

NEW JERSEY WATER SUPPLY AUTHORITY

D&R CANAL SUBMERSED AQUATIC VEGETATION MANAGEMENT PLAN



SÖLITUDE
LAKE MANAGEMENT

**580 Rockport Road
Hackettstown, NJ 07840
(908)-850-0303**

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EXECUTIVE SUMMARY

The Delaware and Raritan Canal (D&R Canal) is a manmade waterway that originates at the Delaware River near Stockton, New Jersey and travels south to Trenton, before turning north and terminating at the Raritan River near the Landing Lane Bridge in New Brunswick, New Jersey. The New Jersey Water Supply Authority is responsible for maintaining a dependable supply of water throughout the 60 mile long D&R Canal. Nuisance aquatic plant growth inhibits the natural flow of water through the Canal and requires active aquatic plant management by the New Jersey Water Supply Authority. In July 2016, an aggressive invasive submersed aquatic plant, hydrilla (*Hydrilla verticillata*), was discovered during routine aquatic plant management via mechanical removal. It was decided that the extent of the hydrilla needed to be assessed prior to determining the appropriate management strategies. Submersed aquatic plant mapping was conducted by a consultant in September, which documented hydrilla occurring at over 56% of the sample sites in 18 miles of the Canal, most of which was on the Feeder Canal side, south of Lambertville to Trenton. That survey also likely established the northern and southern extent of the infestation, but the entire Canal was not surveyed in 2016.

Hydrilla is a relatively recent invader to New Jersey and the Northeast, although several large-scale control programs are underway in nearby New York. Hydrilla has the potential to rapidly spread throughout the Canal via fragmentation and turion dispersal which increases the potential risk to spread to other watersheds. Hydrilla produces tubers, which can persist in the sediment for a minimum of six years. These subterranean tubers are generally resistant to control methods, which complicates and lengthens the duration of control pressure that is required. In the Canal, hydrilla can inhabit the entire length and width of the shallow waterway which will inhibit water flow. The presence of a highly invasive aquatic plant such as hydrilla requires that the New Jersey Water Supply Authority to use a more aggressive and quick-acting submersed aquatic plant control program than has been previously employed at this site.

In 2017, a team of experts assembled by the New Jersey Water Supply Authority have determined that a low dose herbicide injection (Sonar Genesis, a.i. Fluridone) is the most effective submersed aquatic vegetation (SAV) control method for the D&R Canal. Many factors were considered during the formulation of the SAV Management Plan, including:

- A review of other large-scale Northeast hydrilla control programs (Cayuga Inlet (New York), Erie Canal (New York), the Croton River (New York), as well as a program in the Eno River (North Carolina).
- A review of water use restrictions for low dose Fluridone in the D&R Canal
- Several site visits to the D&R Canal by the consultant and team of experts
- A review of the water flow throughout the D&R Canal
- A rhodamine dye study conducted in April 2017 to simulate the movement of an herbicide throughout the D&R Canal
- Bench tests of herbicide residual removal at all four of the water treatment plants that could potentially pull water from the Canal for potable drinking
- An extensive review of other submersed aquatic plant control programs and their applicability to the D&R Canal

In addition to the herbicide injection planned for 2017, hydro-raking is the recommended mechanical method to remove submersed aquatic plants and unconsolidated organic debris to maintain suitable water flow throughout the Canal. In 2017, the entire Canal will be mapped for the abundance and distribution of submersed aquatic vegetation. It would be preferred if hydro-raking was restricted to sections of the Canal that are determined to be hydrilla-free, based on the results of the surveys. However, if water flow becomes restricted in the hydrilla treatment area, hydro-raking will be considered as a suitable method, provided that additional measures are instituted to mitigate the risk of hydrilla fragment spread.

The 2017 selected plant control option and the SAV Management Plan will be adaptive. Each year the results of previous monitoring effort will be reviewed to determine changes to the SAV plan and selected control programs.

This program includes a comprehensive education/outreach component led by the Watershed Protection Program of the New Jersey Water Supply Authority, as well as intensive monitoring by a consultant in 2017 and beyond. These monitoring efforts include SAV mapping of the entire Canal, SAV mapping of the treatment area, hydrilla tuber monitoring and Fluridone sampling and analysis.

INTRODUCTION

The Delaware & Raritan Canal (D&R Canal) was constructed in the 1830's to serve as a transport waterway for coal and other goods. The 60 mile Canal originates on the Delaware River near Raven Rock and terminates at the Raritan River near New Brunswick. The Canal is contained within a linear park managed by the New Jersey Division of Parks and Forestry. The total length of the entire Canal system was approximately 66 miles (106 km), but several sections (such as the route to Bordentown) have since been decommissioned and filled in. A section of the Canal actually runs underneath the city of Trenton as well. The Canal remained in operation until 1932. In 1974, the Canal system was declared a state park. The towpath has been repurposed for all manner of recreation.

The Canal is divided into two sections. The Feeder Canal section (which feeds water into the main Canal) stretches 22 miles (35 km) northward from Trenton, upstream along the east bank of the Delaware River to Bull's Island near Frenchtown. The Feeder Canal collects water from higher elevations to the north, and feeds it to the highest section of the main Canal. The Feeder Canal is approximately 60 feet (18 m) wide and 6 feet (2 m) deep. The Main section of the Canal runs from Trenton (originally Bordentown) on the Delaware River to New Brunswick, emptying into the Raritan River near the Landing Lane Bridge. The Main section is 38 miles long (previously 44 miles (71 km) long), and is approximately 75 feet (23 m) wide and 8 feet (2.4 m) deep.

The New Jersey Water Supply Authority (NJWSA) is responsible for maintaining a dependable uninterrupted supply of water through the D&R Canal to nine customers in central New Jersey along the Canal's 60 mile length. The D&R Canal is owned by the State of New Jersey with jurisdiction over the transmission complex transferred to the Authority in an agreement dated

June 1986. Aquatic plants are an ongoing and increasing concern for operations and maintenance of the Canal. Dense beds of native and invasive plants, including the new emerging threat to New Jersey, the aggressive invasive hydrilla (*Hydrilla verticillata*) have been observed in dispersed locations along the Canal. These thick weed mats reduce water flow, impair water quality, block sunlight, reduce dissolved oxygen, inhibit recreational activities, and impact habitat for fish, waterfowl and other wildlife within the Canal environment. In 2016, the Canal operations staff had extreme difficulty passing the required volume of water through the Canal.

Out of necessity, in July 2016, the NJWSA contracted for submersed aquatic vegetation (SAV) removal with a mechanical hydro-rake on a segment of the Canal north of Trenton. During this project, a significant population of hydrilla was discovered. Subsequently, a detailed submersed aquatic vegetation survey of 18 miles of the Canal identified hydrilla in scattered but occasionally dense patches along 13+ miles, mostly along the Feeder portion of the Canal on the Delaware River side between Lambertville and Trenton.

D&R Canal Uses

According to the D&R Canal State Park website (http://www.danD&RCanal.com/gen_info.html), the 70-mile Delaware and Raritan Canal State Park is one of central New Jersey's most popular recreational corridors utilized for canoeing, kayaking, jogging, hiking, bicycling, fishing and (in locations) horseback riding. The Canal and the park are part of the National Recreation Trail System. This linear park is also a valuable wildlife corridor connecting fields and forests.

Canoes, kayaks and small boats can be launched at several access points along the Canal, and off the towpath shoreline in most locations. Boaters must portage at the locks and at some bridges, which are too low for even a canoe to pass under at peak water capacity. Coast Guard approved personal flotation devices must be available for each boater. **Only electric motors may be used on the Canal.** Canoes and kayaks can be rented from the Griggstown Causeway and in Princeton (near Alexander Road). Therefore these areas see increased boating use. There are also several boat launches to the Delaware River at or in the park. These include Byram, Kingwood, Lambertville, Firemen's Eddy, and Bull's Island.

Fishing is permitted in the entire length of the Canal, and is a popular recreational activity in some locations. Trout are stocked at various locations in certain portions of the Canal during the spring months. Anglers will find bass, sunfish, catfish, perch, pickerel and carp (personal observation) year round. Access for fishing in the Delaware River is available at several locations. Fishing is subject to New Jersey Division of Fish, Game and Wildlife regulations.

The water in the Canal is used for irrigation, cooling and potable water uses. The Canal system supplies water to over 15 water customers in central New Jersey, utilizing approximately 100 million gallons of water per day for drinking water and irrigation.

2016 SUBMERSED AQUATIC PLANT MONITORING RESULTS

Following the discovery and confirmation that hydrilla infested a portion of the Canal, a contractor (SOLitude Lake Management) was retained to map a portion of the Canal to determine the extent of the hydrilla growth. All submersed aquatic vegetation (SAV) was mapped during this project, including abundance and distribution using modified Point-Intercept Methods suitable for a canal.

The Point Intercept Method (PIM) of sampling aquatic macrophytes is generally accepted by lake managers as a suitable procedure to map submersed aquatic macrophytes in a lake. By applying a few modifications, this method can be employed on river systems (such as the Cayuga River Inlet and the Croton River, both located in New York), or in this case for the D&R Canal. The PIM is designed to be utilized by volunteer and citizen science groups, and is the method often preferred by state regulators. For hydrilla delineation projects, the *2013 Monitoring Report of the Cayuga Inlet and Southern Cayuga Lake Monoecious Hydrilla Eradication Project* (Johnson, 2014) was reviewed to develop similar surveying protocols for this project.

The total number of sample locations is typically based on the total acreage of the lake. In a river system, or a Canal system (such as the D&R Canal) sample locations are not placed on a grid, but instead are situated 50 meters apart. A total of 597 sites were sampled along 18.31 miles of the Canal for this project. At each site, two weed rake tosses were conducted. Since most of the submerged aquatic plants occur along the margin of the Canal (and generally not in the center of the Canal), Toss A was always along the west bank, while Toss B was always along the east bank of the Canal. All surveying was conducted from a canoe on the Canal, and weed rake tosses were augmented by visual observations. Table 1, below is a summary of the six sections surveyed in 2016.

Table 1 2016 SAV Sample Section Summary: D&R Canal

Section	Description	Date	Length (miles)	# Sites Surveyed
1	Rte. 179 to Titusville Bridge	9/15 & 9/23/16	5.23	165
2	Titusville Bridge to Washington's Crossing	9/6 & 9/7/16	1.74	57
3	Washington's Crossing to Lower Ferry Rd.	9/7 & 9/8 & 9/16/16	4.50	149
4	Lower Ferry Rd. to Hermitage Ave.	9/9 & 9/16/16	2.12	69
5	Canal Support Structure to Carnegie Rd.	9/21/16	1.97	65
6	Provinceline Road to Alexander Road	9/22/16	2.75	92

Below, Figure 1 depicts the six sections sampled in 2016. Sampled sections are depicted in yellow or blue. Four of the sections were on the Feeder Canal part of the Canal, and two sections were on the Main part of the Canal.

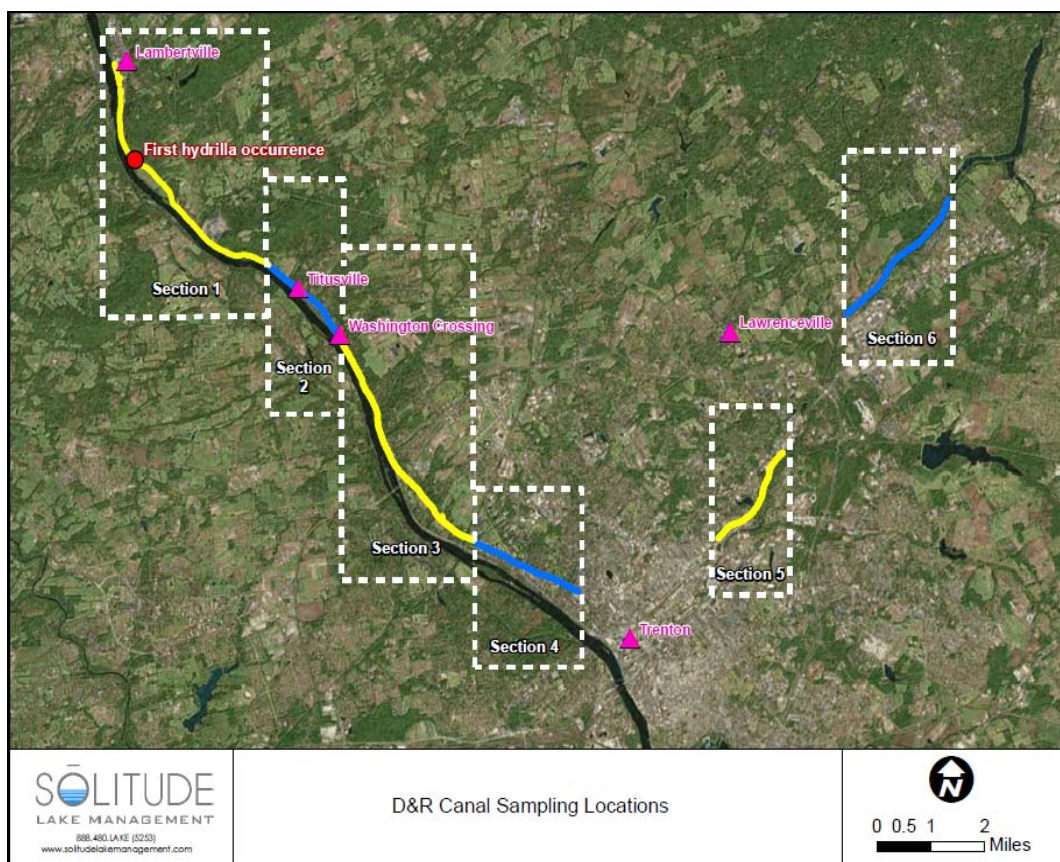


Figure 1: 2016 SAV Monitoring Locations by Section

2016 Hydrilla Summary

The following is a summary of the hydrilla abundance and distribution from our 2016 survey efforts. Below, Table 2 summarizes the hydrilla occurrence per section. At the end of this section, Figure 2 depicts the hydrilla abundance distribution by section displayed in graphical form.

In Section 1, Hydrilla occurred at 67 (or 41%) of the sites we surveyed. However it did not occur until point #12 of sub-section 1.5C, at which point we documented the most northern extent of rooted hydrilla. This area is located just south of the Flea Market located along Route 29, which parallels the Canal. A few additional scattered patches of hydrilla were located here. In addition, south of this point we began to observe the occasional floating fragment of hydrilla (none were observed before that point). We are reasonably confident this represents the northern most extent of hydrilla on the Feeder Canal portion of the Canal. It's possible the initial site of introduction was nearby, just to the north



(perhaps the bridge at Old River Road, which features a nearby Delaware River access point and a fishing dock just south of the bridge on the Canal). At 43 of the sites (or 64%), hydrilla was considered trace density. At 23 of the sites (or 34%) the abundance was considered sparse. At the remaining one site, the density was medium. In addition to the documented hydrilla, we also observed several rooted patches (of various sizes, but typically less than five feet in diameter) while piloting between GPS-referenced sample sites. We also observed a few floating hydrilla fragments. The picture to the right depicts a typical patch of hydrilla occurring along the Canal shoreline intermixed with wild celery.

In Section 2, Hydrilla was common, occurring at 49 (or 89%) of the total sites surveyed. At 12 sites (or 24%) the hydrilla was considered trace density, while at 18 (or 37%) the density was sparse. At 15 sites (or 31%), the hydrilla was considered medium and at four sites (or 8%) it was dense. Clearly, hydrilla is well established throughout this section, and should be a priority target for 2017 control efforts. In addition to the hydrilla recorded during our GPS survey, numerous established beds, some of them quite large (up to 20 feet long) were observed while paddling between sample sites.

In Section 3, Hydrilla was the dominant aquatic plant collected. It was collected at 139 (or 93%) of the total sites surveyed in 2016, and this section should be a priority target for control efforts in 2017. At 38 (or 27%) of the sites, the density of hydrilla was considered to be trace. At 69 (or 50%) of the sites, the density was sparse, while another 28 (or 20%) of the sites were medium density. Four (or 3%) of the sites were considered to be dense. In addition to the extensive hydrilla collected via sampling, numerous patches of hydrilla, some as small as 1 foot diameter clumps, to as large as 15 foot diameter established beds were observed while paddling between sampling sites. Despite the abundance of hydrilla in this section, it does not appear to be crowding out other SAV, yet. There just seems to be a high abundance of SAV growth here that is also suitable to hydrilla.

Table 2: 2016 D&R Canal Hydrilla Occurrence Summary

Section	Description	# Sites Surveyed	# Sites w/Hydrilla	% Sites w/Hydrilla
1	Rte. 179 to Titusville Bridge	165	67	40.6%
2	Titusville Bridge to Washington's Crossing	57	49	86.0%
3	Washington's Crossing to Lower Ferry Rd.	149	139	93.3%
4	Lower Ferry Rd. to Hermitage Ave.	69	60	87.0%
5	Canal Support Structure to Carnegie Rd.	65	22	33.8%
6	Provinceline Road to Alexander Road	92	0	0.0%

Hydrilla was also the dominant aquatic plant collected in Section 4. It occurred at 60 (or 87%) of the sites we surveyed in 2016. Nearly all of the sites we collected were at trace or sparse abundance. Trace sites accounted for 31 (or 52%) while sparse sites accounted for 28 (or 47%). Only one medium site was collected. This is logical, based on the linear characteristics of the Canal and the flow patterns (North to South). The further one gets away from the assumed site of initial introduction, we should observe a decrease in abundance. We did observe a few additional patches of hydrilla, (most of them small), in between our GPS-logged sites, but the frequency of these decreased the further south we traveled down the Canal.

Hydrilla did occur in Section 5, but at a much lower percent occurrence than the previous sections. This is also logical, based on the linear characteristics of the Canal, and water flow. But the presence of hydrilla in this section makes it very likely that hydrilla occurs in the areas between Section 4 and Section 5, which was not surveyed in 2016. This area should be a top priority for monitoring in 2017. **Hydrilla occurred at 22 (or 34%) of the sites in this section.** All sites were considered to be trace density. The hydrilla in this section was found near the shoreline, often obscured under emergent plant growth, duckweed and among other aquatic plants. Most of the hydrilla sites were located near Whitehead Road and toward the Canal support structures. In the lower 2/3's of the section, only three hydrilla sites (rooted plants) were found, but we did observe numerous floating fragments of hydrilla throughout much of this section.

Rooted hydrilla was not collected or observed in Section 6. We did observe floating hydrilla fragments on six occasions while sampling in this section.

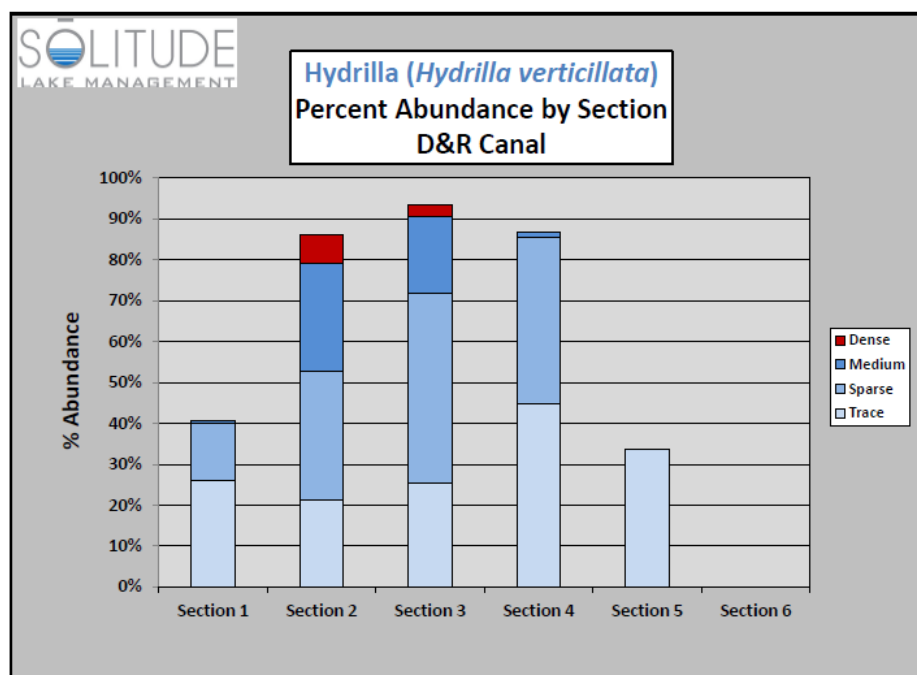


Figure 2: 2016 Hydrilla Abundance Distribution based on Section

2016 Hydrilla Tuber Monitoring Summary

Part of the 2016 SAV monitoring effort not only included mapping all aquatic plant species in select sections of the Canal, but also collecting sediment core samples to determine the hydrilla tuber density at select stations. A map of the 2016 hydrilla tuber sampling stations is located in the Appendix of this report. Sample Stations were established based on the presence of increased

abundance of hydrilla. Sample stations were established at 5 locations, one each in sections 1 through 5. Since no rooted hydrilla was found in Section 6, it was omitted. Furthermore, even though hydrilla density was low in the Main Canal (Section 5), we wanted to assess the hydrilla tuber density here, assuming it has recently infested this location.

