From: Comstock, Gregg
Sent: Thursday, February 15, 2018 10:32 AM
To: 'Valleau, Dana'; 'Jack Kenworthy'
Cc: Monroe, Pamela; Walsh, Ted; Diers, Ted; Mauck, Ridge
Subject: RE: SEC Docket 2015-02 _ Antrim Wind Park Monitoring Plan of 20180206 - NHDES Comments

Jack and Dana.

The NHDES Watershed Management Bureau has reviewed the revised Water Quality Monitoring Plan submitted on 2/14/17 (attached) and find it acceptable. Submission of this plan satisfies the requirement to obtain NHDES approval of a turbidity sampling plan and water quality monitoring plan in accordance with the NHDES Alteration of Terrain Bureau conditions 16 and 17 included in Appendix I of the Site Evaluation Committee's 3/17/17 approval for this project. Copies of these conditions are provided below.

16. Unless otherwise authorized by NHDES the Applicant shall prepare a turbidity sampling plan to confirm that measures to control erosion during construction are not causing or contributing to surface water quality violations. The turbidity sampling plan shall include the turbidity monitoring elements specified in the August, 14, 2013 NHDES Inter-Department Communication entitled "Guidance for SWPPPs, BMP Inspection and Maintenance, Turbidity and Sediment Monitoring for NHDOT Projects with 401 Water Quality Certifications" which includes guidance regarding sampling station number and locations, sampling frequency, sampling duration, size of storms that need to be sampled, how soon after the start of precipitation sampling should begin, quality assurance quality control provisions, and turbidity meter specifications. The plan shall be submitted to NHDES for approval at least 90 days prior to construction. The Applicant shall then implement the approved plan. Unless otherwise authorized by DES, the turbidity sampling results along with station ID, date, time, other field notes, and a description of corrective actions taken when violations of state surface water quality criteria for turbidity are found, shall be submitted to NHDES via electronic mail within 48 hours of collection.

17. Unless otherwise authorized by NHDES, the Applicant shall develop and submit a monitoring plan to NHDES Watershed Management Bureau for approval at least 90 days prior to construction. The purpose of the plan is to confirm that operation of the Activity is not causing or contributing to violations of state surface water quality standards and may include pre and post construction monitoring. The plan shall include the parameters to be sampled, the location, timing and frequency of sampling, sampling and laboratory protocols, quality assurance I quality control provisions as well as when data will be submitted to NHDES. The applicant shall consult with NHDES and submit the monitoring data in a format that can be automatically uploaded into the NHDES Environmental Database. Once approved by NHDES, the Applicant shall implement the sampling plan.

Regards,
Gregg

Gregg Comstock, P.E.
Supervisor, Water Quality Planning Section
NH Department of Environmental Services, Watershed Management Bureau
29 Hazen Drive, PO Box 95
Concord, NH 03302-0095

603-271-2983
gregg.comstock@des.nh.gov

From: Valleau, Dana [mailto:DValleau@trcsolutions.com]
Sent: Wednesday, February 14, 2018 9:12 AM
To: Comstock, Gregg; 'Jack Kenworthy'
Cc: Monroe, Pamela; Walsh, Ted; Diers, Ted
Subject: RE: SEC Docket 2015-02 _ Antrim Wind Park Monitoring Plan of 20180206 - NHDES Comments

Thank you for the review and comments.

Please see attached for the revised complete plan for your approval.

Let us know if you have additional questions or comments.

Dana

Dana Valleau
Environmental Specialist
Planning, Permitting and Licensing

14 Gabriel Drive, Augusta, ME 04330
T: 207.620.3834 | F: 207.621.8226 | C: 207.215.4582

Follow us on LinkedIn or Twitter | www.trcsolutions.com

From: Comstock, Gregg [mailto:Gregg.Comstock@des.nh.gov]
Sent: Monday, February 12, 2018 3:29 PM
To: 'Jack Kenworthy' <jack.kenworthy@waldengreenenergy.com>; Valleau, Dana <DValleau@trcsolutions.com>
Cc: Monroe, Pamela <Pamela.Monroe@sec.nh.gov>; Walsh, Ted <Ted.Walsh@des.nh.gov>; Diers, Ted <Ted.Diers@des.nh.gov>
Subject: SEC Docket 2015-02 _ Antrim Wind Park Monitoring Plan of 20180206 - NHDES Comments

Jack and Dana,

We have reviewed the revised Water Quality Monitoring Plan submitted on 2/6/18 and have included our comments in the attached document. Our comments concern Tables 2 and 3 and are relatively minor.

Please revise and resubmit a complete plan for approval.

Thank you.

Regards,
Gregg

Gregg Comstock, P.E.
Supervisor, Water Quality Planning Section
NH Department of Environmental Services, Watershed Management Bureau
29 Hazen Drive, PO Box 95
Concord, NH 03302-0095
603-271-2983
gregg.comstock@des.nh.gov

Antrim Wind Energy Project
Water Quality Monitoring Plan

Prepared for:

Antrim Wind Energy, LLC
155 Fleet Street
Portsmouth, NH 03801

Prepared by:

TRC Environmental Corporation
14 Gabriel Drive
Augusta, Maine 04330

December 12, 2017
Revision 2
February 14, 2018

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APPENDICES

1.0 INTRODUCTION

Antrim Wind Energy, LLC, (AWE) has received permits from New Hampshire Department of Environmental Services (NHDES) and a Certificate of Site and Facility (Certificate) from the New Hampshire Site Evaluation Committee (NHSEC) to construct the Antrim Wind Energy Project (Project), located in Antrim, New Hampshire (Figure 1). The Project entails construction of 3.3 miles of access road, nine wind turbines, an electrical collection system and substation, and interconnection with an existing Eversource electric transmission line. Construction is expected to occur from May 1 to November 18, 2018.

Condition 16 of the Alteration of Terrain Permit in the Site Evaluation Committee's approval states:

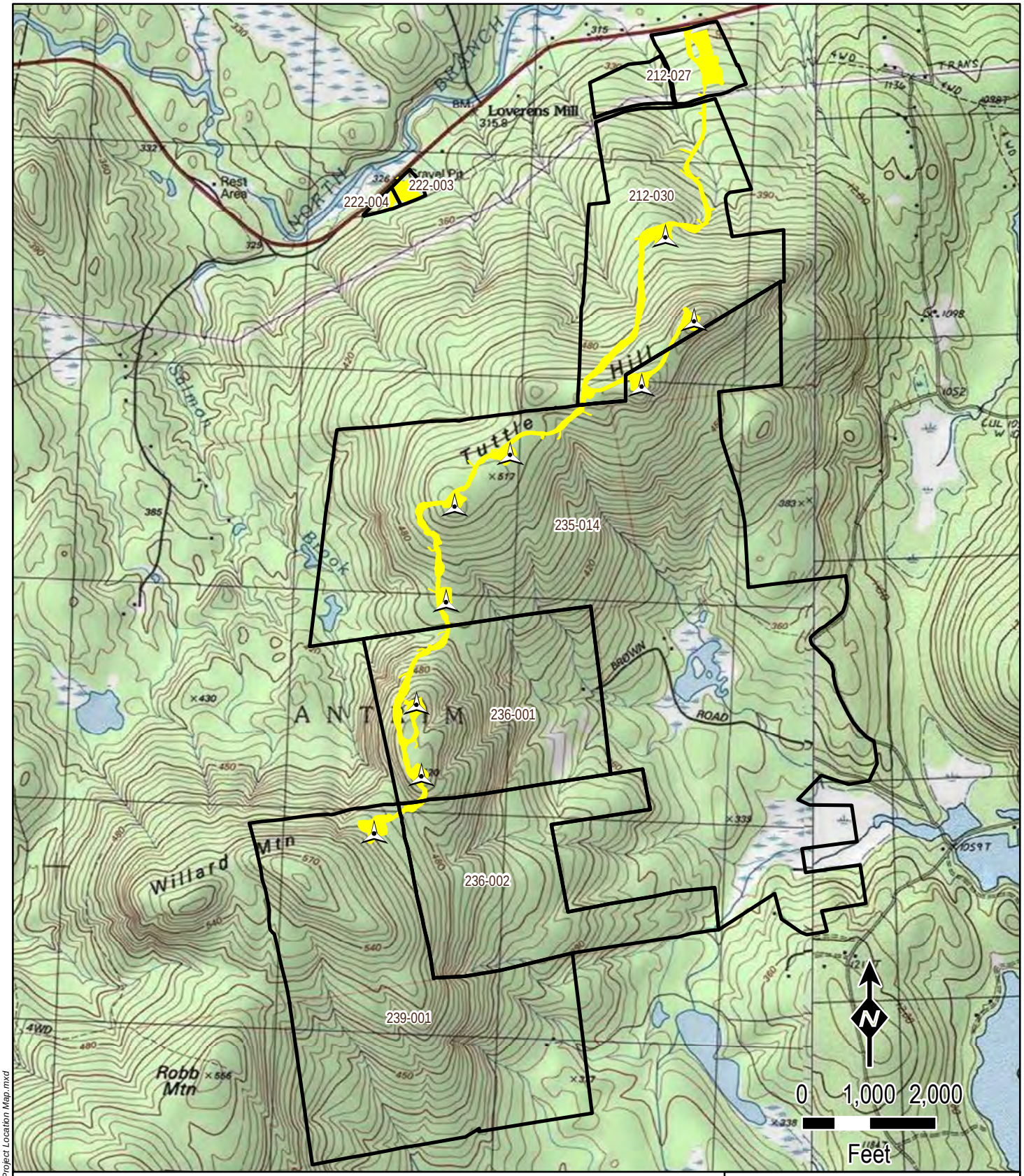
> "16. Unless otherwise authorized by NHDES the Applicant shall prepare a turbidity sampling plan to confirm that measures to control erosion during construction are not causing or contributing to surface water quality violations. The turbidity sampling plan shall include the turbidity monitoring elements specified in the August 14, 2013 NHDES Inter-Department Communication entitled "Guidance for SWPPs, BMP Inspection and Maintenance, Turbidity and Sediment Monitoring for NHDOT Projects with 401 Water Quality Certifications" which includes guidance regarding sampling station number and locations, sampling frequency, sampling duration, size of storms that need to be sampled, how soon after the start of precipitation sampling should begin, quality assurance / quality control provisions, and turbidity meter specifications. The plan shall be submitted to NHDES for approval at least 90 days prior to construction. The Applicant shall then implement the approved plan. Unless otherwise authorized by DES, the turbidity sampling results along with station ID, date, time, other field notes, and a description of corrective actions taken when violations of state surface water quality criteria for turbidity are found, shall be submitted to NHDES via electronic mail within 48 hours of collection."

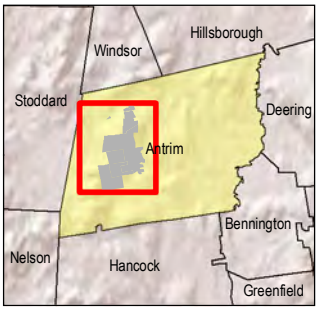
Condition 17 of the Alteration of Terrain Permit in the Site Evaluation Committee's approval states:

> "17. Unless otherwise authorized by NHDES, the Applicant shall develop and submit a monitoring plan to NHDES Watershed Management Bureau for approval at least 90 days prior to construction. The purpose of the plan is to confirm that operation of the Activity is not causing or contributing to violations of state surface water quality standards and may include pre and post construction monitoring. The plan shall include the parameters to be sampled, the location, timing and frequency of sampling, sampling and laboratory protocols, quality assurance / quality control provisions as well as when data will be submitted to NHDES. The applicant shall consult with NHDES and submit the monitoring data in a format that can be automatically uploaded in the NHDES Environmental Database. Once approved by NHDES, the Applicant shall implement the sampling plan."

This document addresses these stated measures and follows guidance for monitoring as outlined in *Guidance for SWPPS, BMP Inspection and Maintenance, Turbidity and Sediment Monitoring for NHDOT Projects with 401 Water Quality Certifications* (2013 Guidance; Appendix 1).

Construction of the Project will disturb up to 57.1 acres. Impervious area post-construction will total 11.7 acres with the remainder of the disturbed area being restored and revegetated. The construction of the Project includes two stream crossings (one ephemeral and one perennial) and wetland fill impacts totaling 0.21 acres to ten small, isolated wetlands. Erosion control best management practices (BMPs) are proposed to minimize the potential for impacts from siltation and sedimentation to water resources in the Project area.





Legend

- Proposed WTG
- Project Footprint
- Project Parcels

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT

354 KEENE ROAD, ANTRIM, NH

Figure 1

Project Location Map

Produced by: TRC | 1/29/2015

V:\PROJECTS\AUGUSTA\Eolian\ANTRIM\Figure C1 Project Location Map.mxd

2.0 STUDY AREA

The Project is located in Antrim, NH. Current landuse is predominantly forested with a rolling, hilly topography. The overall limit of disturbance (LOD) of the Project totals 57.1 acres, with approximately 11.7 acres being converted to impervious area, post-construction. The remainder of the LOD will be restored, stabilized and revegetated following construction.

A wetland and waterbody delineation was performed during August, September, and November 2011 and October 2014 and identified two streams (one ephemeral and one perennial) along with ten isolated wetlands were found within the LOD. The perennial stream, Stream AN-17 is an unnamed, small, shallow perennial stream with a steep gradient that originates from ground- and surface water on the northern slope of Tuttle Hill and flows northerly across the Project site, eventually discharging to the North Branch River. The ephemeral stream is a small unnamed system that originates on the lower slopes of Tuttle Hill and flows northerly toward the North Branch River.

