contractor/Method: Pipkin Construction / Excavator

Depth to Water (ft BGS) _____

8 ATD

Sampling Method: Test Pit

Start/Finish Date _____

8/25/2015

Depth / Elevation (feet)	Sample Type/ID	Tests/Remarks	Material Type	Description	Depth (ft)
				Grassy topsoil Loose, dry to slightly moist, light brown, slightly sandy silt (ML), Fine sand, "fluffy", cobbles, 4-5" on metal refuse	
5				Loose, slightly moist to moist, light brown and black, silty SAND (SM); F-M sand	5
				Wet, light brown, sandy GRAVEL (GP); predominantly fine gravel with coarse gravel, cobbles, F-M sand	
10					10
15					15

Sampler Type:

No Recovery

Static Water Level

Water Level (ATD)

Groundwater Seepage (ATD)

Logged by: **AHP**

Approved by: **JNM**

Figure No. **A - 10**

TEST PIT LEAVENWORTH FISH HATCHERY.GPJ September 24, 2015



Monitoring Well Construction Log

Project Number
140162

Well Number
Asp-MW-1

Sheet
1 of 2

Project Name: Leavenworth Fish Hatchery

Ground Surface Elev. _____

Location: Leavenworth, WA

Top of Casing Elev. _____

Driller/Method: Holt / Rotasonic

Depth to Water (ft BGS) 6 ATD

Sampling Method: Continuous Core

Start/Finish Date 5/26/2015

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Laboratory Tests	PID (ppm)	Unit	Material Type	Description	Depth (ft)
0	Flush-mount monument set in concrete	CC-1				X	Sod (Soft), slightly moist, brown, slightly sandy SILT (ML); fine sand, trace roots	0
5	Bentonite chips							
5	▼ 5/26/2015						Moist to wet, light brown, silty SAND (SM); fine to medium sand	5
10	10/20 silica sand	CC-2						
10	20-slot, 2-inch diameter, schedule 40 PVC						Wet, brown, sandy GRAVEL (GP); coarse sand, predominately fine gravel, some coarse gravel	10
15		CC-3						
15							Wet, light brown, silty SAND (SM); fine to medium sand	15
							Wet, light brown, SAND (SP); coarse sand	
							Wet, light brown, silty SAND (SM); fine to medium sand	
							Wet, light brown, gravelly SAND (SP); medium to coarse sand, fine subrounded gravel	

Sampler Type:

- No Recovery
- Continuous Core

PID - Photoionization Detector

- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: **AHP**

Approved by: **JNM**

Figure No. **A - 9**

KCSWD_SONIC LOG LEAVENWORTH FISH HATCHERY.GPJ June 1, 2015



Monitoring Well Construction Log

Project Number
140162

Well Number
Asp-MW-1

Sheet
2 of 2

Project Name: Leavenworth Fish Hatchery

Ground Surface Elev. _____

Location: Leavenworth, WA

Top of Casing Elev. _____

Driller/Method: Holt / Rotosonic

Depth to Water (ft BGS) 6 ATD

Sampling Method: Continuous Core

Start/Finish Date 5/26/2015

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Laboratory Tests	PID (ppm)	Unit	Material Type	Description	Depth (ft)
25	[Pattern]	CC-4				[Pattern]	Trace silt	25
30	[Pattern]	CC-5				[Pattern]	Wet, light brown, silty SAND (SM); fine sand	30
35	[Pattern]					[Pattern]	Wet, light brown, slightly silty SAND (SP); medium to coarse sand	35
							Bottom of boring at 35 feet bgs	

Sampler Type:

- No Recovery
- Continuous Core

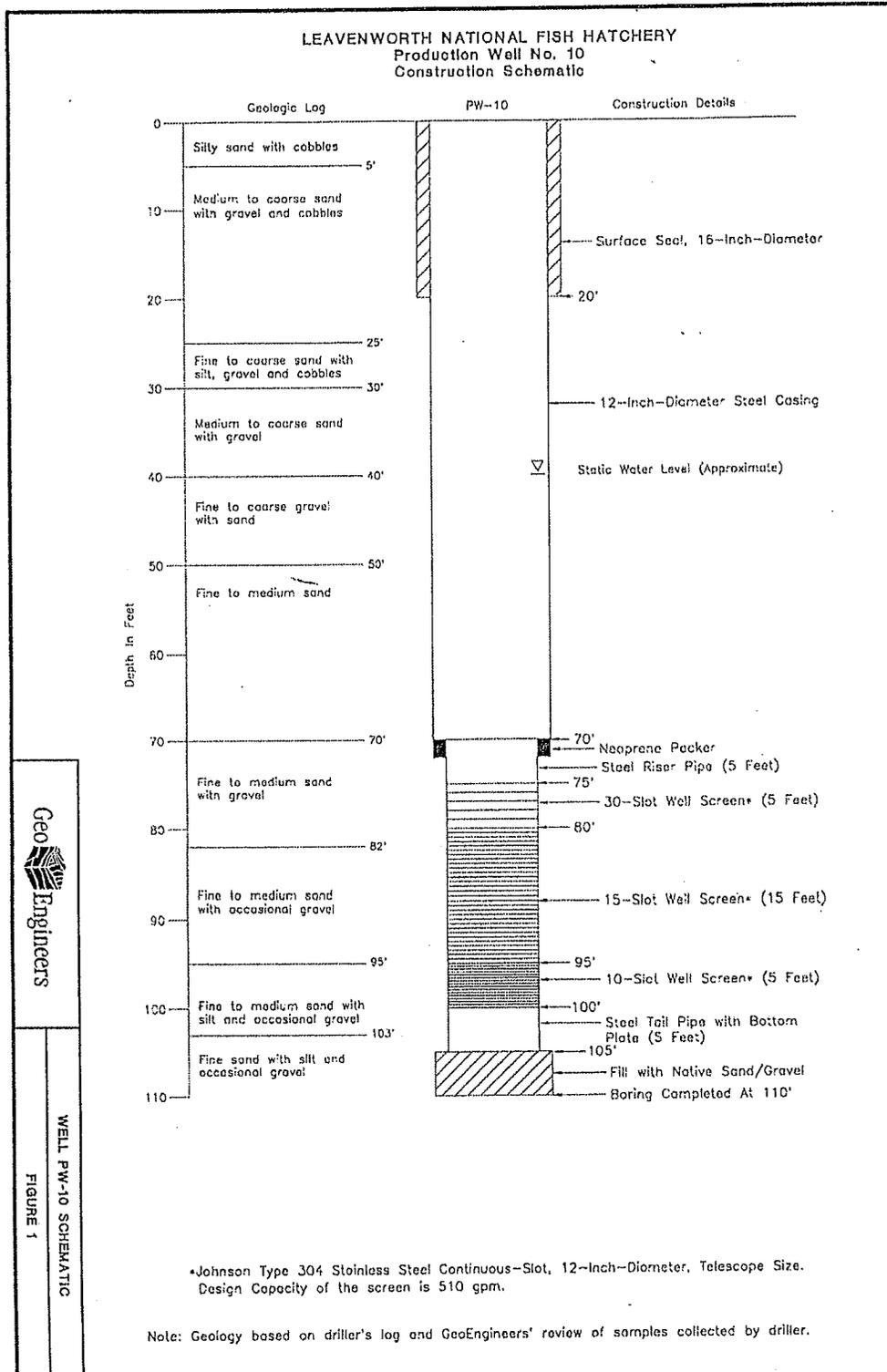
PID - Photoionization Detector

- Static Water Level
- Water Level (ATD)

Logged by: **AHP**

Approved by: **JNM**

Figure No. **A - 9**

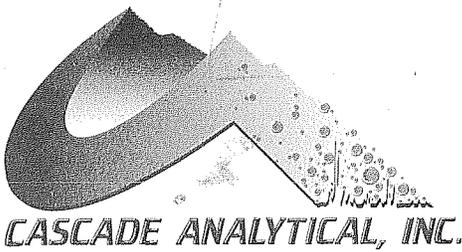


APPENDIX B

Well PW-10 Video Survey

APPENDIX C

Laboratory Certificate of Analysis



3019 G. S. Center Rd.
 Wenatchee, WA 98801
 (509) 662-1888
 Fax: (509) 662-8183
 1-800-545-4206

1008 W. Ahtanum Rd.
 Union Gap, WA 98903
 (509) 452-7707
 Fax: (509) 452-7773

WATER ANALYSIS ORDER FORM

Batch#	SEND RESULTS TO				
	1) Client 2) Billing 3) Both				
	SAMPLE REPRESENTS				
	1) Irrigation 2) Waste Water 3) Other				
SAMPLE BY	1) Client 2) Quality Control 3) Cascade 4) Other				

New Acct. #

(see legend on back) SAMPLE #

CLIENT NAME/ADDRESS
 ASPECT Consulting LLC
 401 2nd Ave S, Suite 201
 Seattle, WA 98104
 SAMPLER'S NAME
 Aaron Pruitt

BILLING NAME/ADDRESS
 Same
 PHONE

E-mail apruitt@aspectconsulting.com E-mail

RELINQUISHED BY: (Signature) [1]	DATE	RELINQUISHED BY: (Signature) [2]	DATE	RELINQUISHED BY: (Signature) [3]	DATE
<i>[Signature]</i>	8/24/15				
(Printed)	TIME	(Printed)	TIME	(Printed)	TIME
Aaron Pruitt	1430				
RECEIVED BY: (Signature)	DATE	RECEIVED BY: (Signature)	DATE	RECEIVED FOR LAB BY: (Signature)	DATE
<i>[Signature]</i>	8/24/15				
(Printed)	TIME	(Printed)	TIME	(Printed)	TIME

IRRIGATION WATER	1	2	3	4	5
Standard					
GENERAL CHEMISTRY					
1135 pH					
1140 Conductivity					
1200 Solids-Dis. (TDS)					
1230 Solids-Susp. (TSS)					
1240 Tot. Phosphorus	X				
1250 Orthophosphate					
1260 Kjeldahl Nitrogen (TKN)					
1170 Nitrate+Nitrite					
1265 NO ₃ (As N)					
1280 Ammonia					
1300 Biol. Oxy. Demand					
1310 Chem. Oxy. Demand					
1190 Sulfate (SO ₄)					
1180 Chloride (Cl)					
1150 Turbidity					
1320 Hexane Ext. Mat.					
1340 Alkalinity					
217 Total N Pkg					

FORM MUST BE COMPLETED BEFORE ANALYSIS WILL BE PERFORMED.

1	ASP-MW-1 - 082415	Sample Date	8/24/15
		Sample Time	1420
2		Sample Date	
		Sample Time	
3		Sample Date	
		Sample Time	
4		Sample Date	
		Sample Time	
5		Sample Date	
		Sample Time	

MICROBIOLOGY					
10040	Total Coliform MF				
10010	Fecal Coliform MF				
10041	Total Coliform MPN				
10011	Fecal Coliform MPN				

METALS - TOTAL OR DISSOLVED					
1391	Antimony (Sb)				
1011	Arsenic (As)				
1025	Barium (Ba)				
1405	Beryllium (Be)				
1031	Cadmium (Cd)				
1045	Chromium (Cr)				
1215	Copper (Cu)				
1065	Iron (Fe)				
1075	Manganese (Mn)				
1081	Mercury (Hg)				
1435	Molybdenum (Mo)				
1051	Lead (Pb)				
1335	Nickel (Ni)				
1091	Selenium (Se)				
1105	Silver (Ag)				
1381	Thallium (Tl)				
1225	Zinc (Zn)				

*METALS - circle type of analysis - T=total or D=dissolved
 Total N package = TKN, NO₃, NO₂, NH₃
 Sample container received by client was sealed Yes _____ No _____
 Sample container received by laboratory was sealed Yes _____ No _____

Disclaimer:
 Cascade Analytical, Inc., makes no warranty of any kind, expressed or implied, and customer assumes all risk and liability from the use of Cascade's test results. Cascade neither assumes nor authorizes any person to assume for Cascade any other liability in connection with the testing done by Cascade Analytical, Inc., and there are no other oral agreements or warranties collateral to or affecting this agreement.
 Cascade Analytical Inc.'s liability to customer as a result of customers use of Cascade's test results shall be limited to a sum equal to the fees paid by customer to Cascade Analytical, Inc. for the testing work.

Customer Signature: Aaron Pruitt Date: 8/24/15

This form also serves as "Chain of Custody."

MINERALS					
1120	Calcium (Ca)				
1130	Magnesium (Mg)				
1115	Potassium (K)				
1110	Sodium (Na)				



(509) 662-1888
Fax: (509) 662-8183
3019 G. S. Center Road
Wenatchee, WA 98801

(509) 452-7707 Batch: 528331
Fax: (509) 452-7773 Client: Aspect Consulting, LLC
1008 W. Ahtanum Rd Account: 12142
Union Gap, WA 98903 Sampler: Aaron
PO Number:

--- Water Analytical Report ---

Report Date: 8/26/15

Aspect Consulting, LLC
350 Madison Ave N
Bainbridge, WA 98110

Laboratory Number: 15-E025190
Sample Identification: MW-1 082415

Date Received: 8/24/15
Date Sampled: 8/24/15

Test Requested	Results	Units	RL	Method	Date Analyzed	Flags
Total Phosphorus	< 0.07	mg/L	0.07	SN 4500-P E	8/26/15	

Approved By Name: *Laura M. [Signature]*

Signature: *[Signature]*

Function: *Pres*

Cascade Analytical uses procedures established by EPA, AOAC, APHA, ASTM, and FDA/BAM. Cascade Analytical makes no warranty of any kind the client assumes all risk and liability from the use of these results. Cascade Analytical, Inc.'s liability to the client as a result of use of Cascade's test results shall be limited to a sum equal to the fees paid by the client to Cascade Analytical, Inc. for analysis. PLEASE REVIEW YOUR DATA IN A TIMELY MANNER. DATA GAPS OR ERRORS AFTER THREE MONTHS WILL NOT BE OUR RESPONSIBILITY. THOUGH WE DO KEEP ALL ANALYTICAL DATA FOR SEVERAL YEARS, SAMPLES ARE DISPOSED OF AFTER SIX WEEKS.



Sample Receipt Form

Date Received: 8/24/15 Time Received: 4:16 Initials: AR

Client Name: Aspect Consulting Project Name: WW

Temperature of cooler upon receipt: 22 °C Thermometer ID: # 4

Custody seals: Intact Broken None N/A

Chain of Custody Completed:

Client name, address, and phone number; Yes No
Date and time of sampling; Yes No
Test requests clear; Yes No
Completed in ink; Yes No
Signed by client; Yes No

All samples received: Yes No

All samples intact: Yes No

Sample ID's match COC form: Yes No

Appropriate containers used: Yes No

Sufficient amount of sample for analysis: Yes No

Correct preservative verified: N/A Yes No

Air bubbles in VOC, TTHM, or HAA5 samples: N/A Yes No

Sample(s) exceed hold time: Yes No

Type of coolant: Ice Blue Ice None Other Comment:

Shipping Method: FedEx UPS USPS Brett & Sons Hand Delivered CAI Sampled

Shipping Container: CAI Cooler CAI Cooler Box Client's Cooler None Other

Samples accepted for analysis: Yes No

Reason for Rejection:

Name of Person Contacted: Date Contacted:

Comments:

DRAFT MEMORANDUM

Project No.: 140162

October 7, 2015

To: Gary Ball, PE U.S. Fish and Wildlife Service

cc: Mark Reiser, McMillen Jacobs Associates

From: Joe Morrice, LHG Associate Hydrogeologist

Re: **Beneficial Use and Relinquishment Risk Assessment – USFWS Water Rights CS4-SWC3058 and CS4-SWC848**

This memorandum (memo) provides Aspect Consulting, LLC's (Aspect) review of beneficial use and relinquishment risks for two water rights at the U.S. Fish and Wildlife Service (USFWS) Entiat and Winthrop hatcheries. We understand USFWS is modifying these rights to add existing or planned groundwater infiltration galleries as additional points of withdrawal. The subject water rights are CS4-SWC3058 (Entiat) and CS4-SWC848 (Winthrop). A change application has been filed with the Okanogan County Conservancy Board (Okanogan Board) for the Winthrop water right, and an application has not yet been filed with the Chelan County Conservancy Board (Chelan Board) for the Entiat water right. Proofs of Appropriation (PAs) have also been filed to certificate the two water rights.

The following sections of this memo:

- Summarize our review of the Entiat and Winthrop water rights and water use,
- Identify quantities of water under these rights that could be certificated based on recent water use data and provisions of the rights (authorized sources), and
- Recommends permitting steps to reduce relinquishment risks, maximize the quantities of water that can be certificated under these rights, and bring permit authorizations in line with current planned water supply operations.

Entiat Water Right Review

The USFWS holds four water right certificates to supply the Entiat Hatchery for fish propagation and hatchery operation purposes. These rights include a combination of groundwater and surface water rights authorizing use of water from the Entiat River and six groundwater wells. Attributes of these water rights, including instantaneous (Q_i) and annual (Q_a) limits on diversions/withdrawals as currently certificated, are summarized below in Table 1.

CS4-SWC3058 originally authorized diversion only from the Entiat River. In 1994 USFWS applied to the Washington State Department of Ecology (Ecology) to add the six wells (shown in Table 1) as additional points of withdrawal; Ecology approved this change in 1996. Certificate SWC3059

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authorizes use of Packwood (also known as Limekiln) Spring, and Certificates 4584-A and G4-25874C authorize use of Well No. 1 and Well Nos. 2, 3, and 4, respectively.

Table 1 – Entiat National Fish Hatchery Water Rights

Water Right	Source(s)	Priority Date	Authorized Withdrawals/Diversions			
			Instantaneous (Qi)	Units ¹	Annual (Qa)	Units
CS4-SWC3058	Entiat River and Well Nos. 1 through 6	6/4/1943	22.5	cfs	---	afy
SWC3059	Packwood (Limekiln) Spring	6/4/1943	7	cfs	---	afy
4584-A	Well No. 1	8/25/1960	800	gpm	800	afy
G4-25874C	Well Nos. 2, 3, and 4	4/19/1978	1,300	gpm	699	afy

Notes:

¹ cfs = cubic feet per second, gpm = gallons per minute, afy = acre-feet per year

All rights are primary, additive rights, with a combined authorized total instantaneous withdrawal/diversion of 15,340 gpm or 34.2 cfs, of which 27.2 cfs is associated with groundwater well and Entiat River sources. The authorized annual quantity from well and Entiat River sources is not specified, but would be determined through certification of CS4-SWC3058 and limited to demonstrated beneficial use.

In 2014 USFWS filed a PA to certificate water use under CS4-SWC3058. The PA was returned by Ecology requesting, among other comments, clarification of the relationship between water rights, and additional discussion of instantaneous and annual quantities requested for certification and the year on which those are based.

Proof of Appropriation and Extent and Validity

Table 2, reproduced from the PA filed by USFWS, provides a summary of water metering data by source, including annual quantities produced and instantaneous diversion/withdrawal rates. Water use under existing certificates must be accounted for in determining the use under CS4-SWC3058 eligible for certification. Water use attributable to withdrawals under Certificates 4584-A and G4-25874C cannot also be included in establishing beneficial use under the subject right.

Annual water use was the greatest in 2013 and is the year that should be used to determine the annual quantity available for certification. Instantaneous uses were highest in 2014, the year that should be used for certifying the instantaneous diversion/withdrawal. The process for arriving at quantities to certificate is described in the following paragraphs.

Total water production in 2013 was 8,814.4 acre-feet, of which 7,947.7 acre-feet was withdrawn/diverted from sources authorized by CS4-SWC3058 (Entiat River and Wells 1 through 6). Withdrawal of 710 acre-feet from Well 1 can be attributed to certificate 4584-A (authorized withdrawal of 800 acre-feet). Total withdrawals from Wells 2, 3, and 4 were 1,167.7 acre-feet, of which 699 acre-feet can be attributed to certificate G4-25874C. Subtracting these quantities (710 + 699 = 1,409 acre-feet) from the total 2013 production from the wells and Entiat River results in an

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annual use under CS4-SWC3058 of 6,538.7 acre-feet per year that could be certificated with the current metering data and authorized sources for CS4-SWC3058.

Similarly, the listed instantaneous use from the wells and river in 2014 was 25.39 cfs (about 11,400 gpm). Of this, 1.05 cfs (470 gpm) can be attributed to Certificate 4584-A and 1.48 cfs (664 gpm) can be attributed to Certificate G4-25874C. Subtracting these from the combined well and river instantaneous use results in an **instantaneous use under CS4-SWC3058 of 22.86 cfs available that could be certificated with the current metering data and authorized sources for CS4-SWC30588**, slightly higher than the authorized instantaneous quantity of 22.5 cfs.

Beyond identifying quantities that could currently be certificated under CS4-SWC3058, it is worth noting that instantaneous and annual use of Well 1 is less than the authorized quantities of 800 gpm and 800 acre-feet per year. Similarly, the instantaneous withdrawals from wells 2, 3, and 4 are less than the authorized 1,300 gpm. These shortfalls in capacity and annual production raise the possibility of relinquishment should these rights be the subject of future water right changes and associated Ecology review.

Recommendations for CS4-SWC3058

We understand USFWS is pursuing additional groundwater source capacity at the Entiat Hatchery, likely through construction of an infiltration gallery system. Construction of an infiltration gallery would increase both instantaneous capacity and availability of annual water supply. To maximize the annual quantity that could be certificated under CS4-SWC3058, we recommend withdrawing the 2014 PA and requesting an extension to the development schedule from Ecology to allow time for construction and several years of operation of the infiltration gallery.

A request for extension of the development schedule must include the basis for why an extension is warranted and demonstrate due diligence in completing the project. The less than anticipated well production and water quality concerns with the Entiat River that have limited use to date under CS4-SWC3058, combined with the need to assess supply options and secure funding, should be an adequate basis for requesting an extension. Due diligence can be demonstrated through ongoing hatchery planning efforts that identify the need for additional water supply capacity and rehabilitation and upgrades to the existing wells and diversion to maximize supplies.

The infiltration gallery system will need to be added as a point of withdrawal to one or more of the USFWS water rights. At a minimum it should be added to CS4-SWC3058, but we also recommend adding the infiltration gallery to the other groundwater rights (CS4-SWC3058, 4584-A, and G4-25874C) to maximize flexibility in how sources and water rights are managed. This would allow any and all of the groundwater rights to use the planned groundwater infiltration gallery, reducing potential relinquishment risks for the less than full use of certificates 4584-A and G4-25874C.

One option would be to add the infiltration gallery to the existing rights as an additional point of withdrawal through the standard Conservancy Board or Ecology change process. This would further expose the Entiat water rights to Ecology review of extent and validity and can be a time consuming process. We instead recommend adding the infiltration gallery to existing rights through a Showing of Compliance with RCW 90.44.100(3).

Under the Showing of Compliance approach, USFWS could add new or existing wells to any or all of the existing groundwater rights, as long as the added wells are located within the legal description of the well locations advertised in the public notice when the original water right (or subsequent change) was approved. Other requirements include tapping the same body of groundwater as the original source, not impairing other existing water rights, and the added well must comply with current State of Washington well construction standards. We expect the planned infiltration gallery to meet all these requirements.

The process is to file a one page form with Ecology for each well to be added certifying that the necessary requirements are met. This approach would not trigger Ecology review of water use history and would not open the rights to a possible relinquishment determination from Ecology. Unlike a water right change, there is no requirement to publish a public notice inviting public comments. A well construction log needs to be filed with the Showing of Compliance, and any new well would need to be constructed before filing with Ecology.

A summary of the recommended approach and steps for the Entiat water rights is as follows:

1. Withdraw 2014 PA and file development schedule extension request with Ecology;
2. Complete groundwater supply upgrades and bring additional source capacity on-line;
3. Add infiltration gallery system to all groundwater rights through Showing of Compliance; and
4. Refile PA with updated water use for expanded system.

Winthrop Water Right Review

The USFWS holds four active water right certificates to supply the Winthrop Hatchery for fish propagation purposes. These rights include a combination of groundwater and surface water rights. Attributes of these water rights as currently certificated are summarized in Table 3.

Certificate 848 (as changed by Certificate of Change Volume 1, Page 201) originally authorized diversion only from the Methow River. This right has been subject to several changes since it was first issued in 1922. In 1989, Ecology approved a change authorizing the nearby Washington Department of Fish and Wildlife State fish hatchery to divert up to 7 cfs of this water right in the event of an emergency water shortage. In 2005, Ecology approved a second change to this water right (file number CS4-SWC848), adding groundwater Infiltration Gallery 3 as a point of withdrawal, with a maximum withdrawal rate of 10 cfs. A change application was also filed with the Okanogan Board in 2013 requesting to add Infiltration Gallery 1 and Infiltration Gallery 2 as additional points of withdrawal to this water right. A draft Report of Examination (ROE) was prepared by USFWS for submission to the Okanogan Board, but processing of this change is on hold pending resolution of the PA and certification of CS4-CWS848.

Surface water claim S4-141302CL authorizes use of an unnamed spring (Spring Branch Spring). This right is controlled by USFWS through a 1941 agreement between the Belsby family, owners of the nearby Spring Creek Ranch, and the U.S. Bureau of Reclamation.

Certificate 7209 was issued for Infiltration Gallery 1. Certificate 7590 appears to have been issued as an additive right to Certificate 7209 authorizing increased withdrawals from Infiltration Gallery 1. No water right file information was identified indicating that this right was later changed to

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authorize withdrawals from Infiltration Gallery 2, and it does not appear that this source is currently authorized under any of the water rights.

Table 3 – Winthrop National Fish Hatchery Water Rights

Water Right	Source(s)	Priority Date	Authorized Withdrawals/Diversions			
			Instantaneous (Qi)	Units ¹	Annual (Qa)	Units
Certificate 848	Methow River and Infiltration Gallery 3	1/10/1922	50	Cfs	---	afy
S4-141302CL	Spring Branch Spring	7/23/1891	10	Cfs	---	afy
Certificate 7209	Infiltration Gallery 1	4/6/1967	1,500	Gpm	2,420	afy
Certificate 7590	Infiltration Gallery 1	2/17/1971	1,500	Gpm	2,400	afy

Notes:

¹ cfs = cubic feet per second, gpm = gallons per minute, afy = acre-feet per year.

All rights are primary, additive rights, with a combined total instantaneous withdrawal/diversion of 29,930 gpm or 66.7 cfs, of which 56.7 cfs is associated with Infiltration Galleries 1 and 3 and Methow River sources. The authorized annual quantity from the Infiltration Gallery 3 and Methow River sources is not specified, but would be determined through certification of CS4-SWC848 and limited to demonstrated beneficial use.

In 2014 USFWS filed a PA to certificate water use under CS4-SWC848. The PA has not been finalized with Ecology.

Proof of Appropriation and Extent and Validity

Table 4, reproduced from the PA filed by USFWS, provides a summary of water metering data by source, including annual quantities produced and instantaneous diversion/withdrawal rates. The quantities that can currently be certificated for CS4-SWC848 are limited to beneficial uses from the permitted sources – the Methow River and Infiltration Gallery 3. Uses from non-permitted sources (Infiltration Galleries 1 and 2) cannot be included in the certification of CS4-SWC848 until they are added as additional points of withdrawal. Withdrawals from Infiltration Galleries 1 and 2 exceed currently permitted quantities under other water rights (Certificates 7209 and 7590).

Instantaneous and annual water deliveries to the Winthrop Hatchery from Infiltration Gallery 3 and the Methow River were the greatest in 2011 with quantities 27.1 cfs and 9,047 acre-feet, respectively. We understand an additional 6 cfs, 4,344 acre-feet per year of water from the Methow River diversion is also used as fish screen bypass water; although unmetered, this water use is considered a beneficial use of CS4-SWC848 for hatchery operations. Adding these quantities to the metered deliveries to the hatchery results in **33.1 cfs, 13,391 acre-feet per year that could be certificated with the current metering data and authorized sources for CS4-SWC848.**

Recommendations for CS4-SWC848

To maximize the annual quantity that could be certificated under CS4-SWC848 we recommend withdrawing the 2014 PA and completing the pending water right change to add Infiltration Galleries 1 and 2 as additional points of withdrawal. Once the additional infiltration galleries are added to this water right, any water production in excess of the authorized amounts under Certificates 7209 and 7590 can be attributed to CS4-SWC848 and included in a revised PA filing.

We also recommend filing a Showing of Compliance to add Infiltration Gallery 2 to Certificates 7209 and 7590, which currently appear to only authorize Infiltration Gallery 1. This will resolve any lingering questions with permitted sources under these rights and will offer greater flexibility in how the sources and water rights are managed and protected from relinquishment. Note that Infiltration Gallery 3 cannot be added as an additional point of withdrawal to these rights through a Showing of Compliance, nor could Infiltration Galleries 1 and 2 be added to CS4-SWC848 through the same process, as the public notices published for these rights did not include overlapping locations (quarter-quarter sections) of the points to be added, as required under RCW 90.44.100(3).¹

Once the infiltration galleries are added to the water rights and several years of new water use data measured, a revised PA should be filed with Ecology to certificate use under CS4-SWC848. Quantities that could be certificated would be the metered peak instantaneous and annual deliveries from the three infiltration galleries and Methow River, less uses attributed to Certificates 7209 and 7590, plus fish screen bypass water of 6 cfs, 4,344 acre-feet per year. If future production and uses are similar to the 2009-2013 uses reported in the PA filing, USFWS would be able to certificate CS4-SWC848 for about 34 cfs and 15,126 acre-feet per year². Higher quantities could be certificated depending on actual beneficial use.