Establishing baseline hydrilla tuber densities is useful to estimate the duration of hydrilla infestation, and to use as a comparison to data collected following the application of control methods. If hydrilla tuber density monitoring continues during control programs, the efficacy of these programs can be gauged, as well as to determine the need to switch control strategies. Table 3, below, is a summary of the hydrilla tuber and turion densities at the five sample stations collected in 2016. In addition, it depicts the number of cores collected at each station. As control efforts are employed at this site, we would anticipate an increase in the number of cores per site, as it will become more difficult to recover tubers over time. It is recommended that these same five stations be used for future monitoring efforts.

Table 3: 2016 Hydrilla Tuber Summary for the D&R Canal

Section	Description	# Cores	Tubers (per m²)	Turions (per m²)
1	Rte. 179 to Titusville Bridge	3	462.8	0.0
2	Titusville Bridge to Washington's Crossing	5	85.6	203.3
3	Washington's Crossing to Lower Ferry Rd.	5	288.9	42.8
4	Lower Ferry Rd. to Hermitage Ave.	3	320.4	17.8
5	Canal Support Structure to Carnegie Rd.	5	10.7	0.0

Hydrilla tuber densities ranged from 462.8 tubers per m² (Section 1) to 10.7 tubers per m² (Section 5). Turion densities ranged from 0.0 turions per m² (in Sections 1 and 5), to 203.3 turions per m² (Section 2). The highest tuber density was in Section 1, located near the first rooted occurrence of hydrilla found during our survey. This is logical, if we assume this was the initial establishment of hydrilla, and giving the natural flow pattern of the Canal. For Sections 2 through 4, if we add the tuber density and turion density, we get similar results (with expected variability). Section 5 was by far the lowest hydrilla tuber density we observed in 2016. This is also logical, as we would expect hydrilla recently became established in this location based on Canal flow patterns (and data collected during the mapping survey). Overall, we estimate the hydrilla in D&R Canal is a relatively recent invader, likely being introduced within the last few years, and it is displaying a natural spread down Canal as influenced by the flow. If left unmanaged, we would expect hydrilla to continue to spread down Canal, possibly all the way to the Raritan River, assuming suitable habitat was present.

2016 Other Submersed Aquatic Vegetation Summary

As mentioned the 2016 SAV monitoring surveys included cataloguing all submersed aquatic plants in the sections of the Canal we surveyed. We don't consider this list to be exhaustive as there do appear to be differences in the aquatic plant community based on geographic location. Table 3, below is a summary of the data collected. It includes data on overall SAV, plus a list of all of the different aquatic plants collected (common and scientific names) along with occurrence

(# of sites) and percent abundance data. Entries in **red** indicate an invasive species, while **green** indicates an algal species. The rest of the entries are considered native species.

Of the 597 GPS referenced locations surveyed, we collected submersed aquatic plants at 576 locations (or 96.5%). This is somewhat biased, as we targeted the shoreline sites, where aquatic plant growth is the most abundant. Nineteen different aquatic plants (plus benthic filamentous algae and one macroscopic algae) were collected in 2016. Small duckweed is a tiny floating aquatic plant generally not considered a part of the submersed aquatic plant community. But it was included in this survey, and actually was the dominant aquatic plant collected/observed in 2016. Hydrilla was the fourth most commonly occurring aquatic plant and was discussed above. Coontail, water stargrass, wild celery, common waterweed, and brittle naiad all commonly occurred in the Canal and shall be discussed in turn in the following section. Although hydrilla growth has the potential to inhibit water flow through the Canal as it becomes more established and spreads, these native species are likely inhibiting the water flows currently and also need to be managed. Small duckweed or benthic filamentous algae will not be discussed in this report, but is discussed in the 2016 Final Report (Doyle, 2017).

Table 4 Submersed Aquatic Plant Abundance Summary: 2016 D&R Canal

Common Name	Scientific Name	# Occurrences	% Occurrence
Overall SAV		576	96.5%
Small Duckweed	<i>Lemna minor</i>	536	89.8%
Coontail	<i>Ceratophyllum demersum</i>	507	84.9%
Water Stargrass	<i>Zosterella dubia</i>	399	66.8%
Hydrilla	<i>Hydrilla verticillata</i>	337	56.4%
Wild Celery	<i>Vallisneria americana</i>	313	52.4%
Common Waterweed	<i>Elodea canadensis</i>	196	32.8%
Benthic Filamentous Algae		189	31.7%
Brittle Naiad	<i>Najas minor</i>	143	24.0%
Eurasian Water Milfoil	<i>Myriophyllum spicatum</i>	60	10.1%
Water Starwort	<i>Callitriche palustris</i>	59	9.9%
Spatterdock	<i>Nuphar variegata</i>	55	9.2%
Watermoss	<i>Fontinalis</i> sp.	44	7.4%
Leafy Pondweed	<i>Potamogeton foliosus</i>	19	3.2%
Muskgrass	<i>Chara</i> sp.	11	1.8%
Curly-leaf Pondweed	<i>Potamogeton crispus</i>	9	1.5%
Long-leaf Pondweed	<i>Potamogeton nodosus</i>	7	1.2%
Pondweed species	<i>Potamogeton</i> sp.	6	1.0%
White Water Crowfoot	<i>Ranunculus longirostris</i>	3	0.5%
Great Duckweed	<i>Spirodela polyrhiza</i>	2	0.3%
Common Bladderwort	<i>Utricularia vulgaris</i>	2	0.3%
Arrowhead rosette	<i>Sagittaria</i> sp.	2	0.3%

Coontail was the second most dominant aquatic plant collected in 2016, following small duckweed. Since small duckweed is a tiny aquatic plant that floats on the surface of the water,

coontail is considered the dominant submersed aquatic plant. It occurred at just under 85% of the sites surveyed in 2016 (n=507). It occurred fairly consistently throughout the six sections. At Section 5, it was collected at 100% of the sites surveyed. Typically it occurred at trace or sparse abundance. Figure 3, below depicts the percent abundance of coontail per Section.

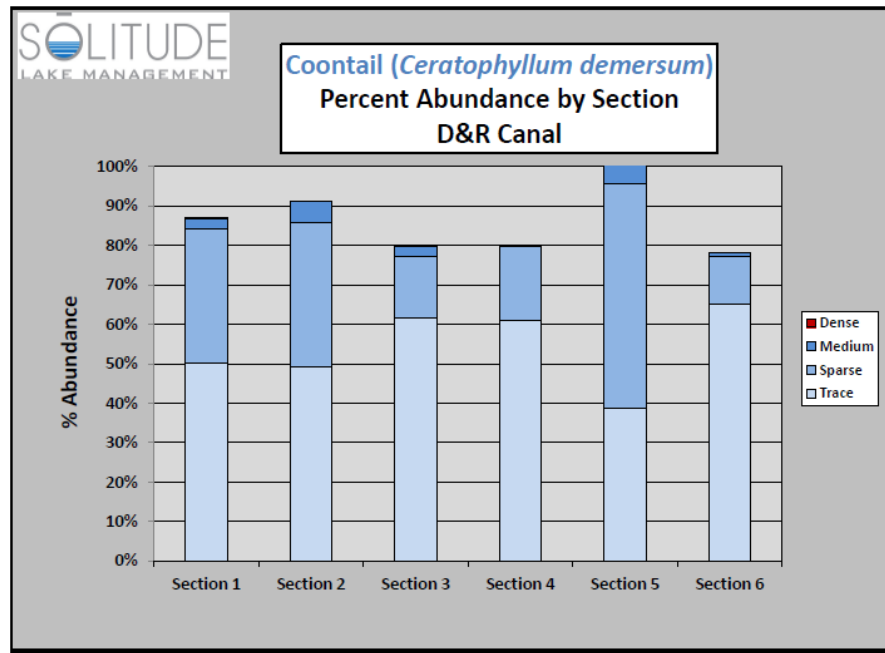


Figure 3: 2016 Coontail Abundance in the D&R Canal

Water Stargrass is a desirable native submersed aquatic plant that was quite common in the Canal. The water stargrass population is robust, with many emergent flowers observed throughout many sections of the Canal. Water stargrass was the second most commonly occurring submersed aquatic plant collected in 2016. It was collected at 399 (or 66.8%) of the sites sampled. It typically occurred near or intermixed with coontail. Water stargrass was most abundant throughout Section 2, exceeding 80% occurrence at sampled sites, as well as having the most medium dense sites, and the only dense sites. Most Sections (all save Section 4) had similar abundance and distributions, typically ranging from 60% to 74% occurrence. Section 4 only had 50% occurrence, and was mostly trace density sites. Figure 4, below depicts the abundance of water stargrass in all six sections.

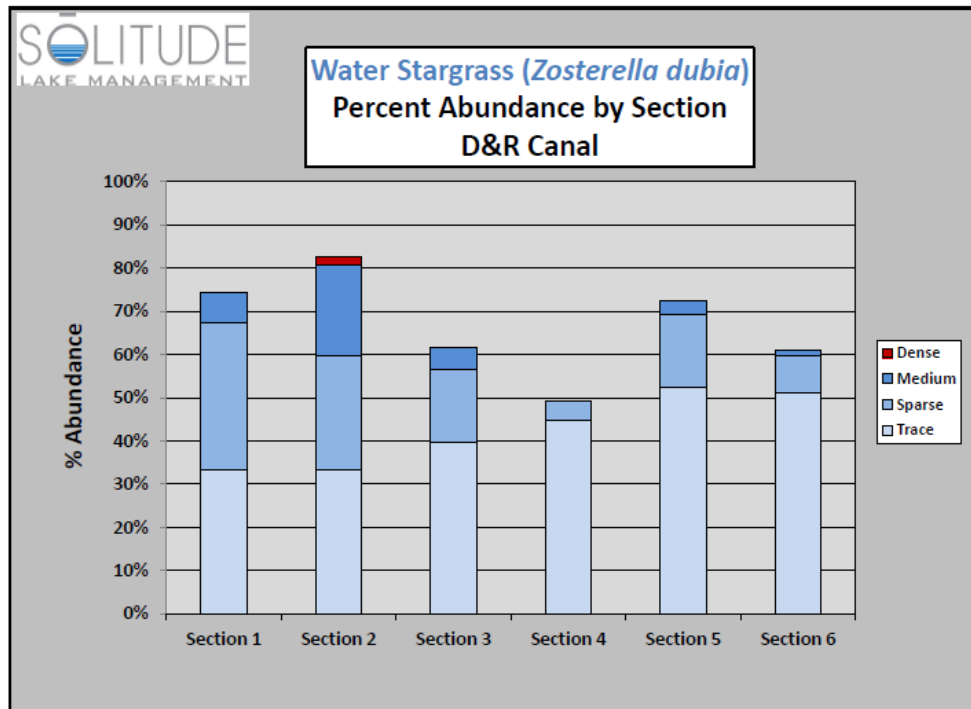


Figure 4: 2016 Water Stargrass Abundance in the D&R Canal

The fourth most common submersed aquatic plant we collected in 2016 (right behind hydrilla) was wild celery. Wild celery is a high quality habitat native submersed aquatic plant, and is often a species installed in lake bottoms for restoration programs. Wild celery occurred at 313 (or 52.4%) of the sites surveyed. Wild Celery was most abundant throughout the Feeder Canal, specifically sections 2 through 4, typically occurring at about 80% of the sites. All three of these sections contained dense stations, and medium sites. Of these, Section 2 had the highest dense and medium sites by far, and subsequently very few trace sites. Section 1 had only 50% wild celery, with an even distribution of trace and sparse sites and only a few medium sites. In the Main Canal (sections 5 and 6), wild celery was much less common. At both of these sections, it occurred at less than 10% of the sites surveyed, with most of these considered trace density. Figure 5, below, depicts the 2016 wild celery abundance in the D&R Canal.

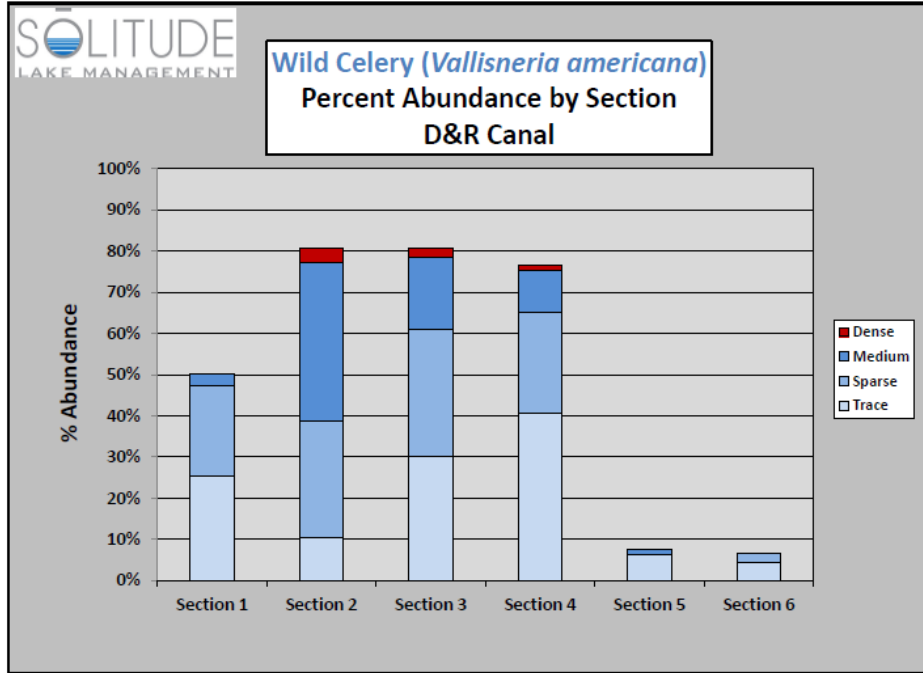


Figure 5: 2016 Wild Celery Abundance in the D&R Canal

Common waterweed is another desirable native submersed aquatic plant. However, common waterweed (*E. canadensis*) can be easily mistaken for hydrilla, especially in the field. During our 2016 survey in the Canal, all specimens of assumed hydrilla or common waterweed were inspected to confirm identification. Common waterweed was confirmed at 196, or just under 33% of the sites surveyed. It commonly occurred intermixed with hydrilla which made identification a challenge. It most commonly occurred in sections 1, 4 and 5. At Sections 5 and 6, it occurred at trace abundance exclusively. In section 1, robust specimens could be mistaken for hydrilla if not closely examined out of the water. Anecdotally, similar common waterweed growth was observed in Canal locations north of Lambertville. At the other four sections, it predominantly occurred at trace abundance with a few sparse occurrences mixed in. Typically, common waterweed grew right along the shoreline in shallow water, intermixed with other submersed plants. Figure 6, below, depicts the common water abundance by section at the D&R Canal.

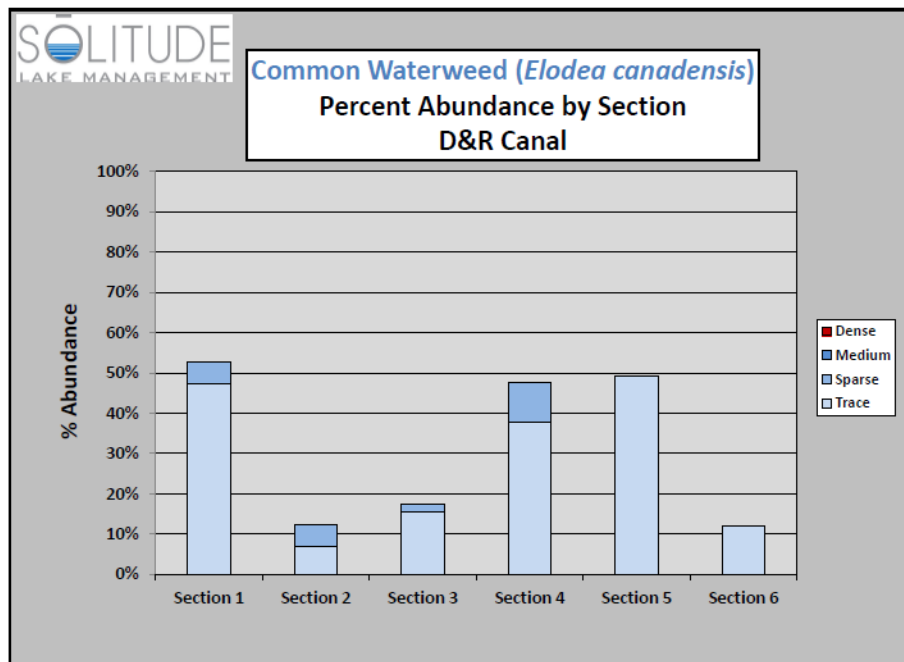


Figure 6: 2016 Common Waterweed Abundance in the D&R Canal

Brittle naiad was the only naiad species we identified in the D&R Canal. Brittle naiad is a prolific seed producer, and is considered an invasive species. It occurred at 143 (or 24.0%) of the sites surveyed in 2016. Brittle naiad was most common in the northern parts of the Feeder Canal, Sections 1 through 3. In these sections, it exceeded 30% occurrence, with Section 2 exceeding 50% occurrence. Although most sites had trace brittle naiad growth, some sparse sites were observed throughout, and Sections 2 and 3 had medium abundance sites. Sections 4 and 5 had less than 10% occurrence, with all sites classified as trace abundance. Section 6 had no brittle naiad. Figure 7, below, depicts the abundance of brittle naiad in the D&R Canal by Section.

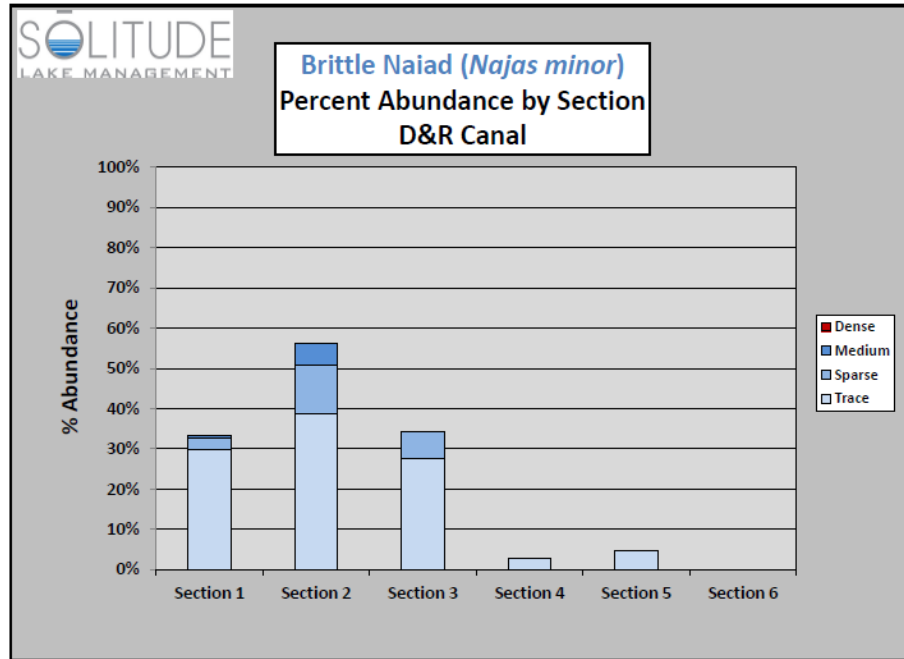


Figure 7: 2016 Brittle Naiad Abundance in the D&R Canal

THE NEED FOR SUBMERSED AQUATIC VEGETATION CONTROL

The NJWSA is required to pass a dependable uninterrupted supply of water through the D&R Canal along its entire 60 mile length to satisfy its numerous customer's variety of uses. Nuisance abundant aquatic plant growth clearly disrupts this potential water flow, and in previous years the application of various aquatic plant controls was required to maintain suitable water flow. The identification of hydrilla in the Canal in 2016 warrants the use of more aggressive aquatic plant control in the Canal. Hydrilla is capable of rapid expansion and could occupy the entire Canal due to its relatively shallow depth. In a few years, hydrilla could be fully topped out and restricting the water flow throughout the Canal. It has been estimated to reduce water flow by up to 85% (True-Meadows et.al, 2016 and <http://ccetompkins.org/environment/invasive-plants/hydrilla/about-hydrilla/economic-impacts>).