This Plan presents a detailed water quality monitoring approach to satisfy Conditions 16 and 17 of the Certificate in accordance with the procedures advised by the 2013 Guidance. Specifically, this Plan provides procedures for monitoring weather conditions at the Project site and water quality, including turbidity, at two stations within the unnamed perennial stream and one downstream of a Project culvert during and following proposed construction.

3.0 WEATHER MONITORING

Precipitation will be monitored on-site at the construction office in accordance with Section E.1 of the 2013 Guidance, which requires a weather station to have the following specifications/capabilities:

- Rainfall measurement accuracy of 0.01 inch,
- Temperature to accuracy of 1 degree Fahrenheit,
- Hourly data storage,
- Remote access capabilities to allow automated email notifications.

This Plan proposes the use of a Davis Vantage Pro2 Plus weather station, or similar device, to maintain a continuous record of temperature, precipitation amount and intensities. This weather station will be installed near the Project's construction office in an open area unencumbered by tree canopy or manmade structures. This equipment will be programmed to provide automated email notifications to Project monitors to alert staff of when rainfall sampling thresholds, as described in Section 4 of this Plan, have been met.

In many instances, sampling may be planned based on an impending forecast. Project staff will monitor online weather forecasts; e.g. http://home.accuweather.com/index.asp?partner=accuweather, to predicting storm total amounts, as well as other factors affecting sampling; e.g., sunrise and sunset times.

4.0 PROPOSED TURBIDITY MONITORING APPROACH

Certificate Condition 16 requires that turbidity sampling be performed, in accordance with the 2013 Guidance, to confirm that sedimentation and erosion control measures implemented during construction are not causing or contributing to surface water quality violations. The 2013 Guidance requires a turbidity plan to specify:

- sampling stations,
- sampling method,
- sampling commencement, duration and frequency,
- quality assurance / quality control (QA/QC) and reporting,
- termination of sampling.

The following sections detail the aforementioned sampling considerations.

4.1 Sampling Stations

Turbidity will be measured at two sites along the unnamed perennial stream (Stream AN-17) and below culvert SD-1 as described in Table 1 and Appendix 2. Samples will be collected.

For each round of sampling, results at stations AWE-C-1 and AWE-C-2 will be compared to AWE-B-1 (background). If AWE-C-1 or AWE-C-2 exceeds background by 10 NTU or more it will be considered an exceedance and NHDES will be notified by email within 24-hours.

Table 1. Sampling Station Descriptions

Station ID	Location Description	Geographical Coordinates	
		Latitude	Longitude
AWE-B-1 (Background)	200-ft upstream from proposed Culvert SD-4	43.070698	-72.005733
AWE-C-1	200-ft downstream from proposed Culvert SD-4	43.071684	-72.006647
AWE-C-2	50-ft downstream of culvert SD-1, located at Rte-9	43.076028	-72.007126

4.2 Sampling Method

Turbidity shall be sampled with a portable turbidimeter such as a Hach 2100P or similar device. Samples will be collected via surface grab method by holding a cleansed, capped sample vial under water at a mid-channel location. The capped vial will be submerged to mid-water depth and then the cap removed to allow the vial to fill with site water. The cap will be replaced while the vial is still submerged and the vial will brought back to the surface. The vial will be wiped dry and clean with lint-free wipes, inverted three times, and then correctly positioned within the turbidimeter for measurement. A sample vial may be cleansed in between samples by triple rinsing the vial and cap with site water.

The U.S. Environmental Protection Agency *Standard Operating Procedure: Calibration of Field Instruments* (USEPA 2017) which is attached as Appendix 3 and the manufacturer's procedures for proper calibration of turbidity and TSS will be followed. Calibrations will be performed using a range of commercially prepared (e.g., Stabical®) calibration standards.

Digital photographs will be taken of each sampling location under dry weather conditions before the turbidity sampling program is initiated and at least one set of photographs will be taken during each sampling event soon after a turbidity exceedance is measured or a plume is visible.

In general, turbidity sampling will be conducted approximately once per hour during daylight hours up to four hours or until sampling results indicate that the turbidity water quality standard has been met.

4.3 Sampling Commencement, Duration, and Frequency

Turbidity monitoring will commence by March 15, 2018, or when it is determined that the onsite soil conditions have thawed and the ground is no longer frozen, whichever condition occurs first.

Turbidity shall be collected based on rainfall conditions as specified by Table 2. Additionally, turbidity sampling shall be conducted whenever plumes are visible due to construction discharges from the site, when sampling results indicate that a violation of the turbidity standards (10 NTU above background) is occurring or when significant sediment deposits are observed in the surface water that are due to construction discharges. Turbidity monitoring shall commence within 2 hours of the discovery of one of these conditions.

Table 2. Sampling Commencements, Durations, and Frequencies Specified by the 2013 Guidance.

Workday		
Weather Forecast	**< 0.5-inches w/in 24-hr Period**	**> 0.5-inches w/in 24-hr Period**
Anticipated Storms	No turbidity sampling is required.	Turbidity sampling shall begin within 2-hours of at least 0.25-inch of rain and every hour thereafter during the workday that stormwater discharges from the site, for up to 4-hours. Turbidity monitoring shall continue at any monitoring station that does not meet water quality standards (≥10 NTU above background) and shall continue for up to 4 hours or nightfall occurs.
Unanticipated Storms	No turbidity sampling is required.	Turbidity sampling shall begin within 2-hours after 0.50-inches of rain has fallen and every hour thereafter during the workday that stormwater discharges from the site up to 4-hours or nightfall occurs.
Non-Workday		
Weather Forecast	**< 1.00 inches w/in 24-hr Period**	**> 1.00 inches w/in 24-hr Period**
Anticipated Storms	No turbidity sampling is required.	Turbidity sampling shall begin within 2-hours after 0.50-inches of rain has fallen and every hour thereafter during the non-workday that stormwater discharges from the site up to 4-hours. Sampling shall occur during daylight hours. If the 0.50-inch notification is given during night hours sampling shall start at the beginning of the following day and continue

		thereafter while stormwater discharges from the site, up to 4-hours. If the rainfall event ends before the next day sample each monitoring station once with a turbidity meter.
Unanticipated Storms	No turbidity sampling is required.	Turbidity sampling shall begin within 2-hours after 1.00-inches of rain has fallen and every hour thereafter during the non-workday that stormwater discharges from the site, up to 4-hours. Sampling shall occur during daylight. If the 1.00-inch notification is given during night hours, then sampling shall start at the beginning of the following day and continue thereafter while stormwater discharges from the site, up to 4-hours. If the rainfall event ends before the next day sample each monitoring station once with a turbidity meter.

4.4 QAQC & Reporting

Quality Assurance/Quality Control as found in the 2013 Guidance will be followed. These measures include:

- A field duplicate shall be performed at a minimum of 10% of each reported test result/matrix combination annually. The field sheets shall clearly indicate the duplicate measurement. If the relative difference between the duplicate measurement and the original measurement exceeds 10%, then the turbidimeter will be re-calibrated and re-measure turbidity. If the difference is continually greater than 10%, then provide notice on field documentation and consult DES after the sampling is complete.
- A field blank shall also be made after every 10th sample. Field blank will be prepared by filling a clean sample container with deionized water and measure immediately following the measurement of the 10th sample.
- Turbidity Meters shall be calibrated daily prior to sample collection and later verified following completion of a day's sampling to ensure that data are bounded by quantitative and chronological calibration brackets.

4.4.1 Compliance and Corrective Actions

If results of the turbidity monitoring indicate water quality exceedances of 10 NTU's or more above background (AWE-B-1), or plumes are visible, the environmental monitor will notify the project manager immediately and assist in identifying and correcting potential sources of turbidity. The environmental manager will coordinate with the project manager and construction crew to identify and implement erosion control measures to eliminate the turbidity source as soon as possible and in future precipitation events.

4.4.2 Reporting

Reports will include the following:

- Field data sheets,
- Calibration/Verification Records,
- Photographs,

- A summary table of each sampling event that shows the date, the total precipitation, the time precipitation started, the amount of precipitation that fell since the last sampling event, the date and time turbidity samples were taken, turbidity results at each station, turbidity results with background subtracted for comparison to turbidity water quality criteria, and identification of any exceedances of turbidity criteria
- QA/QC results, and
- a description of any corrective actions taken to abate any exceedances of turbidity criteria (if applicable).

If no turbidity exceedances occur during a sampling event, reports will be submitted on a monthly basis, by the end of the first week of the subsequent month. If, however, any sampling event indicates an exceedance of turbidity criteria, NHDES will be contacted within 24-hours by email and the report will be provided to NHDES by the subsequent Wednesday. All turbidity data will be submitted to NHDES electronically and in a form that can be automatically uploaded into the NHDES Environmental Monitoring Database (EMD).

4.5 Termination of Sampling

A written (i.e., email or mailed letter) request to stop turbidity monitoring may be submitted to NHDES for approval when all disturbed areas draining to the sampling stations are stabilized and results of at least two storms indicate no exceedances of turbidity criteria.

5.0 PRE AND POST CONSTRUCTION WATER QUALITY SAMPLING

5.1 Inspection/Sampling Locations

The proposed pre- and post-construction water quality monitoring approach involves sampling the unnamed perennial stream (AN-17) stations AWE-B-1 (background) and AWE-C-1 (Table 1).

5.2 Timing and Frequency of Water Quality Sampling

5.2.1 Pre-Construction Monitoring

At least four rounds of pre-construction (or near pre-construction) water quality sampling will be conducted. Weather permitting, one dry and one wet weather sampling event will occur during April 2018 (or as soon as possible if target weather conditions are not met in April). Another dry and wet weather sampling event will occur during the summer months (i.e., June 1 to August 31, 2018) and preferably prior to major earthmoving activities in the area draining to the sampling stations. Sampling for wet-weather events will occur within 4-hours of events that produce at least 0.5-inches of precipitation within 24-hours and sampling during dry weather will occur when no precipitation (i.e., < 0.1-inches) has been recorded for at least 72-hours.

Weather permitting, summer water quality sampling will be conducted during periods of low flow (≤3 X 7Q10) and high temperatures (preferably over 23 degrees C). The United States Geologic Service maintains a stream gage on the Ashuelot River in Gilsum, NH (USGS 01157000[1]). Data from this gage can be used to estimate when the water quality monitoring stations at the Antrim Wind Energy Project are flowing below low flow conditions. The 3 X 7Q10 value for USGS stream gage 1157000 is 10.3 cfs.

5.2.2 Post-Construction Monitoring

At least four rounds of post-construction water quality sampling will be conducted the first summer (i.e., June 1 to August 31) after the project is completed and operational. Weather permitting, two wet weather and two dry weather events (as defined in Section 3.2.1 Pre-Construction Monitoring above) will be sampled. Depending upon results, NHDES may require additional post-construction monitoring.

5.3 Water Quality Sampling Parameters/Protocols

Condition 17 of the Certificate requires that a water quality (WQ) monitoring plan be implemented to confirm that the Project is not causing or contributing to violations of state surface water quality standards. This Plan describes a two-part WQ program that assesses water chemistry as well as physicochemical conditions. Details for each facet are provided in the following sections.

5.3.1 Physicochemical Water Quality Monitoring

A hand held meter, such as a YSI 556 Multiprobe Water Quality Meter or similar, will be used for instantaneous sampling when the multi-parameter datasonde (described below) is not in the water, such as during pre-construction monitoring in April 2018. An alternative method of data collection, instantaneous dissolved oxygen and temperature data will be collected with a hand held meter and water samples may be taken for laboratory analysis. If this alternative is used for monitoring, the sample collection methodology and QA/QC procedures described in Section 5.3.2 will be followed.

[1] https://waterdata.usgs.gov/nh/nwis/uv/?site_no=01157000&PARAmeter_cd=00065,00060

A multi-parameter datasonde (sonde), such as a YSI 6920 or similar instrument with remote continuous data recording capability, will be deployed for a minimum of ten full days at station AWE-C-1 during each the pre-construction and post-construction phases of the Project. These deployments are expected to occur between June 1 and August 31 during a period of low flow (≤3 X 7Q10) and higher water temperature (≥ 23ºC). The sonde will be programmed to measure a suite of physicochemical parameters (Table 3) at 15-minute intervals throughout the entire 10-day study period.

Table 3. Physicochemical Parameters.

Parameter	Unit	Instrument Resolution[1]	Instrument Acurracy[1]	NHDES WQ Standard
Temperature	ºC	0.01	± 0.15 ºC	no "appreciable" increase[5]
Dissolved Oxygen Concentration	mg/L	0.01	0.1 mg/L[3]	≥ 5 mg/L[6]
Dissolved Oxygen Saturation	%	0.1	1% of reading [4]	≥ 75% of saturation on a daily average basis[6]
pH	Standard Units (SU)	0.01	0.2 SU	6.5 – 8.0 SU
Specific Conductance	µmhos/cm	0.001 to 0.1[2]	± 0.5% of reading	n/a

[1] specifications of a YSI 6920 V2 data sonde.
[2] range specific
[3] assumes a measurement range of 0 to 20 mg/L
[4] assumes a measurement range of 0 to 200 percent saturation
[5] such that would interfere with the uses assigned to a Class B stream (RSA 485-A:8, II and VIII)
[6] Env-Wq 1703.07

The sonde will be housed securely within 3-inch PVC pipe with numerous 0.5-inch holes drilled to allow for ample water passage across the probe array. The PVC-housed sonde will be anchored using a cinderblock in a stable and inconspicuous area of the stream exhibiting representative flow. The cinderblock will hold the instrument in place such that the probe array sits 5- to 10-cm above the stream bottom. The cinderblock and instrument will be securely tethered to the bank via a light-gauge airline wire that can be affixed to a hand-driven fence post adjacent to the deployment location.

