

State Surface Water Discharge  
Permit No. Lake Kanasatka - 002

**AUTHORIZATION TO DISCHARGE UNDER  
THE NEW HAMPSHIRE STATE SURFACE WATER DISCHARGE PERMIT**

In compliance with the provisions of the State of New Hampshire Revised Statutes, Title L Water Management and Protection, Chapter 485-A Water Pollution and Waste Disposal,

**Lake Kanasatka Watershed Association (LKWA), Inc., PO Box 774, Center Harbor, NH 03226**

is authorized to apply, as a demonstration:

**Aluminum**

to receiving water named:

**Lake Kanasatka, Moultonborough, New Hampshire (approximately 43.7235N, -71.4476W)**

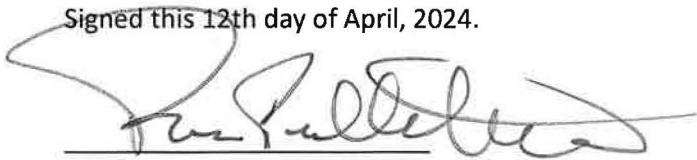
in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit extends until the treatment and monitoring requirements specified herein have been satisfied or if the treatment is determined to be harmful to the aquatic life or human health.

Effective Date: April 15, 2024

Expiration Date: June 30, 2024

Signed this 12th day of April, 2024.

A handwritten signature in black ink, appearing to read "Rene Pelletier", written over a horizontal line.

Rene Pelletier  
Director, Water Division  
New Hampshire Department of Environmental Services



## PART I. PROJECT OVERVIEW

### 1. Project Description

The project permitted herein allows for the application of aluminum compounds as defined below to Lake Kanasatka in Moultonborough, NH to control the frequency and severity of cyanobacteria blooms. The project serves as a demonstration for lake restoration purposes in New Hampshire. Aluminum will be introduced by the addition of aluminum sulfate [Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>] and sodium aluminate [NaAlO<sub>2</sub>] from a vessel outfitted with holding tanks, pumps, hoses, and meters for delivery of the chemicals. Chemicals will be added, as specified below, at a ratio of the volume of aluminum sulfate to sodium aluminate equal to the prescribed dose of aluminum per area. A majority of the aluminum added will precipitate as floc on the lake bottom in the approximate area of application. The aluminum floc will bind with phosphorus in the benthic sediments and significantly reduce the amount of phosphorus that becomes available to fuel cyanobacteria blooms and result in a net benefit of lake condition.

### 2. Purpose, justification, and benefit

The purpose of the project is to restore the recreational use and ecological health of Lake Kanasatka. From 2020 through 2023, Lake Kanasatka experienced cyanobacteria blooms that have interfered with recreation and had ecological impacts for a significant portion of the summer season and stretching into late fall. In total, cyanobacteria warnings were issued for a total of 259 days from 2020 through 2023 and for 121 days in 2023. An evaluation of lake conditions and development of a lake phosphorus loading model identified that 20% of the annual phosphorus load is contributed from lake bottom sediments. Data collected from Lake Kanasatka documented that at depths below 7.5 meters there is little to no dissolved oxygen (anoxia). Anoxia results in the release of phosphorus from the sediments into the overlying water which is then available for uptake by cyanobacteria. Phosphorus concentrations in water collected at a depth of 13 meters ranged from 100-200 ug/L in September and early October 2022 and peaked between 12 and 14 ug/L near the surface.

The goal of the demonstration treatment is to reduce the phosphorus load to Lake Kanasatka released from bottom sediments by 80-90% (~44 kg/yr or 97 lbs/yr) over current conditions towards the goal of meeting a target in-lake annual phosphorus concentration of 7.2 ug/L which is consistent with the lake's historic trophic state (oligotrophic). By reducing the phosphorus load, the risk of cyanobacteria blooms in Lake Kanasatka will be minimized to the extent possible for a period expected to extend 10 – 20 years, provided additional nutrient sources are controlled.

Aluminum application as a demonstration in Lake Kanasatka was chosen as the best alternative compared to other internal nutrient load management options such as aeration, oxygenation, or dredging to achieve the desired outcome of the project as it best targets the source of nutrients, is proven as a successful additive to control the release of phosphorus from the sediments, is most cost effective as compared with other options, and presents a low environmental risk.

