Preparado para:

Ministerio de Ambiente y Recursos Naturales

(MARN)

Proyecto Minero Escobal

Informe Trimestral de Monitoreo Ambiental 21-2017

Preparado por:

MINERA SAN RAFAEL

Departamento de Ambiente

San Rafael Las Flores, Santa Rosa, Guatemala

MAYO - JULIO 2017

I. ÍNDICE GENERAL

II. ÍNDICE DE CUADROS

III. ÍNDICE DE FIGURAS

IV. ÍNDICE DE FOTOGRAFÍAS

1 Resumen ejecutivo

A continuación se presentan los resultados del informe trimestral consolidado comprendido entre Mayo a Julio de 2017, el cual incluye los componentes de calidad del aire: material particulado, metales en material particulado, gases de combustión y niveles de presión sonora. Asimismo la calidad del agua, sedimentos, calidad de efluente, vibraciones, geoquímica de roca y salud y seguridad ocupacional. Lo anterior en cumplimiento a la resolución 549-2012/DIGARN/ODGR/hapc del Ministerio de Ambiente y Recursos Naturales.

1.1 Calidad del aire

Un total de nueve estaciones fueron monitoreadas para determinar la concentración de PM_{10} y niveles de presión sonora. Además se monitorearon siete estaciones para medir concentración de metales en PM_{10}, sólidos sedimentables totales y gases de combustión.

Los valores de PM_{10} registrados durante el monitoreo (7.9 a 37.87 $\mu g/m^3$), se encuentran dentro de los valores máximos permisibles, conforme a los valores establecidos por la EPA, el Banco Mundial (150 $\mu g/m^3$) y conforme a lo establecido en la línea base. En cuatro de siete estaciones se registró presencia de mercurio. Sin embargo la concentración reportada se encuentra por encima del límite de detección del método.

Los valores de partículas sedimentables totales se encuentran entre 4.90 a 11.03 $g/(m^2$ x 30 días), los cuales corresponden a las estaciones EA-2B y EA-4A respectivamente. Ningún registro se encuentra por arriba del valor máximo registrado durante el establecimiento de la línea base.

Los valores de gases de combustión se encontraron por debajo del límite de detección del método en todas las estaciones para SO_2 ($<13\mu g/m^3$) y NO_2 (<9 $\mu g/m^3$).

Los niveles de presión sonora registrados en las estaciones ER-1, ER-2, ER-3, ER-4A, ER-5A y ER-7A presentaron valores de promedio diurno y nocturno dentro de los valores mínimos y máximos registrados en el establecimiento de la línea base, a excepción de las mediciones en promedio diurno de Mayo en la estación ER-2, lo registrado en Mayo en la estación ER-4A en promedio diurno y nocturno, y lo registrado en Mayo, Junio y Julio en la estación ER-7A.

1.2 Calidad del agua

Se monitorearon 11 estaciones de agua superficial, 5 estaciones de agua subterránea (manantiales), 2 estaciones de pozos de producción y 10 estaciones de agua en pozos de monitoreo ubicadas en el AID del proyecto. Del control de calidad (blancos de campo) se obtuvieron resultados confiables tanto en la manipulación de las muestras como en los resultados de los análisis. El agua superficial (**SW**), subterránea (**GW**) y los pozos de monitoreo (**MW**) presentaron un pH alcalino y dentro del rango establecido por la USEPA para la salud humana. No se detectó mercurio y cianuro total en ninguna categoría de agua (SW, GW y MW). Se registraron sólidos suspendidos totales en SW y MW y los resultados encontrados están por debajo de lo establecido por las guías del banco mundial (50 mg/L). Se detectaron cloruros en SW, GW y MW, todos los valores por debajo de lo sugerido por la USEPA (250 mg/L). Se detectó arsénico en todas las categorías de agua (SW, GW y MW) y todos los resultados se encontraron por debajo de los establecido por la USEPA (0.01 mg/L) y dentro del rango registrado durante el establecimiento de la línea base.

1.3 Sedimentos

Se monitorearon 11 estaciones (las mismas de agua superficial). No se detectó cianuro en ninguna de las estaciones muestreadas, a excepción de la estación SED-7. El mercurio se registró en todas las estaciones, en concentraciones por debajo de lo establecido (25 mg/kg) para la disposición de lodos en el suelo establecidos por el Acuerdo 236-2006. Las concentraciones de Cadmio, Cromo y Plomo registradas están por debajo de los valores guía. Todas las estaciones muestreadas registraron concentraciones de Arsénico menor al valor sugerido (50 mg/kg) por el acuerdo 236-2006.

1.4 Calidad del efluente

Del control de calidad (blancos de campo) se obtuvieron resultados confiables tanto en la manipulación de las muestras como en los resultados de los análisis. Los resultados obtenidos durante las descargas de la planta de tratamiento durante el trimestre cumplen con el Acuerdo Gubernativo 236-2006 para entes generadores nuevos.

1.5 Vibraciones

En total se registraron 421 voladuras en tres estaciones de monitoreo. Todas las voladuras registradas se encuentran por debajo de los límites de detección del equipo (2.5 mm/s); el cual incluso es menor al límite a partir del cual, las

vibraciones inducidas por voladuras (50.8 mm/s), pueden ocasionar daños según la norma establecida por United States Bureau of Mines.

1.6 Geoquímica de roca

Se analizó el pH en pasta de 15 muestras de material extraído de los túneles. Las lecturas de pH en pasta obtenidas de las muestras de material extraídas de mina subterránea fueron alcalinas, lo que indica que no hay indicios de un potencial de generación ácida dentro los túneles.

1.7 Salud y seguridad ocupacional

Los resultados obtenidos en los niveles de presión sonora para ambientes laborales, indican que se está por debajo de los límites de nivel de sonido ponderado “A” acorde a OSHA para 24 horas (82-83 dBA) y los resultados de partículas respirables en las estaciones de monitoreo, cumplen con el rango de aceptación que el fabricante establece basado en el equipo marca 3M código 7502 y filtro 3M código 60926 Homologación NIOSH.

2 Introducción

A continuación se presenta al Ministerio de Ambiente y Recursos Naturales (**MARN**), el informe trimestral de monitoreo ambiental del Proyecto Minero Escobal (**el Proyecto**) basado en lo siguiente:

A. Resultados obtenidos durante los monitoreos ambientales referente a la calidad del aire (material particulado, gases de combustión y niveles de presión sonora), calidad de agua, vibraciones, salud y seguridad ocupacional y geoquímica de roca llevados a cabo durante los meses de Mayo a Julio de 2017.

Esto como parte de los compromisos ambientales de Minera San Rafael, S.A. (**la Empresa**) en base a la resolución 549-2012/DIGARN/ODGR/hapc, inciso B, el cual se lee: "La entidad MINERA SAN RAFAEL, SOCIEDAD ANÓNIMA, deberá continuar realizando los monitoreos en base a lo descrito en cada una de las resoluciones citadas en el primer considerando (4590-2008/ELER/CG), (262-2011/ECM/caml), (3061-2011/DIGARN/ECM/beor), llevando su respectivo registro y presentar los resultados de los monitoreos de cada uno de los proyectos de forma trimestral".

- Proyecto de Exploración Minera Oasis ante el MARN con base en la resolución 4590-2008/ELER/CG, compromiso número VII; el cual se lee: "llevar un monitoreo mensual de la calidad de aire y niveles de ruido en el Área de Influencia Directa (**AID**) y presentar resultados mensualmente al MARN."

- Proyecto de Túneles de Exploración Minera Oasis ante el MARN con base en la resolución 262-2011/ECM/caml, compromiso número XII; el cual se lee: "Continuar con el programa de monitoreo de la calidad del agua y aire, implementado desde 2008."

- Proyecto Minero Escobal ante el MARN con base en la resolución 3061-2011/DIGARN/ECM/beor, compromisos número III y número VI; los cuales se leen: "La Empresa deberá de implementar el plan de monitoreo ambiental descrito en capítulo 13 y cumplirá con los límites establecidos por el MARN, además de lineamientos internacionales como Banco Mundial, Corporación Financiera internacional (**CFI**), Agencia de Protección Ambiental de los Estados Unidos (**USEPA**), Organización Mundial de la Salud (**OMS**) y Administración de la Salud y Seguridad Ocupacional (**OSHA**), según el componente que sea monitoreado…" y "Llevar un registro documentado del caudal bombeado de los pozos de abastecimiento y del agua bombeada desde los túneles hacia las piletas, así como de las descargas y los parámetros de descarga…".

B. Resultados de calidad de agua y de calidad de aire, como parte de los compromisos ambientales de la empresa ante el MARN con base en la resolución 3061-2011/DIGARN/ECM/beor, compromisos número XXXI; el cual se lee: "Presentar los informes de monitoreo de la calidad del agua de los cuerpos naturales de agua potencialmente afectados por las actividades del proyecto y de la calidad del aire a este Ministerio en forma anual."

C. Copia de registro documentado del caudal bombeado desde los túneles hacia la planta de tratamiento y de su descarga hacia la Quebrada Escobal, como parte de los compromisos ambientales de la empresa ante el MARN con base en la resolución 3061-2011/DIGARN/ECM/beor, compromisos número VI; el cual se lee: "llevar un registro documentado del caudal bombeado de los pozos de abastecimiento y del agua bombeada desde los túneles hacia las piletas, así como de las descargas y los parámetros de descarga, remitiendo a este Ministerio una copia mensual de estos registros."

D. Resultados del monitoreo ambiental como parte de los compromisos de la empresa ante el MARN con base en la resolución 05801-2016/DIGARN/DCA/OBT/rdor, compromiso número XIII; el cual se lee: "Cumplir fielmente y a cabalidad con los compromisos adquiridos en la Resolución Aprobatoria No. 3061-2011/DIGARN/ECM/beor, de fecha 19 de octubre de 2011, referida al proyecto original denominado Proyecto Minero Escobal…"

Todos los procedimientos y métodos analíticos presentados en el siguiente reporte, pueden consultarse en las versiones previas a estos informes trimestrales. El contenido del presente informe corresponde a la evaluación de los siguientes componentes ambientales.

- Calidad de Aire: Se monitorearon nueve estaciones ubicadas dentro del área de Influencia (**AI**) del proyecto para medir la concentración de material particulado igual o menor a 10 micrómetros (**PM_{10}**), en microgramos por metro cúbico (**$\mu g/m^3$**). También se monitorearon siete estaciones para medir la concentración de metales en PM_{10}, sólidos sedimentables totales (**PST**), y gases de combustión: dióxido de azufre (**SO_2**) y óxidos nitrosos (**NO_x**).

- Calidad de Presión Sonora: Se monitorearon nueve estaciones ubicadas dentro del ID del proyecto, para determinar los niveles de presión sonora, en decibeles escala A (**dBa**) y respuesta lenta.

- Calidad de Agua: Se tomaron muestras en 11 estaciones de agua superficial, 5 estaciones de agua subterránea (manantiales), 2 estaciones de pozos de producción y 11 estaciones de agua en pozos de monitoreo ubicadas en el AID del proyecto. La estación SW-5 no fue monitoreada durante el trimestre, para evitar conflictos sociales.

- Sedimentos: Se tomaron muestras de sedimentos en las mismas estaciones de agua superficial ubicadas en el AI del proyecto. La estación SED-5 no fue monitoreada durante el trimestre, para evitar conflictos sociales.
- Calidad de Efluente: Se tomaron muestras mensuales en el efluente de la Planta de tratamiento de aguas proveniente de túneles y del agua contenida en la pileta de cumplimiento ambiental. En el anexo 11.2 se presenta una copia de los registros diarios; a partir del 12 de Julio de 2017 la planta de tratamiento de aguas proveniente de los túneles dejó de funcionar, debido a la suspensión temporal de la licencia de explotación de Minera San Rafael.
- Vibraciones: Se instalaron tres medidores de vibraciones, los cuales registraron la velocidad de partícula durante cada una de las voladuras. En total se registraron 421 voladuras durante los meses de Mayo a Junio de 2017. Solo se lograron realizar esas mediciones, debido a la suspensión temporal de la licencia de explotación de Minera San Rafael.
- Geoquímica de roca estéril: Se analizó el pH en pasta de 15 muestras de material extraído de los túneles hasta Junio de 2017, lo anterior debido a la suspensión temporal de la licencia de explotación de Minera San Rafael.
- Mediciones de Seguridad y Salud Ocupacional: Se analizaron seis estaciones de monitoreo de presión sonora, tres estaciones de material particulado y se presenta un extracto de las mediciones rutinarias de gases para determinar ácido sulfhídrico (H_2S).
- Copia de registro documentado del caudal bombeado de los pozos del agua bombeada desde los túneles hacia las piletas. En el anexo 12.1 se presenta copia de las lecturas diarias de flujómetros y los cálculos realizados para determinar los caudales bombeados del portal Este y el portal Oeste, durante los meses de Mayo a Julio de 2017.
- Copia de registro documentado del análisis In Situ y kit de Cianuro de efluentes. En el anexo 12.2 se presenta copia de las lecturas diarias de parámetros *In Situ* (pH, temperatura, conductividad y turbidez), así como los resultados obtenidos con el Kit de Cianuro (método colorimétrico) y resultados de muestras enviadas al laboratorio ACZ para la verificación del método colorimétrico, durante los meses de Mayo a Julio 2017. A partir del 12 de Julio de 2017 la planta de tratamiento de aguas proveniente de los túneles dejó de funcionar, debido a la suspensión temporal de la licencia de explotación de Minera San Rafael.

3 Condiciones Ambientales

En el Cuadro 3-1 se describen algunos parámetros meteorológicos en el área del Proyecto y de la Figura 3-1 a la Figura 3-3 se representa la dirección del viento durante Mayo a Julio de 2017.

Cuadro 3-1: Condiciones meteorológicas, Proyecto Minero Escobal

Temperatura (°C)			Velocidad del viento (km/h)			Ráfagas (km/h)	Humedad relativa (%)			Precipitación (mm)
Max	Min	Media	Max	Min	Media	Max	Max	Min	Media	Total
Mayo 2017										
29.4	14.9	21.1	23.9	0.2	2.1	42.6	100	0.8	83.9	220.4
Junio 2017										
28.2	15.1	20.1	15.7	0.2	1.3	21.2	100	26.8	89.4	363.3
Julio 2017										
29	14.9	21.2	18.7	0.2	4.9	29.1	100	7.2	77	159.1

°C = grados centígrados. Km/h = kilómetros por hora. % = porcentaje. mm = milímetros. Max = valor máximo. Min = valor mínimo. Fuente: MSR, 2017.

Durante el trimestre se registró una temperatura promedio de entre los 20.1˚ a los 21.2˚C y en el mes de Julio se registró la menor precipitación (159.1 mm). El mes que mayor humedad relativa promedio presentó fue Junio con 89.4% y el mes que en promedio presentó la mayor velocidad de vientos fue Junio con 1.3 km/h. En la Fotografía 3-1 se muestra la ubicación de la estación meteorológica, donde se registran las condiciones ambientales que se reportan.

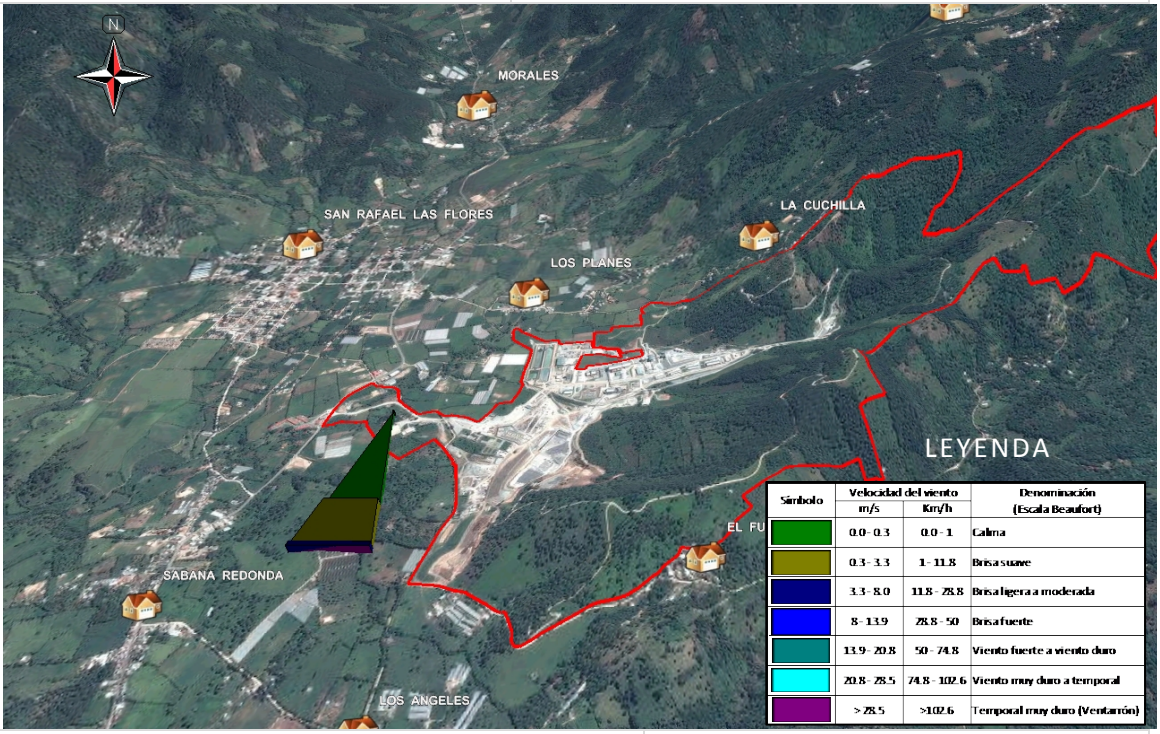
Fotografía 3-1: Estación meteorológica Escobal, San Rafael Las Flores, Santa Rosa

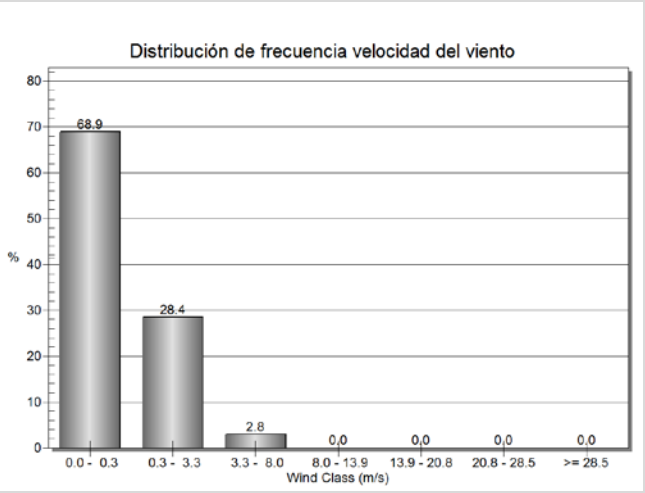
Fuente: MSR, 2017.

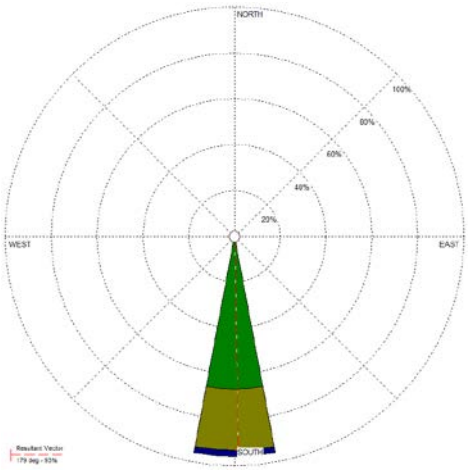
Como se puede observar en la Figura 3-1, Figura 3-2 y Figura 3-3 la predominancia de los vientos del trimestre de Mayo a Julio de 2017 fue de norte a sur.

Figura 3-1: Dirección del viento Mayo 2017, Proyecto Minero Escobal

DIRECCIÓN PREDOMINANTE Y CLASIFICACION DEL VIENTO	ESTACIÓN METEOROLÓGICA EL ESCOBAL DEPARTAMENTO DE AMBIENTE



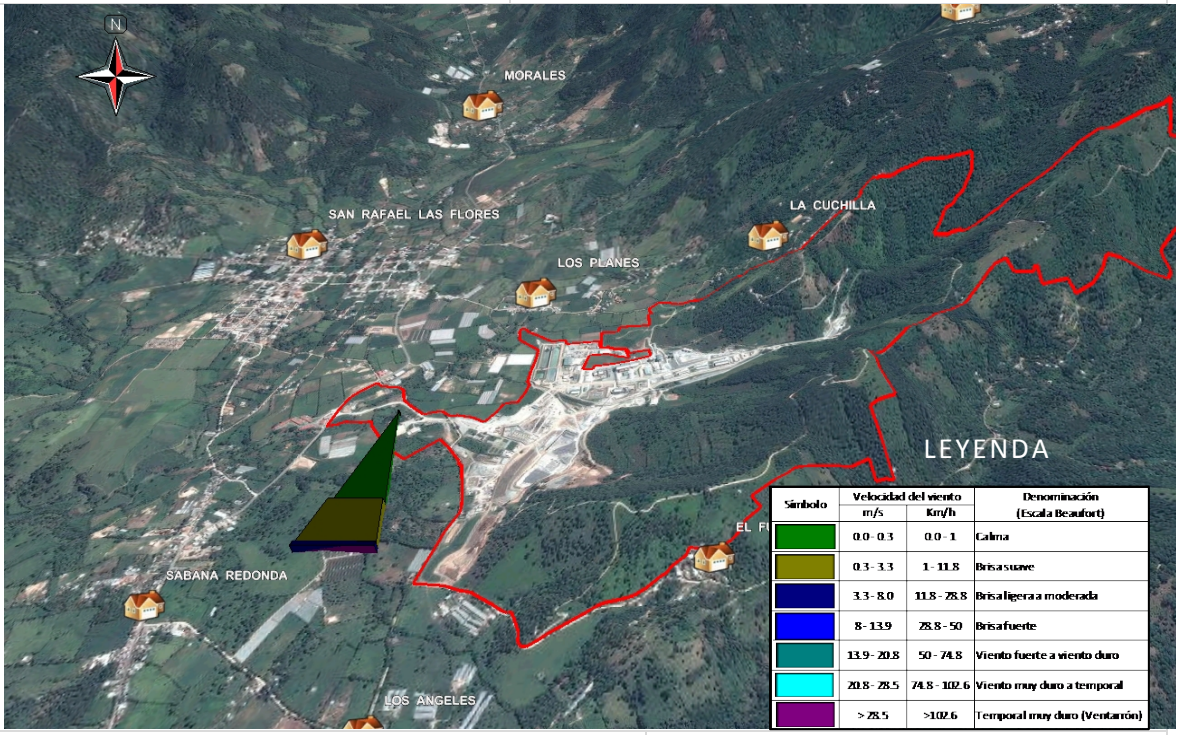


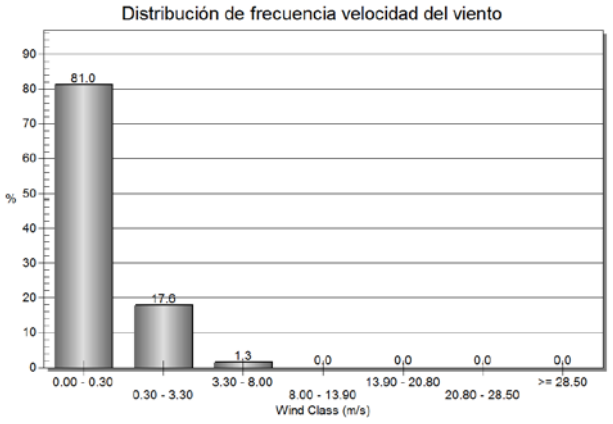


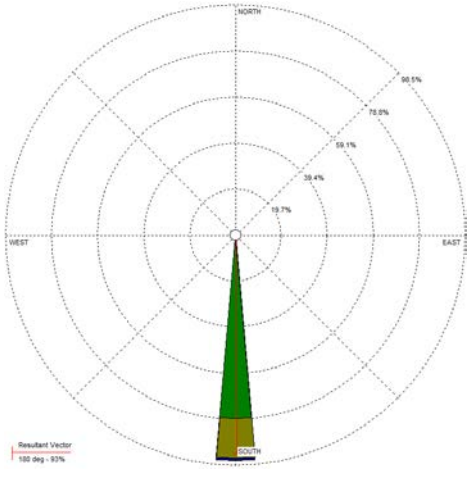
Fuente: MSR, 2017.

Figura 3-2: Dirección del viento Junio 2017, Proyecto Minero Escobal

DIRECCIÓN PREDOMINANTE Y CLASIFICACION DEL VIENTO JUNIO	ESTACIÓN METEOROLÓGICA EL ESCOBAL DEPARTAMENTO DE AMBIENTE



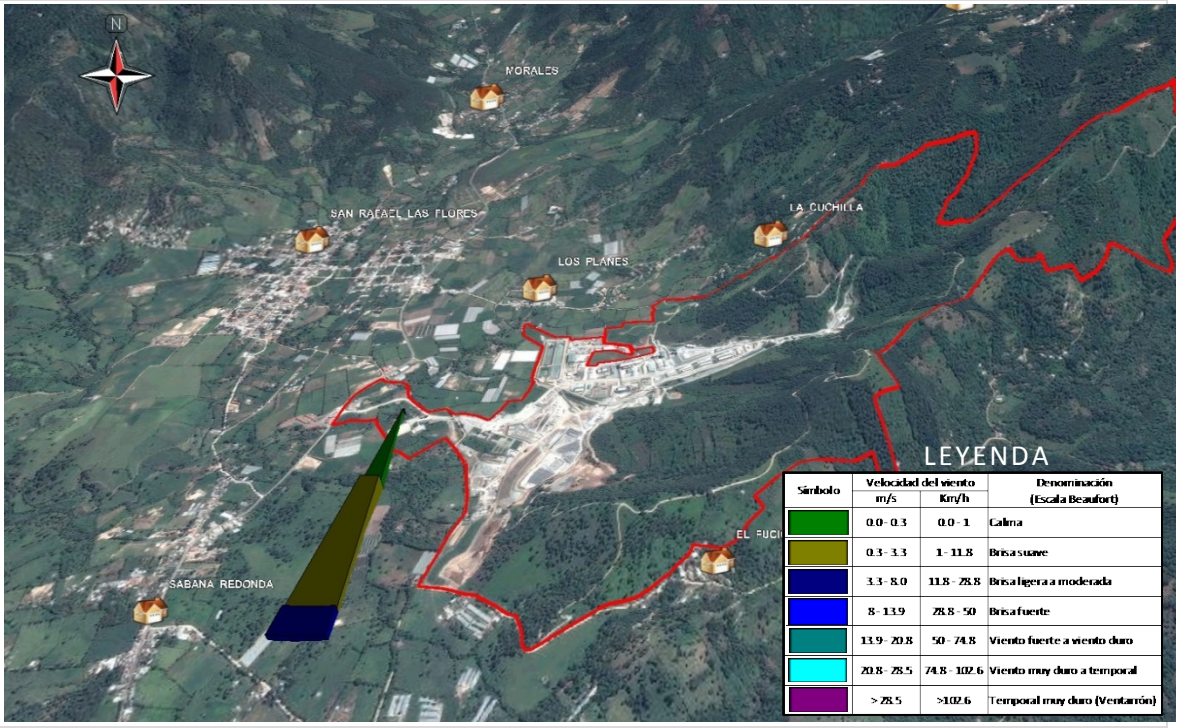


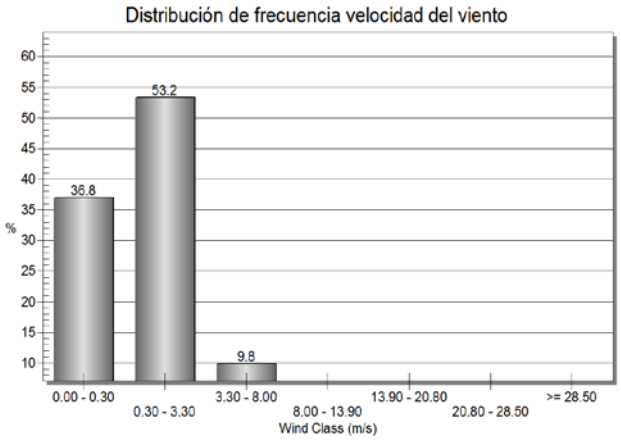


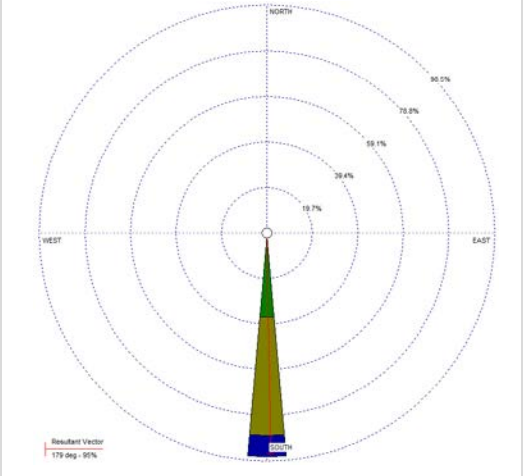
Fuente: MSR, 2017.

Figura 3-3: Dirección del viento Julio 2017, Proyecto Minero Escobal

DIRECCIÓN PREDOMINANTE Y CLASIFICACION DEL VIENTO	ESTACIÓN METEOROLÓGICA EL ESCOBAL DEPARTAMENTO DE AMBIENTE







Fuente: MSR, 2017.

4 Calidad de Aire

4.1 Material Particulado

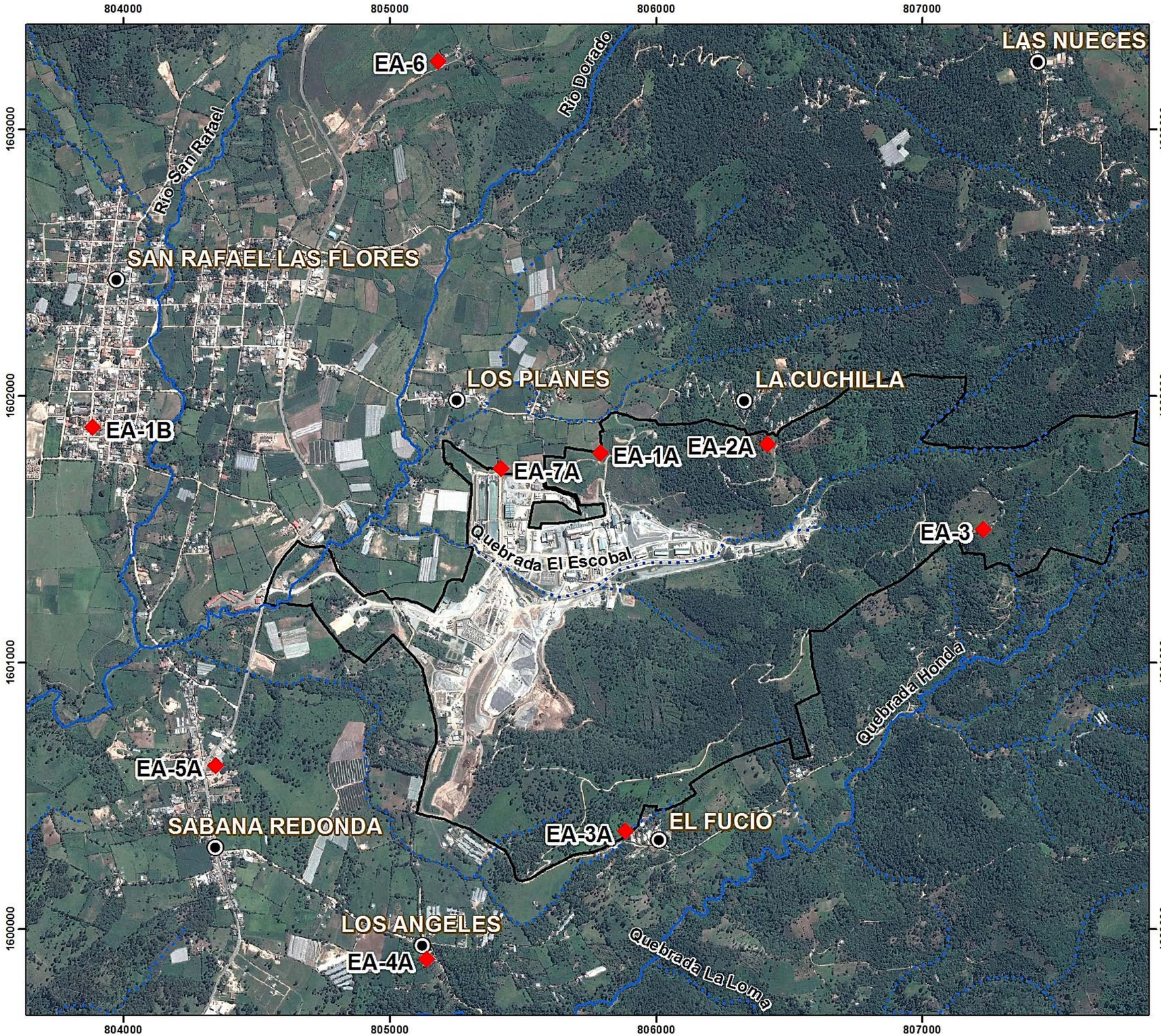
4.1.1 Sitios de Monitoreo

En el Cuadro 4-1 se enlistan las estaciones de monitoreo de material particulado (**PM_{10}**) menor o igual a 10 micrómetros, localizadas dentro de los terrenos de la mina y en la jurisdicción de los centros poblados ubicados en el área de influencia (**AI**) del Proyecto: Los Planes, La Cuchilla, El Fucío, Sabana Redonda, Portón de los Ángeles y San Rafael Las Flores. La ubicación de las estaciones de monitoreo de PM_{10} se presenta en la Figura 4-1.

Cuadro 4-1: Sitios de monitoreo de material particulado, Proyecto Minero Escobal

Estación	Coordenadas		Altitud (msnm)	Sitio	Período línea base
Periodicidad de monitoreo mensual					
EA-1A	805,797	1,601,582	1,417	Depósito de suelos, a inmediaciones de Aldea Los Planes	Febrero 2009 a Mayo 2011
EA-2A	806,427	1,601,605	1,564	Aldea La Cuchilla	
EA-3	807,165	1,601,255	1,679	Área Este del proyecto, a inmediaciones de Aldea El Fucío	
EA-7A*	805,425	1,601,523	1,320	Al noreste de pileta de agua de proceso y pileta de cumplimiento ambiental, Jurisdicción de Aldea Los Planes	No cuenta con línea base
Periodicidad de monitoreo trimestral					
EA-1B	803,894	1,601,727	1,328	Poblado San Rafael Las Flores, cercano a Escuela	No cuenta con línea base
EA-3A	806,000	1,600,108	1,416	Aldea El Fucío	
EA-4A	805,142	1,599,903	1,360	Caserío El Portón de los Ángeles	Enero 2011 a Abril 2011
EA-5A*	804,352	1,600,408	1,339	Aldea Sabana Redonda, al sur-oeste del proyecto	No cuenta con línea base
EA-6	805,168	1,603,247	1,434	Al norte del Proyecto, ruta a Mataquescuintla	Julio 2010 a Abril 2011

*Se incluye como período de línea base de Julio 2010 a Abril 2011 la información registrada en las estaciones EA-5 y EA-7. Sistema de coordenadas proyectadas UTM, DATUM WGS84. Msnm: metros sobre el nivel del mar. Fuente: MSR, 2017.



MAPA DE LOCALIZACIÓN ESTACIONES DE MONITOREO MATERIAL PARTICULADO (PM10)

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL
DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Río Permanente
	Quebrada Intermitente

ESTACIONES DE MONITOREO (PM10)

Símbolo	Estación	X	Y
◆	EA-1A	805791	1601785
	EA-1B	803885	1601881
	EA-2A	806419	1601819
	EA-3	807232	1601498
	EA-3A	805886	1600364
	EA-4A	805140	1599883
	EA-5A	804346	1600611
	EA-6	805181	1603257
	EA-7A	805419	1601726

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografía aérea del proyecto el Escobal año 2014. datos de campo del departamento de Ambiente.

Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala **1:15,000**

N W E S

0 155 310 620 930 1,240
Metros

4.1.2 Resultados

En el Cuadro 4-2 se presentan los resultados de PM_{10} durante los meses de Mayo a Julio de 2017 y los resultados de laboratorio del análisis gravimétrico de filtros y los cálculos realizados para determinar el PM_{10} se presentan en el anexo 12.3.1.

Los valores de PM_{10} registrados durante el monitoreo realizado en todas las localidades, se encuentran dentro de los valores máximos permisibles, conforme a los valores establecidos por la EPA y el Banco Mundial (150 µg/m^3) y dentro de los valores guía de la Organización Mundial de la Salud (50. µg/m^3).

Cuadro 4-2: Resultados de PM_{10}, Proyecto Minero Escobal

Estación	Norma*	Guías*		Línea Base			Resultados		
	USEPA[1]	Banco Mundial[2]	OMS[3]	Promedio	Máximo	Mínimo	May-17	Jun-17	Jul-17
	(µg/m^3)								
EA-1A	150	150**	50	24.36	89.95	3.67	27.87	27.45	6.24
EA-1B				NR	NR	NR	24.54	NA	NA
EA-2A				21.40	76.20	2.74	21.21	7.9	4.58
EA-3				25.68	78.85	1.25	24.14	7.90	<1
EA-3A				NR	NR	NR	22.89	NA	NA
EA-4A				103.55	120.40	86.70	37.87	NA	NA
EA-5A				50.73¥	104.80¥	11.80¥	29.12	NA	NA
EA-6				23.05	57.90	1.70	19.97	NA	NA
EA-7A				46.48¥	115.90¥	13.40¥	17.06	27.87	16.22

µg/m^3 = microgramos por metro cúbico. NR = cálculo No Realizado por falta de datos de línea base. NA = No Analizado. [1]USEPA, 2006. Normas nacionales de calidad de aire ambiental (NAAQS), 40 CFR parte 50 (US). [2]Guías Generales sobre Medio Ambiente, Salud y Seguridad, Corporación Financiera Internacional, Grupo del Banco Mundial 2007. [3]Guía de Calidad del Aire, OMS 2005.* Las normas de calidad de aire ambiental son los niveles de calidad del aire fijados y publicados a partir de procesos legislativos nacionales y procesos regulatorios, mientras que las guías sobre calidad del aire ambiental hacen referencia a niveles de calidad del aire obtenidos principalmente a través de datos clínicos, toxicológicos y epidemiológicos. ** este valor corresponde al límite provisional 1 dado por esta guía. ¥: Corresponde a los valores de línea base de la estación EA-5 y de la estación EA-7 respectivamente. Fuente: MSR, 2017.

Los resultados obtenidos durante los meses de Mayo a Julio de 2017 se encontraron entre los 7.9 a 37.87 µg/m^3. En Mayo el menor valor de PM_{10} se registró en la estación EA-7A (17.06 µg/m^3), mientras que en Junio y Julio se registró en la estación EA-2A (7.9 y 4.58 µg/m^3 respectivamente). Los valores más altos de PM_{10} se registraron en la estación EA-4A durante Mayo (37.87 µg/m^3), mientras que los valores más altos en Junio y Julio se registraron en la estación EA-7A (27.87 y 16.22 µg/m^3) respectivamente. Todos los valores de PM_{10} registrados durante el monitoreo trimestral, se encuentran por debajo de los límites máximos establecidos durante el levantamiento de línea base.

4.2 Metales en Material Particulado

4.2.1 Sitios de Monitoreo

En el Cuadro 4-3 se enlistan las estaciones de monitoreo de metales en material particulado menor o igual a 10 micrómetros (**PM_{10}**) localizadas dentro de los terrenos de la empresa y en la jurisdicción de los centros poblados ubicados en el área de influencia (**AI**) del Proyecto: Los Planes, La Cuchilla, El Fucío, Sabana Redonda, Portón de los Ángeles y San Rafael Las Flores. La ubicación de las estaciones de monitoreo de metales se presenta en la Figura 4-1.

Cuadro 4-3: Sitios de monitoreo de metales en PM_{10}, Proyecto Minero Escobal

Estación	Coordenadas		Altitud (msnm)	Sitio	Período línea base
EA-1B	803,891	1,601,678	1,328	Poblado San Rafael Las Flores, cercano a Escuela	No cuenta con línea base
EA-2A	806,427	1,601,605	1,564	Aledaño a Aldea La Cuchilla	Julio 2010 a Abril 2011
EA-3A	805,892	1,600,161	1,416	Aledaño a Aldea El Fucío	No cuenta con línea base
EA-4A	805,146	1,599,680	1,360	Caserío El Portón de los Ángeles	Enero 2011 a Abril 2011
EA-5A*	804,352	1,600,408	1,339	Aldea Sabana Redonda, al sur-oeste del proyecto	No se cuenta con línea base.
EA-6	805,187	1,603,054	1,434	Al norte del Proyecto, ruta a Mataquescuintla	Julio 2010 a Abril 2011
EA-7A*	805,425	1,601,523	1,320	Al noreste de pileta de agua de proceso y pileta de cumplimiento ambiental, Jurisdicción de Aldea Los Planes	No se cuenta con línea base

*Se incluye como período de línea base de Julio 2010 a Abril 2011 la información registrada en las estaciones EA-5 y EA-7. Sistema de coordenadas proyectadas UTM, DATUM WGS84. Msnm: metros sobre el nivel del mar. Nota: 1er y 3er trimestre del año se analiza metales totales, 2do y 4to trimestre únicamente mercurio total. Fuente: MSR, 2017.

4.2.2 Resultados

En el Cuadro 4-4 se presentan los resultados de concentración de mercurio en PM_{10} durante el mes de Mayo de 2017, los resultados de laboratorio del análisis de metales en filtros y los cálculos realizados para determinar el PM_{10} se presentan en el anexo 12.3.2. En cuatro de las siete estaciones monitoreadas se registró mercurio ligeramente por encima del límite de detección del método, a excepción de la estación EA-1B, EA-2A y EA-6 en donde no se registró presencia de mercurio.

Cuadro 4-4: Resultados de concentración de metales en PM_{10}, Proyecto Minero Escobal

Parámetro	EA-1B	EA-2A	EA-3A	EA-4A	EA-5A	EA-6	EA-7A
	3104-0303	3113-1212	3110-0909	3105-0404	3106-0505	3103-0202	3108-0707
Mayo 2017 (µg/m^3)							
Mercurio	N.D.	N.D.	0.0002	0.0001	0.0003	N.D.	0.00004
Mayo 2016 (µg/m^3)							
Mercurio	0.00008	N.D.	0.00029	0.00012	0.00008	0.00012	0.00004

ND: no detectado. µg/m^3 = microgramos por metro cúbico. Fuente: MSR, 2017.

4.3 Partículas Sedimentables Totales (PST)

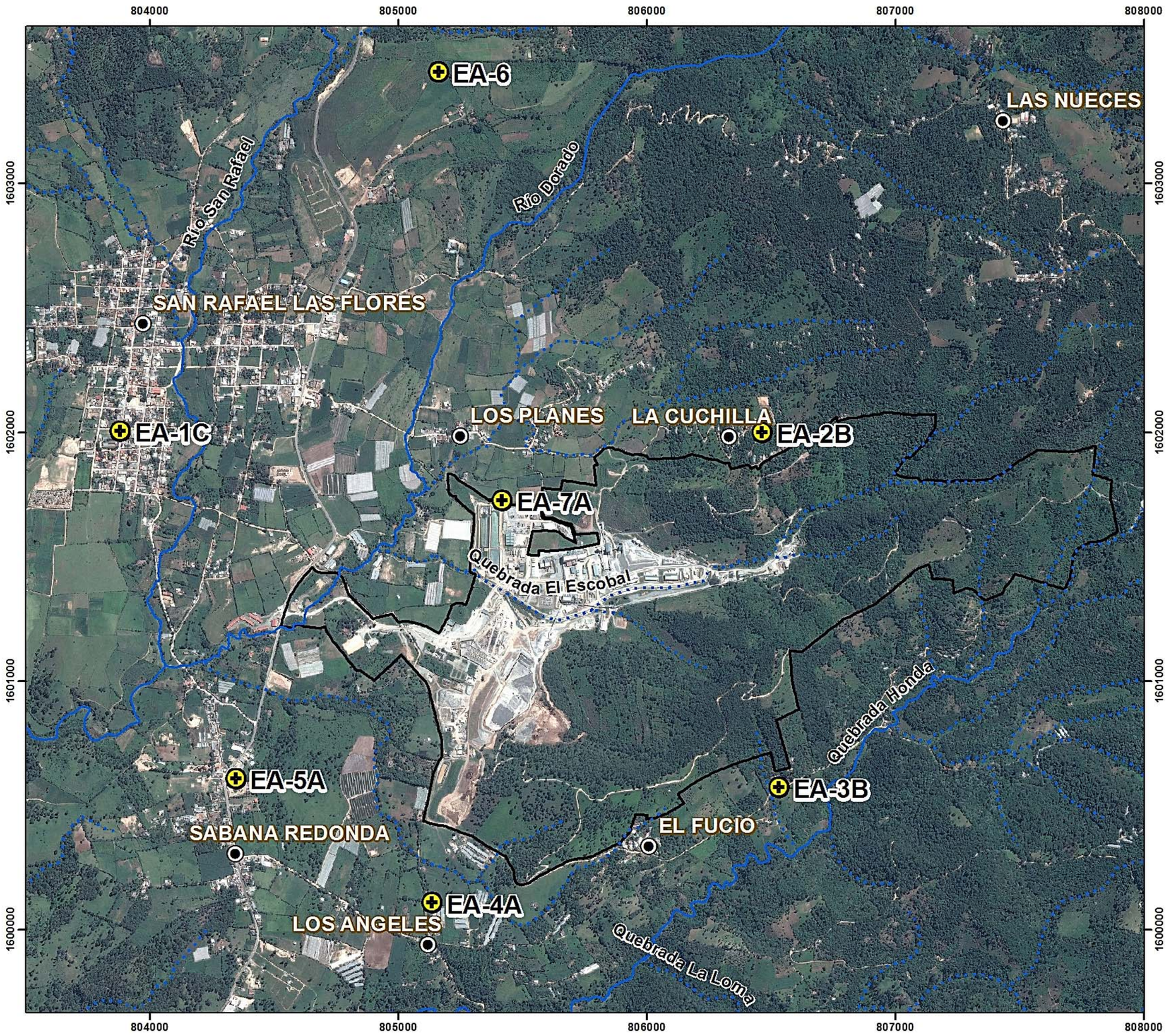
4.3.1 Sitios de Monitoreo

En el Cuadro 4-5 se enlistan las estaciones de monitoreo de PST ubicada en el área de influencia (**AI**) del Proyecto y su ubicación se presenta en la Figura 4-2.

Cuadro 4-5: Sitios de Monitoreo de PST, Proyecto Minero Escobal

Estación	Coordenadas		Altitud (msnm)	Sitio	Período Línea Base
EA-1C	803,887	1,601,801	1,337	Poblado San Rafael Las Flores, cercano a Escuela	No se cuenta con línea base
EA-2B	806,470	1,601,796	1,555	Aldea La Cuchilla	
EA-3B	806,538	1,600,367	1,427	Aldea El Fucío	
EA-4A	805,142	1,599,903	1,360	Caserío El Portón de los Ángeles	Diciembre 2010 a Mayo 2011
EA-5A*	804,352	1,600,408	1,339	Aldea Sabana Redonda, al sur-oeste del proyecto	No se cuenta con línea base
EA-6	805,168	1,603,247	1,434	Al norte del Proyecto, ruta a Mataquescuintla	
EA-7A	805,425	1,601,523	1,320	Noreste de pileta de agua de proceso y pileta de cumplimiento ambiental, Jurisdicción Aldea Los Planes	

*Se incluye como período de línea base de Agosto 2010 a Mayo 2011, la información registrada en la estación EA-5. Sistema de coordenadas proyectadas UTM, DATUM WGS84. Msnm: metros sobre el nivel del mar. Fuente: MSR, 2017.



MAPA DE LOCALIZACIÓN ESTACIONES DE MONITOREO DE PARTICULAS SEDIMENTABLES TOTALES

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL
DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Río Permanente
	Quebrada Intermitente

ESTACIONES DE MONITOREO

Símbolo	Estación	X	Y
	EA-1C	803881	1602004
	EA-2B	806464	1601999
	EA-3B	806532	1600570
	EA-4A	805136	1600106
	EA-5A	804346	1600607
	EA-6	805162	1603450
	EA-7A	805419	1601726

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografía aérea del proyecto el Escobal año 2014, datos de campo del departamento de Ambiente.

Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala **1:16,000**

N
W E
S

0 175 350 700 1,050 1,400
Metros

4.3.2 Resultados

En el Cuadro 4-6 se presentan los resultados de Partículas Sedimentables Totales (**PST**) realizado durante Junio de 2017. El resumen del informe de resultados presentado por el contratista se presenta en el anexo 12.3.3.

Los valores de PST se encuentran entre 4.90 a 11.03 g/(m^2 x 30 días), los cuales corresponden a las estaciones EA-2B y EA-4A respectivamente. De las dos estaciones que cuentan con línea base (EA-4A y EA-5ª), ningún valor registrado durante el monitoreo, se encuentra por encima del valor máximo establecido durante la línea base. Las estaciones EA-1C, EA-2B, EA-3B, EA-6 y EA-7A no cuentan con línea base.

Cuadro 4-6: Resultados de partículas sedimentables totales, Proyecto Minero Escobal

Parámetro	Norma	Guías	EA-1C	EA-2B	EA-3B	EA-4A				EA-5A				EA-6	EA-7A
						Línea Base			Muestreo	Línea Base			Muestreo		
	USEPA[1]	Banco Mundial[2] OMS[3]	Jun-17	Jun-17	Jun-17	Promedio	Mínimo	Máximo	Jun-17	Promedio	Mínimo	Máximo	Jun-17	Jun-17	Jun-17
	g/(m^2 x 30 días)														
Sólidos insolubles	ND	ND	7.74	2.61	4.20	6.27	2.60	10.80	6.90	6.50	0.80	16.00	2.59	3.70	2.46
Sólidos solubles			2.57	2.29	2.85	2.12	0.90	2.90	4.13	11.26	2.00	37.00	7.99	6.87	3.02
Sólidos totales			10.31	4.90	7.05	8.37	4.60	13.00	11.03	17.58	3.20	50.00	10.58	10.57	5.48

[1]USEPA, 2006. Normas nacionales de calidad de aire ambiental (NAAQS), 40 CFR parte 50 (US). [2]Guías Generales sobre Medio Ambiente, Salud y Seguridad, Corporación Financiera Internacional, Grupo del Banco Mundial 2007. ND: estas normas y guías no establecen un límite para estos parámetros. g/(m^2 x 30 días)= gramos por metro cuadrado durante 30 días. Fuente: MSR, 2017.

4.4 Gases de Combustión (SO_2 y NO_2)

4.4.1 Sitios de Monitoreo

En el Cuadro 4-7 se enlistan las estaciones de monitoreo de dióxido de azufre (**SO_2**) y de dióxido de nitrógeno (**NO_2**) ubicada en el área de influencia (**AI**) del Proyecto. La ubicación de las estaciones de monitoreo de SO_2 y NO_2 se presenta en la Figura 4-3.

Cuadro 4-7: Sitios de Monitoreo de SO_2 y NO_2, Proyecto Minero Escobal

Estación	Coordenadas		Altitud (msnm)	Sitio	Período Línea Base
EA-1C	803,887	1,601,801	1,337	Poblado San Rafael Las Flores, cercano a Escuela	No se cuenta con línea base.
EA-2B	806,470	1,601,796	1,555	Aldea La Cuchilla	
EA-3B	803,887	1,601,801	1,427	Aldea El Fucío	
EA-4A	805,142	1,599,903	1,360	Caserío El Portón de los Ángeles	
EA-5A*	804,352	1,600,408	1,339	Aldea Sabana Redonda, al sur-oeste del proyecto	
EA-6	805,168	1,603,247	1,434	Al norte del Proyecto, ruta a Mataquescuintla	
EA-7A*	805,425	1,601,523	1,320	Noreste de pileta de agua de proceso y pileta de cumplimiento ambiental, Jurisdicción Aldea Los Planes	

*Se incluye como período de línea base de Julio 2010 a Abril 2011, la información registrada en las estaciones EA-5 y EA-7. Sistema de coordenadas proyectadas UTM, DATUM WGS84. Msnm: metros sobre el nivel del mar. Fuente: MSR, 2017.

804000
805000
806000
807000
1603000
1602000
1601000
1600000

EA-6
LAS NUECES
Río San Rafael
Río Dorado
SAN RAFAEL LAS FLORES
EA-1C
LOS PLANES
LA CUCHILLA
EA-2B
EA-7A
Quebrada El Escobal
Quebrada Honda
EA-5A
EA-3B
SABANA REDONDA
EL FUCIO
EA-4A
LOS ANGELES

MAPA DE LOCALIZACIÓN ESTACIONES DE MONITOREO DE GASES DE COMBUSTIÓN

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL
DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Río Permanente
	Quebrada Intermitente

ESTACIONES DE MONITOREO

Símbolo	Estación	X	Y
	EA-1C	803881	1602004
	EA-2B	806464	1601999
	EA-3B	806532	1600570
	EA-4A	805136	1600106
	EA-5A	804346	1600607
	EA-6	805162	1603450
	EA-7A	805419	1601726

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografía aérea del proyecto el Escobal año 2014, datos de campo del departamento de Ambiente.

Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala **1:16,000**

N
W
E
S

0 175 350 700 1,050 1,400
Metros

4.4.2 Resultados

En el Cuadro 4-8 se presentan los resultados de las mediciones de SO_2 y NO_2 realizadas en siete estaciones de monitoreo de Calidad de Aire. El informe de resultados presentado por el contratista se presenta en el anexo 12.3.3.

En las mediciones efectuadas durante este trimestre se obtuvieron valores por debajo del límite de detección del método en todas las estaciones para SO_2 (<13 $\mu g/m^3$) y NO_2 (<9 $\mu g/m^3$). Lo que indica que las actividades realizadas durante el presente período, no han variado de acuerdo a los parámetros reportados en los trimestres anteriores.

Cuadro 4-8: Resultados de gases de combustión, Proyecto Minero Escobal

Parámetro	Norma*	Guías*			EA-1C	EA-2B	EA-3B	EA-4A	EA-5A				EA-6	EA-7A			
									Línea base**			Muestreo		Línea base**			Muestreo
	USEPA[1]	Banco Mundial[2]	OMS[3]	British Columbia[4]	Jun-17	Jun-17	Jun-17	Jun-17	Promedio	Mínimo	Máximo	Jun-17	Jun-17	Promedio	Mínimo	Máximo	Jun-17
	(µg/m^3)																
SO_2	370	20	20	160	<13	<13	<13	<13	<13	<13	<13	<13	<13	<13	<13	<13	<13
NO_2	100¥	40¥	40¥	200	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9

Nota: µg/m^3 = microgramos por metro cúbico; SO_2= dióxido de azufre, NO_2= dióxido de nitrógeno. [1]USEPA, 2006. Normas nacionales de calidad de aire ambiental (NAAQS), 40 CFR parte 50 (US). [2]Guías Generales sobre Medio Ambiente, Salud y Seguridad, Corporación Financiera Internacional, Grupo del Banco Mundial 2007. [3]Guía de Calidad del Aire, OMS 2005. [4]Guías para la calidad del aire ambiental. *Las normas de calidad de aire ambiental son los niveles de calidad del aire fijados y publicados a partir de procesos legislativos nacionales y procesos regulatorios, mientras que las guías sobre calidad del aire ambiental hacen referencia a niveles de calidad del aire obtenidos principalmente a través de datos clínicos, toxicológicos y epidemiológicos. **Corresponde a los valores de línea base de la estación EA-5 y de la estación EA-7 respectivamente. ¥ Este valor corresponde a la concentración promedio anual. Fuente: MSR, 2017.

4.5 Niveles de Presión Sonora

4.5.1 Sitios de Monitoreo

En el Cuadro 4-9 se enlistan las estaciones de monitoreo de presión sonora ubicados en el área de influencia (**AI**) del Proyecto, localizadas en la jurisdicción de los centros poblados: Los Planes, La Cuchilla, El Fucío, Sabana Redonda, Portón de los Ángeles y San Rafael Las Flores. La ubicación de las estaciones de monitoreo de presión sonora se presenta en la Figura 4-4.

Cuadro 4-9: Sitios de Monitoreo de Presión Sonora, Proyecto Minero Escobal

Estación	Coordenadas		Altitud (msnm)	Sitio
Periodicidad de monitoreo mensual				
ER-1	805,797	1,601,582	1,417	Depósito de suelos, a inmediaciones de Aldea Los Planes
ER-2	806,427	1,601,605	1,564	Aldea La Cuchilla
ER-3	807,165	1,601,255	1,679	Área este del proyecto, a inmediaciones de Aldea El Fucío
ER-7A	805,425	1,601,523	1,320	Al noreste de pileta de agua de proceso y pileta de cumplimiento ambiental, Jurisdicción de Aldea Los Planes
Periodicidad de monitoreo trimestral				
ER-1A	803,891	1,601,678	1,328	Poblado San Rafael Las Flores, cercano a Escuela
ER-3A	805,892	1,600,161	1,416	Aldea El Fucío
ER-4A	805,146	1,599,680	1,360	Caserío El Portón de los Ángeles
ER-5A	804,352	1,600,408	1,339	Aldea Sabana Redonda, al sur-oeste del proyecto
ER-6	805,187	1,603,054	1,434	Al norte del Proyecto, ruta a Mataquescuintla

Sistema de coordenadas proyectadas UTM, DATUM WGS84. Msnm: metros sobre el nivel del mar.
Fuente: MSR, 2017.

804000 805000 806000 807000 808000

1603000 1602000 1601000 1600000

ER-6
LAS NUECES
Río San Rafael
Río Dorado
SAN RAFAEL LAS FLORES
LOS PLANES
LA CUCHILLA
ER-1A
ER-7A
ER-1
ER-2
ER-3
Quebrada El Escobal
Quebrada Honda
ER-5A
SABANA REDONDA
ER-3A
EL FUCIO
LOS ANGELES
ER-4A
Quebrada La Loma

MAPA DE LOCALIZACIÓN ESTACIONES DE MONITOREO NIVELES DE PRESIÓN SONORA

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL
DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Río Permanente
	Quebrada Intermitente

ESTACIONES DE MONITOREO

Símbolo	Estación	X	Y
●	ER-1	805791	1601785
	ER-1A	803885	1601881
	ER-2	806419	1601819
	ER-3	807232	1601498
	ER-3A	805886	1600364
	ER-4A	805140	1599883
	ER-5A	804346	1600611
	ER-6	805181	1603257
	ER-7A	805419	1601726

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografía aérea del proyecto el Escobal año 2014, datos de campo del departamento de Ambiente.

Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala **1:16,000**

N W E S

0 175 350 700 1,050 1,400
Metros

4.5.2 Resultados

En el Cuadro 4-10 y en el Cuadro 4-11 se presentan los valores registrados de los niveles de presión sonora (**NPS**) durante los meses de Mayo a Julio de 2017. Los informes generados por los equipos de medición se presentan en el anexo 12.3.4.

Los resultados obtenidos de NPS en las estaciones muestreadas respecto al parámetro Leq, están dentro del rango de 41.6 dBa y 88.5 dBa, los cuales corresponden a las estaciones ER-6 y ER-7A respectivamente.

La estación ER-3 presentó el menor promedio diurno (42.37 dBa) y el menor promedio nocturno (39.7 dBa) se registró en la estación ER-6; mientras que la estación ER-7A presentó el mayor promedio diurno (90.6 dBa) y el mayor promedio nocturno (55.1 dBa) se registró en la estación ER-2.

Las estaciones ER-1, ER-2, ER-3, ER-4A, ER-5A y ER-7A presentaron valores de promedio diurno y nocturno dentro de los valores mínimos y máximos registrados en el establecimiento de la línea base, a excepción de las mediciones en promedio diurno de Mayo en la estación ER-2, lo registrado en Mayo en la estación ER-4A en promedio diurno y nocturno, y lo registrado en Mayo, Junio y Julio en la estación ER-7A. Las estaciones ER-1A, ER-3A y ER-6 no cuentan con datos de línea base.

Ninguna de las estaciones monitoreadas presentó valores en promedio diurno y nocturno superiores al valor de la guía para jornada diurna y nocturna del Banco Mundial para zonas industriales (70 dBa), a excepción de la estación ER-7A durante la medición de Junio.

Cuadro 4-10: Resultados trimestrales de los niveles de presión sonora, Proyecto Minero Escobal

Parámetro	Norma*	Guías*			ER-1						ER-2					
					Línea Base						Línea Base					
	USEPA[1]	OMS[2]	Banco Mundial[3]		Promedio	Máximo	Mínimo	May-17	Jun-17	Jul-17	Promedio	Máximo	Mínimo	May-17	Jun-17	Jul-17
			Residencial	Industrial												
	dBA															
Lmin	NL	NL	NL	NL	89.3	99.5	64.6	36	43.5	30	86.7	97.8	64.9	46.2	35.5	44
Lmax					32.5	37.7	27.0	81.1	84.5	79.6	35.2	42.8	26.5	91.9	76.4	79.3
Leq					49.9	57.1	41.2	48.5	47.2	51.2	49.4	58.7	39.7	55.3	47.5	48.7
PD	55	55	55	70	50.5	59.1	39.7	49.7	47.6	50.2	48.8	57.1	39.8	55.6	46	48.6
PN	55	50	45	70	47.6	55.7	39.3	45.5	46.6	52.3	46.6	54.5	37.9	55.1	49.3	49

Parámetro	Norma*	Guías*			ER-3						ER-7A					
					Línea Base						Línea Base**					
	USEPA[1]	OMS[2]	Banco Mundial		Promedio	Máximo	Mínimo	May-17	Jun-17	Jul-17	Promedio	Máximo	Mínimo	May-17	Jun-17	Jul-17
			Residencial	Industrial												
	dBA															
Lmin	NL	NL	NL	NL	87.4	100.7	67.2	31.2	43.7	37.1	87.5	89.0	82.1	44.7	44.4	37.0
Lmax					49.4	56.2	26.9	78.4	81.9	80.5	NR	NR	NR	81.4	79	84.5
Leq					56.8	63.2	39.7	45	49	47	52.8	54.5	50.9	49.3	50.8	50.7
PD	55	55	55	70	56.5	63.1	41.0	42.37	48.42	47.4	52.1	53.5	50.4	49.7	51.7	50.6
PN	55	50	45	70	57.2	64.0	34.1	47.54	49.89	46.4	49.7	50.9	48.8	48.7	48.9	50.9

*Las normas de calidad de aire ambiental son los niveles de calidad del aire fijados y publicados a partir de procesos legislativos nacionales y procesos regulatorios, mientras que las guías sobre calidad del aire ambiental hacen referencia a niveles de calidad del aire obtenidos principalmente a través de datos clínicos, toxicológicos y epidemiológicos. [1]USEPA, 2006. Normas nacionales de niveles de presión sonora. [2]Guías sobre ruido comunitario, OMS 1999. [3]Guías Generales sobre Medio Ambiente, Salud y Seguridad, Corporación Financiera Internacional, Grupo del Banco Mundial 2007. dBA = decibeles en escala A. PD = promedio diurno (de 07:00 a 22:00)- PN = promedio nocturno (de 22:00 a 7:00). Lmax = lectura máxima registrada de dBA. Lmin= lectura mínima registrada de dBA. NL = no hay límite establecido para este parámetro. ** Los valores de línea base corresponden a la estación ER-7. Fuente: MSR, 2017.

Cuadro 4-11: Resultados mensuales de los niveles de presión sonora, Proyecto Minero Escobal

Parámetro	Norma*	Guías*			ER-1A				ER-3ª				ER-4A			
					Línea Base			May-17	Línea Base			May-17	Línea Base			May-17
	USEPA[1]	OMS[2]	Banco Mundial[3]		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
			Residencial	Industrial												
	dBA															
Lmin	NL	NL	NL	NL	NR	NR	NR	44.5	NR	NR	NR	43.8	80.6	78.2	82.1	43.5
Lmax								85.2				84.6	NR	NR	NR	86.9
Leq								52.3				52.8	50.2	49.3	50.9	50.3
PD	55	55	55	70				53.8				50.9	49.5	48.4	50.4	51.6
PN	55	50	45	70				48.0				54.8	48.6	48.2	48.9	49.5

Parámetro	Norma*	Guías*			ER-5A				ER-6			
					Línea Base			May-17	Línea Base			May-17
	USEPA[1]	OMS[2]	Banco Mundial[3]		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
			Residencial	Industrial								
	dBA											
Lmin	NL	NL	NL	NL	91.6	85.1	92.2	35.7	NR	NR	NR	31.2
Lmax					NR	NR	NR	93.5				77.0
Leq					65.8	51.6	67.6	49.8				41.6
PD	55	55	55	70	61.2	50.2	63.8	50.3				42.4
PN	55	50	45	70	62.8	45.9	65.0	48.8				39.7

*Las normas de calidad de aire ambiental son los niveles de calidad del aire fijados y publicados a partir de procesos legislativos nacionales y procesos regulatorios, mientras que las guías sobre calidad del aire ambiental hacen referencia a niveles de calidad del aire obtenidos principalmente a través de datos clínicos, toxicológicos y epidemiológicos. [1]USEPA, 2006. Normas nacionales de niveles de presión sonora. [2]Guías sobre ruido comunitario, OMS 1999. [3]Guías Generales sobre Medio Ambiente, Salud y Seguridad, Corporación Financiera Internacional, Grupo del Banco Mundial 2007. dBA = decibeles en escala A. PD = promedio diurno (de 07:00 a 22:00)- PN = promedio nocturno (de 22:00 a 7:00). Lmax = lectura máxima registrada de dBA. Lmin= lectura mínima registrada de dBA. NL = no hay límite establecido para este parámetro. NR = cálculo No Realizado por falta de datos de línea base. Fuente: MSR, 2017.

5 Calidad del Agua

5.1 Sitios de Monitoreo

En el Cuadro 5-1 se enlistan las estaciones de monitoreo de calidad de agua superficial y subterránea localizadas en las quebradas, ríos, manantiales, pozos de monitoreo y pozos mecánicos ubicados en el área de influencia (**AI**) del Proyecto. La ubicación de las estaciones de monitoreo de calidad de agua superficial y subterránea se presentan en la Figura 5-1, Figura 5-2, Figura 5-3 y Figura 5-4.

Cuadro 5-1: Sitios de Monitoreo de Calidad de Agua, Proyecto Minero Escobal

Estación	Coordenadas		Sitio	Período Línea Base
Agua Superficial				
SW-1	807,053	1,601,682	Quebrada El Escobal, aguas arriba	Junio 2008 a marzo 2011
SW-2	805,811	1,601,164	Quebrada El Escobal, en medio de la propiedad	Junio 2008 a septiembre 2010
SW-2A	805,295	1,601,230	Quebrada El Escobal, salida de la propiedad	No cuenta con línea base
SW-3	805,337	1,602,453	Río El Dorado, aguas arriba	Septiembre 2008 a marzo 2011
SW-4	804,781	1,601,228	Río El Dorado, aguas abajo	
SW-4A	804,629	1,601,052	Río El Dorado, por puente de acceso al Proyecto, 30mts aguas abajo SW-4	No cuenta con línea base
SW-5	810,882	1,603,313	Río Tapalapa	Septiembre 2008 a marzo 2011
SW-6	808,391	1,597,689	Río Los Vados	
SW-7	806,989	1,600,618	Quebrada La Honda	
SW-8	804,054	1,600,834	Unión Río San Rafael y El Dorado	Noviembre 2011 a Diciembre 2012
SW-9	803,772	1,597,635	Río Tapalapa, aguas abajo (cercano a la Ceibita)	
Agua Subterránea, Nacimientos				
GW-1A	808,670	1,599,754	Nacimiento de agua permanente, Aldea El Volcancito	Diciembre 2010 a marzo 2011
GW-2	807,515	1,601,059	Nacimiento de agua permanente, Aldea El Fucío	
GW-3	806,193	1,601,194	El Mora, zona central del proyecto (frente a portal Oeste)	
GW-4	805,992	1,600,533	Aguas arriba del depósito de colas y de GW5	Diciembre 2010
GW-5	805,962	1,600,525	Aguas arriba del depósito de colas	No cuenta con línea base
Agua Subterránea, Pozos de monitoreo				
MW-2	805,206	1,600,565	Sur-oeste del depósito de colas	Diciembre 2010 a marzo 2011
MW-3	805,153	1,600,790	Al oeste del depósito de colas	
MW-4	805,186	1,601,009	Al sur de montículos (acuífero somero)	
MW-5	805,304	1,601,277	Al oeste de taller, en el límite de la propiedad de MSR	
MW-6	805,457	1,601,454	Al norte de almacén general	Diciembre 2010 a

Estación	Coordenadas		Sitio	Período Línea Base
MW-7	805,796	1,601,582	Al oeste de depósito de suelos No. 1	marzo 2011
MW-8	805,304	1,601,277	Al oeste de taller, pozo de abastecimiento de oficinas temporales	Enero 2011 a marzo 2011
MW-9	805,198	1,601,019	Al sur de montículos (Acuífero profundo)	
MW-11	805,612	1,601,064	Al norte de zona de infiltración quebrada Escobal	Marzo 2011
RW-1	804,809	1,600,972	Pozo artesanal ubicado en Finca Suandys	No cuenta con línea base
Agua Subterránea, pozo de producción				
PSA-SR	803,678	1,602,044	Pozo mecánico ubicado en las piscinas de San Rafael las Flores	Marzo 2011
PSA-1	805,212	1,601,203	Pozo mecánico ubicado a un costado de la guardería	No cuenta con línea base
Agua de grifo				
HW-1	803,888	1,601,977	Agua de grifo, casa poblado San Rafael las Flores, cercano a Escuelita	No cuenta con línea base

Sistema de coordenadas proyectadas UTM, DATUM WGS84. Msnm: metros sobre el nivel del mar.
Fuente: MSR, 2017.

MAPA DE LOCALIZACIÓN ESTACIONES DE MONITOREO AGUA SUPERFICIAL

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL
DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Río Permanente
	Quebrada Intermitente

Símbolo	Estación	X	Y
	SW1-E	807047	1601885
	SW2-E	805805	1601367
	SW2A-E	805289	1601433
	SW2B-E	804728	1601341
	SW3-E	805331	1602656
	SW4-E	804775	1601431
	SW4A-E	804623	1601255
	SW5-E	810876	1603516
	SW6-E	808385	1597892
	SW7-E	806995	1600815
	SW8-E	804048	1601037
	SW9-E	803766	1597838

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografía aérea del proyecto el Escobal año 2013, datos de campo del departamento de Ambiente.

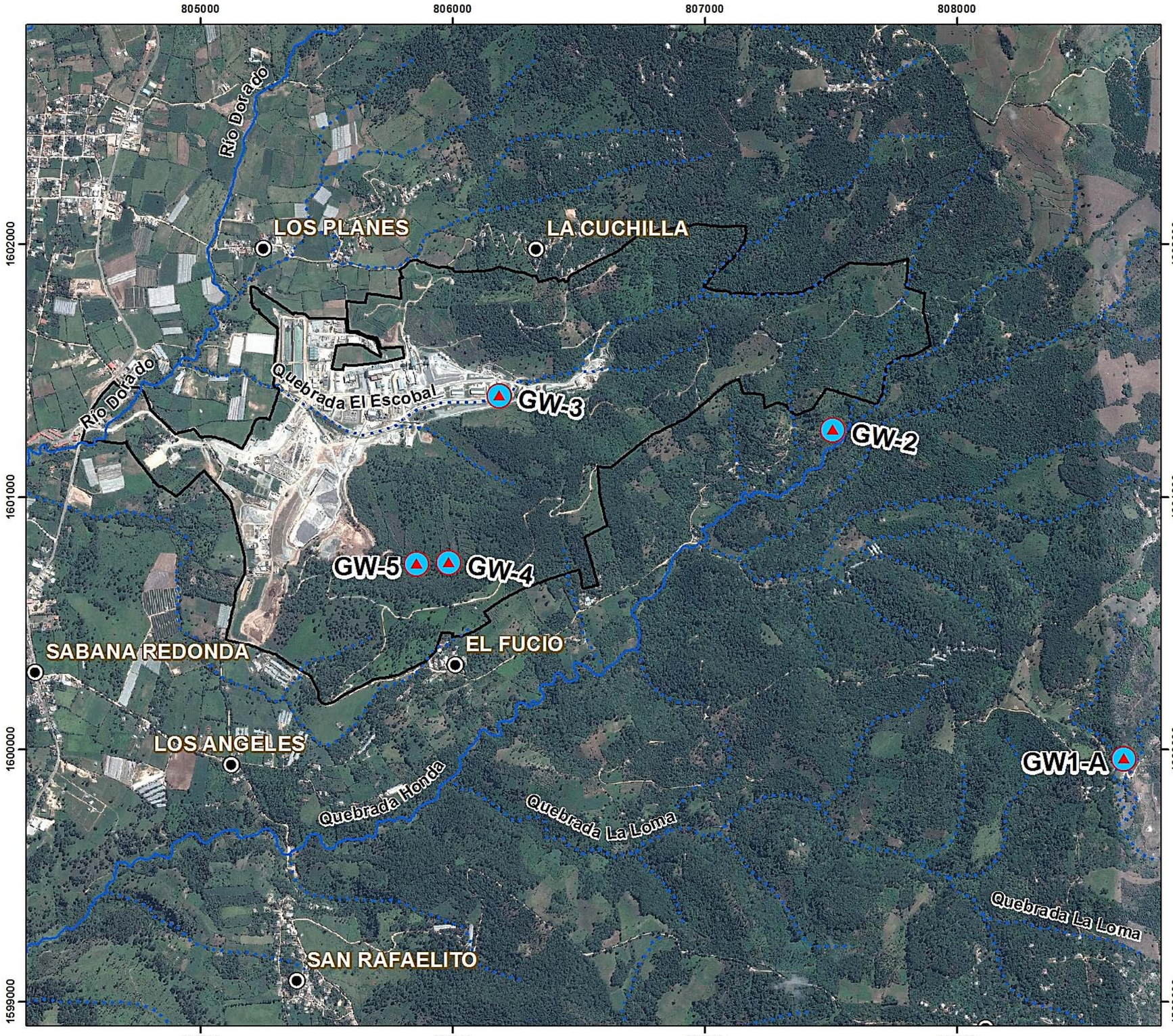
Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala 1:30,000

N W E S

0 315 630 1,260 1,890 2,520
Metros



MAPA DE LOCALIZACIÓN ESTACIONES DE MONITOREO CALIDAD DE AGUA SUBTERRÁNEA

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL

DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Río Permanente
	Quebrada Intermitente

ESTACIONES DE MONITOREO (POZOS)			
Símbolo	Estación	X	Y
	GW-1A	808664	1599957
	GW-2	807509	1601262
	GW-3	806187	1601397
	GW-4	805986	1600736
	GW-5	805858	1600731

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografia aérea del proyecto el Escobal año 2014, datos de campo del departamento de Ambiente.

Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala **1:16,000**

N W E S

0 175 350 700 1,050 1,400
Metros

804000 805000 806000

1602000 1601000 1600000

SAN RAFAEL LAS FLORES
LOS PLANES
LA CUCHILLA
SABANA REDONDA
EL FUCIO
LOS ANGELES

PSA-SR
HW-1
RW-1
PSA-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-9
MW-11

Quebrada El Salitre
Río San Rafael
Río Dorado
Quebrada El Escobal
Quebrada Honda

MAPA DE LOCALIZACIÓN ESTACIONES (POZOS) DE MONITOREO Y REFERENCIA

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL

DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Río Permanente
	Quebrada Intermitente

ESTACIONES DE MONITOREO (POZOS)

Símbolo	Estación	X	Y
⊕	MW-2	805201	1600768
	MW-3	805148	1600993
	MW-4	805181	1601212
	MW-5	805299	1601463
	MW-6	805452	1601657
	MW-7	805791	1601785
	MW-8	805298	1601480
	MW-9	805192	1601222
	MW-11	805607	1601267
●	RW-1	804803	1601175
	PSA-SR	803672	1602247
	HW-1	803888	1601977
	PSA-1	805212	1601203

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografía aérea del proyecto el Escobal año 2014, datos de campo del departamento de Ambiente.

Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala **1:11,000**

N W E S

0 120 240 480 720 960
Metros

804000

805000

1602000

1601000

SAN RAFAEL LAS FLORES

PSA-SR

Quebrada El Salitre

Río Dorado

LOS PLANES

Río San Rafael

Quebrada El Escobal

PSA-1

MAPA DE LOCALIZACIÓN ESTACIONES DE MONITOREO POZOS DE SUMINISTRO

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL
DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Río Permanente
	Quebrada Intermitente

ESTACIONES DE MONITOREO

Símbolo	Estación	X	Y
▲	PSA-1	805212	1601203
	PSA-SR	803672	1602247

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografía aérea del proyecto el Escobal año 2014, datos de campo del departamento de Ambiente.

Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala **1:10,000**

N
W E
S

0 112.5 225 450 675 900
Metros

5.2 Resultados

5.2.1 Control de Calidad

Para el monitoreo correspondiente al mes de Junio y Julio se emplearon muestras control para determinar la confiabilidad de los parámetros analizados por el laboratorio encargado del análisis de muestras. En total se efectuaron 3 muestras blanco y tres muestras duplicado. Los resultados obtenidos se presentan en el Cuadro 5-2.

En las tres muestras del control de calidad de los blancos de campo, se detectaron concentraciones mínimas de calcio disuelto (SW10, GW10 y MW20), cloruros (SW10, GW10 y MW20), amonio (MW20), nitrógeno kjeldahl (MW20), sulfatos (SW10) y alcalinidad total (SW10, GW10 y MW20). Sin embargo las concentraciones detectadas están muy cerca a los límites de detección del método, por lo que se considera que no hay un aporte significativo de estos elementos en los resultados obtenidos. Todos los demás parámetros analizados por el laboratorio son confiables tanto en manipulación de las muestras como en precisión del análisis.

