Willow Creek Water Quality Sampling
May – September 2016

Findings Report

Finalized November 2017

by the **Alaska Department of Environmental Conservation**

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1.0 Summary

Increasing development and recreational activity along with continued mining within the Willow Creek watershed raised concerns over possible water quality degradation and changes to physical habitat resulting in impacts to salmon spawning and rearing habitat. In order to address these concerns, water quality monitoring, physical habitat and biotic assessments were conducted in the summer and fall of 2014 and the spring of 2015. DEC staff conducted follow-up water quality monitoring in the summer of 2016 to achieve two years of monitoring to document water quality health. This report presents the findings from the 2016 water quality monitoring.

Water samples were collected from four Willow Creek monitoring locations during May, July, August and September 2016 to represent different river flow conditions. Laboratory analysis for dissolved metals concentrations, macronutrients, alkalinity, hardness, and fecal coliform bacteria was conducted; additionally instream field measurements for pH, specific conductivity, dissolved oxygen, turbidity and temperature were conducted. Microbial Source Tracking (MST) analysis was conducted to help identify bacteria sources.

Willow Creek water quality met all state water quality criteria (WQC) except for fecal coliform bacteria at two monitoring locations downstream of the Parks Highway. Microbial source tracking on these bacteria samples indicated no evidence of ongoing bacteria pollution from human sources. Additionally, one dissolved led result downstream of the Parks Highway exceeded the chronic aquatic life WQC. This was an anomalous result and no other lead results exceeded criteria during the entire study period.

2.0 Introduction

2.1 Background

Willow Creek is an important and popular salmon and rainbow trout stream within the Matanuska-Susitna Borough near the town of Willow, Alaska. Willow Creek supports Chinook, coho, sockeye, pink, and chum salmon, as well as rainbow trout and Arctic grayling. Willow Creek is accessible from the Parks Highway, Willow Creek Parkway, and Willow Fishhook Road. There are state and private camping facilities near the creek as well as fishing guide services. Willow Creek drains 167 square miles and is in Hydrologic Unit Code (HUC) 19020505.

Development increases in the Willow Creek watershed have the potential to disturb riparian areas, contribute to bank erosion and impact water quality. During rain events runoff from parking lots, roads, yards and fields can contribute sediments, salts and metals to surface streams. All of these factors affect the overall ecological health of the stream including aquatic insects, rearing juvenile salmon and resident fish. Fine sediments in large quantities can limit the amount of living space for aquatic insects, clog the gills of rearing juvenile salmon and resident fish, can block oxygen flow to developing salmon eggs, and can also contribute to increased water temperature. Metal pollutants can be toxic to fish particularly during early incubation and can also alter the odor of a stream affecting migrating salmon's ability to locate spawning areas.

A combination of different land use activities within the Willow Creek drainage could potentially influence water quality and fish habitat. Mining within the upper drainage has been occurring for the past ~ 100 years and is ongoing. Urban development including homes and "hobby" farms, land clearing, and road building has occurred within the watershed and within the river flood-prone area primarily from Shirley-Town Road downstream. Four road bridges cross Willow Creek with two of these (Deneke and Shirley Town) having been lost (and replaced) to floods within the past 10 years. There has been some forest harvest and road building within the Willer-Kash harvest area on the north side of Willow Creek and in the upper Deception Creek drainage. Potential recreational impacts include all-terrain-vehicle trails in the upper drainage and damage to riparian vegetation in the areas of concentrated fishing/camping use primarily downstream of the Parks Highway. Figure 1 shows the Willow Creek drainage.

Figure 1. Location of Willow Creek in south-central Alaska.

2.2 2015 Assessment

In Fiscal Year 2015 (FY15), water quality sampling, biological sampling and habitat measurements were conducted by the Aquatic Restoration & Research Institute (ARRI) under the direction of DEC through an Alaska Clean Water Actions grant. Results of that study are described in the project report by Davis, Davis, Ramage and Briggs (2015) titled "*Willow Creek Water Quality and Habitat Assessment*" at http://dec.alaska.gov/water/wqsar/pdfs/Reports/Willow-Creek-2015-ADEC.pdf.

Water quality sampling conducted in FY15 documented fecal coliform bacteria 30-day geometric means greater than 20 colony forming units (cfu)/100 milliliters (ml) at two monitoring locations downstream of the Parks Highway (Table 1). The values are in exceedance of the fecal coliform bacteria WQC for the drinking water supply designated use (30-day geometric mean not to exceed 20 cfu/100 ml, and not more than 10% of the samples may exceed 40 cfu/100 ml).

Table 1. FY15 fecal coliform bacteria results for the two sites sampled on Willow Creek. Site Willow03 is immediately downstream of the Parks Highway and site Willow04 is near the mouth of Willow Creek in the Willow Creek State Recreation Area.

Date	Willow03	Willow04
7/22/2014	30.00	65.00
7/28/2014	28.00	25.00
8/4/2014	26.00	24.00
8/12/2014	12.00	44.00
8/19/2014	13.00	25.00
Geometric Mean	**20.25**	**33.61**

3.0 Methods

3.1 Project Objectives 2016

1) Measure stream water chemical and nutrient parameters in upstream reference and downstream developed or higher use areas of Willow Creek to determine if results are within WQC. The additional data will enable DEC to reach a water quality assessment determination.

2) Conduct Microbial Source Tracking (MST) analysis for fecal coliform bacteria results that exceed WQC to determine if the source of the bacteria includes human, dog or horse DNA biomarkers.

3.2 Project Description

3.2.1 Parameters for Laboratory Analysis

This project provided a second year of baseline water quality data in Willow Creek to determine if WQC were being met and evaluated current stream health. The water quality assessment was conducted through implementation of a DEC approved Quality Assurance Project Plan (QAPP). Water sample collection occurred at an upstream reference location and at downstream higher use areas (Figure 2 and Table 2).

Water samples for laboratory analysis were collected at four locations distributed longitudinally in the mainstem of Willow Creek on three separate occasions. In order to characterize seasonal water quality, samples were collected once during spring runoff in May 2016, once during summer base flow conditions in July 2016, and once during fall storms in September 2016. Water samples were laboratory analyzed for nitrate+nitrite nitrogen, ammonia nitrogen, total phosphorus, dissolved organic carbon, alkalinity, hardness, and dissolved metals (ICP/MS using EPA 200.8 methods, including the following metals: silver, aluminum, arsenic, barium, beryllium, cadmium, cobalt, chromium, copper, iron, manganese, molybdenum, nickel, lead, antimony, selenium, thallium, vanadium, and zinc). Dissolved mercury was analyzed using EPA 245.1 methods.

Fecal coliform bacteria sampling occurred five times within a 30-day period during summer base flow and early fall storm flow conditions (mid-July – early August) at three sampling locations. One bacteria sampling site was upstream of the Parks Highway (Willow02) and two sampling sites were

downstream of the highway (Willow03 and Willow04). Water samples were analyzed by SGS Laboratory in Anchorage, AK for fecal coliform bacteria using SM 9222D. If the bacteria counts were greater than 20 cfu/100 ml, the samples underwent MST analysis for presence/absence of human, horse, and/or dog bacteroidetes (DNA sequences) to speciate the bacteria source. If the bacteroidetes were present, then quantification of the concentration of these host fecal indicators occurred.

Microbial source tracking is a set of methods used to determine the host (different animals or human) that contributes fecal pollution to a waterway. Variations in DNA sequences between living organisms makes it possible to distinguish between these organisms through molecular biology techniques (Source Molecular 2016).

Laboratory chain of custody forms were filled out and shipped with the water sample coolers to the project laboratories. SGS North America Inc. laboratory in Anchorage, Alaska conducted the fecal coliform bacteria, dissolved metals, chemical, and nutrient analyses. MST analysis was conducted through Source Molecular Corporation laboratory in Miami, Florida.

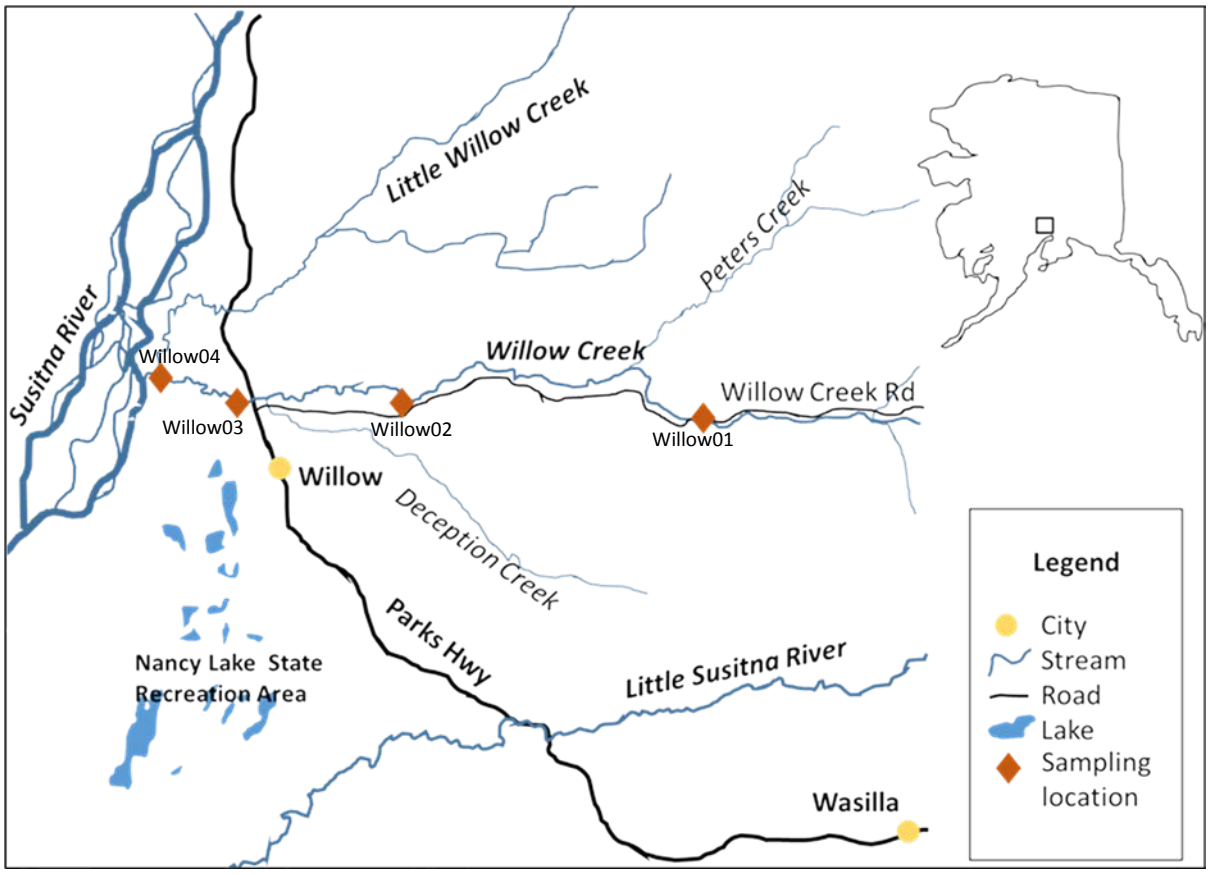

Figure 2. Map of Willow Creek and surrounding area with approximate sampling locations. Modified from Davis, et al. 2015.

Table 2. Willow Creek sampling locations with GPS coordinates using NAD83.

Sampling Site	Location Description	Latitude	Longitude
Willow01	100 meter reach immediately downstream of Willow-Fishhook Road crossing	61.76984	-149.68153
Willow02	100 meter reach immediately downstream of Deneki Road crossing bridge	61.77063	-149.95695
Willow03	100 meter reach quarter mile downstream of Parks Highway crossing	61.76752	-150.07561
Willow04	100 meter reach within Willow Creek State Park, upstream of confluence with Susitna River	61.77696	-150.15544

3.2.2 Field Water Quality Measurements

Field water quality measurements at all four sites included pH, specific conductivity, dissolved oxygen, temperature, and turbidity and were measured using meters concurrent with the water samples collected for laboratory analysis. Specific conductivity, water temperature, dissolved oxygen and pH were measured using a YSI 556 meter and probes. Turbidity was measured using a Hach 2100P turbidimeter using nephelometric turbidity units (NTU). Turbidity measurements involved obtaining three replicate samples at each monitoring location and then calculating an average turbidity value for each location. Meters were calibrated prior to use each sampling date.

Daily stream discharge was obtained each sampling date from the U.S. Geologic Survey (USGS) gauging station 15294005 publically available online. Table 3 outlines the project sampling schedule.

Table 3. Project sample dates for all parameters and all sites in 2016. NA means not applicable and a sample was not taken.

Product	Parameter	Willow01	Willow02	Willow03	Willow04
Laboratory Analysis	Nitrate+Nitrite-N	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21
	Ammonia-N	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21
	Total Phosphorus	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21
	Total Dissolved Phosphorus	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21
	Dissolved Organic Carbon	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21

Product	Parameter	Willow01	Willow02	Willow03	Willow04
	Alkalinity	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21
	Hardness	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21
	Dissolved Metals	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21
	Fecal Coliform	NA	7/19 7/25 7/26 8/1 8/8	7/19 7/25 7/26 8/1 8/8	7/19 7/25 7/26 8/1 8/8
	Microbial Source Tracking	NA	As needed	As needed	As needed
Field Sampling	pH	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21
	Specific Conductivity	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21
	Dissolved Oxygen	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21
	Water Temperature	5/18 7/18 9/21	5/18 7/18 7/19 7/25 7/26 8/1 8/8 9/21	5/18 7/18 7/19 7/25 7/26 8/1 8/8 9/21	5/18 7/18 7/19 7/25 7/26 8/1 8/8 9/21
	Air Temperature	5/18 7/18 9/21	7/19 7/25 7/26 8/1 8/8	7/19 7/25 7/26 8/1 8/8	7/19 7/25 7/26 8/1 8/8
	Turbidity	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21	5/18 7/18 9/21

4.0 Results

4.1. Dissolved Oxygen, pH, and Specific Conductivity

Results for field water quality measurements are shown in Figures 3 through 5. Dissolved oxygen (mg/l) was consistently highest at site Willow01 in the upper watershed throughout the study. Seasonally, the highest dissolved oxygen levels were measured on September 21, 2016 at all sample sites except Willow04 which is located near a small still water side slough. Stream water pH was over 7.0 on all sampling dates. The pH was highest for all four sites on July 18, 2016 and lowest during the spring sampling on May 18, 2016. Specific conductivity (microsiemens per centimeter (µS/cm)) generally followed a similar pattern to stream water pH with highest readings in July and lowest readings in May as shown in Figure 5.

Figure 3. Dissolved oxygen (mg/l) at all sampling locations measured during spring flow (May 18), summer base flow (July 18) and during a fall storm flow event (September 21).

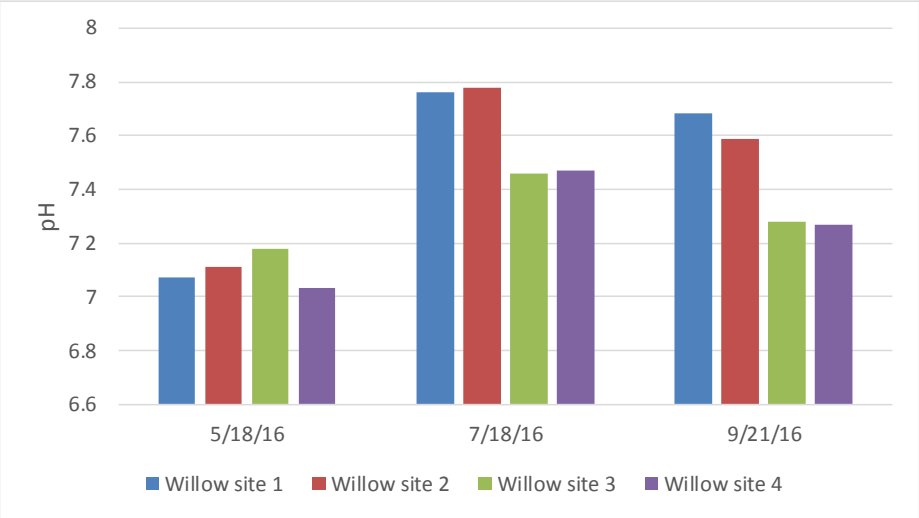

Figure 4. Stream water pH at all sampling locations measured during spring flow (May 18), summer base flow (July 18) and during a fall storm flow event (September 21).

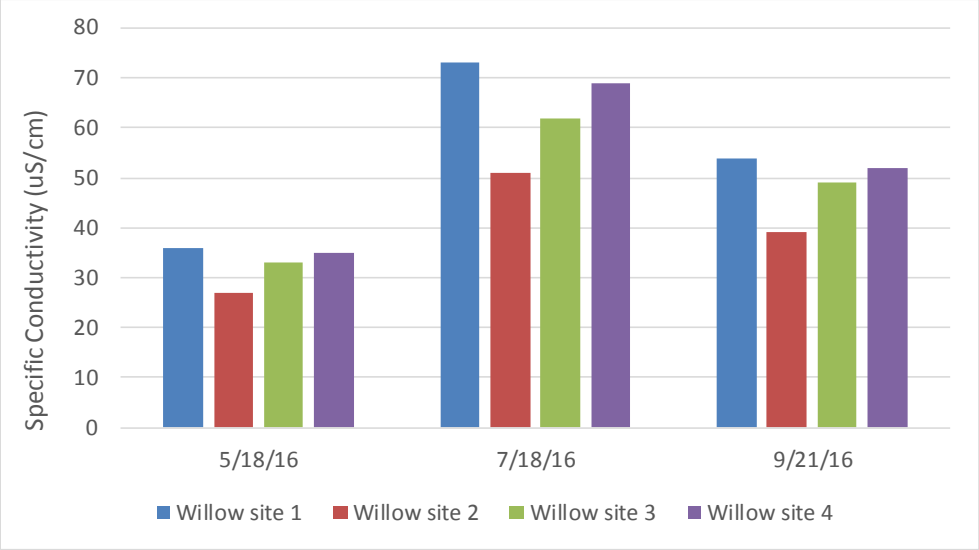

Figure 5. Specific conductivity (µS/cm) at all sampling locations measured during spring flow (May 18), summer base flow (July 18) and during a fall storm flow event (September 21).

4.2 Turbidity

Turbidity was very low throughout the 2016 study at all sites and dates. Daily average turbidity values were less than 5 NTU on all sample dates (Figure 6). Even following storm events, turbidity values were low. A high water event (over 2,000 cfs) occurred on September 13, 2016 following heavy rains. Water quality sampling occurred on September 21, 2016 and turbidity values were less than 2 NTU.

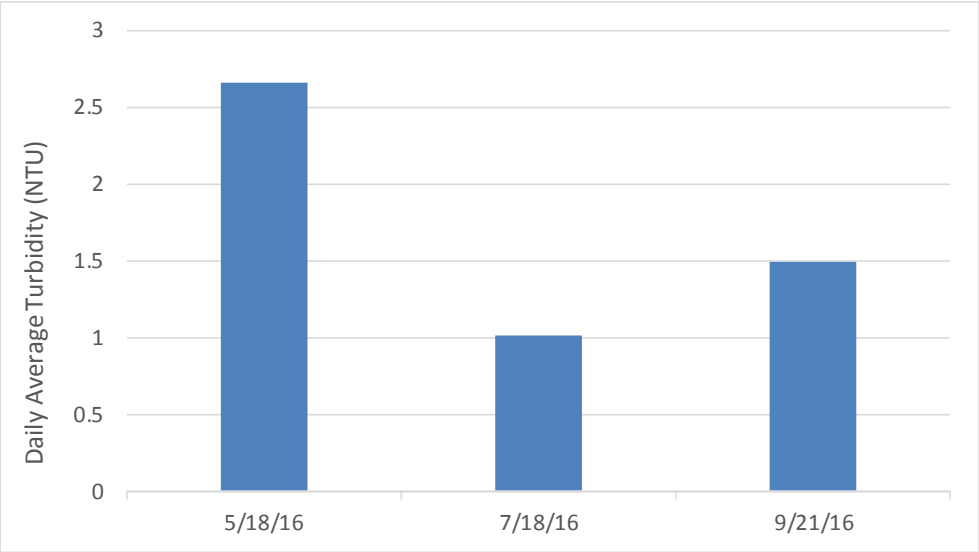

Figure 6. Daily average turbidity (NTU) during spring flow (May 18), summer base flow (July 18) and during a fall storm flow event (September 21).

4.3 Dissolved Metals

The Alaska Water Quality Manual for Toxic and Other Deleterious Organic and Inorganic Substances (Toxics Manual) (ADEC 2008) provides water quality criteria for metals (dissolved or total recoverable) and organic substances in freshwater. The manual presents both acute and chronic criteria for aquatic life in freshwater. Acute criteria are based on one-hour averages, while chronic criteria are based on a four-day average concentration.

This study tested for acute criteria, but measurements could be used to indicate potential exceedances of chronic criteria even though four consecutive days of sampling did not occur (ADEC CALM 2017). The Toxics Manual also outlines criteria for human health consumption for uses of drinking, culinary, food processing, and growth and propagation of aquatic life.

Measurements of dissolved metals in water samples are shown in Table 4 for each sampling date. Results are in micrograms per liter (µg/l). The lead result at monitoring location Willow03 on July 18, 2016 exceeded chronic criterion. All remaining lead results, including all of the replicate samples, were below detectable levels for lead.

Table 4. Dissolved metals at all four sampling locations, measured during spring flow, summer base flow, and a fall storm flow event. ND indicates metals were below detectable levels. All values are in µg/L.

	May 18, 2016			
	Willow01	**Willow02**	**Willow03**	**Willow04**
Aluminum	ND	ND	ND	20.2
Antimony	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND
Barium	11.2	7.11	7.39	7.8

Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Iron	ND	ND	ND	ND
Lead	ND	ND	ND	ND
Magnesium	1880	1130	1250	1230
Manganese	ND	ND	2.11	4.44
Mercury	ND	ND	ND	ND
Molybdenum	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	ND	565	569
Selenium	ND	ND	ND	ND
Silicon	2410	2710	3100	3080
Silver	ND	ND	ND	ND
Sodium	2390	2010	3100	3050
Thallium	ND	ND	ND	ND
Tin	ND	ND	ND	ND
Titanium	ND	ND	ND	ND
Vanadium	ND	ND	ND	ND
Zinc	ND	ND	ND	ND
Aluminum	ND	ND	ND	20.2
Antimony	ND	ND	ND	ND

	July 18, 2016			
	Willow01	**Willow02**	**Willow03**	**Willow04**
Aluminum	ND	ND	ND	ND
Antimony	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND
Barium	17.1	10	11.2	11.7
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	1.19	ND
Iron	ND	ND	ND	ND
Lead	ND	ND	3.28	ND
Magnesium	2960	1560	1680	1620
Manganese	3.47	1.85	15.1	24.4
Mercury	ND	ND	ND	ND
Molybdenum	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	569	615	738	672

Selenium	ND	ND	ND	ND
Silicon	2350	2750	3210	3190
Silver	ND	ND	ND	ND
Sodium	4230	2980	4520	4480
Thallium	ND	ND	ND	ND
Tin	ND	ND	ND	ND
Titanium	ND	ND	ND	ND
Vanadium	ND	ND	ND	ND
Zinc	ND	ND	ND	ND
Aluminum	ND	ND	ND	ND
Antimony	ND	ND	ND	ND

	September 21, 2016			
	Willow01	**Willow02**	**Willow03**	**Willow04**
Aluminum	61.7	49.4	80.8	86
Antimony	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND
Barium	13.9	8.81	10.2	11.4
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	1.00
Iron	ND	ND	275	470
Lead	ND	ND	ND	ND
Magnesium	2660	1530	1700	1720
Manganese	7.27	5.06	20.3	30.8
Mercury	ND	ND	ND	ND
Molybdenum	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	530	605	696	711
Selenium	ND	ND	ND	ND
Silicon	3250	3550	4160	4330
Silver	ND	ND	ND	ND
Sodium	3370	2530	4050	4090
Thallium	ND	ND	ND	ND
Tin	ND	ND	ND	ND
Titanium	ND	ND	ND	ND
Vanadium	ND	ND	ND	ND
Zinc	ND	ND	ND	ND
Aluminum	ND	ND	ND	ND
Antimony	ND	ND	ND	ND

4.4 Nutrient Concentrations including Alkalinity and Hardness

Alkalinity and hardness results are shown in Figures 7 and 8, respectively. Alkalinity ranged from 15.8 mg/l (Willow02 in May 2016) to 30.7 mg/l (Willow01 in July 2016). Hardness, as calcium carbonate ($CaCO_3$), ranged from 16.3 mg/l (Willow02 in May 2016) to 39.2 mg/l (Willow01 in July 2016). Alkalinity and hardness did not display great variation throughout the sampling periods. Willow01 and Willow04 had higher alkalinity than Willow02 and Willow03 at each sampling event. Willow01 consistently had the highest hardness value. Willow02 consistently had the lowest hardness value.

Dissolved organic carbon (DOC), shown in Figure 9, had the lowest result values during summer base flow conditions (July) and the highest results during the fall storm sampling (September). DOC values increased moving from upstream to downstream locations.

Concentrations of total phosphorus, dissolved phosphorus, nitrate and nitrite nitrogen, and ammonia nitrogen are shown in Table 5. Total phosphorus remained fairly constant for each sampling event except for a peak at Willow04 in May. Dissolved phosphorus was not detected in any of the samples. This is likely because the laboratory did not have the ability to detect dissolved phosphorus to the very low levels that likely occur in Willow Creek. Inorganic nitrogen levels were low, and were below detectable levels for most sites in July and September 2016. Nitrogen concentrations were higher in May 2016 during leaf out and the onset of terrestrial production and were detected in low levels at most sites.

Figure 7. Alkalinity (mg/l) at all sampling locations measured during spring flow (May 18), summer base flow (July 18) and during a fall storm flow event (September 21).

Figure 8. Hardness (mg/l $CaCO_3$) at all sampling locations measured during spring flow (May 18), summer base flow (July 18) and during a fall storm flow event (September 21).

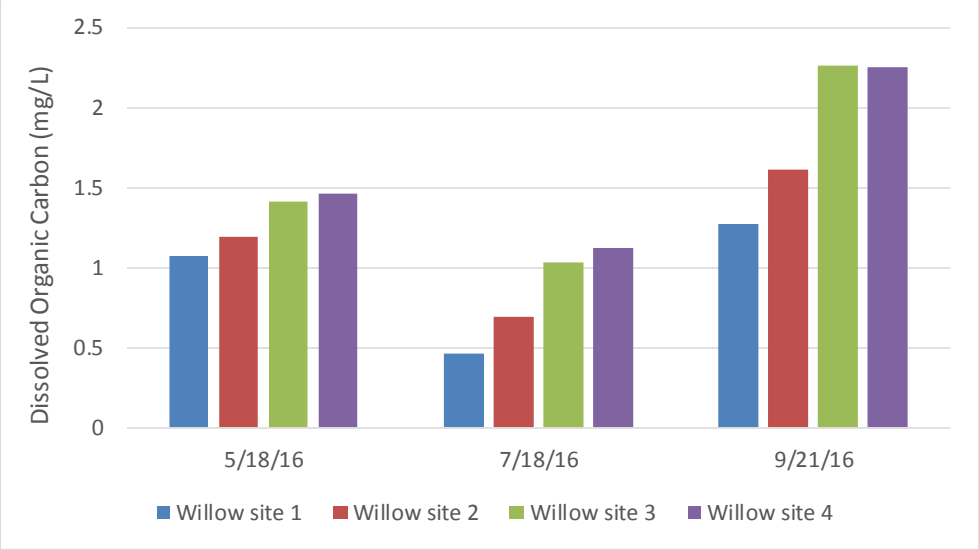

Figure 9. Dissolved organic carbon (mg/l) at all sampling locations measured during spring flow (May 18), summer base flow (July 18) and during a fall storm flow event (September 21).

Table 5. Total phosphorus, dissolved phosphorus, inorganic nitrogen (nitrate+nitrite), and ammonia-nitrogen, measured at all four sampling locations during spring flow, summer base flow, and a fall storm flow event. ND indicates results were below detectable levels.

	Monitoring Date	Willow01	Willow02	Willow03	Willow04
Total Phosphorus (µg/L)	5/18/2016	45	32.5	36	145
	7/18/2016	3.5	8.9	4.4	12.8
	9/21/2016	16.9	7.7	13.6	18.3
Dissolved Phosphorus (µg/L)	5/18/2016	ND	ND	ND	ND
	7/18/2016	ND	ND	ND	ND
	9/21/2016	ND	ND	ND	ND
Nitrate + Nitrite Nitrogen (mg/l)	5/18/2016	0.0564	0.0576	0.0512	0.0836
	7/18/2016	ND	0.107	ND	ND
	9/21/2016	ND	0.0308	ND	0.0426
Ammonia Nitrogen (mg/l)	5/18/2016	ND	ND	ND	0.0375
	7/18/2016	ND	ND	ND	ND
	9/21/2016	ND	ND	ND	ND

4.5 Fecal Coliform Bacteria

Table 6 shows the fecal coliform bacteria results at monitoring sites Willow02, Willow03, and Willow04 for five sampling dates along with stream discharge (cfs) and observed weather for each sampling date. Fecal coliform counts were highest at Willow04, the farthest downstream site; with a geometric mean of 34.28 cfu/100 ml. The fecal coliform bacteria geometric mean exceeded 20 cfu/100 ml at all three monitoring locations. This is the most stringent state water quality criteria for the Water Supply designated use. Fecal coliform bacteria did not exceed water quality criteria for other designated water uses (ADEC 2017).

Table 6. Fecal coliform bacteria (cfu/100 ml) results over a 30-day period for calculating the geometric mean.

Date	Willow02	Willow03	Willow04	Discharge; Weather Observations
7/19/2016	14	25	59	375 cfs; dry weather
7/25/2016	59	20	47	700 cfs; heavy rain 24 hours prior to sampling and morning of sampling. Let up during sampling.
7/26/2016	44	61	87	520 cfs; intermittent rain 24 hours prior
8/1/2016	25	23	25	375 cfs; light intermittent showers 24 hours prior
8/8/2016	57	86	118	685 cfs; heavy rain 24 hours prior but dry during sampling
Geometric Mean	**30.61**	**22.57**	**34.28**	

4.6 Microbial Source Tracking

Microbial source tracking was conducted on 12 samples based on the fecal coliform bacteria results shown in Table 6. DNA biomarkers for human (two different biomarkers used), horse, and dog were examined. For results that returned with DNA present, a second step, termed quantification, occurred. Quantification is used to quantify the amount of that fecal biomarker present in the sample result. Quantification is useful for determining how much of the bacteria load different hosts are contributing. Table 7 shows MST and quantification results.

Table 7. MST results for Willow Creek fecal coliform bacteria water quality samples. ND is not detected and <LOQ is less than the laboratory limit of quantification. A blank means sample was not analyzed.

Sample Date and Site	Human Dorei	Human EPA	Horse	Dog	Comment
7/19/2016 Willow04	ND			ND	Human and dog absent
7/25/2016 Willow02	ND	ND	ND		Human and horse absent
7/26/2016 Willow03	ND			ND	Human and dog absent
7/26/2016 Willow04	Present <LOQ	ND		Present <LOQ	1 Human biomarker present but too low to quantify. Dog present but too low to quantify
8/8/2016 Willow03	Present <LOQ	ND		ND	1 Human biomarker present but too low to quantify
8/8/2016 Willow04	ND			Present <LOQ	Human absent. Dog present but too low to quantify

4.7 Stream Discharge

Willow Creek daily discharge data (USGS gauge 15294005) was downloaded from the USGS gauging station information web page on each sampling date and also at the end of the sampling project. Figure 10 shows the daily mean discharge for the period of May – September 2016 as compared to the 30 year median discharge. Discharge was higher than the 30 year median in May but more closely matched the median in June. Daily mean discharge in July, August, and September was more variable with several storm events creating spikes in the daily mean discharge. In particular, mid-September had a very large storm event and daily discharge exceeded 2,000 cfs (Figure 11).

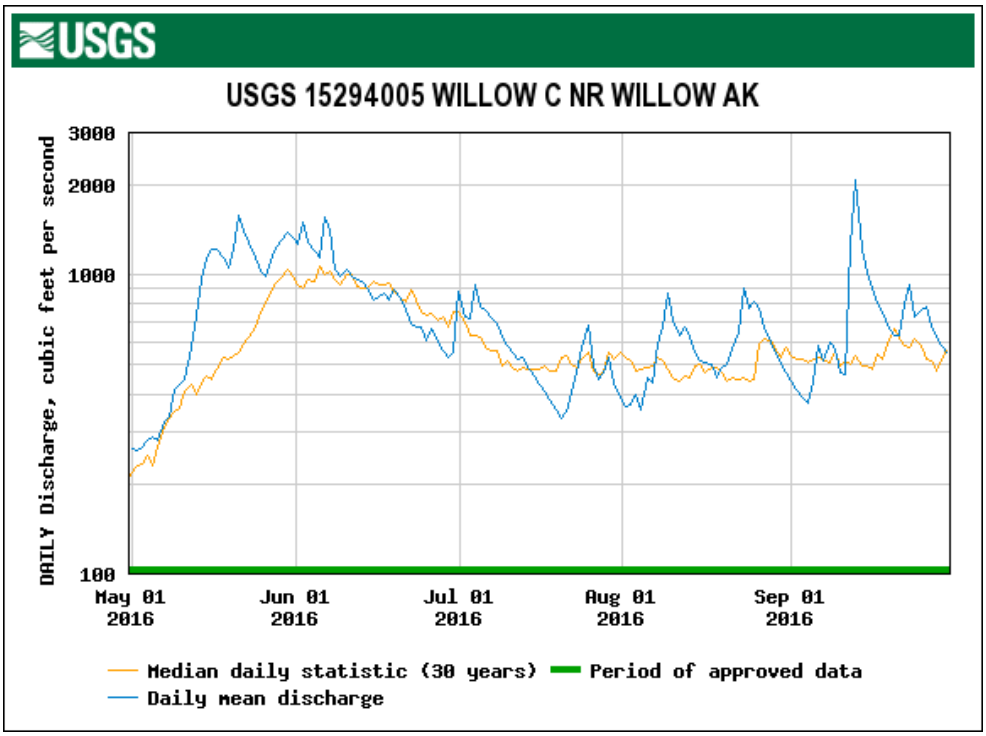

Figure 10. Daily discharge for the 2016 project as measured at USGS gauging station on Willow Creek upstream of Shirley Towne Dr. in Willow. Blue line is 2016 daily mean discharge as compared to the 30 year median discharge value (gold line).

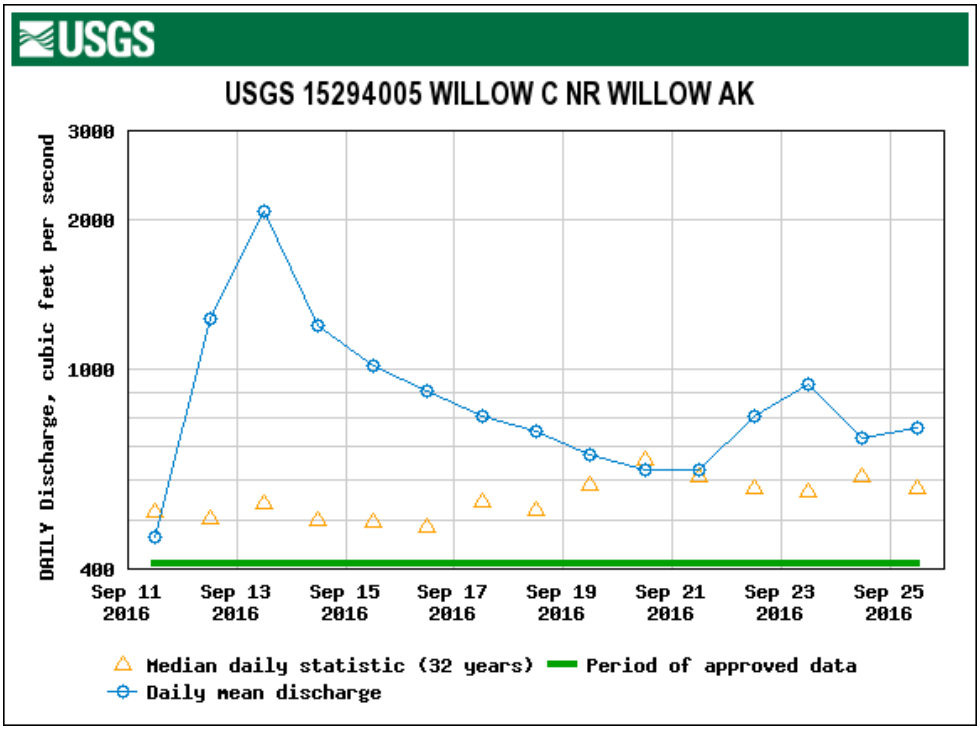

Figure 11. USGS gauging data showing high water event on September 13-14, 2016. Water quality monitoring occurred on September 21.

4.8 Water and Air Temperature

Figure 12 summarizes water temperature data collected during each water quality monitoring date at each site sampled for that date. Willow01, the farthest upstream site, had the coldest temperatures throughout the study. Water temperatures became warmer at each downstream monitoring location with Willow04 recording the highest water temperatures throughout the study.

Air temperature was measured at each sampling location on every monitoring date (Figure 13) except for Willow01 on 7/18/2016 and Willow02 on 7/25/2016 when the sampling equipment failed. Air and water temperatures tended to follow a similar pattern throughout the study.

Water and air temperatures are measured in degrees Celsius (°C).

