

**REQUEST FOR BIDS FOR:**

**PHOSPHORUS INACTIVATION OF SURFICIAL SEDIMENT IN NIPPO LAKE,  
BARRINGTON, NH**

**ISSUED BY NIPPO LAKE ASSOCIATION**

**ON MARCH 22, 2021**



## **SECTION I. INTRODUCTION AND BACKGROUND**

The Nippo Lake Association (hereafter the awarding authority) is soliciting responses for the aluminum treatment of Nippo Lake. The goal of this Request for Bids (RFB) is to identify the respondent who can best complete the work as outlined in these documents. A contract commencing in Spring 2021 is being offered for completing the full scope of work. This RFB and contract work are contingent upon pending State of New Hampshire permit approval required for the appropriation of funds for this project.

This solicitation is being conducted in accordance with the provisions of the laws of the State of New Hampshire, and all contracts must be strictly awarded in accordance with the requirements of the RFB. If it becomes necessary to revise any part of this RFB or otherwise provide additional information, an addendum will be issued to all prospective respondents who received copies of the original request.

Nippo Lake and its watershed exist entirely in the Town of Barrington, New Hampshire (Figure 1). The lake is located at 330 feet above sea level (fasl). The lake's watershed area consists of 294 acres of hilly terrain characterized by steep, mostly forested slopes that run down to the lake shore. Nippo Lake is approximately 0.77 miles long and 0.3 miles wide at its maximum. As a result of the topography surrounding the lake and its shape and size, wind driven waves are typically not large. The lake has two miles of shoreline. The surface area of Nippo Lake is 85 acres with a mean depth of 20 feet and a maximum depth of 54 feet (Figure 2). There are no public beaches or boat launch ramps on Nippo Lake; all access to the lake is private.

Nippo Lake experiences thermal stratification in the summer with an epilimnion, metalimnion, and hypolimnion established from June through fall turnover, which typically occurs in October. The lake contains 640 million gallons of water, and the lake water volume flushes completely every two and a half years. The New Hampshire Department of Environmental Services (NHDES) classification for the lake is mesotrophic. The watershed of the lake includes direct drainage with no major tributaries or any upstream ponds; a small wetland area drains to the lake from the southeast.

Water Quality monitoring from 1982 – 2015 as summarized in the watershed plan for Nippo Lake (NHDES, 2019) has shown a significant increase in epilimnetic total phosphorus, with Nippo Lake briefly crossing into concentrations more indicative of eutrophic lakes in 1995 and has regularly shown elevated epilimnetic phosphorus concentrations since 2010. Average Secchi disk transparency (SDT) depth significantly decreased from 1982 – 2015, and hypolimnetic total phosphorus below 10 meters significantly increased in this same time period. In the summer of 2010, Nippo Lake experienced a cyanobacteria bloom—the first such bloom observed. Subsequent cyanobacteria blooms have been observed annually since 2010. Data collected through 2020 since the completion of the watershed plan are consistent with data presented in the plan. The lake is on the state's list of impaired waters for Primary Contact Recreation (swimming) due to the occurrence of cyanobacteria blooms.

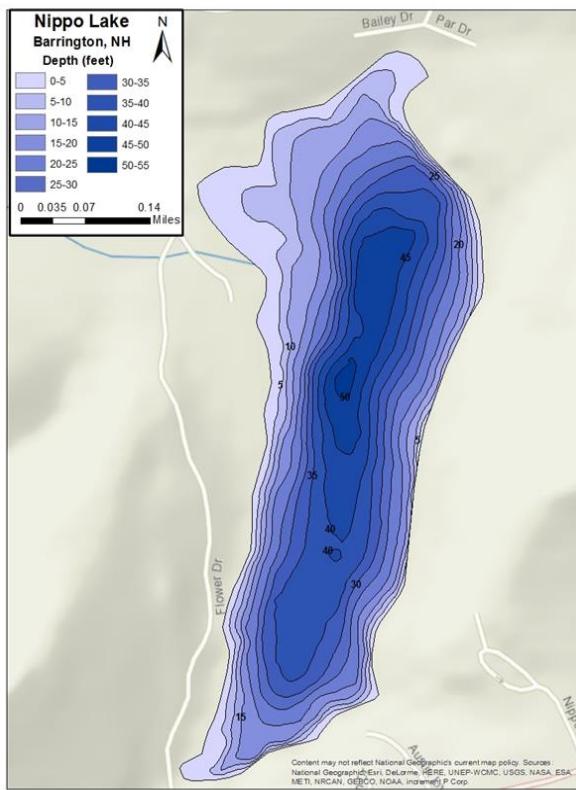
Cyanobacteria blooms pose a serious threat to human health and the quality of life watershed residents depend upon relative to enjoyment of the lake. The blooms are driven by an increase in nutrients, primarily phosphorus, delivered to the lake via various sources and pathways including stormwater

runoff, septic systems, soil erosion, fertilizers, and internal cycling. Additional phosphorus sources include wetlands, small intermittent tributaries, and atmospheric deposition.

**Figure 1. Nippo Lake Watershed Map**



**Figure 2. Nippo Lake Bathymetric Map**



Watershed management activities for Nippo Lake have included installing stormwater management practices to reduce phosphorus loading from residential properties and roads. Overall, watershed inputs have been reduced, but internal phosphorus loading is a dominant source of phosphorus to the lake and further improvement of the lake is dependent on addressing the internal load. The internal phosphorus load to Nippo Lake is estimated at 34 percent of the total load to the lake (Table 1).