Cuadro 5-2: Resultados de control de calidad, blanco y duplicado, para análisis de agua superficial y subterránea

Parámetros	Unidad	Blancos de campo			Muestras duplicado					
		Agua EMSURE (metales) y agua desmineralizada (Fisicoquímicos)			Duplicado	Original	Duplicado	Original	Duplicado	Original
		SW10	GW10	MW20	SW11	SW2A	GW11	GW3	MW21	MW9
Cr VI	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
DBO		<10	N/A	N/A	<10	<10	N/A	N/A	N/A	N/A
Coliformes Fecales	NMP/100 ml	<1.8	<1.5	<1.8	490	23	4.5	<4.5	<1.8	<1.8
Color Real	U Pt/Co	<1	<1	<1	2	11	<1	<1	<1	<1
Materia flotante	U Pt/Co					Ausente		Ausente		Ausente
Aluminio Disuelto	mg/L	<0.03	<0.03	<0.03	0.06	0.05	<0.03	<0.03	0.03	<0.03
Aluminio Total		<0.03	NA	NA	0.27	0.25	NA	NA	NA	NA
Antimonio Disuelto		<0.0004	<0.0004	<0.0004	0.0057	0.0059	0.0006	0.0006	0.0005	<0.0004
Antimonio Total		<0.0004	NA	NA	0.0058	0.0054	NA			
Arsénico Disuelto		<0.0002	<0.0002	<0.0002	0.0061	0.0064	0.0023	0.0023	0.0009	0.0008
Arsénico Total		<0.0002	NA	NA	0.0066	0.0072	NA			
Bario Disuelto		<0.003	<0.003	<0.003	0.063	0.063	0.138	0.140	0.048	0.040
Bario Total		<0.003	NA	NA	0.064	0.058	NA			
Berilio Disuelto		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Berilio Total		<0.01	NA	NA	<0.01	<0.01	NA			
Bismuto Disuelto		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Bismuto Total		<0.04	NA	NA	<0.04	<0.04	NA			
Boro Disuelto		<0.01	<0.01	<0.01	0.10	0.10	<0.01	<0.01	0.06	0.02
Boro Total		<0.01	NA	NA	0.10	0.09	NA			
Cadmio Disuelto		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cadmio Total		<0.0001	NA	NA	0.0002	0.0002	NA			
Calcio Disuelto		0.2	0.3	0.2	272	274	109	112	141	51.4
Calcio Total		<0.1	NA	NA	268	276	NA			

Parámetros	Unidad	Blancos de campo			Muestras duplicado					
		Agua EMSURE (metales) y agua desmineralizada (Fisicoquímicos)			Duplicado	Original	Duplicado	Original	Duplicado	Original
		SW10	GW10	MW20	SW11	SW2A	GW11	GW3	MW21	MW9
Cromo Disuelto	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cromo Total		<0.01	NA	NA	<0.01	<0.01	NA			
Cobalto Disuelto		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalto Total		<0.01	NA	NA	<0.01	<0.01	NA			
Cobre Disuelto		<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Cobre Total		<0.01	NA	NA	<0.01	<0.01	NA			
Galio Disuelto		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Galio Total		<0.1	NA	NA	<0.1	<0.1	NA			
Hierro Disuelto		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hierro Total		<0.02	NA	NA	0.26	0.3	NA			
Plomo Disuelto		<0.0001	<0.0001	<0.0001	0.001	0.001	<0.0001	<0.0001	<0.0001	<0.0001
Plomo Total		<0.0001	NA	NA	0.0127	0.0128	NA			
Litio Disuelto		<0.008	<0.008	<0.008	0.069	0.070	<0.008	<0.008	0.008	0.011
Litio Total		<0.008	NA	NA	0.064	0.061	NA			
Magnesio Disuelto		<0.2	<0.2	<0.2	19.5	19.4	24.0	24.8	18.5	7.9
Magnesio Total		<0.2	NA	NA	19.0	19.4	NA			
Manganeso Disuelto		<0.005	<0.005	<0.005	0.420	0.420	<0.005	<0.005	<0.005	0.062
Manganeso Total		<0.005	NA	NA	0.429	0.429	NA			
Mercurio Disuelto		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercurio Total		<0.0002	NA	NA	<0.0002	<0.0002	NA			
Molibdeno Disuelto		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Molibdeno Total		<0.02	NA	NA	<0.02	<0.02	NA			
Níquel Disuelto		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Níquel Total		<0.008	NA	NA	<0.008	<0.008	NA			
Potasio Disuelto		<0.2	<0.2	<0.2	5.8	5.9	11.5	11.7	7.7	4.4
Potasio Total		<0.2	NA	NA	5.7	5.8	NA			
Escandio Disuelto		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Escandio Total		<0.1	NA	NA	<0.1	<0.1	NA			
Selenio Disuelto		<0.0001	<0.0001	<0.0001	0.0005	0.0006	0.0009	0.0009	0.0006	<0.0001
Selenio Total		<0.0001	NA	NA	0.0005	0.0005	NA			
Plata Disuelta		<0.00005	$<5x10^{-5}$	$<5x10^{-5}$	<0.00005	<0.00005	$<5x10^{-5}$	$<5x10^{-5}$	$<5x10^{-5}$	$<5x10^{-5}$
Plata Total		<0.00005	NA	NA	0.00023	0.00014	NA			
Sodio Disuelto		<0.2	<0.2	<0.2	55.3	55.4	26.8	27.4	30.4	26.1
Sodio Total		<0.2	NA	NA	53.2	54.1	NA			
Estroncio Disuelto		<0.005	<0.005	<0.005	3.3	3.36	0.574	0.583	0.579	0.377
Estroncio Total		<0.005	NA	NA	3.22	3.25	NA			
Talio Disuelto		<0.0001	<0.0001	<0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Talio Total		<0.0001	NA	NA	0.0001	0.0001	NA			
Estaño Disuelto		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Estaño Total		<0.04	NA	NA	<0.04	<0.04	NA			
Titanio Disuelto		<0.005	<0.005	<0.005	0.008	0.007	0.014	0.014	<0.005	<0.005
Titanio Total		<0.005	NA	NA	0.015	0.012	NA			
Uranio Disuelto		<0.0001	<0.0001	<0.0001	0.0002	0.0002	<0.0001	<0.0001	0.0006	0.0001
Uranio Total		<0.0001	NA	NA	0.0002	0.0002	NA			
Vanadio Disuelto		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Vanadio Total		<0.005	NA	NA	<0.005	<0.005	NA			
Zinc Disuelto		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc Total		<0.01	NA		0.01	<0.01	NA			
Grasas y Aceites		<2.1			<2.1	<2				
DQO		<10			<10	<10				
Cloruros		0.5	0.6	<0.5	44.0	44.3	29.2	29.2	27.1	8.1
Cianuro Total		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Fluoruros		<0.05	<0.05	<0.05	0.86	0.87	0.30	0.30	0.22	0.57

Parámetros	Unidad	Blancos de campo			Muestras duplicado					
		Agua EMSURE (metales) y agua desmineralizada (Fisicoquímicos)			Duplicado	Original	Duplicado	Original	Duplicado	Original
		SW10	GW10	MW20	SW11	SW2A	GW11	GW3	MW21	MW9
Nitratos/Nitritos como N	mg/L	<0.02	<0.02	<0.02	1.68	1.68	7.13	7.55	6.46	<0.02
Amonio		<0.05	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	0.1	0.1
Nitrógeno Kjeldahl (TKN)		<1	2	<0.1	0.2	0.3	<0.1	<1	<0.1	<0.1
Fosfatos		<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.16
Fósforo Disuelto (Orto)		<0.02	<0.02	<0.02	<0.02	<0.02	0.31	0.30	0.05	0.06
Fósforo Total		<0.02	<0.02	<0.02	0.25	<0.02	<0.02	<0.02	0.02	0.06
STD (TDS)		<10	<10	<10	1240	1240	700	704	776	256
SST (TSS)		<5	<5	<5	11.0	11.0	<5	<5	<5	<5
ST (TS)		<10	<10	<10	1250	1240	730	736	790	264
Sulfatos		4.4	<1	<1	717	723	300	289	353	47.7
Alcalinidad Total		3.8	3.4	3.0	113	125	89.5	88.4	95.2	158
Hidrocarburos totales (TPH)		<0.1	<0.1	<0.1	<0.1	<0.1	NA			

u.e.: unidades exponenciales. mg/L: miligramos por litro. NMP/100ml: número más probable en 100ml. u Pt/Co: unidades platino cobalto. Fuente: MSR, 2017.

5.2.2 Agua Superficial

En el Cuadro 5-3 se presentan los resultados de la calidad del agua superficial para el mes de Julio en las once estaciones de monitoreo y un resumen estadístico (promedio, valor máximo y valor mínimo) de la línea base establecida para cada estación. Los resultados del laboratorio se presentan en el anexo 12.5.1.

Las estaciones muestreadas presentaron un pH levemente alcalino (7.27 a 8.25 u.e.). En ninguna de las estaciones se detectaron valores de grasas y aceites. En ninguna estación se registró cianuro total cumpliendo con las guías establecidas por la USEPA para la salud humana, el Banco Mundial y el Acuerdo Gubernativo 236-2006 (**Acuerdo**) para aguas residuales. La Demanda Química de Oxígeno (**DQO**) se detectó en las estaciones SW3-E, SW4-E, SW4A-E, SW6-E, SW7-E y SW8-E sin que sobrepasar el valor guía establecido por el Banco Mundial (125 mg/L). En ninguna estación se detectó concentración de Demanda Bioquímica de Oxígeno (**DBO**).

Todas las estaciones muestreadas presentaron concentraciones por debajo de la directriz de la USEPA para la salud humana de Cloruros (250 mg/L), Fluoruros (4 mg/L) y concentraciones por debajo de los valores establecidos por el Acuerdo (10 mg/L) y el Banco Mundial (2 mg/L) para Fósforo total.

En nueve de las once estaciones se detectó sólidos suspendidos totales encontrándose por debajo de los valores establecidos por el Acuerdo (100 mg/L), por el Banco Mundial (50 mg/L) y dentro de los valores establecidos durante el levantamiento de línea base.

Los Sulfatos Totales fueron detectados en la mayoría de las estaciones en concentraciones por debajo de los valores máximos establecidos durante la línea base, a excepción de la estación SW4-E para sulfatos.

La estación SW2A no cuenta con línea base pero se utiliza los valores registrados en la línea base de la estación SW2 como referencia para analizar su comportamiento, ya que las dos estaciones están ubicadas en la quebrada El Escobal aguas abajo y están separadas a escasos 400mts aproximadamente. El Aluminio fue detectado en todas las estaciones en diferentes concentraciones. Sin embargo los datos se encuentran dentro de los límites establecidos durante el levantamiento de la línea base. El Antimonio fue detectado en ocho estaciones, y los valores registrados se encuentran por debajo de los límites máximos establecidos durante la línea base.

Las concentraciones de Arsénico Total se encuentran por debajo de los límites establecidos por el Acuerdo (0.1 mg/L) y respecto de las directrices de la USEPA (0.01mg/L) todas las estaciones se encontraron por debajo del valor guía y dentro los valores máximos registrados durante el establecimiento de la línea base. En ninguna estación de monitoreo de agua superficial fue detectado Mercurio. Y en todas las estaciones fue detectado el Plomo Total, registrándose todas las concentraciones por debajo de los valores guía sugeridos por la USEPA (0.015 mg/L), el Acuerdo (0.4 mg/L) y los valores máximos registrados durante el establecimiento de la línea base.

Cuadro 5-3: Resultados de la Calidad del Agua Superficial, Proyecto Minero Escobal (1/4)

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	SW1-E Quebrada Escobal-aguas arriba				SW2-E Quebrada Escobal-en medio del Proyecto				SW2A-E Quebrada Escobal- salida del Proyecto			
					Línea Base			Jul-17	Línea Base			Jul-17	Línea Base			Jul-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
pH de campo	u.e.	5.0-9.0	6.0-9.0	6.0-9.0	7.509	7.14	8.06	7.88	7.42	6.56	7.87	8.22				8.25
Temperatura (campo)	°C				17.4	13	19.8	18.5	22.4	20.3	25.6	21.8				27.1
Conductividad (campo)	µS/cm				277.9	66.3	566.6	220.2	807.3	177.3	1965	360.1				1483
Oxígeno disuelto (campo)	mg/L				3.6	0.1	6.4	7.73	4.76	3.5	5.8	7.54				6.95
Cr VI					NR	NR	NR	<0.05	NR	NR	NR	<0.05				<0.05
DBO								<10				<10				<10
Coliformes Fecales	NMP/100ml							1700				2400				23
Color Real	U Pt/Co							15				19				11
Materia Flotante								Ausente				Ausente				Ausente
Turbidez	NTU							14.6				7.58				8.52
Aluminio Disuelto					0.035	<0.03	0.09	0.03	0.043	<0.03	0.12	0.03				0.05
Aluminio Total		0.2			5.02	<0.03	35.1	1.38	2.35	0.06	8.77	0.57				0.25
Antimonio Disuelto					<0.0004	<0.0004	0.0006	<0.0004	<0.0004	<0.0004	<0.0004	0.0009				0.0059
Antimonio Total		0.006			<0.0004	<0.0004	0.0007	<0.0004	<0.0004	<0.0004	0.0005	0.0008				0.0054
Arsénico Disuelto					0.00216	0.0005	0.0034	0.0012	0.00184	0.0013	0.0024	0.0028				0.0064
Arsénico Total		0.01		0.1	0.00339	0.0015	0.0094	0.0014	0.00266	0.0012	0.0054	0.0031				0.0072
Bario Disuelto					0.1361	0.086	0.207	0.094	0.109	0.088	0.133	0.085				0.063
Bario Total		1			0.186	0.1	0.434	0.103	0.131	0.096	0.186	0.087				0.058
Berilio Disuelto					<0.002	<0.002	<0.01	<0.01	<0.002	<0.002	<0.002	<0.01				<0.01
Berilio Total		0.004			<0.002	<0.002	<0.01	<0.01	<0.002	<0.002	<0.002	<0.01				<0.01
Bismuto Disuelto					<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.05	<0.04				<0.04
Bismuto Total					<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04				<0.04
Boro Disuelto					<0.01	<0.01	<0.01	0.01	0.114	<0.01	0.29	0.01				0.10
Boro Total					<0.01	<0.01	0.02	<0.01	0.11	<0.01	0.28	<0.01				0.09
Cadmio Disuelto					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	NR	NR	NR	<0.0001
Cadmio Total		0.003		0.1	<0.0001	<0.0001	0.0007	<0.0001	<0.0001	<0.0001	0.0001	<0.0001				0.0002
Calcio Disuelto					45.2	18.9	74.5	25.6	144.9	20.7	333	45.9				274
Calcio Total					45.5	20.9	70.5	25.9	144.6	20.5	331	47.5				276
Cromo Disuelto					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01
Cromo Total		0.1		0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01
Cobalto Disuelto					<0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01				<0.01
Cobalto Total					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01
Cobre Disuelto					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01
Cobre Total		1.3		3	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.02	<0.01				<0.01
Galio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1
Galio Total					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1
Hierro Disuelto					<0.02	<0.02	0.04	<0.02	0.04	<0.02	0.12	<0.02				<0.02
Hierro Total		0.3			2.7	<0.02	19.5	0.61	1.3	0.06	5.19	0.27				0.30
Plomo Disuelto					<0.0001	<0.0001	0.0003	<0.0001	<0.0001	<0.0001	0.0001	<0.0001				0.001
Plomo Total		0.015		0.4	0.0025	<0.0001	0.0191	0.0005	0.00088	<0.0001	0.0038	0.0016				0.0128
Litio Disuelto					<0.02	<0.02	<0.02	<0.008	<0.02	<0.02	<0.02	<0.008				0.070
Litio Total					<0.02	<0.02	<0.02	<0.008	0.02	<0.02	0.02	<0.008				0.061
Magnesio Disuelto					3.9	2.6	5.3	3.4	15.9	3.2	37.3	5.8				19.4
Magnesio Total					4.2	2.8	5.2	3.1	15.1	3.6	32.2	5.8				19.4
Manganeso Disuelto					0.0051	<0.005	0.02	0.005	0.0195	<0.005	0.07	0.026				0.420
Manganeso Total		0.4			0.1041	<0.005	0.721	0.033	0.0602	0.007	0.174	0.033				0.429
Mercurio Disuelto					<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002				<0.0002
Mercurio Total		0.002		0.01	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002				<0.0002
Molibdeno Disuelto					<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02				<0.02

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	SW1-E Quebrada Escobal-aguas arriba				SW2-E Quebrada Escobal-en medio del Proyecto				SW2A-E Quebrada Escobal- salida del Proyecto			
					Línea Base			Jul-17	Línea Base			Jul-17	Línea Base			Jul-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
Molibdeno Total	mg/L				<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02	NR	NR	NR	<0.02
Níquel Disuelto					<0.01	<0.01	0.03	<0.008	0.013	<0.01	0.04	<0.008				<0.008
Níquel Total		0.61		2	<0.01	<0.01	0.04	<0.008	0.022	<0.01	0.04	<0.008				<0.008
Potasio Disuelto					4.4	3.5	5.1	4.6	6.1	4.9	7.6	5.2				5.9
Potasio Total					5.3	3.5	13	4.7	6.3	5.2	7.4	5.3				5.8
Escandio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1
Escandio Total					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1
Selenio Disuelto					<0.0001	<0.0001	0.0001	<0.0001	0.00045	<0.0001	0.0002	0.0002				0.0006
Selenio Total		0.17			0.0001	<0.0001	0.0003	0.0002	0.00011	<0.0001	0.0002	0.0003				0.0005
Plata Disuelta					<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005				<0.00005
Plata Total					<0.00005	<0.00005	0.00015	<0.00005	<0.00005	<0.00005	0.00006	<0.00005				0.00014
Sodio Disuelto					9.81	8.3	11.6	9.1	40.1	9.4	87.8	13.3				55.4
Sodio Total					9.46	7.8	11.8	9.0	39.8	9.4	85.2	13.6				54.1
Estroncio Disuelto					0.17	0.09	0.26	0.123	1.23	0.1	2.99	0.229				3.36
Estroncio Total					0.18	0.1	0.25	0.127	1.23	0.11	2.91	0.236				3.25
Talio Disuelto					<0.0001	<0.0001	0.0002	<0.0001	0.0001	<0.0001	0.0001	<0.0001				0.0001
Talio Total		0.002			<0.0001	<0.0001	0.0004	<0.0001	0.0001	<0.0001	0.0002	<0.0001				0.0001
Estaño Disuelto					<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04				<0.04
Estaño Total					<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04				<0.04
Titanio Disuelto					<0.005	<0.005	<0.005	0.006	<0.005	<0.005	0.007	0.008				0.007
Titanio Total					0.092	<0.005	0.591	0.04	0.2715	<0.005	0.171	0.018				0.012
Uranio Disuelto					0.00013	<0.0001	0.0003	<0.0001	0.00028	<0.0001	0.0006	<0.0001				0.0002
Uranio Total					0.00038	<0.0001	0.0011	<0.0001	0.00024	<0.0001	0.0005	<0.0001				0.0002
Vanadio Disuelto					<0.005	<0.005	0.007	<0.005	0.0065	<0.005	0.015	<0.005				<0.005
Vanadio Total					0.0059	<0.005	0.024	<0.005	<0.005	<0.005	0.006	<0.005				<0.005
Zinc Disuelto					0.053	<0.01	0.1	<0.01	0.046	<0.02	0.1	0.01				<0.01
Zinc Total		7.4		10	0.064	<0.01	0.12	<0.01	0.041	<0.01	0.06	<0.01				<0.01
Grasas y Aceites			10	10	<2.062	<2.062	<2.248	<2	<2.04	<2.04	<2.04	<2.2				<2
DQO			125		15.7	<10	40	<10	<2.04	<2.04	<2.04	<10				<10
Cloruros		250			5	4	7	9.5	<2.04	<2.04	<2.04	10.4				44.3
Cianuro Total		0.14		1	0.004	<0.003	0.015	<0.003	<0.003	<0.003	<0.003	<0.003				<0.003
Fluoruros		4			0.125	<0.1	0.2	0.11	0.6	0.1	1.2	0.18				0.87
Nitratos/Nitritos como N					1.61	0.08	4.87	5.97	2.46	0.03	4.9	5.06				1.68
Amonio					<0.005	<0.005	0.07	<0.05	<0.05	<0.05	0.07	<0.05				<0.05
Nitrógeno Kjeldahl (TKN)					3.53	<0.1	25.9	0.5	0.32	<0.1	0.8	0.1				0.3
Fosfatos					0.185	0.1	0.3	0.09	0.19	0.1	0.4	0.12				<0.06
Fósforo Disuelto (Orto)					0.06	0.03	0.1	0.03	0.06	0.02	0.13	0.04				<0.02
Fósforo Total			2	10	0.37	0.04	2.51	0.05	0.08	0.03	0.19	0.04				<0.02
STD (TDS)		500			225	170	280	212	754	170	1620	302				1240
SST (TSS)			50	100	163.6	<5	780	14.0	67	<5	320	7.0				11.0
ST (TS)					346.3	200	1080	204	850	230	1660	300				1240
Sulfatos		250			26.3	10	42	23.2	472.6	14	1600	73.3				723
Alcalinidad Total					104	38	161	46.2	80	44	119	67.8				125
Hidrocarburos totales (TPH)					<0.1	<0.09	<0.1	<0.1	<0.1	<0.09	<0.1	<0.1				<0.1

Dónde: **u.e**.: unidades exponenciales; **mg/L**: miligramos por litro; **µS/cm**: micro siemens por centímetro; **°C:** grados centígrados; **NMP/100ml:** número más probable en 100ml; **u Pt/Co:** unidades platino cobalto; **NR** = Cálculo No Realizado por falta de datos de línea base. Fuente: MSR, 2017.

Cuadro 5-3: Resultados de la Calidad del Agua Superficial, Proyecto Minero Escobal (2/4)

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	SW3-E Río El Dorado – Aguas arriba				SW4-E Río El Dorado – sobre camino vecinal				SW4A-E Río El Dorado – Aguas abajo			
					Línea Base			Jul-17	Línea Base			Jul-17	Línea Base			Jul-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
pH de campo	u.e.	5.0-9.0	6.0-9.0	6.0-9.0	7.58	7.17	8.17	7.27	7.4	6.56	7.94	7.82				7.89
Temperatura (campo)	°C				19.8	17	24	18.6	21	17.2	24	20.9				23.6
Conductividad (campo)	µS/cm				219.7	80	374.5	155	308.9	120	612	680.6				653.1
Oxígeno disuelto (campo)	mg/L				3.8	0.1	6.8	7.95	4.2	0.1	7.5	7.41				7.23
Cr VI					NR	NR	NR	<0.05	NR	NR	NR	<0.05				<0.05
DBO								<10				<10				<10
Coliformes Fecales	NMP/100ml							3500				49000				49000
Color Real	U Pt/Co							38				13				16
Materia Flotante								Ausente				Ausente				Ausente
Turbidez	NTU							40.70				23.3				25.6
Aluminio Disuelto	mg/L				0.061	<0.03	0.15	0.04	0.03	<0.03	0.1	0.06				0.03
Aluminio Total		0.2			3.25	<0.03	17.4	4.04	5.72	0.1	36	2.14				2.56
Antimonio Disuelto					<0.0004	<0.0004	<0.0004	<0.0004	0.0007	0	0.0011	0.0023				0.0025
Antimonio Total		0.006			<0.0004	<0.0004	<0.0004	0.0004	0.0012	0.0005	0.0037	0.002				0.0023
Arsénico Disuelto					0.00797	0.0041	0.0139	0.0077	0.00541	0.0039	0.0072	0.0067				0.007
Arsénico Total		0.01		0.1	0.00888	0.006	0.0137	0.0092	0.00873	0.0043	0.0326	0.0074				0.0083
Bario Disuelto					0.0915	0.051	0.118	0.066	0.1645	0.08	0.234	0.1				0.104
Bario Total		1			0.12445455	0.098	0.253	0.1	0.2356	0.144	0.567	0.109				0.122
Berilio Disuelto					<0.002	<0.0002	<0.01	<0.01	<0.002	<0.002	<0.01	<0.01				<0.01
Berilio Total		0.004			<0.002	<0.0002	<0.01	<0.01	0.002	<0.002	0.003	<0.01				<0.01
Bismuto Disuelto					<0.01	<0.01	<0.04	<0.04	0.04	<0.04	0.1	<0.04				<0.04
Bismuto Total					<0.01	<0.01	<0.04	<0.04	0.04	<0.04	0.04	<0.04				<0.04
Boro Disuelto					<0.01	<0.01	0.02	<0.01	0.008	<0.01	0.02	0.04				0.04
Boro Total					<0.01	<0.01	0.02	<0.01	0.012	<0.01	0.02	0.02				0.02
Cadmio Disuelto					<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	NR	NR	NR	<0.0001
Cadmio Total		0.003		0.1	<0.0001	<0.0001	0.0002	<0.0001	0.00012	<0.0001	0.0005	<0.0001				0.0001
Calcio Disuelto					27.8	11.7	39.9	18.5	37.4	18.5	61.7	101				96.0
Calcio Total					27.9272727	12.3	38.7	19.3	38.3	17.2	58.9	106				105
Cromo Disuelto					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01
Cromo Total		0.1		0.1	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	0.02	<0.01				<0.01
Cobalto Disuelto					0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01				<0.01
Cobalto Total					0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01				<0.01
Cobre Disuelto					<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01
Cobre Total		1.3		3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01				<0.01
Galio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1
Galio Total					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1
Hierro Disuelto					0.033	<0.02	0.06	<0.02	0.032	<0.02	0.15	<0.02				<0.02
Hierro Total		0.3			1.9	0.06	10.2	1.56	3.8	0.09	26.5	0.82				1.14
Plomo Disuelto					<0.0001	<0.0001	0.0004	<0.0001	<0.0001	<0.0001	0.0002	<0.0001				<0.0001
Plomo Total		0.015		0.4	0.0013	<0.0001	0.0072	0.0015	0.003	<0.0001	0.0198	0.0015				0.0024
Litio Disuelto					<0.02	<0.02	<0.02	<0.008	<0.02	<0.02	<0.02	0.021				0.019
Litio Total					<0.02	<0.02	<0.02	<0.008	0.02	<0.02	0.02	0.015				0.013
Magnesio Disuelto					2.6	1.3	3.5	1.7	4.2	2.4	7.3	8.3				7.9
Magnesio Total					2.7	1.6	3.5	1.5	4.6	2.5	7.3	8.4				8.4
Manganeso Disuelto					0.07418182	0.01	0.381	0.019	0.116	0.011	0.26	0.141				0.143
Manganeso Total		0.4			0.14745455	0.025	0.403	0.068	0.2844	0.101	1.23	0.168				0.188
Mercurio Disuelto					<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002				<0.0002
Mercurio Total		0.002		0.01	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002				<0.0002
Molibdeno Disuelto					0.01	<0.01	0.01	<0.02	<0.01	<0.01	<0.01	<0.02				<0.02

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	SW3-E Río El Dorado – Aguas arriba				SW4-E Río El Dorado – sobre camino vecinal				SW4A-E Río El Dorado – Aguas abajo			
					Línea Base			Jul-17	Línea Base			Jul-17	Línea Base			Jul-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
Molibdeno Total	mg/L				0.01	<0.01	0.01	<0.02	<0.01	<0.01	<0.01	<0.02	NR	NR	NR	<0.02
Níquel Disuelto					<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	0.02	<0.008				<0.008
Níquel Total		0.61		2	<0.01	<0.01	0.05	<0.008	0.01	<0.01	0.06	<0.008				<0.008
Potasio Disuelto					4.2	3.5	5.5	3.5	5.8	4.2	8.7	5.4				6.3
Potasio Total					4.5	3.6	7	4	6.5	4.4	11.7	5.5				6.6
Escandio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1
Escandio Total					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1
Selenio Disuelto					<0.0001	<0.0001	0.0001	<0.0001	0.00014	<0.0001	0.0005	0.0002				0.0002
Selenio Total		0.17			<0.0001	<0.0001	0.0001	<0.0001	0.0002	<0.0001	0.0002	0.0002				0.0002
Plata Disuelta					<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005				<0.00005
Plata Total					<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00011	<0.00005				<0.00005
Sodio Disuelto					12.65	7.7	16.6	8.7	12.44	9	15.6	24.4				23.4
Sodio Total					12.17	7.5	15.4	8.9	12.13	8.6	15.2	24.5				24.5
Estroncio Disuelto					0.19	0.06	0.3	0.114	0.22	0.09	0.36	1.06				0.979
Estroncio Total					0.18818182	0.08	0.3	0.121	0.228	0.11	0.33	1.07				1.03
Talio Disuelto					<0.0001	<0.0001	0.0005	<0.0001	0.0001	<0.0001	0.0001	<0.0001				<0.0001
Talio Total		0.002			<0.0001	<0.0001	0.0002	<0.0001	0.00017	<0.0001	0.0007	<0.0001				<0.0001
Estaño Disuelto					<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04				<0.04
Estaño Total					<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04				<0.04
Titanio Disuelto					<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01				0.009
Titanio Total					0.071	<0.005	0.307	0.083	0.127	0.005	0.534	0.049				0.064
Uranio Disuelto					<0.0001	<0.0001	0.0002	<0.0001	0.00012	<0.0001	0.0004	0.0001				0.0001
Uranio Total					0.00019	<0.0001	0.0005	0.0002	0.00027	<0.0001	0.0009	0.0002				0.0002
Vanadio Disuelto					<0.005	<0.005	0.008	<0.005	<0.005	<0.005	0.011	<0.005				<0.005
Vanadio Total					0.0051	<0.005	0.019	0.006	0.0085	<0.005	0.04	0.005				<0.005
Zinc Disuelto					0.068	<0.01	0.14	<0.01	0.061	0.05	0.14	<0.01				<0.01
Zinc Total		7.4		10	0.174	<0.01	1.01	<0.01	0.065	0.01	0.17	<0.01				<0.01
Grasas y Aceites			10	10	<2.062	<2.04	<2.326	<2.2	<2.062	<2.02	<2.084	<2				<2.4
DQO			125		10.9	<10	40	12	16.8	<10	60	12				16
Cloruros		250			2.7	2	3	3.7	8.5	4	16	18.2				18.7
Cianuro Total		0.14		1	<0.003	<0.003	0.015	<0.003	<0.003	<0.003	0.014	<0.003				<0.003
Fluoruros		4			<0.003	<0.003	0.015	0.13	0.15	0.1	0.2	0.33				0.32
Nitratos/Nitritos como N					0.59	<0.02	1.51	1.34	4.49	1.96	10.1	2.61				2.99
Amonio					0.05	<0.05	0.21	<0.05	0.059	<0.05	0.15	<0.05				<0.05
Nitrógeno Kjeldahl (TKN)					0.35	<0.1	0.6	0.2	0.58	0.1	1.3	0.3				0.3
Fosfatos					0.12	0.1	0.4	0.09	0.36	0.1	1.2	0.19				0.34
Fósforo Disuelto (Orto)					0.04	0.02	0.12	0.02	0.12	0.03	0.39	0.05				0.11
Fósforo Total			2	10	0.05	0.02	0.14	0.06	0.17	0.04	0.39	0.1				0.15
STD (TDS)		500			183.636364	140	220	178	233.6	150	350	532				516
SST (TSS)			50	100	48	5	340	27	115	<5	880	24.0				23.0
ST (TS)					231.8	140	500	188	378.2	260	1180	534				520
Sulfatos		250			16.9	4	25	14.6	27.5	10	57	238				222
Alcalinidad Total					83	38	118	51.6	80	45	102	84.0				81.8
Hidrocarburos totales (TPH)					<0.1	<0.09	<0.2	<0.1	<0.1	<0.09	<0.1	<0.1				<0.1

Dónde: **u.e**.: unidades exponenciales; **mg/L**: miligramos por litro; **µS/cm**: micro siemens por centímetro; **°C:** grados centígrados; **NMP/100ml:** número más probable en 100ml; **u Pt/Co:** unidades platino cobalto; **NR** = Cálculo No Realizado por falta de datos de línea base. Fuente: MSR, 2017.

Cuadro 5-3: Resultados de la Calidad del Agua Superficial, Proyecto Minero Escobal (3/4)

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	SW5-E Río Tapalapa – Aguas arriba				SW6-E Río Los Vados				SW7-E Quebrada La Honda			
					Línea Base			Jul-17	Línea Base			Jul-17	Línea Base			Jul-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
pH de campo	u.e.	5.0-9.0	6.0-9.0	6.0-9.0	7.5	7.1	8		7.4	7.1	7.8	7.33	7.5	6.9	8	7.36
Temperatura (campo)	°C				17.4	14.5	21.5		19.4	12.2	27.3	15.9	18.7	15	21.3	16.8
Conductividad (campo)	µS/cm				72.1	0.1	160.2		259	60	948	92.41	216	120	416.2	153.8
Oxígeno disuelto (campo)	mg/L				4	0	8		4	0	8.3	8.42	3.9	0.1	7.5	8.05
Cr VI					NR	NR	NR		NR	NR	NR	<0.05	NR	NR	NR	<0.05
DBO												<10				<10
Coliformes Fecales	NMP/100ml											2200				5400
Color Real	U Pt/Co											40				43
Materia Flotante												Ausente				Ausente
Turbidez	NTU											32.30				39.8
Aluminio Disuelto					0.055	<0.03	0.14		0.031	<0.03	0.08	0.06	0.033	<0.03	0.13	0.22
Aluminio Total		0.2			1.09	<0.03	3.7		1.89	<0.03	8.1	3.72	3.05	0.1	16.4	5.35
Antimonio Disuelto					<0.0004	<0.0004	<0.0004		<0.0004	<0.0004	0.0013	<0.0004	<0.0004	<0.0004	0.0009	0.0007
Antimonio Total		0.006			<0.0004	<0.0004	<0.0004		<0.0004	<0.0004	<0.0004	<0.0004	0.0005	<0.0004	0.0007	0.0007
Arsénico Disuelto					0.00139	0.0005	0.0024		0.0032	0.0007	0.0076	0.0009	0.00382	0.0022	0.0054	0.0022
Arsénico Total		0.01		0.1	0.00177	0.0013	0.0028		0.00387	0.0025	0.0074	0.0019	0.00446	0.003	0.0061	0.0035
Bario Disuelto					0.0447	0.023	0.072		0.0618	0.027	0.136	0.042	0.0946	0.052	0.143	0.081
Bario Total		1			0.0556	0.039	0.069		0.0806	0.055	0.136	0.071	0.2142	0.088	0.99	0.112
Berilio Disuelto					<0.002	<0.002	<0.01		<0.002	<0.002	<0.01	<0.01	<0.002	<0.002	<0.01	<0.01
Berilio Total		0.004			0.002	<0.002	<0.01		<0.002	<0.002	0.003	<0.01	<0.002	<0.002	0.003	<0.01
Bismuto Disuelto					<0.04	<0.04	<0.04		<0.04	<0.04	0.1	<0.04	<0.04	<0.04	0.04	<0.04
Bismuto Total					<0.04	<0.04	<0.04		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Boro Disuelto					0.01	<0.01	0.01		0.361	<0.01	1.8	0.02	<0.01	<0.01	0.01	0.01
Boro Total					0.01	<0.01	0.02		0.379	<0.01	1.93	<0.01	0.013	<0.01	0.02	<0.01
Cadmio Disuelto					<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cadmio Total		0.003		0.1	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	0.0002	0.0001	<0.0001	<0.0001	0.0003	0.0001
Calcio Disuelto					7.9	3.4	13.7		15.1	5.4	38.9	6.7	23.1	11.2	38.1	14.0
Calcio Total					7.73	3.4	13.1		14.81	5.9	37.5	7.3	23.04	11.5	36.7	15.4
Cromo Disuelto					<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cromo Total		0.1		0.1	0.01	<0.01	0.02		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01
Cobalto Disuelto					<0.01	<0.01	<0.01		<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01
Cobalto Total					<0.01	<0.01	0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Cobre Disuelto					<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobre Total		1.3		3	<0.01	<0.01	0.04		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Galio Disuelto					<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Galio Total					<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hierro Disuelto					0.055	0.03	0.09		0.097	<0.02	0.28	0.05	0.022	<0.02	0.07	0.12
Hierro Total		0.3			0.7	0.16	1.8		1.3	0.33	4.8	1.65	1.8	0.08	9.5	2.17
Plomo Disuelto					<0.0001	<0.0001	0.0001		0.0002	<0.0001	0.0014	<0.0001	<0.0001	<0.0001	<0.0001	0.0003
Plomo Total		0.015		0.4	0.0003	<0.0001	0.0012		0.0007	<0.0001	0.0028	0.0012	0.0015	<0.0001	0.0083	0.0018
Litio Disuelto					<0.02	<0.02	<0.02		0.13	<0.02	0.67	<0.008	<0.02	<0.02	<0.02	<0.008
Litio Total					<0.02	<0.02	<0.02		0.133	<0.02	0.68	<0.008	<0.02	<0.02	<0.02	<0.008
Magnesio Disuelto					1.5	0.8	2.5		3	1.4	7.4	1.7	4.1	2.2	6.4	2.6
Magnesio Total					1.5	0.9	2.5		3.1	1.8	7.5	1.6	4.3	2.6	6.5	2.6
Manganeso Disuelto					0.025	0.006	0.047		0.114	<0.005	0.551	0.014	0.032	0.014	0.074	0.021
Manganeso Total		0.4			0.0406	0.014	0.062		0.1482	0.04	0.543	0.062	0.0981	0.019	0.342	0.052
Mercurio Disuelto					<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercurio Total		0.002		0.01	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molibdeno Disuelto					<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	SW5-E Río Tapalapa – Aguas arriba				SW6-E Río Los Vados				SW7-E Quebrada La Honda			
					Línea Base			Jul-17	Línea Base			Jul-17	Línea Base			Jul-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
Molibdeno Total	mg/L				<0.01	<0.01	<0.01	NA	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02
Níquel Disuelto					<0.01	<0.01	0.01		<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008
Níquel Total		0.61		2	0.013	<0.01	0.03		<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	0.04	<0.008
Potasio Disuelto					3	2.5	3.7		4.1	3.2	7.1	3.2	4.1	3.6	5.4	3.6
Potasio Total					3	2.2	4.1		4.2	3.1	7.5	3.5	4.5	3.6	7	4.2
Escandio Disuelto					<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Escandio Total					<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenio Disuelto					<0.0001	<0.0001	0.0003		<0.0001	<0.0001	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenio Total		0.17			<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001
Plata Disuelta					<0.00005	<0.00005	<0.00005		<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Plata Total					<0.00005	<0.00005	<0.00005		<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00006	<0.00005
Sodio Disuelto					6.34	3.7	10.8		32.16	6	135	6.0	11.69	8.7	15.4	8.5
Sodio Total					5.99	3.4	9.4		31.11	5.3	124	6.2	11.45	8.3	15.5	8.8
Estroncio Disuelto					0.06	0.02	0.09		0.12	0.03	0.33	0.051	0.17	0.07	0.29	0.099
Estroncio Total					0.057	0.02	0.08		0.122	0.04	0.35	0.055	0.174	0.09	0.28	0.106
Talio Disuelto					<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Talio Total		0.002			<0.0001	<0.0001	<0.0001		0.0001	<0.0001	0.0004	<0.0001	<0.0001	<0.0001	0.0002	<0.0001
Estaño Disuelto					<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04
Estaño Total					<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04
Titanio Disuelto					<0.005	<0.005	<0.005		<0.005	<0.005	0.007	<0.005	<0.005	<0.005	0.006	0.010
Titanio Total					0.027	<0.005	0.094		0.05	<0.005	0.22	0.09	0.069	<0.005	0.325	0.111
Uranio Disuelto					<0.0001	<0.0001	<0.0002		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Uranio Total					<0.0001	<0.0001	0.0002		<0.0001	<0.0001	0.0003	0.0001	0.00013	<0.0001	0.0005	0.0001
Vanadio Disuelto					<0.005	<0.005	0.007		<0.005	<0.005	0.01	<0.005	<0.0005	<0.0005	0.008	<0.005
Vanadio Total					<0.005	<0.005	0.009		<0.005	<0.005	0.005	<0.005	0.0047	<0.0005	0.018	<0.005
Zinc Disuelto					0.04	<0.01	0.1		<0.1	<0.1	0.4	<0.01	0.131	<0.01	0.81	<0.01
Zinc Total		7.4		10	0.197	<0.01	1.6		<0.1	<0.1	0.22	<0.01	0.339	<0.01	1.87	<0.01
Grasas y Aceites			10	10	<2.062	<2.02	<2.084		<2.062	<2.02	<2.084	<2.3	<2.062	<2.02	<2.084	<2.2
DQO			125		6.5	<10	20		<10	<10	30	16	10	<10	40	11
Cloruros		250			1.8	1	3		43.9	3	230	5.5	3	5	3	6.0
Cianuro Total		0.14		1	0.003	<0.003	0.014		<0.003	<0.003	0.014	<0.003	<0.003	0.015	<0.003	<0.003
Fluoruros		4			<0.1	<0.1	<0.1		0.11	<0.1	0.3	0.07	<0.1	0.2	0.1	0.12
Nitratos/Nitritos como N					0.13	0.03	0.42		0.3	<0.02	1.22	1.9	<0.1	3.53	0.19	3.50
Amonio					<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	0.1	<0.05	<0.05
Nitrógeno Kjeldahl (TKN)					0.21	<0.1	0.4		0.2	0.1	0.5	0.3	<0.1	0.7	0.4	0.5
Fosfatos					0.04	<0.03	0.2		0.08	<0.03	0.3	<0.06	0.1	0.2	0.09	0.12
Fósforo Disuelto (Orto)					0.15	<0.01	0.06		0.03	<0.01	0.09	<0.02	0.03	0.08	0.03	0.03
Fósforo Total			2	10	0.02	<0.01	0.05		0.04	0.02	0.08	0.05	0.03	0.19	0.19	0.06
STD (TDS)		500			84	60	110		187	90	540	126	140	240	100	182
SST (TSS)			50	100	9	<5	32		21	<5	105	15.0	<5	330	6	<5
ST (TS)					97	70	130		221	120	550	134	150	610	140	196
Sulfatos		250			16.5	<10	47		14	<10	23	8.0	9	38	19.4	18.6
Alcalinidad Total					25	13	43		48	22	108	20.5	30	101	54	35.9
Hidrocarburos totales (TPH)					<0.1	<0.09	<0.09		11.54375	<0.1	92	<0.1	<0.09	<0.1	<0.1	<0.1

Dónde: **u.e**.: unidades exponenciales; **mg/L**: miligramos por litro; **µS/cm**: micro siemens por centímetro; **°C:** grados centígrados; **NMP/100ml:** número más probable en 100ml; **u Pt/Co:** unidades platino cobalto; **NR** = Cálculo No Realizado por falta de datos de línea base. **NA**: No Analizado para evitar problemas sociales en los alrededores de la estación de monitoreo. Fuente: MSR, 2017.

Cuadro 5-3: Resultados de la Calidad del Agua Superficial, Proyecto Minero Escobal (4/4)

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	SW8-E Aguas debajo de la confluencia del Río San Rafael Y el Río El Dorado				SW9-E Río Tapalapa, aguas debajo de la confluencia del Río San Rafael Río Los Vados y Quebrada La Honda			
					Línea Base			Jul-17	Línea Base			Jul-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
pH de campo	u.e.	5.0-9.0	6.0-9.0	6.0-9.0	7.49	7	9.8	7.67	7.86	7.5	10.7	7.74
Temperatura (campo)	°C				22.1	18.9	25.1	19.7	21.8	19.1	24.2	18.1
Conductividad (campo)	µS/cm				363.7	186.8	807.6	392.1	267.4	121.8	518	206.5
Oxígeno disuelto (campo)	mg/L				5.14	0.28	7.48	7.57	6.2	0.8	8.5	8.33
Cr VI					<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
DBO					15	15	25	<10	<10	<10	<10	<10
Coliformes Fecales	NMP/100ml				$2x10^6$	$2x10^4$	$5x10^6$	49000	$9x10^4$	$1x10^2$	$2x10^5$	24000
Color Real	U Pt/Co				172	19	351	18	342	29	824	36
Materia Flotante								Ausente				Ausente
Turbidez	NTU				14.15	6.09	22.2	29.2	25.72	4.93	46.5	43.4
Aluminio Disuelto					0.033	<0.03	0.06	<0.03	0.087	<0.03	0.22	0.07
Aluminio Total		0.2			2.39	0.04	7.35	1.68	2.96	0.4	8.6	4.09
Antimonio Disuelto					0.001	<0.0004	0.0033	0.0009	0.0006	<0.0004	0.0013	<0.0004
Antimonio Total		0.006			0.001	<0.0004	0.0027	0.0009	0.0007	<0.0004	0.0012	0.0004
Arsénico Disuelto					0.0043	0.0025	0.0064	0.0036	0.004	0.0023	0.0057	0.0018
Arsénico Total		0.01		0.1	0.006	0.0041	0.0096	0.0046	0.0042	0.002	0.006	0.003
Bario Disuelto					0.107	0.074	0.143	0.108	0.094	0.056	0.135	0.070
Bario Total		1			0.136	0.102	0.185	0.124	0.121	0.09	0.154	0.095
Berilio Disuelto					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Berilio Total		0.004			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuto Disuelto					<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Bismuto Total					<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Boro Disuelto					0.022	<0.01	0.05	0.02	0.043	<0.01	0.09	0.03
Boro Total					0.023	<0.01	0.06	<0.01	0.041	<0.01	0.1	<0.01
Cadmio Disuelto					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cadmio Total		0.003		0.1	<0.0001	<0.0001	<0.0001	0.0003	<0.0001	<0.0001	0.0002	0.0001
Calcio Disuelto					50.4	17.5	156	45.7	35.7	18.2	78.3	20.0
Calcio Total					52.1	18.6	156	48.2	36.2	18.5	79.7	20.3
Cromo Disuelto	mg/L				<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cromo Total		0.1		0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalto Disuelto					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalto Total					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobre Disuelto					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobre Total		1.3		3	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Galio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Galio Total					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hierro Disuelto					0.06	0.02	0.11	0.03	0.09	<0.02	0.17	0.04
Hierro Total		0.3			1.53	0.05	4.36	1.20	1	0.25	2.2	1.93
Plomo Disuelto					0.0001	<0.0001	0.0003	<0.0001	0.0002	<0.0001	0.0005	<0.0001
Plomo Total		0.015		0.4	0.003	<0.0001	0.0089	0.003	0.0022	0.0002	0.008	0.0019
Litio Disuelto					<0.02	<0.02	0.04	0.009	<0.02	<0.02	0.04	<0.008
Litio Total					<0.02	<0.02	0.04	<0.008	<0.02	<0.02	0.04	<0.008
Magnesio Disuelto					6.3	3.2	14.7	5.5	6	3.3	9.7	3.4
Magnesio Total					6.6	3.3	14.8	5.5	6.2	3.4	10.1	3.2
Manganeso Disuelto					0.095	0.009	0.118	0.133	0.057	0.023	0.148	0.04
Manganeso Total		0.4			0.1808	0.047	0.349	0.190	0.115	0.043	0.187	0.098
Mercurio Disuelto					<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	SW8-E Aguas debajo de la confluencia del Río San Rafael Y el Río El Dorado				SW9-E Río Tapalapa, aguas debajo de la confluencia del Río San Rafael Río Los Vados y Quebrada La Honda			
					Línea Base			Jul-17	Línea Base			Jul-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
Mercurio Total		0.002		0.01	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molibdeno Disuelto					<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02
Molibdeno Total					<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02
Níquel Disuelto					<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008
Níquel Total		0.61		2	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008
Potasio Disuelto					6.5	5.8	7.4	7.1	6	4.5	8.1	4.7
Potasio Total					6.8	6.4	7.8	7.3	6.1	4.8	8.5	4.9
Escandio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Escandio Total					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenio Disuelto					<0.0001	<0.0001	0.0002	0.0001	<0.0001	<0.0001	0.0001	<0.0001
Selenio Total		0.17			0.00011	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Plata Disuelta					<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Plata Total					<0.00005	<0.00005	0.00007	<0.00005	<0.00005	<0.00005	0.00007	<0.00005
Sodio Disuelto					18.8	12.3	33.7	17.8	17.6	10.7	26.9	11.2
Sodio Total					18.4	12.9	34.3	17.9	17.4	11	28.5	11.0
Estroncio Disuelto					0.44	0.16	1.5	0.439	0.29	0.14	0.71	0.171
Estroncio Total					0.44	0.16	1.48	0.444	0.295	0.14	0.73	0.168
Talio Disuelto					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Talio Total		0.002			<0.0001	<0.0001	0.0003	<0.0001	<0.0001	<0.0001	0.0002	<0.0001
Estaño Disuelto					<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04
Estaño Total					<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04
Titanio Disuelto					<0.005	<0.005	0.005	0.006	<0.005	<0.005	0.009	<0.005
Titanio Total					0.069	<0.005	0.195	0.049	0.084	0.015	0.237	0.107
Uranio Disuelto	mg/L				0.00014	<0.0001	0.0003	<0.0001	0.00014	<0.0001	0.0002	<0.0001
Uranio Total					0.00022	0.0001	0.0003	0.0001	0.00022	0.0002	0.0003	0.0001
Vanadio Disuelto					<0.005	<0.005	0.006	<0.005	<0.005	<0.005	0.006	<0.005
Vanadio Total					<0.005	<0.005	0.01	<0.005	0.0054	<0.005	0.012	0.007
Zinc Disuelto					<0.01	<0.01	0.03	0.01	<0.01	<0.01	0.03	<0.01
Zinc Total		7.4		10	0.015	<0.01	0.04	0.03	<0.01	<0.01	0.03	<0.01
Grasas y Aceites			10	10	<2.04	<2.02	<2.062	<2.2	<2.02	<2.02	<5	<2.2
DQO			125		20	<10	40	23	17.8	<10	35	<10
Cloruros		250			10	7	19	13.2	12	6	20	9.5
Cianuro Total		0.14		1	0.007	<0.003	0.014	<0.003	0.006	<0.003	0.013	<0.003
Fluoruros		4			0.27	0.1	0.6	0.18	0.006	<0.003	0.013	0.12
Nitratos/Nitritos como N					3.07	2.01	5.23	3.28	1.97	1.14	3.85	2.37
Amonio					0.24	<0.05	0.58	0.45	0.129	<0.05	0.22	<0.05
Nitrógeno Kjeldahl (TKN)					0.74	<0.1	1.6	1.5	0.57	0.3	0.9	0.6
Fosfatos					0.55	0.3	1	0.47	0.49	0.22	1.3	0.16
Fósforo Disuelto (Orto)					0.18	0.08	0.33	0.13	0.18	0.09	0.49	0.04
Fósforo Total			2	10	0.27	0.12	0.51	0.28	0.25	0.09	0.58	0.08
STD (TDS)		500			312	160	750	320	255	160	440	192
SST (TSS)			50	100	34	<5	102	28.0	73	<5	340	12.0
ST (TS)					362	180	750	312	310	200	450	224
Sulfatos		250			91	22	360	97.6	60	25	169	29.9
Alcalinidad Total					79	50	110	66.4	70	45	90	39.7
Hidrocarburos totales (TPH)					<0.01	<0.01	<0.01	<0.1	70	45	90	<0.09

Dónde: **u.e**.: unidades exponenciales; **mg/L**: miligramos por litro; **µS/cm**: micro siemens por centímetro; **°C:** grados centígrados; **NMP/100ml:** número más probable en 100ml; **u Pt/Co:** unidades platino cobalto; Fuente: MSR, 2017.

5.2.3 Agua Subterránea

En el Cuadro 5-4 se presentan los resultados de la calidad del agua subterránea (manantiales) y los resultados de laboratorio se presentan en el Anexo 12.5.2. Todos los parámetros analizados en las estaciones GW-1A, GW-2, GW-3, GW-4 y GW-5 cumplen con el Acuerdo 236-2006, a excepción la materia flotante encontrada en GW-2 y los coliformes fecales registrados en GW-1A.

La temperatura de las estaciones muestreadas se encontró entre 17.3 y 23.1 °C. La lectura menor de pH se obtuvo en la estación GW-2 (6.04 u.e.) y la mayor en la estación GW-1A (6.95 u.e.). Los Sólidos Suspendidos Totales (**SST**) fueron registrados en dos estaciones, encontrándose en GW-1A un valor por encima del valor máximo establecido durante el levantamiento de línea base. Las concentraciones registradas de Cloruros están por debajo de las guías de la USEPA (250 mg/L).

La concentración de sulfatos está por debajo de las guías de la USEPA (250mg/L) en todas las estaciones de monitoreo, a excepción de GW-3. Los sólidos disueltos totales (**TDS**) están por arriba de las directrices de la USEPA (500mg/L) en dos estaciones (GW-1A y GW-3).

El Cadmio, Cianuro, Berilio, Bismuto, Cobalto, Cobre, Cromo, Galio, Litio, Cromo hexavalente, Mercurio, Molibdeno, Níquel, Escandio, Talio, Estaño, Plata, Vanadio y Zinc no fueron detectados en ninguna de las estaciones. El Selenio fue detectado en GW-3, y sus concentraciones se registraron por debajo de la guía de la USEPA (0.17mg/L). El Antimonio fue detectado en las estaciones GW2 y GW3 en concentraciones por debajo de la guía dada por la USEPA (0.01 mg/L). El Plomo se registró en GW-1A en concentración por debajo de la guía de la USEPA y Acuerdo (0.015 y 0.4 mg/L respectivamente). En todas las estaciones se registró Arsénico. Sin embargo las concentraciones registradas se encuentran por debajo de las guías sugeridas por USEPA (0.01 mg/L) y el Acuerdo (0.1 mg/L).

Cuadro 5-4: Resultados de la Calidad de Agua Subterránea (manantiales), Proyecto Minero Escobal

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	GW-1A				GW-2				GW-3				GW-4				GW-5			
					Nacimiento Aldea El Volcancito				Nacimiento Aldea El Fucío				Nacimiento – Zona central del Proyecto (frente al portal oeste)				Manantial – Aguas arriba del depósito de colas				Manantial – Aguas arriba del depósito de colas debajo de GW-4			
					Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
pH de campo	u.e.	5.0-9.0	6.0-9.0	6.0-9.0	7.08	6.89	7.26	6.95	6.54	6.01	7.16	6.04	6.54	6.21	7.13	6.20	6.13	6.13	6.13					
Temperatura de campo	°C				15.2	14.8	15.6	17.3	21.4	19	23.7	23.1	19.4	18.5	21	21.9	18.1	18.1	18.1					
Conductividad de campo	µS/cm				229.8	223	236.5	124.8	323.4	111.3	500.5	103.1	315.3	236.7	501.1	891.6	147.3	147.3	147.3					
Oxígeno Disuelto de campo	mg/L				0.1	0.03	0.17	4.38	1.18	0.13	2.35	3.73	0.68	0.03	1.26	3.29	0.14	0.14	0.14					
Turbidez	NTU							402				77.9				0.76								
Materia Flotante				Ausente				ND				Presente				Ausente								
Color Aparente	u Pt/Co			500	NR	NR	NR	660	NR	NR	NR	599	NR	NR	NR	2	NR	NR	NR					
Color Real	u Pt/Co							435				66				<1								
Cr (VI)	mg/L			0.1				<0.05				<0.05				<0.05								
Coliformes Fecales	NMP/100mL			<1x10[4]				1.3 x 10[5]				49				<4.5								
Aluminio Disuelto	mg/L	0.2			<0.03	<0.03	<0.03	2.65	0.075	<0.03	0.24	0.03	<0.03	<0.03	0.04	<0.03	1.42	1.42	1.42	NA	NR	NR	NR	NA
Antimonio Disuelto		0.01			<0.0004	<0.0004	<0.0004	<0.0004	0.00078	<0.0004	0.0011	0.0013	0.0004	<0.0004	0.001	0.0006	<0.0004	<0.0004	<0.0004					
Arsénico Disuelto		0.01		0.1	0.001	0.0008	0.0011	0.0031	0.0156	0.0043	0.0299	0.0077	0.0059	0.0037	0.0115	0.0023	0.0008	0.0008	0.0008					
Bario Disuelto		1			0.025	0.022	0.028	0.126	0.24	0.125	0.451	0.104	0.186	0.12	0.328	0.14	0.127	0.127	0.127					
Berilio Disuelto		0.004			<0.01	<0.002	<0.01	<0.01	<0.01	<0.002	<0.01	<0.01	<0.01	<0.002	<0.01	<0.01	<0.002	<0.002	<0.002					
Bismuto Disuelto					<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04					
Boro Disuelto					<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
Cadmio Disuelto		0.003		0.1	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					
Calcio Disuelto					5.7	5.1	6.2	5.9	33.5	9.6	65.3	9.6	31.6	25.7	43.4	112	4.4	4.4	4.4					
Cromo Disuelto		0.1		0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
Cobalto Disuelto					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
Cobre Disuelto		1.3		3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
Galio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Hierro Disuelto		0.3			0.02	<0.02	0.03	2.82	0.103	0.03	0.17	0.03	0.103	<0.02	0.33	<0.02	0.74	0.74	0.74					
Plomo Disuelto		0.015		0.4	<0.0001	<0.0001	0.0001	0.0079	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0009	0.0009	0.0009					
Litio Disuelto					<0.02	<0.02	<0.02	<0.008	<0.02	<0.02	<0.02	<0.008	<0.02	<0.02	<0.02	<0.008	<0.02	<0.02	<0.02					
Magnesio Disuelto					3.1	2.9	3.3	2.5	5.9	1.8	12	1.8	4.9	3.3	8.3	24.8	2.6	2.6	2.6					
Manganeso Disuelto		0.05			<0.005	<0.005	<0.005	0.175	0.123	0.02	0.356	0.063	0.057	<0.005	0.133	<0.005	0.069	0.069	0.069					
Mercurio Disuelto		0.002		0.01	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002					
Molibdeno Disuelto					<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01					
Níquel Disuelto		0.61		2	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01					
Potasio Disuelto					7.3	5.9	8.6	16.4	2.9	1.3	4.3	1	3.8	2.5	5	11.7	4.6	4.6	4.6					
Escandio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Selenio Disuelto		0.17			0.0002	<0.0001	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0009	<0.0001	<0.0001	<0.0001					
Plata Disuelta					<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005					
Sodio Disuelto					17.6	16.9	18.2	4.7	13.5	7.2	22	5.5	11.5	9.3	16.4	27.4	10.3	10.3	10.3					
Estroncio Disuelto					0.03	0.03	0.03	0.048	0.26	0.08	0.56	0.08	0.2	0.12	0.37	0.583	0.03	0.03	0.03					
Talio Disuelto					<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.1	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001					
Estaño Disuelto					<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1					
Titanio Disuelto					<0.005	<0.005	<0.005	0.103	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.014	0.042	0.042	0.042					
Uranio Disuelto					<0.0001	<0.0001	0.0001	0.0009	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002					
Vanadio Disuelto					<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.006	0.006					
Zinc Disuelto		7.4		10	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	0.1	<0.01	0.94	<0.01	3.47	<0.01	0.1	0.1	0.1					
Cloruros		250			15	14	16	15.1	4	2	7	2.6	5	3	6	29.2	4	4	4					

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	GW-1A				GW-2				GW-3				GW-4				GW-5			
					Nacimiento Aldea El Volcancito				Nacimiento Aldea El Fucío				Nacimiento – Zona central del Proyecto (frente al portal oeste)				Manantial – Aguas arriba del depósito de colas				Manantial – Aguas arriba del depósito de colas debajo de GW-4			
					Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
Cianuro Total	mg/L	0.14		1	0.008	<0.003	0.014	<0.003	0.004	<0.003	0.012	<0.003	0.0046	<0.003	0.014	<0.003	<0.003	<0.003	<0.003	NA	NR	NR	NR	NA
Fluoruros					<0.1	<0.1	<0.1	0.08	<0.1	<0.1	<0.1	0.22	0.15	0.1	0.2	0.30	<0.1	<0.1	<0.1					
Nitratos/Nitritos como N					2.19	1.9	2.48	0.05	0.74	0.14	1.1	0.93	1.19	0.05	3.16	7.55	0.07	0.07	0.07					
Amonio					<0.05	<0.05	0.07	<0.05	0.059	<0.05	0.16	0.09	0.065	<0.05	0.14	<0.05	<0.05	<0.05	<0.05					
Nitrógeno Kjeldahl (TKN)					0.7	0.3	1.1	3.0	0.63	0.2	0.9	0.5	0.46	<0.05	1.2	<1	0.3	0.3	0.3					
Fosfatos					0.2	0.1	0.2	1.09	0.4	0.1	0.7	<0.06	0.3	0.1	0.5	<0.06	0.09	0.09	0.09					
Fósforo Total			2	10	0.1	0.02	0.17	0.58	0.18	0.09	0.27	0.11	0.1	0.05	0.15	<0.02	0.03	0.03	0.03					
STD (TDS)		500			190	190	190	592	223	130	350	164	213	190	260	704	170	170	170					
SST (TSS)			50	100	6.5	6	7	131.0	7.7	6	9	14.0	39	5	105	<5	206	206	206					
ST (TS)					200	180	220	734	237.5	140	380	194	217.5	170	270	736	360	360	360					
Sulfatos		250			12.5	11	14	22.3	43	7	90	11.9	30	16	71	289	7	7	7					
Alcalinidad Total					31	31	31	34.3	0.18	0.09	0.27	28.3	83	71	97	88.4	35	35	35					

NA: no analizado por no encontrar agua al momento de la obtención de la muestra. GW-5 fue clausurado y no se reportan resultados para el presente informe trimestral. u.e.: unidades exponenciales. mg/L: miligramos por litro. µS/cm: micro siemens por centímetro. °C: grados centígrados. NMP/100ml: número más probable en 100ml. u Pt/Co: unidades platino cobalto. NR = Cálculo No Realizado por falta de datos de línea base. Fuente: MSR, 2017.

Cuadro 5-5: Resultados de la medición de calidad de agua subterránea (Pozos de Monitoreo, Producción y Artesanal), Proyecto Minero Escobal (1/3)

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	MW-2				MW-3				MW-4				MW-5			
					Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
pH de campo	u.e.	5.0-9.0	6.0-9.0	6.0-9.0	6.56	6.37	6.77		6.44	6.34	6.49	6.62	6.32	6.23	6.41	6.59	6.19	6.04	6.34	6.34
Temperatura de campo	°C				24.4	23.4	25.1		24.1	23.7	24.5	25.3	23.3	22.2	24.4	25.3	23.4	23	24.6	24.2
Conductividad de campo	µS/cm				427.5	211.9	1001.3		803.9	741.6	829.1	608.5	916.9	872.1	944.8	531.6	469.7	401.4	494.1	924.5
Oxígeno Disuelto de campo	mg/L				0.75	0.3	1.21		0.65	0.11	1.44	5.38	0.97	0.48	1.93	6.43	0.82	0.19	1.77	3.60
Turbidez	NTU											0.95				1.70				0.44
Materia flotante	Visual			Ausente								Ausente				Ausente				Ausente
Color Aparente	u Pt/Co			500	NR	NR	NR		NR	NR	NR	4	NR	NR	NR	14	NR	NR	NR	19
Color Real												<1				<1				<1
Cr (VI)	mg/L			0.1								<0.05				<0.05				<0.05
Coliformes Fecales	NMP/100mL			$<1x10^4$								4.5				4.50				4.5
Aluminio Disuelto	mg/L	0.2			0.038	<0.03	0.07	NA	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimonio Disuelto		0.01			<0.0004	<0.0004	<0.0004		<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	0.0005
Arsénico Disuelto		0.01		0.1	0.0011	0.0008	0.0014		0.0023	0.0021	0.0027	0.0022	0.0023	0.0021	0.0028	0.0022	0.0013	0.001	0.0016	0.001
Bario Disuelto		1			0.03	0.024	0.039		0.036	0.032	0.041	0.039	0.042	0.038	0.047	0.024	0.162	0.157	0.166	0.047
Berilio Disuelto		0.004			<0.002	<0.002	0.003		<0.002	<0.002	0.003	<0.01	<0.002	<0.002	0.003	<0.01	<0.002	<0.002	0.003	<0.01
Bismuto Disuelto					<0.04	<0.04	<0.04		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Boro Disuelto					0.014	<0.01	0.04		0.06	0.05	0.07	0.06	0.078	0.06	0.09	0.06	0.015	<0.01	0.03	0.04
Cadmio Disuelto		0.003		0.1	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcio Disuelto					20.6	9.4	48.7		80.3	76.4	83.3	82.4	100	93	107	73.9	40.8	39.2	42.2	145
Cromo Disuelto		0.1		0.1	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalto Disuelto					<0.01	<0.01	<0.1		<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobre Disuelto		1.3		3	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Galio Disuelto					<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hierro Disuelto		0.3			<0.02	<0.02	0.02		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Plomo Disuelto		0.015		0.4	<0.0001	<0.0001	0.0001		<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	0.0002	<0.0001
Litio Disuelto					<0.02	<0.02	<0.02		<0.02	<0.02	0.02	0.015	<0.02	<0.02	0.02	0.014	<0.02	<0.02	<0.02	<0.008
Magnesio Disuelto					3.5	2.4	6.1		10.3	10.1	10.7	10.1	11.3	10.9	11.6	8.1	7.3	6.8	7.6	19.0
Manganeso Disuelto		0.05			0.108	0.03	0.308		<0.005	<0.005	0.008	<0.005	0.009	<0.005	0.021	<0.005	<0.005	<0.005	<0.005	<0.005
Mercurio Disuelto		0.002		0.01	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molibdeno Disuelto					<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02
Níquel Disuelto		0.61		2	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008
Potasio Disuelto					2.2	1.9	2.4		4.2	3.9	4.6	4.2	4.7	4.5	5.2	4.1	6	5.5	6.5	8.0
Escandio Disuelto					<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenio Disuelto		0.17			0.0002	0.0001	0.0002		0.0002	0.0002	0.0002	0.0003	0.0003	0.0002	0.0003	0.0003	0.0004	0.0003	0.0004	0.0006
Plata Disuelta					<0.00005	<0.00005	<0.00005		<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Sodio Disuelto					22	17.4	33.6		29.5	28.2	30.9	28.9	32.3	30.4	35.8	26.5	16.9	15.6	19.1	31.3
Estroncio Disuelto					0.18	0.07	0.46		0.74	0.71	0.77	0.779	0.89	0.84	0.98	0.675	0.27	0.26	0.29	0.597
Talio Disuelto					<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	MW-2				MW-3				MW-4				MW-5			
					Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
Estaño Disuelto	mg/L				<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04
Titanio Disuelto					<0.005	<0.005	<0.005		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Uranio Disuelto					0.00016	<0.0001	0.0005		0.0002	0.0002	0.0002	0.0002	<0.0002	<0.0002	0.0002	0.0001	0.00033	0.0001	0.001	0.0006
Vanadio Disuelto					0.0059	<0.005	0.008		0.0055	<0.005	0.009	<0.005	0.006	<0.005	0.009	0.007	<0.005	<0.005	<0.005	<0.005
Zinc Disuelto		7.4		10	0.031	<0.01	0.11		0.053	<0.01	0.1	0.02	<0.01	<0.01	0.1	0.02	<0.01	<0.01	0.1	<0.01
Cloruros		250			12	3	28		16	16	17	18.4	20	19	21	15.0	9	8	9	27.3
Cianuro Total		0.14		1	0.0039	<0.003	0.011		0.005	<0.003	0.014	<0.003	0.005	<0.003	0.015	<0.003	0.005	<0.003	0.015	<0.003
Fluoruros					0.35	0.2	0.7		0.8	0.8	0.8	0.75	0.8	0.8	0.8	0.88	0.18	0.1	0.2	0.24
Nitratos/Nitritos como N					2.48	2.04	2.93		2.2	2.08	2.26	2.77	2.13	1.98	2.32	2.55	3.32	3	3.57	6.36
Amonio					<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	0.1
Nitrógeno Kjeldahl (TKN)					0.56	<0.1	1.1		<0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	0.3	<0.1
Fosfatos					0.233	0.21	0.27		0.315	0.27	0.37	0.22	0.248	0.24	0.27	0.19	0.203	0.15	0.24	0.06
Fósforo Total			2	10	0.24	0.06	0.44		0.09	0.08	0.1	0.06	0.07	0.06	0.08	0.06	0.06	0.05	0.07	<0.02
STD (TDS)		500			253	190	360		470	460	480	504	553	540	560	454	305	290	320	794
SST (TSS)			50	100	345.8	137	584		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
ST (TS)					597.5	350	810		487.5	450	510	510	555	520	580	454	325	280	350	798
Sulfatos		250			28.5	4	97		166	162	169	185	212.5	210	220	157	72.3	64	76	352
Alcalinidad Total					64	56	80		84	82	86	82.5	85	83	88	96.7	66	61	68	95.9

NA: no analizado por no encontrar agua al momento de la obtención de la muestra. e.: unidades exponenciales. mg/L: miligramos por litro. µS/cm: micro siemens por centímetro. °C: grados centígrados. NMP/100ml: número más probable en 100ml. u Pt/Co: unidades platino cobalto. NR = Cálculo No Realizado por falta de datos de línea base. Fuente: MSR, 2017.

Cuadro 5-5: Resultados de la medición de calidad de agua subterránea (Pozos de Monitoreo, Producción y Artesanal), Proyecto Minero Escobal (2/3)

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	MW-6				MW-7				MW-8				MW-9			
					Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
pH de campo	u.e.	5.0-9.0	6.0-9.0	6.0-9.0	6.22	6.17	6.25	6.25	6.38	6.14	6.98	6.11	6.16	6.07	6.29	6.29	7.15	6.9	7.4	8.17
Temperatura de campo	°C				22.3	21.6	22.8	19.2	22.4	22	23.1	21.9	23.3	23.2	23.4	23.6	27.5	25.9	29	28.8
Conductividad de campo	µS/cm				538.2	342.9	752.6	2021	299.6	285.9	323.8	380.2	426.8	424.6	428.1	600.6	1595	1569	1621	405.2
Oxígeno Disuelto de campo	mg/L				0.69	0.19	1.67	4.24	0.61	0.25	1.19	3.92	0.72	0.16	1.45	4.45	0.38	0.35	0.41	2.21
Turbidez	NTU							0.68				11.7				3.67				4.7
Materia flotante	Visual			Ausente				Ausente				Ausente				Ausente				Ausente
Color Aparente	u Pt/Co			500	NR	NR	NR	4	NR	NR	NR	73	NR	NR	NR	<1	NR	NR	NR	59
Color Real								<1				<1				16				<1
Cr (VI)	mg/L			0.1				<0.05				<0.05				<1				<0.05
Coliformes Fecales	NMP/100mL			<1x10^4				<1.8				4.5				<1.8				<1.8
Aluminio Disuelto	mg/L	0.2			<0.03	<0.03	0.05	<0.03	0.053	<0.03	0.07	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimonio Disuelto		0.01			0.00045	<0.0004	0.0012	<0.0004	0.00063	0.0005	0.0008	0.001	0.001	0.0009	0.0011	0.0008	<0.0004	<0.0004	<0.0004	<0.0004
Arsénico Disuelto		0.01		0.1	0.0028	0.0024	0.0032	0.0019	0.0034	0.0029	0.0041	0.0024	0.0021	0.0019	0.0024	0.0014	0.003	0.0007	0.0052	0.0008
Bario Disuelto		1			0.198	0.134	0.281	0.119	0.156	0.129	0.176	0.497	0.125	0.122	0.129	0.073	0.031	0.028	0.034	0.04
Berilio Disuelto		0.004			<0.002	<0.002	0.003	<0.01	<0.002	<0.002	0.003	<0.01	<0.002	<0.002	0.003	<0.01	<0.01	<0.002	<0.01	<0.01
Bismuto Disuelto					<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.07	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Boro Disuelto					<0.01	<0.01	<0.01	0.08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.09	0.08	0.1	0.02
Cadmio Disuelto		0.003		0.1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcio Disuelto					52.5	35.1	71.9	265	16.7	13.9	19.6	36.4	34.6	32.5	36.3	86.1	185.5	170	201	51.4
Cromo Disuelto		0.1		0.1	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalto Disuelto					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobre Disuelto		1.3		3	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01
Galio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hierro Disuelto		0.3			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	5.52	1.53	9.51	<0.02
Plomo Disuelto		0.015		0.4	<0.0001	<0.0001	<0.0001	0.0001	0.00013	<0.0001	0.0002	0.0033	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Litio Disuelto					<0.02	<0.02	<0.02	<0.008	<0.02	<0.02	<0.02	<0.008	<0.02	<0.02	<0.02	<0.008	0.07	0.07	0.07	0.011
Magnesio Disuelto					7.5	4.9	10.5	27.5	4.8	4.6	5	11.4	6.4	6.3	6.7	13.9	35.8	34.4	37.2	7.9
Manganeso Disuelto		0.05			<0.005	<0.005	0.006	<0.005	0.0065	<0.005	0.012	0.019	0.019	0.012	0.029	<0.005	0.203	0.149	0.257	0.062
Mercurio Disuelto		0.002		0.01	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molibdeno Disuelto					<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02
Níquel Disuelto		0.61		2	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008
Potasio Disuelto					5.7	5	6.5	11.6	6.2	5.4	6.8	9.5	4.8	4.6	5.1	6.1	4.8	4.6	5	4.4
Escandio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenio Disuelto		0.17			0.0005	0.0004	0.0005	0.0007	0.0002	0.0001	0.0002	<0.0001	0.0004	0.0003	0.0006	0.0004	<0.0001	<0.0001	<0.0001	<0.0001
Plata Disuelta					<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00007	<0.00005
Sodio Disuelto					14	12.3	17	58.7	19.1	15.4	27.5	20.5	15.2	15	15.6	23.1	45.1	44.7	45.4	26.1
Estroncio Disuelto					0.26	0.18	0.35	1.36	0.1	0.09	0.11	0.25	0.22	0.21	0.23	0.337	1.64	1.58	1.69	0.377
Talio Disuelto					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parámetros	Unidades	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	MW-6				MW-7				MW-8				MW-9			
					Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
Estaño Disuelto	mg/L				<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04
Titanio Disuelto					<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Uranio Disuelto					0.00013	0.0001	0.0002	0.0004	<0.0001	<0.0001	0.0001	<0.0001	0.00017	0.0001	0.0002	0.0002	<0.0001	<0.0001	0.0004	0.0001
Vanadio Disuelto					<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.005	<0.005	<0.005	<0.005	<0.005
Zinc Disuelto		7.4		10	0.034	<0.01	0.1	0.05	0.034	<0.01	0.1	0.58	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Cloruros		250			11	6	17	57.5	11	9	12	12.2	6	6	6	16.8	37	36	37	8.1
Cianuro Total		0.14		1	0.005	<0.003	0.015	<0.003	0.005	<0.003	0.015	<0.003	0.005	<0.003	0.015	<0.003	0.007	<0.003	0.012	<0.003
Fluoruros					0.18	0.1	0.2	0.14	0.13	0.1	0.2	0.11	0.17	0.1	0.2	0.16	2.55	2.5	2.6	0.57
Nitratos/Nitritos como N					5.08	4.42	6.15	5.13	4.75	4.08	5.24	2.94	2.76	2.63	2.83	4.69	<0.02	<0.02	<0.02	<0.02
Amonio					<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	0.1
Nitrógeno Kjeldahl (TKN)					<0.1	<0.1	0.2	<0.1	0.21	<0.1	0.4	0.3	0.09	<0.1	0.2	<0.1	0.23	<0.1	0.4	<0.1
Fosfatos					0.173	0.15	0.21	0.06	0.113	0.09	0.18	<0.06	0.23	0.21	0.24	0.09	<0.03	<0.03	<0.03	0.16
Fósforo Total			2	10	0.05	0.04	0.06	0.02	0.04	0.01	0.07	<0.02	0.07	0.06	0.08	0.03	<0.01	<0.01	0.02	0.06
STD (TDS)		500			340	260	440	1330	233	220	250	328	277	270	290	510	905	890	920	256
SST (TSS)			50	100	<5	<5	<5	<5	19.75	7	45	<5	9	6	14	6.0	27	25	29	<5
ST (TS)					345	240	450	1390	260	230	280	304	300	290	310	512	940	910	970	264
Sulfatos		250			85.3	33	153	722	19.3	17	23	59.5	54.7	54	55	194	440	440	440	47.7
Alcalinidad Total					65	62	68	63.5	48	41	60	105	68	66	70	71.6	147	136	157	158

u.e.: unidades exponenciales. mg/L: miligramos por litro. µS/cm: micro siemens por centímetro. °C: grados centígrados. NMP/100ml: número más probable en 100ml. u Pt/Co: unidades platino cobalto. NR = Cálculo No Realizado por falta de datos de línea base. Fuente: MSR, 2017.

Cuadro 5-5: Resultados de la medición de calidad de agua subterránea (Pozos de Monitoreo, Producción y Artesanal), Proyecto Minero Escobal (3/3)

Parámetros	Unidad	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	MW11				PSA-SR				HW-1				RW-1				PSA-1			
					Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
pH de campo	u.e.	5.0-9.0	6.0-9.0	6.0-9.0	7.05	7.05	7.05	7.14	7.45	7.45	7.45	7.38				7.21				6.52				7.50
Temperatura de campo	°C				30.4	30.4	30.4	32.0	27.8	27.8	27.8	28.6				25.9				24.1				33.7
Conductividad de campo	µS/cm				2.243	2.243	2.243	151.6	663.9	663.9	663.9	384.2				709.6				476.0				1270
Oxígeno Disuelto de campo	mg/L				0.09	0.09	0.09	2.13	0.05	0.05	0.05	1.03				5.60				5.58				3.42
Turbidez	NTU							0.99				1.66				3.6				1.69				0.76
Materia flotante	Visual			Ausente				Ausente				Ausente				Ausente				Ausente				Ausente
Color Aparente	u Pt/Co			500	NR	NR	NR	175	NR	NR	NR	4				30				3				573
Color Real								<1				<1				<1				<1				7
Cr (VI)	mg/L			0.1				<0.05				<0.05				<0.05				<0.05				<0.05
Coliformes Fecales	NMP/100mL			$<1x10^4$				<1.8				<1.8				<1.8				<1.8				<1.8
Aluminio Disuelto		0.2			<0.03	<0.03	<0.03	<0.03	0.06	0.06	0.06	<0.03				<0.03				<0.03				<0.03
Antimonio Disuelto		0.01			0.001	0.001	0.001	0.0005	<0.0004	<0.0004	<0.0004	0.0007				0.0005				<0.0004				<0.0004
Arsénico Disuelto		0.01		0.1	0.0022	0.0022	0.0022	0.0029	0.0136	0.0136	0.0136	0.0128				0.0089				0.0003				0.004
Bario Disuelto		1			0.033	0.033	0.033	0.024	0.125	0.125	0.125	0.078				0.093				0.099				0.023
Berilio Disuelto		0.004			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01				<0.01				<0.01
Bismuto Disuelto					<0.08	<0.08	<0.08	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04				<0.04				<0.04
Boro Disuelto					0.18	0.18	0.18	0.16	0.07	0.07	0.07	0.09				0.07				0.04				0.12
Cadmio Disuelto		0.003		0.1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001				<0.0001				<0.0001
Calcio Disuelto					271	271	271	221	47.5	47.5	47.5	95				73.3				51.4				191
Cromo Disuelto		0.1		0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01				<0.01				<0.01
Cobalto Disuelto					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01				<0.01				<0.01
Cobre Disuelto		1.3		3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01				<0.01				<0.01
Galio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1				<0.1				<0.1
Hierro Disuelto		0.3			0.21	0.21	0.21	1.10	0.05	0.05	0.05	<0.02	NR	NR	NR	<0.02	NR	NR	NR	<0.02	NR	NR	NR	2.59
Plomo Disuelto		0.015		0.4	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				0.0001				<0.0001				<0.0001
Litio Disuelto					0.06	0.06	0.06	0.075	0.08	0.08	0.08	0.142				0.101				<0.008				0.081
Magnesio Disuelto					41.3	41.3	41.3	32.7	4.1	4.1	4.1	5.7				5.1				9.3				35.2
Manganeso Disuelto		0.05			0.044	0.044	0.044	0.018	0.03	0.03	0.03	0.026				<0.005				<0.005				0.066
Mercurio Disuelto	mg/L	0.002		0.01	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002				<0.0002				<0.0002				<0.0002
Molibdeno Disuelto					0.01	0.01	0.01	<0.02	<0.01	<0.01	<0.01	<0.02				<0.02				<0.02				<0.02
Níquel Disuelto		0.61		2	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	<0.01	<0.008				<0.008				<0.008				<0.008
Potasio Disuelto					5	5	5	4.3	2.5	2.5	2.5	1.9				3.0				7.2				4.5
Escandio Disuelto					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1				<0.1				<0.1
Selenio Disuelto		0.17			0.0006	0.0006	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	0.0005				0.0004				<0.0001				<0.0001
Plata Disuelta					<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005				0.00006				<0.00005				<0.00005
Sodio Disuelto					77.4	77.4	77.4	66.6	55.2	55.2	55.2	82.4				63.7				21.9				47.3
Estroncio Disuelto					2.23	2.23	2.23	2.1	1.33	1.33	1.33	4.48				3.15				0.443				1.85
Talio Disuelto					0.0002	0.0002	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001				<0.0001				<0.0001
Estaño Disuelto					<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04				<0.04				<0.04				<0.04
Titanio Disuelto					<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.014				0.01				<0.005				0.007
Uranio Disuelto					0.0007	0.0007	0.0007	0.0005	0.0002	0.0002	0.0002	0.0003				0.0002				<0.0001				0.0005
Vanadio Disuelto					<0.005	<0.005	<0.005	<0.005	0.005	0.005	0.005	<0.005				<0.005				<0.005				<0.005
Zinc Disuelto		7.4		10	0.04	0.04	0.04	0.02	0.12	0.12	0.12	0.13				0.09				<0.01				<0.01
Cloruros		250			68	68	68	59.0	32	32	32	3.8				7.7				13.0				44.7
Cianuro Total		0.14		1	<0.003	<0.003	<0.003	<0.003	0.003	0.003	0.003	<0.003				<0.003				<0.003				<0.003
Fluoruros					2.7	2.7	2.7	2.65	0.7	0.7	0.7	0.92				0.68				0.71				2.70
Nitratos/Nitritos como N					0.19	0.19	0.19	<0.02	<0.02	<0.02	<0.02	0.19				1.94				4.08				<0.02

Parámetros	Unidad	USEPA Salud Humana	IFC Agua Residual Tratada	Acuerdo 236-2006	MW11				PSA-SR				HW-1				RW-1				PSA-1			
					Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17	Línea Base			Jun-17
					Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo		Promedio	Mínimo	Máximo	
Amonio	mg/L				<0.05	<0.05	<0.05	0.1	0.06	0.06	0.06	<0.05	NR	NR	NR	<0.05	NR	NR	NR	0.1	NR	NR	NR	0.1
Nitrógeno Kjeldahl (TKN)					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1				<1				<0.1				<0.1
Fosfatos					0.03	0.03	0.03	<0.06	0.06	0.06	0.06	<0.06				0.06				<0.06				<0.06
Fósforo Total			2	10	0.06	0.06	0.06	<0.02	0.02	0.02	0.02	<0.02				0.03				<0.02				<0.02
STD (TDS)		500			1370	1370	1370	1160	320	320	320	606				494				358				1000
SST (TSS)			50	100	145	145	145	<5	<5	<5	<5	<5				<5				<5				<5
ST (TS)					1000	1000	1000	1190	300	300	300	622				502				352				1050
Sulfatos		250			700	700	700	623	45	45	45	277				197				125				535
Alcalinidad Total					133	133	133	135	186	186	186	170				132				83.1				156

u.e.: unidades exponenciales. mg/L: miligramos por litro. µS/cm: micro siemens por centímetro. °C: grados centígrados. NMP/100ml: número más probable en 100ml. u Pt/Co: unidades platino cobalto. NR = Cálculo No Realizado por falta de datos de línea base. Fuente: MSR, 2017.

En el Cuadro 5-5 se presentan los resultados de la calidad del agua subterránea (Pozos de Monitoreo, Producción y Artesanal) correspondientes al mes de Junio. Los resultados de laboratorio se presentan en el Anexo 12.5.2. La mayoría de los pozos monitoreados cumplen con los valores establecidos en el Acuerdo 236-2006 para entes generadores nuevos y los valores en general se encuentran dentro del rango estadístico de la línea base.

Los valores de pH estuvieron en el rango de 6.11 a 8.17 u.e. y la temperatura en el rango de 19.2 a 33.7 °C. Las concentraciones registradas de Cloruros están por debajo de las directrices de la USEPA (250 mg/L).

En los pozos MW-5, MW-6, MW-11, PSA-SR y PSA-1 los valores registrados de sulfatos se encuentran por encima de los valores establecidos durante el levantamiento de línea base y por las guías de USEPA (250 mg/L). Todos los demás pozos se encuentran por debajo de las directrices que establece la USEPA.

Se reportaron valores de Sólidos Suspendidos Totales (**SST**) en el pozo MW-8 los cuales se encuentran debajo de las guías establecidas por el Banco Mundial y el Acuerdo (50 y 100 mg/L respectivamente) y dentro de los rangos establecidos en la línea base.

El Aluminio, Berilio, Bismuto, Cadmio, Galio, Cromo, Cobalto, Cobre, Cromo Hexavalente, Mercurio, Molibdeno, Níquel, Plata, Talio, Estaño y Escandio no fueron detectados en ninguno de los pozos monitoreados.

El Antimonio se detectó en los pozos MW5, MW7, MW8, MW-11, PSA-SR y HW-1 en concentraciones por debajo de la guía establecida por la USEPA (0.01 mg/L). El Bario fue detectado en todas las estaciones en concentraciones menores a la guía de la USEPA (1 mg/L).

