UNITED STATES AIR FORCE

COLD BAY LONG RANGE RADAR STATION

Long-Term Monitoring of Groundwater at ST005

Final

Contract Number: FA8903-16-D-0032
Task Order: 0002

November 2017

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
ADEC	Alaska Department of Environmental Conservation
AFCEC	Air Force Civil Engineer Center
AST	Aboveground Storage Tanks
DRO	diesel range organics
GAC	Granular Activated Carbon
IDW	investigative derived waste
LRRS	Long Range Radar Station
LTM	Long Term Monitoring
NAPL	non-aqueous phase liquid
POL	petroleum oil, and lubricant
USAF	U.S. Air Force
WACS	White Alice Communication System

1.0 PURPOSE

This Long-term Groundwater Monitoring Report has been prepared for the U.S. Air Force (USAF) under the Air Force Civil Engineer Center (AFCEC) Contract FA8903-16-D-0032, Delivery Order 0002. The purpose of this Long-term Groundwater Monitoring Report is to summarize analytical results for groundwater samples collected during the September 2016 Monitoring Event at the Cold Bay Long Range Radar Station (LRRS). A Location and Vicinity map for the Cold Bay LRRS is provided in Figure 1.

The 2016 activities consisted of collecting groundwater samples from three monitoring wells (MWs) at Site ST005, ST005-MW3, ST005-MW6, and ST005-MW09. Groundwater samples were collected to monitor the petroleum related contamination as diesel range organics (DRO) by Method AK102. Groundwater monitoring is being conducted in accordance with the 2001 Decision Document, which states that groundwater shall be monitored until DRO concentrations are less than 1,500 micrograms per liter (µg/L) throughout the aquifer (USAF, 2001). The ST005 LTM progress is to be reviewed once every 5 years through the monitored natural attenuation process.

2.0 SITE BACKGROUND

Cold Bay LRRS is located approximately 30 miles from the west end of the Alaska Peninsula, about 640 miles southwest of Anchorage, Alaska (**Figure 1**). The USAF operated the site in support of the White Alice Communication System (WACS). The site was constructed in 1958 and 1959 as the Cold Bay communications link in the extension of the Distant Early Warning Line into the Aleutians. The WACS operated from 1959 until it was deactivated in 1978.

Site ST005 (**Figure 2**) was originally a petroleum, oil, and lubricant (POL) storage area that consisted of two 70,000-barrel aboveground storage tanks (ASTs), a pump house, a fueling island, and associated piping. The ASTs and piping were demolished in 1994. In 1993 and 1996, contaminated soil was discovered inside the dike and near the former pump house.

In 1994, four groundwater monitoring wells were installed and sampled at the POL storage area (ST005-MW1 through ST005-MW4) to assess groundwater contamination. Results from one of the wells (ST005-MW2) adjacent to the former AST location exceeded the DRO cleanup criterion of 1,500 µg/L.

In 2000, only ST005-MW2 was sampled. Two of the three remaining wells (ST005-MW1 and ST005-MW4) were previously decommissioned, and one was erroneously assumed to have been decommissioned (ST005-MW3). Sampling results for ST005-MW2 indicated a DRO concentration exceeding the DRO cleanup criterion (USAF 2001).

In 2003, contaminated soils were excavated up to 15 feet deep, based on the cleanup levels stated in the WACS Declaration of Decision for ST005 (USAF 2001). The soil was thermally treated to the cleanup levels stated in the Declaration of Decision for ST005. Results of soil sampling in 2003 at ST005 confirmed that soil between the ground surface and 15 feet bgs met the cleanup levels. Also conducted in 2003, three storage tanks were emptied and sealed, but left onsite. One 17,000-gallon tank contained fuel mixed with water. The contents of this tank were drained, treated, and disposed of offsite. A Container Express (conex) unit was removed from the site, and two drums were decontaminated, crushed, and disposed of offsite.

In 2003, four monitoring wells were installed (ST005-MW5, ST005-MW6, ST005-MW7, and ST005-MW8). ST005-MW3 was located and returned to service, and groundwater samples were obtained from each of these five wells. ST005-MW5 was installed upgradient of the site adjacent to Baranov Road. Wells ST005-MW7 and ST005-MW8 were installed downgradient of the Main Excavation Area. The fourth well, ST005-MW6, was installed in the area of highest DRO contamination in the floor of the 2003 excavation.

