1. Procedure summary

This procedure details the steps required to determine the total dissolved solids (TDS) value of a sample using the conductivity meter cup.

1.1. Related Procedures

Not applicable for this procedure.

1.2. Procedure impacts and concerns

Safety	Gloves should be worn at all times while performing this procedure.
Quality	TDS that is too high or low can impact productivity performance. Sapphire strains should be maintained between 9 and 12 parts per thousand.
Delivery	Operations may need to change based on TDS values. They should be reported immediately after data is available especially if they fall outside the operating range.
Environmental	Local policies and procedures should be followed as determined by the site leadership.
Cost	Consumables- $2.68/sample Labor- 0.03 hours/sample
Compliance	Compliance with OSHA's Hazardous Waste Operations and Response, and Hazardous Communication Standard in addition to the Sapphire Energy, Inc. Chemical Hygiene Plan is required (see 29 CFR 1910.120 and 1200).

1.3. Responsibilities and owners

Document Owner	Manage content and distribution	Kari Mikkelson
Process Owner	Responsible for content and process validation	Rebecca White
Site Manager	Responsible for implementation and conformance	Rebecca White

2. Process

2.1. Process description

Conductivity meters measure the electrical current produced by ions dissolved in a solution. This measurement can be converted to a TDS value using a predetermined conversion factor. A sample is diluted in distilled water (dH_2O) and poured into the conductivity meter cup. The conductivity reading is taken and TDS (in ppm) is calculated by taking into account the dilution factor of the sample and the setting on the meter itself and multiplying by 0.7.

0.7 was the conversion factor determined by LC to be used at both sites.

2.2. Process diagram: Work Instruction

Not applicable for this procedure.

2.3. Process steps

Equipment and Supplies

15 mL Conical Tubes (Fisher Scientific, Catalog# 05-539-12)
Conductivity Cup Meter (Cat# EW-01489-35)
Test tube rack
1000uL Pipette; Pipette tip 1000uL (

Repeater Pipette
50ml combitips
Kim wipes (Fisher Cat# 06-666-11C)
Invitrogen UltraPure Distilled Water (dH_2O) (Cat# 10977-015)
NIST Traceable Conductivity/ TDS Standard Solution KCI-7000 (CAT# CAS 7732-18-5)
Samples

Tubes for diluting samples are prepared in advance of taking conductivity measurements. An inventory of prepared tubes is kept on hand at all times, so this process does not need to be completed each time a sample is analyzed.

2.3.1. Preparing Tubes for Sample Dilution

2.3.1.1. Open a new package of 15mL conical tubes and remove the lids. Store the lids in a clean 1L beaker.

2.3.1.2. Pour 1, 500mL bottle of Gibco Ultrapure Water (dH_2O) into a clean beaker.

2.3.1.3. Attach the 50mL adapter and a 50mL Combitip to the end of the repeater pipette.

2.3.1.4. Set the position indicator to 9 using the volume selection dial on the top of the pipette.

2.3.1.5. Immerse the end of the Combitip in the water and pull up slowly on the pipette's filling lever to the stop.

2.3.1.6. With the end of the Combitip above the beaker of water push down on the dispenser level once to bring the pipette to the basic position.

Each tube will contain 9mL of dH_2O.

2.3.1.7. Place the Combitip on the wall of the first conical and push down on the dispenser level. Repeat for the next 4 conical tubes.

2.3.1.8. Repeat steps 2.3.1.5-2.3.1.7 for all remaining conical tubes.

2.3.1.9. When all conical tubes have been filled replace the caps and store racks near conductivity meter.

2.3.1.10. Remove Combitip and adapter from repeater pipette. Save adapter for future use and discard the Combitip in the trash.

The tip should be completely full with no air bubbles.

Five conical tubes can be filled at a time when dispensing 9mL/tube with the 50mL Combitip.

2.3.2. Calibrating the Conductivity Meter

2.3.2.1. Remove the bottom cover of the conductivity meter.

2.3.2.2. Set the range switch on the front of the instrument to 1,000.

2.3.2.3. Pour about 10mL of the 7,000ppm conductivity standard into the cell cup making sure that the upper electrode is covered. (See Figure XX)

2.3.2.4. Press the black "Button" on the front of the meter to check the reading. The pointer should give a reading of 7 for this standard.

Calibration should be performed one time per day before any samples are analyzed.

2.3.2.5. If the pointer does not read 7, turn the calibration control unit on the bottom of the meter until it does.

2.3.2.6. Empty the conductivity standard solution into a non-hazardous waste beaker.

2.3.2.7. Replace the bottom cover of the conductivity meter.

2.3.2.8. Rinse the cell cup with dH_2O from a squirt bottle and empty into a non-hazardous waste beaker.

2.3.2.9. Dry the inside of the cell cup with a Kimwipe.

2.3.3. Sample Preparation

2.3.3.1. Collect prepared conical tubes (from 2.3.1 above) for the number of samples to be analyzed and place them in a test tube rack.

2.3.3.2. Set a single channel pipette to collect 1,000uL.

Routine samples are diluted 10-fold and measured with the range switch set to 1,000.

2.3.3.3. Remove caps from the conical tubes.

2.3.3.4. Invert the first sample several times to mix.

2.3.3.5. Using the single channel pipette collect 1,000uL of sample and add it to the first conical tube. Mix up and down several times to rinse tip.

2.3.3.6. Repeat steps 2.3.3.4 and 2.3.3.5 for all remaining samples.

Samples that fall out of this range will need to be diluted differently

2.3.3.7. Replace caps on all the tubes.

2.3.4. Taking Measurements

2.3.4.1. Invert the first prepared sample (from 2.3.3 above) and pour the contents in the cell cup of the

conductivity meter. Ensure the upper electrode is completely covered.
2.3.4.2. Press the black "Button" on the front of the meter to take a reading.
2.3.4.3. Record the value of the pointer on a blank conductivity data template.
2.3.4.4. Empty the sample into a non-hazardous waste beaker.
2.3.4.5. Rinse the cell cup with dH_2O from a squirt bottle and empty into a non-hazardous waste beaker.
2.3.4.6. Dry the inside of the cell cup with a Kimwipe.
2.3.4.7. Repeat steps 2.3.4.1-2.3.4.6 for all remaining samples.
2.3.4.8. When all samples have been analyzed store the conductivity meter covered with a Kimwipe.

or read in a different range as determined by the QAQC supervisor. Keep in mind each tick on the meter has a value of 0.2.

2.3.5. Calculating TDS from Conductivity Readings

2.3.5.1. Calculating TDS for routine pond samples

2.3.5.1.1. Open the Conductivity Data Template. (L:\QAQC\Data Analysis Templates\Conductivity Data Template)

2.3.5.1.2. Enter the readings from the meter into the column labeled "Value."

2.3.5.1.3. The TDS will automatically be calculated.

2.3.5.1.4. Save the data in the appropriate section of the QAQC Raw Data folder on the Columbus drive.

2.3.5.2. Calculating TDS Manually

2.3.5.2.1. TDS can be calculated. Conductivity (µS/cm)=(Reading from meter)x(Sample Dilution factor)x(0.7)

3. Required documents

Input documents
Cultivation Daily Data Sheet

Output documents
Conductivity Data Template
Alkalinity-TDS Data Template

4. Document control

Revision history

R0 – Initial Release – Nicole Heaps	<Date>
R1 – Cheng Fang	04/2013

Document approval
<Name> <Approval date>

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5. Risk analysis

<Risk name>	<Mitigation plan>	<Owner>