El Hierro fue detectado en los pozos MW-11 y PSA-1 y las concentraciones se encuentran por arriba de lo establecido por USEPA (0.3 mg/L). El Arsénico fue detectado en todas las estaciones de pozos de monitoreo y las concentraciones se encuentran dentro los mínimos y máximos establecidos en la línea base y por debajo de lo estipulado por la USEPA (0.01 mg/L). En ninguna estación de monitoreo fue detectado el cianuro total.

6 Sedimentos

6.1 Sitios de Monitoreo

En el Cuadro 6-1 se enlistan las estaciones de monitoreo de sedimentos de las quebradas y ríos ubicados dentro o cercanas al área de influencia (**AI**) del Proyecto y su ubicación se presenta en la Figura 6-1.

Cuadro 6-1: Sitios de Monitoreo de Sedimento, Proyecto Minero Escobal

Estación	Coordenadas		Sitio
SED1	807,053	1,601,682	Quebrada El Escobal, aguas arriba del proyecto
SED2	805,811	1,601,164	Quebrada El Escobal, en medio del proyecto
SED2A	805,295	1,601,230	Quebrada El Escobal, Salida de la Propiedad
SED3	805,337	1,602,453	Rio El Dorado, aguas arriba
SED4	804,781	1,601,228	Rio El Dorado, aguas abajo
SED4A	804,629	1,601,052	Río El Dorado, por puente de acceso al Proyecto (Suandys)
SED5	810,882	1,603,313	Rio Tapalapa, aguas arriba
SED6	808,391	1,597,689	Rio Los Vados, aguas abajo
SED7	806,989	1,600,618	Quebrada La Honda
SED8	804,054	1,600,834	Unión Río San Rafael y El Dorado
SED9	803,772	1,597,635	Río Tapalapa, aguas abajo (cercano a la Ceibita)

Nota: en ninguna de las estaciones monitoreadas se cuenta con línea base de metales en sedimentos. Sistema de coordenadas proyectadas UTM, DATUM WGS84. Msnm: metros sobre el nivel del mar. Fuente: MSR, 2017.

MAPA DE LOCALIZACIÓN ESTACIONES DE MONITOREO DE SEDIMENTOS

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL
DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Río Permanente
	Quebrada Intermitente

ESTACIONES DE MONITOREO

Símbolo	Estación	X	Y
	SED-1	807047	1601885
	SED-2	805805	1601367
	SED-2A	805289	1601433
	SED-2B	804728	1601341
	SED-3	805331	1602656
	SED-4	804775	1601431
	SED-4A	804623	1601255
	SED-5	810876	1603516
	SED-6	808385	1597892
	SED-7	806995	1600815
	SED-8	804048	1601037
	SED-9	803766	1597838

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografía aérea del proyecto el Escobal año 2014, datos de campo del departamento de Ambiente.

Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala **1:30,000**

N W E S

0 315 630 1,260 1,890 2,520
Metros

6.2 Resultados

En el Cuadro 6-2 se presenta los resultados de metales registrados para el mes de Julio 2017. Los resultados del laboratorio se presentan en el Anexo 12.6.

El porcentaje de fósforo total se encuentra en el rango de 0.00579% (SED-2A) a 0.0189% (SED-2). No se detectó cianuro en ninguna de las estaciones muestreadas, excepto en SED-7.

El mercurio se detectó en todas las estaciones y en concentraciones por debajo de lo establecido (25 mg/kg) para la disposición de lodos en el suelo establecidos por el Acuerdo 236-2006. Las concentraciones de Cadmio, Plomo y Cromo registradas están muy por debajo de los valores guía. Todas las estaciones muestreadas registraron concentraciones de Arsénico menor al valor sugerido (50 mg/Kg).

Cuadro 6-2: Resultados de sedimentos, Proyecto Minero Escobal

Parámetro	Unidades	Acuerdo 236-2006 Aplicación al suelo	SED-1 Jul-17	SED-2 Jul-17	SED-2A Jul-17	SED-3 Jul-17	SED-4 Jul-17	SED-4A Jul-17
Arsénico Total	mg/Kg**	50	9.2	36.5	9	24.7	16.8	16.7
Cadmio Total	mg/Kg**	50	0.17	0.89	0.45	0.26	0.36	0.25
Cromo Total	mg/Kg**	1500	2.3	5.6	2.4	3.3	5.1	5.2
Plomo Total	mg/Kg**	500	7.54	75.1	22.9	9.82	10.6	9.4
Mercurio Total	mg/Kg**	25	0.07	0.11	0.07	0.08	0.08	0.07
Cianuro Total	mg/Kg**		<0.1	<0.2	<0.2	<0.1	<0.2	<0.2
Fósforo Total	%		0.0146	0.0189	0.00579	0.00846	0.0086	0.00854

Parámetro	Unidades	Acuerdo 236-2006 Aplicación al suelo	SED-5 Jul-17	SED-6 Jul-17	SED-7 Jul-17	SED-8 Jul-17	SED-9 Jul-17
Arsénico Total	mg/Kg**	50	NA	8.5	10.8	14.9	5.4
Cadmio Total	mg/Kg**	50	NA	0.12	0.27	0.27	0.21
Cromo Total	mg/Kg**	1500	NA	5.6	2.9	3.8	2.7
Plomo Total	mg/Kg**	500	NA	4.28	10.7	9.5	5.74
Mercurio Total	mg/Kg**	25	NA	0.05	0.06	0.08	0.07
Cianuro Total	mg/Kg**		NA	<0.1	0.2	<0.2	<0.2
Fósforo Total	%		NA	0.00634	0.0103	0.00917	0.009

mg/Kg: miligramo por kilogramo. ** mg/kg de materia seca a 104°C. %: porcentaje. *LMP para suelos con pH < 7 unidades, en los suelos que posean pH>7 se podrán disponer lodos hasta un 50% mayor de los valores presentados como LMP. Fuente: MSR, 2017.

7 Calidad de Efluentes

7.1 Sitios de Monitoreo

En el Cuadro 7-1 se describe la estación de monitoreo del efluente hacia la quebrada El Escobal, del agua proveniente de la planta de tratamiento de aguas especiales. Su ubicación se presenta en la Figura 7-1.

Cuadro 7-1: Sitio de Monitoreo de Calidad de Agua del Efluente de Planta de Tratamiento, Proyecto Minero Escobal

Estación	Coordenadas		Sitio
WW9	805,467	1,601,111	Dispositivo para toma de muestras de la planta de tratamiento de aguas residuales de tipo especial del proceso de minado.

Sistema de coordenadas proyectadas UTM, DATUM WGS84. Msnm: metros sobre el nivel del mar. Fuente: MSR, 2017.

MAPA DE LOCALIZACIÓN ESTACIONES DE MONITOREO EFLUENTES PLANTA DE TRATAMIENTO DE AGUAS RESIDUALES

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL

DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Río Permanente
	Quebrada Intermitente

ESTACIÓN DE MONITOREO

Símbolo	Estación	X	Y
	WW9	805461	1601314

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografía aérea del proyecto el Escobal año 2014, datos de campo del departamento de Ambiente.

Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala **1:8,000**

N W E S

0 87.5 175 350 525 700
Metros

7.2 Resultados

Durante los monitoreos correspondientes, se emplearon muestras control para determinar la confiabilidad de los resultados de parámetros analizados por el laboratorio encargado del análisis de las muestras. En total se efectuaron 3 muestras blanco y una muestra duplicado; los resultados obtenidos se presentan en el Cuadro 7-2.

Cuadro 7-2: Resultados de control de calidad para muestras de Efluentes de Planta de Tratamiento, Proyecto Minero Escobal

Mes	**Unidades**	**LMP Acuerdo 236-2006**	**Mayo**	**Junio**	**Julio**	**Mayo**	
Control de Calidad			Blanco	Blanco	Blanco	Duplicado	Original
ID Muestra			**WW10**	**WW10**	**WW10**	**WW11**	**WW9**
No. Reporte Lab.			1097-17	1642-17	1778-17	1219-17	1220-17
Grasas y Aceites	mg/L	10	<5	<5	<5	<5	<5
Materia Flotante	NL	Ausente	ausente	ausente	ausente	ausente	ausente
DBO	mg/L	200	< 10	< 10	< 10	11	10
DQO			< 25	< 25	< 25	31	31
SST (TSS)		100	< 10	< 10	< 10	<10	<10
Nitrógeno Total		20	<10.9	<10.9	<10.9	<10.9	<10.9
Fósforo Total		10	<0.05	<0.05	<0.05	<0.05	<0.05
Arsénico		0.1	<0.002	<0.002	<0.002	0.005	0.004
Cadmio		0.1	<0.02	<0.02	<0.02	<0.02	<0.02
Cobre		3	<0.03	<0.03	<0.03	<0.03	<0.03
Cromo Hexavalente		0.1	<0.05	<0.05	<0.05	<0.05	<0.05
Cianuro Total*		1	<0.003	<0.003	<0.003	<0.003	<0.003
Mercurio		0.01	<0.004	<0.002	<0.004	<0.004	<0.004
Níquel		2	<0.05	<0.05	<0.05	<0.05	<0.05
Plomo		0.4	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc		10	<0.01	<0.01	<0.01	<0.01	<0.01
Color Real	u Pt/Co		<1.8	< 1	< 1	<1	5
Coliformes Fecales	NMP/100ml	$<1x10^4$	<1.8	<1.8	<1.8	2.4×10^2	4.9×10^2

*análisis realizado por laboratorio AZC. u.e. unidades electroquímicas. °C: grados centígrados. mg/L: miligramos por litro. U Pt/Co: unidades de Platino-Cobalto. NMP/100ml: número más probable en 100 mililitros. NL = no hay límite establecido para este parámetro. Fuente: MSR, 2017.

Para la preparación de blancos analíticos de los parámetros fisicoquímicos y metales se utilizó agua desmineralizada y para los parámetros microbiológicos se utilizó agua salvavidas embotellada. Todos los parámetros analizados por los dos laboratorios son confiables en manipulación de las muestras y precisión del análisis.

En el Cuadro 7-3 se pueden observar los resultados de la calidad del efluente de la planta de tratamiento del Proyecto Minero Escobal. Los resultados de laboratorio se presentan en el Anexo 12.7.

Los valores de pH se encontraron en el rango de 7.26 a 8.19 u.e., cumpliendo con el rango establecido en el Acuerdo 6.0-9.0 u.e.

La concentración de Cianuro Total, Grasas y Aceites, Demanda Bioquímica de Oxígeno (**DBO**), Demanda Química de Oxígeno (**DQO**), sólidos sedimentables totales (**SST**), Arsénico Total, Plomo Total, Cadmio Total, Cobre Total, Cromo Hexavalente, Mercurio Total, Níquel Total y Coliformes fecales están por debajo de los valores establecidos por el acuerdo.

Por lo tanto los resultados obtenidos durante las descargas de la planta de tratamiento cumplen con el Acuerdo Gubernativo 236-2006 para entes generadores nuevos, Banco Mundial para el sector minero y la USEPA.

Cuadro 7-3: Calidad del Efluente de la Planta de Tratamiento, Proyecto Minero Escobal

Mes	**Unidades**	**LMP Acuerdo 236-2006**	**Valores Indicador Banco Mundial Sector Minero**	**LMP EPA CFR 440, Subparte J, 440.102, (a)**	**Mayo**	**Junio**	**Julio**
Fecha Muestreo					18/05/2017	21/06/2017	11/07/2017
ID Muestra					**WW9**	**WW9**	**WW9**
No. Reporte Lab.					1220-17	1590-17	1777-17
pH de campo	u.e.	**6.0-9.0**	**6.0-9.0**	**6.0-9.0**	7.26	7.99	8.19
Temperatura de campo	°C		**+/- 3**		27.7	27.6	27.2
Temperatura. Quebrada El Escobal					23.1	19.22	22.4
Grasas y Aceites	mg/L	**10**	**10**		<5	<5	<5
Materia Flotante		**Ausente**			ausente	ausente	ausente
DBO	mg/L	**200**	**50**		10	< 10	< 10
DQO			**150**		31	< 25	< 25
SST (TSS)		**100**	**50**	**30**	<10	< 10	13
Nitrógeno Total		**20**	**10**		<10.9	<10.9	<10.9
Fósforo Total		**10**	**2**		<0.05	<0.05	0.05
Arsénico		**0.1**	**0.1**		0.004	0.006	0.010
Cadmio		**0.1**	**0.05**		<0.02	<0.02	<0.02
Cobre		**3**	**0.3**	**0.3**	<0.03	<0.03	<0.03
Cromo Hexavalente		**0.1**	**0.1**		<0.05	<0.05	<0.05
Cianuro Total*		**1**	**1**		<0.003	<0.003	<0.003
Mercurio		**0.01**	**0.002**	**0.002**	<0.004	<0.004	<0.004
Níquel		**2**	**0.5**		<0.05	<0.05	<0.05
Plomo		**0.4**	**0.2**	**0.6**	<0.05	<0.05	<0.05
Zinc		**10**	**0.5**	**1.5**	<0.01	<0.01	<0.01
Color Real	u Pt/Co	**500**			5	6	<1
Coliformes Fecales	NMP/100ml	**<1x10^4**	**400**		4.9 x 10^2	2.3 x 10^1	<1.8

u.e. unidades electroquímicas. °C: grados centígrados. mg/L: miligramos por litro. U Pt/Co: unidades de Platino-Cobalto. NMP/100ml: número más probable en 100 mililitros. *: análisis efectuados en laboratorio ACZ. Fuente: MSR, 2017.

8 Vibraciones

8.1 Sitios de Monitoreo

La Empresa instaló tres equipos para la medición de vibraciones por medio del equipo eXPeak Seismograph modelo eXAD-8 de la empresa Physical Measurement Technologies, Inc. Estos equipos son automatizados y registran la velocidad (mm/s) y la frecuencia (Hz) de forma constante. La ubicación de las estaciones de monitoreo se presenta en la Figura 8-1 y en el Cuadro 8-1 se presenta la descripción de cada una de las estaciones.

Cuadro 8-1: Estaciones de monitoreo de vibraciones, Proyecto Minero Escobal

Estación	Coordenadas		Sitio
BS-1	806,424	1,601,608	Colindancia con Aldea La Cuchilla
BS-2	806,366	1,601,291	Entre ambos portales
BS-3	805,798	1,601,563	Depósito de Suelo

Sistema de coordenadas proyectadas UTM, DATUM WGS84. Msnm: metros sobre el nivel del mar. Fuente: MSR, 2017.

MAPA DE LOCALIZACIÓN ESTACIONES DE MONITOREO DE VIBRACIONES PERMANENTE

PROYECTO MINERO ESCOBAL
SAN RAFAEL LAS FLORES, SANTA ROSA

MINERA SAN RAFAEL

DEPARTAMENTO DE AMBIENTE

Sistema de coordenadas: WGS 1984 UTM Zone 15N
Proyección: Transverse Mercator
Dato: WGS 1984

LEYENDA

Símbolo	Descripción
	Polígono del Proyecto
	Centro Poblado
	Portal de Acceso
	Río Permanente
	Quebrada Intermitente

ESTACIONES DE MONITOREO

Símbolo	Estación	X	Y
⊗	BS-1	806419	1601819
	BS-2	806361	1601492
	BS-3	805791	1601785

FUENTE: Capas digitales del proyecto ESPREDE/MAGA/IGN del año 2000 Hojas catográficas año 2010 Mataquescuintla (2159-1) y Laguna de Ayarza (2159-II) del IGN, Ortofotos año 2006 del MAGA y Fotografía aérea del proyecto el Escobal año 2014, datos de campo del departamento de Ambiente.

Fecha de Elaboración: Julio 2017

Distancia Horizontal y Vertical de Grilla: 1,000 metros

Escala **1:5,000**

N W E S

0 50 100 200 300 400
Metros

8.2 Resultados

En el Cuadro 8-2 se presentan todas las mediciones de las voladuras registradas en los instrumentos. Todos los resultados se encuentran por debajo del límite de detección del equipo (1.3 mm/s). Según la norma del United States Bureau of Mines, el límite a partir del cual las vibraciones inducidas por una voladura pueden ocasionar daños a estructuras es de 50.8 mm/s. Por lo que se puede determinar que las mismas no son sensibles y por lo tanto no representan un impacto para el ambiente.

Cuadro 8-2 Resultados de medición de vibraciones, Proyecto Minero Escobal

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1330-SUMI	01-may	05:02	<2.5
	1190-6810	01-may	18:07	<2.5
	1215-6960	01-may	18:17	<2.5
	1505-7480	01-may	18:08	<2.5
	1390-6800	01-may	18:10	<2.5
	1215-6890	01-may	05:45	<2.5
	1305-RMUK	01-may	05:45	<2.5
	1315-CFTE	01-may	05:52	<2.5
	1305-7300	02-may	18:10	<2.5
	1305-ACCS	02-may	18:10	<2.5
	1305-RAMP	02-may	18:14	<2.5
	1305-CFTE	02-may	18:15	<2.5
	1290-6410	02-may	18:09	<2.5
	1215-6810	02-may	18:27	<2.5
	1240-6760	02-may	06:23	<2.5
	1265-6600	02-may	06:06	<2.5
	1505-7360	02-may	06:10	<2.5
	1505-7500	02-may	06:10	<2.5
	1430-CFTE	03-may	18:14	<2.5
	1290-BYPASS	03-may	18:13	<2.5
	1415-6780	03-may	18:26	<2.5
	1215-6960	03-may	18:20	<2.5
	1505-CFTO	03-may	18:13	<2.5
	1505-7500	03-may	06:14	<2.5
	1415-6860	03-may	06:23	<2.5
	1415-6880	03-may	06:23	<2.5
	1330-RAMP	03-may	06:26	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1215-6810	03-may	06:14	<2.5
	1415-7410	03-may	06:23	<2.5
	1265-6600	04-may	18:10	<2.5
	1215-6740	04-may	18:10	<2.5
	1305-RAMP	04-may	18:15	<2.5
	1390-6680	04-may	18:25	<2.5
	1505-CFTO	04-may	06:10	<2.5
	1505-7480	04-may	06:10	<2.5
	1215-6960	04-may	06:15	<2.5
	1305-ACCS	04-may	06:03	<2.5
	1315-CFTE	05-may	19:05	<2.5
	1240-6760	05-may	18:53	<2.5
	1330-CFTO	05-may	18:40	<2.5
	1415-6780	05-may	19:10	<2.5
	1190-6410	05-may	18:43	<2.5
	1215-6740	05-may	18:52	<2.5
	1430-CFTE	05-may	18:50	<2.5
	1415-6880	05-may	06:01	<2.5
	1290-BYPASS	05-may	06:16	<2.5
	1215-6810	05-may	06:11	<2.5
	1165-RAMP-E	05-may	06:06	<2.5
	1415-6860	06-may	18:20	<2.5
	1390-6680	06-may	18:11	<2.5
	1305-ACCS	06-may	18:06	<2.5
	1240-6760	06-may	17:55	<2.5
	1505-SERV	06-may	18:10	<2.5
	1305-RAMP	06-may	18:00	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1505-7480	06-may	05:58	<2.5
	1505-7340	06-may	05:58	<2.5
	1215-6960	06-may	00:57	<2.5
	1415-6780	06-may	06:10	<2.5
	1430-7450	07-may	18:06	<2.5
	1415-6860	07-may	18:24	<2.5
	1215-6740	07-may	18:14	<2.5
	1165-RAMP-E	07-may	18:05	<2.5
	1315-RMUK	07-may	18:22	<2.5
	1315-CFTE	07-may	18:22	<2.5
	1455-7370	07-may	18:13	<2.5
	1330-7240	07-may	06:33	<2.5
	1165-RAMP-E	07-may	Sin dato	<2.5
	1265-6600	07-may	06:13	<2.5
	1390-6680	07-may	06:12	<2.5
	1305-RAMP	07-may	06:31	<2.5
	1330-CFTO	07-may	06:32	<2.5
	1505-7480	08-may	18:40	<2.5
	1340-6340	08-may	18:26	<2.5
	1290-BYPASS	08-may	18:25	<2.5
	1390-6700	08-may	06:35	<2.5
	1415-6780	08-may	06:40	<2.5
	1305-RAMP	08-may	06:50	<2.5
	1305-ACCS	08-may	06:34	<2.5
	1165-RAMP-E	09-may	17:55	<2.5
	1215-6580	09-may	18:15	<2.5
	1430-7580	09-may	17:55	<2.5
	1415-6880	09-may	18:05	<2.5
	1455-7400	09-may	06:07	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1505-7340	09-may	06:10	<2.5
	1340-6530	09-may	06:20	<2.5
	1315-RMUK	09-may	06:08	<2.5
	1215-6960	09-may	06:14	<2.5
	1330-CFTO	10-may	18:05	<2.5
	1505-7480	10-may	18:13	<2.5
	1415-6860	10-may	18:10	<2.5
	1390-6680	10-may	18:05	<2.5
	1505-CFTO	10-may	06:23	<2.5
	1415-6780	10-may	06:32	<2.5
	1305-RAMP	10-may	Sin dato	<2.5
	1165-RAMP-E	10-may	06:28	<2.5
	1265-6390	10-may	06:33	<2.5
	1315-CFTE	10-may	06:22	<2.5
	1455-7370	10-may	Sin dato	<2.5
	1390-6700	10-may	06:21	<2.5
	1415-6880	11-may	18:30	<2.5
	1430-7540	11-may	18:21	<2.5
	1215-6580	11-may	18:17	<2.5
	1215-6740	11-may	18:17	<2.5
	1240-6750	11-may	18:27	<2.5
	1265-6790	11-may	18:23	<2.5
	1340-6700	11-may	18:20	<2.5
	1505-7380	11-may	06:19	<2.5
	1505-7480	11-may	06:17	<2.5
	1330-CFTO	11-may	02:24	<2.5
	1505-CFTE	11-may	06:18	<2.5
	1415-6860	11-may	06:37	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1315-6340	11-may	06:24	<2.5
	1290-6790	11-may	06:16	<2.5
	1315-RMUK	12-may	18:21	<2.5
	1265-6380	12-may	18:17	<2.5
	1305-RAMP	12-may	18:14	<2.5
	1215-6580	12-may	06:17	<2.5
	1265-6430	12-may	06:18	<2.5
	1165-RAMP-E	12-may	06:04	<2.5
	1415-6880	12-may	06:03	<2.5
	13900-6680	12-may	06:15	<2.5
	1430-6530	12-may	06:22	<2.5
	1430-7450	13-may	18:13	<2.5
	1505-7480	13-may	18:17	<2.5
	1330-7220	13-may	18:08	<2.5
	1340-6680	13-may	18:16	<2.5
	1315-CFTE	13-may	18:11	<2.5
	1215-6740	13-may	18:05	<2.5
	1505-CFTO	13-may	06:30	<2.5
	1505-7340	13-may	06:30	<2.5
	1415-6860	13-may	06:40	<2.5
	1290-BYPASS	13-may	06:27	<2.5
	1290-6790	13-may	06:25	<2.5
	1505-7380	14-may	18:13	<2.5
	1415-6880	14-may	18:18	<2.5
	1305-RAMP	14-may	18:18	<2.5
	1505-SERV	14-may	06:37	<2.5
	1455-7480	14-may	06:33	<2.5
	1290-6750	14-may	06:53	<2.5
	1215-6580	14-may	06:39	<2.5
	1165-RAMP-E	14-may	06:30	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1330-7220	14-may	06:41	<2.5
	1340-6530	14-may	Sin dato	<2.5
	1430-7540	14-may	06:23	<2.5
	1505-CFTO	15-may	19:12	<2.5
	1315-RMUK	15-may	19:10	<2.5
	1365-6890	15-may	18:55	<2.5
	1505-SERV	15-may	06:18	<2.5
	1265-6390	15-may	06:23	<2.5
	1265-6430	15-may	06:23	<2.5
	1290-BYPASS	15-may	06:25	<2.5
	1305-RAMP	15-may	06:18	<2.5
	1415-6860	15-may	06:30	<2.5
	1290-7040	15-may	06:26	<2.5
	1330-CFTO	16-may	18:41	<2.5
	1330-7220	16-may	18:41	<2.5
	1340-6530	16-may	18:48	<2.5
	1165-RAMP-E	16-may	18:35	<2.5
	1290-6790	16-may	06:32	<2.5
	1505-SERV	16-may	06:42	<2.5
	1505-CFTO	16-may	06:45	<2.5
	1505-7340	16-may	06:44	<2.5
	1505-7380	16-may	06:43	<2.5
	1215-6920	16-may	06:25	<2.5
	1365-6890	16-may	06:33	<2.5
	1390-6680	16-may	06:26	<2.5
	1265-6390	17-may	18:24	<2.5
	1265-6430	17-may	18:27	<2.5
	1305-RAMP	17-may	18:25	<2.5
	1455-CFTE	17-may	18:23	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1290-7440	17-may	18:24	<2.5
	1165-RAMP-E	17-may	06:00	<2.5
	1390-6660	17-may	06:25	<2.5
	1530-RAMP	17-may	06:17	<2.5
	1330-7220	17-may	06:06	<2.5
	1415-6860	17-may	06:30	<2.5
	1415-6880	17-may	06:30	<2.5
	1265-6390	18-may	18:37	<2.5
	1265-6430	18-may	18:35	<2.5
	1340-6530	18-may	18:33	<2.5
	1505-7480	18-may	18:24	<2.5
	1305-RAMP	18-may	18:13	<2.5
	1215-6740	18-may	18:30	<2.5
	1365-6640	18-may	18:11	<2.5
	1240-6580	18-may	06:25	<2.5
	1190-6580	18-may	06:07	<2.5
	1215-6930	18-may	06:17	<2.5
	1505-7380	18-may	06:17	<2.5
	1330-7220	18-may	06:08	<2.5
	1390-6680	19-may	18:49	<2.5
	1315-RMUK	19-may	18:41	<2.5
	1165-RAMP-E	19-may	18:36	<2.5
	1390-6660	19-may	18:50	<2.5
	1305-RAMP	19-may	18:45	<2.5
	1365-6680	19-may	18:49	<2.5
	1265-6390	19-may	06:10	<2.5
	1365-6890	19-may	06:18	<2.5
	1415-6880	19-may	06:21	<2.5
	1505-CFTO	19-may	06:07	<2.5
	1455-CFTE	19-may	06:14	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1530-ACCS	20-may	18:11	<2.5
	1505-7380	20-may	18:13	<2.5
	1505-CFTE	20-may	18:11	<2.5
	1215-6930	20-may	18:12	<2.5
	1265-6430	20-may	18:23	<2.5
	1365-6820	20-may	18:50	<2.5
	1240-6580	20-may	18:17	<2.5
	1365-6680	20-may	18:43	<2.5
	1390-6660	20-may	05:59	<2.5
	1365-6680	20-may	05:59	<2.5
	1190-6380	20-may	06:20	<2.5
	1215-6890	20-may	06:09	<2.5
	1415-6860	20-may	06:08	<2.5
	1165-RAMP-E	20-may	05:58	<2.5
	1390-6680	20-may	05:59	<2.5
	1455-CFTE	21-may	18:17	<2.5
	1305-RAMP	21-may	18:07	<2.5
	1215-CFTE	21-may	18:23	<2.5
	1530-ACCS	21-may	18:09	<2.5
	1365-6890	21-may	18:27	<2.5
	1365-6680	21-may	18:15	<2.5
	1290-BYPASS	21-may	06:12	<2.5
	1265-6430	21-may	06:06	<2.5
	1340-6530	21-may	06:08	<2.5
	1365-6810	21-may	06:04	<2.5
	1505-7380	22-may	18:15	<2.5
	1415-6880	22-may	18:23	<2.5
	1215-6660	22-may	18:18	<2.5
	1265-6390	22-may	18:30	<2.5
	1165-RAMP-E	22-may	18:10	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1365-6680	22-may	18:35	<2.5
	1215-6930	22-may	06:25	<2.5
	1240-6580	22-may	06:17	<2.5
	1265-6430	22-may	06:27	<2.5
	1305-RAMP	22-may	06:19	<2.5
	1390-6680	22-may	06:30	<2.5
	1215-6890	22-may	06:27	<2.5
	1530-ACCS	23-may	18:20	<2.5
	1415-6860	23-may	18:25	<2.5
	1365-6810	23-may	18:10	<2.5
	1340-6330	23-may	18:35	<2.5
	1215-6630	23-may	18:12	<2.5
	1240-6460	23-may	18:23	<2.5
	1505-7480	23-may	00:00	<2.5
	1330-CFTO	23-may	06:23	<2.5
	1365-6890	23-may	06:17	<2.5
	1390-6760	24-may	18:21	<2.5
	1505-7380	24-may	18:30	<2.5
	1390-6660	24-may	18:21	<2.5
	1415-6880	24-may	18:50	<2.5
	1165-RAMP-E	24-may	18:20	<2.5
	1265-6390	24-may	18:28	<2.5
	1315-6500	24-may	18:35	<2.5
	1240-6460	24-may	18:24	<2.5
	1455-CFTE	24-may	06:00	<2.5
	1305-RAMP	24-may	06:14	<2.5
	1290-BYPASS	24-may	06:08	<2.5
	1215-6930	24-may	06:00	<2.5
	1390-6680	24-may	06:05	<2.5
	1265-6660	25-may	18:24	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1340-6530	25-may	18:24	<2.5
	1390-6780	25-may	18:31	<2.5
	1265-6390	25-may	18:38	<2.5
	1265-6430	25-may	18:38	<2.5
	1340-6340	25-may	06:42	<2.5
	1305-RAMP	25-may	06:55	<2.5
	1365-RAMP-E	25-may	06:48	<2.5
	1530-CFTE	25-may	06:46	<2.5
	1365-6810	25-may	06:45	<2.5
	1240-6580	25-may	06:56	<2.5
	1415-6860	26-may	18:37	<2.5
	1390-6860	26-may	18:31	<2.5
	1290-BYPASS	26-may	18:20	<2.5
	1415-6880	26-may	18:36	<2.5
	1365-6890	26-may	18:28	<2.5
	1455-CFTE	26-may	18:21	<2.5
	1240-6460	26-may	18:21	<2.5
	1265-6600	26-may	18:23	<2.5
	1305-CFTE	26-may	06:24	<2.5
	1390-6660	26-may	06:37	<2.5
	1505-CFTO	26-may	06:28	<2.5
	1305-RAMP	26-may	06:40	<2.5
	1330-CFTO	26-may	06:42	<2.5
	1340-6340	26-may	06:25	<2.5
	1165-RAMP-O	27-may	18:06	<2.5
	1215-6930	27-may	18:20	<2.5
	1505-7380	27-may	18:20	<2.5
	1365-6890	27-may	18:08	<2.5
	1165-RAMP-E	27-may	18:06	<2.5
	1215-6580	27-may	18:25	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1365-6810	27-may	06:14	<2.5
	1390-6680	27-may	06:08	<2.5
	1390-6760	27-may	06:10	<2.5
	1455-CFTE	27-may	00:57	<2.5
	1215-6660	27-may	06:04	<2.5
	1340-6530	27-may	06:21	<2.5
	1265-6790	27-may	06:04	<2.5
	1340-6340	27-may	06:18	<2.5
	1265-6430	28-may	18:28	<2.5
	1240-6580	28-may	18:20	<2.5
	1305-RAMP	28-may	18:22	<2.5
	1530-CFTE	28-may	18:25	<2.5
	1265-6390	28-may	18:28	<2.5
	1290-BYPASS	28-may	18:31	<2.5
	1505-CFTO	28-may	06:02	<2.5
	1390-6660	28-may	06:04	<2.5
	1215-6930	28-may	06:10	<2.5
	1165-RAMP-E	28-may	06:05	<2.5
	1365-6890	29-may	18:10	<2.5
	1305-RAMP	29-may	18:16	<2.5
	1340-6530	29-may	18:24	<2.5
	1390-6680	29-may	18:18	<2.5
	1165-RAMP-O	29-may	06:24	<2.5
	1415-6860	29-may	06:15	<2.5
	1505-7380	29-may	06:18	<2.5
	1530-CFTE	29-may	06:15	<2.5
	1265-6430	29-may	06:32	<2.5
	1290-BYPASS	29-may	06:16	<2.5
	1365-6810	29-may	06:42	<2.5
	1415-6780	30-may	18:28	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Mayo	1165-RAMP-E	30-may	18:18	<2.5
	1215-6660	30-may	18:24	<2.5
	1390-6760	30-may	18:26	<2.5
	1305-RAMP	30-may	18:18	<2.5
	1315-6500	30-may	06:11	<2.5
	1455-7370	30-may	07:01	<2.5
	1265-6580	31-may	18:13	<2.5
	1415-6860	31-may	18:13	<2.5
	1240-6580	31-may	18:10	<2.5
	1505-CFTO	31-may	18:02	<2.5
	1215-6390	31-may	18:20	<2.5
	1365-6890	31-may	18:26	<2.5
	1455-CFTE	31-may	06:17	<2.5
	1455-7520	31-may	06:17	<2.5
	1390-6660	31-may	06:18	<2.5
	1165-RAMP-O	31-may	06:29	<2.5
	1165-RAMP-E	31-may	06:12	<2.5
	1305-RAMP	31-may	06:33	<2.5
	1415-6780	31-may	06:12	<2.5
Junio	1265-6430	01-jun	18:17	<2.5
	1290-Bypass	01-jun	18:23	<2.5
	1340-6530	01-jun	18:12	<2.5
	1505-7380	01-jun	18:23	<2.5
	1365-6810	01-jun	18:17	<2.5
	1390-6760	01-jun	06:15	<2.5
	1505-CFTO	01-jun	05:21	<2.5
	1430-7520	01-jun	05:58	<2.5
	1340-SERV	01-jun	Sin dato	<2.5
	1215-6660	01-jun	05:58	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Junio	1305-RAMP	02-jun	18:54	<2.5
	1390-6660	02-jun	18:10	<2.5
	1165-RAMP-EC	02-jun	18:10	<2.5
	1265-6390	02-jun	18:19	<2.5
	1215-6930	02-jun	18:15	<2.5
	1365-6810	02-jun	06:10	<2.5
	1265-6430	02-jun	06:23	<2.5
	1340-6530	02-jun	06:17	<2.5
	1165-RAMP-OC	02-jun	06:10	<2.5
	1365-6890	02-jun	06:10	<2.5
	1240-6580	03-jun	18:27	<2.5
	1290-Bypass	03-jun	18:21	<2.5
	1415-7520	03-jun	18:31	<2.5
	1455-CFTE	03-jun	18:31	<2.5
	1305-RAMP	03-jun	18:23	<2.5
	1265-6890	03-jun	18:32	<2.5
	1215-6660	03-jun	06:15	<2.5
	1215-LONG	03-jun	06:36	<2.5
	1165-RAMP-EC	03-jun	06:06	<2.5
	1390-6710	03-jun	06:05	<2.5
	1415-6860	03-jun	06:13	<2.5
	1265-6430	04-jun	18:10	<2.5
	1290-Bypass	04-jun	17:57	<2.5
	1505-CFTO	04-jun	17:58	<2.5
	1430-7520	04-jun	18:11	<2.5
	1215-6660	04-jun	06:08	<2.5
	1240-6580	04-jun	06:17	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Junio	1165-RAMP-OC	04-jun	06:01	<2.5
	1340-SERV	04-jun	06:00	<2.5
	1340-6530	04-jun	06:08	<2.5
	1215-6930	05-jun	18:06	<2.5
	1365-6810	05-jun	18:13	<2.5
	1455-7520	05-jun	18:05	<2.5
	1455-CFTE	05-jun	18:04	<2.5
	1165-RAMP-EC	05-jun	12:38	<2.5
	1390-6660	05-jun	06:16	<2.5
	1390-6760	05-jun	06:16	<2.5
	1530-CFTE	05-jun	05:58	<2.5
	1165-RMUK	05-jun	05:58	<2.5
	1365-6810	05-jun	05:50	<2.5
	1290-Bypass	06-jun	18:16	<2.5
	1240-6580	06-jun	18:18	<2.5
	1505-CFTO	06-jun	18:20	<2.5
	1165-RAMP-EC	06-jun	18:20	<2.5
	1290-Bypass	06-jun	06:12	<2.5
	1340-6530	06-jun	06:02	<2.5
	1530-CFTE	07-jun	18:17	<2.5
	1265-6430	07-jun	18:20	<2.5
	1165-RAMP-OC	07-jun	18:07	<2.5
	1265-6390	07-jun	18:21	<2.5
	1215-6660	07-jun	18:16	<2.5
	1415-6800	07-jun	06:05	<2.5
	1215-6500	07-jun	05:58	<2.5

Mes	Sitio	Día	HORA	Velocidad de Partícula (mm/s)
Junio	1390-6760	07-jun	06:01	<2.5
	1455-7520	07-jun	05:54	<2.5
	1265-6910	07-jun	06:05	<2.5
	1240-6580	07-jun	06:00	<2.5
	1430-7520	08-jun	17:52	<2.5
	1365-6810	08-jun	18:02	<2.5
	1340-6380	08-jun	18:03	<2.5
	1165-RAMP-OC	08-jun	Sin dato	<2.5
	1215-6620	08-jun	17:53	<2.5
	1165-RAMP-EC	09-jun	18:13	<2.5
Junio	1190-6810	09-jun	18:18	<2.5
	1190-6930	09-jun	05:59	<2.5
	1165-RAMP-OC	10-jun	18:10	<2.5
	1190-6580	10-jun	18:18	<2.5
	1165-RMUK	10-jun	18:27	<2.5
	1215-6420	10-jun	06:10	<2.5
	1165-RAMP-EC	12-jun	12:15	<2.5
	1165-RMUK	12-jun	12:16	<2.5
	1190-6930	12-jun	18:10	<2.5

Donde mm/s: milímetros por segundo. Fuente: MSR, 2017.

9 Geoquímica de Roca Estéril

9.1 Sitios de Monitoreo

En el Cuadro 9-1 se enlistan las muestras analizadas de material extraído de los túneles del proyecto, rampa oeste y rampa este, durante el trimestre. La ubicación de la extracción de las muestras se presenta en la Figura 9-1, Figura 9-2, Figura 9-3, Figura 9-4, Figura 9-5 y Figura 9-6.

Cuadro 9-1: Sitios de Material Extraído de los Túneles, Proyecto Minero Escobal

Código de Muestra	Área	Coordenadas		
		X	Y	Z
GQE-659	1305-7300	807300	1601523	1306
GQE-660	1330-7240	807240	1601513	1331
GQE-661	1330-7260	807260	1601518	1332
GQE-662	1415-6760	806760	1601380.5	1416
GQE-663	1415-6780	806780	1601388	1416
GQE-664	1415-6880	806880	1601392	1416
GQE-665	1430-7520	807520	1601645	1434
GQE-666	1505-7360	807360	1601623	1508
GQE-667	1315-CFTE	807101.5	1601475.5	1326
GQE-668	1430-7540	807540	1601650	1435
GQE-669	1505-7340	807341	1601616	1508
GQE-670	1305-CFTO	807201	1601495	1332
GQE-671	1305-7220	807220	1601515	1332
GQE-672	1305-RAMP	807299.5	1601452.5	1314
GQE-673	1505-CFTO-ZE	807316.5	1601597.5	1508

Fuente: MSR, 2017.

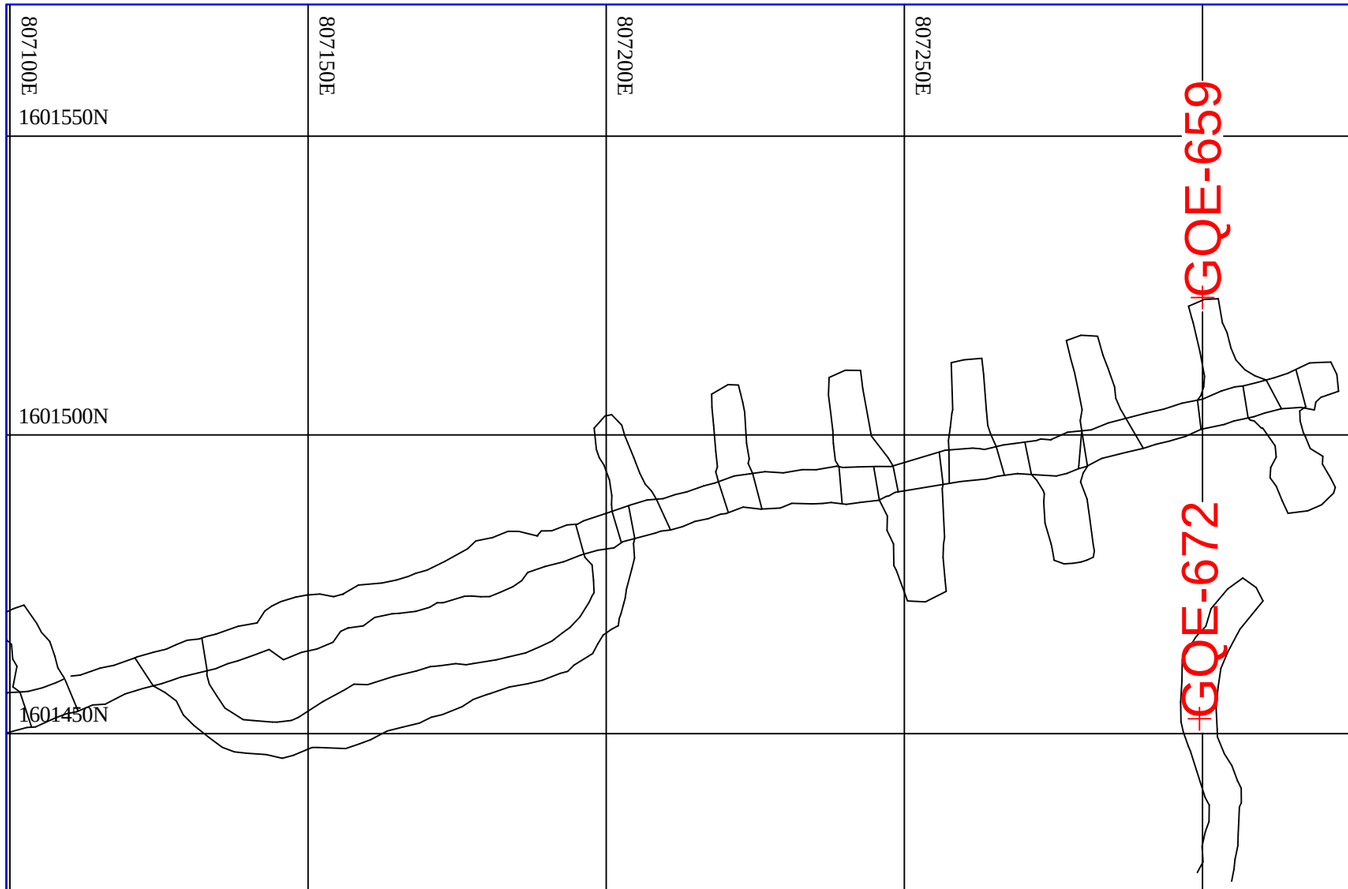
807100E | 807150E | 807200E | 807250E | 807350E | 807400E | 807450E

1601550N

1601500N

1601450N

1601400N



807100E | 807150E | 807200E | 807250E | 807300E | 807350E | 807400E | 807450E

DRENAJE ÁCIDO DE ROCA (ARD)

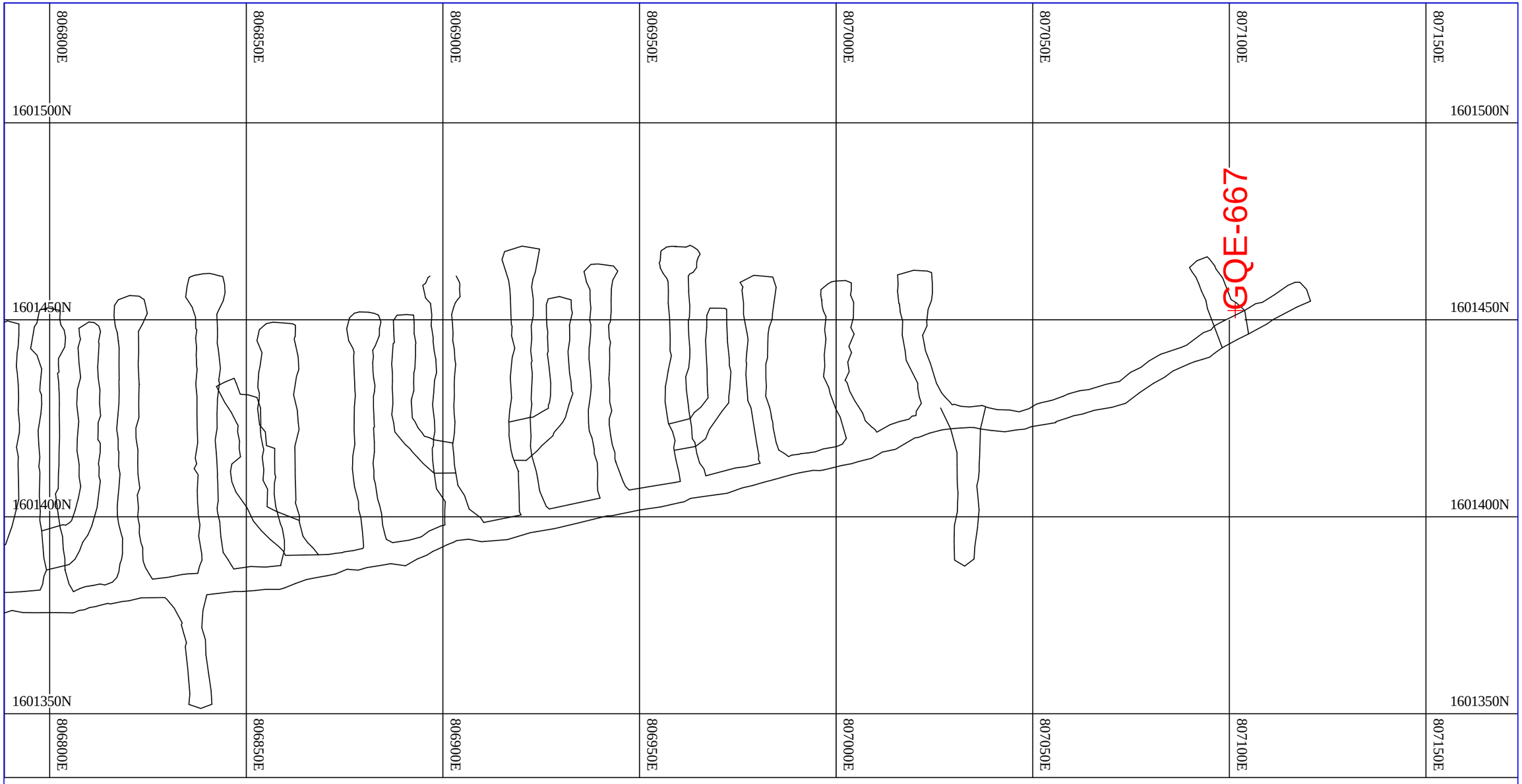
Mayo_Julio_2017

MINERA SAN RAFAEL

Nivel_1305		
DIBUJO:	HCacao	
REVISO:	Ben Gage	
Depto	Geología de Mina	
Scale: 1: 1000	Plan No.	Date: 28-Sep-17

mayo_julio_2017_ard_nivel_1305

SURPAC - GEOVIA



MINERA SAN RAFAEL

DRENAJE ÁCIDO DE ROCA (ARD)

Mayo_Julio_2017

Nivel_1315		
DIBUJO:	HCacao	
REVISO:	Ben Gage	
Depto	Geología de Mina	
Scale: 1: 1000	Plan No.	Date: 28-Sep-17

mayo_julio_2017_ard_nivel_1315

SURPAC - GEOVIA

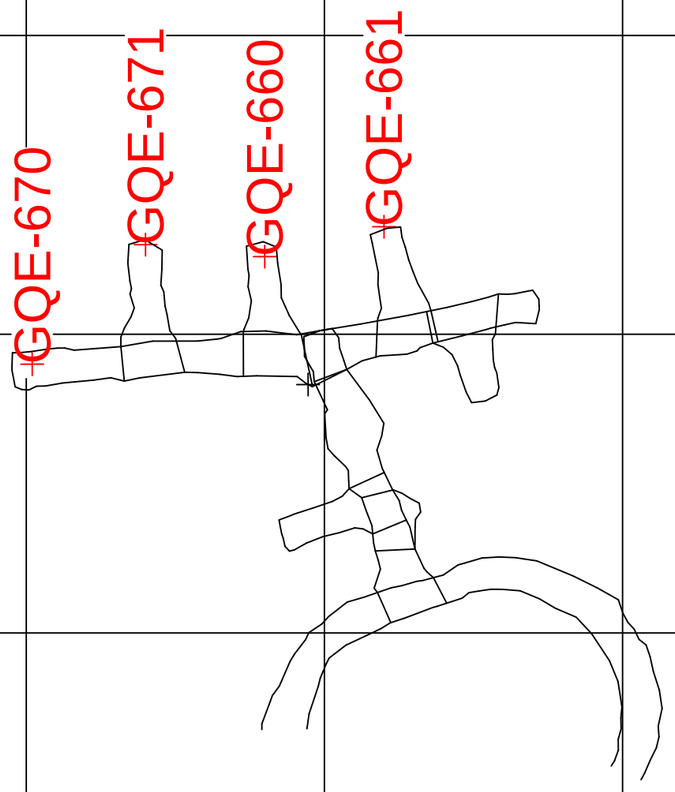
807100E | 807150E | 807200E | 807250E | 807300E | 807350E | 807400E

1601550N

1601500N

1601450N

1601400N



807100E | 807150E | 807200E | 807250E | 807300E | 807350E | 807400E

MINERA SAN RAFAEL

DRENAJE ÁCIDO DE ROCA (ARD)

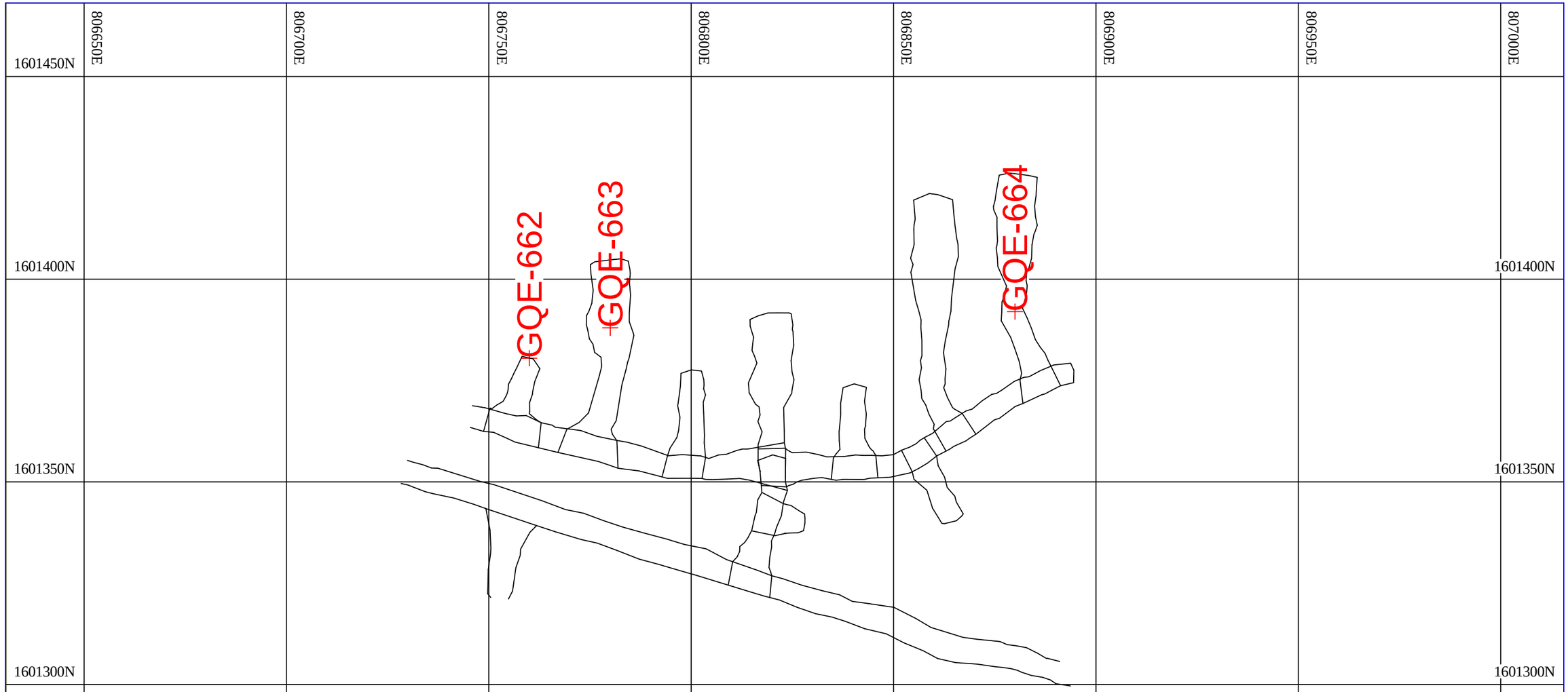
Mayo_Julio_2017

Nivel_1330

DIBUJO:	HCacao
REVISO:	Ben Gage
Depto	Geología de Mina
Scale: 1: 1000	Plan No.
Date:	28-Sep-17

mayo_julio_2017_ard_nivel_1330

SURPAC - GEOVIA



DRENAJE ÁCIDO DE ROCA (ARD)

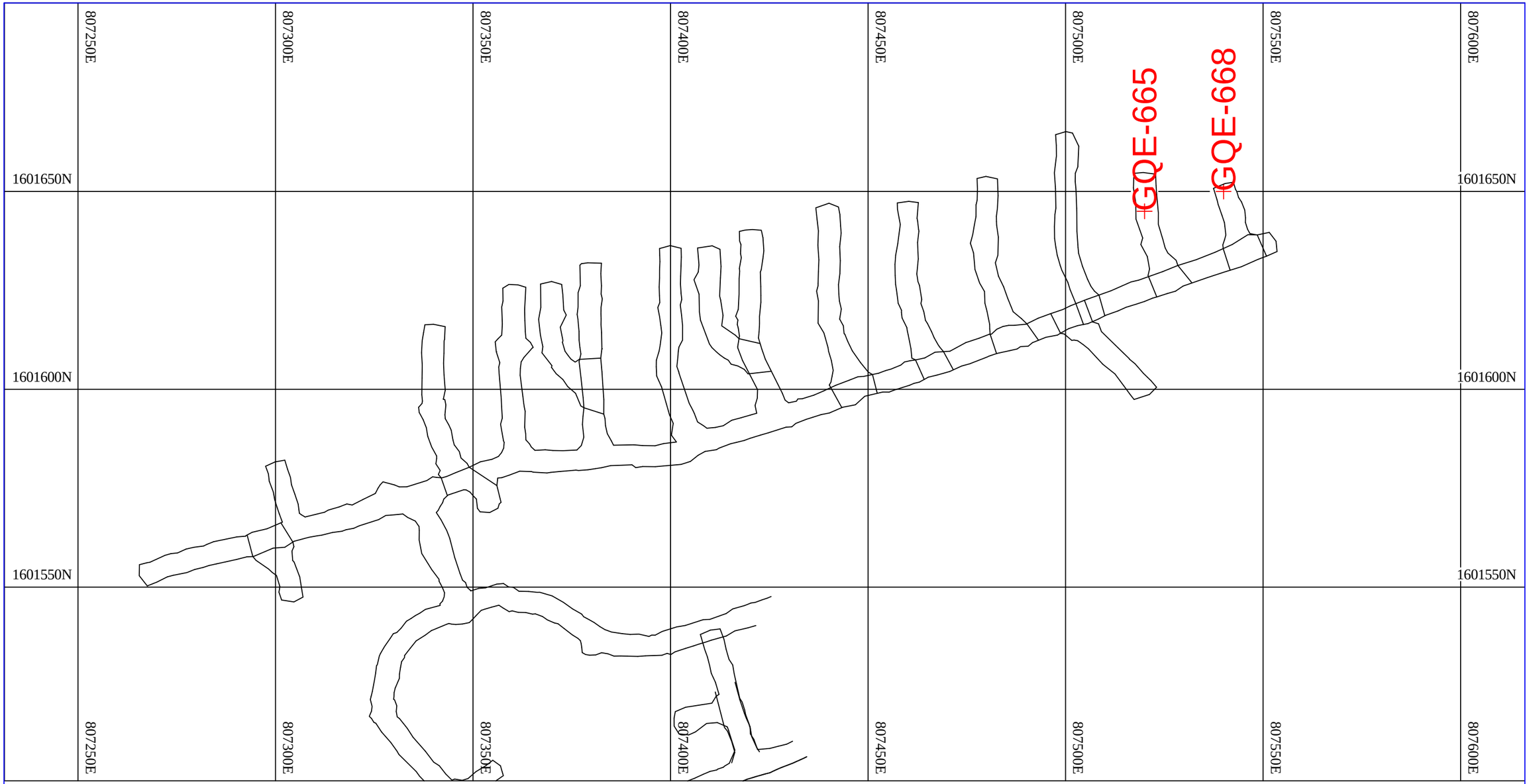
Mayo_Julio_2017

MINERA SAN RAFAEL

Nivel_1415		
DIBUJO:	HCacao	
REVISO:	Ben Gage	
Depto	Geología de Mina	
Scale: 1: 1000	Plan No.	Date: 28-Sep-17

mayo_julio_2017_ard_nivel_1415

SURPAC - GEOVIA



MINERA SAN RAFAEL

DRENAJE ÁCIDO DE ROCA (ARD)

Mayo_Julio_2017

Nivel_1430		
DIBUJO:	HCacao	
REVISO:	Ben Gage	
Depto	Geología de Mina	
Scale: 1: 1000	Plan No.	Date: 28-Sep-17

mayo_julio_2017_ard_nivel_1430

SURPAC - GEOVIA

807250E 807300E 807350E 807400E 807450E 807500E 807550E 807600E

1601700N

1601650N

1601600N

1601550N

+GQE-673

+GQE-669

+GQE-666

807250E 807300E 807350E 807400E 807450E 807500E 807550E 807600E

MINERA SAN RAFAEL

DRENAJE ÁCIDO DE ROCA (ARD)

Mayo_Julio_2017

Nivel_1505		
DIBUJO:	HCacao	
REVISO:	Ben Gage	
Depto	Geología de Mina	
Scale: 1: 1000	Plan No.	Date: 28-Sep-17

mayo_julio_2017_ard_nivel_1505

SURPAC - GEOVIA

9.2 Resultados

Los resultados de pH en pasta se presentan en el Cuadro 9-2. Los valores de pH se encontraron en el rango de 7.56 a 9.30 u.e. los cuales no dieron indicios de un potencial de generación ácida. Por lo que no fue necesario realizar pruebas de laboratorio para el cálculo de ácido base modificado (ABA por sus siglas en inglés) para descartar o confirmar resultados.

Cuadro 9-2: Resultados de pH en Pasta en muestras de material extraído de Túneles, Proyecto Minero Escobal

Código de Muestra	Fecha Toma de Muestra	Fecha Lectura pH	pH pasta	Temperatura (°C)
GQE-659	02/05/2017	06/05/2017	9.09	19.9
GQE-660	02/05/2017	06/05/2017	9.10	18.6
GQE-661	02/05/2017	06/05/2017	8.85	19.4
GQE-662	02/05/2017	06/05/2017	8.39	19.3
GQE-663	02/05/2017	06/05/2017	7.56	19.1
GQE-664	02/05/2017	06/05/2017	9.04	19.3
GQE-665	02/05/2017	06/05/2017	9.01	19.6
GQE-666	02/05/2017	06/05/2017	8.95	19.5
GQE-667	03/05/2017	06/05/2017	8.73	19.3
GQE-668	18/05/2017	20/05/2017	9.30	20.3
GQE-669	21/05/2017	22/05/2017	8.93	18.8
GQE-670	24/05/2017	24/05/2017	8.52	20.7
GQE-671	24/05/2017	24/05/2017	8.79	20.9
GQE-672	24/05/2017	24/05/2017	8.93	20.9
GQE-673	03/06/2017	04/06/2017	8.99	20.2

Fuente: MSR, 2017.

10 Mediciones de Seguridad Industrial y Salud Ocupacional

10.1 Presión Sonora

La medición de Presión Sonora en el trimestre de Mayo a Julio 2017 se muestra en el Cuadro 10-1. Se hicieron monitoreos mediante el uso de dosímetros portables y posteriormente se realizan comparaciones con la norma OSHA y al acuerdo gubernativo 229. Los resultados muestran que se está dentro de parámetros aceptables OSHA en los puntos evaluados. Se determina que los niveles se encuentran dentro parámetros establecidos en ambos ambientes de trabajo. A pesar de no tener un flujo normal en la operación debido a la suspensión temporal de la licencia de explotación se continuaron realizando las mediciones en las áreas; razón por la cual en los meses de Junio y Julio disminuyó la cantidad de dB. Se debe considerar que el parámetro Leq está acumulado para periodo de 10.6 para operaciones en mina subterránea y 12 horas para operaciones en superficie, lo que implica una mayor dosis recibida por efecto de acumulación.

Cuadro 10-1: Resultados de Presión Sonora de Salud Ocupacional, Proyecto Minero Escobal

Superfice Planta de Procesos	2017		
Mes	Mayo	Junio	Julio
Hora Inicio	6:40	6:40	6:44
Duración	10:03 h	11:34 h	10:25 h
Lmax dBA	126	125.8	107.6
Lmin dBA	60.1	60.5	60.1
Prom. Diurno dBA	95.2	90.8	76.7
Límite Nivel de Sonido Ponderado-A dBA acorde a Acuerdo Gubernativo 229-2014, para 12 horas (12.1 horas y 10.6 horas)*	85	85	85
Leq (Normal sin uso de EPP)	95.2	90.8	76.7
Leq ajustado (Con EPP, homologación 27 dBA a 50% = NRR 13.5 dBA)	81.7	77.3	63.2
Resultado (Leq ajustado ≤ Límite, entonces es Aceptable)	Aceptable	Aceptable	Aceptable

Superfice Planta de Procesos	2017		
Mes	Mayo	Junio	Julio
Hora Inicio	6:40	7:18	18:51
Duración	10:03 h	10:10 h	11:03 h
Lmax dBA	121.5	99	118.7
Lmin dBA	60.9	60.1	60
Prom. Diurno dBA	92.9	67.6	93.1
Límite Nivel de Sonido Ponderado-A dBA acorde a Acuerdo Gubernativo 229-2014, para 12 horas (12.1 horas y 10.6 horas)*	85	85	85
Leq (Normal sin uso de EPP)	92.9	67.6	93.1
Leq ajustado (Con EPP, homologación 27 dBA a 50% = NRR 13.5 dBA)	79.4	54.1	79.6
Resultado (Leq ajustado ≤ Límite, entonces es Aceptable)	Aceptable	Aceptable	Aceptable

Interior Mina General	2017		
Mes	Mayo	Junio	Julio
Hora Inicio	7:13	6:38	7:07
Duración	10:43 h	10:20 h	10:28 h
Lmax dBA	116.4	123.4	108.3
Lmin dBA	60.9	60.4	60.1
Prom. Diurno dBA	97.4	83.9	79
Límite Nivel de Sonido Ponderado-A dBA acorde a Acuerdo Gubernativo 229-2014, para 12 horas (12.1 horas y 10.6 horas)*	85	85	85
Leq (Normal sin uso de EPP)	97.4	83.9	79
Leq ajustado (Con EPP, homologación 29 dBA a 50% = NRR 14.5 dBA)	82.9	70.4	64.5
Resultado (Leq ajustado ≤ Límite, entonces es Aceptable)	Aceptable	Aceptable	Aceptable

Interior Mina General	2017		
Mes	Mayo	Junio	Julio
Hora Inicio	7:33	7:00	6:28
Duración	10:23 h	08:22 h	10:45 h
Lmax dBA	124	124.8	109.4
Lmin dBA	60.3	60.4	60.1
Prom. Diurno dBA	99.4	88.3	83.9
Límite Nivel de Sonido Ponderado-A dBA acorde a Acuerdo Gubernativo 229-2014, para 12 horas (12.1 horas y 10.6 horas)*	85	85	85
Leq (Normal sin uso de EPP)	99.4	88.3	83.9
Leq ajustado (Con EPP, homologación 29 dBA a 50% = NRR 14.5 dBA)	84.9	73.8	69.4
Resultado (Leq ajustado ≤ Límite, entonces es Aceptable)	Aceptable	Aceptable	Aceptable

NOTA : Operadores utilizan doble protección Auditiva
dBA = decibeles en escala A y respuesta Lenta.
Lmax = lectura más alta durante la medición
Lmin = lectura más baja durante la medición
Leq = promedio ponderado equivalente de datos durante la medición.
Prom. Diurno = promedio logarítmico de Leq registrados de 07:00 a 18:00 horas o turno diurno Mina

Fuente: MSR, 2017.

10.2 Mediciones de Partículas Respirables

Los resultados se muestran en el Cuadro 10-2 y corresponden al área de interior mina y planta de proceso. Como se aprecia en los resultados obtenidos el límite permisible para fracción respirable PM4 y polvo total PM10 se determina que los niveles se encuentran dentro parámetros establecidos. A pesar de no tener un flujo normal en la operación debido a la suspensión temporal de la licencia de explotación se continuaron realizando las mediciones en las áreas. Durante las mediciones del trimestre se obtuvieron resultados dentro de parámetros aceptables, en algunos casos de manera normal y otros después de la aplicación del factor de compensación por homologación de EPP, por lo tanto se está dentro de rango y en ningún momento se excede el límite normal, que es el parámetro que refiere el fabricante para el respirador usado en las áreas de monitoreo, marca 3M código 7502 y filtro 3M código 60926 P100 Homologación NIOSH.

Cuadro 10-2: Resultados de Material Particulado de Salud Ocupacional, Proyecto Minero Escobal

Superficie Planta de Proceso - TRITURACION							2017		
Trimestre							XXII		
Mes	Unidades	NORMA DE REFERENCIA PARA SILICE/SILICONA	AJUSTE DE EXPOSICIÓN CON LA CERTIFICACION DEL FILTRO 7093C/37173 3M P100 (99.97% DE EFICIENCIA MÍNIMA) CON EPP	NORMA µg/m3	GUIA µg/m3		Mayo	Junio	Julio
Hora Inicio				USEPA[1]	BANCO MUNDIAL[2]	OMS[3]	7:00	7:00	7:00
Duración		OSHA	99.97%				11 h	11 h	11 h
OSHA Fraccion Respirable PM_4	mg/m^3	5	16667	150	150	50	0.527	0.011	0.005
OSHA Polvo Total @ PM_{10}	mg/m^3	15	50000	150	150	50	0.962	0.011	0.005

Nota: OSHA Fracción respirable no fue tomado en esta ocasión, sin embargo sea con el uso de EPP o sin el uso de el (ajustando con la norma OSHA) del respirador mismo, ajuste recomendado por el fabricante, estámos dentro de parámetros, es decir que si comparamos aún la norma para fracción respirable con el resultado de Polvo Total, estamos mas que seguros de estar dentro de norma.

Superficie Planta de Proceso - MOLINO							2017		
Trimestre							XXII		
Mes	Unidades	NORMA DE REFERENCIA PARA SILICE/SILICONA	AJUSTE DE EXPOSICIÓN CON LA CERTIFICACION DEL FILTRO 7093C/37173 3M P100 (99.97% DE EFICIENCIA MÍNIMA) CON EPP	NORMA µg/m3	GUIA µg/m3		Mayo	Junio	Julio
Hora Inicio				USEPA[1]	BANCO MUNDIAL[2]	OMS[3]	7:00	7:00	7:00
Duración		OSHA	99.97%				11 h	11 h	11 h
OSHA Fraccion Respirable PM_4	mg/m^3	5	16667	150	150	50	0.051	0.013	0.014
OSHA Polvo Total @ PM_{10}	mg/m^3	15	50000	150	150	50	0.066	0.013	0.014

Nota: OSHA Fracción respirable no fue tomado en esta ocasión, sin embargo sea con el uso de EPP o sin el uso de el (ajustando con la norma OSHA) del respirador mismo, ajuste recomendado por el fabricante, estámos dentro de parámetros, es decir que si comparamos aún la norma para fracción respirable con el resultado de Polvo Total, estamos mas que seguros de estar dentro de norma.

Superficie Planta de Proceso - FILTROS							2017		
Trimestre							XXII		
Mes	Unidades	NORMA DE REFERENCIA PARA SILICE/SILICONA	AJUSTE DE EXPOSICIÓN CON LA CERTIFICACION DEL FILTRO 7093C/37173 3M P100 (99.97% DE EFICIENCIA MÍNIMA) CON EPP	NORMA µg/m3	GUIA µg/m3		Mayo	Junio	Julio
Hora Inicio				USEPA[1]	BANCO MUNDIAL[2]	OMS[3]	7:00	7:00	7:00
Duración		OSHA	99.97%				11 h	11 h	11 h
OSHA Fraccion Respirable PM_4	mg/m^3	5	16667	150	150	50	0.052	0.008	0.048
OSHA Polvo Total @ PM_{10}	mg/m^3	15	50000	150	150	50	0.061	0.008	0.061

Nota: OSHA Fracción respirable no fue tomado en esta ocasión, sin embargo sea con el uso de EPP o sin el uso de el (ajustando con la norma OSHA) del respirador mismo, ajuste recomendado por el fabricante, estámos dentro de parámetros, es decir que si comparamos aún la norma para fracción respirable con el resultado de Polvo Total, estamos mas que seguros de estar dentro de norma.

Interior Mina General							2017		
Trimestre							XXII		
Mes	Unidades	NORMA DE REFERENCIA PARA SILICE/SILICONA	AJUSTE DE EXPOSICIÓN CON LA CERTIFICACION DEL FILTRO 7093C/37173 3M P100 (99.97% DE EFICIENCIA MÍNIMA) CON EPP	NORMA µg/m3	GUIA µg/m3		Mayo	Junio	Julio
Hora Inicio				USEPA[1]	BANCO MUNDIAL[2]	OMS[3]	7:00	7:00	7:00
Duración		OSHA	99.97%				11 h	11 h	11 h
OSHA Fraccion Respirable PM_4	mg/m^3	5	16667	150	150	50	0.709	0.264	0.060
OSHA Polvo Total @ PM_{10}	mg/m^3	15	50000	150	150	50	0.869	0.480	0.073

Nota: OSHA Fracción respirable no fue tomado en esta ocasión, sin embargo sea con el uso de EPP o sin el uso de el (ajustando con la norma OSHA) del respirador mismo, ajuste recomendado por el fabricante, estámos dentro de parámetros, es decir que si comparamos aún la norma para fracción respirable con el resultado de Polvo Total, estamos mas que seguros de estar dentro de norma.

Interior Mina General							2017		
Trimestre							XXII		
Mes	Unidades	NORMA DE REFERENCIA PARA SILICE/SILICONA	AJUSTE DE EXPOSICIÓN CON LA CERTIFICACION DEL FILTRO 7093C/37173 3M P100 (99.97% DE EFICIENCIA MÍNIMA) CON EPP	NORMA µg/m3	GUIA µg/m3		Mayo	Junio	Julio
Hora Inicio				USEPA[1]	BANCO MUNDIAL[2]	OMS[3]	7:00	7:00	7:00
Duración		OSHA	99.97%				11 h	11 h	11 h
OSHA Fraccion Respirable PM_4	mg/m^3	5	16667	150	150	50	4.500	0.039	0.075
OSHA Polvo Total @ PM_{10}	mg/m^3	15	50000	150	150	50	5.610	0.044	0.078

Nota: OSHA Fracción respirable no fue tomado en esta ocasión, sin embargo sea con el uso de EPP o sin el uso de el (ajustando con la norma OSHA) del respirador mismo, ajuste recomendado por el fabricante, estámos dentro de parámetros, es decir que si comparamos aún la norma para fracción respirable con el resultado de Polvo Total, estamos mas que seguros de estar dentro de norma.

Fuente: MSR, 2017.

10.3 Mediciones de Gas

Las mediciones de Gas, se hacen en forma rutinaria (turno a turno) y debido a que no se ha rebasado los límites permisibles cuando se encuentra maquinaria presente trabajando en las áreas según norma OSHA (Tabla Z1 1910.100 Límites para aires contaminados), los sistemas de ventilación se mantienen trabajando de manera normal. Como se puede apreciar en el Cuadro 10-3 se siguió monitoreando la no presencia de Ácido Sulfhídrico - Sulfuro de Hidrógeno (H_2S) y se omitirá hasta detectarse la primera vez. De igual forma, se seleccionará la primera etapa del ciclo que aparezca en las mediciones rutinarias, por lo que en los resultados se ha colocado como mínimo 3 turnos de alguno de los meses del trimestre, a fin de tener información sistematizada.

Cuadro 10-3: Extracto de las mediciones del XXII trimestre, acorde a procedimiento de tomar la primera etapa del ciclo que aparezca.

FECHA	Lugar	Maquinaria	Etapa de Ciclo	CO (PPM)	H2S (PPM)	Hora	Turno	Reportado por
				Límite Máximo Turno 25ppm, Exposición Breve 50 ppm	Límite 10ppm, Valores mayores a 1ppm alertar.			
Estandar de Seguridad	OSHA							
	ACGIH (MSHA)							
29-jun-17	1386-Rampa ZE.	Ninguna.	Bombeo	0	0	08:00	Diurno.	José Carrillo.
	1190-Nivel. EC	Ninguna.	Bombeo	0	0	08:20		
	1190-Nivel. OC	Ninguna.	Bombeo	0	0	09:00		
	1305-Nivel. EC	Ninguna.	Bombeo	0	0	09:20		
	1315-Monollo.EC	Ninguna.	Bombeo	0	0	09:30		
07-jul-17	Rampa Este Central	Ninguna.	Bombeo	0	0	09:00	Diurno	Ludyn Lima
	Nivel 1190	Ninguna.	Bombeo	0	0	09:15		
	Nivel 1215	Ninguna.	Bombeo	0	0	09:30		
	Rampa oeste	Ninguna.	Bombeo	0	0	09:50		
15-jul-17	Rampa Este Central	Ninguna.	Bombeo	0	0	19:55	Nocturno	Ludyn Lima
	Rampa zona este de 1386 a 1355	Ninguna.	Bombeo	0	0	19:35		
	Nivel 1340	Ninguna.	Bombeo	0	0	19:45		
	Nivel 1215	Ninguna.	Bombeo	0	0	20:15		
	Frente 1305 desendente	Ninguna.	Bombeo	0	0	19:40		
	Rampa oeste	Ninguna.	Bombeo	0	0	20:55		

Fuente: MSR, 2017.

11 Conclusiones

11.1 Mediciones del aire en el ambiente

1) El material particulado (**PM_{10}**), los gases de combustión (**SO_2** y **NO_2**) y los niveles de presión sonora (**NPS**) presentaron valores por debajo de las guías establecidos por la USEPA (**PM_{10}, SO_2** y **NO_2**), Banco Mundial (**PM_{10}, SO_2, NO_2** y **NPS**), OMS ((**PM_{10}**, **SO_2** y **NO_2**) y British Columbia (**SO_2** y **NO_2**). Los niveles de PM_{10} se encontraron dentro de los valores máximos y mínimos registrados durante el establecimiento de la línea base del Proyecto y el mercurio en PM_{10} se detectó en todas las estaciones, a excepción de EA-1B, EA-2A, EA-6, encontrándose ligeramente arriba del límite de detección del método.

11.2 Mediciones del agua, sedimentos y efluentes en el ambiente

2) Del control de calidad (blancos de campo) realizado a los dos laboratorios subcontratados (Laboratorio Ecosistemas Proyectos Ambientales S.A. y ACZ Laboratories, Inc.) para el análisis de agua superficial y efluentes, se obtuvieron resultados confiables tanto en la manipulación de las muestras como en los resultados de los análisis.

3) El agua superficial (**SW**), subterránea (**GW**) y los pozos de monitoreo (**MW**) presentaron un pH alcalino y dentro del rango establecido por la USEPA para la salud humana. No se detectó mercurio y cianuro total en ninguna categoría de agua (SW, GW y MW). Se registraron sólidos suspendidos totales en SW y MW y los resultados encontrados están por debajo de lo establecido por las guías del banco mundial (50 mg/L). Se detectaron cloruros en SW, GW y MW, todos los valores por debajo de lo sugerido por la USEPA (250 mg/L). Se detectó arsénico en todas las categorías de agua (SW, GW y MW) y todos los resultados se encontraron por debajo de los establecido por la USEPA (0.01 mg/L) y dentro del rango registrado durante el establecimiento de la línea base.

4) El efluente (**WW9**) de la planta de tratamiento de aguas residuales de tipo especial del proceso de minado cumple con el Acuerdo Gubernativo 236-2006 para entes generadores nuevos para todas las muestras tomadas durante Mayo a Julio 2017.

11.3 Vibraciones, geoquímica de roca estéril y mediciones de seguridad industrial y salud ocupacional

5) Las vibraciones generadas por las voladuras registradas se encuentran por debajo de los límites de detección del equipo (2.5 mm/s); el cual incluso es menor al límite a partir del cual, las vibraciones inducidas por voladuras,

pueden ocasionar daños según la norma establecida por United States Bureau of Mines.

6) Las lecturas de pH en pasta obtenidas de las muestras de material extraídas de mina subterránea fueron alcalinas, lo que indica que no hay indicios de un potencial de generación ácida dentro los túneles.

7) Los resultados obtenidos en los niveles de presión sonora para ambientes laborales, indican que se está por debajo de los límites de nivel de sonido ponderado “A” acorde a OSHA para 24 horas (82-83 dBA) y el acuerdo gubernativo 229. También los resultados de partículas respirables en las estaciones de monitoreo, cumplen con el rango de aceptación que el fabricante establece basado en el equipo marca 3M código 7502 y filtro 3M código 60926 P100 Homologación NIOSH.

12 Anexos

12.1 Caudal Bombeado de Túneles a Planta de Tratamiento y su descarga hacia la Quebrada El Escobal

En las siguientes tablas se presentan las lecturas diarias realizadas a los flujómetros instalados en las cuatro tuberías provenientes de los portales (2 tuberías por portal) y el flujómetro instalado en el clarificador de la Planta de tratamiento de aguas residuales especiales, así como los cálculos del volumen bombeado durante el día de medición y el caudal proyectado por día en cada una de estas tuberías.

El volumen bombeado por día se determinó restando el volumen acumulado del día anterior al volumen acumulado de ese día. El caudal proyectado se determinó suponiendo que el bombeo de agua es constante durante las 24 horas del día (caudal = volumen/tiempo).

Los flujómetros instalados son de tipo ultrasónicos o de efecto Doppler, los cuales tienen la característica de medir el flujo en dos direcciones. Las bombas empleadas para descargar agua procedente de los sumideros ubicados en los portales trabajan a nivel, por tanto se descartan las lecturas de caudal instantáneo ya que los flujómetros instalados registran tanto el caudal instantáneo de ida (signo positivo) como el caudal instantáneo de retorno (signo negativo), lo que conllevaría a reportar caudales menores a los observados en campo.

Mayo 2017																														
Descarga/fecha	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
LECTURA FLUJÓMETRO (m^3)																															
Portal Este (tubería 6")	191513.88	191514.12	191514.36	191527.93	191528.67	191528.69	191528.88	191529.9	191529.9	191529.91	191529.91	191530.22	191530.23	191530.23	191530.32	191530.7	191531.23	191531.23	191531.25	191531.26	191531.29	191532.14	191532.22	191532.22	191532.22	F	150593.67	150601.68	150602.52	150602.52	150602.5
Total Este (tubería 8")	281623.22	282139.19	282875.76	283465.68	283787.38	284194.6	284598.52	285807.94	286991.71	287718.02	289065.71	290637.14	292462	293169.24	293867.23	294848.83	296352.7	296775.66	297912.28	299052.84	300681.74	301970.2	302842.51	303434.06	303964.29	F	124672.41	125105.71	125819.81	126211.22	126482.5
Portal Oeste (tubería 6")	884577.18	885489.61	886179.89	886179.95	886970.7	887956	888871.21	889262.23	889262.29	889262.29	889262.35	889262.35	889555.07	890571.62	891587.5	892432.22	892820.81	892821.11	892826.14	892826.5	893544.28	894080.77	894640.35	895330.56	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.5
Portal Oeste (tubería 8")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clarificador	464000	466300	468475	470793	473048	475200	477432	479684	481834	484132	486723	489133	491514	493890	496450	499107	501425	503786	506211	508827	510860	513819	516555	519205	520769	523491	526868	529755	532663	535197	537912
VOLUMEN BOMBEADO (m^3)																															
Portal Este (tubería 6")	0	0	0	14	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	-191532	150594	8	1	0	0
Total Este (tubería 8")	36	516	737	590	322	407	404	1209	1184	726	1348	1571	1825	707	698	982	1504	423	1137	1141	1629	1288	872	592	530	-303964	124672	433	714	391	271
Portal Oeste (tubería 6")	798	912	690	0	791	985	915	391	0	0	0	0	293	1017	1016	845	389	0	5	0	718	536	560	690	573	0	0	0	0	0	0
Portal Oeste (tubería 8")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clarificador	1330	2300	2175	2318	2255	2152	2232	2252	2150	2298	2591	2410	2381	2376	2560	2657	2318	2361	2425	2616	2033	2959	2736	2650	1564	2722	3377	2887	2908	2534	2715
CAUDAL PROYECTADO (gpm)																															
Portal Este (tubería 6")	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-35114	27609	1	0	0	0
Total Este (tubería 8")	7	95	135	108	59	75	74	222	217	133	247	288	335	130	128	180	276	78	208	209	299	236	160	108	97	-55727	22857	79	131	72	50
Portal Oeste (tubería 6")	146	167	127	0	145	181	168	72	0	0	0	0	54	186	186	155	71	0	1	0	132	98	103	127	105	0	0	0	0	0	0
Portal Oeste (tubería 8")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clarificador	244	422	399	425	413	395	409	413	394	421	475	442	437	436	469	487	425	433	445	480	373	542	502	486	287	499	619	529	533	465	498

m^3: metro cúbico. Gpm: galones por minuto. F: Fallo de flujómetro, sin lectura. Azul: Por información histórica se determina que el flujómetro se reinició. Anaranjado: Por fallo en el flujómetro, se utilizó la lectura de días siguientes para los cálculos. Fuente: MSR, 2017.