**Table 1. Current Total phosphorus (TP) and water loading by summary source for Nippo Lake**

Loads to Nippo Lake	TP (kg/yr)	TP (%)	Water (m <sup>3</sup> /yr)	Water (%)
Internal Loading	12.9	34.3	NA	NA
Watershed – Nippo Lake <sup>1</sup>	11.6	30.8	550320	53.3
Watershed – Boat Launch	4.8	12.8	122781	11.9
Atmospheric Deposition	3.8	10.1	355,667	34.4
Septic Systems	2.8	7.5	4677	0.5
Waterfowl	1.7	4.5	NA	NA
Total Load to Nippo Lake	37.5	100	1,033,444	100.0

<sup>1</sup>Watershed sources include all runoff and groundwater sources from the watershed.

The lake experiences anoxia at the sediment-water interface at varying depths. These anoxic conditions release sediment-bound phosphorus that in turn drives internal loading in the lake. Sediment sampling conducted in 2018 for the lake indicates that phosphorus has accumulated in the sediments below the deeper waters of Nippo Lake. This sediment phosphorus is released in the summer and early fall when oxygen is low (Table 2).

**Table 2. Estimated phosphorus mass by category in sediments below selected water depths in Nippo Lake**

Water Depth (m)	Water Depth (ft)	Area (acres)	Area (hectares)	Loosely Bound P + Iron Bound P in upper 10 cm of sediments (kg)	Loosely Bound P + Iron Bound P + Labile Organic P in upper 10 cm of sediments (kg)
9	30	27	11	224	857
7	23	42	17	326	1314
3	10	65	26	462	2029
0	0	85	35	606	2663

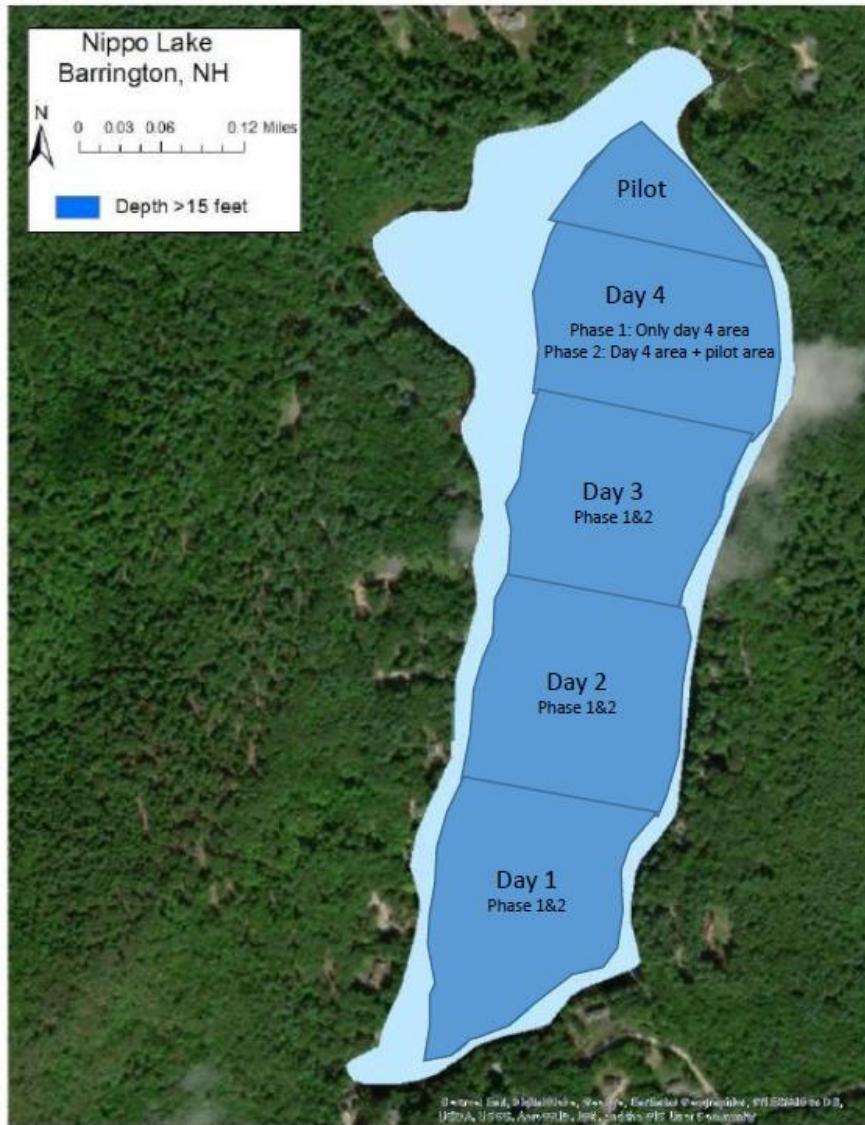
*Source: modified from DKWRC, 2019*

## Proposed Project

The proposed project is an aluminum treatment of Nippo Lake with the goal of reducing phosphorus released from sediment that fuels cyanobacteria blooms. Based on the management plan developed for Nippo Lake, the most important action that can be taken at this time to improve the lake is the reduction of internal loading of phosphorus from sediments exposed to anoxia. With an aluminum application as planned, the lake is expected to have decreases in internal loading ranging from 80-90%.