Prior to deployment, the sonde will be calibrated in a lab against a set of known standards that encompass the range of measurements anticipated to occur. Calibration records showing the date and time of calibration, staff performing the calibration, expiration dates of chemical standards, as appropriate, and initial (pre-calibration) and post-calibration reading measurements will be provided along with report deliverables submitted to the NHDES. Following each deployment (i.e., after completion of a 10-day sampling period), the sonde will be field-verified using the same batch of chemical standards, as appropriate, or otherwise the manufacturer's procedures for verifying performance (e.g. dissolved oxygen optical probes are verified without the use of a chemical standard). This procedure of pre-sampling calibration and post-sampling verification allows for data to be bound by chronological and quantitative calibration brackets.

5.3.2 Water Chemistry Sampling

During each sampling event, water chemistry samples will be taken at both water quality monitoring stations (AWE-B-1 and AWE-C-1). A properly calibrated sonde will be used to collect an instantaneous measurement of temperature, dissolved oxygen (concentration and saturation), pH, and specific conductance. These measurements will be performed within 15-minutes of water sample collection.

Water chemistry samples will be collected as a surface water grab by dipping a pre-cleansed sample container directly into the water column to an approximate depth 20-cm or mid-water column (in shallower water). The sampler shall wade into the mid-channel section of the stream and face upstream into the current while collecting the sample, without disturbing the bottom sediment. The sampler shall be careful not to displace the preservative from pre-preserved sample containers. This surface grab technique is consistent with the U.S. Environmental Protection Agency (EPA) "dipping using a sample container" procedure[2] for surface water sampling and *Ambient Ribver Monitoring Program River and Stream Water Quality Monitoring Sampling Protocols* (NHDES 2016).

Following collection, samples will be securely capped and stored on ice for transport to an analytical laboratory for testing. Samples will be delivered to the laboratory under chain-of-custody within appropriate analyte hold times. Table 4 lists the analyses to be performed for this study.

Table 4. Water Quality Analytical Parameters

Parameter	Unit	Preservation	Hold Time	MDL
Aluminum (Total)	mg/L	$HNO_3$to pH <2 (5.0 ml in 500 ml square"metals" bottle), chilled to 4°C	6 months	0.006 mg/L
Aluminum (Acid-Soluble)	mg/L	Chilled to 4°C	6 months	0.006 mg/L
Iron (Total)	mg/L	$HNO_3$to pH <2 (5.0 ml in 500 ml square"metals" bottle), chilled to 4°C	6 months	0.03 mg/L
Nitrate+Nitrite-Nitrogen	mg/L	Chilled to 4°C	48 hours	0.011 mg/L
Total Kjeldahl Nitrogen	mg/L	$H_2SO_4$to pH<2 (0.7 ml in 250 ml bottle), light protected, chilled to 4°C	28 days	0.038 mg/L
Total Phosphorous	mg/L	$H_2SO_4$to pH<2 (0.7 ml in 250 ml bottle), light protected, chilled to 4°C	28 days	0.001 mg/L
Chloride	mg/L	Chilled at 4°C	28 days	N/C

[2] https://www.epa.gov/sites/production/files/2015-06/documents/Surfacewater-Sampling.pdf

Digital photographs will be taken at each sampling location during each sampling event.

See the attached datasheet in Appendix 4.

5.4 Quality Assurance/Quality Control

All methods used for water quality sampling will be consistent with *Ambient River Monitoring Program River and Stream Water Quality Monitoring Sampling Protocols* (NHDES 2016). Precision and accuracy specifications and calibration procedures/documentation for the data loggers and handheld meters that will be used will meet measurement performance criteria found in the *2014 – 2018 Ambient River Monitoring Program Quality Assurance Project Plan* (NHDES 2014).

The State of New Hampshire DHHS Public Health Laboratory will be used to complete the proposed analyses. Analytical methods used by the laboratory for each laboratory parameter are in Table 4, and includes laboratory detection limits. NHDES Laboratory Services Login and Custody Sheet will be used to document the chain of custody for the samples.

In addition to the above information, this Plan requires the collection of field QA/QC samples to evaluate the sample collection process and ensure that samples have not been artificially contaminated by the sample collection process. The conventional sample frequency for field QA/QC samples is 10% of each reported test result/matrix combination for the life of a project.

5.4.1 Field Duplicate

This Plan requires the collection of a Field Duplicate to assess the variability in the sampling process. Field Duplicates are to be collected in the field immediately coincident with the water chemistry sampling using the same collection and handling procedures described in Section 5.3.2 of this Plan. As this study involves only two sampling stations and two sampling events, yielding four samples, the minimum QA/QC threshold of 10% (i.e., one QA/QC sample for every ten scheduled sample) can be satisfied by performing one Field Duplicate during either the pre-construction or post-construction monitoring event. The station at which this Field Duplicate will be performed will be randomly assigned by the flip of a coin.

5.4.2 Field Blank

This Plan requires the collection of a Field Blank to assess: on-site sampling environment, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions. Field Blanks are to be collected in the field immediately coincident with the water chemistry sampling by pouring analyte-free water into sample containers for each parameter set to be collected. Sample handling and transport will proceed as described in Section 5.3.2 of this Plan. As this study involves only two sampling stations and two sampling events, yielding four samples, the minimum QA/QC threshold of 10% (i.e., one QA/QC sample for every ten scheduled sample) can be satisfied by performing one Field Blank during either the pre-construction or post-construction monitoring event. The station at which this Field Blank will be performed will be randomly assigned by the flip of a coin.

5.5 Reporting

A pre-construction water quality summary report will be submitted to NHDES by December 31, 2018. A second summary report that includes the monitoring data with a comparison of pre- and post-construction monitoring results shall be submitted by December 31 of the year that post-construction monitoring is conducted. At minimum, these reports will include:

- Antecedent weather data,
    - Date and amount of precipitation that fell since the last sampling event;
    - A summary table for each sampling event that shows the date, the total precipitation, the time precipitation started, whether it was a wet or dry sample, the time when samples were taken, and the results of each station;
- Field data sheets for turbidity monitoring and water chemistry and physicochemical measurement,
- Photographic documentation,
- Analytical lab results,
- Chain-of-Custody documents,
- Calibration/Verification documentation,
- QA/QC results and identification of any data that did not meet QA/QC criteria and is therefore considered invalid;
- Data interpretation comparing study results to State surface water quality criteria (Env-Wq 1700), as well as a comparison of pre- and post-construction results.

All water quality data, including digitized field lab forms, will be submitted to DES electronically and in a format that can be compatible with NHDES Environmental Monitoring Database (EMD).

6.0 REFERENCES

New Hampshire Department of Environmental Services. 2016. *Ambient River Monitoring Program River and Stream Water Quality Monitoring Sampling Protocols*. NH Department of Environmental Services, Water Division –Watershed Management Bureau. Updated June 2016.

New Hampshire Department of Environmental Services. 2014. *Ambient River Monitoring Program Quality Assurance Project Plan*. NH Department of Environmental Services, Water Division –Watershed Management Bureau. May 27, 2014.

U.S. Environmental Protection Agency. 2017. *Standard Operating Procedure: Calibration of Field Instruments*. EQASOP – FieldCalibrat3. Quality Assurance Unit, U.S. Environmental Protection Agency – Region 1. Revision Number 3, June 3, 1998, Revised March 23, 2017. 18 p.

D U.S. Environmental Protection Agency. 2013. Decker, C., and K. Simmons. "Surface Water Sampling." *Science and Ecosystem Support Division, SESDPROC-201-R3* (2013).

Appendix 1
Guidance for SWPPS, BMP Inspection and Maintenance, Turbidity and Sediment Monitoring for NHDOT Projects with 401 Water Quality Certifications

STATE OF NEW HAMPSHIRE
Inter-Department Communication

DATE: 8/14/13

FROM: Gregg Comstock, P.E., and
Jocelyn Degler
AT (OFFICE): Water Division
Watershed Management Bureau

SUBJECT: Guidance for SWPPPs, BMP Inspection and Maintenance, Turbidity and Sediment Monitoring for NHDOT Projects with 401 Water Quality Certification

TO: Mark Hemmerlein, Water Quality Program Manager
Bureau of Environment
Department of Transportation

A. Introduction

This memorandum applies to New Hampshire Department of Transportation (DOT) projects that require an individual Clean Water Act section 401 Water Quality Certification (Certification) and provides guidance (Guidance) to DOT Contractors for the following:

- Developing and implementing Stormwater Pollution Prevention Plans (SWPPPs) and BMP inspection and maintenance plans;
- Monitoring for turbidity and sediment deposition and;
- Reporting of results.

These practices are required by the 401 Certification issued for this project to ensure compliance with New Hampshire Surface Water Quality Standards (SWQS). For the most part, the elements described in this Guidance are intended to complement the requirements of the National Pollution Discharge Elimination System (NPDES) Construction General Permit (CGP), as well as reinforce the need to comply with the provisions of the New Hampshire Code of Administrative Rules, part Env-Wq 1500. Where differences exist between these documents, the more stringent criteria shall apply.

B. Definitions

1. **Construction Discharge:** Construction discharges include, but are not limited to, stormwater runoff, snowmelt runoff, and groundwater (i.e., from dewatering) associated with construction activities. Construction discharges include controlled construction discharges (as defined in B.2) and uncontrolled construction discharges (such as overland flow on a side slope).

2. **Controlled Construction Discharges:** Controlled construction discharges are construction discharges where the rate of flow can be regulated such as from a construction settling basin or flocculation system.

3. **Mixing Zones:**

   a. **Complete Mixing Zone (CMZ):** A Complete Mixing Zone (CMZ) is the minimum DES approved distance or area in a Class B surface water that is needed to completely mix the construction discharge with the surface water. The CMZ begins at the point where the construction discharge enters the surface water and ends at a compliance station where the

discharge has completely mixed with the receiving water.

b. **Extended Mixing Zone (EMZ):** An Extended Mixing Zone (EMZ) is any DES approved mixing zone in a Class B surface water that exceeds the length of the CMZ. The EMZ begins at the point where the construction discharge enters the resource water and ends at a compliance station located at the end of the EMZ.

4. **Sampling Stations:**

   a. **Background:** Background stations (with the exception of historical background stations - see section E.4.c) are located upstream and beyond the influence of all construction discharges and are needed for determining compliance with turbidity water quality standards.

   b. **Compliance:** Compliance stations are located downstream of construction discharges and is where compliance with the turbidity standards in section E.9 must be met.

   c. **Discharge:** Discharge stations are located in controlled construction discharges just prior to mixing with a surface water (including wetlands) and is where the turbidity standards in section E.9.a. must be met.

   d. **Sentry:** Sentry stations are located between construction discharges and compliance stations and are typically used as an early warning system to determine if turbidity standards at compliance stations will be met.

5. **Workday:** A workday includes any time, day or night, that construction is active. Typical workdays are daylight hours, Monday through Friday, excluding holidays, but may be extended to include Saturdays, Sundays, and holidays if the contractor is anticipated to have crews on site for those days. If the typical workday is extended to include additional times, this shall be agreed to by all parties and documented in the weekly meeting minutes.

6. **Workweek:** A workweek consists of all scheduled workdays from Monday through Sunday.

C. Plan Requirements And Meetings

Preparation and maintenance of stormwater management plans and/or installation of temporary BMPs to control sediment and erosion during most Department of Transportation (DOT) construction projects are required by the following:

- The NPDES General Stormwater Permit for Discharges from Construction Activities (commonly known as the Construction General Permit or CGP) which requires development of Stormwater Pollution Prevention Plans (SWPPPs); and

- The Memorandum of Agreement (MOA) between the Department of Environmental Services (DES) and DOT which requires all construction projects contracted by, and under direct supervision of, the DOT to incorporate best management practices (BMPs) for erosion and sediment control and stormwater management, for each project that has the potential to significantly alter terrain.

1. **Stormwater Pollution Prevention Plan (SWPPP)**

   a. The SWPPP shall:

      i. Include a plan describing procedures to address and correct emergency construction related stormwater issues in an expeditious manner. The plan shall include the

responsibilities of key individuals, the availability of equipment, and the availability of erosion control and BMP supplies and require that all emergency erosion control and BMP supplies be kept on site.

ii. Prior to winter shutdown, require the construction site to be stabilized in accordance with Env-Wq 1505.03 and Env-Wq 1505.05.

iii. Require all construction settling basins (CSBs), alone or in combination, be sized to retain no less than the construction run-off volume of a 2-year 24-hour storm event on-site and managed to provide sufficient storage between precipitation events in order to prevent overflow, (i.e. uncontrolled releases) and violations of turbidity standards in surface waters. In addition, CSBs shall be managed to control no less than the 10-year, 24 hour storm event to prevent violations of turbidity water quality standards where control means other measures such as larger sized basins, use of pumps, active treatment or combinations thereof to control discharges and/or manage the volume of the 10-year 24-hour storm event

iv. Require all construction discharges to be treated to the maximum extent practicable with a goal of providing treatment for at least the 10 year storm that will meet turbidity water quality standards and removing particles larger than silt and clays [i.e., particles larger than the #270 sieve (0.053 mm)].

v. Include an Erosion Control Inspection and Maintenance Plan that satisfies the requirements of this Guidance and the CGP. The Inspection and Maintenance Plan is a required component of the SWPPP and shall be submitted to DES as specified in the 401 Certification, or at least 15 days prior to construction if requested by DES.

vi. Include a copy of this Guidance, a copy of the DES approved turbidity monitoring locations and mixing zones (if applicable) and any applicable conditions.

vii. Require that no earthmoving activities shall begin until the DOT has approved a SWPPP, meeting the requirements of the most recent CGP, the New Hampshire Code of Administrative Rules part Env-Wq 1505 and 1506, and the provisions of this Guidance.

b. In accordance with the CGP a current copy of the SWPPP shall be kept on site, or at an easily accessible location, and be made available to agencies and the public.

c. The DOT shall be responsible to ensure that the Contractor's SWPPP and appropriate BMP's are implemented.

