LABORATORY NAME:		CERT #:	
PRIMARY ANALYST:		DATE:	
NAME OF PERSON COMPLETING CHECKLIST (PRINT):			
SIGNATURE OF PERSON COMPLETING CHECKLIST:			

Parameter: **Dissolved Oxygen**
Method: **SM 4500 O G-2021 and ASTM D888-18 (B)**

Equipment and reagents:

	DO Meter Model:		**Conductivity meter (if applicable to automatically adjust salinity)** Model: Conductivity standards (µmhos/cm): Value: _____ Exp: _____ Value: _____ Exp: _____ Value: _____ Exp: _____

PLEASE COMPLETE CHECKLIST IN INDELIBLE INK
Please mark Y, N or NA in the column labeled LAB to indicate the common lab practice and in the column labeled SOP to indicate whether it is addressed in the SOP.

	GENERAL	LAB	SOP	EXPLANATION
1	Is the SOP reviewed at least every 2 years? What is the most recent review/revision date of the SOP? [15A NCAC 02H .0805 (g) (4)] **Date:**			Quality assurance, quality control, and Standard Operating Procedure documentation shall indicate the effective date of the document and be reviewed every two years and updated if changes in procedures are made. Verify proper method reference. During review notate deviations from the approved method and SOP.
2	Are all revision dates and procedural edits tracked and documented? [15A NCAC 02H .0805 (g) (4)]			Each laboratory shall have a formal process to track and document review dates and any revisions made in all quality assurance, quality control and SOP documents.
3	Is there North Carolina data available for review?			
4	Are the following items documented with each analysis? [15A NCAC 02H .0805 (g) (2)]			
	The method or SOP reference			
	Laboratory identification			
	Instrument identification			
	Sample collector			
	Signature or initials of the analyst			
	Date of sample collection			
	Time of sample collection			
	Date of sample analysis			
	Time of sample analysis			One time may be documented for sample collection and analysis if there is documentation showing that the analysis is performed *in situ*, or immediately on the sample site.
	Sample identification			
	Proper units of measure			
	Final value to be reported			
	Facility name or permit number [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			If different from Laboratory ID
	Parameter analyzed [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			
	Conductivity calibration standard and check standard values and check standard evaluation [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			Only required when using a Conductivity meter to determine the Salinity for calibration.

	Meter calibration and/or verification date and time(s) [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			
	DO Meter Calibration variables (temperature, elevation or barometric pressure [in mmHg], and salinity) [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			For meters that require manual entry of the barometric pressure, the true pressure (i.e., not corrected to pressure at sea level) must be used.
	Calibration information (DO reading in mg/L or % saturation) [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			
	Theoretical value and DO meter reading for the calibration verification(s), where applicable [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			
	Quality control assessments [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			
	PRESERVATION and STORAGE	**LAB**	**SOP**	**EXPLANATION**
5	Is the sample analyzed within 15 minutes of collection? [40 CFR Part 136.3, Table II]			*In situ* or immediate analysis is recommended due to the unstable nature of dissolved oxygen in samples.
	PROCEDURE – Meter Calibration	**LAB**	**SOP**	**EXPLANATION**
6	Is the meter allowed proper warm-up time? [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			Galvanic sensors require no warm-up time. Polarographic sensors require a 15-minute warm-up time.
7	Is the meter calibrated according to the manufacturer's instructions prior to analysis of samples each day compliance monitoring is performed? [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			
8	Is water-saturated air used for air calibration? [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			This is accomplished by calibrating the electrode in an environment with a high relative humidity. Using dry air for the calibration can result in errant readings.
9	Is the salinity of the sample(s) known or expected to be above 9 ppt? **If not, skip to question # 12.**			
10	Is the meter calibration repeated for each sample site that has varying salinity? [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			
11	If the meter has a conductivity probe that automatically measures salinity, is the conductivity meter calibrated before DO calibration? [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			
	PROCEDURE – Sample Analysis	**LAB**	**SOP**	**EXPLANATION**
12	Is sample movement across the membrane provided during analysis? [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			Movement of water across the membrane (for membrane electrode technologies) is important for accurate readings. Some probes come with stirrers for this purpose. Measurements should be taken while the stirrer is in use or by swirling the DO probe in the sample flow. Preferably, insert the probe into flowing conditions. If analyzed in a container, stir gently with the probe or add a stir bar. Do not put the probe on the sides or the bottom of the container.
	QUALITY ASSURANCE	**LAB**	**SOP**	**EXPLANATION**
13	Are the calibration chamber and probe in good condition?			
14	Is the meter transported by vehicle after initial calibration? **If "no", skip to question # 19.**			
15	Is the meter calibrated at each site before sample analysis? [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			