By reducing the available phosphorus for algal uptake, Nippo Lake will experience ecological benefits related to water quality. Water clarity will increase, resulting in average summer water clarity >5.0 m (16 feet), total algal biomass will decrease and algae composition will favor more desirable species conducive to more efficient energy flow through the food web. Oxygen improvements are also an expected benefit of phosphorus inactivation. The reduction in algae production will translate to less oxygen-demanding organic matter settling into deeper water, but the ongoing oxygen demand of the existing organic sediments will not be appreciably reduced by the treatment. Thus while the zone of anoxia is expected to be thinner, it is unlikely to be eliminated. Improvements in the dissolved oxygen conditions will provide additional habitat for fish species, zooplankton, and benthic invertebrates.

For Nippo Lake, treatment of an area of about 56 acres is expected to minimize internal loading and control algae blooms for 10-20 years. This area represents the sediments below 15 feet in water depth or all the sediments with a high potential to release phosphorus to the water column (Figure 3).



**Figure 3. Proposed treatment areas for Nippo Lake sediment phosphorus inactivation with aluminum.**

Aluminum has been the sediment phosphorus inactivation additive of choice in New England for the last 30 years. It is not a new approach and has been used to successfully manage lakes since the 1970s (Welch and Cooke 1999). Aluminum sulfate (alum) can be applied by itself where lake water alkalinity is high, but in most cases, sodium aluminate is applied with the aluminum sulfate to keep the pH stable. Alkalinity in Nippo Lake is low and ranges from 6 to 12

mg/L with an average of 7mg/L (NHDES EMD; 13 samples, 2016-2020) in Nippo Lake. As such buffering will be needed at the recommended doses to minimize environmental risks (see below).

Application of aluminum for phosphorus inactivation is completed from the surface using vessels specifically designed for that purpose, and chemicals are metered to provide precise ratios of aluminum sulfate to sodium aluminate and tight pH control as well as accurate dose amounts (Figure 6). Barges traverse GPS guided paths for accurate delivery of aluminum to target areas. Dose determination is made from sediment analyses and confirmed with laboratory assays. A review of treated lakes (e.g., Huser et al. 2016, Wagner et al. 2017) indicates improved conditions in virtually all lakes, but varying lengths of time for water quality benefits. Sediment features not yet fully understood appear to affect results, but cyanobacterial dominance has been reduced in nearly all cases. Water clarity is typically 5-7 m the summer after treatment and has remained higher than 3 m in most lakes for more than a decade, often two decades.



**Figure 4. One Current Approach to Application of Aluminum**

Successful aluminum treatment is a function of supplying an adequate dose to the appropriate treatment area. It is generally acknowledged that the targeted treatment area should be at least the area of sediment that can experience anoxia, which facilitates the release of phosphorus bound by iron (Fe-P) as well as loosely bound phosphorus which is typically a much smaller fraction than Fe-P. In addition, labile organic phosphorus can be broken down by microbes to become available so it is often advisable to treat that fraction as well. Treating a slightly larger area where algae may grow on the surficial sediment then float upward in response to change in light and/or temperature is also advisable. The necessary dose is a

matter of both the Fe-P concentration and other sediment constituents that may compete with Fe-P for binding sites on the applied aluminum compounds.

The aluminum to phosphorus ratio (Al:P) necessary for effective inactivation varies inversely with Fe-P concentration, as lower Fe-P levels mean that other constituents are abundant and compete for binding sites (James and Bischoff 2015). When Fe-P is high more Al is needed, but the ratio of Al to P will be lower than for a sample with less Fe-P since the Al will encounter more Fe-P than other possible binding compounds in the situation with higher Fe-P. Binding of Fe-P with Al is more efficient at higher Fe-P. The Al:P ratios for successful treatments tends to range from 10 to 150, and the range of aluminum doses have been 10 to about 200 g/m<sup>2</sup>, although treatments at >100 g/m<sup>2</sup> have generally not been needed, and most Al:P ratios have been near the low end of the known range.

The upper 10 cm (4 inches) of sediment is what can typically interact with the overlying water (Welch et al 2017) although it can be a somewhat thinner or thicker layer in some circumstances. The mass of phosphorus per square meter to a depth of 10 cm is therefore the target of inactivation. Details on the dose calculation for Nippo Lake are presented in Table 3. The target mass of phosphorus in Nippo Lake at the 10 cm sediment depth is 5.7 g/m<sup>2</sup>. The aluminum dose should be between 10 and 20 times the Fe-P and loosely bound phosphorus mass and 5-10 times the labile organic phosphorus mass. Using an Al:P ratio of 15:1 for the Fe-P and the loosely bound P and a ratio of 7.5 for labile organic-P, the recommended areal aluminum dose would be 53 g/m<sup>2</sup> for Nippo Lake.