Junio 2017																														
Descarga/fecha	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
LECTURA FLUJÓMETRO (m^3)																														
Portal Este (tubería 6")	150602.53	150602.53	150602.53	150602.9	150604.46	150604.49	150604.5	150605.05	150605.89	150606.03	150606.09	150606.24	150606.74	F	150607.61	150607.74	150608.6	150608.6	150608.6	150608.6	150608.62	150608.62	150608.62	150610.65	150610.65	150610.65	150610.66	150610.68	150610.71	150610.71
Total Este (tubería 8")	126734.56	128471.68	128707.75	128935.27	129074.8	129096.57	129143.3	129149.64	129202.38	129306.77	129444.42	129464.04	129483.92	F	129516.69	129545.19	129545.2	129617.41	129709.97	129899.89	130043	130145.34	130187.01	130191.93	130192.22	130211.08	130212.02	130247.47	130829.16	131374.61
Portal Oeste (tubería 6")	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	895903.52	895903.52	895903.52	895903.52
Portal Oeste (tubería 8")	0	0	0	0	0	0	0	0	0	0	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	0	0	0	0
Clarificador	541175	544234	547343	550365	553388	556180	559805	562548	565180	567927	570463	573249	575671	578250	580700	583401	586063	589192	592013	595148	598132	601120	604248	607434	610814	613860	616546	619032	622371	625571
VOLUMEN BOMBEADO (m^3)																														
Portal Este (tubería 6")	0	0	0	0	2	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0
Total Este (tubería 8")	252	1737	236	228	140	22	47	6	53	104	138	20	20	16	16	28	0	72	93	190	143	102	42	5	0	19	1	35	582	545
Portal Oeste (tubería 6")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portal Oeste (tubería 8")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clarificador	3263	3059	3109	3022	3023	2792	3625	2743	2632	2747	2536	2786	2422	2579	2450	2701	2662	3129	2821	3135	2984	2988	3128	3186	3380	3046	2686	2486	3339	3200
CAUDAL PROYECTADO (gpm)																														
Portal Este (tubería 6")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Este (tubería 8")	46	318	43	42	26	4	9	1	10	19	25	4	4	3	3	5	0	13	17	35	26	19	8	1	0	3	0	6	107	100
Portal Oeste (tubería 6")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portal Oeste (tubería 8")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clarificador	598	561	570	554	554	512	665	503	483	504	465	511	444	473	449	495	488	574	517	575	547	548	573	584	620	558	492	456	612	587

m^3: metro cúbico. Gpm: galones por minuto. F: Fallo de flujómetro, sin lectura. Anaranjado: Por fallo en el flujómetro, se utilizó la lectura de días siguientes para los cálculos. Fuente: MSR, 2017.

Julio 2017																														
Descarga/fecha	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
LECTURA FLUJÓMETRO (m^3)																															
Portal Este (tubería 6")	150610.71	150610.71	150610.71	150610.71	150610.71	150610.71	150610.71	150610.72	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	150610.85	F	F	F	F
Total Este (tubería 8")	131381.1	131408.98	131518.17	131544.75	131551.75	131604.31	131669.16	131736.55	131796.62	131803.89	131813.02	131824.34	131853.57	131958.45	132026.73	132090.32	132132.64	132228.11	132343.81	132357.66	132365.31	132388.87	132393.87	132425.54	132524.28	132568.84	132568.84	F	F	F	F
Portal Oeste (tubería 6")	F	F	F	F	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	895903.52	F	F	F	F	F	F	F	F	F	F	F	F
Portal Oeste (tubería 8")	F	F	F	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	F	F	F	F	F	F	F	F	F	F	F	F
Clarificador	628540	631656	634720	637795	640882	643949	646802	649901	653109	656073	659110	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726	659726
VOLUMEN BOMBEADO (m^3)																															
Portal Este (tubería 6")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Este (tubería 8")	6	28	109	27	7	53	65	67	60	7	9	11	29	105	68	64	42	95	116	14	8	24	5	32	99	45	0		0	0	0
Portal Oeste (tubería 6")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portal Oeste (tubería 8")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clarificador	2969	3116	3064	3075	3087	3067	2853	3099	3208	2964	3037	616	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAUDAL PROYECTADO (gpm)																															
Portal Este (tubería 6")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Este (tubería 8")	1	5	20	5	1	10	12	12	11	1	2	2	5	19	13	12	8	18	21	3	1	4	1	6	18	8	0		0	0	0
Portal Oeste (tubería 6")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portal Oeste (tubería 8")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clarificador	544	571	562	564	566	562	523	568	588	543	557	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

m^3: metro cúbico. Gpm: galones por minuto. F: Fallo de flujómetro, sin lectura. Fuente: MSR, 2017.

12.2 Análisis In Situ y kit de cianuro (CN) en efluentes

Mayo 2017																															
Parámetro	**Unidades**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
Efluente Planta de Tratamiento Agua de Túneles (WW9)																																
pH	u.e.	7.89	7.72	Sin Descarga			6.83	7.55	7.53	7.3	7.73	7.01	8.23	7.76	7.54	7.21	7.49	7.21	7.47	7.45	6.14	Sin Descarga	6.68	6.99	7.79	Sin Descarga	6.78	6.92	7.29	6.5	Sin Descarga	6.7
Temperatura	°C	26.3	26.5				25.2	25.2	25.5	21.4	25.9	24.9	23.5	25.3	23.8	26.6	26.7	25.7	22.3	26	26.1		26	26.4	23.5		25.8	25.8	25.8	25.4		26.6
Conductividad	µS/cm	2219	2112				2100	2026	2039	1965	2030	2027	1976	1998	1929	3131	1944	2008	2199	2033	1987		2129	1992	1591		1891	2004	2056	1861		1934
Turbidez	NTU	6.5	5.15				8.01	22.6	9.01	5.38	7.6	12	3.89	3.8	6.34	33.1	4.6	16.9	15.1	22.7	18.7		7.72	19.6	60.7		7.52	9.76	12.6	8.83		NA
kit CN	mg/L	0.006	0.009				0.007	0.000	0.005	0.002	0.005	0.000	0.006	0.002	0.004	0.000	0.000	0.027	0.002	0.003	0.013		0.01	0.01	0.007		0.015	0.011	0.004	0.007		0.009
CN Total		NA	NA				NA	NA	<0.003	NA	NA	NA	<0.003	NA	NA	NA	NA	NA	<0.003	<0.003	NA		<0.003	NA	NA		<0.003	NA	<0.003	NA		NA
Pileta de Cumplimiento Ambiental (EP-3 o pileta 3)																																
pH	u.e.	9.19	8.99	8.94	8.85	8.63	8.7	8.21	7.98	7.9	8	7.82	7.91	8.22	8.13	8.22	7.64	8	8.56	8.46	8.41	8.29	8.29	8.28	8.11	8.14	8.23	8.24	7.91	8.2	8.73	8.6
Temperatura	°C	25.1	23.5	21.8	23.1	21	20.7	20.4	22.6	23.4	22.6	23.2	23	24.4	23.9	27.8	24.7	25.2	24.5	25	25.1	25.5	24.3	25	24.2	24.3	23.5	25	24.5	23.4	24.6	24.4
Conductividad	µS/cm	131.5	159.6	666.2	128.1	112.7	129	114.7	1227	1256	1287	1285	1267	1133	1112	1045	1081	1058	871.6	866.9	1003	860.6	818.5	792.4	752.2	770.3	772.1	1568	707.3	690.4	688.7	696.7
Turbidez	NTU	44	38.7	33.7	30.5	25.9	23.3	16.8	24.5	19.1	7.25	10.5	3.9	22.4	10.2	12.1	16.5	9.31	29.3	13.2	11.7	10.4	48.6	29.5	20.6	26.9	17.9	17.9	37.8	13.4	13.2	12.7
Kit CN	mg/L	0.008	0.005	0.002	0.000	0.002	0.002	0.002	0.000	0.003	0.003	0.000	0.001	0.001	0.002	0.008	0.006	0.005	0.001	0.000	0.003	0.001	0.001	0.002	0.000	0.006	0.003	0.000	0.000	0.001	0.001	0.000
CN Total		NA	NA	NA	NA	<0.003	NA	NA	0.009	NA	NA	NA	<0.003	NA	NA	NA	NA	NA	NA	0.003	NA	0.007	NA	NA	NA	NA	<0.003	NA	<0.003	NA	NA	NA

u.e.: unidades exponenciales. mg/L: miligramos por litro. µS/cm: micro siemens por centímetro. °C: grados centígrados. NTU: unidades naftalométricas de turbidez. NA: no analizado. Fuente: MSR, 2017.

Junio 2017																												
Parámetro	**Unidades**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Efluente Planta de Tratamiento Agua de Túneles (WW9)																															
pH	u.e.	Sin Descarga		6.05	7.23	Sin Descarga	7.36	Sin Descarga		4.63	9.01	7.28	Sin Descarga		7.42	7.37	7.38	7.6	7.65	8.06	8.39	8.1	7.94	8.04	7.77	8.24	8.14	8.17	8.17	8.12	8.23
Temperatura	°C			26.5	26.6		23.9			23.9	25.5	27.1			24.6	25	25.8	26.4	25.8	26.2	25.8	25	25.5	26.2	26.5	26.6	25.8	26.8	25	25	27.2
Conductividad	µS/cm			1924	1810		2004			1956	1903	2035			1888	1991	1948	1900	963.4	1941	1945	1917	1953	1965	2148	1090	2010	2066	1914	1973	1933
Turbidez	NTU			7.02	10		14.2			10.9	7.67	28.9			7.6	6.3	14.6	6.18	7.37	18.5	14.1	6	10.1	8.88	10.9	3.2	3.3	11.9	17.9	12.4	13.3
kit CN	mg/L			0.007	0.002		0.007			0.003	0.005	0.006			0.006	0.006	0.005	0.000	0.004	0.001	0.016	0.003	0.002	0.000	0.005	0.006	0.003	0.009	0.004	0.007	0.004
CN Total				NA	<0.003		NA			<0.003	NA	NA			NA	NA	<0.003	NA	<0.003	NA	NA	NA	NA	<0.003	NA	NA	NA	NA	NA	NA	<0.003
Pileta de Cumplimiento Ambiental (EP-3 o pileta 3)																															
pH	u.e.	8.48	8.48	8.56	8.62	8.21	8.29	8.24	8.3	8.52	8.27	8.43	8.41	8.46	8.32	8.25	8.23	8.33	8.58	8.61	7.91	8.47	8.49	8.22	8.11	7.97	8.05	7.96	7.76	8.03	8.14
Temperatura	°C	25.5	24.4	24.5	25.4	24.6	26.6	25	25.4	24.1	24.4	23.3	25.1	17	22.9	22.4	18.1	22.3	21.7	23.3	21.9	21.7	22	22.7	22.2	21.2	25	23.1	23.3	29.9	22.4
Conductividad	µS/cm	690.8	694.2	702.2	729.5	710.8	708.8	705.3	726.1	650.1	697.4	744.6	744	893.8	742.2	746.7	832.1	598	852.4	586.6	599.6	661.3	799	707	775.8	770.4	733.1	769.2	810.4	838	952.1
Turbidez	NTU	10.1	6.99	7.55	5.2	4.77	6.55	2.83	2.99	4.43	3.86	30.6	27.4	13	66.9	100	72.1	85.4	50.8	78.3	33.3	92.1	37	38.6	57.5	20.7	14.9	15.2	14.7	36.9	55.2
Kit CN	mg/L	0.001	0.001	0.007	0.000	0.003	0.001	0.004	0.000	0.005	0.004	0.002	0.002	0.000	0.002	0.005	0.001	0.002	0.000	0.004	0.008	0.007	0.003	0.005	0.000	0.007	0.001	0.009	0.000	0.006	0.007
CN Total		NA	0.005	NA	NA	0.004	NA	NA	NA	0.01	NA	NA	NA	NA	NA	NA	0.006	NA	NA	NA	NA	NA	NA	0.009	NA	0.011	NA	NA	NA	NA	<0.003

u.e.: unidades exponenciales. mg/L: miligramos por litro. µS/cm: micro siemens por centímetro. °C: grados centígrados. NTU: unidades naftalométricas de turbidez. NA: no analizado. Fuente: MSR, 2017.

Julio 2017																															
Parámetro	**Unidades**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
Efluente Planta de Tratamiento Agua de Túneles (WW9)																																
pH	u.e.	8.17	8.13	8.01	7.83	6.36	8.17	8.11	8.03	7.98	8.1	7.12	Sin Descarga																			
Temperatura	°C	24.7	26.4	26.2	25	26.9	25	28.5	25.1	26.3	26.3	18.2																				
Conductividad	µS/cm	1961	1923	2031	2266	2193	1974	1958	1964	1989	1993	2429																				
Turbidez	NTU	6.78	21.6	23.4	20.4	26.3	17.8	8.5	9.39	8.38	24.5	9.44																				
kit CN	mg/L	0.004	0.000	0.002	0.001	0.001	0.004	0.002	0.005	0.007	0.003	0.000																				
Pileta de Cumplimiento Ambiental (EP-3 o pileta 3)																																
pH	u.e.	8.1	8.05	7.82	Sin descarga		8.34	8.23	8.34	8.44	Sin descarga		8.09	8.08	8.04	8.27	7.46	7.79	7.96	6.94	8.01	7.91	7.96	8.07	Sin descarga		8.02	8.1	8.01		
Temperatura	°C	22.7	23.5	25			26.6	22.3	23.3	23.7			23.3	22.6	23.6	24.1	23.2	23.6	23.3	23.1	24.2	24.5	24.2	24			23.5	24.4	24.3		
Conductividad	µS/cm	1020	1011	992.4			938.1	858.1	771.5	726.6			847.4	1209	1454	1419	1423	1517	1584	1628	1736	1785	1794	1751			1937	1925	1743		
Turbidez	NTU	31.1	23.6	20.3			22.3	76.2	19.3	30.7			7.07	18.6	18.5	14.5	7.96	11.4	9.88	7.28	12.9	13.9	10.4	18.7			5.41	6.84	28.9		
kit CN	mg/L	0.005	0.000	0.002			0.000	0.000	0.005	0.003			0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.006	0.003	0.000	0.000			0.000	0.000	0.002		

u.e.: unidades exponenciales. mg/L: miligramos por litro. µS/cm: micro siemens por centímetro. °C: grados centígrados. NTU: unidades naftalométricas de turbidez. NA: no analizado. Fuente: MSR, 2017.

Con el objetivo de verificar si los resultados obtenidos con el método colorimétrico empleado para la determinación rápida de Cianuro (kit de CN), desde el mes de Octubre 2013 se enviaron varias muestras duplicado al laboratorio ACZ para realizar análisis de Cianuro Total.

Según los resultados obtenidos, con el kit colorimétrico se obtienen resultados no confiables debido a que presentan una gran desviación positiva con respecto a los resultados obtenidos en el laboratorio acreditado. Como medida correctiva se investigarán las fuentes de dicha desviación; entre las cuales se contemplan la contaminación cruzada, sustancias contenidas en las aguas analizadas que puedan interferir en el análisis, error humano al realizar el análisis, entre otras. Se realizarán los cambios necesarios para obtener resultados más confiables.

12.3 Resultados crudos de calidad de aire

12.3.1 Material Particulado (PM_{10})

BGI PQ200 Air Sampling System

Downloaded May 2017

Job Details:

Job Name:	EA-1A
Version:	PQ200
Serial No:	3.00
Pump Time:	
Flags:	NA

Job Code:	EA-1A
Site Name:	Los Planes (Top Soil Deposit)
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	650	644	648	mmHg
TA	27.9	16.0	20.3	°C
Q	---	---	16.71	Lpm

QCV	NA	%
Max overheat	NA	°C
occured	NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	4-May-17	13:45:00
Stop:	5-May-17	13:45:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3246-0220**	
Final Wt:	148.940	mg
Initial Wt:	148.270	mg
Delta Wt:	0.670	mg
Total Vol:	24.04	m^3
Mass Conc:	**27.87**	**µg/m^3**

Notes 1: Depósito de Suelos, Proyecto El Escobal
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded February 2017

Job Details:

Job Name:	EA-1B
Version:	PQ200
Serial No:	3.00
Pump Time:	
Flags:	NA

Job Code:	EA-1B
Site Name:	San Rafael Las Flores
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	652	648	650	mmHg
TA	29.4	18.8	23.0	°C
Q	---	---	16.71	Lpm

QCV	NA	%
Max overheat	NA	°C
occured	NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	23-May-17	12:00:00
Stop:	24-May-17	12:00:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3269-1414**	
Final Wt:	148.020	mg
Initial Wt:	147.430	mg
Delta Wt:	0.590	mg
Total Vol:	24.04	m^3
Mass Conc:	**24.54**	**µg/m^3**

Notes 1: San Rafael Las Flores, Santa Rosa.
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded February 2017

Job Details:

Job Name:	EA-2A
Version:	PQ200
Serial No:	1.00
Pump Time:	
Flags:	NA

Job Code:	EA-2A
Site Name:	La Cuchilla.
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	634	628	632	mmHg
TA	28.2	17.8	21.4	°C
Q	---	---	16.70	Lpm

QCV	NA	%
Max overheat	NA	°C
occured	NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	9-May-17	15:35:00
Stop:	10-May-17	15:35:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3263-0808**	
Final Wt:	147.390	mg
Initial Wt:	146.880	mg
Delta Wt:	0.510	mg
Total Vol:	24.04	m^3
Mass Conc:	**21.21**	**µg/m^3**

Notes 1: Aldea La Cuchilla, San Rafael Las Flores, Santa Rosa.
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded February 2017

Job Details:

Job Name:	EA-3
Version:	PQ200
Serial No:	3.00
Pump Time:	
Flags:	NA

Job Code:	EA-3
Site Name:	El Fucío, zona este.
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	627	622	625	mmHg
TA	27.2	16.7	20.2	°C
Q	---	---	16.70	Lpm
QCV			NA	%
Max overheat			NA	°C
occured	NA			

Timer Information:

	Date (dd-mmm)	Time (hh:mm:ss)
Start:	9-May-17	14:35:00
Stop:	10-May-17	14:35:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3265-1010**	
Final Wt:	147.780	mg
Initial Wt:	147.200	mg
Delta Wt:	0.580	mg
Total Vol:	24.03	m^3
Mass Conc:	**24.14**	**µg/m^3**

Notes 1: Aldea El Fucío, San Rafael Las Flores, Santa Rosa.
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded February 2017

Job Details:

Job Name:	EA-3A
Version:	PQ100
Serial No:	3.00
Pump Time:	
Flags:	NA

Job Code:	EA-3A
Site Name:	Aldea El Fucío
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	646	643	644	mmHg
TA	27.0	17.3	21.3	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured	NA			

Timer Information:

	Date (dd-mmm)	Time (hh:mm:ss)
Start:	12-May-17	10:50:00
Stop:	13-May-17	10:50:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3264-0909**	
Final Wt:	148.450	mg
Initial Wt:	147.900	mg
Delta Wt:	0.550	mg
Total Vol:	24.03	m^3
Mass Conc:	**22.89**	**µg/m^3**

Notes 1: Aldea El Fucío, San Rafael Las Flores, Santa Rosa.
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded February 2017

Job Details:

Job Name:	EA-4A
Version:	PQ200
Serial No:	3.00
Pump Time:	
Flags:	NA

Job Code:	EA-4A
Site Name:	Aldea Los Ángeles
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	650	647	649	mmHg
TA	29.8	18.0	22.7	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured	NA			

Timer Information:

	Date (dd-mmm)	Time (hh:mm:ss)
Start:	16-May-17	10:56:00
Stop:	17-May-17	10:56:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3267-1212**	
Final Wt:	149.490	mg
Initial Wt:	148.580	mg
Delta Wt:	0.910	mg
Total Vol:	24.03	m^3
Mass Conc:	**37.87**	**µg/m^3**

Notes 1: Caserío El Portón de los Ángeles, San Rafael Las Flores, Santa Rosa
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded February 2017

Job Details:

Job Name:	EA-5A
Version:	PQ100
Serial No:	1.00
Pump Time:	
Flags:	NA

Job Code:	EA-5A
Site Name:	Sabana Redonda
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	652	649	651	mmHg
TA	29.7	17.9	23.1	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured	NA			

Timer Information:

	Date (dd-mmm)	Time (hh:mm:ss)
Start:	16-May-17	11:46:00
Stop:	17-May-17	11:46:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	3266-1111	
Final Wt:	149.670	mg
Initial Wt:	148.970	mg
Delta Wt:	0.700	mg
Total Vol:	24.04	m^3
Mass Conc:	**29.12**	**µg/m^3**

Notes 1: Aldea Sabana Redonda, San Rafael Las Flores, Santa Rosa

Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded February 2017

Job Details:

Job Name:	EA-6
Version:	PQ200
Serial No:	1.00
Pump Time:	
Flags:	NA

Job Code:	EA-6
Site Name:	Carretera a Mataquesquintla
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	644	640	642	mmHg
TA	24.8	17.8	21.7	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured	NA			

Timer Information:

	Date (dd-mmm)	Time (hh:mm:ss)
Start:	23-May-17	12:49:00
Stop:	24-May-17	12:49:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	3268-1313	
Final Wt:	146.550	mg
Initial Wt:	146.070	mg
Delta Wt:	0.480	mg
Total Vol:	24.04	m^3
Mass Conc:	**19.97**	**µg/m^3**

Notes 1: Carretera a Mataquesquintla, al norte del Proyecto, San Rafael Las Flores Santa Rosa

Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded February 2017

Job Details:

Job Name:	EA-7A
Version:	PQ200
Serial No:	3.00
Pump Time:	
Flags:	NA

Job Code:	EA-7A
Site Name:	Los Planes
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	652	647	650	mmHg
TA	29.8	17.0	21.2	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured	NA			

Timer Information:

	Date (dd-mmm)	Time (hh:mm:ss)
Start:	6-May-17	13:34:00
Stop:	7-May-17	13:34:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	3262-0707	
Final Wt:	146.790	mg
Initial Wt:	146.380	mg
Delta Wt:	0.410	mg
Total Vol:	24.03	m^3
Mass Conc:	**17.06**	**µg/m^3**

Notes 1: Aldea Los Planes, San Rafael Las Flores, Santa Rosa.

Notes 2: Minera San Rafael, S.A.

Reporte Analítico RA-17-11716

Cliente: Minera San Rafael, S.A.

Dirección: Boulevard Los Próceres, 18 calle 24-69 z. 10, Centro Empresarial Zona Pradera, Oficina 1406 torre IV

Proyecto: 178-089 (El Escobal)

Análisis de muestras: Junio, 06 al 08 de 2017

Emisión de reporte: Junio, 08 de 2017

Tipo de muestra: Filtros de cuarzo utilizados para colección de material particulado en aire.

Análisis: Gravimetría en filtros.

Método analítico: 40 CFR, Apéndice J, Parte 50, Capítulo 1, Edición 07-1-97, EPA. Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere. **Acreditado ISO 17025**

Cuadro 1: resultados de filtros peso final

No.	Identificación de la muestra	Código de filtro[1]	Peso inicial* (gramos)	Peso final (gramos)	Incertidumbre (gramos)
Límite de detección del método			0.00005		Al 95% confia1nza K=2
1	EA-1A	3246-0220	0.14827	0.14894	± 0.00005
2	EA-1B	3269-1414	0.14743	0.14802	
3	EA-2A	3263-0808	0.14688	0.14739	
4	EA-3	3265-1010	0.14720	0.14778	
5	EA-3A	3264-0909	0.14790	0.14845	
6	EA-4A	3267-1212	0.14858	0.14949	
7	EA-5A	3266-1111	0.14897	0.14967	
8	EA-6	3268-1313	0.14607	0.14655	
9	EA-7A	3262-0707	0.14638	0.14679	
10	EA-10	3272-1717	0.14875	0.14879	

[1]: Código de filtro asignado por Laboratorio Ambiental, S.A. *: Corresponde a los pesos iníciales indicado en reportes analíticos RA-17-11701. La incertidumbre del método es de **± 0.00005 g**

Tronco I, sector E, lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

Anexos:

Anexo 1. Cadena de Custodia R-02-00909

Este Reporte Analítico ha sido elaborado para uso confidencial y exclusivo del cliente; se prohíbe su reproducción, sin la aprobación escrita del Laboratorio. Los resultados aquí expresados representan el mejor juicio del Laboratorio y son válidos únicamente para la porción de muestra presentada a éste. Laboratorio Ambiental, S.A. no asume ninguna responsabilidad ni garantiza la utilización final que se le dé a la información aquí presentada. Laboratorio Ambiental, S.A. no se responsabiliza por el proceso de muestreo. En caso de requerir alguna modificación en este reporte analítico, solicitarla dentro de los siguientes 30 días a partir de la fecha en que el Laboratorio envió el reporte.

Ing. Diego Silva
Ingeniero Químico, Gestor de Calidad
Colegiado 1595

MSc. BSc. Ana Gabriela Juárez
Especialista ambiental, Director de Laboratorio

Redacción:	Fecha:	Revisión:	Fecha:	Aprobación:	Fecha:	Versión cliente:
G.C.	Jun., 08/17	J.J.	Jun., 08/17	A.G.J.	Jun. 09/17	**02**

Tronco I, sector E, lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

CADENA DE CUSTODIA

Laboratorio Ambiental, S.A.
Tronco 1, Sector E, Lote 14 El Encinal, zona 7 de Mixco, Guatemala, Guatemala.
Teléfono: 24318187, Fax 24318108 ext. 102
www.laboratorio-ambiental.com

Información General				Información para el Reporte	
Empresa	Minera San Rafael			Reportar a:	Erik von Quednow
Contacto	Ing. Miguel Berganza			Proyecto:	Mina El Escobal
Dirección	Blvd. Los Próceres 5, VB C. 24-69 z 10 Empresarial Zona Pradera of. 1406 Torre IV			Formato para reporte[2]	~~WORD~~, PDF, XLS
				Dirección reporte:	Ver info. gral.
Ciudad	Guatemala	Tel. / Cel.	59515248	Observaciones:	
País	GT				
e-mail	mberganza@sanrafael.com.gt				

Plazo de entrega de Reporte (PER)[2]

PER Regular:
- [x] 6 a 8 dias Laborales

PER agilizado: (previa aprobación vía e-mail)
- [ ] 48 a 72 horas
- [ ] 72 a 96 horas

Otro:

Cadena de Custodia No. R-02- 00909

Pág. 1 de 2

Instrucciones

Completar la información solicitada con letra legible.
1. Para uso exclusivo de Laboratorio Ambienta,l dejar en blanco
2. Indicar si se requiere en formato de reporte: **W**ord, **PDF** ó **E**lectrónico
3. Colocar el número de recipientes que correspondan a la descripción del encabezado.

No.	Identificación de las Muestra	Identificación laboratorio[1]	Fecha del muestreo	No. Total recipiente	Descripción recipiente[3]: Vidrio	Porta filtros	Plástico	Otros	Tipo de Matriz[3]: Agua	Aire	Filtros	Macroinvertebrados	Peces	Fauna y Flora	Otros	Preservante[3]: Frio	HNO3	H2SO4	HCl	NaOH	Etanol	Otro	Parámetros a analizar[2] — Fisico-químico de Agua: Alcalinidad	Dureza Total	DQO / DBO 5	Nitrógeno total	Fósforo Total	Cromo hexavalente	Color	Aceites & Grasas / TPH	Metales / Cianuro/Hg	Sólidos totales	Sólidos Suspendidos Totales	Sólidos Disueltos Totales	Microb: Coliformes totales	Colofirmes fecales	E-Coli	Filtros: Pesado Inicial	Pesado final	~~Hg~~	Aire: PM_{10}	NO_2 y SO_2	Biología: Id.Tax. Macroinvertebrados	Id. Tax. Peces	Id.Tax. Herpetofauna	Ecotoxicidad	Varios: Descarga/Análisis de datos	Otro:	Observaciones
1	EA-1A	3246-0220	04/05/07	1		1					X																												X												Favor devolver filtro.
2	EA-1B	3269-1414	23/05/17	1		1					X																												X	X										
3	EA-2A	3263-0808	09/05/17	1		1					X																												X	X										
4	EA-3	3265-1010	09/05/17	1		1					X																												X											Favor devolver filtro.
5	EA-3A	3264-0904	12/05/17	1		1					X																												X	X										
6	EA-4A	3267-1212	16/05/17	1		1					X																												X	X										
7	EA-5A	3266-1111	16/05/17	1		1					X																												X	X										
8	EA-6	3268-1313	23/05/17	1		1					X																												X	X										
9	EA-7A	3262-0707	06/05/17	1		1					X																												X	X										
10	EA-10	3272-1717	27/05/17	1		1					X																												X	X										
11																																																		
12																																																		
13																																																		
14																																																		
15																																																		

Ingreso	Material Entregado por / Firma	Erik von Quednow	Fecha	01/06/2017	Hora	07:15	Para Uso Exclusivo del laboratorio[1]
	Material Recibido por / Firma	G. CUELLAR	Fecha	02-06-17	Hora	11:00	Estado de las muestras: Bueno [X] Malo [ ] (especificar en observaciones)
Egreso	Material Entregado por / Firma		Fecha		Hora		Temperatura de muestras: T. AMBIENTE pH:
	Material Recibido por / Firma		Fecha		Hora		Observaciones:

BGI PQ200 Air Sampling System

Downloaded June 2017

Job Details:

Job Name: EA-1A
Version: PQ200
Serial No: 1.00
Pump Time:
Flags: NA

Job Code: EA-1A
Site Name: Los Planes (Top Soil Deposit)
Station Code:
Operators: EvQ
User1: NA
User2: NA

	Max	Min	Avg	Units
BP	651	648	649	mmHg
TA	31.0	16.6	21.0	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured			NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	7-Jun-17	10:21:00
Stop:	8-Jun-17	10:21:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3289-1717**	
Final Wt:	148.520	mg
Initial Wt:	147.860	mg
Delta Wt:	0.660	mg
Total Vol:	24.04	m^3
Mass Conc:	**27.45**	**µg/m^3**

Notes 1: Depósito de Suelos, Proyecto El Escobal
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded June 2017

Job Details:

Job Name: EA-2A
Version: PQ200
Serial No: 2
Pump Time:
Flags: NA

Job Code: EA-2A
Site Name: La Cuchilla.
Station Code:
Operators: EvQ
User1: NA
User2: NA

	Max	Min	Avg	Units
BP	637	629	633	mmHg
TA	29.2	16.0	20.2	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured			NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	14-Jun-17	10:12:00
Stop:	15-Jun-17	10:12:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3286-1414**	
Final Wt:	146.760	mg
Initial Wt:	146.570	mg
Delta Wt:	0.190	mg
Total Vol:	24.04	m^3
Mass Conc:	**7.90**	**µg/m^3**

Notes 1: Aldea La Cuchilla, San Rafael Las Flores, Santa Rosa.
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded June 2017

Job Details:

Job Name: EA-3
Version: PQ200
Serial No: 1
Pump Time:
Flags: NA

Job Code: EA-3
Site Name: El Fucío, zona este.
Station Code:
Operators: EvQ
User1: NA
User2: NA

	Max	Min	Avg	Units
BP	627	624	625	mmHg
TA	26.9	15.5	19.4	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured			NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	14-Jun-17	11:05:00
Stop:	15-Jun-17	11:05:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3287-1515**	
Final Wt:	145.320	mg
Initial Wt:	145.130	mg
Delta Wt:	0.190	mg
Total Vol:	24.04	m^3
Mass Conc:	**7.90**	**µg/m^3**

Notes 1: Aldea El Fucío, San Rafael Las Flores, Santa Rosa.
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded April 2017

Job Details:

Job Name: EA-7A
Version: PQ200
Serial No: 2.00
Pump Time:
Flags: NA

Job Code: EA-7A
Site Name: Los Planes
Station Code:
Operators: EvQ
User1: NA
User2: NA

	Max	Min	Avg	Units
BP	653	650	651	mmHg
TA	31.3	17.1	21.2	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured			NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	7-Jun-17	10:00:00
Stop:	8-Jun-17	10:00:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3283-1111**	
Final Wt:	146.820	mg
Initial Wt:	146.150	mg
Delta Wt:	0.670	mg
Total Vol:	24.04	m^3
Mass Conc:	**27.87**	**µg/m^3**

Notes 1: Aldea Los Planes, San Rafael Las Flores, Santa Rosa.
Notes 2: Minera San Rafael, S.A.

Reporte Analítico RA-17-11727

Cliente: Minera San Rafael, S.A.

Dirección: Boulevard Los Próceres, 18 calle 24-69 z. 10, Centro Empresarial Zona Pradera, Oficina 1406 torre IV

Proyecto: 178-089 (El Escobal)

Análisis de muestras: Julio, 03 al 06 de 2017

Emisión de reporte: Julio, 06 de 2017

Tipo de muestra: Filtros de cuarzo utilizados para colección de material particulado en aire.

Análisis: Gravimetría en filtros.

Método analítico: 40 CFR, Apéndice J, Parte 50, Capítulo 1, Edición 07-1-97, EPA. Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere. **Acreditado ISO 17025**

Cuadro 1: resultados de filtros peso final

No.	Identificación de la muestra	Código de filtro[1]	Peso inicial* (gramos)	Peso final (gramos)	Incertidumbre (gramos)
Límite de detección del método			0.00005		Al 95% de confianza K=2
1	3289-1717	EA-1A	0.14786	0.14852	± 0.00005
2	3286-1414	EA-2A	0.14657	0.14676	
3	3287-1515	EA-3A	0.14513	0.14532	
4	3283-1111	EA-7A	0.14615	0.14682	

[1]: Código de filtro asignado por Laboratorio Ambiental, S.A. *: Corresponde a los pesos iníciales indicado en reportes analíticos RA-17-11712.

Tronco I, sector E, lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

Anexos:

Anexo 1. Cadena de Custodia R-02-00910

Ing. Diego Silva
Ingeniero Químico, Gestor de Calidad
Colegiado 1595

MSc. BSc. Ana Gabriela Juárez
Especialista ambiental, Director de Laboratorio

Redacción:	Fecha:	Revisión:	Fecha:	Aprobación:	Fecha:	Versión cliente:
G.C.	Jul., 06/17	D.S.	Jul., 06/17	A.G.J.	Jul. 06/17	**02**

Tronco I, sector E, lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

CADENA DE CUSTODIA

Laboratorio Ambiental, S.A.
Tronco 1, Sector E, Lote 14 El Encinal, zona 7 de Mixco, Guatemala, Guatemala.
Teléfono: 24318187, Fax 24318108 ext. 102
www.laboratorio-ambiental.com

Información General				Información para el Reporte	
Empresa	Minera San Rafael			Reportar a:	Erik von Ovedhow
Contacto	Ing. Miguel Bergamza			Proyecto:	Mina El Escobal
Dirección	Blvd. Los Próceres 18/c. 24-69 Z:10 Empresarial Zona Pradera. Torre IV of. 1406			Formato para reporte[2]	PDF, Electrónico (Excel)
				Dirección reporte:	evon@sanrafael.com.gt
Ciudad	Guatemala	Tel. / Cel.	59515248	Observaciones:	
País	GT				
e-mail	MBergamza@sanrafael.com.gt				

Plazo de entrega de Reporte (PER)[2]

PER Regular:
- ☒ 6 a 8 dias Laborales

PER agilizado: (previa aprobación vía e-mail)
- ☐ 48 a 72 horas
- ☐ 72 a 96 horas

Otro:

Cadena de Custodia No. R-02- 00910

Pág. 1 de 2

Instrucciones

Completar la información solicitada con letra legible.
1. Para uso exclusivo de Laboratorio Ambienta,l dejar en blanco
2. Indicar si se requiere en formato de reporte: **W**ord, **PDF** ó Electrónico
3. Colocar el número de recipientes que correspondan a la descripción del encabezado.

No.	Identificación de las Muestra	Identificación laboratorio[1]	Fecha del muestreo	No. Total recipiente	Descripción recipiente[3]: Vidrio	Porta filtros	Plástico	Otros	Tipo de Matriz[3]: Agua	Aire	Filtros	Macroinvertebrados	Peces	Fauna y Flora	Otros	Preservante[3]: Frio	HNO3	H2SO4	HCl	NaOH	Etanol	Otro	Parámetros a analizar[2] — Fisico-químico de Agua: Alcalinidad	Dureza Total	DQO / DBO s	Nitrógeno total	Fósforo Total	Cromo hexavalente	Color	Aceites & Grasas / TPH	Metales / Cianuro/Hg	Sólidos totales	Sólidos Suspendidos Totales	Sólidos Disueltos Totales	Microb: Coliformes totales	Coliformes fecales	E-Coli	Filtros: Pesado Inicial	Pesado final	Si, C, Hg o Metales	Aire: PM_{10}	NO_2 y SO_2	Biología: Id.Tax. Macroinvertebrados	Id. Tax. Peces	Id.Tax. Herpetofauna	Ecotoxicidad	Varios: Descarga/Análisis de datos	Otro:	Observaciones
1	EA-1A	3289-1717	7/6/17	1		1					X																											X												Favor devolver filtro.
2	EA-2A	3286-1414	14/06/17	1		1					X																											X												" " "
3	EA-3	3287-1515	14/06/17	1		1					X																											X												" " "
4	EA-7A	3283-1411	07/06/17	1		1					X																											X												" " "
5																																																		
6																																																		
7																																																		
8																																																		
9																																																		
10																																																		
11																																																		
12																																																		
13																																																		
14																																																		
15																																																		

Ingreso	Material Entregado por / Firma	Erik von Ovedhow	Fecha	22/06/17	Hora	10:00
	Material Recibido por / Firma	G. Cuevas	Fecha	22-Jun-17	Hora	12:10
Egreso	Material Entregado por / Firma		Fecha		Hora	
	Material Recibido por / Firma		Fecha		Hora	

Para Uso Exclusivo del laboratorio[1]

Estado de las muestras	Bueno ☒	Malo ☐	(especificar en observaciones)		
Temperatura de muestras:	T° AMBIENTE			pH:	N.A.
Observaciones:					

BGI PQ200 Air Sampling System

Downloaded July 2017

Job Details:

Job Name:	EA-1A
Version:	PQ200
Serial No:	2.00
Pump Time:	
Flags:	NA

Job Code:	EA-1A
Site Name:	Los Planes (Top Soil Deposit)
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	653	649	651	mmHg
TA	28.1	18.1	25.5	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured			NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	19-Jul-17	13:30:00
Stop:	20-Jul-17	13:30:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3307-0607**	
Final Wt:	148.160	mg
Initial Wt:	148.010	mg
Delta Wt:	0.150	mg
Total Vol:	24.04	m^3
Mass Conc:	**6.24**	**µg/m^3**

Notes 1: Depósito de Suelos, Proyecto El Escobal
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded July 2017

Job Details:

Job Name:	EA-2A
Version:	PQ200
Serial No:	3
Pump Time:	
Flags:	NA

Job Code:	EA-2A
Site Name:	La Cuchilla.
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	635	631	632	mmHg
TA	26.6	15.9	19.5	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured			NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	30-Jul-17	10:39:00
Stop:	31-Jul-17	10:39:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3286-1414**	
Final Wt:	147.630	mg
Initial Wt:	147.520	mg
Delta Wt:	0.110	mg
Total Vol:	24.04	m^3
Mass Conc:	**4.58**	**µg/m^3**

Notes 1: Aldea La Cuchilla, San Rafael Las Flores, Santa Rosa.
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded July 2017

Job Details:

Job Name:	EA-3
Version:	PQ200
Serial No:	1
Pump Time:	
Flags:	NA

Job Code:	EA-3
Site Name:	El Fucío, zona este.
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	627	624	626	mmHg
TA	26.9	15.6	20.0	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured			NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	11-Jul-17	16:50:00
Stop:	12-Jul-17	16:50:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3287-1515**	
Final Wt:	147.730	mg
Initial Wt:	147.730	mg
Delta Wt:	0.000	mg
Total Vol:	24.04	m^3
Mass Conc:	**0.00**	**µg/m^3**

Notes 1: Aldea El Fucío, San Rafael Las Flores, Santa Rosa.
Notes 2: Minera San Rafael, S.A.

BGI PQ200 Air Sampling System

Downloaded July 2017

Job Details:

Job Name:	EA-7A
Version:	PQ200
Serial No:	3.00
Pump Time:	
Flags:	NA

Job Code:	EA-7A
Site Name:	Los Planes
Station Code:	
Operators:	EvQ
User1:	NA
User2:	NA

	Max	Min	Avg	Units
BP	654	649	652	mmHg
TA	28.9	19.2	23.2	°C
Q	---	---	16.71	Lpm
QCV			NA	%
Max overheat			NA	°C
occured			NA	

Timer Information:

	Date dd-mmm	Time hh:mm:ss
Start:	19-Jul-17	10:00:00
Stop:	20-Jul-17	10:00:00
ET:	23:59:00	

Mass Concentration Data:

Filter ID:	**3283-1111**	
Final Wt:	146.490	mg
Initial Wt:	146.100	mg
Delta Wt:	0.390	mg
Total Vol:	24.04	m^3
Mass Conc:	**16.22**	**µg/m^3**

Notes 1: Aldea Los Planes, San Rafael Las Flores, Santa Rosa.
Notes 2: Minera San Rafael, S.A.

Reporte Analítico RA-17-11746

Cliente: Minera San Rafael, S.A.
Dirección: Boulevard Los Próceres, 18 calle 24-69 z. 10, Centro Empresarial Zona Pradera, Oficina 1406 torre IV
Proyecto: 178-089 (El Escobal)
Análisis de muestras: Agosto, 17 al 21 de 2017
Emisión de reporte: Agosto, 21 de 2017

Tipo de muestra: Filtros de cuarzo utilizados para colección de material particulado en aire.
Análisis: Gravimetría en filtros.
Método analítico: 40 CFR, Apéndice J, Parte 50, Capítulo 1, Edición 07-1-97, EPA. Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere. **Acreditado ISO 17025**

Cuadro 1: resultados de filtros peso final

No.	Identificación de la muestra	Código de filtro[1]	Peso inicial* (gramos)	Peso final (gramos)	Incertidumbre (gramos)
Límite de detección del método			0.00005		Al 95% confianza K=2
1	EA-1A	3307-0607	0.14801	0.14816	± 0.00005
2	EA-2A	3310-1111	0.14752	0.14763	
3	EA-3	3285-1330	0.14773	0.14773	
4	EA-7A	3292-0303	0.14610	0.14649	

[1]: Código de filtro asignado por Laboratorio Ambiental, S.A. *: Corresponde a los pesos iníciales indicado en reportes analíticos RA-17-11726 y RA-17-11712.

Tronco I, sector E, lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

Anexos:

Anexo 1. Cadena de Custodia R-02-00912

Este Reporte Analítico ha sido elaborado para uso confidencial y exclusivo del cliente; se prohíbe su reproducción, sin la aprobación escrita del Laboratorio. Los resultados aquí expresados representan el mejor juicio del Laboratorio y son válidos únicamente para la porción de muestra presentada a éste. Laboratorio Ambiental, S.A. no asume ninguna responsabilidad ni garantiza la utilización final que se le dé a la información aquí presentada. Laboratorio Ambiental, S.A. no se responsabiliza por el proceso de muestreo. En caso de requerir alguna modificación en este reporte analítico, solicitarla dentro de los siguientes 30 días a partir de la fecha en que el Laboratorio envió el reporte.

Ing. Diego Silva
Ingeniero Químico, Gestor de Calidad
Colegiado 1595

MSc. BSc. Ana Gabriela Juárez
Especialista ambiental, Director de Laboratorio

Redacción:	Fecha:	Revisión:	Fecha:	Aprobación:	Fecha:	Versión cliente:
G.C.	Ago., 21/17	J.J.	Ago., 22/17	A.G.J.	Ago. 22/17	**01**

Tronco I, sector E, lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

CADENA DE CUSTODIA

Laboratorio Ambiental, S.A.
Tronco 1, Sector E, Lote 14 El Encinal, zona 7 de Mixco, Guatemala, Guatemala.
Teléfono: 24318187, Fax 24318108 ext. 102
www.laboratorio-ambiental.com

Información General			
Empresa	Minera San Rafael		
Contacto	Ing. Miguel Berganza		
Dirección	Blvd. Los Próceres, 18 c. 24-69 Z.10 Empresarial Zona Pradera, Torre IV Of. 1406		
Ciudad	Guatemala	Tel. / Cel.	59515248
País	GT		
e-mail	mberganza@sanrafael.com.gt		

Información para el Reporte	
Reportar a:	Miguel Berganza
Proyecto:	Mina El Escobal
Formato para reporte[2]	PDF, Electrónico (Excel)
Dirección reporte:	evon@sanrafael.com.gt
Observaciones:	Copiar a lbarrios@sanrafael.com.gt y a fsamayoa@sanrafael.com.gt

Plazo de entrega de Reporte (PER)[2]

PER Regular:
- ☒ 6 a 8 dias Laborales

PER agilizado: (previa aprobación vía e-mail)
- ☐ 48 a 72 horas
- ☐ 72 a 96 horas

Otro:

Cadena de Custodia No. R-02- 00912

Pág. 1 de 2

Instrucciones

Completar la información solicitada con letra legible.
1. Para uso exclusivo de Laboratorio Ambienta,l dejar en blanco
2. Indicar si se requiere en formato de reporte: **W**ord, **PDF** ó **E**lectrónico
3. Colocar el número de recipientes que correspondan a la descripción del encabezado.

No.	Identificación de las Muestra	Identificación laboratorio[1]	Fecha del muestreo	No. Total recipiente	Descripción recipiente[3]: Vidrio	Porta filtros	Plástico	Otros	Tipo de Matriz[3]: Agua	Aire	Filtros	Macroinvertebrados	Peces	Fauna y Flora	Otros	Preservante[3]: Frio	HNO3	H2SO4	HCl	NaOH	Etanol ____	Otro	Parámetros a analizar[2] — Fisico-químico de Agua: Alcalinidad	Dureza Total	DQO / DBO 5	Nitrógeno total	Fósforo Total	Cromo hexavalente	Color	Aceites & Grasas / TPH	Metales / Cianuro/Hg	Sólidos totales	Sólidos Suspendidos Totales	Sólidos Disueltos Totales	Microb: Coliformes totales	Colofirmes fecales	E-Coli	Filtros: Pesado Inicial	Pesado final	Si, C, Hg o Metales	Aire: PM_{10}	NO_2 y SO_2	Biología: Id.Tax. Macroinvertebrados	Id. Tax. Peces	Id.Tax. Herpetofauna	Ecotoxicidad	Varios: Descarga/Análisis de datos	Otro:	Observaciones
1	EA-1A	3307-0607	19/07/17	1		X					X																											X												Favor devolver filtro.
2	EA-2A	3310-1111	30/7/17	1		X					X																											X												" " "
3	EA-3	3285-1330	11/7/17	1		X					X																											X												" " "
4	EA-7A	3292-0309	19/7/17	1		X					X																											X												" " "
5																																																			
6																																																			
7																																																			
8																																																			
9																																																			
10																																																			
11																																																			
12																																																			
13																																																			
14																																																			
15																																																			

Ingreso	Material Entregado por / Firma	Ing. Erik von Buchwald	Fecha	04/08/17	Hora	
	Material Recibido por / Firma	G. CUELLAR	Fecha	17-08-17	Hora	10:19
Egreso	Material Entregado por / Firma		Fecha		Hora	
	Material Recibido por / Firma		Fecha		Hora	

Para Uso Exclusivo del laboratorio[1]

Estado de las muestras	Bueno ☒	Malo ☐	(especificar en observaciones)		
Temperatura de muestras:	N° Ambiente			pH:	—
Observaciones:					

12.3.2 Informe de Metales en PM_{10}

Reporte Analítico
RA-17-11717

Cliente: Minera San Rafael

Dirección: Boulevard Los Próceres, 18 calle 24-69 z. 10, Centro Empresarial Zona Pradera, Oficina 1406 torre IV

Proyecto: 178-090

Análisis de muestras: Junio, 21 de 2017

Emisión del reporte: Junio, 22 de 2017

Tipo de muestras: Filtros de cuarzo utilizados para colección de material particulado en aire.

Análisis: Mercurio en filtros por ICP de Masas.

Método analítico: ICP Masas. EPA 7470 Mercury by CV/AA

*Parámetros	LDM (µg)	Estación				
		EA-1B	EA-2A	EA-3A	EA-4A	EA-5A
Código de filtro		3269-1414	3263-0808	3264-0909	3267-1212	3266-1111
Mercurio (Hg)	0.002	<0.002	<0.002	0.006	0.004	0.009

*: Análisis realizados por laboratorio subcontratado (laboratorio acreditado CAN-P-1585, CAN-P-1587, CAN-P-4E (ISO/IEC 17025:2005)). µg: microgramos. <: Menor que el límite de detección del método. LDM: límite de detección del método.

*Parámetros	LDM (µg)	Estación		
		EA-6	EA-7A	EA-10
Código de filtro		3268-1313	3262-0707	3272-1717
Mercurio (Hg)	0.002	<0.002	0.003	0.002

*: Análisis realizados por laboratorio subcontratado (laboratorio acreditado CAN-P-1585, CAN-P-1587, CAN-P-4E (ISO/IEC 17025:2005)). µg: microgramos. <: Menor que el límite de detección del método. LDM: límite de detección del método.

Tronco I, sector E, lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

Anexos:

Anexo 1. Cadenas de Custodia R-02-000909

Anexo 2. Reporte de Laboratorio Subcontratado

Ing. Diego Silva
Ing. Químico, Gestor de Calidad
Colegiado 1595

MSc. BSc. Ana Gabriela Juárez
Especialista ambiental, Director de Laboratorio

Redacción:	Fecha:	Revisión:	Fecha:	Aprobación:	Fecha:	Versión cliente:
G.C.	Junio, 22/17	J.J.	Junio, 22/17	A.G.J.	Junio, 23/17	**01**

Tronco I, sector E, lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

CADENA DE CUSTODIA

Laboratorio Ambiental, S.A.
Tronco 1, Sector E, Lote 14 El Encinal, zona 7 de Mixco, Guatemala, Guatemala.
Teléfono: 24318187, Fax 24318108 ext. 102
www.laboratorio-ambiental.com

Información General				Información para el Reporte	
Empresa	Minera San Rafael			Reportar a:	Erik von Quednow
Contacto	Ing. Miguel Berganza			Proyecto:	Mina El Escobal
Dirección	Blvd. Los Próceres 5, VB C. 24-69 z 10 Empresarial Zona Pradera of. 1406 Torre IV			Formato para reporte[2]	~~WORD~~, PDF, XLS
				Dirección reporte:	Ver info. gral.
Ciudad	Guatemala	Tel. / Cel.	59515248	Observaciones:	
País	GT				
e-mail	mberganza@sanrafael.com.gt				

Plazo de entrega de Reporte (PER)[2]

PER Regular:
- [x] 6 a 8 dias Laborales

PER agilizado: (previa aprobación vía e-mail)
- [ ] 48 a 72 horas
- [ ] 72 a 96 horas

Otro:

Cadena de Custodia No. R-02- 00909

Pág. 1 de 2

Instrucciones

Completar la información solicitada con letra legible.
1. Para uso exclusivo de Laboratorio Ambienta,l dejar en blanco
2. Indicar si se requiere en formato de reporte: **W**ord, **PDF** ó **E**lectrónico
3. Colocar el número de recipientes que correspondan a la descripción del encabezado.

No.	Identificación de las Muestra	Identificación laboratorio[1]	Fecha del muestreo	No. Total recipiente	Descripción recipiente[3]: Vidrio	Porta filtros	Plástico	Otros	Tipo de Matriz[3]: Agua	Aire	Filtros	Macroinvertebrados	Peces	Fauna y Flora	Otros	Preservante[3]: Frio	HNO3	H2SO4	HCl	NaOH	Etanol	Otro	Parámetros a analizar[2] — Fisico-químico de Agua: Alcalinidad	Dureza Total	DQO / DBO 5	Nitrógeno total	Fósforo Total	Cromo hexavalente	Color	Aceites & Grasas / TPH	Metales / Cianuro/Hg	Sólidos totales	Sólidos Suspendidos Totales	Sólidos Disueltos Totales	Microb: Coliformes totales	Colofirmes fecales	E-Coli	Filtros: Pesado Inicial	Pesado final	~~Hg~~	Aire: PM_{10}	NO_2 y SO_2	Biología: Id.Tax. Macroinvertebrados	Id. Tax. Peces	Id.Tax. Herpetofauna	Ecotoxicidad	Varios: Descarga/Análisis de datos	Otro:	Observaciones
1	EA-1A	3246-0220	04/05/07	1		1					X																												X												Favor devolver filtro.
2	EA-1B	3269-1414	23/05/17	1		1					X																												X	X										
3	EA-2A	3263-0808	09/05/17	1		1					X																												X	X										
4	EA-3	3265-1010	09/05/17	1		1					X																												X											Favor devolver filtro.
5	EA-3A	3264-0904	12/05/17	1		1					X																												X	X										
6	EA-4A	3267-1212	16/05/17	1		1					X																												X	X										
7	EA-5A	3266-1111	16/05/17	1		1					X																												X	X										
8	EA-6	3268-1313	23/05/17	1		1					X																												X	X										
9	EA-7A	3262-0707	06/05/17	1		1					X																												X	X										
10	EA-10	3272-1717	27/05/17	1		1					X																												X	X										
11																																																		
12																																																		
13																																																		
14																																																		
15																																																		

Ingreso	Material Entregado por / Firma	Erik von Quednow	Fecha	01/06/2017	Hora	07:15	Para Uso Exclusivo del laboratorio[1]
	Material Recibido por / Firma	G. CUELLAR	Fecha	02-06-17	Hora	11:00	Estado de las muestras: Bueno [X] Malo [ ] (especificar en observaciones)
Egreso	Material Entregado por / Firma		Fecha		Hora		Temperatura de muestras: T. AMBIENTE pH:
	Material Recibido por / Firma		Fecha		Hora		Observaciones:

Your P.O. #: 6489
Your Project #: 178-090
Site Location: MSR
Your C.O.C. #: na

Attention:Diego Silva

CTA Consultoria y Tecnologia Ambiental Mexico, S.A. de C.V.
Av. Insurgentes Sur 1763
Piso 5 Col.Guadalupe INN C.P.
Del.Alvaro Obregon D.F.Mexico CP., --
Mexico 01020

Report Date: 2017/06/21
Report #: R4553067
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7C1415
Received: 2017/06/12, 14:59

Sample Matrix: Filter
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Mercury	8	2017/06/21	2017/06/21	BRL SOP-00104	EPA 7470 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Clayton Johnson
Project Manager - Air Toxics, Source Evaluation
21 Jun 2017 16:19:10

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Clayton Johnson, Project Manager - Air Toxics, Source Evaluation
Email: CJohnson@maxxam.ca
Phone# (905)817-5769
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 1

Maxxam Job #: B7C1415
Report Date: 2017/06/21

CTA Consultoria y Tecnologia Ambiental Mexico, S.A. de C.V.
Client Project #: 178-090
Site Location: MSR
Your P.O. #: 6489
Sampler Initials: MSR

ELEMENTS BY ATOMIC SPECTROSCOPY (FILTER)

Maxxam ID		ENV895	ENV896	ENV897	ENV898	ENV899	ENV900	ENV901		
Sampling Date		2017/05/06	2017/05/09	2017/05/12	2017/05/16	2017/05/16	2017/05/23	2017/05/23		
COC Number		na	na	na	na	na	na	na		
	UNITS	3262-0707	3263-0808	3264-0909	3266-1111	3267-1212	3268-1313	3269-1414	RDL	QC Batch
Metals										
Acid Extractable Mercury (Hg)	ug	0.003	ND	0.006	0.009	0.004	ND	ND	0.002	5037969

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

Maxxam ID		ENV902		
Sampling Date		2017/05/27		
COC Number		na		
	UNITS	3272-1717	RDL	QC Batch
Metals				
Acid Extractable Mercury (Hg)	ug	0.002	0.002	5037969

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B7C1415
Report Date: 2017/06/21

CTA Consultoria y Tecnologia Ambiental Mexico, S.A. de C.V.
Client Project #: 178-090
Site Location: MSR
Your P.O. #: 6489
Sampler Initials: MSR

TEST SUMMARY

Maxxam ID: ENV895 **Collected:** 2017/05/06
Sample ID: 3262-0707 **Shipped:**
Matrix: Filter **Received:** 2017/06/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury	CV/AA	5037969	2017/06/21	2017/06/21	Faye Sabet

Maxxam ID: ENV896 **Collected:** 2017/05/09
Sample ID: 3263-0808 **Shipped:**
Matrix: Filter **Received:** 2017/06/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury	CV/AA	5037969	2017/06/21	2017/06/21	Faye Sabet

Maxxam ID: ENV897 **Collected:** 2017/05/12
Sample ID: 3264-0909 **Shipped:**
Matrix: Filter **Received:** 2017/06/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury	CV/AA	5037969	2017/06/21	2017/06/21	Faye Sabet

Maxxam ID: ENV898 **Collected:** 2017/05/16
Sample ID: 3266-1111 **Shipped:**
Matrix: Filter **Received:** 2017/06/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury	CV/AA	5037969	2017/06/21	2017/06/21	Faye Sabet

Maxxam ID: ENV899 **Collected:** 2017/05/16
Sample ID: 3267-1212 **Shipped:**
Matrix: Filter **Received:** 2017/06/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury	CV/AA	5037969	2017/06/21	2017/06/21	Faye Sabet

Maxxam ID: ENV900 **Collected:** 2017/05/23
Sample ID: 3268-1313 **Shipped:**
Matrix: Filter **Received:** 2017/06/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury	CV/AA	5037969	2017/06/21	2017/06/21	Faye Sabet

Maxxam ID: ENV901 **Collected:** 2017/05/23
Sample ID: 3269-1414 **Shipped:**
Matrix: Filter **Received:** 2017/06/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury	CV/AA	5037969	2017/06/21	2017/06/21	Faye Sabet

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B7C1415
Report Date: 2017/06/21

CTA Consultoria y Tecnologia Ambiental Mexico, S.A. de C.V.
Client Project #: 178-090
Site Location: MSR
Your P.O. #: 6489
Sampler Initials: MSR

TEST SUMMARY

Maxxam ID: ENV902 **Collected:** 2017/05/27
Sample ID: 3272-1717 **Shipped:**
Matrix: Filter **Received:** 2017/06/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury	CV/AA	5037969	2017/06/21	2017/06/21	Faye Sabet

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B7C1415
Report Date: 2017/06/21

CTA Consultoria y Tecnologia Ambiental Mexico, S.A. de C.V.
Client Project #: 178-090
Site Location: MSR
Your P.O. #: 6489
Sampler Initials: MSR

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	24.0°C

Samples have been corrected for desorption efficiencies if average percent recoveries are less than 80% (does not apply to gravimetric and inorganic analysis).

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B7C1415
Report Date: 2017/06/21

QUALITY ASSURANCE REPORT

CTA Consultoria y Tecnologia Ambiental Mexico, S.A. de C.V.
Client Project #: 178-090
Site Location: MSR
Your P.O. #: 6489
Sampler Initials: MSR

			SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5037969	Acid Extractable Mercury (Hg)	2017/06/21	103	90 - 110	ND, RDL=0.002	ug	0.39	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B7C1415
Report Date: 2017/06/21

CTA Consultoria y Tecnologia Ambiental Mexico, S.A. de C.V.
Client Project #: 178-090
Site Location: MSR
Your P.O. #: 6489
Sampler Initials: MSR

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Walt Wang, Scientist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

12.3.3 Informe sobre PST y Gases de Combustión

MONITOREO DE NO_2, SO_2 Y PARTÍCULAS SEDIMENTABLES TOTALES EN LA MINA EL ESCOBAL

Julio – Agosto 2017

San Rafael Las Flores, Santa Rosa, Guatemala

Octubre de 2017

Este resumen presenta los resultados del monitoreo de calidad de aire, realizado para la Mina El Escobal (**la Mina**), por Consultoría y Tecnología Ambiental (**CTA**), en San Rafael Las Flores, Santa Rosa (localización de la Mina).

El propósito del monitoreo fue determinar la calidad de aire ambiental en las comunidades aledañas mediante la medición de la concentración de:

- Gases de combustión (**SO_2** y **NO_2**); y
- Partículas Sedimentables Totales (**PST**).

Este monitoreo fue realizado con las operaciones de la mina suspendidas, para cumplimiento del plan trimestral. Las estaciones de medición se presentan en el Cuadro 1 y la metodología utilizada en el Cuadro 2.

Cuadro 1: Estaciones de monitoreo de SO_2 y NO_2 y PST

Estación	Ubicación	Coordenadas
EA-1C	Frente a Escuela San Rafael	E (m): 803,887 N (m): 1,601,801
EA-2B	Ubicación dentro del proyecto, contiguo a la Aldea la Cuchilla	E (m): 806,420 N (m): 1,601,814
EA-3B	Aldea El Fucío	E (m): 806,538 N (m): 1,600,367
EA-4A	Aldea La Puerta de Los Ángeles	E (m): 805,142 N (m): 1,599,903
EA-5A	Aldea Sabana Redonda	E (m): 804,352 N (m): 1,600,404
EA-6	Norte de la Mina, ruta a Mataquescuintla	E (m): 805,168 N (m): 1,603,247
EA-7A	Perímetro de la Mina colindante con aldea Los Planes	E (m): 805,425 N (m): 1,601,523

Coordenadas en metros (**m**). Datum: WGS84 UTM zona 15N. Fuente: CTA, 2017.

Cuadro 2: Metodologías utilizadas para SO_2 y NO_2 y PST

Gases de Combustión	**SO_2:** Análisis espectrofotométrico, descrito en el Título 40, Parte 50, Apéndice A de la USEPA. **NO_2:** Análisis espectrofotométrico. Método de referencia designado por la USEPA: No. EQN-1277-026.
PST	ASTM D 1739-98 (re-aprobación 2004).

Fuente: CTA, 2017.

Los resultados obtenidos para los gases de combustión se compararon con los valores guía reportados en: Corporación Financiera Internacional (**IFC**)[1], 2007: Guías Generales de ambiente, salud y seguridad, Sección: Emisiones al Aire y Calidad del aire ambiental.

Los resultados de Partículas Sedimentables Totales (**PST**) se compararon con los valores guía reportados en el Ministerio de Ambiente de la provincia canadiense British Columbia (**BC**)[2] con respecto a las partículas sedimentables totales para industrias mineras, de fundición y relacionadas (BC objetivos de calidad del aire para partículas totales suspendidas y caída de polvo, agosto 12, 2013).

En el Cuadro 3 se presentan los resultados obtenidos de la medición de gases de combustión realizada en Julio de 2017; y en el Cuadro 4 se presentan los resultados de la medición de PST para el período de 30 días de 25 Julio a 24 de agosto de 2017 (el período promedio de medición es de 30 ± 2 días, por lo que se cumple lo estipulado por la BC).

Cuadro 3: Resultados de la medición de gases de combustión en $\mu g/m^3$

Estaciones de Muestreo	EA-1C	EA-2B	EA-3B	EA-4A	EA-5A	EA-6	EA-7A	Guías del CFI
SO_2	<13	<13	<13	<13	<13	<13	<13	20 $\mu g/m^3$
NO_2	<9	<9	<9	<9	<9	<9	<9	*40$\mu g/m^3$

SO_2: dióxido de azufre. NO_2: dióxido de nitrógeno. *: Promedio anual.[1]: LDM: Límite de detección del método. $\mu g/m^3$: microgramos sobre metros cúbicos.

Fuente: Laboratorio Ambiental, S. A., 2017.

[1]Guías del IFC: www.ifc.org/ifcext/EnvironmentalGuidelines

[2]Guía de BC: http://www.bcairquality.ca/reports/pdfs/agotable.pdf

Cuadro 4: Resultados de la medición de PST g/ (m^2 x 30 días)

Parámetros	EA-1C	EA-2B	EA-3B	EA-4A	EA-5A	EA-6	EA-7A	Guía de BC
Sólidos Insolubles	7.739	2.610	4.197	6.902	2.593	3.696	2.458	NA
Sólidos Solubles	2.567	2.287	2.848	4.125	7.990	6.873	3.022	
Sólidos Totales	10.307	4.897	7.045	11.028	10.582	10.569	5.480	
Partículas sedimentables totales mg/(dm^2*día)[2]	**3.436**	1.632	2.348	**3.676**	**3.527**	**3.523**	1.827	2.90[1]

g: gramos. m^2: metro cuadrado. mg: miligramos. dm^2: decímetro cuadrado. [1]: valor referido para un período promedio 30 ± 2 días. [2]: Las estaciones fueron muestreadas dentro del período promedio de 30 ± 2 días aprobado por la BC.

Fuente: Laboratorio Ambiental, S. A., 2017.

Gases de Combustión

SO_2:

Como se puede apreciar en el Cuadro 3, las concentraciones se encuentran por debajo del límite de detección del método analítico utilizado en todas las estaciones monitoreadas

NO_2:

En todas las estaciones de muestreo se obtuvieron resultados menores al límite de detección del método analítico utilizado y al establecido por el Banco (**40 µg/m³**).

Partículas Sedimentables Totales

Cuatro de las siete estaciones, presentan valores de PST que superan el valor guía. La estación que presentó la mayor concentración de PST fue la EA-4A (3.676 mg/(dm^2 x día)), esto puede atribuirse en gran medida a que esta estación de muestreo se encuentra cerca de un camino de terracería con una alta carga vehicular de tránsito pesado (camiones, pickups y buses) que generan cantidades significativas de polvo. La estación EA-5A presenta un valor de 3.527 mg/(dm^2 x día), el cual puede estar influenciado por los vientos del sector, la proximidad a la carretera principal y al paso de vehículos.

Las estaciones que presentaron la menor concentración de PST durante el período de monitoreo, fueron la EA-2B y EA-7A con 1.632 mg/(dm^2 x día) y 1.827 mg/(dm^2 x día) respectivamente, ambas se encuentran dentro del perímetro de la mina. Durante la medición las actividades se encontraban suspendidas.

La estación EA-6 es una estación de control que se encuentra alejada de la carretera y cuya influencia por tránsito es mínima, sin embargo es una granja donde tienen ganado vacuno y cuando se realizó la medición se estaban realizando trabajos de construcción en una de las antenas de telefonía ubicadas en el sector, pudiendo influenciar al resultado ya que este presento un valor por arriba de la guía del banco (3.2523 mg/(dm^2 x día)).

Las estación EA-1C presenta un valores de 3.436 mg/(dm^2 x día), valor por arriba de la guía del banco, el que puede estar siendo influenciado por trabajos de asfaltado en el sector y la estación EA-3B presenta un valor de bajo de la guía del banco 2.348 mg/(dm^2 x día).

"Si tiene algún comentario o duda con respecto a la información que aquí se presente, por favor contáctenos"

servicioalcliente@cta-consultoria.com

Trabajo de Campo: J. Juárez, G. Cuellar	Fecha: Julio, 25-28/17	Redacción de Informe: J. Juárez	Fecha: Agosto, 30/2017	
Revisiones: Ing. D. Silva, MSc. BSc. A. Juárez	Fecha: Sep., 8/2017	Aprobación: **Dr. –Ing. Adrián Juárez** **Director Ejecutivo**	Fecha: Sep., 8/2017	Versión Cliente: **02**

Correlativo Informe: Resumen 178-092	Aprobación: **Ing. Erik Von Quednow, Supervisor del Área de Ambiente.**	Fecha de Aprobación: Oct., 13/2017	Número de Hojas Impresas (Incluye Anexos) **17**

Anexos

Anexo 1-1: Reportes analíticos

Reporte Analítico RA-17-11740

Cliente: Minera San Rafael, S.A.

Dirección: Boulevard Los Próceres, 18 calle 24-69 z. 10, Centro Empresarial Zona Pradera, Oficina 1406 torre IV

Proyecto: 178-092 (CTA)

Fecha de muestreo: Julio, 25 al 28 de 2017

Fecha de análisis: Agosto, 11 de 2017

Emisión del reporte: Agosto, 16 de 2017

Tipo de muestras: Soluciones absorbentes para análisis de dióxido de azufre (SO_2) y dióxido de nitrógeno (NO_2).

Análisis: Determinación espectrofotométrica de SO_2 y de NO_2 en la atmósfera.

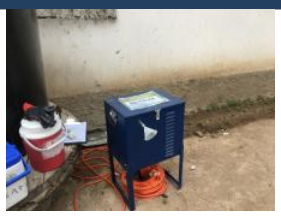
Métodos analíticos:

- SO_2: 40 CFR, parte 50, Apéndice A-2, EPA. Reference Method for the determination of Sulfur Dioxide in the atmosphere (Pararosaniline Method).
- NO_2: EPA Designated Equivalent Method No. EQN-1277-026. Sodium Arsenite method for the determination of Nitrogen Dioxide in the atmosphere.

Cuadro 1: Ubicación de estaciones de muestreo

Estación	Ubicación	Coordenadas	Fotografía	Factores ambientales *
EA-1C	Frente a Escuela San Rafael	N: 1,601,801 E: 803,887		Casa dentro del pueblo, caminos pavimentados. Campo de foot ball de tierra frente a la casa.
EA-2B	A un costado de aldea la Cuchilla, dentro del proyecto	N: 1,601,814 E: 806,420		Dentro de instalaciones del proyecto, en perímetro con malla protectora, arriba de carretera de acceso a estación meteorológica.

Tronco I, Lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

Estación	Ubicación	Coordenadas	Fotografía	Factores ambientales *
EA-3B	Aldea El Fucio	N: 1,600,367 E: 806,538		Camino de terracería cercano al terreno, tráfico vehicular moderado.
EA-4A	Aldea La Puerta de Los Ángeles	N: 1,599,903 E: 805,142		Camino de terracería cercano al terreno, tráfico vehicular alto, los vehículos levantan cantidades considerables de polvo. Evidencia de quema de leña para cocinar.
EA-5A	Aldea Sabana Redonda	N: 1,600,404 E: 804,352		El terreno está cerca de la carretera principal (asfaltada), está en campo abierto y cercano a una fábrica de block.
EA-6	Norte del proyecto, ruta a Mataquescuintla	N: 1,603,247 E: 805,168		Camino de terracería, poco tráfico vehicular, presencia de ganado vacuno en el terreno.
EA-7A	Perímetro del Proyecto colindante con aldea Los Planes	N: 1,601,523 E: 805,425		Camino de terracería, hay movimientos de tierra próximos al punto, el tráfico de vehículos es alto.

Coordenadas en metros (m). Datum: NAD27 UTM zona 16 N. Fuente: LAMSA, 2017. *: Factores ambientales que pueden influir en los resultados.

Tronco I, Lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

Cuadro 2: Resultados gases de combustión SO_2 y NO_2

Parámetro	Unidades	LDM	Identificación de las muestras						
			EA-1C	EA-2B	EA-3B	EA-4A	EA-5A	EA-6	EA-7A
Fecha de muestreo (Julio, 2017)			25-26	27-28	25-26	25-26	26-27	27-28	27-28
SO_2	µg/m^3	13	< 13	< 13	< 13	< 13	< 13	< 13	< 13
	ppm	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
NO_2	µg/m^3	9	< 9	< 9	< 9	<9	< 9	< 9	< 9
	ppm	0.005	< 0.005	< 0.005	< 0.005	<0.005	< 0.005	< 0.005	< 0.005

LDM: límite de detección del método, µg/m^3: microgramos por metro cúbico, ppm: partes por millón.

Cuadro 3: Concentraciones de SO_2 y NO_2 en controles de duplicados

Parámetro	Control con duplicado		
	Unidades	DEA-3B	DEA-5A
SO_2	µg/m^3	< 13	NA
	ppm	< 0.005	NA
NO_2	µg/m^3	NA	< 9
	ppm	NA	< 0.005

<: menor al límite de detección. µg: microgramo. µg/m^3: microgramos por metro cúbico. NA: No Aplica. DEA-3B: duplicado de la estación EA-3B. DEA-5A: duplicado de la estación EA-5A.

Tronco I, Lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

Cuadro 4: Concentraciones de SO_2 y NO_2 – Controles de laboratorio

Parámetro	Unidades	Incertidumbre	CDL		
		Al 95% confianza, k=2	Unidades	Teórica	Real
SO_2	$\mu g/m^3$	± 0.60	µg	15.7	15.8
	ppm	± 0.00023			
NO_2	$\mu g/m^3$	± 2.00	µg/mL	1.00	1.02
	ppm	± 0.00112			

ppm: partes por millón. microgramo. $\mu g/m^3$: microgramo por metro cúbico. µg/mL: microgramo por mililitro. Según los métodos analíticos, la diferencia entre las concentraciones teóricas y reales de los controles no deben ser mayores a 1 µg de SO_2 y a 0.1 µg/mL de NO_2, respectivamente.

Tronco I, Lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

Anexos:

Anexo 1. Cadena de custodia R-02-000960

Este Reporte Analítico ha sido elaborado para uso confidencial y exclusivo del cliente; se prohíbe su reproducción, sin la aprobación escrita del Laboratorio. Los resultados aquí expresados representan el mejor juicio del Laboratorio y son válidos únicamente para la porción de muestra presentada a éste. Laboratorio Ambiental, S.A. no asume ninguna responsabilidad ni garantiza la utilización final que se le dé a la información aquí presentada. En caso de requerir alguna modificación en este reporte analítico, solicitarla dentro de los siguientes 30 días a partir de la fecha en que el Laboratorio envió el reporte.

Ing. Diego Silva
Ing. Químico, Gestor de Calidad
Colegiado 1595

MSc. Ana Gabriela Juárez
Especialista ambiental, Director de Laboratorio

Redacción:	Fecha:	Revisión:	Fecha:	Aprobación:	Fecha:	Versión cliente:
G.C.	Ago., 16/17	D.S.	Ago., 16/17	A.G.J.	Ago. 17/17	**01**

Tronco I, Lote 14, El Encinal, Z.7 Mixco
Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

CADENA DE CUSTODIA

Laboratorio Ambiental, S.A.
Tronco 1, Sector E, Lote 14 El Encinal, zona 7 de Mixco, Guatemala, Guatemala.
Teléfono: 24318187, Fax 24318108 ext. 102
www.laboratorio-ambiental.com

Información General				Información para el Reporte	
Empresa	CONSULTORIA Y TECNOLOGIA AMBIENTAL, S.A.			Reportar a:	Dr. ADRIAN JUAREZ
Contacto	Dr. Ing. ADRIAN JUAREZ			Proyecto:	173-092
Dirección	TRONCO I, SECTOR E, LOTE 14, EL ENCINAL ZONA 7 DE MIXCO.			Formato para reporte[2]	PDF
				Dirección reporte:	Ver. Info. GENERAL
Ciudad	GUATEMALA	Tel. / Cel.	2431-3102	Observaciones:	
País	GUATEMALA				
e-mail	adrianjuarez@ctg-CONSULTORIA.COM				

Plazo de entrega de Reporte (PER)[2]
PER Regular:
☒ 6 a 8 dias Laborales
PER agilizado: (previa aprobación vía e-mail)
☐ 48 a 72 horas
☐ 72 a 96 horas
Otro:

Cadena de Custodia No.
R-02- 00960
Pág. 1 de 1

Instrucciones

Completar la información solicitada con letra legible.
1. Para uso exclusivo de Laboratorio Ambienta,l dejar en blanco
2. Indicar si se requiere en formato de reporte: **W**ord, **PDF** ó Electrónico
3. Colocar el número de recipientes que correspondan a la descripción del encabezado.

No.	Identificación de las Muestra	Identificación laboratorio[1]	Fecha del muestreo	No. Total recipiente	Descripción recipiente[3]: Vidrio	Porta filtros	Plástico	Otros	Tipo de Matriz[3]: Agua	Aire	Filtros	Macroinvertebrados	Peces	Fauna y Flora	Otros	Preservante[3]: Frio	HNO3	H2SO4	HCl	NaOH	Etanol ____	Otro ____	Parámetros a analizar[2] — Fisico-químico de Agua: Alcalinidad	Dureza Total	DQO / DBO 5	Nitrógeno total	Fósforo Total	Cromo hexavalente	Color	Aceites & Grasas / TPH	Metales / Cianuro/Hg	Sólidos totales	Sólidos Suspendidos Totales	Sólidos Disueltos Totales	Microb: Coliformes totales	Colofirmes fecales	E-Coli	Filtros: Pesado Inicial	Pesado final	Si, C, Hg o Metales	Aire: PM_{10}	NO_2 y SO_2	Biología: Id.Tax. Macroinvertebrados	Id. Tax. Peces	Id. Tax. Herpetofauna	Ecotoxicidad	Varios: Descarga/Análisis de datos	Otro:	Observaciones
1	EA-1C	2045-17-07	25-26/07/17	2			2			2						2																												X							
2	EA-2B	2046-17-07	26-28/07/17	2			2			2						2																												X							
3	EA-3B	2047-17-07	25-26/07/17	2			2			2						2																												X							
4	EA-4A	2048-17-07	25-26/07/17	2			2			2						2																												X							
5	EA-5A	2049-17-07	26-27/07/17	2			2			2						2																												X							
6	EA-6	2050-17-07	27-28/07/17	2			2			2						2																												X							
7	EA-7A	2051-17-07	27-28/07/17	2			2			2						2																												X							
8																																																				
9																																																			
10																																																			
11																																																			
12																																																			
13																																																			
14																																																			
15																																																			

Ingreso	Material Entregado por / Firma	J. JUAREZ	Fecha	31-07-17	Hora	8:00
	Material Recibido por / Firma	G. CUEVAR	Fecha	31-07-17	Hora	8:00
Egreso	Material Entregado por / Firma		Fecha		Hora	
	Material Recibido por / Firma		Fecha		Hora	

Para Uso Exclusivo del laboratorio[1]				
Estado de las muestras	Bueno ☒	Malo ☐	(especificar en observaciones)	
Temperatura de muestras:	2046-17-07 T°: 2°	pH:	—	
Observaciones:				

Reporte Analítico
RA-17-11752

Cliente:	Minera San Rafael
Dirección:	Boulevard Los Próceres, 18 calle 24-69 z. 10, Centro Empresarial Zona Pradera, Oficina 1406 torre IV
Proyecto:	178-092 (CTA)
Fecha de muestreo:	Julio 25 a agosto 24, de 2017
Lugar de muestreo:	San Rafael las Flores, Santa Rosa, Guatemala
Fecha de análisis:	Agosto, 28 al 30 de 2017
Emisión del reporte:	Agosto, 31 de 2017

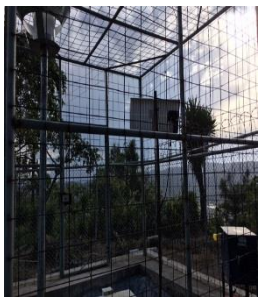
Tipo de muestras:	Partículas sedimentables en aire durante un período de 30 días.
Análisis:	Muestreo y determinación de material particulado total sedimentable en el aire (tasa de sedimentación).
Método analítico:	ASTM D1739-98 (Reapproved 2004) Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter)[1]. *Acreditado ISO 17025

Cuadro 1: Ubicación de estaciones de muestreo

Estación	Ubicación	Fotografía	Factores ambientales
EA-1C	Frente a Escuela San Rafael		Casa dentro del pueblo, caminos pavimentados, vientos fuertes. Campo de foot ball de tierra frente a la casa.

[1] Como complemento del método se agrega sulfato de cobre para evitar el crecimiento de algas durante el periodo de muestreo, según IT-ATM-09 inspecciones reglamentarias de emisiones fugitivas de partículas sedimentables y en suspensión. Consejería de medio ambiente de Andalucía.

Tel.: 2431-8187, 2431-8102 ext. 113, 116.
servicioalcliente@laboratorio-ambiental.com

Estación	Ubicación	Fotografía	Factores ambientales
EA-2B	A un costado de aldea la Cuchilla, dentro del proyecto		Dentro de instalaciones del proyecto, en perímetro con malla protectora, arriba de carretera de acceso a estación meteorológica.
EA-3B	Aldea El Fucío		Camino de terracería cercano al terreno, tráfico vehicular moderado. Se realizan trabajos de introducción de drenajes y construcción.
EA-4A	Aldea La Puerta de Los Ángeles		Camino de terracería cercano al terreno, tráfico vehicular alto, los vehículos levantan cantidades considerables de polvo. Evidencia de quema de leña para cocinar.

Estación	Ubicación	Fotografía	Factores ambientales
EA-5A	Aldea Sabana Redonda		El terreno está cerca de la carretera principal (asfaltada), está en campo abierto y cercano a una fábrica de block.
EA-6	Norte del proyecto, ruta a Mataquescuintla		Camino de terracería, poco tráfico vehicular, presencia de ganado vacuno en el terreno.
EA-7A	Perímetro del Proyecto colindante con aldea Los Planes		Camino de terracería, poco tráfico vehicular, se realizaban trabajos en las piletas de sedimentación, transito de tractores y camiones de volteo.

[2]: Factores ambientales que pueden influir en los resultados. El tiempo de muestreo fue de 30 ± 2 días, de acuerdo a método analítico empleado.