Hydrilla also has serious ecological impacts to the water body that it has infested (as summarized in Table 5, below). Due to its ability to reproduce via fragmentation and turion dispersal, hydrilla is a very real threat to the watershed as well. As of 2017, hydrilla is still classified as an emerging threat in New Jersey (according to the New Jersey Invasive Species Strike Team). If left uncontrolled in the Canal, the potential for hydrilla spread is greater than if it occurred in a lake. Any water bodies/watersheds along the entire 58 mile length of the Canal could be at risk to

hydrilla spread. Therefore, the Watershed Protection Programs of the NJWSA has taken upon itself the need to respond quickly and effectively to target hydrilla abundance to limit the potential for spread. Therefore, more aggressive aquatic control methods are now being considered to target not only the hydrilla, but also the overabundance of other native submersed aquatic plants in 2017.

SUBMERSED AQUATIC VEGETATION CONTROL OPTIONS SUMMARY

Aquatic plants can be roughly divided into three groups. **Emergent Aquatic Plants** are established in shallow (sometimes merely moist sediment) water with leaves extending above the water's surface. Emergent aquatic plant examples include arrowhead, cattails, many bur-reeds and bulrushes. **Floating-leaf Aquatic Plants** inhabit intermediate depth waters, with floating leaves more or less occurring on the water's surface. They can be rooted in the sediment (such as spatterdock and white water lilies), or they can be free-floating (such as watermeal and duckweeds). **Submersed Aquatic Plants** (often referred to as Submersed Aquatic Vegetation, or SAV), refers to aquatic plants rooted in the bottom sediments of a basin and tend to inhabit the shallow and deeper areas of the littoral zone. This zone is defined as the region where light penetration reaches the bottom and can support rooted aquatic plant growth. Submersed aquatic plants include native pondweeds, wild celery and common waterweed, as well as invasive species such as Eurasian water milfoil, hydrilla and brittle naiad.

Aquatic plants play an integral role in aquatic ecosystems worldwide, including ponds, lakes, rivers, canals, estuaries, and bays. Aquatic plants provide food and habitat for fish, wildlife (such as waterfowl and mammals) and other aquatic biota (such as zooplankton and benthic macro-invertebrates). Aquatic plants stabilize sediments, improve water clarity and provide a diverse littoral environment. Although native aquatic plants can reach nuisance amounts, typically the introduction of nonnative invasive aquatic plants often unbalance the delicate aquatic ecosystem, often incurring negative economical and ecological impacts. Table 5, below, summarizes these potential economic and ecological impacts. Therefore, significant resources are often expended to control nuisance aquatic plant growth, often targeting invasive growth.

Table 5: Summary of Negative Impacts Created by Aquatic Plants (derived from Gettys, et al, 2014)

Economic Impacts	Ecological Impacts
Impair commercial/recreational navigation	Degrade water quality
Disrupt hydropower generation/water flow	Reduce species diversity
Increase flood frequency, duration, and intensity	Increase extinction rate of rare, threatened, and endangered (RTE) species
Impair drinking water quality (taste and odor)	Suppress desirable native aquatic plant community
Habitat for insect-borne disease vectors	Alter animal community interactions
Interfere with safe swimming	Increase detritus build-up/reduce water depth
Interfere with fishing	Alter sediment chemistry
Reduce aesthetics/property values	

There are many methods available to lake managers for the control of aquatic plants. These methods can be organized as Physical Control, Chemical Control, and Biological Control. Although the list of options seems daunting, one must consider a myriad of factors when selecting the optimal control method. This includes program goals (invasive species control, fishery management, or open up boat access through dense surface weed growth, for example), a detailed description of the site (water chemistry, water depth, sediment type, equipment access), biology (target and non-target aquatic plants, Rare, Threatened or Endangered species), water uses (recreational, aesthetics, irrigation, fishing, potable water intakes) and budget. For one or more of these factors, some options can be eliminated from an SAV Management Plan, and others will become more attractive. Often an Integrated approach is most sound program that can be developed following a review of existing data. An Integrated Program is two or more control strategies employed in conjunction to increase efficacy or target individual problem species.

Another important factor is the adaptability of a program over time. Knowing exactly how an aquatic system and all of its inhabitants will respond (to aquatic plant control) is not usually possible; uncertainty is a fact of life, especially in lake management (Wagner, 2004). This highlights the importance of the monitoring effort to assess the program goals (usually annually) and achieving milestones, as well as the responsiveness to altering control methods as conditions change or program goals change.

Physical Control options include techniques such as installing benthic barriers, dredging, shading/covering, mechanical removal (both non-mechanical and mechanical), and water level manipulation. **Chemical Control** options include the use of various formulations of copper, contact and systemic herbicides. Contact herbicides result in rapid plant tissue injury, and lack an ability to translocate throughout the plant. Systemic herbicides tend to be slower acting with the active ingredient being mobile throughout plant tissue and thus affecting all parts of the plant including roots and rhizomes. **Biological Control** entails introducing a natural biota that proficiently or preferably grazes on the target aquatic plant. The classical examples include grass carp (*Ctenopharyngodon idella*), various insect bio-controls, or even the installation of desirable native aquatic plants to discourage establishment of invasive species.

Table 6, below, is an extensive summary of various aquatic plant control options, organized by Physical, Chemical and Biological Control Methods (reproduced from Wagner, 2004, with permission). The table includes the Mode of Action (how it works, practicality and notes), advantages, and disadvantages. Finally, the last column is summary of applicability that particular method specifically to the D&R Canal.

Table 6: Summary of Aquatic Plant Control Options (reprinted with permission from Wagner, 2004 and modified).

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO THE D&R CANAL
PHYSICAL CONTROLS				
1) Benthic Barriers	<ul style="list-style-type: none"> ◆ Mat of variable composition laid on bottom of target area, preventing growth ◆ Can cover area for as little as several months or permanently ◆ Maintenance improves effectiveness 	<ul style="list-style-type: none"> ◆ Highly flexible control ◆ Reduces turbidity from soft bottoms ◆ Can cover undesirable substrate ◆ Can improve fish habitat by creating edge effects 	<ul style="list-style-type: none"> ◆ May cause anoxia at sediment-water interface ◆ May limit benthic invertebrates ◆ Non-selective interference with plants in target area ◆ May inhibit spawning/feeding by some fish species 	<ul style="list-style-type: none"> ◆ Limited Applicability at the D&R Canal ◆ Hydrilla has low-light tolerance (Haug, personal communication, 2017). ◆ Small patches only ◆ Possibly viable following aggressive control and in combination with hand pulling
1.a) Porous or loose-weave synthetic materials	<ul style="list-style-type: none"> ◆ Laid on bottom and usually anchored by weights or stakes ◆ Removed and cleaned or flipped and repositioned at least once per year for maximum effect 	<ul style="list-style-type: none"> ◆ Allows some escape of gases which may build up underneath ◆ Panels may be flipped in place or removed for relatively easy cleaning or repositioning 	<ul style="list-style-type: none"> ◆ Allows some growth through pores ◆ Gas may still build up underneath in some cases, lifting barrier from bottom 	<ul style="list-style-type: none"> ◆ Limited Applicability at the D&R Canal ◆ Non-porous material more suitable for hydrilla control
1.b) Non-porous or sheet synthetic materials	<ul style="list-style-type: none"> ◆ Laid on bottom and anchored by many stakes, anchors or weights, or by layer of sand ◆ Not typically removed, but may be swept or “blown” clean periodically 	<ul style="list-style-type: none"> ◆ Prevents all plant growth until buried by sediment ◆ Minimizes interaction of sediment and water column 	<ul style="list-style-type: none"> ◆ Gas build up may cause barrier to float upwards ◆ Strong anchoring makes removal difficult and can hinder maintenance 	<ul style="list-style-type: none"> ◆ Limited Applicability at the D&R Canal ◆ Small scale application only ◆ Labor Intensive

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
1.c) Sediments of a desirable composition	<ul style="list-style-type: none"> ◆ Sediments may be added on top of existing sediments or plants. ◆ Use of sand or clay can limit plant growths and alter sediment-water interactions. ◆ Sediments can be applied from the surface or suction dredged from below muck layer (reverse layering technique) 	<ul style="list-style-type: none"> ◆ Plant biomass and propagules can be buried ◆ Sediment can be made less hospitable ◆ Nutrient release from sediments may be reduced ◆ Surface sediment can be made more appealing to humans ◆ Reverse layering requires no addition or removal of sediment 	<ul style="list-style-type: none"> ◆ Lake depth may decline ◆ Sediments may mix with underlayment ◆ Permitting for added sediment difficult ◆ Addition of sediment may cause initial turbidity ◆ New sediment may contain nutrients or other contaminants ◆ Generally too expensive for large scale application 	<ul style="list-style-type: none"> ◆ Not Applicable for the D&R Canal ◆ Water Flow through the Canal ◆ Reducing water depth would reduce water flow and capacity ◆ Increased turbidity could impact drinking water uses ◆ Target area too large
2) Dredging	<ul style="list-style-type: none"> ◆ Sediment is physically removed by wet or dry excavation, with deposition in a containment area ◆ Dredging can be applied on a limited basis, but is most often a major restructuring of a severely impacted system ◆ Plants and seed beds are removed and re-growth can be limited by light and/or substrate limitation 	<ul style="list-style-type: none"> ◆ Plant removal with some flexibility ◆ Increases water depth ◆ Can reduce pollutant reserves ◆ Can reduce sediment oxygen demand ◆ Can improve spawning habitat for many fish species ◆ Allows complete renovation of aquatic ecosystem 	<ul style="list-style-type: none"> ◆ Temporarily removes benthic invertebrates ◆ May create turbidity ◆ May eliminate fish community (complete dry dredging only) ◆ Possible impacts from containment area discharge ◆ Possible impacts from dredged material disposal ◆ Interference with uses during dredging ◆ Usually very expensive 	<ul style="list-style-type: none"> ◆ Limited Applicability at the D&R Canal ◆ Dredging project planned for Main Canal in 2018 ◆ Generally too expensive for just plant control ◆ Increased water depth would translate to increased water flow

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
2.a) "Dry" excavation	<ul style="list-style-type: none"> ◆ Lake drained or lowered to maximum extent practical ◆ Target material dried to maximum extent possible ◆ Conventional excavation equipment used to remove sediments 	<ul style="list-style-type: none"> ◆ Tends to facilitate a very thorough effort ◆ May allow drying of sediments prior to removal ◆ Allows use of less specialized equipment 	<ul style="list-style-type: none"> ◆ Eliminates most aquatic biota unless a portion left undrained ◆ Eliminates lake use during dredging 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ Need to maintain flow through the Canal.
2.b) "Wet" excavation	<ul style="list-style-type: none"> ◆ Lake level may be lowered, but sediments not substantially dewatered ◆ Draglines, bucket dredges, or long-reach backhoes used to remove sediment 	<ul style="list-style-type: none"> ◆ Tends to require less preparation and be less costly than dry dredging ◆ May allow use of easily acquired equipment ◆ May preserve most aquatic biota 	<ul style="list-style-type: none"> ◆ Usually creates extreme turbidity ◆ Sediment deposition in surrounding area ◆ Normally requires containment area to dry sediments prior to hauling ◆ Severe disruption of ecological function ◆ Lake uses impaired during dredging 	<ul style="list-style-type: none"> ◆ Limited Applicability to the D&R Canal ◆ Could be used to increase capacity and water flow ◆ Unlikely to use for plant control ◆ Turbidity
2.c) Hydraulic (or pneumatic) removal	<ul style="list-style-type: none"> ◆ Lake level not reduced ◆ Suction or cutterhead dredges create slurry which is hydraulically pumped to containment area ◆ Slurry is dewatered; sediment retained, water discharged 	<ul style="list-style-type: none"> ◆ Creates minimal turbidity and limits impact on biota ◆ Can allow some lake uses during dredging ◆ Allows removal with limited access or shoreline disturbance 	<ul style="list-style-type: none"> ◆ Often leaves some sediment behind ◆ Cannot handle extremely coarse or debris-laden materials ◆ Requires advanced and more expensive containment area ◆ Requires overflow discharge from containment area 	<ul style="list-style-type: none"> ◆ Limited Applicability to the D&R Canal ◆ Scheduled to occur in 2018 for capacity increasing in Main Canal ◆ Increased capacity equates to increased water flow

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
3) Dyes and Surface Covers	<ul style="list-style-type: none"> ♦ Water-soluble dye is mixed with lake water, thereby limiting light penetration and inhibiting plant growth ♦ Dyes remain in solution until washed out of system. ♦ Opaque sheet material applied to water surface 	<ul style="list-style-type: none"> ♦ Light limit on plant growth without high turbidity or great depth ♦ May achieve some control of algae as well ♦ May achieve some selectivity for species tolerant of low light 	<ul style="list-style-type: none"> ♦ May not control peripheral or shallow water rooted plants ♦ May cause thermal stratification in shallow ponds ♦ May facilitate anoxia at sediment interface with water ♦ Covers inhibit gas exchange with atmosphere 	<ul style="list-style-type: none"> ♦ Not Applicable at the D&R Canal ♦ Water flow too high for dye use ♦ Area too large for covers and negative impacts to recreation
4) Mechanical Removal ("harvesting")	<ul style="list-style-type: none"> ♦ Plants reduced by mechanical means, possibly with disturbance of soils ♦ Collected plants may be placed on shore for composting or other disposal ♦ Wide range of techniques employed, from manual to highly mechanized ♦ Application once or twice per year usually needed 	<ul style="list-style-type: none"> ♦ Highly flexible control ♦ May remove other debris ♦ Can balance habitat and recreational needs 	<ul style="list-style-type: none"> ♦ Possible impacts on aquatic fauna ♦ Non-selective removal of plants in treated area ♦ Possible spread of undesirable species by fragmentation ♦ Possible generation of turbidity 	<ul style="list-style-type: none"> ♦ Limited Applicability at the D&R Canal ♦ Limited Area ♦ Need to manage hydrilla fragmentation ♦ Need a suitable disposal site for hydrilla removed

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
4.a) Hand pulling	<ul style="list-style-type: none"> Plants uprooted by hand ("weeding") and preferably removed 	<ul style="list-style-type: none"> Highly selective technique 	<ul style="list-style-type: none"> Labor intensive Difficult to perform in dense stands 	<ul style="list-style-type: none"> Limited Applicability at the D&R Canal Need to manage hydrilla fragmentation Need a suitable disposal site for hydrilla removed Possible combination with benthic barrier use
4.b) Cutting (without collection)	<ul style="list-style-type: none"> Plants cut in place above roots without being harvested 	<ul style="list-style-type: none"> Generally efficient and less expensive than complete harvesting 	<ul style="list-style-type: none"> Leaves root systems and part of plant for re-growth Leaves cut vegetation to decay or to re-root Not selective within applied area 	<ul style="list-style-type: none"> Not Applicable at the D&R Canal Hydrilla fragmentation a concern Access with bridges
4.c) Harvesting (with collection)	<ul style="list-style-type: none"> Plants cut at depth of 2-10 feet and collected for removal from lake 	<ul style="list-style-type: none"> Allows plant removal on greater scale 	<ul style="list-style-type: none"> Limited depth of operation Usually leaves fragments which may re-root and spread infestation May impact lake fauna Not selective within applied area More expensive than cutting 	<ul style="list-style-type: none"> Limited Applicability at the D&R Canal Need to manage hydrilla fragmentation Need suitable hydrilla disposal site Harvester Access with bridges could be a concern

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
4.d) Rototilling	<ul style="list-style-type: none"> Plants, root systems, and surrounding sediment disturbed with mechanical blades 	<ul style="list-style-type: none"> Can thoroughly disrupt entire plant 	<ul style="list-style-type: none"> Usually leaves fragments which may re-root and spread infestation May impact lake fauna Not selective within applied area Creates substantial turbidity More expensive than harvesting 	<ul style="list-style-type: none"> Not Applicable at the D&R Canal Hydrilla fragmentation a concern for blades
4.e) Hydro-raking	<ul style="list-style-type: none"> Plants, root systems and surrounding sediment and debris disturbed with mechanical rake, part of material usually collected and removed from lake 	<ul style="list-style-type: none"> Can thoroughly disrupt entire plant Also allows removal of stumps or other obstructions Can remove entire plant, shoots and roots 	<ul style="list-style-type: none"> Usually leaves fragments which may re-root and spread infestation May impact lake fauna Not selective within applied area Creates substantial turbidity More expensive than harvesting 	<ul style="list-style-type: none"> Applicable at the D&R Canal Increased water depth equals increased water flow Need to manage hydrilla fragmentation or identify hydrilla free areas Need a suitable disposal site
5) Water level control	<ul style="list-style-type: none"> Lowering or raising the water level to lower suitability for aquatic plants Disrupts plant life cycle by drying/freezing, or light limitation 	<ul style="list-style-type: none"> Requires only outlet control to affect large area Provides widespread control in increments of water depth Complements dredging and flushing 	<ul style="list-style-type: none"> Potential issues with water supply Potential issues with flooding Potential impacts to non-target flora and fauna 	<ul style="list-style-type: none"> Not Applicable at the D&R Canal Need to pass a minimum amount of water through Canal

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
5.a) Drawdown	<ul style="list-style-type: none"> ◆ Lowering of water over winter period allows desiccation, freezing, and physical disruption of plants, roots and seed beds ◆ Timing and duration of exposure and degree of dewatering are critical aspects ◆ Variable species tolerance to drawdown 	<ul style="list-style-type: none"> ◆ Control with some flexibility ◆ Opportunity for shoreline clean-up/structure repair ◆ Flood control utility ◆ Impacts vegetative propagation species with limited impact to seed producing populations 	<ul style="list-style-type: none"> ◆ Possible impacts on emergent wetlands ◆ Possible effects on overwintering reptiles and amphibians ◆ Reduction in potential supply ◆ Alteration of downstream flows ◆ Possible overwinter water level variation ◆ May result in greater nutrient availability for algae 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ Need to maintain water flow through entire Canal ◆ Inconsistent freezing during winter months
5.b) Flooding	<ul style="list-style-type: none"> ◆ Higher water level in the spring can inhibit seed germination and plant growth ◆ Higher flows which are normally associated with elevated water levels can flush seed and plant fragments from system 	<ul style="list-style-type: none"> ◆ Where water is available, this can be an inexpensive technique ◆ Plant growth need not be eliminated, merely retarded or delayed ◆ Timing of water level control can selectively favor certain desirable species 	<ul style="list-style-type: none"> ◆ Water for raising the level may not be available ◆ Potential peripheral flooding ◆ Possible downstream impacts ◆ Many species may not be affected, and some may be benefitted ◆ Algal nuisances may increase where nutrients are available 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ Hydrilla fragment spread ◆ Canal is typically at full pool

CHEMICAL CONTROL				
OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
6) Herbicides	<ul style="list-style-type: none"> ◆ Liquid or pelletized herbicides applied to target area or to plants directly ◆ Contact or systemic poisons kill plants or limit growth ◆ Typically requires application every 1-5 yrs 	<ul style="list-style-type: none"> ◆ Wide range of control is possible ◆ May be able to selectively eliminate species ◆ May achieve some algae control as well 	<ul style="list-style-type: none"> ◆ Possible toxicity to non-target species ◆ Possible downstream impacts ◆ Restrictions of water use for varying time after treatment ◆ Increased oxygen demand from decaying vegetation ◆ Possible recycling of nutrients to allow other growths 	<ul style="list-style-type: none"> ◆ Applicable at the D&R Canal ◆ Would require multiple years ◆ Manage water use restrictions ◆ Potential control of nuisance native species ◆ Suitable for injection as natural water flow will move herbicide
6.a) Forms of Copper	<ul style="list-style-type: none"> ◆ Contact herbicide ◆ Cellular toxicant, suspected membrane transport disruption ◆ Applied as wide variety of liquid or granular formulations 	<ul style="list-style-type: none"> ◆ Moderately effective control of some submersed plant species ◆ More often an algal control agent 	<ul style="list-style-type: none"> ◆ Toxic to aquatic fauna as a function of concentration, formulation, and water chemistry ◆ Reduced efficacy at colder temperatures ◆ Copper ion persistent; accumulates in sediments 	<ul style="list-style-type: none"> ◆ Limited Applicability at the D&R Canal ◆ Does control hydrilla, but probably better options available ◆ Trout-stocked waters could limit application ◆ Quick uptake but short duration of control

