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MEMORANDUM

7/13/2018

TO: Charity Davidson, SCJ Alliance
FROM: Joe Miller and Pradeep Mugunthan, Four Peaks Environmental Science & Data Solutions
SUBJECT: Wheeler Ridge Hydraulic and Field Water Quality Measurements

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BACKGROUND

Wheeler Ridge, LLC is proposing to develop up to 360 acres of irrigated orchards within the Wheeler Ridge area of Chelan County. To support this effort Wheeler Ridge, LLC has retained SCJ Alliance to prepare a planning-level Programmatic Environmental Impact Statement (PEIS) in accordance with State Environmental Policy Act (SEPA) requirements. As part of the PEIS, SCJ Alliance subcontracted Four Peaks Environmental Science & Data Solutions (Four Peaks) to collect baseline hydraulic and water quality data. The purpose of this memo is to present the data collected and provide an initial characterization of baseline surface water resources identified in Phase 1 of the proposed development.

The proposed orchard development is located in Washington State Department of Ecology's Alkali/Squilchuck Creek Water Resources Inventory Area (WRIA 40). The focal area of Phase 1 data collection is Section 17 within Township 21 North, Range 20 East of Chelan County (Figure 1). Based on an initial desktop evaluation of the project site, two small streams were identified for further evaluation: 1) an unnamed tributary draining into Orr Creek and then Stemilt Creek (hereafter referred to as "Tributary 1"); and an unnamed tributary draining into Squilchuck Creek (hereafter referred to as "Tributary 2"). During field reconnaissance within Section 17, Tributary 2 was found to be dry and therefore was not further evaluated. Tributary 1 was surveyed at three locations, with results presented below.

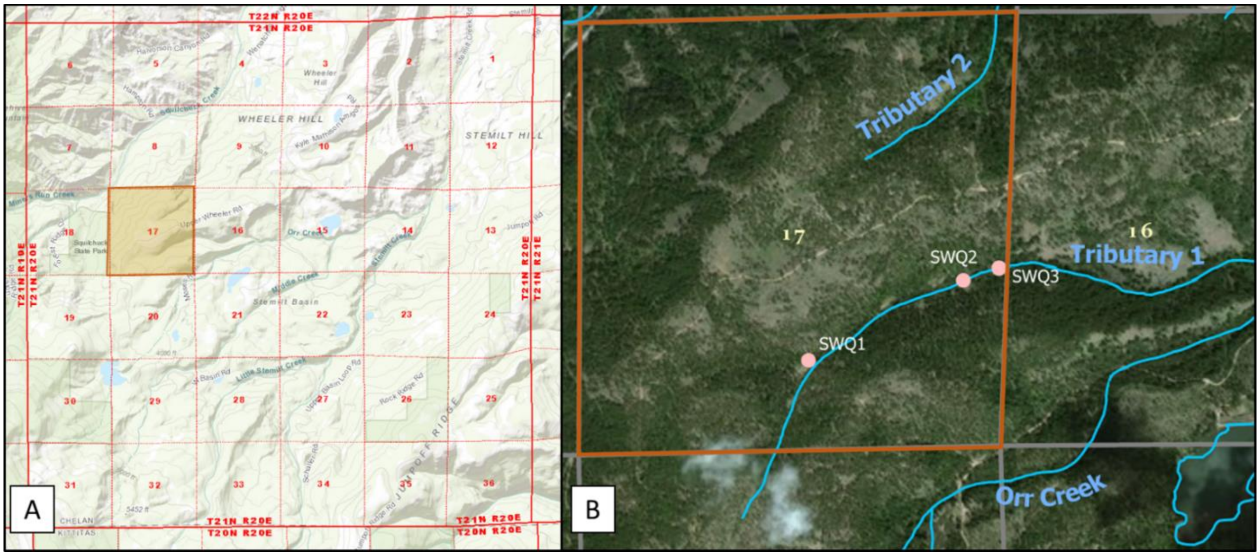


Figure 1. Vicinity Map Depicting Phase 1 Focal Area in Section 17 (Panel A) and Closeup of Hydraulic and Water Quality Measurement Locations (Panel B)

METHODS AND RESULTS

Desktop Review

We reviewed information from a number of agency data sources to further characterize the attributes of Tributary 1. First, we reviewed the Washington State Water Quality Standards (WQS) to determine which designated uses apply (WAC 173-201A). None of the streams in WRIA 40, including Tributary 1, are named in Table 602 of the WQS (WAC 173-201A-602) and therefore fall under the default designated uses of "Salmonid spawning, rearing, and migration; primary contact recreation; domestic, industrial, and agricultural water supply; stock watering; wildlife habitat; harvesting; commerce and navigation; boating; and aesthetic values" (WAC 173-201A-600). Secondly, we reviewed fish passage data provided by the Washington State Department of Fish and Wildlife (http://apps.wdfw.wa.gov/fishpassage/) to confirm the status of fish passage within the project area. Tributary 1 is located above multiple downstream passage barriers which preclude anadromous fish from accessing habitat within Section 17. Finally, we reviewed the Washington State Department of Natural Resources water-type classifications (https://fpamt.dnr.wa.gov/) for Tributary 1 and determined that the portion of the tributary in Section 17 is classified as non-fish bearing.