2. Weekly Erosion Control Meetings and Minutes

a. The Contractor shall hold weekly erosion control meetings with the DOT and their erosion control consultant for the duration of the contract.

b. Minutes of the meeting shall be sent to DES within 3 calendar days of the meeting and to other interested parties upon request. The meeting minutes shall include the following:

i. Printed copies of each 24-hour precipitation forecast for the site for each day of the previous week, and a copy of the 5 day forecast on the day of weekly meeting.

ii. Any new or revised Mixing Zone requests, changes to active sampling locations and a list of all active sampling locations.

D. Inspection Requirements

The effectiveness of construction best management practices (BMPs) to reduce erosion and sedimentation can be evaluated through routine inspection and maintenance of the BMPs. The Erosion Control Inspection and Maintenance Plan (see section C.1.v) shall, at a minimum, meet or exceed (i.e., be more stringent than) the requirements stipulated in this section, Env-Wq 1506 and in Section 4.1 of the CGP..

1. Daily

a. All erosion control measures shall be inspected and maintained daily by the prime contractor from the time construction commences and earth is disturbed until construction is complete.

b. The erosion control consultant shall print the 24-hour precipitation forecast once daily (7-9 am) for the duration of the project. All precipitation forecasts shall be clearly marked with the date and time, kept on file, provided to the DOT Contract Administrator and be made available for other interested parties.

c. The erosion control consultant shall print the 5-day forecast once daily (7-9 am) for the duration of the project. All forecasts shall be clearly marked with the date and time, kept on file, provided to the DOT Contract Administrator and be made available for other interested parties. In addition, the 5-day forecast on the day of the weekly meeting shall be attached to the weekly meeting minutes distributed by the erosion control consultant.

2. Weekly

a. After construction has commenced and earth has been disturbed, the erosion control consultant shall conduct a weekly erosion control site inspection to verify all erosion control measures are maintained properly to protect surface waters (including wetlands).

b. The consultant shall document and report its findings, including recommendations for maintenance of in-place BMPs or the addition of new control measures to the DOT Contract Administrator and other interested parties.

3. Pre-Storm

a. Inspection shall occur within 24 hours prior to the start of any forecasted rain or rain-mix precipitation event of 0.5 inches or more in a 24-hour period that is predicted to occur during the workweek.

b. If the predicted event occurs outside of the workweek, the pre-storm inspection shall occur on the workday just before any scheduled days off, such as holidays and weekends.

c. Unless otherwise approved by DES, the Accuweather website (http://home.accuweather.com/index.asp?partner=accuweather) shall be used for the purpose of predicting future precipitation amounts and determining sunrise and sunset times. Future precipitation amounts on the Accuweather web site may be determined by typing in the location of the project (city, state and/or zip code), clicking on the link for Days 1-5 forecasts and then clicking on the day(s) of interest.

4. Storm Events

a. Inspections for erosion and sediment control performance shall occur whenever plumes are visible, turbidity sampling indicates water quality standards are exceeded or significant sediment deposits are observed in the surface water that are caused, or partially caused by construction discharges.

b. Inspections and corrective action shall be implemented until turbidity water quality standards are met and/or the source of significant sediment deposits is abated.

5. Post Storm

a. Inspections shall occur within 24 hours of the occurrence of 0.25 inches of rain or rain mix event in accordance with the CGP. If the inspection falls on a non-workday, the inspection shall take place on the next workday.

b. Inspections shall occur within 24 hours of the occurrence of 1.0 inch of rain or rain mix event regardless of whether it falls on a workday or non-workday.

c. For a multi-day rain or rain-mix precipitation event, inspections shall occur during each day that follows a day where 0.25 inches or more of rain or rain-mix precipitation has fallen.

d. Precipitation amounts shall be based on precipitation recorded at the weather station described in section E.1.

6. Winter Shutdown

a. Inspections during winter shutdown shall occur as specified in Section 4.1.4.3. of the CGP.

E. Monitoring

Erosion controls, particularly those that are improperly installed and/or maintained, may fail during storm events, potentially causing sediment discharge to surface waters. The extent of sediment discharge as a result of erosion control failures must be quantified to determine compliance with NH surface water quality standards. The turbidity sampling, as described below, is typically necessary only for storms that exceed 0.5 inches in a 24-hour period and/or when a turbidity violation, plume or significant sediment deposit is evident in the surface water as a result of construction discharges (as defined in section 6) from the site. Additional turbidity sampling, however, may be necessary for sites experiencing chronic water quality standard violations due to erosion control problems.

1. Weather

a. Weather Station Specifications: The prime contractor shall be responsible for providing and maintaining a weather station with the following specifications if included in the proposal. The weather station must be capable of measuring precipitation to an accuracy of 0.01 inch, monitor temperature to accuracy of 1 degree Fahrenheit or Celsius, hourly data storage and download, and remote access capabilities to allow automated email notifications.

b. Weather Station Location: The Contractor may use a DES approved off-site weather station, provided that the weather station has the capabilities described in Weather Station Specifications and is reasonably close to the construction area. Weather stations with those capabilities may include the DOT Traffic Management Center's (TMC) Roadway Weather Information System (RWIS) weather stations

c. Automated email notification:

i. Start of rain or rain-mix precipitation event: Once 0.25 inches of rain or rain-mix precipitation has been measured an automated email notification will be sent to the DOT, DES and any other interested parties. The email shall note the intensity of the precipitation.

ii. Continuation of rain or rain-mix precipitation event: Once 0.5 inches of rain or rain-mix precipitation has been measured an automated email notification will be sent to

the DOT, DES and any other interested parties. The email shall note the intensity of the precipitation.

iii. Continuation of rain or rain-mix precipitation event: Once 1.0 inches of rain or rain-mix precipitation has been measured an automated email notification will be sent to the DOT, DES and any other interested parties. The email shall note the intensity of the precipitation.

iv. End of precipitation event: Once six hours without rain or rain-mix precipitation has passed an automated email notification will be sent to the DOT, DES and any other interested parties.

v. The Contractor shall be responsible for obtaining an accurate account of precipitation from the agreed upon weather station and provide that information to the DOT, DES and other interested parties. This information shall be provided in the turbidity monitoring reports (section F.2).

d. If the approved weather station is inoperable, the nearest National Weather Service station with a rain gauge can be used temporarily and a plan shall be developed and implemented to repair and resume use of the approved weather station within two weeks, or as soon as possible.

2. Surface Waters

a. Definitions of background, discharge, sentry and compliance stations are provided in section B.4.

b. Turbidity monitoring at background, discharge, sentry, and compliance stations are typically designated for the project during the design phase, approved by DES, and included in the DOT contract documents. The contractor must monitor these locations from the time construction activities upstream of the compliance station disturb the earth's surface (including clearing) and until the construction area is permanently stabilized in accordance with Env-Wq 1505.03.

c. The DOT, with DES approval, may amend the list of active sampling locations. Any revisions to sampling locations and a list of all active sampling locations shall be documented in the weekly meeting minutes distributed by the erosion control consultant.

d. Sampling conducted to determine compliance with surface water quality standards shall account for lag time, which is the time it takes for water from the construction discharge to reach the DES approved surface water compliance sampling station. The Contractor shall submit and receive DES approval of lag time sampling protocols prior to construction discharges to the extended mixing zone (see section E.3).

e. Turbidity compliance criteria for surface waters are provided in section E.9.b.

f. If compliance with turbidity standards can be demonstrated downstream of all construction discharges but upstream of a DES approved compliance station, the compliance station does not need to be monitored.

g. For Class A waters, compliance sampling stations shall be within the receiving water and no more than 75 feet downstream of the construction discharge.

h. Turbidity sampling of background, sentry and compliance stations shall be in accordance with Table 1 and i. through v. below.

Table 1 - Number of turbidity samples at each station relative to stream width,

Stream/River Width (feet)	Number of Samples from Left Bank[a]	Number of Samples Between Left and Right Bank[b]	Number of Samples from Right Bank[a]
≤ 20	--	1 (mid-channel)	--
20 – 60	1	--	1
60 – 150	1	1	1
>150	1	2	1

[a] collected within plume; if plume is not visible, collect within 10-15 feet of bank
[b] collected equally spaced between samples from left and right banks

i. Rinse sampling container three times with water from the waterbody.

ii. Submerge sampling container a minimum of an arm's length upstream and allow the container to fill.

iii. Do not collect any water immediately adjacent to legs or boots.

iv. Ensure that any introduced air bubbles are removed prior to analysis.

v. Immediately cap the sample container.

i. Quality Assurance/ Quality Control

i. A duplicate measurement shall be made immediately after every 10th sample. The field sheets shall clearly indicate the duplicate measurement. If the relative difference between the duplicate measurement and the original measurement exceeds 10%, then recalibrate the turbidity meter and re-measure turbidity. If the difference is continually greater than 10%, then provide notice on field documentation and consult DES after the sampling is complete.

ii. A blank measurement shall also be made after every 10th sample. For blank measurements simply fill a sample container with deionized water and measure immediately following the measurement of the 10th sample.

iii. Turbidity Meters shall be calibrated every day sampling is conducted and prior to collection of the first sample.

j. Field Analysis and Meter Specifications:

i. Measure turbidity in the field using turbidity meters. All measurements shall be made immediately following sample collection.

ii. Unless otherwise approved by DES, use turbidity meters with an accuracy of ± 2% for readings below 100 NTU and ± 3% for readings above 100 NTU, and resolution of ± 0.1 NTU.

iii. Measuring Turbidity in the Laboratory: If unforeseen complications preclude the use of a field turbidity meter, collect turbidity samples for analysis in a laboratory in accordance with protocols approved by DES.

3. Mixing Zones

a. Definitions of Complete Mixing Zones (CMZs) and Extended Mixing Zones (EMZs) are provided in section B.3.

b. Mixing zones are only allowed in Class B waters; they are not allowed in Class A waters.

c. The compliance station at the end of a CMZ shall be approved by DES and established as follows:

   i. Lotic waterbodies (i.e. flowing waters such as rivers and streams) shall be sampled at a distance downstream of the construction discharge that meets at least one of the following three criteria:

      (1) No more than 75 feet;

      (2) No more than 10 times the average bank full width of the receiving stream (as measured within 25 feet downstream of the discharge point); or

      (3) No more than a distance equal to ½ the average cross-sectional area of the stream (as measured within 25 feet downstream of the discharge point).

   ii. Lentic waterbodies (i.e., waters with little to no discernible flow such as lakes, ponds, marshes, etc.) shall be sampled within or at the edge of the mixing area that does not exceed 5% of the lentic water surface area or 200 feet from the discharge point, whichever is more limiting.

d. All mixing zones (with the exception of those set up to address violations discussed in section E.6) must be pre-approved by DES. The DOT, with DES approval, may add or subtract from the list of active sampling locations and/or establish new or revised mixing zones that were not specified in the contract documents.

e. Any new or revised Mixing Zone requests, changes to active sampling locations and a list of all active sampling locations shall be documented in the weekly meeting minutes distributed by the erosion control consultant.

f. All mixing zones shall comply with Env-Wq 1707.

g. The equations provided in Figure 1(see section G of this Guidance) shall be used to determine compliance with turbidity standards of construction discharges to multiple mixing zones (CMZs and EMZs) in surface waters. An example demonstrating how compliance would be calculated for three construction discharges in series is included in Figure 1.

4. Backgrounds

a. Background sampling stations not specified in contract documents shall be located within the receiving waterbody and at least 50 feet upstream of any construction discharge and outside the zone of influence of any discharge to a lentic (i.e., non-flowing) waterbody.

b. If it is not possible to collect an upstream background sample (such as for compliance stations in the upper headwaters of a drainage area) background shall be set at 0 NTUs.

c. Historical Background: A DES approved historical background based on pre-construction turbidity measurements may be used for situations such as when there is no upstream background sampling location or for determining compliance.

   i. Historical backgrounds must be approved in writing by DES.

   ii. The contractor may request a historical background level from DES through DOT. This request shall include:

      (1) Results of a minimum of 10 turbidity measurements taken during at least 5

different storm events at locations approved by DES and at a time when there is no influence of construction activities from the project on turbidity levels.

(2) Turbidity monitoring results shall include the information specified in section F.2.