**Table 3. Calculation of aluminum dose from sediment data using an aluminum sulfate to sodium aluminate ratio of 1.8.**

	Loosely Sorbed and Fe-P only	Biogenic (labile) P only	Total of all available forms <sup>1</sup>
Treatment area for scenario	15+ Feet (4.5m)	15+ Feet (4.5m)	15+ Feet (4.5m)
Per acre cost			
Mean Available Sediment P (mg/kg DW)	158	520	678
Target Depth of Sediment to be Treated (cm)	10	10	
Volume of Sediment to be Treated per m <sup>2</sup> (m <sup>3</sup> )	0.100	0.100	
Specific Gravity of Sediment	1.03	1.03	
Percent Solids (as a fraction)	0.082	0.082	
Mass of Sediment to be Treated (kg/m <sup>2</sup> )	8.4	8.4	
Mass of P to be Treated (g/m <sup>2</sup> )	1.33	4.39	5.73
Target Area (ac)	1	1	1
Target Area (m <sup>2</sup> )	4032	4032	4032
Aluminum sulfate (alum) @ 11.1 lb/gal and 4.4% aluminum (lb/gal)	0.4884	0.4884	0.4884
Sodium aluminate (aluminate) @ 12.1 lb/gal and 10.38% aluminum (lb/gal)	1.256	1.256	1
Stoich. Ratio (ratio of Al to P in treatment)	15	7.5	
Resulting areal dose (g Al/m <sup>2</sup> )	20	33	53
Ratio of alum to aluminate during treatment (volumetric)	1.80	1.80	1.80
Aluminum Load			
Dose (kg/area)	81	133	214
Dose (lb/area)	178	292	470
Dose (gal alum) with Alum only	364	598	962
Application (gal/ac) for alum	364	598	962
Dose (gal alum) @ specified ratio of Alum to Aluminate	150	246	396
Dose (gal aluminate) @ specified ratio of Alum to Aluminate	83	137	220
Application (gal/ac) for Alum in Alum+Aluminate Trtmt	150	246	396
Application (gal/ac) for Aluminate in Alum+Aluminate Trtmt	83	137	220
Acreage to be treated (ac)	56.00	56.00	56.00
Acreage to be treated (ha)	22.68	22.68	22.68
Total mass of P to be inactivated (kg)	302.66	996.09	1298.74

<sup>1</sup>Note that rows that are not additive are not displayed

For treatment of Nippo Lake, a 1.8:1 volumetric ratio of alum (aluminum sulfate) to aluminate (sodium aluminate) is recommended during the application to stabilize pH. This ratio may be adjusted as the treatment progresses in response to field measurements of pH to keep the pH in the desired range between 6 and 8 standard units. The alum and aluminate solutions are expected to be 4.4% and 10.2% aluminum, respectively. At the recommended ratio and dose this equates to additions of 22,176 gallons of alum and 12,320 gallons of aluminate over 56 acres of sediment surface in Nippo Lake.

### Timing and sequencing of aluminum application

Aluminum application to Nippo Lake is proposed to occur in 3 phases (Figure 3). Since aluminum has not been used as method to inactivate sediment phosphorus in New Hampshire lakes since the 1980s, the first phase (pilot) will include an aluminum application in a 10-acre pilot plot at a dose of 26.5 g/m<sup>2</sup> in the target treatment area. The pilot phase is designed to evaluate environmental, limnological, ecological, and biological conditions and make necessary

adjustments to the application dose rate and alum:aluminate ratio to minimize risks to aquatic organisms (see below). The first application will occur over the remaining 46 acres that were not treated initially. The second application will occur over the entire 56 acres. For both applications, a dose of 26.5 g/m<sup>2</sup> will be applied in all locations exceeding 15 feet deep. When the mass of aluminum from all three applications is combined, the total dose will be equivalent to 53 g/m<sup>2</sup>.

The pilot phase is proposed for May 2021 and will be completed in a single day. The remaining applications will be scheduled 2-3 weeks after the pilot (Table 4). For the first and second applications, a maximum of one-quarter (25%) of the total area scheduled to be included in the respective application will be treated in a single day (12 acres/day for application 1 and 14 acres/day for application 2). The purpose of limiting the daily application area to 25% of the total area is to provide refuge from the treatment area for mobile aquatic organisms. The goal would be for each application to occur over four consecutive days. Following completion of the first application, environmental conditions will be evaluated to determine if the second application could proceed the following day or if a period of time is needed to protect aquatic life. One approach utilized in other treatments has been to complete the first dose on a Friday, monitor through the weekend, and resume treatment on Monday.

**Table 4. Proposed treatment areas.**

Approximate Treatment area	Pilot treatment (May 2021)	Application 1 (2-3 weeks after Pilot)	Application 2 (2-3 days after Treatment 1)
Pilot Area (acres)	10		
Day/Area 1 (acres)		12	14
Day/Area 2 (acres)		12	14
Day/Area 3 (acres)		12	14
Day/Area 4 (acres)		12	14

## **SECTION II. KEY DATES FOR THIS REQUEST**

### **A. KEY DATES FOR THIS REQUEST**

<b>3/22/2021</b>	RFB released
<b>3/24/2021</b>	Last day for questions to awarding authority
<b>3/26/2021</b>	Issue addendum if required
<b>3/30/2021</b>	Response due to awarding authority by <b>4:00 PM EST</b>
<b>4/06/2021</b>	Notice of Award
<b>4/19/2021</b>	Contract work to commence pending approval
<b>08/01/2021</b>	Preferred target completion date
<b>10/01/2021</b>	Contract work to be completed by this date

Note that an application for Authorization to Discharge Under the New Hampshire State Surface Water Discharge Permit has been submitted to NHDES by the Nippo Lake Association. The draft Authorization to Discharge Under the New Hampshire State Surface Water Discharge Permit was released for public comment by NHDES on March 19, 2021 (Link to draft permit: [Permit to add aluminum compounds to Nippo Lake, Barrington \(nh.gov\)](#)).