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
<p>6.c) Forms of diquat</p> <p>(6,7-dihydropyrido [1,2-2',1'-c] pyrazinediium dibromide)</p>	<ul style="list-style-type: none"> ◆ Contact herbicide ◆ Absorbed by foliage but not roots ◆ Strong oxidant; disrupts most cellular functions ◆ Applied as a liquid, sometimes in conjunction with copper 	<ul style="list-style-type: none"> ◆ Moderate control of some emerged plant species, moderately to highly effective control of floating or submersed species ◆ Limited toxicity to fish at recommended dosages ◆ Rapid action 	<ul style="list-style-type: none"> ◆ Non-selective in treated area ◆ Potentially toxic to zooplankton at recommended dosage ◆ Inactivated by suspended particles; ineffective in turbid/muddy water ◆ Time delays on use for water supply, agriculture and recreation 	<ul style="list-style-type: none"> ◆ Limited Applicability at the D&R Canal ◆ Needs to be mixed with copper to be effective on hydrilla. ◆ Limited use on hydrilla in the Northeast ◆ Better herbicide options available
<p>6.d) Forms of glyphosate</p> <p>(N-[phosphonomethyl] glycine)</p>	<ul style="list-style-type: none"> ◆ Contact herbicide ◆ Absorbed through foliage, disrupts enzyme formation and function in uncertain manner ◆ Applied as liquid spray 	<ul style="list-style-type: none"> ◆ Moderately to highly effective control of emerged and floating plant species ◆ Can be used selectively, based on application to individual plants ◆ Rapid action ◆ Low toxicity to aquatic fauna at recommended dosages ◆ No time delays for use of treated water 	<ul style="list-style-type: none"> ◆ Non-selective in treated area ◆ Inactivation by suspended particles; ineffective in muddy waters ◆ Not for use within 0.5 miles of potable water intakes 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ Hydrilla is not controlled by glyphosate

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
<p>6.f) Forms of fluridone</p> <p>(1-methyl-3-phenyl-5-[-3-{trifluoromethyl} phenyl]-4[1H]-pyridinone)</p>	<ul style="list-style-type: none"> ◆ Systemic herbicide ◆ Inhibits carotenoid pigment synthesis and impacts photosynthesis ◆ Best applied as liquid or granules during early growth phase of plants 	<ul style="list-style-type: none"> ◆ Can be used selectively, based on concentration ◆ Gradual deterioration of affected plants limits impact on oxygen level (BOD) ◆ Effective against several difficult-to-control species ◆ Low toxicity to fauna 	<ul style="list-style-type: none"> ◆ Impacts on non-target plant species possible at higher doses ◆ Extremely soluble and mixable; difficult to perform partial lake treatments ◆ Requires extended contact time 	<ul style="list-style-type: none"> ◆ Applicable at the D&R Canal ◆ Large scale control possible ◆ Successfully used at other large sites in the Northeast ◆ Slow acting; requires long contact time, but at low dose which limits water use restrictions ◆ Best method of introduction is via injection ◆ Spot treatment with granular formulations possible ◆ Depending on dose, could have reduced impacts on nuisance native SAV
<p>6.g Amine salt of triclopyr</p> <p>(3,5,6-trichloro-2-pyridinyloxy acetic acid)</p>	<ul style="list-style-type: none"> ◆ Systemic herbicide ◆ Readily absorbed by foliage, translocated throughout plant ◆ Disrupts enzyme systems specific to plants ◆ Applied as liquid spray or subsurface injected liquid 	<ul style="list-style-type: none"> ◆ Effectively controls many floating and submersed plant species ◆ Selectively effective against dicot plant species ◆ Effective against several difficult-to-control species ◆ Low toxicity to fauna ◆ Fast action 	<ul style="list-style-type: none"> ◆ Impacts on non-target plant species possible at higher doses ◆ Current time delay of 30 days on consumption of fish from treated areas ◆ Necessary restrictions on use of treated water for supply or recreation not yet certain 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ Hydrilla has low susceptibility ◆ Better herbicide options available

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
6.h flumioxazin (N-(7-fluoro-3,4-dihydro-3-oxo-4-prop-2-ynyl-2H-1,4-benzoxazin-6-yl)cyclohex-1-ene-1,2-dicarboxamide.)	<ul style="list-style-type: none"> ◆ Contact herbicide ◆ Inhibits plant specific enzyme (PPO) ◆ Causes rapid desiccation and necrosis 	<ul style="list-style-type: none"> ◆ Effectively controls submersed and floating-leaf plants ◆ Higher light intensity creates better efficacy ◆ Plant control can be rapid ◆ Can also control many forms of algae 	<ul style="list-style-type: none"> ◆ pH impacts efficacy ◆ Re-growth can be rapid on mature plants or slow growing plants ◆ Needs 4-6 hours of contact 	<ul style="list-style-type: none"> ◆ Limited Applicability at the D&R Canal ◆ Requires tank mixing to control hydrilla ◆ Better herbicide option available
6.i Bispyribac-Sodium (2,6-bis[(4,6-dimethoxypyrimidin-2-yl)oxy]benzoate)	<ul style="list-style-type: none"> ◆ Systemic herbicide ◆ Inhibits plant specific enzyme (ALS) ◆ New Growth is stunted 	<ul style="list-style-type: none"> ◆ Large-scale control of submersed aquatic and floating-leaf plants ◆ Effective on herbicide resistant aquatic plants ◆ Minimal impacts to target native plants ◆ Long lasting effects 	<ul style="list-style-type: none"> ◆ Extended exposure required for submersed aquatic plant control ◆ Minimal use on monoecious hydrilla ◆ Lengthy irrigation restrictions ◆ Soluble powder formulation 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ Better herbicide option available ◆ Limited use in Northeast ◆ Not labeled for injection application
6. k Imazamox (2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-(methoxymethyl)-3-pyridinecarboxylic acid.)	<ul style="list-style-type: none"> ◆ Systemic Herbicide ◆ Inhibits plant specific enzyme (ALS) ◆ New growth is stunted 	<ul style="list-style-type: none"> ◆ Selective emergent aquatic plant control ◆ Available in liquid and granular formulations ◆ Quick acting, but decomposition takes several weeks 	<ul style="list-style-type: none"> ◆ A short exposure approach ◆ Could require multiple applications per season 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ Can provide sustained growth suppression for dioecious hydrilla ◆ Potable water use and irrigation restrictions ◆ Better herbicide options available

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
BIOLOGICAL CONTROL				
7) Biological introductions	<ul style="list-style-type: none"> ◆ Fish, insects or pathogens which feed on or parasitize plants are added to system to affect control 	<ul style="list-style-type: none"> ◆ Provides potentially continuing control with one treatment ◆ Harnesses biological interactions to produce desired conditions ◆ May produce potentially useful fish biomass as an end product 	<ul style="list-style-type: none"> ◆ Typically involves introduction of non-native species ◆ Effects may not be controllable ◆ Plant selectivity may not match desired target species ◆ May impact non-target species 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ NJDF&W restricts grass carp introductions to sites less than 10 surface acres ◆ No commercially available insect or pathogen control at this time.
7.a) Herbivorous fish	<ul style="list-style-type: none"> ◆ Grass carp most commonly used ◆ Sterile juveniles stocked at density to allows control ◆ Control achieved over multiple years ◆ Growth of individuals can offset losses 	<ul style="list-style-type: none"> ◆ May greatly reduce plant biomass ◆ May provide multiple years of control from single stocking ◆ Sterility intended to prevent population perpetuation and allow later adjustments 	<ul style="list-style-type: none"> ◆ May eliminate all plant biomass, or impact non-target species ◆ Funnels energy into algae ◆ Alters habitat ◆ May escape upstream or downstream 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ NJDF&W will not issue a permit for the use of grass carp in the Canal
7.b) Herbivorous insects	<ul style="list-style-type: none"> ◆ Larvae or adults stocked at density intended to allow control with limited growth ◆ Intended to selectively control target species ◆ Milfoil weevil is best known, but still experimental 	<ul style="list-style-type: none"> ◆ Involves species native to region, or even targeted lake ◆ Expected to have no negative effect on non-target species ◆ May facilitate longer term control with limited management 	<ul style="list-style-type: none"> ◆ Incomplete control likely; oscillating cycle of control and re-growth expected ◆ Predation by fish may complicate control ◆ Other lake management actions may interfere 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ No insect bio-controls commercially available for purchase

OPTION	MODE OF ACTION	ADVANTAGES	DISADVANTAGES	APPLICABILITY TO SITE
7.c) Fungal/bacterial/ viral pathogens	<ul style="list-style-type: none"> ◆ Inoculum used to seed lake or target plant patch ◆ Growth of pathogen population expected to achieve control over target species 	<ul style="list-style-type: none"> ◆ May be highly species specific ◆ May provide substantial control after minimal inoculation effort 	<ul style="list-style-type: none"> ◆ Effectiveness and longevity of control not well known ◆ Infection ecology suggests incomplete control likely 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ No pathogens commercially available for use
7.d) Selective plantings	<ul style="list-style-type: none"> ◆ Establishment of plant assemblage resistant to undesirable species ◆ Plants introduced as seeds, cuttings or whole plants 	<ul style="list-style-type: none"> ◆ Can restore native assemblage ◆ Can encourage assemblage most suitable to lake uses ◆ Supplements targeted species removal effort 	<ul style="list-style-type: none"> ◆ Largely experimental ◆ May not prevent nuisance species from returning ◆ Introduced species may become nuisances 	<ul style="list-style-type: none"> ◆ Not Applicable at the D&R Canal ◆ The addition of native plants into the Canal would inhibit water flow

D&R CANAL PREFERRED SUBMERSED AQUATIC VEGETATION CONTROL OPTIONS

In 2017, Fluridone injection and hydro-raking appear to be the most suitable aquatic plant control options due to the potable water intakes present on the Canal. However, there are a few other options (Endothall and Copper use) that could be applicable, but likely not for 2017 for a variety of reasons. Additionally, options such as hand pulling or benthic barrier use could be applicable in future years at this site once we see an immediate reduction of biomass of the target aquatic plants. Therefore this SAV Management Plan will be adaptive and shall be reviewed each year. Revisions to the Plan will be recommended based on monitoring results for approval by the NJWSA.

2017 Option A: Fluridone Injection

The preferred management strategy to control monoecious hydrilla in the multi-use Delaware & Raritan Canal (D&R Canal) is a low-rate (<5 ppb active), sustained injection of the aquatic herbicide Sonar Genesis (0.5 lb fluridone per gal). For this project we are targeting a sustained Fluridone rate between 2 ppb and 4 ppb for the duration of the treatment. A Sonar Genesis product label is included in the Appendix. The strategy of sustained Sonar injection into flowing aquatic systems infested with monoecious hydrilla has been shown in recent years to be an effective method of control. Best recent project examples of the approach include the effort to eradicate hydrilla from infested tributaries of Cayuga Lake, New York, and management of the

Eno River—an environmentally-sensitive small river in North Carolina. In both projects, custom-built, cellular-controlled, automated injection systems are utilized to precisely apply low concentrations of the Sonar Genesis herbicide based on near real-time discharge data from USGS. Summary of results of the Sonar program for Cayuga Lake are available from its Local Task Force and are also described on the Task Force website (<http://ccetompkins.org/environment/invasive-nuisance-species/aquatic-invasives/hydrilla/fighting-hydrilla-in-the-cayuga-lake-watershed>). Summary of the Eno River hydrilla management effort using Sonar Genesis is provided as supplemental information in the Appendix of this Plan.

The D&R Canal has a number of important conditions and uses that must be considered when designing a management effort for its monoecious hydrilla infestation. Its primary function as a public water supply transmission system requires that management efforts are compatible with potable and irrigation uses of the Canal. The public water supply use requires that a relatively consistent flow be maintained in the Canal. NJWSA has described that 140 CFS is the general average for Canal flow, and USGS data confirm that discharge is maintained in a tight range near this level. The consistent discharge is maintained through a combination of controlled gravity-based flow-through sluice gate systems, occasional active pumping of water into the Canal and self-leveling spillways at various points on the Canal. The Canal has some inputs from small streams, mainly in the upper part of the Canal upstream of the potential hydrilla management zone, and also receives stormwater discharge at various locations in the Canal. Management efforts—particularly those with a registered aquatic herbicide requiring certain concentration and exposure to be maintained for selective hydrilla control—must plan for the specific hydrology of the Canal and adaptively implement a strategy that accounts for inputs and outflows leading to a generally steady-state discharge. Management strategy also needs to not restrict recreational small boating on the Canal. Finally, the D&R Canal is habitat for state-threatened aquatic animal species including the wood turtle and yellow lampmussel. A hydrilla management program should be designed to have no impact on these species.

A management strategy focused on use of low-dose, controlled injection of Sonar Genesis appears to be a solid fit for the D&R Canal and its monoecious hydrilla management. Relative to public water withdrawal, Sonar Genesis has no restrictions on potable water consumption at use rates below 20 ppb. USEPA recently provided new Human Health Benchmarks for Pesticides in drinking water that cited Sonar (fluridone) with acute (1-day exposure) risk only at concentrations above 34,500 ppb and chronic health risk only at levels above 960 ppb (<https://ofmpub.epa.gov/apex/pesticides/f?p=109:3>). A preliminary plan to apply Sonar Genesis at 2 – 4 ppb to the target treatment zone in the D&R Canal will keep Sonar (fluridone) concentrations well below the label potable limit and orders of magnitude beneath EPA’s new health benchmarks. Monoecious hydrilla has been shown to be highly sensitive to Sonar (Netherland, 2015) and concentrations maintained at or above 2 ppb for 60+ days should control

the D&R Canal's hydrilla infestation if active management is initiated at earliest signs of hydrilla tuber germination and growth. See below for more comments on duration of treatment program relative to management objectives. Past environmental and human health risk assessments specific to hydrilla management with Sonar support that a low-dose injection program poses negligible risk to threatened aquatic animal species and human health. Relative to ecological risk to specific threatened species in the D&R Canal, Sonar has a 30-year history of aquatic use without effects on turtle species or freshwater mussels. Two early studies of Sonar use qualitatively reported no adverse effects observed to crayfish, bass, bluegill, catfish, long-neck soft-shelled turtles, frogs, water snakes and waterfowl from the use of 0.1 to 1.0 ppm fluridone during field experiments (Arnold, 1979, McCowen et al., 1979). In the many years since, no adverse effects on turtles have been noted including four recent consecutive seasons of management in 9,000-acre Lake Waccamaw, home to three threatened turtle species: Chicken turtle (*Deirochelys reticularia*), Spotted turtle (*Clemmys guttata*) and Striped Mud Turtle (*Kinosternon baurii*). Relative to threatened yellow lampmussel, for management of monoecious hydrilla in sensitive aquatic sites in North Carolina including Waccamaw and the Eno River, toxicity of fluridone to freshwater mollusks and the NC-endangered Panhandle pebblesnail (*Somatogyrus virginicus*) was specifically evaluated (Archambault et al. 2015, and Archambault and Cope 2016). The assessment concluded that Sonar applications, well in excess of labeled rates, posed no acute or chronic threat to these sensitive species. Relative to human health, along with past assessments throughout Sonar's history of use and the updated USEPA human health benchmarks, the State of North Carolina also recently concluded that Sonar use on the Eno River for monoecious hydrilla management posed negligible risk to human health (included in Appendix). Eno River hydrilla management has occurred the last two years without any impact on water uses including heavy recreational activity.

Relative to irrigation uses, at use rates below 5 ppb, Sonar Genesis has no restrictions for watering irrigated crops or other vegetation with the exception of greenhouse, nursery, and hydroponics where a 1 ppb limit is imposed. This limit exists to conservatively avoid risk of herbicide injury to potentially sensitive plants in these settings. The primary irrigation withdrawals from the hydrilla-infested section of the D&R Canal appear to be for golf course or other general irrigation. A Sonar Genesis treatment program for the D&R Canal using rates of 2 – 4 ppb will not impact these irrigation uses. There are multiple municipal use intakes ranging from 11 – 26 miles downstream of the currently known hydrilla-infested area. It is likely that low levels of Sonar herbicide reduced below the 2 – 4 ppb target will reach these intakes. Municipal public water supply withdrawal can lead to all forms of water use including potential use in greenhouses, nurseries, or hydroponic systems. While not in conflict with the primary drinking water use of municipal withdrawal, there would be potential conflict for use of raw water (no drinking water treatment processes) for specialized irrigation use. However, it is anticipated that physical dilution, herbicide degradation in the Canal, and standard drinking water treatment processes that remove various biological and chemical contaminants from source

water will avoid this scenario. This projection is under evaluation using tracer dye monitoring in the Canal and benchtop testing of water treatment processes. See the relevant sections, below, on the dye study results and the benchtop testing.

Relative to specifics of a Sonar Genesis treatment program for the D&R Canal, hydrilla growth in the Canal is anticipated to begin in mid-May to early June (water temperatures increasing into the mid-upper 60s °F). A low-dose Sonar program should be initiated at the earliest signs of hydrilla growth confirmed through regular field observations beginning roughly May 1 depending on spring weather and associated water temperatures. Injection equipment is already in place in the field at a suitable location (Lambertville) and is ready for start of treatment by mid-May. The low-dose Sonar program would target 4 ppb and seek to maintain 2 – 4 ppb in the hydrilla-infested section of the D&R Canal for 60 - 90 days. Past work using this strategy for monoecious hydrilla control supports a 60-day minimum exposure for satisfactory control of initially germinating hydrilla tubers in the mid-late spring period. However, other project results have documented that monoecious hydrilla tubers do have later asynchronous tuber germination through the summer. A management program focused on maximum hydrilla control and best reduction in hydrilla tubers should plan for up to 120 days of sustained low-dose Sonar injection. This extended program will control all germinating tubers during the growth season and prevent any late-season recovery and possible risk of formation of new tubers. Current understanding of monoecious hydrilla tuber persistence suggests tubers can remain dormant for 5 to 10 years post formation. Management programs focused on hydrilla eradication must manage aggressively for at least 5 years to reach potential levels for eradication. Efforts focused on longer-term maintenance control in flowing systems, but not seeking eradication, should manage actively for 2 to 3 seasons and then monitor intensively to assess future needs for 1 or more repeat management cycles in subsequent years.

Based on 140 CFS projected D&R Canal discharge and maintenance of a 4 ppb target rate for 120 days, 719 gallons of Sonar Genesis are projected for optimal hydrilla treatment. If it is determined that more than 140 CFS should be projected for the D&R Canal, additional herbicide should be budgeted for optimal control. Native aquatic plant suppression in the D&R Canal is a secondary objective of a potential SAV management plan. This partial reduction in native plant biomass would assist maintenance of free, unobstructed water flow through the Canal. Sonar Genesis injection to the D&R Canal will result in light to moderate suppression of native plants in the Canal depending on exact Sonar levels maintained. Sonar levels close to the minimum for hydrilla growth (just above 2 ppb) will produce only light growth regulation to plants such as coontail, wild celery and common waterweed. If levels can be maintained efficiently at or near 4 ppb, growth suppression will be stronger. Full control of these species at sub 5 ppb rates is highly unlikely. Any growth regulation achieved through Sonar injection should be a favorable complement to other native plant removal strategies such as hydro-raking or localized chelated copper herbicide application, as discussed below.

Sonar Genesis injection would be conducted using cellular-controlled equipment that can be adjusted remotely to apply more or less herbicide based on flow conditions and monitoring of achieved Sonar concentrations. These systems also have various monitoring of application rate and herbicide tank levels to ensure proper operation and will send text message alarms if not operating properly. The systems can be run on 110VAC or via 24VDC battery systems, and in the case of the D&R Canal project, AC power is available for use. A single injection system is anticipated to be sufficient for treating the areas of D&R Canal infested with hydrilla according to the 2016 monitoring results. This was supported by the results of the 2017 dye study (see below). The movement of water through the Canal (2 - 3 day travel time for 24 miles based on Canal dimensions and dependent on discharge per NJWSA data) should carry treated water through the main target area of the Canal with just low-level dissipation (Sonar breaks down primarily via photolysis by sunlight) and dilution. Reduced concentrations of Sonar should carry further through the Canal (water movement projects to roughly 1-week travel time through entire 60 mile Canal) leading to some potential movement of herbicide into nuisance weed growth areas further downstream.

The Sonar injection program would be complemented by routine monitoring of Sonar (fluridone) concentrations in the Canal, as described in the Monitoring section, below.

2017 Dye Study to Support Fluridone Use

The dye study was conducted in April 2017 to confirm retention times and dilution-based dissipation within a section of the D&R Canal known to be infested with monoecious hydrilla management zone as well as refine expectations of water movement and potential herbicide dissipation within the full 60 mile canal system. Rhodamine dye is considered a reasonable predictor of Sonar/fluridone herbicide dissipation under most conditions over short time periods such as the travel times through various sections of the Canal.