The demonstration project will improve the overall condition of Lake Kanasatka by reducing the frequency and extent of cyanobacteria blooms and, in turn, the length of time when the waterbody is a potential health risk to human, pet, and livestock health and increasing the length of time it is suitable for recreation. Secondly, by reducing the dominance of cyanobacteria, a more balanced and adaptive

**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

plankton community is expected to proliferate which will contribute to a healthy aquatic community, including fisheries. Lastly, a reduction in nutrient availability is expected to increase water clarity and dissolved oxygen concentrations during the summer months.

**PART II. CHEMICAL ADDITIVES AND RECEIVING WATER LIMITS**

1. Chemical additives - During the period beginning on the effective date and lasting through the expiration date, the Permittee is authorized to apply aluminum sulfate (alum) and sodium aluminate (aluminate) to Lake Kanasatka to control the growth of cyanobacteria and algae in the lake by reducing the amount of phosphorus in surficial bottom sediments that becomes available in the overlying surface water. The active ingredient in these compounds is aluminum. The application shall be limited as specified below in Table 1.

Table 1. Limits of chemical addition to Lake Kanasatka, Moultonborough, NH.

Chemical Additive	Limit of Application <sup>1</sup>		
	Approximate Ratio of Application <sup>2</sup>	Maximum Daily Dose <sup>3</sup> (grams of aluminum / m <sup>2</sup> )	Permit Dose Maximum <sup>4</sup> (grams of aluminum / m <sup>2</sup> )
<b>Aluminum Sulfate</b> , Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ; ~4.4% aluminum by volume	2 parts aluminum sulfate by volume	25 in total when combined with Sodium Aluminate	50 in total when combined with Sodium Aluminate
<b>Sodium Aluminate</b> , NaAlO <sub>2</sub> ; ~10.2% aluminum by volume	1 part sodium aluminate by volume	25 in total when combined with Aluminum Sulfate	50 in total when combined with Aluminum Sulfate

2. Receiving water limits - The receiving water is defined as Lake Kanasatka, Moultonborough, New Hampshire. Chemical additives, as defined above, shall be added to the receiving water in 3 distinct phases: Pilot, Phase 1 and Phase 2. Each phase will be broken into daily events that occur in a 14-acre pilot zone and three primary zones (A, B, and C, ~50 acres each) treated during phase one and phase two (See Map 1). The limits of receiving water quality criteria are specified in Table 2.

**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

Table 2. Limit of receiving water criteria in Lake Kanasatka, Moultonborough, NH.

Receiving Water Characteristics	Receiving Water Limitation <sup>5</sup>		
	Daily Event Maximum <sup>6</sup>	Weekly Average <sup>7</sup>	End of Permit Term <sup>8</sup>
Acid Soluble Aluminum <sup>9</sup> , ug/L	750	87	Pre-alum application ambient concentration <sup>10</sup>
Turbidity <sup>11</sup>	10 NTUs above conditions prior to treatment	10 NTUs above conditions prior to treatment	10 NTUs above conditions prior to treatment
pH <sup>12</sup>	6.5 - 8.0 Standard Units	6.5 - 8.0 Standard Units	6.5 - 8.0 Standard Units

Tables 1 and 2 Footnotes:

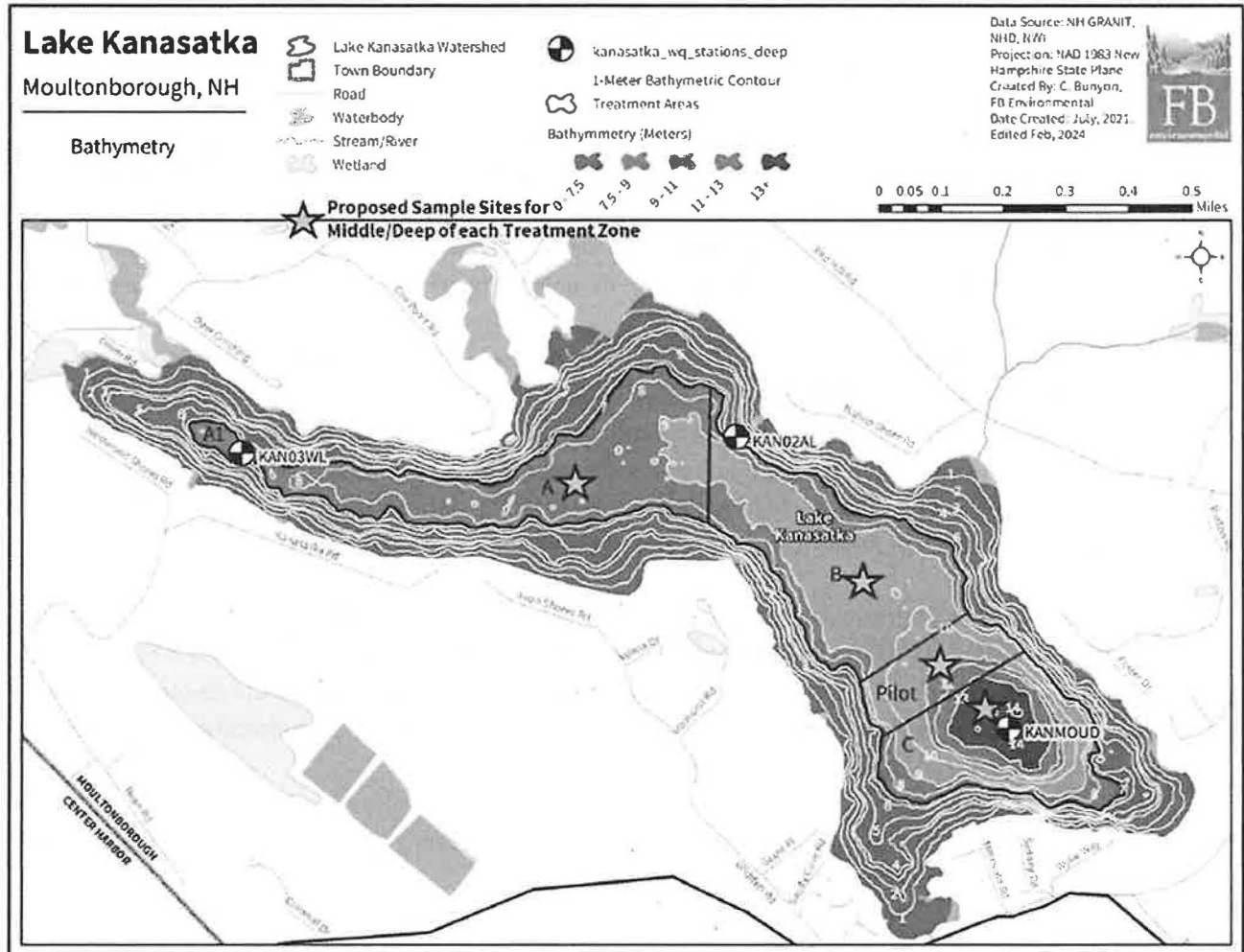
1. Adherence to the Limit of Application shall be estimated and reported by the Permittee to NHDES based on the known mass of aluminum in the chemical compounds, the percentage of aluminum in the solutions applied, and measured as the volumes of solutions applied.
2. The Approximate Ratio of Application is the ratio of alum to aluminate which is added on a given day. The ratio may be adjusted during any application in order to control pH within a target range of 6.5 – 8.0 standard units within a treatment zone to minimize risks to aquatic life. Adjustments to the ratio of alum to aluminate must be accounted for in the limits of the maximum daily dose and the permit dose maximum. If the pH of Lake Kanasatka is outside the range of pH noted above as measured in the Before Treatment monitoring events (See PART VI. MONITORING), then the pH during this monitoring event shall set the upper or lower bound of the target pH range during treatment.
3. The Maximum Daily Dose applies to the zone planned for treatment during each respective phase and is the sum of that contributed by alum and aluminate.
4. The Permit Dose Maximum applies to areas equal to or greater than 24 feet in depth (approximately 153 acres in total) and represents the cumulative total mass of aluminum contributed by alum and aluminate for all treatments.
5. The Receiving Water Limitations are defined as the average of the concentrations or measurements from Lake Kanasatka as defined in 7, 8, and 9 below.