## **SECTION III. CONDITIONS**

### **A. KEY CONDITIONS**

1. The awarding authority may cancel this RFB, in whole or in part, or may reject all responses submitted in response, or may procure only some goods and/or services outlined in this RFB whenever such action is determined to be fiscally advantageous to the Association or if it is otherwise in the best interest of the Association.
2. The awarding authority may request that supplementary information be furnished to assure that a vendor has the technical competence, the business and technical organization, and the financial resources adequate to successfully perform the necessary work.
3. Required forms are provided by the awarding authority in the attached appendices. All responses shall be in ink or typewritten and must be presented in an organized and clear manner.
4. Questions or clarifications arising from these documents shall be submitted in writing. They should be sent to the **individual named in section VI**. They must be submitted in accordance with Section II "Key Dates for This Request".
5. Each vendor shall acknowledge receipt of any and all addendum issued to the RFB by so indicating in the Cover Letter/General Response. Failure to do so may constitute cause to reject the response as being incomplete.
6. The vendor shall sign the response correctly in ink or in the case of an organization, firm, partnership or corporation, a person having the legal authority from said organization to sign the response will sign the document.
7. Vendors may correct, modify or withdraw the original response on or before the date and time as stated. Corrections or modifications shall be in sealed envelopes, clearly marked to indicate the contents, with the name and address of the vendor.
8. Any late correction or modification to the response will not be accepted. A vendor who wishes to withdraw a response must make a request in writing.
9. Each vendor shall be presumed to have read and be thoroughly familiar with these documents. Unfamiliarity with these documents shall in no way relieve any vendor from any obligation with respect to the response.
10. The vendor's response to provide said services and products must remain valid for 90 days past the submission deadline.
11. All applicable state laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over response/purchase shall apply to the contract throughout, and they shall be deemed to be included in the contract the same as though herein written out in full.
12. It is understood that the vendor has submitted the response in good faith and has not colluded with any other individuals, firms, or corporations in creating the response to subvert the market process. See Certificate of Non-Collusion attached (Appendix A).
13. All costs involved in preparing the response will be borne by the vendor. The vendor shall be familiar with all state, local and other laws relating to this type of work.

14. All vendors are to include a statement that the response is in accordance with this Request for Bids and that the vendor has read and understands all sections and provisions herein. Exceptions, if any, are to be clearly stated.
15. No award will be made to any vendor who cannot satisfy the awarding authority that he/she has sufficient ability and sufficient capital to enable him/her to meet the requirements of these specifications. The awarding authority's decision or judgment on these matters shall be final, conclusive and binding.
16. Any response received after the date and time stated in the RFB may be deemed "non-compliant" relative to the RFB response requirements and may not be opened. Unopened responses will be returned to the vendor.
17. Any contract resulting from this RFB shall be awarded to the vendor whose response is deemed to be the most highly advantageous to the awarding authority, which will be the sole judge in determining whether a vendor's response satisfies the requirements of this RFB.
18. Response to this Request for Bids acknowledges the vendor's acceptance of all sections and requirements of this document. The Request for Bids along with the vendor's response will be written into the successful vendor's contract.

#### **B. SITE VISITS**

Site visits are optional and may be arranged by contacting **individual named in section VI**.

#### **C. QUESTIONS AND CLARIFICATIONS**

Questions requesting clarification shall be submitted in email to the awarding authority prior to **4:00 PM EST on 03/24/2021** in order to afford adequate time to respond with a correction or additional information prior to the deadline for submission of responses. Should it be found necessary, a written addendum will be incorporated into the RFB and will become part of the contract. Those who have received a copy of the RFB will be notified of such changes.

#### **D. NOTIFICATION OF AWARD**

All vendors that submit responses to this RFB will be notified of the selection decision within 7 days of the date responses are due unless otherwise notified. In no case, will the award be made beyond 30 days unless the vendor agrees to extend the period of time in which the response is valid.

#### **E. CONTRACT**

This Request for Bids, as well as the selected vendor's response, and any addenda to that response will become part of the final contract. The Contract shall be subject to Force Majeure considerations. Either party hereto shall be excused from performance of any act under the contract if prevented from the performance of any act required by reasons of strikes, lockouts, labor trouble, inability to procure materials, failure of power, fire, winds, Acts of God, riots, insurrections, war or other reason of a like nature not reasonably within the control of the party. The period for the performance of such obligation shall be extended for an equivalent period for no additional cost. Continued prevention from performance by such causes for periods aggregating sixty (60) or more days shall be deemed to render performance impossible, and either party shall thereafter have the right to terminate this contract.

## **F. FAILURE TO PERFORM**

It is expected that if the vendor does not fulfill the terms of the agreed upon contract, the awarding authority may contract with another vendor to provide the necessary services. If the costs associated with the second contract exceed the costs associated with the awarded vendor, the awarding authority reserves the right to collect the difference from the awarded vendor. This may also include court costs and legal fees associated with the collection of the monies owed.