Field Data Collection

Baseline flow measurements and water quality samples were collected at three sampling locations[1] along Tributary 1 on May 16, 2018 (Figure 1 and Table 1). Flow was calculated at each of the three Tributary 1 sampling locations by multiplying the measured water velocity by the cross-sectional area of the channel. Velocity measurements were obtained with a Global Water FP201 flow probe and the cross-sectional area of the channel was determined by measuring the channel width and depth at several locations across a transect at each site.

During the site visit, Tributary 1 was narrow (less than 3 feet wide) and shallow (only a few inches deep; Figure 2) and appeared to originate from a groundwater source near sampling location SWQ 1. At each sampling location we attempted to locate a relatively narrow and deep channel cross-section to improve the accuracy of the flow estimate (Table 2). In general, flow estimates (Table 2) were consistent with visual observations (Figure 2) suggesting that flow increased moving from the upstream to downstream sampling locations (i.e., SWQ 1 had the lowest flow and SWQ 3 had the highest flow). Because the channel was very shallow at all sampling locations and constrained the location of cross-sectional velocity measurements to a very limited number of points within the thalweg (i.e., we were unable to obtain flow measurements in slower, shallower portions of the channel), the velocity estimates used in the flow calculations are likely representative of the fastest flowing water in the channel. Assuming that the higher velocity water is heavily represented in the flow calculations, the estimated flows are expected to be somewhat higher than the actual flows in the tributary at each of the three sampling locations.

Table 1. Sampling Location Information

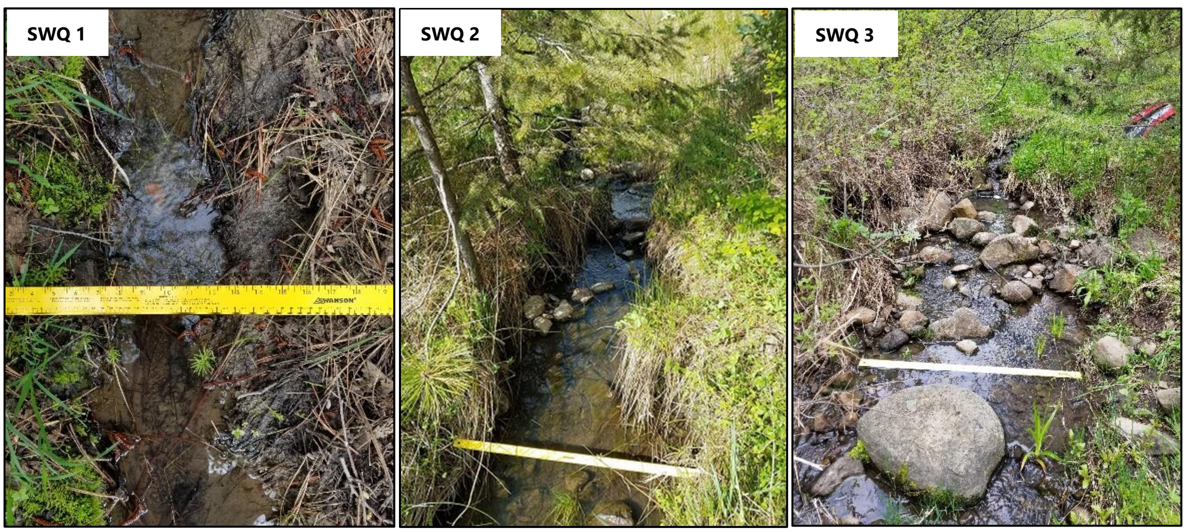
Sampling Location	Notes	Latitude[1]	Longitude[1]	Elevation[1] (ft)
SWQ1	Furthest upstream sampling location	47.30713	-120.35578	3,741
SWQ2	Located approximately 0.4 mile downstream of SWQ1	47.30984	-120.34822	3,579
SWQ3	Located approximately 0.1 mile downstream of SWQ2	47.31021	-120.3464	3,500

Notes: 1. Locations were documented using a Garmin™ *Etrex 20x* GPS Unit; Map Datum: WGS 84
2. The sampling locations were documented with an alphanumeric code where the first three letters "SWQ" are an acronym for Surface Water Quality and the number (i.e., 1, 2 or 3) refers to sequentially sampled geographic site

[1] No flow was observed in Tributary 2 on May 16, 2018.