At 10:09 AM on April 18, 2017, a 48-hour injection of rhodamine WT dye was initiated using automated, cellular-controlled injection equipment that is planned for potential use on a subsequent Sonar Genesis treatment. The sub-surface injection occurred from a secure location below the Lambertville Lock and assumed a canal water discharge below the lock of 87 MGD (million gallons per day) or 135 CFS (cubic feet per second). From April 18 through April 28, 2017, intensive monitoring was conducted at 17 established sampling stations. Dye concentrations were monitored using discrete measurements with a Turner Designs Databank Datalogger equipped with a Cyclops-7F submersible optical sensor for rhodamine quantification. The sensor was calibrated using standard solutions created from Canal water and measured at ambient water temperature at the start of the study (15 °C or 59 °F). Measurements of dye concentration were measured at 17 different locations throughout the canal from below Lambertville Lock to near the Canal end at Landing Lane Bridge in New Brunswick (Table 1 – injector location and 17 sites, site map in Appendix). An initial set of 13 locations was scoped and then an additional four sites were added early in the monitoring to enhance resolution of

sampling. Measurements were made in the morning and late afternoon/early evening during the first two days of dye injection and then switched to a daily schedule until 10 days after injection start (April 28, or 8 days after end of the injection). Figure 8, below depicts the dye injected in the Lambertville area.



Figure 8: April 18 Dye Injection near Lambertville

Recovery of the 5 ppb target concentration was very good in the upper sections of the Canal with less than 5% difference versus target concentration at the first monitoring locations within a few miles of the injection point. Travel times per NJWSA records matched very well with the timing of dye detection for the first third or so of the monitored area (18 of the nearly 50 miles). However, correlation between timing of dye detection and historical estimated Canal travel time did appear to decrease in the last 2/3 of the monitored area. It is not clear if this was due to differences in Canal dimensions and theoretical retention times for the Feeder Canal area and other Main Sections of the Canal. Regardless of the cause, it appeared to take longer to detect dye in various downstream locations 20+ miles from the injection point compared to projected travel times, and this discrepancy appeared to increase with time and distance of travel of the dye. Recovery of the target 5 ppb dye concentration also decreased with time and distance. At Alexander Road, roughly the halfway point of the Canal study area at 24 miles downstream from the injection point, the maximum concentration of dye measured was 3.45 ppb or 69% of the 5 ppb target level. At the end of the study area at Landing Lane Bridge, a high reading of just 2.12 ppb or ~42% of the 5 ppb applied dye concentration was recovered. This reduced measurement of dye is likely the result of several factors including potential ‘downstream’ dilution with untreated water coming in from minor tributaries or runoff, potential photolytic or other degradation of the dye, possible dye association with sediments of the Canal, and potential

horizontal spread of the dye ‘pulse’ over time. It is not easily determined which of these mechanisms is dominant although actual breakdown of the dye should not be fast based on past studies using rhodamine as a conservative tracer.

The data from the dye study here support that a 4 ppb target concentration of Sonar Genesis applied at Lambertville should travel efficiently through the now-anticipated target zone for hydrilla management of ~24 miles (to approximately Alexander Road). By the time the herbicide reaches the end of the potential 2017 management zone, a confirmed period of 2.5 – 3 days, it should be still at effective levels for monoecious hydrilla control (2.76 ppb, projected based on rhodamine results). The results also support that reduced levels of herbicide lower than levels in the target area would be observed at the various municipal intake areas. At a 4 ppb applied concentration at Lambertville, readings of 1.7 – 2.3 ppb are projected based on the dye results, however, actual monitoring of Sonar herbicide dissipation may show a slightly different pattern given some differences in physical behavior and degradation processes between Sonar and dye. A final plan for potential Sonar management of monoecious hydrilla in 2017 and future years should be designed based on anticipated herbicide movement in the Canal as measured in this dye study and removal processes associated with drinking water treatment protocols of the various municipal treatment plants. A final plan should also be adaptively implemented based on measured concentrations of Sonar achieved in the Canal and adjusted as needed for effective aquatic weed control with the least use rate applied.

2017 Water Process Bench Tests to Support Fluridone Use

Since there are several municipal water intakes anywhere from 11 to 26 miles downstream of the 2017 hydrilla management zone, simulations of drinking water treatment processes for the relevant municipal treatment plants are currently being cooperatively conducted to document the level of removal of any trace Fluridone that may reach intake areas as a result of the upstream hydrilla treatment. In late April and early March, the manufacturer of Sonar Genesis (SePro Corporation) in conjunction with the NJWSA and SLM conducted a series of bench tests to simulate Sonar removal during the various water treatment processes employed by the multiple drinking water suppliers. These “jar tests” were conducted on site following protocols from the water supply authorities.

Each facility does have unique processes that are only partially represented in this testing. In general, additional steps in treatment processes will incrementally remove Fluridone but generally at lower percentages. The most common removal process for Fluridone is the use of activated carbon, which in various forms has been demonstrated to have a high sorption capacity for the herbicide (example, Sun et al. 2011, 2012) and has been used in various field applications nationally to deactivate the herbicide. Most of the facilities (but not all) withdrawing from D&R Canal have activated carbon in their processes.

Jar tests were simulated in 2.0 liter volumes, spiked with various concentrations on Fluridone from a 10 mg/L stock solution provided by the manufacturer. These concentrations were 1.0 ppb, 2.0 ppb and 4.0 ppb, selected because our anticipated treatment rate will be 2.0 ppb to 4.0 ppb. Following mixing, each sample was then manipulated with treatment processes, such as permanganate, polyaluminum chloride, chlorination and/or activated carbon as appropriate to

standard treating practices. Mixing at standard RPM and/or waiting was performed to simulate transit and contact times as well. Following the appropriate treatment processes, samples of the Fluridone spiked water/treated water were collected in labeled 125 mL plastic amber bottles and packed in a cooler on blue ice for overnight shipping to the analytical laboratory. All samples were sent with the appropriate filled-out chain of custody form.

The results of these jar tests, in addition to the dye study results, will be used to determine the target concentration for the 24 mile hydrilla treatment area of the canal and to simulate the Fluridone concentration at the various downstream municipal drinking water intakes. The weekly Fluridone monitoring program will be used to confirm these anticipated concentrations and allow a mechanism for dose alteration during the course of the injection. As of the drafting of this report, these bench tests are ongoing. It is likely that additional jar tests could be conducted later in 2017 to assess the feasibility of using different herbicide products at this site.

2017 Permit Requirements for Fluridone Use

N.J.A.C. 7:30-9.3 mandates an Aquatic Pesticide Permit for most applications of pesticides to any waters of the State of New Jersey or aquatic sites. All aquatic pesticides are considered restricted use in New Jersey and therefore can only be applied by an NJDEP certified pesticide applicator. Therefore, to apply Sonar Genesis to control vegetation in the Delaware & Raritan Canal an Aquatic Pesticide General Permit issued by NJDEP Bureau of Licensing and Pesticide Operations will be required. The permit will be obtained by the Commercial Pesticide Applicator Business, SOLitude Lake Management (Cert #99877A). Treatments will be conducted under the supervision of Commercial Pesticide Applicators, Robert Schindler (Cert #50684B) and Glenn Sullivan (Cert #27915A). Copies of the permit and water use restrictions pertaining to the approved pesticide will be provided to the New Jersey Water Supply Authority prior to the start treatment and are included in the Appendix of this report.

Additionally, a New Jersey Pollutant Discharge Elimination System Pesticide General Permit (NJ0178217) Request for Authorization (RFA) issued by NJDEP Bureau of Surface Water Permitting will also be required. The permit is in accordance with NJPDES Rules N.J.A.C. 7:14A and authorizes the application of biological and chemical pesticides in water when applications are made for, among other targets, aquatic pests in, over or near surface waters of the State. This permit is not specific to each individual application site, but instead to the applicator business. SOLitude Lake Management has an existing RFA on file but will modify it to include pesticide applications to "canals".

On April 11, 2017 the D&R Canal Commission issued General Permit 1 #17-5006 for Zone A projects necessary to carry out the repair, rehabilitation, maintenance or reconstruction of a structure, road, utility line, or stormwater management measure. The Authority dug a temporary trench over Park property to place PVC conduit and modify an existing handhold box in order to conduct a tracer dye test. The Authority posted temporary signs related to the activity.

On May 17, 2016 it is anticipated that the D&R Canal Commission will issue a General Permit 1 for Zone A projects to allow for the posting of signs required for injection of Sonar Genesis for a period of 120 days during the 2017 treatment cycle.

2017 Option B: Hydro-raking

Hydro-raking is a mechanical control option that could be applicable to the nuisance SAV that occurs in the D&R Canal. Hydro-raking has been conducted in previous seasons at the D&R Canal, as recent as in 2016. The use of a hydro-rake in the Feeder Canal led to the discovery of hydrilla in late July 2016. Figure 8 (below) depicts a hydro-rake removing submersed aquatic plants in the D&R Canal in 2016.

A hydro-rake is a paddle-driven floating backhoe outfitted with a york rake, similar to farming equipment. The York rake is pulled through the bottom sediments of the site, ripping out established roots and rhizomes, along with plant masses and the associated unconsolidated organic debris. It is most effective on floating-leaf aquatic plants (such as water chestnut, or water lilies) that tend to have thick extensive networks of rhizomes. Hydro-raking is also effective on emergent aquatic plant removal, floating island removal and stump removal. It is less effective on true submersed aquatic plants, but their removal, along with the unconsolidated organic debris (decaying plants and leaf litter) does tend to increase water depth and therefore water flow, especially in the moving aquatic systems. Access to the Canal is difficult for the hydro-rake, and requires a crane to put the machine in the water, remove it from the water, and to bypass the bridges.



Figure 9: Hydro-raking submersed aquatic plants in the D&R Canal (2016)

The increased water flow benefits and the removal of the entire plant structure (as opposed to just cutting the plants via traditional mechanical harvesting) are a few of the reasons why this option is suitable for the D&R Canal. In addition, the use of mechanical aquatic plant control does not require potable water use restrictions, and disrupts the Canal uses only in a small localized area of the park. Although the operation of a hydro-rake does disrupt the benthic community and create significant turbidity associated with the disturbance of bottom sediments, these effects are also localized so overall impacts to the Canal are minimal.

The presence of hydrilla in the Canal does complicate the use of this aquatic plant control method, primarily due to fragmentation the plants. Hydrilla fragments (and/or turions and tubers) can become dislodged and be carried down Canal via natural water flow patterns. Due to this potential risk of hydrilla fragment spread, we recommend all future hydro-raking projects be conducted in locations of the Canal that are confirmed to be hydrilla-free. Therefore, in 2017, the entire 60 mile length of the Canal will be surveyed for abundance and distribution of all submersed aquatic plants (SAV). The results of this survey shall be used to designate preferred hydro-rake locations that are hydrilla-free.

That being stated, the primary function of the D&R Canal is providing a dependable water supply to all of its customers. Therefore, based on prevailing conditions (especially in the middle to late summer when aquatic plant abundance is at its highest) it might become a necessity to hydro-rake in areas of the Canal with confirmed hydrilla. If that is the case, the following steps will be taken in an effort to minimize hydrilla fragment spread:

- Floating turbidity curtains shall be temporarily installed to reduce fragment spread downstream. These curtains will be re-deployed as the hydro-rake works different locations, and will be cleaned on a regular basis.
- The NJWSA will consider the use of volunteers to be on the water (in kayaks or canoes) to collect hydrilla fragments from the hydro-raking process. Potential sources of volunteers include the New Jersey Invasive Strike Team (NJISST), or members of one or more of the various Friends of the D&R Canal organizations.
- The NJWSA will institute comprehensive aquatic plant decontamination procedures for the hydro-rake and all other equipment utilized during this phase of aquatic plant management. This will include cleaning the hydro-rake (and trailer) each time the unit is placed in or removed from the water to minimize the risk of plant fragment spread into other parts of the Canal, or other water bodies in the region.
- All hydro-raked biomass will be de-watered on site (along the grassy strip next to the towpath), and then sun-dried for at least 4-5 days. The dried biomass will then be buried off site.

It is also important to note that according to the manufacturer of Fluridone (SePro Corporation), hydrilla fragments that are generated in Fluridone-treated water (at a concentration of 2-4 ppb) will not remain viable to generate additional plants (M. Heilman, personal communication, 2017).

Additional Option: Endothall Injection/Spot Treatment

Endothall is the active ingredient of the aquatic use herbicide Aquathol® K and has been commercially available since the 1950s. The mode of action was recently discovered to be unlike any other commercial herbicide, a serine/threonine protein phosphatase inhibitor (Bajsa et al. 2011). Aquathol® K has previously been referred to as a contact herbicide due to the noted quick knock down and control of the target weeds. Recent research has reclassified endothall as a systemic herbicide and demonstrates translocation inside of key invasive species like hydrilla and Eurasian water milfoil at a higher rate than other systemic herbicides such as fluridone, penoxsulam and triclopyr (Ortiz et al. 2017).

The use pattern of Aquathol® K has evolved over time from predominately lake and pond applications to now incorporating flowing water sites such as canals. Approximately 80% of all chemically treated irrigation canals, or 140,000 miles, in the Western U.S are treated with endothall. This treated water is used to irrigate over 40,000,000 acres of food crops due to the lack of any irrigation restriction on any endothall product. In addition, Aquathol® K has no restriction on swimming, fishing or animal consumption. The lack of a fishing restriction is due to the level of safety seen in acute toxicity studies on fish. Generally, an application rate 25 times or greater than the concentration proposed for this project was determined as the LC50 rate even on sensitive species like rainbow trout fry (Serdar 1993). The only restriction on the product is a maximum contaminant level (MCL) of 0.1 ppm for the use of endothall treated water for potable uses.

Aquathol® K has been shown to be extremely effective in the control of numerous invasive and nuisance aquatic plant species that are found in the D&R Canal. Eurasian water milfoil (*Myriophyllum spicatum*) was found to be controlled at 3.0 ppm with a 12 hr exposure time (Netherland, Green and Getsinger 1991). Curly-leaf pondweed (*Potamogeton crispus*) is extremely sensitive to Aquathol® K, with treatments as low as 0.5 ppm achieving near complete control (Skogerboe and Getsinger 2002). Complete control of Coontail (*Ceratophyllum demersum*) was achieved with an application rate of 4.0 ppm Aquathol® K (Skogerboe and Getsinger 2002). Monoecious hydrilla (*Hydrilla verticillata*) was shown to be controlled with Aquathol® K at 2 ppm and 4 ppm with exposure times ranging from 24 to 72 hours (Poovey and Getsinger 2010). Treatments of 2 ppm with 48 hr exposure and 3 ppm with 24 hr exposure reduced hydrilla shoot biomass by 88 to 98% (Netherland, Green and Getsinger 1991).

Prior Northeast U.S. monoecious hydrilla projects have utilized Aquathol® K in the treatment and control of the plant. Cayuga Inlet has been treated primarily with Aquathol® K, with a secondary application of fluridone as a safety protocol to potentially control any infrequent late sprouting tubers. A significant reduction in monoecious hydrilla occurrence was noted (Johnson 2013, 2014 and 2015). The Erie Canal project used Aquathol® K solely for the control of monoecious hydrilla (USACE 2014). The frequency of hydrilla occurrence was reduced from 33% to 4% in the infested 7 miles of the Canal in the first year of the project (Netherland and Jones 2015). In addition, monoecious hydrilla tuber densities were reduced by 98% after the second year of Aquathol® K treatments (Netherland and Jones 2015).

A single injection point below the Lamberville Lock would be ideal to treat the approximately 16 miles of monoecious hydrilla on the D&R Canal with Aquathol® K. The herbicide would be continuously injected into the Canal through the use of an electric pump coupled with a highly accurate flow meter to ensure the correct application rate. UPI recommends either a 12 hour injection at 4 ppm or 24 hour injection at 2ppm. A representative from UPI and/or SOLitude Lake Management will be onsite, at the application site, throughout the entire application. In conjunction with the herbicide application UPI recommends applying Rhodamine WT dye in order to monitor and track the movement of the treated water. UPI will provide several fluorometers for use in order to track the treated water as it moves down the Canal. As a secondary safety protocol UPI recommends the use of the ProTest, infield residue monitoring to track the concentration of endothall in the water to both ensure the proper application rate is being achieved but also to track the treated water.

Aquathol® K can also be used for smaller scale spot-treatments. The spot-treatment approach has been used at the Erie Canal during the 2015 and 2016 seasons as well as at Mystic Lake in Barnstable, Massachusetts in 2014 and 2015 and Coventry Lake in Coventry, Connecticut in 2016. These spot-treatments have been completed by performing two applications of 1.5 – 2.0 ppm approximately 24 hours apart. The objective was to maintain adequate concentrations over a 48-hour period. In some cases, impermeable limno-barriers (curtains) were used to sequester concentrations for the desired period. These spot-treatment approaches may be worth considering if sections of the Canal do not receive adequate herbicide concentrations during the injection treatments or to manage smaller areas of re-growth in subsequent years.

While endothall appears to be an attractive option for hydrilla control at the D&R Canal, the MCL of 0.1 ppm for potable water use restriction is a concern. Logistically, this needs to be accounted for, likely requiring the diversion of water flow at or near the water intakes that are used for potable drinking water. There are numerous ways to accomplish these water manipulations, but the processes need to be more thoroughly examined via dialogue with NJWSA staff and the individual water supply customers. In addition, bench testing (similar to what has been conducted for Fluridone use) can be conducted to determine if any of the water

treatment processes can reduce any residual endothall concentrations. SOLitude Lake Management and the NJWSA, in consultation with the manufacturer of endothall (UPI) will investigate these water diversions and supporting bench testing in 2017 to keep this product available for potential use at this site in the future.

Additional Option: Chelated Copper Herbicide Application

Copper has been used as an aquatic pesticide since the 1950's, and is still the most proscribed active ingredient for algae control throughout the country. Copper loses efficacy in harder waters, and so in the 1970's manufacturers introduced chelated copper products to target both algae and vascular plants under a wider range of conditions. Most manufacturers that produce or market a chelated copper algaecide also offer a chelated copper herbicide that contains 8-9% copper. More commonly used products include Komeen® and Nautique® (SePRO), Harpoon® (Applied Biochemists) and Current® (UPI).

Chelated copper herbicides are considered contact herbicides. Copper is a cell toxicant, and produces fairly rapid plant breakdown, typically in 1 to 6 weeks. Control is short-term compared to other herbicides, and plant re-growth can normally be found within 6 to 8 weeks after application. In most states, chelated copper herbicides are tank-mixed with other products to increase efficacy. This doesn't occur in New Jersey since NJDEP does not allow simultaneous application of two herbicides.

Chelated copper herbicides have no labeled water use restrictions, and they are most widely used in irrigation waters or where potable water intakes are present. The herbicide Nautique® includes application to flowing waters on its label directions. Application rates range from 0.5-1.0 ppm, which equate to a maximum application rate of up to 3.34 gallons per acre foot, a high volume compared to most non-copper herbicides. Komeen® has a purple color, and applications are known to turn a lake or pond purple temporarily due to the high application rate.

Chelated copper herbicides, particularly Nautique with its flowing water treatment language, could be used in the D & R Canal. Chelated coppers have a short contact time requirement, and can be used effectively in spot applications. The lack of any water use restrictions make the products well-suited for the treatment of hydrilla in the Canal. At typical use rates for hydrilla, a chelated copper herbicide will be broad-spectrum, and will likely impact most other submersed aquatic plants in addition to algal species as well.

The most negative argument against Nautique use in the Canal is the short duration of control. Most chelated copper herbicide products, when applied for macrophyte control alone, need to be re-applied within 6 to 8 weeks. NJDEP increases that interval, and does not permit application to the same treatment area until 12 weeks after the initial application. Still, chelated copper use could be a suitable product for late season spot treatment depending on monitoring results.

Another potential concern with Nautique or chelated copper herbicides is the following statement on the EPA Specimen Labels:

“Do not use in waters containing trout or other fish species that are highly sensitive to copper if the alkalinity is less than 50 ppm. Fish toxicity generally decreases when the hardness of water increases.”

The alkalinity and hardness concentrations in the D&R Canal would be tested prior to any treatment with chelated copper products. If alkalinity and hardness are determined to be lower than 50 ppm, potentially adverse impacts to trout could be mitigated by reducing the total area being treated, avoiding treatment of any areas known to hold trout, delaying treatment timing until post June 15th and/or by making sure that there is adequate untreated water nearby to serve as refuge areas immediately following treatment.