## **G. TERMINATION OF CONTRACT**

Subject to the provisions of the section explaining Force Majeure, if the vendor shall fail to fulfill in a timely and satisfactory manner its obligations under this agreement, or if the vendor shall violate any of the covenants, conditions, or stipulations of this agreement, which failure or violation shall continue for seven (7) business days after written notice of such failure or violation is received by the vendor, then the awarding authority shall thereupon have the right to terminate this agreement by giving written notice to the vendor of such termination and specifying the effective date thereof, at least seven (7) days before the effective date of such termination.

## **H. INSURANCE REQUIREMENTS**

### **1. Indemnification**

The vendor shall indemnify, defend, and save harmless the awarding authority from and against all suits and claims of liability of every name and nature, including attorney's fees and costs of defending any action or claim, for or on account of any claim, loss, liability or injuries to persons or damage to property of the awarding authority or any person, firm, corporation or association arising out of or resulting from any act, omission, or negligence of the vendor, subcontractors and their agents or employees in the performance of the work covered by this Agreement and/or their failure to comply with terms and conditions of this Agreement. The foregoing provisions shall not be deemed to be released, waived or modified in any respect by reason of any surety or insurance provided by the vendor under contract with the awarding authority.

### **2. Insurance Requirements**

The vendor shall, before commencing performance of the contract, be responsible for providing and maintaining insurance coverage in force for the life of the contract of the kind and in adequate amounts to secure all of the obligations under the contract and with insurance companies acceptable to the awarding authority. All such insurance carried should not be less than the kinds and amounts designated herein, and the vendor agrees that the stipulation herein of the kinds and limits of coverage shall in no way limit the liability of the vendor to any such kinds and amounts of insurance coverage. Under all insurance coverage, required or not required by the awarding authority, the vendor shall defend, indemnify, and hold harmless the awarding authority against any claim based upon negligent, accidental or intentional acts or omissions of the vendor, its employees or its agents in providing its services to the awarding authority or its dependents pursuant to the agreement. Insurance coverage types and minimum amounts will be as follows:

- Comprehensive General Liability Insurance**

The vendor shall carry comprehensive public liability insurance against all claims of bodily injuries, death or property damage, in amounts not less than \$1,000,000 each occurrence and \$2,000,000 general aggregate.

- **Automobile Liability and Property Damage Insurance**  
The vendor shall carry business Automobile Liability Insurance covering all owned vehicles with a combined single limit no less than One Million Dollars (\$1,000,000) to cover all damage caused by contracted employees of the awarded vendor.
- **Workers' Compensation Insurance**  
The vendor shall carry Workers' Compensation Insurance as required by law.
- **Excess Liability**  
The vendor shall carry excess liability insurance of not less than One Million Dollars (\$1,000,000) covering over general liability, automobile, and worker's compensation insurance.
- **Pollution Liability Insurance**  
The vendor shall carry pollution liability insurance providing for a limit of not less than One Million Dollars (\$1,000,000), adding the awarding authority as an additional insured. The coverage must extend to first party liability, third party liability and include remediation expense, outside the limits of liability, of a minimum of One Million Dollars (\$1,000,000).

## I. LICENSES AND PERMITS

The vendor is responsible for attaining and holding in good standing all relevant licenses and certificates associated with the completion of these services. The awarding authority will supply to the vendor the final NHDES approval for treatment.

## J. MONITORING AND INSPECTION

This project will be managed through the awarding authority. On a regular basis the awarding authority (and/or its agent) may visit the site to inspect and monitor the vendor's operations. A representative of the awarding authority and/or its agent may board any vessel used by the vendor in performing their operations and shall have the authority to cease any and all vendor operations at any time.

## SECTION IV. SCOPE OF WORK

### A. MOBILIZATION AND STAGING AREA SET UP

The vendor shall get all necessary equipment to the site and establish an appropriate staging area from which the vendor shall operate. Chemicals and sensitive equipment must be stored securely whenever the vendor is not on site. The awarding authority will assist in locating the staging area and providing secure storage. Any overnight or off-time security personnel will be the responsibility of the vendor.

At Nippo Lake, the most appropriate site for access and staging appears to be at the North end of the lake at the end of Golf Course Way (Figure 5). Although interference with boating activity during treatment is to be avoided, it will not likely be necessary to close the lake to all boat access. The staging site and activities related to delivery of, storage of and boat refilling operations with aluminum products should be described in the response. The awarding authority may offer vendor access to specified docking structures the adequacy of which it shall be vendor's responsibility to determine. In any event, any docking structures required for access to the treatment vessel should also be described. If a temporary dock is needed, the contractor should identify and execute any local or state permits needed to install the structure.



**Figure 5: Potential staging area for phosphorus inactivation project at end of Golf Course Way**

## B. OPERATIONS AND MAINTENANCE PLAN

An operations and management plan will be provided to the Nippo Lake Association by the selected vendor prior to the beginning of the pilot in-lake application/treatment for review and to ensure environmental safety. The operations and management plan will be developed in conjunction with the vendor so that the plan conforms to the equipment the vendors plan on using to deliver and apply the aluminum solutions. The plan will specifically include, but not be limited to, the following:

- 1) Details on the access and staging areas including a basic site map.
- 1) The method of chemical delivery, transfer, and on-site storage as well as the length of time chemicals will be stored at the site and plans for securing chemicals during storage.
- 2) Safety measures for minimizing chemical spillage, leakage, and containment.
- 3) The names and contact information for the persons responsible for chemical management as well as emergency contact information.
- 4) Proposed location and content of signage, including posting of any local or state permits as required, prior to, during and after the treatment.
- 5) Details for cleaning up at the access and chemical transfer points following application.