Cuadro 2: Resultados Partículas Sedimentables Totales (PST)

No.	Identificación de la muestra	Tasa de sedimentación [1]			
		Material insoluble en agua [g/(m²·30 días)]	Material soluble en agua [g/(m²·30 días)]	Total* para un periodo de 30 días [g/(m²·30 días)].	Total* para un periodo de 1 día [mg/(dm² · día)].
LDM		0.0019	0.017	0.019	0.006
1	EA-1C	7.739	2.567	10.307	3.436
2	EA-2B	2.610	2.287	4.897	1.632
3	EA-3B	4.197	2.848	7.045	2.348
4	EA-4A	6.902	4.125	11.028	3.676
5	EA-5A	2.593	7.990	10.582	3.527
6	EA-6	3.696	6.873	10.569	3.523
7	EA-7A	2.458	3.022	5.480	1.827

LDM: límite de detección del método. g: gramos; mg: miligramos. m^2: metros cuadrados. dm^2: decímetro cuadrado. [1]: las fuentes de incertidumbre para el método de análisis han sido establecidos por el laboratorio y se encuentran descritas en su respectivo procedimiento analítico.

Anexos:

Anexo 1. Cadena de Custodia R-02-000967

Este Reporte Analítico ha sido elaborado para uso confidencial y exclusivo del cliente; se prohíbe su reproducción, sin la aprobación escrita del Laboratorio. Los resultados aquí expresados representan el mejor juicio del Laboratorio y son válidos únicamente para la porción de muestra presentada a éste. Laboratorio Ambiental, S.A. no asume ninguna responsabilidad ni garantiza la utilización final que se le dé a la información aquí presentada. En caso de requerir alguna modificación en este reporte analítico, solicitarla dentro de los siguientes 30 días a partir de la fecha en que el Laboratorio envió el reporte.

Ing. Diego Silva
Ing. Químico, Gestor de Calidad
Colegiado 1595

MSc. BSc. Ana Gabriela Juárez
Especialista ambiental, Director de Laboratorio

Redacción:	Fecha:	Revisión:	Fecha:	Aprobación:	Fecha:	Versión cliente:
G.C.	Agosto, 31/17	J.J / D.S.	Agosto, 31/17	A.G.J.	Agosto, 31/17	**01**

CADENA DE CUSTODIA

Laboratorio Ambiental, S.A.
Tronco 1, Sector E, Lote 14 El Encinal, zona 7 de Mixco, Guatemala, Guatemala.
Teléfono: 24318187, Fax 24318108 ext. 102
www.laboratorio-ambiental.com

Laboratorio AMBIENTAL

Información General				Información para el Reporte	
Empresa	CONSULTORÍA Y TECNOLOGÍA AMBIENTAL, S.A.			Reportar a:	Dr. ADRIAN JUAREZ.
Contacto	Dr. Ing. ADRIAN JUÁREZ			Proyecto:	178-092
Dirección	TRONCO 1, SECTOR E, LOTE 14, EL ENCINAL ZONA 7 DE MIXCO			Formato para reporte[2]	PDF
				Dirección reporte:	CORREO Dr. ADRIAN JUAREZ
Ciudad	GUATEMALA	Tel. / Cel.		Observaciones:	
País	GUATEMALA				
e-mail	adrianjuarez@cta-consultoria.com				

Plazo de entrega de Reporte (PER)[2]

PER Regular:
- [x] 6 a 8 dias Laborales

PER agilizado: (previa aprobación vía e-mail)
- [ ] 48 a 72 horas
- [ ] 72 a 96 horas

Otro:

Cadena de Custodia No.

R-02- 00967

Pág. _____ de _____

Instrucciones

Completar la información solicitada con letra legible.
1. Para uso exclusivo de Laboratorio Ambienta,l dejar en blanco
2. Indicar si se requiere en formato de reporte: **W**ord, **PDF** ó **E**lectrónico
3. Colocar el número de recipientes que correspondan a la descripción del encabezado.

No.	Identificación de las Muestra	Identificación laboratorio[1]	Fecha del muestreo	No. Total recipiente	Descripción recipiente[3]				Tipo de Matriz[3]							Preservante[3]						Parámetros a analizar[2]																										Observaciones
					Vidrio	Porta filtros	Plástico	Otros	Agua	Aire	Filtros	Macroinvertebrados	Peces	Fauna y Flora	Otros	Frio	HNO3	H2SO4	HCl	NaOH	Etanol ____	Otro ____	Alcalinidad	Dureza Total	DQO / DBO 5	Nitrógeno total	Fósforo Total	Cromo hexavalente	Color	Aceites & Grasas / TPH	Metales / Cianuro/Hg	Sólidos totales	Sólidos Suspendidos Totales	Sólidos Disueltos Totales	Coliformes totales	Coliformes fecales	E-Coli	Pesado Inicial	Pesado final	Si, C, Hg o Metales	PM_{10}	NO_2 y SO_2	Id.Tax. Macroinvertebrados	Id. Tax. Peces	Id.Tax. Herpetofauna	Ecotoxicidad	Descarga/Análisis de datos	Otro:	
1	EA-1C	2074-17-08	24-08-17	1			1			1											1																										X	TSP
2	EA-2B	2075-17-08	24-08-17	1			1			1											1																										X	TSP
3	EA-3B	2076-17-08	24-08-17	1			1			1											1																										X	TSP
4	EA-4A	2077-17-08	24-08-17	1			1			1											1																										X	TSP
5	EA-5A	2078-17-08	24-08-17	1			1			1											1																										X	TSP
6	EA-6	2079-17-08	24-08-17	1			1			1											1																										X	TSP
7	EA-7A	2080-17-08	24-08-17	1			1			1											1																										X	TSP
8																																																
9																																															Muestreo realizado de Acuerdo a IT-045, por 29 días continuos (inicio el 25 julio al 24 Agosto 2017)
10																																															
11																																															
12																																															
13																																															
14																																															
15																																															

Ingreso	Material Entregado por / Firma	G. CUEVAR	Fecha	24-08-17	Hora	16:30	
	Material Recibido por / Firma	J. JUAREZ	Fecha	24-08-17	Hora	16:30	
Egreso	Material Entregado por / Firma		Fecha		Hora		
	Material Recibido por / Firma		Fecha		Hora		

Para Uso Exclusivo del laboratorio[1]

Estado de las muestras	Bueno [x]	Malo [ ]	(especificar en observaciones)
Temperatura de muestras:	N.A.	pH:	—
Observaciones:			

12.3.4 Presión Sonora

ER-1

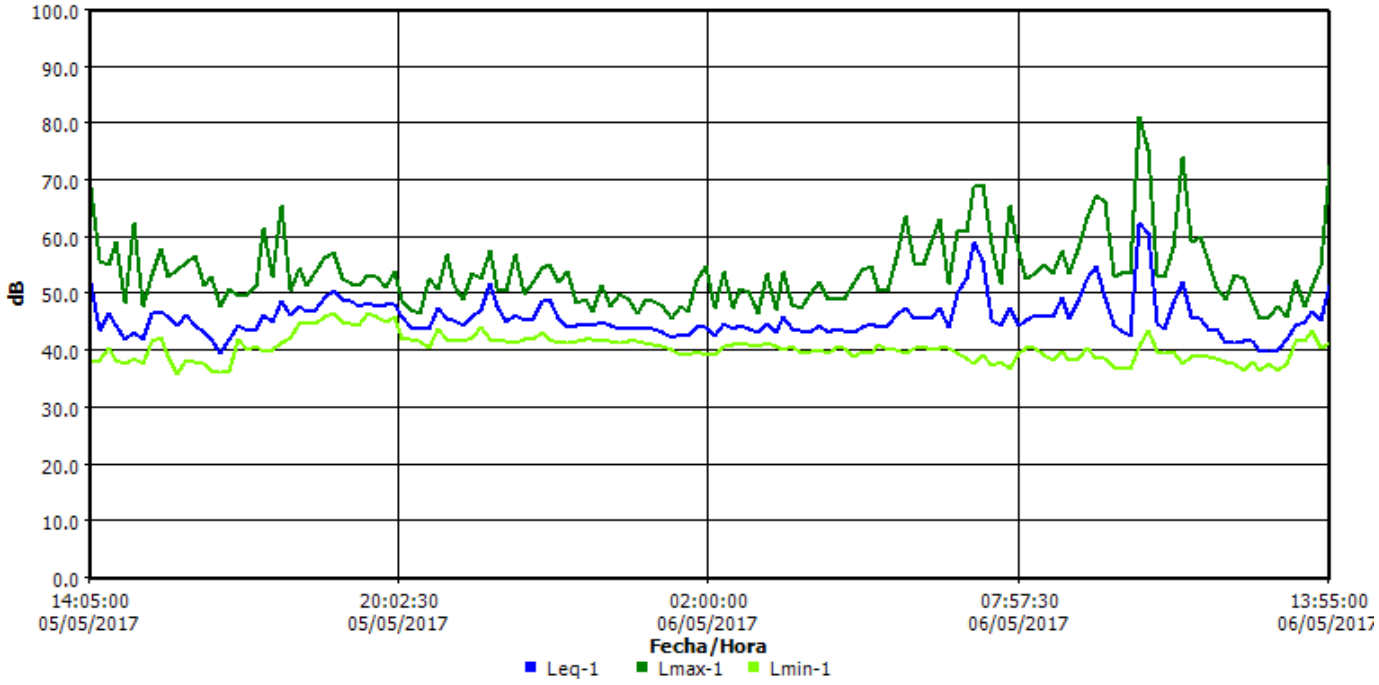
Panel de información

Ubicación	Depósito de suelos norte, a inmediaciones de Aldea Los Planes
Nombre	ER-1
Sesión padre	S193
Hora de inicio	Viernes, 05 de Mayo de 2017 13:55:00
Hora de paro	Sábado, 06 de Mayo de 2017 13:55:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	100 dB
Ponderación	1	A	Respuesta	1	SLOW
Lmin	1	36 dB	Lmax	1	81.1 dB
Lpk	1	104.1 dB	Leq	1	48.5 dB

Gráfica de datos de registro



ER-2

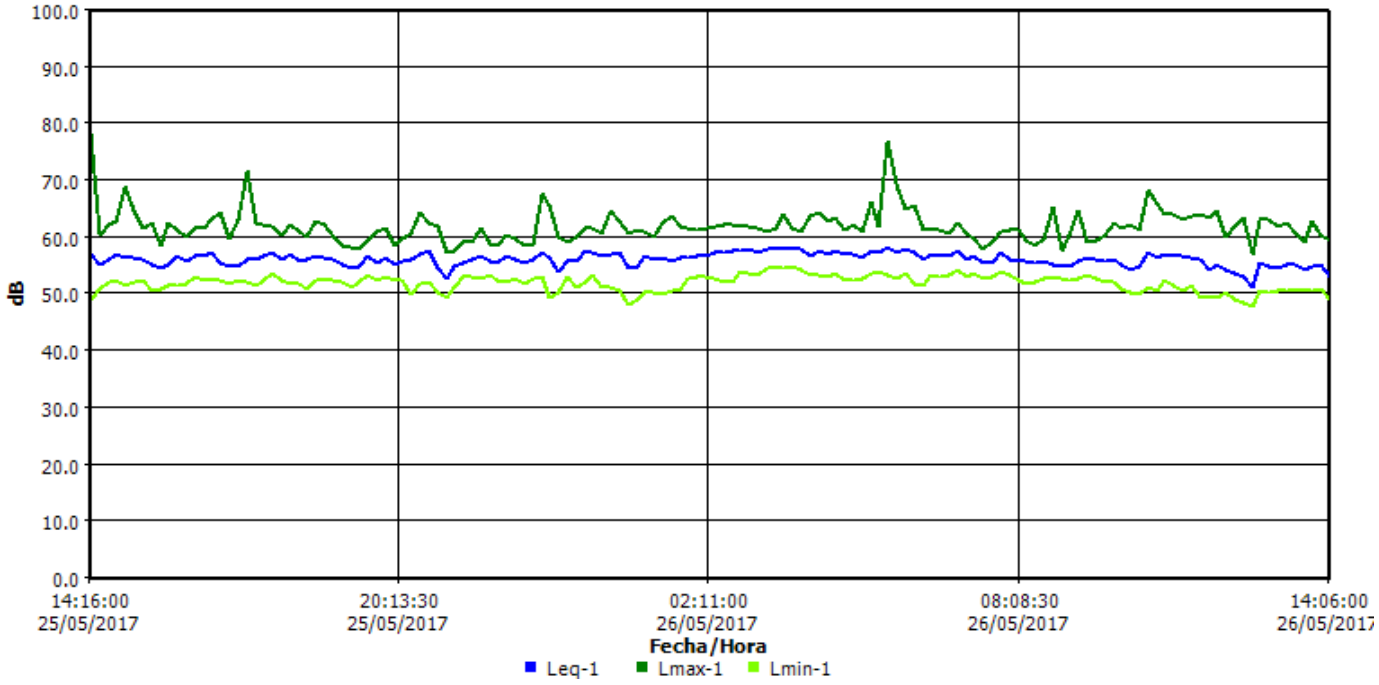
Panel de información

Ubicación	Aldea La Cuchilla
Nombre	ER-2
Sesión padre	S056
Hora de inicio	Jueves, 25 de Mayo de 2017 14:06:00
Hora de paro	Viernes, 26 de Mayo de 2017 14:06:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	48 dB	Lmax	1	78.2 dB
Lpk	1	95.4 dB	Leq	1	56.2 dB

Gráfica de datos de registro



ER-3

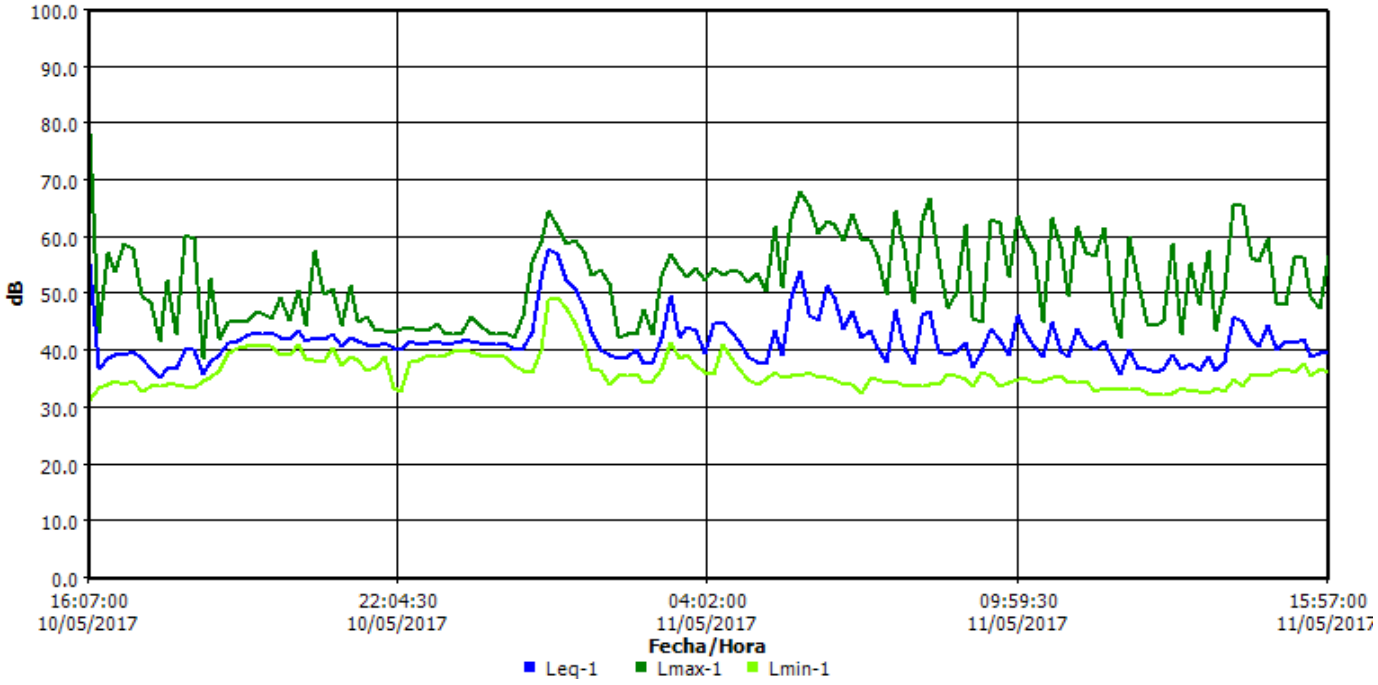
Panel de información

Ubicación	Área Este del proyecto, a inmediaciones de Aldea El Fucio.
Nombre	ER-3
Sesión padre	S194
Hora de inicio	Miércoles, 10 de Mayo de 2017 15:57:00
Hora de paro	Jueves, 11 de Mayo de 2017 15:57:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	100 dB
Ponderación	1	A	Respuesta	1	SLOW
Lmin	1	31.2 dB	Lmax	1	78.4 dB
Lpk	1	99.3 dB	Leq	1	45 dB

Gráfica de datos de registro



ER-7A

15/05/2017

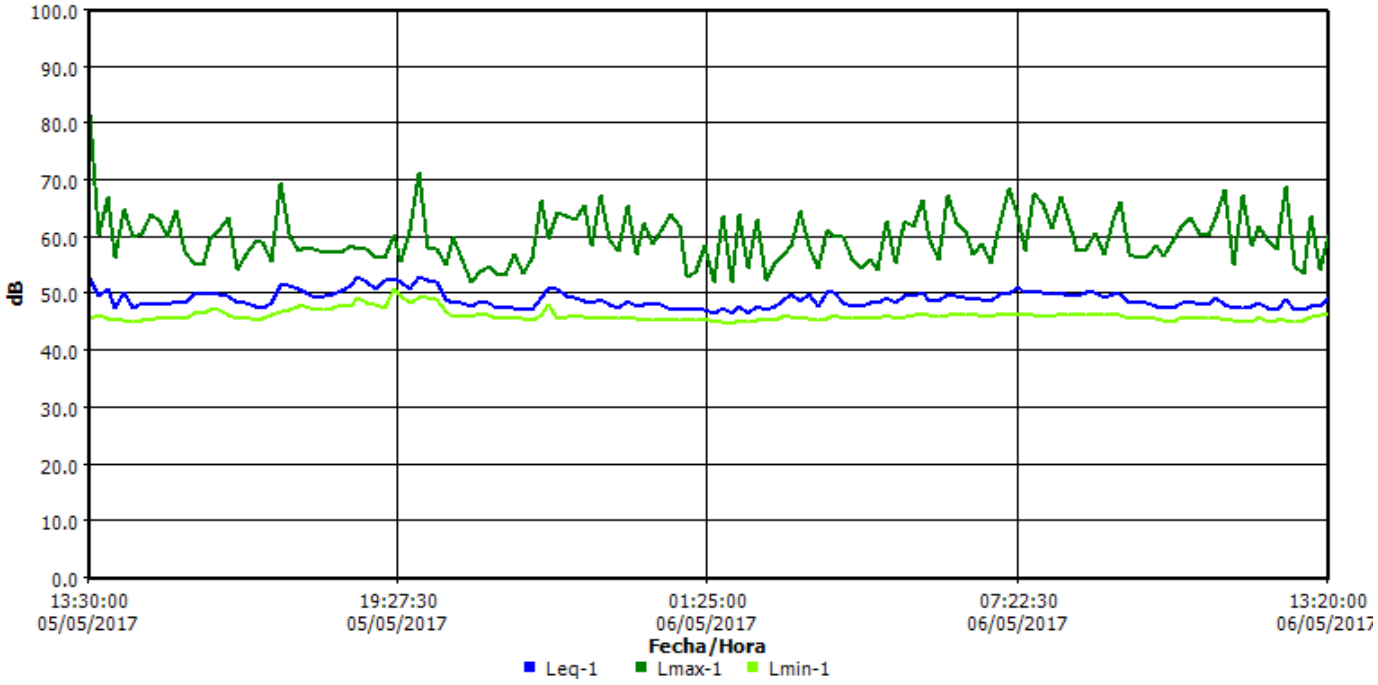
Panel de información

Ubicación	Aledaño a Aldea Los Planes
Nombre	ER-7A
Sesión padre	S051
Hora de inicio	Viernes, 05 de Mayo de 2017 13:20:00
Hora de paro	Sábado, 06 de Mayo de 2017 13:20:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	44.7 dB	Lmax	1	81.4 dB
Lpk	1	97.1 dB	Leq	1	49.3 dB

Gráfica de datos de registro



ER-1A

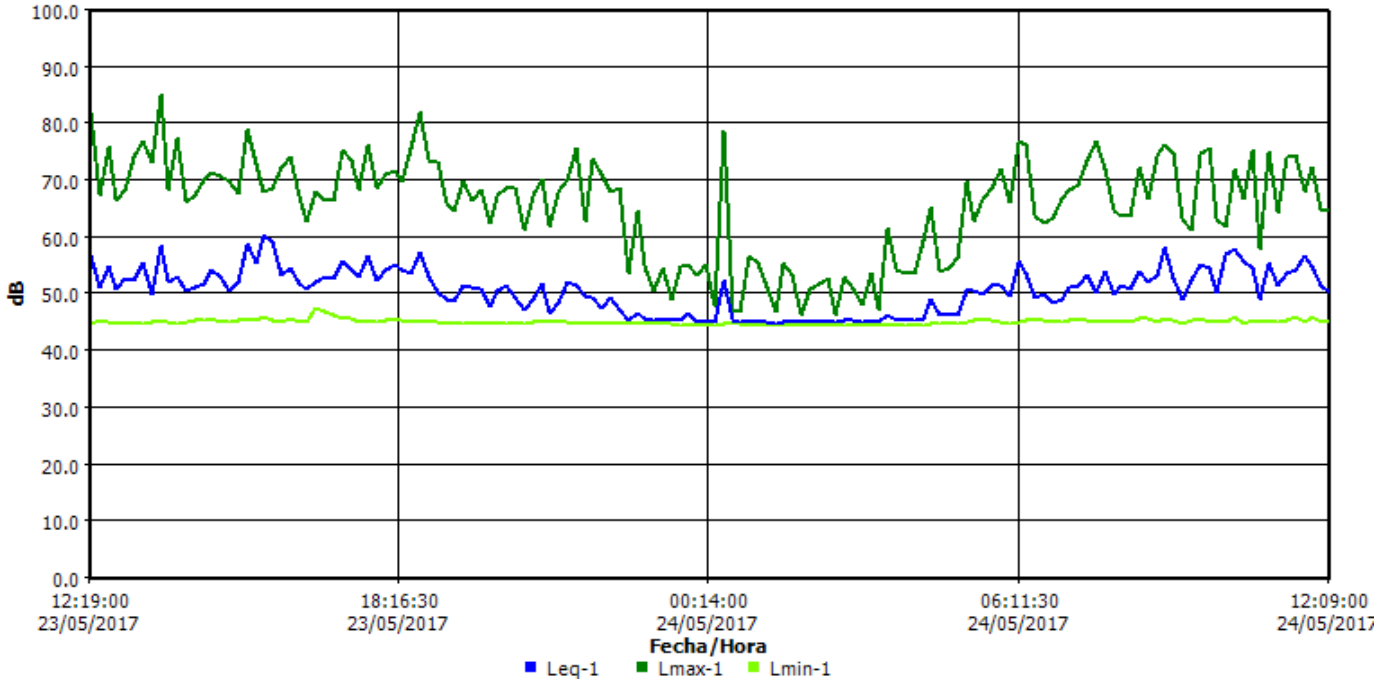
Panel de información

Ubicación	Poblado San Rafael las Flores, cercano a la Escuela
Nombre	ER-1A
Sesión padre	S055
Hora de inicio	Martes, 23 de Mayo de 2017 12:09:00
Hora de paro	Miércoles, 24 de Mayo de 2017 12:09:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	44.5 dB	Lmax	1	85.2 dB
Lpk	1	101.6 dB	Leq	1	52.3 dB

Gráfica de datos de registro



ER-3A

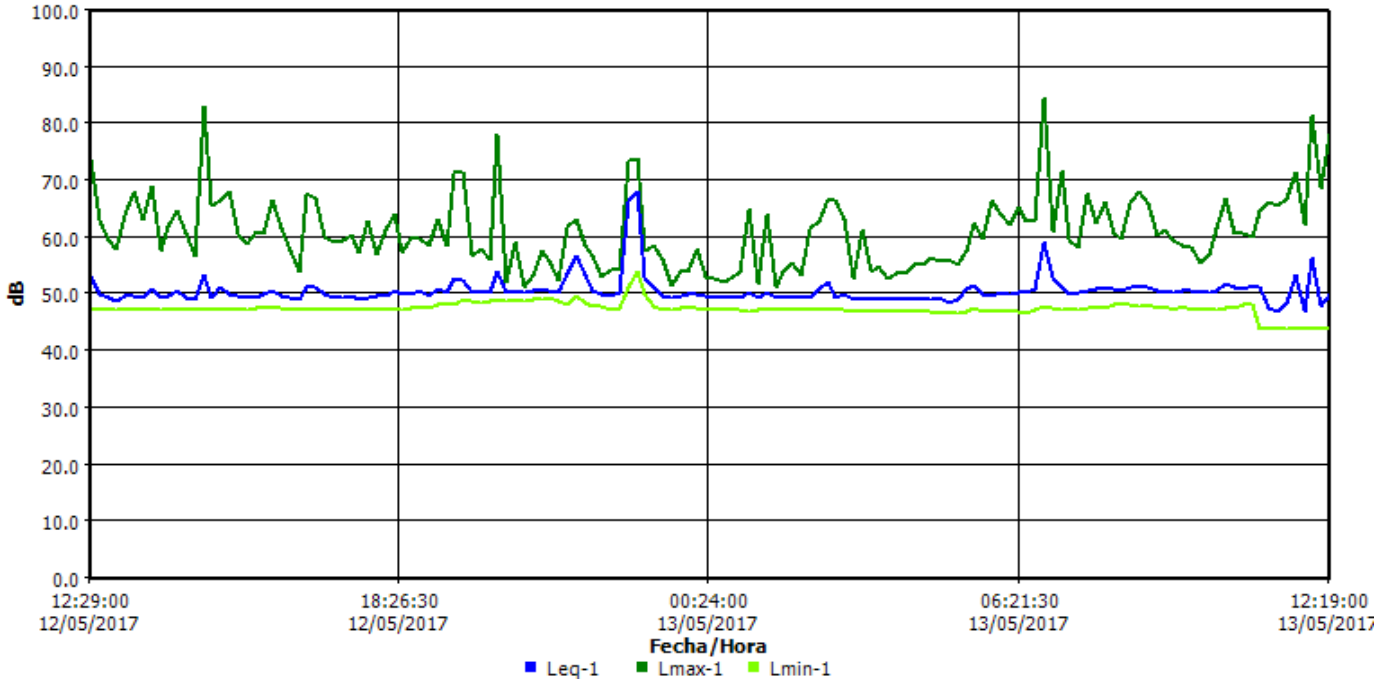
Panel de información

Ubicación	Aledaño a Aldea El Fucio
Nombre	ER-3A
Sesión padre	S053
Hora de inicio	Viernes, 12 de Mayo de 2017 12:19:00
Hora de paro	Sábado, 13 de Mayo de 2017 12:19:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	43.8 dB	Lmax	1	84.6 dB
Lpk	1	98.7 dB	Leq	1	52.8 dB

Gráfica de datos de registro



ER-4A

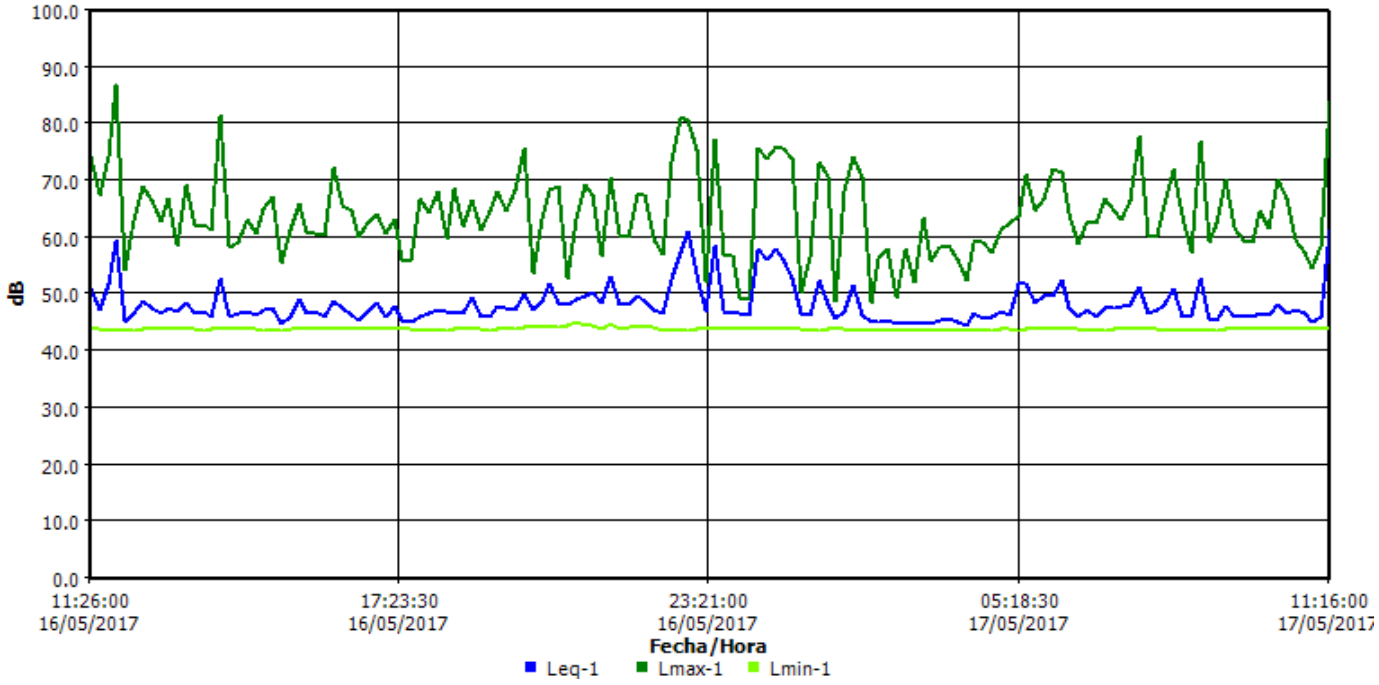
Panel de información

Ubicación	Caserío El Portón de los Ángeles
Nombre	EA-4A
Sesión padre	S054
Hora de inicio	Martes, 16 de Mayo de 2017 11:16:00
Hora de paro	Miércoles, 17 de Mayo de 2017 11:16:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	43.5 dB	Lmax	1	86.9 dB
Lpk	1	98.2 dB	Leq	1	50.3 dB

Gráfica de datos de registro



ER-5A

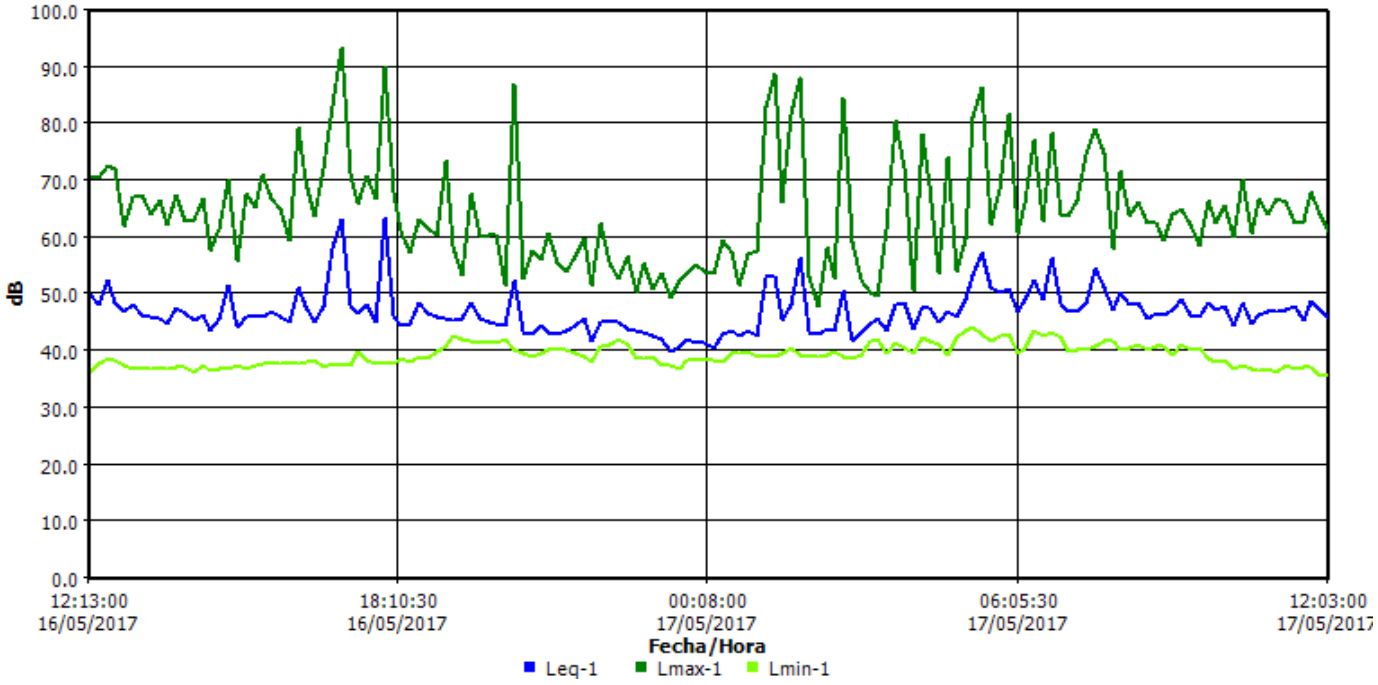
Panel de información

Ubicación	Aldea Sabana Redonda, al sur-oeste del proyecto
Nombre	ER-5A
Sesión padre	S275
Hora de inicio	Martes, 16 de Mayo de 2017 12:03:00
Hora de paro	Miércoles, 17 de Mayo de 2017 12:03:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	35.7 dB	Lmax	1	93.5 dB
Lpk	1	110.7 dB	Leq	1	49.8 dB

Gráfica de datos de registro



ER-6

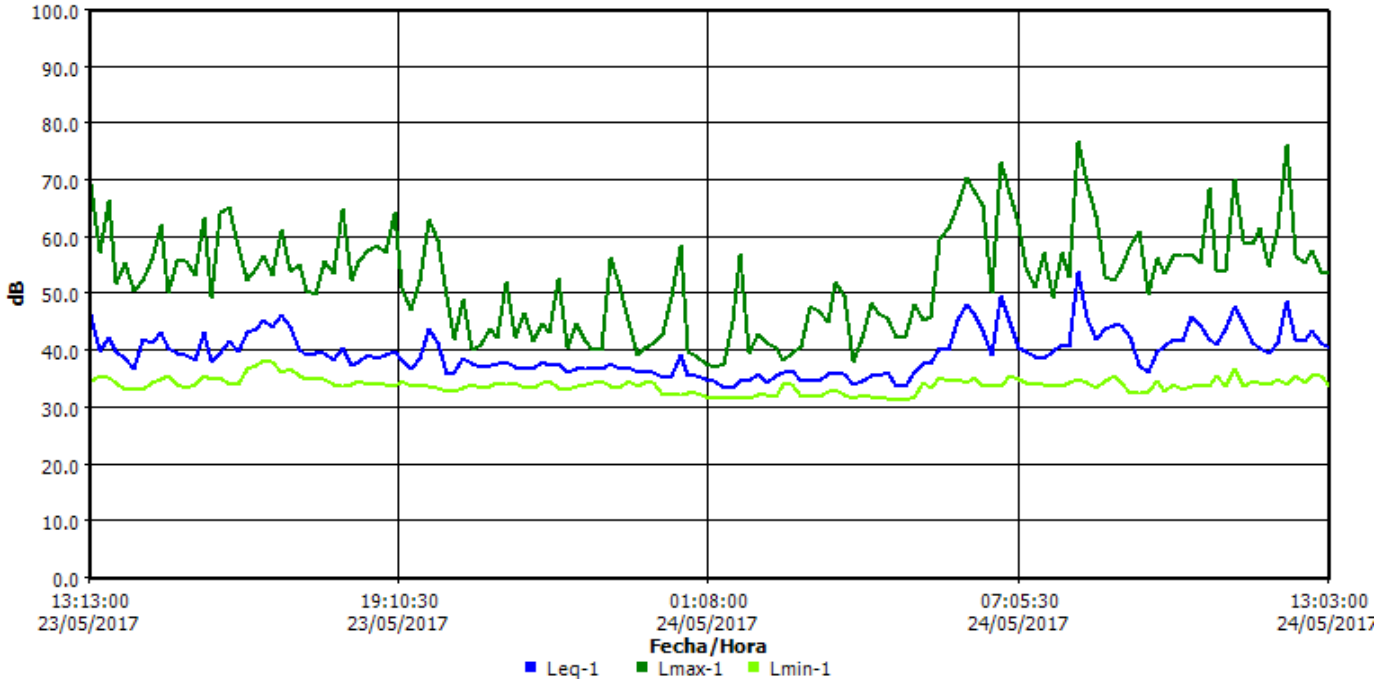
Panel de información

Ubicación	Al norte del proyecto, ruta a Mataquescuintla
Nombre	ER-6
Sesión padre	S276
Hora de inicio	Martes, 23 de Mayo de 2017 13:03:00
Hora de paro	Miércoles, 24 de Mayo de 2017 13:03:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	31.2 dB	Lmax	1	77 dB
Lpk	1	93 dB	Leq	1	41.6 dB

Gráfica de datos de registro



ER-1

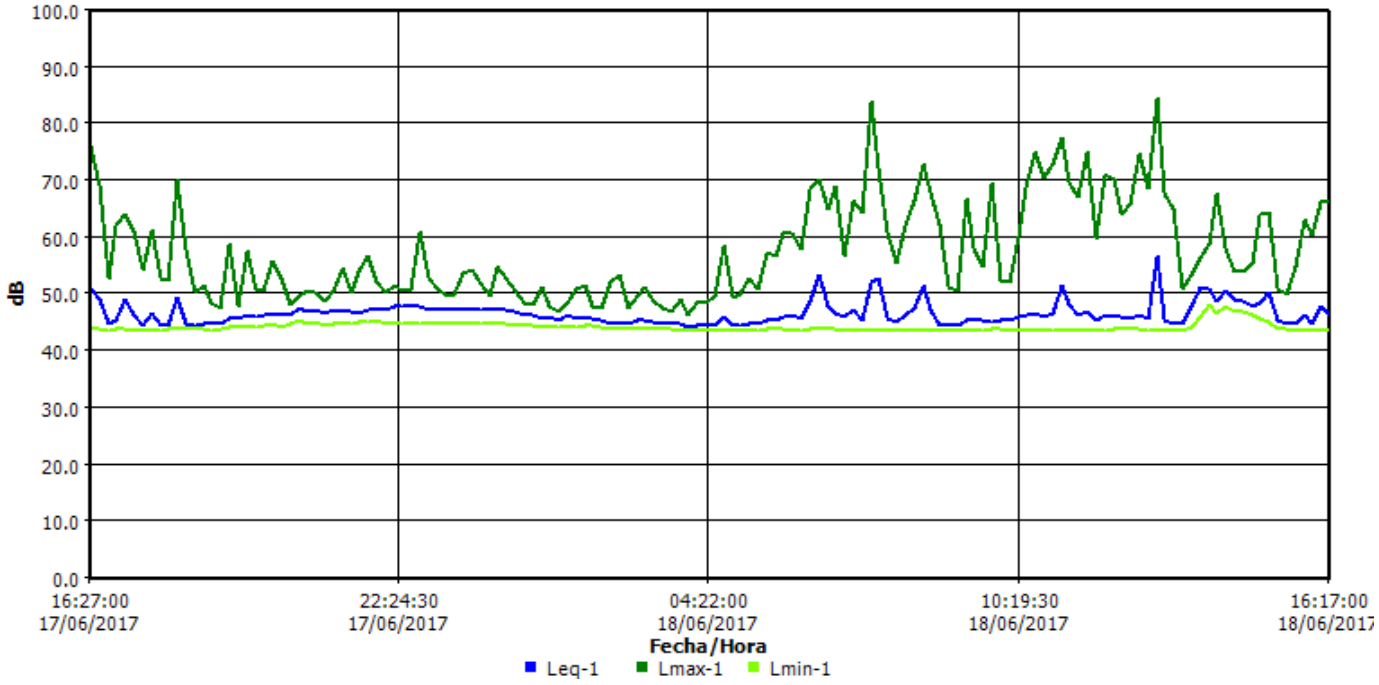
Panel de información

Ubicación	Depósito de suelos, a inmediaciones de Aldea Los Planes
Nombre	ER-1
Sesión padre	S059
Hora de inicio	Sábado, 17 de Junio de 2017 16:17:00
Hora de paro	Domingo, 18 de Junio de 2017 16:17:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	43.5 dB	Lmax	1	84.5 dB
Lpk	1	99.1 dB	Leq	1	47.2 dB

Gráfica de datos de registro



ER-2

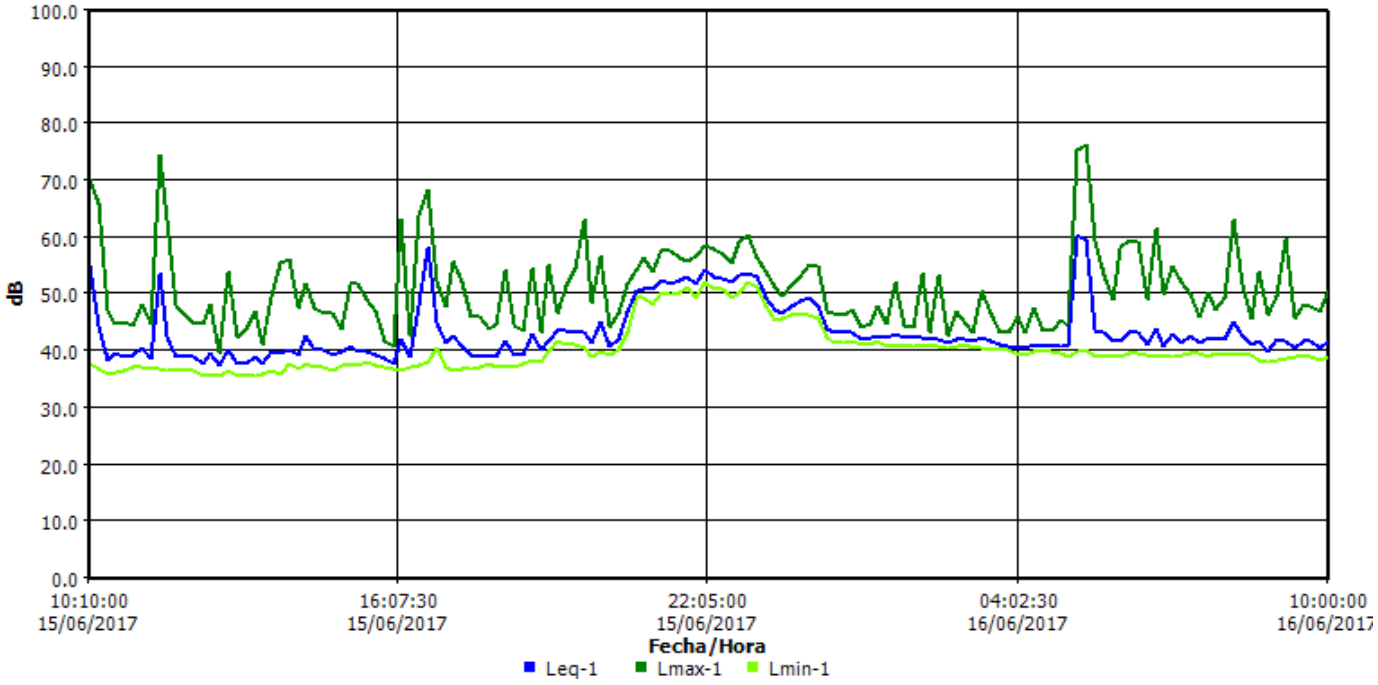
Panel de información

Ubicación	Aldea La Cuchilla
Nombre	ER-2
Sesión padre	S203
Hora de inicio	Jueves, 15 de Junio de 2017 10:00:00
Hora de paro	Viernes, 16 de Junio de 2017 10:00:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	100 dB
Ponderación	1	A	Respuesta	1	SLOW
Lmin	1	35.5 dB	Lmax	1	76.4 dB
Lpk	1	98.6 dB	Leq	1	47.5 dB

Gráfica de datos de registro



ER-3

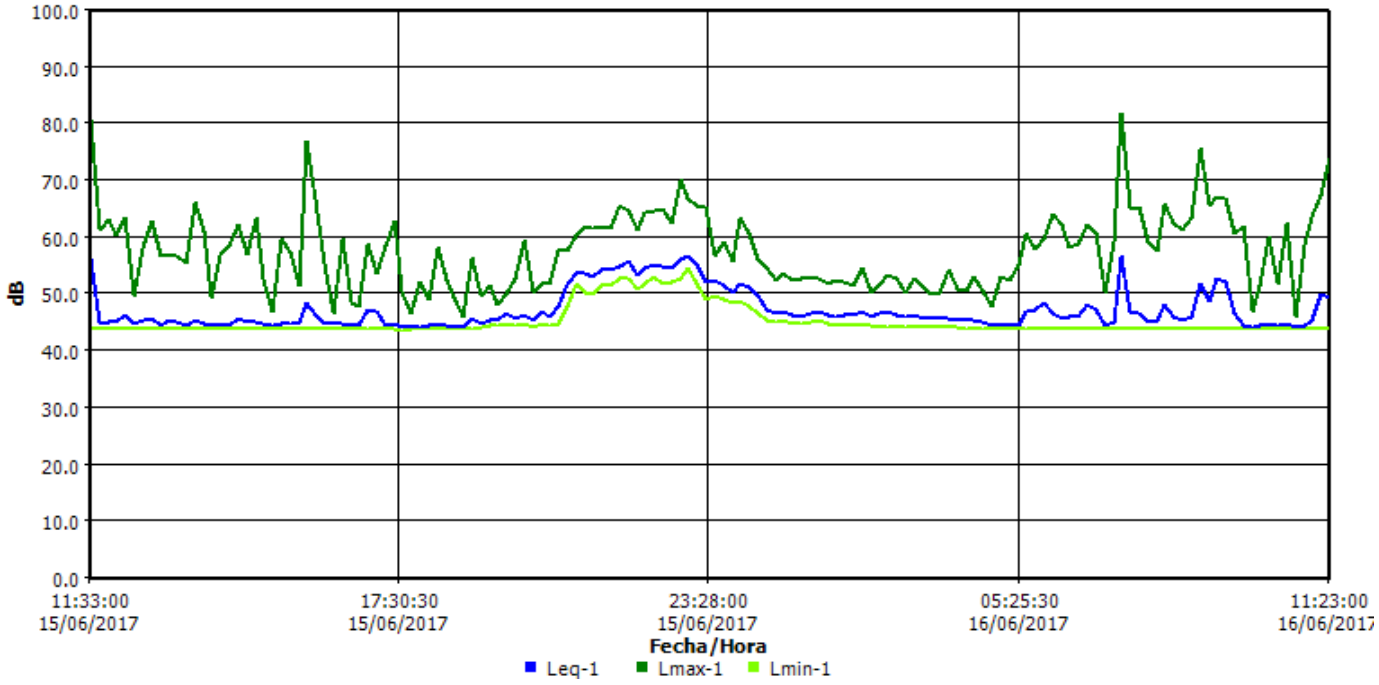
Panel de información

Ubicación	Área Este del proyecto, a inmediaciones de Aldea El Fucio
Nombre	ER-3
Sesión padre	S058
Hora de inicio	Jueves, 15 de Junio de 2017 11:23:00
Hora de paro	Viernes, 16 de Junio de 2017 11:23:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	43.7 dB	Lmax	1	81.9 dB
Lpk	1	99.6 dB	Leq	1	49 dB

Gráfica de datos de registro



ER-7A

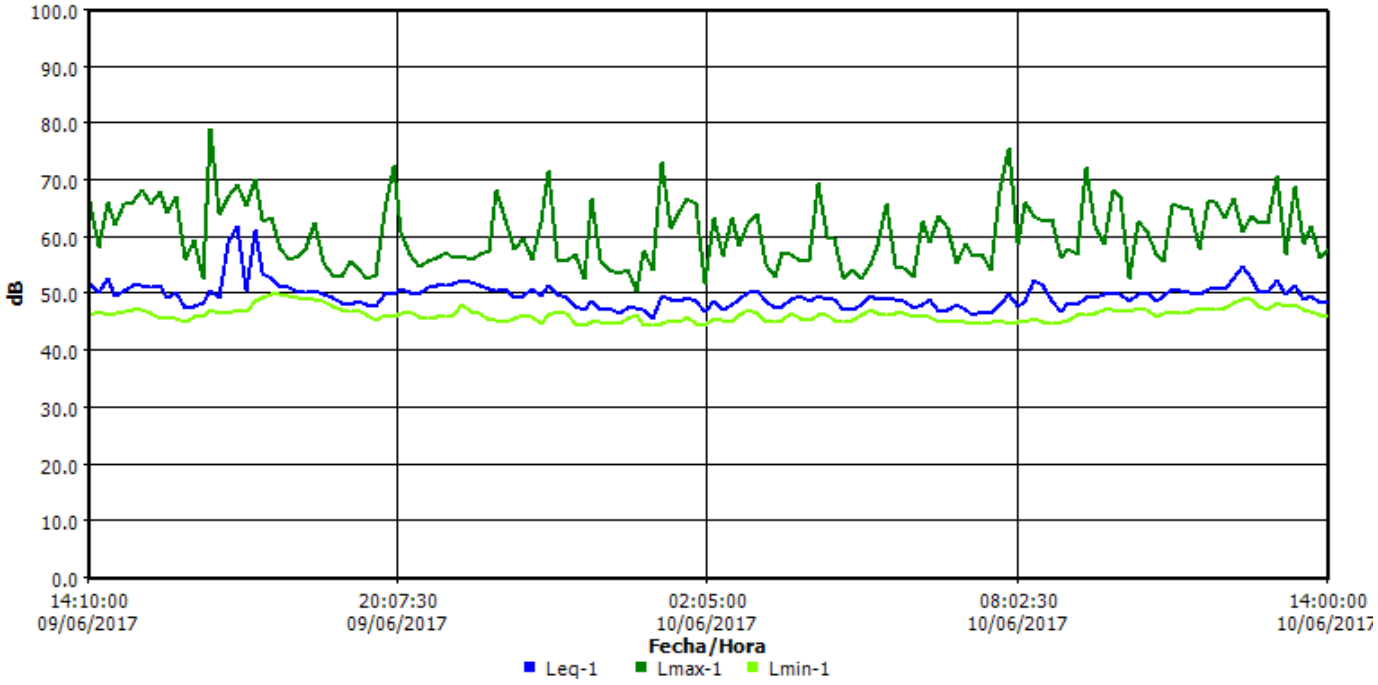
Panel de información

Ubicación	Aledaño a Aldea Los Planes
Nombre	ER-7A
Sesión padre	S057
Hora de inicio	Viernes, 09 de Junio de 2017 14:00:00
Hora de paro	Sábado, 10 de Junio de 2017 14:00:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	44.4 dB	Lmax	1	79 dB
Lpk	1	102.9 dB	Leq	1	50.8 dB

Gráfica de datos de registro



ER-1

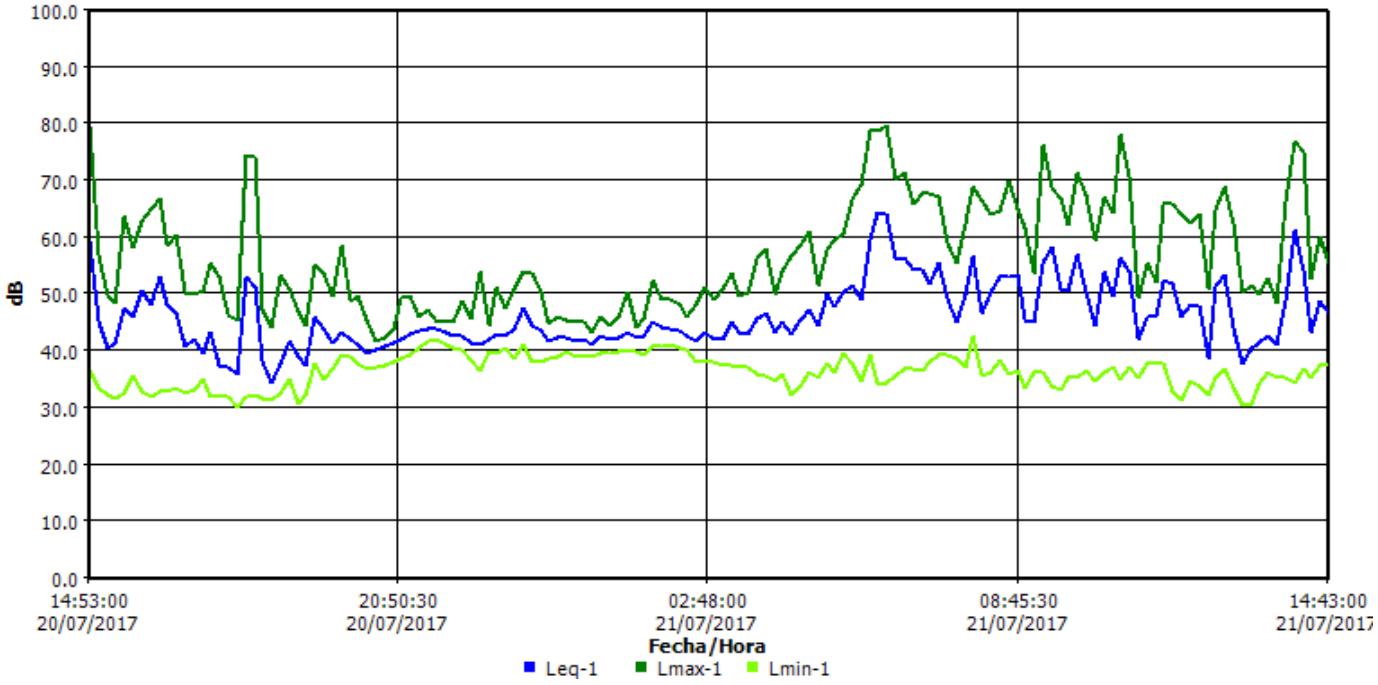
Panel de información

Ubicación	Depósito de suelos, a inmediaciones de Aldea Los Planes
Nombre	ER-1
Sesión padre	S208
Hora de inicio	Jueves, 20 de Julio de 2017 14:43:00
Hora de paro	Viernes, 21 de Julio de 2017 14:43:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	100 dB
Ponderación	1	A	Respuesta	1	SLOW
Lmin	1	30 dB	Lmax	1	79.6 dB
Lpk	1	103.7 dB	Leq	1	51.2 dB

Gráfica de datos de registro



ER-2

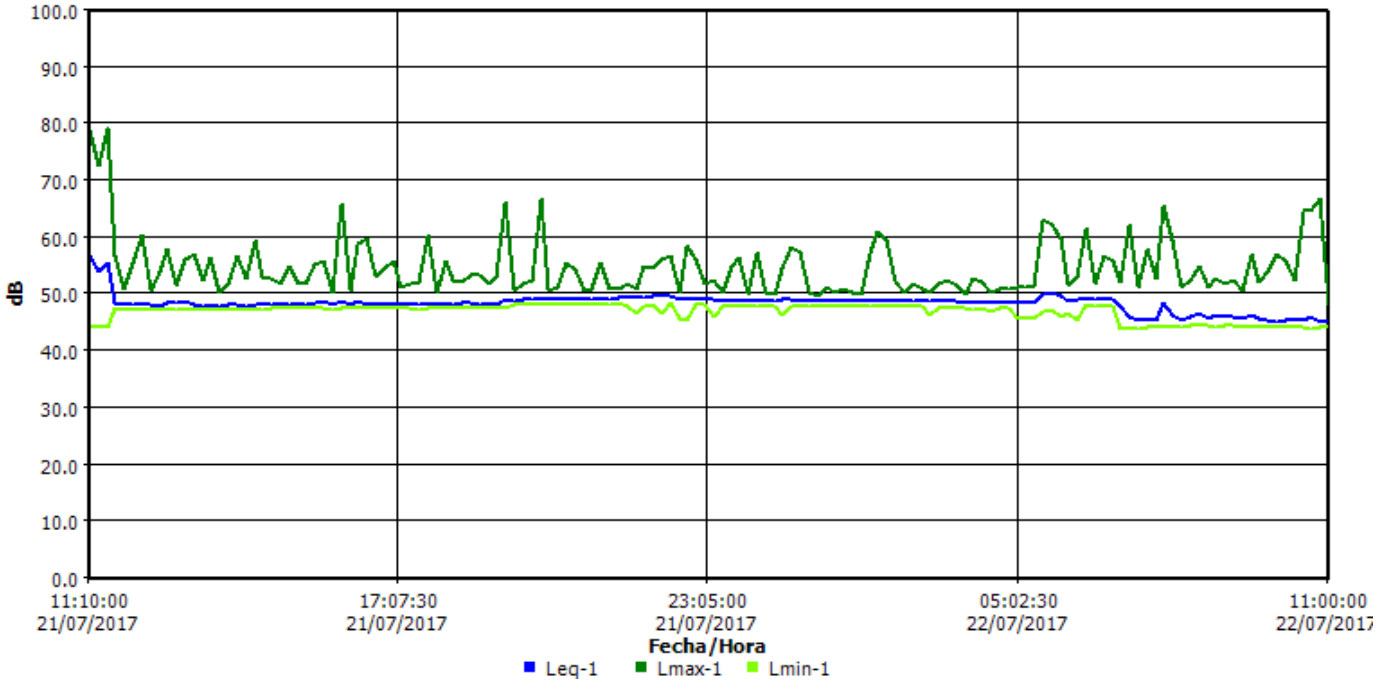
Panel de información

Ubicación	Aldea La Cuchilla
Nombre	ER-2
Sesión padre	S062
Hora de inicio	Viernes, 21 de Julio de 2017 11:00:00
Hora de paro	Sábado, 22 de Julio de 2017 11:00:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	44 dB	Lmax	1	79.3 dB
Lpk	1	96.5 dB	Leq	1	48.7 dB

Gráfica de datos de registro



ER-3

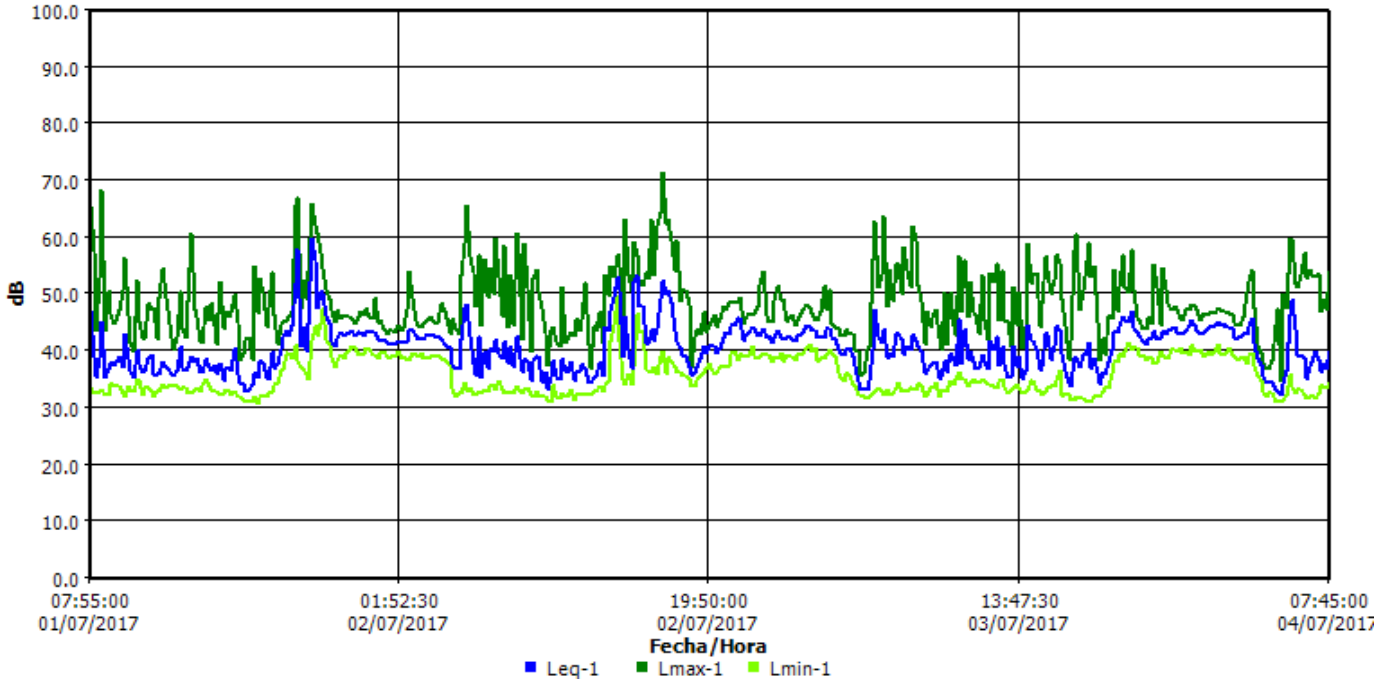
Panel de información

Ubicación	Área Estedel proyecto, a inmediaciones de Aldea El Fucio.
Nombre	ER-3
Sesión padre	S205
Hora de inicio	Sábado, 01 de Julio de 2017 07:45:00
Hora de paro	Martes, 04 de Julio de 2017 07:45:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	100 dB
Ponderación	1	A	Respuesta	1	SLOW
Lmin	1	30.6 dB	Lmax	1	71.3 dB
Lpk	1	99.4 dB	Leq	1	43.3 dB

Gráfica de datos de registro



ER-7A

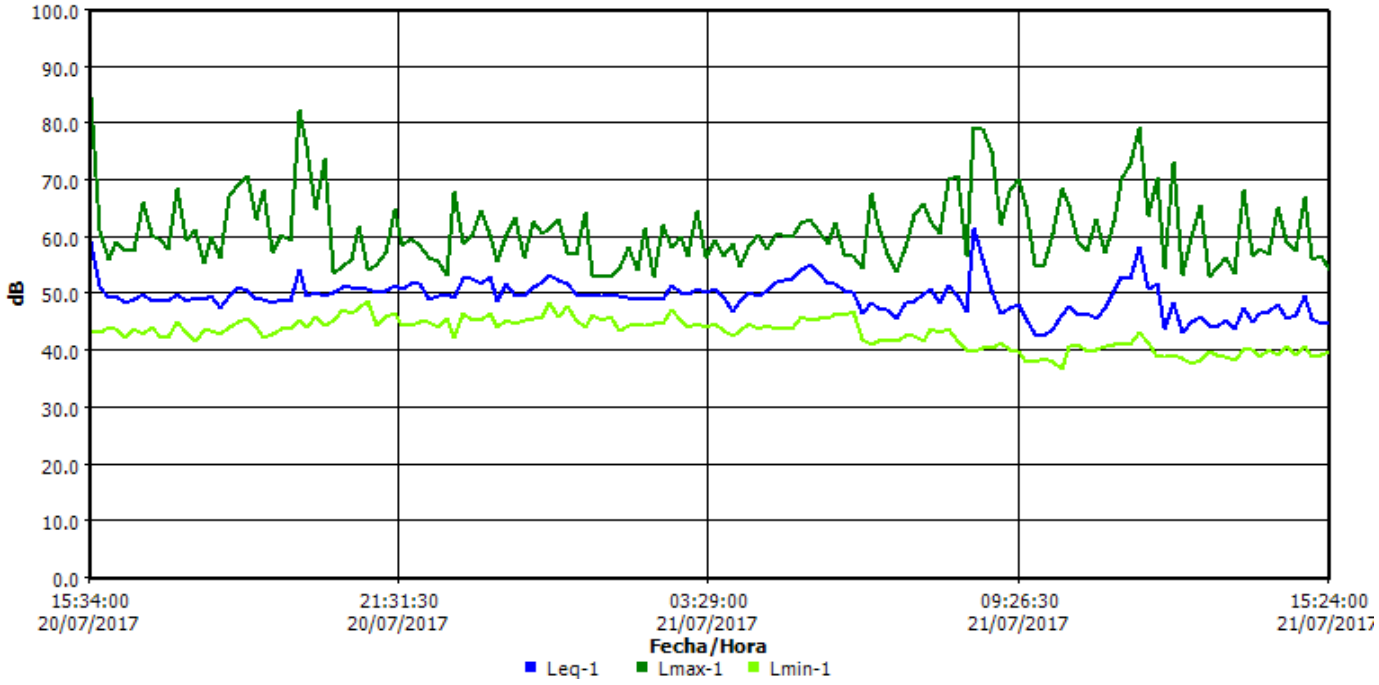
Panel de información

Ubicación	Al noreste de pileta de agua de proceso y pileta de cumplimiento ambiental, juri
Nombre	ER-7A
Sesión padre	S279
Hora de inicio	Jueves, 20 de Julio de 2017 15:24:00
Hora de paro	Viernes, 21 de Julio de 2017 15:24:00
Nombre del usuario	

Panel general de datos

Descripción	Medidor/Sensor	Valor	Descripción	Medidor/Sensor	Valor
Índice de intercambio	1	3 dB	Umbral int.	1	80 dB
Ponderación	1	A	Respuesta	1	FAST
Lmin	1	37 dB	Lmax	1	84.5 dB
Lpk	1	113 dB	Leq	1	50.7 dB

Gráfica de datos de registro



12.4 Certificados de verificación de los equipos utilizados

12.4.1 Material Particulado (PM_{10}) y Presión Sonora

Analítica Química Internacional, S.A.

Centro Comercial El Molino, Km. 15, Calzada Roosevelt, Zona 2 de Mixco, Local 22
Guatemala, Centro América. PBX: (502) 2502-4700, Directo: (502) 2502-4712
Email: info@anaqui.com , Web: www.anaqui.com

CERTIFICADO DE CALIBRACION

CERTIFICADO No.: *001270516*
CLIENTE: *MINERA SAN RAFAEL*
INSTRUMENTO: *MEDIDOR MULTIPARAMETRICO*
MODELO: STAR A329
NÚMERO DE SERIE: *G03757* **FECHA:** *27 de Mayo del 2016*

En la siguiente tabla, aparecen las diferentes pruebas realizadas al equipo con los estándares correspondientes, como también los resultados obtenidos por el instrumento y la tolerancia aceptada, para pasar satisfactoriamente las pruebas.

Valor Esperado	Valor Promedio del Equipo	Incertidumbre	Condición
PH			
4.01 ± 0.01 pH	4.01 pH	± 0.01 pH	PASA
7.00 ± 0.01 pH	6.99 pH	± 0.01 pH	PASA
10.01 ± 0.02 pH	10.02 pH	± 0.02 Ph	PASA
% de Pendiente	98.2%	N/A	PASA
CONDUCTIVIDAD			
147µS	146 µS	±5 µS	PASA
100 µS	100 µS	±5 µS	PASA
1 µS	1 µS	±5 µS	PASA
OXIGENO DISUELTO			
100% Sat	100% sat	±5 sat	PASA

Control Ambiente : Temperatura : 28.0 °C

Estándares Utilizados:

Buffer 4	Marca: THERMO	Catálogo: 910410-WA	Lote: TR2A
Buffer 7	Marca: THERMO	Catálogo: 910725	Lote: TT1B
Buffer 10	Marca: THERMO	Catálogo: 911025-WA	Lote: TS1A

CONDUCTIVITY CALIBRATION KIT Marca: THERMO Serie: 0816

CONDUCTIVITY STANDARD 147 µS Marca: THERMO Lote: TU1A

La incertidumbre se calculó según la Guía para la Evaluación y Expresión de la Incertidumbre para la Medición de los Resultados del NIST de los Estados Unidos de Norteamérica, nota técnica No. 1297.
La Incertidumbre Expandida está calculada para un intervalo de confianza de no menos del 95% (el cual da un factor de cobertura de K=2).
Los resultados aquí presentados son válidos únicamente para el momento de la calibración.

Certificate of Analysis

For Conductivity Calibration Kit

I certify the **1010001** Conductivity Calibration Kit, Serial number **0816** was inspected and tested **on 9/10/2015** and has met or exceeded Thermo Fisher Scientific, Water and Lab Products' specifications.

Tolerances of 0.1 % are met by the following results:

Specification	A	B	C	D	E	F
Nominal Resistance	**1,000.000 KΩ**	**100.000 KΩ**	**10.000 KΩ**	**1.000 KΩ**	**100.000 Ω**	**10.000 Ω**
Nominal Conductance	**1.0000 uS**	**10.0000 uS**	**100.0000 uS**	**1,000.0000 uS**	**10.0000 mS**	**100.0000 mS**

New Kit Calibration	A	B	C	D	E	F
Actual Resistance	**999.920 KΩ**	**100.001 KΩ**	**10.004 KΩ**	**1.000 KΩ**	**100.031 Ω**	**9.999 Ω**
Actual Conductance	**1.0001 uS**	**9.9999 uS**	**99.9600 uS**	**1000.0000 uS**	**9.9969 mS**	**100.0100 mS**

Recommended calibration interval for this kit is 1 year from the date it is put into service.

Thermo Fisher Scientific, Environmental Instruments Division, Water Analysis Instrument's test equipment is traceable to NIST and meets the requirements of ANSI/NCSL/Z540-1.

Thermo Fisher is certified to be in compliance with the requirements of ISO 9001: 2008 and is registered under QMI File #001911. Calibration vendors for our test equipment are chosen for their expertise in different aspects of metrology and process certification, which may include (but are not limited to) ISO 9001: 2008 and, ISO/IEC 17025: 2005.

Meter Used: Fluke 8840A QC#307 ***Calibration Due: 9/16/2016***

Certified by:
Thermo Fisher Scientific
Water and Lab Products
Quality Assurance
Date: 9/10/2015

North America
Toll Free: 1-800-225-1480
Tel: 1-978-232-6000

Germany
Tel: (49) 6184-90-6000
info.water.uk@thermofisher.com

India
Tel: (91) 22-4157-8800

Japan
Tel: (81) 045-453-9175
wat.asia@thermofisher.com

InfoWaterAU@thermofisher.com

Certificate Of Analysis

Product Information:

Part Number	910410-WA
Description	PH 4.01 BUFFER, COLOR-RED, 10 POUCHES
Lot Number	TR2A
Expiration Date	05/31/2017
Method Of Analysis	POTENTIOMETRIC

Actual Analysis:

Acceptance Range	Results	Unit Of Measure
4.01 +/- 0.01 PH UNITS AT 25 C	4.01	PH UNITS AT 25 C

Traceability:

N.I.S.T Chemical	SRM#
DISODIUM HYDROGEN PHOSPHATE	186 II g
POTASSIUM DIHYDROGEN PHOSPHATE	186 I g
POTASSIUM HYDROGEN PHTHALATE	185 i

Certificate Date:05/26/2015

Approved By:

Quality Representative

thermoscientific.com/water

Water Analysis Instruments

North America
Toll Free: 1-800-225-1480
Tel: 1-978-232-6000
info.water@thermo.com

Netherlands
Tel: (31) 033-2463887
info.water.uk@thermo.com

China
Tel: (86) 21-68654588
wai.asia@thermofisher.com

India
Tel: (91) 22-4157-8800
wai.asia@thermofisher.com

Singapore
Tel: (65) 6778-6876
wai.asia@thermofisher.com

Japan
Tel: (81) 045-453-9175
wai.asia@thermofisher.com

Australia
Tel: (613) 9757-4300
in Australia (1300) 735-295
InfoWaterAU@thermofisher.com

244721-001 Rev.H

Thermo SCIENTIFIC
Part of Thermo Fisher Scientific

Certificate Of Analysis

Product Information:

Part Number	910710
Description	PH 7.00 BUFFER, COLOR-YELLOW, 10 POUCHES
Lot Number	TT1B
Expiration Date	05/31/2017
Method Of Analysis	POTENTIOMETRIC

Actual Analysis:

Acceptance Range	Results	Unit Of Measure
7.00 +/- 0.01 PH UNITS AT 25 C	7.01	PH UNITS AT 25 C

Traceability:

N.I.S.T Chemical	SRM#
DISODIUM HYDROGEN PHOSPHATE	186 II g
POTASSIUM DIHYDROGEN PHOSPHATE	186 I g
SODIUM BICARBONATE	191d-I
SODIUM CARBONATE	191d-II

Certificate Date:05/26/2015

Approved By:

Quality Representative

thermoscientific.com/water

Water Analysis Instruments

North America
Toll Free: 1-800-225-1480
Tel: 1-978-232-6000
info.water@thermo.com

Netherlands
Tel: (31) 033-2463887
info.water.uk@thermo.com

China
Tel: (86) 21-68654588
wai.asia@thermofisher.com

India
Tel: (91) 22-4157-8800
wai.asia@thermofisher.com

Singapore
Tel: (65) 6778-6876
wai.asia@thermofisher.com

Japan
Tel: (81) 045-453-9175
wai.asia@thermofisher.com

Australia
Tel: (613) 9757-4300
in Australia (1300) 735-295
InfoWaterAU@thermofisher.com

244721-001 Rev.H

Thermo SCIENTIFIC
Part of Thermo Fisher Scientific

Certificate Of Analysis

Product Information:

Part Number	911010
Description	PH 10.01 BUFFER, COLOR-BLUE, 10 POUCHES
Lot Number	TS1A
Expiration Date	05/31/2017
Method Of Analysis	POTENTIOMETRIC

Actual Analysis:

Acceptance Range	Results	Unit Of Measure
10.01 + /- 0.02 PH UNITS AT 25 C	10.02	PH UNITS AT 25 C

Traceability:

N.I.S.T Chemical	SRM#
DISODIUM HYDROGEN PHOSPHATE	186 II g
POTASSIUM DIHYDROGEN PHOSPHATE	186 I g
SODIUM BICARBONATE	191d-I
SODIUM CARBONATE	191d-II

Certificate Date:05/26/2015

Approved By:

Quality Representative

thermoscientific.com/water

Water Analysis Instruments

North America
Toll Free: 1-800-225-1480
Tel: 1-978-232-6000
info.water@thermo.com

Netherlands
Tel: (31) 033-2463887
info.water.uk@thermo.com

India
Tel: (91) 22-4157-8800
wai.asia@thermofisher.com

Japan
Tel: (81) 045-453-9175
wai.asia@thermofisher.com

China
Tel: (86) 21-68654588
wai.asia@thermofisher.com

Singapore
Tel: (65) 6778-6876
wai.asia@thermofisher.com

Australia
Tel: (613) 9757-4300
in Australia (1300) 735-295
InfoWaterAU@thermofisher.com

244721-001 Rev.H

Thermo SCIENTIFIC
Part of Thermo Fisher Scientific

Certificate Of Analysis

Product Information:

Part Number	01100910
Description	147 uS/CM CONDUCTIVITY STD, 10 POUCHES
Lot Number	TU1A
Expiration Date	06/30/2016
Method Of Analysis	CONDUCTIVITY

Actual Analysis:

Acceptance Range	Results	Unit Of Measure
147 US/CM +/- 10 US/CM AT 25 C	142	US/CM AT 25 C

Traceability:

N.I.S.T Chemical	SRM#
POTASSIUM CHLORIDE	918b

Certificate Date:06/04/2015

Approved By:

Quality Representative

thermoscientific.com/water

Water Analysis Instruments

North America
Toll Free: 1-800-225-1480
Tel: 1-978-232-6000
info.water@thermo.com

Netherlands
Tel: (31) 033-2463887
info.water.uk@thermo.com

China
Tel: (86) 21-68654588
wai.asia@thermofisher.com

India
Tel: (91) 22-4157-8800
wai.asia@thermofisher.com

Singapore
Tel: (65) 6778-6876
wai.asia@thermofisher.com

Japan
Tel: (81) 045-453-9175
wai.asia@thermofisher.com

Australia
Tel: (613) 9757-4300
in Australia (1300) 735-295
InfoWaterAU@thermofisher.com

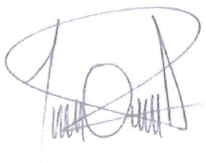
Thermo SCIENTIFIC
Part of Thermo Fisher Scientific

244721-001 Rev.H

Analítica Química Internacional, S.A.

Centro Comercial El Molino, Km. 15, Calzada Roosevelt, Zona 2 de Mixco, Local 22
Guatemala, Centro América. PBX: (502) 2502-4700, Directo: (502) 2502-4712
Email: info@anaqui.com , Web: www.anaqui.com

COMENTARIOS: De acuerdo con estos resultados, el instrumento pasa a satisfacción con todas las pruebas realizadas, por lo que **cumple** con los requerimientos detallados en la hoja de especificaciones del fabricante.



Jordy Orlando Paz López
DPTO. DE SERVICIO TECNICO

ThermoFisher SCIENTIFIC

The world leader in serving science

March 3, 2015

A QUIEN PUEDA INTERESAR

Por la presente comunicación queremos hacer constar que la empresa

Analitica Quimica Internacional, S.A.
Molino de las Flores 3
52 Avenida 1-80 Zona 2 Mixco
Guatemala

Es distribuidor autorizado de los productos Thermo Fisher Scientific, Laboratory Products Group, Water Analysis Instruments, Orion Products en Guatemala. Los productos que se incluyen bajo esta autorización son los siguientes:

1) PH Electrodes, Meter and Accessories
2) Ion Selective Electrodes, Meter and Accessories
3) Dissolved Oxygen Electrodes, Meter and Accessories
4) Conductivity Electrodes, Meters and Accessories
5) Turbidez
6) Colorimetría
7) Espectrofotometria
8) Orion On-Line Process Monitoring
9) AquaSensor Water-Waste Water Systems

Por la tanto Analitica Quimica Internacional Anaqui cuenta con el personal tecnico debidamente capacitado para prestar el servicio tecnico y de reparación de nuestros productos. Igualmente la empresa esta autorizada a presentar ofertas y cotizaciones tanto a entes privados y públicos. La presente carta de distribución tiene una validez de dos (2) años contado a partir de la presente fecha y se renovara automáticamente por un (1) año más al menos que alguna de las partes notifique por escrito lo contrario.

Atentamente,

Delffy Ramones
Sales Manager, Latin America
Thermo Fisher Scientific
LPG WAI Orion Products
P: 978-232-6156
F: 978-232-1029
E-Mail: delffy.ramones@thermofisher.com

CERTIFICADO DE VERIFICACIÓN DE CALIBRACIÓN DE EQUIPOS PARA MEDICIÓN DE TSP, $PM_{2.5}$ y PM_{10}

May-17

Certificado Numero: **2100**

Características del Equipo

Nombre de equipo: Ambient Particulate Sampler

Modelo: PQ200 BGI Instruments

Fabricante: BGI Incorporated

Unidades de medición: Litros Por Minuto (LPM)

Rango de flujo: De 1.00 a 25.00 LPM

Descripción: Se utiliza el Calibrador BGI "Trical - Nist", el proceso de calibración consiste en hacer pasar por el equipo PQ200 un flujo de aire, el cual es ajustado a un valor especifico bajo condiciones estándar de presión y temperatura (1 Atm y 25 ºC para obtener el valor de flujo real.

Nota: El fabricante establece que el equipo no requiere Re-calibración de fabrica, por lo tanto se utiliza el calendario establecido por CTA para el mantenimiento y calibración.

Información de la Calibración

Equipo No.:	**2**	**Fecha de Verificación de Calibración:**	**05/23/17**
Número de Serie :	**877**	**Vigencia:**	**30 Días**

Valores Ambientales	
Temperatura (°C)	23.90
Presión (Pulg.Hg)	24.41
Humedad Relativa (%)	61.00

Parámetro	Lectura Calibración PQ200	Lectura Patrón
Flujo (LPM)	16.70	16.71*
Temperatura Ambiente (°C)	23.90	23.90*
Temperatura Filtro (°C)	23.90	23.90*
Barómetro (Pulg.Hg)	24.41	24.41*

Test de vacio		
SP (cm H_2O)	35.00	SP < 33
Pi - Vacio inicial (cm H_2O)	95.00	ΔP < 5
Pf - Vacio final (cm H_2O)	93.00	

Estado del Equipo: **CALIBRADO**

(*)Multimetro ambiental 1227U10 traceable. NIST (National Institute of Standards and Technology).

Patrón Utilizado

Nombre el Equipo: TriCal Nist

No. Serie 000103-3

Rango de Flujo: 0.1-30 LPM

Rango de Temperatura: -40 a 50 °C

Rango de Presión Barométrica: 400-800 mm Hg

No. Método: RFPS-1298-124

Fecha de Calibración del Patrón Utilizado: 05/12/16

Responsables:

Luis Rey — **Luis Rey**, Responsable

Hasan Zolata — **Ing. Hasan Zolata**, Supervisor

CTA
CONSULTORIA Y TECNOLOGIA AMBIENTAL, S.A.

Falla reportada

Cliente solicita revisión y mantenimiento general.

Observaciones

Revisión general sistema de carga.

Diagnostico

Después de cargar al 100% el equipos, se procedió a correr una prueba de 24 hrs. configurado a 16.7 LPM, encontrando que el equipo funciona correctamente. Se realizara mantenimiento general de todos sus componentes.

Trabajos realizados

Mantenimiento de los siguientes componentes:

- Bomba de vacio (diafragmas, valvulas, ejes)
- Motor eléctrico
- Sensor de flujo másico
- Conexiones del circuito de vacio
- Sistema mecánico de Porta filtro
- Mantenimiento de tarjeta electrónica.
- Ventilador
- Barómetro atmosférico
- Pantalla Anti-Radiación

Al finalizar el mantenimiento se efectuaron las siguientes verificaciones:

- Prueba de fuga de cada sección del circuito
- Calibración de flujo con patrón trazable ante el NIST
- Calibración de presión barométrica y temperatura con patrón trazable ante el NIST.
- Test final: 1 corridas de más de 26 horas exitosas.

Repuestos utilizados

- Ninguno.

Responsables:

Luis Rey Hasan Zolata

Luis Rey	**Ing. Hasan Zolata**
Responsable	Supervisor

CONSULTORIA Y TECNOLOGIA AMBIENTAL, S.A.