16	If not, is a post-analysis verification performed at the end of the analysis day? [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			This can be performed by back calculating the theoretical DO for the current air calibration conditions (e.g., temperature, elevation, barometric pressure, etc.). Refer to Attachment 1.
17	Does the calculated theoretical DO value verify the meter reading within ±0.5 mg/L? [NC WW/GW LCB Approved Procedure for the Analysis of Dissolved Oxygen (DO)]			The calculated DO value must verify the meter reading within ±0.5 mg/L.
18	If the meter reading does not verify within ±0.5 mg/L, what corrective action is taken? [15A NCAC 02H .0805 (g) (8)] **Answer:**			The meter must be recalibrated and all samples since the last successful calibration must be reanalyzed. If reanalysis is not possible, all of the data must be qualified.
19	Is the data qualified on the Discharge Monitoring Report (DMR) or client report if Quality Control (QC) requirements are not met? [15A NCAC 02H .0805 (e) (5)]			Reported data associated with quality control failures, improper sample collection, holding time exceedances, or improper preservation shall be qualified as such.

Additional Comments:

Inspector: _____ Date: _____

Attachment 1: Dissolved Oxygen Meter Calibration Verification When Salinity is Zero

DO meters/probes must be calibrated each day of use prior to sample analysis. If the meter cannot be calibrated, the calibration must be verified each day of use. Additionally, when transporting the DO meter by vehicle, a post analysis calibration verification must be analyzed at the end of the run for all types of DO probes, unless the meter is recalibrated at each sample site prior to sample analysis. Below is a procedure for verifying the calibration of a DO probe.

1) Follow the manufacturer's instructions for meter operation.
2) Place probe in a plastic bag, the probe storage cup, the storage well of the meter (each containing a wet sponge), or a BOD bottle partially filled with water. Allow appropriate instrument warm up time.
3) Read DO and temperature.
4) Check the temperature vs. DO mg/L table below and apply appropriate atmospheric (barometric) pressure or altitude correction factor.
5) Calculated (theoretical) DO value must verify meter reading within ± 0.5 mg/L.

Temp. °C	DO mg/L		Temp. °C	DO mg/L
4.0	13.11		19.5	9.18
4.5	12.94		20.0	9.09
5.0	12.77		20.5	9.00
5.5	12.61		21.0	8.92
6.0	12.45		21.5	8.83
6.5	12.30		22.0	8.74
7.0	12.14		22.5	8.66
7.5	11.99		23.0	8.58
8.0	11.84		23.5	8.50
8.5	11.70		24.0	8.42
9.0	11.56		24.5	8.34
9.5	11.42		25.0	8.26
10.0	11.29		25.5	8.18
10.5	11.16		26.0	8.11
11.0	11.03		26.5	8.04
11.5	10.90		27.0	7.97
12.0	10.78		27.5	7.90
12.5	10.66		28.0	7.83
13.0	10.54		28.5	7.76
13.5	10.42		29.0	7.69
14.0	10.31		29.5	7.62
14.5	10.20		30.0	7.56
15.0	10.08		30.5	7.50
15.5	9.98		31.0	7.43
16.0	9.87		31.5	7.37
16.5	9.77		32.0	7.31
17.0	9.67		32.5	7.24
17.5	9.57		33.0	7.18
18.0	9.47		33.5	7.12
18.5	9.38		34.0	7.07
19.0	9.28		34.5	7.01

Ref: YSI Model 5000/5100 DO Meter Manual. Slight variations in DO, pressure, and/or altitude may be found in other manuals.

Atmospheric Pressure mm Hg	Equivalent Altitude Ft.	Correction Factor
760	0	1.00
752	278	.99
745	558	.98
737	841	.97
730	1126	.96
722	1413	.95
714	1703	.94
707	1995	.93
699	2290	.92
692	2587	.91
684	2887	.90
676	3190	.89
669	3496	.88
661	3804	.87
654	4115	.86
646	4430	.85
638	4747	.84
631	5067	.83
623	5391	.82
616	5717	.81
608	6047	.80
600	6381	.79
593	6717	.78

Example: If ambient temperature is 21°C and elevation is approximately 1126 ft, the theoretical DO would be:

8.92 X 0.96 = 8.56 mg/L

or, if ambient temperature is 21°C and the atmospheric (barometric) pressure is 745 mm Hg, the theoretical DO would be:

8.92 X 0.98 = 8.74 mg/L

Attachment 2: Dissolved Oxygen Meter Calibration Verification When Salinity is Greater Than Zero

If calibrated at a salinity greater than zero, use the following table and column with applicable salinity:

Table 1 - OXYGEN SOLUBILITY TABLE

Solubility of Oxygen in mg/L in water exposed to water-saturated air at 760 mmHg pressure[3].