We recommend revising the draft change ROE pending before the Okanogan Board to address the less than full water use since approval of CS4-SWC848 in 2005. Draft change ROE revisions should identify reasons for non-use and applicable statutory exemptions to relinquishment. Potentially applicable exemptions to relinquishment include the unavailability of water exemption (given less than expected groundwater yields and surface water quality concerns) and the determined future development (DFD) exemption based on changing hatchery operations and needs. Additionally, use of Infiltration Galleries 1 and 2 beyond the limits of Certificates 7209 and 7590 constitute a *de facto* change to CS4-SWC848 that should be accounted for in quantifying this water right.

The arguments for these exemptions to relinquishment are case-specific and will require input from USFWS on the specific details for the Winthrop Hatchery. A redline-edited copy of the draft ROE prepared by USFWS outlining the suggested revisions and establishing the structure of the arguments for non-use of water under this right is provided under separate cover.

¹ CS4-SWC848 authorizes points of withdrawal in the NW1/4SE1/4 of Section 3, while Certificates 7209 and 7590 authorize points of withdrawal in the NE1/4SE1/4 of Section 3.

² Based on reported instantaneous and annual use from 2010.

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A summary of the recommended approach for the Winthrop water rights and steps is as follows:

1. Withdraw 2014 PA and complete the pending water right change application to add Infiltration Galleries 1 and 2 as additional points of withdrawal.
2. Refile PA with updated Infiltration Galleries added.
3. Revise draft ROE to identify exemptions to relinquishment

Limitations

Work for this project was performed for the McMillen Jacobs Associates (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Attachments

Table 2 – Water Production by Source – Entiat National Fish Hatchery

Table 4 – Water Production by Source – Winthrop National Fish Hatchery

W:\140162 McMillen Hatcheries\Deliverables\Entiat and Winthrop Water Rights Memo\Draft\Entiat_Winthrop_WR_Memo.docx

Table 2 - Water Production by Source - Entiat National Fish Hatchery

Project 140162 - Entiat and Winthrop National Fish Hatcheries

Chelan and Okanogan Counties, WA

Source and Instantaneous Diversion/Withdrawal in Cubic Feet per Second

Year	Packwood Springs	Entiat River	Well 1	Well 2	Well 3	Well 4	Well 5	Well 6	Total	Well and River Total
2009	1.93	0.00	0.84	0.70	0.64	0.61	0.45	0.00	5.16	3.23
2010	2.86	0.00	0.68	0.66	0.51	0.59	0.40	0.00	5.70	2.84
2011	4.71	1.79	0.95	0.52	0.51	0.67	0.28	0.42	9.85	5.14
2012	1.79	0.00	1.01	0.50	0.44	0.57	0.67	0.35	5.32	3.53
2013	1.92	17.80	1.05	0.50	0.48	0.60	0.49	0.35	23.20	21.28
2014	1.12	22.20	1.05	0.47	0.47	0.54	0.39	0.27	26.51	25.39

Source and Annual Volume in Acre-Feet

Year	Packwood Springs	Entiat River	Well 1	Well 2	Well 3	Well 4	Well 5	Well 6	Total	Well and River Total
2009	940.6	0	181.9	394.1	213.3	359.9	286.0	0	2,375.8	1,435.1
2010	913.6	0	497.2	227.2	207.2	421.9	239.6	0	2,506.6	1,593.0
2011	1388.6	0	476.7	219.1	317.2	237.0	46.2	140.4	2,825.2	1,436.7
2012	881.3	671.3	620.5	318.0	242.1	337.3	302.6	139.7	3,512.8	2,631.4
2013	866.7	5683.1	710.0	555.4	273.4	338.9	234.8	152.0	8,814.4	7,947.7

Associated Water Rights

CS4-SWC3058		x	x	x	x	x	x	x	
SWC-3059	x								
4584-A			x						
G4-25874C				x	x	x			

Table 4 - Water Production by Source - Winthrop National Fish Hatchery

Project 140162 - Entiat and Winthrop National Fish Hatcheries
Chelan and Okanogan Counties, WA

Year	Source and Instantaneous Diversion/Withdrawal in Cubic Feet per Second						Gallery 3 and River Total
	Gallery 1	Gallery 2	Gallery 3	Foghorn (Methow) to Hatchery	Total Use	Foghorn (Methow) to Hatchery	
2009	3.6	9.2	6.7	19.4	38.9	19.4	26.1
2010	5.5	10.4	7.6	19.1	42.6	19.1	26.7
2011	5.5	7.8	6.3	20.8	40.4	20.8	27.1
2012	4.9	12.3	4.5	17.0	38.7	17.0	21.5
2013	5.4	10.7	4.3	17.4	37.8	17.4	21.7

Year	Source and Annual Volume in Acre-Feet						Gallery 3 and River Total
	Foghorn to Hatchery	Gallery 1	Gallery 2	Foghorn (Methow) to Hatchery	Total Use	Foghorn (Methow) to Hatchery	
2009	1,616	4,985	1,100	5,553	13,254	5,553	6,653
2010	2,312	5,330	1,498	6,350	15,490	6,350	7,848
2011	2,416	1,158	2,605	6,442	12,621	6,442	9,047
2012	2,250	4,773	1,060	5,030	13,113	5,030	6,090
2013	2,170	5,876	715	6,458	15,219	6,458	7,173

Associated Water Rights

CS4-SWC848 x

S4-141302CL

Certificate 7209

Certificate 7590

APPENDIX C
MEETING NOTES

DRAFT MEETING MINUTES

McMILLEN, LLC

To:	Meeting Attendees	Project:	Leavenworth Fisheries Complex Planning Report
From:	Tom Finnegan, PE	Cc:	File
Date:	April 9, 2014	Contract No:	
Subject:	Project Scoping Meeting		

1.0 INTRODUCTION

1.1 Purpose

The purpose of this memorandum is to discuss points from our March 14, 2014 35% design review meeting on the Quinault National Fish Hatchery Fish Exclusion Barrier project. The meeting was held to reach consensus on the project scope and direction so that the project can move forward with design and permitting. The meeting was held at the Leavenworth National Fish Hatchery in Leavenworth, Washington and included representatives from USFWS, USBR and McMillen-LLC.

1.2 Attendance

The meeting attendees were as follows, with Robert Hamilton calling in by phone:

Name	Organization	Email	Phone
Steve Croci	USFWS	Steve_croci@fws.gov	509-548-2916
Dave Irving	USFWS	Dave_irving@fws.gov	509-548-2912
Kim Hubbard	USFWS	kim_hubbard@fws.gov	503-231-2363
Rich Johnson	USFWS	Rich_r_johnson@fws.gov	503-231-6835
Julie Collins	USFWS	Julie_collins@fws.gov	503-231-6217
Robert Hamilton	USBR	rhamilton@usbr.gov	208-378-5087
Mark Reiser	McMillen, LLC	Mark_reiser@mcmillen-llc.com	503-886-8956
Tom Finnegan	McMillen, LLC	tom.finnegan@mcmillen-llc.com	206-858-8889

2.0 MEETING NOTES

After brief introductions around the room, Dave and Kim gave a brief introduction of the project.

The Leavenworth Fisheries Complex encompasses Leavenworth, Entiat, and Winthrop National Fish Hatcheries. The hatcheries were built as mitigation for the construction of Grand Coulee Dam, and were constructed between 1939 and 1942. The concrete and piping is now almost 75 years old and much of it is in very poor condition. A number of fixes have been done to various

parts and pieces over the years. The goal of this particular project is to develop a long term master plan for the future of the three facilities.

- There are listed species of salmon in Icicle Creek, and thus concerns about the impacts from the diversion structure and intake as well as other hatchery structures in the creek, water withdrawals from the creek, and hatchery effluent.
- A work group is looking at water use and demand in the Icicle Creek drainage basin. The group is looking at a package of projects to improve water efficiency in the basin.
- FWS is looking for ways to improve water use efficiency at the hatcheries. The potential impact of climate change over the long term on water availability also needs to be considered.
- BPA does provide some of the money for the facilities and thus they are always looking for ways to reduce production costs. What is the most cost effective way to meet mitigation requirements?
- FWS wants to be able to maximize the use of their water rights. The alternatives developed need to be flexible enough to accommodate changes in production goals in the future.
- As part of the project, FWS would like to look at the potential of moving all or parts of their programs to other sites. Relocation may not end up being viable, but FWS would like to show that it was considered. Relocation would have to consider land acquisition costs, water rights, permitting issues, and change of release location.
- The Yakama Nation has looked at some acclimation sites in the upper Columbia Basin as part of their coho restoration program.
- A change of release location would require renegotiation of the US vs. Oregon settlement.
- FWS would like to add as a line item to the project scope survey mapping of the piping systems for all three hatcheries. There have been lost of changes over the years and the record keeping and as-builts have not been the best. There are some long time employees that can provide some institutional knowledge, but some of those employees are looking at retiring soon, so the institutional knowledge could be lost.
- There are concerns at the levels of phosphorus in the effluent, so some consideration should be given to how to improve the situation.
- The FWS doesn't have the best boundary survey data on the hatcheries.
- NMFS wants to include a compliance schedule for screening and fish passage in the Biological Opinion they are preparing.
- The economic analysis does need to consider some of socio-economic benefits and trade-offs to the local community, tribes, and recreational fishermen.
- The scope of work for this project relates to the Grand Coulee mitigation, but there are some other programs going on at Leavenworth and Winthrop.

- A study in 2011 looked at increasing the water storage at Upper and Lower Snow Lake, as well as at automation of the control valve.
- The kickoff meeting would include WDFW and that Yakama and Colville tribes.
- Presentation meetings would take place in Wenatchee.
- Kim should be cc'd on everything so that she knows what is going on with the project.
- The rough budget is around \$200,000+

The meeting adjourned at approximately 12:00 PM PST.

3.0 ACTION ITEMS

- Tom will draft up meeting notes
- McMillen will prepare a scope and budget

DRAFT MEETING MINUTES

McMILLEN, LLC

To:	Meeting Attendees	Project:	Leavenworth Fisheries Complex Planning Report
From:	Tom Finnegan, PE	Cc:	File, Mort McMillen, PE
Date:	June 12, 2014	Contract No:	Contract No.
Subject:	Project Kickoff Meeting June 2, 2014		

1.0 INTRODUCTION

1.1 Purpose

The purpose of this memorandum is to discuss points from our June 2, 2014 project kick-off meeting on the Leavenworth Fisheries Complex Alternatives Analysis Project. The meeting was held to review the scope of the project. The meeting was held at the Confluence Technology Center in Wenatchee, Washington and included representatives from USFWS, the Yakama Nation, Confederated Colville Tribes, US Bureau of Reclamation (USBR), Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology (DOE), Dan Warren and Associates, and McMillen-LLC.

1.2 Attendance

The meeting attendees were as follows:

Name	Organization	Email	Phone
Steve Croci	USFWS - LFC	Steve_croci@fws.gov	509-548-7641
Dave Irving	USFWS - LFC	Dave_irving@fws.gov	509-548-2912
Kim Hubbard	USFWS	kim_hubbard@fws.gov	503-231-2363
Craig Chisam	USFWS – Entiat NFH	Craig_chisam@fws.gov	509-784-1131
Matt Cooper	USFWS – MCR FRO	Matt_cooper@fws.gov	509-548-2992
Bill Gale	USFWS – MCR FRO	William_gale@fws.gov	509-548-2991
Jim Craig	USFWS – MCR FRO	Jim_1_craig@fws.gov	509-548-2999
Joy Evered	USFWS – Olympia Fish Health Center	joy_evered@fws.gov	360-753-9046
Rich Johnson	USFWS - Portland	Rich_r_johnson@fws.gov	503-231-6835
Andy Goodwin	USFWS	Andrew_goodwin@fws.gov	503-231-6784
Steve Kolk	USBR	skolk@usbr.gov	509-667-8494
Bob Hamilton	USBR	rhamilton@usbr.gov	208-378-5087
Keely Murdoch	Yakama Nation	murk@yakamafish-nsn.gov	509-548-2206
Greg Wolfe	Yakama Nation	wolg@yakamafish-nsn.gov	509-881-0674
Tom Scribner	Yakama Nation	scrt@yakamafish-nsn.gov	503-331-9850
Chuck Brushwood	Colville Tribe Fisheries	Charles.brushwood@colvilletribe.com	509-422-7749

Mike Kaputa	Chelan County	Mike.kaputa@co.chelan.wa.gov	509-670-6935
Charlie McKinney	Wash. Dept. of Ecology	Cnck467@doe.wa.gov	509-457-7107
Charity Davidson	WDFW	Charity.davidson@dfw.wa.gov	509-662-0507
Tom Wegge	TCW Consulting	twegge@tcwecon.com	916-451-3372
Dan Haller	Aspect Consulting	dhaller@aspectconsulting.com	509-895-5462
Lars Mobrand	DJ Warren & Assoc.	Lars.mobrand@gmail.com	206-919-3892
Dan Warren	DJ Warren & Assoc.	Dan.warren@djwassociates.com	541-929-4639
Mark Reiser	McMillen, LLC	mark.reiser@mcmillen-llc.com	503-886-8956
Tom Finnegan	McMillen, LLC	tom.finnegan@mcmillen-llc.com	206-858-8889

1.3 Agenda

The meeting agenda was structured around the tasks in the statement of work.

The purpose of the session was:

- Review and confirm project purpose and goals
- Review data and information provided to Project Team by USFWS and other potential needs
- Review and confirm proposed scope and schedule for all tasks and deliverables

A summary of each of the major points of discussion associated with these agenda items is presented in the following paragraphs.

2.0 MEETING NOTES

2.1 Opening/Introduction

After brief introductions around the room, Dave Irving gave a brief introduction of the project and reminded the group that the Leavenworth Fisheries Complex has three over guiding purposes: mitigation responsibilities for Grand Coulee Dam, Tribal Trust, and US vs. Oregon legal obligations. There are potentially \$40-\$50M of infrastructure needs at the three hatcheries which are now about 70-years old. A number of studies have been done that have documented infrastructure deficiencies and needs at the three facilities. The questions that come out of those studies are: what is the priority for addressing the infrastructure needs, and what is the road map over the next 20-years for cost effectively and efficiently addressing the needs.

2.2 Review of the Project Scope

Mark Reiser started the review of the project scope.

Task A1 – Data Collection and Review

- USFWS has already provided a large amount of background information and reports for the three facilities which the project team has started to review.
- Kim asked USFWS staff to review the documents that have been provided to McMillen to determine whether or not there are any additional documents that also should be provided.

Task A2 – Kick-Off Meeting, Site Visits and Operational Review

- The project team site visits will take place June 3rd thru June 5th.

Task A3 – Develop Detailed Bioprogramming/Water Budget Alternatives

- The production numbers and species produced at the three facilities could potentially change and evolve over time, however, for comparison purposes, the alternatives will use the production levels spelled out in US vs. Oregon. The one caveat is that for Leavenworth, 1.6M Spring Chinook salmon smolts should be used instead of the current production of 1.2M. It was noted that US v. Oregon production levels are a moving target and subject to on-going negotiations. The current US v. Oregon management Agreement is valid thru 2017.
- USFWS will need to provide the production numbers that the evaluation will be based on for both current and future for each of the facilities.
- US V Oregon release numbers need to be provided by the USFWS as part of the production numbers provided to the contractors.
- The Yakama Nation's for the mid-Columbia Coho program has an approved Step 1 Master Plan but does not have approved Step 2 / or Step 3 submittals. Future construction dates are unknown at this time. The Yakama Coho programs at Leavenworth and Winthrop are to be included in the analysis. Their present thinking is that adult holding and incubation may be moved to the proposed facility.
- The current criteria for density and flow indices are in the HGMP's. USFWS will need to confirm the density, flow indices, and water turnover rates that should be used in the analysis, and in general it would be helpful if USFWS could provide to other criteria from the USFWS Columbia Basin Hatchery Review Team Report (2007) that are being utilized at all three sites.
- Bill Gale indicated that there are no present adult return goals for the LHC programs. Straying into upper Wenatchee will be a limiting factor on any proposed production increases at LNFH.
- USBR will not want to fund any excess production beyond mitigation requirements.

Task A4 – Develop Infrastructure Alternatives – Three Existing Sites

- One question that should be addressed as part of the analysis is – what is the best technology to use at each facility to make a more efficient use of the water available, as well as of the water right?
- In addition to initial capital costs, full life-cycle costs need to be considered, including: operations, maintenance, and energy efficiency.
- Dave Irving reiterated that USFWS is all for improving water efficiency, and for even potentially putting water back into the creek for beneficial use, but that the USFWS is not intending to relinquish its water rights.

- A reliable, gravity fed water supply is often preferable, however, reuse and recirculation technologies should be considered where appropriate or if needed based on the program numbers provided by USFWS.
- Mechanical systems need to have redundant capabilities where appropriate.
- If a more efficient use of water could potentially allow for greater production, that should be discussed in general terms in the report, but the current production numbers should be used for the comparison.
- The alternatives should look at utilizing the full water rights and not just the current water usage or availability. Currently, water is unavailable because of limits to infrastructure, which in turn limits production potential.
- Alternatives should compare costs and impacts of utilizing the full water rights versus utilizing the the current usage needed to meet production goals.
- For construction of any alternative, it should be assumed that production at the facilities will need to be maintained. Complex managers feel obligated to maintain at least 90% of production goals during construction if possible. USBR pointed out that this may not be feasible economically for the duration of the surface water improvement project at Leavenworth due to the high cost of temporary pumping.
- For construction of alternatives, the project team should look at a 15-20 year timeline. Annual appropriations from Congress for construction are likely to be limited to \$5-\$10M in any one year.
- Dan Warren asked if goals for SAR's should be considered in developing the alternatives. There is no defined adult return goal. US vs. Oregon only stipulates smolt production requirements.
- Phosphorous loading (TMDL for Icicle Creek), is a significant issue at Leavenworth that will need to be considered. There are currently no guidelines for optimizing the use of the two existing pollution abatement ponds.
- Greg Wolfe strongly recommended that the intakes and water supplies be looked at as a first priority. The intakes and water supplies should meet current NMFS screening criteria, provide quality pathogen free water, at the right temperature, and with high reliability.
- Dan Warren asked if the USFWS had draft recommendations for density and flow indices for recirculation/reuse systems. The USFWS does have a group headed by Andy Goodwin, that is formally looking at recirculation/reuse systems, and their recommendations would be provided to the project team.
- Steve Croci noted that some of the infrastructure at the facilities is in relatively good shape and may not need to be replaced for 20-years. It was noted, however, that there is still a need for a road map for infrastructure repairs and upgrades and a establishment of priorities for what needs to be done for the facilities to be able to function for another 50+ years.

- Potential impacts to infrastructure that is still in good condition if infrastructure that is in poor condition fails should be considered.

Task A5 – Evaluate Geographically Separate Alternatives

- The initial look at geographically separate alternatives will be done at a high level and will not look at specific sites.
- It was asked whether or not the three geographically separate alternatives would be tied to the tributaries – Wenatchee, Methow, Entiat and Okanogan. The Grand Coulee mitigation obligations are tied to these four tributaries. It was also mentioned that it was unlikely that releases would be allowed outside these tributaries due to biological risks and harvest issues.
- It will be important to include an evaluation of stray rates if a centralized location is used for rearing and acclimation sites are utilized in the tributaries.

Task A6 – Optional Additive Task - Select Three Geographically Separated Sites for More Detailed Evaluation

- This task has not been authorized at this time and will only be authorized if there is a very strong push to look at geographically separate alternatives in much greater detail than is done in task A5.

Task A7 – Assess Fishery, Conservation and Socio-Economic Benefits

- Tom Wegge noted that for the economic analysis there will need to be a breakout between tribal ceremonial and subsistence harvest numbers versus commercial and sport harvest numbers as the two categories has different valuations. The database of coded wire tag recovery should provide a lot of the data as it is broken out by user group.
- Adult fish beyond what is required for broodstock is surplus out to various tribes, which should be considered in determining benefits.
- Leavenworth and Winthrop provide adult broodstock, fish or eggs to the Colville Tribe for their spring Chinook hatchery programs. This need is likely to continue for at least the next 7-10 years at a minimum from LNFH and potentially for the next 20 years for WNFH support of Okanogan program dependent on how successful the conservation efforts are at establishing locally adapted broodstock.

Task A8 – Assess Biological and Environmental Risks – Three Selected Alternatives

- Clarified that legal issues would be identified by the consulting team but no legal consulting services would be included in the risk assessments.

Task A9 – Perform Economic Cost-Benefit Analysis and Biological Risk Benefit

- Tom Wegge asked if fish production levels would be constant across alternatives. Rich Johnson indicated that the benefit analysis should be based on production not SAR's. The

SAR data will, however, be needed to evaluate the economic and biological risks of the alternatives.

Task A10 – Evaluate and Compare Selected Alternatives

- Mark Reiser explained that once a draft of the report is prepared, another meeting will be scheduled in October to present the findings of the alternative analysis. The report would not be finalized until mid-December, which should provide ample time for interested parties to provide comments.
- Lars stressed that in order to evaluate alternatives, USFWS would need to provide a concise summary of production goals to the consulting team. Kim indicated that the service would provide the goals shortly.

Task A11 – Prepare As-Built Flow Schematics

- McMillen will be preparing as-built flow schematics for the three facilities. There have been numerous changes and upgrades over the last 70 years and there hasn't always been the best record keeping.

2.3 Review of Schedule

Mark went thru the current milestone schedule for the project.

3.0 CLOSING

Dave thanked all the attendees for participating in the meeting.

The general consensus of the group was to proceed with the Alternatives Analysis as outlined in the project scope.

The meeting adjourned at approximately 4:00 PM PST.

4.0 ACTION ITEMS

- USFWS will provide an explicit memo clarifying the release numbers that should be used as the basis for developing and comparing the alternatives.
- USFWS will provide SAR numbers which is the other critical component to be able to provide the biological risk and economic analysis.
- USFWS will provide adult contribution rates to various harvest sectors
- USFWS will provide adult return numbers to each hatchery and the disposition of those fish particularly for broodstock use and/or distribution to Tribes for subsistence and ceremonial purposes.
- USFWS will confirm density and flow indices that should be used in the analysis

- USFWS will provide draft recommendations for density and flow indices for recirculation/reuse systems.
- USFWS to provide available water chemistry data for each site.
- McMillen will setup a SharePoint site for the project so that USFWS can share data with the project team.
- McMillen will prepare draft meeting notes

MEETING NOTES

McMILLEN, LLC

To:	Meeting Attendees	Project:	Leavenworth Fisheries Complex Planning Report
From:	Tom Finnegan, PE	Cc:	File
Date:	September 12, 2014	Contract No:	Contract No. 14-055
Subject:	Task A5 Draft Review Meeting		

1.0 INTRODUCTION

1.1 Purpose

The purpose of this memorandum is to discuss points from our September 12, 2014 conference call meeting on the Leavenworth Fisheries Complex Alternatives Analysis Project to discuss the draft matrix and writeup for Task A5 – *Evaluate Geographically Separate Alternatives*. The conference call included representatives from USFWS, US Bureau of Reclamation (USBR), D.J. Warren and Associates, and McMillen-LLC.

1.2 Attendance

The meeting attendees were as follows:

Name	Organization	Email	Phone
Steve Croci	USFWS - LFC	steve_croci@fws.gov	509-548-7641
Dave Irving	USFWS - LFC	dave_irving@fws.gov	509-548-2912
Kim Hubbard	USFWS	kim_hubbard@fws.gov	503-231-2363
Jim Craig	USFWS – MCR FRO	jim_1_craig@fws.gov	509-548-2999
Bill Gale	USFWS – MCR FRO	william_gale@fws.gov	509-548-2991
Joy Evered	USFWS – Olympia Fish Health Center	joy_evered@fws.gov	360-753-9046
Sharon Lutz	USFWS – Olympia Fish Health Center	sharon_lutz@fws.gov	360-753-9046
Wendy Olson	USFWS – Olympia Fish Health Center	wendy_olson@fws.gov	360-753-9046
Rich Johnson	USFWS - Portland	rich_r_johnson@fws.gov	503-231-6835
Andy Goodwin	USFWS	andrew_goodwin@fws.gov	503-231-6784
Bob Hamilton	USBR	rhamilton@usbr.gov	208-378-5087
Kevin Malone	DJ Warren & Assoc.	kmmalone@wavecable.com	206-919-3892
Dan Warren	DJ Warren & Assoc.	dan.warren@djwassociates.com	541-929-4639
Rachel Kutschera	DJ Warren & Assoc.	rachel.kutschera@djwassociates.com	541-929-4639
Mark Reiser	McMillen, LLC	mark.reiser@mcmillen-llc.com	503-886-8956
Tom Finnegan	McMillen, LLC	tom.finnegan@mcmillen-llc.com	206-858-8889
Jim Harper	McMillen, LLC	jim.harper@mcmillen-llc.com	503-886-8956

1.3 Agenda

The purpose of the session was:

- Review the draft matrix and summary write-up for the evaluation of geographically separate alternatives
- Finalize a list of alternatives to complete task A5
- Review scope for the phosphorous study

2.0 MEETING NOTES

2.1 Opening/Introduction

Mark Reiser gave a brief overview of the meeting agenda and objectives.. The scope and budget for Task A5 only allows for a very high level view. The purpose of the rough draft of the alternative matrix and summary write-up was to get options in front of the group to think about such that a refined list of alternatives and evaluation criteria can be decided on.

2.2 Review of the Draft Matrix and Summary Writeup

- Steve Croci had a proposal for what alternatives he thought, on first review, should be considered. They include: new facility on the Wenatchee upstream of Icicle Creek, new facility on the Wenatchee downstream of Icicle Creek, rearing of fish at another facility (Wells, Chief Joe etc.) and acclimation at LNFH, full rearing elsewhere on the Columbia main stem, full rearing elsewhere on a tributary.
- More discussion should be provided on why we are not considering moving Entiat or Winthrop. These two sites would need substantial investments for infrastructure repair/rebuild, but do not currently have the lawsuits or phosphorous release issues that Leavenworth does.
- Could some of the litigation issues that Leavenworth is facing end up moving to Entiat or Winthrop? Some of the wild fish advocate groups are entirely opposed to hatcheries in any form.
- Any potential new sites on the Entiat or Methow would need to first have water available, potential to acquire a water right, and not have the problematic TMDL requirements.
- Some additional discussion should be provided in the description of the alternatives of the availability of water rights at the various sites.
- Some additional discussion should be provided on what would happen to the YN coho program. The YN has not been successful locating a new in-basin site for the coho production, so if Leavenworth is not available, there may not be anywhere to move the acclimation.
- There has been some mention that if USFWS moved out of Leavenworth, then the YN and potentially the CCT would likely be interested in taking over the facility.

- Bob Hamilton asked if it would be possible for the tribes to take over the facility. The original property deeds note that if fish production by the government stops, then the property would revert back to the Bullitt family. It is likely that the tribes would work through the BIA, so it could be argued that the government was still producing fish. The issue would need to be investigated by lawyers to determine whether there would be an issue.
- The Dryden site was abandoned by the YN apparently due to some onerous requirements from the county for lead remediation. The site used to be a shooting range. There were also strict phosphorous TMDL requirements that couldn't likely be met. McMillen to investigate further since this site is under consideration.
- The matrix and write-up should note whether the alternative site would be able to accommodate the production of 1.6M spring chinook.
- The operation costs for moving fish between alternative sites and Leavenworth needs to be taken into account.
- Operating multiple sites will also add to program operation costs.
- Several individuals noted that all of the options appear to be dead ends that are not viable for one reason or another. This being the case, should more money be spent in authorizing Task A6 to look at the alternatives in more detail? This will be discussed after more progress is made on A5.
- Bob Hamilton said that the USBR needs to have enough information so that they can justify to management and congress that moving the operations can't be justified. If it is going to cost ~\$50M to rebuild Leavenworth, someone will point out that it might be cheaper to just build a new facility. The USBR would like to see ~10% design level cost estimates for the alternatives (This level of detail would go beyond the scope of task A5).
- Bill Gale noted that the viability of the alternatives is not strictly limited to costs. The biological risks from increased straying would be significant for all of the options. These risks could rule out all of the alternatives. Bob Hamilton agreed that those risks need to be clearly spelled out and that the money that would need to be spent to help mitigate those risks, such as building and operation barrier weirs, needs to be determined.
- USBR management has repeatedly asked about the possibility of moving the production to Chief Joseph. Mark noted that there is potentially space available at the site but about \$10-\$15M would need to be spent on developing a water supply. That is in addition to the costs that would be required for building the rest of the required infrastructure.
- Kim Hubbard suggested that columns for implementation costs and for operational costs be added for each of the alternatives to allow for easy cost comparison.
- Dan Warren asked if current operational costs for the facilities could be provided to help give us a basis for the projected operational costs for the alternatives. Dave Irving said that he would get together with Steve and Bob Hamilton next week to put together a spreadsheet with a basic breakdown of the operation budgets. The budget for the Mid-Columbia River Fishery Resource Office should also be included.

