III. Proposed Water Quality Monitoring Effort for 2022 in Response to Directive I B of the EO

The goal of this study is to understand the potential effects of aerially applied herbicides following their use in managed blocks of Maine's softwood stands. This is a difficult assessment because of the multitude of inputs and various landscapes that determine the answer. This study will not answer the question of whether or not there are effects. The scope of this study focuses solely on the presence/absence of pesticide active ingredients in the environment. Stream health is best measured by looking at the entire ecosystem and by measuring changes in algae, plants, microorganisms, macroinvertebrates, and larger aquatic organisms, which is a major undertaking when done correctly. Instead of measuring stream health, this study is intended to measure to what degree pesticide active ingredients occur in nearby streams. The detection (and concentration) of pesticides is an indication of the potential of effects from aerial herbicide practices.

This overall study design focuses on determining the amount of pesticide reaching the nearest stream immediately after the spray event to assess drift and assess run-off from the treated area by sampling the nearby stream over a longer period of time. This study is simple in design but challenging logistically due to the remoteness of the locations and the rapidly changing spray plans which are controlled more by weather than the calendar.

This study is to be conducted in cooperation with timber companies during their regularly planned fall site prep and conifer release spray programs. From their proposed treatment blocks, BPC staff will select study sites. Selection criteria focus on isolating treatment plots co-located to streams but separated away from other treated spray blocks. The study sites will need to be accessible by BPC staff for the deployment, sample collection, and maintenance of autosamplers. Remote actuated autosampling devices will allow staff the flexibility to collect samples on the continuously shifting schedule set by the cooperating timber companies. State regulations stipulate a 25-foot minimum distance. However, timber industry representatives indicate we will not be able to locate sprays that close to streams. Timber industry best management practices typically stipulate greater distances. All efforts will be made to identify the streams closest to spray blocks for sampling. In addition to pesticide regulations, forestry best management practices have formulae in relation to shoreline zoning that prescribes how many and how close to a stream trees can be removed. The goal of study site selection will be to choose streams as close to the treated area as possible, with the recognition that there will be a gradient of distances.

Research question:

Are herbicides used in aerial forestry programs reaching forest streams?

Sample size:

TREATMENT: 20 spray block locations
(Includes 20 close site and 20 distant site samples)
CONTROL: 10 no-spray block locations
(Includes 10 close site and 10 distant site samples)

Timing:

Pre-spray sampling: In summer (May-July 2022), sampling locations will be identified, autosamplers emplaced, and a full suite of samples collected. Sampling begins immediately following emplacement, and samplers will collect a sample (as composite) each hour for 24 hours.

Post-spray sampling: In late-summer and fall (September-October 2022) two post-spray samples will be collected in a manner consistent with the sampling frequency set by the pre-spray sampling. Samples will be collected immediately following the spray event to assess spray drift. Samples will also be collected to capture the runoff from the site during the first rain event following the spray.

Post spray sampling schedule:

Close sites:

Day of spray (Drift)- At each location, a section of stream closest to the treatment block will be sampled over a 24 hour period following (sampling begins within 15 minutes following the aerial spraying for the post-spray sampling). Composite autosampling will sample the water every hour for 24 hours, combining each sample into a single container. This sampling approach reduces the cost of the analysis (by reducing the number of analytical samples from 24 to one) yet preserves the ability to identify the average concentration entering the water over the 24 hour period.

First rain event following spray (Runoff)- Using the same location as the day-of-spray sampling location, the stream will be sampled over a 24 hour period following the first rain event (within an hour following the start of the rain). Composite autosampling will sample the water every hour for 24 hours, combining each sample into a single container.

Distant sites:

Day of spray (Drift)- At each location, a section of stream downstream from the treatment block will be sampled over a 24 hour period following (within 15 minutes of the aerial spraying for the post-spray sampling). Composite autosampling will sample the water every hour for 24 hours, combining each sample into a single container. Topographical maps will dictate the location of the autosampler. Maps will be assessed to find the stream location likely to receive all of the runoff from the location.

First rain event following spray (Runoff)- Using the same location as the day-of-spray sampling location, the stream will be sampled over a 24 hour period following the first rain event (within an hour following the start of the rain). Composite autosampling will sample the water every hour for 24 hours, combining each sample into a single container. Topographical maps will dictate the location of the autosampler. Maps will be assessed to find the stream location likely to receive all of the runoff from the location.

Equipment choice:

Remote actuated compositing autosamplers will be rented to complete this study. Composite sampling allows sampling to occur over a range of times which is essential to

capture the variation created by topography at each site. Each sample is of equal volume such that at the end of the sample period, the pesticide concentration in the water can be divided by 24, and an hourly average pesticide concentration can be derived. Literature reviews indicate that immediately following application, and during the first rain event, are the two most likely times to detect herbicides following aerial applications. Pesticide concentrations in nearby streams tend to fall below detection levels quickly after the application (within the day) except for rainfall events when they are transiently detected again.

The remote actuating aspect of the samplers is critical to be able to keep up with the helicopter and weather schedules. Flight plans are ever-changing based on weather. This feature additionally comes into play to ensure the first-flush rainfall is captured. In both of these scenarios, BPC staff will set up the autosamplers according to when the anticipated treatments are planned to happen. Should plans change, staff will not have wasted time and effort reaching the location; the autosampler can simply wait in place for the spray event. The spray events happen in a very compressed calendar schedule, so the autosampler is not likely to wait very long. To capture the first rain event, autosamplers will be set up to receive samples as soon as the spray event samples have been collected, and they will remain until rainfall.

Chemical analyses:

Consistent with BPC practice, the collected samples will be transported, on ice, to the office and stored at 4°C until ready to ship. Samples are packed on ice and shipped to the Montana Agricultural Laboratory for analysis. The water samples are processed through a pesticide analysis panel that can identify up to 102 unique analytes (roughly 80 parent compounds plus their degradation products).