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Date: February 18, 2020
To: Beth Callahan, Project Manager, Maine Department of Environmental Protection
John Hopeck, Ph.D., Division of Environmental Assessment, Maine Department of Environmental Protection
From: Elizabeth M. Ransom, P.G. Ransom Consulting, Inc.
Subject: Nordic Aquafarms, Inc., Land-based Aquaculture Facility, Belfast, Maine
L-28319-26-A-N, Review Comments
Project No.: 171.05027

This memo provides responses to the Review Memorandum from Dr. John Hopeck to Beth Callahan dated January 14, 2020 and revised January 27, 2020. For clarity, the entire comment from the technical memorandum has been copied below and italicized. Responses are in regular text.

1) *Monitoring Program*

- a) *The applicant states that automated data-logging equipment, including equipment with the capacity for in-situ conductivity measurement, will be installed “[w]here practical”, and that data will be compiled in an accessible electronic format. Prior to construction, the applicant must submit for review and approval a specific program identifying the instrumentation to be installed at specific locations by specific dates, and the proposed monitoring parameters and frequencies at each location. The applicant correctly notes that there will be a lengthy initial period of construction at the site, followed by a period of gradual buildout to full production. Some monitoring points may be in locations that could be damaged by construction, and so it might be acceptable to delay installation of these instruments until after grading and other major construction in the relevant area is nearly complete, however, any other monitoring point, and any monitoring location that could be protected during construction, should be established and used for collection of background data during this period. During this initial non-pumping period, collection of groundwater level and quality data should be no less often than monthly; drinking water wells and shallow groundwater wells are likely to show more rapid fluctuation in water level, and must therefore be measured more frequently. As previously noted, surface water levels may vary rapidly and so should be measured in near real-time to the extent practical. Shorter intervals between collection of groundwater level data will be necessary during the period ramping up to full production and for some period afterward, possibly as short as the 12 months suggested by the applicant, depending on the amount and rate of groundwater withdrawal, climatic factors, and the Department’s assessment of the data to that point. It may also be appropriate to reduce data collection and reporting frequency at some or all monitoring points if groundwater usage by the facility stabilizes at some level less than the anticipated full production volume, due to*
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market demand, more efficient water usage, or other factors, provided that the Department determines that data collected to that point show no unreasonable adverse impacts, or threats of such impacts, on groundwater or surface water quality and quantity. Increases in usage beyond this lower rate and amount, however, would then require approval by the Department and would trigger return to the original monitoring program. Data must be submitted to the Department within fourteen days of its receipt by the applicant, unless the Department requires more frequent reporting if it observes evidence of possible adverse impacts or other factors. Data must be submitted electronically using the most recent format accepted by the Department (see <https://www.maine.gov/dep/maps-data/egad/#ed> for current requirements) and in hard copy.

Nordic acknowledges that a revised Water Resources Monitoring Plan (WRMP) is needed by the Department “as soon as possible,” as Dr. Hopeck mentions in Section 5)a) of his memorandum. Nordic anticipates having a revised WRMP, including specific locations, proposed equipment, measurement frequency, expected dates of installation for equipment, and data submission frequency to the Department within two months of receipt of a permit conditioned upon such a revised and updated WRMP. Implementation of the monitoring network, including equipment purchase, installation, and configuration will take place as quickly as possible after approval of the Department of the proposed plan; however, it is also subject to the final proposed construction timeline, which is in turn dependent on the timing of receipt of a permit. Due to considerable costs associated with installing and configuring the proposed monitoring network, it is important that Nordic has a commitment to move forward with permitting for groundwater withdrawal conditioned upon the revised and updated WRMP prior to commencing this stage of the project. Nordic is committed to working with the Department in good faith regarding monitoring and is committed to establishing a monitoring network that meets the Department’s requirements.

Nordic would, however, like to highlight that currently background groundwater data is being collected from the following monitoring points on an hourly basis: DRX-103, GWW-101, GWW-102, NTB-101, NTB-102, PZ-1D, PZ-1S, PZ-2, PZ-3, and PZ-4S. Water levels are currently being measured on a 15-minute basis in the following private water supply wells: WSW-1, WSW-2, WSW-3, WSW-4, and WSW-4. All the transducers in these monitoring points have been operating since the January 2019 pumping test or before.