Temp °C	Chlorinity: 0 Salinity: 0	5.0 ppt 9.0 ppt	10.0 ppt 18.1 ppt	15.0 ppt 27.1 ppt	20.0 ppt 36.1 ppt	25.0 ppt 45.2 ppt
0.0	14.621	13.728	12.888	12.097	11.355	10.657
1.0	14.216	13.356	12.545	11.783	11.066	10.392
2.0	13.829	13.000	12.218	11.483	10.790	10.139
3.0	13.460	12.660	11.906	11.195	10.526	9.897
4.0	13.107	12.335	11.607	10.920	10.273	9.664
5.0	12.770	12.024	11.320	10.656	10.031	9.441
6.0	12.447	11.727	11.046	10.404	9.799	9.228
7.0	12.139	11.442	10.783	10.162	9.576	9.023
8.0	11.843	11.169	10.531	9.930	9.362	8.826
9.0	11.559	10.907	10.290	9.707	9.156	8.636
10.0	11.288	10.656	10.058	9.493	8.959	8.454
11.0	10.027	10.415	9.835	9.287	8.769	8.279
12.0	10.777	10.183	9.621	9.089	8.586	8.111
13.0	10.537	9.961	9.416	8.899	8.411	7.949
14.0	10.306	9.747	9.218	8.716	8.242	7.792
15.0	10.084	9.541	9.027	8.540	8.079	7.642
16.0	9.870	9.344	8.844	8.370	7.922	7.496
17.0	9.665	9.153	8.667	8.207	7.770	7.356
18.0	9.467	8.969	8.497	8.049	7.624	7.221
19.0	9.276	8.792	8.333	7.896	7.483	7.090
20.0	9.092	8.621	8.174	7.749	7.346	6.964
21.0	8.915	8.456	8.021	7.607	7.214	6.842
22.0	8.743	8.297	7.873	7.470	7.087	6.723
23.0	8.578	8.143	7.730	7.337	6.963	6.609
24.0	8.418	7.994	7.591	7.208	6.844	6.498
25.0	8.263	7.850	7.457	7.093	6.728	6.390
26.0	8.113	7.711	7.327	6.962	6.615	6.285
27.0	7.968	7.575	7.201	6.845	6.506	6.184
28.0	7.827	7.444	7.079	6.731	6.400	6.085
29.0	7.691	7.317	6.961	6.621	6.297	5.990
30.0	7.559	7.194	6.845	6.513	6.197	5.896
31.0	7.430	7.073	6.733	6.409	6.100	5.806
32.0	7.305	6.957	6.624	6.307	6.005	5.717
33.0	7.183	6.843	6.518	6.208	5.912	5.631
34.0	7.065	6.732	6.415	6.111	5.822	5.546
35.0	6.950	6.624	6.314	6.017	5.734	5.464
36.0	6.837	6.519	6.215	5.925	5.648	5.384
37.0	6.727	6.416	6.119	5.835	5.564	5.305
38.0	6.620	6.316	6.025	5.747	5.481	5.228
39.0	6.515	6.217	5.932	5.660	5.400	5.152
40.0	6.412	6.121	5.842	5.576	5.321	5.078
41.0	6.312	6.026	5.753	5.493	5.243	5.005
42.0	6.213	5.934	5.667	5.411	5.167	4.993
43.0	6.116	5.843	5.581	5.331	5.091	4.861
44.0	6.021	5.753	5.497	5.252	5.017	4.793
45.0	5.927	5.665	5.414	5.174	4.944	4.724
46.0	5.835	5.578	5.333	5.097	4.872	4.656
47.0	5.744	5.493	5.252	5.021	4.801	4.589
48.0	5.654	5.408	5.172	4.947	4.730	4.523
49.0	5.565	5.324	5.094	4.872	4.660	4.457
50.0	5.477	5.242	5.016	4.799	4.591	4.392