- Rich Johnson noted that a couple of the alternatives have fish being released for either Chief Joseph or from Peshastin Creek which would eliminate the fishery at the usual and accustomed fishing site at Leavenworth. This would likely eliminate those alternatives from consideration. Mark and Kevin agreed that was the case, which is why the rest of the alternatives show fish being returned to Leavenworth for acclimation before release. It was felt necessary to at least show the option of moving the release site so that it could be explained why those options would not likely be feasible.
- Alternatives with off-site rearing and on-site acclimation are likely to have a high stray rate. The current stray rate at Leavenworth is very low. USFWS can provide information on stray rates for the various programs in the region.
- Kevin Malone asked about whether Leavenworth would be staying with a segregated program, or if they would be moving to an integrated program as the HGMP, HRT and HSRG all suggested that this action be considered as an alternative strategy. Bill Gale responded that Leavenworth would not likely move to an integrated program due to the likely much higher stray rates that would occur. The Chiwawa integrated program, which has off-site rearing and on-site acclimation, has a significant stray rate problem.
- Joy Evered asked about the mention of reuse water for some of the alternatives. It was not clear whether the reuse would be serial reuse, or treated reuse. Serial reuse is currently only used for 1 or 2 week periods. Long term serial reuse would likely result in disease (BKD) issues with spring chinook.
- Bob Hamilton noted that the reports will be read by non-engineers and non-scientists. So that things need to be clearly and simply explained to be understandable to those not familiar with fish hatchery operations and technology. Kim Hubbard suggested that perhaps the executive summary could be simplified to achieve this purpose.
- Dan Warren asked if it would be desirable to get outside input on the potential US vs. Oregon and policy/legal issues with some of the alternatives. McMillen have legal/policy contacts with extensive understanding of the issues that could weigh in with their opinions if that were deemed to be valuable.

3.0 ACTION ITEMS

- USFWS will provide operation budgets for the three facilities
- USFWS will provide data on the stray rates for the various regional programs
- McMillen will type up the new proposed list of alternatives and send that out to the group for review and comment (Done). End of next week is target for confirmation of alternatives to be included.
- McMillen will prepare draft meeting notes. Scope of phosphorous study to be increased to look at Entiat and Winthrop.

MEETING NOTES

McMILLEN, LLC

To:	Meeting Attendees	Project:	Leavenworth Fisheries Complex Planning Report
From:	Tom Finnegan, PE	Cc:	File
Date:	Octoberber 21, 2014	Contract No:	Contract No.
Subject:	Task A5 Review Meeting		

1.0 INTRODUCTION

1.1 Purpose

The purpose of this memorandum is to discuss points from our October 21, 2014 conference call meeting on the Leavenworth Fisheries Complex Alternatives Analysis Project to discuss the revised matrix and writeup for Task A5 – *Evaluate Geographically Separate Alternatives*. The conference call included representatives from USFWS, US Bureau of Reclamation (USBR), D.J. Warren and Associates, and McMillen-LLC.

1.2 Attendance

The meeting attendees were as follows:

Name	Organization	Email	Phone
Steve Croci	USFWS - LFC	Steve_croci@fws.gov	509-548-7641
Dave Irving	USFWS - LFC	Dave_irving@fws.gov	509-548-2912
Kim Hubbard	USFWS	kim_hubbard@fws.gov	503-231-2363
Jim Craig	USFWS – MCR FRO	jim_1_craig@fws.gov	509-548-2999
Bill Gale	USFWS – MCR FRO	william_gale@fws.gov	509-548-2991
Bob Hamilton	USBR	rhamilton@usbr.gov	208-378-5087
Kevin Malone	DJ Warren & Assoc.	kmmalone@wavecable.com	206-919-3892
Dan Warren	DJ Warren & Assoc.	Dan.warren@djwassociates.com	541-929-4639
Mark Reiser	McMillen, LLC	mark.reiser@mcmillen-llc.com	503-886-8956
Tom Finnegan	McMillen, LLC	tom.finnegan@mcmillen-llc.com	206-858-8889

1.3 Agenda

The purpose of the session was:

- Review initial screening of geographically separate alternatives
- Shortlist alternatives for further analysis

2.0 MEETING NOTES

2.1 Opening/Introduction

Mark Reiser gave a brief overview of the meeting agenda and objectives. Comments have been received so far from Steve Croci, Joy Evered, Bill Gale, Bob Hamilton, Julie Collins and Kim Hubbard.

2.2 Review of the Alternatives

- Bob Hamilton noted that the first four alternatives all could have a fatal flaw in that they did not maintain the usual and accustomed fishing spot at Leavenworth. Would it be possible to get an opinion from the solicitor's office on the legal and policy issues involved with modifying US vs. Oregon to eliminate or move the usual and accustomed fishing spot. It is possible that USFWS may need to maintain the site and the run.
- Alternative GS5 is the only alternative that would maintain the usual and accustomed fishing spot.
- Dan Warren pointed out that McMillen have contacts with people who are very familiar with all of the legal and policy issues related to US vs. Oregon. We could probably get an initial opinion on what it would take to get US vs. Oregon modified.
- Mark Reiser said that initial screening appeared to rule out alternatives GS1 and GS4.
- Alternative GS1 – relocating Leavenworth NFH to a site upstream of Icicle Creek. As pointed out by Bill Gale in his comments, there would be issues with trapping adults at Tumwater dam (bull trout, EAS issues...). It would be very difficult to get the project approved. There would also still be issues finding water sources and getting water rights, as well as issues with phosphorous.
- Alternative GS4 – relocating Leavenworth NFH to a new site in one of the tributaries, Entiat, Methow or Okanogan. The spring chinook program on the Entiat was discontinued due to EAS issues. There is already spring chinook programs on the Methow, and the river probably can't accommodate an additional 1.2-1.6 million smolts. The Okanogan is probably too warm.
- Bill Gale had a few comments on alternative GS2. Alternative GS2 – relocating Leavenworth to a site downstream of Icicle Creek, such as Dryden or Peshastin Creek. The PUD's and Tribes have both looked closely at the Dryden site and didn't think it was viable for a few reasons. There would also still be a phosphorous discharge issue. Peshastin Creek freezes up in the winter so finding enough water could be an issue there.
- Bill also had some comments on Alternative GS4- relocating Leavenworth to an existing facility on the mainstem Columbia – Chief Joseph Hatchery, CCT Resident Hatchery, or Wells Dam. Bill felt that it would be very difficult to develop a sharing agreement with Douglas County PUD to build at Wells Dam, and space may not be available. The Colville's may be reluctant to expand the spring chinook program in the Chief Joseph area until they have more data on the homing fidelity and stray rates of the fish from the

existing program. There would be ESA concerns with additional stray into the Methow or Okanogan.

- Mark pointed out that for the CCT Resident hatchery site, the new facility would be a separate isolated program built on property adjacent to the existing hatchery. Space is available and the ability to acquire water rights looks favorable.
- Dan mentioned that for the Chief Joseph site, space does appear to be available, but the relief tunnel water supply would need to be developed, which could be a fairly significant cost item.
- Mark mentioned that there is currently a Columbia River Transboundary conference going on currently that is beginning discussions of the possibility of putting salmon upstream of Chief Joseph and Grand Coulee. The potential implementation of those proposals is obviously a long ways off, but do we need to take a similar long-term view in our analysis.
- Steve Croci asked about the possibility of putting a new facility on a tributary upstream of Grand Coulee with a trap and haul around Chief Joseph and Grand Coulee. Bob felt that the possibility of putting fish above Grand Coulee is so far off and has so many technical and policy issues that would need to be resolved, that we should consider those possibilities at this time.
- Bob mentioned that the Grand Coulee mitigation was written 80 years ago and that a lot more was known today about fish biology and ecology. We have a chance to do things correctly now.
- Bob pointed out the choice of fish rearing technology has a big impact on water demands. Mark said that more on that issue would be added, and that McMillen would be looking at alternative technologies for the rehabilitation of the existing site alternatives.
- Bob mentioned that while Entiat and Winthrop have so far been able to avoid lawsuits and challenges from environmental and fishing groups related to water use and effluent discharges, those issues could come up in the future.
- Kim Hubbard asked if we could get some quick opinions on the potential fatal flaw issues with the alternatives so that we could wrap up Task 5 for the draft report. If upper management from USBR decide at that point that they want additional analysis done, then additional funds could be released at that time.
- Bill Gale gave a summary of the potential issues with trapping adults at Tumwater Dam and why it would be problematic for Alternative GS1.

3.0 ACTION ITEMS

- McMillen will solicit some opinions on the legal and policy issues with the alternatives to identify any fatal flaws or what would be required to make any of the alternatives reality.
- McMillen will prepare draft meeting notes

DRAFT MEETING MINUTES

McMILLEN, LLC

To:	Meeting Attendees	Project:	Leavenworth Fisheries Complex Planning Report
From:	Tom Finnegan, PE	Cc:	File
Date:	December 17, 2014	Contract No:	Contract No.
Subject:	Draft Report Review Meeting		

1.0 INTRODUCTION

1.1 Purpose

The purpose of this memorandum is to discuss points from our December 17, 2014 conference call meeting on the Leavenworth Fisheries Complex Alternatives Analysis Project to discuss the rough draft of the Alternative analysis Report. The conference call included representatives from USFWS, US Bureau of Reclamation (USBR), D.J. Warren and Associates, and McMillen-LLC.

1.2 Attendance

Name	Organization	Email	Phone
Steve Croci	USFWS - LFC	steve_croci@fws.gov	509-548-7641
Dave Carie	USFWS - Leavenworth NFH	dave_carie@fws.gov	509-548-7641
Travis Collier	USFWS – Leavenworth NFH	travis_collier@fws.gov	509-548-7641
Kim Hubbard	USFWS	kim_hubbard@fws.gov	503-231-2363
Andy Goodwin	USFWS	andrew_goodwin@fws.gov	503-231-6784
Craig Chism	USFWS – Entiat NFH	craig_chisam@fws.gov	509-784-1131
Chris Pasley	USFWS – Winthrop NFH	chris_pasley@fws.gov	509-996-2424
Wendy Olson	USFWS - OFHC	wendy_olson@fws.gov	360-753-9046
Joy Evered	USFWS - OFHC	joy_evered@fws.gov	360-753-9046
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Dan Warren	DJ Warren & Assoc.	dan.warren@djwassociates.com	541-929-4639
Mark Reiser	McMillen, LLC	mark.reiser@mcmjac.com	503-886-8956
Jim Harper	McMillen, LLC	jim.harper@mcmjac.com	503-886-8956
Tom Finnegan	McMillen, LLC	tom.finnegan@mcmjac.com	206-858-8889

1.3 Agenda

The purpose of the session was:

- Review the rough draft of the Alternatives Analysis Report
- Determine action items and next steps to finish the draft of the report.

2.0 MEETING NOTES

2.1 Opening/Introduction

Mark Reiser gave a brief overview of the meeting agenda and objectives. Comments have been received so far from Steve Croci, Craig Chism, Chris Pasley, Andy Goodwin and Kim Hubbard.

2.2 Review of Section 4 – Geographically Separate Alternatives

- Rough costs were developed for relocating all three of the facilities to geographically separate sites using data from recently constructed hatchery facilities, or from facilities that have been recently designed and estimated to a high degree of confidence.
- The estimated costs for relocating the facilities would be significantly higher than the estimated costs for modernization. The one possible exception could be at Leavenworth.
- A number of sites were looked at further for relocating Leavenworth in the Wenatchee basin, the Methow, the Okanogan, as well as on the main stem Columbia River. Significant problems were found with all of the options and relocation was not looked at further.
- Steve asked if we could beef up Section 4.9 some so that it very clear to upper management and those that may not be as familiar with the issues as to why the alternative was ruled out.

2.3 Review of Section 5 – Existing Site Alternatives

- Mark explained that the same basic issues that were reviewed for the geographically separate sites were also considered for the existing site alternatives and included: Land Issues, Water Quality and Quantity, Biological Analysis and Policy and Legal. In addition the following further issues were also considered: Socio-Economics, Capital Costs, Operating Costs and Environmental Compliance.
- One piece that was not included in the rough draft was the socio-economics which McMillen just received. That section will be distributed separately for people to review.
- Steve had questions on the allocation of operating costs in Section 5.3.7 and asked if the text could be clarified as it currently makes the costs for Leavenworth appear to very high. Dan explained how the costs were allocated and suggested that perhaps the tables in appendix E be moved up into the text.
- Steve Dan and Mark will have an off-line discussion on how to present the operating cost info.

2.4 Review of Entiat

- Craig has provided some clarifying comments for the Section 2 portion on Entiat.
- There is a definite deficit of groundwater most of the time. The new infiltration gallery project that is underway may address the issue.

- There appear to be adequate water rights and surface water, although there are reliability issues with the surface water intake.
- There is a small surplus of rearing volume.
- The 22.5cfs surface water right can also come from groundwater sources since the surface and groundwater are closely hydrologically connected.
- Steve finds the Water Supply and Rearing Volume Summary table confusing. He felt that it paints the picture that the facility has excess water that they aren't using. Whereas the facility in reality does not get the water they have rights to.
- Kim suggested that maybe two separate tables could be shown, one for the water rights and one for the typical usage.
- Steve reiterated that the emphasis should be on securing groundwater rights. The facilities may be able to get by now, but programs could change in the future, or with potential climate change there could be a warming of the surface water or more disease issues, so groundwater could become more important.
- Craig said that the ENFH facility would take the full 22.5cfs of surface water when they can. They sometimes can't get the full amount due to icing of the river and intake, or during low flows when NOAA limits how much they can take so that the bypass reach doesn't become dewatered.
- In some cases, such as in April, more water is being used that is required based on just the flow index, but more water is typically better if it is available as there is better turnover and more consistent DO in the raceways.
- Mark reviewed the issues that have been identified with the surface water supply system and the proposed modifications. One potential modification that is not currently shown in Table 6.2 is a disinfection system for the surface water supply to address the myxobolus parasite. Joy noted that there may also be some virus issues in the surface water.
- Mark said that it would be possible for the facility to rear all the fish in just two banks of raceways, which would have some operational and cost benefits. Joy noted that if a higher rearing density was used then there may not be as much flexibility to address unforeseen issues. Mark noted that the remaining third raceway bank would not be removed under this scenario, just not used under normal conditions, so there would still be flexibility to move fish around if needed.
- Andy said that he now had a better understanding of the Aeroboost system, so some of his previous concerns go away, however, he did note that it did not appear that any anadromous fish have yet been raised with the system, so there would still be some unknowns. Mark noted that since it is new technology, there would not be any data available for some time.
- Andy had questions about the suitability of the 40 micron screens proposed for use with a UV system. The screen wouldn't take out fine particles and if there were periods with clay turbidity that there could be issues with the effectiveness of the UV system. Mark explained that a finer filtration could be provided, but there would trade-offs in cost and

operation. If a UV system were to be considered, then it would be advisable to get better turbidity data. Craig said that they do get some periods of high turbidity during freshets and at spring runoff. With the recent fires in the basin they do appear to be seeing more turbidity.

- Steve reiterated that we don't want to necessarily make it appear that the FWS is promoting reduction of water use by looking at alternative rearing strategies, but instead they are being looked at to address low water availability issues, climate change, etc.
- Steve asked if the priority ratings could be clarified to give more guidance on what modifications should be tackled first. Mark said that it was intended that in Section 7 an implementation plan would be included that will show the implementation of proposed modifications over 20 years, assuming funding being made available. Mark said that it would be good to get opinions from the hatchery staff on what they thought were the most critical items that needed to be addressed. Steve's priorities are:
 1. Robust water supply –infrastructure that provides ability to use full water rights.
 2. Modernize rearing units
 3. Good effluent treatment
- Craig asked if a pump back alternative could be included in with the proposed modifications. Currently, when the river flows get low, NOAA limits the amount of water the hatchery can take out of the river so that there is water remaining in the bypass reach. If the drain water could be pumped back and discharged immediately downstream of the intake, then there would be no bypass reach and they should be able to take their full water right.
- Steve asked if we could allow for some additional expansion of the groundwater system beyond the current infiltration project as it was not known how much water that new system would be able to produce.

2.5 Review of Winthrop

- Mark noted that there was a discrepancy in the total property ownership at the site between what was shown on the County assessor maps and some drawings that Chris has. The actual ownership area will be confirmed.
- Mark noted that there were some minor deficiencies in groundwater supplies in the fall period.
- Mark explained that the biggest challenge at Winthrop was the deficit of juvenile rearing volume due to the poor condition of the old Foster-Lucas ponds. There appears to be a deficit of about 42,000cf if the ponds that aren't currently suitable aren't used.
- The backwater channel that the Yakama Nation (YN) is currently using for coho acclimation has lots of volume and could potentially raise about 200,000 coho. The YN did have a disease problem one year when they were holding 200,000 coho, but the fish were being held in the summer when the water temps get very warm. The YN no longer holds fish in the back channel during the summer months.

- No costs have been developed for a potential surface water disinfection system alternative. There are spawning Spring Chinook and steelhead above the intake, but there has not been any disease problems so far, so a disinfection system is likely not a high priority now. Due to the volume of water, costs for construction and operation of a full flow disinfection system would be high. Steve suggested a system to treat lower flows during July-November be considered.
- Joy noted that part of the reason why they likely haven't had any disease problems was the way the facility manages its water. The facility isn't currently taking surface water when the Spring Chinook are in the system spawning.
- Mark noted that there isn't a groundwater aeration system, which was a bit unusual and he recommended that FWS consider installing one to improve water quality. Chris said that since the infiltration galleries are so shallow, they get pretty good oxygen levels (9ppm), and they have relatively low oxygen consumption in the raceways. Mark indicated that aerating the water would allow the water to become fully saturated (11ppm), which would be beneficial and would also reduce risk of gas-bubble disease.
- Some of the old steel piping is in very poor condition and should be a high priority for replacement. Chris noted that the section of pipe that recently failed showed evidence of having been previously damaged, which lead to its failure. Chris also noted that he did not see any indication of any wooden plugs in the main steel supply line and perhaps the comment from staff was inaccurate.
- Looking at option for rearing vessels, Mark asked if FWS had any preference between raceways and circulars. Chris expressed a preference for raceways as it was what he was most familiar with. Rich indicated a preference for circulars for any new rearing units. Steve felt that either could work well, but really large circulars would not be recommended. If a disease issue were to arise in a rearing vessel, then all the fish in the rearing vessel might need to be killed off. Chris noted that volitional release is preferred for steelhead and coho, which may be difficult to set up in circular vessels. Circulars would need to be sized and designed appropriately.
- Bob felt that there might be a preference for circulars to potentially reduce water use and waste/phosphorous removal.
- Bob asked about the trade-offs between fiberglass or concrete circulars. Concrete would be more expensive, but need to consider the projected service life for fiberglass vs. concrete.
- For a large scale replacement of rearing vessels in the location of the C bank, Mark asked where the fish could be relocated. Could the fish be relocated at another facility, placed in the old rearing ponds in A or B bank, or perhaps in the back channel? It was noted that another facility would not likely have room. B bank could be used temporarily if new units were built in C bank footprint.
- Mark said that the 26-foot circulars that were considered for the Leavenworth pilot study have about 3,000cf of volume per tank. The volume of an 8'x80' raceway is about half and would be about equivalent in volume to a 20-foot circular. The 10'x100' raceways have about 4,000cf of volume each.

- Currently the facility holds about 50,000 coho per pond in the C bank, or 20,000 steelhead.
- Mark explained that there is a trade-off in costs when looking at tank sizes. Smaller tanks provide more flexibility, but costs will be higher.
- If concrete raceways were used, Chris would likely go with 10'x100' raceways in the C bank.
- Mark asked Chris about a discrepancy that had been noted between different sets of drawings with the drain piping in the area of the pollution abatement pond. Chris confirmed that the 1996 project was never constructed.
- Steve asked Chris if the addition of office space was still a priority, now that one of the residences had been converted to office space for the FRO. Chris said that it wasn't a high priority now.

2.6 Review of Leavenworth

- Mark noted that there has been a reduction in groundwater production with the operation changes at Structure 2 reducing the water recharge from the Hatchery Channel.
- One potential unknown is the YN coho program. The current master plan show coho production reducing from the current 600,000 smolts to 35,000 in the next few years. The YN has been trying to develop their own facility in the basin, but they have been running into difficulties. It is not clear how long the YN will be at Leavenworth, or what their production levels will be. The surface water deficit that is currently being shown would go away if the coho production were reduced to 35,000 smolts.
- There appears to be some deficit in early rearing volume according to the density index. The facility has made up for it by providing more water than is required according to the flow index. Joy would like to include the alternative of providing enough early rearing volume to meet density targets. This would require an additional 69 troughs and 8,000 sf building.
- Steve asked about the alternative of using circulars for early rearing. Mark explained that from what he has read and heard from other experts is that rectangular vessels appear to be preferred to circulars for early rearing. It would be costly to replumb the building for circulars.
- There appears to be enough volume for rearing of juvenile Spring Chinook. The deficit is for rearing the coho, which are being reared in substandard vessels.
- Mark said that there appears to be enough volume for the juveniles in the two sets of raceways without having to place fish out in the adult ponds. Steve noted that they do get a bit better returns from fish that are released from the adult ponds compared to the 8'x80' raceways. Moving the fish to the adult ponds might be more related to the flow index and turnover rates rather than the density index.
- Mark noted that they are using a density index of 0.15 at Leavenworth compared to 0.11 at the other two facilities. Steve and Joy noted that they have been producing high quality fish with good returns at that level, so they have not moved to the lower number.

- Mark noted that costs for the intake screen replacement have not been developed. Bob said that the USBR have prepared a set of screening alternatives as part of starting the SEPA/NEPA process.
- Aspect Consulting has completed the geophysical survey. They had good conditions and were able to take some additional sections. A write-up on the analysis should be available after the first of the year.
- For the proposed pumpback system to provide groundwater recharging, the DOE is wanting some additional groundwater modeling to be performed to see if there would be any water quality issues.
- If the highly restrictive phosphorous limits are kept in place for the final NPDES permit, then a filtration and clarification project would be required.
- Joy said that she would have concerns with the proposed groundwater reuse system for early rearing and disinfection treatment would need to be provided as part of that alternative.
- Mark asked if the addition of a chiller should be added to the list of proposed modifications. The water at Leavenworth is naturally colder than at Entiat or Winthrop, so a chiller is probably not as critical, although it would provide some flexibility. Steve said that the two chiller systems at Entiat and Winthrop cost around \$50,000 each.
- Bob asked if for the rearing vessel replacement options if it would be better to take out the north bank of ponds. Mark said that it was shown taking out the south bank as there appeared to be potential issue with maintaining space around the garage and the proposed phosphorous treatment system. If the new rearing vessels were placed at the north end, it is likely that both the north bank and the middle bank of Foster-Lucas ponds would have to come out. Steve prefers to locate new rearing at the north end.
- For historic preservation, some of the small Foster-Lucas ponds will need to be kept. From a historic preservation perspective, it would be preferable to keep the two modified ponds in the middle bank, and a couple original ponds. The rest of the ponds could likely come out.
- Bob asked if whether freezing would be an issue with the fiberglass tanks. Currently, just a cover is being shown for that option. The existing covered 10'x100' raceways don't freeze up as much as the uncovered 8'x80' raceways. If enough groundwater is available, then that would really help to prevent the vessels from freezing.
- Bob asked if freezing temperatures would be a problem for the fiberglass material over time. Fiberglass tanks will be less prone to damage from freezing than concrete which spalls and degrades relatively quickly.
- A centralized PRAS system would need to be fully enclosed to protect all of the associated equipment, but the tanks could be in covered unconditioned space like Eastbank.

- Bob asked if whether the phosphorous treatment system would need to be enclosed to protect from freezing. Currently the filter system is shown as being enclosed, but the clarifier and sludge thickener do not require a building.
- Steve pointed out the enclosing and heating a building to house the vessels would be very energy intensive.
- Steve noted that the NPDES write-up is based on the permit from 2005. The facility put together a permit application in 2011 that has a number of changes in it. Write-ups will be changed accordingly.
- Steve explained that the DOE would begin the 401 certification process with the EPA once FWS had completed a groundwater study and prepared a flow management plan. The groundwater study should be done by the end of January 2015. There are ongoing negotiations with NMFS on how FWS operate their system. The flow management plan can't be completed until there is an agreement.
- Jim talked with both DOE and EPA and both said that the 5.7µg/l requirement probably shouldn't be in the permit.
- Jim found a good example of a phosphorous treatment system from a hatchery in Michigan that has very similar loads. For that facility they have disc filters at the end of the raceways, and only the backwash from the filters is chemically treated and clarified.
- A clarifier and a sludge thickener have been preliminarily sized. For the 25-foot circular sludge thickener shown, the sludge would need to be hauled off every 2 or 3 days, which would be a significant new operational expense. A belt filter could be incorporated to concentrate the sludge and significantly reduce the haul off frequency.
- It is recommended that a pilot project be done prior to design so the system could be better dialed in to the conditions.
- Bob asked whether the flocculants would help remove some of the aqueous phosphorous. Jim said that it would remove some, but that there would still be some phosphorous in the discharge.
- Jim noted that there appeared to be a fairly significant amount of flow always going through the pollution abatement pond. Steve suggested that there could be a fair amount of leakage from the standpipes. The standpipes are not gasketed, it is just metal on concrete.
- The phosphorous treatment shown assumes vacuuming of waste instead of sweeping. If the current system of sweeping and pulling standpipes is retained, then the system would need to be much larger to handle the higher flows.
- Steve pointed out that vacuuming could not be used for the early rearing as the fish are too small and it is likely that fish would get sucked up by the vacuum.
- Steve said that they really haven't been using the low phosphorous feed lately due to some fish health issues they experienced when they were using it.

3.0 ACTION ITEMS / NEXT STEPS

- McMillen will prepare draft meeting notes. (Done)
- Steve, Dan and Mark will have an off-line discussion on how to present the operating cost info. (Done)
- The socio-economic analysis will be sent out separately for people to review. (Done)
- The phosphorous study draft will also be sent out separately for review. (Done)
- Work will continue on adding more detail to Section 6 and costs will be developed further for recommended combinations of modifications. (In Process)
- The review comments will be incorporated into the report. (Done)
- A more polished draft should be ready by mid-January.
- The FWS will provide a recommended maximum number of fish per raceway or circular rearing vessel.
- Mark will work with Steve and Kim to revise the Section 3 tables to make the information more clear.
- An implementation plan with a prioritization will be developed.
- FWS will look further at their ponding scheme as to why they have been moving fish to the adult ponds at Leavenworth.

DRAFT MEETING MINUTES

McMILLEN, LLC

To:	Meeting Attendees	Project:	Leavenworth Fisheries Complex Planning Report
From:	Mark Reiser, Jim Harper	Cc:	File
Date:	March 4, 2015	Contract No:	Contract No.
Subject:	Pre-Meeting to the Draft Report Stakeholders Meeting		

1.0 INTRODUCTION

1.1 Purpose

The purpose of this memorandum is to provide highlights from the March 4, 2015 meeting held at the USFWS building in Portland. The purpose of the meeting was to review the talking points for the upcoming March 17 meeting to be held at the Leavenworth Fish Hatchery Site.

1.2 Attendance

Name	Organization	Email	Phone
Steve Croci	USFWS - LFC	steve_croci@fws.gov	509-548-7641
Kim Hubbard	USFWS	kim_hubbard@fws.gov	503-231-2363
Dave Irving	USFWS	Dave_irving@fws.gov	509-548-2912
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Julie Collins	USFWS	Julie_collins@fws.gov	503-231-6217
Mark	USFWS		
Roy Elicker	USFWS		
Bob Hamilton	USBR	rhamilton@usbr.gov	208-378-5087
Jason	USFWS.		
Valeria	USFWS		
Mark Reiser	McMillen, LLC	Reiser@mcmjac.com	503-886-8956
Jim Harper	McMillen, LLC	Jharper@mcmjac.com	503-886-8956

1.3 Agenda

The meeting agenda was to discuss the content of the presentation of the draft alternatives analysis report to the stakeholders with Roy Elicker and staff.

2.0 MEETING HIGHLIGHTS

For most of the meeting Mark Reiser ran through a summary of the Draft Alternative Analysis Report. Mark said a draft power-point presentation has been developing based on the summary and this will be the same information presented at the March 17 meeting.

The presentation has not been included in these meeting highlights, however other discussions included:

- Expected attendance at 3/17/15 meeting at LNFH include: FWS, BPA, BPR, Chelan County, Yakama Tribe, Colville Tribe
- McMillen Qualifications should be included at the beginning of PPT
- Provide some Background of whose project it is – FWS, BOR
- Report should be circulated to participants prior to meeting. It should be expected that the draft report will be accessible to general public once the documents is circulated to meeting invitees.
- FWS Comments will be sent back to McMillen within a week. Send draft report out to 3/17 meeting participants after receiving comments from FWS.
- Report is based on 1.2M versus 1.6M fish volumes. These numbers will be revisited in 2018.
- Page 4 of summary: 53-cfs under surface water although right is 42-cfs. Report should explain this. The discussion should include turnover rates and operations.
- Remove “recommended” in water use graphs. This is the predicted water use based on FI.
- Removing “recommended” applies to all three hatcheries.
- High elevation Storage should be included in discussion on long-term issues and climate change.
- The 70% reuse number was questioned however in a group discussion with several existing hatchery examples the 50%-70% reuse number was acceptable to everyone.
- Both concrete and fiberglass tanks have a 30-year design life.
- Public Outreach staff joined the meeting – Jason and Valeria.
- Jason to get with Patricia with BOR and discuss roll-out of report.
- Legal Staff will be given the opportunity to review the documents prior to distributing.
- Reduce the draft summary to 5 pages or so to function as an Executive Summary (ES).

3.0 ACTION ITEMS / NEXT STEPS

- Incorporate McMillen qualifications into introduction of PPT
- Page 4 of ES 53-cfs under surface water although right is 42-cfs. Report should explain this. The discussion should include turnover rates and operations.
- Remove “recommended” in water use graphs. This is the water use based on FI.
- Removing “recommended” applies to all three hatcheries.
- High elevation Storage should be included in discussion on long-term issues and climate change.
- ES should be reduced to 5 pages.