(3) If the area has been disturbed or cleared, include the date of disturbance.

iii. DES will then determine the historical background based on the median or other appropriate statistic.

d. If a compliance station has multiple upstream background stations or the number of background stations is modified, a composite background turbidity for determining compliance shall be determined using one of the following two methods:

i. A 2 year -24 hour runoff volume weighted average turbidity value based on each background station that is derived using engineering software such as HydroCAD or an approved equal. Calculations for determining the average runoff volume weighted composite background turbidity values shall be provided with the storm reports. An example calculation is provided below in section D.4.d.iii.

ii. The composite background turbidity value shall be set equal to the lowest turbidity reading or be based on a flow weighted average of turbidity measurements at the background stations. Flow estimates (in cubic feet per second) may be approximate and based on simple estimates of velocity (i.e., time it takes a stick to travel a known distance in feet per second) multiplied by the wetted cross sectional area (visual estimate of the average depth (in feet) multiplied by a visual estimate of the average width (in feet) of the flowing water). Flow calculations and calculations for determining the flow weighted composite background turbidity values shall be submitted with the storm reports.

iii. An example of how the composite background turbidity shall be computed based on predicted 2 year -24 hour storm volume is provided below:

Background Station	2 year - 24 hour storm volume (ac-ft)	Fraction of total volume	Turbidity Reading (NTU)
08-B1	1.3	0.22	20
08-B2	2.7	0.45	5
08-B3	2.0	0.33	12
	6.0		

Composite background turbidity = (0.22 x 20) + (0.45 x 5) + (0.33 x 12) = 10.6 NTU

5. Controlled Construction Discharges

a. Definitions of construction discharges and controlled construction discharges are provided in section B.

b. Design requirements for controlled construction discharges and construction settling basins are provided in section C.1.a.

c. Turbidity compliance criteria for controlled construction discharges are provided in section E.9.a.

d. Discharge sampling shall occur within the controlled construction discharge just prior to mixing with a surface water (including wetlands).

e. The frequency of turbidity monitoring of controlled construction discharges and associated

surface waters when controlled construction discharges occur shall comply with the monitoring requirements in Env-Wq 1506.12(j)(3)e of the NH Alteration of Terrain regulations (Env-Wq 1500). Sampling may be limited to just daily sampling of construction discharges from construction settling basin (CSBs) when flocculants are not being used, there is no new flow entering the CSBs that could increase the turbidity in the CSB and turbidity in the construction discharges from the CSBs are no greater than

i. 10 NTU above background taken during the precipitation event for Class B surface waters,

ii. a DES Approved Historical Background level, or

iii. 0 NTU above background taken during the precipitation event for Class A surface waters, respectively.

f. Controlled construction discharges from CSBs to surface waters shall be conducted during or soon (i.e., within approximately 72 hours) after a precipitation event, if necessary, to provide adequate storage in preparation for a predicted precipitation event. Unless otherwise directed by DES, releases beyond the 72-hour window are allowed if additional detention time will reduce the amount of sediment discharged to the receiving water.

g. When controlled construction discharges commence, loadings from the discharges to surface waters shall be gradually and incrementally increased in steps followed by compliance monitoring to ensure that turbidity standards in the discharge and surface waters are met.

i. If standards are met, loadings from the construction discharges may be gradually increased to the next level, followed by compliance monitoring, and so on.

ii. If compliance cannot be met, the turbidity loading from the construction discharges shall be immediately and substantially reduced by either reducing the turbidity in the discharges (i.e., via further treatment) and/or reducing the construction discharge flow rates so that turbidity standards are once again attained as soon as possible.

h. Once monitoring from a controlled construction discharge as described in E.5.g.ii above indicates a return to compliance with turbidity standards, and if the system is deemed capable of meeting turbidity standards, flow from the construction discharge to surface waters may be gradually increased in small increments, followed by compliance monitoring (starting at hour one) to confirm that turbidity standards are met.

i. If the controlled construction discharge exceeds the criteria in section E.9 or the compliance point exceeds water quality standards, sampling shall be conducted in the surface water to document the duration and extent of any water quality violation at a frequency of at least one sample round every hour until turbidity standards are met. The monitor shall also sample the extent of the violation by sampling downstream every 100 feet until the resource meets water quality standards.

j. Should violations continue for longer than 3 hours, flow from the pertinent construction discharges to the surface water shall immediately cease and the treatment system shall be assessed to determine if it is capable of discharging without resulting in a turbidity standards violation. Turbidity sampling shall continue until the water quality standards have been met at the compliance point or until sunset. If sampling is suspended due to darkness the violation is assumed to continue and sampling shall resume within one hour of sunrise on the following day.

6. Plumes, Violations of Turbidity Standards or Evidence of Sediment Deposits

a. Hourly turbidity sampling of individual locations is required whenever plumes are visible due

to construction discharges from the site, when sampling results indicate that a violation of the turbidity standards is occurring or when significant sediment deposits are observed in the surface water that are due or partially due to construction discharges. Turbidity monitoring shall commence within 2 hours of the discovery of a violation.

b. Whenever a turbidity plume is observed, or surface water quality sampling indicates that there is a violation of the turbidity standard at the compliance point, the following actions shall be taken by the monitor:

   i. Immediately contact the Contractor and the NHDOT Contract Administrator to take remedial action, as needed.

   ii. The Contractor shall take appropriate corrective actions until the condition causing the violation has been identified and corrected.

   iii. Set up a Complete Mix Mixing Zone (CMZ) around the suspected discharge (Plume) with its corresponding background, and compliance stations (see E.3.c.).

   iv. Begin sampling the background, discharge, and compliance. If the turbidity standard cannot be met at the compliance station, continue sampling downstream (for lotic - flowing waters), or away (for lentic - non-flowing waters) from the compliance point, at approximately 100 foot intervals, until turbidity standards have been met to document the extent of the water quality violation.

   v. Continue hourly sampling as needed to document both the extent and duration of the violation. If sampling must be suspended due to darkness, sampling shall continue within one hour of sunrise the next day, and continue until compliance is obtained.

   vi. Include all sampling data with a chronology of actions taken to correct the situation in the turbidity monitoring report, as specified in section F.2.

c. Unless otherwise required by DES, sampling shall occur during daylight hours only. If the event extends past sunset the violation is assumed to continue and sampling shall recommence within 1 hour of sunrise of the following day.

7. Precipitation Events

a. Definitions of workday and workweek are in section B.

b. For storms forecasted to be less than 0.5 inches, and when the actual rain or rain mix accumulation is less than 0.5 inches, no turbidity sampling is required.

c. Workday Sampling: For storms forecasted to be greater than 0.5 inches in 24 hours that begin during a workday:

   i. Begin sampling within 2 hrs after at least 0.25 inch of rain or rain mix has fallen and every hour thereafter that stormwater discharges from the site occur, up to four hours or sunset, whichever comes sooner.

   ii. Sampling shall occur during daylight hours unless controlled construction discharges are occurring or unless otherwise directed by DES through DOT.

   iii. If the 0.25 inch rain notification is received between sunset and sunrise of two workdays, sampling shall start within one hour of sunrise and continue every hour thereafter that stormwater discharges from the site occur, up to four hours or until sunset. If an end rainfall notification is received before sunrise sample each sample site once commencing within an hour of sunrise and include result with the post-rainfall inspection report.

iv. If the 0.25 inch rain notification is received during a workday followed by another workday and it is less than four hours to sunset:

(1) The monitor shall attempt to complete as many rounds of sampling prior to sunset. Sampling shall be suspended at sunset but shall resume within one hour of sunrise and continue every hour thereafter that construction stormwater discharges from the site occur, up to four hours.

(2) If it is less than 2 hours to sunset at the time of the notification sampling may begin within an hour of sunrise on the following workday.

(3) If an end rainfall notification is received before sunrise sample each sample site once commencing within an hour of sunrise and include results with the post-rainfall inspection report.

v. If the storm starts and the 0.25 inch rain notification is received within 2 hours of sunset on a workday, followed by a non-workday no sampling is required if less than 1.0 inch of rain or rain-mix accumulates.

d. Workday Sampling: For storms forecasted to be less than 0.50 inches in 24 hours but which exceed 0.50 inches in 24 hours:

i. Begin sampling within 2 hours after 0.50 inches of rain or rain-mix has fallen and every hour thereafter during the workday that stormwater discharges from the site occur, up to four hours.

ii. Sampling shall occur during daylight hours unless controlled construction discharges are occurring or unless otherwise directed by DES through DOT.

iii. If the 0.5 inch rain notification is received between sunset and sunrise of two workdays, sampling shall start within one hour of sunrise and continue every hour thereafter that stormwater discharges from the site occur, up to four hours or until sunset. If an end rainfall notification is received before sunrise sample each sample site once commencing within an hour of sunrise and include result with the post-rainfall inspection report.

iv. If the 0.5 inch rain notification is received during a workday followed by another workday and it is less than four hours to sunset:

(1) The monitor shall attempt to complete as many rounds of sampling prior to sunset. Sampling shall be suspended at sunset but shall resume within one hour of sunrise and continue every hour thereafter that stormwater discharges from the site occur, up to four hours.

(2) If it is less than 2 hours to sunset at the time of the notification sampling may begin within an hour of sunrise on the following workday.

(3) If an end rainfall notification is received before sunrise sample each sample site once commencing within an hour of sunrise and include results with the post-rainfall inspection report.

v. If the 0.5 inch rain notification is received within 2 hours of sunset of a workday followed by a non-workday no sampling will be required if less than 1.0 inch of rain or rain-mix accumulates. If greater than 1.0 inch of rain falls sampling shall start within 1 hour of sunrise on the following day and continue every hour thereafter that stormwater discharges from the site occur, up to four hours. If an end rainfall notification is received before sunrise sample each sample site once and include

result with the post-rainfall inspection report.

e. Non-Workday Sampling: For storms forecasted to be less than 1.0 inches, and when the actual rain or rain mix is less than 1.0 inch no turbidity sampling required on a non-workday.

f. Non-Workday Sampling: For forecasted storms greater than 1.0 inch in 24 hours:

   i. Begin sampling within 2 hours after 0.50 inches of rain or rain mix has fallen and every hour thereafter during the non-workday that stormwater discharges from the site occur, up to four hours.

   ii. Sampling shall occur during daylight hours unless controlled construction discharges are occurring or unless otherwise directed by DES through DOT.

   iii. If the 0.5 inch notification is received between sunset and sunrise sampling shall start within 1 hour of sunrise the following day and continue every hour thereafter that stormwater discharges from the site occur, up to four hours. If an end rainfall notification is received before the next day sample each sample site once and include result with the post-rainfall inspection report.

g. Non-Workday Sampling: For storms not forecasted to be greater than 1.0 inch in 24 hours but which exceed 1.0 inches in 24 hours:

   i. Begin sampling within 2 hours after 1.0 inches of rain or rain mix has fallen and every hour thereafter during the non-workday that stormwater discharges from the site occur, up to four hours.

   ii. Sampling shall occur during daylight hours unless controlled construction discharges are occurring or unless otherwise directed by DES through DOT.

   iii. If the 1.0 inch notification is received between sunset and sunrise sampling shall start at sunrise the next day and continue every hour thereafter that stormwater discharges from the site occur, up to four hours. If an end rainfall notification is received before sunrise sample each sample site once and include result with the post-rainfall inspection report

h. Fast Moving Isolated Storms: For storms not forecasted to be greater than 1.0 inch in 24 hours but which exceed 0.25 inches and the storm in question was a fast moving isolated storm (such as a summer thunder storm), the monitor shall mobilize within 2 hours and conduct a single round of sampling. If it is determined that there is no discharge leaving the site and the weather and radar indicate no further rain or rain mix, no further sampling is required. However, if an additional 0.25 inches of precipitation is recorded the monitor must return to the site and complete the unfinished rounds.

i. Sampling requirements for events that are all snow or during Winter Shutdown are provided in section E.10.b and E.10.c respectively.

8. Sediment Deposition Inspections

a. Inspection Prior to Construction:

   i. Prior to commencement of construction activities, the contractor shall set up locations every 50 to 100 feet along the Extended Mixing Zone that will function as the standard observation points for benthic observation.

   ii. Pictures shall be taken of all standard observation points and visual observation of all accessible portions of mixing zones shall occur to document sediment conditions prior to commencement of construction activities in the upstream watershed.

b. Inspection During Construction:

i. All accessible portions of Mixing Zones that receive controlled construction discharges at turbidity levels greater than 30 NTUs, shall be visually inspected and photographs taken along standard observation points within 7 days of when such controlled construction discharges occur to determine if construction related discharges have resulted in significant sediment deposits that would have detrimental impact on the benthic communities.

9. Turbidity Compliance Criteria and Thresholds

a. In Controlled Construction Discharges:

i. Controlled Construction Discharges to Class A waters shall not exceed 0 NTUs above background taken during the precipitation event or 0 NTUs above a DES approved historical background.

ii. Controlled Construction Discharges to Class B waters shall not exceed 50 NTUs.

b. In Surface Waters at Compliance Locations:

i. Surface waters within Class A watersheds shall not exceed 0 NTUs above background taken during the precipitation event or 0 NTUs above a DES approved historical background.

ii. Surface waters within Class B watershed shall not exceed 10 NTUs above background taken during a precipitation event or 10 NTUs above a DES approved historical background.

10. Relief of Monitoring Requirements

a. If sampling results for at least 5 consecutive events indicate that turbidity standards are being met, and the area in question has been stabilized in accordance with Env-Wq 1505.03, a request can be made to DES through DOT to suspend or reduce the turbidity monitoring requirements.

b. Turbidity sampling for events that are only snow shall not be required. If the event is a mixed precipitation event it shall be at the discretion of DES if sampling is necessary after consultation with the DOT field staff.

c. Turbidity sampling during winter shutdown shall not be required, provided the site is stabilized in accordance with Env-Wq 1505.03 and Env-Wq 1505.05 and unless there is evidence of in-stream turbidity violations during this time (i.e., visual plumes or turbidity measurements conducted according to DES accepted protocol). If turbidity violations are found to exist, monitoring and reporting shall commence within 24 hours of discovery of the violation, and shall be conducted in accordance with the requirements of this Guidance. If the site is not stabilized prior to winter shutdown in accordance with Env-Wq 1505.03 and Env-Wq 1505.05, DES may require additional turbidity monitoring to confirm there are no turbidity violations during winter shutdown.

F. Reporting

1. BMP Inspection and Maintenance Reports

a. Written inspection and maintenance reports shall be conducted as prescribed in Section 4.1.7 of the CGP and Env-Wq 1505.02 and made available to DES, the DOT Contract Administrator and other interested parties, upon request.

b. Minimum Required information:

i. Predicted 24-hour precipitation for pre-storm inspection reports and measured precipitation amounts for post-inspection reports;

ii. Total project area, including but not limited to cleared area, active construction area, temporally stabilized area and permanently stabilized area;

iii. A determination if erosion control measures during dry weather inspections are properly installed;

iv. Determinations if erosion control measures during wet weather inspections are properly installed and functioning adequately to protect surface water quality;

v. A summary describing all corrective actions taken to resolve any deficient erosion control measures and the time it took to resolve them; and

vi. Pictures of the general condition of the site and deficient BMPs.