With regard to planned monitoring, Nordic intends to install pressure transducers (or similar devices such as USGS-style bubblers) in all surface water and groundwater monitoring locations that can accept, or be modified to accept, such devices. In general, Nordic anticipates groundwater measurement frequency in locations with pressure transducers will be every hour, reservoir stage measurements will be hourly, Little River stage height measurements will be every 15 minutes, and private water supply well measurements will be every 15 minutes. A subset of wells (to include, at a minimum, GWW-103, GWW-101, WSW-4, and NTB-101) will be equipped with pressure and conductivity transducers, which will record conductivity measurements coincident with pressure readings. Nordic intends to use one of several commercially available product suites to accomplish this task and will solicit quotes from several manufacturers prior to submission of the revised WRMP with an aim to provide specific equipment proposals to the Department in that document.

Nordic acknowledges the Department’s desire for flexibility in monitoring frequency and data reporting frequency, as well as the variables Dr. Hopeck discusses pertaining to increases and/or reductions in monitoring frequency. Nordic intends to configure the monitoring network in such a way that changes in

measurement frequency and data reporting frequency to the Department can be adjusted as deemed appropriate by the Department.

Nordic will also include a proposed timeline for monitoring equipment installation, accounting for construction phasing, possible damage or decommissioning of existing monitoring points, and installation timelines for proposed new or replacement monitoring points, as proposed in the original WRMP and revised via subsequent correspondence.

Nordic acknowledges the 14-day timeframe between data receipt and delivery of said data to the Department, unless a shorter timeframe is required by the Department, as well as the need to submit data using the most recent electronic format accepted by the Department and in hard copy.

- b) *The applicant has agreed to install new overburden monitoring wells OVB-101, OVB-102, and OVB-103 as pairs of shallow and deep wells, with shallow wells screened in the silty overburden and deeper wells extending to and below the overburden/weathered rock transition. It is understood that groundwater elevations at the locations of the deeper wells may be below the elevation of bedrock – overburden interface during at least some of the year (in which case the bedrock aquifer monitoring locations may be sufficient to define the approximate water table elevation at the paired-well locations) and that it may be difficult to obtain water quality samples from the shallow wells screened in fine sediments. However, the Department considers that the primary purpose of these well pairs is to assess the effects of groundwater withdrawal from the bedrock aquifer, and consequent significant localized drawdown of water level in that aquifer, on water levels at the bedrock – overburden interface and in the overburden, that may be more relevant to supporting the smaller streams and wetlands in the area. Water quality data from these shallow wells will be valuable but not necessarily as significant as water levels, so that, if standard sampling protocols must be modified in some cases, the Department may find that such modifications are acceptable as long as they do not prevent accurate measurement of water levels at required times and intervals.*

Nordic acknowledges and understands the Department’s priorities regarding groundwater elevation measurements and water quality sampling in the proposed overburden well pairs.

- c) *The applicant proposes to install shallow and deep piezometers “in the vicinity of wetland W7”; as noted previously, these should be installed as close as possible to a wetland monitoring tract. Proposed piezometer locations and wetland monitoring tract locations should be shown in the revised plan to be submitted for review and approval. Shallow wells in particular could be subject to freezing, but pressure transducers should be used unless the applicant can demonstrate specific reasons that they cannot be used. Water levels in shallow piezometers could be expected to fluctuate relatively rapidly, as also noted above, so that monthly monitoring will not be sufficient to assess the range of normal conditions during the background monitoring phase, although quarterly data reporting should be acceptable during the background data collection phase. Automated data collection would allow frequent measurements sufficient to assess conditions before and during operation of the pumping well. If the rate of variation in the wetland piezometers is shown to be relatively slow during operation of the facility, the applicant may apply to reduce the measurement frequency.*

Nordic intends to install the proposed shallow and deep piezometers either within the wetland W7 monitoring tract or as close to it as possible. Nordic will consult with pressure transducer manufacturers

regarding possible equipment implications should pressure transducers freeze; however, Nordic anticipates installing pressure transducers in these monitoring points barring indications from the transducer manufacturer that this would result in damage to the transducer. In the event that freezing will jeopardize the equipment, Nordic intends to install pressure transducers in these monitoring points during times of the year when freezing is unlikely. Nordic acknowledges the requirements for an application to reduce the frequency of monitoring in wetland piezometers.