Land use at the site is recreational, and the actions taken remain protective of human health and the environment; however, contaminants remain onsite above levels stated in the Declaration of Decision (USAF 2001). In 2006, ADEC requested groundwater monitoring once every two years (biennial) starting in 2007 (ADEC 2006). Significant reduction of DRO in groundwater was not expected over the span of two years due to the low rate of biodegradation. Following the 2007 field season, monitored natural attenuation was recommended to continue on a five year basis.

In order to better monitor the migration of contaminants and natural attenuation at Site ST005, monitoring well ST005-MW9 was installed and sampled in July 2008. The well was installed directly downgradient of where the highest DRO results were obtained in the excavation floor as identified during the 2003 excavation.

Groundwater samples were collected from the three monitoring wells (ST005-MW3, ST005-MW6, and ST005-MW09) in 2009, 2014 and again in 2016 as part of the LTM.

Results from the 2016 monitoring are presented in Section 3 along with a comparative trend analysis.

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LONG-TERM MONITORING OF GROUNDWATER AT ST005
COLD BAY LONG RANGE RADAR STATION, ALASKA

LOCATION AND VICINITY MAP

FIGURE
2-1

185750705.02020301

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DRO Groundwater Concentrations (µg/L)	Sample Date											
	1994	2000	Aug-03	May-04	Sep-04	May-05	Oct-05	Oct-07	Jul-08	Sep-09	Jul-14	Sep-16
ST005-MW3	1.1	-	844	997	1,560	1,060	1,230	950	-	1,440 M	807 J	2,510
ST005-MW6	-	-	2,600	4,200	3,880	1,600	4,240	3,400	-	2,340 M	1,750 J	3,130
ST005-MW9	-	-	-	-	-	-	-	-	250 J, B	ND (800) M	412 J	787

Key:
(#) - method detection limit
µg/L - micrograms per liter
B - analyte detected in associated blank as well as in the sample
J- results is an estimated value,
M - potential matrix interference
ND - not detected above method detection limit

LONG-TERM MONITORING OF GROUNDWATER AT ST005
COLD BAY LONG RANGE RADAR STATION, ALASKA

ST005 SITE MAP

FIGURE
2-2

185750705.02020301

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3.0 LONG-TERM GROUNDWATER MONITORING

3.1 2016 Groundwater Monitoring

The order of sampling for the 2016 LTM events was the same as in 2009 and 2014, and were sampled from lowest known previous contaminant concentration to highest; ST005-MW9, ST005-MW3, and ST005-MW6. Samples were collected in 2016 with disposable Teflon bailers based per the ADEC approved work plan (USAF, 2016).

A properly decontaminated non-aqueous phase liquid (NAPL)/ water interface probe was used to measure depth to groundwater and determine the presence or absence of detectable NAPL in each well prior to sampling. No measurable NAPL was detected (greater than 0.01 foot) during the 2016 LTM sampling event.

Table 3-1 presents the 2016 analytical results of the LTM at ST005-MW9, ST005-MW3, and ST005-MW6, along with the historical analytical results for the site. DRO Concentrations in each of the three monitoring wells was greater than the previous sampling event in 2014. Both ST005-MW (2,500 ug/L) and ST005-MW6 (3,130 ug/L) were above the ADEC groundwater cleanup levels of 1,500 ug/L for DRO.

The laboratory data and Alaska Department of Environmental Conservation (ADEC) Laboratory Data Review Checklist are provided in Appendix A. Groundwater sampling field forms are provided in Appendix B.

3.2 Decontamination and Waste Management.

All equipment decontamination and investigative derived waste (IDW) was conducted as per the work plan (USAF, 2016). The NAPL interface probe was decontaminated with Alconox and water, and wiped dry with new, paper towel between measurements of the monitoring well locations.

Purge water was filtered through a 5-gallon granulated activated carbon filter (GAC) and discharged to the ground surface approximately 25 feet to the west of ST005-MW-6, within ST005, approximately 190 feet from the approximated high tide mark of Cold Bay, the nearest surface water body.

All other IDW were disposable, used only once at each monitoring well, and limited to Teflon bailers, string, and nitrile gloves. All IDW was disposed of at the Cold Bay landfill and burned in the dedicated burn unit associated with the landfill.