### **C. ALUM TRANSFER AND SAFE HANDLING**

The vendor shall plan and schedule the timely delivery, storage and transfer of aluminum sulfate and sodium aluminate. All piping shall be appropriate to the materials being transferred, corrosion resistant, with proper joint seals, and free of observable defects. All storage tanks, pipes, hoses, couplings and connectors for aluminum compounds must meet corrosion resistance standards for those aluminum compounds.

The vendor will have a spill prevention, control and contingency plan in place, a written copy (part of Operation and Maintenance Plan described above) will be accessible on site and will have adequate spill control materials to properly clean up after any spill.

### **D. ALUMINUM APPLICATION**

The vendor shall conduct the aluminum sulfate/sodium aluminate application utilizing an appropriate vessel with a subsurface injection system that allows for controlled application and proper mixing of liquid aluminum sulfate and sodium aluminate at variable boat speeds. The barge position in the lake shall be managed by a global positioning system and depth monitoring system that allows the operator to know where the vessel is and direct application within the target area and only in the target area.

The treatment vessel will be loaded with aluminum compounds at the designated location properly set up to address equipment issues, refueling, spills of fuel or aluminum compounds, and to minimize any environmental damage.

The vendor shall apply the aluminum sulfate and sodium aluminate at a ratio that results in a pH between 6 and 8, with a preferred range of 6.5 to 7.5 and an average pH target of 7. It is assumed that a ratio of 1.8:1 (alum to aluminate by volume) will result in the desired conditions, but the vendor will be responsible for ratio adjustment to maintain the pH within the range of 6-8 standard units. Chemicals must be simultaneously distributed by means of a dual manifold or other appropriate injection system. Injection will facilitate an active mixing zone of at least 10 feet (3 m) on initial injection with a preference for a 15 to 20-foot mixing zone as water depth and thermal regime allow. It is acknowledged that the mixing zone will be subject to the thermal regime at the time of treatment, but an early spring treatment is preferred and should allow for maximum mixing.

The vendor will be responsible for application in a pattern that will lead to uniform distribution of aluminum floc on the bottom in the target area with minimum drift outside the target area. The application rate to any target area shall not exceed a dose of 30 g/m<sup>2</sup> within any 24-hour period. Where an area must be treated more than once to achieve the target dose, at least 24 hours must elapse between treatments of the same area.

The dose to be applied will be 53 g/m<sup>2</sup> over the target area. The target area covers 56 acres.

It is expected that the treatment will occur in the spring, with a target time range as early in April or May as possible if contracting and weather permits.

## **E. RESPONSIVE MONITORING**

Water quality will be extensively monitored before, during and after the treatment in order to document important water quality parameters and the extent of stratification in order to maximize aluminum treatment efficacy and minimize potential impacts to aquatic life. The narrative below describes a proposed monitoring plan which is summarized in Appendix A. The monitoring plan will be finalized once a vendor has been selected and with input from NHDES. The monitoring scope is provided to the application vendor for informational purposes only.

Monitoring will be conducted by a separate contractor of the awarding authority, but the vendor is responsible for meeting the above conditions and should plan for assisting in any monitoring needed to aid in the direction of treatment. Anticipated third party monitoring will include daily pH and alkalinity testing in the treatment zone and in reference areas outside the treatment zone, daily surface and subsurface inspection for floc formation and settling and any distress to visible aquatic organisms. Monthly water chemistry monitoring for features such as temperature, oxygen, phosphorus and nitrogen is conducted. All data will be available to the vendor as quickly as possible, with field measures available the same day as collected. The third party monitor will communicate immediately with the vendor if any problems are indicated, including high or low pH, fish kills, or other negative impacts that may require cessation and/or modification of the treatment protocol.

At a minimum, the vendor should be prepared to check alkalinity, pH, and temperature in the treatment zone during treatment, if third party monitoring crews are not immediately available but typically, those data will be supplied by the third party monitor.

## **F. DEMOBILIZATION AND SITE RESTORATION**

The vendor will remove all equipment related to the aluminum treatment at the end of the treatment process. All disturbed areas will be restored to their former conditions or better, as appropriate and feasible. The awarding authority will inspect the staging area and certify that the vendor has properly vacated and restored that area.

## **G. REPORTING**

The vendor will maintain ongoing communication with the awarding authority and/or its agent and will advise all relevant parties on an ongoing basis as to application status, results, and all other conditions relevant to application. The vendor shall keep daily records of the following:

- Hours of operation
- Quantities of aluminum sulfate and sodium aluminate applied
- Acreage of lake treated (daily and cumulative)
- Location (on map) of area treated each day
- Summary of chemical deliveries
- Explanation of any downtime, including weather conditions and equipment problems
- Any monitoring conducted by the vendor

The vendor shall also provide a completed coverage map at the end of the application, with any defined treatment sectors identified and the total quantities of aluminum sulfate and sodium aluminate applied to each. A concise summary report including all information relevant to the treatment is to be provided within 30 days of completion of the project.