Table 2. Flow Calculation Parameters and Flow Estimates for Sampling Transects in Tributary 1

Sampling Location	Channel Width (ft)	Measured Velocity (ft/s)	Cross-sectional Area (ft^2)	Estimated Flow (ft^3/s)
SWQ 1	0.42	0.5	0.03	0.02
SWQ 2	1.33	0.4	0.15	0.06
SWQ 3	1.00	1.5	0.10	0.14



Note: The ruler shown in each picture has a total length of 3 ft.

Figure 2. Vicinity Photographs of Sampling Locations SWQ 1, SWQ 2, and SWQ 3 within Tributary 1

Water Quality

Field parameters including temperature, dissolved oxygen (DO), DO saturation, pH, and specific conductance were measured at the three locations in Tributary 1 using a YSI ProDSS Handheld with a multi-parameter sonde. The equipment was calibrated[2] prior to use (see Attachment A for calibration certificate).

Temperature and DO are two of the most important water quality parameters for aquatic life. In general, low temperatures and high dissolved oxygen are associated with better water quality and are required to support sensitive aquatic species such as salmonids (Bjornn and Reiser,

[2] Calibration of pH was verified at pH 4, 7 and 10 using reference solutions. For DO, the barometric pressure setting was adjusted to the pressure reported in Wenatchee on the day of sampling such that the DO readings were representative of the local conditions.

1991). The pH of aquatic habitats is a measure of acid-base equilibrium where values less than 7.0 are considered acidic and those higher than 7.0 are alkaline. High or low pH values may contribute to toxic conditions for aquatic life [WAC 173-201A-200(1)(g)]. Specific conductance is a measure of how well water conducts an electric current and reflects the concentration of ions that are present in aquatic habitats. High specific conductance may indicate the presence of anthropogenic pollutants or other natural substances that are toxic to aquatic life (Clements and Kotalik, 2016).

Overall, the water quality measurements in Tributary 1 appeared to reflect groundwater contributions upstream (SWQ 1) and then reflected increasing effects of exposure to atmospheric conditions downstream. The field parameter data collected for each sampling site is summarized in Table 3.

Sampling location SWQ 1 had the lowest temperature and DO, presumably reflecting the relatively cool groundwater source from which Tributary 1 originates. Sampling locations SWQ 2 and SWQ 3 exhibited higher temperatures and DO which likely increased as a result of more exposure to surface-air temperatures and atmospheric oxygen, respectively, as the water traveled downstream (Table 3). This pattern was also observed with increasing DO saturation, where downstream sampling locations were nearly 100% saturated compared to SWQ 1 which was near 50% (Table 3). The temperatures and DO values downstream of SWQ 1 were protective of sensitive aquatic species (i.e., temperature < 12 °C, and DO > 8.0 mg/L; WAC 173-201A-200). However, the low DO observed at SWQ 1 (Table 3) was likely a legacy of groundwater conditions. The pH values measured in Tributary 1 were at or close to 7.0 (Table 3), reflecting neutral or slightly alkaline water conditions. Values in this range are protective of sensitive aquatic life (WAC 173-201A-200). The specific conductance measurements at all three sampling locations were similar to one another and within the range of values expected for the region (Griffith, 2014) and those collected from other groundwater sources in the nearby, fish-bearing Wenatchee River Basin (Ecology 2006). In summary, the limited sampling in Tributary 1 presented variable surface water quality conditions that were representative of a groundwater source and generally protective of sensitive aquatic life.

Table 3. Field Water Quality Parameters Measured on May 16, 2018

Field Parameter	SWQ1	SWQ2	SWQ3
Time	8:17 AM	9:18 AM	9:50 AM
Temperature (°C)[1]	5.5	10.5	10.6
Dissolved Oxygen (mg/L)[2]	6.3	8.8	9.1
Dissolved Oxygen Saturation[3] (%)	50.2%	94.5%	94.8%
Specific Conductance (mS/cm)[4]	0.2	0.1	0.1
pH	7.0	7.2	7.3

Notes:
1. °C = degrees Celsius;
2. mg/L = milligrams per liter;
3. Estimated based on temperature, barometric pressure (29.8 inches) and specific conductance from U.S. Geological Survey's DO Tables
4. mS/cm = milli-Siemens per centimeter

REFERENCES

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Clements, W.H., Kotalik, C., 2016. Effects of major ions on natural benthic communities: an experimental assessment of the US Environmental Protection Agency aquatic life benchmark for conductivity. Freshwater Science 35, 126–138. https://doi.org/10.1086/685085

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ATTACHMENT A – FIELD EQUIPMENT CALIBRATION CERTIFICATE