Table 3-1 Cold Bay Site ST005 Long Term Monitoring Groundwater Analytical Results

DRO Groundwater Concentrations (µg/L)	Sample Date											
	1994	2000	Aug-03	May-04	Sep-04	May-05	Oct-05	Oct-07	Jul-08	Sep-09	Jul-14	Sep-16
ST005-MW3	1.1	-	844	997	1,560	1,060	1,230	950	-	1,440 M	807 J	2,510
ST005-MW6	-	-	2,600	4,200	3,880	1,600	4,240	3,400	-	2,340 M	1,750 J	3,130
ST005-MW9	-	-	-	-	-	-	-	-	250 J, B	ND (800) M	412 J	787

Key:

µg/L - micrograms per liter
B – sample analyte detected in associated method blank
DRO – diesel range organics
J – result estimated
ND – analyte not detected

4.0 CONCLUSIONS AND RECOMMENDATIONS

The LTM groundwater sampling event for the Cold Bay LRRS, Site ST005 is complete for 2016. Concentrations of DRO in each of the three wells has increased since the previous sampling round conducted in July 2014. The next round of long-term monitoring at ST005 is scheduled for 2018. ? Sampling of the three monitoring wells is planned to continue until DRO concentrations over three consecutive monitoring events are below ADEC cleanup levels.

The increase in DRO concentrations may be due to a fluctuation in groundwater depth and potential increased mobility of existing subsurface contamination.

APPENDIX A

Laboratory Data and
ADEC Data Review Checklist

Laboratory Data Review Checklist

Completed By:

Douglas Quist

Title:

Senior Chemist

Date:

11-1-2017

CS Report Name:

Cold Bay LRRS Long-Term Monitoring of Groundwater at ST005, Final, Nov 2017

Report Date:

November 2017

Consultant Firm:

Stantec Consulting Inc

Laboratory Name:

SGS

Laboratory Report Number:

1165299

ADEC File Number:

Hazard Identification Number:

1165299

1. Laboratory

   a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

   (●) Yes ( ) No Comments:

   b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

   ( ) Yes (●) No Comments:

   NA – All samples were analyzed by SGS.

2. Chain of Custody (CoC)

   a. CoC information completed, signed, and dated (including released/received by)?

   (●) Yes ( ) No Comments:

   b. Correct Analyses requested?

   (●) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

   a. Sample/cooler temperature documented and within range at receipt (0° to 6° C)?

   (●) Yes ( ) No Comments:

   b. Sample preservation acceptable – acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

   (●) Yes ( ) No Comments:

   c. Sample condition documented – broken, leaking (Methanol), zero headspace (VOC vials)?

   (●) Yes ( ) No Comments:

d. If there were any discrepancies, were they documented? For example, incorrect sample containers/preservation, sample temperature outside of acceptable range, insufficient or missing samples, etc.?

○ Yes ◉ No Comments:

Not applicable, no discrepancies

e. Data quality or usability affected?

Comments:

NA

4. Case Narrative

a. Present and understandable?

○ Yes ◉ No Comments:

NA - No case narrative, not applicable due to number of samples.

b. Discrepancies, errors, or QC failures identified by the lab?

○ Yes ◉ No Comments:

NA - No discrepancies or QC failures.

c. Were all corrective actions documented?

○ Yes ◉ No Comments:

NA - No corrective actions required.

d. What is the effect on data quality/usability according to the case narrative?

Comments:

NA – data usability is not affected.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No Comments:

b. All applicable holding times met?

◉ Yes ○ No Comments:

c. All soils reported on a dry weight basis?

○ Yes ◉ No Comments:

NA – groundwater samples only.

d. Are the reported LOQs less than the Cleanup Level or the minimum required detection level for the project?

◉ Yes ○ No Comments:

e. Data quality or usability affected?

○ Yes ◉ No Comments:

NA

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No Comments:

Two method blanks reported, 1351831 (0.300U mg/L) and 1351897 (0.300U mg/L).

ii. All method blank results less than limit of quantitation (LOQ)?

○ Yes ◉ No Comments:

iii. If above LOQ, what samples are affected?

Comments:

NA

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ◉ No Comments:

NA

v. Data quality or usability affected?

Comments:

NA

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics – One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

(●) Yes ( ) No Comments:

ii. Metals/Inorganics – one LCS and one sample duplicate reported per matrix, analysis and 20 samples?

( ) Yes (●) No Comments:

NA

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

(●) Yes ( ) No Comments:

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/MSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

(●) Yes ( ) No Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

NA

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

( ) Yes (●) No Comments:

NA

vii. Data quality or usability affected? (Use comment box to explain.)

Comments:

NA

c. Surrogates – Organics Only

i. Are surrogate recoveries reported for organic analyses – field, QC and laboratory samples?

(•) Yes ( ) No Comments:

ii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

(•) Yes ( ) No Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

( ) Yes (•) No Comments:

NA – no failed surrogate recoveries.

iv. Data quality or usability affected?