**State Surface Water Discharge**  
**Permit No. Lake Kanasatka - 002**

6. For aluminum and turbidity, attainment of the Daily Event Maxima receiving water limitation is defined as the average of all samples collected during each sampling event within the respective treatment zone after a daily treatment has been completed in the respective zone. For pH, attainment of the Daily Event Maxima receiving water limitation shall be determined as the 1-hour running average of continuous pH measures taken throughout a day's treatment period within the respective daily treatment zone. A record of the single sample maximum aluminum concentration, maximum turbidity reading, as well as the minimum and maximum 1-hour running average pH record shall be reported for each day of monitoring.
7. For aluminum and turbidity, a daily average of all samples collected within each respective treatment zone shall be computed. To determine attainment of the Weekly Average receiving water limitation, the daily average within each zone shall be averaged over a running period of 96-hours (4-days). For pH, attainment of the Weekly Average receiving water limitation shall use the same computation as described in #6.
8. The End of Permit Term receiving water limitation shall be the average of all samples collected within the respective treatment zone during the last month of monitoring in the year in which the treatment occurs. If the average of acid soluble aluminum concentration or turbidity of all samples in an After Treatment monitoring event is equal to or less than the value computed based on the average concentration in the Before Treatment monitoring event as described in PART VI. MONITORING, then it shall represent the End of Permit Term limitation and subsequent aluminum monitoring is not required.
9. Acid soluble aluminum concentration shall be determined using EPA method 200.7 with a laboratory quantitation limit of at least 15 ug/L.
10. Pre-alum application ambient concentration is defined as the pre-alum application ambient sampled concentration, plus 20% of the remaining assimilative capacity for aluminum within the lake.
11. Turbidity shall be estimated using Standard Method 2130 B by way of a suitable field or laboratory meter that measures to the nearest 0.1 NTU.
12. pH shall be estimated using Standard Method 4500-H+B by way of a suitable field or laboratory meter that measures to the nearest 0.01 standard units. Given that the chemical addition permitted herein is temporary in nature and does not represent a continuous discharge of effluent pollutants from a fixed location, the concept of "end of pipe" limits as required in Env-Wq 301.17, are not directly applicable to this permit. The aluminum product sinks through the water column absorbing phosphorus as it falls and binding with phosphorus in the sediment. The critical point of measure is not an end of pipe but rather the receiving water within the immediate application zone during the treatment. Therefore, the end of pipe pH criteria, as defined in Env-Wq 301.17, does not apply, except that the receiving water limits must be met.

**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

Map 1. Proposed treatment zones (A, B, C, plus Pilot within zone C) and sampling sites for middle/deep of each treatment zone.



**PART III. ADHERENCE TO WATER QUALITY STANDARDS**

1. The addition of aluminum sulfate and sodium aluminate as provided herein shall not cause a violation of the water quality criteria of the receiving water defined in Table 2.
2. The discharge shall be free from substances in kind or quantity that settle to form chronic harmful benthic deposits; float as foam, debris, scum or other visible substances; produce odor, color, taste or turbidity that is not naturally occurring and would render the surface water

**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

unsuitable for its designated uses; result in the dominance of nuisance species; or interferes with recreational activities except as occurs for the explicit purpose of this permit.

3. The discharge shall not result in toxic substances or chemical constituents in concentrations or combinations in the receiving water that injure or are inimical to plants, animals, humans or aquatic life; or persist in the environment or accumulate in aquatic organisms to levels that result in harmful concentrations in edible portions of fish, shellfish, other aquatic life, or wildlife that might consume aquatic life.
4. The Permittee shall not at any time, either alone or in conjunction with any other person(s), cause directly or indirectly the discharge of any chemicals into receiving waters except chemicals that have been applied in accordance with the permit limits contained herein in such a manner as to not lower the applicable water quality class, interfere with the existing uses or designated uses assigned to waters by the legislature, or violate any of the conditions listed in the permit.
5. The Permittee shall conduct monitoring in accordance with the conditions specified in the permit (See PART VI MONITORING), using analyses performed in accordance to those prescribed or referred to herein. If the Permittee monitors any pollutant more frequently than required by the permit using similar procedures as conditioned in this permit, the results of such monitoring shall be included in the calculation and reporting of the data so long as the additional samples do not bias the results for the purpose of meeting the permit limitations.
6. The chemical additives and receiving water limitations contained in the permit and the classification of waters requirements as provided by RSA 485-A:8 shall be met and maintained at all times. Whenever it is demonstrated that the limitations are not adequate to maintain said classification requirements, the Permittee shall be required to cease chemical additions until such time as the classification requirements are met.
7. The department maintains the authority to suspend or revoke this permit at any time following the criteria and procedures set forth in Env-Wq 301.10.