SUBMERSED AQUATIC VEGETATION MONITORING 2017-2019

An SAV program as complicated as the one proposed in this document can only be effective with a detailed comprehensive monitoring program. This monitoring is essential not only to determine the efficacy of the ongoing control strategies, but to make timely, scientific-based alterations to this multi-year program. As such, the monitoring components for this project shall include (at a minimum), herbicide dose monitoring, SAV mapping in the rest of the Canal (~40 miles) not conducted in 2016, SAV mapping in the active treatment area (2017-2019), and hydrilla tuber monitoring (2017-2019) using stations established in 2016.

Fluridone Monitoring

The Sonar injection program would be complemented by routine monitoring of Sonar (fluridone) concentrations in the Canal. We recommend that nine total sampling stations be established to monitor Fluridone in the Canal. These are not physical stations, but instead represent locations (typically) bridges that a field biologist will travel to for pulling sub-surface water samples. Five stations will be established in the hydrilla treatment area and an additional four sampling stations will be established at all points of water withdrawal. A map of these sampling stations for the 2017 treatment season is included in the Appendix of this report.

Canal samples will be collected 1, 3, 5, 6, 7, 8, 9, 11 and 14 days after the start of the injection treatment and then weekly throughout the period of Sonar injection. Once the injection has concluded, samples will be collected every two weeks until all sample sites have non-detect results. Water samples will be overnight shipped to SePRO's laboratory (Whitaker's, North Carolina) and analytically tested via its FasTEST HPLC method. Results are available within 48 hours of receipt and will be catalogued in a data spreadsheet suitable to forward to the NJWSA, for sharing with stakeholders or posting on a project website. Up to 180 total water samples are

estimated to be needed for full monitoring of a 120-day management program. NJWSA might also collect additional water samples for independent analysis at its own cost.

Table 7: 2017 Herbicide Concentration Sampling Station Summary

Station	Station Description	Miles Downstream from Injection
1	Fireman's Eddy Bridge	1.19
2	Washington's Crossing Bridge	6.23
3	Lower Ferry Road Bridge	10.89
4	Carnegie Road Bridge	18.63
5	Alexander Road Bridge	24.17
6	Route 518 Bridge	29.88
7	Canal Road/Suydam Road Lot	35.27
8	10 Mile Lock	41.84
9	Landing Lane Bridge	49.61

The results will be used to make alterations to the injection dosing program as needed. As such, we recommend sampling early in the week and getting an expedited turnaround time for the results to facilitate the effective alteration of dosing if required. The year-end summary report will include a summary of all the annual fluridone results and any recommended alterations to the program. In addition, fluridone results shall be posted on the hydrilla project website (see below for details).

40 Mile Sections of the Canal Not Previously Mapped

In 2016, limited time and budget restricted the SAV mapping survey to about 18 miles of the Canal. This was suitable to determine the extent of the hydrilla infestation (the first rooted occurrence in the northern part of the Feeder Canal and the most southern extent in the Main Canal), as well as establish the relative abundance and distribution of all SAV in the areas mapped. The NJWSA would like the entire length of the Canal mapped in 2017. This will establish baseline submersed aquatic plant communities throughout all 60 miles, plus identify any other areas infested with hydrilla. This survey will be crucial to determine areas in need of hydro-raking, and areas that can be hydro-raked with no fear of spreading hydrilla fragments.

In 2017 (only), using modified Point Intercept Methods (Madsen, 1999), the consultant will conduct an SAV survey the 40 miles of the Canal that were not surveyed in 2016. This survey will follow procedures established during the 2016 SAV mapping of the Canal (SOLitude Lake Management, 2017). All field work for this monitoring effort shall take place between August 15, 2017 and September 30, 2017. All monitoring efforts shall be conducted by boat or canoe.

All sample stations shall be GPS-referenced with a handheld GPS unit with sub-foot accuracy (Trimble GeoXH, or equivalent). Sample stations shall be established every 50 meters along the Canal. At each sampling station, two weed rake tosses shall be conducted, one along each shoreline. For consistency in data collection, Toss A shall be performed along the west shore and Toss B shall be conducted along the east shore. The survey will be augmented by visual

observations of other SAV and additional rooted beds of hydrilla and/or floating hydrilla fragments.

All submersed aquatic plants will be identified to the lowest practical taxa (typically to species) and assigned one of five standard densities (none, Trace, Sparse, Medium, or Dense) based on established protocols (Madsen, 1999 and Johnson, 2014).

All equipment will be inspected, cleaned and dried following decontamination procedures (NYSDEC, 2014) to prevent spread of aquatic invasive species to other sections of the Canal, and other locations in New Jersey. Inspection and Cleaning procedures will be recorded daily on project data sheets.

Data collected will be displayed in tabular and map formats. Map shapefiles will be turned over to the NJWSA for preparation using ArcGIS version 10.3. Maps will display the abundance and distribution for each species collected. It will be difficult to display the map data on traditional 8" by 11" paper, therefore, it is suggested that map outputs be displayed on interactive maps that can be placed on the project website. Using the data collected and the maps generated each year, we shall prepare an annual final written report, including all maps, spreadsheets of data, aquatic plant ecological summaries (including pictures) and monitoring methods. This data will be crucial to determine future SAV control programs at this site.

Treatment Area SAV Mapping

In 2017 through 2019, using modified Point Intercept Methods (Madsen, 1999), the consultant will conduct an SAV survey throughout the treatment area of the project. At this time (2017) this will be the same sites sampled in the 18 miles of the Canal conducted in 2016. We understand that if hydrilla is detected in additional locations of the Canal, this monitoring effort will need to increase in subsequent years. This survey will follow procedures established during the 2016 SAV mapping of the Canal (SOLitude Lake Management, 2017). All field work for this monitoring effort shall take place between August 15, 2017 and September 30, 2017, the peak time for aquatic plant growth, especially native species. All monitoring efforts shall be conducted by boat or canoe.

All sample stations shall be GPS-referenced with a handheld GPS unit with sub-foot accuracy (Trimble GeoXH, or equivalent). Sample stations shall be established every 50 meters along the Canal. At each sampling station, two weed rake tosses shall be conducted, one along each shoreline. For consistency in data collection, Toss A shall be performed along the west shore and Toss B shall be conducted along the east shore. The survey will be augmented by visual observations of other SAV and additional rooted beds of hydrilla and/or floating hydrilla fragments.

All submersed aquatic plants will be identified to the lowest practical taxa (typically to species) and assigned one of five standard densities (none, Trace, Sparse, Medium, or Dense) based on established protocols (Madsen, 1999 and Johnson, 2014).

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Hydrilla Tuber Monitoring

Since most forms of hydrilla control don't impact the tubers in the sediment, we can expect several years of this project before we observe control. Sampling the sediment for tubers is a suitable method to determine the efficacy of hydrilla control in addition to the SAV mapping surveys described above. The data collected in 2016 and sampling stations established (five) will be used as a baseline to track the changes in hydrilla tuber density over time. If additional infestations of hydrilla are located, additional sample stations can be added to the program. The results of this monitoring will be used to make adjustments on the control programs in later years, especially to determine the appropriate time to shift methods to less aggressive activities.

Tuber sampling will be conducted according to Johnson (2014) using a modified post hole digger (surface area 173 cm²). Cores will be washed through a fine mesh screen on site, or back at SLM's laboratory. In 2017, ten (10) cores per site will be processed to determine the hydrilla tuber density at a given station. It is likely that the number of cores will need to be increased to 20 per site in the later stages of this project, as we observe tuber attrition following the pressure of active control methods. All turions from plant fragments will be collected and counted as well.

A handheld GPS unit with sub-foot accuracy (Trimble Geo XH, or equivalent) will be used to return to each sample station each year of the sampling. Hydrilla tuber monitoring will occur at the end of the growing season (late October to November) for all three years (2017, 2018 and 2019) of this project.

A written report of the hydrilla tuber monitoring efforts will be prepared and included in the final annual monitoring report. This report will include methods used, a data summary, comparison to previous year's tuber data, and future hydrilla control program alterations.

COMMUNICATION/OUTREACH/EDUCATION

The aggressive control of aquatic plants on a dynamic system such as the D&R Canal requires a significant amount of planning between the diverse array of stakeholders, the consultants and

experts directing the program, and the general public. Therefore, communication during all facets of this project will be crucial to keep stakeholders informed and engaged on the program, especially as it changes over time. Outreach and education will be important facets of this project and shall be spearheaded by the NJWSA's Watershed Protection Programs.

Stakeholders

New Jersey Water Supply Authority - The Authority was created by the New Jersey Water Supply Act on October 7, 1981, and in connection with the Act, all water supply facilities owned or operated by the State were transferred or leased to the Authority for operations and maintenance. The Authority is responsible for assuring that the D&R Canal is able to pass 100 million gallons of water per day.

New Jersey Water Supply Authority Canal Customers - The Authority has nine Canal customers with intakes in Hunterdon, Mercer, Somerset and Middlesex Counties. Water from the Canal is used for irrigation, drinking water and process water.

D&R Canal Commission - The Commission was established in October, 1974, when the D&R Canal State Park Law was signed. The Commission was created to review projects impacting the Canal Park, undertake planning for the development of the Canal Park, and to administer a land use regulatory program to protect the Canal Park from harmful impacts of new development.

New Jersey Division of Parks & Forestry - The Division of Parks and Forestry maintains and is the steward for more than 400,000 acres composed of 11 state forests, 39 state parks, 43 natural areas and more than 50 historic sites. The NJ Forest Service monitors and maintains 775,000 acres of state-owned open space - forests which produce clean water and air, absorb runoff, provide recreation, and are home to thousands of species of wildlife.

New Jersey Department of Environmental Protection - In April 22, 1970, the New Jersey Department of Environmental Protection began operations by consolidating its past programs into a unified major agency to administer environmental protection and conservation efforts. NJDEP began in a role to manage natural resources and solve pollution problems and now is a leader with major pollution prevention efforts and innovative environmental management strategies.

New Jersey Division of Fish & Wildlife - The N.J. Division of Fish and Wildlife is a professional environmental agency dedicated to the protection, management and wise use of New Jersey's fish and wildlife resources to maximize their long-term biological, recreational and economic values for all New Jersey residents. The Division is within the Natural and Historic Resources Group of the New Jersey Department of Environmental Protection. The N.J. division of Fish and Wildlife manages a trout stocking program in the D&R Canal.

New Jersey Department of Environmental Protection Historic Preservation Office - New Jersey's Historic Preservation Office (SHPO), located within the Department of Environmental Protection, implements the State's historic preservation program and brings expertise in a variety of fields essential to preserving historic resources. SHPO employs historians, researchers,

planners, architectural historians, architects, engineers and archaeologists. SHPO is responsible for reviewing all projects on the D&R Canal to preserve the historic nature of the Canal structure.

Friends Organizations - The Friends groups include historical and open space organizations whose missions include bringing awareness to the historic nature of the D&R Canal preserving and protecting the greenways and the Canal State Park, and developing and interpreting the historical natural resources along the D&R Canal. See the Appendix for a full list of the Friends Organizations that are associated with the D&R Canal.

Communication

NJWSA will host a project-specific page on their website (www.NJWSA.ORG/hydrilla.html), for the ease of communicating various program updates to the various stakeholders and the general public. The website will contain information on the D&R Canal, hydrilla SAV ecology, and the outreach/educational components of this plan. Links to other websites (with permission) shall also be provided. In addition, all reports generated during this project, starting with the 2016 SAV Monitoring Reports, shall be maintained on the website. All Fluridone monitoring results (FasTEST) as well as any additional herbicide monitoring shall be posted within 72-96 hours of sample receipt from the analytical laboratory. We anticipate this website going live in mid-May 2017.

The NJWSA shall create a D&R Canal Hydrilla Task Force (name subject to change). The members of this Task Force are yet to be determined, but will be included in this revised Plan later in 2017. During active SAV management this Task Force shall have planned monthly conference calls for all project updates.

The NJWSA will send a letter to the 16 municipalities along the Canal to inform them of the proposed SAV management plan for 2017. This letter will serve as public notice of the project, and is anticipate to be sent by mid-May, 2017. A copy of this letter is included in the Appendix of this Plan.

The NJWSA will present project updates at D&R Canal Commission meetings, which occur monthly.

Outreach/Education

The NJWSA Website shall contain educational resources (links, with permission) regarding the project and the ecology of the aquatic plants being controlled.

The NJWSA shall develop informational signage for this project. This will include Hydrilla alert/equipment cleaning guidance for boat permits issued by D&R Canal State Park, and special park event permits for boating events (Dragon boat races, SUP races, etc.). Informational signage will be posted at D&R Canal State Park kiosks at Bulls Island & Kingston. Finally, informational signage is to be posted alongside signage required by the aquatic pesticide application permit.

Since the discovery of hydrilla in the D&R Canal, the Watershed Protection Programs of the NJWSA has been actively giving oral presentations on hydrilla ecology and updates regarding this project. As of May 2017, these presentations include:

Hydrilla Alert, NJ Water Monitoring Council, September 2016, Heather Desko/NJWSA

Hydrilla Identification, NJDEP/USGS - NJ Water Monitoring staff, September 2016, Heather Desko/NJWSA

Hydrilla in the D&R Canal, NJWSA Board Meeting, October 2016, Heather Desko/NJWSA

Hydrilla Alert, NJWSA Employee Winter Training - February 2017, Heather Desko/NJWSA

Hydrilla in the D&R Canal, NJ Invasive Species Conference 2017, Chris Doyle/SLM, Heather Desko/NJWSA

D&R Canal Aquatic Plant Management, D&R Canal Commission meeting, April 19, 2017, Heather Desko/NJWSA, Chris Doyle/SLM, Mark Heilman/SePRO, Justin Nawrocki/UPI

D&R Canal Aquatic Plant Management, Canal water users meeting, April 19, 2017, Heather Desko/NJWSA, Chris Doyle/SLM, Mark Heilman/SePRO, Cody Gray/UPI

Aquatic Invasive Species - Technical Session topic for NJ Water Monitoring Council, May 24, 2017: including a presentation on hydrilla in the Canal, Heather Desko/NJWSA

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APPENDIX A:

2016 SAV Monitoring Results

2016 Plant Distribution Tables by Section

2016 Plant Abundance Distribution by Section

2016 Hydrilla Tuber Sampling Results

Delaware and Raritan Canal
Section 1
Aquatic Macrophyte Abundance Distribution
September 15 and 23, 2016

	Total		Trace		Sparse		Medium		Dense	
	Sites	%	Sites	%	Sites	%	Sites	%	Sites	%
Total Sites	165									
Overall Abundance	155	94%	37	24%	61	39%	52	34%	4	3%
Coontail	144	87%	83	58%	56	39%	4	3%	1	1%
Small Duckweed	141	85%	70	50%	66	47%	5	4%	0	0%
Water Stargrass	123	75%	55	45%	56	46%	12	10%	0	0%
Common Waterweed	87	53%	78	90%	9	10%	0	0%	0	0%
Wild Celery	83	50%	42	51%	36	43%	5	6%	0	0%
Hydrilla	67	41%	43	64%	23	34%	1	1%	0	0%
Brittle Naiad	55	33%	49	89%	5	9%	1	2%	0	0%
Benthic Filamentous Algae	45	27%	41	91%	3	7%	0	0%	1	2%
Eurasian Water Milfoil	9	5%	9	100%	0	0%	0	0%	0	0%
Leafy Pondweed	6	4%	5	83%	0	0%	1	17%	0	0%
Great Duckweed	2	1%	2	100%	0	0%	0	0%	0	0%
Long Leaf Pondweed	2	1%	2	100%	0	0%	0	0%	0	0%
Common Bladderwort	1	1%	1	100%	0	0%	0	0%	0	0%
Arrowhead Rosette	0	0%	0	0%	0	0%	0	0%	0	0%
Curly-leaf Pondweed	0	0%	0	0%	0	0%	0	0%	0	0%
Muskgrass	0	0%	0	0%	0	0%	0	0%	0	0%
Pondweed sp.	0	0%	0	0%	0	0%	0	0%	0	0%
Spatterdock	0	0%	0	0%	0	0%	0	0%	0	0%
Water Starwort	0	0%	0	0%	0	0%	0	0%	0	0%
Watermoss	0	0%	0	0%	0	0%	0	0%	0	0%

Delaware and Raritan Canal
Section 2
Aquatic Macrophyte Abundance Distribution
September 6-7, 2016

	Total		Trace		Sparse		Medium		Dense	
	Sites	%	Sites	%	Sites	%	Sites	%	Sites	%
Total Sites	57									
Overall Abundance	57	100%	3	5%	16	28%	24	42%	14	25%
Small Duckweed	57	100%	12	21%	31	54%	13	23%	1	2%
Coontail	52	91%	28	54%	21	40%	3	6%	0	0%
Hydrilla	49	86%	12	24%	18	37%	15	31%	4	8%
Water Stargrass	47	82%	19	40%	15	32%	12	26%	1	2%
Wild Celery	46	81%	6	13%	16	35%	22	48%	2	4%
Brittle Naiad	32	56%	22	69%	7	22%	3	9%	0	0%
Benthic Filamentous Algae	14	25%	13	93%	1	7%	0	0%	0	0%
Common Waterweed	7	12%	4	57%	3	43%	0	0%	0	0%
Common Bladderwort	1	2%	1	100%	0	0%	0	0%	0	0%
Eurasian Water Milfoil	1	2%	1	100%	0	0%	0	0%	0	0%
Long-leaf Pondweed	1	2%	1	100%	0	0%	0	0%	0	0%
Arrowhead Rosette	0	0%	0	0%	0	0%	0	0%	0	0%
Curly-leaf Pondweed	0	0%	0	0%	0	0%	0	0%	0	0%
Great Duckweed	0	0%	0	0%	0	0%	0	0%	0	0%
Leafy Pondweed	0	0%	0	0%	0	0%	0	0%	0	0%
Muskgrass	0	0%	0	0%	0	0%	0	0%	0	0%
Pondweed sp.	0	0%	0	0%	0	0%	0	0%	0	0%
Spatterdock	0	0%	0	0%	0	0%	0	0%	0	0%
Water Starwort	0	0%	0	0%	0	0%	0	0%	0	0%
Watermoss	0	0%	0	0%	0	0%	0	0%	0	0%
White Water Crowfoot	0	0%	0	0%	0	0%	0	0%	0	0%

Delaware and Raritan Canal
Section 3
Aquatic Macrophyte Abundance Distribution
September 7-9, 2016

	Total		Trace		Sparse		Medium		Dense	
	Sites	%	Sites	%	Sites	%	Sites	%	Sites	%
Total Sites	149									
Overall Abundance	144	97%	26	18%	60	42%	42	29%	16	11%
Hydrilla	139	93%	38	27%	69	50%	28	20%	4	3%
Small Duckweed	137	92%	64	47%	59	43%	14	10%	0	0%
Wild Celery	120	81%	45	38%	46	38%	26	22%	3	3%
Coontail	119	80%	92	77%	23	19%	4	3%	0	0%
Water Stargrass	92	62%	59	64%	25	27%	8	9%	0	0%
Benthic Filamentous Algae	58	39%	57	98%	1	2%	0	0%	0	0%
Brittle Naiad	51	34%	41	80%	10	20%	0	0%	0	0%
Common Waterweed	26	17%	23	88%	3	12%	0	0%	0	0%
Leafy Pondweed	8	5%	8	100%	0	0%	0	0%	0	0%
Spatterdock	4	3%	3	75%	1	25%	0	0%	0	0%
Eurasian Water Milfoil	3	2%	3	100%	0	0%	0	0%	0	0%
Long-leaf Pondweed	2	1%	2	100%	0	0%	0	0%	0	0%
Arrowhead Rosette	0	0%	0	0%	0	0%	0	0%	0	0%
Common Bladderwort	0	0%	0	0%	0	0%	0	0%	0	0%
Curly-leaf Pondweed	0	0%	0	0%	0	0%	0	0%	0	0%
Great Duckweed	0	0%	0	0%	0	0%	0	0%	0	0%
Muskgrass	0	0%	0	0%	0	0%	0	0%	0	0%
Pondweed sp.	0	0%	0	0%	0	0%	0	0%	0	0%
Water Starwort	0	0%	0	0%	0	0%	0	0%	0	0%
Watermoss	0	0%	0	0%	0	0%	0	0%	0	0%
White Water Crowfoot	0	0%	0	0%	0	0%	0	0%	0	0%

Delaware and Raritan Canal
Section 4
Aquatic Macrophyte Abundance Distribution
September 9 and 16, 2016