2. Turbidity Monitoring Reports

a. Turbidity monitoring reports shall contain all water quality sampling results, as required by this Guidance, compiled into a table or spreadsheet, along with a descriptive narrative or summary that includes the following:

i. Date(s) of sampling;

ii. Names of samplers and report preparer;

iii. Sunrise and sunset times;

iv. Predicted and actual precipitation amounts;

v. Time and amount of precipitation notification;

vi. Start and end times of sampling;

vii. Summary of sampling results including duplicates and blanks;

viii. Time when meter calibration was conducted and calibration results:

ix. Summary of any exceedances of the turbidity compliance criteria and thresholds and a summary of corrective actions, if needed; and

b. DOT and DES shall be notified of all non-compliance events immediately.

c. DOT and DES shall receive a full report within 24 hours of discovery of a non-compliance event.

d. DOT and DES shall receive all turbidity-monitoring reports within two days of completion of the event.

e. All reporting shall be transmitted to DES and DOT via electronic mail.

3. Sediment Deposit Monitoring Reports

a. Sediment Deposit monitoring reports shall contain information to allow DES to determine if an event had detrimental impacts on the benthic communities. Reports shall include the following:

i. Descriptive narrative and summary;

ii. Date(s) of monitoring;

iii. Names of the persons who conducted the monitoring and prepared the report;

iv. All water quality sampling results pertinent to the event;

v. A compiled table or spreadsheet of field measurements;

vi. Pictures with appropriate labels and a plan showing the location of where the pictures were taken;

vii. The field data form for recording benthic deposit observations; and

viii. Duration, estimated volume and estimated rates of controlled construction discharges, unless waived by DES.

b. DOT and DES shall be notified of all non-compliance events on the same day that they were discovered.

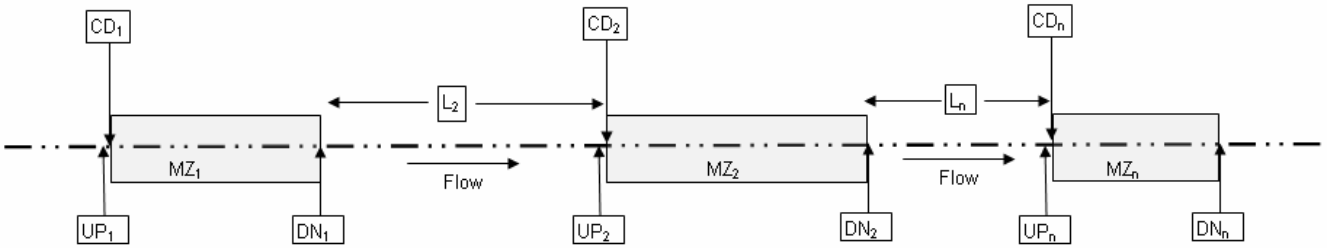
c. DOT and DES shall receive a full report within 24 hours of discovery of a non-compliance event.

d. DOT and DES shall receive the pre-construction sediment monitoring report (section E.8.a) within one month of when it was conducted.

e. DOT and DES shall receive all other sediment monitoring reports within a week of completion of the event. This requirement may be relaxed to monthly upon approval by DOT and DES.

f. All reporting shall be transmitted to DES and DOT via electronic mail.

G. Figure 1



Turbidity Compliance Equations: **The maximum allowable turbidity in NTUs at the downstream boundary of the mixing zone for CDn shall be equal to the greater of** $10 + UP_n - [RF_n \times (DN_{n-1} - UP_{n-1})]$ or $10 + DN_{n-1}$

where:

CD_n = The Construction Discharge (CD) of interest

UP_n = the measured turbidity concentration upstream of the CD of interest (NTU)

DN_n = the measured turbidity concentration at the downstream boundary of the mixing zone for the CD of interest (NTU)

MZ_n = the length of the Mixing Zone (MZ) of interest (ft)

L_n = the distance from the end of the mixing zone for the upstream CD to the CD of interest (ft)

RF_n = Reduction Factor for the CD of interest which is a function of Ln as shown in the table below:

L_n (ft)	RFn
≤ 500	1
> 500 ≤ 1000	0.75
>1000 ≤ 1500	0.5
>1500 ≤ 2000	0.25
>2000	0

Example: **Calculation of maximum allowable turbidity for 3 construction discharges in series (CD_1, CD_2 and CD_3 - see diagram above)**

CD_n	L_n (ft)	UP_n (NTU)	DN_n (NTU)	RF_n	$10 + UP_n - [RF_n \times (DN_{n-1} - UP_{n-1})]$	$10 + DN_{n-1}$	Max Allowable Turbidity at DN_n (NTU)	Comments
CD_1		21	30		10+ 21 = **31**	10 + 0 = 10	**31**	In compliance since measured DN of 30 is < 31 NTU
CD_2	1200	32	42	0.5	10 + 32 - [0.5 x (30-21)] = 37.5	10 + 30 = **40**	**40**	Violation since measured DN of 42 is > 40 NTU
CD_3	1700	50	55	0.25	10 + 50 - [0.25 x (42-32)] = **57.5**	10 + 42 = 52	**57.5**	In compliance since measured DN of 55 is < 57.5 NTU

APPENDIX 2
Monitoring Locations

Station AWE-C-2
Lat: 43.076028
Long: -72.007126

SD-1

Keene Rd

Keene Rd

Russell Rd

Old Cemetery Rd

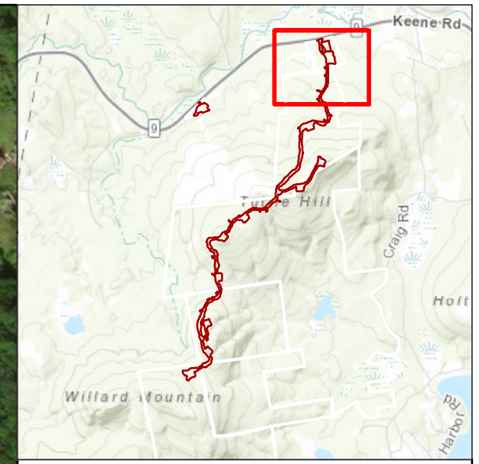
High Range Rd

AN-17

Station AWE-C-1
Lat: 43.071684
Long: -72.006647

SD-4

Station AWE-B-1
Lat: 43.070698
Long: -72.005733



Legend

- Water Quality Monitoring Station
- Culvert
- Proposed Disturbance Area
- Wetlands
- Perennial Stream
- Intermittent Stream
- Drainage

N

0 125 250 500

Feet

Antrim Wind Energy

ANTRIM WIND ENERGY PROJECT
ANTRIM, NH

Water Quality Monitoring Stations

Produced by: TRC

1/29/2018

APPENDIX 3
Standard Operating Procedure:
Calibration of Field Instruments

STANDARD OPERATING PROCEDURE
CALIBRATION OF FIELD INSTRUMENTS
(temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction potential [ORP], and turbidity)

Quality Assurance Unit
U.S. Environmental Protection Agency – Region 1
11 Technology Drive
North Chelmsford, MA 01863

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Prepared by: _____ 3/23/17
(Robert Reinhart, Quality Assurance Unit) Date

Approved by: _____ 3/23/17
(John Smaldone, Quality Assurance Unit) Date

Revision Page

Date	Rev #	Summary of changes	Sections
6/03/98	1	Draft	
01/19/10	2	Finalized	
3/23/17	3	Updated	All sections

Table of Contents

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide a framework for calibrating field instruments used to measure water quality parameters for groundwater and surface water. Water quality parameters include temperature, pH, dissolved oxygen, specific conductance, oxidation/reduction potential [ORP], and turbidity. This SOP supplements, but does not replace, EPA analytical methods listed in 40 CFR 136 and 40 CFR 141 for temperature, dissolved oxygen, conductivity/specific conductance, pH and turbidity.

This SOP is written for instruments that measure temperature, pH, dissolved oxygen, specific conductance, turbidity, and/or oxidation/reduction potential [ORP] and the probe readings for pH, dissolved oxygen, and specific conductance are automatically corrected for temperature.

For groundwater monitoring, the instrument must be equipped with a flow-through-cell and the display/logger or computer display screen needs to be large enough to simultaneously contain the readouts of each probe in the instrument. Turbidity is measured using a separate instrument. It must not be measured in a flow-through-cell because the flow-through-cell acts as a sediment trap. This procedure is applicable for use with the *EPA Region 1 Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells.*

2.0 HEALTH AND SAFETY WARNINGS

Read all labels on the standards and note any warnings on the labels. Wear appropriate personal protection equipment (e.g., gloves, eye shields, etc.) when handling the standards. If necessary, consult the Safety Data Sheets (SDS) for additional safety information on the chemicals in the standards.

3.0 GENERAL

All monitoring instruments must be calibrated before they are used to measure environmental samples. For instrument probes that rely on the temperature sensor (pH, dissolved oxygen, specific conductance, and oxidation/reduction potential [ORP]), each temperature sensor needs to be checked for accuracy against a thermometer that is traceable to the National Institute of Standards and Technology (NIST). Before any instrument is calibrated or used to perform

environmental measurements, the instrument must stabilize (warm-up) according to manufacturer's instructions and must have no air bubbles lodged between the probe and probe guard.

Most projects will require at least two standards to bracket the expected measurement range. This means that one standard is less than the expected value and one is higher. When an environmental sample measurement falls outside the calibration range, the instrument must be re-calibrated to bracket the new range before continuing measurements. Otherwise, the measurements that are outside the calibration range will need to be qualified.

This SOP requires that the manufacturer's instruction manual (including the instrument specifications) accompany the instrument into the field.

4.0 FREQUENCY OF CALIBRATION

At a minimum, the instrument is calibrated prior to use on the day the measurements are to be performed. A post calibration check at the end of the day is performed to determine if the instrument drifted out of calibration. Some projects may require more frequent calibration checks throughout the day in addition to the check at the end of the day. For these checks, the instrument can be recalibrated during the day if the instrument drifted out of calibration and only the data measured prior to the check would need to be qualified. The calibration/post calibration data information is recorded in Table 1.

Instruments (e.g., sonde) that monitor continuously over a period of time are calibrated before deployment. When these instruments are recovered, the calibration is checked to determine if any of them drifted out of calibration.

Some instruments lose their calibration criteria when they are turned off. Those instruments can either be left on all day (battery dependent) or calibrated at each sampling location.

Ideally, the temperature of the standards should be close to the temperature of the ambient water that is being measured.

5.0 CALIBRATION PROCEDURES

Prior to calibration, all instrument probes and cable connections must be cleaned and the battery

checked according to the manufacturer's instructions. Failure to perform these steps (proper maintenance) can lead to erratic measurements.

If a multi-probe instrument is to be used, program the instrument to display the parameters to be measured (e.g., temperature, pH, percent dissolved oxygen, mg/L dissolved oxygen, specific conductance, and ORP).

The volume of the calibration solutions must be sufficient to cover both the probe and temperature sensor (see manufacturer's instructions for the volume to be used).

Check the expiration date of the standards. Do not use expired standards.

All standards are stored according to manufacturer instructions.

5.1 TEMPERATURE

Most instrument manuals state there is no calibration of the temperature sensor, but the temperature sensor must be checked to determine its accuracy. This accuracy check is performed at least once per year and the accuracy check date/information is kept with the instrument. If the accuracy check date/information is not included with the instrument or the last check was over a year, the temperature sensor accuracy needs to be checked at the beginning of the sampling event. If the instrument contains multiple temperature sensors, each sensor must be checked. This procedure is not normally performed in the field. If the instrument is obtained from a rental company, the rental company should perform the calibration check and include with the instrument documentation that it was performed.

Verification Procedure

1. Fill a container with water and adjust the water temperature to below the water body's temperature to be measured. Use ice or warm water to adjust the temperature.

2. Place a thermometer that is traceable to the National Institute of Standards and Technology (NIST) and the instrument's temperature sensor into the water. Wait for both temperature readings to stabilize.

3. Compare the two measurements. The instrument's temperature sensor must agree with the reference thermometer measurement within the accuracy of the sensor (e.g., ±0.2°C). If the measurements do not agree, the instrument may not be working

properly and the manufacturer needs to be consulted.

4. Adjust the water temperature to a temperature higher than the water body to be measured.

5. Compare the two measurements. The instrument's temperature sensor must agree with the reference thermometer measurement within the accuracy of the sensor (e.g., ±0.2°C). If the measurements do not agree, the instrument may not be working properly and the manufacturer needs to be consulted.

5.2 pH (electrometric)

The pH of a sample is determined electrometrically using a glass electrode.

Choose the appropriate buffered standards that will bracket the expected values at the sampling locations. If the water body's pH is unknown, then three standards are needed for the calibration: one close to 7, one at least two pH units below 7, and the other at least two pH units above 7. Instruments that will not accept three standards will need to be re-calibrated if the water sample's pH is outside the initial calibration range described by the two standards.

Calibration Procedure

1. Allow the buffered standards to equilibrate to the ambient temperature.

2. Fill calibration containers with the buffered standards so each standard will cover the pH probe and temperature sensor.

3. Remove probe from its storage container, rinse with deionized water, and remove excess water.

4. Select measurement mode. Immerse probe into the initial standard (e.g., pH 7).

5. Wait until the readings stabilize. If the reading does not change within 30 seconds, select calibration mode and then select "pH". Enter the buffered standard value into instrument.

6. Remove probe from the initial standard, rinse with deionized water, and remove excess water.

7. Immerse probe into the second standard (e.g., pH 4). Repeat step 5.

8. Remove probe from the second standard, rinse with deionized water, and remove excess water. If instrument only accepts two standards, the calibration is complete. Go to step 11. Otherwise continue.