**PART IV. UNAUTHORIZED DISCHARGES**

1. This permit authorizes the application of aluminum sulfate and sodium aluminate in quantities defined in Table 1 to specific areas of Lake Kanasatka as a demonstration. Controlled application or release of these chemicals from any other sources or locations into Lake Kanasatka or its tributaries are not authorized by this permit.
2. The Permittee shall report any noncompliance which may endanger health or the environment including but not limited to receiving water permit limit violations, chemical spills, change of volume or type of pollutant and any adverse incidents as defined in the permit. Information shall be provided verbally within 24-hours from the time an incident occurs. A written report shall also be provided within 5-days of the time the Permittee becomes aware of the circumstances. The written report shall contain a description of the noncompliance and its cause; the period of



**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

**PART V. SPECIAL CONDITIONS**

1. A mixing zone as defined in Env-Wq 1707.02 is designated as the respective daily treatment zone as specified in this permit. Mixing zone water quality criteria must be met at all times within the specified treatment zone on the day(s) of treatment.
2. The Permittee shall request termination of the permit when the monitoring specified herein has been completed. NHDES shall respond to the termination request in writing.
3. The Permittee is responsible for ensuring that the entity applying the chemicals allowed by this permit controls the amount applied as necessary to meet applicable state water quality criteria standards as defined in PART III. ADHERENCE TO WATER QUALITY STANDARDS of this permit.
4. If the Permittee or the entity applying the chemicals allowed by this permit becomes aware (e.g., through self-monitoring or by notification from the state or third party), or the State determines that the chemicals have caused or contributed to an excursion of any applicable water quality criteria, the Permittee is responsible for ensuring that the entity applying the chemicals takes appropriate corrective action(s) up to and including ceasing aluminum compound treatments and any reasonable actions necessary to correct excursions to the water quality criteria associated with this permit.
5. An Operations and Management Plan must be submitted to NHDES by the Permittee prior to the addition of chemicals included in this permit. The Operations and Management Plan shall be reviewed and approved by NHDES prior to application of the chemicals to Lake Kanasatka. The NHDES approved Operations and Management Plan, along with all supporting maps and documents, must be retained by an officer of LKWA. The Operations and Management Plan and all supporting documents must be readily available, upon request, and copies of any of these documents provided, upon request, to the State, federal, or local agencies governing chemical applications within their respective jurisdictions. The Operations and Management Plan shall contain no less than:
  - a) A clear statement that this is a demonstration project.
  - b) Details on the access and staging areas including a basic site map.
  - c) 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.
  - d) Safety measures for minimizing chemical spillage or leakage and chemical spillage containment measures.
  - e) The names and contact information for the persons responsible for chemical management as well as emergency contact information.
  - f) Details for cleaning up at the access and chemical transfer points following application.

**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

6. A trained traffic control officer shall be present during all chemical deliveries. Any staging areas shall be maintained in such way as to minimize vandalization including but not limited to restricted access areas, locked valves on storage tanks, and periodic surveillance by local law enforcement officers.
7. Notice by the Permittee of the planned chemical application shall be given to all abutters of Lake Kanasatka and properties adjacent to the tributary outlet via mail or email at least 3-days prior to treatment. Notice of chemical application shall also be posted every 500 feet along the shoreline and at common public access points at least 3-days prior to the chemical application and maintained in place for at least 30 days following the last date of application.
8. The Permittee shall provide NHDES a description of the vessel to be used for the application of chemicals including the pumps, hoses, holding tanks, meters, and onboard spillage containment measures along with the vessel's size, engine type and horsepower prior to any application of chemicals to Lake Kanasatka. The vessel shall electronically track the volumes of each chemical added and the course of application on each given day.
9. Chemical applications shall occur in three phases as follows (see Map 1):
  - a) Pilot phase – 14 acres of Lake Kanasatka in an area >24 feet deep at a rate of 25g of aluminum / m<sup>2</sup>.
  - b) Phase 1 – 139 acres of Lake Kanasatka excluding the area treated in the pilot phase in an area >24 feet deep at a rate of 25g of aluminum / m<sup>2</sup>.
  - c) Phase 2 – 153 acres of Lake Kanasatka in an area >24 feet deep at a rate of 25g of aluminum / m<sup>2</sup>.
10. The timing and duration of the three phases shall be as follows:
  - a) Pilot phase – a one to two-day application duration.
  - b) Phase 1 – at least two weeks and not more than one month following the pilot phase and upon NHDES review of water quality data from the pilot phase. The application period shall be up to five days. No more than 52 acres shall be treated on any one day.
  - c) Phase 2 – at least two days following Phase 1 and upon evaluation of water quality conditions in Lake Kanasatka prior to initiation of phase 2. The application period shall be up to five days. No more than 52 acres shall be treated on any one day.
11. A change to the timing and duration of the project authorized by this permit may be requested by the Permittee provided good cause is submitted in writing and approved by NHDES. Changes in the timing and duration of the demonstration project must not extend the project initiation beyond the end of May 2024.
12. The Permittee shall provide NHDES with a final map depicting the three application zones at least 14 days prior to commencing any chemical applications. The application zones shall be labeled: PILOT; ZONE A; ZONE B; and ZONE C. No chemical shall be added by the Permittee prior

**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

to receiving approval, in writing or email, of the application zones by NHDES. The application zones shall correspond to phases as follows:

- a) PILOT ZONE (~14 acres) – Pilot phase only.
- b) ZONE A (50.1, Area A1=1.7 acres; Area A=48.4 acres) – Phases 1 and 2.
- c) ZONE B (50.4 acres) – Phases 1 and 2.
- d) ZONE C (51.3 acres including Pilot Zone) – Phases 1 (less Pilot Zone) and 2.