- d) *The relevant section of the Little River channel presents certain problems for collection of accurate flow data at some times of year and under certain flow conditions. However, instrumentation can be installed to obtain real-time and continuous data during most of the year at a measured cross section, particularly since the bedrock channel minimizes the risk of major changes in channel cross-section; as previously noted, an appropriate location for such measurement should be defined as part of the background monitoring plan. Use of surrogate watersheds is possible, but the applicant has presented no information demonstrating that the watershed of the Ducktrap River above the USGS gauging station is equivalent to or can be effectively scaled to that of the relevant watershed of the Little River. Annual flow statistics should not be used as bases for comparison or for setting performance standards, since these mask important seasonal and short-term variations. As also previously noted, monthly or even weekly stage measurements are not adequate to accurately assess pumping impacts on surface water systems, which are subject to rapid changes due to precipitation and other factors. Consider 2019 data from the Ducktrap River, on which the applicant proposes to measure stage at monthly intervals. The lowest stage height for the year (1.14 feet, approximately 0.19 cfs) was measured on August 7th; data from August 8th show a stage height more than twice that value (3.35 feet, approximately 127 cfs), while data from the same time on the 9th indicate a stage height of 2.23 feet and a flow of 16.2 cfs. Monthly stage measurements are not adequate to capture the possible range of flow conditions in this system, although monthly download frequency may be acceptable during non-pumping periods, provided that data storage is sufficient to allow automated data collection at a frequency acceptable to the Department.*

Nordic acknowledges the Department's preference for near real-time measurement of stage height and/or flow from the Little River. Nordic will propose a location along the relevant reach of the Little River to establish a USGS-style bubbler gage (or other acceptable technology) that will record stage height at 15-minute intervals. Similarly, Nordic will propose a plan and timeline for establishing a rating curve that can be used to calculate discharge of the Little River from stage height at the gage. Nordic anticipates installing the stage height measurement equipment as soon as reasonable after approval from the Department, as mentioned above, and will plan to conduct manual discharge measurements of the stream (or propose another acceptable technology) regularly (e.g. approximately monthly) and at a variety of flows throughout the background data collection period such that a reliable rating curve can be developed prior to any pumping taking place. As noted previously, due to considerable costs associated with installing and configuring the proposed monitoring network, as well as the need to coordinate around the construction timeline (which cannot be finalized until a permit is received), it is important that Nordic has a commitment to move forward with permitting for groundwater withdrawal conditioned upon the revised and updated WRMP prior to commencing this stage of the project. Nordic is committed to working with the Department in good faith regarding monitoring and is committed to establish a monitoring network that meets the Department's requirements.

- e) *The applicant has agreed to record intake data daily “on a source-specific basis”. Such usage prior to operational-level usage can be reported to the Department monthly, but more frequent reporting and possibly a more detailed breakdown to identify peak usage times could be required at some point if the Department finds such information useful in interpreting streamflow, stage, or groundwater elevation data.*

Nordic acknowledges the need to have flexibility in how frequently intake data is collected. Nordic intends to install equipment that can measure intake data in near-real time if necessary. Equipment choices will be specified by design engineers prior to or during the construction process and can be provided to the Department, if requested.

- f) *The applicant has agreed that any changes to the monitoring program, other than those necessary to address damage to a monitoring point or loss of access to a monitoring location due to decisions of a property owner not subject to this permit, must be approved by the Department. Any locations lost due to damage must be replaced as soon as possible and as closely as possible, in location and design, to the damaged point. The Department should be notified of the loss of such points as soon as possible, and may require installation of additional monitoring locations on accessible property to replace monitoring locations lost for either cause. Replacement of monitoring locations may require specific approval by the Department and modification of the permit.*

Nordic acknowledges the Department’s requirements regarding replacement of monitoring locations due to voluntary withdrawal by a party not subject to this permit or damage, as well as Department notification, replacement timeline, approval of the Department, and possible modifications to the permit.