9. Immerse probe in third buffered standard (e.g., pH 10) and repeat step 5.

10. Remove probe from the third standard, rinse with deionized water, and remove excess water.

11. Select measurement mode, if not already selected. To ensure that the initial calibration standard (e.g., pH 7) has not changed, immerse the probe into the initial standard. Wait for the readings to stabilize. The reading should read the initial standard value within the manufacturer's specifications. If not, re-calibrate the instrument. If re-calibration does not help, consult the manufacturer or replace the unit.

12. The calibration is complete. Rinse the probe with deionized water and store the probe according to manufacturer's instructions.

13. Record the calibration information on Table 1.

5.3 DISSOLVED OXYGEN

Dissolved oxygen (DO) content in water is measured using a membrane electrode. To ensure proper operation, the DO probe's membrane and electrolyte should be replaced prior to calibration for the sampling event. The new membrane may need to be conditioned before it is used; consult manufacturer's manual on how the conditioning is to be performed. Failure to perform this step may lead to erratic measurements. Before performing the calibration/measurements, inspect the membrane for air bubbles and nicks.

Note: Some manufacturers require an altitude correction instead of a barometric correction. In that case, enter the altitude correction according to the manufacturer's directions in Step 5 and then proceed to Step 6.

Note: Some instruments have a built-in barometer. Follow the manufacturer's instructions for

entering the barometric value in step 5.

Calibration Procedure

1. Gently dry the temperature sensor and remove any water droplets from the DO probe's sensor membrane according to manufacturer's instructions. Note that the evaporation of moisture on the temperature sensor or DO probe may influence the readings during calibration.

2. Create a 100 percent water-saturated air environment by placing a wet sponge or a wet paper towel on the bottom of the DO calibration container. Place the DO probe into the calibration container. The probe is loosely fitted into the calibration container to prevent the escape of moisture evaporating from the sponge or paper towel while maintaining ambient pressure (see manufacturer's instructions). Note that the probe and the temperature sensor must not come in contact with these wet items.

3. Allow the confined air to become saturated with water vapor (saturation occurs in approximately 10 to 15 minutes). During this time, turn on the instrument to allow the DO probe to warm-up. Select the measurement mode. Check the temperature readings. Readings must stabilize before continuing to the next step.

4. Select calibration mode; then select "DO %".

5. Enter the local barometric pressure (usually in mm of mercury) for the sampling location into the instrument. This measurement must be determined from an on-site barometer. Do not use barometric pressure obtained from the local weather services unless the pressure is corrected for the elevation of the sampling location. [Note: inches of mercury times 25.4 mm/inch equals mm of mercury or consult Oxygen Solubility at Indicated Pressure chart attached to the SOP for conversion at selected pressures].

6. The instrument should indicate that the calibration is in progress. After calibration, the instrument should display percent saturated DO.

7. Select measurement mode and set the display to read DO mg/L and temperature. Compare the DO mg/L reading to the Oxygen Solubility at Indicated Pressure chart attached to the SOP. The numbers should agree. If they do not agree within the accuracy of the instrument (usually ± 0.2 mg/L), repeat calibration. If this does not work, change the membrane and electrolyte solution.

8. Remove the probe from the container and place it into a 0.0 mg/L DO solution (see footnote). Check temperature readings. They must stabilize before continuing.

9. Wait until the "mg/L DO" readings have stabilized. The instrument should read less than 0.5 mg/L (assuming an accuracy of ± 0.2 mg/L). If the instrument reads above 0.5 mg/L or reads negative, it will be necessary to clean the probe, and change the membrane and electrolyte solution. If this does not work, try a new 0.0 mg/L DO solution. If these changes do not work, contact the manufacturer. Note: some projects and instruments may have different accuracy requirements. The 0.5 mg/L value may need to be adjusted based on the accuracy requirements of the project or instrument.

10. After the calibration has been completed, rinse the probe with deionized water and store the probe according to manufacturer's instructions. It is important that all of the 0.0 mg/L DO solution be rinsed off the probe so as not to effect the measurement of environmental samples.

11. Record calibration information on Table 1.

Note: You can either purchase the 0.0 mg/L DO solution from a vendor or prepare the solution yourself. To prepare a 0.0 mg/L DO solution, follow the procedure stated in Standard Methods (Method 4500-O G). The method basically states to add excess sodium sulfite (until no more dissolves) and a trace amount of cobalt chloride (read warning on the label before use) to water. This solution is prepared prior to the sampling event. Note: This solution can be made without cobalt chloride, but the probe will take longer to respond to the low DO concentration.

5.4 SPECIFIC CONDUCTANCE

Conductivity is used to measure the ability of an aqueous solution to carry an electrical current. Specific conductance is the conductivity value corrected to 25°C.

Most instruments are calibrated against a single standard which is near the specific conductance of the environmental samples. The standard can be either below or above the specific conductance of the environmental samples. A second standard is used to check the linearity of the instrument in the range of measurements.

When performing specific conductance measurement on groundwater or surface water and the

measurement is outside the initial calibration range defined by the two standards, the instrument will need to be re-calibrated using the appropriate standards.

Specific Conductance Calibration Procedure

1. Allow the calibration standards to equilibrate to the ambient temperature.

2. Fill calibration containers with the standards so each standard will cover the probe and temperature sensor. Remove probe from its storage container, rinse the probe with deionized water or a small amount of the standard (discard the rinsate), and place the probe into the standard.

3. Select measurement mode. Wait until the probe temperature has stabilized.

4. Select calibration mode, then specific conductance. Enter the specific conductance standard value. Make sure that the units on the standard are the same as the units used by the instrument. If not, convert the units on the standard to the units used by the instrument.

5. Select measurement mode. The reading should remain within manufacturer's specifications. If it does not, re-calibrate. If readings continue to change after re-calibration, consult manufacturer or replace calibration solution.

6. Remove probe from the standard, rinse the probe with deionized water or a small amount of the second standard (discard the rinsate), and place the probe into the second standard. The second standard will serve to verify the linearity of the instrument. Read the specific conductance value from the instrument and compare the value to the specific conductance on the standard. The two values should agree within the specifications of the instrument. If they do not agree, re-calibrate. If readings do not compare, then the second standard may be outside the linear range of the instrument. Use a standard that is closer to the first standard and repeat the verification. If values still do not compare, try cleaning the probe or consult the manufacturer.

7. After the calibration has been completed, rinse the probe with deionized water and store the probe according to manufacturer's instructions.

8. Record the calibration information on Table 1.

Note: For projects where specific conductance is not a critical measurement it may be possible to calibrate with one standard in the range of the expected measurement.

5.5 OXIDATION/REDUCTION POTENTIAL (ORP)

The oxidation/reduction potential is the electrometric difference measured in a solution between an inert indicator electrode and a suitable reference electrode. The electrometric difference is measured in millivolts and is temperature dependent.

Calibration or Verification Procedure

1. Allow the calibration standard (a Zobell solution: read the warning on the label before use) to equilibrate to ambient temperature.

2. Remove the probe from its storage container and place it into the standard.

3. Select measurement mode.

4. Wait for the probe temperature to stabilize, and then read the temperature.

5. If the instrument is to be calibrated, do Steps 6 and 7. If the instrument calibration is to be verified, then go to Step 8.

6. Look up the millivolt (mv) value at this temperature from the millivolt versus temperature correction table usually found on the standard bottle or on the standard instruction sheet. You may need to interpolate millivolt value between temperatures. Select “calibration mode”, then “ORP”. Enter the temperature-corrected ORP value into the instrument.

7. Select measurement mode. The readings should remain unchanged within manufacturer’s specifications. If they change, re-calibrate. If readings continue to change after re-calibration, try a new Zobell solution or consult manufacturer. Go to Step 9.

8. If the instrument instruction manual states that the instrument is factory calibrated, then verify the factory calibration against the Zobell solution. If they do not agree within the specifications of the instrument, try a new Zobell solution. If it does not agree, the

instrument will need to be re-calibrated by the manufacturer.

9. After the calibration has been completed, rinse the probe with deionized water and store the probe according to manufacturer's instructions.

10. Record the calibration information on Table 1.

5.6 TURBIDITY

The turbidity method is based upon a comparison of intensity of light scattered by a sample under defined conditions with the intensity of light scattered by a standard reference suspension. A turbidimeter is a nephelometer with a visible light source for illuminating the sample and one or more photo-electric detectors placed ninety degrees to the path of the light source. Note: the below calibration procedure is for a turbidimeter which the sample is placed into a cuvette.

Some instruments will only accept one standard. For those instruments, the second, third, etc., standards will serve as check points.

Calibration Procedures

1. Allow the calibration standards to equilibrate at the ambient temperature. The use of commercially available polymer primary standards (AMCO-AEPA-1) is preferred; however, the standards can be prepared using Formazin (read the warning on the label before use) according to the EPA analytical Method 180.1. Other standards may be used if they can be shown that they are equivalent to the previously mentioned standards.

2. If the standard cuvette is not sealed, rinse a cuvette with deionized water. Shake the cuvette to remove as much water as possible. Do not wipe dry the inside of the cuvette because lint from the wipe may remain in the cuvette. Add the standard to the cuvette.

3. Before performing the calibration procedure, make sure the cuvettes are not scratched and the outside surfaces are dry and free from fingerprints and dust. If the cuvette is scratched or dirty, discard or clean the cuvette respectively. Note: Some manufacturers require the cuvette to be orientated in the instrument in a particular direction for accurate reading.

4. Select a low value standard such as a zero or 0.02 NTU and calibrate according to manufacturer's instructions. Note: a zero standard (approximately 0 NTU) can be prepared by passing distilled water through a 0.45 micron pore size membrane filter.

5. Select a high standard and calibrate according to manufacturer's instructions or verify the calibration if instrument will not accept a second standard. In verifying, the instrument should read the standard value to within the specifications of the instrument. If the instrument has range of scales, check each range that will be used during the sampling event with a standard that falls within that range.

6. Record the calibration information on Table 1.

6.0 POST CALIBRATION CHECK

After the initial calibration is performed, the instrument's calibration may drift during the measurement period. As a result, you need to determine the amount of drift that occurred after collecting the measurements. This is performed by placing the instrument in measurement mode (not calibration mode) and placing the probe in one or more of the standards used during the initial calibration; for turbidity place the standard in a cuvette and then into the turbidimeter. Wait for the instrument to stabilize and record the measurement (Table 1). Compare the measurement value to the initial calibration value. This difference in value is then compared to the drift criteria or post calibration criteria described in the quality assurance project plan or the sampling and analysis plan for the project. If the check value is outside the criteria, then the measurement data will need to be qualified.

For the dissolved oxygen calibration check, follow the calibration instructions steps one through three while the instrument is in measurement mode. Record dissolved oxygen value (mg/L), temperature, and barometric pressure. Compare the measurement value to the Oxygen Solubility at Indicated Pressure chart attached to this SOP. The value should be within the criteria specified for the project. If measurement value drifted outside the criteria, the data will need to be qualified.

If the quality assurance project plan or the sampling and analysis plan do not list the drift criteria or the post-calibration criteria, use the criteria below.

Measurement	Post Calibration Criteria
Dissolved Oxygen	± 0.5 mg/L of sat. value* < 0.5 mg/L for the 0 mg/L solution, but not a negative value
Specific Conductance	±5% of standard or ± 10 µS/cm (whichever is greater)
pH	± 0.3 pH unit with pH 7 buffer*
Turbidity	± 5% of standard
ORP	± 10 mv*

Note: * Table 8.1, USEPA Region 1 *YSI 6-Series Sondes and Data Logger SOP*, January 27, 2016, revision 13.

7.0 DATA MANAGEMENT AND RECORDS MANAGEMENT

All calibration records must be documented in the project's log book or on a calibration log sheet. At a minimum, include the instrument manufacturer, model number, instrument identification number (when more than one instrument of the same model is used), the standards used to calibrate the instruments (including source), the calibration date, the instrument readings, the post calibration check, and the name of the person(s) who performed the calibration. An example of a calibration log sheet is shown in Table 1.

8.0 REFERENCES

Standard Methods for the Examination of Water and Wastewater, 20th edition, 1998.

Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised March 1983.

Turbidity - Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

USEPA Region 1 YSI 6-Series Sondes and Data Logger SOP, January 27, 2016, revision 13.

USGS Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting, Techniques and Methods 1-D3.

TABLE 1

INSTRUMENT CALIBRATION LOG

Project Name_____ Date_____ Weather_____

Calibrated by_____ Instrument_____
Serial Number_____

Parameters	Morning Calibration	Morning Temperature	End of Day Calibration Check*	End of Day Temperature
Specific Conductance Standard #1				
Specific Conductance Standard #2				
pH (7)				
pH (4)				
pH (10)				
ORP Zobel solution				
Dissolved Oxygen 100% water saturated air mg/L				
Dissolved Oxygen Zero Dissolved Oxygen Solution mg/L				
Barometric Pressure mm Hg		NA		NA
Turbidity Standard #1				
Turbidity Standard #2				
Turbidity Standard #3				

* For each Parameter, chose one standard as your check standard. If possible, choose the one that is closest to the ambient measurement value.