13. The Permittee is responsible for applying and securing any additional permits that may be required to carry out this project. The issuance of this permit does not relieve the Permittee from obtaining any other permits or approvals required by law.
14. All unauthorized activities on, in, or from the waterbody are prohibited during all periods of chemical treatment associated with this permit. Further, swimming in and water withdrawal from Lake Kanasatka are prohibited for 24-hours following each day of chemical treatment as it relates to this permit.
15. Given that waterbody and weather conditions are dynamic, NHDES maintains the authority to require minor changes, where reasonable, in the chemical application plan and timing of the project permitted herein. The purpose of any required changes would be limited to those that allow for a better evaluation of compliance with the receiving water limits, minimization of harm to aquatic life, and insurance of public safety.
16. Application of aluminum compounds as permitted herein shall occur when the average water temperature from the surface to the bottom of Lake Kanasatka in an area that is at least 10 meters deep is 5 degrees Celsius or greater.
17. The Permittee is responsible for uploading all water quality data collected as outlined in PART VI. MONITORING to the NHDES Environmental Monitoring Database (EMD) by December 31, 2024.

**PART VI. MONITORING**

The Permittee is responsible for monitoring Lake Kanasatka prior to, during, and after chemical treatment allowed by this permit as described below. All water samples shall be collected from the respective proposed sample sites noted on Map 1 in treatment zones A, B, C, and Pilot.

**Before treatment** – A single monitoring event shall be completed up to three weeks in advance of the pilot treatment. At each proposed sample location, a vertical water column profile shall be completed at no less than 1-meter intervals and measurements of dissolved oxygen (mg/L), temperature (degrees Celsius), pH (standard units), and specific conductance ( $\mu\text{mhos}$ ) shall be taken. At the same locations, Secchi disc transparency shall be estimated with the aid of a view scope to the nearest 0.25 meters. Acid neutralizing capacity, ANC (mg/L), hardness (mg/L as  $\text{CaCO}_3$ ), dissolved organic carbon (DOC, mg/L), chlorophyll-*a* ( $\mu\text{g/L}$ ), and turbidity (NTU) shall be estimated in a sample from the same locations based

**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

on a depth-integrated composite sample collected to a depth that coincides with the middle of the metalimnion or to a depth of 7-meters, whichever is less. Total aluminum, acid soluble aluminum, and total phosphorus (all as  $\mu\text{g/L}$ ) shall be estimated at each sample location in discrete samples collected at depths of 1, 3, 5, 9, and 13 meters. Phytoplankton samples and zooplankton samples shall be collected and preserved for identification at each location by way of a vertical net haul to a depth of no less than 10 meters. Net hauls shall utilize a net with a mesh size equal to  $50\mu\text{m}$ . All aluminum, hardness, pH, and DOC data shall be reported to NHDES at least 3-days prior to any additional application of aluminum compounds, excluding the pilot treatment.

**During Treatment** – For all treatment zones (Pilot, A, B, and C) continuous pH monitoring shall be completed and recorded within the active treatment zone beginning 30-minutes prior to and ending 30-minutes after chemical application of aluminum compounds. Continuous pH monitoring shall take place approximately 10 – 20 meters behind the treatment vessel.

Within 2-hours after the pilot treatment is completed a vertical water column profile shall be completed at the pilot zone monitoring station at no less than 1-meter intervals and measurements of dissolved oxygen ( $\text{mg/L}$ ), temperature (degrees Celsius), pH (standard units), and specific conductance ( $\mu\text{mhos}$ ) shall be taken. At the same location, Secchi disc transparency shall be estimated with the aid of a view scope.