DRAFT MEETING MINUTES

McMILLEN, LLC

To:	Meeting Attendees	Project:	Leavenworth NFH Circular Tank Project
From:	Tom Finnegan, PE	Cc:	File
Date:	September 8, 2015	Contract No:	Contract No.
Subject:	Draft Scope Review Meeting		

1.0 INTRODUCTION

1.1 Purpose

The purpose of this memorandum is to discuss points from our September 8, 2015 conference call meeting on the Leavenworth NFH Circular Tank Project (Project) to discuss the draft scope of work and budget for design. The conference call included representatives from USFWS, US Bureau of Reclamation (USBR), and McMillen Jacobs Assoc.

1.2 Attendance

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Tom Finnegan	McMillen, LLC	finnegan@mcmjac.com	206-743-9202

1.3 Agenda

The purpose of the session was:

- Review the rough draft of the scope and budget for the design of the Project.
- Determine action items and next steps to finish the scope and budget so that the contract can be awarded before fiscal year end.

2.0 MEETING NOTES

- Mark explained that an initial proposal for a design of 18 tanks with centralized partial reuse aquaculture system (CPRAS) and surface water treatment for 10-12 cfs was prepared. That proposal came in much higher than the currently available design funds.

- Mark revised the design proposal for a 4-tank project with centralized PRAS. The surface water treatment facility design was broken out as a separate task. It was also determined that survey would not be required for the tank portion of the project, but as-built topo up near the sand settling basin would still be needed for the water treatment portion of the project.
- A detailed drawings list was prepared for both portions of the Project with 80 sheets expected for the 4-tank CPRAS and an additional 16 sheets required for the water treatment system.
- Mark noted that the hours for some of the sheets was very minimal due to the assumption that McMillen Jacobs would be able to reuse with minimal works much of the design work that was done a couple of years ago for the pilot project that was never completed.
- FWS would like to wrap up the proposal so that the work can be awarded this fiscal year.
- Bob said that his original vision was that the work at Leavenworth would be very similar to the work at Winthrop, providing some savings in design as well as some future efficiency in operations and maintenance.
- Mark noted that for Winthrop the current work is for an alternatives analysis that is looking at three options. The circular tank option that is being looked at is a simpler system than what is being proposed at Leavenworth. The tanks would be designed for flow through, with the ability to do serial reuse between two tanks. There would not be the CPRAS system.
- Bob concern from a policy level is that the water scarcity and phosphorous issues that are currently such a concern at Leavenworth could eventually become concerns at Winthrop and Entiat. Bob wanted to know if there would be any design cost savings if both Winthrop and Leavenworth were to use the same rearing vessels?
- Steve noted that the conditions at Winthrop are very different from Leavenworth and that they don't have the water quantity or quality concerns at Winthrop.
- Bob asked if the Winthrop tanks could be designed with the ability to retrofit them in the future to add CPRAS if water quantity or quality were to become an issue?
- Steve and Mark noted that the currently proposed tank arrangements are different at Winthrop and Leavenworth. At Winthrop the current circular tank concept is for two rows of seven 30-foot diameter tanks. The pilot project design for Leavenworth was showing 26-foot diameter tanks in 4-tank modules.
- Mark noted that the 30-foot diameter tank size for Winthrop was chosen based on the results of the Lyons Ferry circular tank project VE study that recommended the 30-foot size over the 26-foot for cost savings. Using 30-foot tanks instead of 26-foot tanks at Winthrop would reduce the number of tanks required from 16 to 14.
- Bob had a couple of comments on the Scope of Work – The reference to the Coho smolts should be removed. The USBR is not interested in paying for the Yakama Nation's project. The Class 4 construction cost estimate for the 35% design should be a class 3 estimate, as that is more in line with what USBR is used to seeing at that stage.
- Bob had a question about whether SHPPO compliance would be required for the project. Steve responded that it would be required.
- Bob also had a few minor edits for the FWS scope document.
- Bob had a question on the volume needed if the 10x100's remain in service and if FWS would get the water savings the Biological Opinion requires. Steve noted that they

currently raise half of their fish in the 10x100's and half in the 8x80's with 20cfs going to each set of raceways. Replacing the 8x80's with circulars with CPRAS would allow them to get down to 30cfs total, depending on the level of reuse. To get down to 20cfs total, the 10x100's would have to be replaced with circulars with CPRAS, or would have to be retrofit with an Aeroboost system or something similar. Building the 4 tank "pilot" project would allow some experimentation in rearing densities.

- It was noted that there is plenty of space available for the 10x100's to be replaced with circulars in the future if desired.
- Bob is going to try and get additional money to build the project all at once, or possibly in just two phases and not piecemeal. There would be substantial cost savings if all of the tanks were built at once.
- Dave Irving noted that the purpose of the original pilot study was threefold: could FWS effectively raise spring Chinook salmon on station in circular tanks, could FWS reduce their water requirements, and could FWS reduce the phosphorous load.
- Kim noted that the current design budget available for this fiscal year only allows for the design of four tanks. Once we get into the new fiscal year, it might be possible to get additional design budget and modify the contract to add further design of the rest of the tanks.
- Bob noted that the current concept has a cover over the tanks only instead of a heated and enclosed space. Bob wanted to know how well fiberglass stands up over time to freezing temperatures. Mark said that they appear to do fine.
- Bob wanted to know what design effort would be required to add some kind of treatment system to the effluent end. The phosphorous study did look at treatment, but it was for the full 40cfs as that is how the facility is currently plumbed. Bob was interested in doing something simpler that would at least make a dent in the phosphorous load. If just the cleaning effluent flows from the circular tanks were treated, then the treatment system could be much simpler. FWS would not be able to meet the current DOE phosphorous load limits with that approach, however, FWS could potentially show DOE that they were making an effort, and hopefully get DOE to relax their phosphorous load requirements.
- Kim noted that one of the reasons for going with a design for just a four tank module was that the design could be finished up in time for it to put out to construction next spring. If the scope was to be changed to a design for the full project, than the design may not be completed in time to go to construction in the spring.
- The current Biological Opinion requires compliance within 8-years. If FWS shows sufficient progress, there would likely be room to renegotiate the time frame with NMFS.
- Kim asked Bob how much money for construction FWS could realistically expect to get. The current estimate for replacing the 8x80's is about \$8M. A water treatment system for 10cfs would add about \$1.5M and a treatment system for phosphorous would add more.
- Mark will update the original proposal. Optional design tasks will be added for replacement or retrofit of the 10x100's and for adding effluent treatment.

3.0 ACTION ITEMS / NEXT STEPS

- McMillen Jacobs will prepare draft meeting notes.

- Mark will revise the original scope and budget and get them back to Kim for review later this week.
-

DRAFT MEETING NOTES

McMILLEN, LLC

To:	Meeting Attendees	Project:	LFC Planning Report
From:	Tom Finnegan, PE	Cc:	File
Date:	September 23, 2015	Contract No:	Contract No.
Subject:	90% Review Meeting		

1.0 INTRODUCTION

1.1 Purpose

The purpose of this memorandum is to discuss points from our September 23, 2015 meeting on the Leavenworth FC Alternatives Analysis Project (Project) to discuss the 90% draft of the Alternatives Analysis. The meeting included representatives from USFWS, US Bureau of Reclamation (USBR), and McMillen Jacobs Assoc.

1.2 Attendance

Name	Organization	Email	Phone
Steve Croci	USFWS - LFC	steve_croci@fws.gov	509-548-7641
Dave Irving	USFWS - LFC	dave.irving@fws.gov	509-548-2912
Chris Pasley	USFWS - Winthrop NFH	chris_pasley@fws.gov	509-996-2424
Kim Hubbard	USFWS	kim_hubbard@fws.gov	503-231-2363
Bill Gale	USFWS – MCRFO	william_gale@fws.gov	509-548-2991
Rich Johnson	USFWS	rich_r_johnson@fws.gov	503-231-6835
Andy Goodwin	USFWS – Fish Health	andy_goodwin@fws.gov	503-231-6855
Amanda Smith	USFWS – Public Affairs	amanda_smith@fws.gov	
Roy Elicker	USFWS	roy_elicker@fws.gov	
Tim Parsons	USBR		
Bob Hamilton	USBR	rhamilton@usbr.gov	208-378-5087
Mark Reiser	McMillen Jacobs	reiser@mcmjac.com	503-886-8956
Tom Finnegan	McMillen Jacobs	finnegan@mcmjac.com	206-743-9202
Derek Nelson	McMillen Jacobs	dnelson@mcmjac.com	208-985-1535

1.3 Agenda

The purpose of the session was:

- Review the draft 90% of the Alternatives Analysis for the Project.
- Get input on the PowerPoint presentation

2.0 MEETING NOTES

- Mark provided a brief review of the agenda for the meeting and then started to go thru the PowerPoint presentation.
- For the presentation in Wenatchee, the same group that attended the kick-off meeting will be invited and will include: Yakama Nation, Colville Tribe, Chelan County, WDFW, Washington Department of Ecology, and the Icicle Creek Workgroup. The meeting is a stakeholder meeting and not a public meeting.
- It was asked if the draft report would be sent out ahead of the meeting. Rich suggested that the report be sent out with the meeting invites, 2-3 weeks prior to the meeting.
- Rich said that he had talked recently with the two tribes and they had perceived the document as more of a construction document. Rich had assured them that the report was being used to assess the conditions of the existing facilities and to provide some guidance for the future of the facilities.
- Tim asked about the term “Tribal Trust” and what it exactly meant in this context. What specific obligations are required to be met with the hatcheries? Tim had been counseled by their solicitor’s office to avoid the term unless it was clearly defined.
- Dave said that in his mind, the three obligations of the facility were: mitigation for Grand Coulee, meet obligations of US versus Oregon, and Tribal Trust.
- Rich said that FWS would talk with their tribal liaison to discuss the issue.
- A bullet for climate change should be added to the project background slide.
- It should be noted that the existing conditions concerns are not in priority order.
- Groundwater production was listed as a concern for Entiat, but they do have a design completed for a new infiltration gallery.
- Outdoor rearing units were not listed as a concern for Entiat as at the time the report had been written Entiat had completed a rehab of the rearing units with an epoxy coating. Since then there has been issues with the epoxy lining failing and it was not clear if the problem was in the preparation, application, or in the product itself.
- Tim noted that seismic upgrades to occupied structures were listed for Leavenworth but not Entiat and Winthrop. Mark noted that the seismic upgrades had been identified by USBR in their 2012 inspection report of the three facilities.
- The production targets table should emphasize that the targets are current. Only the final columns of the table showing the targets used in the analysis should be shown.
- There was some discussion on the table showing the water supply and rearing volume summary, and the following water summary graph. Tim suggested removing the table and simplifying the chart, perhaps separating groundwater and surface water. It was then suggested that perhaps the two slides be replaced by a single slide with a few bullet points providing the takeaway from the analysis. The details in the report could be referenced. For Leavenworth,
 - Need to develop more groundwater
 - Desire to reduce surfacewater use during critical months of the year
 - Need to be smarter and more efficient with water use in the future
- Roy stated that the Tribes would like to meet to review the document and provide input before it is presented to the other stakeholders or public. Roy said that he would get

together with Tim to discuss process and approach. The Tribes would also be contacted to set up meetings.

- The wider stakeholder meeting will likely need to be pushed back to November.
- It was asked if after meeting with the Tribes, it would be a good idea to meet with the US versus Oregon groups. Since there are no proposed changes to the production targets, it was not felt to be necessary to talk separately with that group.
- There was some discussion on the use of the word “Preferred Alternative”. There could be some NEPA implications. It could appear that an alternative was being chosen before going thru the NEPA process. Another term should perhaps be considered – “Best Value”, “Best Meets Criteria” etc.
- It should be made clear that the ‘Range of Magnitude Cost Evaluation’ is construction cost only and does not include property acquisition, water rights, abandonment of existing facilities, design, permitting etc...It should also be made clear what cost it would equate to for the three facilities.
- For the ‘Geographically Separate Alternatives’ mention that no compelling reason was found to move either Entiat or Winthrop. The matrix presented in the report should also be referenced.
- For the ‘Geographically Separate Alternatives Evaluation’ add a bullet for Legal Issues.
- For the ‘Geographically Separate Alternatives – Summary’, remove the bullet on difficulty in obtaining funding.
- For the ‘Estimated Regional Economic Impacts’ make clear what the total economic benefit is. Tim thought that the numbers looked low.

3.0 ACTION ITEMS / NEXT STEPS

- Amanda will take a first shot at editing the PowerPoint presentation to simplify it.
- Roy and Tim will get together to discuss process and how to proceed with the Yakama and Colville Tribes
- McMillen Jacobs will prepare meeting notes.
- Mark will talk with Tom Wegge to get some clarifications on the economic benefits.
-

DRAFT MEETING NOTES

McMILLEN, LLC

To:	Meeting Attendees	Project:	Leavenworth FC Presentation
From:	Tom Finnegan, PE	Cc:	File
Date:	November 7, 2015	Contract No:	Contract No.
Subject:	Review Meeting		

1.0 INTRODUCTION

1.1 Purpose

The purpose of this memorandum is to discuss points from our November 7, 2015 meeting on the Leavenworth FC Alternatives Analysis Project (Project) to discuss the PowerPoint presentation. The meeting included representatives from USFWS, and McMillen Jacobs Assoc.

1.2 Attendance

Name	Organization	Email	Phone
Kim Hubbard	USFWS	kim_hubbard@fws.gov	503-231-2363
Amanda Smith	USFWS – Public Affairs	amanda_smith@fws.gov	
Mark Reiser	McMillen Jacobs	reiser@mcmjac.com	503-886-8956
Tom Finnegan	McMillen Jacobs	finnegan@mcmjac.com	206-743-9202

1.3 Agenda

The purpose of the session was to review the updated PowerPoint presentation.

2.0 MEETING NOTES

- Kim said that the presentation have to get pushed back to January, depending on when FWS can schedule a meeting with the Tribes.
- The draft report cannot be released publically until the final edits are made. Mark asked about the phosphorous study section, as there had been some disagreement on whether it should be included or not. Kim also wants to confirm that USBR is ok with the recommendations section.
- The agenda can just be some bullet-points without any start and end times.
- Amanda asked if anyone else would be presenting besides Mark as a change in face can help keep the audience engaged. Kim said that Roy and Rich want it clear that the report is McMillen document that provides recommendations and is not a decision document, so it is probably best if McMillen do the presenting. Roy, Tim, or Dave Irving will likely do the initial intro.

- The DJ Warren logo should be added next to McMillen's.
- Kim mentioned that the USBR logo should be added to the report since the recommendations are being provided to both FWS and USBR.
- Roy is setting up the meeting with the Tribes. Hopefully they can be convinced to meet together, but it is possible there will have to be separate meeting with each tribe. McMillen should plan on attending the meeting(s) to give the presentation.
- In the introduction, the FWS/USBR introducer should summarize why the alternatives analysis contract was issued.
- Add the phosphorous study and groundwater investigation to the scope of work.
- Add as slide summarizing the groundwater investigation work Aspect is finishing up.
- Amanda suggested that some photos be added to add some visual interest as it is currently all text.
- Aerial photos of the three facilities should be added after the discussion slide so that they are available during any discussion.

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3.0 ACTION ITEMS / NEXT STEPS

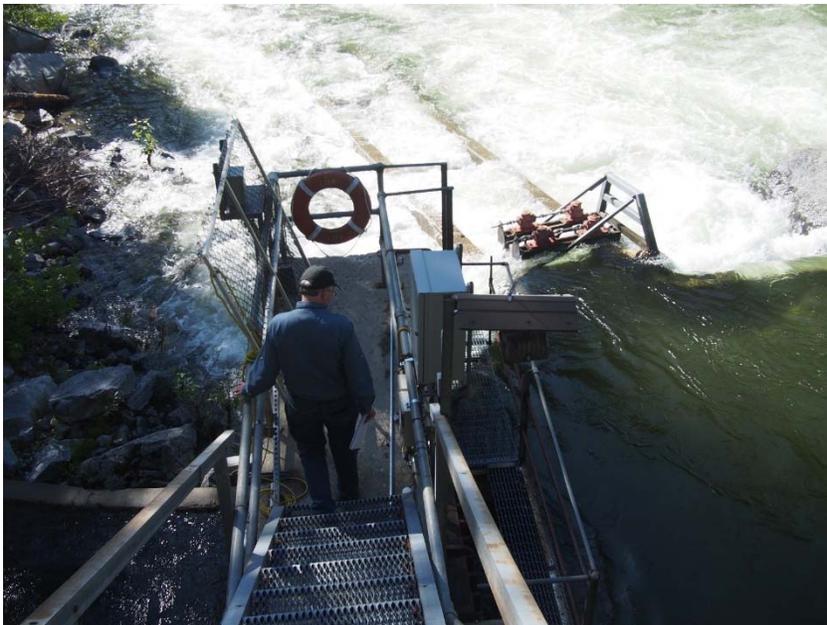
- Tom will finish making the edits
- McMillen Jacobs will prepare meeting notes.
- Amanda will check with Roy on the schedule for meeting with the Tribes.
- Kim will check with Bob Hamilton on the final edits to the draft report.

APPENDIX D
PHOTOGRAPHS

LEAVENWORTH NATIONAL FISH HATCHERY PHOTOGRAPHS



Photograph 1. Diversion Dam



Photograph 2. Surface Water Intake Fishway/Sluice



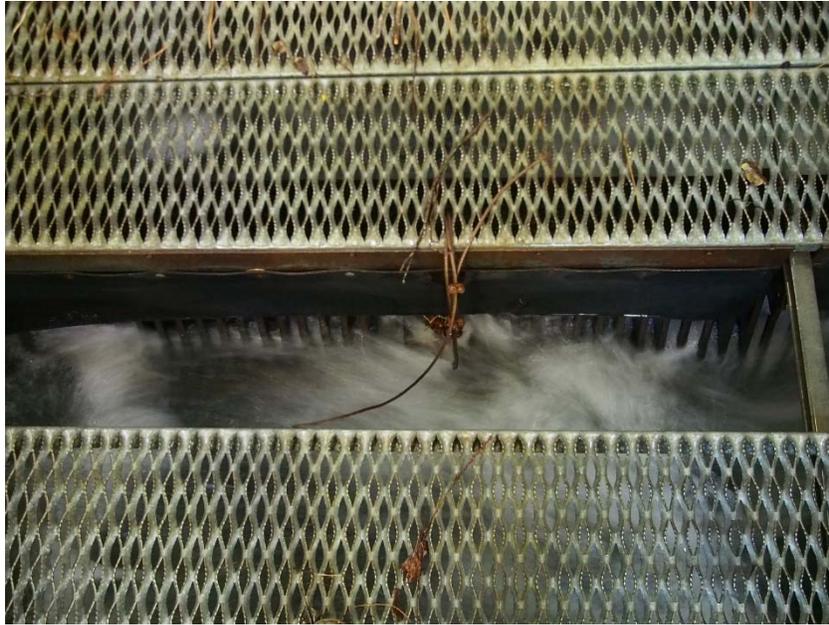
Photograph 3. Surface Water Intake Channel



Photograph 4. Surface Water Intake Trashrack



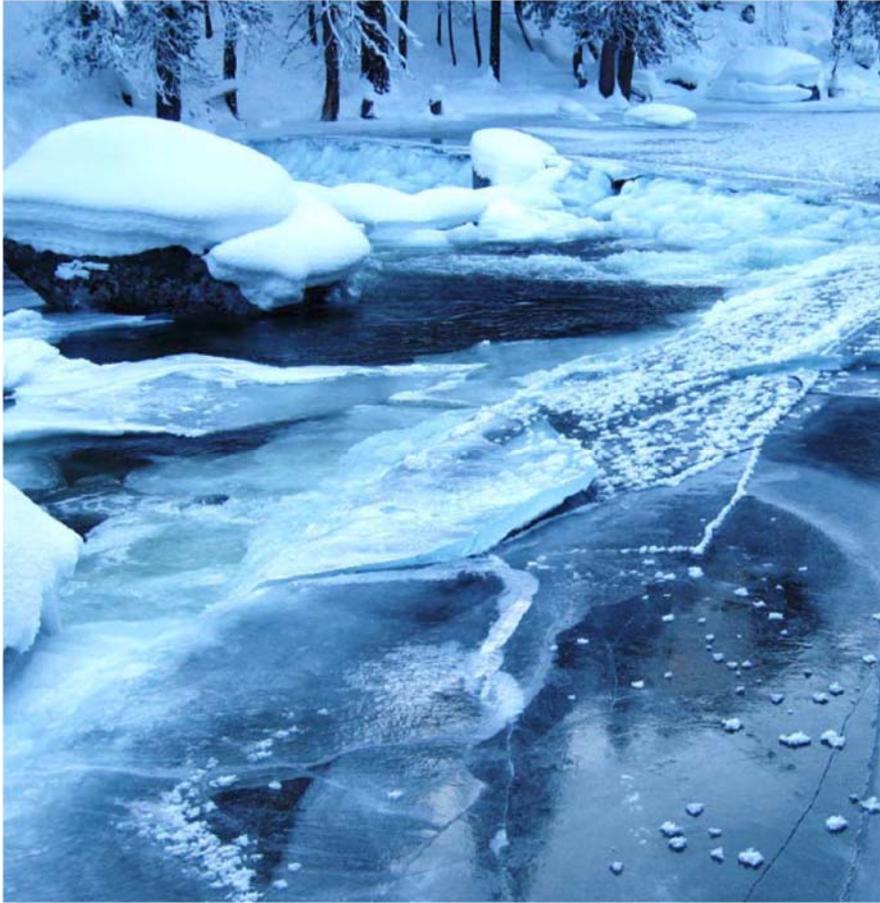
Photograph 5. Intake Building



Photograph 6. Surface Intake Screen



Photograph 7. Intake Building Access



Photograph 8. Intake Icing Conditions



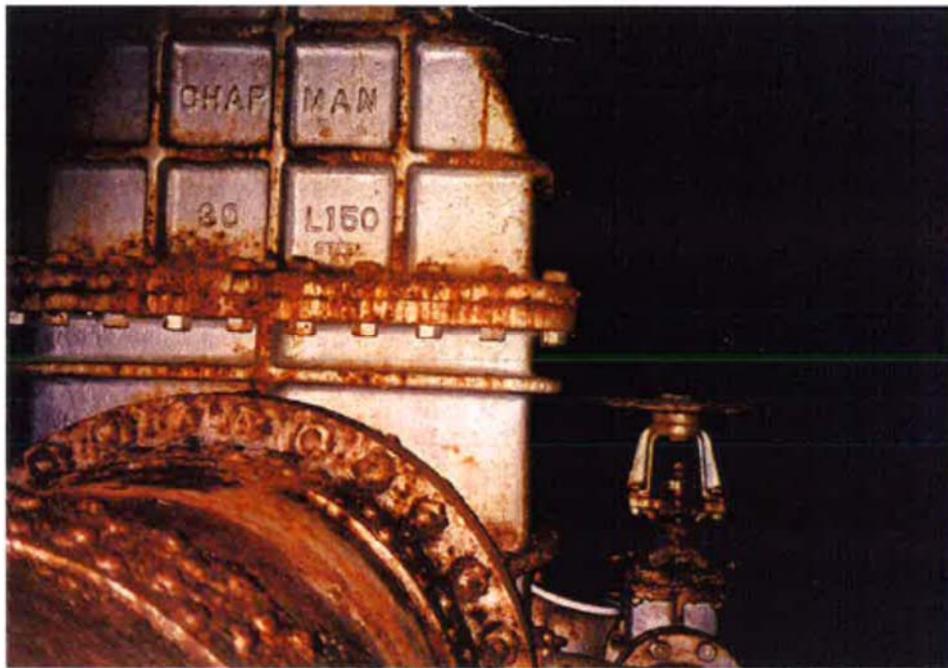
Photograph 9. Surface Water Pipeline Manhole Access



Photograph 10. Sand Settling Basin



Photograph 11. Screen Chamber



Photograph 12. Guard Gate and Bypass Valve



Photograph 13. Flanged Pipe Downstream of Guard Gate



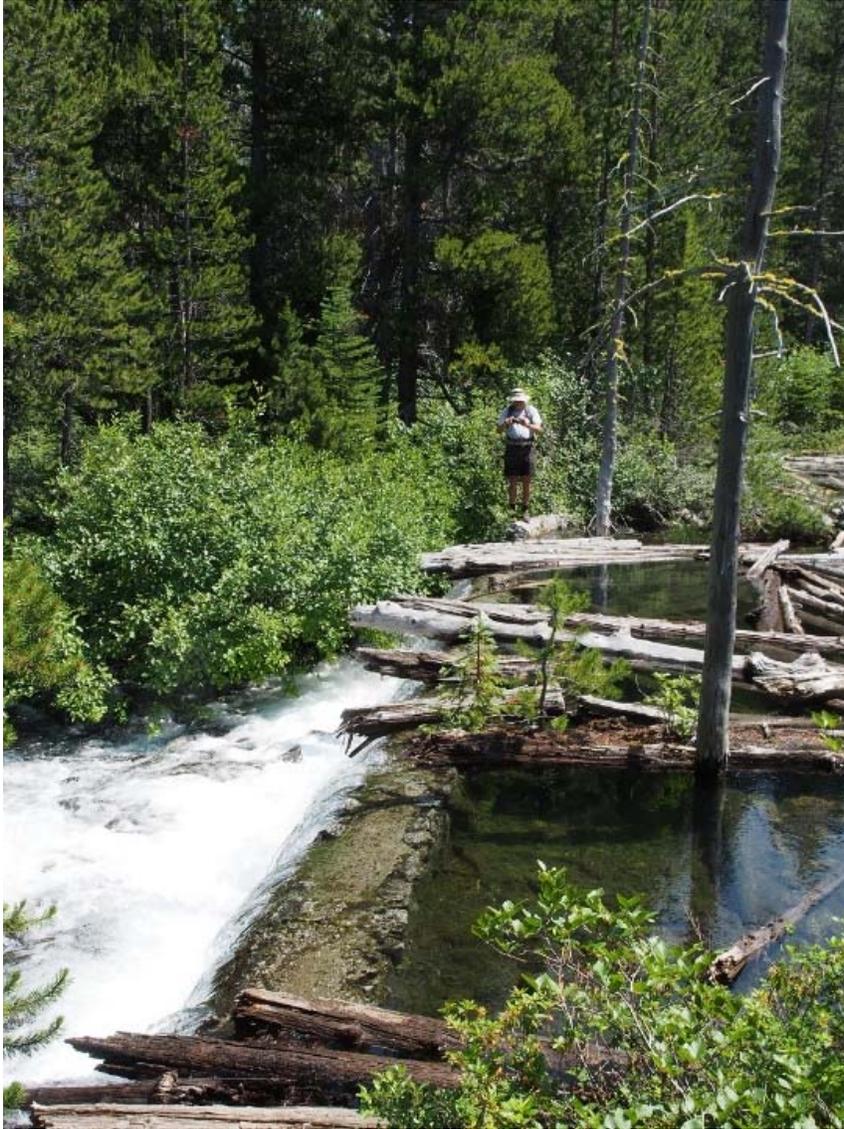
Photograph 14. Upper Snow Lake Outlet Structure