Comments:

d. Trip blank – Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples?
(If not, enter explanation below.)

( ) Yes (•) No Comments:

NA – no trip blanks required, DRO analysis only.

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

( ) Yes (•) No Comments:

NA – no trip blanks required, DRO analysis only.

iii. All results less than LOQ?

( ) Yes (•) No Comments:

NA – no trip blanks required, DRO analysis only.

iv. If above LOQ, what samples are affected?

Comments:

NA – no trip blanks required, DRO analysis only.

v. Data quality or usability affected?

Comments:

NA – no trip blanks required, DRO analysis only.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

(•) Yes ( ) No Comments:

ii. Submitted blind to lab?

(•) Yes ( ) No Comments:

iii. Precision – All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

RPD (%) = Absolute value of: $\frac{(R_1-R_2)}{((R_1+R_2)/2)} \times 100$

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

(•) Yes ( ) No Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

Comments:

Data quality is not affected, RPD is 21% (0.637 vs. 0.787 mg/L)

f. Decontamination or Equipment Blank (If not applicable, a comment stating why must be entered below).

( ) Yes ( ) No (•) Not Applicable

i. All results less than LOQ?

○ Yes ◉ No Comments:

NA – No Equipment Blank, disposable bailers only.

ii. If above LOQ, what samples are affected?

Comments:

NA – No Equipment Blank, disposable bailers only.

iii. Data quality or usability affected?

Comments:

NA – No Equipment Blank, disposable bailers only.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

◉ Yes ○ No Comments:

APPENDIX B

Field Forms

GROUNDWATER SAMPLING FORM

LOCATION NAME: Cold Bay LRRS
LOCATION DESCRIPTION: ST005
ELEVATION _____ (GPS or Survey) (FT or M)
SITE: ST005-MW9 Sample ID #: 16COBST005-MW9 DATE: 9-6-2016
SAMPLE TYPE: Grab FIELD CREW: DQ TIME Start: 1715 End 1805
WEATHER: SKY: Cloudy PRECIP: 0 WIND: 20 Air Temp. 50

GROUNDWATER : DEVELOPMENT _____ **SAMPLING** X

Well Condition: Secured with Padlock - Flush Mount Bolts Cut - Replaced with combo lock 0911
Casing Ht. Above Ground: Flush (FT.) Diameter: 2.0 in
Well Depth: ~~34.3~~/34.65 ft. BTOC (Meas./Rec.) 42155 Static Water Level: 34.3/34.65 ft. BTOC 8.25'
Casing (C) = _____ Well X Outside Protective Begin Depth 34.30 (ft.) End Depth 34.65 (ft.)

ONE PURGE VOLUME: 7.48 x (dia./24)^2 x 3.14 x (Depth-W. L.)= 1.35 gal.

PURGING:	Gallons	Time	Temperature (°C) ± 3%	E.C. (~~µmhos/cm~~)* ± 3% µS/cm	pH* ± 0.1	Redox (mV) ± 10 mV
METHOD	0	1727	6.93	197	5.36	73.9
	2	1732	6.23	105	5.68	55.7
Teflon Bailer	4	1738	5.81	106	5.91	43.8
	6	1745	5.91	104	6.00	38.9
Submersible Pump	8	1752	5.93	106	6.01	38.5
	8+	1800	5.84	102	5.99	39.6
_____						
(other)						

* TEMP. CORRECTED @ 25C

SAMPLE COLLECTION

Method: Teflon Bailer Appearance: Slightly gray / Clear-

Analyte	Time	Analyte	Time	Analyte	Time
	1752				

SS004 DRO AK102 SS006 VOCs SW8260B (TCE, *cis*-1,2DCE, *trans*-1,2DCE, and vinyl chloride only)

COMMENTS: QA/QC Label ID: Dupl. X Trip Blank _____ MS/MSD _____

PHOTO TAKEN # X

Calibration/Standard: pH (4) / (7) / (10) EC Standard: EC Reading

Decon completed: by NA date

REMARKS:

EC, Temperature, and Redox are factory calibrated

GROUNDWATER SAMPLING FORM

LOCATION NAME: Cold Bay LRRS
LOCATION DESCRIPTION: ST005
ELEVATION _____ (GPS or Survey) (FT or M)
SITE: ST005-MW3 Sample ID #: 16COBST005-MW3 DATE: 9-6-2016
SAMPLE TYPE: Grab FIELD CREW: DQ TIME Start: 1935 End 2010
WEATHER: SKY: Overcast PRECIP: ϕ - light Rain WIND: 20 Air Temp. 50

GROUNDWATER : DEVELOPMENT _____ **SAMPLING** X

Well Condition: Locked But Aluminum Cap Tab Broken - Replaced lock with combo lock 0911
Casing Ht. Above Ground: 3.08 (OC) (FT.) Diameter: 2.0 in
Well Depth: 44.3/44.6 ft. BTOC (Meas./Rec.) Static Water Level: 40.4/40.7 ft. BTOC
Casing (C) = _____ Well X Outside Protective Begin Depth 40.4 (ft.) End Depth 40.9 (ft.)