Within 2-hours after the pilot treatment is completed acid neutralizing capacity, ANC ( $\text{mg/L}$ ), hardness ( $\text{mg/L}$  as  $\text{CaCO}_3$ ), dissolved organic carbon (DOC,  $\text{mg/L}$ ), and turbidity (NTU) shall be estimated in separate samples from the pilot zone based on a depth-integrated composite sample collected to a depth that coincides with the middle of the metalimnion or to a depth of 7-meters, whichever is less. Within 2-hours after the pilot treatment is completed, total aluminum and acid soluble aluminum shall be estimated from discrete samples collected at depths of 1, 3, 5, 9, and 13 meters at the pilot zone sampling station. Within 2-hours after the pilot treatment is completed, phytoplankton samples and zooplankton samples from the pilot zone shall be collected and preserved for identification by way of a vertical net haul to a depth of no less than 10 meters. Net hauls shall utilize a net with a mesh size equal to  $50\mu\text{m}$ . At all times during treatment and for approximately 1-hour after treatment, continuous surveys of distressed aquatic life and other wildlife present on or in Lake Kanasatka shall be conducted and treatment shall immediately cease if any are observed. A camera shall be used to evaluate and record the condition of the “floc” on the bottom sediments within the pilot zone on the day of treatment.

On all Phase 1 and Phase 2 treatment days, vertical water column profiles shall be completed no more than 2-hours prior to treatment in zones A, B, and C at no less than 1-meter intervals and include measurements of dissolved oxygen ( $\text{mg/L}$ ), temperature (degrees Celsius), pH (standard units), and specific conductance ( $\mu\text{mhos}$ ). Secchi disc transparency shall be estimated in each zone prior to treatment beginning. No more than 2-hours prior to treatment on each treatment day, acid neutralizing capacity, ANC ( $\text{mg/L}$ ), hardness ( $\text{mg/L}$  as  $\text{CaCO}_3$ ), dissolved organic carbon (DOC,  $\text{mg/L}$ ), chlorophyll-*a* ( $\mu\text{g/L}$ ), and turbidity (NTU) shall be estimated in samples from zones A, B, and C based on a depth-integrated composite sample collected to a depth that coincides with the middle of the metalimnion or to a depth of 7-meters, whichever is less. No more than 2-hours prior to treatment on each treatment day, total aluminum and acid soluble aluminum shall be estimated in discrete samples collected at depths of 1, 3, 5, 9, and 13 meters within zones A, B, and C.

**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

Within 2-hours after each treatment is completed and only within the treatment zone, acid neutralizing capacity, ANC (mg/L), hardness (mg/L as CaCO<sub>3</sub>), dissolved organic carbon (DOC, mg/L), and turbidity (NTU) shall be estimated based on a depth-integrated composite sample collected to a depth that coincides with the middle of the metalimnion or to a depth of 7-meters, whichever is less. Within 2-hours after each treatment and only within the treatment zone, total aluminum and acid soluble aluminum shall be estimated in separate discrete samples collected at depths of 1, 3, 5, 9, and 13 meters. Within 2-hours after each treatment and only within the treatment zone, phytoplankton samples and zooplankton samples shall be collected and preserved for identification by way of a vertical net haul to a depth of no less than 10 meters. Net hauls shall utilize a net with a mesh size equal to 50µm. At all times during treatment and for approximately 1-hour after treatment, continuous surveys of distressed aquatic life and other wildlife present on or in Lake Kanasatka shall be conducted and treatment shall immediately cease if any are observed. A camera shall be used to evaluate and record the condition of the "floc" on the bottom sediments within the treatment zone on the day of treatment.

**After Treatment** – For the pilot treatment only, monitoring shall occur the day after and one week after treatment is completed in the pilot zone, zone A and zone C following the description below. Monitoring after the completion of phase 2 shall occur the next day, then weekly for the next four weeks, then monthly through October 2024. After phase 2 is complete, monitoring shall occur in zones A, B, and C the next day and for all weekly monitoring events. Monthly monitoring shall occur only in zone C. Estimates of ANC, hardness, DOC, total aluminum, acid soluble aluminum, and turbidity can cease once the average concentration of acid soluble aluminum from all samples on the day of collection are equal to or less than the average of all "before treatment" samples.