	Total		Trace		Sparse		Medium		Dense	
	Sites	%	Sites	%	Sites	%	Sites	%	Sites	%
Total Sites	69									
Overall Abundance	64	93%	16	25%	32	50%	15	23%	1	2%
Hydrilla	60	87%	31	52%	28	47%	1	2%	0	0%
Small Duckweed	58	84%	30	52%	28	48%	0	0%	0	0%
Coontail	55	80%	42	76%	13	24%	0	0%	0	0%
Wild Celery	53	77%	28	53%	17	32%	7	13%	1	2%
Water Stargrass	34	49%	31	91%	3	9%	0	0%	0	0%
Common Waterweed	33	48%	26	79%	7	21%	0	0%	0	0%
Benthic Filamentous Algae	17	25%	17	100%	0	0%	0	0%	0	0%
Eurasian Water Milfoil	9	13%	9	100%	0	0%	0	0%	0	0%
Curly leaf pondweed	5	7%	5	100%	0	0%	0	0%	0	0%
Waterstarwort	3	4%	3	100%	0	0%	0	0%	0	0%
Brittle Naiad	2	3%	2	100%	0	0%	0	0%	0	0%
Long-leaf Pondweed	2	3%	2	100%	0	0%	0	0%	0	0%
Leafy pondweed	1	1%	1	100%	0	0%	0	0%	0	0%
Pondweed sp.	1	1%	1	100%	0	0%	0	0%	0	0%
Arrowhead Rosette	0	0%	0	0%	0	0%	0	0%	0	0%
Common Baldderwort	0	0%	0	0%	0	0%	0	0%	0	0%
Great Duckweed	0	0%	0	0%	0	0%	0	0%	0	0%
Muskgrass	0	0%	0	0%	0	0%	0	0%	0	0%
Spatterdock	0	0%	0	0%	0	0%	0	0%	0	0%
Watermoss	0	0%	0	0%	0	0%	0	0%	0	0%
White Water Crowfoot	0	0%	0	0%	0	0%	0	0%	0	0%

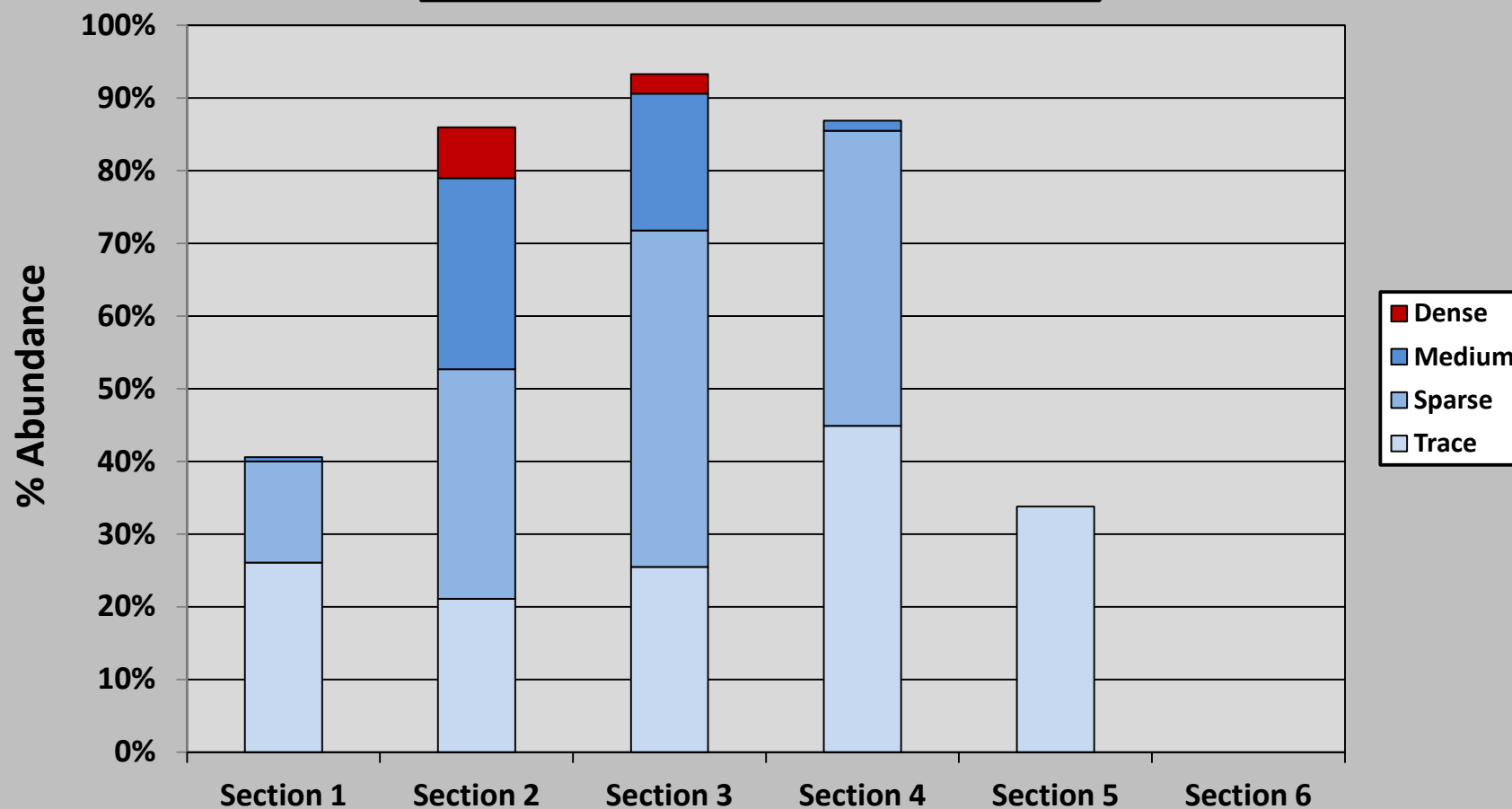
Delaware and Raritan Canal
Section 5
Aquatic Macrophyte Abundance Distribution
September 21, 2016

	Total		Trace		Sparse		Medium		Dense	
	Sites	%	Sites	%	Sites	%	Sites	%	Sites	%
Total Sites	65									
Overall Plant Abundance	65	100%	14	22%	42	65%	9	14%	0	0%
Coontail	65	100%	25	38%	37	57%	3	5%	0	0%
Small Duckweed	64	98%	52	81%	12	19%	0	0%	0	0%
Water Stargrass	47	72%	34	72%	11	23%	2	4%	0	0%
Eurasian Water Milfoil	34	52%	32	94%	2	6%	0	0%	0	0%
Common Waterweed	32	49%	32	100%	0	0%	0	0%	0	0%
Hydrilla	22	34%	22	100%	0	0%	0	0%	0	0%
Spatterdock	14	22%	14	100%	0	0%	0	0%	0	0%
Benthic Filamentous Algae	9	14%	8	89%	1	11%	0	0%	0	0%
Wild Celery	5	8%	4	80%	0	0%	1	20%	0	0%
Curly-leaf Pondweed	4	6%	4	100%	0	0%	0	0%	0	0%
Brittle Naiad	3	5%	3	100%	0	0%	0	0%	0	0%
Water Starwort	3	5%	3	100%	0	0%	0	0%	0	0%
Arrowhead Rosette	2	3%	2	100%	0	0%	0	0%	0	0%
Leafy Pondweed	1	2%	1	100%	0	0%	0	0%	0	0%
Pondweed sp.	1	2%	1	100%	0	0%	0	0%	0	0%
Common Bladderwort	0	0%	0	0%	0	0%	0	0%	0	0%
Great Duckweed	0	0%	0	0%	0	0%	0	0%	0	0%
Long-leaf Pondweed	0	0%	0	0%	0	0%	0	0%	0	0%
Muskgrass	0	0%	0	0%	0	0%	0	0%	0	0%
Watermoss	0	0%	0	0%	0	0%	0	0%	0	0%
White Water Crowfoot	0	0%	0	0%	0	0%	0	0%	0	0%

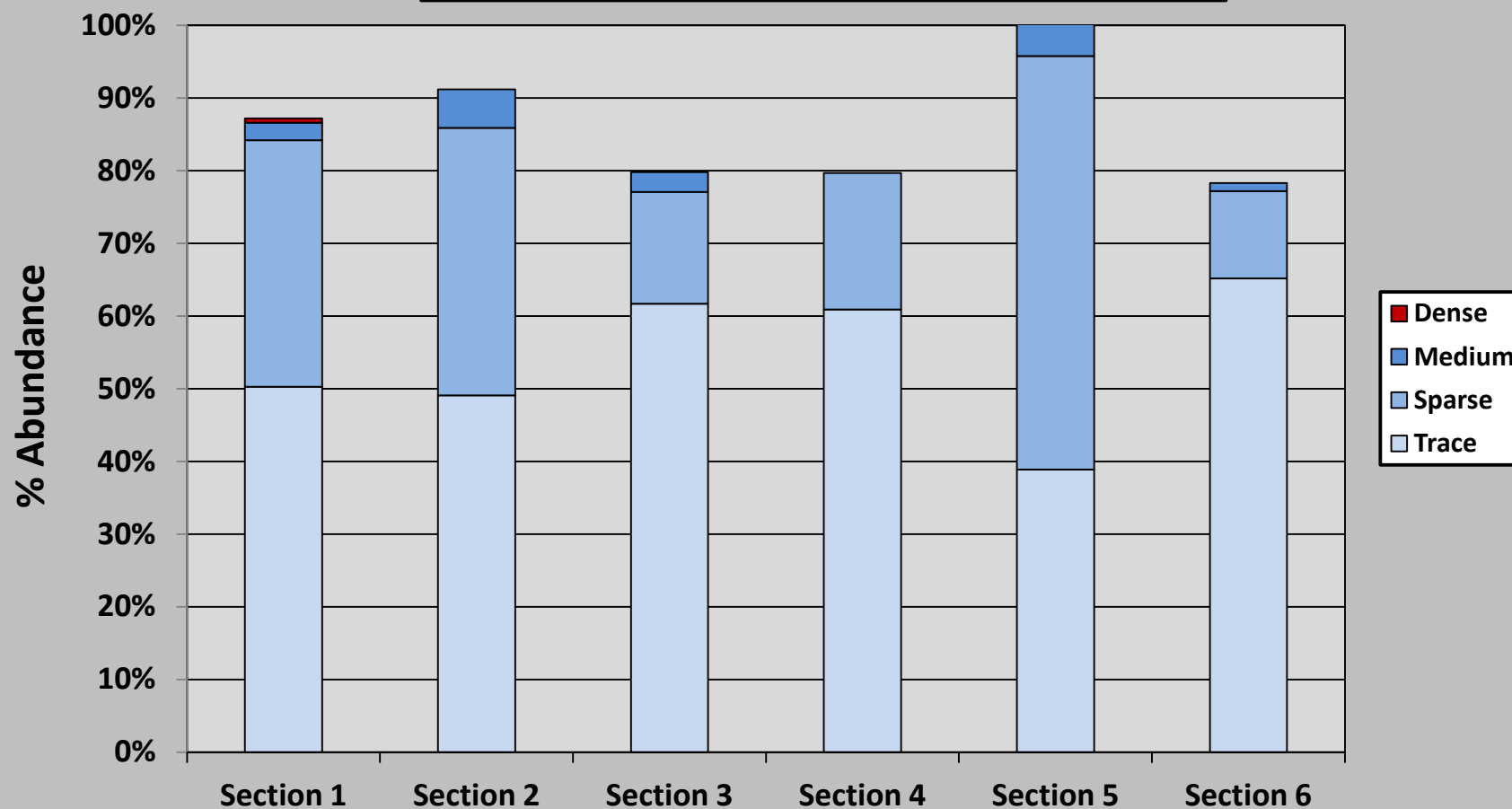
Delaware and Raritan Canal
Section 6
Aquatic Macrophyte Abundance Distribution
September 22, 2016

	Total		Trace		Sparse		Medium		Dense	
	Sites	%	Sites	%	Sites	%	Sites	%	Sites	%
Total Sites	92									
Overall Abundance	91	99%	33	36%	46	51%	11	12%	1	1%
Small Duckweed	89	97%	52	58%	36	40%	0	0%	1	1%
Coontail	72	78%	60	83%	11	15%	1	1%	0	0%
Water Stargrass	56	61%	47	84%	8	14%	1	2%	0	0%
Water Starwort	53	58%	50	94%	3	6%	0	0%	0	0%
Benthic Filamentous Algae	46	50%	26	57%	14	30%	6	13%	0	0%
Watermoss	44	48%	42	95%	2	5%	0	0%	0	0%
Spatterdock	37	40%	31	84%	6	16%	0	0%	0	0%
Common Waterweed	11	12%	11	100%	0	0%	0	0%	0	0%
Muskgrass	11	12%	8	73%	3	27%	0	0%	0	0%
Wild Celery	6	7%	4	67%	2	33%	0	0%	0	0%
Eurasian Water Milfoil	4	4%	4	100%	0	0%	0	0%	0	0%
Pondweed sp.	4	4%	4	100%	0	0%	0	0%	0	0%
Leafy Pondweed	3	3%	3	100%	0	0%	0	0%	0	0%
White Water Crowfoot	3	3%	3	100%	0	0%	0	0%	0	0%
Arrowhead Rosette	0	0%	0	0%	0	0%	0	0%	0	0%
Brittle Naiad	0	0%	0	0%	0	0%	0	0%	0	0%
Common Bladderwort	0	0%	0	0%	0	0%	0	0%	0	0%
Curly-leaf Pondweed	0	0%	0	0%	0	0%	0	0%	0	0%
Great Duckweed	0	0%	0	0%	0	0%	0	0%	0	0%
Hydrilla	0	0%	0	0%	0	0%	0	0%	0	0%
Long-leaf Pondweed	0	0%	0	0%	0	0%	0	0%	0	0%

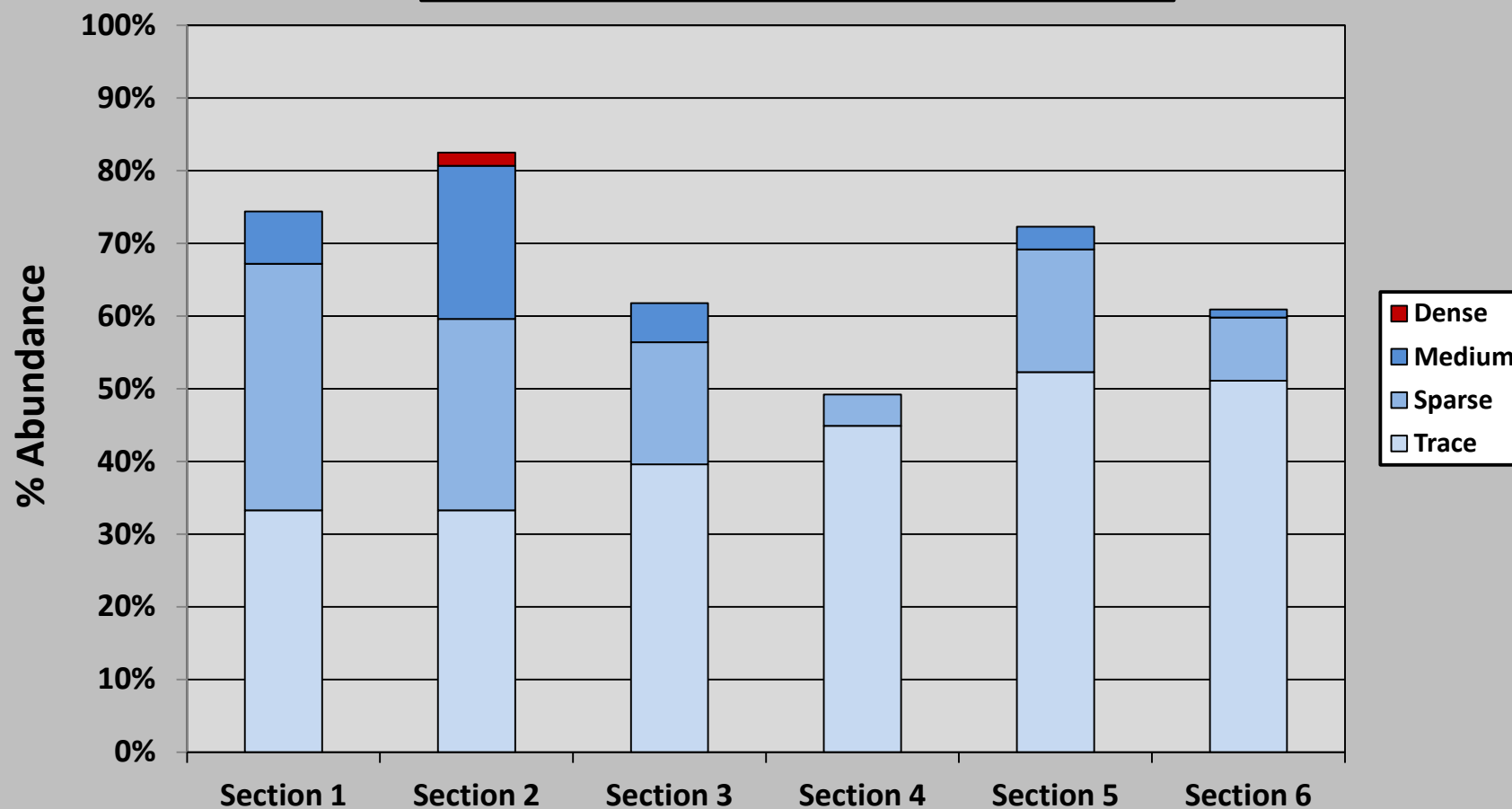
Hydrilla (Hydrilla verticillata)
Percent Abundance by Section
D&R Canal



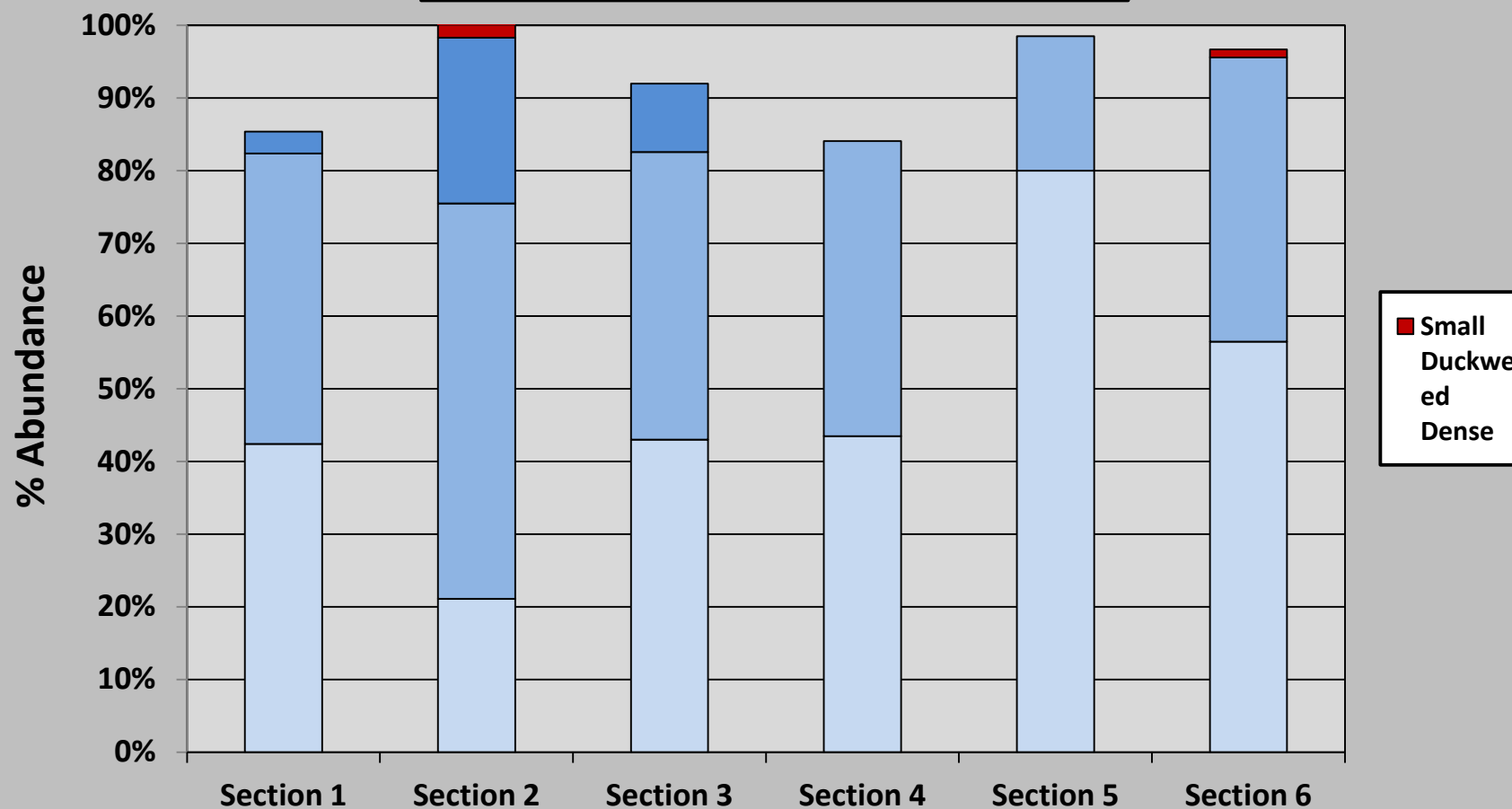
Coontail (*Ceratophyllum demersum*)
Percent Abundance by Section
D&R Canal