CONSULTORIA Y TECNOLOGIA AMBIENTAL, S.A.

BGI PQ200 Air Sampling System

Downloaded 2017 26 may 07:43:30

Job Details:		Job Code:	4
Job Name:	17MAY26C.JOB	Site Name:	CTA
Version:	5.62	Station Code:	LABEL
Serial No:	877	Operators:	LREY
Pump Time:	4914:42	User1:	_98
Flags:		User2:	

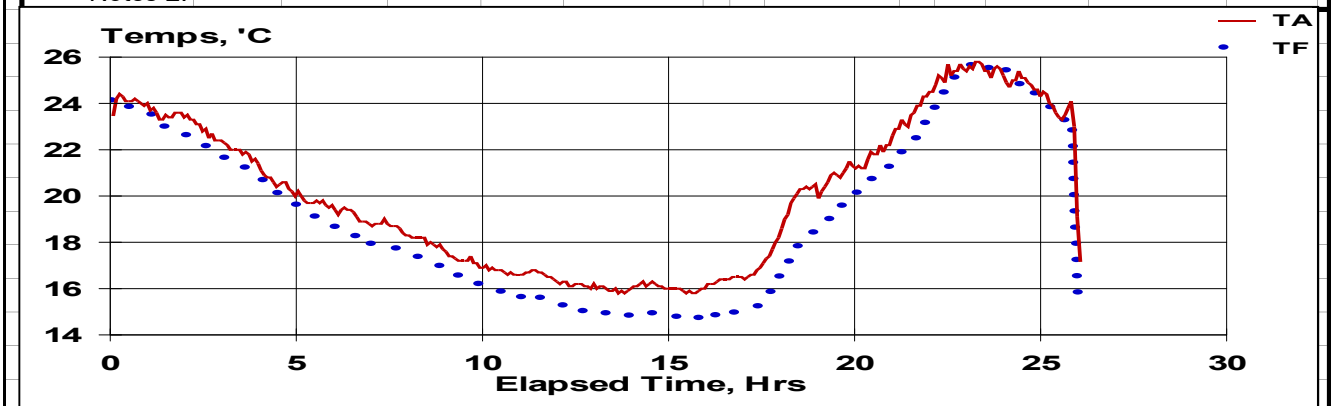
	Max	Min	Avg	Units
BP	621	618	619	mmHg
TA	26.1	15.7	20.1	°C
Q	---	---	16.71	Lpm
QCV			0.63	%
Max overheat			2.3	°C
occured	25-may 15:08:54			

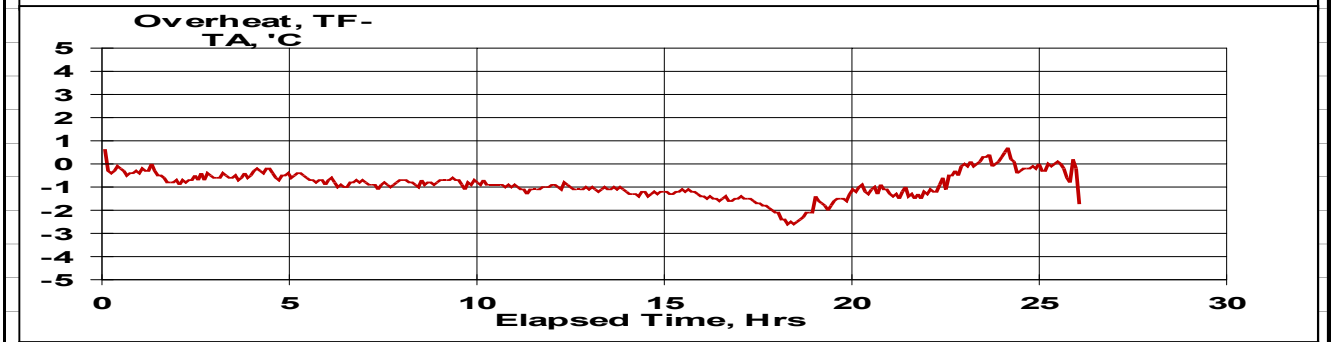
Timer Information:	Date	Time
	dd-mmm	hh:mm:ss
Start:	17-24-may	12:55:08
Stop:	17-25-may	15:05:04
ET:	26:09:00	

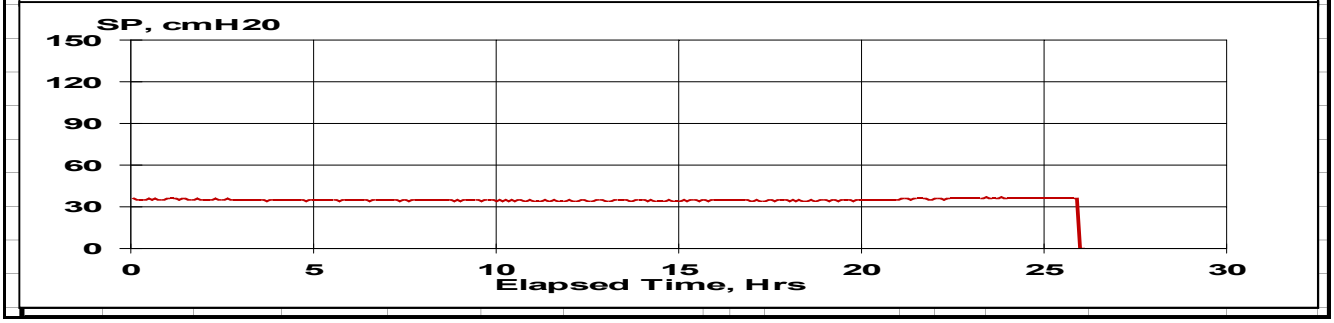
Mass Concentration Data:		
Filter ID:		
Final Wt:		mg
Initial Wt:		mg
Delta Wt:	0.000	mg
Total Vol:	26.214	m^3
Mass Conc:	0	µg/m3

Notes 1: 4ta

Notes 2:







Hourly Averaged Data

Date	Start Hour	BP	AmbT	Filt T	Delta T	SP	Flow
yy-dd-mmm	hh:mm:ss	mmHg	°C	°C	°C	cmH2O	aLpm
17-24-may	13:00:08	620	24.1	23.8	-0.3	35	16.71
17-24-may	14:00:08	619	23.5	23.0	-0.5	36	16.72
17-24-may	15:00:08	618	22.9	22.2	-0.6	35	16.71
17-24-may	16:00:08	618	21.9	21.3	-0.5	35	16.72
17-24-may	17:00:08	619	20.6	20.2	-0.4	35	16.72
17-24-may	18:00:08	619	19.8	19.1	-0.6	35	16.72
17-24-may	19:00:08	620	19.2	18.4	-0.8	35	16.71
17-24-may	20:00:08	620	18.7	17.8	-0.9	35	16.72
17-24-may	21:00:08	620	18.0	17.2	-0.8	35	16.72
17-24-may	22:00:08	621	17.3	16.5	-0.8	35	16.72
17-24-may	23:00:08	620	16.8	15.9	-0.9	35	16.71
17-25-may	0:00:08	620	16.6	15.6	-1.1	34	16.71
17-25-may	1:00:08	620	16.2	15.2	-1.0	35	16.71
17-25-may	2:00:08	620	16.0	14.9	-1.1	35	16.72
17-25-may	3:00:08	620	16.1	14.9	-1.3	34	16.70
17-25-may	4:00:08	620	15.9	14.7	-1.2	35	16.71
17-25-may	5:00:08	619	16.3	14.8	-1.5	35	16.72
17-25-may	6:00:08	620	17.0	15.3	-1.7	35	16.71
17-25-may	7:00:08	620	19.7	17.4	-2.3	34	16.71
17-25-may	8:00:08	620	20.7	19.1	-1.7	35	16.71
17-25-may	9:00:08	621	21.6	20.5	-1.1	35	16.71
17-25-may	10:00:08	621	23.3	22.0	-1.3	36	16.72
17-25-may	11:00:08	621	25.1	24.2	-0.9	36	16.71
17-25-may	12:00:08	620	25.5	25.6	0.1	36	16.71
17-25-may	13:00:08	620	25.0	25.1	0.0	36	16.71
17-25-may	14:00:08	619	24.0	23.8	-0.2	36	16.72
17-25-may	15:00:08	619	23.0	23.2	0.2	36	16.70

CERTIFICADO DE VERIFICACIÓN DE CALIBRACIÓN DE SONÓMETROS

May-17

Certificado Numero: **2101**

Características del Equipo

Nombre de equipo:	Sound Level Meter
Modelo:	SoundPro SE/DL
Fabricante:	Quest Technologies
Unidades de medición:	Decibeles
Precisión:	0.5 dB a 25ºC; 1.0 dB arriba del rango de temperatura de -10ºC a 50ºC. Segundo Detector de picos: 1.5dB desde 40 hasta +10dB relativo al límite superior del rango. Análisis en frecuencia desde 16Hz hasta 16KHz en bandas de octavas y desde 12.5Hz hasta 20KHz en tercios de bandas de octavas
Rango de medición:	4 hz (-3dB) a 50kHz (-3dB) en carga lineal únicamente.

Información de la Calibración

Equipo No.:	**1**	**Fecha de Verificación de Calibración:**	**05/24/17**	**m/d/a**
Número de Serie :	**BGI020002**	**Vigencia:**	**30 Días**	

Valores Ambientales	
Temperatura °C	24.10
Presión (Pulg. Hg)	24.40
Humedad Relativa (%):	65.00

Lectura de Calibración	114.00	dB
Relectura	114.00	dB

Estado del Equipo: **CALIBRADO**

Características del Equipo de Calibración

Equipo:	QC-10 Calibrator
Numero Serie:	QIC100169
Fabricante:	Quest Technologies
Rango:	94-114 dB
Fecha Emisión:	05/18/16
Certificado No.:	ICA- 677916

Responsables

Luis Rey

Luis Rey
Responsable

Hasan Zolata

Ing. Hasan Zolata
Supervisor

CTA
CONSULTORIA Y TECNOLOGIA AMBIENTAL, S.A.

CERTIFICADO DE VERIFICACIÓN DE CALIBRACIÓN DE SONÓMETROS

May-17

Falla reportada

Cliente solicita revisión y mantenimiento general.

Observaciones

Efectuar corrida de prueba de 72 hrs.

Diagnostico

Después de revisar el equipo, se realizó una corrida de prueba de 72 hrs identificando que el equipo funciona correctamente, se efectuará mantenimiento general.

Trabajos realizados

Mantenimiento de los siguientes componentes:

- Revisión y mantenimiento general de consola de muestreo y kit outdoor.

Al finalizar el mantenimiento se efectuaron las siguientes verificaciones:

- Calibración del equipo.
- Verificación de funciones.
- Test de medición de sonido.
- Revisión de kit outdoor.

Repuestos utilizados

- Ninguno

Responsables:

Luis Rey

Luis Rey
Responsable

Hasan Zolata

Ing. Hasan Zolata
Supervisor

CONSULTORIA Y TECNOLOGIA AMBIENTAL, S.A.

Consultoría y Tecnología Ambiental S.A.
Reporte de sesión

07/07/2017

Información general

Nombre	S198_BGI020002_26052017_075824
Hora de inicio	18/05/2017 03:16:21 p.m.
Nombre del dispositivo	BGI020002
Tipo de modelo	SoundPro DL
Revisión del firmware del dispositivo	R.13F
Hora de paro	21/05/2017 03:17:21 p.m.
Duración:	3.00:01:00

Panel de datos de resumen

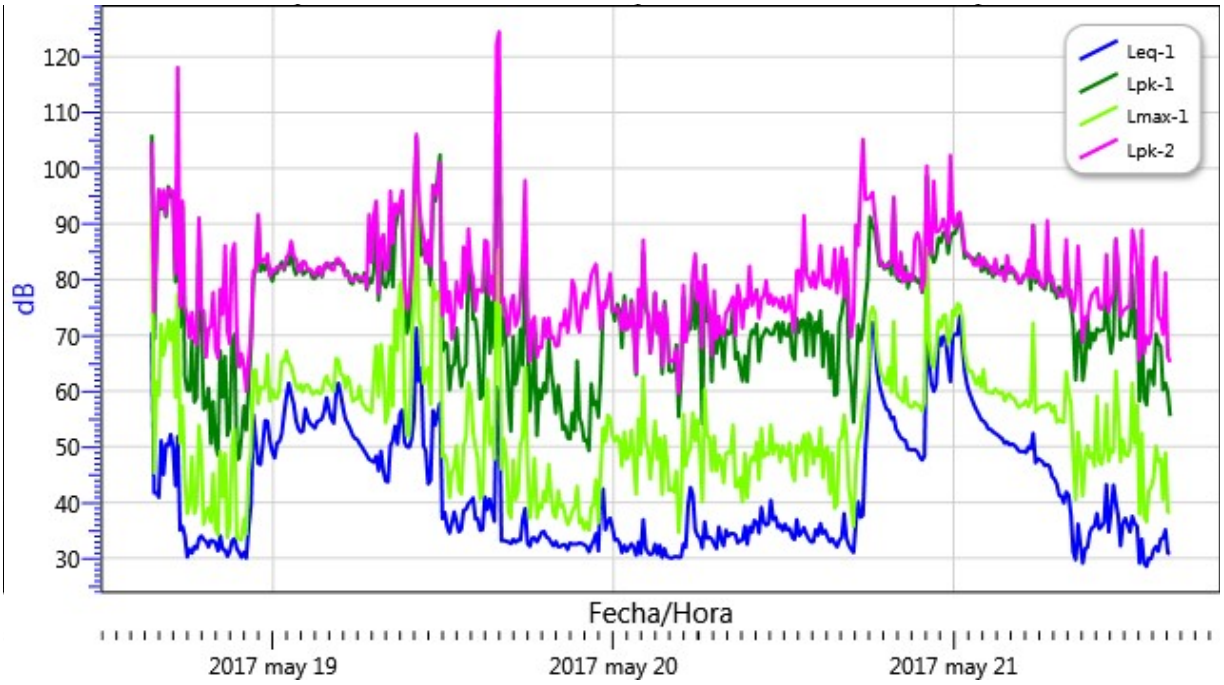
Descripción	Medidor	Valor	Descripción	Medidor	Valor
Leq	1	57.3 dB	CNEL	1	65.5 dB
Dose8	1	0.5 %	Dosis	1	4.9 %
Horas de exp.	1	0 Pa²-Hours	L10	1	56.6 dB
L90	1	29.9 dB	LDN	1	65.4 dB
Lmax	1	95.2 dB	Lmin	1	27.3 dB
Lpk	1	106 dB	OL%	1	0 %
PKtime	1	19/05/2017 03:52:06 p.m.	ProjectedTWA (1.00:00)	1	62 dB
Promedio ponderado de tiempo (TWA)	1	66.8 dB	Rtime	1	3.00:01:00
Segundos de exp.	1	55.6 Pa²-Sec	SEL	1	111.4 dB
Takt	1	58.5 dB	UL, tiempo límite superior	1	00:00:00
Índice de intercambio	1	3 dB	Ponderación	1	A
Respuesta	1	SLOW	Ancho de banda	1	OFF
Índice de intercambio	2	3 dB	Ponderación	2	Z
Respuesta	2	FAST			

Historial de calibración

Fecha	Acción de calibración	Nivel	Tipo de modelo del calibrador	Número de serie	Fecha de certificación
18/05/2017 03:15:11 p.m.	Calibración	114.0	QC-10	QIC100169	12/05/2016

Gráfica de datos de registro

S198_BGI020002_26052017_075824: Gráfica de datos de registro



Mesa Labs 10 Park Place Butler, NJ 07405
NIST Traceable Calibration Facility, ISO 9001:2008 Registered

MesaLabs

CERTIFICATE OF CALIBRATION - NIST TRACEABILITY

(Refer to instruction manual for further details of calibration)

tetraCal Serial Number: **508** DATE: 14-Jun-2017

Calibration Operator: E. Albujar

Critical Venturi Flow Meter: Max Uncertainity = 0.346%
Serial Number: 1A *CEESI NVLAP NIST Data File 07BGI-0001*
Serial Number: 2A *CEESI NVLAP NIST Data File 07BGI-0003*
Serial Number: 3A *CEESI NVLAP NIST Data File 07BGI-0004*
Serial Number: 4A *CEESI NVLAP NIST Data File 07BGI-0002*

Room Temperature: +- 0.03°C from -5°C - 70°C Room Temperature: 23.9 °C
Brand: Telatemp Serial Number: 358654
Std Cal Date 18-Oct-16 Std Cal Due Date 18-Oct-17
tetraCal:
Ambient Temperature (set): 23.9 °C
Aux (filter) Temperature (set): °C

Barometric Pressure ans Absolute Pressure
Vaisala Model PTB330(50-1100) Digital Accuracy: 0.03371%
Serial Number: C4310002
Std Cal Date 27-Mar-17 Std Cal Due Date 27-Mar-18
tetraCal:
Barometric pressure (set): 751.5 mm of Hg

Results of Venturi Calibration
Flow Rate (Q) vs. Pressure Drop (ΔP). Where: Q=Lpm, ΔP= Cm of H2O

No. 1 C 5.87896 ΔP ^ 0.52266
No. 2 C 1.15426 ΔP ^ 0.52451
No. 3 C 0.34293 ΔP ^ 0.54594

Overall Uncertainty: 0.35%

Date Placed In Service_____
(To be filled in by operator upon receipt)

Recommended Recalibration Date _____
(12 months from date placed in service)

Revised: March 2016
Cal102-03T1 Rev B

To Check a Tetra Cal 14-Jun-2017 E. Albujar
6 - 30.00 Lpm
VER. **3.41P**

BP= 751.5 mm of Hg

Maximum allowable error at any flow rate is .75%.
Serial No. 508

Reading Abs. P Crit. Vent. mm of Hg	Room TEMP	CV Qa Flow Lpm	Qa TriCal Indicated	% Error	
189.06	23.9	7.44	7.48	0.57	
494.73	23.9	19.79	19.76	-0.14	Average %
727.2	23.9	29.18	29.23	0.19	0.20

To Check a Tetra Cal
1.20 - 6.00 Lpm

BP= 751.5 mm of Hg

Reading Abs. P Crit. Vent. mm of Hg	Room TEMP	CV Qa Flow Lpm	Qa Tri Cal Indicated	% Error	
138.0	23.8	1.54	1.55	0.39	
330.3	23.8	3.76	3.76	-0.02	Average %
519.2	23.8	5.93	5.94	0.16	0.18

To Check a Tetra Cal
0.10 - 1.20 Lpm

BP= 751.5 mm of Hg

Reading Abs. P Crit. Vent. mm of Hg	Room TEMP	CV Qa Flow Lpm	Qa TriCal Indicated	% Error	
171.53	23.9	0.305	0.307	0.63	
434.15	23.9	0.818	0.816	-0.26	Average %
626.38	23.9	1.194	1.197	0.28	0.22

To Check a Tetra Cal 14-Jun-2017 E. Albujar Pre recert
6 - 30.00 Lpm BP= 748.5 mm of Hg
VER. **3.41P**

Maximum allowable error at any flow rate is .75%.
Serial No. 508

Reading Abs. P Crit. Vent. mm of Hg	Room TEMP	CV Qa Flow Lpm	Qa TriCal Indicated	% Error	
199.19	26.4	7.94	7.94	-0.06	
409.11	26.4	16.53	16.40	-0.80	Average %
699.83	26.4	28.42	28.70	0.97	0.04

To Check a Tetra Cal BP= 748.5 mm of Hg
1.20 - 6.00 Lpm

Reading Abs. P Crit. Vent. mm of Hg	Room TEMP	CV Qa Flow Lpm	Qa Tri Cal Indicated	% Error	
140.0	26.3	1.58	1.58	-0.04	
303.4	26.3	3.49	3.45	-1.07	Average %
480.2	26.3	5.55	5.55	-0.08	-0.40

To Check a Tetra Cal BP= 748.5 mm of Hg
0.10 - 1.20 Lpm

Reading Abs. P Crit. Vent. mm of Hg	Room TEMP	CV Qa Flow Lpm	Qa TriCal Indicated	% Error	
234.7	26.4	0.434	0.432	-0.42	
440.95	26.4	0.842	0.85	0.98	Average %
614.46	26.4	1.185	1.189	0.34	0.30

12.5 Informe Original de los Resultados Analíticos obtenidos de muestras de agua del Laboratorio ACZ Laboratories, INC. Correspondiente al Monitoreo de Junio y Julio 2017

12.5.1 Muestras de Agua Superficial (SW)

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

July 31, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38447

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 14, 2017. This project has been assigned to ACZ's project number, L38447. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38447. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 30, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. July 31, 2017

Project ID: Escobal
ACZ Project ID: L38447

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 3 miscellaneous samples from Tahoe Resources, Inc. on July 14, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L38447. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times except for parameters flagged with "H" flags (H3, H1), received either after the hold time expired or too close to the hold time.

Sample Analysis

These samples were analyzed for inorganic, organic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports. The following required further explanation not provided by the Extended Qualifier Report:

1. For samples with a TDS ratio over 1.2 and a TDS value greater than 150 mg/L, the samples were not retested based on historical re-analysis data and the sample matrix.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-7

ACZ Sample ID: ***L38447-01***
Date Sampled: *07/11/17 06:12*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/17/17 16:56	wtc
Cyanide, WAD	SM4500-CN I- distillation								07/17/17 13:32	wtc
Nitrogen, total Kjeldahl	M351.2 - Block Digestor								07/21/17 11:30	wtc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 12:49	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:12	bsu/las
Total Hot Plate Digestion	M200.2 ICP								07/26/17 12:33	aeh
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 18:51	enb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-7

ACZ Sample ID: ***L38447-01***
Date Sampled: *07/11/17 06:12*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1	0.22			mg/L	0.03	0.2	07/28/17 11:13	dcm
Aluminum, total	M200.7 ICP	1	5.35		*	mg/L	0.03	0.2	07/28/17 0:20	aeh
Antimony, dissolved	M200.8 ICP-MS	1	0.0007	B		mg/L	0.0004	0.002	07/26/17 18:46	enb
Antimony, total	M200.8 ICP-MS	1	0.0007	B		mg/L	0.0004	0.002	07/27/17 18:40	mfm
Arsenic, dissolved	M200.8 ICP-MS	1	0.0022			mg/L	0.0002	0.001	07/25/17 15:04	enb
Arsenic, total	M200.8 ICP-MS	1	0.0035			mg/L	0.0002	0.001	07/27/17 18:40	mfm
Barium, dissolved	M200.7 ICP	1	0.081			mg/L	0.003	0.02	07/28/17 11:13	dcm
Barium, total	M200.7 ICP	1	0.112			mg/L	0.003	0.02	07/28/17 0:20	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:13	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:20	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 11:13	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:20	aeh
Boron, dissolved	M200.7 ICP	1	0.01	B		mg/L	0.01	0.05	07/28/17 11:13	dcm
Boron, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:20	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:04	enb
Cadmium, total	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/27/17 18:40	mfm
Calcium, dissolved	M200.7 ICP	1	14.0			mg/L	0.1	0.5	07/28/17 11:13	dcm
Calcium, total	M200.7 ICP	1	15.4			mg/L	0.1	0.5	07/28/17 0:20	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:13	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:20	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:13	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:20	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:13	dcm
Copper, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:20	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:13	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:20	aeh
Iron, dissolved	M200.7 ICP	1	0.12			mg/L	0.02	0.05	07/28/17 11:13	dcm
Iron, total	M200.7 ICP	1	2.17		*	mg/L	0.02	0.05	07/28/17 0:20	aeh
Lead, dissolved	M200.8 ICP-MS	1	0.0003	B		mg/L	0.0001	0.0005	07/25/17 15:04	enb
Lead, total	M200.8 ICP-MS	1	0.0018			mg/L	0.0001	0.0005	07/27/17 18:40	mfm
Lithium, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 11:13	dcm
Lithium, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:20	aeh
Magnesium, dissolved	M200.7 ICP	1	2.6			mg/L	0.2	1	07/28/17 11:13	dcm
Magnesium, total	M200.7 ICP	1	2.6			mg/L	0.2	1	07/28/17 0:20	aeh
Manganese, dissolved	M200.7 ICP	1	0.021	B		mg/L	0.005	0.03	07/28/17 11:13	dcm
Manganese, total	M200.7 ICP	1	0.052			mg/L	0.005	0.03	07/28/17 0:20	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 11:56	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:27	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 11:13	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:20	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 11:13	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:20	aeh
Potassium, dissolved	M200.7 ICP	1	3.6			mg/L	0.2	1	07/28/17 11:13	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-7

ACZ Sample ID: ***L38447-01***
Date Sampled: *07/11/17 06:12*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	4.2			mg/L	0.2	1	07/28/17 0:20	aeh
Scandium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:13	dcm
Scandium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:20	aeh
Selenium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0003	07/25/17 15:04	enb
Selenium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0003	07/27/17 18:40	mfm
Silver, dissolved	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/25/17 15:04	enb
Silver, total	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/27/17 18:40	mfm
Sodium, dissolved	M200.7 ICP	1	8.5			mg/L	0.2	1	07/28/17 11:13	dcm
Sodium, total	M200.7 ICP	1	8.8			mg/L	0.2	1	07/28/17 0:20	aeh
Strontium, dissolved	M200.7 ICP	1	0.099			mg/L	0.005	0.03	07/28/17 11:13	dcm
Strontium, total	M200.7 ICP	1	0.106			mg/L	0.005	0.03	07/28/17 0:20	aeh
Thallium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:04	enb
Thallium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 18:40	mfm
Tin, dissolved	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 11:13	dcm
Tin, total	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 0:20	aeh
Titanium, dissolved	M200.7 ICP	1	0.010	B		mg/L	0.005	0.03	07/28/17 11:13	dcm
Titanium, total	M200.7 ICP	1	0.111			mg/L	0.005	0.03	07/28/17 0:20	aeh
Uranium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:04	enb
Uranium, total	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/27/17 18:40	mfm
Vanadium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 11:13	dcm
Vanadium, total	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 0:20	aeh
Zinc, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:13	dcm
Zinc, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:20	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-7

ACZ Sample ID: ***L38447-01***
Date Sampled: *07/11/17 06:12*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	35.9		*	mg/L	2	20	07/21/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Total Alkalinity		1	35.9		*	mg/L	2	20	07/21/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			3.7			%			07/31/17 0:00	calc
Sum of Anions			1.3			meq/L			07/31/17 0:00	calc
Sum of Cations			1.4			meq/L			07/31/17 0:00	calc
Chemical Oxygen Demand	M410.4	1	11	B	*	mg/L	10	20	07/24/17 13:13	emk
Chloride	SM4500Cl-E	1	6.0		*	mg/L	0.5	2	07/24/17 11:34	jmm
Conductivity @25C	SM2510B	1	154		*	umhos/cm	1	10	07/21/17 1:57	emk
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:05	bce
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/18/17 17:11	bce
Fluoride	SM4500F-C	1	0.12	B	*	mg/L	0.05	0.3	07/25/17 18:06	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		46			mg/L	0.2	5	07/31/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	1	3.50		*	mg/L	0.02	0.1	07/25/17 20:08	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1		U	*	mg/L	0.05	0.2	07/17/17 15:25	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	1	0.5		*	mg/L	0.1	0.5	07/21/17 16:01	wtc
pH (lab)	SM4500H+ B									
pH		1	7.9	H	*	units	0.1	0.1	07/21/17 0:00	emk
pH measured at		1	22.0		*	C	0.1	0.1	07/21/17 0:00	emk
Phosphate	Calculation based on dissolved Phosphorus		0.12	B		mg/L	0.06	0.2	07/31/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1	0.04	B	*	mg/L	0.02	0.05	07/19/17 10:41	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1	0.03	BH	*	mg/L	0.02	0.05	07/19/17 20:58	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1	0.06		*	mg/L	0.02	0.05	07/18/17 21:51	pjb
Residue, Filterable (TDS) @180C	SM2540C	1	182		*	mg/L	10	20	07/17/17 12:34	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1		U	*	mg/L	5	20	07/18/17 10:42	els
Residue, Total (TS) @ 105C	SM2540B	1	196		*	mg/L	10	20	07/14/17 15:18	abd
Sulfate	D516-02/-07 - Turbidimetric	1	18.6		*	mg/L	1	5	07/21/17 13:19	jmm
Sulfide as S	SM4500S2-D	150		UH	*	mg/L	3	20	07/19/17 16:23	emk
TDS (calculated)	Calculation		75.8			mg/L			07/31/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		2.40						07/31/17 0:00	calc

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-8

ACZ Sample ID: ***L38447-02***
Date Sampled: *07/11/17 09:10*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/17/17 17:01	wtc
Cyanide, WAD	SM4500-CN I- distillation								07/17/17 13:40	wtc
Nitrogen, total Kjeldahl	M351.2 - Block Digestor								07/21/17 11:42	wtc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 12:56	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:15	bsu/las
Total Hot Plate Digestion	M200.2 ICP								07/26/17 12:46	aeh
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 19:02	enb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-8

ACZ Sample ID: ***L38447-02***
Date Sampled: *07/11/17 09:10*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1		U		mg/L	0.03	0.2	07/28/17 11:16	dcm
Aluminum, total	M200.7 ICP	1	1.68			mg/L	0.03	0.2	07/28/17 0:23	aeh
Antimony, dissolved	M200.8 ICP-MS	1	0.0009	B		mg/L	0.0004	0.002	07/26/17 18:53	enb
Antimony, total	M200.8 ICP-MS	1	0.0009	B		mg/L	0.0004	0.002	07/27/17 18:43	mfm
Arsenic, dissolved	M200.8 ICP-MS	1	0.0036			mg/L	0.0002	0.001	07/25/17 15:13	enb
Arsenic, total	M200.8 ICP-MS	1	0.0046			mg/L	0.0002	0.001	07/27/17 18:43	mfm
Barium, dissolved	M200.7 ICP	1	0.108			mg/L	0.003	0.02	07/28/17 11:16	dcm
Barium, total	M200.7 ICP	1	0.124			mg/L	0.003	0.02	07/28/17 0:23	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:16	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:23	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 11:16	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:23	aeh
Boron, dissolved	M200.7 ICP	1	0.02	B		mg/L	0.01	0.05	07/28/17 11:16	dcm
Boron, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:23	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:13	enb
Cadmium, total	M200.8 ICP-MS	1	0.0003	B		mg/L	0.0001	0.0005	07/27/17 18:43	mfm
Calcium, dissolved	M200.7 ICP	1	45.7			mg/L	0.1	0.5	07/28/17 11:16	dcm
Calcium, total	M200.7 ICP	1	48.2			mg/L	0.1	0.5	07/28/17 0:23	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:16	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:23	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:16	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:23	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:16	dcm
Copper, total	M200.7 ICP	1	0.01	B		mg/L	0.01	0.05	07/28/17 0:23	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:16	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:23	aeh
Iron, dissolved	M200.7 ICP	1	0.03	B		mg/L	0.02	0.05	07/28/17 11:16	dcm
Iron, total	M200.7 ICP	1	1.20			mg/L	0.02	0.05	07/28/17 0:23	aeh
Lead, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:13	enb
Lead, total	M200.8 ICP-MS	1	0.003			mg/L	0.0001	0.0005	07/27/17 18:43	mfm
Lithium, dissolved	M200.7 ICP	1	0.009	B		mg/L	0.008	0.04	07/28/17 11:16	dcm
Lithium, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:23	aeh
Magnesium, dissolved	M200.7 ICP	1	5.5			mg/L	0.2	1	07/28/17 11:16	dcm
Magnesium, total	M200.7 ICP	1	5.5			mg/L	0.2	1	07/28/17 0:23	aeh
Manganese, dissolved	M200.7 ICP	1	0.133			mg/L	0.005	0.03	07/28/17 11:16	dcm
Manganese, total	M200.7 ICP	1	0.190			mg/L	0.005	0.03	07/28/17 0:23	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 11:56	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:28	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 11:16	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:23	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 11:16	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:23	aeh
Potassium, dissolved	M200.7 ICP	1	7.1			mg/L	0.2	1	07/28/17 11:16	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-8

ACZ Sample ID: ***L38447-02***
Date Sampled: *07/11/17 09:10*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	7.3			mg/L	0.2	1	07/28/17 0:23	aeh
Scandium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:16	dcm
Scandium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:23	aeh
Selenium, dissolved	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0003	07/25/17 15:13	enb
Selenium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0003	07/27/17 18:43	mfm
Silver, dissolved	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/25/17 15:13	enb
Silver, total	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/27/17 18:43	mfm
Sodium, dissolved	M200.7 ICP	1	17.8			mg/L	0.2	1	07/28/17 11:16	dcm
Sodium, total	M200.7 ICP	1	17.9			mg/L	0.2	1	07/28/17 0:23	aeh
Strontium, dissolved	M200.7 ICP	1	0.439			mg/L	0.005	0.03	07/28/17 11:16	dcm
Strontium, total	M200.7 ICP	1	0.444			mg/L	0.005	0.03	07/28/17 0:23	aeh
Thallium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:13	enb
Thallium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 18:43	mfm
Tin, dissolved	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 11:16	dcm
Tin, total	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 0:23	aeh
Titanium, dissolved	M200.7 ICP	1	0.006	B		mg/L	0.005	0.03	07/28/17 11:16	dcm
Titanium, total	M200.7 ICP	1	0.049			mg/L	0.005	0.03	07/28/17 0:23	aeh
Uranium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:13	enb
Uranium, total	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/27/17 18:43	mfm
Vanadium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 11:16	dcm
Vanadium, total	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 0:23	aeh
Zinc, dissolved	M200.7 ICP	1	0.01	B		mg/L	0.01	0.05	07/28/17 11:16	dcm
Zinc, total	M200.7 ICP	1	0.03	B		mg/L	0.01	0.05	07/28/17 0:23	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-8

ACZ Sample ID: ***L38447-02***
Date Sampled: *07/11/17 09:10*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	66.4		*	mg/L	2	20	07/21/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Total Alkalinity		1	66.4		*	mg/L	2	20	07/21/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			0.0			%			07/31/17 0:00	calc
Sum of Anions			3.8			meq/L			07/31/17 0:00	calc
Sum of Cations			3.8			meq/L			07/31/17 0:00	calc
Chemical Oxygen Demand	M410.4	1	23		*	mg/L	10	20	07/24/17 13:20	emk
Chloride	SM4500Cl-E	1	13.2		*	mg/L	0.5	2	07/24/17 11:34	jmm
Conductivity @25C	SM2510B	1	368		*	umhos/cm	1	10	07/21/17 2:05	emk
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:10	bce
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/18/17 17:12	bce
Fluoride	SM4500F-C	1	0.18	B	*	mg/L	0.05	0.3	07/25/17 18:21	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		137			mg/L	0.2	5	07/31/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	1	3.28		*	mg/L	0.02	0.1	07/25/17 20:09	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1	0.45		*	mg/L	0.05	0.2	07/17/17 15:29	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	1	1.5		*	mg/L	0.1	0.5	07/21/17 16:02	wtc
pH (lab)	SM4500H+ B									
pH		1	8.0	H	*	units	0.1	0.1	07/21/17 0:00	emk
pH measured at		1	21.9		*	C	0.1	0.1	07/21/17 0:00	emk
Phosphate	Calculation based on dissolved Phosphorus		0.47			mg/L	0.06	0.2	07/31/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1	0.15		*	mg/L	0.02	0.05	07/19/17 10:43	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1	0.13	H	*	mg/L	0.02	0.05	07/19/17 20:59	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1	0.28		*	mg/L	0.02	0.05	07/18/17 21:52	pjb
Residue, Filterable (TDS) @180C	SM2540C	1	320		*	mg/L	10	20	07/17/17 12:36	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1	28.0		*	mg/L	5	20	07/18/17 10:44	els
Residue, Total (TS) @ 105C	SM2540B	1	312		*	mg/L	10	20	07/14/17 15:19	abd
Sulfate	D516-02/-07 - Turbidimetric	5	97.6		*	mg/L	5	25	07/21/17 13:26	jmm
Sulfide as S	SM4500S2-D	1		UH	*	mg/L	0.02	0.1	07/19/17 16:30	emk
TDS (calculated)	Calculation		229			mg/L			07/31/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		1.40						07/31/17 0:00	calc

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-9

ACZ Sample ID: ***L38447-03***
Date Sampled: *07/11/17 08:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/17/17 17:07	wtc
Cyanide, WAD	SM4500-CN I- distillation								07/17/17 13:48	wtc
Nitrogen, total Kjeldahl	M351.2 - Block Digestor								07/21/17 11:54	wtc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:02	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:18	bsu/las
Total Hot Plate Digestion	M200.2 ICP								07/26/17 12:59	aeh
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 19:12	enb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-9

ACZ Sample ID: ***L38447-03***
Date Sampled: *07/11/17 08:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1	0.07	B		mg/L	0.03	0.2	07/28/17 11:19	dcm
Aluminum, total	M200.7 ICP	1	4.09			mg/L	0.03	0.2	07/28/17 0:26	aeh
Antimony, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0004	0.002	07/26/17 18:55	enb
Antimony, total	M200.8 ICP-MS	1	0.0004	B		mg/L	0.0004	0.002	07/27/17 18:47	mfm
Arsenic, dissolved	M200.8 ICP-MS	1	0.0018			mg/L	0.0002	0.001	07/25/17 15:17	enb
Arsenic, total	M200.8 ICP-MS	1	0.003			mg/L	0.0002	0.001	07/27/17 18:47	mfm
Barium, dissolved	M200.7 ICP	1	0.070			mg/L	0.003	0.02	07/28/17 11:19	dcm
Barium, total	M200.7 ICP	1	0.095			mg/L	0.003	0.02	07/28/17 0:26	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:19	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:26	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 11:19	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:26	aeh
Boron, dissolved	M200.7 ICP	1	0.03	B		mg/L	0.01	0.05	07/28/17 11:19	dcm
Boron, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:26	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:17	enb
Cadmium, total	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/27/17 18:47	mfm
Calcium, dissolved	M200.7 ICP	1	20.0			mg/L	0.1	0.5	07/28/17 11:19	dcm
Calcium, total	M200.7 ICP	1	20.3			mg/L	0.1	0.5	07/28/17 0:26	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:19	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:26	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:19	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:26	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:19	dcm
Copper, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:26	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:19	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:26	aeh
Iron, dissolved	M200.7 ICP	1	0.04	B		mg/L	0.02	0.05	07/28/17 11:19	dcm
Iron, total	M200.7 ICP	1	1.93			mg/L	0.02	0.05	07/28/17 0:26	aeh
Lead, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:17	enb
Lead, total	M200.8 ICP-MS	1	0.0019			mg/L	0.0001	0.0005	07/27/17 18:47	mfm
Lithium, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 11:19	dcm
Lithium, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:26	aeh
Magnesium, dissolved	M200.7 ICP	1	3.4			mg/L	0.2	1	07/28/17 11:19	dcm
Magnesium, total	M200.7 ICP	1	3.2			mg/L	0.2	1	07/28/17 0:26	aeh
Manganese, dissolved	M200.7 ICP	1	0.040			mg/L	0.005	0.03	07/28/17 11:19	dcm
Manganese, total	M200.7 ICP	1	0.098			mg/L	0.005	0.03	07/28/17 0:26	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 11:57	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:29	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 11:19	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:26	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 11:19	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:26	aeh
Potassium, dissolved	M200.7 ICP	1	4.7			mg/L	0.2	1	07/28/17 11:19	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-9

ACZ Sample ID: ***L38447-03***
Date Sampled: *07/11/17 08:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	4.9			mg/L	0.2	1	07/28/17 0:26	aeh
Scandium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:19	dcm
Scandium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:26	aeh
Selenium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0003	07/25/17 15:17	enb
Selenium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0003	07/27/17 18:47	mfm
Silver, dissolved	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/25/17 15:17	enb
Silver, total	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/27/17 18:47	mfm
Sodium, dissolved	M200.7 ICP	1	11.2			mg/L	0.2	1	07/28/17 11:19	dcm
Sodium, total	M200.7 ICP	1	11.0			mg/L	0.2	1	07/28/17 0:26	aeh
Strontium, dissolved	M200.7 ICP	1	0.171			mg/L	0.005	0.03	07/28/17 11:19	dcm
Strontium, total	M200.7 ICP	1	0.168			mg/L	0.005	0.03	07/28/17 0:26	aeh
Thallium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:17	enb
Thallium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 18:47	mfm
Tin, dissolved	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 11:19	dcm
Tin, total	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 0:26	aeh
Titanium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 11:19	dcm
Titanium, total	M200.7 ICP	1	0.107			mg/L	0.005	0.03	07/28/17 0:26	aeh
Uranium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:17	enb
Uranium, total	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/27/17 18:47	mfm
Vanadium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 11:19	dcm
Vanadium, total	M200.7 ICP	1	0.007	B		mg/L	0.005	0.03	07/28/17 0:26	aeh
Zinc, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:19	dcm
Zinc, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:26	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-9

ACZ Sample ID: ***L38447-03***
Date Sampled: *07/11/17 08:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	39.7		*	mg/L	2	20	07/21/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Total Alkalinity		1	39.7		*	mg/L	2	20	07/21/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			5.6			%			07/31/17 0:00	calc
Sum of Anions			1.7			meq/L			07/31/17 0:00	calc
Sum of Cations			1.9			meq/L			07/31/17 0:00	calc
Chemical Oxygen Demand	M410.4	1		U	*	mg/L	10	20	07/24/17 13:27	emk
Chloride	SM4500Cl-E	1	9.5		*	mg/L	0.5	2	07/24/17 11:34	jmm
Conductivity @25C	SM2510B	1	201		*	umhos/cm	1	10	07/21/17 2:14	emk
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:11	bce
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/18/17 17:13	bce
Fluoride	SM4500F-C	1	0.12	B	*	mg/L	0.05	0.3	07/25/17 18:25	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		64			mg/L	0.2	5	07/31/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	1	2.37		*	mg/L	0.02	0.1	07/25/17 20:14	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1		U	*	mg/L	0.05	0.2	07/17/17 15:31	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	1	0.6		*	mg/L	0.1	0.5	07/21/17 16:03	wtc
pH (lab)	SM4500H+ B									
pH		1	7.9	H	*	units	0.1	0.1	07/21/17 0:00	emk
pH measured at		1	22.0		*	C	0.1	0.1	07/21/17 0:00	emk
Phosphate	Calculation based on dissolved Phosphorus		0.16	B		mg/L	0.06	0.2	07/31/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1	0.05		*	mg/L	0.02	0.05	07/19/17 10:45	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1	0.04	BH	*	mg/L	0.02	0.05	07/19/17 21:00	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1	0.08		*	mg/L	0.02	0.05	07/18/17 21:53	pjb
Residue, Filterable (TDS) @180C	SM2540C	1	192		*	mg/L	10	20	07/17/17 12:37	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1	12.0	B	*	mg/L	5	20	07/18/17 10:46	els
Residue, Total (TS) @ 105C	SM2540B	1	224		*	mg/L	10	20	07/14/17 15:20	abd
Sulfate	D516-02/-07 - Turbidimetric	5	29.9		*	mg/L	5	25	07/21/17 13:27	jmm
Sulfide as S	SM4500S2-D	1		UH	*	mg/L	0.02	0.1	07/19/17 16:51	emk
TDS (calculated)	Calculation		103			mg/L			07/31/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		1.86						07/31/17 0:00	calc

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Tahoe Resources, Inc. ACZ Project ID: ***L38447***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38447-01	WG427720	Aluminum, total	M200.7 ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG427243	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427378	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427243	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427168	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427066	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427720	Iron, total	M200.7 ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG427558	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
			M353.2 - H2SO4 preserved	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426973	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427341	Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
	WG427076	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426921	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427018	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.

Inorganic Extended Qualifier Report

Tahoe Resources, Inc.

ACZ Project ID: ***L38447***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
	WG427312	Sulfate	D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	D1	Sample required dilution due to matrix.
			SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38447***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38447-02	WG427243	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427378	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427243	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427168	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427066	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427558	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
			M353.2 - H2SO4 preserved	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426973	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427341	Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
	WG427076	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426921	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427018	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
	WG427312	Sulfate	D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.

Tahoe Resources, Inc.

ACZ Project ID: ***L38447***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
			SM4500S2-D	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38447***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38447-03	WG427243	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427378	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427243	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427168	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427066	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427558	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
			M353.2 - H2SO4 preserved	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426973	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427341	Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
	WG427076	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426921	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427018	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
	WG427312	Sulfate	D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.

Tahoe Resources, Inc.

ACZ Project ID: ***L38447***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
			SM4500S2-D	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	QD	Reported value is the background-corrected concentration, as described by the method.
			SM4500S2-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-7

ACZ Sample ID: ***L38447-01***
Date Sampled: *07/11/17 6:12*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 4:37
Analysis Date: 07/24/17 19:32

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	1.11	*	mg/L	0.1	0.6
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	68.3		1.11	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-7

ACZ Sample ID: ***L38447-01***
Date Sampled: *07/11/17 6:12*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427298
Analyst: ITM
Extract Date:
Analysis Date: 07/21/17 13:23

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1.09	*	mg/L	2.2	10.9

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-8

ACZ Sample ID: ***L38447-02***
Date Sampled: *07/11/17 9:10*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 5:30
Analysis Date: 07/24/17 19:56

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	0.99	*	mg/L	0.1	0.5
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	67.2		0.99	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-8

ACZ Sample ID: ***L38447-02***
Date Sampled: *07/11/17 9:10*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427298
Analyst: ITM
Extract Date:
Analysis Date: 07/21/17 13:39

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1.08	*	mg/L	2.2	10.8

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-9

ACZ Sample ID: ***L38447-03***
Date Sampled: *07/11/17 8:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 6:22
Analysis Date: 07/24/17 20:19

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	0.93	*	mg/L	0.09	0.5
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	80.3		0.93	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-9

ACZ Sample ID: ***L38447-03***
Date Sampled: *07/11/17 8:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427298
Analyst: ITM
Extract Date:
Analysis Date: 07/21/17 13:54

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1.1	*	mg/L	2.2	11

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
LCL	Lower Control Limit
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #4) Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
UCL	Upper Control Limit
Sample	Value of the Sample of interest

QC Sample Types

SURR	Surrogate	*LFM*	Laboratory Fortified Matrix
INTS	Internal Standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
LCSS	Laboratory Control Sample - Soil	*MS/MSD*	Matrix Spike/Matrix Spike Duplicate
LCSW	Laboratory Control Sample - Water	*PBS*	Prep Blank - Soil
LFB	Laboratory Fortified Blank	*PBW*	Prep Blank - Water

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
O	Analyte concentration is estimated due to result exceeding calibration range.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
J	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/4-90/020. Methods for the Determination of Organic Compounds in Drinking Water (I), July 1990.
(3)	EPA 600/R-92/129. Methods for the Determination of Organic Compounds in Drinking Water (II), July 1990.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Excluding Oil & Grease, solid & biological matrices for organic analyses are reported on a wet weight basis.
(3)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(4)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Organic Extended Qualifier Report

ACZ Project ID: ***L38447***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38447-01	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427298	Oil and Grease	1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38447-02	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427298	Oil and Grease	1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38447-03	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427298	Oil and Grease	1664A - Gravimetric	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38447***

Metals Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Bismuth, dissolved	M200.7 ICP
Bismuth, total	M200.7 ICP
Gallium, dissolved	M200.7 ICP
Gallium, total	M200.7 ICP
Scandium, dissolved	M200.7 ICP
Scandium, total	M200.7 ICP

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38447
Date Received: 07/14/2017 10:26
Received By:
Date Printed: 7/14/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?		X	

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]	X		
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?		X	

Some parameters were received past hold time.

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4828	13.4	<=6.0	13	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38447
Date Received: 07/14/2017 10:26
Received By:
Date Printed: 7/14/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc. L38447

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios	Address: Blvd los Próceres 18 Calle 24-69 Z 10 Empresarial Z Piadera, Torre IV oficina 1406
Company: Minera San Rafael	
E-mail: LBarrios@sanrafael.com.gt	Telephone: (502) 5696-4268

Copy of Report to:

Name: EvonQuednow@sanrafael.com.gt	E-mail: fsamayoa@sanrafael.com.gt
Company: Minera San Rafael	Telephone:

Invoice to:

Name: Luisa Fernanda Barrios	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information** **State**_____ **Zip code**_____ **Time Zone**_____

***Sampler's Signature:** _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW							
SW-7	11-07-17 06:12	SW	10	—							
SW-8	11-07-17 09:10	SW	10	—							
SW-9	11-07-17 08:00	SW	10	—							

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

MARKS

L38447 Chain of Custody

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	12/07/17 06:00		12/7/17
Juan Ajulos	12/07/17 09:00		9:30
			12/7/17 1644

MINERA SAN RAFAEL

Guatemala July 12th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,

Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

August 01, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38448

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 14, 2017. This project has been assigned to ACZ's project number, L38448. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38448. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 31, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. August 01, 2017

Project ID: Escobal
ACZ Project ID: L38448

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 2 miscellaneous samples from Tahoe Resources, Inc. on July 14, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L38448. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times except for parameters flagged with "H" flags (H3, H1), received either after the hold time expired or too close to the hold time.

Sample Analysis

These samples were analyzed for inorganic, organic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2A

ACZ Sample ID: ***L38448-01***
Date Sampled: *07/11/17 15:14*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/17/17 17:12	wtc
Cyanide, WAD	SM4500-CN I- distillation								07/17/17 13:56	wtc
Nitrogen, total Kjeldahl	M351.2 - Block Digestor								07/21/17 12:06	wtc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:05	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:21	bsu/las
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 19:23	enb
Total Hot Plate Digestion	M200.2 ICP								07/26/17 13:11	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2A

ACZ Sample ID: ***L38448-01***
Date Sampled: *07/11/17 15:14*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1	0.05	B		mg/L	0.03	0.2	07/27/17 22:57	dcm
Aluminum, total	M200.7 ICP	1	0.25			mg/L	0.03	0.2	07/28/17 0:29	aeh
Antimony, dissolved	M200.8 ICP-MS	1	0.0059			mg/L	0.0004	0.002	07/26/17 19:01	enb
Antimony, total	M200.8 ICP-MS	1	0.0054			mg/L	0.0004	0.002	07/27/17 18:50	mfm
Arsenic, dissolved	M200.8 ICP-MS	1	0.0064			mg/L	0.0002	0.001	07/25/17 15:26	enb
Arsenic, total	M200.8 ICP-MS	1	0.0072			mg/L	0.0002	0.001	07/27/17 18:50	mfm
Barium, dissolved	M200.7 ICP	1	0.063			mg/L	0.003	0.02	07/27/17 22:57	dcm
Barium, total	M200.7 ICP	1	0.058			mg/L	0.003	0.02	07/28/17 0:29	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:57	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:29	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/27/17 22:57	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:29	aeh
Boron, dissolved	M200.7 ICP	1	0.10			mg/L	0.01	0.05	07/27/17 22:57	dcm
Boron, total	M200.7 ICP	1	0.09			mg/L	0.01	0.05	07/28/17 0:29	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:26	enb
Cadmium, total	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0005	07/27/17 18:50	mfm
Calcium, dissolved	M200.7 ICP	1	274			mg/L	0.1	0.5	07/27/17 22:57	dcm
Calcium, total	M200.7 ICP	1	276			mg/L	0.1	0.5	07/28/17 0:29	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:57	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:29	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	08/01/17 11:19	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:29	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:57	dcm
Copper, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:29	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/27/17 22:57	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:29	aeh
Iron, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.05	07/27/17 22:57	dcm
Iron, total	M200.7 ICP	1	0.30			mg/L	0.02	0.05	07/28/17 0:29	aeh
Lead, dissolved	M200.8 ICP-MS	1	0.001			mg/L	0.0001	0.0005	07/25/17 15:26	enb
Lead, total	M200.8 ICP-MS	1	0.0128			mg/L	0.0001	0.0005	07/27/17 18:50	mfm
Lithium, dissolved	M200.7 ICP	1	0.070			mg/L	0.008	0.04	07/27/17 22:57	dcm
Lithium, total	M200.7 ICP	1	0.061			mg/L	0.008	0.04	07/28/17 0:29	aeh
Magnesium, dissolved	M200.7 ICP	1	19.4			mg/L	0.2	1	07/27/17 22:57	dcm
Magnesium, total	M200.7 ICP	1	19.4			mg/L	0.2	1	07/28/17 0:29	aeh
Manganese, dissolved	M200.7 ICP	1	0.420			mg/L	0.005	0.03	07/27/17 22:57	dcm
Manganese, total	M200.7 ICP	1	0.429			mg/L	0.005	0.03	07/28/17 0:29	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 11:58	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:30	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/27/17 22:57	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:29	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/27/17 22:57	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:29	aeh
Potassium, dissolved	M200.7 ICP	1	5.9			mg/L	0.2	1	07/27/17 22:57	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2A

ACZ Sample ID: ***L38448-01***
Date Sampled: *07/11/17 15:14*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	5.8			mg/L	0.2	1	07/28/17 0:29	aeh
Scandium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/27/17 22:57	dcm
Scandium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:29	aeh
Selenium, dissolved	M200.8 ICP-MS	1	0.0006			mg/L	0.0001	0.0003	07/25/17 15:26	enb
Selenium, total	M200.8 ICP-MS	1	0.0005			mg/L	0.0001	0.0003	07/27/17 18:50	mfm
Silver, dissolved	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/25/17 15:26	enb
Silver, total	M200.8 ICP-MS	1	0.00014	B		mg/L	0.00005	0.0003	07/27/17 18:50	mfm
Sodium, dissolved	M200.7 ICP	1	55.4			mg/L	0.2	1	07/27/17 22:57	dcm
Sodium, total	M200.7 ICP	1	54.1			mg/L	0.2	1	07/28/17 0:29	aeh
Strontium, dissolved	M200.7 ICP	1	3.36			mg/L	0.005	0.03	07/27/17 22:57	dcm
Strontium, total	M200.7 ICP	1	3.25			mg/L	0.005	0.03	07/28/17 0:29	aeh
Thallium, dissolved	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/25/17 15:26	enb
Thallium, total	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/27/17 18:50	mfm
Tin, dissolved	M200.7 ICP	1		U		mg/L	0.04	0.2	07/27/17 22:57	dcm
Tin, total	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 0:29	aeh
Titanium, dissolved	M200.7 ICP	1	0.007	B		mg/L	0.005	0.03	07/27/17 22:57	dcm
Titanium, total	M200.7 ICP	1	0.012	B		mg/L	0.005	0.03	07/28/17 0:29	aeh
Uranium, dissolved	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0005	07/25/17 15:26	enb
Uranium, total	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0005	07/27/17 18:50	mfm
Vanadium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/27/17 22:57	dcm
Vanadium, total	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 0:29	aeh
Zinc, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:57	dcm
Zinc, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:29	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2A

ACZ Sample ID: ***L38448-01***
Date Sampled: *07/11/17 15:14*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	124		*	mg/L	2	20	07/21/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Total Alkalinity		1	125		*	mg/L	2	20	07/21/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			-2.7			%			08/01/17 0:00	calc
Sum of Anions			19			meq/L			08/01/17 0:00	calc
Sum of Cations			18.0			meq/L			08/01/17 0:00	calc
Chemical Oxygen Demand	M410.4	1		U	*	mg/L	10	20	07/24/17 13:34	emk
Chloride	SM4500Cl-E	1	44.3		*	mg/L	0.5	2	07/24/17 11:34	jmm
Conductivity @25C	SM2510B	1	1290		*	umhos/cm	1	10	07/21/17 2:23	emk
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:11	bce
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/18/17 17:14	bce
Fluoride	SM4500F-C	1	0.87		*	mg/L	0.05	0.3	07/25/17 18:28	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		764			mg/L	0.2	5	08/01/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	1	1.68		*	mg/L	0.02	0.1	07/25/17 20:16	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1		U	*	mg/L	0.05	0.2	07/17/17 17:30	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	1	0.3	B	*	mg/L	0.1	0.5	07/25/17 23:06	pjb
pH (lab)	SM4500H+ B									
pH		1	8.3	H	*	units	0.1	0.1	07/21/17 0:00	emk
pH measured at		1	21.9		*	C	0.1	0.1	07/21/17 0:00	emk
Phosphate	Calculation based on dissolved Phosphorus			U		mg/L	0.06	0.2	08/01/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1		U	*	mg/L	0.02	0.05	07/19/17 10:46	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1		UH	*	mg/L	0.02	0.05	07/19/17 21:01	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1		U	*	mg/L	0.02	0.05	07/18/17 21:54	pjb
Residue, Filterable (TDS) @180C	SM2540C	1	1240		*	mg/L	10	20	07/17/17 12:39	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1	11.0	B	*	mg/L	5	20	07/18/17 10:47	els
Residue, Total (TS) @ 105C	SM2540B	1	1240		*	mg/L	10	20	07/14/17 15:22	abd
Sulfate	D516-02/-07 - Turbidimetric	20	723		*	mg/L	20	100	07/21/17 13:28	jmm
Sulfide as S	SM4500S2-D	1		UH	*	mg/L	0.02	0.1	07/19/17 17:11	emk
TDS (calculated)	Calculation		1200			mg/L			08/01/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		1.03						08/01/17 0:00	calc

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-10

ACZ Sample ID: ***L38448-02***
Date Sampled: *07/11/17 12:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/17/17 17:18	wtc
Cyanide, WAD	SM4500-CN I- distillation								07/17/17 14:04	wtc
Nitrogen, total Kjeldahl	M351.2 - Block Digestor				*				07/25/17 8:55	wtc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:09	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:25	bsu/las
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 19:34	enb
Total Hot Plate Digestion	M200.2 ICP								07/26/17 13:49	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-10

ACZ Sample ID: ***L38448-02***
Date Sampled: *07/11/17 12:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1		U		mg/L	0.03	0.2	07/27/17 23:06	dcm
Aluminum, total	M200.7 ICP	1		U		mg/L	0.03	0.2	07/28/17 0:39	aeh
Antimony, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0004	0.002	07/26/17 19:03	enb
Antimony, total	M200.8 ICP-MS	1		U		mg/L	0.0004	0.002	07/27/17 18:53	mfm
Arsenic, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0002	0.001	07/25/17 15:29	enb
Arsenic, total	M200.8 ICP-MS	1		U		mg/L	0.0002	0.001	07/27/17 18:53	mfm
Barium, dissolved	M200.7 ICP	1		U		mg/L	0.003	0.02	07/27/17 23:06	dcm
Barium, total	M200.7 ICP	1		U		mg/L	0.003	0.02	07/28/17 0:39	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 23:06	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:39	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/27/17 23:06	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:39	aeh
Boron, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 23:06	dcm
Boron, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:39	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:29	enb
Cadmium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 18:53	mfm
Calcium, dissolved	M200.7 ICP	1	0.2	B		mg/L	0.1	0.5	07/27/17 23:06	dcm
Calcium, total	M200.7 ICP	1		U		mg/L	0.1	0.5	07/28/17 0:39	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 23:06	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:39	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	08/01/17 11:29	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:39	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 23:06	dcm
Copper, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:39	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/27/17 23:06	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:39	aeh
Iron, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.05	07/27/17 23:06	dcm
Iron, total	M200.7 ICP	1		U		mg/L	0.02	0.05	07/28/17 0:39	aeh
Lead, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:29	enb
Lead, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 18:53	mfm
Lithium, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/27/17 23:06	dcm
Lithium, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:39	aeh
Magnesium, dissolved	M200.7 ICP	1		U		mg/L	0.2	1	07/27/17 23:06	dcm
Magnesium, total	M200.7 ICP	1		U		mg/L	0.2	1	07/28/17 0:39	aeh
Manganese, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/27/17 23:06	dcm
Manganese, total	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 0:39	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 12:03	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:31	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/27/17 23:06	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:39	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/27/17 23:06	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:39	aeh
Potassium, dissolved	M200.7 ICP	1		U		mg/L	0.2	1	07/27/17 23:06	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-10

ACZ Sample ID: ***L38448-02***
Date Sampled: *07/11/17 12:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	U		mg/L	0.2	1	07/28/17 0:39	aeh
Scandium, dissolved	M200.7 ICP	1	U	*	mg/L	0.1	0.5	07/27/17 23:06	dcm
Scandium, total	M200.7 ICP	1	U	*	mg/L	0.1	0.5	07/28/17 0:39	aeh
Selenium, dissolved	M200.8 ICP-MS	1	U		mg/L	0.0001	0.0003	07/25/17 15:29	enb
Selenium, total	M200.8 ICP-MS	1	U		mg/L	0.0001	0.0003	07/27/17 18:53	mfm
Silver, dissolved	M200.8 ICP-MS	1	U		mg/L	0.00005	0.0003	07/25/17 15:29	enb
Silver, total	M200.8 ICP-MS	1	U		mg/L	0.00005	0.0003	07/27/17 18:53	mfm
Sodium, dissolved	M200.7 ICP	1	U		mg/L	0.2	1	07/27/17 23:06	dcm
Sodium, total	M200.7 ICP	1	U		mg/L	0.2	1	07/28/17 0:39	aeh
Strontium, dissolved	M200.7 ICP	1	U		mg/L	0.005	0.03	07/27/17 23:06	dcm
Strontium, total	M200.7 ICP	1	U		mg/L	0.005	0.03	07/28/17 0:39	aeh
Thallium, dissolved	M200.8 ICP-MS	1	U		mg/L	0.0001	0.0005	07/25/17 15:29	enb
Thallium, total	M200.8 ICP-MS	1	U		mg/L	0.0001	0.0005	07/27/17 18:53	mfm
Tin, dissolved	M200.7 ICP	1	U		mg/L	0.04	0.2	07/27/17 23:06	dcm
Tin, total	M200.7 ICP	1	U		mg/L	0.04	0.2	07/28/17 0:39	aeh
Titanium, dissolved	M200.7 ICP	1	U		mg/L	0.005	0.03	07/27/17 23:06	dcm
Titanium, total	M200.7 ICP	1	U		mg/L	0.005	0.03	07/28/17 0:39	aeh
Uranium, dissolved	M200.8 ICP-MS	1	U		mg/L	0.0001	0.0005	07/25/17 15:29	enb
Uranium, total	M200.8 ICP-MS	1	U		mg/L	0.0001	0.0005	07/27/17 18:53	mfm
Vanadium, dissolved	M200.7 ICP	1	U		mg/L	0.005	0.03	07/27/17 23:06	dcm
Vanadium, total	M200.7 ICP	1	U		mg/L	0.005	0.03	07/28/17 0:39	aeh
Zinc, dissolved	M200.7 ICP	1	U		mg/L	0.01	0.05	07/27/17 23:06	dcm
Zinc, total	M200.7 ICP	1	U		mg/L	0.01	0.05	07/28/17 0:39	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-10

ACZ Sample ID: ***L38448-02***
Date Sampled: *07/11/17 12:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	3.8	B	*	mg/L	2	20	07/21/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Total Alkalinity		1	3.8	B	*	mg/L	2	20	07/21/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			n/a			%			08/01/17 0:00	calc
Sum of Anions			0.182	B		meq/L			08/01/17 0:00	calc
Sum of Cations				U		meq/L			08/01/17 0:00	calc
Chemical Oxygen Demand	M410.4	1		U	*	mg/L	10	20	07/24/17 13:41	emk
Chloride	SM4500Cl-E	1	0.5	B	*	mg/L	0.5	2	07/24/17 11:34	jmm
Conductivity @25C	SM2510B	1	7.1	B	*	umhos/cm	1	10	07/21/17 2:32	emk
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:12	bce
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/18/17 17:18	bce
Fluoride	SM4500F-C	1		U	*	mg/L	0.05	0.3	07/25/17 18:34	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		0.499	B		mg/L	0.2	5	08/01/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	1		U	*	mg/L	0.02	0.1	07/25/17 20:17	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1		U	*	mg/L	0.05	0.2	07/17/17 17:36	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	10		U	*	mg/L	1	5	07/25/17 22:01	pjb
pH (lab)	SM4500H+ B									
pH		1	7.2	H	*	units	0.1	0.1	07/21/17 0:00	emk
pH measured at		1	21.9		*	C	0.1	0.1	07/21/17 0:00	emk
Phosphate	Calculation based on dissolved Phosphorus			U		mg/L	0.06	0.2	08/01/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1		U	*	mg/L	0.02	0.05	07/19/17 10:50	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1		UH	*	mg/L	0.02	0.05	07/19/17 21:03	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1		U	*	mg/L	0.02	0.05	07/18/17 21:55	pjb
Residue, Filterable (TDS) @180C	SM2540C	1		U	*	mg/L	10	20	07/17/17 12:40	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1		U	*	mg/L	5	20	07/18/17 10:49	els
Residue, Total (TS) @ 105C	SM2540B	1		U	*	mg/L	10	20	07/14/17 15:23	abd
Sulfate	D516-02/-07 - Turbidimetric	1	4.4	B	*	mg/L	1	5	07/21/17 13:20	jmm
Sulfide as S	SM4500S2-D	1		UH	*	mg/L	0.02	0.1	07/19/17 17:18	emk
TDS (calculated)	Calculation		7.42			mg/L			08/01/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		n/a						08/01/17 0:00	calc

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Tahoe Resources, Inc. ACZ Project ID: ***L38448***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38448-01	WG427243	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427378	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427243	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427168	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427066	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427558	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
			M353.2 - H2SO4 preserved	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426988	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	LA	Recovery for target analyte in the control sample (LCS or LFB) exceeded the acceptance criteria. Target analyte was not detected in the sample [< MDL].
			M350.1 Auto Salicylate w/gas diffusion	M1	Matrix spike recovery was high, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
			M350.1 Auto Salicylate w/gas diffusion	VC	CCV recovery was above the acceptance limits. Target analyte was not detected in the sample [< MDL].
	WG427561	Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
			M365.1 - Automated Ascorbic Acid	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427076	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Extended Qualifier Report

Tahoe Resources, Inc.

ACZ Project ID: ***L38448***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
	WG426921	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427018	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
	WG427312	Sulfate	D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38448***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38448-02	WG427243	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427378	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427243	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427168	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427066	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427558	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
			M353.2 - H2SO4 preserved	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426988	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	LA	Recovery for target analyte in the control sample (LCS or LFB) exceeded the acceptance criteria. Target analyte was not detected in the sample [< MDL].
			M350.1 Auto Salicylate w/gas diffusion	M1	Matrix spike recovery was high, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427472	Nitrogen, total Kjeldahl	M351.2 - Block Digestor	D1	Sample required dilution due to matrix.
	WG427559		M351.2 - TKN by Block Digester	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
			M365.1 - Automated Ascorbic Acid	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427076	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated

Tahoe Resources, Inc. ACZ Project ID: ***L38448***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
					sample is too low for accurate evaluation (< 10x MDL).
	WG426921	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427018	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
	WG427312	Sulfate	D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2A

ACZ Sample ID: ***L38448-01***
Date Sampled: *07/11/17 15:14*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 7:15
Analysis Date: 07/24/17 20:42

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	1.03	*	mg/L	0.1	0.5
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	73.4		1.03	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2A

ACZ Sample ID: ***L38448-01***
Date Sampled: *07/11/17 15:14*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427298
Analyst: ITM
Extract Date:
Analysis Date: 07/21/17 14:10

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1	*	mg/L	2	10

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-10

ACZ Sample ID: ***L38448-02***
Date Sampled: *07/11/17 12:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 8:07
Analysis Date: 07/24/17 21:06

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	0.97	*	mg/L	0.1	0.5
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	74.9		0.97	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-10

ACZ Sample ID: ***L38448-02***
Date Sampled: *07/11/17 12:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427298
Analyst: ITM
Extract Date:
Analysis Date: 07/21/17 14:26

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1.04	*	mg/L	2.1	10.4

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
LCL	Lower Control Limit
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #4) Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
UCL	Upper Control Limit
Sample	Value of the Sample of interest

QC Sample Types

SURR	Surrogate	*LFM*	Laboratory Fortified Matrix
INTS	Internal Standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
LCSS	Laboratory Control Sample - Soil	*MS/MSD*	Matrix Spike/Matrix Spike Duplicate
LCSW	Laboratory Control Sample - Water	*PBS*	Prep Blank - Soil
LFB	Laboratory Fortified Blank	*PBW*	Prep Blank - Water

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
O	Analyte concentration is estimated due to result exceeding calibration range.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
J	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/4-90/020. Methods for the Determination of Organic Compounds in Drinking Water (I), July 1990.
(3)	EPA 600/R-92/129. Methods for the Determination of Organic Compounds in Drinking Water (II), July 1990.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Excluding Oil & Grease, solid & biological matrices for organic analyses are reported on a wet weight basis.
(3)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(4)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Organic Extended Qualifier Report

ACZ Project ID: ***L38448***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38448-01	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427298	Oil and Grease	1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38448-02	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427298	Oil and Grease	1664A - Gravimetric	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38448***

Metals Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Bismuth, dissolved	M200.7 ICP
Bismuth, total	M200.7 ICP
Gallium, dissolved	M200.7 ICP
Gallium, total	M200.7 ICP
Scandium, dissolved	M200.7 ICP
Scandium, total	M200.7 ICP

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38448
Date Received: 07/14/2017 10:26
Received By:
Date Printed: 7/14/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?		X	

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]	X		
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?		X	

Some parameters were received past hold time.

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4876	17.2	<=6.0	13	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID:	L38448
Date Received:	07/14/2017 10:26
Received By:	
Date Printed:	7/14/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc. L38448

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios	Address: Blvd Los próceres 16 Calle 24-69 z10 Empresarial 2 pradera Torre IV Oficina 1406
Company: Minera San Rafael	
E-mail: LBarrios@sanrafael.com.gt	Telephone: (502) 56964268

Copy of Report to:

Name: EvaQuadrona@sanrafael.com.gt	E-mail: Fsamayoa@sanrafael.com.gt
Company: Minera San Rafael	Telephone:

Invoice to:

Name: Luisa Fernanda Barrios	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information** **State**____ **Zip code**____ **Time Zone**____

***Sampler's Signature:** ____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	Sul							
Sw - 2A	11-07-17 15:14	Sw	10	✓							
Sw - 1D	11-07-17 12:00	Sw	10	✓							

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

L38448 Chain of Custody

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
(Luisa Fernanda Barrios)	12/07/17 06:00		12/7/17
Juan Aguilera	12/07/2017 09:20		9:30
			12/8/17 10:26

MINERA SAN RAFAEL

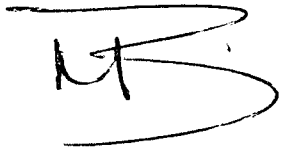
Guatemala July 12th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,



Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

July 31, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38449

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 14, 2017. This project has been assigned to ACZ's project number, L38449. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38449. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 30, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. July 31, 2017

Project ID: Escobal
ACZ Project ID: L38449

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 3 miscellaneous samples from Tahoe Resources, Inc. on July 14, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L38449. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times except for parameters flagged with "H" flags (H3, H1), received either after the hold time expired or too close to the hold time.