For each "After Treatment" monitoring event vertical water column profiles shall be completed at no less than 1-meter intervals and measurements of dissolved oxygen (mg/L), temperature (degrees Celsius), pH (standard units), and specific conductance (µmhos) shall be recorded and Secchi disc transparency shall be estimated. Additionally, at each location acid neutralizing capacity, ANC (mg/L), hardness (mg/L as CaCO<sub>3</sub>), dissolved organic carbon (DOC, mg/L), chlorophyll-*a* (µg/L), and turbidity (NTU) shall be estimated in separate samples based on a depth-integrated composite sample collected to a depth that coincides with the middle of the metalimnion or to a depth of 7-meters, whichever is less. Total aluminum, acid soluble aluminum, and total phosphorus (all as µg/L) shall be estimated in separate discrete samples collected at depths of 1, 3, 5, 9, and 13 meters at each location. Phytoplankton samples and zooplankton samples from zones A, B, and C shall be collected and preserved for identification by way of a vertical net haul to a depth of no less than 10 meters. Net hauls shall utilize a net with a mesh size equal to 50µm. During one of the weekly "after treatment" monitoring events, a camera shall be used to evaluate and record the condition of the "floc" on the bottom sediments within the treatment area.

**Quality control/Quality Assurance measures** – All field instruments shall be calibrated on the day of use. This includes pH sensors, dissolved oxygen sensors, specific conductance sensors, and turbidity sensors. For laboratory submitted samples that estimate ANC, hardness, DOC, total aluminum, acid soluble aluminum, total phosphorus, and chlorophyll-*a* as required by this permit, a field-duplicate sample shall be collected and submitted for analysis for at least 10% of the total number of samples for each parameter.

**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

**PART VII. REPORTING AND RECORDKEEPING REQUIREMENTS**

1. The Permittee shall submit records of the chemicals applied and the following information:
  - a) The name, chemical formula, and percent aluminum by volume, and the supplier of the chemicals applied to Lake Kanasatka.
  - b) A daily account of the volume of each chemical applied, total mass of aluminum per area (dose), location (zone), estimated area of treatment, and geo-referenced vessel track of chemical application as well as copies of the field records supporting the daily account.
  - c) A map showing the treatment zones, dates during which chemicals were applied within each respective zone.
  - d) A record of the approximate average ratio by volume of sodium aluminate to aluminum sulfate applied on each treatment day including periods during the treatment when the ratio was intentionally modified from the requirements specified in this permit in order to meet the pH range as specified in Table 1, footnote 2.
  - e) An electronic record of continuous pH readings taken within the treatment zone on each respective day chemicals are applied to that treatment zone.
  - f) Notes of any equipment failures or deviations from the Operations and Management Plan as required herein.
2. The Permittee shall submit copies of all laboratory results (including Chain of Custody) and all records of data collected in the field electronically, as applicable, no later than 14-days following the completion of the entire treatment, except as required following the pilot phase (see PART VI. MONITORING Before treatment).
3. The Permittee shall retain records of all monitoring information, including all calibration and maintenance records, copies of all laboratory reports required by this permit, and electronic records of all data required by this permit, for a period of at least 3-years from the date of the last monitoring event.
4. A draft report that summarizes all components of this project shall be submitted to NHDES for review by end February 2025. NHDES shall be afforded an opportunity to comment and request revision to the report. A final report shall be submitted to NHDES by April 2025.
5. Submittal of requests and reports to NHDES
  - a) The following requests, reports, and information required as a condition of this permit shall be submitted to New Hampshire Department of Environmental Services, Water Division (NHDES-WD):
    - 1) Notification of chemical application at least three (3) days prior to the commencement of the application;
    - 2) Notification of any substantial change (realized or anticipated) in the volume or character of aluminum compounds being introduced into the receiving water;
    - 3) Notification of chemical spills;



**State Surface Water Discharge  
Permit No. Lake Kanasatka - 002**

4) Notification of spillage or leakage of permitted chemicals and containment or lack of containment as defined in the operations and management plan and changes to safety measures to prevent future incidents.

b. These reports, information, and requests shall be submitted to NHDES-WD electronically at [david.neils@des.nh.gov](mailto:david.neils@des.nh.gov).

**6. Verbal Reports and Verbal Notifications**

a) Any verbal reports or verbal notifications, as required as a condition of this permit, shall be made to NHDES. This includes verbal reports and notifications which require reporting within 24-hours.

b) Verbal reports and verbal notifications shall be made to:

NHDES Contact: 603-271-8865

**PART VIII. APPEAL, MODIFICATION, AND TRANSFER OF PERMIT**

1. Appeal - Any person aggrieved by the decision may file an appeal with the N.H. Water Council ("Council") that meets the requirements specified in RSA 21-O:14 and the Water Council's procedural rules Env-WC 100 et seq. The appeal must be filed directly with the Council within 30-days of the date of permit issuance.
2. Permit Modification – Modifications to this permit by the Permittee shall follow the process and procedures set forth in Env-Wq 301.13
3. Permit transfer - The permit shall not be transferable.