Oxygen Solubility at Indicated Pressure

Temp.	Pressure (Hg)							
	760	755	750	745	740	735	730	mm
EC	29.92	29.72	29.53	29.33	29.13	28.94	28.74	in
0	14.57	14.47	14.38	14.28	14.18	14.09	13.99	mg/l
1	14.17	14.08	13.98	13.89	13.79	13.70	13.61	
2	13.79	13.70	13.61	13.52	13.42	13.33	13.24	
3	13.43	13.34	13.25	13.16	13.07	12-98	12.90	
4	13.08	12.99	12.91	12.82	12.73	12.65	12.56	
5	12.74	12.66	12.57	12.49	12.40	12.32	12.23	
6	12.42	12.34	12.26	12.17	12.09	12.01	11.93	
7	12.11	12.03	11.95	11.87	11.79	11.71	11.63	
8	11.81	11.73	11.65	11.57	11.50	11.42	11.34	
9	11.53	11.45	11.38	11.30	11.22	11.15	11.07	
10	11.28	11.19	11.11	11.04	10.96	10.89	10.81	
11	10.99	10.92	10.84	10.77	10.70	10.62	10.55	
12	10.74	10.67	10.60	10.53	10.45	10.38	10.31	
13	10.50	10.43	10.36	10.29	10.22	10.15	10.08	
14	10.27	10.20	10.13	10.06	10.00	9.93	9.86	
15	10.05	9.98	9.92	9.85	9.78	9.71	9.65	
16	9.83	9.76	9.70	9.63	9.57	9.50	9.43	
17	9.63	9.57	9.50	9.44	9.37	9.31	9.24	
18	9.43	9.37	9.30	9.24	9.18	9.11	9.05	
19	9.24	9.18	9.12	9.05	8.99	8.93	8.87	
20	9.06	9.00	8.94	8.88	8.82	8.75	8.69	
21	8.88	8.82	8.76	8.70	8.64	8.58	8.52	
22	8.71	8.65	8.59	8.53	8.47	8.42	8.36	
23	8.55	8.49	8.43	8.38	8.32	8.26	8.20	
24	8.39	8.33	8.28	8.22	8.16	8.11	8.05	
25	8.24	8.18	8.13	8.07	8.02	7.96	7.90	
26	8.09	8.03	7.98	7.92	7.87	7.81	7.76	
27	7.95	7.90	7.84	7.79	7.73	7.68	7.62	
28	7.81	7.76	7.70	7.65	7.60	7.54	7.49	
29	7.68	7.63	7.57	7.52	7.47	7.42	7.36	
30	7.55	7.50	7.45	7.39	7.34	7.29	7.24	
31	7.42	7.37	7.32	7.27	7.22	7.16	7.11	
32	7.30	7.25	7.20	7.15	7.10	7.05	7.00	
33	7.08	7.13	7.08	7.03	6.98	6.93	6.88	
34	7.07	7.02	6.97	6.92	6.87	6.82	6.78	
35	6.95	6.90	6.85	6.80	6.76	6.71	6.66	
36	6.84	6.79	6.76	6.70	6.65	6.60	6.55	
37	6.73	6.68	6.64	6.59	6.54	6.49	6.45	
38	6.63	6.58	6.54	6.49	6.44	6.40	6.35	
39	6.52	6.47	6.43	6.38	6.35	6.29	6.24	
40	6.42	6.37	6.33	6.28	6.24	6.19	6.15	
41	6.32	6.27	6.23	6.18	6.14	6.09	6.05	
42	6.22	6.18	6.13	6.09	6.04	6.00	5.95	
43	6.13	6.09	6.04	6.00	5.95	5.91	5.87	
44	6.03	5.99	5.94	5.90	5.86	5.81	5.77	
45	5.94	5.90	5.85	5.81	5.77	5.72	5.68	

(Continued)

Source: Draft EPA Handbook of Methods for Acid Deposition Studies, Field Operations for Surface Water Chemistry, EPA/600/4-89/020, August 1989.

Oxygen Solubility at Indicated Pressure (continued)

Temp.	Pressure (Hg)								
	725	720	715	710	705	700	695	690	mm
EC	28.54	28.35	28.15	27.95	27.76	27.56	27.36	27.17	in
0	13.89	13.80	13.70	13.61	13.51	13.41	13.32	13.22	mg/l
1	13.51	13.42	13.33	13.23	13.14	13.04	12.95	12.86	
2	13.15	13.06	12.07	12.88	12.79	12.69	12.60	12.51	
3	12.81	12.72	12.63	12.54	12.45	12.36	12.27	12.18	
4	12.47	12.39	12.30	12.21	12.13	12.04	11.95	11.87	
5	12.15	12.06	11.98	11.89	11.81	11.73	11.64	11.56	
6	11.84	11.73	11.68	11.60	11.51	11.43	11.35	11.27	
7	11.55	11.47	11.39	11.31	11.22	11.14	11.06	10.98	
8	11.26	11.18	11.10	11.02	10.95	10.87	10.79	10.71	
9	10.99	10.92	10.84	10.76	10.69	10.61	10.53	10.46	
10	10.74	10.66	10.59	10.51	10.44	10.36	10.29	10.21	
11	10.48	10.40	10.33	10.28	10.18	10.11	10.04	9.96	
12	10.24	10.17	10.10	10.02	9.95	9.88	9.81	9.46	
13	10.01	9.94	9.87	9.80	9.73	9.66	9.59	9.52	
14	9.79	9.72	9.65	9.68	9.51	9.45	9.38	9.31	
15	9.58	9.51	9.44	9.58	9.31	9.24	9.18	9.11	
16	9.37	9.30	9.24	9.17	9.11	9.04	8.97	8.91	
17	9.18	9.11	9.05	8.98	8.92	8.85	8.79	8.73	
18	8.99	8.92	8.86	8.80	8.73	8.67	8.61	8.54	
19	8.81	8.74	8.68	8.62	8.56	8.49	8.43	8.37	
20	8.63	8.57	8.51	8.45	8.39	8.33	8.27	8.21	
21	8.46	8.40	8.34	8.28	8.22	8.16	8.10	8.04	
22	8.30	8.24	8.18	8.12	8.06	8.00	7.95	7.89	
23	8.15	8.09	8.03	7.97	7.91	7.86	7.80	7.74	
24	7.99	7.94	7.88	7.82	7.76	7.71	7.65	7.59	
25	7.85	7.79	7.74	7.68	7.60	7.57	7.51	7.46	
26	7.70	7.65	7.59	7.54	7.48	7.43	7.37	7.32	
27	7.57	7.52	7.46	7.41	7.35	7.30	7.25	7.19	
28	7.44	7.38	7.33	7.28	7.22	7.17	7.12	7.06	
29	7.31	7.26	7.21	7.15	7.10	7.05	7.00	6.94	
30	7.19	7.14	7.08	7.03	6.98	6.93	6.88	6.82	
31	7.06	7.01	6.96	6.91	6.86	6.81	6.76	6.70	
32	6.95	6.90	6.85	6.80	6.70	6.70	6.64	6.59	
33	6.83	6.78	6.73	6.68	6.83	6.58	6.53	6.48	
34	6.73	6.68	6.63	6.58	6.53	6.48	6.43	6.38	
35	6.61	6.56	6.51	6.47	6.42	6.37	6.36	6.27	
36	6.51	6.46	6.41	6.36	6.31	6.27	6.22	6.17	
37	6.40	6.35	6.31	6.26	6.21	6.16	6.12	6.07	
38	6.30	6.26	6.21	6.16	6.12	6.07	6.02	5.98	
39	6.26	6.15	6.11	6.06	6.01	5.97	5.92	5.87	
40	6.10	6.06	6.01	5.96	5.92	5.86	5.83	5.78	
41	6.00	5.96	5.91	5.87	5.82	5.78	5.73	5.69	
42	5.91	5.86	5.82	5.77	5.73	5.69	5.64	5.60	
43	5.82	5.78	5.73	5.69	5.65	5.60	5.56	5.51	
44	5.72	5.68	5.64	5.59	5.55	5.51	5.46	5.42	
45	5.64	5.59	5.55	5.51	5.47	5.42	5.38	5.34	

Source: Draft EPA Handbook of Methods for Acid Deposition Studies, Field Operations for Surface Water Chemistry, EPA/600/4-89/020, August 1989.

APPENDIX 4
Sample Field Datasheet

NH Department of Environmental Services

Antrim Wind Energy Project
Water Quality Monitoring Program

DIRECTIONS: Use this form when obtaining TEMP./D.O. Please fill out completely.

STREAM NAME: _____ TOWN _____

(Circle): Upstream/Midstream/Downstream

WATER LEVEL (circle): Full Top of Bank, Mid-way, Low, Dry

FLOW (circle): High, Moderate, Low, None

Avg. Stream Depth (in) _____

COUNTY _____

STATION DESCRIPTION _____

MONTH DAY YEAR

MONITORS 1 & 2 (Last name, First name)

STATION: LAT _____

LONG _____

DATUM _____

MIDAS _____

STATION #

-WEATHER OBSERVATIONS-
CIRCLE ONE:

SKY CONDITION AT TIME OF SAMPLING

Clear	Drizzle
Partly sunny	Light Rain
Partly cloudy	Heavy Rain
Overcast	Snow
Foggy	Sleet

IF PRECIPITATING, EVENT BEGAN:
Date _____
Time _____

-WIND CONDITIONS-
CIRCLE ONE:

Calm (0–2 km/h)
Slight breeze (2-8 km/h)
Moderate wind (8-15 km/h)
Gusty (15–25 km/h) Strong gusts (25-40 km/h) Storm winds (>40 km/h)

WIND DIRECTION (CIRCLE ONE:)

N	S
NE	SW
E	W
SE	NW

-AIR TEMPERATURE (°C)-
(CIRCLE ONE:)

< 0	15 – 20
0 – 5	20 – 25
5 – 10	25 – 30
10 – 15	> 30

ADDITIONAL WEATHER COMMENTS:
_____
_____
_____

METERS USED:

Meter (enter model):
YSI Meter: _____
Hach Meter: _____
Other Meter: _____

		WATER TEMP (°C)	DO % SAT	DO % mg/L
PRE-Sampling Calibration:	Hand-held			
	Data Logger			
POST-Sampling Calibration:	Hand-held			
	Data Logger			

TEMPERATURE/DISSOLVED OXYGEN

MILITARY TIME:
WATER TEMP (°C)
DO % SAT
DO % mg/L
SAMPLE #

REQUIRED QA/QC Duplicate (1 for every 10 samples)

MILITARY TIME:
WATER TEMP (°C)
DO % SAT
DO % mg/L
SAMPLE #

ADDITIONAL GRAB SAMPLING:

pH : COMMENTS: _____

SPECIFIC CONDUCTANCE (UMHO/CM): COMMENTS: _____

TURBIDITY (NTU): COMMENTS: _____

LABORATORY SAMPLES COLLECTED: (if applicable:) _____
_____
_____

METHODS USED: _____
_____
_____

LABORATORY USED: _____

Description of construction activity in area and implemented BMPs:

Other Field/Wildlife Observations:

Photos Taken:

Field Form Prepared By TRC Environmental Solutions
14 Gabriel Drive Augusta, ME 04330

NH Department of Environmental Services

Antrim Wind Energy Project
Water Quality Monitoring Program

DIRECTIONS: Use this form when obtaining TURBIDITY. Please fill out completely.

STREAM NAME: _____ TOWN _____

(Circle): Upstream/Midstream/Downstream

WATER LEVEL (circle): Full Top of Bank / Mid-way / Low / Dry

FLOW (circle): High / Moderate / Low / None

Avg. Stream Depth (in) _____

COUNTY _____

STATION DESCRIPTION _____

MONTH DAY YEAR

MONITORS 1 & 2 (Last name, First name)

STATION: LAT _____

LONG _____

DATUM _____

MIDAS _____

STATION #

-WEATHER OBSERVATIONS-
CIRCLE ONE:

SKY CONDITION AT TIME OF SAMPLING

Clear / Partly sunny / Partly cloudy / Overcast / Foggy

Drizzle / Light Rain / Heavy Rain / Snow / Sleet

-WIND CONDITIONS-
CIRCLE ONE:

Calm (0–2 km/h)
Slight breeze (2-8 km/h)
Moderate wind (8-15 km/h)
Gusty (15–25 km/h) Strong gusts (25-40 km/h) Storm winds (>40 km/h)

-AIR TEMPERATURE (°C)-
(CIRCLE ONE:)

< 0 / 0 – 5 / 5 – 10 / 10 – 15 / 15 – 20 / 20 – 25 / 25 – 30 / > 30

IF PRECIPITATING, EVENT BEGAN:
Date _____
Time _____

WIND DIRECTION (CIRCLE ONE:)
N / NE / E / SE / S / SW / W / NW

ADDITIONAL WEATHER COMMENTS:
_____
_____
_____

TURBIDITY METERS USED:

Meter (enter model):
YSI Meter: _____
Hach Meter: _____
Other Meter: _____

		WATER TEMP (°C)	TURBIDITY (NTU):
PRE-Sampling Calibration:	Hand-held		
POST-Sampling Calibration:	Hand-held		

TURBIDITY	SAMPLE #	ADDITIONAL READINGS (if applicable:)	SAMPLE #		SAMPLE #		SAMPLE #
MILITARY TIME:		MILITARY TIME:		MILITARY TIME:		MILITARY TIME:	
WATER TEMP (°C)		WATER TEMP (°C)		WATER TEMP (°C)		WATER TEMP (°C)	
TURBIDITY (NTU):		TURBIDITY (NTU):		TURBIDITY (NTU):		TURBIDITY (NTU):	
COMMENTS: _____		COMMENTS: _____		COMMENTS: _____		COMMENTS: _____	

REQUIRED QA/QC Duplicate (1 for every 10 samples)

MILITARY TIME:

WATER TEMP (°C)

SAMPLE #

TURBIDITY (NTU):

METER USED: _____

REQUIRED BLANK Duplicate (1 for every 10 samples)

MILITARY TIME:

WATER TEMP (°C)

SAMPLE #

TURBIDITY (NTU):

METER USED: _____

ADDITIONAL COMMENTS:
_____
_____
_____
_____
_____

Description of construction activity in area and implemented BMPs:

Other Field/Wildlife Observations:

Photos Taken:

Field Form Prepared By TRC Environmental Solutions
14 Gabriel Drive Augusta, ME 04330