Photograph 15. Upper Snow Lake Outlet Control Valve



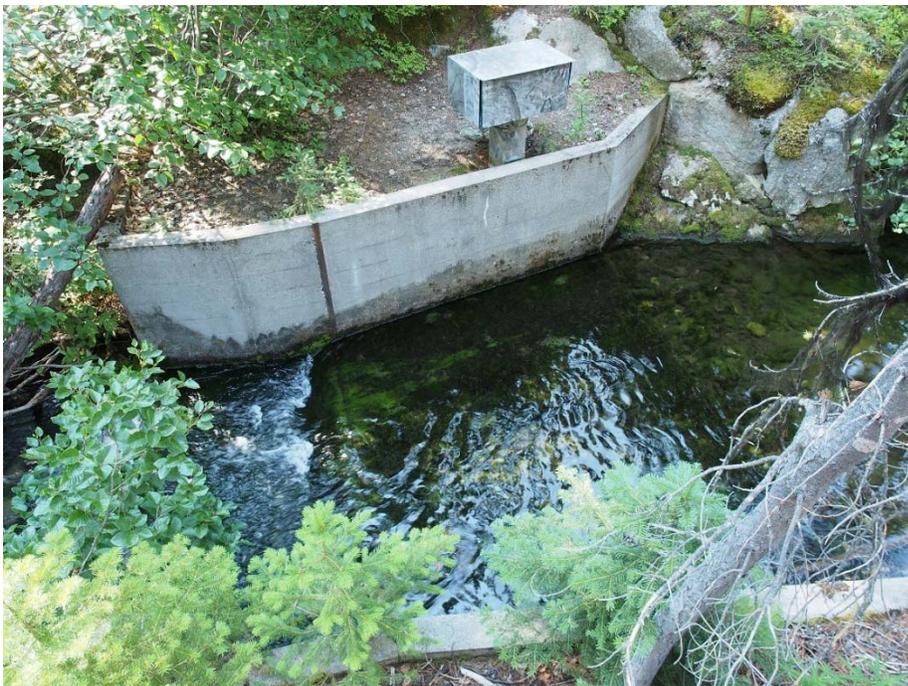
Photograph 16. Upper Snow Lake Dam



Photograph 17. Lower Snow Lake Dam



Photograph 18. Nada Lake Dam



Photograph 19. Nada Lake Measuring Flume



Photograph 20. Well No. 3



Photograph 21. Hatchery Channel



Photograph 22. Structure 2



Photograph 23. Structure 2 Gate Hoist



Photograph 24. Structure 2 Stilling Basin



Photograph 25. Well No. 6



Photograph 26. Aeration Chamber for Wells 4,5 &6



Photograph 27. Aeration Chamber



Photograph 28. Aeration Chamber



Photograph 29. Truck Fill



Photograph 30. Fishway



Photograph 31. Adult Holding Ponds



Photograph 32. Fish Lock



Photograph 33. Fish Spawning Shed



Photograph 34. Structure 5



Photograph 35. Structure 5 Debris



Photograph 36. Structure 5 Support Piers



Photograph 37. Incubation Trays



Photograph 38. Incubation Water Chiller



Photograph 39. Incubation Water UV Treatment



Photograph 40. Early Rearing Troughs



Photograph 41. Large Foster-Lucas Ponds



Photograph 42. Small Foster-Lucas Ponds



Photograph 43. 8'x80' Raceways



Photograph 44. 10'x100' Raceways



Photograph 45. Water Reuse Pump



Photograph 46. Metal Shop



Photograph 47. Emergency Generator

ENTIAT NATIONAL FISH HATCHERY PHOTOGRAPHS



Photograph 1. Diversion Dam



Photograph 2. Surface Water Intake Trashrack



Photograph 3. Surface Water Intake



Photograph 4. Surface Intake Icing



Photograph 5. Lime Kiln Spring



Photograph 6. Lime Kiln Spring Intake



Photograph 7. Screen Chamber Intake



Photograph 8. Pre-Settling Basin



Photograph 9. Screen Chamber Icing



Photograph 10. Well No. 1



Photograph 11. Well No. 2



Photograph 12. Well No. 3



Photograph 13. Well No. 4



Photograph 14. Well No. 5



Photograph 15. Well No. 6



Photograph 16. Aeration Chamber



Photograph 17. Flowmeters



Photograph 18. Flowmeters



Photograph 19. Fishway



Photograph 20. Fish Ladder Entrance



Photograph 21. Adult Holding Ponds and Spawning Shed



Photograph 22. Spawning Shed



Photograph 23. Incubation Trays



Photograph 24. Incubation Water Chiller



Photograph 25. Early Rearing Raceways



Photograph 26. Raceways



Photograph 27. Raceway Gripstrut Gap Hazard



Photograph 28. Orchard Adjacent to Raceways



Photograph 29. Pollution Abatement Pond



Photograph 30. Trout Pond



Photograph 31. Trout Pond Wetland



Photograph 32. Hatchery Building



Photograph 33. Emergency Generator



Photograph 34. Diesel Fuel Storage

WINTHROP NATIONAL FISH HATCHERY PHOTOGRAPHS



Photograph 1. Foghorn Dam



Photograph 2. Surface Water Intake



Photograph 3. Spring Branch Spring



Photograph 4. Screen Chamber Intake



Photograph 5. Rotating Drum Screen



Photograph 6. Infiltration Gallery No. 1 Pumps and Enclosure



Photograph 7. Infiltration Gallery No. 2 Pump



Photograph 8. Infiltration Gallery No. 3



Photograph 9. Valve Vault Adjacent to Infiltration Gallery No. 2



Photograph 10. Valve Box



Photograph 11. Valve Chamber



Photograph 12. Valve Chamber



Photograph13. Fishway



Photograph 14. Adult Holding Ponds and Spawning Building



Photograph 15. Incubation Trays



Photograph 16. Incubation Water Chiller



Photograph 17. Early Rearing Troughs



Photograph 18. Foster Lucas Ponds B



Photograph 19. Foster Lucas Ponds B - Beaver Relocation



Photograph 20. Foster Lucas Ponds C



Photograph 21. Raceways D



Photograph 22. Raceways D Cover Support Structure



Photograph 23. Pollution Abatement Pond



Photograph 24. Hatchery Building



Photograph 25. Storage (Feed) Building



Photograph 26. Storage Shed



Photograph 27. Emergency Generator



Photograph 28. Diesel Fuel Storage



Photograph Early Rearing Troughs



Photograph Foster Lucas Ponds B



Photograph Foster Lucas Ponds B - Beaver Relocation



Photograph Foster Lucas Ponds C



Photograph Raceways D



Photograph Raceways D Cover Support Structure



Photograph Pollution Abatement Pond



Photograph Hatchery Building



Photograph Storage (Feed) Building



Photograph Storage Shed



Photograph Emergency Generator



Photograph Diesel Fuel Storage

APPENDIX E
COST DETAILS

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APPENDIX E-1
2014 LNFHC OPERATIONS COSTS

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Table E-1: FY2014 Budget Summary for Leavenworth Fisheries Complex

Expense Area	Hatcheries Operations Cost	MCRFRO Cost ¹	Olympia FHC Cost ²	Total
Salaries	\$2,115,102	\$574,289	\$207,516	\$2,896,907
Travel	\$0	\$33,413	\$10,989	\$44,402
Utilities and Rent	\$168,400	\$11,852	\$50,500	\$230,752
Supplies and Materials	\$514,000	\$45,270	\$31,529	\$590,799
Marking and Tagging	\$0	\$353,500	\$0	\$353,500
Vehicles	\$153,500	\$12,743	\$9,720	\$175,963
Facilities Maintenance	\$701,000	\$0	\$0	\$701,000
<i>Subtotal</i>	\$3,652,002	\$1,031,067	\$310,254	\$4,993,323
Overhead (26.0874%)	\$952,712	\$268,979	\$80,937	\$1,302,628
TOTALS	\$4,604,714	\$1,300,046	\$391,191	\$6,295,951

¹ Mid-Columbia River Fishery Resource Office

² Olympia Washington Fish Health Center

Table E-2: Annual operating expenses, Leavenworth National Fish Hatchery

Expense Area	Site Location	Estimated Operations Costs (2014 Dollars)	Total Cost
Payroll (Taxes, Benefits, Mark-ups)		<i>Roll-up thru row 21</i>	\$992,686
Supv Fish Biologist (GS-0482-14)	Complex	\$158,903	\$77,195
Supv Fish Biologist (GS-0482-12)	Complex	\$117,510	\$57,086
Administrative Officer (GS-0341-09)	Complex	\$75,533	\$36,694
Purchasing Agent (GS-1105-05)	Complex	\$59,175	\$28,747
I&E Specialist (GS-1001-09)	Complex	\$69,795	\$33,906
Information Receptionist (GS-0304-04)	Complex	\$57,286	\$27,830
Info Technology Speclst (GS-2210-11)	Complex	\$103,574	\$50,316
Fish Biologist (GS-0482-11)	Complex	\$99,472	\$48,323
Supv Fish Biologist (GS-0482-12)	Leavenworth		\$98,384
Supv Fish Biologist (GS-0482-11)	Leavenworth		\$91,840
Fish Biologist (GS-0482-5/7/9)	Leavenworth		\$57,853
Fish Biologist (GS-0482-5/7/9)	Leavenworth		\$57,853
Maintenance Worker Lead (WG-4749-08)	Leavenworth		\$71,200
Maintenance Worker (WG-4749-08)	Leavenworth		\$74,718
Maintenance Worker (WG-4749-08)	Leavenworth		\$62,395
Animal Caretaker Lead (WG-5048-05)	Leavenworth		\$61,864
Animal Caretaker (WG-5048-05)	Leavenworth		\$56,481
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)			\$74,327
Repairs and Maintenance (Site, Buildings, Equipment)			\$179,320
Rent and Lease (Equipment, Vehicles)			\$0
Program Supplies (Shop, Office)			\$26,233
Program Supplies (Lab, Water System, Eggtake, Incubation)			\$75,000
Program Supplies (Rearing and Release)			\$75,000
Program Supplies (Tagging, Tag Recovery, Field)			\$42,750
Telephone			\$14,100
Utilities – Process Water Heating (Propane, Natural Gas)			\$8,400
Utilities – Supply Pumping, Energy Recovery Pumping			\$0
Utilities – Other			\$68,939
Travel Costs (Mileage, Lodging, Per diem)			\$17,489
Education and Training			\$0
Subcontracts (Professional Fees, Testing, Sampling)			\$0
Facility Insurance			\$0
		<i>SUBTOTAL</i>	\$1,574,244
		<i>OH at 26.0874%</i>	\$410,679
		<i>TOTAL</i>	\$1,984,924

Notes and Assumptions:

- Costs shown are 2014 dollars (2015 needs) and were provided by USFWS in a file dated May 21, 2014
- Labor costs for "Complex" Employees were allocated to individual sites as follows: LWNRH 48.58%, ENFH 16.19%, WNFH 35.22%
- For purposes of this cost presentation total overhead costs for the full LNFHC of (26.0874%) are not shown for each individual site
- Cost areas shown are modified slightly from workbook provided by USFWS dated May 21, 2014

Table E-3: Annual operating expenses, Entiat National Fish Hatchery

Expense Area	Site Location	Estimated Operations Costs (2014 Dollars)	Total Cost
Payroll (Taxes, Benefits, Mark-ups)		<i>Roll-up thru row 15</i>	\$373,998
Supv Fish Biologist (GS-0482-14)	Complex	\$158,903	\$25,726
Supv Fish Biologist (GS-0482-12)	Complex	\$117,510	\$19,025
Administrative Officer (GS-0341-09)	Complex	\$75,533	\$12,229
Purchasing Agent (GS-1105-05)	Complex	\$59,175	\$9,580
I&E Specialist (GS-1001-09)	Complex	\$69,795	\$11,300
Information Receptionist (GS-0304-04)	Complex	\$57,286	\$9,275
Info Technology Speclst (GS-2210-11)	Complex	\$103,574	\$16,769
Fish Biologist (GS-0482-11)	Complex	\$99,472	\$16,104
Fish Biologist (GS-0482-12)	Entiat		\$107,933
Fish Biologist (GS-0482-09)	Entiat		\$74,069
Maintenance Mechanic (WG-4749-09)	Entiat		\$71,988
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)			\$24,771
Repairs and Maintenance (Site, Buildings, Equipment)			\$240,940
Rent and Lease (Equipment, Vehicles)			\$0
Program Supplies (Shop, Office)			\$8,743
Program Supplies (Lab, Water System, Eggtake, Incubation)			\$24,285
Program Supplies (Rearing and Release)			\$37,500
Program Supplies (Tagging, Tag Recovery, Field)			\$39,247
Telephone			\$2,900
Utilities – Process Water Heating (Propane, Natural Gas)			\$0
Utilities – Supply Pumping, Energy Recovery Pumping			\$0
Utilities – Other			\$34,153
Travel Costs (Mileage, Lodging, Per diem)			\$5,828
Education and Training			\$0
Subcontracts (Professional Fees, Testing, Sampling)			\$0
Facility Insurance			\$0
	<i>SUBTOTAL</i>		\$792,365
	<i>OH at 26.0874%</i>		\$206,707
	<i>TOTAL</i>		\$999,072

Notes and Assumptions:

- Costs shown are 2014 dollars (2015 needs) and were provided by USFWS in a file dated May 21, 2014
- Labor costs for “Complex” Employees were allocated to individual sites as follows: LWNRH 48.58%, ENFH 16.19%, WNFH 35.22%
- For purposes of this cost presentation total overhead costs for the full LNFHC of (26.0874%) are not shown for each individual site
- Cost areas shown are modified slightly from workbook provided by USFWS dated May 21, 2014

Table E-4: Annual operating expenses, Winthrop National Fish Hatchery

Expense Area	Site Location	Estimated Operations Costs (2014 Dollars)	Total Cost
Payroll (Taxes, Benefits, Mark-ups)		<i>Roll-up thru row 19</i>	\$748,344
Supv Fish Biologist (GS-0482-14)	Complex	\$158,903	\$55,966
Supv Fish Biologist (GS-0482-12)	Complex	\$117,510	\$41,387
Administrative Officer (GS-0341-09)	Complex	\$75,533	\$26,603
Purchasing Agent (GS-1105-05)	Complex	\$59,175	\$20,841
I&E Specialist (GS-1001-09)	Complex	\$69,795	\$24,582
Information Receptionist (GS-0304-04)	Complex	\$57,286	\$20,176
Info Technology Speclst (GS-2210-11)	Complex	\$103,574	\$36,479
Fish Biologist (GS-0482-11)	Complex	\$99,472	\$35,034
Supv Fish Biologist (GS-0482-12)	Winthrop		\$114,484
Fish Biologist (GS-0482-11)	Winthrop		\$105,225
Fish Biologist (GS-0482-09)	Winthrop		\$72,430
Maintenance Worker (WG-4749-08)	Winthrop		\$74,125
Animal Caretaker (WG-5048-05)	Winthrop		\$59,644
Animal Caretaker (WG-5048-03)	Winthrop		\$58,159
Animal Caretaker Pathways (WG-5048-02)	Winthrop		\$3,210
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)			\$53,887
Repairs and Maintenance (Site, Buildings, Equipment)			\$274,871
Rent and Lease (Equipment, Vehicles)			\$0
Program Supplies (Shop, Office)			\$17,384
Program Supplies (Lab, Water System, Eggtake, Incubation)			\$52,830
Program Supplies (Rearing and Release)			\$37,500
Program Supplies (Tagging, Tag Recovery, Field)			\$30,994
Telephone			\$5,300
Utilities – Process Water Heating (Propane, Natural Gas)			\$0
Utilities – Supply Pumping, Energy Recovery Pumping			\$0
Utilities – Other			\$51,604
Travel Costs (Mileage, Lodging, Per diem)			\$12,679
Education and Training			\$0
Subcontracts (Professional Fees, Testing, Sampling)			\$0
Facility Insurance			\$0
		<i>SUBTOTAL</i>	\$1,285,393
		<i>OH at 26.0874%</i>	\$335,326
		<i>TOTAL</i>	\$1,620,718

Notes and Assumptions:

- Costs shown are 2014 dollars (2015 needs) and were provided by USFWS in a file dated May 21, 2014

- Labor costs for "Complex" Employees were allocated to individual sites as follows: LWNRH 48.58%, ENFH 16.19%, WNFH 35.22%
- For purposes of this cost presentation total overhead costs for the full LNFHC of (26.0874%) are not shown for each individual site
- Cost areas shown are modified slightly from workbook provided by USFWS dated May 21, 2014

APPENDIX E-2
2014 LNFHC BUDGET SUMMARY PROVIDED BY USFWS

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2014 Budget Summary
Leavenworth Fisheries Complex Budget

Operations and Maintenance

Item	Cost	
Salary		\$2,115,102
Utility		\$168,400
Supplies & Materials		\$514,000
Vehicle		\$153,500
Maintenance		\$701,000
	Sub-Total	\$3,652,002
	Overhead	26.1% \$952,712
		1.26
	Total	\$4,604,714

Special Projects - not part of Operations and Maintenance budget request.

Item	Cost	
Water Quality Monitoring		\$80,000
Entiat NFH increase ground water production		\$500,000
Winthrop NFH paving		\$220,000
	Sub-Total	\$800,000
	Overhead	26.10% \$208,699
		1.26
	Total	\$1,008,699

2015 Salary

Leavenworth Fisheries Complex Budget

Position	Employee	Location	FTE	Tenure	Benefit Rate (%)	Salary (\$)	Fringe (\$)	Total Salary & Fringe (\$)
Supv Fish Biologist (GS-0482-14)	Irving, David B	Complex	1	Permanent	35.6	\$117,185	41,717.86	\$158,902.86
Supv Fish Biologist (GS-0482-12)	Croci, Stephen J	Complex	1	Permanent	37.1	\$85,711	31,798.78	\$117,509.78
Administrative Officer (GS-0341-09)	DellaPenna, Terence A	Complex	1	Permanent	35.1	\$55,909	19,624.06	\$75,533.06
Purchasing Agent (GS-1105-05)	Townsend, Viola A	Complex	1	Permanent	55.9	\$37,957	21,217.96	\$59,174.96
I&E Specialist (GS-1001-09)	Vacant	Complex	1	Permanent	32.4	\$52,715	17,079.66	\$69,794.66
Information Receptionist (GS-0304-04)	Leonard, Patricia L	Complex	1	Permanent	60	\$35,804	21,482.40	\$57,286.40
Info Technology Speclst (GS-2210-11)	Smith, Julie A	Complex	1	Permanent	39.4	\$74,300	29,274.20	\$103,574.20
Fish Biologist (GS-0482-11)	Cappellini, Malenna MJ	Complex	1	Permanent	39.1	\$71,511	27,960.80	\$99,471.80
Fish Biologist (GS-0482-12)	Chisam, Craig A	Entiat	1	Permanent	45.6	\$74,130	33,803.28	\$107,933.28
Fish Biologist (GS-0482-9)	Homer, Joshua	Entiat	1	Permanent	44.9	\$51,117	22,951.53	\$74,068.53
Maintenance Mechanic (WG-4749-09)	Reeves, Jason S	Entiat	1	Permanent	34.3	\$53,602	18,385.54	\$71,987.69
Supv Fish Biologist (GS-0482-12)	Vacant	Leavenworth	1	Permanent	37	\$71,813	26,570.81	\$98,383.81
Supv Fish Biologist (GS-0482-11)	Collier, Travis M	Leavenworth	1	Permanent	39.2	\$65,977	25,863.00	\$91,840.03
Fish Biologist (GS-0482-5/7/9)	Foster, Chris	Leavenworth	1	Term	42.9	\$40,485	17,368.07	\$57,853.07
Fish Biologist (GS-0482-5/7/9)	Vacant	Leavenworth	1	Permanent	42.9	\$40,485	17,368.07	\$57,853.07
Maintenance Worker Lead (WG-4749-08)	Clarine, Ronald G	Leavenworth	1	Permanent	31.2	\$54,268	16,931.61	\$71,199.60
Maintenance Worker (WG-4749-08)	Gifford, Leroy C	Leavenworth	1	Permanent	46.5	\$51,002	23,715.80	\$74,717.52
Maintenance Worker (WG-4749-08)	Douglas, Roy E	Leavenworth	1	Permanent	38.4	\$45,083	17,311.97	\$62,395.22
Animal Caretaker Lead (WG-5048-05)	Judd, Terri L	Leavenworth	1	Permanent	31.8	\$46,938	14,926.18	\$61,863.84
Animal Caretaker (WG-5048-05)	Love, Shaun	Leavenworth	1	Permanent	31.4	\$42,984	13,497.05	\$56,481.28
Supv Fish Biologist (GS-0482-12)	Pasley, Chris R	Winthrop	1	Permanent	41.2	\$81,079	33,404.55	\$114,483.55
Fish Biologist (GS-0482-11)	Carie, David	Winthrop	1	Permanent	39.6	\$75,376	29,848.90	\$105,224.90
Fish Biologist (GS-0482-09)	Gerwig, Robert M	Winthrop	1	Permanent	37.4	\$52,715	19,715.41	\$72,430.41
Maintenance Worker (WG-4749-08)	Adams, Robert W	Winthrop	1	Permanent	45.2	\$51,050	23,074.80	\$74,125.24
Animal Caretaker (WG-5048-05)	Dammann, Chris M	Winthrop	1	Permanent	40.5	\$42,451	17,192.80	\$59,644.16
Animal Caretaker (WG-5048-03)	Rosander-Mail, Jeremy T	Winthrop	1	Permanent	54.8	\$37,570	20,588.48	\$58,158.71
Animal Caretaker Pathways (WG-5048-02)	Vacant	Winthrop	0.3	Temporary	7.7	\$9,935	765.00	\$3,210.00
Total						1,519,153.07	603,438.55	\$2,115,101.62

2015 Utility
 Leavenworth Fisheries Complex Budget

Location	Utility	Cost
Winthrop	Electricity	\$37,000
	Water	\$0
	Waste	\$1,800
	Phone	\$4,200
	Internet	\$700
	Cell phone	\$400
	Cleaning	\$0
	Landscaping	\$0
Entiat	Electricity	\$26,000
	Water	\$0
	Waste	\$2,200
	Phone	\$2,000
	Internet	\$500
	Cell phone	\$400
	Cleaning	\$0
	Landscaping	\$0
Leavenworth (includes Complex Office)	Electricity	\$45,000
	Water	\$8,400
	Waste	\$6,200
	Phone	\$7,200
	Internet	\$1,700
	Cell phone	\$5,200
	Cleaning	\$0
	Landscaping	\$19,500
Total		\$168,400

2015 Supplies and Materials
Leavenworth Fisheries Complex Budget

Item	Cost	LW	Entiat	Winthrop
Fish Food	\$300,000	48.58%	16.19%	35.22%
Office supplies	\$38,000	48.58%	16.19%	35.22%
Uniform	\$16,000	48.58%	16.19%	35.22%
Information Technology	\$36,000	48.58%	16.19%	35.22%
Field supplies	\$88,000	48.58%	16.19%	35.22%
Travel	\$36,000	48.58%	16.19%	35.22%
Total	\$514,000			

2015 Vehicle
Leavenworth Fisheries Complex Budget

Item	Cost	LW	Entiat	Winthrop
Fuel	\$29,000	48.58%	16.19%	35.22%
Vehicle repair	\$11,000	48.58%	16.19%	35.22%
Vehicle maintenance	\$13,500	48.58%	16.19%	35.22%
Vehicle replacement (2)	\$60,000	48.58%	16.19%	35.22%
Tractor replacement	\$40,000	48.58%	16.19%	35.22%
	Total	\$153,500		

2015 Cyclical Maintenance
 Leavenworth Fisheries Complex Budget

Facility	Item	Cost	
Winthrop	Repave/seal all pavement inside main gate	\$220,000	
Winthrop	Replace pole building with metal storage building	\$40,000	
Winthrop	Paint / side hatchery building	\$15,000	\$275,000
Entiat	Fish counter	\$25,000	
Entiat	Well #4 rehabilitation (infiltration gallery)	\$241,000	\$266,000
Leavenworth	Replace gates and controlers on Nursey Building	\$50,000	
Leavenworth	Emergency generator building	\$50,000	
Leavenworth	Resurface well and shop roads	\$25,000	
Leavenworth	FRO Walkway cover	\$35,000	\$160,000
Total		\$701,000	

2015 Special Projects
 Leavenworth Fisheries Complex Budget

Item	Cost	Required	Required by	Justification
Leavenworth NFH Ground Water Analysis	\$80,000.00	No		<p>Additional funding would be used to conduct an analysis at Leavenworth NFH to improve ground water production and reduce and/or eliminate the need to operate structure 2 for ground water recharge. Ground water production is limited and recent changes to structure 2 to improve conditions for endangered species in Icicle Creek have further limited the volume of ground water. The Icicle Creek Workgroup already committed \$70,000 to conduct an analysis.</p> <p>Additional funding would be used to rehabilitate well #4. Ground water availability is limited and surface water has compromised quality at certain times of the year. After exploring various means to improve ground water production, constructing an infiltration gallery at well #4 is the most feasible alternative.</p>
Entiat NFH increase ground water production	\$500,000.00	No		<p>Asphalt surfaces inside the main hatchery gate need to be replaced. Several areas have substantial deterioration and minor sink holes are present. A Tort claim against the hatchery resulted when a person injured their ankle after stepping in a minor sink hole. The hatchery will receive funding from the Department of Transportation to rehabilitate the entrance road and visitor parking lot in 2015 - 2016, this project would complement that one and resources would be shared to help reduce costs.</p>
Winthrop NFH paving	\$220,000.00	No		
Total	\$800,000.00			

APPENDIX E-3

**LEAVENWORTH FISHERIES COMPLEX BUDGET PROVIDED
BY BUREAU OF RECLAMATION**

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Attachment A

Leavenworth Fisheries Complex Budget

Leavenworth O&M Funding
(\$1,000)

Item	2014	2015	2016	2017	2018	Total
O&M Power Funding (About 92% From BPA)	\$5,691	\$5,891	\$6,097	\$6,280	\$6,468	\$30,427
Appropriated O&M (About 8% from Reclamation)	\$495	\$512	\$530	\$546	\$562	\$2,645
Subtotal	\$6,186	\$6,403	\$6,627	\$6,826	\$7,030	\$33,072
Winthrop PASS Measures Funded by CSRO ^{1/}	\$188	\$195	\$202			\$585
Winthrop PASS Measures Funded by Grand Coulee O&M ^{1/}				\$209	\$216	\$425
Start Intake Rehab NEPA ^{2/}	\$250					\$250
Water Quality Monitoring ^{2/}	\$50					\$50
Funding to Pay for Potential Water Rights Lawsuit Plaintiff Attorney Fees ^{2/}	\$50					\$50
Revised Total	\$6,724	\$6,598	\$6,829	\$7,035	\$7,246	\$34,432

^{1/} Assumes non-structural measures are successful at addressing issues

^{2/} Carryover from FY 13 to provide for funding to start environmental activities associated with the water delivery system and funding to pay for the plaintiffs litigation costs (in the event they are awarded legal fees)

Revised: 6/3/2013

FY2014 Budget Summary for the Leavenworth Fisheries Complex.

Item	Hatcheries Cost	MCFRO ^{1/} Cost	Olym FHC ^{2/} Cost	Total
Salaries	\$2,184,597	\$574,289	\$207,516	\$2,966,402
Travel	\$37,000	\$33,413	\$10,989	\$81,402
Utilities & Rent	\$178,100	\$11,852	\$50,500	\$240,452
Supplies & Materials	\$480,000	\$45,270	\$31,529	\$556,799
Marking & Tagging		\$353,500		\$353,500
Vehicles	\$160,000	\$12,743	\$9,720	\$182,463
Facilities Maintenance	\$525,000			\$525,000
Sub-Total	\$3,564,697	\$1,031,067	\$310,254	\$4,906,018
Overhead (26.0874%)	\$929,937	\$268,979	\$80,937	\$1,279,853
O&M Total	\$4,494,634	\$1,300,046	\$391,191	\$6,185,871
			Round to	\$6,186,000
Winthrop PASS Measures				\$188,000
Start LNFH Intake Rehab NEPA				\$250,000
Water Quality Monitoring				\$50,000
Potential Attorney Fees				\$50,000
			Grand Total	\$6,724,000

^{1/} Mid-Columbia River Fishery Resource Office

^{2/} Olympia Washington Fish Health Center

Revised: 6/5/2013

LNFH Cost Details

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Replace Upper Snow Lake Valves						
General- Mob/Demob, Helicopter, Site Prep...	1	LS	\$109,000.00	\$109,000	20.0%	\$ 130,800
Guard Gate Supply and Install	1	LS	\$66,000.00	\$66,000	20.0%	\$ 79,200
Control Valve Supply and Install	1	LS	\$189,250.00	\$189,250	20.0%	\$ 227,100
Telemetry	1	LS	\$95,000.00	\$95,000	20.0%	\$ 114,000
Subtotal						\$ 551,100
Div 1 General Requirements Costs - 15%						\$ 82,665
Overhead - 10%						\$ 55,110
Profit - 10%						\$ 55,110
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 743,985
Design, Permitting and Const Mgmt. - 20%						\$ 148,797
Budgetary Cost						\$ 892,782
Snow Lake Dam Repairs						
Helicopter Transport	1	LS	\$45,000.00	\$45,000	20.0%	\$ 54,000
Site Prep/TEESC	1	LS	\$25,000.00	\$25,000	20.0%	\$ 30,000
Patch and Repair Mortar USLD	1	LS	\$15,000.00	\$15,000	20.0%	\$ 18,000
Remove Wood Debris	1	LS	\$15,000.00	\$15,000	20.0%	\$ 18,000
Structural Improvements	1	LS	\$150,000.00	\$150,000	20.0%	\$ 180,000
Wood Footbridge Over Crest	1	LS	\$65,000.00	\$65,000	20.0%	\$ 78,000
Patch and Repair Mortar LSLD	1	LS	\$10,000.00	\$10,000	20.0%	\$ 12,000
Lower Crest of LSLD	1	LS	\$10,000.00	\$10,000	20.0%	\$ 12,000
Subtotal						\$ 402,000
Div 1 General Requirements Costs - 15%						\$ 60,300
Overhead - 10%						\$ 40,200
Profit - 10%						\$ 40,200
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 542,700
Design, Permitting and Const Mgmt. - 20%						\$ 108,540
Budgetary Cost						\$ 651,240
Well Development - 6 Wells at 1 to 2 cfs ea.						
Drilling and Casing	6	EA	\$100,000.00	\$600,000	20.0%	\$ 720,000
Well Screen	6	EA	\$10,000.00	\$60,000	20.0%	\$ 72,000
Well Pump	6	EA	\$40,000.00	\$240,000	20.0%	\$ 288,000
Transmission Piping Allowance	1	LS	\$320,000.00	\$320,000	20.0%	\$ 384,000
Power and Controls	1	LS	\$300,000.00	\$300,000	20.0%	\$ 360,000
Subtotal						\$ 1,824,000
Div 1 General Requirements Costs - 15%						\$ 273,600
Overhead - 10%						\$ 182,400
Profit - 10%						\$ 182,400
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 2,462,400
Design, Permitting and Const Mgmt. - 20%						\$ 492,480
Budgetary Cost						\$ 2,954,880
GW Aeration/Gas Stabilization Headbox						
Headbox Structure	1	LS	\$75,000.00	\$75,000	20.0%	\$ 90,000
Packed Columns	3	EA	\$10,000.00	\$30,000	20.0%	\$ 36,000
Yard Piping Modifications	1	LS	\$50,000.00	\$50,000	20.0%	\$ 60,000
Headbox Supply Manifold	1	LS	\$8,000.00	\$8,000	20.0%	\$ 9,600
Valves	1	LS	\$40,000.00	\$40,000	20.0%	\$ 48,000
Subtotal						\$ 243,600
Div 1 General Requirements Costs - 15%						\$ 36,540
Overhead - 10%						\$ 24,360
Profit - 10%						\$ 24,360
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 328,860
Design, Permitting and Const Mgmt. - 20%						\$ 65,772
Budgetary Cost						\$ 394,632
Remote Controls for 7 Exist Wells						