- g) *The applicant proposes to use an offsite weather station to obtain meteorological data for the site, stating that this station is located “approximately 3.1 miles to the north of the Site” and that “comparison of monthly statistical descriptors for the Belfast station and other nearby stations...does not suggest significant local variability.” However, no analysis of these data is presented to support this statement, the proposed station does not appear to be in the same watershed as the proposed development, and the applicant does not control the operation, data content, or data quality at this station. Assessment of local influences, many of which may be shorter-term than a month, is important to assess the short-term variations that may be observed, particularly in streamflow, at the site. Consequently, the applicant should establish an on-site station, or station at a location owned or controlled by the applicant, within the Little River watershed and near the areas potentially impacted by the development. Potential locations for this station should be proposed in the revised monitoring plan. Note that other large groundwater users are generally required to establish similar monitoring stations for measurement of conditions in the area affected by their operations; recharge patterns as this site will differ from those at many other large groundwater extraction sites due to the different nature of the overburden and other factors, however, data from within a suitable location within the area potentially affected are still preferable to those from outside the area, particularly in the absence of detailed comparisons and lack of control over these existing monitoring locations.*

Nordic will establish an on-site station to measure and record meteorological data, including temperature and precipitation. Nordic will include a proposed location for this station in the revised WRMP discussed in our response to Section 1)a) above and intends to establish this station while installing and configuring the rest of the monitoring network

- h) *The applicant has agreed that it is necessary to establish warning levels that are “indicative of conditions trending toward a potential adverse impact, as opposed to being confirmation of occurrence”, and that these levels must be defined by analysis of the baseline data and approved by the Department prior to operation. The applicant suggests that language in the monitoring plan be interpreted to read that remedial actions may be required under “extreme” events; rather than use an undefined term such as “extreme”, the plan should establish specific quantifiable measures of adverse impact that would require one or more of the actions specified, based on statistical analysis of the background data. Since warning and action levels must be set conservatively, it is important that the background data set capture the range of pre-operational variation and extreme values as completely as possible. It is understood that, particularly with groundwater, this does not always require the largest possible data set, but, as indicated above, data must be collected with sufficient frequency to capture this information to the extent practical.*

Nordic acknowledges the Department’s preferences regarding language and agrees with Dr. Hopeck’s recommended approach for establishing warning and action levels. Nordic expects to perform a statistical analysis of background data collected prior to and during the construction period to establish such levels. Relative to action levels, this approach is anticipated to support establishment of “specific quantifiable measures of adverse impact that would require one or more of the actions specified.” Nordic anticipates the statistical analysis, will be submitted along with proposed warning and action levels, as an addendum to the revised WRMP prior to operation.

2) *Blasting*

- a) *The applicant has agreed to the apply Department standards for adverse effects of blasting and has clarified their understanding of the Department’s air overpressure standard regarding the number of blasts per day. Note, however, that the Department’s minimum air overpressure limit applies to four or more blasts per day, and does not limit the applicant to four blasts per day, although the applicant may voluntarily limit the number of blasts to no more than four per day.*

Nordic acknowledges the Department’s clarification regarding how air overpressure standards are applied.

- b) *The applicant indicates that the Department standards for pre-blast surveys will be applied. (Note that there is a minor typographical error in the copy of the review memo text provided by the applicant and in the applicant’s response; the correct reference is to 38 MRS §490-Z(14), rather than 38 MRS §490-2(14).) Use of the 2000-foot pre-blast survey radius is likely to include both dams and associated structures in the pre-blast survey area. The record indicates that the Maine Emergency Management Agency, among others, has raised questions, although not necessarily related to the proposed development, regarding the structural integrity of the dams. Consequently, the applicant should confer with the Maine Emergency Management Agency prior to the pre-blast survey of the dams, to identify particular concerns of that agency, if any, which much [sic] be addressed in the pre-blast surveys. If any such issues are identified, MEMA staff should review the completed surveys to determine that those issues have been addressed properly, and the applicant should follow any recommendations of MEMA staff regarding blast monitoring or related issues at the dams.*

Nordic acknowledges the Department's comments regarding the pre-blast survey area and will confer with the Maine Emergency Management Agency as recommended.

3) *Geotechnical Survey*

- a) *The applicant states that boring B303 was not performed.*
- b) *The applicant states that "no additional design parameters have been provided to the geotechnical engineer...nor have any additional geotechnical evaluations been conducted." Consequently, the applicant must submit for review and approval prior to construction a final geotechnical report, once the "structural loads, tolerable settlement amounts, and grading and drainage plans" have been finalized.*

Nordic acknowledges the need to provide a final geotechnical report and will provide this information to the Department once finalized.