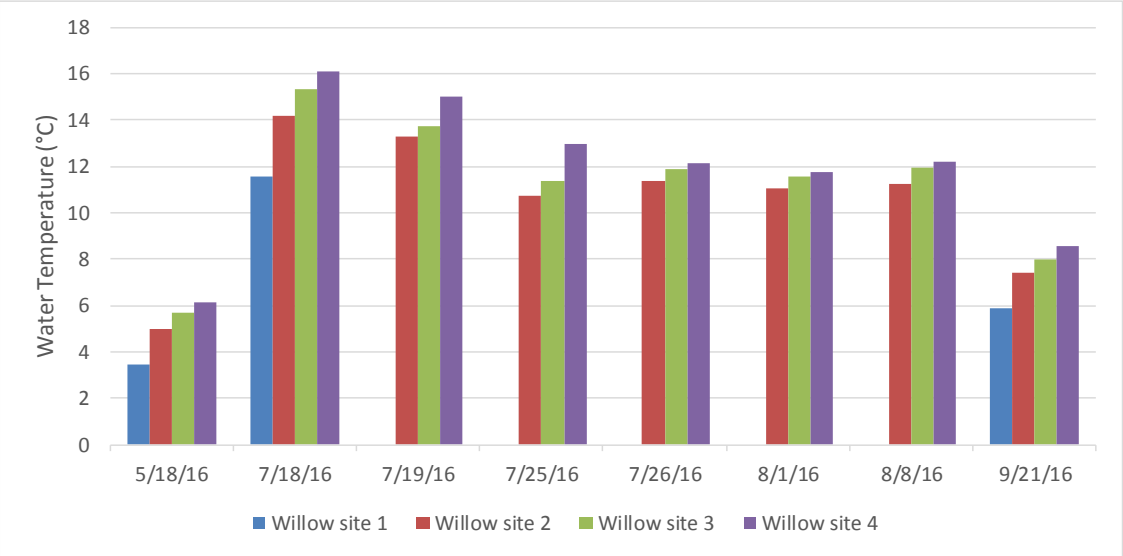

Figure 12. Water temperature (°C) at all sampling locations measured during all monitoring dates.

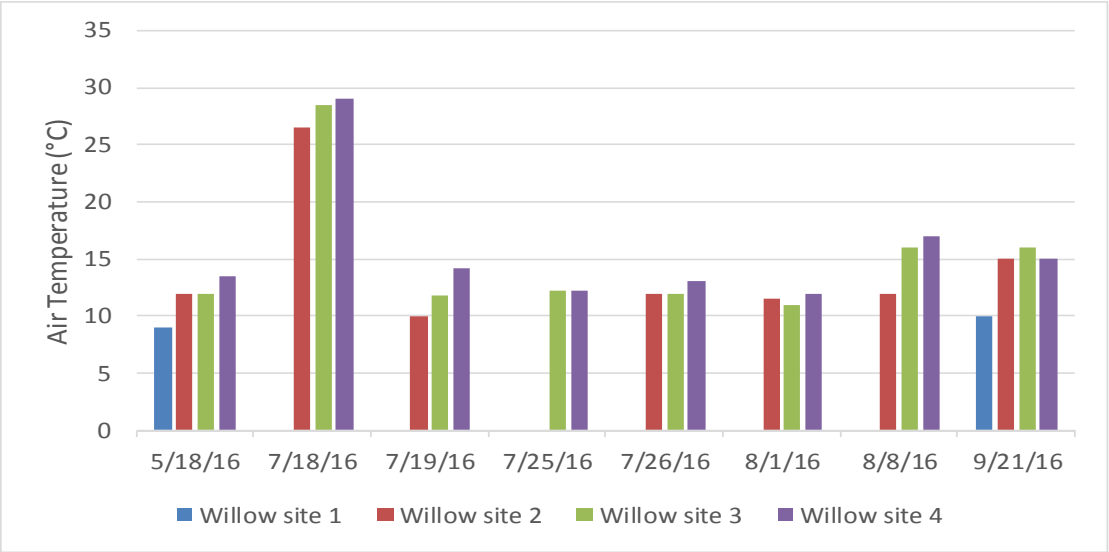

Figure 13. Air temperature (°C) at all sampling locations measured during all monitoring dates.

5.0 Discussion

The results of this study indicate that water quality in Willow Creek is overall in good condition and meets WQC. Field measurements of water chemistry were consistent throughout the data collection period. Stream water pH remained between 7.00 and 7.80 on all sampling dates, with lower measurements in the spring and higher measurements in July coinciding with warmer water temperatures. Specific conductivity was highest in July and typically had a higher value at Willow01 and then decreased at Willow02 with each farther downstream monitoring location increasing. Higher conductivity at Willow01 may be indicative of increased mineralization of the stream at higher altitudes. Dissolved oxygen was above WQC at all sites on all monitoring dates. All of these field measurement findings are consistent with the 2015 Willow Creek assessment (Davis, et al. 2015).

All measured dissolved metals in Willow Creek fell below state acute and chronic toxicity criteria for freshwater (ADEC 2008) except for one lead result at Willow03 on July 18 that was 3.28 µg/l and exceeded the chronic criterion. The replicate sample at Willow03 taken immediately after taking the first sample did not detect any lead. The anomalous result may have been a sampling error with a contaminated vial or a laboratory error while being processed. Alternatively, there might have been some type of lead contamination detected in the one sample but no others during the entire study period. This chronic lead result is based on a single sample on one day. Any future monitoring efforts should consider conducting a 4-day sampling regime to get a true 4-day average to compare to the chronic criterion.

Aluminum was present at all monitoring locations in September after a storm event but was generally not detected in the spring or summer sampling events. The detected aluminum was in a dissolved form and not comparable to acute and chronic criteria which uses total recoverable

aluminum (ADEC 2008). If aluminum becomes a water quality concern, future monitoring should analyze for total recoverable aluminum.

Alkalinity and hardness remained consistent throughout the study, and measurements were similar to those in the 2015 Willow Creek assessment (Davis, et al. 2015). Levels of inorganic nitrogen and ammonia nitrogen were low. Ammonia nitrogen was only detected in one sample in the spring. Nitrate+nitrite nitrogen was detected at all four monitoring locations in May but only at Willow02 during the remaining sampling events in July and September. As stated in the 2015 Willow Creek assessment report (Davis, et al. 2015), it is likely that nitrogen is a limiting nutrient in Willow Creek. Low stream nitrogen has been observed previously in other area streams during the growing season as nitrogen is taken up by upland and riparian vegetation.

Turbidity was consistently very low with daily averages, and all readings within the daily average, less than the most stringent WQC of 5 NTU over the natural condition. Monitoring location Willow01 was used for establishing the natural condition. All turbidity results for all dates and sites were less than 5 NTU over the natural condition. The highest turbidity for all sites was during spring sampling in May (daily average 2.66 NTU). Lowest turbidity values were during summer base flow in July (1.01 NTU daily average). Turbidity values increased slightly during September fall storm sampling (daily average 1.49 NTU). Turbidity values in 2016 were consistent with the low turbidity measured in the 2015 Willow Creek assessment (Davis, et al. 2015).

State water quality standards outline water temperature criteria for use by anadromous fish, stating that temperatures should not exceed 20 degrees centigrade (C) at any time; not exceed 13 degrees C for spawning areas and egg and fry incubation; and temperatures should not exceed 15 degrees C for fish migration and rearing areas (ADEC 2017). During water temperature grab sampling, three monitoring locations exceeded 13 degrees C and two locations exceeded 15 degrees C (Willow03 and Willow04). Stream temperature was lowest at upstream monitoring locations and increased at downstream monitoring locations. Because water temperatures were only recorded once per day at each location, it does not give a complete picture of how water temperature varies throughout a 24 hour period.

Due to unsafe sampling conditions at site Willow04, samples were taken near shore on an outside stream bend adjacent to a still-water side slough. However, the other sampling sites were in the main stream channel in riffle reaches. This may have contributed to some of the warmer water temperature (and increased bacteria) readings at Willow04. Even so, water temperatures were generally optimal for salmon rearing at all of the monitoring locations during the summer months and measured values are unlikely to negatively affect salmon migration.

Levels of fecal coliform bacteria exceeded both conditions in the Water Supply designated use criterion (30-day geometric mean not to exceed 20 cfu/100 ml, and not more than 10% of the samples may exceed 40 cfu/100 ml). As shown in Table 1, this result is consistent with findings from the 2015 Willow Creek assessment (Davis, et al. 2015). Bacteria levels remained consistent throughout the sampling period and do not indicate large amounts of sewage or fecal waste entering Willow Creek. The fecal coliform Water Recreation criteria were met.

All of the Willow Creek water quality monitoring occurred prior to DEC adopting new freshwater recreation criteria to include *Escherichia coli* (*E. coli*) (ADEC 2017). As such, no *E. coli* analysis occurred. This bacteria species should be added for any future Willow Creek monitoring efforts.

After conducting MST analysis, both Willow03 and Willow 04 found biomarkers for human and dog present but at levels too low to quantify (Table 7). A property with horses near the creek is immediately upstream of site Willow02. However, no horse biomarkers were present in the MST analysis of the water sample taken downstream of this property.

The fecal coliform bacteria present in Willow Creek are most likely naturally occurring from wildlife sources with a possibility of sporadic bacteria associated with dogs or even possibly human. Evidence of beaver, gulls, moose and other wildlife were present during all water monitoring dates and sites.

MST sensitivity and specificity are important considerations when evaluating MST results (USEPA 2005). The Human Dorei biomarker is more sensitive than the Human EPA biomarker but both marker types have high credibility (USEPA 2011). None of the samples detected the Human EPA biomarker. The very low levels of Human Dorei and dog detected during MST analysis indicates very small amounts of sporadic contamination. Results were too low for the laboratory to quantify.

Monitoring location Willow04 is located near a still water side slough draining a wetland area. There is beaver activity upstream and downstream of the monitoring location. Detecting fecal coliform bacteria at this location is not surprising. On 8/8/2016 Willow04 recorded the highest fecal coliform bacteria result during the entire study of 118 cfu/100 m/l. However, this same sample was absent of human biomarkers during MST analysis.

Human Dorei will at times cross-react with dog biomarkers (Griffith, et al. 2013) and show a positive detect for human biomarkers when it is actually dog. This could be the case at Willow04 on 7/26/2016. It is important to note that on 8/8/2016 Human Dorei was absent and dog was detected but at levels too low to quantify from site Willow04. This raises the question if an analysis cross-reaction occurred on the 7/26/2016 sample for Willow04 and the detected Human Dorei biomarker may have actually been a dog biomarker. It is also possible the positive dog biomarkers are actually detecting wild canids such as fox or coyote especially since monitoring location Willow04 is in a relatively remote state park and located upstream of the campground. No research has been conducted on possible MST cross-reactions between dog and beaver biomarkers.

Frequency of detection is an important aspect of MST analysis (Cao, et al. 2013). If a biomarker is detected at very low levels but not every time, it is evidence that there is likely not an ongoing source of bacteria pollution; it is not persistent pollution.

If human bacteria is actually present in Willow Creek it is at very low levels, not from a continuous discharge, and is very sporadic. Sand bar rest rooms are a possible source for the Human Dorei biomarker especially since the bacteria was only detected in the downstream reaches of the stream where people fish, raft, camp, and recreate. Wet weather higher bacteria results might indicate movement of fecal material (from any source) from near shore areas into the stream.

6.0 Recommendations

Willow Creek water quality currently meets state water quality criteria. Recommendations are to keep Willow Creek water quality from degrading. This can be done through land use management, education, and implementing best management practices for construction and mining operations. Land use management actions to consider include: encouraging riparian buffers along the stream corridor, not building in the flood zone, and managing stormwater runoff so it does not directly discharge to the creek. Best management practices for mining operations and construction activities vary by site conditions but preventing sediment or other polluted runoff from entering Willow Creek are important components.

Education actions to consider include encouraging campground visitors to pick up their dog's fecal waste and disposing of it in trash cans (and not in the river). This will lead to less likelihood of dog fecal material polluting Willow Creek. Best management practices could include installing pet waste baggie stations with signage and trash bins at the campgrounds.

Signage and other outreach avenues could be implemented to help people learn how to properly dispose of their fecal waste while fishing, rafting, camping or recreating in remote areas of Willow Creek that have no restroom facilities available.

7.0 References

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Appendix A: Project Photos

Looking downstream of monitoring location Willow01 in September 2016	
Looking across monitoring location Willow01 in September 2016	
Looking downstream of monitoring location Willow02 in September 2016	

Looking upstream of monitoring location Willow02 in May 2016	
Looking downstream of monitoring location Willow03 in July 2016	
Looking upstream of monitoring location Willow03 in July 2016. Note people fishing and a dog on the bank.	

Looking downstream of monitoring location Willow04 in May 2016. The near bank on the left side of the photo had evidence of recent beaver activity.	
Looking upstream of monitoring location Willow04 in May 2016. Note still water side slough in the right of the photo.	
Bird feces observed on rocks next to the creek at monitoring location Willow03	
Recent beaver activity in the riparian area adjacent to monitoring location Willow04	

Appendix B: Laboratory Reports

Laboratory Report of Analysis

To: ADEC-Air & Water Quality
1700 E. Bogard Rd Bldg B, Suite 103
Wasilla, AK 99654

Report Number: **1162494**

Client Project: **Willow Creek**

Dear Laura Eldred,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Forest at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Forest Taylor Date
Project Manager
Forest.Taylor@sgs.com

Print Date: 06/27/2016 11:33:08AM

Case Narrative

SGS Client: **ADEC-Air & Water Quality**
SGS Project: **1162494**
Project Name/Site: **Willow Creek**
Project Contact: **Laura Eldred**

Refer to sample receipt form for information on sample condition.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

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Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8021B, 8082A, 8260B, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

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Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
Willow 01	1162494001	05/18/2016	05/18/2016	Drinking Water
Willow 02	1162494002	05/18/2016	05/18/2016	Water (Surface, Eff., Ground)
Willow 03	1162494003	05/18/2016	05/18/2016	Water (Surface, Eff., Ground)
Willow 04	1162494004	05/18/2016	05/18/2016	Water (Surface, Eff., Ground)
Willow 03 Rep	1162494005	05/18/2016	05/18/2016	Water (Surface, Eff., Ground)

Method	Method Description
SM21 2320B	Alkalinity as CaCO3 QC
SM21 4500-NH3 G	Ammonia-N (W) SM21 4500-NH3 G
SM21 2340B	Dissolved Hardness as CaCO3 ICP-MS
SM 5310B	Dissolved Organic Carbon
SM21 4500NO3-F	Flow Injection Analysis
EP245.1	Mercury EPA 245.1 DISSOLVED
EP200.8	Metals in Drinking Water by ICP-MS DISSO
SM21 4500P-B,E	Total Phosphorus (W)

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Detectable Results Summary

Client Sample ID: **Willow 01**
Lab Sample ID: 1162494001

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	15.6J	ug/L
	Barium	11.2	ug/L
	Calcium	6370	ug/L
	Copper	0.531J	ug/L
	Hardness as CaCO3	23.7	mg/L
	Magnesium	1880	ug/L
	Manganese	0.652J	ug/L
	Potassium	446J	ug/L
	Silicon	2410	ug/L
	Sodium	2390	ug/L
Waters Department	A kalinity	20.7	mg/L
	Nitrate-N	0.0564J	mg/L
	Total Organic Carbon,Dissolved	1.07	mg/L
	Total Phosphorus	0.0450J	mg/L

Client Sample ID: **Willow 02**
Lab Sample ID: 1162494002

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	19.1J	ug/L
	Barium	7.11	ug/L
	Calcium	4680	ug/L
	Copper	0.747J	ug/L
	Hardness as CaCO3	16.3	mg/L
	Lead	0.129J	ug/L
	Magnesium	1130	ug/L
	Manganese	0.419J	ug/L
	Potassium	494J	ug/L
	Silicon	2710	ug/L
	Sodium	2010	ug/L
Waters Department	A kalinity	15.8	mg/L
	Nitrate-N	0.0576J	mg/L
	Total Organic Carbon,Dissolved	1.19	mg/L
	Total Phosphorus	0.0325J	mg/L

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Detectable Results Summary

Client Sample ID: **Willow 03**
Lab Sample ID: 1162494003

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	17.6J	ug/L
	Barium	7.39	ug/L
	Calcium	5280	ug/L
	Copper	0.693J	ug/L
	Hardness as CaCO3	18.3	mg/L
	Magnesium	1250	ug/L
	Manganese	2.11	ug/L
	Potassium	565	ug/L
	Silicon	3100	ug/L
	Sodium	3100	ug/L
Waters Department	A kalinity	17.0	mg/L
	Nitrate-N	0.0512J	mg/L
	Total Organic Carbon,Dissolved	1.41	mg/L
	Total Phosphorus	0.0360J	mg/L

Client Sample ID: **Willow 04**
Lab Sample ID: 1162494004

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	20.2	ug/L
	Barium	7.80	ug/L
	Calcium	5590	ug/L
	Copper	0.724J	ug/L
	Hardness as CaCO3	19.0	mg/L
	Iron	143J	ug/L
	Magnesium	1230	ug/L
	Manganese	4.44	ug/L
	Potassium	569	ug/L
	Silicon	3080	ug/L
	Sodium	3050	ug/L
Waters Department	A kalinity	17.5	mg/L
	Ammonia-N	0.0375J	mg/L
	Nitrate-N	0.0836J	mg/L
	Total Organic Carbon,Dissolved	1.46	mg/L
	Total Phosphorus	0.145	mg/L

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Detectable Results Summary

Client Sample ID: **Willow 03 Rep**
Lab Sample ID: 1162494005

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	16.9J	ug/L
	Barium	7.48	ug/L
	Calcium	5070	ug/L
	Copper	0.627J	ug/L
	Hardness as CaCO3	17.4	mg/L
	Magnesium	1150	ug/L
	Manganese	2.08	ug/L
	Potassium	544	ug/L
	Silicon	2840	ug/L
	Sodium	2920	ug/L
Waters Department	A kalinity	16.6	mg/L
	Ammonia-N	0.0788J	mg/L
	Nitrate-N	0.0604J	mg/L
	Total Organic Carbon,Dissolved	1.36	mg/L
	Total Phosphorus	0.0155J	mg/L

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Results of **Willow 01**

Client Sample ID: **Willow 01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494001
Lab Project ID: 1162494

Collection Date: 05/18/16 10:18
Received Date: 05/18/16 17:02
Matrix: Drinking Water
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		05/23/16 19:05

Batch Information

Analytical Batch: MCV5708
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 05/23/16 19:05
Container ID: 1162494001-A

Prep Batch: MXX29782
Prep Method: METHOD
Prep Date/Time: 05/23/16 12:57
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 01**

Client Sample ID: **Willow 01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494001
Lab Project ID: 1162494

Collection Date: 05/18/16 10:18
Received Date: 05/18/16 17:02
Matrix: Drinking Water
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	15.6	J	20.0	6.20	ug/L	1		06/09/16 13:42
Antimony	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:42
Arsenic	2.50	U	5.00	1.50	ug/L	1		06/09/16 13:42
Barium	11.2		3.00	0.940	ug/L	1		06/09/16 13:42
Beryllium	0.200	U	0.400	0.130	ug/L	1		06/09/16 13:42
Cadmium	0.250	U	0.500	0.150	ug/L	1		06/09/16 13:42
Calcium	6370		500	150	ug/L	1		06/09/16 13:42
Chromium	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:42
Cobalt	2.00	U	4.00	1.20	ug/L	1		06/09/16 13:42
Copper	0.531	J	1.00	0.310	ug/L	1		06/09/16 13:42
Iron	125	U	250	78.0	ug/L	1		06/09/16 13:42
Lead	0.100	U	0.200	0.0620	ug/L	1		06/09/16 13:42
Magnesium	1880		50.0	15.0	ug/L	1		06/09/16 13:42
Manganese	0.652	J	1.00	0.310	ug/L	1		06/09/16 13:42
Molybdenum	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:42
Nickel	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:42
Phosphorus	100	U	200	62.0	ug/L	1		06/09/16 13:42
Potassium	446	J	500	150	ug/L	1		06/09/16 13:42
Selenium	2.50	U	5.00	1.50	ug/L	1		06/09/16 13:42
Silicon	2410		1000	310	ug/L	1		06/09/16 13:42
Silver	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:42
Sodium	2390		500	150	ug/L	1		06/09/16 13:42
Thallium	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:42
Tin	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:42
Titanium	3.13	U	6.25	3.13	ug/L	1		06/09/16 13:42
Vanadium	10.0	U	20.0	6.20	ug/L	1		06/09/16 13:42
Zinc	2.50	U	5.00	2.50	ug/L	1		06/09/16 13:42

Batch Information

Analytical Batch: MMS9393
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 06/09/16 13:42
Container ID: 1162494001-A

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 06/06/16 14:02
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	23.7		5.00	5.00	mg/L	1		06/09/16 13:42

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 01**

Client Sample ID: **Willow 01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494001
Lab Project ID: 1162494

Collection Date: 05/18/16 10:18
Received Date: 05/18/16 17:02
Matrix: Drinking Water
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9393
Analytical Method: SM21 2340B
Analyst: VDL
Analytical Date/Time: 06/09/16 13:42
Container ID: 1162494001-A

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 06/06/16 14:02
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **Willow 01**

Client Sample ID: **Willow 01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494001
Lab Project ID: 1162494

Collection Date: 05/18/16 10:18
Received Date: 05/18/16 17:02
Matrix: Drinking Water
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	1.07		0.500	0.150	mg/L	1		05/19/16 16:28

Batch Information

Analytical Batch: WTC2599
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 05/19/16 16:28
Container ID: 1162494001-D

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	20.7		10.0	3.10	mg/L	1		05/20/16 20:33

Batch Information

Analytical Batch: WTI4456
Analytical Method: SM21 2320B
Analyst: ACF
Analytical Date/Time: 05/20/16 20:33
Container ID: 1162494001-B

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500	U	0.100	0.0310	mg/L	1		05/24/16 15:25

Batch Information

Analytical Batch: WDA3787
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 05/24/16 15:25
Container ID: 1162494001-C

Prep Batch: WXX11510
Prep Method: METHOD
Prep Date/Time: 05/24/16 14:30
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.0564	J	0.100	0.0300	mg/L	2		05/19/16 13:51
Nitrite-N	0.0500	U	0.100	0.0300	mg/L	2		05/19/16 13:51

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 01**

Client Sample ID: **Willow 01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494001
Lab Project ID: 1162494

Collection Date: 05/18/16 10:18
Received Date: 05/18/16 17:02
Matrix: Drinking Water
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WFI2478
Analytical Method: SM21 4500NO3-F
Analyst: NEG
Analytical Date/Time: 05/19/16 13:51
Container ID: 1162494001-B

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.0450	J	0.0500	0.0155	mg/L	1		06/01/16 11:37

Batch Information

Analytical Batch: WDA3792
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 06/01/16 11:37
Container ID: 1162494001-C

Prep Batch: WXX11517
Prep Method: SM21 4500P-B,E
Prep Date/Time: 05/31/16 17:58
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 25 mL

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494002
Lab Project ID: 1162494

Collection Date: 05/18/16 10:24
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		05/23/16 19:08

Batch Information

Analytical Batch: MCV5708
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 05/23/16 19:08
Container ID: 1162494002-A

Prep Batch: MXX29782
Prep Method: METHOD
Prep Date/Time: 05/23/16 12:57
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494002
Lab Project ID: 1162494

Collection Date: 05/18/16 10:24
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	19.1	J	20.0	6.20	ug/L	1		06/09/16 13:48
Antimony	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:48
Arsenic	2.50	U	5.00	1.50	ug/L	1		06/09/16 13:48
Barium	7.11		3.00	0.940	ug/L	1		06/09/16 13:48
Beryllium	0.200	U	0.400	0.130	ug/L	1		06/09/16 13:48
Cadmium	0.250	U	0.500	0.150	ug/L	1		06/09/16 13:48
Calcium	4680		500	150	ug/L	1		06/09/16 13:48
Chromium	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:48
Cobalt	2.00	U	4.00	1.20	ug/L	1		06/09/16 13:48
Copper	0.747	J	1.00	0.310	ug/L	1		06/09/16 13:48
Iron	125	U	250	78.0	ug/L	1		06/09/16 13:48
Lead	0.129	J	0.200	0.0620	ug/L	1		06/09/16 13:48
Magnesium	1130		50.0	15.0	ug/L	1		06/09/16 13:48
Manganese	0.419	J	1.00	0.310	ug/L	1		06/09/16 13:48
Molybdenum	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:48
Nickel	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:48
Phosphorus	100	U	200	62.0	ug/L	1		06/09/16 13:48
Potassium	494	J	500	150	ug/L	1		06/09/16 13:48
Selenium	2.50	U	5.00	1.50	ug/L	1		06/09/16 13:48
Silicon	2710		1000	310	ug/L	1		06/09/16 13:48
Silver	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:48
Sodium	2010		500	150	ug/L	1		06/09/16 13:48
Thallium	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:48
Tin	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:48
Titanium	3.13	U	6.25	3.13	ug/L	1		06/09/16 13:48
Vanadium	10.0	U	20.0	6.20	ug/L	1		06/09/16 13:48
Zinc	2.50	U	5.00	2.50	ug/L	1		06/09/16 13:48

Batch Information

Analytical Batch: MMS9393
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 06/09/16 13:48
Container ID: 1162494002-A

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 06/06/16 14:02
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	16.3		5.00	5.00	mg/L	1		06/09/16 13:48

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J flagging is activated

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494002
Lab Project ID: 1162494

Collection Date: 05/18/16 10:24
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9393
Analytical Method: SM21 2340B
Analyst: VDL
Analytical Date/Time: 06/09/16 13:48
Container ID: 1162494002-A

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 06/06/16 14:02
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494002
Lab Project ID: 1162494

Collection Date: 05/18/16 10:24
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	1.19		0.500	0.150	mg/L	1		05/19/16 16:43

Batch Information

Analytical Batch: WTC2599
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 05/19/16 16:43
Container ID: 1162494002-D

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	15.8		10.0	3.10	mg/L	1		05/20/16 20:42

Batch Information

Analytical Batch: WTI4456
Analytical Method: SM21 2320B
Analyst: ACF
Analytical Date/Time: 05/20/16 20:42
Container ID: 1162494002-B

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500	U	0.100	0.0310	mg/L	1		05/24/16 15:27

Batch Information

Analytical Batch: WDA3787
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 05/24/16 15:27
Container ID: 1162494002-C

Prep Batch: WXX11510
Prep Method: METHOD
Prep Date/Time: 05/24/16 14:30
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.0576	J	0.100	0.0300	mg/L	2		05/19/16 13:53
Nitrite-N	0.0500	U	0.100	0.0300	mg/L	2		05/19/16 13:53

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494002
Lab Project ID: 1162494

Collection Date: 05/18/16 10:24
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WFI2478
Analytical Method: SM21 4500NO3-F
Analyst: NEG
Analytical Date/Time: 05/19/16 13:53
Container ID: 1162494002-B

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.0325	J	0.0500	0.0155	mg/L	1		06/01/16 11:41

Batch Information

Analytical Batch: WDA3792
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 06/01/16 11:41
Container ID: 1162494002-C

Prep Batch: WXX11517
Prep Method: SM21 4500P-B,E
Prep Date/Time: 05/31/16 17:58
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 25 mL

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494003
Lab Project ID: 1162494

Collection Date: 05/18/16 13:09
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		05/23/16 19:11

Batch Information

Analytical Batch: MCV5708
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 05/23/16 19:11
Container ID: 1162494003-A

Prep Batch: MXX29782
Prep Method: METHOD
Prep Date/Time: 05/23/16 12:57
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494003
Lab Project ID: 1162494

Collection Date: 05/18/16 13:09
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	17.6	J	20.0	6.20	ug/L	1		06/09/16 13:51
Antimony	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:51
Arsenic	2.50	U	5.00	1.50	ug/L	1		06/09/16 13:51
Barium	7.39		3.00	0.940	ug/L	1		06/09/16 13:51
Beryllium	0.200	U	0.400	0.130	ug/L	1		06/09/16 13:51
Cadmium	0.250	U	0.500	0.150	ug/L	1		06/09/16 13:51
Calcium	5280		500	150	ug/L	1		06/09/16 13:51
Chromium	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:51
Cobalt	2.00	U	4.00	1.20	ug/L	1		06/09/16 13:51
Copper	0.693	J	1.00	0.310	ug/L	1		06/09/16 13:51
Iron	125	U	250	78.0	ug/L	1		06/09/16 13:51
Lead	0.100	U	0.200	0.0620	ug/L	1		06/09/16 13:51
Magnesium	1250		50.0	15.0	ug/L	1		06/09/16 13:51
Manganese	2.11		1.00	0.310	ug/L	1		06/09/16 13:51
Molybdenum	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:51
Nickel	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:51
Phosphorus	100	U	200	62.0	ug/L	1		06/09/16 13:51
Potassium	565		500	150	ug/L	1		06/09/16 13:51
Selenium	2.50	U	5.00	1.50	ug/L	1		06/09/16 13:51
Silicon	3100		1000	310	ug/L	1		06/09/16 13:51
Silver	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:51
Sodium	3100		500	150	ug/L	1		06/09/16 13:51
Thallium	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:51
Tin	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:51
Titanium	3.13	U	6.25	3.13	ug/L	1		06/09/16 13:51
Vanadium	10.0	U	20.0	6.20	ug/L	1		06/09/16 13:51
Zinc	2.50	U	5.00	2.50	ug/L	1		06/09/16 13:51

Batch Information

Analytical Batch: MMS9393
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 06/09/16 13:51
Container ID: 1162494003-A

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 06/06/16 14:02
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	18.3		5.00	5.00	mg/L	1		06/09/16 13:51

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494003
Lab Project ID: 1162494

Collection Date: 05/18/16 13:09
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9393
Analytical Method: SM21 2340B
Analyst: VDL
Analytical Date/Time: 06/09/16 13:51
Container ID: 1162494003-A

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 06/06/16 14:02
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494003
Lab Project ID: 1162494

Collection Date: 05/18/16 13:09
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	1.41		0.500	0.150	mg/L	1		05/19/16 16:57

Batch Information

Analytical Batch: WTC2599
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 05/19/16 16:57
Container ID: 1162494003-D

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	17.0		10.0	3.10	mg/L	1		05/20/16 20:51

Batch Information

Analytical Batch: WTI4456
Analytical Method: SM21 2320B
Analyst: ACF
Analytical Date/Time: 05/20/16 20:51
Container ID: 1162494003-B

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500	U	0.100	0.0310	mg/L	1		05/24/16 15:29

Batch Information

Analytical Batch: WDA3787
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 05/24/16 15:29
Container ID: 1162494003-C

Prep Batch: WXX11510
Prep Method: METHOD
Prep Date/Time: 05/24/16 14:30
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.0512	J	0.100	0.0300	mg/L	2		05/19/16 13:54
Nitrite-N	0.0500	U	0.100	0.0300	mg/L	2		05/19/16 13:54

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494003
Lab Project ID: 1162494

Collection Date: 05/18/16 13:09
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WFI2478
Analytical Method: SM21 4500NO3-F
Analyst: NEG
Analytical Date/Time: 05/19/16 13:54
Container ID: 1162494003-B

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.0360	J	0.0500	0.0155	mg/L	1		06/01/16 11:43

Batch Information

Analytical Batch: WDA3792
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 06/01/16 11:43
Container ID: 1162494003-C

Prep Batch: WXX11517
Prep Method: SM21 4500P-B,E
Prep Date/Time: 05/31/16 17:58
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 25 mL

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494004
Lab Project ID: 1162494

Collection Date: 05/18/16 14:14
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		05/23/16 19:25

Batch Information

Analytical Batch: MCV5709
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 05/23/16 19:25
Container ID: 1162494004-A

Prep Batch: MXX29783
Prep Method: METHOD
Prep Date/Time: 05/23/16 12:57
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494004
Lab Project ID: 1162494

Collection Date: 05/18/16 14:14
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	20.2		20.0	6.20	ug/L	1		06/09/16 13:57
Antimony	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:57
Arsenic	2.50	U	5.00	1.50	ug/L	1		06/09/16 13:57
Barium	7.80		3.00	0.940	ug/L	1		06/09/16 13:57
Beryllium	0.200	U	0.400	0.130	ug/L	1		06/09/16 13:57
Cadmium	0.250	U	0.500	0.150	ug/L	1		06/09/16 13:57
Calcium	5590		500	150	ug/L	1		06/09/16 13:57
Chromium	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:57
Cobalt	2.00	U	4.00	1.20	ug/L	1		06/09/16 13:57
Copper	0.724	J	1.00	0.310	ug/L	1		06/09/16 13:57
Iron	143	J	250	78.0	ug/L	1		06/09/16 13:57
Lead	0.100	U	0.200	0.0620	ug/L	1		06/09/16 13:57
Magnesium	1230		50.0	15.0	ug/L	1		06/09/16 13:57
Manganese	4.44		1.00	0.310	ug/L	1		06/09/16 13:57
Molybdenum	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:57
Nickel	1.00	U	2.00	0.620	ug/L	1		06/09/16 13:57
Phosphorus	100	U	200	62.0	ug/L	1		06/09/16 13:57
Potassium	569		500	150	ug/L	1		06/09/16 13:57
Selenium	2.50	U	5.00	1.50	ug/L	1		06/09/16 13:57
Silicon	3080		1000	310	ug/L	1		06/09/16 13:57
Silver	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:57
Sodium	3050		500	150	ug/L	1		06/09/16 13:57
Thallium	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:57
Tin	0.500	U	1.00	0.310	ug/L	1		06/09/16 13:57
Titanium	3.13	U	6.25	3.13	ug/L	1		06/09/16 13:57
Vanadium	10.0	U	20.0	6.20	ug/L	1		06/09/16 13:57
Zinc	2.50	U	5.00	2.50	ug/L	1		06/09/16 13:57

Batch Information

Analytical Batch: MMS9393
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 06/09/16 13:57
Container ID: 1162494004-A

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 06/06/16 14:02
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	19.0		5.00	5.00	mg/L	1		06/09/16 13:57

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494004
Lab Project ID: 1162494

Collection Date: 05/18/16 14:14
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9393
Analytical Method: SM21 2340B
Analyst: VDL
Analytical Date/Time: 06/09/16 13:57
Container ID: 1162494004-A

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 06/06/16 14:02
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494004
Lab Project ID: 1162494

Collection Date: 05/18/16 14:14
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	1.46		0.500	0.150	mg/L	1		05/19/16 17:10

Batch Information

Analytical Batch: WTC2599
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 05/19/16 17:10
Container ID: 1162494004-D

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	17.5		10.0	3.10	mg/L	1		05/20/16 21:00

Batch Information

Analytical Batch: WTI4456
Analytical Method: SM21 2320B
Analyst: ACF
Analytical Date/Time: 05/20/16 21:00
Container ID: 1162494004-B

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0375	J	0.100	0.0310	mg/L	1		05/24/16 17:42

Batch Information

Analytical Batch: WDA3787
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 05/24/16 17:42
Container ID: 1162494004-C

Prep Batch: WXX11510
Prep Method: METHOD
Prep Date/Time: 05/24/16 14:30
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.0836	J	0.100	0.0300	mg/L	2		05/19/16 13:56
Nitrite-N	0.0500	U	0.100	0.0300	mg/L	2		05/19/16 13:56

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494004
Lab Project ID: 1162494

Collection Date: 05/18/16 14:14
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WFI2478
Analytical Method: SM21 4500NO3-F
Analyst: NEG
Analytical Date/Time: 05/19/16 13:56
Container ID: 1162494004-B

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.145		0.0500	0.0155	mg/L	1		06/01/16 11:44

Batch Information

Analytical Batch: WDA3792
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 06/01/16 11:44
Container ID: 1162494004-C

Prep Batch: WXX11517
Prep Method: SM21 4500P-B,E
Prep Date/Time: 05/31/16 17:58
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 25 mL

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494005
Lab Project ID: 1162494

Collection Date: 05/18/16 13:10
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		05/23/16 19:31

Batch Information

Analytical Batch: MCV5709
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 05/23/16 19:31
Container ID: 1162494005-A

Prep Batch: MXX29783
Prep Method: METHOD
Prep Date/Time: 05/23/16 12:57
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494005
Lab Project ID: 1162494

Collection Date: 05/18/16 13:10
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	16.9	J	20.0	6.20	ug/L	1		06/09/16 14:03
Antimony	0.500	U	1.00	0.310	ug/L	1		06/09/16 14:03
Arsenic	2.50	U	5.00	1.50	ug/L	1		06/09/16 14:03
Barium	7.48		3.00	0.940	ug/L	1		06/09/16 14:03
Beryllium	0.200	U	0.400	0.130	ug/L	1		06/09/16 14:03
Cadmium	0.250	U	0.500	0.150	ug/L	1		06/09/16 14:03
Calcium	5070		500	150	ug/L	1		06/09/16 14:03
Chromium	1.00	U	2.00	0.620	ug/L	1		06/09/16 14:03
Cobalt	2.00	U	4.00	1.20	ug/L	1		06/09/16 14:03
Copper	0.627	J	1.00	0.310	ug/L	1		06/09/16 14:03
Iron	125	U	250	78.0	ug/L	1		06/09/16 14:03
Lead	0.100	U	0.200	0.0620	ug/L	1		06/09/16 14:03
Magnesium	1150		50.0	15.0	ug/L	1		06/09/16 14:03
Manganese	2.08		1.00	0.310	ug/L	1		06/09/16 14:03
Molybdenum	1.00	U	2.00	0.620	ug/L	1		06/09/16 14:03
Nickel	1.00	U	2.00	0.620	ug/L	1		06/09/16 14:03
Phosphorus	100	U	200	62.0	ug/L	1		06/09/16 14:03
Potassium	544		500	150	ug/L	1		06/09/16 14:03
Selenium	2.50	U	5.00	1.50	ug/L	1		06/09/16 14:03
Silicon	2840		1000	310	ug/L	1		06/09/16 14:03
Silver	0.500	U	1.00	0.310	ug/L	1		06/09/16 14:03
Sodium	2920		500	150	ug/L	1		06/09/16 14:03
Thallium	0.500	U	1.00	0.310	ug/L	1		06/09/16 14:03
Tin	0.500	U	1.00	0.310	ug/L	1		06/09/16 14:03
Titanium	3.13	U	6.25	3.13	ug/L	1		06/09/16 14:03
Vanadium	10.0	U	20.0	6.20	ug/L	1		06/09/16 14:03
Zinc	2.50	U	5.00	2.50	ug/L	1		06/09/16 14:03

Batch Information

Analytical Batch: MMS9393
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 06/09/16 14:03
Container ID: 1162494005-A

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 06/06/16 14:02
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	17.4		5.00	5.00	mg/L	1		06/09/16 14:03