LNFH Cost Details

Cabling	2000	LF	\$15.00	\$30,000	20.0%	\$ 36,000
Trenching	2,000	LF	\$5.00	\$10,000	20.0%	\$ 12,000
Controllers	7	EA	\$5,000.00	\$35,000	20.0%	\$ 42,000
Programming and Start-Up	1	LS	\$7,000.00	\$7,000	20.0%	\$ 8,400
Subtotal						\$ 98,400
Div 1 General Requirements Costs - 15%						\$ 14,760
Overhead - 10%						\$ 9,840
Profit - 10%						\$ 9,840
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 132,840
Design, Permitting and Const Mgmt. - 20%						\$ 26,568
Budgetary Cost						\$ 159,408
Effluent Pumpback & Aquifer Recharge - 28 cfs						
(See Anchor QEA Report for details)						
Earthwork and Site Restoration	1	LS	\$72,000.00	\$72,000	20.0%	\$ 86,400
28 cfs Pumpstation	1	LS	\$263,200.00	\$263,200	20.0%	\$ 315,840
30-inch Pipeline	1	LS	\$34,500.00	\$34,500	20.0%	\$ 41,400
Subtotal						\$ 443,640
Div 1 General Requirements Costs - 15%						\$ 66,546
Overhead - 10%						\$ 44,364
Profit - 10%						\$ 44,364
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 598,914
Design, Permitting and Const Mgmt. - 20%						\$ 119,783
Budgetary Cost						\$ 718,697
Pipe Replacements						
10" GW Wells 1,2,3,& 7	890	LF	\$80.00	\$71,200	20.0%	\$ 85,440
14" GW Wells 1,2,3,& 7	1,625	LF	\$112.00	\$182,000	20.0%	\$ 218,400
10" GW Wells 4, 5 &6	1,330	LF	\$80.00	\$106,400	20.0%	\$ 127,680
14" GW Wells 4, 5 &6	190	LF	\$112.00	\$21,280	20.0%	\$ 25,536
18" Drain from 8x80 to Adult Pond	375	LF	\$144.00	\$54,000	20.0%	\$ 64,800
24" Drain from 8x80 to Adult Pond	140	LF	\$192.00	\$26,880	20.0%	\$ 32,256
18" Drain from Screen to PA Pond	670	LF	\$144.00	\$96,480	20.0%	\$ 115,776
36" Drain to PA Pond	330	LF	\$288.00	\$95,040	20.0%	\$ 114,048
36" Main Drain from Raceways	125	LF	\$288.00	\$36,000	20.0%	\$ 43,200
48" Main Drain from Raceways	275	LF	\$384.00	\$105,600	20.0%	\$ 126,720
18" Cleaning Waste Drain from 10x100's	345	LF	\$144.00	\$49,680	20.0%	\$ 59,616
18" Main Drain from Screen	115	LF	\$144.00	\$16,560	20.0%	\$ 19,872
36" Main Drain from Screen	460	LF	\$288.00	\$132,480	20.0%	\$ 158,976
15" Drain from Hatchery Building	265	LF	\$120.00	\$31,800	20.0%	\$ 38,160
18" Drain from HB to PA Pond	675	LF	\$144.00	\$97,200	20.0%	\$ 116,640
18" Drain from Adult Pond	105	LF	\$144.00	\$15,120	20.0%	\$ 18,144
15" Drain from Adult Pond	110	LF	\$120.00	\$13,200	20.0%	\$ 15,840
24" Drain from Adult Pond	290	LF	\$192.00	\$55,680	20.0%	\$ 66,816
18" Drain from Hatchery Building	340	LF	\$144.00	\$48,960	20.0%	\$ 58,752
Subtotal						\$ 1,506,672
Div 1 General Requirements Costs - 15%						\$ 226,001
Overhead - 10%						\$ 150,667
Profit - 10%						\$ 150,667
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 2,034,007
Design, Permitting and Const Mgmt. - 20%						\$ 406,801
Budgetary Cost						\$ 2,440,809
Replace Reuse Pump #1 with Duplex System						
Selective Demolition	1	LS	\$5,000.00	\$5,000	20.0%	\$ 6,000
Wet Well Modifications	1	LS	\$8,000.00	\$8,000	20.0%	\$ 9,600
Duplex Pumps - 8 cfs Ea.	2	EA	\$55,000.00	\$110,000	20.0%	\$ 132,000
12-inch Discharge Piping and Valves	1	LS	\$25,000.00	\$25,000	20.0%	\$ 30,000
Power, Level Switches and Controls	1	LS	\$26,000.00	\$26,000	20.0%	\$ 31,200
Subtotal						\$ 208,800
Div 1 General Requirements Costs - 15%						\$ 31,320
Overhead - 10%						\$ 20,880
Profit - 10%						\$ 20,880
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 281,880

LNFH Cost Details

Design, Permitting and Const Mgmt. - 20%						\$ 56,376
Budgetary Cost						\$ 338,256
Replace Spawning Area						
Selective Demolition	1	LS	\$20,000.00	\$20,000	20.0%	\$ 24,000
Concrete Rehabilitation	10,000	CF	\$15.00	\$150,000	20.0%	\$ 180,000
New Crowding Channel and Crowder	1	LS	\$120,000.00	\$120,000	20.0%	\$ 144,000
Holding Pond Crowders	1	EA	\$350,000.00	\$350,000	20.0%	\$ 420,000
Pumps and Piping	1	LS	\$350,000.00	\$350,000	20.0%	\$ 420,000
Spawning and Sorting Building	3,000	SF	\$120.00	\$360,000	20.0%	\$ 432,000
Sorting and Handling Systems - Inside Building	1	LS	\$280,000.00	\$250,000	20.0%	\$ 300,000
Power and Controls	1	LS	\$150,000.00	\$150,000	20.0%	\$ 180,000
Subtotal						\$ 2,100,000
Div 1 General Requirements Costs - 15%						\$ 315,000
Overhead - 10%						\$ 210,000
Profit - 10%						\$ 210,000
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 2,835,000
Design, Permitting and Const Mgmt. - 20%						\$ 567,000
Budgetary Cost						\$ 3,402,000
Add Building with 69 Early Rearing Troughs						
Sitework	1	LS	\$50,000.00	\$50,000	20.0%	\$ 60,000
New Building	8,000	SF	\$150.00	\$1,200,000	20.0%	\$ 1,440,000
Piping	1	LS	\$160,000.00	\$160,000	20.0%	\$ 192,000
Fiberglass Rearing Troughs 89 CF Ea.	69	EA	\$4,000.00	\$276,000	20.0%	\$ 331,200
Subtotal						\$ 1,500,000
Div 1 General Requirements Costs - 15%						\$ 225,000
Overhead - 10%						\$ 150,000
Profit - 10%						\$ 150,000
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 2,025,000
Design, Permitting and Const Mgmt. - 20%						\$ 405,000
Budgetary Cost						\$ 2,430,000
GW Reuse System for Existing Early Rearing Tanks						
12-inch Piping - Buried	160	LF	\$96.00	\$15,360	20.0%	\$ 18,432
Aeration Headbox	1	LS	\$60,000.00	\$60,000	20.0%	\$ 72,000
UV Disinfection - 7 cfs	7	CFS	\$9,000.00	\$63,000	20.0%	\$ 75,600
Supply Headers - Indoors	500	LF	\$144.00	\$72,000	20.0%	\$ 86,400
Supply Drops	122	EA	\$300.00	\$36,600	20.0%	\$ 43,920
Subtotal						\$ 147,600
Div 1 General Requirements Costs - 15%						\$ 22,140
Overhead - 10%						\$ 14,760
Profit - 10%						\$ 14,760
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 199,260
Design, Permitting and Const Mgmt. - 20%						\$ 39,852
Budgetary Cost						\$ 239,112
Roof Cover Over 3 Banks of 8 x 80 Rearing Units						
Metal Roof and Steel Framing	49,000	SF	\$25.00	\$1,225,000	20.0%	\$ 1,470,000
Concrete Column Footings	1	LS	\$120,000.00	\$120,000	20.0%	\$ 144,000
Lighting	49,000	SF	\$3.00	\$147,000	20.0%	\$ 176,400
Subtotal						\$ 1,470,000
Div 1 General Requirements Costs - 15%						\$ 220,500
Overhead - 10%						\$ 147,000
Profit - 10%						\$ 147,000
Sales Tax 8.2% - Included in Unit Costs Above						\$ 162,729
Const. Cost						\$ 2,147,229
Design, Permitting and Const Mgmt. - 20%						\$ 396,900
Budgetary Cost						\$ 2,544,129
Refurbish Conc. Surfaces - 3 Banks - 8 x 80 Raceways						
Pressure Washing	900	MH	\$50.00	\$45,000	20.0%	\$ 54,000
Cementall Place and Finish	66,000	CF	\$5.50	\$363,000	20.0%	\$ 435,600
Epoxy Coating System	66,000	CF	\$5.00	\$330,000	20.0%	\$ 396,000
Subtotal						\$ 885,600

ENFH Cost Details

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Intake/Fish Screen Modifications						
Cofferdam/Dewatering Allowance	1	LS	\$100,000.00	\$100,000	20.0%	\$ 120,000
Screen Assembly	22	CFS	\$12,000.00	\$264,000	20.0%	\$ 316,800
Concrete Modifications	1	LS	\$50,000.00	\$50,000	20.0%	\$ 60,000
Channel Modifications	1	LS	\$75,000.00	\$75,000	20.0%	\$ 90,000
Trash Rack	1	LS	\$40,000.00	\$40,000	20.0%	\$ 48,000
Groundwater Diffusers	1	LS	\$20,000.00	\$20,000	20.0%	\$ 24,000
Power, Lighting and Controls	1	LS	\$75,000.00	\$75,000	20.0%	\$ 90,000
Subtotal						\$ 748,800
Div 1 General Requirements Costs - 15%						\$ 112,320
Overhead - 10%						\$ 74,880
Profit - 10%						\$ 74,880
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 1,010,880
Design, Permitting and Const Mgmt. - 20%						\$ 202,176
Budgetary Cost						\$ 1,213,056
Surface Water Disinfection						
40 Micron Drum Screen	10	CFS	\$16,000.00	\$160,000	20.0%	\$ 192,000
UV Disinfection	10	CFS	\$10,000.00	\$100,000	20.0%	\$ 120,000
Sitework	1	LS	\$25,000.00	\$25,000	20.0%	\$ 30,000
Yard Piping	1	LS	\$40,000.00	\$40,000	20.0%	\$ 48,000
Power, Lighting and Controls	1	LS	\$26,000.00	\$26,000	20.0%	\$ 31,200
Subtotal						\$ 421,200
Div 1 General Requirements Costs - 15%						\$ 63,180
Overhead - 10%						\$ 42,120
Profit - 10%						\$ 42,120
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 568,620
Design, Permitting and Const Mgmt. - 20%						\$ 113,724
Budgetary Cost						\$ 682,344
Effluent Pumpback System						
Concrete Pump Sump	1	LS	\$15,000.00	\$15,000	20.0%	\$ 18,000
Pumps - 5 cfs ea	2	EA	\$44,000.00	\$88,000	20.0%	\$ 105,600
Sitework	1	LS	\$25,000.00	\$25,000	20.0%	\$ 30,000
18-inch Transmission Piping	1800	LF	\$150.00	\$270,000	20.0%	\$ 324,000
Power, Lighting and Controls	1	LS	\$50,000.00	\$50,000	20.0%	\$ 60,000
Subtotal						\$ 537,600
Div 1 General Requirements Costs - 15%						\$ 80,640
Overhead - 10%						\$ 53,760
Profit - 10%						\$ 53,760
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 725,760
Design, Permitting and Const Mgmt. - 20%						\$ 145,152
Budgetary Cost						\$ 870,912
Flow Meters at Raceway Supply Pipes						
Flow Meters - Mag Type	6	EA	\$5,000.00	\$30,000	20.0%	\$ 36,000
Local Indicators	6	EA	\$1,200.00	\$7,200	20.0%	\$ 8,640
Manholes	6	EA	\$2,500.00	\$15,000	20.0%	\$ 18,000
Trenching	1	LS	\$8,000.00	\$8,000	20.0%	\$ 9,600
Power and Monitoring	1	LS	\$13,000.00	\$13,000	20.0%	\$ 15,600
Subtotal						\$ 87,840
Div 1 General Requirements Costs - 15%						\$ 13,176
Overhead - 10%						\$ 8,784
Profit - 10%						\$ 8,784
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 118,584
Design, Permitting and Const Mgmt. - 20%						\$ 23,717
Budgetary Cost						\$ 142,301

ENFH Cost Details

Pipe Replacements						
36-inch RW Pipe	1,025	LF	\$288.00	\$295,200	20.0%	\$ 354,240
8" Well #2	285	LF	\$64.00	\$18,240	20.0%	\$ 21,888
8" Well #3	770	LF	\$64.00	\$49,280	20.0%	\$ 59,136
8" Well #4	590	LF	\$64.00	\$37,760	20.0%	\$ 45,312
18" GW - Head Box to Bank A Raceways	125	LF	\$144.00	\$18,000	20.0%	\$ 21,600
12" GW - Raceways to Hatchery Building	330	LF	\$96.00	\$31,680	20.0%	\$ 38,016
12" GW - Headbox to Raceways	400	LF	\$96.00	\$38,400	20.0%	\$ 46,080
30" RW - Valve Chamber to Rearing Units	120	LF	\$240.00	\$28,800	20.0%	\$ 34,560
24" RW - Valve Chamber to Rearing Units	115	LF	\$192.00	\$22,080	20.0%	\$ 26,496
18" RW - Valve Chamber to Rearing Units	315	LF	\$144.00	\$45,360	20.0%	\$ 54,432
24" Main Drain from Raceways	620	LF	\$192.00	\$119,040	20.0%	\$ 142,848
12" Main Drain from Hatchery Building	140	LF	\$96.00	\$13,440	20.0%	\$ 16,128
18" Cleaning Waste Drain	400	LF	\$144.00	\$57,600	20.0%	\$ 69,120
Subtotal						\$ 929,856
Div 1 General Requirements Costs - 15%						\$ 139,478
Overhead - 10%						\$ 92,986
Profit - 10%						\$ 92,986
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 1,255,306
Design, Permitting and Const Mgmt. - 20%						\$ 251,061
Budgetary Cost						\$ 1,506,367
Roof Cover Over Rearing Units						
Metal Roof and Steel Framing	24,300	SF	\$25.00	\$607,500	20.0%	\$ 729,000
Concrete Column Footings	1	LS	\$60,000.00	\$60,000	20.0%	\$ 72,000
Lighting	24,300	SF	\$3.00	\$72,900	20.0%	\$ 87,480
Subtotal						\$ 888,480
Div 1 General Requirements Costs - 15%						\$ 133,272
Overhead - 10%						\$ 88,848
Profit - 10%						\$ 88,848
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 1,199,448
Design, Permitting and Const Mgmt. - 20%						\$ 239,890
Budgetary Cost						\$ 1,439,338
Alt- Technology - LHO's at Middle Bank Raceways						
LHO Units	10	EA	\$2,200.00	\$22,000	20.0%	\$ 26,400
Oxygen Concentrators	2	EA	\$35,000.00	\$70,000	20.0%	\$ 84,000
Oxygen Piping	1	LS	\$12,000.00	\$12,000	20.0%	\$ 14,400
Metering Panels	8	EA	\$1,500.00	\$12,000	20.0%	\$ 14,400
Oxygen Equipment Building	150	SF	\$150.00	\$22,500	20.0%	\$ 27,000
Power and Lighting	1	LS	\$16,000.00	\$16,000	20.0%	\$ 19,200
Subtotal						\$ 185,400
Div 1 General Requirements Costs - 15%						\$ 27,810
Overhead - 10%						\$ 18,540
Profit - 10%						\$ 18,540
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 250,290
Design, Permitting and Const Mgmt. - 20%						\$ 50,058
Budgetary Cost						\$ 300,348

Winthrop Cost Details

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Surface Water Disinfection - 10 cfs						
40 Micron Drum Screen	10	CFS	\$16,000.00	\$160,000	20.0%	\$ 192,000
UV Disinfection	10	CFS	\$10,000.00	\$100,000	20.0%	\$ 120,000
Concrete Sump	1	LS	\$40,000.00	\$40,000	20.0%	\$ 48,000
Sitework	1	LS	\$25,000.00	\$25,000	20.0%	\$ 30,000
Yard Piping	1	LS	\$40,000.00	\$40,000	20.0%	\$ 48,000
Power, Lighting and Controls	1	LS	\$20,000.00	\$20,000	20.0%	\$ 24,000
Subtotal						\$ 462,000
Div 1 General Requirements Costs - 15%						\$ 69,300
Overhead - 10%						\$ 46,200
Profit - 10%						\$ 46,200
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 623,700
Design, Permitting and Const Mgmt. - 20%						\$ 124,740
Budgetary Cost						\$ 748,440
Additional Well - 1 to 2 cfs						
Drilling and Casing	1	LS	\$60,000.00	\$60,000	20.0%	\$ 72,000
Well Screen	1	LS	\$10,000.00	\$10,000	20.0%	\$ 12,000
Well Pump	1	LS	\$25,000.00	\$25,000	20.0%	\$ 30,000
8-inch Transmission Piping	1	LS	\$60,000.00	\$60,000	20.0%	\$ 72,000
Power and Controls	1	LS	\$50,000.00	\$50,000	20.0%	\$ 60,000
Subtotal						\$ 246,000
Div 1 General Requirements Costs - 15%						\$ 36,900
Overhead - 10%						\$ 24,600
Profit - 10%						\$ 24,600
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 332,100
Design, Permitting and Const Mgmt. - 20%						\$ 66,420
Budgetary Cost						\$ 398,520
GW Aeration/Gas Stabilization Headbox						
Headbox Structure	1	LS	\$75,000.00	\$75,000	20.0%	\$ 90,000
48-inch Dia Packed Columns	3	EA	\$10,000.00	\$30,000	20.0%	\$ 36,000
Yard Piping Modifications	1	LS	\$50,000.00	\$50,000	20.0%	\$ 60,000
Headbox Supply Manifold	1	LS	\$8,000.00	\$8,000	20.0%	\$ 9,600
Valves	1	LS	\$40,000.00	\$40,000	20.0%	\$ 48,000
Subtotal						\$ 243,600
Div 1 General Requirements Costs - 15%						\$ 36,540
Overhead - 10%						\$ 24,360
Profit - 10%						\$ 24,360
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 328,860
Design, Permitting and Const Mgmt. - 20%						\$ 65,772
Budgetary Cost						\$ 394,632
Pipe Replacements						
36-inch RW Pipe	565	LF	\$288.00	\$162,720	20.0%	\$ 195,264
22" "Spring Line" to Valve Chamber	560	LF	\$176.00	\$98,560	20.0%	\$ 118,272
16" IG #3 to "Spring Line"	480	LF	\$128.00	\$61,440	20.0%	\$ 73,728
24" IG #2 to "Spring Line"	615	LF	\$192.00	\$118,080	20.0%	\$ 141,696
10" IG #1 to Valve Chamber	115	LF	\$80.00	\$9,200	20.0%	\$ 11,040
12" IG #1 to Valve Vault	90	LF	\$96.00	\$8,640	20.0%	\$ 10,368
10" Valve Vault Misc Piping	125	LF	\$80.00	\$10,000	20.0%	\$ 12,000
10" GW - Head Box to Rearing Units	290	LF	\$80.00	\$23,200	20.0%	\$ 27,840
36" SW - Valve Chamber to 8x80s D Bank	350	LF	\$288.00	\$100,800	20.0%	\$ 120,960
24" SW to Raceways	150	LF	\$192.00	\$28,800	20.0%	\$ 34,560
18" SW to Adult Holding	250	LF	\$144.00	\$36,000	20.0%	\$ 43,200
18" Reuse from Adult Holding	325	LF	\$144.00	\$46,800	20.0%	\$ 56,160
12" Reuse Pumpback Pipe	405	LF	\$96.00	\$38,880	20.0%	\$ 46,656

Winthrop Cost Details

36" Main Drain from Raceways	245	LF	\$288.00	\$70,560	20.0%	\$ 84,672
39" Main Drain	125	LF	\$312.00	\$39,000	20.0%	\$ 46,800
12" Cleaning Waste Drain	125	LF	\$96.00	\$12,000	20.0%	\$ 14,400
18" Cleaning Waste Drain	580	LF	\$144.00	\$83,520	20.0%	\$ 100,224
Subtotal						\$ 1,137,840
Div 1 General Requirements Costs - 15%						\$ 170,676
Overhead - 10%						\$ 113,784
Profit - 10%						\$ 113,784
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 1,536,084
Design, Permitting and Const Mgmt. - 20%						\$ 307,217
Budgetary Cost						\$ 1,843,301
Replace 41,000 CF of Rearing Volume						
Demolition - B Bank and Partial C Bank Ponds	1	LS	\$60,000.00	\$60,000	20.0%	\$ 72,000
Cut and Plug Piping	1	LS	\$8,000.00	\$8,000	20.0%	\$ 9,600
16 New 26-foot Dia Circular Tanks - Dual Drain	41000	CF	\$20.00	\$820,000	20.0%	\$ 984,000
24-inch SW Supply Piping	250	LF	\$192.00	\$48,000	20.0%	\$ 57,600
18-inch SW Supply Piping	260	LF	\$144.00	\$37,440	20.0%	\$ 44,928
18-inch GW Supply Piping	545	LF	\$144.00	\$78,480	20.0%	\$ 94,176
8-inch Supply Branches	32	EA	\$1,000.00	\$32,000	20.0%	\$ 38,400
6-inch Tank Drains	400	LF	\$60.00	\$24,000	20.0%	\$ 28,800
Main Drains	360	LF	\$192.00	\$69,120	20.0%	\$ 82,944
Bottom Drain to PAP	550	LF	\$128.00	\$70,400	20.0%	\$ 84,480
Valves and Fittings	1	LS	\$60,000.00	\$60,000	20.0%	\$ 72,000
Standpipe Assemblies	16	LS	\$1,000.00	\$16,000	20.0%	\$ 19,200
Power and Alarms	1	LS	\$40,000.00	\$40,000	20.0%	\$ 48,000
Surface Restoration	1	LS	\$40,000.00	\$40,000	20.0%	\$ 48,000
Subtotal						\$ 1,684,128
Div 1 General Requirements Costs - 15%						\$ 252,619
Overhead - 10%						\$ 168,413
Profit - 10%						\$ 168,413
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 2,273,573
Design, Permitting and Const Mgmt. - 20%						\$ 454,715
Budgetary Cost						\$ 2,728,287
Roof Cover Over Rearing Units						
Metal Roof and Steel Framing	17,650	SF	\$25.00	\$441,250	20.0%	\$ 529,500
Concrete Column Footings	1	LS	\$40,000.00	\$40,000	20.0%	\$ 48,000
Lighting	17,650	SF	\$3.00	\$52,950	20.0%	\$ 63,540
Subtotal						\$ 641,040
Div 1 General Requirements Costs - 15%						\$ 96,156
Overhead - 10%						\$ 64,104
Profit - 10%						\$ 64,104
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 865,404
Design, Permitting and Const Mgmt. - 20%						\$ 173,081
Budgetary Cost						\$ 1,038,485
Refurbish D and E Bank Raceway Surfaces						
Pressure Washing	600	MH	\$50.00	\$30,000	20.0%	\$ 36,000
Cementall Place and Finish	44000	CF	\$5.50	\$242,000	20.0%	\$ 290,400
Epoxy Coating System	44000	CF	\$5.00	\$220,000	20.0%	\$ 264,000
Subtotal						\$ 590,400
Div 1 General Requirements Costs - 15%						\$ 88,560
Overhead - 10%						\$ 59,040
Profit - 10%						\$ 59,040
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 797,040
Design, Permitting and Const Mgmt. - NA						
Budgetary Cost						\$ 797,040

Winthrop Cost Details

Alt- Technology - LHO's at E Bank Raceways						
LHO Units	15	EA	\$2,200.00	\$33,000	20.0%	\$ 39,600
Oxygen Concentrators	2	EA	\$35,000.00	\$70,000	20.0%	\$ 84,000
Oxygen Piping	1	LS	\$30,000.00	\$30,000	20.0%	\$ 36,000
Metering Panels	8	EA	\$1,500.00	\$12,000	20.0%	\$ 14,400
Oxygen Equipment Building	150	SF	\$150.00	\$22,500	20.0%	\$ 27,000
Power and Lighting	1	LS	\$25,000.00	\$25,000	20.0%	\$ 30,000
Subtotal						\$ 231,000
Div 1 General Requirements Costs - 15%						\$ 34,650
Overhead - 10%						\$ 23,100
Profit - 10%						\$ 23,100
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 311,850
Design, Permitting and Const Mgmt. - 20%						\$ 62,370
Budgetary Cost						\$ 374,220
Alt- Technology -Aeroboost at New Circular Tanks						
Aeroboost Units Units	48	EA	\$1,900.00	\$91,200	20.0%	\$ 109,440
Air Blowers	2	EA	\$26,000.00	\$52,000	20.0%	\$ 62,400
Air Piping	1	LS	\$30,000.00	\$30,000	20.0%	\$ 36,000
Control Panel	1	EA	\$20,000.00	\$20,000	20.0%	\$ 24,000
Blower Shed	150	SF	\$150.00	\$22,500	20.0%	\$ 27,000
Power and Lighting	1	LS	\$25,000.00	\$25,000	20.0%	\$ 30,000
Subtotal						\$ 288,840
Div 1 General Requirements Costs - 15%						\$ 43,326
Overhead - 10%						\$ 28,884
Profit - 10%						\$ 28,884
Sales Tax 8.2% - Included in Unit Costs Above						
Const. Cost						\$ 389,934
Design, Permitting and Const Mgmt. - 20%						\$ 77,987
Budgetary Cost						\$ 467,921



Water Management Technologies
 P.O. Box 66125 Baton Rouge, LA USA 70896
 (225) 755-0026 Fax (225) 755-0995
 Email: info@w-m-t.com
 Web: www.w-m-t.com

Date: 11/24/2014
 Quote: Valid 60 days
 Terms: See Below
 Rev: 0

Customer: Mr. Mark Reiser / McMillian Engineers LLC
 Phone: (503) 886-8956
 Fax:
 Email: Mark Reiser <mark.reiser@mcmillan-llc.com>

Leavenworth NFH

Low Head Oxygenation - LHO			
Qty	Description	Unit Price	Price
30	WMT LHO's - 80' Raceway Design, 5052 Aluminum, per specification	\$ 1,600.00	\$ 48,000.00
15	Packing & Crating	\$ 115.00	\$ 1,725.00
7	WMT LHO's - 100' Raceway Design, 5052 Aluminum, per specification	\$ 1,950.00	\$ 13,650.00
4	Packing & Crating	\$ 127.00	\$ 508.00
18	WMT Oxygen Flow meter panel with NEMA 4 enclosure - Includes 2 flow meters, needle valves, copper fittings and tube. Mounts between raceways, mounting hardware and green oxygen hose by others.	\$ 567.00	\$ 10,206.00
1	WMT Oxygen Flow meter panel with NEMA 4 enclosure - Includes 1 flow meter, needle valve, copper fittings and tube. Mounts between raceways, mounting hardware and green oxygen hose by others.	\$ 520.00	\$ 520.00
1	WMT site visit - LHO's and OSI O2 Generator - 3 days / one day on site.	\$ 4,500.00	\$ 4,500.00
1	Freight - estimated to be determined at time of shipment	\$ 8,500.00	\$ 8,500.00

Delivery = 6-8 weeks from order.

Total: \$ 87,609.00

OSI O2 Generator			
Qty	Description	Unit Price	Price
1	OSI Oxygen Generator - 250 LPM	\$ 59,400.00	\$ 59,400.00
1	Packing & Crating	\$ 175.00	\$ 175.00
1	Freight - estimated to be determined at time of shipment	\$ 1,200.00	\$ 1,200.00

Delivery = 6-8 weeks from order.

Total: \$ 60,775.00

Grand Total \$ 148,384.00

APPENDIX F

**FORMAL PLANNING REPORT* COMMENTS AND
RESPONSES**

*The Leavenworth Fisheries Complex Planning Report was originally called the Alternatives Analysis Final Draft Report. Thus the comment letters refer to it by that title.



CLEAN, FLOWING WATERS FOR WASHINGTON

The Center for
Environmental Law & Policy

Amanda Smith
United States Fish and Wildlife Service
911 NE 11th Ave
Portland, OR 97232

May 6, 2016

RE: Leavenworth Alternatives Analysis

Dear Ms. Smith:

CELP appreciates the opportunity to comment on the Leavenworth Fisheries Complex, Alternatives Analysis (Final Draft Report). We believe that the Report sets forth possibilities to significantly reduce the environmental impact of the Leavenworth National Fish Hatchery - in particular, by reducing water use.

Water use: CELP is pleased to see that the Report discusses several technologies that could significantly reduce water use at the LNFH (Section 6.1). Given that there are serious and long-standing instream flow issues in Icicle Creek, and the LNFH is experiencing difficulty in obtaining adequate groundwater supplies to sustain its operations, CELP believes that these water conservation technologies should be given the very highest priority.

The Overriding Consideration of the Public Interest exception to instream flows:

Washington law provides that instream flows, once adopted, may not be impaired by subsequent appropriations of water. There is a single, narrowly drawn exception to this principle for instances where “it is clear that overriding considerations of the public interest will be served.” See RCW 90.54.020(3)(a). There are suggestions in the Report that this “OCPI” exception might provide an avenue for the hatcheries of the Leavenworth complex to obtain additional water. See Section 4.1.2.2 (Obtaining New Water Rights); 4.8.2 (Water Supply Quality and Quantity Summary).