4) *Groundwater*

- a) *The applicant has agreed to submit for review and approval prior to construction a site-specific construction Spill Prevention, Control, and Countermeasures Plan, and, prior to operation, a site-specific Spill Prevention, Control, and Countermeasures Plan for operation of the facility.*
- b) *The applicant indicates that the "environmental due diligence" and "environmental tests" performed on the property identified areas of the site in which PAHs "exceeded MEDEP standards for commercial workers." If the applicant has not already done so, copies of the relevant reports should be provided to the Bureau of Remediation and Waste Management for their assessment as to whether additional action is required prior to development of other use of the area in which this contamination was found.*

Nordic will consult with the MEDEP Bureau of Remediation and Waste Management regarding the PAH exceedances observed at the site prior to redevelopment of the area in question.

5) *Water Supply*

- a) *As indicated previously, there are reasons to believe that the model submitted underestimates the potential for loss of surface water to the fractured bedrock aquifer; the applicant has not explicitly addressed this in the response, and, while the submitted water budget may be internally consistent increased leakage from the Little River may change elements of that budget. However, the Department considers that, in general, the residence time of water in the reach of the Little River between the two reservoirs, which is also the reach in the which the effects of greatest drawdown in the bedrock aquifer will occur and which is largely exposed bedrock, will be small, and so the increased leakage could be a relatively small portion of the flow under most conditions. The Department considers the existing model to be sufficient proof-of-concept with regard to the possible volume of water to be obtained, but notes, as described above, that the monitoring program must be implemented to assess impacts on existing wells, including possible effects of salt-water intrusion and lower water levels, and reduced groundwater discharge to wetlands and surface waters; effects of groundwater withdrawal on these latter resources are expected to relate largely to the extent to which they receive*

discharge from the weathered bedrock or deeper bedrock aquifer, and the effectiveness of the marine sediments at separating flow in the surficial aquifer from that in the bedrock aquifers. In any event, this plan must be finalized as soon as possible so that sufficient background data can be collected to adequately characterize pre-operational conditions; the Department notes that significant amounts of information, as outlined in this memo, must still be submitted for review and approval before the plan to collect this information can be considered complete.

Nordic acknowledges the Department's perspective on areas of uncertainty associated with the numerical modeling results, as well as the Department's assessment that the referenced potential leakage occurring within the subject reach of the Little River is likely to be a small portion of flow. This perspective is generally consistent with Nordic's current interpretation of pumping data, water level data, and streamflow measurements collected during the hydrogeologic investigation. It is our position that this small potential leakage is not practical to quantify and thus incorporate into the water budget because there was no measurable response to stream flow during our aquifer tests.

Nordic understands the need to implement the monitoring program, as described above and in previous correspondence and, as discussed above, is committed to finalizing the monitoring plan for Department review within two months of receipt of a permit conditioned upon the revised and updated WRMP. Nordic recognizes the need for as complete of a background data record as possible and is committed to establishing this monitoring network quickly and efficiently once approved by the Department.

- b) The applicant states that the utility "currently monitors both water quantity and water quality in the Goose River aquifer" and that "additional information regarding flows and flow measurements locations" will be provided to the Department "prior to initiation of the project." However, the previous memorandum requested this information, along with a determination of minimum flows required in the Goose River to maintain flows consistent with Department requirements. This information has not been provided. Such information is necessary to define the operational monitoring standards for the proposed development, and must be submitted for review and approval sufficiently far in advance of the operational phase of the development for adequate background data to be obtained and for effective performance standards and warning and action levels to be determined. The Department cannot determine, without the requested information, whether the existing data can be used toward these goals or whether alternate monitoring locations and methods will need to be established for adequate baseline and operational monitoring. The applicant should anticipate, however, that the monitoring program and other requirements will be similar to those that will be required for the Little River, as described above and in the previous memorandum.*

Nordic understands the Department's desire to review the existing data and current data collection methods for the Belfast Water District (BWD). Nordic's understanding has been that its status with the BWD is no different than that of any other customer of the BWD, except that the BWD has requested a minimum purchase quantity as a condition of Nordic's contract with the BWD. As such, Nordic has understood BWD compliance with Chapter 587 rules to be the responsibility of the BWD. This said, Nordic is committed to meeting Department monitoring requirements in connection with the proposed water use, and would appreciate the opportunity to discuss monitoring of the BWD system with Dr. Hopeck, other Department staff as appropriate, and BWD staff and their hydrogeologist through an in-person consultation. Nordic is available for such a consultation at the earliest convenience of Dr. Hopeck, the BWD, and the hydrogeologist representing the BWD and is committed to working with the

Department and BWD in good faith to achieve a solution that is agreeable to Nordic, the BWD, and the Department.