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494005
Lab Project ID: 1162494

Collection Date: 05/18/16 13:10
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9393
Analytical Method: SM21 2340B
Analyst: VDL
Analytical Date/Time: 06/09/16 14:03
Container ID: 1162494005-A

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 06/06/16 14:02
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494005
Lab Project ID: 1162494

Collection Date: 05/18/16 13:10
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	1.36		0.500	0.150	mg/L	1		05/19/16 17:27

Batch Information

Analytical Batch: WTC2599
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 05/19/16 17:27
Container ID: 1162494005-D

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	16.6		10.0	3.10	mg/L	1		05/20/16 21:09

Batch Information

Analytical Batch: WTI4456
Analytical Method: SM21 2320B
Analyst: ACF
Analytical Date/Time: 05/20/16 21:09
Container ID: 1162494005-B

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0788	J	0.100	0.0310	mg/L	1		05/24/16 17:44

Batch Information

Analytical Batch: WDA3787
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 05/24/16 17:44
Container ID: 1162494005-C

Prep Batch: WXX11510
Prep Method: METHOD
Prep Date/Time: 05/24/16 14:30
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.0604	J	0.100	0.0300	mg/L	2		05/19/16 13:58
Nitrite-N	0.0500	U	0.100	0.0300	mg/L	2		05/19/16 13:58

Print Date: 06/27/2016 11:33:13AM

J flagging is activated

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1162494005
Lab Project ID: 1162494

Collection Date: 05/18/16 13:10
Received Date: 05/18/16 17:02
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WFI2478
Analytical Method: SM21 4500NO3-F
Analyst: NEG
Analytical Date/Time: 05/19/16 13:58
Container ID: 1162494005-B

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.0155	J	0.0500	0.0155	mg/L	1		06/01/16 11:45

Batch Information

Analytical Batch: WDA3792
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 06/01/16 11:45
Container ID: 1162494005-C

Prep Batch: WXX11517
Prep Method: SM21 4500P-B,E
Prep Date/Time: 05/31/16 17:58
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 25 mL

Method Blank

Blank ID: MB for HBN 1734839 [MXX/29782]
Blank Lab ID: 1325987

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1162494001, 1162494002, 1162494003

Results by **EP245.1**

Parameter	Results	LOQ/CL	DL	Units
Mercury	0.100U	0.200	0.0620	ug/L

Batch Information

Analytical Batch: MCV5708
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 5/23/2016 5:25:29PM

Prep Batch: MXX29782
Prep Method: METHOD
Prep Date/Time: 5/23/2016 12:57:00PM
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Blank Spike Summary

Blank Spike ID: LCS for HBN 1162494 [MXX29782]
Blank Spike Lab ID: 1325988
Date Analyzed: 05/23/2016 17:28

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003

Results by **EP245.1**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Mercury	4	4.10	103	(85-115)

Batch Information

Analytical Batch: **MCV5708**
Analytical Method: **EP245.1**
Instrument: **PSA Millennium mercury AA**
Analyst: **NEG**

Prep Batch: **MXX29782**
Prep Method: **METHOD**
Prep Date/Time: **05/23/2016 12:57**
Spike Init Wt./Vol.: 4 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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200 West Potter Drive Anchorage, AK 95518
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Matrix Spike Summary

Original Sample ID: 1162380001
MS Sample ID: 1325989 MS
MSD Sample ID:

Analysis Date: 05/23/2016 18:06
Analysis Date: 05/23/2016 18:09
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003

Results by **EP245.1**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Mercury	0.100U	8.00	8.04	101				70-130		

Batch Information

Analytical Batch: MCV5708
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 5/23/2016 6:09:26PM

Prep Batch: MXX29782
Prep Method: Digestion Mercury 245.1 (W)
Prep Date/Time: 5/23/2016 12:57:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 50.00mL

Print Date: 06/27/2016 11:33:32AM

Matrix Spike Summary

Original Sample ID: 1162491002
MS Sample ID: 1325990 MS
MSD Sample ID:

Analysis Date: 05/23/2016 18:50
Analysis Date: 05/23/2016 18:53
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003

Results by **EP245.1**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Mercury	0.200U	8.00	6.38	80				70-130		

Batch Information

Analytical Batch: MCV5708
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 5/23/2016 6:53:26PM

Prep Batch: MXX29782
Prep Method: Digestion Mercury 245.1 (W)
Prep Date/Time: 5/23/2016 12:57:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 50.00mL

Print Date: 06/27/2016 11:33:32AM

Method Blank

Blank ID: MB for HBN 1734845 [MXX/29783]
Blank Lab ID: 1326011

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1162494004, 1162494005

Results by **EP245.1**

Parameter	Results	LOQ/CL	DL	Units
Mercury	0.100U	0.200	0.0620	ug/L

Batch Information

Analytical Batch: MCV5709
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 5/23/2016 7:19:48PM

Prep Batch: MXX29783
Prep Method: METHOD
Prep Date/Time: 5/23/2016 12:57:00PM
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

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t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Blank Spike Summary

Blank Spike ID: LCS for HBN 1162494 [MXX29783]
Blank Spike Lab ID: 1326012
Date Analyzed: 05/23/2016 19:22

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494004, 1162494005

Results by **EP245.1**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Mercury	4	3.66	91	(85-115)

Batch Information

Analytical Batch: **MCV5709**
Analytical Method: **EP245.1**
Instrument: **PSA Millennium mercury AA**
Analyst: **NEG**

Prep Batch: **MXX29783**
Prep Method: **METHOD**
Prep Date/Time: **05/23/2016 12:57**
Spike Init Wt./Vol.: 4 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1162494004
MS Sample ID: 1326013 MS
MSD Sample ID:

Analysis Date: 05/23/2016 19:25
Analysis Date: 05/23/2016 19:28
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494004, 1162494005

Results by **EP245.1**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Mercury	0.100U	8.00	6.95	87				70-130		

Batch Information

Analytical Batch: MCV5709
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 5/23/2016 7:28:38PM

Prep Batch: MXX29783
Prep Method: Digestion Mercury 245.1 (W)
Prep Date/Time: 5/23/2016 12:57:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 50.00mL

Print Date: 06/27/2016 11:33:35AM

Method Blank

Blank ID: MB for HBN 1735393 [MXX/29827]
Blank Lab ID: 1328079

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **EP200.8**

Parameter	Results	LOQ/CL	DL	Units
Aluminum	10.0U	20.0	6.20	ug/L
Antimony	0.500U	1.00	0.310	ug/L
Arsenic	2.50U	5.00	1.50	ug/L
Barium	1.50U	3.00	0.940	ug/L
Beryllium	0.200U	0.400	0.130	ug/L
Cadmium	0.250U	0.500	0.150	ug/L
Calcium	250U	500	150	ug/L
Chromium	1.00U	2.00	0.620	ug/L
Cobalt	2.00U	4.00	1.20	ug/L
Copper	0.500U	1.00	0.310	ug/L
Iron	125U	250	78.0	ug/L
Lead	0.100U	0.200	0.0620	ug/L
Magnesium	25.0U	50.0	15.0	ug/L
Manganese	0.500U	1.00	0.310	ug/L
Molybdenum	1.00U	2.00	0.620	ug/L
Nickel	1.00U	2.00	0.620	ug/L
Phosphorus	100U	200	62.0	ug/L
Potassium	250U	500	150	ug/L
Selenium	2.50U	5.00	1.50	ug/L
Silicon	500U	1000	310	ug/L
Silver	0.500U	1.00	0.310	ug/L
Sodium	250U	500	150	ug/L
Thallium	0.500U	1.00	0.310	ug/L
Tin	0.500U	1.00	0.310	ug/L
Titanium	12.5U	25.0	7.75	ug/L
Vanadium	10.0U	20.0	6.20	ug/L
Zinc	2.50U	5.00	2.50	ug/L

Batch Information

Analytical Batch: MMS9393
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: VDL
Analytical Date/Time: 6/9/2016 1:36:52PM

Prep Batch: MXX29827
Prep Method: E200.2
Prep Date/Time: 6/6/2016 2:02:25PM
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Blank Spike Summary

Blank Spike ID: LCS for HBN 1162494 [MXX29827]
Blank Spike Lab ID: 1328080
Date Analyzed: 06/09/2016 13:39

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **EP200.8**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Aluminum	1000	1030	103	(85-115)
Antimony	1000	1020	102	(85-115)
Arsenic	1000	1010	101	(85-115)
Barium	1000	999	100	(85-115)
Beryllium	100	109	109	(85-115)
Cadmium	100	102	102	(85-115)
Calcium	10000	9910	99	(85-115)
Chromium	400	413	103	(85-115)
Cobalt	500	507	101	(85-115)
Copper	1000	976	98	(85-115)
Iron	5000	5230	105	(85-115)
Lead	1000	1000	100	(85-115)
Magnesium	10000	11100	111	(85-115)
Manganese	500	510	102	(85-115)
Molybdenum	400	395	99	(85-115)
Nickel	1000	991	99	(85-115)
Phosphorus	500	533	107	(85-115)
Potassium	10000	10300	103	(85-115)
Selenium	1000	1000	100	(85-115)
Silicon	10000	10900	109	(85-115)
Silver	100	98.9	99	(85-115)
Sodium	10000	11000	110	(85-115)
Thallium	10	9.75	98	(85-115)
Tin	100	103	103	(85-115)
Titanium	100	99.6	100	(85-115)
Vanadium	200	200	100	(85-115)
Zinc	1000	969	97	(85-115)

Batch Information

Analytical Batch: **MMS9393**
Analytical Method: **EP200.8**
Instrument: **Perkin Elmer Nexlon P5**
Analyst: **VDL**

Prep Batch: **MXX29827**
Prep Method: **E200.2**
Prep Date/Time: **06/06/2016 14:02**
Spike Init Wt./Vol.: 1000 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

Print Date: 06/27/2016 11:33:38AM

Matrix Spike Summary

Original Sample ID: 1162494001
MS Sample ID: 1328081 MS
MSD Sample ID:

Analysis Date: 06/09/2016 13:42
Analysis Date: 06/09/2016 13:45
Analysis Date:
Matrix: Drinking Water

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **EP200.8**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Aluminum	15.6J	1000	1030	102				70-130		
Antimony	0.500U	1000	1020	102				70-130		
Arsenic	2.50U	1000	998	100				70-130		
Barium	11.2	1000	1020	101				70-130		
Beryllium	0.200U	100	106	106				70-130		
Cadmium	0.250U	100	103	103				70-130		
Calcium	6370	10000	15400	90				70-130		
Chromium	1.00U	400	409	102				70-130		
Cobalt	2.00U	500	519	104				70-130		
Copper	0.531J	1000	960	96				70-130		
Iron	125U	5000	5290	106				70-130		
Lead	0.100U	1000	1020	102				70-130		
Magnesium	1880	10000	12200	103				70-130		
Manganese	0.652J	500	513	102				70-130		
Molybdenum	1.00U	400	395	99				70-130		
Nickel	1.00U	1000	982	98				70-130		
Phosphorus	100U	500	525	105				70-130		
Potassium	446J	10000	10200	98				70-130		
Selenium	2.50U	1000	1020	102				70-130		
Silicon	2410	10000	12900	105				70-130		
Silver	0.500U	100	100	100				70-130		
Sodium	2390	10000	12700	103				70-130		
Thallium	0.500U	10.0	9.96	100				70-130		
Tin	0.500U	100	103	103				70-130		
Titanium	3.13U	100	96.5	97				70-130		
Vanadium	10.0U	200	198	99				70-130		
Zinc	2.50U	1000	968	97				70-130		

Batch Information

Analytical Batch: MMS9393
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: VDL
Analytical Date/Time: 6/9/2016 1:45:49PM

Prep Batch: MXX29827
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 6/6/2016 2:02:25PM
Prep Initial Wt./Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Print Date: 06/27/2016 11:33:38AM

Method Blank

Blank ID: MB for HBN 1734463 [WFI/2478]
Blank Lab ID: 1325291

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500NO3-F**

Parameter	Results	LOQ/CL	DL	Units
Nitrate-N	0.0402J	0.100	0.0300	mg/L
Nitrite-N	0.0500U	0.100	0.0300	mg/L
Total Nitrate/Nitrite-N	0.0406J	0.100	0.0300	mg/L

Batch Information

Analytical Batch: WFI2478
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: NEG
Analytical Date/Time: 5/19/2016 12:35:01PM

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Method Blank

Blank ID: MB for HBN 1734463 [WFI/2478]
Blank Lab ID: 1325301

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500NO3-F**

Parameter	Results	LOQ/CL	DL	Units
Nitrate-N	0.0306J	0.100	0.0300	mg/L
Nitrite-N	0.0500U	0.100	0.0300	mg/L
Total Nitrate/Nitrite-N	0.0316J	0.100	0.0300	mg/L

Batch Information

Analytical Batch: WFI2478
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: NEG
Analytical Date/Time: 5/19/2016 2:31:35PM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1162494 [WFI2478]
Blank Spike Lab ID: 1325290
Date Analyzed: 05/19/2016 12:33

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500NO3-F**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Nitrate-N	2.5	2.63	105	(70-130)
Nitrite-N	2.5	2.52	101	(90-110)
Total Nitrate/Nitrite-N	5	5.15	103	(90-110)

Batch Information

Analytical Batch: **WFI2478**
Analytical Method: **SM21 4500NO3-F**
Instrument: **Astoria segmented flow**
Analyst: **NEG**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 2.5 mg/L Extract Vol: 5 mL
Dupe Init Wt./Vol.: Extract Vol:

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1162494 [WFI2478]
Blank Spike Lab ID: 1325299
Date Analyzed: 05/19/2016 14:29

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500NO3-F**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Nitrate-N	2.5	2.83	113	(70-130)
Nitrite-N	2.5	2.54	101	(90-110)
Total Nitrate/Nitrite-N	5	5.37	107	(90-110)

Batch Information

Analytical Batch: **WFI2478**
Analytical Method: **SM21 4500NO3-F**
Instrument: **Astoria segmented flow**
Analyst: **NEG**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 2.5 mg/L Extract Vol: 5 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1162494005
MS Sample ID: 1325294 MS
MSD Sample ID: 1325295 MSD

Analysis Date: 05/19/2016 13:58
Analysis Date: 05/19/2016 14:00
Analysis Date: 05/19/2016 14:01
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500NO3-F**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Nitrate-N	0.0604J	2.50	2.65	103	2.50	2.70	106	70-130	2.00	(< 25)
Nitrite-N	0.0500U	2.50	2.58	103	2.50	2.59	104	90-110	0.41	(< 25)

Batch Information

Analytical Batch: WFI2478
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: NEG
Analytical Date/Time: 5/19/2016 2:00:05PM

Prep Batch:
Prep Method:
Prep Date/Time:
Prep Initial Wt./Vol.: 5.00mL
Prep Extract Vol: 5.00mL

Print Date: 06/27/2016 11:33:44AM

Method Blank

Blank ID: MB for HBN 1734700 [WTC/2599]
Blank Lab ID: 1325612

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM 5310B**

Parameter	Results	LOQ/CL	DL	Units
Total Organic Carbon	0.268J	0.500	0.150	mg/L

Batch Information

Analytical Batch: WTC2599
Analytical Method: SM 5310B
Instrument: TOC Analyzer
Analyst: VDL
Analytical Date/Time: 5/19/2016 1:38:09PM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1162494 [WTC2599]
Blank Spike Lab ID: 1325610
Date Analyzed: 05/19/2016 13:22

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM 5310B**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Total Organic Carbon	75	76.4	102	(80-120)

Batch Information

Analytical Batch: **WTC2599**
Analytical Method: **SM 5310B**
Instrument: **TOC Analyzer**
Analyst: **VDL**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 75 mg/L Extract Vol: 30 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1162408002
MS Sample ID: 1325613 MS
MSD Sample ID: 1325614 MSD

Analysis Date: 05/19/2016 13:53
Analysis Date: 05/19/2016 14:06
Analysis Date: 05/19/2016 14:22
Matrix: Drinking Water

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM 5310B**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Organic Carbon	0.529	10.0	10.6	101	10.0	10.6	101	75-125	0.19	(< 25)

Batch Information

Analytical Batch: WTC2599
Analytical Method: SM 5310B
Instrument: TOC Analyzer
Analyst: VDL
Analytical Date/Time: 5/19/2016 2:06:51PM

Prep Batch:
Prep Method:
Prep Date/Time:
Prep Initial Wt./Vol.: 30.00mL
Prep Extract Vol: 30.00mL

Print Date: 06/27/2016 11:33:47AM

Method Blank

Blank ID: MB for HBN 1734503 [WTI/4456]
Blank Lab ID: 1325551

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 2320B**

Parameter	Results	LOQ/CL	DL	Units
Alkalinity	5.00U	10.0	3.10	mg/L

Batch Information

Analytical Batch: WTI4456
Analytical Method: SM21 2320B
Instrument: Titration
Analyst: ACF
Analytical Date/Time: 5/20/2016 7:40:17PM

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Duplicate Sample Summary

Original Sample ID: 1167928002
Duplicate Sample ID: 1325553
QC for Samples:

Analysis Date: 05/20/2016 18:11
Matrix: Water (Surface, Eff., Ground)

Results by **SM21 2320B**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Alkalinity	ND	5.00U	mg/L	0.00	(< 25)

Batch Information

Analytical Batch: WTI4456
Analytical Method: SM21 2320B
Instrument: Titration
Analyst: ACF

Print Date: 06/27/2016 11:33:49AM

Duplicate Sample Summary

Original Sample ID: 1162534002
Duplicate Sample ID: 1325554
Analysis Date: 05/20/2016 18:45
Matrix: Drinking Water

QC for Samples:

1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 2320B**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Alkalinity	78.8	79.5	mg/L	0.86	(< 25)

Batch Information

Analytical Batch: WTI4456
Analytical Method: SM21 2320B
Instrument: Titration
Analyst: ACF

Print Date: 06/27/2016 11:33:49AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1162494 [WTI4456]
Blank Spike Lab ID: 1325552
Date Analyzed: 05/20/2016 18:19

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 2320B**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Alkalinity	250	222	89	(85-115)

Batch Information

Analytical Batch: **WTI4456**
Analytical Method: **SM21 2320B**
Instrument: **Titration**
Analyst: **ACF**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 250 mg/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

Print Date: 06/27/2016 11:33:50AM

Method Blank

Blank ID: MB for HBN 1734914 [WXX/11510]
Blank Lab ID: 1326303

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500-NH3 G**

Parameter	Results	LOQ/CL	DL	Units
Ammonia-N	0.0500U	0.100	0.0310	mg/L

Batch Information

Analytical Batch: WDA3787
Analytical Method: SM21 4500-NH3 G
Instrument: Discrete Analyzer 2
Analyst: NEG
Analytical Date/Time: 5/24/2016 3:13:29PM

Prep Batch: WXX11510
Prep Method: METHOD
Prep Date/Time: 5/24/2016 2:30:00PM
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1162494 [WXX11510]
Blank Spike Lab ID: 1326304
Date Analyzed: 05/24/2016 15:15

Spike Duplicate ID: LCSD for HBN 1162494 [WXX11510]
Spike Duplicate Lab ID: 1326305
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500-NH3 G**

	Blank Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Ammonia-N	1	1.03	103	1	1.03	103	(75-125)	0.16	(< 25)

Batch Information

Analytical Batch: **WDA3787**
Analytical Method: **SM21 4500-NH3 G**
Instrument: **Discrete Analyzer 2**
Analyst: **NEG**

Prep Batch: **WXX11510**
Prep Method: **METHOD**
Prep Date/Time: **05/24/2016 14:30**
Spike Init Wt./Vol.: 1 mg/L Extract Vol: 6 mL
Dupe Init Wt./Vol.: 1 mg/L Extract Vol: 6 mL

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Matrix Spike Summary

Original Sample ID: 1162355001
MS Sample ID: 1326306 MS
MSD Sample ID: 1326307 MSD

Analysis Date: 05/24/2016 15:18
Analysis Date: 05/24/2016 15:20
Analysis Date: 05/24/2016 15:22
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500-NH3 G**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Ammonia-N	0.100U	1.00	.935	94	1.00	0.888	89	75-125	5.10	(< 25)

Batch Information

Analytical Batch: WDA3787
Analytical Method: SM21 4500-NH3 G
Instrument: Discrete Analyzer 2
Analyst: NEG
Analytical Date/Time: 5/24/2016 3:20:25PM

Prep Batch: WXX11510
Prep Method: Ammonia by SM21 4500F prep (W)
Prep Date/Time: 5/24/2016 2:30:00PM
Prep Initial Wt./Vol.: 6.00mL
Prep Extract Vol: 6.00mL

Print Date: 06/27/2016 11:33:54AM

Method Blank

Blank ID: MB for HBN 1735102 [WXX/11517]
Blank Lab ID: 1327226

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500P-B,E**

Parameter	Results	LOQ/CL	DL	Units
Total Phosphorus	0.00420J	0.0100	0.00310	mg/L

Batch Information

Analytical Batch: WDA3792
Analytical Method: SM21 4500P-B,E
Instrument: Discrete Analyzer 3
Analyst: NEG
Analytical Date/Time: 6/1/2016 11:34:08AM

Prep Batch: WXX11517
Prep Method: SM21 4500P-B,E
Prep Date/Time: 5/31/2016 5:58:00PM
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Blank Spike Summary

Blank Spike ID: LCS for HBN 1162494 [WXX11517]
Blank Spike Lab ID: 1327227
Date Analyzed: 06/01/2016 11:35

Spike Duplicate ID: LCSD for HBN 1162494 [WXX11517]
Spike Duplicate Lab ID: 1327228
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500P-B,E**

	Blank Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Phosphorus	0.2	0.205	102	0.2	0.204	102	(75-125)	0.64	(< 25)

Batch Information

Analytical Batch: **WDA3792**
Analytical Method: **SM21 4500P-B,E**
Instrument: **Discrete Analyzer 3**
Analyst: **NEG**

Prep Batch: **WXX11517**
Prep Method: **SM21 4500P-B,E**
Prep Date/Time: **05/31/2016 17:58**
Spike Init Wt./Vol.: 0.2 mg/L Extract Vol: 25 mL
Dupe Init Wt./Vol.: 0.2 mg/L Extract Vol: 25 mL

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Matrix Spike Summary

Original Sample ID: 1162494001
MS Sample ID: 1327229 MS
MSD Sample ID: 1327230 MSD

Analysis Date: 06/01/2016 11:37
Analysis Date: 06/01/2016 11:39
Analysis Date: 06/01/2016 11:40
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1162494001, 1162494002, 1162494003, 1162494004, 1162494005

Results by **SM21 4500P-B,E**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Phosphorus	0.0450J	1.00	1	96	1.00	0.982	94	75-125	2.00	(< 25)

Batch Information

Analytical Batch: WDA3792
Analytical Method: SM21 4500P-B,E
Instrument: Discrete Analyzer 3
Analyst: NEG
Analytical Date/Time: 6/1/2016 11:39:13AM

Prep Batch: WXX11517
Prep Method: Total Phosphorus (W) Ext.
Prep Date/Time: 5/31/2016 5:58:00PM
Prep Initial Wt./Vol.: 5.00mL
Prep Extract Vol: 25.00mL

Print Date: 06/27/2016 11:33:58AM

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CHAIN OF CUSTODY RECORD

1162494

Locations Nationwide
Alaska — Maryland
New Jersey — New York
North Carolina — Indiana
West Virginia — Kentucky
www.us.sgs.com

Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.

Page 1 of 1

Section 1

CLIENT: ADEC Water Quality

CONTACT: Laura Eldred — PHONE NO: 376-1855

PROJECT NAME: Willow Creek — PROJECT/ PWSID/ PERMIT#:

REPORTS TO: Laura Eldred — E-MAIL: laura.eldred@alaska.gov

INVOICE TO: ADEC NTP — QUOTE #: 335652 — P.O. #:

Section 2

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	Section 3 # CONTAINERS	Type C = COMP G = GRAB MI = Multi Incre-mental Soils	Preservative: Metals ICP/MS	Mercury	Alkalinity	Nitrate/ Nitrite	Ammonia	Tot. Phos.	DOC	REMARKS/ LOC ID
1a	Willow 01	5/18/16	10:18	W	1	G	X	X						
1b-d	Willow 01	5/18/16	10:18	W	3	G			X	X	X	X	X	
2a	Willow 02	5/18/16	10:24	W	1	G	X	X						
2b-d	Willow 02	5/18/16	10:26	W	3	G			X	X	X	X	X	
3a	Willow 03	5/18/16	13:09	W	1	G	X	X						
3b-d	Willow 03	5/18/16	13:09	W	3	G			X	X	X	X	X	
4a	Willow 04	5/18/16	14:14	W	1	G	X	X						
4b-d	Willow 04	5/18/16	14:14	W	3	G			X	X	X	X	X	
5a-d	Willow 03 Rep	5/18/16	13:10	W	4	G	X	X	X	X	X	X	X	

Section 5

	Date	Time	Received By:
Relinquished By: (1)	5/18/16	15:35	Jeanne Swarts
Relinquished By: (2)	5/18/16	1657	
Relinquished By: (3)			
Relinquished By: (4)	5/18/16	17:02	Received For Laboratory By: 5/18/16 17:02

Section 4

DOD Project? Yes (No)

Cooler ID:

Data Deliverable Requirements: level 2 SEDD + pdf

Requested Turnaround Time and/or Special Instructions:

Temp Blank °C: 6.7° #238
or Ambient [ ]
(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle)
(INTACT) BROKEN ABSENT
(See attached Sample Receipt Form)

200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
[ ] 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

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SGS Quote # 335652

Description	Matrix	Count	Unit Price	EXTENDED
LL 200.8 Diss Scan w/hardns(W)	Water	15	$150.00	$2,250.00
Metals Digestion, Water	Water	15	$20.00	$300.00
Mercury Diss. EPA 245.1 (DW)	Water	15	$45.00	$675.00
Lab Filter for Metals	Water	15	$20.00	$300.00
Alkalinity, Total as CaCO3 (W)	Water	15	$35.00	$525.00
Nitrate/Nitrite Combo Flow (W)	Water	15	$50.00	$750.00
Ammonia by SM 4500G (W)	Water	15	$35.00	$525.00
Total Phosphorus (W)	Water	15	$50.00	$750.00
Dissolved Organic Carbon	Water	15	$60.00	$900.00
Fecal Coliiform	Water	40	$100.00	$4,000.00
			Total Price:	**$10,975.00**

SGS will arrange for sample kits to be staged for pickup during normal business hours at Mat-Su Test Lab. Client will arrange for samples to return to SGS.

Mat-Su Test Lab
9161 E. Frontage Rd.
Suite 15
Palmer, AK

Metals to be run in Dissolved 200.8 Scan are: Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Fe, Mn, Mo, Ni, Se, Ag, Tl, V, Zn

SGS will get bacteria results to ADEC as quickly as possible. Any results over 20 cfu will result in a phone call so microbial source tracking can begin.

1162494

SAMPLE RECEIPT FORM

Review Criteria:	Yes	N/A	No	Comments/Action Taken:
Were **custody seals** intact? Note # & location, if applicable. COC accompanied samples?	☑ ☑	☐ ☐	☐ ☐	***Exemption permitted if sampler hand carries/delivers.***
Temperature blank compliant* (i.e., 0-6°C after CF)? *If >6 °C, were samples collected <8 hours ago?* *If <0 °C, were all sample containers ice free?* Cooler ID: [1] _____ @ 6.7 _____ w/ Therm.ID: 238 _____ Cooler ID: _____ @ _____ w/ Therm.ID: _____ Cooler ID: _____ @ _____ w/ Therm.ID: _____ Cooler ID: _____ @ _____ w/ Therm.ID: _____ Cooler ID: _____ @ _____ w/ Therm.ID: _____ If samples are received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled."	☐ ☑ ☐	☐ ☐ ☑	☑ ☐ ☐	***Exemption permitted if chilled & collected <8 hrs ago.*** client notified of temp, proceed with analysis ***Note: Identify containers received at non-compliant temperature. Use form FS-0029 if more space is needed.***
Delivery method (specify all that apply): ☑Client (hand carried) ☐USPS ☐Lynden ☐AK Air ☐Alert Courier ☐UPS ☐FedEx ☐RAVN ☐C&D Delivery ☐Carlile ☐Pen Air ☐Warp Speed ☐Other: _____ → *For WO# with airbills, was the WO# & airbill info recorded in the Front Counter eLog?*	☐	☑	☐	
	Yes	N/A	No	
Were samples received within hold time? Do samples **match COC*** (i.e., sample IDs, dates/times collected)? Were analyses requested unambiguous?	☑ ☑ ☐	☐ ☐ ☐	☐ ☐ ☐	***Note: Refer to form F-083 "Sample Guide" for hold times.*** ***Note: If times differ <1hr, record details and login per COC.***
Were samples in **good condition** (no leaks/cracks/breakage)? Packing material used (specify all that apply): ☐Bubble Wrap ☐Separate plastic bags ☐Vermiculite ☐Other:	☑	☐	☐	
Were **proper containers** (type/mass/volume/preservative*) used? Were **Trip Blanks** (i.e., VOAs, LL-Hg) in cooler with samples? Were all VOA vials **free of headspace** (i.e., bubbles ≤6 mm)? Were all soil VOAs **field extracted** with MeOH+BFB?	☑ ☐ ☐ ☐	☐ ☑ ☑ ☑	☐ ☐ ☐ ☐	☐ ***Exemption permitted for metals (e.g., 200.8/6020A).***
For preserved waters (other than VOA vials, LL-Mercury or microbiological analyses), was **pH verified and compliant**? If pH was adjusted, were bottles flagged (i.e., stickers)?	☑ ☐	☐ ☑	☐ ☐	
For **special handling** (e.g., "MI" soils, foreign soils, lab filter for dissolved…, lab extract for volatiles, Ref Lab, limited volume), were bottles/paperwork flagged (e.g., sticker)?	☐	☑	☐	
For **RUSH/SHORT Hold Time**, were COC/Bottles flagged accordingly? Was Rush/Short HT email sent, if applicable?	☑	☐	☐	Lab Filter for DOC and Metals/Mercury
For **SITE-SPECIFIC QC, e.g. BMS/BMSD/BDUP**, were containers / paperwork flagged accordingly?	☐	☑	☐	
For any question answered "No," has the PM been notified and the problem resolved (or paperwork put in their bin)?	☐	☑	☐	SRF Completed by: EET PM notified:
Was **PEER REVIEW** of ***sample numbering/labeling completed?***	☐	☐	☐	Peer Reviewed by:
Additional notes (if applicable):				

Note to Client: *Any "no" answer above indicates non-compliance with standard procedures and may impact data quality.*

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1162494001-A	HNO3 to pH < 2	PA			
1162494001-B	No Preservative Required	OK			
1162494001-C	H2SO4 to pH < 2	OK			
1162494001-D	HCL to pH < 2	PA			
1162494002-A	HNO3 to pH < 2	PA			
1162494002-B	No Preservative Required	OK			
1162494002-C	H2SO4 to pH < 2	OK			
1162494002-D	HCL to pH < 2	PA			
1162494003-A	HNO3 to pH < 2	PA			
1162494003-B	No Preservative Required	OK			
1162494003-C	H2SO4 to pH < 2	OK			
1162494003-D	HCL to pH < 2	PA			
1162494004-A	HNO3 to pH < 2	PA			
1162494004-B	No Preservative Required	OK			
1162494004-C	H2SO4 to pH < 2	OK			
1162494004-D	HCL to pH < 2	PA			
1162494005-A	HNO3 to pH < 2	PA			
1162494005-B	No Preservative Required	OK			
1162494005-C	H2SO4 to pH < 2	OK			
1162494005-D	HCL to pH < 2	PA			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM- The container was received damaged.
FR- The container was received frozen and not usable for Bacteria or BOD analyses.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

Laboratory Report of Analysis

To: ADEC-Air & Water Quality
1700 E. Bogard Rd Bldg B, Suite 103
Wasilla, AK 99654

Report Number: **1163988**

Client Project: **Willow Creek**

Dear Laura Eldred,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Forest at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Forest Taylor Date
Project Manager
Forest.Taylor@sgs.com

SGS North America Inc. 200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Case Narrative

SGS Client: **ADEC-Air & Water Quality**
SGS Project: **1163988**
Project Name/Site: **Willow Creek**
Project Contact: **Laura Eldred**

Refer to sample receipt form for information on sample condition.

MB for HBN 1739627 [MXX/29985] (1337792) MB

200.8 - Metals analytes nickel and zinc are detected in the MB above the LOQ. The associated sample concentrations are either less than the LOQ or 10 times greater than the concentration in the MB.