The Report notes that “OCPI has been receiving more scrutiny and resistance from some environmental groups . . . because they consider OCPI to undermine the purpose of the flow rules.” Report at 77. In fact, recent Washington Supreme Court decisions have very much limited the use of OCPI, precisely because it *does* undermine the purpose of instream flows. In *Swinomish Indian Tribal Community v. Ecology*, 178 Wn.2d 571, 311 P.3d 6 (2013), the Washington Supreme Court held that OCPI does not allow Ecology to reassess the relative merits of uses and reallocate water. More recently, the Court’s *Foster v. Ecology* decision, citing *Swinomish*, reiterated that the statutory scheme “rigorously protects minimum flows” and that OCPI “does not allow for the permanent impairment of minimum flows.” *Foster v. Ecology*, No. 90386-7 (Washington Supreme Court, October 8, 2015). Any consideration of

alternatives for the Leavenworth Complex should reflect the very strong likelihood that OCPI will not be available as an avenue for obtaining additional water.

We hope these comments are helpful, and would be happy to respond to any questions you might have. Please contact me at the above address if you have any questions regarding CELPs' comments.

Sincerely,

/Dan Von Seggern/

Dan J. Von Seggern
Staff Attorney

May 6, 2016

Amanda Smith
U. S. Fish and Wildlife Service
911 NE 11th AVE.
Portland, OR. 97232

Subject: Public comment on the United States Department of Interior – Fish and Wildlife Service Draft Final Report titled “Leavenworth Fisheries Complex Alternatives Analysis”.

Dear Ms. Smith,

Public Utility District No. 2 of Grant County, (GPUD) owns and operates the Wanapum and Priest Rapids hydroelectric developments on the Columbia River, known collectively as the Priest Rapids Project (PRP). A new Federal Energy Regulatory Commission (FERC 2008) operating license was issued for the PRP on April 17, 2008 (FERC #2114). Included in the PRP license order was a 2008 Biological Opinion (BiOp) issued by the National Marine Fisheries Service (NMFS 2008) which addressed Upper Columbia River spring Chinook and summer steelhead listed under the endangered species act (ESA).

GPUD is required to implement (as a requirement of the NMFS BiOp) spring Chinook programs in the Methow and Wenatchee Basins. GPUD co-funds very robust monitoring and evaluation (M&E) programs in both the Methow and Wenatchee Basins. Over the last five years (2010-2015), GPUD alone has funded operations, maintenance and M&E costs in the Methow and Wenatchee Basins at an average annual program cost of \$858,000 and \$845,000 respectively. M&E activities consist of spawning ground surveys, run composition, juvenile production, broodstock collections, spawning, tagging, and release.

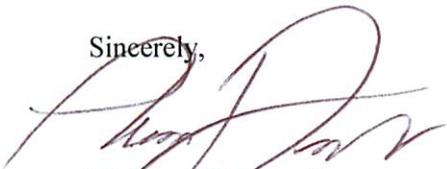
Based on our review of the United States Department of Interior – Fish and Wildlife Service’s Draft Final Report titled “*Leavenworth Fisheries Complex Alternatives Analysis*”; M&E activities or costs were not included in the alternatives analysis for any of the hatchery programs within the Leavenworth Complex. GPUD strongly believes that when developing an alternatives analysis all costs must be included so the public can have a full understanding of all costs and impacts associated with implementing a hatchery program. This is particularly important given that: 1) M&E costs can be substantial over the life of a hatchery program, and 2) artificial supplementation may have impacts to ESA listed natural origin fish and those impacts should be evaluated via a robust M&E program.

The Winthrop National Fish Hatchery (WNFH) program has for decades produced and released the largest number and highest proportion of spring Chinook in the Methow and Chewuch basins; however, the US Fish and Wildlife Service (USFWS) has never implemented an M&E program to evaluate the impacts of the WNFH programs on the natural population. The genetic legacy of those decades of hatchery releases remains, and, even with the current reduced release numbers and management efforts to contain escapement as described in the WNFH Hatchery Genetic Management Plan, WNFH-origin fish will continue to contribute to the natural-spawning population, and therefore will have an effect on ESA listed, natural-origin fish. Even after recent program reductions in spring Chinook, the WNFH has and will continue to produce the majority of hatchery-origin spring Chinook in the Methow Basin.

GPUD strongly believes that the USFWS (funded via US Bureau of Reclamation, USBOR) must conduct sufficient M&E activities in the Methow and Wenatchee Basins to quantify the risk that the Leavenworth Fisheries Complex programs present to ESA-listed populations and demonstrate acceptable minimization of that risk. This is especially true of numerically dominant programs like WNFH (400,000 spring Chinook; 200,000 steelhead), that have the potential to have the greatest impact on ESA-listed populations and provide the largest share of spawners and carcasses recovered during surveys. In particular, the WNFH program, which is comprised of F1 progeny from the Methow Fish Hatchery relies entirely on the effectiveness of an adult-management program to minimize contribution of hatchery fish to natural spawning. Only a robust M&E program can evaluate the effectiveness of the WNFH management program in preventing WNFH hatchery-origin spawners from spawning with wild fish on the spawning grounds, and measuring the subsequent effects on the natural population.

GPUD appreciates the opportunity to review and comment on the United States Department of Interior – Fish and Wildlife Service Draft Final Report titled “Leavenworth Fisheries Complex Alternatives Analysis”. If you have questions, please contact me at 509-764-0500 (ext. 2312) or via email at Tdresser@gcpud.org.

Sincerely,



Thomas J Dresser Jr.
Fish, Wildlife and Water Quality Manager
Public Utility District No 2 of Grant County, Washington
30 C Street SW
Ephrata, Washington 98823

Cc: Shane Bickford – Douglas PUD

ADDRESS PO Box 878
Ephrata, WA 98823

PHONE 509 766 2505
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Alene Underwood – Chelan PUD
Jeff Korth – WDFW
Jim Brown - WDFW
Deanne Palvik-Kunkel – GPUD
Peter Graf – GPUD
Todd Pearsons - GPUD
NR-Records

Literature Cited.

- FERC (Federal Energy Regulatory Commission). 2008. Order Issuing New License for Public Utility District No. 2 of Grant County, 123 FERC ¶ 61,049, Washington D.C. [Priest Rapids Project FERC License](#)
- NMFS (National Marine Fisheries Service). 2008. Biological Opinion and Magnuson-Steven Fishery Conservation and Management Act. New license for the Priest Rapids hydroelectric Project. February 1, 2008. [Upper Columbia River spring-run Chinook salmon and Upper Columbia River Steelhead Biological Opinion](#)



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

May 6, 2016

Ms. Amanda Smith
Public Affairs Officer, Fisheries
U.S. Fish and Wildlife Service
911 NE 11th Avenue
Portland, OR 97232

RE: Leavenworth Fisheries Complex Alternatives Analysis

Dear Ms. Smith:

Thank you for presenting to the Icicle Work Group (IWG) on April 19th and for the opportunity to comment on the Leavenworth Fisheries Complex Alternatives Analysis.

Chelan County and Washington Department of Ecology's Office of Columbia River co-convened the IWG in December 2012 to find collaborative solutions for water management within the Icicle Creek subbasin. The U.S. Fish and Wildlife Service (USFWS) and U.S. Bureau of Reclamation (USBOR) along with other stakeholders representing local, state and federal agencies, tribes, irrigation and agricultural interests and environmental organizations, are working to develop a comprehensive water resource management plan for Icicle Creek. The Icicle Strategy seeks to provide an alternative to long-term litigation in the Icicle. We look forward to continuing our collaborative relationship with USFWS and USBOR.

The objective of the Icicle Strategy is to implement a group of projects that will meet all of the guiding principles established by the IWG. Several of these guiding principles, or goals, are directly related to operations at LNFH and projects evaluated in the Leavenworth Fisheries Complex Alternatives Analysis:

- Streamflow that provides passage, provides healthy habitat, serves channel formation function, meets aesthetic and water quality objectives, and is resilient to climate change.
- A Sustainable LNFH that provides healthy fish and adequate numbers, is resource efficient (with 20 cfs of water conservation), significantly reduces phosphorus loading, had appropriately screened diversion(s), and does not impede fish passage.
- Meet Tribal Treaty and federally-protected Harvest Right at all times.
- Protect Non-Treaty Harvest.
- Comply with state and federal law.

Ms. Amanda Smith
May 6, 2016
Page 2 of 2

In order to meet these guiding principles, we encourage USFWS and USBOR to implement infrastructure improvements at LNFH, including the installation of circular tanks, groundwater augmentation, and effluent pumpback. These projects are critical to the 20 cfs conservation goals set for LNFH. Additionally, we encourage fish screen replacement and support the evaluation of passage improvements at Structure 2.

Currently, the IWG is developing a Programmatic Environmental Impact Statement (PIES) that evaluates the guiding principles and projects identified to meet the guiding principles, known as the base package. There are several projects proposed at LNFH that have been identified in the base package and will be included in this PEIS. The PEIS is expected to be complete in the fall of 2017. We encourage USFWS and USBOR to work with us in determining a NEPA integration strategy.

We are somewhat concerned with the lack of a firm schedule in the Alternatives Analysis. We would like to work with USFWS and USBOR to develop an aggressive implementation schedule that describes a critical path to project completion. We also urge you to accelerate the project implementation timeline where funding is available. As we plan for implementation of a base package of projects for Icicle Creek, we hope to coordinate with you on a project prioritization and funding strategy that will ensure that all of our goals are met.

Thank you for the opportunity to comment and express the IWG's support for the projects reviewed in the Alternatives Analysis. We look forward to continued collaboration with USFWS and USBOR through the IWG and long-term success in Icicle Creek. If you have any questions or would like to discuss these comments further, please let us know.

Sincerely,

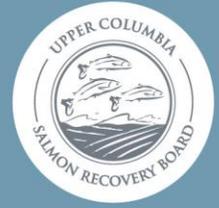


G. Thomas Tebb, L.Hg., L.E.G.
Director
Office of Columbia River



Keith Goehner, Commissioner
Chelan County

Working to restore viable and sustainable populations of salmon, steelhead and other at-risk species through collaborative, economically sensitive efforts, combined resources, and wise resource management of the Upper Columbia Region.



May 6, 2016

ATTN: Amanda Smith
U.S. Fish and Wildlife Service
911 NE 11th Ave
Portland, OR 97232
Amanda_Smith@fws.gov

Ms. Smith,

As the entity responsible for the development and coordination of implementing the *Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan* (Recovery Plan), the Upper Columbia Salmon Recovery Board (UCSRB) appreciates the opportunity to comment on the Leavenworth Fisheries Complex Alternatives Analysis. Our comments relate to the facilities and operations outlined in the report as well as the listed hatchery programs associated with those facilities. Two of the main objectives for hatcheries in the Recovery Plan are to “help develop ongoing hatchery programs that are consistent with recovery,” and “provide for tribal and non-tribal fishery obligations.” Concurrent with these hatchery objectives, our organization has been working with partners for over 15 years to improve habitat for listed salmon and steelhead as a primary driver for recovery. We strongly support efforts to improve conditions for listed species through collaboration (e.g. the efforts of the Icicle Work Group) and recognize the importance of these hatcheries in helping to meet treaty, mitigation, and harvest obligations. Our intent is by no means to supersede these efforts and entities but rather provide comments about how improvements at the Leavenworth complex hatcheries fit in larger context of salmon recovery efforts.

We aim to support the U.S. Bureau of Reclamation and U.S. Fish and Wildlife Service in their efforts to improve Leavenworth Complex hatchery programs and facilities in support of regional recovery efforts. This effort is in line with Endangered Species Act regulations—specifically section 7(a)1 pertaining to federal agency obligations to contribute to the conservation of endangered and threatened species. Although this was not the intent of the Alternatives Analysis report we feel it is an important part of the larger master planning process and should be considered early in the process. We encourage continued active participation of salmon recovery partners in this effort.

Leavenworth Fisheries Complex Hatchery Programs

Leavenworth NFH, Entiat NFH, and Winthrop NFH are three of the major hatcheries in the region, releasing half of the total number of hatchery fish in the entire Upper Columbia (Wenatchee, Entiat, Chelan, Methow, and Okanogan basins). These hatcheries also rear and release 25% of the listed fish in the region. The Entiat Hatchery is the only hatchery program in the Entiat and the Winthrop facility releases the majority of listed fish in the Methow River. All three facilities are the only hatcheries outside the mainstem Columbia River, and are sited in major spawning areas for salmon and steelhead and in important habitat for bull trout. They are the only hatcheries in the Upper Columbia producing fish to mitigate for actions outside the region (Grand Coulee Dam).

Although it was not the intent of the analysis to examine in detail the Leavenworth complex hatchery programs we do believe it is important context to include in any future planning processes. We recommend that you reference the effects of the programs that were outlined in the U.S. Fish and Wildlife Service's Columbia Basin Hatchery Review Team's 2007 report on the Leavenworth Complex hatcheries. We do not feel the draft Alternatives Analysis adequately described the program effects. Hatchery programs are listed as a major threat to natural populations based on the findings in NOAA's last 5-year status review (Ford 2011). All three populations (Wenatchee, Entiat, and Methow spring Chinook and steelhead) are at a high risk for diversity due to hatchery program effects. Furthermore, hatchery fish represent over 50% of returning fish in all three populations. Of all the Leavenworth complex programs Winthrop NFH spring Chinook and steelhead programs have the largest potential to affect recovery because they are the only listed programs and those programs contribute the majority of returning listed hatchery fish to that subbasin.

Leavenworth Fisheries Complex Hatcheries

The Leavenworth complex hatcheries are in the Icicle, Entiat, and Methow spring Chinook, steelhead, and bull trout population areas. All three populations have an important role in recovery of the species. Icicle Creek is a minor spawning area for spring Chinook and a major spawning area for steelhead. The Entiat River is a major spawning area for both spring Chinook and steelhead, and provides foraging and overwinter habitat for bull trout. The Middle Methow river is a major spawning area for spring Chinook and steelhead, and a portion of the core area for bull trout, including foraging and overwinter habitat. Because of the importance of these areas for salmon, steelhead, and bull trout recovery it is imperative that the needs of listed species are considered in this planning effort.

Habitat evaluation and prioritization in the Upper Columbia are outlined in the Biological Strategy, a document that both informed the development of the Recovery Plan, and (in later versions) describes the strategy for implementing the habitat portions of the plan.

The Biological Strategy says the following about ecological concerns and habitat impairments that could be linked to hatchery facilities and operations:

- LNFH- Icicle Watershed- decreased water quantity, mechanical injury (diversions), channel structure and form, sediment, and riparian condition, and temperature.
- ENFH- Lower Entiat River- riparian condition, mechanical injury (diversion screens), decreased water quantity
- WNFH- Upper-Middle Methow River- channel structure and form (bank armoring and other human features), decreased water quantity, and mechanical injury.

The alternatives analysis and the associated planning process are incredibly important. The Master Plan will contain project priorities, preliminary plans, designs, costs, and constructions schedules to update the hatcheries to achieve fish production targets and meet federal and state laws and environmental regulations. Key areas for focus, from our perspective, are:

- Details of facility impacts on habitat – especially the five main areas of effect as outlined by NOAA (water source and quantity, screen criteria, barriers, instream structures, streambank and floodplain armoring and alterations, pollutant discharge).
- Biological Risks and Benefits (we recommend that this section either be revised or removed as written).
- Infrastructure alternatives that benefit listed fish and fish habitat (and specifics about how they will do this in terms of the five areas of effect mentioned above).
- Given the current status of habitat and populations in the areas where these facilities and programs occur, we encourage the Fish and Wildlife Service and Bureau of Reclamation to work collaboratively to ensure development and implementation of such measures is done with salmon, steelhead, and bull trout recovery in mind.

Thank you for considering the above comments. Please do not hesitate to contact me at 509-888-0321 or melody.kreimes@ucsrb.org if you have any questions.

Sincerely,

Melody Kreimes
Executive Director, UCSRB



State of Washington
Department of Fish and Wildlife

Mailing Address: 1550 Alder St NW, Ephrata, WA 98823, (509) 754-4624, TDD (360) 902-2207
Main Office Location: Natural Resources Building, 1111 Washington Street SE, Olympia WA

May 6, 2016

U.S. Fish and Wildlife Service
Amanda Smith
911 N.E. 11th Ave.
Portland, Oregon 97232

**SUBJECT: LEAVENWORTH FISHERIES COMPLEX ALTERNVATIVES ANALYSIS
FINAL DRAFT REPORT**

Dear Ms. Smith:

The mission statement for the Washington Department of Fish and Wildlife (WDFW) mandates that WDFW “preserve, protect and perpetuate fish, wildlife and ecosystems while providing sustainable fish and wildlife recreational and commercial opportunities”. With that in mind, WDFW reviewed the Leavenworth Fisheries Complex Alternatives Analysis Final Draft Report for potential impacts to fish, wildlife, their habitats and recreational opportunities and offers the following comments for the above referenced project at this time.

- 1) WDFW supports maintaining the Leavenworth National Fish Hatchery (LNFH) at its current location. Whether an in-basin or out-of-basin location, each of the relocation alternatives outlined in the analysis report have the potential to negatively impact WDFW’s ongoing Hatchery Genetic Management Plans (HGMP)¹ for ESA listed Upper Columbia spring Chinook programs/populations in the Wenatchee, Entiat and Methow River Basins.

In terms of genetic risks associated with excessive hatchery-origin introgression impacts to natural-origin stocks, adult straying is a concern as well as excessive returns of hatchery adults on the spawning grounds. For instance, facilities such as Tumwater Dam located on the Wenatchee River, can serve as an effective tool for managing hatchery adult spring Chinook escapement. However, this is effective only at certain periods during the return. Specifically, trapping operations at Tumwater Dam are unable to occur 24 hours a day during portions of July and August when the peak sockeye return occurs. During these peak periods, fish densities within the trapping facility are high, thus trapping operations are curtailed to avoid contributing to adult spawning migration delays (WDFW and Chelan County Public Utilities District (CCPUD) Tumwater Trapping Plan for Operations²) that might contribute to increased pre-spawn mortality and affect salmonid run-timing. During this period when trapping is curtailed, late-returning hatchery spring Chinook in excess of escapement goals identified in the HGMP, would be able to make passage upstream of Tumwater Dam thereby potentially adversely

affecting the proportion of hatchery-origin spring Chinook spawners (pHOS) on spawning grounds in the upper Wenatchee River Basin. Exceeding pHOS represents a genetic and competitive risk to Endangered Species Act (ESA)-listed natural-origin spring Chinook. Effective adult fish trapping facilities such as Tumwater Dam are not present on the main stem of the Entiat and Methow Rivers; therefore fisheries managers would be relegated to using other much less effective methods of managing adult hatchery-origin fish and pHOS may climb to unacceptable levels as identified in the Upper Columbia Spring Chinook HGMP.

With these concerns and the fact that the current LNFH spring Chinook program has resulted in a minimal stray rate historically, WDFW recommends building/upgrading infrastructure to improve water quality and water consumptive improvements to existing sites as outlined in the ES-5.0 Existing Sites Alternative Evaluation of the Leavenworth Fisheries Complex Alternatives Analysis Final Draft Report.

- 2) Among the listed infrastructure improvements scheduled for the next ten years at LNFH is the Surface Water Intake Screens project. WDFW strongly recommends screening the LNFH Surface Water Intake as an early action and not waiting to address this improvement until other proposed infrastructure improvements to reduce the volume of diverted water are developed. WDFW makes this recommendation due to the current impacts to ESA-listed fish and to resident fish species which are currently becoming entrained into hatchery from the Surface Water Intake. The Revised Code of Washington (RCW) 77.57 requires all surface water diversion to be screened; delaying screening of the LNFH Surface Water Intake for up to ten years is an unacceptable amount of impact and inconsistent with Washington State Law. A Surface Water Intake Screen can be designed for current water use levels (54 cfs) that can be also used for a water intake designed for reduced water use. WDFW recommends a screening method be developed immediately, designed to comply with state and federal fish screen criteria and regulations³ to reduce the quantity of ESA-listed fish and other fish species being entrained into the hatchery facility from the unscreened Surface Water Intake. WDFW recommends working with our Fish Screening Program regarding screen design and implementation for the LNFH.

For the Entiat National Fish Hatchery (ENFH) Surface Water Intake Screen, WDFW also recommends working with our Fish Screening Program regarding screen design and implementation. For the Winthrop National Fish Hatchery (WNFH) Surface Water Intake Screen, WDFW Fish Screening Program believes that further evaluation of the fish screen at the WNFH is needed. WDFW recommends working with our Fish Screening Program. Contact Jenni Novak, WDFW Fish Screen Biologist, at jenni.novak@dfw.wa.gov or 509-314-5215.

- 3) WDFW recommends adding “Improved Fish Passage at In-Water Structures” at LNFH to the prioritized list of infrastructure improvements listed in Section 7.2.1 Leavenworth NFH Implementation Priorities of the Leavenworth Fisheries Complex Alternatives

Analysis Final Draft Report. WDFW strongly supports modernizing the hatchery facilities such that LNFH no longer acts as a fish passage barrier in Icicle Creek.

- 4) In addition to infrastructure improvements, WDFW recommends that the Leavenworth Fisheries Complex Alternatives Analysis Final Draft Report and Master Plan improve the in-water and riparian habitat adjoining these facilities. The sections of the river adjoining these facilities (LNFH, ENFH, and WNFH) are designated critical habitat for steelhead, bull trout and Chinook salmon. WDFW recommends incorporating habitat improvements when developing the 5- to 10- year master plan. Examples include, but are not limited to, riparian enhancement, fish passage improvements, fish screening (previously mentioned), and large woody debris projects.
- 5) Lastly, but not least, WDFW highly recommends incorporating a monitoring and evaluation (M&E) plan, including an adaptive management component, as part of this Master Plan. Monitoring and evaluation is essential in providing the information necessary to improve performance and provide the certainty that hatchery objectives are achieved, especially when coupled with an adaptive management plan. Current and future management outcomes would be improved, and impacts lessened for the LNFH, ENFH and WNFH.

WDFW welcomes the opportunity to work with U.S. Fish and Wildlife Service on developing and implementing recommendations from this Leavenworth Fisheries Complex Alternatives Analysis Final Draft Report and the subsequent 5- to 10- year Master Plan to be developed. Please keep WDFW apprised of the status of the Leavenworth Fisheries Complex Alternatives Analysis Final Draft Report and Master Plan. If you have any questions, please call me at 509-754-4624, Ext: 212.

Sincerely,



Carmen Andonaegui
WDFW Region 2 Habitat Program Manager
1550 Alder St NW
Ephrata, WA 98823
carmen.andonaegui@dfw.wa.gov

Cc: James Brown, WDFW Region 2 Director
Jeff Korth, WDFW Region 2 Fish Program Manager

References:

¹Methow Hatchery Spring Chinook Program Hatchery and Genetic Management Plan (HGMP). February 12, 2010.

Upper Columbia River Spring-run Chinook Salmon White River Supplementation Program Hatchery and Genetic Management Plan (HGMP). September 2005.

Wenatchee Upper Columbia River Spring Chinook: Chiwawa Spring Chinook. October 14, 2009.

²Tumwater Trapping Plan for Operations Beginning June 1, 2011. May 5, 2011.

³Washington State RCW 77.57.070, RCW 77.57.010, and 77.15.310.

NMFS (National Marine Fisheries Service) 2008. Anadromous Salmonid Passage Facility Design. Northwest Region. February 8, 2008.

NMFS 1996. Juvenile Fish Screen Criteria for Pump Intakes Addendum. Environmental and Technical Services Division. Portland, Oregon. May 9, 1996.



Confederated Tribes and Bands
of the Yakama Nation

Established by the
Treaty of June 9, 1855

May 1, 2016

Ms. Amanda Smith
US Fish and Wildlife Service
911 NE 11th Ave
Portland, OR 97232

Re: Yakama Nation comments on Leavenworth Fisheries Complex alternatives report

Dear Ms. Smith,

The Yakama Nation is pleased to submit the attached comments on the captioned subject. Our two organizations have a long and generally collaborative partnership in matters relating to the Leavenworth Complex and its important contribution to Yakama Nation fisheries and fishery enhancement efforts. It is clearly in our joint interests to ensure that Complex hatcheries remain fully capable of implementing well into the foreseeable future the mission for which they were constructed. We are confident that our federal trust relationship will produce a strong and productive collaboration in planning for Complex updates that meet the needs of Treaty trust resources, tribal fisheries, and the federal obligation to mitigate for Grand Coulee Dam.

As you know, the Confederated Tribes and Bands of the Yakama Nation is a federally-recognized Indian tribe with certain rights that were reserved in the Treaty with the Yakama of June 9, 1855 (12 Stat. 951). Among these reserved rights, Article III reserved the right to fish at "all usual and accustomed fishing places" in perpetuity. One such place near present-day Leavenworth was so important to certain tribes present at the Walla Walla treaty grounds that it was specifically identified and included as the "Wanatschapam Fishery" in Article X of the Yakama Treaty. A remnant of that historical tribal fishery was resurrected in 1987 and continues to this day in Icicle Creek. This fishery is one of few remaining opportunities for tribal members with ancestral ties in that area to harvest the prized spring chinook salmon that return to Leavenworth NFH.

The Yakama Nation has a continuing and vital interest in the operation of the Complex and its contribution to tribal fisheries in the Columbia River and Icicle Creek. The Complex also is vital to Yakama Nation efforts to reintroduce coho salmon to upper Columbia tributaries, recondition wild steelhead kelts for repeat spawning, and support steelhead supplementation in the Methow. My staff have prepared specific comments on the Alternatives Analysis as it relates to these interests and activities. We generally support efforts to reduce the "environmental footprint" of Complex hatcheries, but we must be equally supportive of, and insistent upon, the persistence of Complex programs as partial mitigation for the loss of those salmon runs destroyed by Grand Coulee Dam. Particularly in the case of Leavenworth NFH, reducing the environmental footprint

is not only consistent with, but is critical to, the hatchery's long-term persistence in the Icicle watershed. We are confident that full consideration of these comments and inclusion of Yakama staff in the design of Complex upgrades will produce a plan that achieves both intents. We also assume that the Service will consult with tribal leadership and appropriate staff before embarking on a final course of action.

On behalf of the Yakama Nation, thank you for the opportunity to comment on the Leavenworth Fisheries Complex Alternatives Analysis Report. I look forward to continued correspondence and collaboration as this process moves forward. Should you have any questions on the attached comments or on matters relating to Leavenworth Complex operations, please contact Steve Parker at 509/945-0786 or pars@yakamafish-nsn.gov.

Sincerely,



Philip Rigdon, Superintendent
Department of Natural Resources

cc: Gerald Lewis, Fish and Wildlife Committee
Tom Zeilman, *U.S. v Oregon* Counsel
Paul Ward, Fisheries Resource Management Program
Steve Parker, Fisheries Resource Management Program
Paul Lumley, CRITFC

I. GENERAL COMMENTS

The Yakama Nation maintains a durable interest in the operations of the Leavenworth Fisheries Complex (Complex) hatcheries in our northern Treaty territories. These hatcheries produce spring chinook, summer chinook, and steelhead that contribute importantly to tribal fisheries at usual and accustomed places on the lower Columbia River and in Icicle Creek. Complex hatcheries also play a critical role in our efforts to reintroduce and restore coho salmon and steelhead in the upper Columbia tributaries through a strong and effective partnership between the tribe and the USFWS. It is with these fishery interests and partnerships in mind that we offer the following comments.

The Complex hatcheries (Leavenworth, Entiat, and Winthrop NFHs) were constructed pursuant to the Grand Coulee Fish Mitigation Plan (GCFMP) as partial mitigation for salmon losses associated with the construction and operation of Grand Coulee Dam. Grand Coulee (and subsequently Chief Joseph Dam) was designed and built without fish ladders and continues to block access to roughly one-third of the salmon-producing watersheds in the Columbia Basin. The several thousands of adult salmon produced by the Complex are intended to replace the estimated several millions of wild adult salmon that historically returned annually to the Columbia Basin above Grand Coulee.

The Yakama Nation regards the mitigation provided by Complex hatcheries as a promise by the United States to replace, in a small way, the massive losses of wild summer chinook and other salmonids incurred by tribal fishers as a result of the construction of Grand Coulee Dam. The policy decision to construct Grand Coulee Dam was made in full knowledge of the consequences to fisheries and to salmon and other fish resources. Accordingly, the Yakama Nation asserts that Complex hatchery mitigation programs must persist as long as Grand Coulee does.

The fish production programs at Complex hatcheries are required not only by federal statute but also by order of the U.S. District Court of Oregon in *U.S. v Oregon*, the Treaty fishing rights lawsuit for the Columbia River case area. The parties to the lawsuit, which include the Yakama Nation and US Fish and Wildlife Service, collaboratively have drafted the *2008-2017 U.S. v Oregon Columbia River Fish Management Agreement*, which describes conservation, harvest, and hatchery production measures intended to ensure long-term conservation of the resource while fairly sharing the harvestable fish. The Agreement includes a lengthy Appendix B describing all Columbia Basin hatchery programs and smolt production goals, including those of Complex hatcheries, that contribute to Treaty and non-Treaty fisheries in the Columbia River. Hatchery program goals are established by the tribal, federal, and state fishery co-managers who are party to the *U.S. v Oregon* lawsuit. When agreed to by all of these co-managers, the hatchery programs for Complex and other anadromous fish hatcheries are incorporated into Appendix B of the Agreement and adopted by the federal court as a binding order on the parties. This court order can only be amended by agreement of the parties.