ONE PURGE VOLUME: 7.48 x (dia./24)^2 x 3.14 x (Depth-W. L.)= 0.64 gal.

PURGING:	Gallons	Time	Temperature (°C) ± 3%	E.C. (µmhos/cm)* ± 3%	pH* ± 0.1	Redox (mV) ± 10 mV
METHOD	0	1935	6.50	247	5.76	50.6
	1	1941	6.34	226	6.10	33.5
Teflon Bailer	2	1948	6.01	217	6.30	23.1
	3	1953	5.83	215	6.31	22.0
Submersible Pump	4	1958	5.86	210	6.36	15.3
	5	2003	5.86	209	6.40	13.9
	5+	2010	5.85	212	6.38	16.7
_____						
(other)						

* TEMP. CORRECTED @ 25C

SAMPLE COLLECTION

Method: Teflon Bailer Appearance: Slightly Turbid / Rust-Beige.

Analyte	Time	Analyte	Time	Analyte	Time
2003					

~~SS004 DRO AK102~~ ~~SS006 VOCs SW8260B (TCE, *cis*-1,2DCE, *trans*-1,2DCE, and vinyl chloride only)~~

COMMENTS: QA/QC Label ID: Dupl._____ Trip Blank_____ MS/MSD_____

PHOTO TAKEN # X

Calibration/Standard: pH (4) / (7) / (10) EC Standard: EC Reading

Decon completed: by NA date

REMARKS:

EC, Temperature, and Redox are factory calibrated

GROUNDWATER SAMPLING FORM

LOCATION NAME: Cold Bay LRRS
LOCATION DESCRIPTION: ST005
ELEVATION _____ (GPS or Survey) (FT or M)
SITE: ST005-MW6 Sample ID #: 16COBST005-MW6 DATE: 7-6-2016
SAMPLE TYPE: Grab FIELD CREW: DQ TIME Start: 2015 End 2100
WEATHER: SKY: Cloudy PRECIP: Raining WIND: 20 Air Temp. 50

GROUNDWATER : DEVELOPMENT _____ **SAMPLING** X

Well Condition: Well Locked - Bot Secure Tab Broken - Replaced Lock on Well Cap - Combo lock 0911
Casing Ht. Above Ground: 2.33 (FT.) Diameter: 2.0 in
Well Depth: 41.5/42.3 ft. BTOC (Meas./Rec.) Static Water Level: 34.90/35.60 ft. BTOC 6.6'
Casing (C) = _____ Well X Outside Protective Begin Depth 34.90 (ft.) End Depth 34.93 (ft.)

ONE PURGE VOLUME: 7.48 x (dia./24)^2 x 3.14 x (Depth-W. L.)= 1.08 gal.

PURGING:	Gallons	Time	Temperature (°C) ± 3%	E.C. (µmhos/cm)* ± 3%	pH* ± 0.1	Redox (mV) ± 10 mV
METHOD	0	2020	6.21	263	6.36	19.6
	1	2025	5.95	256	6.30	22.7
Teflon Bailer	2	2030	5.75	257	6.29	23.6
	3	2035	5.84	256	6.32	21.5
Submersible Pump	4	2041	5.96	253	6.38	17.9
	→ 5	2047	5.80	250	6.39	17.8
	5+	2055	5.79	249	6.41	17.4
_____						
(other)						

* TEMP. CORRECTED @ 25C

SAMPLE COLLECTION

Method: Teflon Bailer Appearance: Clear

Analyte	Time	Analyte	Time	Analyte	Time
	2047				

SS004 DRO AK102 SS006 VOCs SW8260B (TCE, *cis*-1,2DCE, *trans*-1,2DCE, and vinyl chloride only)

COMMENTS: QA/QC Label ID: Dupl._____ Trip Blank_____ MS/MSD X

PHOTO TAKEN # X

Calibration/Standard: pH (4) / (7) / (10) EC Standard: EC Reading

Decon completed: by NA date

REMARKS:

EC, Temperature, and Redox are factory calibrated