1163955001MS (1339186) MS

4500NH3-G - Ammonia - MS recovery is outside of QC criteria due to sample dilution. Refer to LCS for accuracy requirements.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

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Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8021B, 8082A, 8260B, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
Willow 01	1163988001	07/18/2016	07/18/2016	Water (Surface, Eff., Ground)
Willow 02	1163988002	07/18/2016	07/18/2016	Water (Surface, Eff., Ground)
Willow 03	1163988003	07/18/2016	07/18/2016	Water (Surface, Eff., Ground)
Willow 04	1163988004	07/18/2016	07/18/2016	Water (Surface, Eff., Ground)
Willow 03 Rep	1163988005	07/18/2016	07/18/2016	Water (Surface, Eff., Ground)

Method	Method Description
SM21 2320B	Alkalinity as CaCO3 QC
SM21 4500-NH3 G	Ammonia-N (W) SM21 4500-NH3 G
SM 5310B	Dissolved Organic Carbon
EPA 300.0	Ion Chromatographic Analysis
EP245.1	Mercury EPA 245.1 DISSOLVED
EP200.8	Metals in Drinking Water by ICP-MS DISSO
SM21 4500P-B,E	Total Phosphorus (W)

Detectable Results Summary

Client Sample ID: **Willow 01**
Lab Sample ID: 1163988001

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	8.76J	ug/L
	Barium	17.1	ug/L
	Calcium	10900	ug/L
	Copper	0.330J	ug/L
	Magnesium	2960	ug/L
	Manganese	3.47	ug/L
	Potassium	569	ug/L
	Silicon	2350	ug/L
	Sodium	4230	ug/L
	Zinc	3.03J	ug/L
Waters Department	A kalinity	30.7	mg/L
	Total Organic Carbon,Dissolved	0.462J	mg/L
	Total Phosphorus	0.00350J	mg/L

Client Sample ID: **Willow 02**
Lab Sample ID: 1163988002

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	11.7J	ug/L
	Barium	10.0	ug/L
	Calcium	7150	ug/L
	Copper	0.321J	ug/L
	Magnesium	1560	ug/L
	Manganese	1.85	ug/L
	Nickel	1.44J	ug/L
	Potassium	615	ug/L
	Silicon	2750	ug/L
	Sodium	2980	ug/L
	Zinc	4.59J	ug/L
Waters Department	A kalinity	22.7	mg/L
	Nitrate-N	0.107J	mg/L
	Total Organic Carbon,Dissolved	0.694	mg/L
	Total Phosphorus	0.00890J	mg/L

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Detectable Results Summary

Client Sample ID: **Willow 03**
Lab Sample ID: 1163988003

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	14.1J	ug/L
	Barium	11.2	ug/L
	Calcium	8440	ug/L
	Copper	1.19	ug/L
	Iron	89.6J	ug/L
	Lead	3.28	ug/L
	Magnesium	1680	ug/L
	Manganese	15.1	ug/L
	Nickel	1.74J	ug/L
	Potassium	738	ug/L
	Silicon	3210	ug/L
	Sodium	4520	ug/L
Waters Department	A kalinity	23.0	mg/L
	Total Organic Carbon,Dissolved	1.03	mg/L
	Total Phosphorus	0.00440J	mg/L

Client Sample ID: **Willow 04**
Lab Sample ID: 1163988004

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	10.8J	ug/L
	Barium	11.7	ug/L
	Calcium	8000	ug/L
	Copper	0.393J	ug/L
	Iron	174J	ug/L
	Magnesium	1620	ug/L
	Manganese	24.4	ug/L
	Nickel	1.44J	ug/L
	Potassium	672	ug/L
	Silicon	3190	ug/L
	Sodium	4480	ug/L
	Zinc	4.67J	ug/L
Waters Department	A kalinity	24.6	mg/L
	Total Organic Carbon,Dissolved	1.12	mg/L
	Total Phosphorus	0.0128	mg/L

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Detectable Results Summary

Client Sample ID: **Willow 03 Rep**
Lab Sample ID: 1163988005

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	10.6J	ug/L
	Barium	10.2	ug/L
	Calcium	7490	ug/L
	Copper	0.424J	ug/L
	Magnesium	1570	ug/L
	Manganese	13.8	ug/L
	Nickel	1.62J	ug/L
	Potassium	675	ug/L
	Silicon	3050	ug/L
	Sodium	4280	ug/L
Waters Department	A kalinity	24.4	mg/L
	Nitrate-N	0.105J	mg/L
	Total Organic Carbon,Dissolved	1.04	mg/L
	Total Phosphorus	0.0156	mg/L

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Results of **Willow 01**

Client Sample ID: **Willow 01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988001
Lab Project ID: 1163988

Collection Date: 07/18/16 09:40
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		08/01/16 19:12

Batch Information

Analytical Batch: MCV5727
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 08/01/16 19:12
Container ID: 1163988001-B

Prep Batch: MXX30051
Prep Method: METHOD
Prep Date/Time: 08/01/16 15:20
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 01**

Client Sample ID: **Willow 01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988001
Lab Project ID: 1163988

Collection Date: 07/18/16 09:40
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	8.76	J	20.0	6.20	ug/L	1		07/23/16 18:32
Antimony	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:32
Arsenic	2.50	U	5.00	1.50	ug/L	1		07/23/16 18:32
Barium	17.1		3.00	0.940	ug/L	1		07/23/16 18:32
Beryllium	0.200	U	0.400	0.130	ug/L	1		07/23/16 18:32
Cadmium	0.250	U	0.500	0.150	ug/L	1		07/23/16 18:32
Calcium	10900		500	150	ug/L	1		07/23/16 18:32
Chromium	1.00	U	2.00	0.620	ug/L	1		07/23/16 18:32
Cobalt	2.00	U	4.00	1.20	ug/L	1		07/23/16 18:32
Copper	0.330	J	1.00	0.310	ug/L	1		07/23/16 18:32
Iron	125	U	250	78.0	ug/L	1		07/23/16 18:32
Lead	0.100	U	0.200	0.0620	ug/L	1		07/23/16 18:32
Magnesium	2960		50.0	15.0	ug/L	1		07/23/16 18:32
Manganese	3.47		1.00	0.310	ug/L	1		07/23/16 18:32
Molybdenum	1.00	U	2.00	0.620	ug/L	1		07/23/16 18:32
Nickel	1.00	U	2.00	0.620	ug/L	1		08/02/16 19:30
Phosphorus	100	U	200	62.0	ug/L	1		07/23/16 18:32
Potassium	569		500	150	ug/L	1		07/23/16 18:32
Selenium	2.50	U	5.00	1.50	ug/L	1		07/23/16 18:32
Silicon	2350		1000	310	ug/L	1		07/26/16 16:50
Silver	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:32
Sodium	4230		500	150	ug/L	1		07/23/16 18:32
Thallium	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:32
Tin	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:32
Titanium	3.13	U	6.25	3.13	ug/L	1		07/23/16 18:32
Vanadium	10.0	U	20.0	6.20	ug/L	1		08/02/16 19:30
Zinc	3.03	J	5.00	2.50	ug/L	1		08/02/16 19:30

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 01**

Client Sample ID: **Willow 01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988001
Lab Project ID: 1163988

Collection Date: 07/18/16 09:40
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9461
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 07/23/16 18:32
Container ID: 1163988001-B

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 07/21/16 11:05
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9463
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 07/26/16 16:50
Container ID: 1163988001-B

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 07/21/16 11:05
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9475
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 08/02/16 19:30
Container ID: 1163988001-B

Prep Batch: MXX30034
Prep Method: E200.2
Prep Date/Time: 07/29/16 09:34
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **Willow 01**

Client Sample ID: **Willow 01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988001
Lab Project ID: 1163988

Collection Date: 07/18/16 09:40
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.100	U	0.200	0.0620	mg/L	1		07/19/16 14:45
Nitrite-N	0.100	U	0.200	0.0620	mg/L	1		07/19/16 14:45

Batch Information

Analytical Batch: WIC5554
Analytical Method: EPA 300.0
Analyst: ACF
Analytical Date/Time: 07/19/16 14:45
Container ID: 1163988001-D

Prep Batch: WXX11560
Prep Method: METHOD
Prep Date/Time: 07/19/16 11:55
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	0.462	J	0.500	0.150	mg/L	1		07/21/16 11:37

Batch Information

Analytical Batch: WTC2614
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 07/21/16 11:37
Container ID: 1163988001-G

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	30.7		10.0	3.10	mg/L	1		07/20/16 18:08

Batch Information

Analytical Batch: WTI4486
Analytical Method: SM21 2320B
Analyst: ACF
Analytical Date/Time: 07/20/16 18:08
Container ID: 1163988001-C

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500	U	0.100	0.0310	mg/L	1		07/20/16 13:10

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 01**

Client Sample ID: **Willow 01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988001
Lab Project ID: 1163988

Collection Date: 07/18/16 09:40
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WDA3818
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 07/20/16 13:10
Container ID: 1163988001-E

Prep Batch: WXX11567
Prep Method: METHOD
Prep Date/Time: 07/20/16 12:30
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.00350	J	0.0100	0.00310	mg/L	1		07/28/16 12:52

Batch Information

Analytical Batch: WDA3826
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 07/28/16 12:52
Container ID: 1163988001-E

Prep Batch: WXX11570
Prep Method: SM21 4500P-B,E
Prep Date/Time: 07/26/16 14:30
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988002
Lab Project ID: 1163988

Collection Date: 07/18/16 10:47
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		08/01/16 19:15

Batch Information

Analytical Batch: MCV5727
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 08/01/16 19:15
Container ID: 1163988002-B

Prep Batch: MXX30051
Prep Method: METHOD
Prep Date/Time: 08/01/16 15:20
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988002
Lab Project ID: 1163988

Collection Date: 07/18/16 10:47
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	11.7	J	20.0	6.20	ug/L	1		07/23/16 18:35
Antimony	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:35
Arsenic	2.50	U	5.00	1.50	ug/L	1		07/23/16 18:35
Barium	10.0		3.00	0.940	ug/L	1		07/23/16 18:35
Beryllium	0.200	U	0.400	0.130	ug/L	1		07/23/16 18:35
Cadmium	0.250	U	0.500	0.150	ug/L	1		07/23/16 18:35
Calcium	7150		500	150	ug/L	1		07/23/16 18:35
Chromium	1.00	U	2.00	0.620	ug/L	1		07/23/16 18:35
Cobalt	2.00	U	4.00	1.20	ug/L	1		07/23/16 18:35
Copper	0.321	J	1.00	0.310	ug/L	1		07/23/16 18:35
Iron	125	U	250	78.0	ug/L	1		07/23/16 18:35
Lead	0.100	U	0.200	0.0620	ug/L	1		07/23/16 18:35
Magnesium	1560		50.0	15.0	ug/L	1		07/23/16 18:35
Manganese	1.85		1.00	0.310	ug/L	1		07/23/16 18:35
Molybdenum	1.00	U	2.00	0.620	ug/L	1		07/23/16 18:35
Nickel	1.44	J	2.00	0.620	ug/L	1		07/23/16 18:35
Phosphorus	100	U	200	62.0	ug/L	1		07/23/16 18:35
Potassium	615		500	150	ug/L	1		07/23/16 18:35
Selenium	2.50	U	5.00	1.50	ug/L	1		07/23/16 18:35
Silicon	2750		1000	310	ug/L	1		07/26/16 16:53
Silver	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:35
Sodium	2980		500	150	ug/L	1		07/23/16 18:35
Thallium	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:35
Tin	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:35
Titanium	3.13	U	6.25	3.13	ug/L	1		07/23/16 18:35
Vanadium	10.0	U	20.0	6.20	ug/L	1		08/02/16 19:33
Zinc	4.59	J	5.00	2.50	ug/L	1		07/23/16 18:35

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988002
Lab Project ID: 1163988

Collection Date: 07/18/16 10:47
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9461
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 07/23/16 18:35
Container ID: 1163988002-B

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 07/21/16 11:05
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9463
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 07/26/16 16:53
Container ID: 1163988002-B

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 07/21/16 11:05
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9475
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 08/02/16 19:33
Container ID: 1163988002-B

Prep Batch: MXX30034
Prep Method: E200.2
Prep Date/Time: 07/29/16 09:34
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988002
Lab Project ID: 1163988

Collection Date: 07/18/16 10:47
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.107	J	0.200	0.0620	mg/L	1		07/19/16 15:52
Nitrite-N	0.100	U	0.200	0.0620	mg/L	1		07/19/16 15:52

Batch Information

Analytical Batch: WIC5554
Analytical Method: EPA 300.0
Analyst: ACF
Analytical Date/Time: 07/19/16 15:52
Container ID: 1163988002-D

Prep Batch: WXX11560
Prep Method: METHOD
Prep Date/Time: 07/19/16 11:55
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	0.694		0.500	0.150	mg/L	1		07/21/16 11:50

Batch Information

Analytical Batch: WTC2614
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 07/21/16 11:50
Container ID: 1163988002-G

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	22.7		10.0	3.10	mg/L	1		07/20/16 18:15

Batch Information

Analytical Batch: WTI4486
Analytical Method: SM21 2320B
Analyst: ACF
Analytical Date/Time: 07/20/16 18:15
Container ID: 1163988002-C

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500	U	0.100	0.0310	mg/L	1		07/20/16 13:11

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988002
Lab Project ID: 1163988

Collection Date: 07/18/16 10:47
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WDA3818
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 07/20/16 13:11
Container ID: 1163988002-E

Prep Batch: WXX11567
Prep Method: METHOD
Prep Date/Time: 07/20/16 12:30
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.00890	J	0.0100	0.00310	mg/L	1		07/28/16 12:53

Batch Information

Analytical Batch: WDA3826
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 07/28/16 12:53
Container ID: 1163988002-E

Prep Batch: WXX11570
Prep Method: SM21 4500P-B,E
Prep Date/Time: 07/26/16 14:30
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988003
Lab Project ID: 1163988

Collection Date: 07/18/16 11:38
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		08/01/16 19:18

Batch Information

Analytical Batch: MCV5727
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 08/01/16 19:18
Container ID: 1163988003-B

Prep Batch: MXX30051
Prep Method: METHOD
Prep Date/Time: 08/01/16 15:20
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988003
Lab Project ID: 1163988

Collection Date: 07/18/16 11:38
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	14.1	J	20.0	6.20	ug/L	1		07/23/16 18:38
Antimony	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:38
Arsenic	2.50	U	5.00	1.50	ug/L	1		07/23/16 18:38
Barium	11.2		3.00	0.940	ug/L	1		07/23/16 18:38
Beryllium	0.200	U	0.400	0.130	ug/L	1		07/23/16 18:38
Cadmium	0.250	U	0.500	0.150	ug/L	1		07/23/16 18:38
Calcium	8440		500	150	ug/L	1		07/23/16 18:38
Chromium	1.00	U	2.00	0.620	ug/L	1		07/23/16 18:38
Cobalt	2.00	U	4.00	1.20	ug/L	1		07/23/16 18:38
Copper	1.19		1.00	0.310	ug/L	1		07/23/16 18:38
Iron	89.6	J	250	78.0	ug/L	1		07/23/16 18:38
Lead	3.28		0.200	0.0620	ug/L	1		07/23/16 18:38
Magnesium	1680		50.0	15.0	ug/L	1		07/23/16 18:38
Manganese	15.1		1.00	0.310	ug/L	1		07/23/16 18:38
Molybdenum	1.00	U	2.00	0.620	ug/L	1		07/23/16 18:38
Nickel	1.74	J	2.00	0.620	ug/L	1		07/23/16 18:38
Phosphorus	100	U	200	62.0	ug/L	1		07/23/16 18:38
Potassium	738		500	150	ug/L	1		07/23/16 18:38
Selenium	2.50	U	5.00	1.50	ug/L	1		07/23/16 18:38
Silicon	3210		1000	310	ug/L	1		07/26/16 17:02
Silver	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:38
Sodium	4520		500	150	ug/L	1		07/23/16 18:38
Thallium	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:38
Tin	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:38
Titanium	3.13	U	6.25	3.13	ug/L	1		07/23/16 18:38
Vanadium	10.0	U	20.0	6.20	ug/L	1		08/02/16 19:36
Zinc	2.50	U	5.00	2.50	ug/L	1		08/02/16 19:36

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988003
Lab Project ID: 1163988

Collection Date: 07/18/16 11:38
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9461
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 07/23/16 18:38
Container ID: 1163988003-B

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 07/21/16 11:05
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9463
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 07/26/16 17:02
Container ID: 1163988003-B

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 07/21/16 11:05
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9475
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 08/02/16 19:36
Container ID: 1163988003-B

Prep Batch: MXX30034
Prep Method: E200.2
Prep Date/Time: 07/29/16 09:34
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988003
Lab Project ID: 1163988

Collection Date: 07/18/16 11:38
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.100	U	0.200	0.0620	mg/L	1		07/19/16 16:14
Nitrite-N	0.100	U	0.200	0.0620	mg/L	1		07/19/16 16:14

Batch Information

Analytical Batch: WIC5554
Analytical Method: EPA 300.0
Analyst: ACF
Analytical Date/Time: 07/19/16 16:14
Container ID: 1163988003-D

Prep Batch: WXX11560
Prep Method: METHOD
Prep Date/Time: 07/19/16 11:55
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	1.03		0.500	0.150	mg/L	1		07/21/16 12:03

Batch Information

Analytical Batch: WTC2614
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 07/21/16 12:03
Container ID: 1163988003-G

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	23.0		10.0	3.10	mg/L	1		07/20/16 18:21

Batch Information

Analytical Batch: WTI4486
Analytical Method: SM21 2320B
Analyst: ACF
Analytical Date/Time: 07/20/16 18:21
Container ID: 1163988003-C

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500	U	0.100	0.0310	mg/L	1		07/20/16 13:16

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988003
Lab Project ID: 1163988

Collection Date: 07/18/16 11:38
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WDA3818
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 07/20/16 13:16
Container ID: 1163988003-E

Prep Batch: WXX11567
Prep Method: METHOD
Prep Date/Time: 07/20/16 12:30
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.00440	J	0.0100	0.00310	mg/L	1		07/28/16 12:54

Batch Information

Analytical Batch: WDA3826
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 07/28/16 12:54
Container ID: 1163988003-E

Prep Batch: WXX11570
Prep Method: SM21 4500P-B,E
Prep Date/Time: 07/26/16 14:30
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988004
Lab Project ID: 1163988

Collection Date: 07/18/16 12:53
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		08/01/16 19:21

Batch Information

Analytical Batch: MCV5727
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 08/01/16 19:21
Container ID: 1163988004-B

Prep Batch: MXX30051
Prep Method: METHOD
Prep Date/Time: 08/01/16 15:20
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988004
Lab Project ID: 1163988

Collection Date: 07/18/16 12:53
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	10.8	J	20.0	6.20	ug/L	1		07/23/16 18:41
Antimony	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:41
Arsenic	2.50	U	5.00	1.50	ug/L	1		07/23/16 18:41
Barium	11.7		3.00	0.940	ug/L	1		07/23/16 18:41
Beryllium	0.200	U	0.400	0.130	ug/L	1		07/23/16 18:41
Cadmium	0.250	U	0.500	0.150	ug/L	1		07/23/16 18:41
Calcium	8000		500	150	ug/L	1		07/23/16 18:41
Chromium	1.00	U	2.00	0.620	ug/L	1		07/23/16 18:41
Cobalt	2.00	U	4.00	1.20	ug/L	1		07/23/16 18:41
Copper	0.393	J	1.00	0.310	ug/L	1		07/23/16 18:41
Iron	174	J	250	78.0	ug/L	1		07/23/16 18:41
Lead	0.100	U	0.200	0.0620	ug/L	1		07/23/16 18:41
Magnesium	1620		50.0	15.0	ug/L	1		07/23/16 18:41
Manganese	24.4		1.00	0.310	ug/L	1		07/23/16 18:41
Molybdenum	1.00	U	2.00	0.620	ug/L	1		07/23/16 18:41
Nickel	1.44	J	2.00	0.620	ug/L	1		07/23/16 18:41
Phosphorus	100	U	200	62.0	ug/L	1		07/23/16 18:41
Potassium	672		500	150	ug/L	1		07/23/16 18:41
Selenium	2.50	U	5.00	1.50	ug/L	1		07/23/16 18:41
Silicon	3190		1000	310	ug/L	1		07/26/16 17:05
Silver	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:41
Sodium	4480		500	150	ug/L	1		07/23/16 18:41
Thallium	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:41
Tin	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:41
Titanium	3.13	U	6.25	3.13	ug/L	1		07/23/16 18:41
Vanadium	10.0	U	20.0	6.20	ug/L	1		08/02/16 19:39
Zinc	4.67	J	5.00	2.50	ug/L	1		07/23/16 18:41

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988004
Lab Project ID: 1163988

Collection Date: 07/18/16 12:53
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9461
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 07/23/16 18:41
Container ID: 1163988004-B

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 07/21/16 11:05
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9463
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 07/26/16 17:05
Container ID: 1163988004-B

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 07/21/16 11:05
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9475
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 08/02/16 19:39
Container ID: 1163988004-B

Prep Batch: MXX30034
Prep Method: E200.2
Prep Date/Time: 07/29/16 09:34
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988004
Lab Project ID: 1163988

Collection Date: 07/18/16 12:53
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.100	U	0.200	0.0620	mg/L	1		07/19/16 16:37
Nitrite-N	0.100	U	0.200	0.0620	mg/L	1		07/19/16 16:37

Batch Information

Analytical Batch: WIC5554
Analytical Method: EPA 300.0
Analyst: ACF
Analytical Date/Time: 07/19/16 16:37
Container ID: 1163988004-D

Prep Batch: WXX11560
Prep Method: METHOD
Prep Date/Time: 07/19/16 11:55
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	1.12		0.500	0.150	mg/L	1		07/21/16 12:17

Batch Information

Analytical Batch: WTC2614
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 07/21/16 12:17
Container ID: 1163988004-G

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	24.6		10.0	3.10	mg/L	1		07/20/16 18:27

Batch Information

Analytical Batch: WTI4486
Analytical Method: SM21 2320B
Analyst: ACF
Analytical Date/Time: 07/20/16 18:27
Container ID: 1163988004-C

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500	U	0.100	0.0310	mg/L	1		07/20/16 13:18

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988004
Lab Project ID: 1163988

Collection Date: 07/18/16 12:53
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WDA3818
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 07/20/16 13:18
Container ID: 1163988004-E

Prep Batch: WXX11567
Prep Method: METHOD
Prep Date/Time: 07/20/16 12:30
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.0128		0.0100	0.00310	mg/L	1		07/28/16 12:55

Batch Information

Analytical Batch: WDA3826
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 07/28/16 12:55
Container ID: 1163988004-E

Prep Batch: WXX11570
Prep Method: SM21 4500P-B,E
Prep Date/Time: 07/26/16 14:30
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988005
Lab Project ID: 1163988

Collection Date: 07/18/16 11:42
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		08/01/16 19:24

Batch Information

Analytical Batch: MCV5727
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 08/01/16 19:24
Container ID: 1163988005-B

Prep Batch: MXX30051
Prep Method: METHOD
Prep Date/Time: 08/01/16 15:20
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988005
Lab Project ID: 1163988

Collection Date: 07/18/16 11:42
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	10.6	J	20.0	6.20	ug/L	1		07/23/16 18:44
Antimony	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:44
Arsenic	2.50	U	5.00	1.50	ug/L	1		07/23/16 18:44
Barium	10.2		3.00	0.940	ug/L	1		07/23/16 18:44
Beryllium	0.200	U	0.400	0.130	ug/L	1		07/23/16 18:44
Cadmium	0.250	U	0.500	0.150	ug/L	1		07/23/16 18:44
Calcium	7490		500	150	ug/L	1		07/23/16 18:44
Chromium	1.00	U	2.00	0.620	ug/L	1		07/23/16 18:44
Cobalt	2.00	U	4.00	1.20	ug/L	1		07/23/16 18:44
Copper	0.424	J	1.00	0.310	ug/L	1		07/23/16 18:44
Iron	125	U	250	78.0	ug/L	1		07/23/16 18:44
Lead	0.100	U	0.200	0.0620	ug/L	1		07/23/16 18:44
Magnesium	1570		50.0	15.0	ug/L	1		07/23/16 18:44
Manganese	13.8		1.00	0.310	ug/L	1		07/23/16 18:44
Molybdenum	1.00	U	2.00	0.620	ug/L	1		07/23/16 18:44
Nickel	1.62	J	2.00	0.620	ug/L	1		07/23/16 18:44
Phosphorus	100	U	200	62.0	ug/L	1		07/23/16 18:44
Potassium	675		500	150	ug/L	1		07/23/16 18:44
Selenium	2.50	U	5.00	1.50	ug/L	1		07/23/16 18:44
Silicon	3050		1000	310	ug/L	1		07/26/16 17:08
Silver	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:44
Sodium	4280		500	150	ug/L	1		07/23/16 18:44
Thallium	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:44
Tin	0.500	U	1.00	0.310	ug/L	1		07/23/16 18:44
Titanium	3.13	U	6.25	3.13	ug/L	1		07/23/16 18:44
Vanadium	10.0	U	20.0	6.20	ug/L	1		08/02/16 19:42
Zinc	2.50	U	5.00	2.50	ug/L	1		08/02/16 19:42

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988005
Lab Project ID: 1163988

Collection Date: 07/18/16 11:42
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9461
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 07/23/16 18:44
Container ID: 1163988005-B

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 07/21/16 11:05
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9463
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 07/26/16 17:08
Container ID: 1163988005-B

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 07/21/16 11:05
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9475
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 08/02/16 19:42
Container ID: 1163988005-B

Prep Batch: MXX30034
Prep Method: E200.2
Prep Date/Time: 07/29/16 09:34
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988005
Lab Project ID: 1163988

Collection Date: 07/18/16 11:42
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.105	J	0.200	0.0620	mg/L	1		07/19/16 16:59
Nitrite-N	0.100	U	0.200	0.0620	mg/L	1		07/19/16 16:59

Batch Information

Analytical Batch: WIC5554
Analytical Method: EPA 300.0
Analyst: ACF
Analytical Date/Time: 07/19/16 16:59
Container ID: 1163988005-D

Prep Batch: WXX11560
Prep Method: METHOD
Prep Date/Time: 07/19/16 11:55
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	1.04		0.500	0.150	mg/L	1		07/21/16 12:30

Batch Information

Analytical Batch: WTC2614
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 07/21/16 12:30
Container ID: 1163988005-G

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	24.4		10.0	3.10	mg/L	1		07/20/16 18:33

Batch Information

Analytical Batch: WTI4486
Analytical Method: SM21 2320B
Analyst: ACF
Analytical Date/Time: 07/20/16 18:33
Container ID: 1163988005-C

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500	U	0.100	0.0310	mg/L	1		07/20/16 13:20

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1163988005
Lab Project ID: 1163988

Collection Date: 07/18/16 11:42
Received Date: 07/18/16 15:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WDA3818
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 07/20/16 13:20
Container ID: 1163988005-E

Prep Batch: WXX11567
Prep Method: METHOD
Prep Date/Time: 07/20/16 12:30
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.0156		0.0100	0.00310	mg/L	1		07/28/16 12:57

Batch Information

Analytical Batch: WDA3826
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 07/28/16 12:57
Container ID: 1163988005-E

Prep Batch: WXX11570
Prep Method: SM21 4500P-B,E
Prep Date/Time: 07/26/16 14:30
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Print Date: 08/05/2016 4:16:24PM

J flagging is activated

Method Blank

Blank ID: MB for HBN 1739627 [MXX/29985]
Blank Lab ID: 1337792

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

Parameter	Results	LOQ/CL	DL	Units
Aluminum	10.0U	20.0	6.20	ug/L
Antimony	0.500U	1.00	0.310	ug/L
Arsenic	2.50U	5.00	1.50	ug/L
Barium	1.50U	3.00	0.940	ug/L
Beryllium	0.200U	0.400	0.130	ug/L
Cadmium	0.250U	0.500	0.150	ug/L
Calcium	250U	500	150	ug/L
Chromium	1.00U	2.00	0.620	ug/L
Cobalt	2.00U	4.00	1.20	ug/L
Copper	0.500U	1.00	0.310	ug/L
Iron	125U	250	78.0	ug/L
Lead	0.100U	0.200	0.0620	ug/L
Magnesium	25.0U	50.0	15.0	ug/L
Manganese	0.500U	1.00	0.310	ug/L
Molybdenum	1.00U	2.00	0.620	ug/L
Nickel	2.42*	2.00	0.620	ug/L
Phosphorus	100U	200	62.0	ug/L
Potassium	250U	500	150	ug/L
Selenium	2.50U	5.00	1.50	ug/L
Silicon	500U	1000	310	ug/L
Silver	0.500U	1.00	0.310	ug/L
Sodium	250U	500	150	ug/L
Thallium	0.500U	1.00	0.310	ug/L
Tin	0.500U	1.00	0.310	ug/L
Titanium	12.5U	25.0	7.75	ug/L
Zinc	11.1*	5.00	2.50	ug/L

Method Blank

Blank ID: MB for HBN 1739627 [MXX/29985]
Blank Lab ID: 1337792

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

Parameter	Results	LOQ/CL	DL	Units

Batch Information

Analytical Batch: MMS9461
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: VDL
Analytical Date/Time: 7/23/2016 6:14:37PM

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 7/21/2016 11:05:47AM
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Analytical Batch: MMS9463
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: VDL
Analytical Date/Time: 7/26/2016 4:38:29PM

Prep Batch: MXX29985
Prep Method: E200.2
Prep Date/Time: 7/21/2016 11:05:47AM
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [MXX29985]
Blank Spike Lab ID: 1337793
Date Analyzed: 07/23/2016 18:17

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Aluminum	1000	909	91	(85-115)
Antimony	1000	857	86	(85-115)
Arsenic	1000	896	90	(85-115)
Barium	1000	858	86	(85-115)
Beryllium	100	98.8	99	(85-115)
Cadmium	100	89.5	90	(85-115)
Calcium	10000	9020	90	(85-115)
Cobalt	500	425	85	(85-115)
Copper	1000	889	89	(85-115)
Iron	5000	4470	90	(85-115)
Lead	1000	880	88	(85-115)
Magnesium	10000	8960	90	(85-115)
Manganese	500	444	89	(85-115)
Molybdenum	400	347	87	(85-115)
Phosphorus	500	450	90	(85-115)
Potassium	10000	9020	90	(85-115)
Selenium	1000	911	91	(85-115)
Silver	100	91.7	92	(85-115)
Sodium	10000	9230	92	(85-115)
Thallium	10	8.99	90	(85-115)
Tin	100	87.5	88	(85-115)
Titanium	100	90.8	91	(85-115)
Chromium	400	348	87	(85-115)
Nickel	1000	901	90	(85-115)
Silicon	10000	8770	88	(85-115)
Zinc	1000	907	91	(85-115)

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [MXX29985]
Blank Spike Lab ID: 1337793
Date Analyzed: 07/26/2016 16:41

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL

Batch Information

Analytical Batch: **MMS9461**
Analytical Method: **EP200.8**
Instrument: **Perkin Elmer Nexlon P5**
Analyst: **VDL**

Prep Batch: **MXX29985**
Prep Method: **E200.2**
Prep Date/Time: **07/21/2016 11:05**
Spike Init Wt./Vol.: 1000 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

Analytical Batch: **MMS9463**
Analytical Method: **EP200.8**
Instrument: **Perkin Elmer Nexlon P5**
Analyst: **VDL**

Prep Batch: **MXX29985**
Prep Method: **E200.2**
Prep Date/Time: **07/21/2016 11:05**
Spike Init Wt./Vol.: 400 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1337794
MS Sample ID: 1337795 MS
MSD Sample ID:

Analysis Date: 07/23/2016 18:20
Analysis Date: 07/23/2016 18:29
Analysis Date:
Matrix: Drinking Water

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Aluminum	10.0U	1000	977	98				70-130		
Antimony	0.500U	1000	997	100				70-130		
Arsenic	3.66J	1000	1010	101				70-130		
Barium	17.0	1000	1010	99				70-130		
Beryllium	0.200U	100	108	108				70-130		
Cadmium	0.250U	100	101	101				70-130		
Calcium	44300	10000	52400	81				70-130		
Chromium	2.56	400	393	98				70-130		
Cobalt	2.00U	500	505	101				70-130		
Copper	192	1000	1200	101				70-130		
Iron	125U	5000	5070	101				70-130		
Lead	6.59	1000	1000	100				70-130		
Magnesium	5460	10000	15100	96				70-130		
Manganese	2.38	500	509	101				70-130		
Molybdenum	1.00U	400	407	102				70-130		
Nickel	5.79	1000	1030	103				70-130		
Phosphorus	100U	500	511	102				70-130		
Potassium	1280	10000	11200	99				70-130		
Selenium	2.50U	1000	1070	107				70-130		
Silver	0.500U	100	106	106				70-130		
Sodium	2570	10000	12500	100				70-130		
Thallium	0.500U	10.0	9.96	100				70-130		
Tin	0.500U	100	100	100				70-130		
Titanium	12.5U	100	104	104				70-130		
Zinc	36.5	1000	1050	101				70-130		
Silicon	5240	10000	15000	97				70-130		

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Matrix Spike Summary

Original Sample ID: 1337794
MS Sample ID: 1337795 MS
MSD Sample ID:

Analysis Date: 07/26/2016 16:44
Analysis Date: 07/26/2016 16:47
Analysis Date:
Matrix: Drinking Water

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL

Batch Information

Analytical Batch: MMS9461
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: VDL
Analytical Date/Time: 7/23/2016 6:29:36PM

Prep Batch: MXX29985
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 7/21/2016 11:05:47AM
Prep Initial Wt./Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Analytical Batch: MMS9463
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: VDL
Analytical Date/Time: 7/26/2016 4:47:27PM

Prep Batch: MXX29985
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 7/21/2016 11:05:47AM
Prep Initial Wt./Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Print Date: 08/05/2016 4:16:28PM

Matrix Spike Summary

Original Sample ID: 1338413
MS Sample ID: 1338414 MS
MSD Sample ID:

Analysis Date: 07/23/2016 19:05
Analysis Date: 07/23/2016 19:08
Analysis Date:
Matrix: Drinking Water

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Aluminum	6.53J	1000	947	94				70-130		
Antimony	0.500U	1000	958	96				70-130		
Arsenic	2.50U	1000	1010	101				70-130		
Barium	72.6	1000	1020	94				70-130		
Beryllium	0.200U	100	104	104				70-130		
Cadmium	0.250U	100	98	98				70-130		
Calcium	71400	10000	79300	79				70-130		
Chromium	1.00U	400	382	96				70-130		
Cobalt	2.00U	500	491	98				70-130		
Copper	1.81	1000	979	98				70-130		
Iron	157J	5000	5230	101				70-130		
Lead	5.77	1000	969	96				70-130		
Magnesium	33600	10000	42000	83				70-130		
Manganese	25.6	500	535	102				70-130		
Molybdenum	1.00U	400	412	103				70-130		
Nickel	3.17	1000	1000	100				70-130		
Phosphorus	100U	500	511	102				70-130		
Potassium	1220	10000	11200	100				70-130		
Selenium	2.50U	1000	1030	103				70-130		
Silicon	4140	10000	13600	95				70-130		
Silver	0.500U	100	104	104				70-130		
Sodium	5150	10000	14800	96				70-130		
Thallium	0.500U	10.0	9.94	99				70-130		
Tin	0.500U	100	96.5	97				70-130		
Titanium	12.5U	100	99.4	99				70-130		
Zinc	1060	1000	2010	95				70-130		

Batch Information

Analytical Batch: MMS9461
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: VDL
Analytical Date/Time: 7/23/2016 7:08:29PM

Prep Batch: MXX29985
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 7/21/2016 11:05:47AM
Prep Initial Wt./Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Print Date: 08/05/2016 4:16:28PM

Method Blank

Blank ID: MB for HBN 1740564 [MXX/30034]
Blank Lab ID: 1340479

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

Parameter	Results	LOQ/CL	DL	Units
Nickel	1.00U	2.00	0.620	ug/L
Vanadium	10.0U	20.0	6.20	ug/L
Zinc	2.50U	5.00	2.50	ug/L

Batch Information

Analytical Batch: MMS9478
Analytical Method: EP200.8
Instrument: Perkin Elmer NexIon P5
Analyst: VDL
Analytical Date/Time: 8/3/2016 6:42:18PM

Prep Batch: MXX30034
Prep Method: E200.2
Prep Date/Time: 7/29/2016 9:34:55AM
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [MXX30034]
Blank Spike Lab ID: 1340480
Date Analyzed: 08/03/2016 18:45

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Nickel	1000	1110	111	(85-115)
Vanadium	200	220	110	(85-115)
Zinc	1000	1140	114	(85-115)

Batch Information

Analytical Batch: **MMS9478**
Analytical Method: **EP200.8**
Instrument: **Perkin Elmer Nexlon P5**
Analyst: **VDL**

Prep Batch: **MXX30034**
Prep Method: **E200.2**
Prep Date/Time: **07/29/2016 09:34**
Spike Init Wt./Vol.: 1000 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1340481
MS Sample ID: 1340482 MS
MSD Sample ID:

Analysis Date: 08/02/2016 19:09
Analysis Date: 08/02/2016 19:12
Analysis Date:
Matrix: Drinking Water

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Nickel	35.7	1000	1010	98				70-130		
Vanadium	10.0U	200	198	99				70-130		
Zinc	579	1000	1540	96				70-130		

Batch Information

Analytical Batch: MMS9475
Analytical Method: EP200.8
Instrument: Perkin Elmer NexIon P5
Analyst: VDL
Analytical Date/Time: 8/2/2016 7:12:53PM

Prep Batch: MXX30034
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 7/29/2016 9:34:55AM
Prep Initial Wt./Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Print Date: 08/05/2016 4:16:32PM

Matrix Spike Summary

Original Sample ID: 1340483
MS Sample ID: 1340484 MS
MSD Sample ID:

Analysis Date: 08/02/2016 19:48
Analysis Date: 08/02/2016 19:51
Analysis Date:
Matrix: Drinking Water

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP200.8**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Nickel	1.00U	1000	1080	108				70-130		
Vanadium	10.0U	200	215	108				70-130		
Zinc	30.9	1000	1140	110				70-130		

Batch Information

Analytical Batch: MMS9475
Analytical Method: EP200.8
Instrument: Perkin Elmer NexIon P5
Analyst: VDL
Analytical Date/Time: 8/2/2016 7:51:45PM

Prep Batch: MXX30034
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 7/29/2016 9:34:55AM
Prep Initial Wt./Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Print Date: 08/05/2016 4:16:32PM

Method Blank

Blank ID: MB for HBN 1740911 [MXX/30051]
Blank Lab ID: 1341736

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP245.1**

Parameter	Results	LOQ/CL	DL	Units
Mercury	0.100U	0.200	0.0620	ug/L

Batch Information

Analytical Batch: MCV5727
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 8/1/2016 7:06:26PM

Prep Batch: MXX30051
Prep Method: METHOD
Prep Date/Time: 8/1/2016 3:20:00PM
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [MXX30051]
Blank Spike Lab ID: 1341737
Date Analyzed: 08/01/2016 19:09

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP245.1**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Mercury	4	4.04	101	(85-115)

Batch Information

Analytical Batch: **MCV5727**
Analytical Method: **EP245.1**
Instrument: **PSA Millennium mercury AA**
Analyst: **NEG**

Prep Batch: **MXX30051**
Prep Method: **METHOD**
Prep Date/Time: **08/01/2016 15:20**
Spike Init Wt./Vol.: 4 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1164201001
MS Sample ID: 1341738 MS
MSD Sample ID:

Analysis Date: 08/01/2016 19:27
Analysis Date: 08/01/2016 19:30
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP245.1**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Mercury	0.200U	8.00	7.92	99				70-130		

Batch Information

Analytical Batch: MCV5727
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 8/1/2016 7:30:00PM

Prep Batch: MXX30051
Prep Method: Digestion Mercury 245.1 (W)
Prep Date/Time: 8/1/2016 3:20:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 50.00mL

Print Date: 08/05/2016 4:16:35PM

Matrix Spike Summary

Original Sample ID: 1168319004
MS Sample ID: 1341739 MS
MSD Sample ID:

Analysis Date: 08/01/2016 19:56
Analysis Date: 08/01/2016 19:59
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EP245.1**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Mercury	0.100U	8.00	7.92	99				70-130		

Batch Information

Analytical Batch: MCV5727
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 8/1/2016 7:59:20PM

Prep Batch: MXX30051
Prep Method: Digestion Mercury 245.1 (W)
Prep Date/Time: 8/1/2016 3:20:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 50.00mL

Print Date: 08/05/2016 4:16:35PM

Method Blank

Blank ID: MB for HBN 1739830 [WTC/2614]
Blank Lab ID: 1338580

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM 5310B**

Parameter	Results	LOQ/CL	DL	Units
Total Organic Carbon	0.250U	0.500	0.150	mg/L

Batch Information

Analytical Batch: WTC2614
Analytical Method: SM 5310B
Instrument: TOC Analyzer
Analyst: VDL
Analytical Date/Time: 7/21/2016 10:11:03AM

Print Date: 08/05/2016 4:16:36PM

Method Blank

Blank ID: MB for HBN 1739830 [WTC/2614]
Blank Lab ID: 1338714

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM 5310B**

Parameter	Results	LOQ/CL	DL	Units
Total Organic Carbon	0.250U	0.500	0.150	mg/L

Batch Information

Analytical Batch: WTC2614
Analytical Method: SM 5310B
Instrument: TOC Analyzer
Analyst: VDL
Analytical Date/Time: 7/21/2016 4:29:30PM

Print Date: 08/05/2016 4:16:36PM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [WTC2614]
Blank Spike Lab ID: 1338578
Date Analyzed: 07/21/2016 09:57

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM 5310B**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Total Organic Carbon	75	78.0	104	(80-120)

Batch Information

Analytical Batch: **WTC2614**
Analytical Method: **SM 5310B**
Instrument: **TOC Analyzer**
Analyst: **VDL**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 75 mg/L Extract Vol: 30 mL
Dupe Init Wt./Vol.: Extract Vol:

Print Date: 08/05/2016 4:16:37PM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [WTC2614]
Blank Spike Lab ID: 1338713
Date Analyzed: 07/21/2016 16:16

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM 5310B**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Total Organic Carbon	75	77.2	103	(80-120)

Batch Information

Analytical Batch: **WTC2614**
Analytical Method: **SM 5310B**
Instrument: **TOC Analyzer**
Analyst: **VDL**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 75 mg/L Extract Vol: 30 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1168242013
MS Sample ID: 1338581 MS
MSD Sample ID: 1338582 MSD

Analysis Date: 07/21/2016 10:26
Analysis Date: 07/21/2016 10:41
Analysis Date: 07/21/2016 10:55
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM 5310B**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Organic Carbon	1.60	10.0	11.6	100	10.0	11.3	97	75-125	3.00	(< 25)

Batch Information

Analytical Batch: WTC2614
Analytical Method: SM 5310B
Instrument: TOC Analyzer
Analyst: VDL
Analytical Date/Time: 7/21/2016 10:41:41AM

Prep Batch:
Prep Method:
Prep Date/Time:
Prep Initial Wt./Vol.: 30.00mL
Prep Extract Vol: 30.00mL

Print Date: 08/05/2016 4:16:38PM

Matrix Spike Summary

Original Sample ID: 1338668
MS Sample ID: 1338671 MS
MSD Sample ID: 1338672 MSD

Analysis Date: 07/21/2016 16:44
Analysis Date: 07/21/2016 16:58
Analysis Date: 07/21/2016 17:11
Matrix: Drinking Water

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM 5310B**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Organic Carbon	2.22	10.0	12.6	103	10.0	12.6	104	75-125	0.32	(< 25)