Sample Analysis

These samples were analyzed for inorganic, organic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports. The following required further explanation not provided by the Extended Qualifier Report:

1. For the sample with a TDS ratio over 1.2 and a value over 150 mg/L, the sample was not retested based on historical re-analysis data and the sample matrix.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4

ACZ Sample ID: ***L38449-01***
Date Sampled: *07/11/17 09:45*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/17/17 17:23	wtc
Cyanide, WAD	SM4500-CN I- distillation								07/17/17 14:12	wtc
Nitrogen, total Kjeldahl	M351.2 - Block Digestor								07/25/17 9:07	wtc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:12	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/18/17 13:37	wtc
Total Hot Plate Digestion	M200.2 ICP								07/26/17 14:02	aeh
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 19:45	enb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4

ACZ Sample ID: ***L38449-01***
Date Sampled: *07/11/17 09:45*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1	0.06	B		mg/L	0.03	0.2	07/28/17 11:34	dcm
Aluminum, total	M200.7 ICP	1	2.14			mg/L	0.03	0.2	07/28/17 0:48	aeh
Antimony, dissolved	M200.8 ICP-MS	1	0.0023			mg/L	0.0004	0.002	07/26/17 19:06	enb
Antimony, total	M200.8 ICP-MS	1	0.002			mg/L	0.0004	0.002	07/27/17 18:56	mfm
Arsenic, dissolved	M200.8 ICP-MS	1	0.0067			mg/L	0.0002	0.001	07/25/17 15:33	enb
Arsenic, total	M200.8 ICP-MS	1	0.0074			mg/L	0.0002	0.001	07/27/17 18:56	mfm
Barium, dissolved	M200.7 ICP	1	0.100			mg/L	0.003	0.02	07/28/17 11:34	dcm
Barium, total	M200.7 ICP	1	0.109			mg/L	0.003	0.02	07/28/17 0:48	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:34	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:48	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 11:34	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:48	aeh
Boron, dissolved	M200.7 ICP	1	0.04	B		mg/L	0.01	0.05	07/28/17 11:34	dcm
Boron, total	M200.7 ICP	1	0.02	B		mg/L	0.01	0.05	07/28/17 0:48	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:33	enb
Cadmium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 18:56	mfm
Calcium, dissolved	M200.7 ICP	1	101			mg/L	0.1	0.5	07/28/17 11:34	dcm
Calcium, total	M200.7 ICP	1	106			mg/L	0.1	0.5	07/28/17 0:48	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:34	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:48	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:34	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:48	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:34	dcm
Copper, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:48	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:34	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:48	aeh
Iron, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.05	07/28/17 11:34	dcm
Iron, total	M200.7 ICP	1	0.82			mg/L	0.02	0.05	07/28/17 0:48	aeh
Lead, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:33	enb
Lead, total	M200.8 ICP-MS	1	0.0015			mg/L	0.0001	0.0005	07/27/17 18:56	mfm
Lithium, dissolved	M200.7 ICP	1	0.021	B		mg/L	0.008	0.04	07/28/17 11:34	dcm
Lithium, total	M200.7 ICP	1	0.015	B		mg/L	0.008	0.04	07/28/17 0:48	aeh
Magnesium, dissolved	M200.7 ICP	1	8.3			mg/L	0.2	1	07/28/17 11:34	dcm
Magnesium, total	M200.7 ICP	1	8.4			mg/L	0.2	1	07/28/17 0:48	aeh
Manganese, dissolved	M200.7 ICP	1	0.141			mg/L	0.005	0.03	07/28/17 11:34	dcm
Manganese, total	M200.7 ICP	1	0.168			mg/L	0.005	0.03	07/28/17 0:48	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 12:04	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:52	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 11:34	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:48	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 11:34	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:48	aeh
Potassium, dissolved	M200.7 ICP	1	5.4			mg/L	0.2	1	07/28/17 11:34	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4

ACZ Sample ID: ***L38449-01***
Date Sampled: *07/11/17 09:45*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	5.5			mg/L	0.2	1	07/28/17 0:48	aeh
Scandium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:34	dcm
Scandium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:48	aeh
Selenium, dissolved	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0003	07/25/17 15:33	enb
Selenium, total	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0003	07/27/17 18:56	mfm
Silver, dissolved	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/25/17 15:33	enb
Silver, total	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/27/17 18:56	mfm
Sodium, dissolved	M200.7 ICP	1	24.4			mg/L	0.2	1	07/28/17 11:34	dcm
Sodium, total	M200.7 ICP	1	24.5			mg/L	0.2	1	07/28/17 0:48	aeh
Strontium, dissolved	M200.7 ICP	1	1.06			mg/L	0.005	0.03	07/28/17 11:34	dcm
Strontium, total	M200.7 ICP	1	1.07			mg/L	0.005	0.03	07/28/17 0:48	aeh
Thallium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:33	enb
Thallium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 18:56	mfm
Tin, dissolved	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 11:34	dcm
Tin, total	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 0:48	aeh
Titanium, dissolved	M200.7 ICP	1	0.010	B		mg/L	0.005	0.03	07/28/17 11:34	dcm
Titanium, total	M200.7 ICP	1	0.049			mg/L	0.005	0.03	07/28/17 0:48	aeh
Uranium, dissolved	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/25/17 15:33	enb
Uranium, total	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0005	07/27/17 18:56	mfm
Vanadium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 11:34	dcm
Vanadium, total	M200.7 ICP	1	0.005	B		mg/L	0.005	0.03	07/28/17 0:48	aeh
Zinc, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:34	dcm
Zinc, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:48	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4

ACZ Sample ID: ***L38449-01***
Date Sampled: *07/11/17 09:45*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	84.0		*	mg/L	2	20	07/24/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/24/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/24/17 0:00	emk
Total Alkalinity		1	84.0		*	mg/L	2	20	07/24/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			-1.4			%			07/31/17 0:00	calc
Sum of Anions			7.2			meq/L			07/31/17 0:00	calc
Sum of Cations			7			meq/L			07/31/17 0:00	calc
Chemical Oxygen Demand	M410.4	1	12	B	*	mg/L	10	20	07/24/17 13:48	emk
Chloride	SM4500Cl-E	1	18.2		*	mg/L	0.5	2	07/24/17 11:34	jmm
Conductivity @25C	SM2510B	1	740		*	umhos/cm	1	10	07/21/17 15:06	abd
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:13	bce
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/18/17 17:15	bce
Fluoride	SM4500F-C	1	0.33		*	mg/L	0.05	0.3	07/25/17 18:49	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		286			mg/L	0.2	5	07/31/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	1	2.61		*	mg/L	0.02	0.1	07/25/17 20:18	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1		U	*	mg/L	0.05	0.2	07/17/17 15:32	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	1	0.3	B	*	mg/L	0.1	0.5	07/25/17 22:02	pjb
pH (lab)	SM4500H+ B									
pH		1	8.0	H	*	units	0.1	0.1	07/21/17 0:00	abd
pH measured at		1	20.4		*	C	0.1	0.1	07/21/17 0:00	abd
Phosphate	Calculation based on dissolved Phosphorus		0.19	B		mg/L	0.06	0.2	07/31/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1	0.06		*	mg/L	0.02	0.05	07/19/17 10:51	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1	0.05	H	*	mg/L	0.02	0.05	07/19/17 21:06	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1	0.10		*	mg/L	0.02	0.05	07/19/17 12:12	las
Residue, Filterable (TDS) @180C	SM2540C	1	532		*	mg/L	10	20	07/17/17 12:42	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1	24.0		*	mg/L	5	20	07/18/17 10:51	els
Residue, Total (TS) @ 105C	SM2540B	1	534		*	mg/L	10	20	07/14/17 15:24	abd
Sulfate	D516-02/-07 - Turbidimetric	10	238		*	mg/L	10	50	07/21/17 13:28	jmm
Sulfide as S	SM4500S2-D	1	0.02	BH	*	mg/L	0.02	0.1	07/19/17 17:25	emk
TDS (calculated)	Calculation		448			mg/L			07/31/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		1.19						07/31/17 0:00	calc

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4A

ACZ Sample ID: ***L38449-02***
Date Sampled: *07/11/17 14:25*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/17/17 17:28	wtc
Cyanide, WAD	SM4500-CN I- distillation								07/17/17 14:20	wtc
Nitrogen, total Kjeldahl	M351.2 - Block Digestor								07/25/17 9:33	wtc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:15	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/18/17 13:43	wtc
Total Hot Plate Digestion	M200.2 ICP								07/26/17 14:14	aeh
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 19:56	enb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4A

ACZ Sample ID: ***L38449-02***
Date Sampled: *07/11/17 14:25*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1	0.03	B		mg/L	0.03	0.2	07/28/17 11:37	dcm
Aluminum, total	M200.7 ICP	1	2.56			mg/L	0.03	0.2	07/28/17 0:52	aeh
Antimony, dissolved	M200.8 ICP-MS	1	0.0025			mg/L	0.0004	0.002	07/26/17 19:08	enb
Antimony, total	M200.8 ICP-MS	1	0.0023			mg/L	0.0004	0.002	07/27/17 19:05	mfm
Arsenic, dissolved	M200.8 ICP-MS	1	0.007			mg/L	0.0002	0.001	07/25/17 15:36	enb
Arsenic, total	M200.8 ICP-MS	1	0.0083			mg/L	0.0002	0.001	07/27/17 19:05	mfm
Barium, dissolved	M200.7 ICP	1	0.104			mg/L	0.003	0.02	07/28/17 11:37	dcm
Barium, total	M200.7 ICP	1	0.122			mg/L	0.003	0.02	07/28/17 0:52	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:37	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:52	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 11:37	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:52	aeh
Boron, dissolved	M200.7 ICP	1	0.04	B		mg/L	0.01	0.05	07/28/17 11:37	dcm
Boron, total	M200.7 ICP	1	0.02	B		mg/L	0.01	0.05	07/28/17 0:52	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:36	enb
Cadmium, total	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/27/17 19:05	mfm
Calcium, dissolved	M200.7 ICP	1	96.0			mg/L	0.1	0.5	07/28/17 11:37	dcm
Calcium, total	M200.7 ICP	1	105			mg/L	0.1	0.5	07/28/17 0:52	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:37	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:52	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:37	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:52	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:37	dcm
Copper, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:52	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:37	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:52	aeh
Iron, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.05	07/28/17 11:37	dcm
Iron, total	M200.7 ICP	1	1.14			mg/L	0.02	0.05	07/28/17 0:52	aeh
Lead, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:36	enb
Lead, total	M200.8 ICP-MS	1	0.0024			mg/L	0.0001	0.0005	07/27/17 19:05	mfm
Lithium, dissolved	M200.7 ICP	1	0.019	B		mg/L	0.008	0.04	07/28/17 11:37	dcm
Lithium, total	M200.7 ICP	1	0.013	B		mg/L	0.008	0.04	07/28/17 0:52	aeh
Magnesium, dissolved	M200.7 ICP	1	7.9			mg/L	0.2	1	07/28/17 11:37	dcm
Magnesium, total	M200.7 ICP	1	8.4			mg/L	0.2	1	07/28/17 0:52	aeh
Manganese, dissolved	M200.7 ICP	1	0.143			mg/L	0.005	0.03	07/28/17 11:37	dcm
Manganese, total	M200.7 ICP	1	0.188			mg/L	0.005	0.03	07/28/17 0:52	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 12:05	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:53	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 11:37	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:52	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 11:37	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:52	aeh
Potassium, dissolved	M200.7 ICP	1	6.3			mg/L	0.2	1	07/28/17 11:37	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4A

ACZ Sample ID: ***L38449-02***
Date Sampled: *07/11/17 14:25*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	6.6			mg/L	0.2	1	07/28/17 0:52	aeh
Scandium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:37	dcm
Scandium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:52	aeh
Selenium, dissolved	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0003	07/25/17 15:36	enb
Selenium, total	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0003	07/27/17 19:05	mfm
Silver, dissolved	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/25/17 15:36	enb
Silver, total	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/27/17 19:05	mfm
Sodium, dissolved	M200.7 ICP	1	23.4			mg/L	0.2	1	07/28/17 11:37	dcm
Sodium, total	M200.7 ICP	1	24.5			mg/L	0.2	1	07/28/17 0:52	aeh
Strontium, dissolved	M200.7 ICP	1	0.979			mg/L	0.005	0.03	07/28/17 11:37	dcm
Strontium, total	M200.7 ICP	1	1.03			mg/L	0.005	0.03	07/28/17 0:52	aeh
Thallium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:36	enb
Thallium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 19:05	mfm
Tin, dissolved	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 11:37	dcm
Tin, total	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 0:52	aeh
Titanium, dissolved	M200.7 ICP	1	0.009	B		mg/L	0.005	0.03	07/28/17 11:37	dcm
Titanium, total	M200.7 ICP	1	0.064			mg/L	0.005	0.03	07/28/17 0:52	aeh
Uranium, dissolved	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/25/17 15:36	enb
Uranium, total	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0005	07/27/17 19:05	mfm
Vanadium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 11:37	dcm
Vanadium, total	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 0:52	aeh
Zinc, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:37	dcm
Zinc, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:52	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4A

ACZ Sample ID: ***L38449-02***
Date Sampled: *07/11/17 14:25*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	81.8		*	mg/L	2	20	07/24/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/24/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/24/17 0:00	emk
Total Alkalinity		1	81.8		*	mg/L	2	20	07/24/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			-0.7			%			07/31/17 0:00	calc
Sum of Anions			6.8			meq/L			07/31/17 0:00	calc
Sum of Cations			6.7			meq/L			07/31/17 0:00	calc
Chemical Oxygen Demand	M410.4	1	16	B	*	mg/L	10	20	07/24/17 14:09	emk
Chloride	SM4500Cl-E	1	18.7		*	mg/L	0.5	2	07/24/17 11:35	jmm
Conductivity @25C	SM2510B	1	688		*	umhos/cm	1	10	07/21/17 15:15	abd
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:14	bce
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/18/17 17:19	bce
Fluoride	SM4500F-C	1	0.32		*	mg/L	0.05	0.3	07/25/17 18:53	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		272			mg/L	0.2	5	07/31/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	1	2.99		*	mg/L	0.02	0.1	07/25/17 20:19	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1		U	*	mg/L	0.05	0.2	07/17/17 15:33	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	1	0.3	B	*	mg/L	0.1	0.5	07/25/17 22:04	pjb
pH (lab)	SM4500H+ B									
pH		1	8.1	H	*	units	0.1	0.1	07/21/17 0:00	abd
pH measured at		1	20.3		*	C	0.1	0.1	07/21/17 0:00	abd
Phosphate	Calculation based on dissolved Phosphorus		0.34			mg/L	0.06	0.2	07/31/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1	0.11		*	mg/L	0.02	0.05	07/19/17 10:52	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1	0.11	H	*	mg/L	0.02	0.05	07/19/17 21:07	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1	0.15		*	mg/L	0.02	0.05	07/19/17 11:33	las
Residue, Filterable (TDS) @180C	SM2540C	1	516		*	mg/L	10	20	07/17/17 12:43	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1	23.0		*	mg/L	5	20	07/18/17 10:52	els
Residue, Total (TS) @ 105C	SM2540B	1	520		*	mg/L	10	20	07/14/17 15:26	abd
Sulfate	D516-02/-07 - Turbidimetric	10	222		*	mg/L	10	50	07/21/17 13:46	jmm
Sulfide as S	SM4500S2-D	1		UH	*	mg/L	0.02	0.1	07/19/17 17:32	emk
TDS (calculated)	Calculation		426			mg/L			07/31/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		1.21						07/31/17 0:00	calc

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-6

ACZ Sample ID: ***L38449-03***
Date Sampled: *07/11/17 07:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/17/17 17:39	wtc
Cyanide, WAD	SM4500-CN I- distillation								07/17/17 14:28	wtc
Nitrogen, total Kjeldahl	M351.2 - Block Digestor								07/25/17 9:58	wtc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:18	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/18/17 13:48	wtc
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 20:28	enb
Total Hot Plate Digestion	M200.2 ICP								07/26/17 14:27	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-6

ACZ Sample ID: ***L38449-03***
Date Sampled: *07/11/17 07:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1	0.06	B		mg/L	0.03	0.2	07/28/17 11:40	dcm
Aluminum, total	M200.7 ICP	1	3.72			mg/L	0.03	0.2	07/28/17 0:55	aeh
Antimony, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0004	0.002	07/26/17 19:10	enb
Antimony, total	M200.8 ICP-MS	1		U		mg/L	0.0004	0.002	07/27/17 19:14	mfm
Arsenic, dissolved	M200.8 ICP-MS	1	0.0009	B		mg/L	0.0002	0.001	07/25/17 15:39	enb
Arsenic, total	M200.8 ICP-MS	1	0.0019			mg/L	0.0002	0.001	07/27/17 19:14	mfm
Barium, dissolved	M200.7 ICP	1	0.042			mg/L	0.003	0.02	07/28/17 11:40	dcm
Barium, total	M200.7 ICP	1	0.071			mg/L	0.003	0.02	07/28/17 0:55	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:40	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:55	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 11:40	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:55	aeh
Boron, dissolved	M200.7 ICP	1	0.02	B		mg/L	0.01	0.05	07/28/17 11:40	dcm
Boron, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:55	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:39	enb
Cadmium, total	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/27/17 19:14	mfm
Calcium, dissolved	M200.7 ICP	1	6.7			mg/L	0.1	0.5	07/28/17 11:40	dcm
Calcium, total	M200.7 ICP	1	7.3			mg/L	0.1	0.5	07/28/17 0:55	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:40	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:55	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:40	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:55	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:40	dcm
Copper, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:55	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:40	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:55	aeh
Iron, dissolved	M200.7 ICP	1	0.05			mg/L	0.02	0.05	07/28/17 11:40	dcm
Iron, total	M200.7 ICP	1	1.65			mg/L	0.02	0.05	07/28/17 0:55	aeh
Lead, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:39	enb
Lead, total	M200.8 ICP-MS	1	0.0012			mg/L	0.0001	0.0005	07/27/17 19:14	mfm
Lithium, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 11:40	dcm
Lithium, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:55	aeh
Magnesium, dissolved	M200.7 ICP	1	1.7			mg/L	0.2	1	07/28/17 11:40	dcm
Magnesium, total	M200.7 ICP	1	1.6			mg/L	0.2	1	07/28/17 0:55	aeh
Manganese, dissolved	M200.7 ICP	1	0.014	B		mg/L	0.005	0.03	07/28/17 11:40	dcm
Manganese, total	M200.7 ICP	1	0.062			mg/L	0.005	0.03	07/28/17 0:55	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 12:06	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:54	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 11:40	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:55	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 11:40	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:55	aeh
Potassium, dissolved	M200.7 ICP	1	3.2			mg/L	0.2	1	07/28/17 11:40	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-6

ACZ Sample ID: ***L38449-03***
Date Sampled: *07/11/17 07:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	3.5			mg/L	0.2	1	07/28/17 0:55	aeh
Scandium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 11:40	dcm
Scandium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:55	aeh
Selenium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0003	07/25/17 15:39	enb
Selenium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0003	07/27/17 19:14	mfm
Silver, dissolved	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/25/17 15:39	enb
Silver, total	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/27/17 19:14	mfm
Sodium, dissolved	M200.7 ICP	1	6.0			mg/L	0.2	1	07/28/17 11:40	dcm
Sodium, total	M200.7 ICP	1	6.2			mg/L	0.2	1	07/28/17 0:55	aeh
Strontium, dissolved	M200.7 ICP	1	0.051			mg/L	0.005	0.03	07/28/17 11:40	dcm
Strontium, total	M200.7 ICP	1	0.055			mg/L	0.005	0.03	07/28/17 0:55	aeh
Thallium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:39	enb
Thallium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 19:14	mfm
Tin, dissolved	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 11:40	dcm
Tin, total	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 0:55	aeh
Titanium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 11:40	dcm
Titanium, total	M200.7 ICP	1	0.090			mg/L	0.005	0.03	07/28/17 0:55	aeh
Uranium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:39	enb
Uranium, total	M200.8 ICP-MS	1	0.0001	B		mg/L	0.0001	0.0005	07/27/17 19:14	mfm
Vanadium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 11:40	dcm
Vanadium, total	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 0:55	aeh
Zinc, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 11:40	dcm
Zinc, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:55	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-6

ACZ Sample ID: ***L38449-03***
Date Sampled: *07/11/17 07:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	20.5		*	mg/L	2	20	07/24/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/24/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/24/17 0:00	emk
Total Alkalinity		1	20.5		*	mg/L	2	20	07/24/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			6.2			%			07/31/17 0:00	calc
Sum of Anions			0.736			meq/L			07/31/17 0:00	calc
Sum of Cations			0.833			meq/L			07/31/17 0:00	calc
Chemical Oxygen Demand	M410.4	1	16	B	*	mg/L	10	20	07/24/17 14:16	emk
Chloride	SM4500Cl-E	1	5.5		*	mg/L	0.5	2	07/24/17 11:35	jmm
Conductivity @25C	SM2510B	1	99.4		*	umhos/cm	1	10	07/21/17 15:23	abd
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:16	bce
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/18/17 17:20	bce
Fluoride	SM4500F-C	1	0.07	B	*	mg/L	0.05	0.3	07/25/17 19:01	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		24			mg/L	0.2	5	07/31/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	1	1.90		*	mg/L	0.02	0.1	07/25/17 20:21	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1		U	*	mg/L	0.05	0.2	07/17/17 15:35	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	1	0.3	B	*	mg/L	0.1	0.5	07/25/17 22:07	pjb
pH (lab)	SM4500H+ B									
pH		1	7.6	H	*	units	0.1	0.1	07/21/17 0:00	abd
pH measured at		1	20.4		*	C	0.1	0.1	07/21/17 0:00	abd
Phosphate	Calculation based on dissolved Phosphorus			U		mg/L	0.06	0.2	07/31/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1		U	*	mg/L	0.02	0.05	07/19/17 10:53	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1		UH	*	mg/L	0.02	0.05	07/19/17 21:08	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1	0.05		*	mg/L	0.02	0.05	07/19/17 11:34	las
Residue, Filterable (TDS) @180C	SM2540C	1	126		*	mg/L	10	20	07/17/17 12:45	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1	15.0	B	*	mg/L	5	20	07/18/17 10:54	els
Residue, Total (TS) @ 105C	SM2540B	1	134		*	mg/L	10	20	07/14/17 15:27	abd
Sulfate	D516-02/-07 - Turbidimetric	1	8.0		*	mg/L	1	5	07/21/17 13:38	jmm
Sulfide as S	SM4500S2-D	1		UH	*	mg/L	0.02	0.1	07/19/17 17:39	emk
TDS (calculated)	Calculation		43.9			mg/L			07/31/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		2.87						07/31/17 0:00	calc

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Tahoe Resources, Inc. ACZ Project ID: ***L38449***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38449-01	WG427451	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427378	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427326	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427168	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427066	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427451	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427558	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
			M353.2 - H2SO4 preserved	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426973	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427559	Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427326	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
			M365.1 - Automated Ascorbic Acid	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427096	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426921	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427018	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
	WG427312	Sulfate	D516-02/-07 - Turbidimetric	M2	Matrix spike recovery was low, the recovery of the

Tahoe Resources, Inc. ACZ Project ID: ***L38449***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
					associated control sample (LCS or LFB) was acceptable.
			D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
	WG427451	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38449***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38449-02	WG427451	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427378	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427326	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427168	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427066	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427451	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427558	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
			M353.2 - H2SO4 preserved	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426973	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427559	Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427326	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
			M365.1 - Automated Ascorbic Acid	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427096	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426921	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427018	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
	WG427312	Sulfate	D516-02/-07 - Turbidimetric	M2	Matrix spike recovery was low, the recovery of the

Tahoe Resources, Inc. ACZ Project ID: ***L38449***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
					associated control sample (LCS or LFB) was acceptable.
			D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	QD	Reported value is the background-corrected concentration, as described by the method.
	WG427451	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38449***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38449-03	WG427451	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427378	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427326	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427168	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427066	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427451	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427558	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
	WG426973	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427559	Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427326	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
			M365.1 - Automated Ascorbic Acid	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427096	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426921	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427018	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
	WG427312	Sulfate	D516-02/-07 - Turbidimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Extended Qualifier Report

Tahoe Resources, Inc.

ACZ Project ID: ***L38449***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	QD	Reported value is the background-corrected concentration, as described by the method.
	WG427451	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4

ACZ Sample ID: ***L38449-01***
Date Sampled: *07/11/17 9:45*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 9:00
Analysis Date: 07/24/17 21:29

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	1.02	*	mg/L	0.1	0.5
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	70.4		1.02	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4

ACZ Sample ID: ***L38449-01***
Date Sampled: *07/11/17 9:45*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427652
Analyst: GSS
Extract Date:
Analysis Date: 07/27/17 11:01

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1.02	*	mg/L	2	10.2

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4A

ACZ Sample ID: ***L38449-02***
Date Sampled: *07/11/17 14:25*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 9:52
Analysis Date: 07/24/17 21:52

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	0.97	*	mg/L	0.1	0.5
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	76.6		0.97	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-4A

ACZ Sample ID: ***L38449-02***
Date Sampled: *07/11/17 14:25*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427652
Analyst: GSS
Extract Date:
Analysis Date: 07/27/17 11:21

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1.18	*	mg/L	2.4	11.8

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-6

ACZ Sample ID: ***L38449-03***
Date Sampled: *07/11/17 7:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 10:45
Analysis Date: 07/24/17 22:39

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	0.98	*	mg/L	0.1	0.5
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	78		0.98	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-6

ACZ Sample ID: ***L38449-03***
Date Sampled: *07/11/17 7:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427652
Analyst: GSS
Extract Date:
Analysis Date: 07/27/17 11:41

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1.14	*	mg/L	2.3	11.4

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
LCL	Lower Control Limit
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #4) Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
UCL	Upper Control Limit
Sample	Value of the Sample of interest

QC Sample Types

SURR	Surrogate	*LFM*	Laboratory Fortified Matrix
INTS	Internal Standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
LCSS	Laboratory Control Sample - Soil	*MS/MSD*	Matrix Spike/Matrix Spike Duplicate
LCSW	Laboratory Control Sample - Water	*PBS*	Prep Blank - Soil
LFB	Laboratory Fortified Blank	*PBW*	Prep Blank - Water

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
O	Analyte concentration is estimated due to result exceeding calibration range.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
J	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/4-90/020. Methods for the Determination of Organic Compounds in Drinking Water (I), July 1990.
(3)	EPA 600/R-92/129. Methods for the Determination of Organic Compounds in Drinking Water (II), July 1990.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Excluding Oil & Grease, solid & biological matrices for organic analyses are reported on a wet weight basis.
(3)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(4)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Organic Extended Qualifier Report

ACZ Project ID: ***L38449***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38449-01	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38449-02	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38449-03	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38449***

Metals Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Bismuth, dissolved	M200.7 ICP
Bismuth, total	M200.7 ICP
Gallium, dissolved	M200.7 ICP
Gallium, total	M200.7 ICP
Scandium, dissolved	M200.7 ICP
Scandium, total	M200.7 ICP

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38449
Date Received: 07/14/2017 10:26
Received By:
Date Printed: 7/14/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	X		

A change was made in the Date:Time Line 2 section prior to ACZ custody.

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]	X		
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?		X	

Some parameters were received past hold time.

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4589	12.1	<=6.0	14	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID:	L38449
Date Received:	07/14/2017 10:26
Received By:	
Date Printed:	7/14/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc. L38449

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios	Address: Blvd los Próceres 18 calle 24-69 Z 10 Empresarial Z Pradera, Torre IV oficina 1406
Company: Minera San Rafael	
E-mail: LBarrios@sanrafael.com.gt	Telephone: (502) 5696 4268

Copy of Report to:

Name: Evonquednow@sanrafael.com.gt	E-mail: fsamayoa@sanrafael.com.gt
Company: Minera San Rafael	Telephone:

Invoice to:

Name: Luisa Fernanda Barrios	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information** **State**_____ **Zip code**_____ **Time Zone**_____

***Sampler's Signature:** _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW
SW-4	11-07-17 09:45	SW	10	✓
SW-4A	11-07-17 14:25	SW	10	✓
SW-6	11-07-17 07:00	SW	10	✓

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	12/07/17 06:00		12/7/17
Juan Aguilar	12/07/2017 09:00		9:30
			7:40 1626

Chain of Custody 38449

MINERA SAN RAFAEL

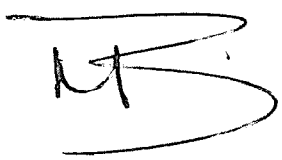
Guatemala July 12th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,



Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

August 01, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38450

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 14, 2017. This project has been assigned to ACZ's project number, L38450. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38450. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 31, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. August 01, 2017

Project ID: Escobal
ACZ Project ID: L38450

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 2 miscellaneous samples from Tahoe Resources, Inc. on July 14, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L38450. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times except for parameters flagged with "H" flags (H3, H1), received either after the hold time expired or too close to the hold time.

Sample Analysis

These samples were analyzed for inorganic, organic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports. The following required further explanation not provided by the Extended Qualifier Report:

1. For samples with a TDS ratio over 1.2 and a TDS value greater than 150 mg/L, the samples were not retested based on historical re-analysis data and the sample matrix.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-3

ACZ Sample ID: ***L38450-01***
Date Sampled: *07/11/17 10:20*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/19/17 16:01	jdk
Cyanide, WAD	SM4500-CN I- distillation								07/17/17 14:36	wtc
Nitrogen, total Kjeldahl	M351.2 - Block Digestor								07/25/17 10:10	wtc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 13:21	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/18/17 13:54	wtc
Total Hot Plate Digestion	M200.2 ICP								07/26/17 14:39	aeh
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 20:39	enb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-3

ACZ Sample ID: ***L38450-01***
Date Sampled: *07/11/17 10:20*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1	0.04	B		mg/L	0.03	0.2	07/27/17 23:09	dcm
Aluminum, total	M200.7 ICP	1	4.04			mg/L	0.03	0.2	07/28/17 0:58	aeh
Antimony, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0004	0.002	07/26/17 19:12	enb
Antimony, total	M200.8 ICP-MS	1	0.0004	B		mg/L	0.0004	0.002	07/27/17 19:17	mfm
Arsenic, dissolved	M200.8 ICP-MS	1	0.0077			mg/L	0.0002	0.001	07/25/17 15:42	enb
Arsenic, total	M200.8 ICP-MS	1	0.0092			mg/L	0.0002	0.001	07/27/17 19:17	mfm
Barium, dissolved	M200.7 ICP	1	0.066			mg/L	0.003	0.02	07/27/17 23:09	dcm
Barium, total	M200.7 ICP	1	0.100			mg/L	0.003	0.02	07/28/17 0:58	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 23:09	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:58	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/27/17 23:09	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:58	aeh
Boron, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 23:09	dcm
Boron, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:58	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:42	enb
Cadmium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 19:17	mfm
Calcium, dissolved	M200.7 ICP	1	18.5			mg/L	0.1	0.5	07/27/17 23:09	dcm
Calcium, total	M200.7 ICP	1	19.3			mg/L	0.1	0.5	07/28/17 0:58	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 23:09	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:58	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	08/01/17 11:32	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:58	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 23:09	dcm
Copper, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:58	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/27/17 23:09	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:58	aeh
Iron, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.05	07/27/17 23:09	dcm
Iron, total	M200.7 ICP	1	1.56			mg/L	0.02	0.05	07/28/17 0:58	aeh
Lead, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:42	enb
Lead, total	M200.8 ICP-MS	1	0.0015			mg/L	0.0001	0.0005	07/27/17 19:17	mfm
Lithium, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/27/17 23:09	dcm
Lithium, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:58	aeh
Magnesium, dissolved	M200.7 ICP	1	1.7			mg/L	0.2	1	07/27/17 23:09	dcm
Magnesium, total	M200.7 ICP	1	1.5			mg/L	0.2	1	07/28/17 0:58	aeh
Manganese, dissolved	M200.7 ICP	1	0.019	B		mg/L	0.005	0.03	07/27/17 23:09	dcm
Manganese, total	M200.7 ICP	1	0.068			mg/L	0.005	0.03	07/28/17 0:58	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 12:07	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:55	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/27/17 23:09	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:58	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/27/17 23:09	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:58	aeh
Potassium, dissolved	M200.7 ICP	1	3.5			mg/L	0.2	1	07/27/17 23:09	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-3

ACZ Sample ID: ***L38450-01***
Date Sampled: *07/11/17 10:20*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	4.0			mg/L	0.2	1	07/28/17 0:58	aeh
Scandium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/27/17 23:09	dcm
Scandium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:58	aeh
Selenium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0003	07/25/17 15:42	enb
Selenium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0003	07/27/17 19:17	mfm
Silver, dissolved	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/25/17 15:42	enb
Silver, total	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/27/17 19:17	mfm
Sodium, dissolved	M200.7 ICP	1	8.7			mg/L	0.2	1	07/27/17 23:09	dcm
Sodium, total	M200.7 ICP	1	8.9			mg/L	0.2	1	07/28/17 0:58	aeh
Strontium, dissolved	M200.7 ICP	1	0.114			mg/L	0.005	0.03	07/27/17 23:09	dcm
Strontium, total	M200.7 ICP	1	0.121			mg/L	0.005	0.03	07/28/17 0:58	aeh
Thallium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:42	enb
Thallium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 19:17	mfm
Tin, dissolved	M200.7 ICP	1		U		mg/L	0.04	0.2	07/27/17 23:09	dcm
Tin, total	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 0:58	aeh
Titanium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/27/17 23:09	dcm
Titanium, total	M200.7 ICP	1	0.083			mg/L	0.005	0.03	07/28/17 0:58	aeh
Uranium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/25/17 15:42	enb
Uranium, total	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0005	07/27/17 19:17	mfm
Vanadium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/27/17 23:09	dcm
Vanadium, total	M200.7 ICP	1	0.006	B		mg/L	0.005	0.03	07/28/17 0:58	aeh
Zinc, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 23:09	dcm
Zinc, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:58	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-3

ACZ Sample ID: ***L38450-01***
Date Sampled: *07/11/17 10:20*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	51.6		*	mg/L	2	20	07/24/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/24/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/24/17 0:00	emk
Total Alkalinity		1	51.6		*	mg/L	2	20	07/24/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			3.2			%			08/01/17 0:00	calc
Sum of Anions			1.5			meq/L			08/01/17 0:00	calc
Sum of Cations			1.6			meq/L			08/01/17 0:00	calc
Chemical Oxygen Demand	M410.4	1	12	B	*	mg/L	10	20	07/24/17 14:23	emk
Chloride	SM4500Cl-E	1	3.7		*	mg/L	0.5	2	07/24/17 12:11	jmm
Conductivity @25C	SM2510B	1	165		*	umhos/cm	1	10	07/21/17 15:31	abd
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:52	bce
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/18/17 17:20	bce
Fluoride	SM4500F-C	1	0.13	B	*	mg/L	0.05	0.3	07/25/17 19:08	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		53			mg/L	0.2	5	08/01/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	1	1.34		*	mg/L	0.02	0.1	07/25/17 20:23	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1		U	*	mg/L	0.05	0.2	07/17/17 17:39	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	1	0.2	B	*	mg/L	0.1	0.5	07/25/17 22:08	pjb
pH (lab)	SM4500H+ B									
pH		1	8.0	H	*	units	0.1	0.1	07/21/17 0:00	abd
pH measured at		1	20.5		*	C	0.1	0.1	07/21/17 0:00	abd
Phosphate	Calculation based on dissolved Phosphorus		0.09	B		mg/L	0.06	0.2	08/01/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1	0.03	B	*	mg/L	0.02	0.05	07/19/17 10:54	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1	0.02	BH	*	mg/L	0.02	0.05	07/19/17 21:11	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1	0.06		*	mg/L	0.02	0.05	07/19/17 11:38	las
Residue, Filterable (TDS) @180C	SM2540C	1	178		*	mg/L	10	20	07/17/17 12:46	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1	27.0		*	mg/L	5	20	07/18/17 10:56	els
Residue, Total (TS) @ 105C	SM2540B	1	188		*	mg/L	10	20	07/14/17 15:28	abd
Sulfate	D516-02/-07 - Turbidimetric	1	14.6		*	mg/L	1	5	07/21/17 13:38	jmm
Sulfide as S	SM4500S2-D	1		UH	*	mg/L	0.02	0.1	07/19/17 17:46	emk
TDS (calculated)	Calculation		82.5			mg/L			08/01/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		2.16						08/01/17 0:00	calc

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Tahoe Resources, Inc. ACZ Project ID: ***L38450***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38450-01	WG427451	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427382	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427326	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427169	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427066	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427451	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427558	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
	WG426988	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	LA	Recovery for target analyte in the control sample (LCS or LFB) exceeded the acceptance criteria. Target analyte was not detected in the sample [< MDL].
			M350.1 Auto Salicylate w/gas diffusion	M1	Matrix spike recovery was high, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427559	Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427326	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
			M365.1 - Automated Ascorbic Acid	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427096	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426921	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427018	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Extended Qualifier Report

Tahoe Resources, Inc.

ACZ Project ID: ***L38450***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
	WG427312	Sulfate	D516-02/-07 - Turbidimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	QD	Reported value is the background-corrected concentration, as described by the method.
	WG427451	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-3

ACZ Sample ID: ***L38450-01***
Date Sampled: *07/11/17 10:20*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 11:37
Analysis Date: 07/24/17 23:02

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	0.97	*	mg/L	0.1	0.5
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	78.6		0.97	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-3

ACZ Sample ID: ***L38450-01***
Date Sampled: *07/11/17 10:20*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427298
Analyst: ITM
Extract Date:
Analysis Date: 07/21/17 14:41

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1.1	*	mg/L	2.2	11

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
LCL	Lower Control Limit
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #4) Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
UCL	Upper Control Limit
Sample	Value of the Sample of interest

QC Sample Types

SURR	Surrogate	*LFM*	Laboratory Fortified Matrix
INTS	Internal Standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
LCSS	Laboratory Control Sample - Soil	*MS/MSD*	Matrix Spike/Matrix Spike Duplicate
LCSW	Laboratory Control Sample - Water	*PBS*	Prep Blank - Soil
LFB	Laboratory Fortified Blank	*PBW*	Prep Blank - Water

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
O	Analyte concentration is estimated due to result exceeding calibration range.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
J	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/4-90/020. Methods for the Determination of Organic Compounds in Drinking Water (I), July 1990.
(3)	EPA 600/R-92/129. Methods for the Determination of Organic Compounds in Drinking Water (II), July 1990.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Excluding Oil & Grease, solid & biological matrices for organic analyses are reported on a wet weight basis.
(3)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(4)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Organic Extended Qualifier Report

ACZ Project ID: ***L38450***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38450-01	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427298	Oil and Grease	1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38450-02	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427298	Oil and Grease	1664A - Gravimetric	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38450***

Metals Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Bismuth, dissolved	M200.7 ICP
Bismuth, total	M200.7 ICP
Gallium, dissolved	M200.7 ICP
Gallium, total	M200.7 ICP
Scandium, dissolved	M200.7 ICP
Scandium, total	M200.7 ICP

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38450
Date Received: 07/14/2017 10:26
Received By:
Date Printed: 7/14/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	X		

A change was made in the ID Line 1 and Remarks section prior to ACZ custody.

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]	X		
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?		X	

Some parameters were received past hold time.

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4761	16.2	<=6.0	15	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38450
Date Received: 07/14/2017 10:26
Received By:
Date Printed: 7/14/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc. L38450

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa fernanda Bonrios	Address: Blvd. los Próceres 18 calle 24-69 Z 10
Company: Minera San Rafael	Empresarial 2 Piedra, Torre IV oficina 1406
E-mail: LBonrios@sanrafael.com.gt	Telephone: (502) 5696 4268

Copy of Report to:

Name: fvonQuednow@sanrafael.com.gt	E-mail: fsamayoa@sanrafael.com.gt
Company: Minera San Rafael	Telephone:

Invoice to:

Name: Luisa fernanda Bonrios	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information** **State**_____ **Zip code**_____ **Time Zone**_____

***Sampler's Signature:** _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	Sieve
~~SW-27~~	~~11-07-17 15:14~~	~~SW~~	~~10~~	✓
SW-3	11-07-17 10:20	SW	10	—
SW-3B	11-07-17 11:55	SW	10	✓

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

~~COC From this shipment, please make create projects for.~~
~~1. WW-9, WW-10 total cn analysis.~~
~~2. SW-3B, SW-13, WW-9, WW-10 SW profile.~~
~~3. The rest of SW stations.~~

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Bonrios	11/07/17 06:00		12/7/17
Juan Aguilera	11-07-2017 09:00		9:33
			7/11/17 1006

L38450 Chain of Custody

MINERA SAN RAFAEL

Guatemala July 12th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,

Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

August 01, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38445

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 14, 2017. This project has been assigned to ACZ's project number, L38445. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38445. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 31, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. August 01, 2017

Project ID: Escobal
ACZ Project ID: L38445

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 5 miscellaneous samples from Tahoe Resources, Inc. on July 14, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L38445. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times except for parameters flagged with "H" flags (H3, H1), received either after the hold time expired or too close to the hold time.

Sample Analysis

These samples were analyzed for inorganic, organic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-1

ACZ Sample ID: ***L38445-03***
Date Sampled: *07/11/17 17:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/21/17 10:35	las/bsu
Cyanide, WAD	SM4500-CN I- distillation								07/20/17 14:07	las/bsu
Nitrogen, total Kjeldahl	M351.2 - Block Digestor								07/20/17 14:18	jdk
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 12:33	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 12:49	bsu/las
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 18:29	enb
Total Hot Plate Digestion	M200.2 ICP								07/26/17 12:08	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-1

ACZ Sample ID: ***L38445-03***
Date Sampled: *07/11/17 17:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1	0.03	B		mg/L	0.03	0.2	07/27/17 22:35	dcm
Aluminum, total	M200.7 ICP	1	1.38		*	mg/L	0.03	0.2	07/28/17 0:13	aeh
Antimony, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0004	0.002	07/26/17 15:23	enb
Antimony, total	M200.8 ICP-MS	1		U		mg/L	0.0004	0.002	07/27/17 20:38	mfm
Arsenic, dissolved	M200.8 ICP-MS	1	0.0012			mg/L	0.0002	0.001	07/26/17 15:23	enb
Arsenic, total	M200.8 ICP-MS	1	0.0014			mg/L	0.0002	0.001	07/27/17 20:38	mfm
Barium, dissolved	M200.7 ICP	1	0.094			mg/L	0.003	0.02	07/27/17 22:35	dcm
Barium, total	M200.7 ICP	1	0.103			mg/L	0.003	0.02	07/28/17 0:13	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:35	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:13	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/27/17 22:35	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:13	aeh
Boron, dissolved	M200.7 ICP	1	0.01	B		mg/L	0.01	0.05	07/27/17 22:35	dcm
Boron, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:13	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/26/17 15:23	enb
Cadmium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 20:38	mfm
Calcium, dissolved	M200.7 ICP	1	25.6			mg/L	0.1	0.5	07/27/17 22:35	dcm
Calcium, total	M200.7 ICP	1	25.9			mg/L	0.1	0.5	07/28/17 0:13	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:35	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:13	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	08/01/17 10:57	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:13	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:35	dcm
Copper, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:13	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/27/17 22:35	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:13	aeh
Iron, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.05	07/27/17 22:35	dcm
Iron, total	M200.7 ICP	1	0.61		*	mg/L	0.02	0.05	07/28/17 0:13	aeh
Lead, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/26/17 15:23	enb
Lead, total	M200.8 ICP-MS	1	0.0005			mg/L	0.0001	0.0005	07/27/17 20:38	mfm
Lithium, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/27/17 22:35	dcm
Lithium, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:13	aeh
Magnesium, dissolved	M200.7 ICP	1	3.4			mg/L	0.2	1	07/27/17 22:35	dcm
Magnesium, total	M200.7 ICP	1	3.1			mg/L	0.2	1	07/28/17 0:13	aeh
Manganese, dissolved	M200.7 ICP	1	0.005	B		mg/L	0.005	0.03	07/27/17 22:35	dcm
Manganese, total	M200.7 ICP	1	0.033			mg/L	0.005	0.03	07/28/17 0:13	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 11:47	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:19	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/27/17 22:35	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:13	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/27/17 22:35	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:13	aeh
Potassium, dissolved	M200.7 ICP	1	4.6			mg/L	0.2	1	07/27/17 22:35	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-1

ACZ Sample ID: ***L38445-03***
Date Sampled: *07/11/17 17:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	4.7			mg/L	0.2	1	07/28/17 0:13	aeh
Scandium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/27/17 22:35	dcm
Scandium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:13	aeh
Selenium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0003	07/26/17 15:23	enb
Selenium, total	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0003	07/27/17 20:38	mfm
Silver, dissolved	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/26/17 15:23	enb
Silver, total	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/27/17 20:38	mfm
Sodium, dissolved	M200.7 ICP	1	9.1			mg/L	0.2	1	07/27/17 22:35	dcm
Sodium, total	M200.7 ICP	1	9.0			mg/L	0.2	1	07/28/17 0:13	aeh
Strontium, dissolved	M200.7 ICP	1	0.123			mg/L	0.005	0.03	07/27/17 22:35	dcm
Strontium, total	M200.7 ICP	1	0.127			mg/L	0.005	0.03	07/28/17 0:13	aeh
Thallium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/26/17 15:23	enb
Thallium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 20:38	mfm
Tin, dissolved	M200.7 ICP	1		U		mg/L	0.04	0.2	07/27/17 22:35	dcm
Tin, total	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 0:13	aeh
Titanium, dissolved	M200.7 ICP	1	0.006	B		mg/L	0.005	0.03	07/27/17 22:35	dcm
Titanium, total	M200.7 ICP	1	0.040			mg/L	0.005	0.03	07/28/17 0:13	aeh
Uranium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/26/17 15:23	enb
Uranium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 20:38	mfm
Vanadium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/27/17 22:35	dcm
Vanadium, total	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 0:13	aeh
Zinc, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:35	dcm
Zinc, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:13	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-1

ACZ Sample ID: ***L38445-03***
Date Sampled: *07/11/17 17:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	46.2		*	mg/L	2	20	07/21/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Total Alkalinity		1	46.2		*	mg/L	2	20	07/21/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			10.5			%			08/01/17 0:00	calc
Sum of Anions			1.7			meq/L			08/01/17 0:00	calc
Sum of Cations			2.1			meq/L			08/01/17 0:00	calc
Chemical Oxygen Demand	M410.4	1		U	*	mg/L	10	20	07/24/17 12:10	emk
Chloride	SM4500Cl-E	1	9.5		*	mg/L	0.5	2	07/24/17 11:32	jmm
Conductivity @25C	SM2510B	1	211		*	umhos/cm	1	10	07/21/17 1:05	emk
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/21/17 15:11	las
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/21/17 12:09	jdk
Fluoride	SM4500F-C	1	0.11	B	*	mg/L	0.05	0.3	07/25/17 17:22	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		78			mg/L	0.2	5	08/01/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	3	5.97		*	mg/L	0.06	0.3	07/22/17 0:28	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1		U	*	mg/L	0.05	0.2	07/17/17 15:15	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	1	0.5		*	mg/L	0.1	0.5	07/20/17 22:36	pjb
pH (lab)	SM4500H+ B									
pH		1	7.9	H	*	units	0.1	0.1	07/21/17 0:00	emk
pH measured at		1	22.4		*	C	0.1	0.1	07/21/17 0:00	emk
Phosphate	Calculation based on dissolved Phosphorus		0.09	B		mg/L	0.06	0.2	08/01/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1	0.03	B	*	mg/L	0.02	0.05	07/19/17 10:33	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1	0.03	BH	*	mg/L	0.02	0.05	07/19/17 20:50	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1	0.05		*	mg/L	0.02	0.05	07/18/17 21:40	pjb
Residue, Filterable (TDS) @180C	SM2540C	1	212		*	mg/L	10	20	07/17/17 12:27	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1	14.0	B	*	mg/L	5	20	07/18/17 15:49	che
Residue, Total (TS) @ 105C	SM2540B	1	204		*	mg/L	10	20	07/14/17 15:10	abd
Sulfate	D516-02/-07 - Turbidimetric	1	23.2		*	mg/L	1	5	07/21/17 10:01	jmm
Sulfide as S	SM4500S2-D	1		UH	*	mg/L	0.02	0.1	07/19/17 15:49	emk
TDS (calculated)	Calculation		104			mg/L			08/01/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		2.04						08/01/17 0:00	calc

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2

ACZ Sample ID: ***L38445-04***
Date Sampled: *07/11/17 15:58*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/21/17 10:43	las/bsu
Cyanide, WAD	SM4500-CN I- distillation								07/20/17 14:15	las/bsu
Nitrogen, total Kjeldahl	M351.2 - Block Digestor								07/20/17 14:46	jdk
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 12:37	bsu/las
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								07/17/17 12:56	bsu/las
Total Hot Plate Digestion	M200.2 ICP-MS								07/25/17 18:40	enb
Total Hot Plate Digestion	M200.2 ICP								07/26/17 12:21	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2

ACZ Sample ID: ***L38445-04***
Date Sampled: *07/11/17 15:58*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, dissolved	M200.7 ICP	1	0.03	B		mg/L	0.03	0.2	07/27/17 22:44	dcm
Aluminum, total	M200.7 ICP	1	0.57		*	mg/L	0.03	0.2	07/28/17 0:16	aeh
Antimony, dissolved	M200.8 ICP-MS	1	0.0009	B		mg/L	0.0004	0.002	07/26/17 15:26	enb
Antimony, total	M200.8 ICP-MS	1	0.0008	B		mg/L	0.0004	0.002	07/27/17 20:41	mfm
Arsenic, dissolved	M200.8 ICP-MS	1	0.0028			mg/L	0.0002	0.001	07/26/17 15:26	enb
Arsenic, total	M200.8 ICP-MS	1	0.0031			mg/L	0.0002	0.001	07/27/17 20:41	mfm
Barium, dissolved	M200.7 ICP	1	0.085			mg/L	0.003	0.02	07/27/17 22:44	dcm
Barium, total	M200.7 ICP	1	0.087			mg/L	0.003	0.02	07/28/17 0:16	aeh
Beryllium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:44	dcm
Beryllium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:16	aeh
Bismuth, dissolved	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/27/17 22:44	dcm
Bismuth, total	M200.7 ICP	1		U	*	mg/L	0.04	0.2	07/28/17 0:16	aeh
Boron, dissolved	M200.7 ICP	1	0.01	B		mg/L	0.01	0.05	07/27/17 22:44	dcm
Boron, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:16	aeh
Cadmium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/26/17 15:26	enb
Cadmium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 20:41	mfm
Calcium, dissolved	M200.7 ICP	1	45.9			mg/L	0.1	0.5	07/27/17 22:44	dcm
Calcium, total	M200.7 ICP	1	47.5			mg/L	0.1	0.5	07/28/17 0:16	aeh
Chromium, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:44	dcm
Chromium, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:16	aeh
Cobalt, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	08/01/17 11:07	dcm
Cobalt, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:16	aeh
Copper, dissolved	M200.7 ICP	1		U		mg/L	0.01	0.05	07/27/17 22:44	dcm
Copper, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:16	aeh
Gallium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/27/17 22:44	dcm
Gallium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:16	aeh
Iron, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.05	07/27/17 22:44	dcm
Iron, total	M200.7 ICP	1	0.27		*	mg/L	0.02	0.05	07/28/17 0:16	aeh
Lead, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/26/17 15:26	enb
Lead, total	M200.8 ICP-MS	1	0.0016			mg/L	0.0001	0.0005	07/27/17 20:41	mfm
Lithium, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/27/17 22:44	dcm
Lithium, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:16	aeh
Magnesium, dissolved	M200.7 ICP	1	5.8			mg/L	0.2	1	07/27/17 22:44	dcm
Magnesium, total	M200.7 ICP	1	5.8			mg/L	0.2	1	07/28/17 0:16	aeh
Manganese, dissolved	M200.7 ICP	1	0.026	B		mg/L	0.005	0.03	07/27/17 22:44	dcm
Manganese, total	M200.7 ICP	1	0.033			mg/L	0.005	0.03	07/28/17 0:16	aeh
Mercury, dissolved	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/24/17 11:48	sck
Mercury, total	M245.1 CVAA	1		U		mg/L	0.0002	0.001	07/21/17 11:19	sck
Molybdenum, dissolved	M200.7 ICP	1		U		mg/L	0.02	0.1	07/27/17 22:44	dcm
Molybdenum, total	M200.7 ICP	1		U		mg/L	0.02	0.1	07/28/17 0:16	aeh
Nickel, dissolved	M200.7 ICP	1		U		mg/L	0.008	0.04	07/27/17 22:44	dcm
Nickel, total	M200.7 ICP	1		U		mg/L	0.008	0.04	07/28/17 0:16	aeh
Potassium, dissolved	M200.7 ICP	1	5.2			mg/L	0.2	1	07/27/17 22:44	dcm

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2

ACZ Sample ID: ***L38445-04***
Date Sampled: *07/11/17 15:58*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Potassium, total	M200.7 ICP	1	5.3			mg/L	0.2	1	07/28/17 0:16	aeh
Scandium, dissolved	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/27/17 22:44	dcm
Scandium, total	M200.7 ICP	1		U	*	mg/L	0.1	0.5	07/28/17 0:16	aeh
Selenium, dissolved	M200.8 ICP-MS	1	0.0002	B		mg/L	0.0001	0.0003	07/26/17 15:26	enb
Selenium, total	M200.8 ICP-MS	1	0.0003			mg/L	0.0001	0.0003	07/27/17 20:41	mfm
Silver, dissolved	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/26/17 15:26	enb
Silver, total	M200.8 ICP-MS	1		U		mg/L	0.00005	0.0003	07/27/17 20:41	mfm
Sodium, dissolved	M200.7 ICP	1	13.3			mg/L	0.2	1	07/27/17 22:44	dcm
Sodium, total	M200.7 ICP	1	13.6			mg/L	0.2	1	07/28/17 0:16	aeh
Strontium, dissolved	M200.7 ICP	1	0.229			mg/L	0.005	0.03	07/27/17 22:44	dcm
Strontium, total	M200.7 ICP	1	0.236			mg/L	0.005	0.03	07/28/17 0:16	aeh
Thallium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/26/17 15:26	enb
Thallium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 20:41	mfm
Tin, dissolved	M200.7 ICP	1		U		mg/L	0.04	0.2	07/27/17 22:44	dcm
Tin, total	M200.7 ICP	1		U		mg/L	0.04	0.2	07/28/17 0:16	aeh
Titanium, dissolved	M200.7 ICP	1	0.008	B		mg/L	0.005	0.03	07/27/17 22:44	dcm
Titanium, total	M200.7 ICP	1	0.018	B		mg/L	0.005	0.03	07/28/17 0:16	aeh
Uranium, dissolved	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/26/17 15:26	enb
Uranium, total	M200.8 ICP-MS	1		U		mg/L	0.0001	0.0005	07/27/17 20:41	mfm
Vanadium, dissolved	M200.7 ICP	1		U		mg/L	0.005	0.03	07/27/17 22:44	dcm
Vanadium, total	M200.7 ICP	1		U		mg/L	0.005	0.03	07/28/17 0:16	aeh
Zinc, dissolved	M200.7 ICP	1	0.01	B		mg/L	0.01	0.05	07/27/17 22:44	dcm
Zinc, total	M200.7 ICP	1		U		mg/L	0.01	0.05	07/28/17 0:16	aeh

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2

ACZ Sample ID: ***L38445-04***
Date Sampled: *07/11/17 15:58*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	67.8		*	mg/L	2	20	07/21/17 0:00	emk
Carbonate as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Hydroxide as CaCO3		1		U	*	mg/L	2	20	07/21/17 0:00	emk
Total Alkalinity		1	67.8		*	mg/L	2	20	07/21/17 0:00	emk
Cation-Anion Balance	Calculation									
Cation-Anion Balance			4.5			%			08/01/17 0:00	calc
Sum of Anions			3.2			meq/L			08/01/17 0:00	calc
Sum of Cations			3.5			meq/L			08/01/17 0:00	calc
Chemical Oxygen Demand	M410.4	1		U	*	mg/L	10	20	07/24/17 12:17	emk
Chloride	SM4500Cl-E	1	10.4		*	mg/L	0.5	2	07/24/17 11:33	jmm
Conductivity @25C	SM2510B	1	333		*	umhos/cm	1	10	07/21/17 1:22	emk
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/21/17 15:12	las
Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/21/17 12:10	jdk
Fluoride	SM4500F-C	1	0.18	B	*	mg/L	0.05	0.3	07/25/17 17:33	abd
Hardness as CaCO3 (dissolved)	SM2340B - Calculation		138			mg/L	0.2	5	08/01/17 0:00	calc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	3	5.06		*	mg/L	0.06	0.3	07/22/17 0:31	pjb
Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	1		U	*	mg/L	0.05	0.2	07/17/17 15:16	bce
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	1	0.1	B	*	mg/L	0.1	0.5	07/20/17 22:38	pjb
pH (lab)	SM4500H+ B									
pH		1	8.2	H	*	units	0.1	0.1	07/21/17 0:00	emk
pH measured at		1	22.2		*	C	0.1	0.1	07/21/17 0:00	emk
Phosphate	Calculation based on dissolved Phosphorus		0.12	B		mg/L	0.06	0.2	08/01/17 0:00	calc
Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	1	0.04	B	*	mg/L	0.02	0.05	07/19/17 10:36	las
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	1	0.04	BH	*	mg/L	0.02	0.05	07/19/17 20:51	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1	0.04	B	*	mg/L	0.02	0.05	07/18/17 21:43	pjb
Residue, Filterable (TDS) @180C	SM2540C	1	302		*	mg/L	10	20	07/17/17 16:13	che
Residue, Non-Filterable (TSS) @105C	SM2540D	1	7.0	B	*	mg/L	5	20	07/18/17 15:51	che
Residue, Total (TS) @ 105C	SM2540B	1	300		*	mg/L	10	20	07/14/17 15:11	abd
Sulfate	D516-02/-07 - Turbidimetric	5	73.3		*	mg/L	5	25	07/21/17 10:07	jmm
Sulfide as S	SM4500S2-D	1		UH	*	mg/L	0.02	0.1	07/19/17 15:56	emk
TDS (calculated)	Calculation		196			mg/L			08/01/17 0:00	calc
TDS (ratio - measured/calculated)	Calculation		1.54						08/01/17 0:00	calc

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38445-03	WG427720	Aluminum, total	M200.7 ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG427243	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	M1	Matrix spike recovery was high, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427378	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427243	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427338	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427313	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427720	Iron, total	M200.7 ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG427353	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
			M353.2 - H2SO4 preserved	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426973	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427274	Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
	WG427076	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
					sample is too low for accurate evaluation (< 10x MDL).
	WG426921	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427055	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
			SM2540B	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427308	Sulfate	D516-02/-07 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38445-04	WG427720	Aluminum, total	M200.7 ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG427243	Bicarbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
		Carbonate as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427401	Chemical Oxygen Demand	M410.4	M1	Matrix spike recovery was high, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M410.4	Q6	Sample was received above recommended temperature.
			M410.4	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427378	Chloride	SM4500Cl-E	Q6	Sample was received above recommended temperature.
	WG427243	Conductivity @25C	SM2510B	Q6	Sample was received above recommended temperature.
	WG427338	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427313	Cyanide, WAD	SM4500-CN I,E-Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			SM4500-CN I,E-Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427524	Fluoride	SM4500F-C	Q6	Sample was received above recommended temperature.
			SM4500F-C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Hydroxide as CaCO3	SM2320B - Titration	Q6	Sample was received above recommended temperature.
	WG427720	Iron, total	M200.7 ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG427353	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	Q6	Sample was received above recommended temperature.
			M353.2 - H2SO4 preserved	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426973	Nitrogen, ammonia	M350.1 Auto Salicylate w/gas diffusion	Q6	Sample was received above recommended temperature.
			M350.1 Auto Salicylate w/gas diffusion	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427274	Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M351.2 - TKN by Block Digester	Q6	Sample was received above recommended temperature.
			M351.2 - TKN by Block Digester	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	pH	SM4500H+ B	Q6	Sample was received above recommended temperature.
		pH measured at	SM4500H+ B	Q6	Sample was received above recommended temperature.
	WG427095	Phosphorus, dissolved	M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427173	Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	H3	Sample was received and analyzed past holding time.
			M365.1 - Automated Ascorbic Acid	Q6	Sample was received above recommended temperature.
	WG427076	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	Q6	Sample was received above recommended temperature.
			M365.1 - Auto Ascorbic Acid (digest)	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
					sample is too low for accurate evaluation (< 10x MDL).
	WG426977	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427055	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
			SM2540B	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427308	Sulfate	D516-02/-07 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.
L38445-05	WG427169	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-1

ACZ Sample ID: ***L38445-03***
Date Sampled: *07/11/17 17:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 0:15
Analysis Date: 07/24/17 17:09

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	0.97	*	mg/L	0.1	0.5
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	76.7		0.97	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-1

ACZ Sample ID: ***L38445-03***
Date Sampled: *07/11/17 17:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427652
Analyst: GSS
Extract Date:
Analysis Date: 07/27/17 10:20

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	0.99	*	mg/L	2	9.9

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2

ACZ Sample ID: ***L38445-04***
Date Sampled: *07/11/17 15:58*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Diesel Range Organics (C10-C28)

Analysis Method: **M8015D GC/FID**
Extract Method: **M3520**

Workgroup: WG427448
Analyst: gss
Extract Date: 07/18/17 1:07
Analysis Date: 07/24/17 17:33

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
TPH C10 to C28			U	1	*	mg/L	0.1	0.5
Surrogate Recoveries	**CAS**	**% Recovery**		**Dilution**	**XQ**	**Units**	**LCL**	**UCL**
OTP	84-15-1	74.1		1	*	%	60	120

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SW-2

ACZ Sample ID: ***L38445-04***
Date Sampled: *07/11/17 15:58*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG427652
Analyst: GSS
Extract Date:
Analysis Date: 07/27/17 10:41

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1.11	*	mg/L	2.2	11.1

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
LCL	Lower Control Limit
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #4) Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
UCL	Upper Control Limit
Sample	Value of the Sample of interest

QC Sample Types

SURR	Surrogate	*LFM*	Laboratory Fortified Matrix
INTS	Internal Standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
LCSS	Laboratory Control Sample - Soil	*MS/MSD*	Matrix Spike/Matrix Spike Duplicate
LCSW	Laboratory Control Sample - Water	*PBS*	Prep Blank - Soil
LFB	Laboratory Fortified Blank	*PBW*	Prep Blank - Water

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
O	Analyte concentration is estimated due to result exceeding calibration range.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
J	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/4-90/020. Methods for the Determination of Organic Compounds in Drinking Water (I), July 1990.
(3)	EPA 600/R-92/129. Methods for the Determination of Organic Compounds in Drinking Water (II), July 1990.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Excluding Oil & Grease, solid & biological matrices for organic analyses are reported on a wet weight basis.
(3)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(4)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Organic Extended Qualifier Report

ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38445-01	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38445-03	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38445-04	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

Metals Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Bismuth, dissolved	M200.7 ICP
Bismuth, total	M200.7 ICP
Gallium, dissolved	M200.7 ICP
Gallium, total	M200.7 ICP
Scandium, dissolved	M200.7 ICP
Scandium, total	M200.7 ICP

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38445
Date Received: 07/14/2017 10:25
Received By:
Date Printed: 7/14/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	X		

A change was made in the ID Line 5 section prior to ACZ custody.

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]	X		
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?		X	

Some parameters were received past hold time.

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4754	14.3	<=6.0	15	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38445
Date Received: 07/14/2017 10:25
Received By:
Date Printed: 7/14/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc L38445

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios	Address: Blvd los próceres 18 Calle 24-69 z10
Company: Minera San Rafael	Empresarial Z pradera, Torre IV Oficina 1406
E-mail: LBarriosa@sanrafael.com.gt	Telephone: (502) 56964268

Copy of Report to:

Name: EvanRuedaow@sanrafael.com.gt	E-mail: FSamayoa@sanrafael.com.gt.
Company: Minera San Rafael	Telephone:

Invoice to:

Name: Luisa Fernanda Barrios	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information** **State**____ **Zip code**____ **Time Zone**____

***Sampler's Signature:** [signature]

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION — **ANALYSES REQUESTED** *(attach list or use quote number)*

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW	CN total						
SW-13	11-07-17 - 11:10	SW	10	✓							
WW-10	11-07-17 12:00	SW	1		✓						
SW-1	11-07-17 17:00	SW	10	✓							
SW-2	11-07-17 15:58	SW	10	✓							
~~WW-10~~ WW-9	11-07-17 05:00-14:00	WW	1		✓						

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

L38445 Chain of Custody

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	12/07/17 06:00	[signature]	12/7/17
Juan Aguilera	12-07-2017 09:00	[signature]	9:30
			12/8/17 10:25

MINERA SAN RAFAEL

Guatemala July 12th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,

Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestras: 12 muestras de agua
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 110717
Fecha de ingreso de muestra: 120717
Fecha de análisis: 120717-210717
Fecha del informe: 210717

Resultados:

Correlativo Ecosistemas	Identificación de la Muestra	Color Aparente (UC HZ equiv. Unid. Pt-Co)	Color Real (UC HZ equiv. Unid. Pt-Co)	Demanda Bioquimica de Oxigeno DBO_5 mg/l	* Demanda Química de Oxígeno DQO mg/l	* Cromo Hexavalente Cr(VI) mg/l	** Coliformes Fecales (NMP/100ml)
9057	SW-1	75	15	<10	<25	<0.05	1.70E+03
9058	SW-2	39	19	<10	<25	<0.05	2.40E+03
9059	SW-2A	29	11	<10	<25	<0.05	2.30E+01
9060	SW-3	203	38	<10	<25	<0.05	3.50E+03
9061	SW-4	120	13	<10	<25	<0.05	4.90E+04
9062	SW-4A	127	16	<10	<25	<0.05	4.90E+04
9063	SW-6	154	40	<10	<25	<0.05	2.20E+03
9064	SW-7	240	43	<10	<25	<0.05	5.40E+03
9065	SW-8	119	18	<10	<25	<0.05	4.90E+04
9066	SW-9	168	36	<10	<25	<0.05	2.40E+04
9067	SW-10	<1	<1	<10	<25	<0.05	<1.8
9068	SW-11	31	2	<10	<25	<0.05	4.90E+02

Notas:

Captación de muestras: Las muestras fueron captadas por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración.
Metodología: Espectrofotométricos / SMWW: Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977 .
Fotométricos Merck. NMP: Número más probable.
N.D. No detectable. Debajo del límite de detección.
Límites de detección: Cromo hexavalente (0.05 mg/l).
Los resultados obtenidos corresponden únicamente a las muestras recibidas por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referidos a laboratorio acreditado.*

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

12.5.2 Muestras de Agua Subterránea (GW) pozos de monitoreo y suministro

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua compuesta (según información del cliente)
Alicuota 1: 10:01 horas
Alicuota 2: 13:01 horas
Alicuota 3: 16:01 horas
Alicuota 4: 19:01 horas
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 180517
Fecha de ingreso de muestra: 190517
Fecha de análisis: 190517-290517
Fecha del informe: 290517

Identificación de la muestra: WW-9 descarga planta de tratamiento
Correlativo Ecosistemas: 8400

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	7.40	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	N.D.	EPA 1664	10
Materia Flotante	---	---	ausente ***	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxigeno DQO	mg/l	25	31	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	0.32	---	---
Relación DQO/DBO_5	---	---	3.10	---	---
* Sólidos Suspendidos	mg/l	10	< 10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	< 0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	N.D.	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	N.D.	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	0.004	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	N.D.	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	N.D.	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	N.D.	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	N.D.	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	N.D.	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

					Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006
PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	N.D.	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	N.D.	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	51	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	5	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	4.9×10^2	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
N.D. No detectable. Debajo del límite de detección.
NMP: Número más probable.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

June 01, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L37430

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on May 26, 2017. This project has been assigned to ACZ's project number, L37430. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L37430. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after July 01, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Max Janicek has reviewed and approved this report.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-9

ACZ Sample ID: ***L37430-02***
Date Sampled: *05/18/17 19:01*
Date Received: *05/26/17*
Sample Matrix: *Waste Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								05/31/17 10:14	jdk/wtc

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	05/31/17 21:29	pjb

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Extended Qualifier Report

Tahoe Resources, Inc.

ACZ Project ID: ***L37430***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L37430-01	WG423848	Cyanide, total	M335.4 - Colorimetric w/ distillation	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L37430-02	WG423848	Cyanide, total	M335.4 - Colorimetric w/ distillation	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

Certification Qualifiers

Tahoe Resources, Inc.

ACZ Project ID: ***L37430***

No certification qualifiers associated with this analysis

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L37430
Date Received: 05/26/2017 10:31
Received By:
Date Printed: 5/26/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?		X	

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]			X
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4317	11	<=6.0	13	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L37430
Date Received: 05/26/2017 10:31
Received By:
Date Printed: 5/26/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

L37430

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios
Company: Minera San Rafael
E-mail: LBarrios@sanrafael.com.gt
Address: Blvd Los proceres 18 calle 24-69 z10 Empresarial z Pradera, Torre IV Oficina 1406
Telephone: (502) 5696 4268

Copy of Report to:

Name: Evon Quednau@sanrafael.com.gt
Company: Minera San Rafael
E-mail: Esamayoa@sanrafael.com.gt
Telephone:

Invoice to:

Name: Luisa Fernanda Barrios
Company:
E-mail:
Address:
Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: VF / EvQ **Sampler's Site Information** **State**_____ **Zip code**_____ **Time Zone**_____

***Sampler's Signature:** _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:
PO#: El Escobal
Reporting state for compliance testing:
Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	Sw	CN total						
WW-10	18-05-17 - 12:00	Sw	10	/							
(WW-9) Descarga Planta de tratamiento	18-05-17 10:01 - 14:01	WW	10	/							
(WW8) Entrada Planta de tratamiento	18-05-17 - 15:38	Sw	1		/						
(SW-1A) Aguas Grojba Quebrada el Escobal	18-05-17 - 15:02	Sw	1		/						
SW-2A Aguas abajo quebrada el Escobal	18-05-17 14:05	Sw	1		/						
(SW-9) Union Rio SanRafael Rio Los Vados	18-05-17 10:57	Sw	1		/						
(SW-8) Aguas abajo rio SanRafael	18-05-17 11:45	Sw	1		/						
(SW4A) Aguas Abajo rio el Dorado	18-05-17 13:36	Sw	1		/						
1.* (WW-11) Descarga planta de tratamiento	18-05-17 10:01 - 14:01	WW	1		/						
2. (WW 9) Descarga planta de tratamiento	18-05-17 10:01 - 14:01	WW	1		/						

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

#3 For COC's #1, 2, 3 please report all results in one document, except for the two samples in this COC marked with a star.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	23/05/17 08:00		10:25
Juan Aguilar	23-05-2017 08:30		23/5/17
			5/24/17 1031

FRMAD050.06.14.14

White - Return with sample. Yellow - Retain for your records.

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 080517
Fecha de ingreso de muestra: 090517
Fecha de análisis: 090517-170517
Fecha del informe: 170517

Identificación de la muestra: WW-10
Correlativo Ecosistemas: 8284

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	7.02	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	N.D.	EPA 1664	10
Materia Flotante	---	---	ausente ***	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	< 10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	< 25	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	---	---	---
Relación DQO/DBO_5	---	---	---	---	---
* Sólidos Suspendidos	mg/l	10	< 10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	< 0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	N.D.	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	N.D.	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	N.D.	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	N.D.	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	N.D.	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	N.D.	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	N.D.	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	N.D.	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	N.D.	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	N.D.	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	< 1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	< 1.8	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
N.D. No detectable. Debajo del límite de detección.
NMP: Número más probable.
El valor DQO/DBO $_5$ y DBO $_5$/DQO no se ha determinado porque el resultado se encuentra abajo de nuestros límites de detección.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Revised Analytical Report

May 22, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L37093

Luisa Fernanda:

Enclosed are revised analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on May 11, 2017 and originally reported on May 17, 2017. Refer to the case narrative for an explanation of the changes. This project was assigned to ACZ's project number, L37093. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L37093. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after June 16, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. May 22, 2017

Project ID: Escobal
ACZ Project ID: L37093

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 3 miscellaneous samples from Tahoe Resources, Inc. on May 11, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L37093. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times.

Sample Analysis

These samples were analyzed for inorganic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports.

This report was revised on 05/22/17 to report the re-distillation and reanalysis of total cyanide on sample WW-9 (L37093-01). The re-analysis did not confirm the original value.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-10

ACZ Sample ID: ***L37093-02***
Date Sampled: *05/08/17 12:09*
Date Received: *05/11/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								05/16/17 14:26	mtc/bsu

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	05/16/17 19:57	pjb

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Extended Qualifier Report

Tahoe Resources, Inc.

ACZ Project ID: ***L37093***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L37093-01	WG423240	Cyanide, total	M335.4 - Colorimetric w/ distillation	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L37093-02	WG422966	Cyanide, total	M335.4 - Colorimetric w/ distillation	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L37093-03	WG422966	Cyanide, total	M335.4 - Colorimetric w/ distillation	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

Certification Qualifiers

Tahoe Resources, Inc. ACZ Project ID: ***L37093***

No certification qualifiers associated with this analysis

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L37093
Date Received: 05/11/2017 10:32
Received By:
Date Printed: 5/11/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?		X	

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]			X
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4367	8.1	<=6.0	13	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L37093
Date Received: 05/11/2017 10:32
Received By:
Date Printed: 5/11/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

L37093

CHAIN of CUSTODY

Report to:

Name: Miguel Beranza	Address: Blvd los Próceres 18 calle 24-69 Z 10
Company: J Minera San Rafael	Fm Residencial Z. Pradera Torre IV oficina 1406
E-mail: MBeranza@sanrafael.com.gt	Telephone: (502) 5951-5748

Copy of Report to:

Name: Luisa Fernanda Barrios	E-mail: LBarrios@sanrafael.com.gt
Company: Minera San Rafael	Telephone: (502) 5696-4268

Invoice to:

Name: Miguel Beranza	Address:
Company: J J	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information** **State**_____ **Zip code**_____ **Time Zone**_____

***Sampler's Signature:** _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW	CN TOTAL						
WW-9	8-5-17 08:30-17:30	WW	10	1							
WW-10	8-5-17 12:00	SW	10	1							
WW-9	8-5-17 08:30-17:30	WW	1		1						
WW-10	8-5-17 12:00	SW	1		1						
Pileta 3	8-5-17 9-5-17 11:00-08:27	SW	1		1						

1* 2* 3

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

L37093 Chain of Custody

REMARKS

Please present these three results in one report.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	09/05/17 08:00		11:15am
Juan Aguilar	09-05-2017 09:15		9/5/17

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua compuesta (según información del cliente)
Alicuota 1: 06:00 horas
Alicuota 2: 09:00 horas
Alicuota 3: 12:00 horas
Alicuota 4: 15:00 horas
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 210617
Fecha de ingreso de muestra: 220617
Fecha de análisis: 220617-040717
Fecha del informe: 040717

Identificación de la muestra: WW-9
Correlativo Ecosistemas: 8805

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	7.83	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	<5	EPA 1664	10
Materia Flotante ***	---	---	ausente	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	<10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	<25	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	---	---	---
Relación DQO/DBO_5	---	---	---	---	---
* Sólidos Suspendidos	mg/l	10	<10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	<0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	<10.9	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	<0.05	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	0.006	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	<0.02	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	<0.03	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	<0.05	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	<0.004	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	<0.05	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL
17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	<0.05	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	<0.01	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	28	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	6	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	2.30E+01	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
NMP: Número más probable.
El valor DQO/DBO_5 y DBO_5/DQO no se ha determinado porque el resultado se encuentra abajo de nuestros límites de detección.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

July 10, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38132

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on June 29, 2017. This project has been assigned to ACZ's project number, L38132. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38132. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 09, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-9

ACZ Sample ID: ***L38132-02***
Date Sampled: *06/21/17 15:00*
Date Received: *06/29/17*
Sample Matrix: *Waste Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/04/17 10:22	wtc

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/05/17 20:35	pjb

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Extended Qualifier Report

Tahoe Resources, Inc.

ACZ Project ID: ***L38132***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38132-01	*N*G426290	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L38132-02	*N*G426171	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L38132-03	*N*G426290	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L38132-04	*N*G426290	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

Certification Qualifiers

Tahoe Resources, Inc.

ACZ Project ID: ***L38132***

No certification qualifiers associated with this analysis

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38132
Date Received: 06/29/2017 10:19
Received By:
Date Printed: 6/29/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?		X	

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]			X
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4884	15.6	<=6.0	15	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38132
Date Received: 06/29/2017 10:19
Received By:
Date Printed: 6/29/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc. L38132

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios
Company: Minera San Rafael
E-mail: LBarrios@SanraFael.com.gt
Address: Blvd los procures 18 Calle 24-69 Z 10 Empresarial 2 Prados Torre IV Oficina 1406
Telephone: (502) 56964268

Copy of Report to:

Name: EvonQuednow@SanraFael.com.gt
Company: Minera San Rafael
E-mail: FSamayoa@SanraFael.com.gt
Telephone:

Invoice to:

Name: Luisa Fernanda Barrios
Company:
E-mail:
Address:
Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

"NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF Sampler's Site Information State_____ Zip code_____ Time Zone_____

Sampler's Signature: _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:
PO#: El Escobal
Reporting state for compliance testing:
Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW	Total CN						
WW-10	21/06/17 12:00	WW	10	/							
WW-9	21/06/17 06:15h	WW	10	/							
WW-9	25/06/17 06:15h	WW	10	/							
1. WW-10	25/06/17 12:00	WW	1		/						
* 2. WW-9	21/06/17 06:15h	WW	1		/						
3. WW-9	25/06/17 06:15h	WW	1		/						
4. WW-11	25/06/17 06:15h	WW	1		/						

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

COC # 1/2 Present all SW from the numbered COCs in one report.
* Present cyanide results in a separated report.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	26/06/17 06:30		26/6/17
Juan Aguilera	26-06-2017 09:30		10:00
		ROSP	6/29/17 10:01

L38132 Chain of Custody

MINERA SAN RAFAEL

Guatemala June 26th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,

Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL
17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 250617
Fecha de ingreso de muestra: 260617
Fecha de análisis: 260617-070717
Fecha del informe: 070717

Identificación de la muestra: WW-10
Correlativo Ecosistemas: 8873

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	6.90	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	<5	EPA 1664	10
Materia Flotante ***	---	---	ausente	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	<10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	<25	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	---	---	---
Relación DQO/DBO_5	---	---	---	---	---
* Sólidos Suspendidos	mg/l	10	<10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	<0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	<10.9	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	<0.05	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	<0.002	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	<0.02	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	<0.03	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	<0.05	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	<0.002	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	<0.05	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL
17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	<0.05	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	<0.01	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	<1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	<1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	<1.8	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
NMP: Número más probable.
El valor DQO/DBO$_5$ y DBO$_5$/DQO no se ha determinado porque el resultado se encuentra abajo de nuestros límites de detección.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

July 10, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38132

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on June 29, 2017. This project has been assigned to ACZ's project number, L38132. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38132. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 09, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-10

ACZ Sample ID: ***L38132-01***
Date Sampled: *06/25/17 12:00*
Date Received: *06/29/17*
Sample Matrix: *Waste Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/06/17 12:12	jdk

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/06/17 23:26	pjb

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua compuesta (según información del cliente)
Alicuota 1: 05:00 horas
Alicuota 2: 08:00 horas
Alicuota 3: 11:00 horas
Alicuota 4: 14:00 horas
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 110717
Fecha de ingreso de muestra: 120717
Fecha de análisis: 120717-210717
Fecha del informe: 210717

Identificación de la muestra: WW-9
Correlativo Ecosistemas: 9069

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	8.01	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	<5	EPA 1664	10
Materia Flotante ***	---	---	ausente	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	<10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	<25	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	---	---	---
Relación DQO/DBO_5	---	---	---	---	---
* Sólidos Suspendidos	mg/l	10	13	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	<0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	<10.9	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	0.05	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	0.010	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	<0.02	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	<0.03	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	<0.05	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	<0.004	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	<0.05	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	<0.05	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	<0.01	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	41	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	<1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	<1.8	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
NMP: Número más probable.
El valor DQO/DBO$_5$ y DBO$_5$/DQO no se ha determinado porque el resultado se encuentra abajo de nuestros límites de detección.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

August 01, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38445

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 14, 2017. This project has been assigned to ACZ's project number, L38445. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38445. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 31, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. August 01, 2017

Project ID: Escobal
ACZ Project ID: L38445

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 5 miscellaneous samples from Tahoe Resources, Inc. on July 14, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L38445. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times except for parameters flagged with "H" flags (H3, H1), received either after the hold time expired or too close to the hold time.

Sample Analysis

These samples were analyzed for inorganic, organic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-9

ACZ Sample ID: ***L38445-05***
Date Sampled: *07/11/17 14:00*
Date Received: *07/14/17*
Sample Matrix: *Waste Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/19/17 15:52	jdk

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:51	bce

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
					sample is too low for accurate evaluation (< 10x MDL).
	WG426977	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427055	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
			SM2540B	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427308	Sulfate	D516-02/-07 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.
L38445-05	WG427169	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Organic Extended Qualifier Report

ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38445-01	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38445-03	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38445-04	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

Metals Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Bismuth, dissolved	M200.7 ICP
Bismuth, total	M200.7 ICP
Gallium, dissolved	M200.7 ICP
Gallium, total	M200.7 ICP
Scandium, dissolved	M200.7 ICP
Scandium, total	M200.7 ICP

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38445
Date Received: 07/14/2017 10:25
Received By:
Date Printed: 7/14/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	X		

A change was made in the ID Line 5 section prior to ACZ custody.

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]	X		
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?		X	

Some parameters were received past hold time.

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4754	14.3	<=6.0	15	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38445
Date Received: 07/14/2017 10:25
Received By:
Date Printed: 7/14/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc L38445

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios	Address: Blvd los próceres 18 calle 24-69 z10
Company: Minera San Rafael	Empresarial Zona pradera, Torre IV Oficina 1406
E-mail: LBarrios@sanrafael.com.gt	Telephone: (502) 56964268

Copy of Report to:

Name: EvanRuedaM@sanrafael.com.gt	E-mail: FSamayoa@sanrafael.com.gt.
Company: Minera San Rafael	Telephone:

Invoice to:

Name: Luisa Fernanda Barrios	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information State**____ **Zip code**____ **Time Zone**____

***Sampler's Signature:** [signature]

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION — **ANALYSES REQUESTED** *(attach list or use quote number)*

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW	CN total							
SW-13	11-07-17 - 11:10	SW	10	✓								
WW-10	11-07-17 12:00	SW	1		✓							
SW-1	11-07-17 17:00	SW	10	✓								
SW-2	11-07-17 15:58	SW	10	✓								
~~WW-10~~ WW-9	11-07-17 05:00-14:00	WW	1		✓							

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	12/07/17 06:00	[signature]	12/7/17
Juan Aguilera	12-07-2017 09:00	[signature]	9:30
			12/8/17 10:15

L38445 Chain of Custody

MINERA SAN RAFAEL

Guatemala July 12th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,

Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 110717
Fecha de ingreso de muestra: 120717
Fecha de análisis: 120717-210717
Fecha del informe: 210717

Identificación de la muestra: WW-10
Correlativo Ecosistemas: 9070

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	6.70	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	<5	EPA 1664	10
Materia Flotante ***	---	---	ausente	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	<10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	<25	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	---	---	---
Relación DQO/DBO_5	---	---	---	---	---
* Sólidos Suspendidos	mg/l	10	<10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	<0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	<10.9	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	<0.05	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	<0.002	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	<0.02	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	<0.03	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	<0.05	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	<0.004	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	<0.05	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	<0.05	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	<0.01	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	<1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	<1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	<1.8	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
NMP: Número más probable.
El valor DQO/DBO_5 y DBO_5/DQO no se ha determinado porque el resultado se encuentra abajo de nuestros límites de detección.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.
Se prohibe la reproducción total o parcial de este informe sin la autorización escrita de Ecosistemas Proyectos Ambientales.
* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

August 01, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38445

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 14, 2017. This project has been assigned to ACZ's project number, L38445. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38445. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 31, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. August 01, 2017

Project ID: Escobal
ACZ Project ID: L38445

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 5 miscellaneous samples from Tahoe Resources, Inc. on July 14, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L38445. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times except for parameters flagged with "H" flags (H3, H1), received either after the hold time expired or too close to the hold time.

Sample Analysis

These samples were analyzed for inorganic, organic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-10

ACZ Sample ID: ***L38445-02***
Date Sampled: *07/11/17 12:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/21/17 10:20	las/bsu

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/21/17 15:09	las

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
					validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
			SM2540B	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427308	Sulfate	D516-02/-07 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	QD	Reported value is the background-corrected concentration, as described by the method.
			SM4500S2-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.
L38445-02	WG427338	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Organic Extended Qualifier Report

ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38445-01	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38445-03	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38445-04	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

Metals Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Bismuth, dissolved	M200.7 ICP
Bismuth, total	M200.7 ICP
Gallium, dissolved	M200.7 ICP
Gallium, total	M200.7 ICP
Scandium, dissolved	M200.7 ICP
Scandium, total	M200.7 ICP

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38445
Date Received: 07/14/2017 10:25
Received By:
Date Printed: 7/14/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	X		

A change was made in the ID Line 5 section prior to ACZ custody.

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]	X		
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?		X	

Some parameters were received past hold time.

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4754	14.3	<=6.0	15	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38445
Date Received: 07/14/2017 10:25
Received By:
Date Printed: 7/14/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc L38445

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios

Company: Minera San Rafael

E-mail: LBarrios@sanrafael.com.gt

Address: Blvd los próceres 18 calle 24-69 z10 Empresarial Zona pradera, Torre IV Oficina 1406

Telephone: (502) 56964268

Copy of Report to:

Name: EvanRuedrow@sanrafael.com.gt

Company: Minera San Rafael

E-mail: FSamayoa@sanrafael.com.gt.

Telephone:

Invoice to:

Name: Luisa Fernanda Barrios

Company:

E-mail:

Address:

Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information** **State**____ **Zip code**____ **Time Zone**____

***Sampler's Signature:** [signature]

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION — **ANALYSES REQUESTED** *(attach list or use quote number)*

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW	CN total							
SW-13	11-07-17 - 11:10	SW	10	✓								
WW-10	11-07-17 12:00	SW	1		✓							
SW-1	11-07-17 17:00	SW	10	✓								
SW-2	11-07-17 15:58	SW	10	✓								
~~WW-10~~ WW-9	11-07-17 05:00-14:00	WW	1		✓							

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

L38445 Chain of Custody

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	12/07/17 06:00	[signature]	12/7/17
Juan Aguilera	12-07-2017 09:00	[signature]	9:30
			2/14/17 1025

MINERA SAN RAFAEL

Guatemala July 12th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,

Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.

12.6 Informes originales de los Resultados Analíticos obtenidos del muestreo de sedimentos, Julio 2017

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Revised Analytical Report

September 14, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38694

Luisa Fernanda:

Enclosed are revised analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 25, 2017 and originally reported on August 23, 2017. Refer to the case narrative for an explanation of the changes. This project was assigned to ACZ's project number, L38694. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38694. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after September 22, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Case Narrative

Tahoe Resources, Inc. September 14, 2017

Project ID: Escobal
ACZ Project ID: L38694

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 11 sediment samples from Tahoe Resources, Inc. on July 25, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L38694. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times except for parameters flagged with an "H1", received too close to the hold time.

Sample Analysis

These samples were analyzed for inorganic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports.