Complex hatchery operations may significantly affect the watersheds in which they are located in terms of water quality and quantity, ecological interactions with other fish and wildlife

species, including some listed under the Endangered Species Act, and the creation of obstacles or hazards to fish migrations. These potential interactions have brought Complex hatcheries under intense scrutiny and, in some cases, litigation by neighbors, state and federal environmental agencies, environmental non-profits, and other fishery co-managers. It is imperative that hatchery modifications resulting from this Alternatives Analysis address and adequately resolve the complaints cited by critics of Complex hatcheries.

Leavenworth NFH is routinely targeted by critics for its relatively large environmental impact on the small Icicle watershed. The operation of Leavenworth NFH is central to planning by the Icicle Work Group (IWG) convened by Washington Dept. of Ecology and Chelan County Dept. Natural Resources to develop water storage, conservation, and management opportunities in the Icicle watershed. Leavenworth NFH is the second-largest consumer of surface water diverted from Icicle Creek. The hatchery's surface water demand and consequent ecological effects in the bypass reach of Icicle Creek have been the source of contention and litigation for over two decades. The Icicle watershed planning process has developed a base package of proposed actions anticipates that Leavenworth NFH will implement conservation measures on-station that reduce its surface water demand by at least 20 cfs. Yakama Nation, as a member of the IWG, supports the inclusion of hatchery upgrades in the watershed plan and anticipates that a thorough review of design alternatives will identify a variety of water conservation measures that substantially reduce the hatchery's surface water demand and contribute to achieving instream flow targets for Icicle Creek in all seasons.

Complex hatcheries also are required by the ESA to operate within terms and conditions specified in Section 7 biological opinions (BiOps) and incidental take permits that are meant to ensure that hatchery operations "do not impede the recovery" of listed species. ESA-listed bull trout and steelhead occur in all watersheds occupied by Complex hatcheries, and Winthrop NFH operates a supplementation program for ESA-listed steelhead that is rationalized on the basis of increasing the ESA-listed population in the Methow watershed. The impact of surface water withdrawals by Leavenworth NFH and attendant consequences for critical habitat in Icicle Creek have been noted in both bull trout and steelhead BiOps and has provided fertile ground for legal challenges of hatchery practices and, indeed, the existence of Leavenworth NFH itself. The opportunity provided by the Alternatives Analysis to modify infrastructure and operating practices must, at a minimum, fully resolve the operational liabilities at Leavenworth NFH that leave it exposed to ongoing and future litigation.

The spring chinook salmon that are produced at Leavenworth and Winthrop NFHs is particularly prized by tribal members because of its cultural importance as the first salmon to return each year, and because the richness of fats and oils in its flesh gives it unsurpassed flavor and nutritional value. In addition to the contribution of Complex hatcheries to tribal fisheries in Zone 6 (Bonneville –McNary dams), Leavenworth NFH supports an important subsistence fishery of great cultural and dietary value to members of the Yakama Nation. Salmon is a staple food for tribal members, and fishers who come to Icicle Creek typically are fishing to supply the subsistence needs of one to several households and elders who are no longer able to fish for themselves. The Icicle fishery plays an essential and significant role in supplying tribal needs for spring chinook, particularly for families having ancestral ties to the area. Because of the importance of Complex hatcheries in meeting these needs, the Yakama

Nation is vitally interested and must be closely involved in planning the modifications that will keep these programs robust and sustainable well into the future for the benefit of generations of Yakama people yet to come.

The draft AA does a reasonably thorough and adequate job of reviewing the technical considerations in evaluating alternatives to status quo Complex operations and arrives at the appropriate conclusion. We note, however, that descriptions of the regulatory and co-management context for the purpose and need of the AA are a bit thin, and we point out specific instances in the comments that follow where additional information could clarify how these external pressures may, in some cases, require a change in status quo hatchery operation that justifies the need for this analysis. We also note a number of misconceptions or cases where new developments need to be reflected in the AA.

II. SPECIFIC COMMENTS

Spring Chinook

1. The AA mistakenly states at numerous places that the current Leavenworth NFH program of 1.2 million spring chinook smolts meets *U.S. v Oregon* and GCFMP obligations. While this is strictly true for the current *U.S. v Oregon* plan, it is so only because the parties agreed to reduce the program from 1.65 million in 2007 (itself a reduction from 2.2 million prior to 2004) at the request of the Service as a result of fish health concerns created by failing infrastructure and water management constraints. The AA notes further at Section 3.1.1 that the Service has concluded that the 1.2 million goal is likely to remain and should be used for planning purposes.

This presumption has not been vetted with the *U.S. v Oregon* parties and improperly constrains the analysis of facility needs and potential design criteria. The *U.S. v Oregon* parties fully intended, when they agreed to reduce the Leavenworth NFH smolt goal from 1.65 million to 1.2 million, that the program would be restored to 1.65 million when facility constraints are resolved. The tribal parties, and perhaps others, intend to seek additional spring chinook production opportunities as part of the next *U.S. v Oregon* management agreement when the current one expires in 2017. The Service should include in the AA, and plan for in facility design criteria, analyses of facility needs and the biological consequences of restoring the spring chinook smolt program to the pre-2008 goal of 1.65 million and the pre-2005 goal of 2.2 million.

2. Section 2 misses an opportunity to describe the legal and environmental contexts that shape current hatchery operations and will affect, if not determine, design criteria for facility upgrades. At the very least, there should be a thorough discussion of ESA terms and conditions where, in the case of Leavenworth NFH, such conditions justify the need to significantly modify facilities and water management. The hatchery's unsustainable "environmental footprint" in the Icicle watershed should be described in some detail, as it rationalizes the large investment in infrastructure that will be requested pursuant to this AA. Section 2.1.18 describes NPDES/TMDL compliance in some detail, but there is virtually no discussion of ESA BiOp terms and conditions, the instream flow benefits to

Icicle Creek expected by the Icicle Watershed Group, or the need to sustain the tribal fishery in Icicle Creek adjacent to the hatchery grounds. These considerations aid the understanding of why this AA is necessary and how new investments in hatchery infrastructure must balance the demands of the Service's mitigation responsibility, tribal trust obligation, ESA compliance schedule, and the public interest in Icicle Creek.

Coho

3. **Section 3-Biological Programming and Operations:** Current production numbers are accurate for existing programs at Winthrop and Leavenworth, but the coho program at Entiat NFH was shifted to Leavenworth NFH in 2009 as described in Table 3.1 and text. Section 3.1.1 correctly notes that the Yakama Nation coho program should be expected to remain at Leavenworth NFH at some level into the foreseeable future due to delays in project implementation schedules. Production changes are based on, and reference, the 2012 EIS document which required assumptions about program development timelines and the ramp-down of release numbers currently reared at Complex hatcheries. The Wenatchee program is currently constrained by the lack of adult coho ascending Tumwater Canyon, and this has not allowed us to achieve Broodstock Development Phase 2 (BDP2) goals. Additional studies have allowed us to develop a contingency BDP2 plan that is elaborated in the current draft of the Master Plan being prepped for ISRP review. However, the timelines identified in the AA for a reduction in program numbers at Leavenworth are considerably longer than 10-15 years and are probably closer to 25 years. The AA would benefit from updated information in the current Master Plan.
4. Table 3-3 shows that surface water (presumably first pass considering there is a color code for reuse) is provided for coho adult holding and spawning Sep-Nov. The coho program is primarily on reuse (2nd pass) water during that timeframe. The table should reflect or clarify that very little first pass water is delivered to coho during that time.
5. **3.3.2- Leavenworth NFH Operating Summary, Surface Water Supply:** The assertion that future reductions in coho program numbers would eliminate the surface water deficit is incorrect. Coho are on 2nd or sometimes 3rd pass water, so no additional surface water is being withdrawn for that program.
6. *Juvenile Rearing Volume:* While the text indicates that the coho program is not included in total facility rearing volume (122,600 cf) due to the poor condition of LFLs and SFLs, the program is included in Table 3-4 to demonstrate hatchery water deficits in March and April. This is misleading because coho are on 2nd or 3rd pass water, thus the exceedance of water supply in March and April is either non-existent or unrelated to coho being reared on-station. Since the AA leans heavily toward conditions required for spring chinook rearing (e.g.- separate ground and surface water supply valves to each unit), Yakama Nation staff need to be consulted on how or if the coho program is to be included in new infrastructure designs.

7. **3.3.5- Winthrop NFH Operating Summary:** The number of coho spawning pairs is expected to increase from 220 to approximately 450 by fall of 2017 in preparation for moving out of the BDP 1 & 2 and into Natural Production Phases (NPP) of the coho program.
8. **Section 4.0 - Geographically Separate Alternatives Evaluation:** The rationale for not including coho in the relocation analysis presumes changes in the coho program's use of Leavenworth NFH that are intended but are not confirmed, particularly in the time frames that are assumed in the coho Master Plans and FEIS. Water rights, discharge permits, and facility costs are all very uncertain at this time for the off-station coho facilities. Consequently, the AA should reflect continued reliance by the coho program on Leavenworth NFH at the current level (adult holding/spawning/early incubation and spring acclimation) for the foreseeable future. Also, the EIS and MP discuss releasing a fraction of the program at Leavenworth NFH to provide for harvest opportunity and a failsafe for broodstock recovery if needed in low run years. Finally, our new MP revision and the current ESA consultations consider the option for adult outplanting in streams where acclimation sites are limited but carrying capacity for coho is high to supplement the adult returns from acclimated releases. This option is currently incorporated into our BAs under consultation.
9. **Section 6.2.4 - Adult Holding and Spawning and Fish Ladder:** In describing the deficiencies to adult holding and spawning facilities at Leavenworth NFH, #6 correctly identifies the difficulty for adult coho attempting to enter the ladder entrance during low flows. Coho will not ascend the ladder until higher flows occur, which puts coho broodstock recovery at risk waiting for flow events that may or may not arrive. The description of potential corrective measures unfortunately makes no mention of ladder changes that are needed to improve coho entry into the ladder. Repairing the fish ladder is identified as a low-cost, medium priority in Table 7-1, but this is a high priority for the coho program. Hatchery swim-ins currently produce about one quarter of the total coho program and, swim-ins are likely to be the primary source of adult outplants in the future. Replacement of the spawning facility is shown as a high priority, and it would make sense to consolidate fish ladder repairs with facility replacement when that occurs.
10. **Section 6.2.6.2 – 8 X 80 ft Raceway Replacement (LNFH):** It is not clear in this section how the options would affect the future use of existing vessels by the coho program. Specifically, we need to know what the plan is for the LFLs in the replacement scenario. One alternative in the refurbishing scenario rehabilitates the 8x80s to extend rearing vessel life but only in the context of spring chinook if circular tanks are not installed. The coho program needs are not mentioned anywhere in these scenarios except to note that the program will require separate facilities to be installed at its cost. It is unclear why the Service comes to this conclusion, but it is very clear that we need to consult further on this element of the AA.
11. **Section 6.2.8.1 – Short Term Phosphorus Management Plan:** The AA misstates the cleaning protocol for the coho program LFLs. YN staff do not broom waste through the drain pipe on the LFL since being made aware by Leavenworth NFH staff about the lack

of connection to the pollution abatement pond. Coho program staff vacuum the LFLs and re-direct the waste to the SFL ponds, where it can be diverted to the abatement pond.

12. **Section 6.4.5 - Incubation and Early Rearing:** Coho staff need to follow up with Winthrop NFH staff to ensure that there is enough incubation for the 1.3 million eggs that will be needed for the Natural Production Phase of the coho program.

Steelhead

13. The AA does not, but should, consider facility needs for offsite acclimation and in-basin broodstock collection so that the integrated steelhead program at Winthrop NFH can offer meaningful benefits to the recovery of the ESA-listed population. The Winthrop NFH steelhead program is an integrated conservation program designed to support a more natural life history in smolts that will supplement the naturally-spawning Methow population upon adult return. The program could be more effective and fully rationalized if smolts are acclimated and released off-station in or near appropriate natural habitats. The AA also should consider options to improve the in-basin collection of natural origin broodstock for the program, which are currently collected by hatchery staff using hook-and-line gear. This is both inefficient and exceedingly stressful to fish selected for broodstock and those released after capture. An effective integrated conservation program needs a reliable means of collecting natural origin broodstock to transition away from a dependency on hatchery origin returns to fulfill program smolt production goals.

Kelts

14. Long-term kelt reconditioning activities are conducted at the Methow Steelhead Kelt Facility (MSKF), which was constructed by Yakama Nation on Winthrop NFH grounds. The MSKF contains 4 kelt rearing tanks that measure 12 ft. in diameter and have 3 ft. of water depth. The rearing volume is 340 ft³ for each tank and a total rearing volume of 1,360 ft³. This volume allows a maximum of 136 adults at a density of 10 ft³/adult. The tank design flow assumes the maximum adult capacity of 34 each, or 34 gpm at a flow density of 1 adult/gpm. Although the project has not yet neared maximum capacity of the facility, the number and size of the tanks has allowed flexibility for segregation of kelts by collection location to minimize fish health risks.

Kelts are reconditioned on a combination of surface and well water. Surface water is used when natural water temperatures are desired and well water is added to temper excessively high water temps in the summer months. Well water is used exclusively during periods of high surface water turbidity or when fish spawning above the surface water intake pose a fish health risk to the kelts.

Table 1 summarizes the benefits and impacts to the operation of the MSKF of proposed infrastructure alternatives shown in Table 6-7 of the AA for modifications to the Winthrop NFH. Alternatives taken from the AA document are categorized into those that are critically important to kelt reconditioning activities, those that would directly benefit kelt reconditioning activities but are not critical at this time, those that would indirectly

benefit kelt reconditioning activities, and those that would have no impact on kelt reconditioning activities.

Table 1 - Proposed alternative for Winthrop NFW modifications categorized by their importance to continued function of the MSKF. Item numbers and descriptions correspond to Table 6-7 in the LFCOA document (page 181).

Importance to UCKRP	Item #	Item Description	Benefit to UCKRP
Critically Important	6.4.3a	• Video Survey of Piping Systems	<ul style="list-style-type: none"> • Insure pipes supplying MSKF do not leak/rupture and result in fish mortality due to water loss • Insure supply of ground water during power loss • Insure surface water supply to MSKF • Prevent fish health issues in kelts. Reduce well water need • Insure enough well water to maintain >60°F • Eliminate periodic dissolved gas issues in MSKF tank 4 • Access to MSKF valves and improved water distribution • Reduce water loss, more available for MSKF • Used by MSKF crew during summer as primary bathroom • Reduced groundwater and surface water demand prevents water shortage from impacting MSKF • Insures no power interruption to MSKF
	6.4.3b	• Pipe Replacement Allowance	
	6.4.10a	• Gen-Set For Gallery #3	
	6.4.1a	• Recoat Sluice Gates	
	6.4.1b	• Surface Water Disinfection	
	6.4.2a	• Add Well For Redundancy at Peak Flow Periods	
	6.4.2a	• Add Central Aeration/Gas Stabilization Head Box	
	6.4.3c	• Upgrade Valve Chambers to Meet Confined Space Regs.	
	6.4.3d	• Add valve to prevent GW overflow at Screen Chamber	
6.4.9e	• Comfort Station Accessibility and Repairs		
Directly Benefit	6.4.7a	• Add Low Head Oxygenators to 15 Existing E Bank Raceways	<ul style="list-style-type: none"> • Insures no power interruption to MSKF
	6.4.7b	• Incorporate LHO/Serial Reuse into New Rearing Units	
	6.4.7c	• Incorporate Aerobio Boost Units at New Circular Tanks	
	6.4.10b	• Electrical As-built	
	6.4.10c	• Other Misc. - Broken J Boxes, Modify VFD Cabinet	
	6.4.6a	• Replace 41,000 CF of Rearing Volume - (16) 26 ft Dia Circulars	
	6.4.6b	• 17,650 sf Roof Cover for New Rearing Units	
	6.4.6c	• Existing 8 x80 Raceways - Conc. Sealing & Asphalt Repair	
	6.4.6d	• Refurbish Existing 8 x 80 Raceways	
No Effect	6.4.8a	• Connect New Rearing Units To Pollution Abatement Pond	None
	6.4.9a	• Hatchery Building Seismic Upgrades	
	6.4.9b	• Hatchery Building - Add 400 sf Office Space	
	6.4.9c	• Shop - Fish Transfer Hose Storage Racks	
	6.4.9d	• Residence - Seismic Upgrades	
	6.4.6a	• Replace 41,000 CF of Rearing Volume - (16) 26 ft Dia Circulars	
	6.4.6b	• 17,650 sf Roof Cover for New Rearing Units	
	6.4.6c	• Existing 8 x80 Raceways - Conc. Sealing & Asphalt Repair	
	6.4.6d	• Refurbish Existing 8 x 80 Raceways	



Colville Confederated Tribes

Fish and Wildlife Department

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5 May 2016

Roy E. Elicker II
Assistant Regional Director, Fishery Resources
U.S. Fish & Wildlife Service
911 NE 11th Ave.
Portland, OR 97232

Re: Comments on the Leavenworth Fisheries Complex Alternatives Analysis Final Draft Report

Dear Mr. Elicker:

Thank you for visiting the Confederated Tribes of the Colville Reservation (CTCR) Government Center in Nespelem on March 15, 2016 and presenting, with your staff and USBR Deputy Regional Director Tim Personius, information about the Leavenworth Fisheries Complex (LFC) Alternatives Analysis Final Draft Report (Alternatives Report). As you know the Leavenworth National Fish Hatchery (LNFH) and the Wenatshapam fishery it supports are vitally important to CTCR. Until this year it was the only fishery that provided our Tribe an opportunity to harvest spring Chinook. LNFH also serves as the broodstock source for CTCR's Chief Joseph Hatchery Program segregated spring Chinook harvest component. These functions of LNFH are critical to fulfilling its congressionally designated role as mitigation for the blockage of anadromous fish passage caused by Grand Coulee Dam.

CTCR has devoted significant resources to supporting USFWS and the LNFH by dedicating staff to the Icicle Work Group and participating as a party in the *WFC v. Irving* litigation in support of USFWS and the other federal defendants. We also participated in the injunction phase of litigation over LNFH's biological opinion for bull trout. CTCR is committed to continuing its support of the USFWS in operating and the USBR in funding LNFH and the other hatcheries of the LFC in a sustainable manner and in such a way that fulfills the United States' trust obligation to CTCR and its members. My staff and I have reviewed the Alternatives Report and offer the following comments:

- I am pleased that the Alternatives Report concludes that alternative strategies to relocate all or part of the LNFH spring Chinook program are not viable and that continued use of the existing hatchery locations is the recommended alternative. CTCR fought hard to adjudicate its continued right to harvest salmon at Wenatshapam¹ and relocation of the LNFH would be

¹ *United States v. Confederated Tribes of the Colville Reservation*, 606 F.3d 698 (9th Cir. 2010).

severely undermine CTCR's harvest rights and would be inconsistent with the United States' obligation to protect those rights.

- I appreciate that the Alternatives Report identifies water supply improvements critical to fish production and health among its highest implementation priorities. USFWS and the USBR must address hatchery water quantity and quality in order to meet full hatchery production goals, better protect the hatchery from persistent legal challenges and meet their mitigation obligations and trust obligation to CTCR, particularly considering current and future climate change impacts and scenarios.
- In your March 15, 2016 presentation you identified "important infrastructure improvements to...comply with regulatory practices and avoid failures that would impact fish production" as medium implementation priorities. USFWS should add these improvements to its other highest priorities to ensure continued uninterrupted hatchery production. This is especially true at LNFH where the USFWS must screen its surface water intake and meet instream flow goals to comply with the requirements in NMFS' May 2015 biological opinion (BiOp).
- The Alternatives Report identifies surface water screens for its LNFH surface water supply system as a high priority on Table 7.1 and identifies a cost range of 5.5 million dollars; however it only identifies one million dollars of funding for that improvement between now and FY 2035. NMFS' May 2015 BiOp requires USFWS to have a water delivery system in place and operating that complies with NMFS 2011 screening and passage criteria within eight years, or by May of 2023. Acknowledging that USFWS will need to comply with NEPA and other regulatory requirements in addition to preliminary and final design, bid, and construction processes in order to complete this task, USFWS and USBR should seek and obtain full funding and begin design and construction of this needed improvement as soon as possible in order to ensure continued uninterrupted hatchery production and operations.
- The Alternatives Report also identifies circular reuse rearing tanks as an alternative rearing technology that offer advantages over traditional raceways, including improved effluent management and water velocity control and reduced water demand. CTCR supports the USFWS' use of such circular reuse rearing tanks as an alternative to refurbishing its concrete raceways; USFWS and USBR should prioritize, obtain funding for and implement design and construction of this alternative rearing technology at the LFC hatcheries.

While it is true that NMFS' May 2015 BiOp for LNFH is currently in litigation, USFWS and USBR should prioritize and immediately begin design and construction of infrastructure improvements that are required by the incidental take statement's terms and conditions, especially screening its surface water diversion and making improvements that reduce LNFH reliance on surface water from Icicle Creek. As the U.S. Supreme Court has made clear, USFWS and USBR would be proceeding at their own peril if they disregard the mandates of the BiOp and the incidental take statement. In addition, delayed implementation of the BiOp by USFWS and USBR imperils the Tribal fishery at Wenatshapam that LNFH supports and risks the agencies breaching their trust obligation to CTCR. Many of these issues have been known and studied for over a decade and now is the appropriate time to resolve them for the long-term benefit of the fishery and the listed species affected by the hatchery.

Respectfully,



Randall Friedlander

Director, Fish and Wildlife Department
Confederated Tribes of the Colville Reservation

Table 1. Responses to comments made by federal, state, county, and Tribal partners on the draft Leavenworth Fisheries Complex Alternative Analysis (AA).**

Commenter	Responses
Center of Environmental Law and Policy	The main concern appears to be related to the acquisition of additional water rights as new hatchery alternatives are developed (and the subsequent environmental impacts). However, as a result of the analysis, the hatcheries will not be moving to any new locations and there are no plans to acquire additional water rights. The Leavenworth NFH has plans to reduce surface water use by incorporating water conservation measures, while Entiat NFH and Winthrop NFH are considering a shift in some of their surface water rights to ground water rights, potentially leaving more water in their respective rivers.
Grant Public Utility District	We agree with Grant County PUD that monitoring and evaluation is a critical and necessary component of any hatchery program and we place the highest priority on compliance with the various Biological Opinions and other environmental permits related to hatchery production. However, the intent of the AA was to utilize a current “snapshot” of operations at the Complex hatcheries and use that information to determine whether other alternative situations (e.g. geographically separate alternatives) were viable as well as an evaluation of the benefits and risks of maintaining production at the current locations. This comparison was by design a high level analysis and was specifically focused on Federal Government’s mitigation responsibilities for the construction and operation of Grand Coulee Dam. A detailed description of Monitoring and Evaluation activities is not warranted for this analysis and will instead be considered in other more detailed planning processes.
Chelan County and Washington Department of Ecology	As suggested by comments, we suggest that the US Fish and Wildlife Service (USFWS) develop a NEPA strategy for the projects envisioned by the AA, and USFWS stated in meetings they will also be using the results of the AA to inform a more detailed project implementation schedule. In summary, the USFWS stated they intend to use the AA to help prioritize projects and update facilities at the hatcheries, develop an Implementation Plan and project schedule, and develop a strategy to seek funding to complete projects within the next five to ten years. They look forward to working with you to meet the missions of the Leavenworth Fisheries Complex and the Icicle Work Group.
Upper Columbia Salmon Recovery Board	We agree with the Upper Columbia Salmon Recovery Board that a consideration of how changes to the Leavenworth Complex facilities may impact and can promote recovery efforts for listed species should be an important aspect of our planning and implementation processes. The USFWS has stated that they look forward to working with you and all of the co-managers to determine how our actions can best facilitate and support the recovery of listed species. The USFWS also stated that they welcome your current and future input as to how operational and facility changes can most feasibly minimize any impacts to listed population in the Upper Columbia River region.
Washington Department of Fish and Wildlife	We agree that the current location for Leavenworth NFH production is the best option for this production and plan to move forward with facility improvements to achieve the desired improvements in water quantity and quality in Icicle Creek as well as improving the quality of hatchery rearing conditions. Similar to WDFW’s stated position we have ranked the water intake screening project at Leavenworth NFH as being of the highest importance and recommended plan to move forward with this action as soon as possible. The USFWS stated that their overall strategy is to use the analysis to help prioritize projects and update facilities at the hatcheries, develop an Implementation Plan and project schedule, and develop a strategy to seek funding to complete projects within the next five to ten years. The USFWS wants to assure you that they will comply with the Terms and Conditions outlined in the USFWS and NMFS BiOPs while implementing these changes. This includes improving fish passage at our hatcheries, using unused hatchery water to help meet minimum flow needs, changing hatchery operations to improve riparian and riverine habitat in streams next to our hatcheries, acquiring required CWA permits, and installing fish screens to meet ESA requirements. The USFWS look forward to working with you to meet the missions of the Leavenworth Fisheries Complex and the Washington Department of Fish and Wildlife.
Confederated Tribes and Bands of the Yakama Nation	<p>Yakama Nation General Comments</p> <p>We agree that it is in everyones joint interests to ensure that Complex hatcheries remain fully capable of implementing well into the foreseeable future to meet the needs of Treaty trust resources, including the Yakama Nations coho program, tribal fisheries, and our obligations pursuant to the Grand Coulee Fish Mitigation. We further agree that it is critically important that as everyone moves forward to modify hatchery infrastructure and operations to meet these obligations they do so in as environmentally a sound way as possible.</p> <p>The intent of the AA was to utilize a current “snapshot” of operations at the Complex hatcheries and use that information to determine whether other alternative situations (e.g. geographically separate alternatives) were viable as well as an evaluation of the benefits and risks of maintaining production at the current locations. This comparison was by design a high level analysis and was specifically focused on Federal</p>

	<p>Government’s mitigation responsibilities for the construction and operation of Grand Coulee Dam. The provision of detailed information regarding environmental compliance or projected changes in production is not necessary at this time nor would they notably change the results and conclusions of the AA. This information will need to be pulled together as more detailed implementation plans are developed and infrastructure improvements are pursued. This information is most efficiently considered at the individual hatchery level rather than trying to encapsulate such an extensive amount of information into a single document. The USFWS has stated they will continue to coordinate these efforts with the tribe.</p> <p>Yakama Nation Specific Comments:</p> <p>Where feasible we have incorporated as many of the edits and suggestions made by the Yakama Nation and the USFWS stated they are committed to a continued dialogue as they develop more detailed plans for needed improvements at Leavenworth, Entiat and Winthrop NFHs. In the interest of brevity we will not detail these changes however there are a few larger issues that were identified that deserve some discussion and are included below:</p> <p>US v Oregon Columbia River Fish Management Agreement</p> <p>The Alternative Analysis was predicated on Leavenworth NFH program meeting its current obligation of 1.2M spring Chinook salmon smolts as per the 2008-2017 U.S. v. Oregon Columbia River Fish Management Agreement. We acknowledge however that this production level represents a reduction from the previous level of 1.65M spring Chinook salmon smolts. As you are aware this reduction was an interim action until such time that concerns over water quality and quantity, fish health, hatchery infrastructure issues, and ESA straying risks could be resolved. We do not anticipate changing the Alternative Analysis to reflect the 1.65M goal. With the completion of the Alternatives Analysis and through the concerted efforts of the USFWS and their partners however, it is their intention to pursue infrastructure and operational improvements to increase spring Chinook salmon smolt production at Leavenworth NFH – perhaps to the 1.65M production level or greater while also meeting water conservation and other ecological goals for the program. The new infrastructure and necessary operational changes will take some time to become proficient but increasing production from current levels is our intention. To better address this concern we have suggested specific language changes to better express this intent, and to make the joint commitments within the current Management Agreement clear.</p> <p>Yakama Nation Coho Reintroduction Efforts</p> <p>We recognize the Alternative Analysis identified a time line (10-15 years) for the Yakama Nations coho Salmon program that failed to incorporate an adjusted timeframe closer to the 25 year period you recommended. We also acknowledge the infrastructure deficiencies mentioned. The USFWS has worked to support this program at both Winthrop and Leavenworth hatcheries in the past and has stated they will continue to do so for the long-term. The USFWS will work closely with the Yakama Nation to ensure the various coho related infrastructure needs are considered and they can work jointly to seek the funding necessary to implement these changes.</p> <p>Description of Permitting Requirements</p> <p>We agree that it is important to consider the various permit requirements and environmental compliance issues as specific alternatives are being evaluated and contemplated. While the current draft of the AA may not fully describe these issues this is at least in part because some of the requirements are still being developed and discussed with the regulatory agencies. The USWFS certainly had these current and pending requirements in mind. As the Alternatives Analysis was developed the participants assumed there was a commitment to describe how the various environmental compliance issues will be best resolved. This would occur through the more detailed planning that would be a result of the findings of the actions that are implemented.</p>
<p>The Confederated Tribes of the Colville Reservation</p>	<p>We agree that it is in the parties’ joint interests to ensure that Complex hatcheries remain fully capable of meeting our production goals well into the foreseeable future to meet the needs of Treaty Trust resources, including supplying brood stock for the CCT’s spring Chinook program at Chief Joe Dam and the tribal fishery on Icicle Creek. We further agree that it is critically important to move forward, without hesitation, to modify and improve hatchery infrastructure and operations to meet those obligations.</p>

**Now referred to as the Leavenworth Fisheries Complex Planning Report.