Batch Information

Analytical Batch: WTC2614
Analytical Method: SM 5310B
Instrument: TOC Analyzer
Analyst: VDL
Analytical Date/Time: 7/21/2016 4:58:12PM

Prep Batch:
Prep Method:
Prep Date/Time:
Prep Initial Wt./Vol.: 30.00mL
Prep Extract Vol: 30.00mL

Print Date: 08/05/2016 4:16:38PM

Method Blank

Blank ID: MB for HBN 1739833 [WTI/4486]
Blank Lab ID: 1338591

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 2320B**

Parameter	Results	LOQ/CL	DL	Units
Alkalinity	5.00U	10.0	3.10	mg/L

Batch Information

Analytical Batch: WTI4486
Analytical Method: SM21 2320B
Instrument: Titration
Analyst: ACF
Analytical Date/Time: 7/20/2016 4:37:09PM

Print Date: 08/05/2016 4:16:39PM

Method Blank

Blank ID: MB for HBN 1739833 [WTI/4486]
Blank Lab ID: 1338595

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 2320B**

Parameter	Results	LOQ/CL	DL	Units
Alkalinity	5.00U	10.0	3.10	mg/L

Batch Information

Analytical Batch: WTI4486
Analytical Method: SM21 2320B
Instrument: Titration
Analyst: ACF
Analytical Date/Time: 7/20/2016 7:46:43PM

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Duplicate Sample Summary

Original Sample ID: 1168280001
Duplicate Sample ID: 1338593

Analysis Date: 07/20/2016 20:08
Matrix: Water (Surface, Eff., Ground)

QC for Samples:

1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 2320B**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Alkalinity	ND	5.00U	mg/L	0.00	(< 25)

Batch Information

Analytical Batch: WTI4486
Analytical Method: SM21 2320B
Instrument: Titration
Analyst: ACF

Print Date: 08/05/2016 4:16:40PM

Duplicate Sample Summary

Original Sample ID: 1163963001
Duplicate Sample ID: 1338597
QC for Samples:

Analysis Date: 07/20/2016 16:59
Matrix: Drinking Water

Results by **SM21 2320B**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Alkalinity	106	105	mg/L	0.27	(< 25)

Batch Information

Analytical Batch: WTI4486
Analytical Method: SM21 2320B
Instrument: Titration
Analyst: ACF

Print Date: 08/05/2016 4:16:40PM

Duplicate Sample Summary

Original Sample ID: 1163942001
Duplicate Sample ID: 1338598
Analysis Date: 07/20/2016 17:12
Matrix: Water (Surface, Eff., Ground)

QC for Samples:

1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 2320B**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Alkalinity	12.3	12.6	mg/L	2.40	(< 25)

Batch Information

Analytical Batch: WTI4486
Analytical Method: SM21 2320B
Instrument: Titration
Analyst: ACF

Print Date: 08/05/2016 4:16:40PM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [WTI4486]
Blank Spike Lab ID: 1338592
Date Analyzed: 07/20/2016 16:43

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 2320B**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Alkalinity	250	253	101	(85-115)

Batch Information

Analytical Batch: **WTI4486**
Analytical Method: **SM21 2320B**
Instrument: **Titration**
Analyst: **ACF**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 250 mg/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [WTI4486]
Blank Spike Lab ID: 1338596
Date Analyzed: 07/20/2016 19:53

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 2320B**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Alkalinity	250	240	96	(85-115)

Batch Information

Analytical Batch: **WTI4486**
Analytical Method: **SM21 2320B**
Instrument: **Titration**
Analyst: **ACF**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 250 mg/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

Print Date: 08/05/2016 4:16:41PM

Method Blank

Blank ID: MB for HBN 1739709 [WXX/11560]
Blank Lab ID: 1338205

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EPA 300.0**

Parameter	Results	LOQ/CL	DL	Units
Nitrate-N	0.100U	0.200	0.0620	mg/L
Nitrite-N	0.100U	0.200	0.0620	mg/L
Total Nitrate/Nitrite-N	0.100U	0.200	0.0620	mg/L

Batch Information

Analytical Batch: WIC5554
Analytical Method: EPA 300.0
Instrument: Metrohm 733 DX2
Analyst: ACF
Analytical Date/Time: 7/19/2016 2:01:07PM

Prep Batch: WXX11560
Prep Method: METHOD
Prep Date/Time: 7/19/2016 11:55:00AM
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [WXX11560]
Blank Spike Lab ID: 1338206
Date Analyzed: 07/19/2016 14:23

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EPA 300.0**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Nitrate-N	5	5.10	102	(90-110)
Nitrite-N	5	5.09	102	(90-110)
Total Nitrate/Nitrite-N	10	10.2	102	(90-110)

Batch Information

Analytical Batch: **WIC5554**
Analytical Method: **EPA 300.0**
Instrument: **Metrohm 733 DX2**
Analyst: **ACF**

Prep Batch: **WXX11560**
Prep Method: **METHOD**
Prep Date/Time: **07/19/2016 11:55**
Spike Init Wt./Vol.: 5 mg/L Extract Vol: 10 mL
Dupe Init Wt./Vol.: Extract Vol:

Print Date: 08/05/2016 4:16:43PM

Matrix Spike Summary

Original Sample ID: 1163988001
MS Sample ID: 1338207 MS
MSD Sample ID: 1338208 MSD

Analysis Date: 07/19/2016 14:45
Analysis Date: 07/19/2016 15:07
Analysis Date: 07/19/2016 15:30
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **EPA 300.0**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Nitrate-N	0.100U	5.00	5.13	103	5.00	5.18	104	90-110	0.89	(< 15)
Nitrite-N	0.100U	5.00	5.17	103	5.00	5.07	101	90-110	1.90	(< 15)

Batch Information

Analytical Batch: WIC5554
Analytical Method: EPA 300.0
Instrument: Metrohm 733 DX2
Analyst: ACF
Analytical Date/Time: 7/19/2016 3:07:57PM

Prep Batch: WXX11560
Prep Method: EPA 300.0 Extraction Waters/Liquids
Prep Date/Time: 7/19/2016 11:55:00AM
Prep Initial Wt./Vol.: 10.00mL
Prep Extract Vol: 10.00mL

Print Date: 08/05/2016 4:16:45PM

Method Blank

Blank ID: MB for HBN 1740025 [WXX/11567]
Blank Lab ID: 1339183

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 4500-NH3 G**

Parameter	Results	LOQ/CL	DL	Units
Ammonia-N	0.0500U	0.100	0.0310	mg/L

Batch Information

Analytical Batch: WDA3818
Analytical Method: SM21 4500-NH3 G
Instrument: Discrete Analyzer 2
Analyst: NEG
Analytical Date/Time: 7/20/2016 12:56:39PM

Prep Batch: WXX11567
Prep Method: METHOD
Prep Date/Time: 7/20/2016 12:30:00PM
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [WXX11567]
Blank Spike Lab ID: 1339184
Date Analyzed: 07/20/2016 12:58

Spike Duplicate ID: LCSD for HBN 1163988 [WXX11567]
Spike Duplicate Lab ID: 1339185
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 4500-NH3 G**

	Blank Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Ammonia-N	1	0.931	93	1	0.935	94	(75-125)	0.41	(< 25)

Batch Information

Analytical Batch: **WDA3818**
Analytical Method: **SM21 4500-NH3 G**
Instrument: **Discrete Analyzer 2**
Analyst: **NEG**

Prep Batch: **WXX11567**
Prep Method: **METHOD**
Prep Date/Time: **07/20/2016 12:30**
Spike Init Wt./Vol.: 1 mg/L Extract Vol: 6 mL
Dupe Init Wt./Vol.: 1 mg/L Extract Vol: 6 mL

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Matrix Spike Summary

Original Sample ID: 1163955001
MS Sample ID: 1339186 MS
MSD Sample ID: 1339187 MSD

Analysis Date: 07/20/2016 14:06
Analysis Date: 07/20/2016 14:08
Analysis Date: 07/20/2016 14:09
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 4500-NH3 G**

		Matrix Spike (mg/L)				Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)		Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Ammonia-N	34.9	1.00	35.2	28	*	1.00	35.7	75	75-125	1.30	(< 25)

Batch Information

Analytical Batch: WDA3818
Analytical Method: SM21 4500-NH3 G
Instrument: Discrete Analyzer 2
Analyst: NEG
Analytical Date/Time: 7/20/2016 2:08:19PM

Prep Batch: WXX11567
Prep Method: Ammonia by SM21 4500F prep (W)
Prep Date/Time: 7/20/2016 12:30:00PM
Prep Initial Wt./Vol.: 6.00mL
Prep Extract Vol: 6.00mL

Print Date: 08/05/2016 4:16:49PM

Method Blank

Blank ID: MB for HBN 1740223 [WXX/11570]
Blank Lab ID: 1339718

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 4500P-B,E**

Parameter	Results	LOQ/CL	DL	Units
Total Phosphorus	0.00580J	0.0100	0.00310	mg/L

Batch Information

Analytical Batch: WDA3826
Analytical Method: SM21 4500P-B,E
Instrument: Discrete Analyzer 2
Analyst: NEG
Analytical Date/Time: 7/28/2016 12:46:00PM

Prep Batch: WXX11570
Prep Method: SM21 4500P-B,E
Prep Date/Time: 7/26/2016 2:30:00PM
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Blank Spike Summary

Blank Spike ID: LCS for HBN 1163988 [WXX11570]
Blank Spike Lab ID: 1339719
Date Analyzed: 07/28/2016 12:47

Spike Duplicate ID: LCSD for HBN 1163988 [WXX11570]
Spike Duplicate Lab ID: 1339720
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 4500P-B,E**

	Blank Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Phosphorus	0.2	0.218	109	0.2	0.202	101	(75-125)	7.80	(< 25)

Batch Information

Analytical Batch: **WDA3826**
Analytical Method: **SM21 4500P-B,E**
Instrument: **Discrete Analyzer 2**
Analyst: **NEG**

Prep Batch: **WXX11570**
Prep Method: **SM21 4500P-B,E**
Prep Date/Time: **07/26/2016 14:30**
Spike Init Wt./Vol.: 0.2 mg/L Extract Vol: 25 mL
Dupe Init Wt./Vol.: 0.2 mg/L Extract Vol: 25 mL

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Matrix Spike Summary

Original Sample ID: 1340822
MS Sample ID: 1339721 MS
MSD Sample ID: 1339722 MSD

Analysis Date: 07/28/2016 13:46
Analysis Date: 07/28/2016 13:46
Analysis Date: 07/28/2016 13:47
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1163988001, 1163988002, 1163988003, 1163988004, 1163988005

Results by **SM21 4500P-B,E**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Phosphorus	1.60	0.200	1.82	112	0.200	1.84	121	75-125	0.98	(< 25)

Batch Information

Analytical Batch: WDA3826
Analytical Method: SM21 4500P-B,E
Instrument: Discrete Analyzer 2
Analyst: NEG
Analytical Date/Time: 7/28/2016 1:46:53PM

Prep Batch: WXX11570
Prep Method: Total Phosphorus (W) Ext.
Prep Date/Time: 7/26/2016 2:30:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 25.00mL

Print Date: 08/05/2016 4:16:52PM

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CHAIN OF CUSTODY RECORD

1163988

Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.

Section 1

CLIENT: ADEC Water Quality

CONTACT: Laura Eldred PHONE NO: 376-1855

PROJECT NAME: Willow Creek PROJECT/ PWSID/ PERMIT#:

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INVOICE TO: diann.douglas@alaska.gov QUOTE #:

P.O. #: CT180001889

Section 2

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	Section 3 # CONTAINERS	Type C = COMP G = GRAB MI = Multi Incremental Soils	Preservative: dissolved metals + mercury	Alkalinity	NO2/NO3 Combo	NH3 and T-phos	DOC	REMARKS/ LOC ID
(1) A-B	Willow 01	7/18/16	09:40	W	5	G	X	X	X	X	X	
(2) A-B	Willow 02		10:47		5		X	X	X	X	X	
(3) A-B	Willow 03		11:38		5		X	X	X	X	X	
(4) A-B	Willow 04		12:53		5		X	X	X	X	X	
(5) A-B	Willow03Rep		11:42		5		X	X	X	X	X	

Section 5

	Date	Time	
Relinquished By: (1)	7/18/16	13:19	Received By:
Relinquished By: (2)			Received By:
Relinquished By: (3)			Received By:
Relinquished By: (4)	7/18/16	15:16	Received For Laboratory By:

Section 4

DOD Project? Yes (No)

Cooler ID:

Data Deliverable Requirements: Level 2 EDD

Requested Turnaround Time and/or Special Instructions:

Temp Blank °C: 4.8 #286 or Ambient [ ]

(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle) INTACT BROKEN (ABSENT)

(See attached Sample Receipt Form)

Hand delivered

[X] 200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
[ ] 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

SGS

e-SAMPLE RECEIPT FORM

1163988

Review Criteria	Y/N (yes/no)	Exceptions Noted below
		exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location		Absent
COC accompanied samples?	Y	
**exemption permitted if chilled & collected <8hrs ago or chlling not required (i e., waste, oil)		
Temperature blank compliant* (i.e., 0-6 °C after CF)?	Y	Cooler ID: 1 @ 4.8 °C Therm ID: 238
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
*If >6°C, were samples collected <8 hours ago?	Y	
If <0°C, were sample containers ice free?	Y	
If samples received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".		
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
		Note: Refer to form F-083 "Sample Guide" for hold times.
Were samples received within hold time?	Y	
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	Y	
**Note: If times differ <1hr, record details & login per COC.		
Were analyses requested unambiguous?	Y	
		***Exemption permitted for metals (e.g 200.8/6020A).
Were proper containers (type/mass/volume/preservative***)used?	Y	
IF APPLICABLE		
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?	Y	
Were all VOA vials free of headspace (i.e., bubbles ≤ 6mm)?	Y	
Were all soil VOAs field extracted with MeOH+BFB?	Y	

Note to Client: Any "no" answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1163988001-A	No Preservative Required	OK			
1163988001-B	HNO3 to pH < 2	OK			
1163988001-C	No Preservative Required	OK			
1163988001-D	No Preservative Required	OK			
1163988001-E	H2SO4 to pH < 2	OK			
1163988001-F	No Preservative Required	OK			
1163988001-G	HCL to pH < 2	OK			
1163988002-A	No Preservative Required	OK			
1163988002-B	HNO3 to pH < 2	OK			
1163988002-C	No Preservative Required	OK			
1163988002-D	No Preservative Required	OK			
1163988002-E	H2SO4 to pH < 2	OK			
1163988002-F	No Preservative Required	OK			
1163988002-G	HCL to pH < 2	OK			
1163988003-A	No Preservative Required	OK			
1163988003-B	HNO3 to pH < 2	OK			
1163988003-C	No Preservative Required	OK			
1163988003-D	No Preservative Required	OK			
1163988003-E	H2SO4 to pH < 2	OK			
1163988003-F	No Preservative Required	OK			
1163988003-G	HCL to pH < 2	OK			
1163988004-A	No Preservative Required	OK			
1163988004-B	HNO3 to pH < 2	OK			
1163988004-C	No Preservative Required	OK			
1163988004-D	No Preservative Required	OK			
1163988004-E	H2SO4 to pH < 2	OK			
1163988004-F	No Preservative Required	OK			
1163988004-G	HCL to pH < 2	OK			
1163988005-A	No Preservative Required	OK			
1163988005-B	HNO3 to pH < 2	OK			
1163988005-C	No Preservative Required	OK			
1163988005-D	No Preservative Required	OK			
1163988005-E	H2SO4 to pH < 2	OK			
1163988005-F	No Preservative Required	OK			
1163988005-G	HCL to pH < 2	OK			

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM- The container was received damaged.
FR- The container was received frozen and not usable for Bacteria or BOD analyses.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

Laboratory Report of Analysis

To: ADEC-Air & Water Quality
1700 E. Bogard Rd Bldg B, Suite 103
Wasilla, AK 99654

Report Number: **1165628**

Client Project: **Willow Creek**

Dear Laura Eldred,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Forest at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Forest Taylor Date
Project Manager
Forest.Taylor@sgs.com

Print Date: 10/13/2016 3:36:14PM

Case Narrative

SGS Client: **ADEC-Air & Water Quality**
SGS Project: **1165628**
Project Name/Site: **Willow Creek**
Project Contact: **Laura Eldred**

Refer to sample receipt form for information on sample condition.

1165611001MS (1354427) MS

4500NO3-F - Nitrate/Nitrite - MS recovery is outside of QC criteria. Refer to LCS for accuracy requirements.

1165611001MSD (1354428) MSD

4500NO3-F - Nitrate/Nitrite - MSD recovery is outside of QC criteria. Refer to LCS for accuracy requirements.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8021B, 8082A, 8260B, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

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Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
Willow01	1165628001	09/21/2016	09/21/2016	Water (Surface, Eff., Ground)
Willow02	1165628002	09/21/2016	09/21/2016	Water (Surface, Eff., Ground)
Willow03	1165628003	09/21/2016	09/21/2016	Water (Surface, Eff., Ground)
Willow04	1165628004	09/21/2016	09/21/2016	Water (Surface, Eff., Ground)
Willow03 rep	1165628005	09/21/2016	09/21/2016	Water (Surface, Eff., Ground)

Method	Method Description
SM21 2320B	Alkalinity as CaCO3 QC
SM21 4500-NH3 G	Ammonia-N (W) SM21 4500-NH3 G
SM21 2340B	Dissolved Hardness as CaCO3 ICP-MS
SM 5310B	Dissolved Organic Carbon
SM21 4500NO3-F	Flow Injection Analysis
EP245.1	Mercury EPA 245.1 DISSOLVED
EP200.8	Metals in Drinking Water by ICP-MS DISSO
SM21 4500P-B,E	Total Phosphorus (W)

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Detectable Results Summary

Client Sample ID: **Willow01**
Lab Sample ID: 1165628001

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	61.7	ug/L
	Arsenic	1.54J	ug/L
	Barium	13.9	ug/L
	Calcium	8850	ug/L
	Copper	0.645J	ug/L
	Hardness as CaCO3	33.0	mg/L
	Iron	112J	ug/L
	Magnesium	2660	ug/L
	Manganese	7.27	ug/L
	Potassium	530	ug/L
	Silicon	3250	ug/L
	Sodium	3370	ug/L
Waters Department	A kalinity	28.0	mg/L
	Total Organic Carbon,Dissolved	1.27	mg/L
	Total Phosphorus	0.0169	mg/L

Client Sample ID: **Willow02**
Lab Sample ID: 1165628002

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	49.4	ug/L
	Barium	8.81	ug/L
	Calcium	6010	ug/L
	Copper	0.748J	ug/L
	Hardness as CaCO3	21.3	mg/L
	Iron	93.2J	ug/L
	Magnesium	1530	ug/L
	Manganese	5.06	ug/L
	Potassium	605	ug/L
	Silicon	3550	ug/L
	Sodium	2530	ug/L
Waters Department	A kalinity	22.6	mg/L
	Nitrate-N	0.0308J	mg/L
	Total Organic Carbon,Dissolved	1.61	mg/L
	Total Phosphorus	0.00770J	mg/L

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Detectable Results Summary

Client Sample ID: **Willow03**
Lab Sample ID: 1165628003

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	80.8	ug/L
	Barium	10.2	ug/L
	Calcium	7240	ug/L
	Copper	0.902J	ug/L
	Hardness as CaCO3	25.1	mg/L
	Iron	275	ug/L
	Magnesium	1700	ug/L
	Manganese	20.3	ug/L
	Potassium	696	ug/L
	Silicon	4160	ug/L
	Sodium	4050	ug/L
	Titanium	3.27J	ug/L
Waters Department	A kalinity	24.4	mg/L
	Total Organic Carbon,Dissolved	2.26	mg/L
	Total Phosphorus	0.0136	mg/L

Client Sample ID: **Willow04**
Lab Sample ID: 1165628004

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	86.0	ug/L
	Barium	11.4	ug/L
	Calcium	7660	ug/L
	Copper	1.00	ug/L
	Hardness as CaCO3	26.2	mg/L
	Iron	470	ug/L
	Magnesium	1720	ug/L
	Manganese	30.8	ug/L
	Nickel	0.788J	ug/L
	Potassium	711	ug/L
	Silicon	4330	ug/L
	Sodium	4090	ug/L
	Titanium	3.57J	ug/L
Waters Department	A kalinity	25.8	mg/L
	Nitrate-N	0.0426J	mg/L
	Total Organic Carbon,Dissolved	2.25	mg/L
	Total Phosphorus	0.0183	mg/L

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Detectable Results Summary

Client Sample ID: **Willow03 rep**
Lab Sample ID: 1165628005

	Parameter	Result	Units
Dissolved Metals by ICP/MS	Aluminum	73.1	ug/L
	Barium	9.95	ug/L
	Calcium	6990	ug/L
	Copper	0.847J	ug/L
	Hardness as CaCO3	24.2	mg/L
	Iron	277	ug/L
	Magnesium	1650	ug/L
	Manganese	20.1	ug/L
	Potassium	661	ug/L
	Silicon	4060	ug/L
	Sodium	3880	ug/L
Waters Department	A kalinity	24.5	mg/L
	Total Organic Carbon,Dissolved	2.32	mg/L
	Total Phosphorus	0.0176	mg/L

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Results of **Willow01**

Client Sample ID: **Willow01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628001
Lab Project ID: 1165628

Collection Date: 09/21/16 10:18
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		09/30/16 13:22

Batch Information

Analytical Batch: MCV5741
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 09/30/16 13:22
Container ID: 1165628001-G

Prep Batch: MXX30242
Prep Method: METHOD
Prep Date/Time: 09/29/16 14:56
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

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Results of **Willow01**

Client Sample ID: **Willow01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628001
Lab Project ID: 1165628

Collection Date: 09/21/16 10:18
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	61.7		20.0	6.20	ug/L	1		09/27/16 17:24
Antimony	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:24
Arsenic	1.54 J		5.00	1.50	ug/L	1		09/27/16 17:24
Barium	13.9		3.00	0.940	ug/L	1		09/27/16 17:24
Beryllium	0.200 U		0.400	0.130	ug/L	1		09/27/16 17:24
Cadmium	0.250 U		0.500	0.150	ug/L	1		09/27/16 17:24
Calcium	8850		500	150	ug/L	1		09/27/16 17:24
Chromium	1.00 U		2.00	0.620	ug/L	1		09/27/16 17:24
Cobalt	2.00 U		4.00	1.20	ug/L	1		09/27/16 17:24
Copper	0.645 J		1.00	0.310	ug/L	1		09/27/16 17:24
Iron	112 J		250	78.0	ug/L	1		09/27/16 17:24
Lead	0.100 U		0.200	0.0620	ug/L	1		09/27/16 17:24
Magnesium	2660		50.0	15.0	ug/L	1		09/27/16 17:24
Manganese	7.27		1.00	0.310	ug/L	1		09/27/16 17:24
Molybdenum	1.00 U		2.00	0.620	ug/L	1		09/27/16 17:24
Nickel	1.00 U		2.00	0.620	ug/L	1		09/27/16 17:24
Phosphorus	100 U		200	62.0	ug/L	1		09/27/16 17:24
Potassium	530		500	150	ug/L	1		09/27/16 17:24
Selenium	2.50 U		5.00	1.50	ug/L	1		09/27/16 17:24
Silicon	3250		1000	310	ug/L	1		09/27/16 17:24
Silver	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:24
Sodium	3370		500	150	ug/L	1		09/27/16 17:24
Thallium	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:24
Tin	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:24
Titanium	3.13 U		6.25	3.13	ug/L	1		09/27/16 17:24
Vanadium	10.0 U		20.0	6.20	ug/L	1		09/27/16 17:24
Zinc	2.50 U		5.00	2.50	ug/L	1		09/27/16 17:24

Batch Information

Analytical Batch: MMS9551
Analytical Method: EP200.8
Analyst: ACF
Analytical Date/Time: 09/27/16 17:24
Container ID: 1165628001-G

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 09/27/16 09:52
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	33.0		5.00	5.00	mg/L	1		09/27/16 17:24

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow01**

Client Sample ID: **Willow01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628001
Lab Project ID: 1165628

Collection Date: 09/21/16 10:18
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9551
Analytical Method: SM21 2340B
Analyst: ACF
Analytical Date/Time: 09/27/16 17:24
Container ID: 1165628001-G

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 09/27/16 09:52
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

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Results of **Willow01**

Client Sample ID: **Willow01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628001
Lab Project ID: 1165628

Collection Date: 09/21/16 10:18
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	1.27		0.500	0.150	mg/L	1		09/27/16 18:29

Batch Information

Analytical Batch: WTC2634
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 09/27/16 18:29
Container ID: 1165628001-F

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	28.0		10.0	3.10	mg/L	1		09/23/16 20:33

Batch Information

Analytical Batch: WTI4519
Analytical Method: SM21 2320B
Analyst: KBE
Analytical Date/Time: 09/23/16 20:33
Container ID: 1165628001-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500 U		0.100	0.0310	mg/L	1		09/29/16 13:44

Batch Information

Analytical Batch: WDA3863
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 09/29/16 13:44
Container ID: 1165628001-D

Prep Batch: WXX11639
Prep Method: METHOD
Prep Date/Time: 09/29/16 13:00
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.0500 U		0.100	0.0300	mg/L	2		09/21/16 17:39
Nitrite-N	0.0500 U		0.100	0.0300	mg/L	2		09/21/16 17:39

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow01**

Client Sample ID: **Willow01**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628001
Lab Project ID: 1165628

Collection Date: 09/21/16 10:18
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WFI2505
Analytical Method: SM21 4500NO3-F
Analyst: KBE
Analytical Date/Time: 09/21/16 17:39
Container ID: 1165628001-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.0169		0.0100	0.00310	mg/L	1		10/12/16 17:44

Batch Information

Analytical Batch: WDA3870
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 10/12/16 17:44
Container ID: 1165628001-D

Prep Batch: WXX11653
Prep Method: SM21 4500P-B,E
Prep Date/Time: 10/07/16 16:15
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

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Results of **Willow02**

Client Sample ID: **Willow02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628002
Lab Project ID: 1165628

Collection Date: 09/21/16 11:12
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		09/30/16 13:25

Batch Information

Analytical Batch: MCV5741
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 09/30/16 13:25
Container ID: 1165628002-G

Prep Batch: MXX30242
Prep Method: METHOD
Prep Date/Time: 09/29/16 14:56
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow02**

Client Sample ID: **Willow02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628002
Lab Project ID: 1165628

Collection Date: 09/21/16 11:12
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	49.4		20.0	6.20	ug/L	1		09/27/16 17:27
Antimony	0.500	U	1.00	0.310	ug/L	1		09/27/16 17:27
Arsenic	2.50	U	5.00	1.50	ug/L	1		09/27/16 17:27
Barium	8.81		3.00	0.940	ug/L	1		09/27/16 17:27
Beryllium	0.200	U	0.400	0.130	ug/L	1		09/27/16 17:27
Cadmium	0.250	U	0.500	0.150	ug/L	1		09/27/16 17:27
Calcium	6010		500	150	ug/L	1		09/27/16 17:27
Chromium	1.00	U	2.00	0.620	ug/L	1		09/27/16 17:27
Cobalt	2.00	U	4.00	1.20	ug/L	1		09/27/16 17:27
Copper	0.748	J	1.00	0.310	ug/L	1		09/27/16 17:27
Iron	93.2	J	250	78.0	ug/L	1		09/27/16 17:27
Lead	0.100	U	0.200	0.0620	ug/L	1		09/27/16 17:27
Magnesium	1530		50.0	15.0	ug/L	1		09/27/16 17:27
Manganese	5.06		1.00	0.310	ug/L	1		09/27/16 17:27
Molybdenum	1.00	U	2.00	0.620	ug/L	1		09/27/16 17:27
Nickel	1.00	U	2.00	0.620	ug/L	1		09/27/16 17:27
Phosphorus	100	U	200	62.0	ug/L	1		09/27/16 17:27
Potassium	605		500	150	ug/L	1		09/27/16 17:27
Selenium	2.50	U	5.00	1.50	ug/L	1		09/27/16 17:27
Silicon	3550		1000	310	ug/L	1		09/27/16 17:27
Silver	0.500	U	1.00	0.310	ug/L	1		09/27/16 17:27
Sodium	2530		500	150	ug/L	1		09/27/16 17:27
Thallium	0.500	U	1.00	0.310	ug/L	1		09/27/16 17:27
Tin	0.500	U	1.00	0.310	ug/L	1		09/27/16 17:27
Titanium	3.13	U	6.25	3.13	ug/L	1		09/27/16 17:27
Vanadium	10.0	U	20.0	6.20	ug/L	1		09/27/16 17:27
Zinc	2.50	U	5.00	2.50	ug/L	1		09/27/16 17:27

Batch Information

Analytical Batch: MMS9551
Analytical Method: EP200.8
Analyst: ACF
Analytical Date/Time: 09/27/16 17:27
Container ID: 1165628002-G

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 09/27/16 09:52
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	21.3		5.00	5.00	mg/L	1		09/27/16 17:27

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J flagging is activated

Results of **Willow02**

Client Sample ID: **Willow02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628002
Lab Project ID: 1165628

Collection Date: 09/21/16 11:12
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9551
Analytical Method: SM21 2340B
Analyst: ACF
Analytical Date/Time: 09/27/16 17:27
Container ID: 1165628002-G

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 09/27/16 09:52
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

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Results of **Willow02**

Client Sample ID: **Willow02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628002
Lab Project ID: 1165628

Collection Date: 09/21/16 11:12
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	1.61		0.500	0.150	mg/L	1		09/27/16 18:42

Batch Information

Analytical Batch: WTC2634
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 09/27/16 18:42
Container ID: 1165628002-F

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	22.6		10.0	3.10	mg/L	1		09/23/16 20:39

Batch Information

Analytical Batch: WTI4519
Analytical Method: SM21 2320B
Analyst: KBE
Analytical Date/Time: 09/23/16 20:39
Container ID: 1165628002-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500 U		0.100	0.0310	mg/L	1		09/29/16 13:46

Batch Information

Analytical Batch: WDA3863
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 09/29/16 13:46
Container ID: 1165628002-D

Prep Batch: WXX11639
Prep Method: METHOD
Prep Date/Time: 09/29/16 13:00
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.0308 J		0.100	0.0300	mg/L	2		09/21/16 17:41
Nitrite-N	0.0500 U		0.100	0.0300	mg/L	2		09/21/16 17:41

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Results of **Willow02**

Client Sample ID: **Willow02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628002
Lab Project ID: 1165628

Collection Date: 09/21/16 11:12
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WFI2505
Analytical Method: SM21 4500NO3-F
Analyst: KBE
Analytical Date/Time: 09/21/16 17:41
Container ID: 1165628002-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.00770	J	0.0100	0.00310	mg/L	1		10/12/16 17:45

Batch Information

Analytical Batch: WDA3870
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 10/12/16 17:45
Container ID: 1165628002-D

Prep Batch: WXX11653
Prep Method: SM21 4500P-B,E
Prep Date/Time: 10/07/16 16:15
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow03**

Client Sample ID: **Willow03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628003
Lab Project ID: 1165628

Collection Date: 09/21/16 11:55
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		09/30/16 13:28

Batch Information

Analytical Batch: MCV5741
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 09/30/16 13:28
Container ID: 1165628003-G

Prep Batch: MXX30242
Prep Method: METHOD
Prep Date/Time: 09/29/16 14:56
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow03**

Client Sample ID: **Willow03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628003
Lab Project ID: 1165628

Collection Date: 09/21/16 11:55
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	80.8		20.0	6.20	ug/L	1		09/27/16 17:30
Antimony	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:30
Arsenic	2.50 U		5.00	1.50	ug/L	1		09/27/16 17:30
Barium	10.2		3.00	0.940	ug/L	1		09/27/16 17:30
Beryllium	0.200 U		0.400	0.130	ug/L	1		09/27/16 17:30
Cadmium	0.250 U		0.500	0.150	ug/L	1		09/27/16 17:30
Calcium	7240		500	150	ug/L	1		09/27/16 17:30
Chromium	1.00 U		2.00	0.620	ug/L	1		09/27/16 17:30
Cobalt	2.00 U		4.00	1.20	ug/L	1		09/27/16 17:30
Copper	0.902 J		1.00	0.310	ug/L	1		09/27/16 17:30
Iron	275		250	78.0	ug/L	1		09/27/16 17:30
Lead	0.100 U		0.200	0.0620	ug/L	1		09/27/16 17:30
Magnesium	1700		50.0	15.0	ug/L	1		09/27/16 17:30
Manganese	20.3		1.00	0.310	ug/L	1		09/27/16 17:30
Molybdenum	1.00 U		2.00	0.620	ug/L	1		09/27/16 17:30
Nickel	1.00 U		2.00	0.620	ug/L	1		09/27/16 17:30
Phosphorus	100 U		200	62.0	ug/L	1		09/27/16 17:30
Potassium	696		500	150	ug/L	1		09/27/16 17:30
Selenium	2.50 U		5.00	1.50	ug/L	1		09/27/16 17:30
Silicon	4160		1000	310	ug/L	1		09/27/16 17:30
Silver	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:30
Sodium	4050		500	150	ug/L	1		09/27/16 17:30
Thallium	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:30
Tin	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:30
Titanium	3.27 J		6.25	3.13	ug/L	1		09/27/16 17:30
Vanadium	10.0 U		20.0	6.20	ug/L	1		09/27/16 17:30
Zinc	2.50 U		5.00	2.50	ug/L	1		09/27/16 17:30

Batch Information

Analytical Batch: MMS9551
Analytical Method: EP200.8
Analyst: ACF
Analytical Date/Time: 09/27/16 17:30
Container ID: 1165628003-G

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 09/27/16 09:52
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	25.1		5.00	5.00	mg/L	1		09/27/16 17:30

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J flagging is activated

Results of **Willow03**

Client Sample ID: **Willow03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628003
Lab Project ID: 1165628

Collection Date: 09/21/16 11:55
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9551
Analytical Method: SM21 2340B
Analyst: ACF
Analytical Date/Time: 09/27/16 17:30
Container ID: 1165628003-G

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 09/27/16 09:52
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **Willow03**

Client Sample ID: **Willow03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628003
Lab Project ID: 1165628

Collection Date: 09/21/16 11:55
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	2.26		0.500	0.150	mg/L	1		09/27/16 18:56

Batch Information

Analytical Batch: WTC2634
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 09/27/16 18:56
Container ID: 1165628003-F

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	24.4		10.0	3.10	mg/L	1		09/23/16 20:45

Batch Information

Analytical Batch: WTI4519
Analytical Method: SM21 2320B
Analyst: KBE
Analytical Date/Time: 09/23/16 20:45
Container ID: 1165628003-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500 U		0.100	0.0310	mg/L	1		09/29/16 13:47

Batch Information

Analytical Batch: WDA3863
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 09/29/16 13:47
Container ID: 1165628003-D

Prep Batch: WXX11639
Prep Method: METHOD
Prep Date/Time: 09/29/16 13:00
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.0500 U		0.100	0.0300	mg/L	2		09/21/16 17:43
Nitrite-N	0.0500 U		0.100	0.0300	mg/L	2		09/21/16 17:43

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow03**

Client Sample ID: **Willow03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628003
Lab Project ID: 1165628

Collection Date: 09/21/16 11:55
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WFI2505
Analytical Method: SM21 4500NO3-F
Analyst: KBE
Analytical Date/Time: 09/21/16 17:43
Container ID: 1165628003-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.0136		0.0100	0.00310	mg/L	1		10/12/16 17:49

Batch Information

Analytical Batch: WDA3870
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 10/12/16 17:49
Container ID: 1165628003-D

Prep Batch: WXX11653
Prep Method: SM21 4500P-B,E
Prep Date/Time: 10/07/16 16:15
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

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Results of **Willow04**

Client Sample ID: **Willow04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628004
Lab Project ID: 1165628

Collection Date: 09/21/16 13:55
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		09/30/16 13:42

Batch Information

Analytical Batch: MCV5742
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 09/30/16 13:42
Container ID: 1165628004-G

Prep Batch: MXX30243
Prep Method: METHOD
Prep Date/Time: 09/29/16 14:56
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow04**

Client Sample ID: **Willow04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628004
Lab Project ID: 1165628

Collection Date: 09/21/16 13:55
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	86.0		20.0	6.20	ug/L	1		09/27/16 17:33
Antimony	0.500	U	1.00	0.310	ug/L	1		09/27/16 17:33
Arsenic	2.50	U	5.00	1.50	ug/L	1		09/27/16 17:33
Barium	11.4		3.00	0.940	ug/L	1		09/27/16 17:33
Beryllium	0.200	U	0.400	0.130	ug/L	1		09/27/16 17:33
Cadmium	0.250	U	0.500	0.150	ug/L	1		09/27/16 17:33
Calcium	7660		500	150	ug/L	1		09/27/16 17:33
Chromium	1.00	U	2.00	0.620	ug/L	1		09/27/16 17:33
Cobalt	2.00	U	4.00	1.20	ug/L	1		09/27/16 17:33
Copper	1.00		1.00	0.310	ug/L	1		09/27/16 17:33
Iron	470		250	78.0	ug/L	1		09/27/16 17:33
Lead	0.100	U	0.200	0.0620	ug/L	1		09/27/16 17:33
Magnesium	1720		50.0	15.0	ug/L	1		09/27/16 17:33
Manganese	30.8		1.00	0.310	ug/L	1		09/27/16 17:33
Molybdenum	1.00	U	2.00	0.620	ug/L	1		09/27/16 17:33
Nickel	0.788	J	2.00	0.620	ug/L	1		09/27/16 17:33
Phosphorus	100	U	200	62.0	ug/L	1		09/27/16 17:33
Potassium	711		500	150	ug/L	1		09/27/16 17:33
Selenium	2.50	U	5.00	1.50	ug/L	1		09/27/16 17:33
Silicon	4330		1000	310	ug/L	1		09/27/16 17:33
Silver	0.500	U	1.00	0.310	ug/L	1		09/27/16 17:33
Sodium	4090		500	150	ug/L	1		09/27/16 17:33
Thallium	0.500	U	1.00	0.310	ug/L	1		09/27/16 17:33
Tin	0.500	U	1.00	0.310	ug/L	1		09/27/16 17:33
Titanium	3.57	J	6.25	3.13	ug/L	1		09/27/16 17:33
Vanadium	10.0	U	20.0	6.20	ug/L	1		09/27/16 17:33
Zinc	2.50	U	5.00	2.50	ug/L	1		09/27/16 17:33