This project was revised on 09/14/17 to report the re-analysis of total cyanide for sample SED-7 (L38694-08). No other changes were made.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-1

ACZ Sample ID: ***L38694-01***
Date Sampled: *07/11/17 17:00*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								07/26/17 12:37	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 14:13	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25300	8180		*	mg/Kg	30	100	08/17/17 17:15	msh
Antimony, total (3050)	M6020 ICP-MS	505	0.5	B	*	mg/Kg	0.2	1	08/10/17 18:43	msh
Arsenic, total (3050)	M6020 ICP-MS	505	9.2			mg/Kg	0.1	0.5	08/10/17 18:43	msh
Barium, total (3050)	M6020 ICP-MS	505	125		*	mg/Kg	0.3	1	08/10/17 18:43	msh
Boron, total (3050)	M6010B ICP	101	2	B		mg/Kg	1	5	08/22/17 13:10	dcm
Cadmium, total (3050)	M6020 ICP-MS	505	0.17	B		mg/Kg	0.05	0.3	08/10/17 18:43	msh
Calcium, total (3050)	M6010B ICP	101	2690			mg/Kg	10	50	08/22/17 13:10	dcm
Chromium, total (3050)	M6020 ICP-MS	505	2.3			mg/Kg	0.3	1	08/10/17 18:43	msh
Copper, total (3050)	M6020 ICP-MS	505	8.7			mg/Kg	0.2	1	08/10/17 18:43	msh
Iron, total (3050)	M6010B ICP	101	9720		*	mg/Kg	2	5	08/22/17 13:10	dcm
Lead, total (3050)	M6020 ICP-MS	505	7.54			mg/Kg	0.05	0.3	08/10/17 18:43	msh
Magnesium, total (3050)	M6010B ICP	101	1020			mg/Kg	20	100	08/22/17 13:10	dcm
Manganese, total (3050)	M6020 ICP-MS	505	471		*	mg/Kg	0.2	1	08/10/17 18:43	msh
Mercury, total	M7471A CVAA	230	0.07	B	*	mg/Kg	0.05	0.2	08/02/17 9:01	sck
Molybdenum, total (3050)	M6010B ICP	101		U		mg/Kg	2	10	08/22/17 13:10	dcm
Nickel, total (3050)	M6020 ICP-MS	505	4.0		*	mg/Kg	0.3	2	08/10/17 18:43	msh
Potassium, total (3050)	M6010B ICP	101	1870			mg/Kg	20	100	08/22/17 13:10	dcm
Selenium, total (3050)	M6020 ICP-MS	505	0.12			mg/Kg	0.05	0.1	08/10/17 18:43	msh
Silver, total (3050)	M6020 ICP-MS	505	0.05	B		mg/Kg	0.03	0.1	08/10/17 18:43	msh
Zinc, total (3050)	M6020 ICP-MS	25300	60	B	*	mg/Kg	50	100	08/17/17 17:15	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	81.0		*	%	0.1	0.5	07/31/17 10:57	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:42	dbt
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 10:34	jlw
Digestion - Hot Plate	M3050B ICP								08/03/17 10:34	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/03/17 7:05	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-1

ACZ Sample ID: ***L38694-01***
Date Sampled: *07/11/17 17:00*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	24.7		UH	*	mg/Kg	0.1	0.5	08/01/17 14:50	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	59.1	0.0146		*	%	0.00059	0.00296	08/05/17 1:28	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-2

ACZ Sample ID: ***L38694-02***
Date Sampled: *07/11/17 15:58*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								07/26/17 12:51	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 14:26	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25300	9180		*	mg/Kg	30	100	08/17/17 17:18	msh
Antimony, total (3050)	M6020 ICP-MS	505	1.6		*	mg/Kg	0.2	1	08/10/17 18:45	msh
Arsenic, total (3050)	M6020 ICP-MS	505	36.5			mg/Kg	0.1	0.5	08/10/17 18:45	msh
Barium, total (3050)	M6020 ICP-MS	505	121		*	mg/Kg	0.3	1	08/10/17 18:45	msh
Boron, total (3050)	M6010B ICP	101		U		mg/Kg	1	5	08/22/17 13:14	dcm
Cadmium, total (3050)	M6020 ICP-MS	505	0.89			mg/Kg	0.05	0.3	08/10/17 18:45	msh
Calcium, total (3050)	M6010B ICP	101	4100			mg/Kg	10	50	08/22/17 13:14	dcm
Chromium, total (3050)	M6020 ICP-MS	505	5.6			mg/Kg	0.3	1	08/10/17 18:45	msh
Copper, total (3050)	M6020 ICP-MS	505	13.1			mg/Kg	0.2	1	08/10/17 18:45	msh
Iron, total (3050)	M6010B ICP	101	20000		*	mg/Kg	2	5	08/22/17 13:14	dcm
Lead, total (3050)	M6020 ICP-MS	505	75.1			mg/Kg	0.05	0.3	08/10/17 18:45	msh
Magnesium, total (3050)	M6010B ICP	101	3930			mg/Kg	20	100	08/22/17 13:14	dcm
Manganese, total (3050)	M6020 ICP-MS	505	564		*	mg/Kg	0.2	1	08/10/17 18:45	msh
Mercury, total	M7471A CVAA	229	0.11	BH	*	mg/Kg	0.05	0.2	08/11/17 16:26	sck
Molybdenum, total (3050)	M6010B ICP	101		U		mg/Kg	2	10	08/22/17 13:14	dcm
Nickel, total (3050)	M6020 ICP-MS	505	7.2		*	mg/Kg	0.3	2	08/10/17 18:45	msh
Potassium, total (3050)	M6010B ICP	101	1520			mg/Kg	20	100	08/22/17 13:14	dcm
Selenium, total (3050)	M6020 ICP-MS	505	0.13			mg/Kg	0.05	0.1	08/10/17 18:45	msh
Silver, total (3050)	M6020 ICP-MS	505	2.62			mg/Kg	0.03	0.1	08/10/17 18:45	msh
Zinc, total (3050)	M6020 ICP-MS	505	102		*	mg/Kg	1	3	08/10/17 18:45	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	79.8		*	%	0.1	0.5	07/31/17 14:51	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:44	dbt
Digestion - Hot Plate	M3050B ICP								08/03/17 10:58	jlw
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 10:58	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/03/17 8:47	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-2

ACZ Sample ID: ***L38694-02***
Date Sampled: *07/11/17 15:58*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	26.4		UH	*	mg/Kg	0.2	0.5	08/01/17 14:51	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	39	0.0189		*	%	0.00039	0.00195	08/05/17 1:15	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-2A

ACZ Sample ID: ***L38694-03***
Date Sampled: *07/11/17 15:14*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								07/26/17 13:05	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 14:40	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25300	12300		*	mg/Kg	30	100	08/17/17 17:19	msh
Antimony, total (3050)	M6020 ICP-MS	505	0.7	B	*	mg/Kg	0.2	1	08/10/17 18:50	msh
Arsenic, total (3050)	M6020 ICP-MS	505	9.0			mg/Kg	0.1	0.5	08/10/17 18:50	msh
Barium, total (3050)	M6020 ICP-MS	505	140		*	mg/Kg	0.3	1	08/10/17 18:50	msh
Boron, total (3050)	M6010B ICP	101		U		mg/Kg	1	5	08/22/17 13:18	dcm
Cadmium, total (3050)	M6020 ICP-MS	505	0.45			mg/Kg	0.05	0.3	08/10/17 18:50	msh
Calcium, total (3050)	M6010B ICP	101	4530			mg/Kg	10	50	08/22/17 13:18	dcm
Chromium, total (3050)	M6020 ICP-MS	505	2.4			mg/Kg	0.3	1	08/10/17 18:50	msh
Copper, total (3050)	M6020 ICP-MS	505	8.6			mg/Kg	0.2	1	08/10/17 18:50	msh
Iron, total (3050)	M6010B ICP	101	9130		*	mg/Kg	2	5	08/22/17 13:18	dcm
Lead, total (3050)	M6020 ICP-MS	505	22.9			mg/Kg	0.05	0.3	08/10/17 18:50	msh
Magnesium, total (3050)	M6010B ICP	101	1490			mg/Kg	20	100	08/22/17 13:18	dcm
Manganese, total (3050)	M6020 ICP-MS	505	744		*	mg/Kg	0.2	1	08/10/17 18:50	msh
Mercury, total	M7471A CVAA	268	0.07	B	*	mg/Kg	0.05	0.3	08/02/17 9:03	sck
Molybdenum, total (3050)	M6010B ICP	101		U		mg/Kg	2	10	08/22/17 13:18	dcm
Nickel, total (3050)	M6020 ICP-MS	505	2.7		*	mg/Kg	0.3	2	08/10/17 18:50	msh
Potassium, total (3050)	M6010B ICP	101	1400			mg/Kg	20	100	08/22/17 13:18	dcm
Selenium, total (3050)	M6020 ICP-MS	505	0.08	B		mg/Kg	0.05	0.1	08/10/17 18:50	msh
Silver, total (3050)	M6020 ICP-MS	505	0.87			mg/Kg	0.03	0.1	08/10/17 18:50	msh
Zinc, total (3050)	M6020 ICP-MS	25300	70	B	*	mg/Kg	50	100	08/17/17 17:19	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	66.7		*	%	0.1	0.5	07/31/17 16:48	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:46	dbt
Digestion - Hot Plate	M3050B ICP								08/03/17 11:23	jlw
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 11:23	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/03/17 10:29	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-2A

ACZ Sample ID: ***L38694-03***
Date Sampled: *07/11/17 15:14*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	29.1		UH	*	mg/Kg	0.2	0.6	08/01/17 14:51	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	32.2	0.00579		*	%	0.00032	0.00161	08/05/17 1:16	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-3

ACZ Sample ID: ***L38694-04***
Date Sampled: *07/11/17 10:20*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								07/26/17 13:19	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 14:54	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25300	9780		*	mg/Kg	30	100	08/17/17 17:24	msh
Antimony, total (3050)	M6020 ICP-MS	505	2.7		*	mg/Kg	0.2	1	08/10/17 18:56	msh
Arsenic, total (3050)	M6020 ICP-MS	505	24.7			mg/Kg	0.1	0.5	08/10/17 18:56	msh
Barium, total (3050)	M6020 ICP-MS	505	182		*	mg/Kg	0.3	1	08/10/17 18:56	msh
Boron, total (3050)	M6010B ICP	101		U		mg/Kg	1	5	08/22/17 13:22	dcm
Cadmium, total (3050)	M6020 ICP-MS	505	0.26	B		mg/Kg	0.05	0.3	08/10/17 18:56	msh
Calcium, total (3050)	M6010B ICP	101	3210			mg/Kg	10	50	08/22/17 13:22	dcm
Chromium, total (3050)	M6020 ICP-MS	505	3.3			mg/Kg	0.3	1	08/10/17 18:56	msh
Copper, total (3050)	M6020 ICP-MS	505	5.3			mg/Kg	0.2	1	08/10/17 18:56	msh
Iron, total (3050)	M6010B ICP	101	11000		*	mg/Kg	2	5	08/22/17 13:22	dcm
Lead, total (3050)	M6020 ICP-MS	505	9.82			mg/Kg	0.05	0.3	08/10/17 18:56	msh
Magnesium, total (3050)	M6010B ICP	101	990			mg/Kg	20	100	08/22/17 13:22	dcm
Manganese, total (3050)	M6020 ICP-MS	505	478		*	mg/Kg	0.2	1	08/10/17 18:56	msh
Mercury, total	M7471A CVAA	213	0.08	B	*	mg/Kg	0.04	0.2	08/02/17 9:03	sck
Molybdenum, total (3050)	M6010B ICP	101		U		mg/Kg	2	10	08/22/17 13:22	dcm
Nickel, total (3050)	M6020 ICP-MS	505	2.9		*	mg/Kg	0.3	2	08/10/17 18:56	msh
Potassium, total (3050)	M6010B ICP	101	1800			mg/Kg	20	100	08/22/17 13:22	dcm
Selenium, total (3050)	M6020 ICP-MS	505	0.08	B		mg/Kg	0.05	0.1	08/10/17 18:56	msh
Silver, total (3050)	M6020 ICP-MS	505	0.04	B		mg/Kg	0.03	0.1	08/10/17 18:56	msh
Zinc, total (3050)	M6020 ICP-MS	25300	60	B	*	mg/Kg	50	100	08/17/17 17:24	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	81.2		*	%	0.1	0.5	07/31/17 18:45	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:47	dbt
Digestion - Hot Plate	M3050B ICP								08/03/17 11:48	jlw
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 11:48	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/03/17 12:12	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-3

ACZ Sample ID: ***L38694-04***
Date Sampled: *07/11/17 10:20*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	23.8		UH	*	mg/Kg	0.1	0.5	08/01/17 14:54	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	31.9	0.00846		*	%	0.00032	0.0016	08/05/17 1:17	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-4

ACZ Sample ID: ***L38694-05***
Date Sampled: *07/11/17 09:45*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								07/26/17 13:32	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 15:07	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25300	10800		*	mg/Kg	30	100	08/17/17 17:25	msh
Antimony, total (3050)	M6020 ICP-MS	505	3.1		*	mg/Kg	0.2	1	08/10/17 18:58	msh
Arsenic, total (3050)	M6020 ICP-MS	505	16.8			mg/Kg	0.1	0.5	08/10/17 18:58	msh
Barium, total (3050)	M6020 ICP-MS	505	178		*	mg/Kg	0.3	1	08/10/17 18:58	msh
Boron, total (3050)	M6010B ICP	101		U		mg/Kg	1	5	08/22/17 13:41	dcm
Cadmium, total (3050)	M6020 ICP-MS	505	0.36			mg/Kg	0.05	0.3	08/10/17 18:58	msh
Calcium, total (3050)	M6010B ICP	101	3340			mg/Kg	10	50	08/22/17 13:41	dcm
Chromium, total (3050)	M6020 ICP-MS	505	5.1			mg/Kg	0.3	1	08/10/17 18:58	msh
Copper, total (3050)	M6020 ICP-MS	505	6.0			mg/Kg	0.2	1	08/10/17 18:58	msh
Iron, total (3050)	M6010B ICP	101	14400		*	mg/Kg	2	5	08/22/17 13:41	dcm
Lead, total (3050)	M6020 ICP-MS	505	10.6			mg/Kg	0.05	0.3	08/10/17 18:58	msh
Magnesium, total (3050)	M6010B ICP	101	1230			mg/Kg	20	100	08/22/17 13:41	dcm
Manganese, total (3050)	M6020 ICP-MS	505	525		*	mg/Kg	0.2	1	08/10/17 18:58	msh
Mercury, total	M7471A CVAA	239	0.08	B	*	mg/Kg	0.05	0.2	08/02/17 9:07	sck
Molybdenum, total (3050)	M6010B ICP	101		U		mg/Kg	2	10	08/22/17 13:41	dcm
Nickel, total (3050)	M6020 ICP-MS	505	3.4		*	mg/Kg	0.3	2	08/10/17 18:58	msh
Potassium, total (3050)	M6010B ICP	101	1740			mg/Kg	20	100	08/22/17 13:41	dcm
Selenium, total (3050)	M6020 ICP-MS	505	0.07	B		mg/Kg	0.05	0.1	08/10/17 18:58	msh
Silver, total (3050)	M6020 ICP-MS	505	0.13			mg/Kg	0.03	0.1	08/10/17 18:58	msh
Zinc, total (3050)	M6020 ICP-MS	25300	80	B	*	mg/Kg	50	100	08/17/17 17:25	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	77.2		*	%	0.1	0.5	07/31/17 20:42	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:49	dbt
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 13:02	jlw
Digestion - Hot Plate	M3050B ICP								08/03/17 13:02	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/03/17 13:54	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-4

ACZ Sample ID: ***L38694-05***
Date Sampled: *07/11/17 09:45*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	28.4		UH	*	mg/Kg	0.2	0.6	08/01/17 14:55	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	42.8	0.00860		*	%	0.00043	0.00214	08/05/17 1:18	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-4A

ACZ Sample ID: ***L38694-06***
Date Sampled: *07/11/17 14:25*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								07/26/17 13:46	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 15:21	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25300	9890		*	mg/Kg	30	100	08/17/17 17:27	msh
Antimony, total (3050)	M6020 ICP-MS	505	3.4		*	mg/Kg	0.2	1	08/10/17 19:00	msh
Arsenic, total (3050)	M6020 ICP-MS	505	16.7			mg/Kg	0.1	0.5	08/10/17 19:00	msh
Barium, total (3050)	M6020 ICP-MS	505	228		*	mg/Kg	0.3	1	08/10/17 19:00	msh
Boron, total (3050)	M6010B ICP	101		U		mg/Kg	1	5	08/22/17 13:45	dcm
Cadmium, total (3050)	M6020 ICP-MS	505	0.25	B		mg/Kg	0.05	0.3	08/10/17 19:00	msh
Calcium, total (3050)	M6010B ICP	101	2870			mg/Kg	10	50	08/22/17 13:45	dcm
Chromium, total (3050)	M6020 ICP-MS	505	5.2			mg/Kg	0.3	1	08/10/17 19:00	msh
Copper, total (3050)	M6020 ICP-MS	505	11.1			mg/Kg	0.2	1	08/10/17 19:00	msh
Iron, total (3050)	M6010B ICP	101	17300		*	mg/Kg	2	5	08/22/17 13:45	dcm
Lead, total (3050)	M6020 ICP-MS	505	9.36			mg/Kg	0.05	0.3	08/10/17 19:00	msh
Magnesium, total (3050)	M6010B ICP	101	1240			mg/Kg	20	100	08/22/17 13:45	dcm
Manganese, total (3050)	M6020 ICP-MS	505	526		*	mg/Kg	0.2	1	08/10/17 19:00	msh
Mercury, total	M7471A CVAA	246	0.07	B	*	mg/Kg	0.05	0.2	08/02/17 9:08	sck
Molybdenum, total (3050)	M6010B ICP	101		U		mg/Kg	2	10	08/22/17 13:45	dcm
Nickel, total (3050)	M6020 ICP-MS	505	3.6		*	mg/Kg	0.3	2	08/10/17 19:00	msh
Potassium, total (3050)	M6010B ICP	101	1710			mg/Kg	20	100	08/22/17 13:45	dcm
Selenium, total (3050)	M6020 ICP-MS	505	0.06	B		mg/Kg	0.05	0.1	08/10/17 19:00	msh
Silver, total (3050)	M6020 ICP-MS	505	0.09	B		mg/Kg	0.03	0.1	08/10/17 19:00	msh
Zinc, total (3050)	M6020 ICP-MS	25300	70	B	*	mg/Kg	50	100	08/17/17 17:27	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	78.6		*	%	0.1	0.5	07/31/17 22:39	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:51	dbt
Digestion - Hot Plate	M3050B ICP								08/03/17 13:27	jlw
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 13:27	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/03/17 15:36	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-4A

ACZ Sample ID: ***L38694-06***
Date Sampled: *07/11/17 14:25*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	28.4		UH	*	mg/Kg	0.2	0.6	08/01/17 14:56	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	29.8	0.00854		*	%	0.0003	0.00149	08/05/17 1:19	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-6

ACZ Sample ID: ***L38694-07***
Date Sampled: *07/11/17 07:00*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								07/26/17 14:00	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 15:35	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25300	5060		*	mg/Kg	30	100	08/17/17 17:28	msh
Antimony, total (3050)	M6020 ICP-MS	505	0.5	B	*	mg/Kg	0.2	1	08/10/17 19:02	msh
Arsenic, total (3050)	M6020 ICP-MS	505	8.5			mg/Kg	0.1	0.5	08/10/17 19:02	msh
Barium, total (3050)	M6020 ICP-MS	505	74.0		*	mg/Kg	0.3	1	08/10/17 19:02	msh
Boron, total (3050)	M6010B ICP	101		U		mg/Kg	1	5	08/22/17 13:49	dcm
Cadmium, total (3050)	M6020 ICP-MS	505	0.12	B		mg/Kg	0.05	0.3	08/10/17 19:02	msh
Calcium, total (3050)	M6010B ICP	101	1230			mg/Kg	10	50	08/22/17 13:49	dcm
Chromium, total (3050)	M6020 ICP-MS	505	5.6			mg/Kg	0.3	1	08/10/17 19:02	msh
Copper, total (3050)	M6020 ICP-MS	505	5.3			mg/Kg	0.2	1	08/10/17 19:02	msh
Iron, total (3050)	M6010B ICP	101	11500		*	mg/Kg	2	5	08/22/17 13:49	dcm
Lead, total (3050)	M6020 ICP-MS	505	4.28			mg/Kg	0.05	0.3	08/10/17 19:02	msh
Magnesium, total (3050)	M6010B ICP	101	910			mg/Kg	20	100	08/22/17 13:49	dcm
Manganese, total (3050)	M6020 ICP-MS	505	239		*	mg/Kg	0.2	1	08/10/17 19:02	msh
Mercury, total	M7471A CVAA	201	0.05	B	*	mg/Kg	0.04	0.2	08/02/17 9:09	sck
Molybdenum, total (3050)	M6010B ICP	101		U		mg/Kg	2	10	08/22/17 13:49	dcm
Nickel, total (3050)	M6020 ICP-MS	505	2.0		*	mg/Kg	0.3	2	08/10/17 19:02	msh
Potassium, total (3050)	M6010B ICP	101	1400			mg/Kg	20	100	08/22/17 13:49	dcm
Selenium, total (3050)	M6020 ICP-MS	505	0.07	B		mg/Kg	0.05	0.1	08/10/17 19:02	msh
Silver, total (3050)	M6020 ICP-MS	505		U		mg/Kg	0.03	0.1	08/10/17 19:02	msh
Zinc, total (3050)	M6020 ICP-MS	25300		U	*	mg/Kg	50	100	08/17/17 17:28	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	82.8		*	%	0.1	0.5	08/01/17 0:36	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:52	dbt
Digestion - Hot Plate	M3050B ICP								08/03/17 13:51	jlw
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 13:51	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/03/17 17:19	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-6

ACZ Sample ID: ***L38694-07***
Date Sampled: *07/11/17 07:00*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	22.8		UH	*	mg/Kg	0.1	0.5	08/01/17 14:57	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	24.3	0.00634		*	%	0.00024	0.00122	08/05/17 1:20	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-7

ACZ Sample ID: ***L38694-08***
Date Sampled: *07/11/17 06:12*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								09/12/17 13:00	wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 15:49	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25300	11900		*	mg/Kg	30	100	08/17/17 17:30	msh
Antimony, total (3050)	M6020 ICP-MS	505	2.0		*	mg/Kg	0.2	1	08/10/17 19:04	msh
Arsenic, total (3050)	M6020 ICP-MS	505	10.8			mg/Kg	0.1	0.5	08/10/17 19:04	msh
Barium, total (3050)	M6020 ICP-MS	505	140		*	mg/Kg	0.3	1	08/10/17 19:04	msh
Boron, total (3050)	M6010B ICP	101		U		mg/Kg	1	5	08/22/17 13:53	dcm
Cadmium, total (3050)	M6020 ICP-MS	505	0.27	B		mg/Kg	0.05	0.3	08/10/17 19:04	msh
Calcium, total (3050)	M6010B ICP	101	1630			mg/Kg	10	50	08/22/17 13:53	dcm
Chromium, total (3050)	M6020 ICP-MS	505	2.9			mg/Kg	0.3	1	08/10/17 19:04	msh
Copper, total (3050)	M6020 ICP-MS	505	7.4			mg/Kg	0.2	1	08/10/17 19:04	msh
Iron, total (3050)	M6010B ICP	101	13000		*	mg/Kg	2	5	08/22/17 13:53	dcm
Lead, total (3050)	M6020 ICP-MS	505	10.7			mg/Kg	0.05	0.3	08/10/17 19:04	msh
Magnesium, total (3050)	M6010B ICP	101	1030			mg/Kg	20	100	08/22/17 13:53	dcm
Manganese, total (3050)	M6020 ICP-MS	505	519		*	mg/Kg	0.2	1	08/10/17 19:04	msh
Mercury, total	M7471A CVAA	249	0.06	B	*	mg/Kg	0.05	0.2	08/02/17 9:12	sck
Molybdenum, total (3050)	M6010B ICP	101		U		mg/Kg	2	10	08/22/17 13:53	dcm
Nickel, total (3050)	M6020 ICP-MS	505	2.3		*	mg/Kg	0.3	2	08/10/17 19:04	msh
Potassium, total (3050)	M6010B ICP	101	2140			mg/Kg	20	100	08/22/17 13:53	dcm
Selenium, total (3050)	M6020 ICP-MS	505	0.07	B		mg/Kg	0.05	0.1	08/10/17 19:04	msh
Silver, total (3050)	M6020 ICP-MS	505	0.08	B		mg/Kg	0.03	0.1	08/10/17 19:04	msh
Zinc, total (3050)	M6020 ICP-MS	25300	60	B	*	mg/Kg	50	100	08/17/17 17:30	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	73.5		*	%	0.1	0.5	08/01/17 2:33	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:54	dbt
Digestion - Hot Plate	M3050B ICP								08/03/17 14:16	jlw
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 14:16	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/03/17 19:01	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-7

ACZ Sample ID: ***L38694-08***
Date Sampled: *07/11/17 06:12*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	33.3		UH	*	mg/Kg	0.2	0.7	09/12/17 22:51	pjb
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	40.2	0.0103		*	%	0.0004	0.00201	08/05/17 1:24	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-8

ACZ Sample ID: ***L38694-09***
Date Sampled: *07/11/17 09:10*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								08/08/17 12:20	jdk/bsu
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 16:02	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25300	8370		*	mg/Kg	30	100	08/17/17 17:31	msh
Antimony, total (3050)	M6020 ICP-MS	505	1.8		*	mg/Kg	0.2	1	08/10/17 19:06	msh
Arsenic, total (3050)	M6020 ICP-MS	505	14.9			mg/Kg	0.1	0.5	08/10/17 19:06	msh
Barium, total (3050)	M6020 ICP-MS	505	127		*	mg/Kg	0.3	1	08/10/17 19:06	msh
Boron, total (3050)	M6010B ICP	101		U		mg/Kg	1	5	08/22/17 14:01	dcm
Cadmium, total (3050)	M6020 ICP-MS	505	0.27	B		mg/Kg	0.05	0.3	08/10/17 19:06	msh
Calcium, total (3050)	M6010B ICP	101	2190			mg/Kg	10	50	08/22/17 14:01	dcm
Chromium, total (3050)	M6020 ICP-MS	505	3.8			mg/Kg	0.3	1	08/10/17 19:06	msh
Copper, total (3050)	M6020 ICP-MS	505	7.2			mg/Kg	0.2	1	08/10/17 19:06	msh
Iron, total (3050)	M6010B ICP	101	11700		*	mg/Kg	2	5	08/22/17 14:01	dcm
Lead, total (3050)	M6020 ICP-MS	505	9.53			mg/Kg	0.05	0.3	08/10/17 19:06	msh
Magnesium, total (3050)	M6010B ICP	101	960			mg/Kg	20	100	08/22/17 14:01	dcm
Manganese, total (3050)	M6020 ICP-MS	505	415		*	mg/Kg	0.2	1	08/10/17 19:06	msh
Mercury, total	M7471A CVAA	266	0.08	B	*	mg/Kg	0.05	0.3	08/02/17 9:13	sck
Molybdenum, total (3050)	M6010B ICP	101		U		mg/Kg	2	10	08/22/17 14:01	dcm
Nickel, total (3050)	M6020 ICP-MS	505	2.7		*	mg/Kg	0.3	2	08/10/17 19:06	msh
Potassium, total (3050)	M6010B ICP	101	1740			mg/Kg	20	100	08/22/17 14:01	dcm
Selenium, total (3050)	M6020 ICP-MS	505	0.06	B		mg/Kg	0.05	0.1	08/10/17 19:06	msh
Silver, total (3050)	M6020 ICP-MS	505	0.41			mg/Kg	0.03	0.1	08/10/17 19:06	msh
Zinc, total (3050)	M6020 ICP-MS	25300	80	B	*	mg/Kg	50	100	08/17/17 17:31	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	74.9		*	%	0.1	0.5	08/01/17 4:30	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:56	dbt
Digestion - Hot Plate	M3050B ICP								08/03/17 14:41	jlw
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 14:41	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/03/17 20:43	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-8

ACZ Sample ID: ***L38694-09***
Date Sampled: *07/11/17 09:10*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	32.3		UH	*	mg/Kg	0.2	0.6	08/09/17 16:48	jdk/wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	45.1	0.00917		*	%	0.00045	0.00226	08/05/17 1:25	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-9

ACZ Sample ID: ***L38694-10***
Date Sampled: *07/11/17 08:00*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								08/08/17 12:46	jdk/bsu
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 16:16	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25300	8290		*	mg/Kg	30	100	08/17/17 17:33	msh
Antimony, total (3050)	M6020 ICP-MS	505	0.6	B	*	mg/Kg	0.2	1	08/10/17 19:08	msh
Arsenic, total (3050)	M6020 ICP-MS	505	5.4			mg/Kg	0.1	0.5	08/10/17 19:08	msh
Barium, total (3050)	M6020 ICP-MS	505	113		*	mg/Kg	0.3	1	08/10/17 19:08	msh
Boron, total (3050)	M6010B ICP	101		U		mg/Kg	1	5	08/22/17 14:05	dcm
Cadmium, total (3050)	M6020 ICP-MS	505	0.21	B		mg/Kg	0.05	0.3	08/10/17 19:08	msh
Calcium, total (3050)	M6010B ICP	101	1560			mg/Kg	10	50	08/22/17 14:05	dcm
Chromium, total (3050)	M6020 ICP-MS	505	2.7			mg/Kg	0.3	1	08/10/17 19:08	msh
Copper, total (3050)	M6020 ICP-MS	505	5.7			mg/Kg	0.2	1	08/10/17 19:08	msh
Iron, total (3050)	M6010B ICP	101	9030		*	mg/Kg	2	5	08/22/17 14:05	dcm
Lead, total (3050)	M6020 ICP-MS	505	5.74			mg/Kg	0.05	0.3	08/10/17 19:08	msh
Magnesium, total (3050)	M6010B ICP	101	910			mg/Kg	20	100	08/22/17 14:05	dcm
Manganese, total (3050)	M6020 ICP-MS	505	307		*	mg/Kg	0.2	1	08/10/17 19:08	msh
Mercury, total	M7471A CVAA	270	0.07	B	*	mg/Kg	0.05	0.3	08/02/17 9:14	sck
Molybdenum, total (3050)	M6010B ICP	101		U		mg/Kg	2	10	08/22/17 14:05	dcm
Nickel, total (3050)	M6020 ICP-MS	505	1.6	B	*	mg/Kg	0.3	2	08/10/17 19:08	msh
Potassium, total (3050)	M6010B ICP	101	1390			mg/Kg	20	100	08/22/17 14:05	dcm
Selenium, total (3050)	M6020 ICP-MS	505	0.09	B		mg/Kg	0.05	0.1	08/10/17 19:08	msh
Silver, total (3050)	M6020 ICP-MS	505	0.05	B		mg/Kg	0.03	0.1	08/10/17 19:08	msh
Zinc, total (3050)	M6020 ICP-MS	25300	50	B	*	mg/Kg	50	100	08/17/17 17:33	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	69.2		*	%	0.1	0.5	08/01/17 6:27	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:58	dbt
Digestion - Hot Plate	M3050B ICP								08/03/17 15:05	jlw
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 15:05	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/03/17 22:25	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-9

ACZ Sample ID: ***L38694-10***
Date Sampled: *07/11/17 08:00*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	35.2		UH	*	mg/Kg	0.2	0.7	08/09/17 16:49	jdk/wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	40.8	0.00882		*	%	0.00041	0.00204	08/05/17 1:26	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-11

ACZ Sample ID: ***L38694-11***
Date Sampled: *07/11/17 15:14*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9013 - Manual Distillation								08/08/17 13:13	jdk/bsu
Phosphorus, total	M365.1 - Auto Ascorbic Acid Digestion								08/04/17 16:30	wtc

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum, total (3050)	M6020 ICP-MS	25500	14600		*	mg/Kg	30	100	08/17/17 17:34	msh
Antimony, total (3050)	M6020 ICP-MS	510	0.5	B	*	mg/Kg	0.2	1	08/10/17 19:10	msh
Arsenic, total (3050)	M6020 ICP-MS	510	8.4			mg/Kg	0.1	0.5	08/10/17 19:10	msh
Barium, total (3050)	M6020 ICP-MS	510	146		*	mg/Kg	0.3	1	08/10/17 19:10	msh
Boron, total (3050)	M6010B ICP	102		U		mg/Kg	1	5	08/22/17 14:08	dcm
Cadmium, total (3050)	M6020 ICP-MS	510	0.48			mg/Kg	0.05	0.3	08/10/17 19:10	msh
Calcium, total (3050)	M6010B ICP	102	4920			mg/Kg	10	50	08/22/17 14:08	dcm
Chromium, total (3050)	M6020 ICP-MS	510	2.2			mg/Kg	0.3	1	08/10/17 19:10	msh
Copper, total (3050)	M6020 ICP-MS	510	8.0			mg/Kg	0.2	1	08/10/17 19:10	msh
Iron, total (3050)	M6010B ICP	102	9770		*	mg/Kg	2	5	08/22/17 14:08	dcm
Lead, total (3050)	M6020 ICP-MS	510	19.1			mg/Kg	0.05	0.3	08/10/17 19:10	msh
Magnesium, total (3050)	M6010B ICP	102	1670			mg/Kg	20	100	08/22/17 14:08	dcm
Manganese, total (3050)	M6020 ICP-MS	510	631		*	mg/Kg	0.2	1	08/10/17 19:10	msh
Mercury, total	M7471A CVAA	255	0.13	BH	*	mg/Kg	0.05	0.3	08/11/17 16:31	sck
Molybdenum, total (3050)	M6010B ICP	102		U		mg/Kg	2	10	08/22/17 14:08	dcm
Nickel, total (3050)	M6020 ICP-MS	510	2.5		*	mg/Kg	0.3	2	08/10/17 19:10	msh
Potassium, total (3050)	M6010B ICP	102	1340			mg/Kg	20	100	08/22/17 14:08	dcm
Selenium, total (3050)	M6020 ICP-MS	510	0.07	B		mg/Kg	0.05	0.1	08/10/17 19:10	msh
Silver, total (3050)	M6020 ICP-MS	510	0.58			mg/Kg	0.03	0.1	08/10/17 19:10	msh
Zinc, total (3050)	M6020 ICP-MS	25500	90	B	*	mg/Kg	50	100	08/17/17 17:34	msh

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Solids, Percent	D2216-80	1	66.2		*	%	0.1	0.5	08/01/17 8:25	dbt

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								07/31/17 12:59	dbt
Digestion - Hot Plate	M3050B ICP								08/03/17 15:30	jlw
Digestion - Hot Plate	M3050B ICP-MS								08/03/17 15:30	jlw
Sieve-2000 um (2.0mm)	ASA No.9, 15-4.2.2								08/04/17 0:08	dbt

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: SED-11

ACZ Sample ID: ***L38694-11***
Date Sampled: *07/11/17 15:14*
Date Received: *07/25/17*
Sample Matrix: *Sediment*

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M9012B - Automated Colorimetric	36.6		UH	*	mg/Kg	0.2	0.7	08/09/17 16:49	jdk/wtc
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	40.3	0.00990		*	%	0.0004	0.00202	08/05/17 1:27	pjb

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Tahoe Resources, Inc.

ACZ Project ID: ***L38694***

Aluminum, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG429218													
WG429218ICV	ICV	08/17/17 16:56	MS170721-3	.1		.0995	mg/L	100	90	110			
WG429218ICB	ICB	08/17/17 16:57				U	mg/L		-0.003	0.003			
WG428143PBS	PBS	08/17/17 17:11				1.62	mg/Kg		-1.5	1.5			B7
WG428143LCSS	LCSS	08/17/17 17:12	PCN52821	8080		9129	mg/Kg		4130	12000			
WG428143LCSSD	LCSSD	08/17/17 17:14	PCN52821	8080		9122	mg/Kg		4130	12000	0	20	
L38694-11MS	MS	08/17/17 17:36	MS250XS	25.5	14600	14981	mg/Kg	1494	75	125			M3
L38694-11MSD	MSD	08/17/17 17:37	MS250XS	25.5	14600	12808	mg/Kg	-7027	75	125	16	20	M3

Antimony, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.02		.01854	mg/L	93	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.0012	0.0012			
WG428143PBS	PBS	08/10/17 18:37				U	mg/Kg		-0.6	0.6			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	123		85.8	mg/Kg		1.24	246			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	123		105.9	mg/Kg		1.24	246	21	20	RK
L38694-11MS	MS	08/10/17 19:12	MS170801-3	5.0898	.5	3.56	mg/Kg	60	75	125			M2
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	5.0898	.5	3.31	mg/Kg	55	75	125	7	20	M2

Arsenic, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.05		.05323	mg/L	106	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.0006	0.0006			
WG428143PBS	PBS	08/10/17 18:37				U	mg/Kg		-0.3	0.3			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	145		145.6	mg/Kg		115	176			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	145		152.5	mg/Kg		115	176	5	20	
L38694-11MS	MS	08/10/17 19:12	MS170801-3	25.551	8.4	35.03	mg/Kg	104	75	125			
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	25.551	8.4	36.75	mg/Kg	111	75	125	5	20	

Barium, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.05		.05221	mg/L	104	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.0015	0.0015			
WG428143PBS	PBS	08/10/17 18:37				U	mg/Kg		-0.9	0.9			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	209		201.1	mg/Kg		174	245			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	209		212.3	mg/Kg		174	245	5	20	
L38694-11MS	MS	08/10/17 19:12	MS170801-3	25.551	146	377.86	mg/Kg	907	75	125			M3
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	25.551	146	165.16	mg/Kg	75	75	125	78	20	RD

Tahoe Resources, Inc.

ACZ Project ID: ***L38694***

Boron, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG429537													
WG429537ICV	ICV	08/22/17 12:31	II170731-3	2		2.091	mg/L	105	90	110			
WG429537ICB	ICB	08/22/17 12:35				U	mg/L		-0.03	0.03			
WG428143PBS	PBS	08/22/17 12:59				2.5	mg/Kg		-3	3			
WG428143LCSS	LCSS	08/22/17 13:03	PCN52821	126		128.1	mg/Kg		91.8	160			
WG428143LCSSD	LCSSD	08/22/17 13:06	PCN52821	126		140.3	mg/Kg		91.8	160	9	20	
L38694-04MS	MS	08/22/17 13:26	II170728-5	50.5505	U	50.2	mg/Kg	99	75	125			
L38694-04MSD	MSD	08/22/17 13:37	II170728-5	50.5505	U	50.9	mg/Kg	101	75	125	1	20	

Cadmium, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.05		.05228	mg/L	105	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.0003	0.0003			
WG428143PBS	PBS	08/10/17 18:37				U	mg/Kg		-0.15	0.15			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	87.6		86.44	mg/Kg		72.4	103			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	87.6		98.8	mg/Kg		72.4	103	13	20	
L38694-11MS	MS	08/10/17 19:12	MS170801-3	25.5255	.48	26.673	mg/Kg	103	75	125			
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	25.5255	.48	26.178	mg/Kg	101	75	125	2	20	

Calcium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG429537													
WG429537ICV	ICV	08/22/17 12:31	II170731-3	100		100.4	mg/L	100	90	110			
WG429537ICB	ICB	08/22/17 12:35				U	mg/L		-0.3	0.3			
WG428143PBS	PBS	08/22/17 12:59				U	mg/Kg		-30	30			
WG428143LCSS	LCSS	08/22/17 13:03	PCN52821	5690		5281	mg/Kg		4610	6760			
WG428143LCSSD	LCSSD	08/22/17 13:06	PCN52821	5690		5921	mg/Kg		4610	6760	11	20	
L38694-04MS	MS	08/22/17 13:26	II170728-5	6732.36811	3210	9774	mg/Kg	97	75	125			
L38694-04MSD	MSD	08/22/17 13:37	II170728-5	6732.36811	3210	9685	mg/Kg	96	75	125	1	20	

Chromium, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.05		.05335	mg/L	107	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.0015	0.0015			
WG428143PBS	PBS	08/10/17 18:37				U	mg/Kg		-0.9	0.9			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	143		138.3	mg/Kg		114	171			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	143		156.2	mg/Kg		114	171	12	20	
L38694-11MS	MS	08/10/17 19:12	MS170801-3	25.5	2.2	27.59	mg/Kg	100	75	125			
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	25.5	2.2	27.88	mg/Kg	101	75	125	1	20	

Tahoe Resources, Inc.

ACZ Project ID: ***L38694***

Copper, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.05		.0541	mg/L	108	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.0012	0.0012			
WG428143PBS	PBS	08/10/17 18:37				U	mg/Kg		-0.6	0.6			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	173		169	mg/Kg		141	204			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	173		188.7	mg/Kg		141	204	11	20	
L38694-11MS	MS	08/10/17 19:12	MS170801-3	25.041	8	35.97	mg/Kg	112	75	125			
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	25.041	8	33.12	mg/Kg	100	75	125	8	20	

Cyanide, total M9012B - Automated Colorimetric

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428010													
WG428010ICV	ICV	08/01/17 14:32	WI170731-2	.3006		.2835	mg/L	94	90	110			
WG428010ICB	ICB	08/01/17 14:33				U	mg/L		-0.003	0.003			
WG427563PBS	PBS	08/01/17 14:34				U	mg/Kg		-0.2	0.2			
WG427563LCSS	LCSS	08/01/17 14:35	PCN44352	57.2		54.8	mg/Kg		10	66.8			
L38693-01DUP	DUP	08/01/17 14:36			U	U	mg/Kg				0	20	RA
L38693-02MS	MS	08/01/17 14:38	1XCN	11.48	U	9.77	mg/Kg	85	85	115			
WG428652													
WG428652ICV	ICV	08/09/17 16:43	WI170731-2	.3006		.2886	mg/L	96	90	110			
WG428652ICB	ICB	08/09/17 16:44				U	mg/L		-0.003	0.003			
WG428485PBS	PBS	08/09/17 16:45				U	mg/Kg		-0.2	0.2			
WG428485LCSS	LCSS	08/09/17 16:46	PCN44352	57.2		59	mg/Kg		10	66.8			
L38894-01DUP	DUP	08/09/17 16:51			U	U	mg/Kg				0	20	RA
L38906-04MS	MS	08/09/17 16:53	1XCN	9.8	U	7.76	mg/Kg	79	85	115			M2

Iron, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG429537													
WG429537ICV	ICV	08/22/17 12:31	II170731-3	2		1.95	mg/L	98	90	110			
WG429537ICB	ICB	08/22/17 12:35				U	mg/L		-0.06	0.06			
WG428143PBS	PBS	08/22/17 12:59				U	mg/Kg		-6	6			
WG428143LCSS	LCSS	08/22/17 13:03	PCN52821	15000		13460	mg/Kg		7020	23100			
WG428143LCSSD	LCSSD	08/22/17 13:06	PCN52821	15000		12860	mg/Kg		7020	23100	5	20	
L38694-04MS	MS	08/22/17 13:26	II170728-5	101.1111	11000	13049.2	mg/Kg	2027	75	125			M3
L38694-04MSD	MSD	08/22/17 13:37	II170728-5	101.1111	11000	12352.3	mg/Kg	1337	75	125	5	20	M3

Lead, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.05		.05371	mg/L	107	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.0003	0.0003			
WG428143PBS	PBS	08/10/17 18:37				U	mg/Kg		-0.15	0.15			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	146		144.49	mg/Kg		119	173			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	146		154.02	mg/Kg		119	173	6	20	
L38694-11MS	MS	08/10/17 19:12	MS170801-3	25.551	19.1	50.241	mg/Kg	122	75	125			
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	25.551	19.1	46.139	mg/Kg	106	75	125	9	20	

Tahoe Resources, Inc.

ACZ Project ID: ***L38694***

Magnesium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG429537													
WG429537ICV	ICV	08/22/17 12:31	II170731-3	100		101.4	mg/L	101	90	110			
WG429537ICB	ICB	08/22/17 12:35				U	mg/L		-0.6	0.6			
WG428143PBS	PBS	08/22/17 12:59				U	mg/Kg		-60	60			
WG428143LCSS	LCSS	08/22/17 13:03	PCN52821	2640		2553	mg/Kg		2020	3260			
WG428143LCSSD	LCSSD	08/22/17 13:06	PCN52821	2640		2604	mg/Kg		2020	3260	2	20	
L38694-04MS	MS	08/22/17 13:26	II170728-5	4950.64125	990	5738	mg/Kg	96	75	125			
L38694-04MSD	MSD	08/22/17 13:37	II170728-5	4950.64125	990	5748	mg/Kg	96	75	125	0	20	

Manganese, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.05		.05244	mg/L	105	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.0012	0.0012			
WG428143PBS	PBS	08/10/17 18:37				U	mg/Kg		-0.6	0.6			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	309		306.4	mg/Kg		252	367			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	309		327.4	mg/Kg		252	367	7	20	
L38694-11MS	MS	08/10/17 19:12	MS170801-3	25.5255	631	2278.28	mg/Kg	6453	75	125			M3
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	25.5255	631	589.87	mg/Kg	-161	75	125	118	20	M3 RD

Mercury, total M7471A CVAA

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG427966													
WG427966ICV	ICV	08/02/17 8:14	HG170714-6	.01001		.0102	mg/L	102	90	110			
WG427966ICB	ICB	08/02/17 8:16				.0002	mg/L		-0.0006	0.0006			
WG427968													
WG427968PBS	PBS	08/02/17 8:54				U	mg/Kg		-0.12	0.12			
WG427968LCSS	LCSS	08/02/17 8:55	PCN52514	12.3		10	mg/Kg		8.8	15.8			
WG427968LCSSD	LCSSD	08/02/17 8:57	PCN52514	12.3		10.31	mg/Kg		8.8	15.8	3	20	
L38694-07MS	MS	08/02/17 9:10	HG170714-8	1.09109	.05	1.083	mg/Kg	95	85	115			
L38694-07MSD	MSD	08/02/17 9:11	HG170714-8	1.06106	.05	1.049	mg/Kg	94	85	115	3	20	
WG428805													
WG428805ICV	ICV	08/11/17 16:15	HG170714-6	.01001		.0102	mg/L	102	90	110			
WG428805ICB	ICB	08/11/17 16:17				.00044	mg/L		-0.0006	0.0006			
WG428805PBS	PBS	08/11/17 16:19				.083	mg/Kg		-0.12	0.12			
WG428805LCSS	LCSS	08/11/17 16:20	PCN52514	12.3		10.98	mg/Kg		8.8	15.8			
WG428805LCSSD	LCSSD	08/11/17 16:21	PCN52514	12.3		10.47	mg/Kg		8.8	15.8	5	20	
L38694-02MS	MS	08/11/17 16:27	HG170714-8	1.17117	.11	1.212	mg/Kg	94	85	115			
L38694-02MSD	MSD	08/11/17 16:28	HG170714-8	1.13113	.11	1.2	mg/Kg	96	85	115	1	20	

Tahoe Resources, Inc.

ACZ Project ID: ***L38694***

Molybdenum, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG429537													
WG429537ICV	ICV	08/22/17 12:31	II170731-3	2		2.075	mg/L	104	90	110			
WG429537ICB	ICB	08/22/17 12:35				U	mg/L		-0.06	0.06			
WG428143PBS	PBS	08/22/17 12:59				U	mg/Kg		-6	6			
WG428143LCSS	LCSS	08/22/17 13:03	PCN52821	116		112.6	mg/Kg		91.5	141			
WG428143LCSSD	LCSSD	08/22/17 13:06	PCN52821	116		128.5	mg/Kg		91.5	141	13	20	
L38694-04MS	MS	08/22/17 13:26	II170728-5	49.3612755	U	45.4	mg/Kg	92	75	125			
L38694-04MSD	MSD	08/22/17 13:37	II170728-5	49.3612755	U	45.7	mg/Kg	93	75	125	1	20	

Nickel, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.05		.05484	mg/L	110	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.0018	0.0018			
WG428143PBS	PBS	08/10/17 18:37				U	mg/Kg		-0.9	0.9			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	129		130.8	mg/Kg		107	151			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	129		153.7	mg/Kg		107	151	16	20	RL
L38694-11MS	MS	08/10/17 19:12	MS170801-3	25.551	2.5	28.59	mg/Kg	102	75	125			
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	25.551	2.5	28.77	mg/Kg	103	75	125	1	20	

Phosphorus, total M365.1 - Auto Ascorbic Acid (digest)

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428356													
WG428356ICV	ICV	08/05/17 0:54	WI170802-2	4		3.7	mg/L	93	90	110			
WG428356ICB	ICB	08/05/17 0:55				U	mg/L		-0.1	0.1			
WG428282PBS	PBS	08/05/17 0:57				U	%		-0.0002	0.0002			
WG428282LFB	LFB	08/05/17 0:58	WI170628-2	2.5		2.29	%	92	85	115			
L38632-01DUP	DUP	08/05/17 1:00			3.94	2.95	%				29	20	RD
L38693-01MS	MS	08/05/17 1:02	10XTKNPTS	922.5	1.33	1.56	%	249	75	125			M3

Potassium, total (3050) M6010B ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG429537													
WG429537ICV	ICV	08/22/17 12:31	II170731-3	20		20.4	mg/L	102	90	110			
WG429537ICB	ICB	08/22/17 12:35				U	mg/L		-0.6	0.6			
WG428143PBS	PBS	08/22/17 12:59				U	mg/Kg		-60	60			
WG428143LCSS	LCSS	08/22/17 13:03	PCN52821	2400		2454	mg/Kg		1720	3080			
WG428143LCSSD	LCSSD	08/22/17 13:06	PCN52821	2400		2474	mg/Kg		1720	3080	1	20	
L38694-04MS	MS	08/22/17 13:26	II170728-5	9901.85012	1800	12373	mg/Kg	107	75	125			
L38694-04MSD	MSD	08/22/17 13:37	II170728-5	9901.85012	1800	12453	mg/Kg	108	75	125	1	20	

Tahoe Resources, Inc.

ACZ Project ID: ***L38694***

Selenium, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.05		.05262	mg/L	105	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.0003	0.0003			
WG428143PBS	PBS	08/10/17 18:37				.057	mg/Kg		-0.15	0.15			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	178		173.32	mg/Kg		140	216			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	178		189.61	mg/Kg		140	216	9	20	
L38694-11MS	MS	08/10/17 19:12	MS170801-3	12.76275	.07	12.327	mg/Kg	96	75	125			
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	12.76275	.07	12.443	mg/Kg	97	75	125	1	20	

Silver, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.02004		.021034	mg/L	105	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.00015	0.00015			
WG428143PBS	PBS	08/10/17 18:37				U	mg/Kg		-0.09	0.09			
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	31.3		29.37	mg/Kg		23.5	39.1			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	31.3		30.89	mg/Kg		23.5	39.1	5	20	
L38694-11MS	MS	08/10/17 19:12	MS170801-3	5.1051	.58	5.684	mg/Kg	100	75	125			
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	5.1051	.58	5.593	mg/Kg	98	75	125	2	20	

Solids, Percent D2216-80

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG427861													
WG427861PBS	PBS	07/31/17 9:00				U	%		-0.1	0.1			
L38694-01DUP	DUP	07/31/17 12:54			81	78.65	%				3	20	

Zinc, total (3050) M6020 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG428754													
WG428754ICV	ICV	08/10/17 18:25	MS170721-3	.05		.0515	mg/L	103	90	110			
WG428754ICB	ICB	08/10/17 18:27				U	mg/L		-0.006	0.006			
WG428143PBS	PBS	08/10/17 18:37				7.9	mg/Kg		-3	3			B7
WG428143LCSS	LCSS	08/10/17 18:39	PCN52821	194		196	mg/Kg		159	229			
WG428143LCSSD	LCSSD	08/10/17 18:41	PCN52821	194		208	mg/Kg		159	229	6	20	
L38694-11MS	MS	08/10/17 19:12	MS170801-3	25.5102	55	71.9	mg/Kg	66	75	125			M2
L38694-11MSD	MSD	08/10/17 19:14	MS170801-3	25.5102	55	68.9	mg/Kg	54	75	125	4	20	M2
WG429218													
WG429218ICV	ICV	08/17/17 16:56	MS170721-3	.05		.0515	mg/L	103	90	110			
WG429218ICB	ICB	08/17/17 16:57				U	mg/L		-0.006	0.006			
WG428143PBS	PBS	08/17/17 17:11				U	mg/Kg		-3	3			
WG428143LCSS	LCSS	08/17/17 17:12	PCN52821	194		210	mg/Kg		159	229			
WG428143LCSSD	LCSSD	08/17/17 17:14	PCN52821	194		209	mg/Kg		159	229	0	20	
L38694-11MS	MS	08/17/17 17:36	MS250XS	25.5051	90	107	mg/Kg	67	75	125			M3
L38694-11MSD	MSD	08/17/17 17:37	MS250XS	25.5051	90	100	mg/Kg	39	75	125	7	20	M3

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-01	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428010	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG427968	Mercury, total	M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG429218	Zinc, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-02	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428010	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428805	Mercury, total	M7471A CVAA	HC	Initial analysis within holding time. Reanalysis was past holding time, which was required due to a QC failure during the initial analysis.
			M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428754	Zinc, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-03	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428010	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG427968	Mercury, total	M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG429218	Zinc, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-04	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428010	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG427968	Mercury, total	M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG429218	Zinc, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-05	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428010	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG427968	Mercury, total	M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG429218	Zinc, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-06	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428010	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG427968	Mercury, total	M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG429218	Zinc, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-07	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428010	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG427968	Mercury, total	M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG429218	Zinc, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-08	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG431080	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG427968	Mercury, total	M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG429218	Zinc, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-09	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428652	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG427968	Mercury, total	M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG429218	Zinc, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-10	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428652	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG427968	Mercury, total	M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG429218	Zinc, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38694-11	WG429218	Aluminum, total (3050)	M6020 ICP-MS	B7	Target analyte detected in prep / method blank at or above acceptance limit. Sample value is > 10X the concentration in the method blank.
			M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Antimony, total (3050)	M6020 ICP-MS	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RK	LCSS/LCSSD recovery within acceptance criteria but RPD exceeded the laboratory control limit. Acceptable MS/MSD RPD demonstrates precision.
		Barium, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428652	Cyanide, total	M9012B - Automated Colorimetric	H1	Sample prep or analysis performed past holding time. See case narrative.
			M9012B - Automated Colorimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M9012B - Automated Colorimetric	Q6	Sample was received above recommended temperature.
			M9012B - Automated Colorimetric	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG429537	Iron, total (3050)	M6010B ICP	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG428754	Manganese, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M6020 ICP-MS	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG428805	Mercury, total	M7471A CVAA	HC	Initial analysis within holding time. Reanalysis was past holding time, which was required due to a QC failure during the initial analysis.
			M7471A CVAA	Q6	Sample was received above recommended temperature.
	WG428754	Nickel, total (3050)	M6020 ICP-MS	RL	Recovery for either the LCS or LCS duplicate was outside of the acceptance limits; the RPD was within the acceptance limits.
	WG428356	Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			M365.1 - Auto Ascorbic Acid (digest)	RD	For a solid matrix, the duplicate RPD (spike or matrix) exceeded the control limit, which is attributable to the non-homogeneity of the sample.
	WG429218	Zinc, total (3050)	M6020 ICP-MS	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.

Certification Qualifiers

Tahoe Resources, Inc. ACZ Project ID: ***L38694***

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Solids, Percent	D2216-80

Wet Chemistry

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38694
Date Received: 07/25/2017 10:01
Received By:
Date Printed: 7/25/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?		X	
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?		X	
The 'sampled by' field on the Chain of Custody was not completed.			
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?		X	

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]			X
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?		X	
Some parameters were received past hold time.			

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
NA26503	23.4	<=6.0	14	N/A

Was ice present in the shipment container(s)?

No - Wet or gel ice was not present in the shipment container(s).

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38694
Date Received: 07/25/2017 10:01
Received By:
Date Printed: 7/25/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc. L38694

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios	Address: Blvd los Próceres 18 Calle 24-69 Z 10
Company: Minera San Rafael	Empresarial, Z Pradera, Torre IV oficina 1406
E-mail: LBarrios@sanrafael.com.gt	Telephone: (502) 5696 4268

Copy of Report to:

Name: EvonQuednow@sanrafael.com.gt	E-mail: fsamayoa@sanrafael.com.gt
Company: Minera San Rafael	Telephone:

Invoice to:

Name: Luisa Fernanda Barrios	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: _____ **Sampler's Site Information** **State**_____ **Zip code**_____ **Time Zone**_____

***Sampler's Signature:** _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SED							
SED-1	11/07/17 17:00	SO	1	✓							
SED-2	11/07/17 15:58	SO	1	✓							
SED-2A	11/07/17 15:14	SO	1	✓							
SED-3	11/07/17 10:20	SO	1	✓							
SED-4	11/07/17 09:45	SO	1	✓							
SED-4A	11/07/17 14:25	SO	1	✓							
SED-6	11/07/17 07:00	SO	1	✓							
SED-7	11/07/17 06:12	SO	1	✓							
SED-8	11/07/17 08:10	SO	1	✓							
SED-9	11/07/17 08:00	SO	1	✓							

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

COC#1: Please include COC#2 in the same project report. (SED-11)

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Erik von Quednow	17/07/17 09:00		17/7/17
Juan Ajcalon	17-07-2017 9:30		10:10
			745-21001

L38694 Chain of Custody

FRMAD050.06.14.14 White - Return with sample. Yellow - Retain for your records.

ACZ Laboratories, Inc. 63894

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa fernanda Barrios	Address: Blvd los Próceres 18 calle 24-69, Z 10
Company: Minera San Rafael	Empresarial 2 pradera Torre IV oficina 1406
E-mail: LBarrios@sanrafael.com.gt	Telephone: (502) 5696 42 68

Copy of Report to:

Name: EvanQuednow@sanrafael-com.gt	E-mail: fSamayoa@sanrafael.com.gt
Company: Minera San Rafael.com.gt	Telephone:

Invoice to:

Name: Luisa fernanda Barrios	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: _____ **Sampler's Site Information** **State**_____ **Zip code**_____ **Time Zone**_____

***Sampler's Signature:** _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SED							
SED-11	11/07/17 15:14	SO	1	/							

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

COC#2: to be included in COC#1 project report.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Erik von Quednow	17/07/17 09:00		17/7/17
Juan Aguilera	17.07.2017 09:30		10:10
			20/07/2017

12.7 Informes originales de los Resultados Analíticos obtenidos del Efluente en los meses de Mayo a Julio 2017

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua compuesta (según información del cliente)
Alicuota 1: 10:01 horas
Alicuota 2: 13:01 horas
Alicuota 3: 16:01 horas
Alicuota 4: 19:01 horas
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 180517
Fecha de ingreso de muestra: 190517
Fecha de análisis: 190517-290517
Fecha del informe: 290517

Identificación de la muestra: WW-9 descarga planta de tratamiento
Correlativo Ecosistemas: 8400

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	7.40	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	N.D.	EPA 1664	10
Materia Flotante	---	---	ausente ***	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxigeno DQO	mg/l	25	31	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	0.32	---	---
Relación DQO/DBO_5	---	---	3.10	---	---
* Sólidos Suspendidos	mg/l	10	< 10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	< 0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	N.D.	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	N.D.	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	0.004	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	N.D.	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	N.D.	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	N.D.	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	N.D.	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	N.D.	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

					Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006
PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	N.D.	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	N.D.	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	51	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	5	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	4.9×10^2	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
N.D. No detectable. Debajo del límite de detección.
NMP: Número más probable.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua compuesta (según información del cliente)
Alicuota 1: 10:01 horas
Alicuota 2: 13:01 horas
Alicuota 3: 16:01 horas
Alicuota 4: 19:01 horas
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 180517
Fecha de ingreso de muestra: 190517
Fecha de análisis: 190517-290517
Fecha del informe: 290517

Identificación de la muestra: WW-11 descarga planta de tratamiento
Correlativo Ecosistemas: 8399

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	7.41	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	N.D.	EPA 1664	10
Materia Flotante	---	---	ausente ***	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	11	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	31	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	0.35	---	---
Relación DQO/DBO_5	---	---	2.82	---	---
* Sólidos Suspendidos	mg/l	10	< 10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	< 0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	N.D.	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	N.D.	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	0.005	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	N.D.	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	N.D.	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	N.D.	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	N.D.	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	N.D.	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL
17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

					Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006
PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	N.D.	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	N.D.	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	56	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	< 1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	2.4×10^2	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
N.D. No detectable. Debajo del límite de detección.
NMP: Número más probable.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

June 01, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L37430

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on May 26, 2017. This project has been assigned to ACZ's project number, L37430. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L37430. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after July 01, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Max Janicek has reviewed and approved this report.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-11

ACZ Sample ID: ***L37430-01***
Date Sampled: *05/18/17 19:01*
Date Received: *05/26/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								05/31/17 10:05	jdk/wtc

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	05/31/17 21:28	pjb

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-9

ACZ Sample ID: ***L37430-02***
Date Sampled: *05/18/17 19:01*
Date Received: *05/26/17*
Sample Matrix: *Waste Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								05/31/17 10:14	jdk/wtc

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	05/31/17 21:29	pjb

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Extended Qualifier Report

Tahoe Resources, Inc.

ACZ Project ID: ***L37430***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L37430-01	WG423848	Cyanide, total	M335.4 - Colorimetric w/ distillation	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L37430-02	WG423848	Cyanide, total	M335.4 - Colorimetric w/ distillation	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

Certification Qualifiers

Tahoe Resources, Inc.

ACZ Project ID: ***L37430***

No certification qualifiers associated with this analysis

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L37430
Date Received: 05/26/2017 10:31
Received By:
Date Printed: 5/26/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?		X	

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]			X
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4317	11	<=6.0	13	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L37430
Date Received: 05/26/2017 10:31
Received By:
Date Printed: 5/26/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

L37430

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios
Company: Minera San Rafael
E-mail: LBarrios@sanrafael.com.gt
Address: Blvd Los proceres 18 calle 24-69 z10 Empresarial z Pradera, Torre IV Oficina 1406
Telephone: (502) 5696 4268

Copy of Report to:

Name: Evon Quednau@sanrafael.com.gt
Company: Minera San Rafael
E-mail: Esamayoa@sanrafael.com.gt
Telephone:

Invoice to:

Name: Luisa Fernanda Barrios
Company:
E-mail:
Address:
Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: VF / EvQ **Sampler's Site Information** **State**_____ **Zip code**_____ **Time Zone**_____

***Sampler's Signature:** _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:
PO#: El Escobal
Reporting state for compliance testing:
Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	Sw	CN total						
WW-10	18-05-17 - 12:00	Sw	10	/							
(WW-9) Descarga Planta de tratamiento	18-05-17 10:01 - 14:01	WW	10	/							
(WW8) Entrada Planta de tratamiento	18-05-17 - 15:38	Sw	1		/						
(SW-1A) Aguas Grojba Quebrada el Escobal	18-05-17 - 15:02	Sw	1		/						
SW-2A Aguas abajo quebrada el Escobal	18-05-17 14:05	Sw	1		/						
(SW-9) Union Rio SanRafael Rio Los Vados	18-05-17 10:57	Sw	1		/						
(SW-8) Aguas abajo rio SanRafael	18-05-17 11:45	Sw	1		/						
(SW4A) Aguas Abajo rio el Dorado	18-05-17 13:36	Sw	1		/						
1.* (WW-11) Descarga planta de tratamiento	18-05-17 10:01 - 14:01	WW	1		/						
2. (WW 9) Descarga planta de tratamiento	18-05-17 10:01 - 14:01	WW	1		/						

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

#3 For COC's #1, 2, 3 please report all results in one document, except for the two samples in this COC marked with a star.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	23/05/17 08:00		10:25
Juan Aguilar	23-05-2017 08:30		23/5/17
			5/24/17 1031

FRMAD050.06.14.14

White - Return with sample. Yellow - Retain for your records.

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 080517
Fecha de ingreso de muestra: 090517
Fecha de análisis: 090517-170517
Fecha del informe: 170517

Identificación de la muestra: WW-10
Correlativo Ecosistemas: 8284

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	7.02	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	N.D.	EPA 1664	10
Materia Flotante	---	---	ausente ***	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	< 10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	< 25	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	---	---	---
Relación DQO/DBO_5	---	---	---	---	---
* Sólidos Suspendidos	mg/l	10	< 10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	< 0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	N.D.	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	N.D.	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	N.D.	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	N.D.	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	N.D.	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	N.D.	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	N.D.	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	N.D.	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	N.D.	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	N.D.	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	< 1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	< 1.8	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
N.D. No detectable. Debajo del límite de detección.
NMP: Número más probable.
El valor DQO/DBO $_5$ y DBO $_5$/DQO no se ha determinado porque el resultado se encuentra abajo de nuestros límites de detección.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Revised Analytical Report

May 22, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L37093

Luisa Fernanda:

Enclosed are revised analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on May 11, 2017 and originally reported on May 17, 2017. Refer to the case narrative for an explanation of the changes. This project was assigned to ACZ's project number, L37093. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L37093. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after June 16, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. May 22, 2017

Project ID: Escobal
ACZ Project ID: L37093

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 3 miscellaneous samples from Tahoe Resources, Inc. on May 11, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L37093. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times.

Sample Analysis

These samples were analyzed for inorganic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports.

This report was revised on 05/22/17 to report the re-distillation and reanalysis of total cyanide on sample WW-9 (L37093-01). The re-analysis did not confirm the original value.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-10

ACZ Sample ID: ***L37093-02***
Date Sampled: *05/08/17 12:09*
Date Received: *05/11/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								05/16/17 14:26	mtc/bsu

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	05/16/17 19:57	pjb

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Extended Qualifier Report

Tahoe Resources, Inc.

ACZ Project ID: ***L37093***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L37093-01	WG423240	Cyanide, total	M335.4 - Colorimetric w/ distillation	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L37093-02	WG422966	Cyanide, total	M335.4 - Colorimetric w/ distillation	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L37093-03	WG422966	Cyanide, total	M335.4 - Colorimetric w/ distillation	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

Certification Qualifiers

Tahoe Resources, Inc. ACZ Project ID: ***L37093***

No certification qualifiers associated with this analysis

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L37093
Date Received: 05/11/2017 10:32
Received By:
Date Printed: 5/11/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?		X	

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]			X
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4367	8.1	<=6.0	13	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L37093
Date Received: 05/11/2017 10:32
Received By:
Date Printed: 5/11/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

L37093

CHAIN of CUSTODY

Report to:

Name: Miguel Beranza	Address: Blvd los Próceres 18 calle 24-69 Z 10
Company: J Minera San Rafael	Fm Residencial Z. Pradera Torre IV oficina 1406
E-mail: MBeranza@sanrafael.com.gt	Telephone: (502) 5951-5748

Copy of Report to:

Name: Luisa Fernanda Barrios	E-mail: LBarrios@sanrafael.com.gt
Company: Minera San Rafael	Telephone: (502) 5696-4268

Invoice to:

Name: Miguel Beranza	Address:
Company: J J	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information** **State**_____ **Zip code**_____ **Time Zone**_____

***Sampler's Signature:** _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW	CN TOTAL						
WW-9	8-5-17 08:30-17:30	WW	10	1							
WW-10	8-5-17 12:00	SW	10	1							
WW-9	8-5-17 08:30-17:30	WW	1		1						
WW-10	8-5-17 12:00	SW	1		1						
Pileta 3	8-5-17 9-5-17 11:00-08:27	SW	1		1						

1* 2* 3

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

L37093 Chain of Custody

REMARKS

Please present these three results in one report.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	09/05/17 08:00		11:15am
Juan Aguilar	09-05-2017 09:15		9/5/17

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua compuesta (según información del cliente)
Alicuota 1: 06:00 horas
Alicuota 2: 09:00 horas
Alicuota 3: 12:00 horas
Alicuota 4: 15:00 horas
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 210617
Fecha de ingreso de muestra: 220617
Fecha de análisis: 220617-040717
Fecha del informe: 040717

Identificación de la muestra: WW-9
Correlativo Ecosistemas: 8805

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	7.83	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	<5	EPA 1664	10
Materia Flotante ***	---	---	ausente	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	<10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	<25	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	---	---	---
Relación DQO/DBO_5	---	---	---	---	---
* Sólidos Suspendidos	mg/l	10	<10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	<0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	<10.9	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	<0.05	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	0.006	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	<0.02	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	<0.03	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	<0.05	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	<0.004	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	<0.05	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL
17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	<0.05	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	<0.01	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	28	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	6	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	2.30E+01	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
NMP: Número más probable.
El valor DQO/DBO_5 y DBO_5/DQO no se ha determinado porque el resultado se encuentra abajo de nuestros límites de detección.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

July 10, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38132

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on June 29, 2017. This project has been assigned to ACZ's project number, L38132. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38132. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 09, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-9

ACZ Sample ID: ***L38132-02***
Date Sampled: *06/21/17 15:00*
Date Received: *06/29/17*
Sample Matrix: *Waste Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/04/17 10:22	wtc

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/05/17 20:35	pjb

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Extended Qualifier Report

Tahoe Resources, Inc.

ACZ Project ID: ***L38132***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38132-01	*N*G426290	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L38132-02	*N*G426171	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L38132-03	*N*G426290	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L38132-04	*N*G426290	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

Certification Qualifiers

Tahoe Resources, Inc.

ACZ Project ID: ***L38132***

No certification qualifiers associated with this analysis

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38132
Date Received: 06/29/2017 10:19
Received By:
Date Printed: 6/29/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?		X	

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]			X
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4884	15.6	<=6.0	15	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38132
Date Received: 06/29/2017 10:19
Received By:
Date Printed: 6/29/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc. L38132

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios
Company: Minera San Rafael
E-mail: LBarrios@SanraFael.com.gt
Address: Blvd los procures 18 Calle 24-69 Z 10 Empresarial 2 Prados Torre IV Oficina 1406
Telephone: (502) 56964268

Copy of Report to:

Name: EvonQuednow@SanraFael.com.gt
Company: Minera San Rafael
E-mail: FSamayoa@SanraFael.com.gt
Telephone:

Invoice to:

Name: Luisa Fernanda Barrios
Company:
E-mail:
Address:
Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

"NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF Sampler's Site Information State_____ Zip code_____ Time Zone_____

Sampler's Signature: _____

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #:
PO#: El Escobal
Reporting state for compliance testing:
Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW	Total CN						
WW-10	21/06/17 12:00	WW	10	/							
WW-9	21/06/17 06:15h	WW	10	/							
WW-9	25/06/17 06:15h	WW	10	/							
1. WW-10	25/06/17 12:00	WW	1		/						
* 2. WW-9	21/06/17 06:15h	WW	1		/						
3. WW-9	25/06/17 06:15h	WW	1		/						
4. WW-11	25/06/17 06:15h	WW	1		/						

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

COC # 1/2 Present all SW from the numbered COCs in one report.
* Present cyanide results in a separated report.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	26/06/17 06:30		26/6/17
Juan Aguilera	26-06-2017 09:30		10:00
		ROSP	6/29/17 10:01

L38132 Chain of Custody

MINERA SAN RAFAEL

Guatemala June 26th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,

Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL
17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 250617
Fecha de ingreso de muestra: 260617
Fecha de análisis: 260617-070717
Fecha del informe: 070717

Identificación de la muestra: WW-10
Correlativo Ecosistemas: 8873

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	6.90	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	<5	EPA 1664	10
Materia Flotante ***	---	---	ausente	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	<10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	<25	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	---	---	---
Relación DQO/DBO_5	---	---	---	---	---
* Sólidos Suspendidos	mg/l	10	<10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	<0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	<10.9	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	<0.05	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	<0.002	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	<0.02	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	<0.03	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	<0.05	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	<0.002	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	<0.05	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL
17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	<0.05	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	<0.01	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	<1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	<1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	<1.8	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
NMP: Número más probable.
El valor DQO/DBO$_5$ y DBO$_5$/DQO no se ha determinado porque el resultado se encuentra abajo de nuestros límites de detección.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

July 10, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38132

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on June 29, 2017. This project has been assigned to ACZ's project number, L38132. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38132. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 09, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-10

ACZ Sample ID: ***L38132-01***
Date Sampled: *06/25/17 12:00*
Date Received: *06/29/17*
Sample Matrix: *Waste Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/06/17 12:12	jdk

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/06/17 23:26	pjb

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua compuesta (según información del cliente)
Alicuota 1: 05:00 horas
Alicuota 2: 08:00 horas
Alicuota 3: 11:00 horas
Alicuota 4: 14:00 horas
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 110717
Fecha de ingreso de muestra: 120717
Fecha de análisis: 120717-210717
Fecha del informe: 210717

Identificación de la muestra: WW-9
Correlativo Ecosistemas: 9069

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	8.01	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	<5	EPA 1664	10
Materia Flotante ***	---	---	ausente	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	<10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	<25	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	---	---	---
Relación DQO/DBO_5	---	---	---	---	---
* Sólidos Suspendidos	mg/l	10	13	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	<0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	<10.9	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	0.05	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	0.010	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	<0.02	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	<0.03	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	<0.05	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	<0.004	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	<0.05	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	<0.05	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	<0.01	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	41	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	<1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	<1.8	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
NMP: Número más probable.
El valor DQO/DBO$_5$ y DBO$_5$/DQO no se ha determinado porque el resultado se encuentra abajo de nuestros límites de detección.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.

* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

August 01, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38445

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 14, 2017. This project has been assigned to ACZ's project number, L38445. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38445. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 31, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. August 01, 2017

Project ID: Escobal
ACZ Project ID: L38445

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 5 miscellaneous samples from Tahoe Resources, Inc. on July 14, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L38445. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times except for parameters flagged with "H" flags (H3, H1), received either after the hold time expired or too close to the hold time.

Sample Analysis

These samples were analyzed for inorganic, organic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-9

ACZ Sample ID: ***L38445-05***
Date Sampled: *07/11/17 14:00*
Date Received: *07/14/17*
Sample Matrix: *Waste Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/19/17 15:52	jdk

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/19/17 18:51	bce

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
					sample is too low for accurate evaluation (< 10x MDL).
	WG426977	Residue, Filterable (TDS) @180C	SM2540C	Q6	Sample was received above recommended temperature.
	WG427055	Residue, Non-Filterable (TSS) @105C	SM2540D	Q6	Sample was received above recommended temperature.
			SM2540D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
			SM2540B	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427308	Sulfate	D516-02/-07 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.
L38445-05	WG427169	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Organic Extended Qualifier Report

ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38445-01	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38445-03	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38445-04	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

Metals Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Bismuth, dissolved	M200.7 ICP
Bismuth, total	M200.7 ICP
Gallium, dissolved	M200.7 ICP
Gallium, total	M200.7 ICP
Scandium, dissolved	M200.7 ICP
Scandium, total	M200.7 ICP

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38445
Date Received: 07/14/2017 10:25
Received By:
Date Printed: 7/14/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	X		

A change was made in the ID Line 5 section prior to ACZ custody.

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]	X		
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?		X	

Some parameters were received past hold time.

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4754	14.3	<=6.0	15	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38445
Date Received: 07/14/2017 10:25
Received By:
Date Printed: 7/14/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc L38445

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios
Company: Minera San Rafael
E-mail: LBarrios@sanrafael.com.gt

Address: Blvd los próceres 18 calle 24-69 z10 Empresarial Z pradera, Torre IV Oficina 1406
Telephone: (502) 56964268

Copy of Report to:

Name: EvanRuedaw@sanrafael.com.gt
Company: Minera San Rafael

E-mail: FSamayoa@sanrafael.com.gt.
Telephone:

Invoice to:

Name: Luisa Fernanda Barrios
Company:
E-mail:

Address:
Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information** **State**_____ **Zip code**_____ **Time Zone**_____

***Sampler's Signature:** [signature]

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION — **ANALYSES REQUESTED** *(attach list or use quote number)*

Quote #:
PO#: El Escobal
Reporting state for compliance testing:
Check box if samples include NRC licensed material? ☐

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW	CN total						
SW-13	11-07-17 - 11:10	SW	10	✓							
WW-10	11-07-17 12:00	SW	1		✓						
SW-1	11-07-17 17:00	SW	10	✓							
SW-2	11-07-17 15:58	SW	10	✓							
~~WW-10~~ WW-9	11-07-17 05:00-14:00	WW	1		✓						

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

L38445 Chain of Custody

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	12/07/17 06:00	[signature]	12/7/17
Juan Aguilera	12-07-2017 09:00	[signature]	9:30
			12/8/17 10:15

MINERA SAN RAFAEL

Guatemala July 12th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,

Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco I Guatemala I Ofibodegas Zaragoza 2 I Bodega 2
502 + 2437 7224 I 2437 4455
laboratorio@ecosistemas.com.gt I info@ecosistemas.com.gt I www.ecosistemas.com.gt

REG 016 Resultados de Análisis

Muestra: 1 muestra de agua
Análisis solicitado por: Ing. Miguel Berganza
Dirección: Km. 97.5 carretera Mataquescuintla, Aldea Sabana Redonda, San Rafael Las Flores. Santa Rosa
Procedencia de la muestra: Proyecto Escobal
Fecha de muestreo: 110717
Fecha de ingreso de muestra: 120717
Fecha de análisis: 120717-210717
Fecha del informe: 210717

Identificación de la muestra: WW-10
Correlativo Ecosistemas: 9070

Acuerdo Gubernativo 236-2006 (excepto cianuros)

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Potencial de Hidrogeno pH (Laboratorio)	unidades	1	6.70	SMWW 4500H-B	6 a 9
* Aceites y Grasas	mg/l	5	<5	EPA 1664	10
Materia Flotante ***	---	---	ausente	Visual	ausente
Demanda Bioquimica de Oxigeno DBO_5	mg/l	10	<10	Oxitop-Merck Análogo SMWW 5210D	ver nota
* Demanda Química de Oxígeno DQO	mg/l	25	<25	Reflujo Cerrado, Merck, análogo SMWW 5220D	no especificado
Relación DBO_5/DQO	---	---	---	---	---
Relación DQO/DBO_5	---	---	---	---	---
* Sólidos Suspendidos	mg/l	10	<10	SMWW 2540D	100
* Sólidos Sedimentables	ml/l	0.1	<0.1	SMWW 2540F	no especificado
* Nitrógeno Total	mg/l	10.9	<10.9	Digestión alcalina persulfato colorimétrico HACH	20
* Fósforo Total	mg/l	0.05	<0.05	Spectroquant Merck Análogo EPA 365.2+3, SMWW 4500-P E, ISO 6978/1, DIN EN 1189 D11	10
* Arsénico As	mg/l	0.002	<0.002	UNICAM AN40177_E10/03C	0.1
* Cadmio Cd	mg/l	0.02	<0.02	SMWW 3111B	0.1
* Cobre Cu	mg/l	0.03	<0.03	SMWW 3111B	3
* Cromo Hexavalente Cr(VI)	mg/l	0.05	<0.05	Colorimétrico Merck, análogo SMWW 3500-Cr	0.1
* Mercurio Hg	mg/l	0.004	<0.004	UNICAM AN40181_E10/03C	0.01
* Niquel Ni	mg/l	0.05	<0.05	SMWW 3111B	2

ECOSISTEMAS
PROYECTOS AMBIENTALES

LABORATORIO AMBIENTAL E INDUSTRIAL

17 avenida 2-39 zona 4 Mixco | Guatemala | Ofibodegas Zaragoza 2 | Bodega 2
502 + 2437 7224 | 2437 4455
laboratorio@ecosistemas.com.gt | info@ecosistemas.com.gt | www.ecosistemas.com.gt

PARAMETRO	DIMENSIONAL	LIMITE DE DETECCION	RESULTADO	METODOLOGIA	Límites Máximos Permisibles Entes Generadores Nuevos Acuerdo 236-2006 descarga a cuerpo receptor
* Plomo Pb	mg/l	0.05	<0.05	SMWW 3111B	0.4
* Zinc Zn	mg/l	0.01	<0.01	SMWW 3111B	10
Color Aparente	UC HZ equiv. Unid. Pt-Co	1	<1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	500
Color Real	UC HZ equiv. Unid. Pt-Co	1	<1	Colorimétrico Merck, análogo APHA 2120B, DIN 53409	
** Coliformes Fecales	NMP/100ml	1.8	<1.8	NMP	$< 1 \times 10^4$

Notas:

Captación de muestras: La muestra fue captada por personal ajeno a Ecosistemas.
Transporte y preservación de la muestra: Refrigeración. pH < 2 en muestra para análisis de metales y Aceites y Grasas.
Metodología: Espectrofotométricos / Standard Methods for water and wastewater APHA, AWWA, 22 edic.
Organic Reagents for Trace Analysis. J.Fries/H. Getrost. E. Merck Darmstadt. 1977. EPA 1664
NMP: Número más probable.
El valor DQO/DBO_5 y DBO_5/DQO no se ha determinado porque el resultado se encuentra abajo de nuestros límites de detección.
Respecto a la DBO el acuerdo 236-2006 la relaciona como "carga" junto al caudal y como meta de cumplimiento un valor de DBO de 200 mg/l (ver Acuerdo Artículo 21).
Los resultados obtenidos corresponden únicamente a la muestra recibida por el personal de Ecosistemas Proyectos Ambientales.
Se prohibe la reproducción total o parcial de este informe sin la autorización escrita de Ecosistemas Proyectos Ambientales.
* **Análisis acreditado COGUANOR NTG/ISO/IEC 17025:2005 según OGA LE 006-04**
*** Análisis referido a laboratorio acreditado.*
**** El resultado se basa en el análisis visual de la muestra enviada por el cliente al laboratorio.*
Comparación de descarga según información del cliente.

Ing. Oscar Páez
Gerente Técnico

VoBo Ing. Fernando Fuentes
Gerente de Calidad

Luis Fernando Fuentes Méndez
Ingeniero Químico
Colegiado 876

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

August 01, 2017

Report to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

Bill to:
Luisa Fernanda
Tahoe Resources, Inc.
Boulevard Los Proceres 18 c. 24-69 zona 10
Centro
Corporativo Zona Pradera, Torre 4 Of. 1408 Guatema

cc: Eric von Quednow, Fernando Samayoa

Project ID: Escobal
ACZ Project ID: L38445

Luisa Fernanda:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on July 14, 2017. This project has been assigned to ACZ's project number, L38445. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L38445. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after August 31, 2017. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

Tahoe Resources, Inc. August 01, 2017

Project ID: Escobal
ACZ Project ID: L38445

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 5 miscellaneous samples from Tahoe Resources, Inc. on July 14, 2017. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L38445. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times except for parameters flagged with "H" flags (H3, H1), received either after the hold time expired or too close to the hold time.

Sample Analysis

These samples were analyzed for inorganic, organic parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports.

Tahoe Resources, Inc.
Project ID: Escobal
Sample ID: WW-10

ACZ Sample ID: ***L38445-02***
Date Sampled: *07/11/17 12:00*
Date Received: *07/14/17*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Manual Distillation								07/21/17 10:20	las/bsu

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Cyanide, total	M335.4 - Colorimetric w/ distillation	0.5		U	*	mg/L	0.003	0.01	07/21/17 15:09	las

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
					validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG426853	Residue, Total (TS) @ 105C	SM2540B	Q6	Sample was received above recommended temperature.
			SM2540B	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427308	Sulfate	D516-02/-07 - Turbidimetric	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
			D516-02/-07 - Turbidimetric	Q6	Sample was received above recommended temperature.
	WG427149	Sulfide as S	SM4500S2-D	H1	Sample prep or analysis performed past holding time. See case narrative.
			SM4500S2-D	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			SM4500S2-D	Q6	Sample was received above recommended temperature.
			SM4500S2-D	QD	Reported value is the background-corrected concentration, as described by the method.
			SM4500S2-D	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG427243	Total Alkalinity	SM2320B - Titration	Q6	Sample was received above recommended temperature.
L38445-02	WG427338	Cyanide, total	M335.4 - Colorimetric w/ distillation	Q6	Sample was received above recommended temperature.
			M335.4 - Colorimetric w/ distillation	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Organic Extended Qualifier Report

ACZ Project ID: ***L38445***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L38445-01	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38445-03	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.
L38445-04	WG427448	*All Compounds*	M8015D GC/FID	Q6	Sample was received above recommended temperature.
		TPH C10 to C28	M8015D GC/FID	Q9	Insufficient sample received to meet method QC requirements.
	WG427652	Oil and Grease	1664A - Gravimetric	M2	Matrix spike recovery was low, the recovery of the associated control sample (LCS or LFB) was acceptable.
			1664A - Gravimetric	Q6	Sample was received above recommended temperature.

Tahoe Resources, Inc. ACZ Project ID: ***L38445***

Metals Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Bismuth, dissolved	M200.7 ICP
Bismuth, total	M200.7 ICP
Gallium, dissolved	M200.7 ICP
Gallium, total	M200.7 ICP
Scandium, dissolved	M200.7 ICP
Scandium, total	M200.7 ICP

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38445
Date Received: 07/14/2017 10:25
Received By:
Date Printed: 7/14/2017

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?			X
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	X		

A change was made in the ID Line 5 section prior to ACZ custody.

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]	X		
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?		X	

Some parameters were received past hold time.

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4754	14.3	<=6.0	15	N/A

Was ice present in the shipment container(s)?

Yes - Gel ice was present in the shipment container(s) but was thawed by receipt at ACZ.

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Tahoe Resources, Inc.
Escobal

ACZ Project ID: L38445
Date Received: 07/14/2017 10:25
Received By:
Date Printed: 7/14/2017

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc L38445

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Luisa Fernanda Barrios	Address: Blvd los próceres 18 Calle 24-69 z10
Company: Minera San Rafael	Empresarial Z pradera, Torre IV Oficina 1406
E-mail: LBarrios@sanrafael.com.gt	Telephone: (502) 56964268

Copy of Report to:

Name: EvanRuedacw@sanrafael.com.gt	E-mail: FSamayoa@sanrafael.com.gt.
Company: Minera San Rafael	Telephone:

Invoice to:

Name: Luisa Fernanda Barrios	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☐

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: LF **Sampler's Site Information** **State**____ **Zip code**____ **Time Zone**____

***Sampler's Signature:** [signature]

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION — **ANALYSES REQUESTED** *(attach list or use quote number)*

Quote #:

PO#: El Escobal

Reporting state for compliance testing:

Check box if samples include NRC licensed material? ☐

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	SW	CN total							
SW-13	11-07-17 - 11:10	SW	10	✓								
WW-10	11-07-17 12:00	SW	1		✓							
SW-1	11-07-17 17:00	SW	10	✓								
SW-2	11-07-17 15:58	SW	10	✓								
~~WW-10~~ WW-9	11-07-17 05:00-14:00	WW	1		✓							

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

L38445 Chain of Custody

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Luisa Fernanda Barrios	12/07/17 06:00	[signature]	12/7/17
Juan Aguilera	12-07-2017 07:00	[signature]	9:30
			12/8/17 10:15

MINERA SAN RAFAEL

Guatemala July 12th 2017

To whom it may concern:

Minera San Rafael, S.A is sending a case with samples of water, which is not contaminated, that are going to be analyzed by the ACZ Laboratories in Steamboat Springs, Colorado, USA.

If you have any question or doubt, please contact Miguel Berganza at Minera San Rafael, S.A. (502 – 5951-5248) or Sue Webber at ACZ Laboratories (970-879-6590).

Sincerely yours,

Miguel Berganza
Environment Department.
Mina El Escobal
Minera San Rafael, S.A.