#### **SECTION V. VENDOR QUALIFICATIONS**

All vendors replying to this RFB will be experienced in the application of aluminum to lakes. In addition to the bid response, short (one paragraph to single page) write-ups should be provided for five projects demonstrating that experience, each with a contact person, email and phone number that the awarding authority can use to further evaluate performance on those projects.

Additionally, a list of all personnel to be deployed on this project should be provided, with personnel assignments and a paragraph of qualifications for each person to conduct the assigned work. No substitutions are allowed without the approval of the awarding authority.

## **SECTION VI. BID RESPONSE SUBMISSION REQUIREMENTS**

The response shall be delivered in a sealed envelope or by email to the individual noted below **by 4:00 PM on March 30, 2021 to address or email noted below.**

**Nippo Lake Association  
Attn: Kevin M. Fitzgerald  
ADDRESS c/o P.O. Box 313  
334 Flower Drive  
Barrington, NH 03825**

**Tel: (603) 315-8026  
Email: kevinmfitzgeraldpc@gmail.com**

### **CERTIFICATE OF NON-COLLUSION**

The undersigned certifies under penalties of perjury that this bid has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification the word "person" shall mean any natural person, business, partnership, corporation, union, committee, club or other organization, entity, or group of individuals.

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

TELEPHONE \_\_\_\_\_

NAME (print) \_\_\_\_\_

SIGNATURE \_\_\_\_\_

TITLE \_\_\_\_\_

DATE \_\_\_\_\_

**BID SUBMITTAL**

For the treatment of 56 acres of Nippo Lake at 53 g/m<sup>2</sup> according to the specifications in the RFB dated \_\_\_\_\_.

Contract Bid Price (Lump Sum): \_\_\_\_\_  
(words)  
\$ \_\_\_\_\_  
(figures)

BIDDER: \_\_\_\_\_  
(indicate correct name of bidding entity)

By: (Signature) \_\_\_\_\_

(Printed Name) \_\_\_\_\_

Title: \_\_\_\_\_

Submittal Date: \_\_\_\_\_

Address for Giving Notices: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone Number: \_\_\_\_\_

Fax Number: \_\_\_\_\_

Contact Name & Email Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Bidder's License No.: \_\_\_\_\_

**Appendix A**  
Proposed Nippo Lake phosphorus inactivation project monitoring plan



Treatment Phase	Approximate date(s) of Monitoring	Type of Monitoring	Frequency	Location(s) and Depth(s)	Parameters Monitored	Comments
Pre-treatment 1	March/April 2021; no more than 3-weeks prior to pilot treatment	Water quality monitoring	Single sample event	3 locations (2@~10m deep, 1@~14m deep) along the north-south centerline of the lake. Sample depth is 1m increments for field measures and 1/3,1/2, and 2/3 of total depth for grab samples	Field measurements: temperature, pH, dissolved oxygen, specific conductance, Secchi disc transparency. Grab samples: alkalinity, hardness, dissolved organic carbon, acid soluble aluminum, total aluminum, total phosphorus, chlorophyll-a.	Results must be made available for review prior to any treatments.
Pre-treatment 2	May 2021; no more than 2-days prior to treatments 1 and 2.	Shoreline survey of aquatic organism distress and underwater video. Water quality monitoring.	Prior initiation of the first and second treatments (2 events total);	Field measures: Deep spot (>14m) at 1m intervals. Grab samples at 1/3,1/2, and 2/3 of total depth; Additional 10 pH field measures at 0.5m depth from various locations around lake at locations with depth <5m.	Field measurements: temperature, pH, dissolved oxygen, specific conductance, Secchi disc transparency. Grab samples: alkalinity, hardness, dissolved organic carbon, acid soluble aluminum, total aluminum, total phosphorus, chlorophyll-a. Zooplankton and phytoplankton samples from deep spot.	Field measured data will be reviewed prior to treatment; grab sample data will not be available prior to treatment

During Treatment	–May 2021	Shoreline survey of aquatic organism distress and underwater video. Water quality monitoring	Field measurements: beginning, middle, end of each treatment day (8 treatment days proposed). Grab samples: end of treatment day. Visual observations : Continuous throughout day.	One sample location in each of 4 treatment “sectors”. Field measurements and grab samples at 1/3 and 2/3 of total depth. Additional 10 pH field measurements at 0.5m at various locations around lake at locations with depth <5m.	Field measured: temperature, pH, dissolved oxygen, specific conductance, Secchi disc transparency. Grab samples: alkalinity, hardness, dissolved organic carbon, acid soluble aluminum, total aluminum, total phosphorus, chlorophyll- <i>a</i> . Phytoplankton and zooplankton samples at end of day.	Field measured data will be reviewed prior to and after treatment; Grab sample data will not be available for up to 2-3 weeks after sample collection
Post-Treatment	May 2021 – October 2022	Water quality monitoring.	2021: 1-week post second treatment, monthly June – September 2021. 2022: Ice-out, August, and October.	Field measurements from deep spot at 1m intervals. Grab samples at 1/3, 1/2, and 2/3 of total depth. Zooplankton and phytoplankton samples	Field measurements: temperature, pH, dissolved oxygen, specific conductance, Secchi disc transparency. Grab samples: alkalinity, hardness, dissolved organic carbon, acid soluble aluminum, total aluminum, total phosphorus, chlorophyll- <i>a</i> . Phytoplankton and zooplankton samples.	Monitoring should mimic pre-treatment 2 monitoring.