Batch Information

Analytical Batch: MMS9551
Analytical Method: EP200.8
Analyst: ACF
Analytical Date/Time: 09/27/16 17:33
Container ID: 1165628004-G

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 09/27/16 09:52
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	26.2		5.00	5.00	mg/L	1		09/27/16 17:33

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow04**

Client Sample ID: **Willow04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628004
Lab Project ID: 1165628

Collection Date: 09/21/16 13:55
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9551
Analytical Method: SM21 2340B
Analyst: ACF
Analytical Date/Time: 09/27/16 17:33
Container ID: 1165628004-G

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 09/27/16 09:52
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

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Results of **Willow04**

Client Sample ID: **Willow04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628004
Lab Project ID: 1165628

Collection Date: 09/21/16 13:55
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	2.25		0.500	0.150	mg/L	1		09/27/16 19:09

Batch Information

Analytical Batch: WTC2634
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 09/27/16 19:09
Container ID: 1165628004-F

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	25.8		10.0	3.10	mg/L	1		09/23/16 20:52

Batch Information

Analytical Batch: WTI4519
Analytical Method: SM21 2320B
Analyst: KBE
Analytical Date/Time: 09/23/16 20:52
Container ID: 1165628004-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500 U		0.100	0.0310	mg/L	1		09/29/16 13:49

Batch Information

Analytical Batch: WDA3863
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 09/29/16 13:49
Container ID: 1165628004-D

Prep Batch: WXX11639
Prep Method: METHOD
Prep Date/Time: 09/29/16 13:00
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.0426 J		0.100	0.0300	mg/L	2		09/21/16 17:45
Nitrite-N	0.0500 U		0.100	0.0300	mg/L	2		09/21/16 17:45

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow04**

Client Sample ID: **Willow04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628004
Lab Project ID: 1165628

Collection Date: 09/21/16 13:55
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WFI2505
Analytical Method: SM21 4500NO3-F
Analyst: KBE
Analytical Date/Time: 09/21/16 17:45
Container ID: 1165628004-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.0183		0.0100	0.00310	mg/L	1		10/12/16 17:50

Batch Information

Analytical Batch: WDA3870
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 10/12/16 17:50
Container ID: 1165628004-D

Prep Batch: WXX11653
Prep Method: SM21 4500P-B,E
Prep Date/Time: 10/07/16 16:15
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

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Results of **Willow03 rep**

Client Sample ID: **Willow03 rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628005
Lab Project ID: 1165628

Collection Date: 09/21/16 11:57
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Mercury	0.100	U	0.200	0.0620	ug/L	1		09/30/16 13:45

Batch Information

Analytical Batch: MCV5742
Analytical Method: EP245.1
Analyst: NEG
Analytical Date/Time: 09/30/16 13:45
Container ID: 1165628005-G

Prep Batch: MXX30243
Prep Method: METHOD
Prep Date/Time: 09/29/16 14:56
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow03 rep**

Client Sample ID: **Willow03 rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628005
Lab Project ID: 1165628

Collection Date: 09/21/16 11:57
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Aluminum	73.1		20.0	6.20	ug/L	1		09/27/16 17:36
Antimony	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:36
Arsenic	2.50 U		5.00	1.50	ug/L	1		09/27/16 17:36
Barium	9.95		3.00	0.940	ug/L	1		09/27/16 17:36
Beryllium	0.200 U		0.400	0.130	ug/L	1		09/27/16 17:36
Cadmium	0.250 U		0.500	0.150	ug/L	1		09/27/16 17:36
Calcium	6990		500	150	ug/L	1		09/27/16 17:36
Chromium	1.00 U		2.00	0.620	ug/L	1		09/27/16 17:36
Cobalt	2.00 U		4.00	1.20	ug/L	1		09/27/16 17:36
Copper	0.847 J		1.00	0.310	ug/L	1		09/27/16 17:36
Iron	277		250	78.0	ug/L	1		09/27/16 17:36
Lead	0.100 U		0.200	0.0620	ug/L	1		09/27/16 17:36
Magnesium	1650		50.0	15.0	ug/L	1		09/27/16 17:36
Manganese	20.1		1.00	0.310	ug/L	1		09/27/16 17:36
Molybdenum	1.00 U		2.00	0.620	ug/L	1		09/27/16 17:36
Nickel	1.00 U		2.00	0.620	ug/L	1		09/27/16 17:36
Phosphorus	100 U		200	62.0	ug/L	1		09/27/16 17:36
Potassium	661		500	150	ug/L	1		09/27/16 17:36
Selenium	2.50 U		5.00	1.50	ug/L	1		09/27/16 17:36
Silicon	4060		1000	310	ug/L	1		09/27/16 17:36
Silver	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:36
Sodium	3880		500	150	ug/L	1		09/27/16 17:36
Thallium	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:36
Tin	0.500 U		1.00	0.310	ug/L	1		09/27/16 17:36
Titanium	3.13 U		6.25	3.13	ug/L	1		09/27/16 17:36
Vanadium	10.0 U		20.0	6.20	ug/L	1		09/27/16 17:36
Zinc	2.50 U		5.00	2.50	ug/L	1		09/27/16 17:36

Batch Information

Analytical Batch: MMS9551
Analytical Method: EP200.8
Analyst: ACF
Analytical Date/Time: 09/27/16 17:36
Container ID: 1165628005-G

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 09/27/16 09:52
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	24.2		5.00	5.00	mg/L	1		09/27/16 17:36

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow03 rep**

Client Sample ID: **Willow03 rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628005
Lab Project ID: 1165628

Collection Date: 09/21/16 11:57
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Dissolved Metals by ICP/MS**

Batch Information

Analytical Batch: MMS9551
Analytical Method: SM21 2340B
Analyst: ACF
Analytical Date/Time: 09/27/16 17:36
Container ID: 1165628005-G

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 09/27/16 09:52
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

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Results of **Willow03 rep**

Client Sample ID: **Willow03 rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628005
Lab Project ID: 1165628

Collection Date: 09/21/16 11:57
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon,Dissolved	2.32		0.500	0.150	mg/L	1		09/27/16 19:22

Batch Information

Analytical Batch: WTC2634
Analytical Method: SM 5310B
Analyst: VDL
Analytical Date/Time: 09/27/16 19:22
Container ID: 1165628005-F

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Alkalinity	24.5		10.0	3.10	mg/L	1		09/23/16 20:59

Batch Information

Analytical Batch: WTI4519
Analytical Method: SM21 2320B
Analyst: KBE
Analytical Date/Time: 09/23/16 20:59
Container ID: 1165628005-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Ammonia-N	0.0500 U		0.100	0.0310	mg/L	1		09/29/16 13:51

Batch Information

Analytical Batch: WDA3863
Analytical Method: SM21 4500-NH3 G
Analyst: NEG
Analytical Date/Time: 09/29/16 13:51
Container ID: 1165628005-D

Prep Batch: WXX11639
Prep Method: METHOD
Prep Date/Time: 09/29/16 13:00
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Nitrate-N	0.0500 U		0.100	0.0300	mg/L	2		09/21/16 17:46
Nitrite-N	0.0500 U		0.100	0.0300	mg/L	2		09/21/16 17:46

Print Date: 10/13/2016 3:36:32PM

J flagging is activated

Results of **Willow03 rep**

Client Sample ID: **Willow03 rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1165628005
Lab Project ID: 1165628

Collection Date: 09/21/16 11:57
Received Date: 09/21/16 16:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WFI2505
Analytical Method: SM21 4500NO3-F
Analyst: KBE
Analytical Date/Time: 09/21/16 17:46
Container ID: 1165628005-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Phosphorus	0.0176		0.0100	0.00310	mg/L	1		10/12/16 17:51

Batch Information

Analytical Batch: WDA3870
Analytical Method: SM21 4500P-B,E
Analyst: NEG
Analytical Date/Time: 10/12/16 17:51
Container ID: 1165628005-D

Prep Batch: WXX11653
Prep Method: SM21 4500P-B,E
Prep Date/Time: 10/07/16 16:15
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

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Method Blank

Blank ID: MB for HBN 1744074 [MXX/30227]
Blank Lab ID: 1354579

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **EP200.8**

Parameter	Results	LOQ/CL	DL	Units
Aluminum	10.0U	20.0	6.20	ug/L
Antimony	0.500U	1.00	0.310	ug/L
Arsenic	2.50U	5.00	1.50	ug/L
Barium	1.50U	3.00	0.940	ug/L
Beryllium	0.200U	0.400	0.130	ug/L
Cadmium	0.250U	0.500	0.150	ug/L
Calcium	250U	500	150	ug/L
Chromium	1.00U	2.00	0.620	ug/L
Cobalt	2.00U	4.00	1.20	ug/L
Copper	0.500U	1.00	0.310	ug/L
Iron	125U	250	78.0	ug/L
Lead	0.100U	0.200	0.0620	ug/L
Magnesium	25.0U	50.0	15.0	ug/L
Manganese	0.500U	1.00	0.310	ug/L
Molybdenum	1.00U	2.00	0.620	ug/L
Nickel	1.00U	2.00	0.620	ug/L
Phosphorus	100U	200	62.0	ug/L
Potassium	250U	500	150	ug/L
Selenium	2.50U	5.00	1.50	ug/L
Silicon	500U	1000	310	ug/L
Silver	0.500U	1.00	0.310	ug/L
Sodium	250U	500	150	ug/L
Thallium	0.500U	1.00	0.310	ug/L
Tin	0.500U	1.00	0.310	ug/L
Titanium	12.5U	25.0	7.75	ug/L
Vanadium	10.0U	20.0	6.20	ug/L
Zinc	2.50U	5.00	2.50	ug/L

Batch Information

Analytical Batch: MMS9551
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: ACF
Analytical Date/Time: 9/27/2016 4:33:32PM

Prep Batch: MXX30227
Prep Method: E200.2
Prep Date/Time: 9/27/2016 9:52:01AM
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Blank Spike Summary

Blank Spike ID: LCS for HBN 1165628 [MXX30227]
Blank Spike Lab ID: 1354580
Date Analyzed: 09/27/2016 16:36

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **EP200.8**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Aluminum	1000	976	98	(85-115)
Antimony	1000	963	96	(85-115)
Arsenic	1000	936	94	(85-115)
Barium	1000	991	99	(85-115)
Beryllium	100	94.7	95	(85-115)
Cadmium	100	97.5	98	(85-115)
Calcium	10000	10200	102	(85-115)
Chromium	400	372	93	(85-115)
Cobalt	500	468	94	(85-115)
Copper	1000	972	97	(85-115)
Iron	5000	5040	101	(85-115)
Lead	1000	973	97	(85-115)
Magnesium	10000	10100	101	(85-115)
Manganese	500	476	95	(85-115)
Molybdenum	400	386	96	(85-115)
Nickel	1000	982	98	(85-115)
Phosphorus	500	486	97	(85-115)
Potassium	10000	9720	97	(85-115)
Selenium	1000	922	92	(85-115)
Silicon	10000	9970	100	(85-115)
Silver	100	101	101	(85-115)
Sodium	10000	9910	99	(85-115)
Thallium	10	9.82	98	(85-115)
Tin	100	98.4	98	(85-115)
Titanium	100	92.9	93	(85-115)
Vanadium	200	177	89	(85-115)
Zinc	1000	952	95	(85-115)

Batch Information

Analytical Batch: **MMS9551**
Analytical Method: **EP200.8**
Instrument: **Perkin Elmer Nexlon P5**
Analyst: **ACF**

Prep Batch: **MXX30227**
Prep Method: **E200.2**
Prep Date/Time: **09/27/2016 09:52**
Spike Init Wt./Vol.: 1000 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

Print Date: 10/13/2016 3:37:29PM

Matrix Spike Summary

Original Sample ID: 1354583
MS Sample ID: 1354584 MS
MSD Sample ID:

Analysis Date: 09/27/2016 17:18
Analysis Date: 09/27/2016 17:21
Analysis Date:
Matrix: Drinking Water

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **EP200.8**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Aluminum	392	1000	1460	107				70-130		
Antimony	0.500U	1000	983	98				70-130		
Arsenic	2.50U	1000	939	94				70-130		
Barium	13.1	1000	1030	101				70-130		
Beryllium	0.200U	100	84.9	85				70-130		
Cadmium	0.250U	100	96	96				70-130		
Calcium	8310	10000	17800	95				70-130		
Chromium	0.622J	400	374	93				70-130		
Cobalt	2.00U	500	477	96				70-130		
Copper	1.22	1000	946	95				70-130		
Iron	842	5000	5750	98				70-130		
Lead	0.0928J	1000	936	94				70-130		
Magnesium	3960	10000	14900	109				70-130		
Manganese	9.42	500	494	97				70-130		
Molybdenum	1.00U	400	367	92				70-130		
Nickel	1.07J	1000	970	97				70-130		
Phosphorus	100U	500	532	106				70-130		
Potassium	5280	10000	14500	92				70-130		
Selenium	2.50U	1000	923	92				70-130		
Silicon	2670	10000	13000	103				70-130		
Silver	0.500U	100	95.2	95				70-130		
Sodium	26700	10000	37600	109				70-130		
Thallium	0.500U	10.0	9.35	94				70-130		
Tin	0.500U	100	101	101				70-130		
Titanium	11.4J	100	106	94				70-130		
Vanadium	10.0U	200	184	92				70-130		
Zinc	9.25	1000	932	92				70-130		

Batch Information

Analytical Batch: MMS9551
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: ACF
Analytical Date/Time: 9/27/2016 5:21:35PM

Prep Batch: MXX30227
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 9/27/2016 9:52:01AM
Prep Initial Wt./Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Print Date: 10/13/2016 3:37:33PM

Method Blank

Blank ID: MB for HBN 1744341 [MXX/30242]
Blank Lab ID: 1355768

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1165628001, 1165628002, 1165628003

Results by **EP245.1**

Parameter	Results	LOQ/CL	DL	Units
Mercury	0.100U	0.200	0.0620	ug/L

Batch Information

Analytical Batch: MCV5741
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 9/30/2016 12:06:54PM

Prep Batch: MXX30242
Prep Method: METHOD
Prep Date/Time: 9/29/2016 2:56:00PM
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1165628 [MXX30242]
Blank Spike Lab ID: 1355769
Date Analyzed: 09/30/2016 12:15

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003

Results by **EP245.1**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Mercury	4	4.51	113	(85-115)

Batch Information

Analytical Batch: **MCV5741**
Analytical Method: **EP245.1**
Instrument: **PSA Millennium mercury AA**
Analyst: **NEG**

Prep Batch: **MXX30242**
Prep Method: **METHOD**
Prep Date/Time: **09/29/2016 14:56**
Spike Init Wt./Vol.: 4 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1165635001
MS Sample ID: 1355770 MS
MSD Sample ID:

Analysis Date: 09/30/2016 12:18
Analysis Date: 09/30/2016 12:23
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003

Results by **EP245.1**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Mercury	0.200U	8.00	9.94	124				70-130		

Batch Information

Analytical Batch: MCV5741
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 9/30/2016 12:23:22PM

Prep Batch: MXX30242
Prep Method: Digestion Mercury 245.1 (W)
Prep Date/Time: 9/29/2016 2:56:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 50.00mL

Print Date: 10/13/2016 3:37:54PM

Matrix Spike Summary

Original Sample ID: 1165724002
MS Sample ID: 1355771 MS
MSD Sample ID:

Analysis Date: 09/30/2016 13:04
Analysis Date: 09/30/2016 13:07
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003

Results by **EP245.1**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Mercury	0.100U	8.00	9.78	122				70-130		

Batch Information

Analytical Batch: MCV5741
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 9/30/2016 1:07:18PM

Prep Batch: MXX30242
Prep Method: Digestion Mercury 245.1 (W)
Prep Date/Time: 9/29/2016 2:56:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 50.00mL

Print Date: 10/13/2016 3:37:54PM

Method Blank

Blank ID: MB for HBN 1744344 [MXX/30243]
Blank Lab ID: 1355784

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1165628004, 1165628005

Results by **EP245.1**

Parameter	Results	LOQ/CL	DL	Units
Mercury	0.100U	0.200	0.0620	ug/L

Batch Information

Analytical Batch: MCV5742
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 9/30/2016 1:36:52PM

Prep Batch: MXX30243
Prep Method: METHOD
Prep Date/Time: 9/29/2016 2:56:00PM
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 50 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1165628 [MXX30243]
Blank Spike Lab ID: 1355785
Date Analyzed: 09/30/2016 13:39

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628004, 1165628005

Results by **EP245.1**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Mercury	4	4.43	111	(85-115)

Batch Information

Analytical Batch: **MCV5742**
Analytical Method: **EP245.1**
Instrument: **PSA Millennium mercury AA**
Analyst: **NEG**

Prep Batch: **MXX30243**
Prep Method: **METHOD**
Prep Date/Time: **09/29/2016 14:56**
Spike Init Wt./Vol.: 4 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

Print Date: 10/13/2016 3:38:02PM

Matrix Spike Summary

Original Sample ID: 1165647001
MS Sample ID: 1355786 MS
MSD Sample ID:

Analysis Date: 09/30/2016 13:48
Analysis Date: 09/30/2016 13:51
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628004, 1165628005

Results by **EP245.1**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Mercury	0.200U	8.00	9.87	123				70-130		

Batch Information

Analytical Batch: MCV5742
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 9/30/2016 1:51:34PM

Prep Batch: MXX30243
Prep Method: Digestion Mercury 245.1 (W)
Prep Date/Time: 9/29/2016 2:56:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 50.00mL

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Matrix Spike Summary

Original Sample ID: 1165647011
MS Sample ID: 1355787 MS
MSD Sample ID:

Analysis Date: 09/30/2016 14:26
Analysis Date: 09/30/2016 14:29
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628004, 1165628005

Results by **EP245.1**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Mercury	0.200U	8.00	10	125				70-130		

Batch Information

Analytical Batch: MCV5742
Analytical Method: EP245.1
Instrument: PSA Millennium mercury AA
Analyst: NEG
Analytical Date/Time: 9/30/2016 2:29:42PM

Prep Batch: MXX30243
Prep Method: Digestion Mercury 245.1 (W)
Prep Date/Time: 9/29/2016 2:56:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 50.00mL

Print Date: 10/13/2016 3:38:06PM

Method Blank

Blank ID: MB for HBN 1744044 (WFI/2505)
Blank Lab ID: 1354451

Matrix: Water (Surface, Eff., Ground)

QC for Samples:

Results by **SM21 4500NO3-F**

Parameter	Results	LOQ/CL	DL	Units
Nitrate-N	0.0500U	0.100	0.0300	mg/L
Nitrite-N	0.0500U	0.100	0.0300	mg/L
Total Nitrate/Nitrite-N	0.0500U	0.100	0.0300	mg/L

Batch Information

Analytical Batch: WFI2505
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: KBE
Analytical Date/Time: 9/21/2016 3:25:43PM

Method Blank

Blank ID: MB for HBN 1744044 (WFI/2505)
Blank Lab ID: 1354457

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 4500NO3-F**

Parameter	Results	LOQ/CL	DL	Units
Nitrate-N	0.0500U	0.100	0.0300	mg/L
Nitrite-N	0.0500U	0.100	0.0300	mg/L
Total Nitrate/Nitrite-N	0.0500U	0.100	0.0300	mg/L

Batch Information

Analytical Batch: WFI2505
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: KBE
Analytical Date/Time: 9/21/2016 4:11:13PM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1165628 [WFI2505]
Blank Spike Lab ID: 1354449
Date Analyzed: 09/21/2016 15:23

Matrix: Water (Surface, Eff., Ground)

QC for Samples:

Results by **SM21 4500NO3-F**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Nitrate-N	2.5	2.51	100	(70-130)
Nitrite-N	2.5	2.52	101	(90-110)
Total Nitrate/Nitrite-N	5	5.03	101	(90-110)

Batch Information

Analytical Batch: **WFI2505**
Analytical Method: **SM21 4500NO3-F**
Instrument: **Astoria segmented flow**
Analyst: **KBE**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 2.5 mg/L Extract Vol: 5 mL
Dupe Init Wt./Vol.: Extract Vol:

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1165628 [WFI2505]
Blank Spike Lab ID: 1354455
Date Analyzed: 09/21/2016 16:09

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 4500NO3-F**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Nitrate-N	2.5	2.56	102	(70-130)
Nitrite-N	2.5	2.54	102	(90-110)
Total Nitrate/Nitrite-N	5	5.10	102	(90-110)

Batch Information

Analytical Batch: **WFI2505**
Analytical Method: **SM21 4500NO3-F**
Instrument: **Astoria segmented flow**
Analyst: **KBE**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 2.5 mg/L Extract Vol: 5 mL
Dupe Init Wt./Vol.: Extract Vol:

Print Date: 10/13/2016 3:38:15PM

Matrix Spike Summary

Original Sample ID: 1165461001
MS Sample ID: 1354425 MS
MSD Sample ID: 1354426 MSD

Analysis Date: 09/21/2016 14:55
Analysis Date: 09/21/2016 14:57
Analysis Date: 09/21/2016 14:59
Matrix: Drinking Water

QC for Samples:

Results by **SM21 4500NO3-F**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Nitrate/Nitrite-N	0.100U	5.00	4.95	99	5.00	5.02	100	90-110	1.40	(< 25)

Batch Information

Analytical Batch: WFI2505
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: KBE
Analytical Date/Time: 9/21/2016 2:57:43PM

Prep Batch:
Prep Method:
Prep Date/Time:
Prep Initial Wt./Vol.: 5.00mL
Prep Extract Vol: 5.00mL

Matrix Spike Summary

Original Sample ID: 1165611001
MS Sample ID: 1354427 MS
MSD Sample ID: 1354428 MSD

Analysis Date: 09/21/2016 15:41
Analysis Date: 09/21/2016 15:43
Analysis Date: 09/21/2016 15:44
Matrix: Drinking Water

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 4500NO3-F**

		Matrix Spike (mg/L)				Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)		Spike	Result	Rec (%)		RPD (%)	RPD CL
Nitrate-N	0.100U	2.50	3.38	135	*	2.50	2.93	117		14.10	(< 25)
Nitrite-N	0.100U	2.50	2.52	101		2.50	2.84	113	*	11.90	(< 25)

CL
70-130
90-110

Batch Information

Analytical Batch: WFI2505
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: KBE
Analytical Date/Time: 9/21/2016 3:43:13PM

Prep Batch:
Prep Method:
Prep Date/Time:
Prep Initial Wt./Vol.: 5.00mL
Prep Extract Vol: 5.00mL

Print Date: 10/13/2016 3:38:24PM

Matrix Spike Summary

Original Sample ID: 1165628005
MS Sample ID: 1354805 MS
MSD Sample ID: 1354806 MSD

Analysis Date: 09/21/2016 17:46
Analysis Date: 09/21/2016 17:48
Analysis Date: 09/21/2016 17:50
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 4500NO3-F**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)						
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)		CL	RPD (%)	RPD CL
Nitrate-N	0.0500U	2.50	2.68	107	2.50	2.51	101		70-130	6.40	(< 25)
Nitrite-N	0.0500U	2.50	2.62	105	2.50	2.82	113	*	90-110	7.50	(< 25)

Batch Information

Analytical Batch: WFI2505
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: KBE
Analytical Date/Time: 9/21/2016 5:48:33PM

Prep Batch:
Prep Method:
Prep Date/Time:
Prep Initial Wt./Vol.: 5.00mL
Prep Extract Vol: 5.00mL

Print Date: 10/13/2016 3:38:24PM

Method Blank

Blank ID: MB for HBN 1744220 [WTC/2634]
Blank Lab ID: 1355205

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM 5310B**

Parameter	Results	LOQ/CL	DL	Units
Total Organic Carbon	0.370J	0.500	0.150	mg/L

Batch Information

Analytical Batch: WTC2634
Analytical Method: SM 5310B
Instrument: TOC Analyzer
Analyst: VDL
Analytical Date/Time: 9/27/2016 3:10:30PM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1165628 [WTC2634]
Blank Spike Lab ID: 1355203
Date Analyzed: 09/27/2016 14:55

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM 5310B**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Total Organic Carbon	75	79.6	106	(80-120)

Batch Information

Analytical Batch: **WTC2634**
Analytical Method: **SM 5310B**
Instrument: **TOC Analyzer**
Analyst: **VDL**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 75 mg/L Extract Vol: 30 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1355210
MS Sample ID: 1355211 MS
MSD Sample ID: 1355212 MSD

Analysis Date: 09/27/2016 15:25
Analysis Date: 09/27/2016 15:41
Analysis Date: 09/27/2016 15:54
Matrix: Drinking Water

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM 5310B**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Organic Carbon	1.82	10.0	12.5	107	10.0	12.9	111	75-125	3.10	(< 25)

Batch Information

Analytical Batch: WTC2634
Analytical Method: SM 5310B
Instrument: TOC Analyzer
Analyst: VDL
Analytical Date/Time: 9/27/2016 3:41:08PM

Prep Batch:
Prep Method:
Prep Date/Time:
Prep Initial Wt./Vol.: 30.00mL
Prep Extract Vol: 30.00mL

Print Date: 10/13/2016 3:38:41PM

Method Blank

Blank ID: MB for HBN 1744066 [WTI/4519]
Blank Lab ID: 1354542

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 2320B**

Parameter	Results	LOQ/CL	DL	Units
Alkalinity	5.00U	10.0	3.10	mg/L

Batch Information

Analytical Batch: WTI4519
Analytical Method: SM21 2320B
Instrument: Titration
Analyst: KBE
Analytical Date/Time: 9/23/2016 10:17:47PM

Duplicate Sample Summary

Original Sample ID: 1165651001
Duplicate Sample ID: 1354544
Analysis Date: 09/23/2016 22:43
Matrix: Water (Surface, Eff., Ground)

QC for Samples:

1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 2320B**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Alkalinity	79.2	77.6	mg/L	2.10	(< 25)

Batch Information

Analytical Batch: WTI4519
Analytical Method: SM21 2320B
Instrument: Titration
Analyst: KBE

Print Date: 10/13/2016 3:38:46PM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1165628 [WTI4519]
Blank Spike Lab ID: 1354543
Date Analyzed: 09/23/2016 22:26

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 2320B**

Blank Spike (mg/L)

Parameter	Spike	Result	Rec (%)	CL
Alkalinity	250	242	97	(85-115)

Batch Information

Analytical Batch: **WTI4519**
Analytical Method: **SM21 2320B**
Instrument: **Titration**
Analyst: **KBE**

Prep Batch:
Prep Method:
Prep Date/Time:
Spike Init Wt./Vol.: 250 mg/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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Method Blank

Blank ID: MB for HBN 1744270 [WXX/11639]
Blank Lab ID: 1355449

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 4500-NH3 G**

Parameter	Results	LOQ/CL	DL	Units
Ammonia-N	0.0500U	0.100	0.0310	mg/L

Batch Information

Analytical Batch: WDA3863
Analytical Method: SM21 4500-NH3 G
Instrument: Discrete Analyzer 2
Analyst: NEG
Analytical Date/Time: 9/29/2016 1:19:26PM

Prep Batch: WXX11639
Prep Method: METHOD
Prep Date/Time: 9/29/2016 1:00:00PM
Prep Initial Wt./Vol.: 6 mL
Prep Extract Vol: 6 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1165628 [WXX11639]
Blank Spike Lab ID: 1355450
Date Analyzed: 09/29/2016 13:21

Spike Duplicate ID: LCSD for HBN 1165628 [WXX11639]
Spike Duplicate Lab ID: 1355451
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 4500-NH3 G**

	Blank Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Ammonia-N	1	1.03	103	1	1.01	101	(75-125)	1.80	(< 25)

Batch Information

Analytical Batch: **WDA3863**
Analytical Method: **SM21 4500-NH3 G**
Instrument: **Discrete Analyzer 2**
Analyst: **NEG**

Prep Batch: **WXX11639**
Prep Method: **METHOD**
Prep Date/Time: **09/29/2016 13:00**
Spike Init Wt./Vol.: 1 mg/L Extract Vol: 6 mL
Dupe Init Wt./Vol.: 1 mg/L Extract Vol: 6 mL

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Matrix Spike Summary

Original Sample ID: 1165622001
MS Sample ID: 1355452 MS
MSD Sample ID: 1355453 MSD

Analysis Date: 09/29/2016 13:31
Analysis Date: 09/29/2016 13:32
Analysis Date: 09/29/2016 13:34
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 4500-NH3 G**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Ammonia-N	0.0893J	1.00	1.06	97	1.00	1.02	93	75-125	3.60	(< 25)

Batch Information

Analytical Batch: WDA3863
Analytical Method: SM21 4500-NH3 G
Instrument: Discrete Analyzer 2
Analyst: NEG
Analytical Date/Time: 9/29/2016 1:32:47PM

Prep Batch: WXX11639
Prep Method: Ammonia by SM21 4500F prep (W)
Prep Date/Time: 9/29/2016 1:00:00PM
Prep Initial Wt./Vol.: 6.00mL
Prep Extract Vol: 6.00mL

Print Date: 10/13/2016 3:38:56PM

Method Blank

Blank ID: MB for HBN 1745619 [WXX/11653]
Blank Lab ID: 1358671

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 4500P-B,E**

Parameter	Results	LOQ/CL	DL	Units
Total Phosphorus	0.00810J	0.0100	0.00310	mg/L

Batch Information

Analytical Batch: WDA3870
Analytical Method: SM21 4500P-B,E
Instrument: Discrete Analyzer 3
Analyst: NEG
Analytical Date/Time: 10/12/2016 6:43:34PM

Prep Batch: WXX11653
Prep Method: SM21 4500P-B,E
Prep Date/Time: 10/7/2016 4:15:00PM
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Blank Spike Summary

Blank Spike ID: LCS for HBN 1165628 [WXX11653]
Blank Spike Lab ID: 1358672
Date Analyzed: 10/12/2016 17:35

Spike Duplicate ID: LCSD for HBN 1165628 [WXX11653]
Spike Duplicate Lab ID: 1358673
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 4500P-B,E**

	Blank Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Phosphorus	0.2	0.204	102	0.2	0.216	108	(85-115)	5.50	(< 25)

Batch Information

Analytical Batch: **WDA3870**
Analytical Method: **SM21 4500P-B,E**
Instrument: **Discrete Analyzer 3**
Analyst: **NEG**

Prep Batch: **WXX11653**
Prep Method: **SM21 4500P-B,E**
Prep Date/Time: **10/07/2016 16:15**
Spike Init Wt./Vol.: 0.2 mg/L Extract Vol: 25 mL
Dupe Init Wt./Vol.: 0.2 mg/L Extract Vol: 25 mL

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Matrix Spike Summary

Original Sample ID: 1165622001
MS Sample ID: 1358674 MS
MSD Sample ID: 1358675 MSD

Analysis Date: 10/12/2016 17:38
Analysis Date: 10/12/2016 17:39
Analysis Date: 10/12/2016 17:40
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1165628001, 1165628002, 1165628003, 1165628004, 1165628005

Results by **SM21 4500P-B,E**

		Matrix Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Phosphorus	0.114	0.200	.31	98	0.200	0.307	97	75-125	0.97	(< 25)

Batch Information

Analytical Batch: WDA3870
Analytical Method: SM21 4500P-B,E
Instrument: Discrete Analyzer 3
Analyst: NEG
Analytical Date/Time: 10/12/2016 5:39:16PM

Prep Batch: WXX11653
Prep Method: Total Phosphorus (W) Ext.
Prep Date/Time: 10/7/2016 4:15:00PM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 25.00mL

Print Date: 10/13/2016 3:39:03PM

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CHAIN OF CUSTODY RECORD

1165628

Locations Nationwide
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Instructions: Sections 1 - 5 must be filled out.
Omissions may delay the onset of analysis.

Page 1 of 1

Section 1

CLIENT: ADEC Water Quality

CONTACT: Laura Eldred PHONE NO: 376-1855

PROJECT NAME: Willow Creek PROJECT/ PWSID/ PERMIT#:

REPORTS TO: E-MAIL: laura.eldred@alaska.gov

INVOICE TO: diann.douglas@alaska.gov QUOTE #: P.O. #: CT # 16000205 1

Section 2

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	# CONTAINERS	Type C = COMP G = GRAB MI = Multi Incremental Soils	Section 3 Preservative: NO2, NO3 Combo	Alkalinity	NH3, TKNess	DOC	Hardness	Diss LL Metals + Hg 200.8 & 245.1	REMARKS/ LOC ID
(1) A-B	Willow 01	9/21/16	10:18	W	6	G	X	X	X	X	X	X	
(2) A-B	Willow 02	"	11:12	W	6	G	"	"	"	"	"	"	
(3) A-B	Willow 03	"	11:55	W	6	G	"	"	"	"	"	"	
(4) A-B	Willow 04	"	13:55	W	6	G	"	"	"	"	"	"	
(5) A-B	Willow 03 Rep	"	11:57	W	6	G	"	"	"	"	"	"	

Section 5

	Date	Time	
Relinquished By: (1)	9/21/16	2:20pm	Received By:
Relinquished By: (2)			Received By:
Relinquished By: (3)			Received By:
Relinquished By: (4)	9/21/16	16:16	Received For Laboratory By:

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Section 4

DOD Project? Yes (No)

Cooler ID:

Data Deliverable Requirements: Level 2

Requested Turnaround Time and/or Special Instructions:

Temp Blank °C: 1.9 #D3
or Ambient [ ]
(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle)
(INTACT) BROKEN ABSENT
(See attached Sample Receipt Form)

Hand Delivered

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1165628001-A	No Preservative Required	OK			
1165628001-B	No Preservative Required	OK			
1165628001-C	No Preservative Required	OK			
1165628001-D	H2SO4 to pH < 2	OK			
1165628001-E	No Preservative Required	OK			
1165628001-F	HCL to pH < 2	OK			
1165628001-G	HNO3 to pH < 2	OK			
1165628002-A	No Preservative Required	OK			
1165628002-B	No Preservative Required	OK			
1165628002-C	No Preservative Required	OK			
1165628002-D	H2SO4 to pH < 2	OK			
1165628002-E	No Preservative Required	OK			
1165628002-F	HCL to pH < 2	OK			
1165628002-G	HNO3 to pH < 2	OK			
1165628003-A	No Preservative Required	OK			
1165628003-B	No Preservative Required	OK			
1165628003-C	No Preservative Required	OK			
1165628003-D	H2SO4 to pH < 2	OK			
1165628003-E	No Preservative Required	OK			
1165628003-F	HCL to pH < 2	OK			
1165628003-G	HNO3 to pH < 2	OK			
1165628004-A	No Preservative Required	OK			
1165628004-B	No Preservative Required	OK			
1165628004-C	No Preservative Required	OK			
1165628004-D	H2SO4 to pH < 2	OK			
1165628004-E	No Preservative Required	OK			
1165628004-F	HCL to pH < 2	OK			
1165628004-G	HNO3 to pH < 2	OK			
1165628005-A	No Preservative Required	OK			
1165628005-B	No Preservative Required	OK			
1165628005-C	No Preservative Required	OK			
1165628005-D	H2SO4 to pH < 2	OK			
1165628005-E	No Preservative Required	OK			
1165628005-F	HCL to pH < 2	OK			
1165628005-G	HNO3 to pH < 2	OK			

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM- The container was received damaged.
FR- The container was received frozen and not usable for Bacteria or BOD analyses.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

Laboratory Analysis Report

Laura Eldred
Alaska Department of Environmental Conservation
1700 E. Bogard Rd
Bldg B, Suite 103
Wasilla, AK 99654

Work Order:	1164005
	Willow Creek
Client:	ADEC-Air & Water Quality
Report Date:	July 28, 2016

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. If you have any questions regarding this report, or if we can be of any other assistance, please contact your SGS Project Manager at 907-562-2343. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO 17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8015C, 8021B, 8082A, 8260B, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.
The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content.
All DRO/RRO analyses are integrated per SOP.

SGS Ref.#	1164005001		
Client Name	ADEC-Air & Water Quality	**Printed Date/Time**	07/28/2016 19:42
Project Name/#	Willow Creek	**Collected Date/Time**	07/19/2016 7:25
Client Sample ID	Willow 02	**Received Date/Time**	07/19/2016 11:15
Matrix	Water (Surface, Eff., Ground)	**Technical Director**	**Stephen C. Ede**

Sample Remarks:

Parameter	Results	LOQ	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Microbiology Laboratory									
Fecal Coliform	14	1.00	col/100mL	SM21 9222D	A			07/19/16	ACF

SGS Ref.#	1164005002		
Client Name	ADEC-Air & Water Quality	**Printed Date/Time**	07/28/2016 19:42
Project Name/#	Willow Creek	**Collected Date/Time**	07/19/2016 7:55
Client Sample ID	Willow 03	**Received Date/Time**	07/19/2016 11:15
Matrix	Water (Surface, Eff., Ground)	**Technical Director**	**Stephen C. Ede**

Sample Remarks:

Parameter	Results	LOQ	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Microbiology Laboratory									
Fecal Coliform	25	1.00	col/100mL	SM21 9222D	A			07/19/16	ACF

SGS Ref.#	1164005003		
Client Name	ADEC-Air & Water Quality	**Printed Date/Time**	07/28/2016 19:42
Project Name/#	Willow Creek	**Collected Date/Time**	07/19/2016 7:57
Client Sample ID	Willow 03 Rep	**Received Date/Time**	07/19/2016 11:15
Matrix	Water (Surface, Eff., Ground)	**Technical Director**	**Stephen C. Ede**

Sample Remarks:

Parameter	Results	LOQ	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Microbiology Laboratory									
Fecal Coliform	26	1.00	col/100mL	SM21 9222D	A			07/19/16	ACF

SGS Ref.#	1164005004		
Client Name	ADEC-Air & Water Quality	**Printed Date/Time**	07/28/2016 19:42
Project Name/#	Willow Creek	**Collected Date/Time**	07/19/2016 8:49
Client Sample ID	Willow 04	**Received Date/Time**	07/19/2016 11:15
Matrix	Water (Surface, Eff., Ground)	**Technical Director**	**Stephen C. Ede**

Sample Remarks:

Parameter	Results	LOQ	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Microbiology Laboratory									
Fecal Coliform	59	1.00	col/100mL	SM21 9222D	A			07/19/16	ACF

SGS

SGS North America Inc.
CHAIN OF CUSTODY RECORD

1164005

www.us.sgs.com

Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.

Page 1 of 1

Section 1

CLIENT: ADEC - Willow Creek

CONTACT: Laura Eldred PHONE NO: 376-1855

PROJECT NAME: Willow Creek PROJECT/ PWSID/ PERMIT#:

REPORTS TO: Laura Eldred E-MAIL: laura.eldred@alaska.gov

INVOICE TO: diann.douglas@alaska.gov QUOTE #: P.O. #: CT-18000 1889

Section 2

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	# CONTAINERS	Type C = COMP G = GRAB MI = Multi Incremental Soils	Preservative: Fecal Coliform Bacteria	REMARKS/ LOC ID
(1) A	Willow 02	07/19/16	07:25	W	1	G	X	
(2) A	Willow 03	7/19/16	07:55	W	1	G	X	
(3) A	Willow 03 Rep	7/19/16	07:57	W	1	G	X	
(4) A	Willow 04	7/19/16	08:49	W	1	G	X	

Section 5

	Date	Time	
Relinquished By: (1)	7/19/16	09:14	Received By:
Relinquished By: (2)			Received By:
Relinquished By: (3)			Received By:
Relinquished By: (4)	7/19/16	11:15	Received For Laboratory By:

Section 4

DOD Project? Yes No

Cooler ID:

Data Deliverable Requirements: Level 2

Requested Turnaround Time and/or Special Instructions:

Send results as soon as available plz

Temp Blank °C: Chilled or Ambient [ ]

(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle) INTACT BROKEN (ABSENT)

(See attached Sample Receipt Form)

[x] 200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
[ ] 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

Hand delivered

e-SAMPLE RECEIPT FORM

1164005

Review Criteria	Y/N (yes/no)	Exceptions Noted below
	Y	exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location		ABSENT
COC accompanied samples?	Y	
Y **exemption permitted if chilled & collected <8hrs ago or chlling not required (i e., waste, oil)		
Temperature blank compliant* (i.e., 0-6 °C after CF)?		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
If >6°C, were samples collected <8 hours ago?	Y	Chilled
If <0°C, were sample containers ice free?		
If samples received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".		
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
		Note: Refer to form F-083 "Sample Guide" for hold times.
Were samples received within hold time?	Y	
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	Y	
**Note: If times differ <1hr, record details & login per COC.		
Were analyses requested unambiguous?	Y	
		***Exemption permitted for metals (e.g 200.8/6020A).
Were proper containers (type/mass/volume/preservative***)used?	Y	
IF APPLICABLE		
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?		
Were all VOA vials free of headspace (i.e., bubbles ≤ 6mm)?		
Were all soil VOAs field extracted with MeOH+BFB?		
Note to Client: Any "no" answer above indicates non-compliance with standard procedures and may impact data quality.		

Additional notes (if applicable):

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1164005001-A	Na2S2O3 for Chlorine Redu	OK			
1164005002-A	Na2S2O3 for Chlorine Redu	OK			
1164005003-A	Na2S2O3 for Chlorine Redu	OK			
1164005004-A	Na2S2O3 for Chlorine Redu	OK			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM- The container was received damaged.
FR- The container was received frozen and not usable for Bacteria or BOD analyses.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

Laboratory Report of Analysis

To: ADEC-Air & Water Quality
1700 E. Bogard Rd Bldg B, Suite 103
Wasilla, AK 99654

Report Number: **1164146**

Client Project: **Willow Creek**

Dear Laura Eldred,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Forest at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

_____

Forest Taylor Date
Project Manager
Forest.Taylor@sgs.com

Print Date: 07/28/2016 12:28:54PM

Case Narrative

SGS Client: **ADEC-Air & Water Quality**
SGS Project: **1164146**
Project Name/Site: **Willow Creek**
Project Contact: **Laura Eldred**

Refer to sample receipt form for information on sample condition.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

Print Date: 07/28/2016 12:28:55PM

Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8021B, 8082A, 8260B, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

SGS North America Inc. 200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
Willow 02	1164146001	07/25/2016	07/25/2016	Water (Surface, Eff., Ground)
Willow 03	1164146002	07/25/2016	07/25/2016	Water (Surface, Eff., Ground)
Willow 03 Rep	1164146003	07/25/2016	07/25/2016	Water (Surface, Eff., Ground)
Willow 04	1164146004	07/25/2016	07/25/2016	Water (Surface, Eff., Ground)

Method	Method Description
SM21 9222D	Fecal Coliform (MF)

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Detectable Results Summary

Client Sample ID: **Willow 02**
Lab Sample ID: 1164146001
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	59	col/100mL

Client Sample ID: **Willow 03**
Lab Sample ID: 1164146002
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	20	col/100mL

Client Sample ID: **Willow 03 Rep**
Lab Sample ID: 1164146003
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	30	col/100mL

Client Sample ID: **Willow 04**
Lab Sample ID: 1164146004
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	47	col/100mL

SGS North America Inc.
200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164146001
Lab Project ID: 1164146

Collection Date: 07/25/16 07:25
Received Date: 07/25/16 11:18
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	59		1.00	1.00	col/100mL	1		07/25/16 13:10

Batch Information

Analytical Batch: BTF14999
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 07/25/16 13:10
Container ID: 1164146001-A

Print Date: 07/28/2016 12:29:01PM

J flagging is activated

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164146002
Lab Project ID: 1164146

Collection Date: 07/25/16 07:58
Received Date: 07/25/16 11:18
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	20		1.00	1.00	col/100mL	1		07/25/16 13:10

Batch Information

Analytical Batch: BTF14999
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 07/25/16 13:10
Container ID: 1164146002-A

Print Date: 07/28/2016 12:29:01PM

J flagging is activated

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164146003
Lab Project ID: 1164146

Collection Date: 07/25/16 07:58
Received Date: 07/25/16 11:18
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	30		1.00	1.00	col/100mL	1		07/25/16 13:10

Batch Information

Analytical Batch: BTF14999
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 07/25/16 13:10
Container ID: 1164146003-A

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164146004
Lab Project ID: 1164146

Collection Date: 07/25/16 08:45
Received Date: 07/25/16 11:18
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	47		1.00	1.00	col/100mL	1		07/25/16 13:10

Batch Information

Analytical Batch: BTF14999
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 07/25/16 13:10
Container ID: 1164146004-A

Print Date: 07/28/2016 12:29:01PM

J flagging is activated

Method Blank

Blank ID: MB for HBN 1740226 [BTF/14999]
Blank Lab ID: 1339731

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1164146001, 1164146002, 1164146003, 1164146004

Results by **SM21 9222D**

Parameter	Results	LOQ/CL	DL	Units
Fecal Coliform	1.00U	1.00	1.00	col/100mL

Batch Information

Analytical Batch: BTF14999
Analytical Method: SM21 9222D
Instrument:
Analyst: K.W
Analytical Date/Time: 7/25/2016 1:10:00PM

Print Date: 07/28/2016 12:29:03PM

SGS

SGS North America Inc.
CHAIN OF CUSTODY RECORD

1164146

Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.

Section 1

CLIENT: ADEC - Willow Creek

CONTACT: Laura Eldred PHONE NO: 376-1855

PROJECT NAME: Willow Creek PROJECT/ PWSID/ PERMIT#:

REPORTS TO: laura.eldred@alaska.gov E-MAIL:

INVOICE TO: per NTP QUOTE #:

P.O. #: CT 18000 1889

Section 2

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	Section 3 # CONTAINERS	Type C = COMP G = GRAB MI = Multi Incre-mental Soils	Preservative: FC Bacteria SM 9222D	REMARKS/ LOC ID
1 A	Willow 02	7/25/16	07:25	W	1	G	X	
2 A	Willow 03	"	07:58	"	1	"	X	
3 A	Willow 03 Rep	"	07:58	"	1	"	X	
4 A	Willow 04	"	08:45	"	1	"	X	

Section 5

	Date	Time	Received By:
Relinquished By: (1) Tom K. Ellerbe	7/25/16	11:18	
Relinquished By: (2)			
Relinquished By: (3)			
Relinquished By: (4)	7/25/16	11:18	Received For Laboratory By:

Section 4

DOD Project? Yes (No)

Cooler ID:

Data Deliverable Requirements: Level 2

Requested Turnaround Time and/or Special Instructions: Send results ASAP plz

Temp Blank °C: 5.8 #200

or Ambient [ ]

(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle)

INTACT BROKEN (ABSENT)

(See attached Sample Receipt Form)

[ ] 200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
[ ] 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

SGS

e-SAMPLE RECEIPT FORM

1164146

Review Criteria	Y/N (yes/no)	Exceptions Noted below
	Y	exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location	Y	Absent
COC accompanied samples?	Y	
**exemption permitted if chilled & collected <8hrs ago or chlling not required (i e., waste, oil)	Y	
Temperature blank compliant* (i.e., 0-6 °C after CF)?	Y	Cooler ID: 1 @ 5.8 °C Therm ID: 200
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
*If >6°C, were samples collected <8 hours ago?	Y	
If <0°C, were sample containers ice free?	Y	
If samples received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".		
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
		Note: Refer to form F-083 "Sample Guide" for hold times.
Were samples received within hold time?	Y	
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	Y	
**Note: If times differ <1hr, record details & login per COC.		
Were analyses requested unambiguous?	Y	
	Y	***Exemption permitted for metals (e.g 200.8/6020A).
Were proper containers (type/mass/volume/preservative***)used?	Y	
IF APPLICABLE		
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?	Y	
Were all VOA vials free of headspace (i.e., bubbles ≤ 6mm)?	Y	
Were all soil VOAs field extracted with MeOH+BFB?	Y	

Note to Client: Any "no" answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

Requested to be called if hit over 20 occurs.

Requested that results be reported as soon as possible.

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1164146001-A	Na2S2O3 for Chlorine Redu	OK			
1164146002-A	Na2S2O3 for Chlorine Redu	OK			
1164146003-A	Na2S2O3 for Chlorine Redu	OK			
1164146004-A	Na2S2O3 for Chlorine Redu	OK			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM- The container was received damaged.
FR- The container was received frozen and not usable for Bacteria or BOD analyses.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

Laboratory Report of Analysis

To: ADEC-Air & Water Quality
1700 E. Bogard Rd Bldg B, Suite 103
Wasilla, AK 99654

Report Number: **1164170**

Client Project: **Willow Creek**

Dear Laura Eldred,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Forest at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Forest Taylor Date
Project Manager
Forest.Taylor@sgs.com

SGS North America Inc. 200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Case Narrative

SGS Client: **ADEC-Air & Water Quality**
SGS Project: **1164170**
Project Name/Site: **Willow Creek**
Project Contact: **Laura Eldred**

Refer to sample receipt form for information on sample condition.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

Print Date: 07/28/2016 12:30:27PM

Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8021B, 8082A, 8260B, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

Print Date: 07/28/2016 12:30:29PM

Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
Willow Creek 02	1164170001	07/26/2016	07/26/2016	Water (Surface, Eff., Ground)
Willow Creek 03	1164170002	07/26/2016	07/26/2016	Water (Surface, Eff., Ground)
Willow Creek 03 Rep	1164170003	07/26/2016	07/26/2016	Water (Surface, Eff., Ground)
Willow Creek 04	1164170004	07/26/2016	07/26/2016	Water (Surface, Eff., Ground)

Method	Method Description
SM21 9222D	Fecal Coliform (MF)

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Detectable Results Summary

Client Sample ID: **Willow Creek 02**
Lab Sample ID: 1164170001
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	44	col/100mL

Client Sample ID: **Willow Creek 03**
Lab Sample ID: 1164170002
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	61	col/100mL

Client Sample ID: **Willow Creek 03 Rep**
Lab Sample ID: 1164170003
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	78	col/100mL

Client Sample ID: **Willow Creek 04**
Lab Sample ID: 1164170004
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	87	col/100mL

SGS North America Inc.
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t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Results of **Willow Creek 02**

Client Sample ID: **Willow Creek 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164170001
Lab Project ID: 1164170

Collection Date: 07/26/16 07:35
Received Date: 07/26/16 11:30
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	44		1.00	1.00	col/100mL	1		07/26/16 12:24

Batch Information

Analytical Batch: BTF15000
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 07/26/16 12:24
Container ID: 1164170001-A

Results of **Willow Creek 03**

Client Sample ID: **Willow Creek 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164170002
Lab Project ID: 1164170

Collection Date: 07/26/16 08:07
Received Date: 07/26/16 11:30
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	61		1.00	1.00	col/100mL	1		07/26/16 12:24

Batch Information

Analytical Batch: BTF15000
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 07/26/16 12:24
Container ID: 1164170002-A

Print Date: 07/28/2016 12:30:32PM

J flagging is activated

Results of **Willow Creek 03 Rep**

Client Sample ID: **Willow Creek 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164170003
Lab Project ID: 1164170

Collection Date: 07/26/16 08:07
Received Date: 07/26/16 11:30
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	78		1.00	1.00	col/100mL	1		07/26/16 12:24

Batch Information

Analytical Batch: BTF15000
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 07/26/16 12:24
Container ID: 1164170003-A

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t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Results of **Willow Creek 04**

Client Sample ID: **Willow Creek 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164170004
Lab Project ID: 1164170

Collection Date: 07/26/16 08:54
Received Date: 07/26/16 11:30
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	87		1.00	1.00	col/100mL	1		07/26/16 12:24

Batch Information

Analytical Batch: BTF15000
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 07/26/16 12:24
Container ID: 1164170004-A

Print Date: 07/28/2016 12:30:32PM

J flagging is activated

Method Blank

Blank ID: MB for HBN 1740334 [BTF/15000]
Blank Lab ID: 1340035

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1164170001, 1164170002, 1164170003, 1164170004

Results by **SM21 9222D**

Parameter	Results	LOQ/CL	DL	Units
Fecal Coliform	1.00U	1.00	1.00	col/100mL

Batch Information

Analytical Batch: BTF15000
Analytical Method: SM21 9222D
Instrument:
Analyst: K.W
Analytical Date/Time: 7/26/2016 12:24:00PM

Print Date: 07/28/2016 12:30:34PM

SGS

SGS North America Inc.
CHAIN OF CUSTODY RECORD

1164170

Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.

Page 1 of 1

Section 1

CLIENT: ADEC - Willow Creek

CONTACT: Laura Eldred PHONE NO: 376-1855

PROJECT NAME: Willow Creek PROJECT/ PWSID/ PERMIT#:

REPORTS TO: laura.eldred@alaska.gov E-MAIL:

INVOICE TO: per NTP QUOTE #:

P.O. #: CT 18000 1889

Section 2

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	Section 3 # CONTAINERS	Section 3 Type C = COMP G = GRAB MI = Multi Incre-mental Soils	Preservative: 4°C Bacteria 9223A	REMARKS/ LOC ID
(1) A	Willow 02	7/26/16	07:35	W	1	G		
(2) A	Willow 03	7/26/16	08:07	W	1	G		
(3) A	Willow 03Rep	7/26/16	08:07	W	1	G		
(4) A	Willow 04	7/26/16	08:54	W	1	G		

Section 5

	Date	Time	
Relinquished By: (1) Laura K. Eldred	7/26/16	11:30	Received By:
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	7/26/16	11:30	Received For Laboratory By: Daye Brown

Section 4

DOD Project? Yes (No)

Cooler ID:

Data Deliverable Requirements: Level 2

Requested Turnaround Time and/or Special Instructions: Send results as soon as available

Temp Blank °C: 6.6 #200 or Ambient [ ]

(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT

(See attached Sample Receipt Form)

Page 11 of 13

[ ] 200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
[ ] 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

http://www.sgs.com/terms-and-conditions

Haddelbrid

F083-Kit_Request_and_COC_Templates-Blank
Revised 2013-03-24

SGS

e-SAMPLE RECEIPT FORM

1164170

Review Criteria	Y/N (yes/no)	Exceptions Noted below
	Y	exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location		Absent
COC accompanied samples?	Y	
		**exemption permitted if chilled & collected <8hrs ago or chlling not required (i e., waste, oil)
Temperature blank compliant* (i.e., 0-6 °C after CF)?	N	Cooler ID: 1 @ 6.6 °C Therm ID: 200
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
*If >6°C, were samples collected <8 hours ago?	Y	
If <0°C, were sample containers ice free?	Y	
If samples received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".		
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
		Note: Refer to form F-083 "Sample Guide" for hold times.
Were samples received within hold time?	Y	
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	Y	
**Note: If times differ <1hr, record details & login per COC.		
Were analyses requested unambiguous?	Y	
		***Exemption permitted for metals (e.g 200.8/6020A).
Were proper containers (type/mass/volume/preservative***)used?	Y	
IF APPLICABLE		
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?	Y	
Were all VOA vials free of headspace (i.e., bubbles ≤ 6mm)?	Y	
Were all soil VOAs field extracted with MeOH+BFB?	Y	

Note to Client: Any "no" answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1164170001-A	Na2S2O3 for Chlorine Redu	OK			
1164170002-A	Na2S2O3 for Chlorine Redu	OK			
1164170003-A	Na2S2O3 for Chlorine Redu	OK			
1164170004-A	Na2S2O3 for Chlorine Redu	OK			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM- The container was received damaged.
FR- The container was received frozen and not usable for Bacteria or BOD analyses.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

Laboratory Report of Analysis

To: ADEC-Air & Water Quality
1700 E. Bogard Rd Bldg B, Suite 103
Wasilla, AK 99654

Report Number: **1164541**

Client Project: **Willow Creek**

Dear Laura Eldred,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Forest at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Forest Taylor Date
Project Manager
Forest.Taylor@sgs.com

SGS North America Inc. 200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Case Narrative

SGS Client: **ADEC-Air & Water Quality**
SGS Project: **1164541**
Project Name/Site: **Willow Creek**
Project Contact: **Laura Eldred**

Refer to sample receipt form for information on sample condition.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

SGS North America Inc.
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t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8021B, 8082A, 8260B, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

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Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
Willow 02	1164541001	08/08/2016	08/08/2016	Water (Surface, Eff., Ground)
Willow 03	1164541002	08/08/2016	08/08/2016	Water (Surface, Eff., Ground)
Willow 03 Rep	1164541003	08/08/2016	08/08/2016	Water (Surface, Eff., Ground)
Willow 04	1164541004	08/08/2016	08/08/2016	Water (Surface, Eff., Ground)

Method	Method Description
SM21 9222D	Fecal Coliform (MF)

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Detectable Results Summary

Client Sample ID: **Willow 02**
Lab Sample ID: 1164541001
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	57	col/100mL

Client Sample ID: **Willow 03**
Lab Sample ID: 1164541002
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	86	col/100mL

Client Sample ID: **Willow 03 Rep**
Lab Sample ID: 1164541003
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	101	col/100mL

Client Sample ID: **Willow 04**
Lab Sample ID: 1164541004
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	118	col/100mL

SGS North America Inc.
200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164541001
Lab Project ID: 1164541

Collection Date: 08/08/16 07:57
Received Date: 08/08/16 12:14
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	57		1.00	1.00	col/100mL	1		08/08/16 13:20

Batch Information

Analytical Batch: BTF15032
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 08/08/16 13:20
Container ID: 1164541001-A

Print Date: 08/16/2016 8:09:49AM

J flagging is activated

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164541002
Lab Project ID: 1164541

Collection Date: 08/08/16 08:34
Received Date: 08/08/16 12:14
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	86		1.00	1.00	col/100mL	1		08/08/16 13:20

Batch Information

Analytical Batch: BTF15032
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 08/08/16 13:20
Container ID: 1164541002-A

Print Date: 08/16/2016 8:09:49AM

J flagging is activated

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164541003
Lab Project ID: 1164541

Collection Date: 08/08/16 08:34
Received Date: 08/08/16 12:14
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	101		1.00	1.00	col/100mL	1		08/08/16 13:20

Batch Information

Analytical Batch: BTF15032
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 08/08/16 13:20
Container ID: 1164541003-A

Print Date: 08/16/2016 8:09:49AM

J flagging is activated

Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164541004
Lab Project ID: 1164541

Collection Date: 08/08/16 09:28
Received Date: 08/08/16 12:14
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	118		2.00	2.00	col/100mL	1		08/08/16 13:20

Batch Information

Analytical Batch: BTF15032
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 08/08/16 13:20
Container ID: 1164541004-A

Print Date: 08/16/2016 8:09:49AM

J flagging is activated

Method Blank

Blank ID: MB for HBN 1741345 [BTF/15032]
Blank Lab ID: 1343836

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1164541001, 1164541002, 1164541003, 1164541004

Results by **SM21 9222D**

Parameter	Results	LOQ/CL	DL	Units
Fecal Coliform	1.00U	1.00	1.00	col/100mL

Batch Information

Analytical Batch: BTF15032
Analytical Method: SM21 9222D
Instrument:
Analyst: K.W
Analytical Date/Time: 8/8/2016 1:20:00PM

Print Date: 08/16/2016 8:09:51AM

SGS

SGS North America Inc.
CHAIN OF CUSTODY RECORD

1164541

Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.

Section 1

CLIENT: ADEC Water Quality

CONTACT: Laura Eldred PHONE NO: 376-1855

PROJECT NAME: Willow Creek PROJECT/ PWSID/ PERMIT#:

REPORTS TO: laura.eldred@alaska.gov E-MAIL:

INVOICE TO: per contract QUOTE #:

P.O. #: CT 18000 1889

Section 2

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	# CONTAINERS	Type C = COMP G = GRAB MI = Multi Incre-mental Soils	Section 3 Preservative: Fecal Coliform Sm 9222D	REMARKS/ LOC ID
1A	Willow 02	8/8/16	757	W	1	G		
2A	Willow 03	8/8/16	834	W	1	G		
3A	Willow03 Rep	8/8/16	834	W	1	G		
4A	Willow04	8/8/16	928	W	1	G		

Section 5

	Date	Time	Received By:
Relinquished By: (1) Laura K. Eldred	8/8/16	9:55	Cindy J. Hadden
Relinquished By: (2)			Received By:
Relinquished By: (3)			Received By:
Relinquished By: (4)	8/8/16	12:14	Received For Laboratory By:

Section 4

DOD Project? Yes (No)

Cooler ID:

Data Deliverable Requirements: Level 2

Requested Turnaround Time and/or Special Instructions:

Send results ASAP please

Temp Blank °C: Chilled or Ambient [ ]

(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle) INTACT BROKEN (ABSENT)

(See attached Sample Receipt Form)

[X] 200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
[ ] 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

Hadden/Mod

e-SAMPLE RECEIPT FORM

1164541

Review Criteria	Y/N (yes/no)	Exceptions Noted below
	Y	exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location		ABSENT
COC accompanied samples?	Y	
	Y	**exemption permitted if chilled & collected <8hrs ago or chlling not required (i e., waste, oil)
Temperature blank compliant* (i.e., 0-6 °C after CF)?		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
If >6°C, were samples collected <8 hours ago?	Y	Chilled
If <0°C, were sample containers ice free?		
If samples received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".		
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
		Note: Refer to form F-083 "Sample Guide" for hold times.
Were samples received within hold time?	Y	
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	Y	
**Note: If times differ <1hr, record details & login per COC.		
Were analyses requested unambiguous?	Y	
		***Exemption permitted for metals (e.g 200.8/6020A).
Were proper containers (type/mass/volume/preservative***)used?	Y	
IF APPLICABLE		
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?		
Were all VOA vials free of headspace (i.e., bubbles ≤ 6mm)?		
Were all soil VOAs field extracted with MeOH+BFB?		

Note to Client: Any "no" answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1164541001-A	Na2S2O3 for Chlorine Redu	OK			
1164541002-A	Na2S2O3 for Chlorine Redu	OK			
1164541003-A	Na2S2O3 for Chlorine Redu	OK			
1164541004-A	Na2S2O3 for Chlorine Redu	OK			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM- The container was received damaged.
FR- The container was received frozen and not usable for Bacteria or BOD analyses.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

Laboratory Report of Analysis

To: ADEC-Air & Water Quality
1700 E. Bogard Rd Bldg B, Suite 103
Wasilla, AK 99654

Report Number: **1164313**

Client Project: **Willow Creek**

Dear Laura Eldred,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Forest at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Forest Taylor Date
Project Manager
Forest.Taylor@sgs.com

SGS North America Inc. 200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Case Narrative

SGS Client: **ADEC-Air & Water Quality**
SGS Project: **1164313**
Project Name/Site: **Willow Creek**
Project Contact: **Laura Eldred**

Refer to sample receipt form for information on sample condition.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

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Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8021B, 8082A, 8260B, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

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Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
Willow 02	1164313001	08/01/2016	08/01/2016	Water (Surface, Eff., Ground)
Willow 03	1164313002	08/01/2016	08/01/2016	Water (Surface, Eff., Ground)
Willow 03 Rep	1164313003	08/01/2016	08/01/2016	Water (Surface, Eff., Ground)
Willow 04	1164313004	08/01/2016	08/01/2016	Water (Surface, Eff., Ground)

Method	Method Description
SM21 9222D	Fecal Coliform (MF)

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Detectable Results Summary

Client Sample ID: **Willow 02**
Lab Sample ID: 1164313001
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	25	col/100mL

Client Sample ID: **Willow 03**
Lab Sample ID: 1164313002
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	23	col/100mL

Client Sample ID: **Willow 03 Rep**
Lab Sample ID: 1164313003
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	15	col/100mL

Client Sample ID: **Willow 04**
Lab Sample ID: 1164313004
Microbiology Laboratory

Parameter	Result	Units
Fecal Coliform	25	col/100mL

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Results of **Willow 02**

Client Sample ID: **Willow 02**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164313001
Lab Project ID: 1164313

Collection Date: 08/01/16 07:29
Received Date: 08/01/16 11:33
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	25		1.00	1.00	col/100mL	1		08/01/16 13:02

Batch Information

Analytical Batch: BTF15010
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 08/01/16 13:02
Container ID: 1164313001-A

Print Date: 08/04/2016 8:47:11AM

J flagging is activated

Results of **Willow 03**

Client Sample ID: **Willow 03**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164313002
Lab Project ID: 1164313

Collection Date: 08/01/16 07:58
Received Date: 08/01/16 11:33
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	23		1.00	1.00	col/100mL	1		08/01/16 13:02

Batch Information

Analytical Batch: BTF15010
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 08/01/16 13:02
Container ID: 1164313002-A

Print Date: 08/04/2016 8:47:11AM

J flagging is activated

Results of **Willow 03 Rep**

Client Sample ID: **Willow 03 Rep**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164313003
Lab Project ID: 1164313

Collection Date: 08/01/16 07:58
Received Date: 08/01/16 11:33
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	15		1.00	1.00	col/100mL	1		08/01/16 13:02

Batch Information

Analytical Batch: BTF15010
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 08/01/16 13:02
Container ID: 1164313003-A

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Results of **Willow 04**

Client Sample ID: **Willow 04**
Client Project ID: **Willow Creek**
Lab Sample ID: 1164313004
Lab Project ID: 1164313

Collection Date: 08/01/16 08:49
Received Date: 08/01/16 11:33
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Microbiology Laboratory**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Fecal Coliform	25		1.00	1.00	col/100mL	1		08/01/16 13:02

Batch Information

Analytical Batch: BTF15010
Analytical Method: SM21 9222D
Analyst: K.W
Analytical Date/Time: 08/01/16 13:02
Container ID: 1164313004-A

Print Date: 08/04/2016 8:47:11AM

J flagging is activated

Method Blank

Blank ID: MB for HBN 1740878 [BTF/15010]
Blank Lab ID: 1341590

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1164313001, 1164313002, 1164313003, 1164313004

Results by **SM21 9222D**

Parameter	Results	LOQ/CL	DL	Units
Fecal Coliform	1.00U	1.00	1.00	col/100mL

Batch Information

Analytical Batch: BTF15010
Analytical Method: SM21 9222D
Instrument:
Analyst: K.W
Analytical Date/Time: 8/1/2016 1:02:00PM

Print Date: 08/04/2016 8:47:13AM

SGS

SGS North America Inc.
CHAIN OF CUSTODY RECORD

1164313

Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.

Section 1

CLIENT: ADEC - Willow Creek

CONTACT: Laura Eldred PHONE NO: 907-376-1855

PROJECT NAME: Willow Creek PROJECT/ PWSID/ PERMIT#:

REPORTS TO: laura.eldred@alaska.gov E-MAIL:

INVOICE TO: Per NTP QUOTE #: P.O. #: CT 18000 1889

Section 2

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	# CONTAINERS	Type C = COMP G = GRAB MI = Multi Incremental Soils	Preservative: Fc Bacteria SM 9222D	REMARKS/ LOC ID
(1) A	Willow 02	8/1/16	07:29	3	1	G		
(2) A	Willow 03	8/1/16	07:58	3	1	G		
(3) A	Willow 03 Rep	8/1/16	07:58	3	1	G		
(4) A	Willow 04	8/1/16	08:49	3	1	G		

Section 5

	Date	Time	
Relinquished By: (1) Laura K. Eldred	8/1/16	09:09	Received By: Peter Pope
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date 8/1/16	Time 11:33	Received For Laboratory By:

Section 4

DOD Project? Yes (No)

Cooler ID:

Data Deliverable Requirements: Level 2

Requested Turnaround Time and/or Special Instructions: Call with preliminary results ASAP if over 20 cfu

Temp Blank °C: Cooler Temp. 1.0 #D11 or Ambient [ ]

(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT

(See attached Sample Receipt Form)

Hand Delivered

[ ] 200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
[ ] 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

SGS

e-SAMPLE RECEIPT FORM

1164313

Review Criteria	Y/N (yes/no)	Exceptions Noted below
	Y	exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location		ABSENT
COC accompanied samples?	Y	
		**exemption permitted if chilled & collected <8hrs ago or chlling not required (i e., waste, oil)
Temperature blank compliant* (i.e., 0-6 °C after CF)?	Y	Cooler ID: 1 @ 1.0 °C Therm ID: D11
		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
		Cooler ID: @ °C Therm ID:
If >6°C, were samples collected <8 hours ago?		
If <0°C, were sample containers ice free?		
If samples received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".		
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
		Note: Refer to form F-083 "Sample Guide" for hold times.
Were samples received within hold time?	Y	
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	Y	
**Note: If times differ <1hr, record details & login per COC.		
Were analyses requested unambiguous?	Y	
		***Exemption permitted for metals (e.g 200.8/6020A).
Were proper containers (type/mass/volume/preservative***)used?	Y	
IF APPLICABLE		
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?		
Were all VOA vials free of headspace (i.e., bubbles ≤ 6mm)?		
Were all soil VOAs field extracted with MeOH+BFB?		

Note to Client: Any "no" answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1164313001-A	Na2S2O3 for Chlorine Redu	OK			
1164313002-A	Na2S2O3 for Chlorine Redu	OK			
1164313003-A	Na2S2O3 for Chlorine Redu	OK			
1164313004-A	Na2S2O3 for Chlorine Redu	OK			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM- The container was received damaged.
FR- The container was received frozen and not usable for Bacteria or BOD analyses.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

Source Molecular
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4985 SW 74th Court, Miami, FL 33155 USA
Tel: (1) 786-220-0379, Fax: (1) 786-513-2733, Email: info@sourcemolecular.com

Preliminary Interpretation of Dog "Quantification" ID™ Results

Detection and quantification of the fecal Dog gene biomarker for Dog fecal contamination by real-time quantitative Polymerase Chain Reaction (qPCR) DNA analytical technology

Submitter: Alaska Dept. Environmental Conservation
Date Received: July 27, 2016
Report Generated: October 25, 2016

SM #	Client #	Approximate Contribution of Dog Fecal Pollution in Water Sample	Comment
SM-6J11001	Willow 03	Not Detected	Dog fecal biomarker not detected
SM-6J11002	Willow 04	Not Detected	Dog fecal biomarker not detected
SM-6J11003	Willow 04	**Low Concentration**	Low levels of Dog fecal biomarker

Source Molecular
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Tel: (1) 786-220-0379, Fax: (1) 786-513-2733, Email:

Dog Bacteroidetes Quantification ID™

Detection and quantification of the fecal Dog gene biomarker for Dog fecal contamination by real-time quantitative Polymerase Chain Reaction (qPCR) DNA

Submitter: Alaska Dept. Environmental Conservation
Date Received: July 27, 2016
Report Generated: October 25, 2016

SM #	Client #	Analysis Requested	Marker Quantified (copies/100 ml)	DNA Analytical Results
SM-6J11001	Willow 03	Dog Bacteroidetes ID	ND	Absent
SM-6J11002	Willow 04	Dog Bacteroidetes ID	ND	Absent
SM-6J11003	Willow 04	Dog Bacteroidetes ID	<LOQ	**Present**

ND: Not Detected
<LOQ: Detected below level of quantification

Laboratory Comments

Submitter: Alaska Dept. Environmental Conservation
Report Generated: October 25, 2016

Negative Results
In sample(s) classified as negative, the dog-associated fecal gene biomarker(s) was either not detected in test replicates, one replicate was detected at a cycle threshold greater than 35 and the other was not, or one replicate was detected at a cycle threshold less than 35 and the other was not after repeated analysis. It is important to note that a negative result does not mean that the sample does not definitely have dog fecal contamination. Only repeated sampling (both during wet and dry sampling events) will enable you to draw more definitive conclusions as to the contributor(s) of fecal pollution.

Positive Results
In sample(s) classified as positive, the dog-associated fecal gene biomarker(s) was detected in both test replicates suggesting that dog fecal contamination is present in the water sample(s). The biomarker(s) serve as an indicator of the targeted fecal pollution, but the presence of the biomarker does not signify conclusively the presence of that form of fecal pollution. Only repeated sampling (both during wet and dry sampling events) will enable you to draw more definitive conclusions as to the contributor(s) of fecal pollution.

<LOQ Results
In sample(s) classified as <LOQ, the dog-associated fecal biomarker was detected in both test replicates but in quantities below the limit of quantification. This result indicates that fecal indicators associated with dog were present in the sample(s) but in low concentrations.

Dog Fecal Reference Samples
The client is encouraged to submit fecal samples from suspected sources in the surrounding area in order to gain a better understanding of the concentration of the dog-associated fecal genetic marker in the geographic region of interest. A more precise interpretation would be available to the client with the submittal of such baseline samples.

Result Interpretations
Quantitative results are reported along with interpretations. Interpretations are given as "negative", “trace”, "low concentration", "moderate concentration", or "high concentration" based on the concentration of the genetic markers found in the water samples.

Additional Testing
A portion of all samples has been frozen and will be archived for 3 months. The client is encouraged to perform additional tests on the sample(s) for other hosts suspected of contributing to the fecal contamination. A list of available tests can be found at **sourcemolecular.com/tests**

DNA Analytical Method Explanation

Each submitted water sample was filtered through 0.45 micron membrane filters. Each filter was placed in a separate, sterile 2ml disposable tube containing a unique mix of beads and lysis buffer. The sample was homogenized for 1min and the DNA extracted using the Generite DNA-EZ ST1 extraction kit (GeneRite, NJ), as per manufacturer's protocol.

Amplifications to detect the target gene biomarker were run on an Applied Biosystems StepOnePlus real-time thermal cycler (Applied Biosystems, Foster City, CA) in a final reaction volume of 20ul containing sample extract, forward primer, reverse primer, probe and an optimized buffer. The following thermal cycling parameters were used: 95 °C for 10 min and 40 cycles of 95°C for 15 s and 60°C for 1 min. All assays were run in duplicate. Absolute quantification was achieved by extrapolating target gene copy numbers from a standard curve generated from serial dilutions of known gene copy numbers.

For quality control purposes, a positive control consisting of Dog fecal DNA and a negative control consisting of PCR-grade water, were run alongside the sample(s) to ensure a properly functioning reaction and reveal any false negatives or false positives. The accumulation of PCR product is detected and graphed in an amplification plot. If the fecal indicator organism is absent in the sample, this accumulation is not detected and the sample is considered negative. If accumulation of PCR product is detected, the sample is considered positive.

Theory Explanation of Dog Bacteroidetes "Quantification" ID™

The phylum *Bacteroidetes* is composed of three large groups of bacteria with the best-known category being *Bacteroidaceae*. This family of gram-negative bacteria is found primarily in the intestinal tracts and mucous membranes of warm-blooded animals and is sometimes considered pathogenic.

Comprising *Bacteroidaceae* are the genus *Bacteroides* and *Prevotella*. The latter genus was originally classified within the former (i.e. *Bacteroides*), but since the 1990's it has been classified in a separate genus because of new chemical and biochemical findings. *Bacteroides* and *Prevotella* are gram-negative, anaerobic, rod-shaped bacteria that inhabitant of the oral, respiratory, intestinal, and urogenital cavities of humans, animals, and insects. They are sometimes pathogenic.

Fecal *Bacteroidetes* are considered for several reasons an interesting alternative to more traditional indicator organisms such as *E. coli* and *Enterococci*.[1] Since they are strict anaerobes, they are indicative of recent fecal contamination when found in water systems. This is a particularly strong reference point when trying to determine recent outbreaks in fecal pollution. They are also more abundant in feces of warm-blooded animals than *E. coli* and *Enterococci*. Furthermore, these latter two organisms are facultative anaerobes and as such they can be problematic for monitoring purposes since it has been shown that they are able to proliferate in soil, sand and sediments.

The Dog Bacteroidetes ID™ service is designed around the principle that fecal *Bacteroidetes* are found in large quantities in feces of warm-blooded animals.[2,3,4,5,6] Furthermore, certain categories of *Bacteroidetes* have been shown to be predominately detected in dog. Within these *Bacteroidetes*, certain strains of the *Bacteroides* and *Prevotella* genus have been found in dog.[2,3,5,6] As such, these bacterial strains can be used as indicators of dog fecal contamination.

One of the advantages of the Dog Bacteroidetes ID™ service is that the entire water is sampled and filtered for fecal *Bacteroidetes*. As such, this method avoids the randomness effect of culturing and selecting bacterial isolates off a petri dish. This is a particular advantage for highly contaminated water systems with potential multiple sources of fecal contamination.

Accuracy of the results is possible because the method uses PCR DNA technology. PCR allows quantities of DNA to be amplified into large number of small copies of DNA sequences. This is accomplished with small pieces of DNA called primers that are complementary and specific to the genomes to be detected.

Through a heating process called thermal cycling, the double stranded DNA is denatured and inserted with complementary primers to create exact copies of the DNA fragment desired. This process is repeated rapidly many times ensuring an exponential progression in the number of copied DNA. If the primers are successful in finding a site on the DNA fragment that is specific to the genome to be studied, then billions of copies of the DNA fragment will be available and detected in real-time. The accumulation of DNA product is plotted as an amplification curve. The absence of an amplification curve would indicate that the dog *Bacteroidetes* gene biomarker is not present.

References

[1] Scott, Troy M., Rose, Joan B., Jenkins, Tracie M., Farrah, Samuel R., Lukasik, Jerzy **Microbial Source Tracking: Current Methodology and Future Directions.** Appl. Environ. Microbiol. (2002) 68: 5796-5803.

[2] Bernhard, A.E., and K.G. Field (2000a). **Identification of nonpoint sources of fecal pollution in coastal waters by using host-specific 16S ribosomal DNA genetic markers from fecal anaerobes.** Applied and Environmental Microbiology, 66: 1,587-1,594.

[3] Bernhard, A.E., and K.G. Field (2000b). **A PCR assay to discriminate human and ruminant feces on the basis of host differences in Bacteroides-Prevotella genes encoding 16S rRNA.** Applied and Environmental Microbiology, 66: 4,571-4,574.

[4] Kreader, C.A. (1995). **Design and evaluation of Bacteroides DNA probes for the specific detection of human fecal pollution.** Applied and Environmental Microbiology, 61: 1,171-1,179.

[5] Fogarty, Lisa R., Voytek, Mary **A.Comparison of Bacteroides-Prevotella 16S rRNA Genetic Markers for Fecal Samples from Different Animal Species** Appl. Environ. Microbiol. 2005 71: 5999-6007.

[6] Dick, Linda K., Bernhard, Anne E., Brodeur, Timothy J., Santo Domingo, Jorge W., Simpson, Joyce M., Walters, Sarah P., Field, Katharine G. **Host**

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Preliminary Interpretation of Dog "Quantification" ID™ Results

Detection and quantification of the fecal Dog gene biomarker for Dog fecal contamination by real-time quantitative Polymerase Chain Reaction (qPCR) DNA analytical technology

Submitter: Alaska Dept. Environmental Conservation
Date Received: Various
Report Generated: December 5, 2016

SM #	Client #	Date Collected	Date Received	Approximate Contribution of Dog Fecal Pollution in Water Sample	Comment
SM-6K17001	Willow 03	8/8/2016	8/9/2016	Not Detected	Dog fecal biomarker not detected
SM-6K17002	Willow 04	7/26/2016	7/27/2016	**Low Concentration**	Low levels of dog fecal biomarker

Source Molecular
Leader in Microbial Source Tracking

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Tel: (1) 786-220-0379, Fax: (1) 786-513-2733, Email: info@sourcemolecular.com

Dog Bacteroidetes Quantification ID™

Detection and quantification of the fecal Dog gene biomarker for Dog fecal contamination by real-time quantitative Polymerase Chain Reaction (qPCR) DNA analytical technology

Submitter: Alaska Dept. Environmental Conservation
Date Received: Various
Report Generated: December 5, 2016

SM #	Client #	Date Collected	Date Received	Analysis Requested	Marker Quantified (copies/100 ml)	DNA Analytical Results
SM-6K17001	Willow 03	8/8/2016	8/9/2016	Dog Bacteroidetes ID	ND	Absent
SM-6K17002	Willow 04	7/26/2016	7/27/2016	Dog Bacteroidetes ID	<LOQ	**Present**

ND: Not Detected
<LOQ: Below level of quantification

Laboratory Comments

Submitter: Alaska Dept. Environmental Conservation
Report Generated: December 5, 2016

Negative Results
In sample(s) classified as negative, the dog-associated fecal gene biomarker(s) was either not detected in test replicates, one replicate was detected at a cycle threshold greater than 35 and the other was not, or one replicate was detected at a cycle threshold less than 35 and the other was not after repeated analysis. It is important to note that a negative result does not mean that the sample does not definitely have dog fecal contamination. Only repeated sampling (both during wet and dry sampling events) will enable you to draw more definitive conclusions as to the contributor(s) of fecal pollution.

<LOQ Results
In sample(s) classified as <LOQ, the dog-associated fecal biomarker was detected in both test replicates but in quantities below the limit of quantification. This result indicates that fecal indicators associated with dog were present in the sample(s) but in low concentrations.

Dog Fecal Reference Samples
The client is encouraged to submit fecal samples from suspected sources in the surrounding area in order to gain a better understanding of the concentration of the dog-associated fecal genetic marker in the geographic region of interest. A more precise interpretation would be available to the client with the submittal of such baseline samples.

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Quantitative results are reported along with interpretations. Interpretations are given as "negative", “trace”, "low concentration", "moderate concentration", or "high concentration" based on the concentration of the genetic markers found in the water samples.

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A portion of all samples has been frozen and will be archived for 3 months. The client is encouraged to perform additional tests on the sample(s) for other hosts suspected of contributing to the fecal contamination. A list of available tests can be found at **sourcemolecular.com/tests**

DNA Analytical Method Explanation

Each submitted water sample was filtered through 0.45 micron membrane filters. Each filter was placed in a separate, sterile 2ml disposable tube containing a unique mix of beads and lysis buffer. The sample was homogenized for 1min and the DNA extracted using the Generite DNA-EZ ST1 extraction kit (GeneRite, NJ), as per manufacturer's protocol.

Amplifications to detect the target gene biomarker were run on an Applied Biosystems StepOnePlus real-time thermal cycler (Applied Biosystems, Foster City, CA) in a final reaction volume of 20ul containing sample extract, forward primer, reverse primer, probe and an optimized buffer. The following thermal cycling parameters were used: 95 °C for 10 min and 40 cycles of 95°C for 15 s and 60°C for 1 min. All assays were run in duplicate. Absolute quantification was achieved by extrapolating target gene copy numbers from a standard curve generated from serial dilutions of known gene copy numbers.

For quality control purposes, a positive control consisting of Dog fecal DNA and a negative control consisting of PCR-grade water, were run alongside the sample(s) to ensure a properly functioning reaction and reveal any false negatives or false positives. The accumulation of PCR product is detected and graphed in an amplification plot. If the fecal indicator organism is absent in the sample, this accumulation is not detected and the sample is considered negative. If accumulation of PCR product is detected, the sample is considered positive.

Theory Explanation of Dog Bacteroidetes "Quantification" ID™

The phylum *Bacteroidetes* is composed of three large groups of bacteria with the best-known category being *Bacteroidaceae*. This family of gram-negative bacteria is found primarily in the intestinal tracts and mucous membranes of warm-blooded animals and is sometimes considered pathogenic.

Comprising *Bacteroidaceae* are the genus *Bacteroides* and *Prevotella*. The latter genus was originally classified within the former (i.e. *Bacteroides*), but since the 1990's it has been classified in a separate genus because of new chemical and biochemical findings. *Bacteroides* and *Prevotella* are gram-negative, anaerobic, rod-shaped bacteria that inhabitant of the oral, respiratory, intestinal, and urogenital cavities of humans, animals, and insects. They are sometimes pathogenic.

Fecal *Bacteroidetes* are considered for several reasons an interesting alternative to more traditional indicator organisms such as *E. coli* and *Enterococci*.[1] Since they are strict anaerobes, they are indicative of recent fecal contamination when found in water systems. This is a particularly strong reference point when trying to determine recent outbreaks in fecal pollution. They are also more abundant in feces of warm-blooded animals than *E. coli* and *Enterococci*. Furthermore, these latter two organisms are facultative anaerobes and as such they can be problematic for monitoring purposes since it has been shown that they are able to proliferate in soil, sand and sediments.

The Dog Bacteroidetes ID™ service is designed around the principle that fecal *Bacteroidetes* are found in large quantities in feces of warm-blooded animals.[2,3,4,5,6] Furthermore, certain categories of *Bacteroidetes* have been shown to be predominately detected in dog. Within these *Bacteroidetes*, certain strains of the *Bacteroides* and *Prevotella* genus have been found in dog.[2,3,5,6] As such, these bacterial strains can be used as indicators of dog fecal contamination.

One of the advantages of the Dog Bacteroidetes ID™ service is that the entire water is sampled and filtered for fecal *Bacteroidetes*. As such, this method avoids the randomness effect of culturing and selecting bacterial isolates off a petri dish. This is a particular advantage for highly contaminated water systems with potential multiple sources of fecal contamination.

Accuracy of the results is possible because the method uses PCR DNA technology. PCR allows quantities of DNA to be amplified into large number of small copies of DNA sequences. This is accomplished with small pieces of DNA called primers that are complementary and specific to the genomes to be detected.

Through a heating process called thermal cycling, the double stranded DNA is denatured and inserted with complementary primers to create exact copies of the DNA fragment desired. This process is repeated rapidly many times ensuring an exponential progression in the number of copied DNA. If the primers are successful in finding a site on the DNA fragment that is specific to the genome to be studied, then billions of copies of the DNA fragment will be available and detected in real-time. The accumulation of DNA product is plotted as an amplification curve. The absence of an amplification curve would indicate that the dog *Bacteroidetes* gene biomarker is not present.

References

[1] Scott, Troy M., Rose, Joan B., Jenkins, Tracie M., Farrah, Samuel R., Lukasik, Jerzy **Microbial Source Tracking: Current Methodology and Future Directions.** Appl. Environ. Microbiol. (2002) 68: 5796-5803.

[2] Bernhard, A.E., and K.G. Field (2000a). **Identification of nonpoint sources of fecal pollution in coastal waters by using host-specific 16S ribosomal DNA genetic markers from fecal anaerobes.** Applied and Environmental Microbiology, 66: 1,587-1,594.

[3] Bernhard, A.E., and K.G. Field (2000b). **A PCR assay to discriminate human and ruminant feces on the basis of host differences in Bacteroides-Prevotella genes encoding 16S rRNA.** Applied and Environmental Microbiology, 66: 4,571-4,574.

[4] Kreader, C.A. (1995). **Design and evaluation of Bacteroides DNA probes for the specific detection of human fecal pollution.** Applied and Environmental Microbiology, 61: 1,171-1,179.

[5] Fogarty, Lisa R., Voytek, Mary **A.Comparison of Bacteroides-Prevotella 16S rRNA Genetic Markers for Fecal Samples from Different Animal Species** Appl. Environ. Microbiol. 2005 71: 5999-6007.

[6] Dick, Linda K., Bernhard, Anne E., Brodeur, Timothy J., Santo Domingo, Jorge W., Simpson, Joyce M., Walters, Sarah P., Field, Katharine G. **Host**

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Human Fecal Toolbox ID™

Detection of the fecal Human gene biomarker for Human fecal contamination by quantitative Polymerase Chain Reaction (qPCR) DNA analytical technology

Submitter: Alaska Dept. Environmental Conservation
Date Received: Various
Report Generated: October 7, 2016

SM #	Client #	Date Received	Analysis Requested	Species	DNA Analytical Results
SM-6I12001	Willow 03	7/27/2016	Human Bacteroidetes ID	Dorei	Absent
SM-6I12002	Willow 04	7/20/2016	Human Bacteroidetes ID	Dorei	Absent
SM-6I12003	Willow 04	8/9/2016	Human Bacteroidetes ID	Dorei	Absent

Laboratory Comments

Negative Results

In sample(s) classified as negative, the human-associated Bacteroidetes gene biomarker was either not detected in test replicates, one replicate was detected at a cycle threshold greater than 35 and the other was not, or one replicate was detected at a cycle threshold less than 35 and the other was not after repeated analysis. It is important to note that a negative result does not mean that the sample does not definitely have human fecal contamination. Only repeated sampling (both during wet and dry sampling events) will enable you to draw more definitive conclusions as to the contributor(s) of fecal pollution.
In order to strengthen the result, a negative sample should be analyzed further for human fecal contamination with other DNA analytical tests. A list of human fecal ID tests can be found at **www.sourcemolecular.com/human**.

Human Fecal Reference Samples

The client is encouraged to submit samples from the surrounding wastewater facilities and/or septic systems in order to gain a better understanding of the concentration of the human-associated fecal Bacteroidetes genetic marker as well as the concentration of the general fecal Bacteroidetes genetic marker in the geographic region of interest. A more precise interpretation would be available to the client with the submittal of such baseline samples.

Additional Testing

A portion of all samples has been frozen and will be archived for 3 months. The client is encouraged to perform additional tests on the sample(s) for other hosts suspected of contributing to the fecal contamination. A list of available tests can be found at **www.sourcemolecular.com/tests**

DNA Analytical Method Explanation

Each submitted water sample was filtered through 0.45 micron membrane filters. Each filter was placed in a separate, sterile 2ml disposable tube containing a unique mix of beads and lysis buffer. The sample was homogenized for 1min and the DNA extracted using the Generite DNA-EZ ST1 extraction kit (GeneRite, NJ), as per manufacturer's protocol.

Amplifications were run on an Applied Biosystems StepOnePlus real-time thermal cycler (Applied Biosystems, Foster City, CA) in a final reaction volume of 20ul containing the sample extract, forward primer, reverse primer, probe and an optimized buffer. The following thermal cycling parameters were used: 50°C for 2 min, 95°C for 10 min and 40 cycles of 95°C for 15 s and 60°C for 1 min. '
All assays were run in duplicate.

For quality control purposes, a positive control consisting of appropriate genomic DNA and a negative control consisting of PCR-grade water were run alongside the sample(s) to ensure a properly functioning reaction and to reveal any false negatives or false positives. The accumulation of PCR product is detected and graphed in an amplification plot. If the fecal indicator organism is absent in the sample, this accumulation is not detected and the sample is considered negative. If accumulation of PCR product is detected, the sample is considered positive.

Human Bacteroidetes ID™ Species*: B. dorei*

The **Human Bacteroidetes ID™ Species*: B. dorei*** service targets the species *Bacteroides dorei*. *B. dorei* is an anaerobe that is frequently shed from the gastrointestinal tract and isolated from human feces worldwide. It is a newly discovered species that is widely distributed in the USA.[1,2] The human-associated marker DNA sequence is located on the 16S rRNA gene of *B. dorei*.[3] The marker is the microbial source tracking (MST) marker of choice for detecting human fecal pollution due to its exceptional sensitivity and specificity. Internal validations have been conducted on hundreds of sewage, septage, human and animal host fecal samples collected from throughout the U.S and archived in the Source Molecular fecal bank. The marker has also been evaluated in both inland and coastal waters. A recent, comprehensive, multi-laboratory MST method evaluation study, exploring the performance of current MST methods, concluded the *B. dorei* qPCR assay to be the top performing human-associated assay amongst those tested. The success and consistency of this marker in numerous studies around the world[1,3,4] makes the **Human Bacteroidetes ID™ Species*: B. dorei*** service the primary service for identifying human fecal pollution at Source Molecular.

Fecal *Bacteroidetes* are considered for several reasons an interesting alternative to more traditional indicator organisms such as *E. coli* and *Enterococci*.[5] Since they are strict anaerobes, they are indicative of recent fecal contamination when found in water systems. This is a particularly strong reference point when trying to determine recent outbreaks in fecal pollution. They are also more abundant in feces of warm-blooded animals than *E. coli* and *Enterococci*.

The Human Bacteroidetes ID™ service is designed around the principle that fecal *Bacteroidetes* are found in large quantities in feces of warm-blooded animals.[3,5,6,7,8] Furthermore, certain strains of *Bacteroidetes* have been found to be associated with humans.[3,6] As such, these bacterial strains can be used as indicators of human fecal contamination.

Accuracy of the results is possible because the method amplifies DNA into a large number of small copies of the gene biomarker of interest. This is accomplished with small pieces of DNA called primers that are complementary and specific to the unique *B. dorei* DNA sequence. Through a heating process called thermal cycling, the double stranded DNA is denatured, hybridized to the complementary primers and amplified to create many copies of the DNA fragment desired. If the primers are successful in finding a site on the DNA fragment that is specific to the *B. dorei* DNA sequence, then billions of copies of the DNA fragment will be available and detected in real-time. The accumulation of DNA product is plotted as an amplification curve by the qPCR software. The absence of an amplification curve indicates that the *B. dorei* gene biomarker is not detected in the water sample because it is either not present or present at concentrations below the analytical detection limit.

To strengthen the validity of the results, additional tests targeting other high-ranking, human-associated *Bacteroidetes* species should be performed, such as
Human Bacteroidetes ID™ Species*: B. stercoris*,
Human Bacteroidetes ID™ Species*: B. fragilis,* and
Human Bacteroidetes ID™ Species*: B. thetaiotaomicron*.

[1]Boehm, A., Fuhrman, J., Mrse, R., Grant, S. **Tiered approach for identification of a human fecal pollution source at a recreational beach: case study at Avalon Bay, Catalina Island, California**. Environ Sci Technol. 2003 37**:** 673–680.
[2]Bakir, M., Sakamoto, M., Kitahara, M., Matsumoto, M., Benno, Y. **Bacteroides dorei sp. nov., isolated from human faeces**. Int. J. Syst. Evol. Microbiol. 2006 56: 1639–1641.
[3] Bernhard, A., Field, K. **A PCR assay to discriminate human and ruminant feces on the basis of host differences in Bacteroides-Prevotella genes encoding 16S rRNA.** Appl. Environ. Microbiol. 2000b 66: 4571-4574.
[4]Ahmed, w., Masters, N., Toze, S. **Consistency in the host specificity and host sensitivity of the Bacteroides HF183 marker for sewage pollution tracking. Lett. Appl. Microbiol. 2012 55: 283-289.**
[5] Scott, T., Rose, J., Jenkins, T., Farrah, S., Lukasik, J. **Microbial Source Tracking: Current Methodology and Future Directions.** Appl. Environ. Microbiol. 2002 68: 5796-5803.
[6] Bernhard, A., Field, K. **Identification of nonpoint sources of fecal pollution in coastal waters by using host-specific 16S ribosomal DNA genetic markers from fecal anaerobes.** Appl. Environ. Microbiol. 2000a 66: 1587-1594.
[7] Fogarty, L., Voytek, M. **A Comparison of Bacteroides-Prevotella 16S rRNA Genetic Markers for Fecal Samples from Different Animal Species.** Appl. Environ. Microbiol. 2005 71: 5999-6007.
[8] Dick, L., Bernhard, A., Brodeur, T., Santo Domingo, J., *et al*. **Host Distributions of Uncultivated Fecal Bacteroidales Bacteria Reveal Genetic**

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Horse Fecal Toolbox ID™

Detection of the fecal Horse gene biomarker for Horse fecal contamination by quantitative Polymerase Chain Reaction (qPCR) DNA analytical technology

Submitter: Alaska Dept. Environmental Conservation
Date Received: July 26, 2016
Date Reported: August 24, 2016

SM #	Client #	Analysis Requested	DNA Analytical Results
SM-6H17004	Willow 02	Horse Bacteroidetes ID	Absent

Laboratory Comments

Negative Results

In sample(s) classified as negative, the horse-associated fecal gene biomarker was either not detected in test replicates, one replicate was detected at a cycle threshold greater than 35 and the other was not, or one replicate was detected at a cycle threshold less than 35 and the other was not after repeated analysis. It is important to note that a negative result does not mean that the sample does not definitely have horse fecal contamination. Only repeated sampling (both during wet and dry sampling events) will enable you to draw more definitive conclusions as to the contributor(s) of fecal pollution.

Horse Fecal Reference Samples

The client is encouraged to submit fecal samples from suspected sources in the surrounding area in order to gain a better understanding of the concentration of the horse-associated fecal genetic marker in the geographic region of interest. A more precise interpretation would be available to the client with the submittal of such baseline samples.

Additional Testing

A portion of all samples has been frozen and will be archived for 3 months. The client is encouraged to perform additional tests on the sample(s) for other hosts suspected of contributing to the fecal contamination. A list of available tests can be found at **sourcemolecular.com/tests**.

DNA Analytical Method Explanation

Each submitted water sample was filtered through 0.45 micron membrane filters. Each filter was placed in a separate, sterile 2ml disposable tube containing a unique mix of beads and lysis buffer. The sample was homogenized for 1min and the DNA extracted using the Generite DNA-EZ ST1 extraction kit (GeneRite, NJ), as per manufacturer's protocol.

Amplifications to detect the target gene biomarker were run on an Applied Biosystems StepOnePlus real-time thermal cycler (Applied Biosystems, Foster City, CA) in a final reaction volume of 20ul containing sample extract, forward primer, reverse primer, probe and an optimized buffer. The following thermal cycling parameters were used: 95°C for 10 min and 40 cycles of 95°C for 15 s and 60°C for 1 min. All assays were run in duplicate.

For quality control purposes, a positive control consisting of horse fecal DNA and a negative control consisting of PCR-grade water, were run alongside the sample(s) to ensure a properly functioning reaction and reveal any false negatives or false positives. The accumulation of PCR product is detected and graphed in an amplification plot. If the fecal indicator organism is absent in the sample, this accumulation is not detected and the sample is considered negative. If accumulation of PCR product is detected, the sample is considered positive.

Horse Bacteroidetes Theory Explanation

The phylum *Bacteroidetes* is composed of three large groups of bacteria with the best-known category being *Bacteroidaceae*. This family of gram-negative bacteria is found primarily in the intestinal tracts and mucous membranes of warm-blooded animals and is sometimes considered pathogenic.

Comprising *Bacteroidaceae* are the genus *Bacteroides* and *Prevotella*. The latter genus was originally classified within the former (i.e. *Bacteroides*), but since the 1990's it has been classified in a separate genus because of new chemical and biochemical findings. *Bacteroides* and *Prevotella* are gram-negative, anaerobic, rod-shaped bacteria that inhabitant of the oral, respiratory, intestinal, and urogenital cavities of humans, animals, and insects. They are sometimes pathogenic.

Fecal *Bacteroidetes* are considered for several reasons an interesting alternative to more traditional indicator organisms such as *E. coli* and *Enterococci*.[1] Since they are strict anaerobes, they are indicative of recent fecal contamination when found in water systems. This is a particularly strong reference point when trying to determine recent outbreaks in fecal pollution. They are also more abundant in feces of warm-blooded animals than *E. coli* and *Enterococci*. Furthermore, these latter two organisms are facultative anaerobes and as such they can be problematic for monitoring purposes since it has been shown that they are able to proliferate in soil, sand and sediments.

The Horse Bacteroidetes ID™ service is designed around the principle that fecal *Bacteroidetes* are found in large quantities in feces of warm-blooded animals.[2,3,4,5,6] Furthermore, certain categories of *Bacteroidetes* have been shown to be predominately detected in horses. Within these *Bacteroidetes*, certain strains of the *Bacteroides* and *Prevotella* genus have been found in horses.[2,6] As such, these bacterial strains can be used as indicators of horse fecal contamination.

One of the advantages of the Horse Bacteroidetes ID™ service is that the entire water is sampled and filtered for fecal *Bacteroidetes*. As such, this method avoids the randomness effect of culturing and selecting bacterial isolates off a petri dish. This is a particular advantage for highly contaminated water systems with potential multiple sources of fecal contamination.

Accuracy of the results is possible because the method uses PCR DNA technology. PCR allows quantities of DNA to be amplified into large number of small copies of DNA sequences. This is accomplished with small pieces of DNA called primers that are complementary and specific to the genomes to be detected.

Through a heating process called thermal cycling, the double stranded DNA is denatured and inserted with complementary primers to create exact copies of the DNA fragment desired. This process is repeated rapidly many times ensuring an exponential progression in the number of copied DNA. If the primers are successful in finding a site on the DNA fragment that is specific to the genome to be studied, then billions of copies of the DNA fragment will be available and detected in real-time. The accumulation of DNA product is plotted as an amplification curve. The absence of an amplification curve would indicate that the horse *Bacteroidetes* gene biomarker is not present.

References

[1] Scott, Troy M., Rose, Joan B., Jenkins, Tracie M., Farrah, Samuel R., Lukasik, Jerzy **Microbial Source Tracking: Current Methodology and Future Directions.** Appl. Environ. Microbiol. (2002) 68: 5796-5803.

[2] Bernhard, A.E., and K.G. Field (2000a). **Identification of nonpoint sources of fecal pollution in coastal waters by using host-specific 16S ribosomal DNA genetic markers from fecal anaerobes.** Applied and Environmental Microbiology, 66: 1,587-1,594.

[3] Bernhard, A.E., and K.G. Field (2000b). **A PCR assay to discriminate human and ruminant feces on the basis of host differences in Bacteroides-Prevotella genes encoding 16S rRNA.** Applied and Environmental Microbiology, 66: 4,571-4,574.

[4] Kreader, C.A. (1995). **Design and evaluation of Bacteroides DNA probes for the specific detection of human fecal pollution.** Applied and Environmental Microbiology, 61: 1,171-1,179.

[5] Fogarty, Lisa R., Voytek, Mary **A.Comparison of Bacteroides-Prevotella 16S rRNA Genetic Markers for Fecal Samples from Different Animal Species** Appl. Environ. Microbiol. 2005 71: 5999-6007.

[6] Dick, Linda K., Bernhard, Anne E., Brodeur, Timothy J., Santo Domingo, Jorge W., Simpson, Joyce M., Walters, Sarah P., Field, Katharine G.

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Preliminary Interpretation of Human Fecal Pollution ID™ Results

Detection and quantification of the fecal Human gene biomarker for Human fecal contamination by real-time quantitative Polymerase Chain Reaction (qPCR) DNA analytical technology

Submitter: Alaska Dept. Environmental Conservation
Date Received: July 26, 2016
Report Generated: August 24, 2016

SM #	Client #	Approximate Contribution of Human Fecal Pollution in Water Sample	Comment
SM-6G26001	Willow 02	Not Detected	2 Human fecal biomarkers not detected
SM-6G27003	Willow 04	**Low Concentration**	Low levels of 1 human fecal biomarker
SM-6H09008	Willow 03	**Low Concentration**	Low levels of 1 human fecal biomarker

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Human Fecal Pollution ID™ Quantification

Detection and quantification of the fecal Human gene biomarker for Human fecal contamination by real-time quantitative Polymerase Chain Reaction (qPCR) DNA analytical technology

Submitter: Alaska Dept. Environmental Conservation
Date Received: July 26, 2016
Report Generated: August 24, 2016

SM #	Client #	Analysis Requested	Target	Marker Quantified (copies/100 ml)	DNA Analytical Results
SM-6G26001	Willow 02	Human Bacteroidetes ID 1	Dorei	ND	Absent
SM-6G27003	Willow 04	Human Bacteroidetes ID 1	Dorei	<LOQ	**Present**
SM-6H09008	Willow 03	Human Bacteroidetes ID 1	Dorei	<LOQ	**Present**
SM-6H17001	Willow 02	Human Bacteroidetes ID 2	EPA	ND	Absent
SM-6H17002	Willow 04	Human Bacteroidetes ID 2	EPA	ND	Absent
SM-6H17003	Willow 03	Human Bacteroidetes ID 2	EPA	ND	Absent

ND: Not Detected
<LOQ: Detected below level of quantification

Laboratory Comments

Submitter: Alaska Dept. Environmental Conservation

Report Generated: August 24, 2016

Negative Results

In sample(s) classified as negative, the human-associated Bacteroidetes gene biomarker(s) was either not detected in test replicates, one replicate was detected at a cycle threshold greater than 35 and the other was not, or one replicate was detected at a cycle threshold less than 35 and the other was not after repeated analysis. It is important to note that a negative result does not mean that the sample does not definitely have human fecal contamination. Only repeated sampling (both during wet and dry sampling events) will enable you to draw more definitive conclusions as to the contributor(s) of fecal pollution.

In order to strengthen the result, a negative sample should be analyzed further for human fecal contamination with other DNA analytical tests. A list of human fecal ID tests can be found at **www.sourcemolecular.com/human**.

<LOQ Results

In sample(s) classified as <LOQ, the human-associated Bacteroidetes biomarker was detected in both test replicates but in quantities below the limit of quantification. This result indicates that fecal indicators associated with human were present in the sample(s) but in low concentrations.

Human Fecal Reference Samples

The client is encouraged to submit samples from the surrounding wastewater facilities and/or septic systems in order to gain a better understanding of the concentration of the human-associated fecal Bacteroidetes genetic marker as well as the concentration of the general fecal Bacteroidetes genetic marker in the geographic region of interest. A more precise interpretation would be available to the client with the submittal of such baseline samples.

Result Interpretations

Quantitative results are reported along with interpretations. Interpretations are given as "negative", "low concentration", "moderate concentration", or "high concentration" based on the concentration of the genetic markers found in the water samples.

Additional Testing

A portion of all samples has been frozen and will be archived for 3 months. The client is encouraged to perform additional tests on the sample(s) for other hosts suspected of contributing to the fecal contamination. A list of available tests can be found at **www.sourcemolecular.com/tests**

DNA Analytical Method Explanation

All reagents, chemicals and apparatuses were verified and inspected beforehand to ensure that no false negatives or positives could be generated. In that regard, positive and negative controls were run to attest the integrity of the analysis. All inspections and controls tested negative for possible extraneous contaminates, including PCR inhibitors.

Each submitted water sample was filtered through 0.45 micron membrane filters. Each filter was placed in a separate, sterile 2ml disposable tube containing a unique mix of beads and lysis buffer. The sample was homogenized for 1min and the DNA extracted using the Generite DNA-EZ ST1 extraction kit (GeneRite, NJ), as per manufacturer's protocol.

Amplifications were run on an Applied Biosystems StepOnePlus real-time thermal cycler (Applied Biosystems, Foster City, CA) in a final reaction volume of 20ul containing sample extract, forward primer, reverse primer, probe and an optimized buffer. The following thermal cycling parameters were used: 50°C for 2 min, 95°C for 10 min and 40 cycles of 95°C for 15 s and 60°C for 1 min. All assays were run in duplicate. Absolute quantification was achieved by extrapolating genome copy numbers from standard curves generated from serial dilutions of Human specific and generic genomic DNA.

For quality control purposes, a positive control consisting of appropriate genomic DNA and a negative control consisting of PCR-grade water were run alongside the sample(s) to ensure a properly functioning reaction and reveal any false negatives or false positives.

Human Bacteroidetes ID™ Species*: B. dorei*

The **Human Bacteroidetes ID™ Species*: B. dorei*** service targets the species *Bacteroides dorei*. *B. dorei* is an anaerobe that is frequently shed from the gastrointestinal tract and isolated from human feces worldwide. It is a newly discovered species that is widely distributed in the USA.[1,2] The human-associated marker DNA sequence is located on the 16S rRNA gene of *B. dorei*.[3] The marker is the microbial source tracking (MST) marker of choice for detecting human fecal pollution due to its exceptional sensitivity and specificity. Internal validations have been conducted on hundreds of sewage, septage, human and animal host fecal samples collected from throughout the U.S and archived in the Source Molecular fecal bank. The marker has also been evaluated in both inland and coastal waters. A recent, comprehensive, multi-laboratory MST method evaluation study, exploring the performance of current MST methods, concluded the *B. dorei* qPCR assay to be the top performing human-associated assay amongst those tested. The success and consistency of this marker in numerous studies around the world[1,3,4] makes the **Human Bacteroidetes ID™ Species*: B. dorei*** service the primary service for identifying human fecal pollution at Source Molecular.

Fecal *Bacteroidetes* are considered for several reasons an interesting alternative to more traditional indicator organisms such as *E. coli* and *Enterococci*.[5] Since they are strict anaerobes, they are indicative of recent fecal contamination when found in water systems. This is a particularly strong reference point when trying to determine recent outbreaks in fecal pollution. They are also more abundant in feces of warm-blooded animals than *E. coli* and *Enterococci*.

The Human Bacteroidetes ID™ service is designed around the principle that fecal *Bacteroidetes* are found in large quantities in feces of warm-blooded animals.[3,5,6,7,8] Furthermore, certain strains of *Bacteroidetes* have been found to be associated with humans.[3,6] As such, these bacterial strains can be used as indicators of human fecal contamination.

Accuracy of the results is possible because the method amplifies DNA into a large number of small copies of the gene biomarker of interest. This is accomplished with small pieces of DNA called primers that are complementary and specific to the unique *B. dorei* DNA sequence. Through a heating process called thermal cycling, the double stranded DNA is denatured, hybridized to the complementary primers and amplified to create many copies of the DNA fragment desired. If the primers are successful in finding a site on the DNA fragment that is specific to the *B. dorei* DNA sequence, then billions of copies of the DNA fragment will be available and detected in real-time. The accumulation of DNA product is plotted as an amplification curve by the qPCR software. The absence of an amplification curve indicates that the *B. dorei* gene biomarker is not detected in the water sample because it is either not present or present at concentrations below the analytical detection limit.

To strengthen the validity of the results, additional tests targeting other high-ranking, human-associated *Bacteroidetes* species should be performed, such as
Human Bacteroidetes ID™ Species*: B. stercoris*,
Human Bacteroidetes ID™ Species*: B. fragilis,* and
Human Bacteroidetes ID™ Species*: B. thetaiotaomicron*.

[1]Boehm, A., Fuhrman, J., Mrse, R., Grant, S. **Tiered approach for identification of a human fecal pollution source at a recreational beach: case study at Avalon Bay, Catalina Island, California**. Environ Sci Technol. 2003 37**:** 673–680.
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[7] Fogarty, L., Voytek, M. **A Comparison of Bacteroides-Prevotella 16S rRNA Genetic Markers for Fecal Samples from Different Animal Species.** Appl. Environ. Microbiol. 2005 71: 5999-6007.
[8] Dick, L., Bernhard, A., Brodeur, T., Santo Domingo, J., *et al*. **Host Distributions of Uncultivated Fecal Bacteroidales Bacteria Reveal Genetic**

Human Bacteroidetes ID™: EPA Developed Assay

The **Human Bacteroidetes ID™: EPA Developed Assay** service targets a functional gene biomarker in *Bacteroidales*-like anaerobic bacteria that is present in high concentrations in the human gut. The U.S Environmental Protection Agency (U.S. EPA) was the first to target the biomarker using quantitative Polymerase Chain Reaction (qPCR) technology in order to detect ground and surface waters impacted by human fecal pollution.[1] Since it's development, the assay has been used succesfully around the U.S to identify fecal pollution originating from human sources, such as sewage and septage wastewaters.

The U.S. EPA Developed assay has been shown to be highly associated with human fecal pollution. It has successfully been validated in multiple nationwide studies using at least 300 individual reference fecal material from 22 different animal species known to commonly contaminate environmental waters.[1,2] A reported 99.2% specificity to human fecal material makes this one of the leading assays to confirm the presence of fecal contamination that is of human origin.[1] The *Bacteroidales*-like bacteria is widely distributed. It was detected in 100% of hundreds of sewage and human reference fecal samples collected from more than 20 human populations, making it highly sensitive. Internal validations have also been conducted on hundreds of wastewater, human and animal host fecal samples archived in the Source Molecular fecal bank.

Fecal anaerobic bacteria are considered for several reasons an interesting alternative to more traditional fecal indicator organisms such as *E. coli* and *Enterococci*.[3] Since they are strict anaerobes, they are indicative of recent fecal contamination when found in water systems.[3] This is a particularly strong reference point when trying to determine recent outbreaks in fecal pollution. They are also more abundant in feces of warm-blooded animals than *E. coli* and *Enterococci*.

The **Human Bacteroidetes ID™: EPA Developed Assay** service is designed around the principle that fecal *Bacteroidales*-like bacteria are found in large quantities in feces of warm-blooded animals.[4,5] Furthermore, certain strains have been shown to be associated with humans.[4,5] As such, these bacterial strains can be used as indicators of human fecal contamination. An advantage of the Human Bacteroidetes ID™ service is that the entire portion of water sampled is filtered to concentrate bacteria. As such, this method avoids the randomness effect of culturing and selecting bacterial isolates. This is an advantage for highly contaminated water systems with potential multiple sources of fecal contamination.

Accuracy of the results is possible because the method amplifies DNA into a large number of copies of the gene biomarker of interest. This is accomplished with small pieces of DNA called primers that are complementary and specific to the gene biomarker. Through a heating process called thermal cycling, the double stranded DNA is denatured, hybridized to the complementary primers and amplified to create many copies of the DNA fragment. If the primers are successful in finding a site on the DNA fragment that is specific to the human-associated biomarker, billions of copies of the DNA fragment will be available and detected in real-time. The accumulation of DNA product is plotted as an amplification curve by qPCR software. The absence of an amplification curve indicates that the gene biomarker is not detectable in the water sample either because it is not present or present at concentrations below the analytical detection limit.

To strengthen the validity of the results, additional tests targeting other high-ranking, human-associated *Bacteroidetes* species should be performed, such as
Human Bacteroidetes ID™ Species*: B. dorei*,
Human Bacteroidetes ID™ Species*: B. fragilis,* and
Human Bacteroidetes ID™ Species*: B. stercoris*

[1] Shanks, O., Kelty, C., Sivaganesan, M., Varma, M. and Haugland, R. **Quantitative PCR for Genetic Markers of Human Fecal Pollution**. Appl. Environ. Microbiol. 2009 75: 5507-5513.
[2] Layton, B., Cao, Y., Ebentier, D., Hanley, K., Ballesté, E., Brandão, J., *et al*. **Performance of Human Fecal Anaerobe-Associated PCR-Based Assays in a Multi-Laboratory Method Evaluation Study.** Water Research. 2013 In Press.
[3] Scott, T., Rose, J., Jenkins, T., Farrah, S. and Lukas k, J. **Microbial Source Tracking: Current Methodology and Future Directions.** Appl. Environ. Microbiol. 2002 68: 5796-5803.
[4] Bernhard, A., Field, K. **Identification of nonpoint sources of fecal pollution in coastal waters by using host-specific 16S ribosomal DNA genetic markers from fecal anaerobes.** Appl. Environ. Microbiol. 2000a 66: 1587-1594.
[5] Bernhard, A., Field, K. **A PCR assay to discriminate human and ruminant feces on the basis of host differences in Bacteroides-Prevotella genes encoding 16S rRNA.** Appl. Environ. Microbiol. 2000b 66: 4571-4574.