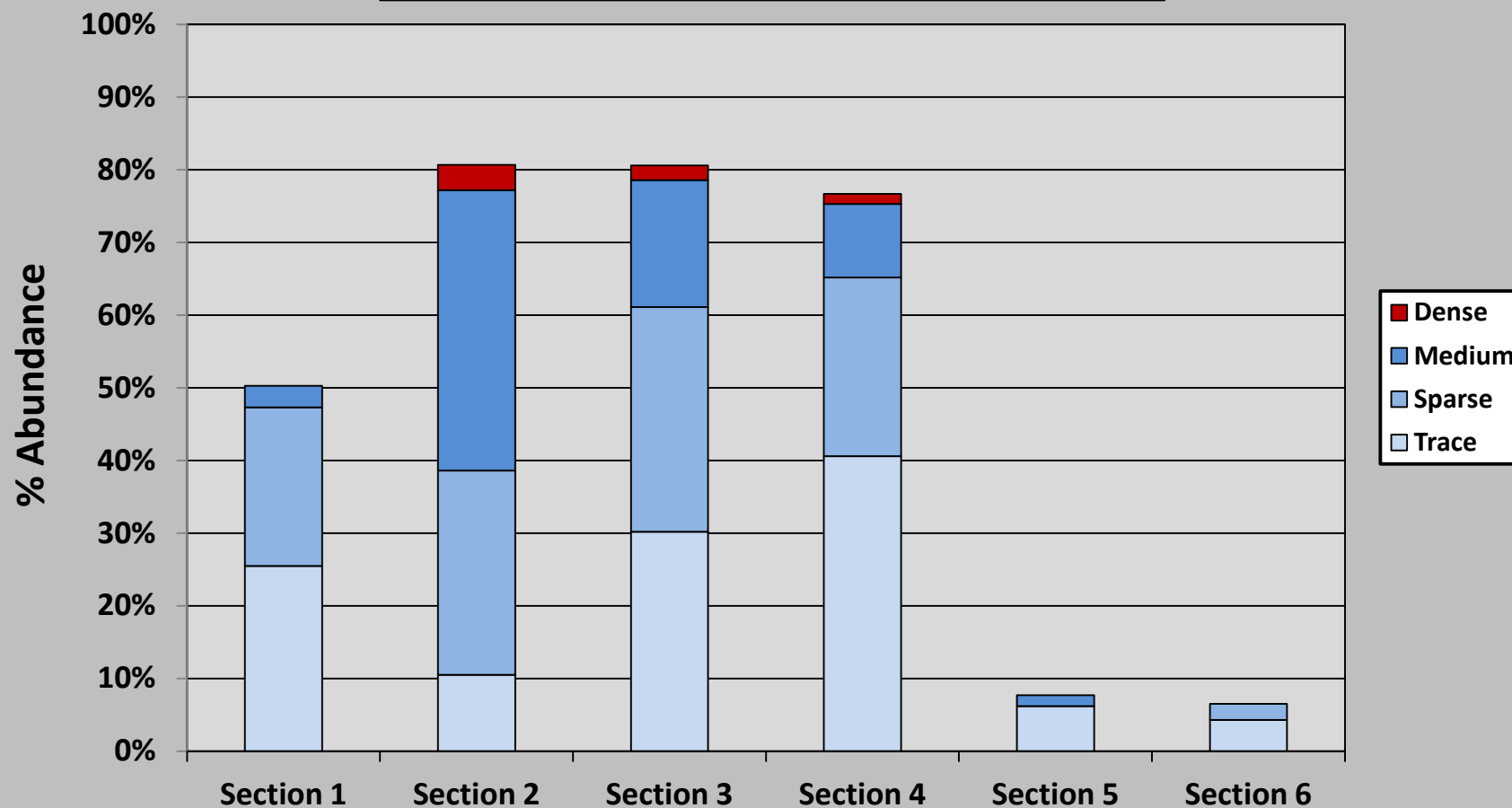
Water Stargrass (*Zosterella dubia*)
Percent Abundance by Section
D&R Canal



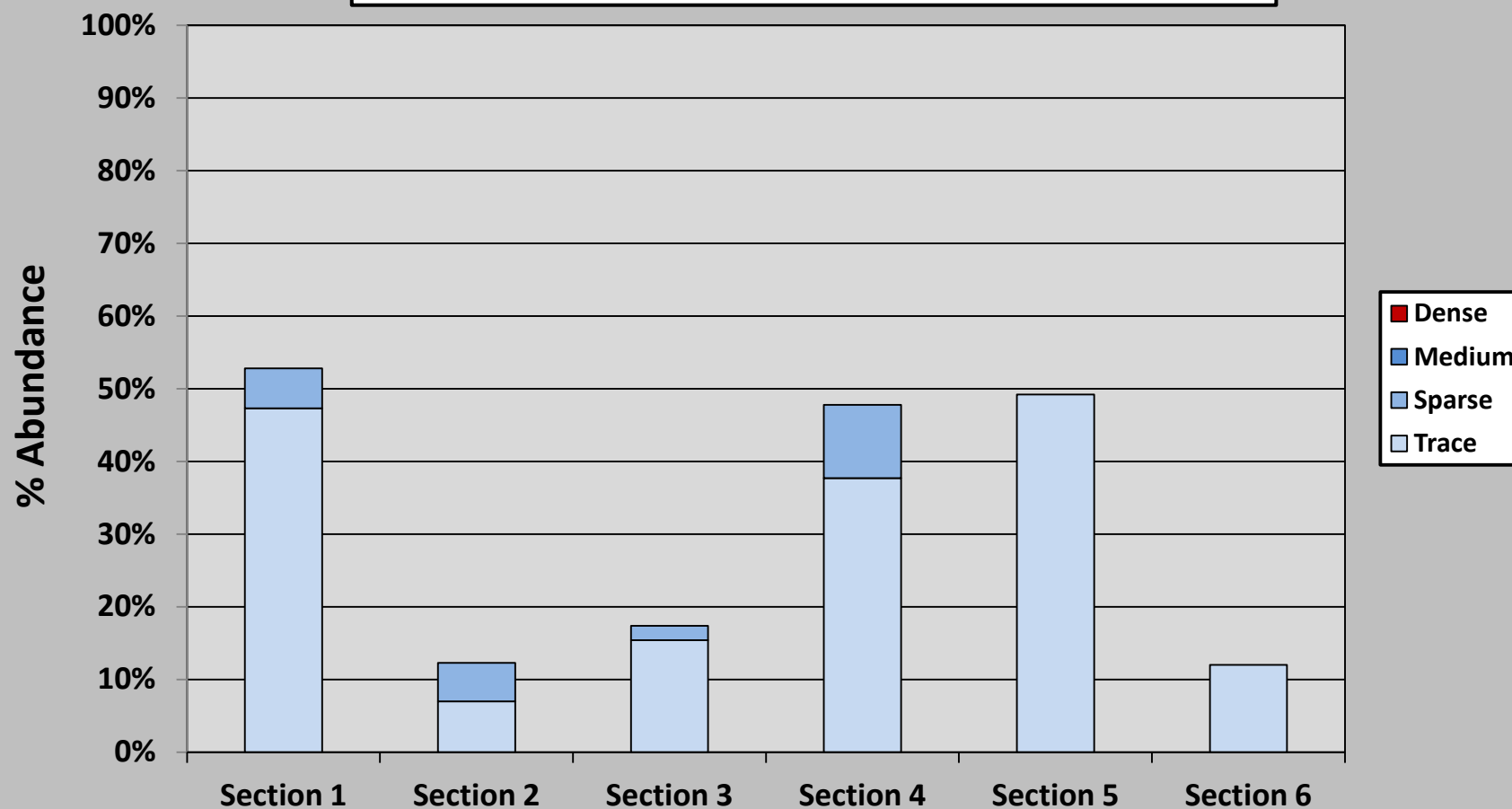
Small Duckweed (*Lemna minor*)
Percent Abundance by Section
D&R Canal



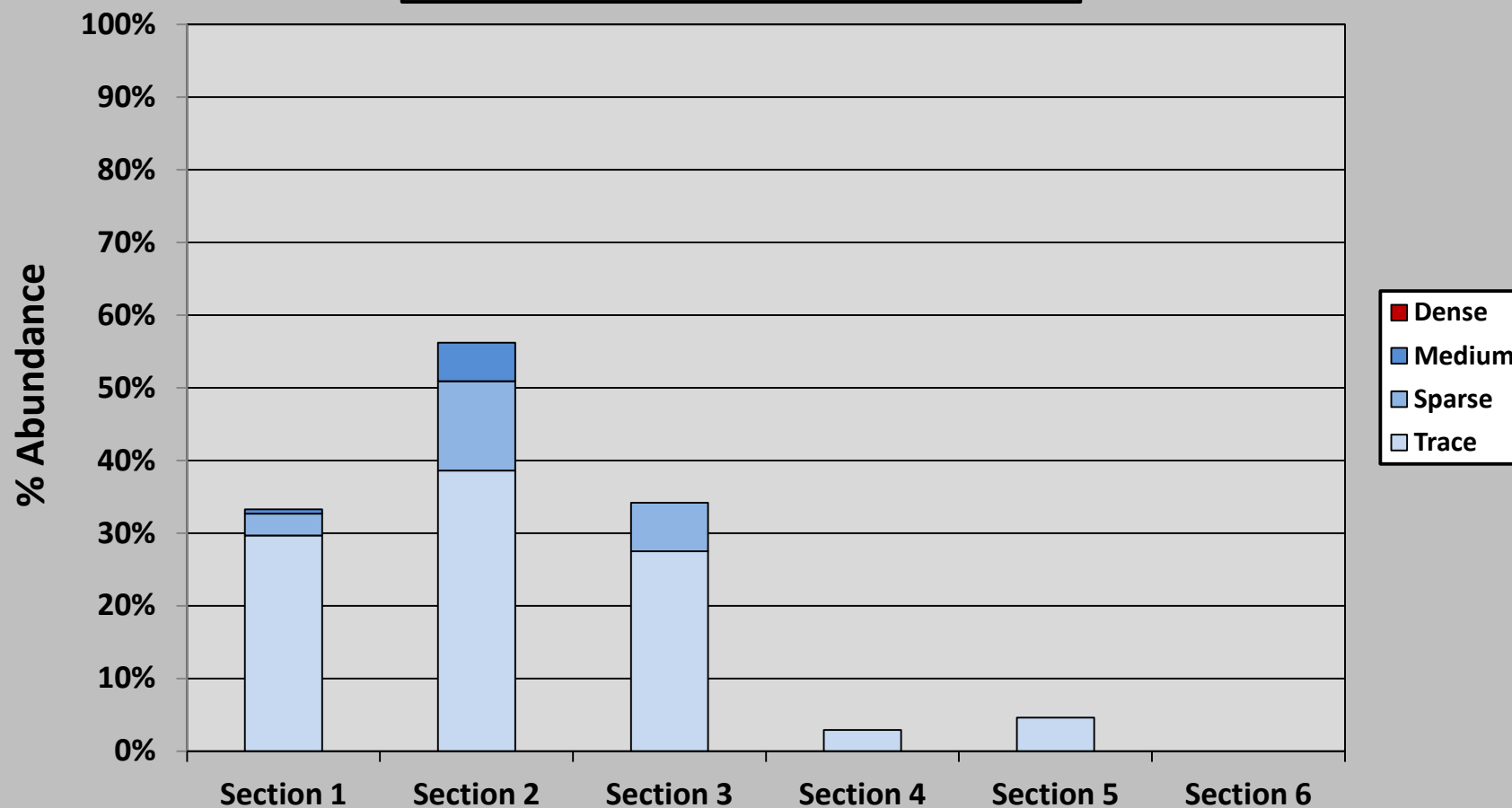
Wild Celery (*Vallisneria americana*)
Percent Abundance by Section
D&R Canal



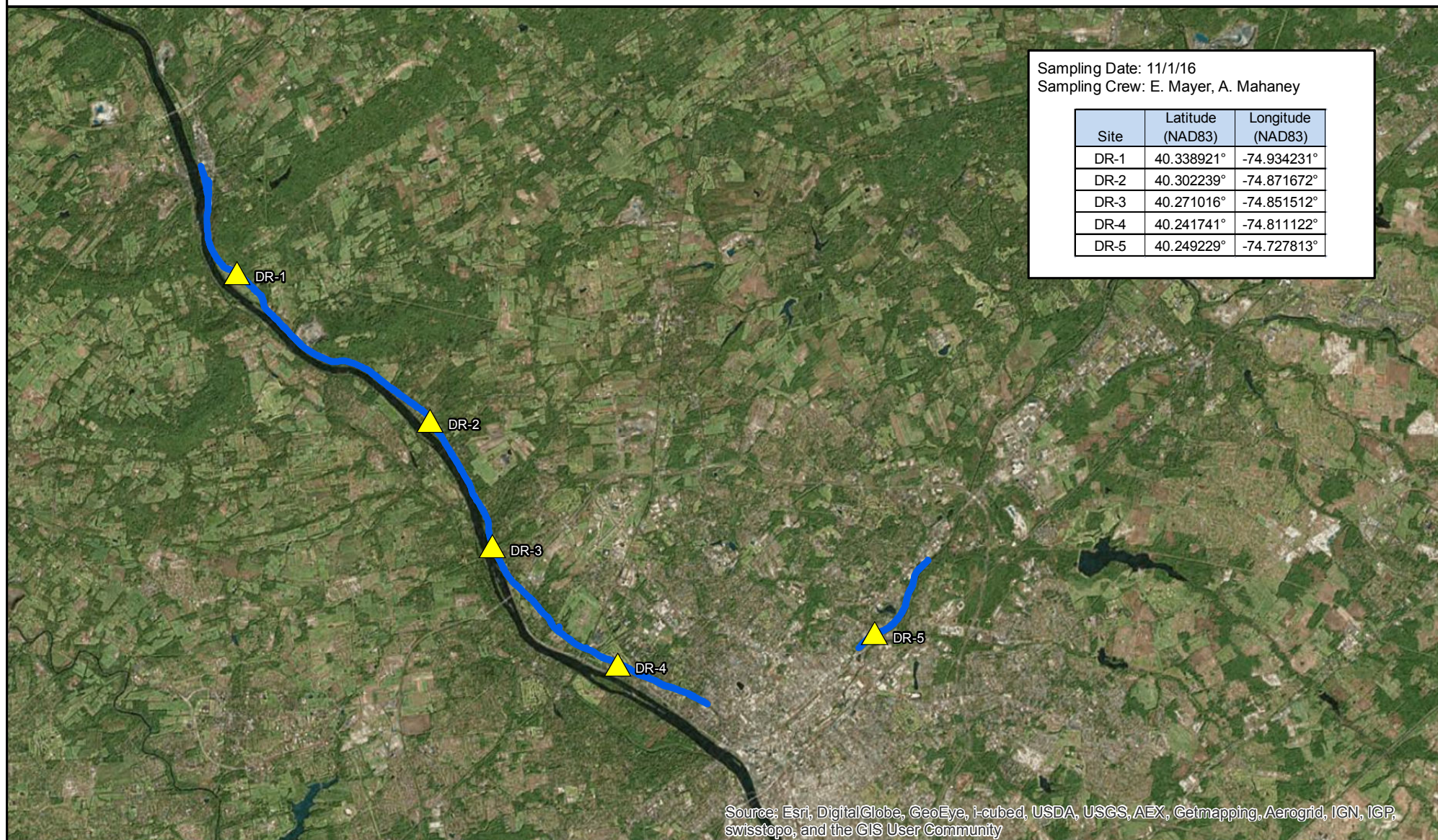
Common Waterweed (*Elodea canadensis*)
Percent Abundance by Section
D&R Canal



Brittle Naiad (*Najas minor*)
Percent Abundance by Section
D&R Canal



DELAWARE AND RARITAN CANAL
Mercer County, New Jersey



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2016 HYDRILLA TUBER SAMPLING



0 1.75 3.5 Miles

APPENDIX B:


Site Maps

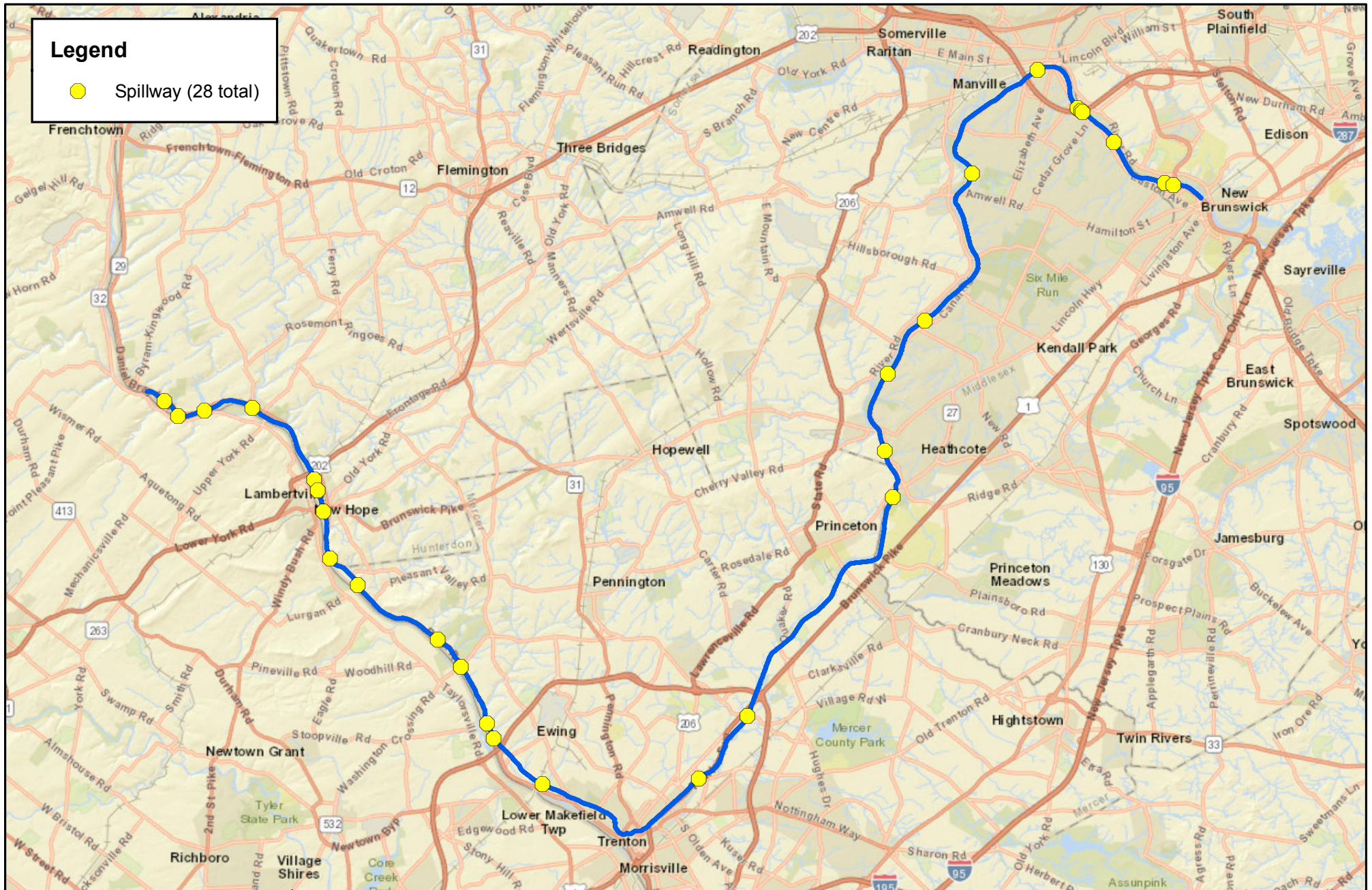
D&R Canal Spillways Map

2016 D&R Canal Herbicide Treatment Map

2016 D&R Canal FasTest Sampling Station Map

Legend

 Spillway (28 total)



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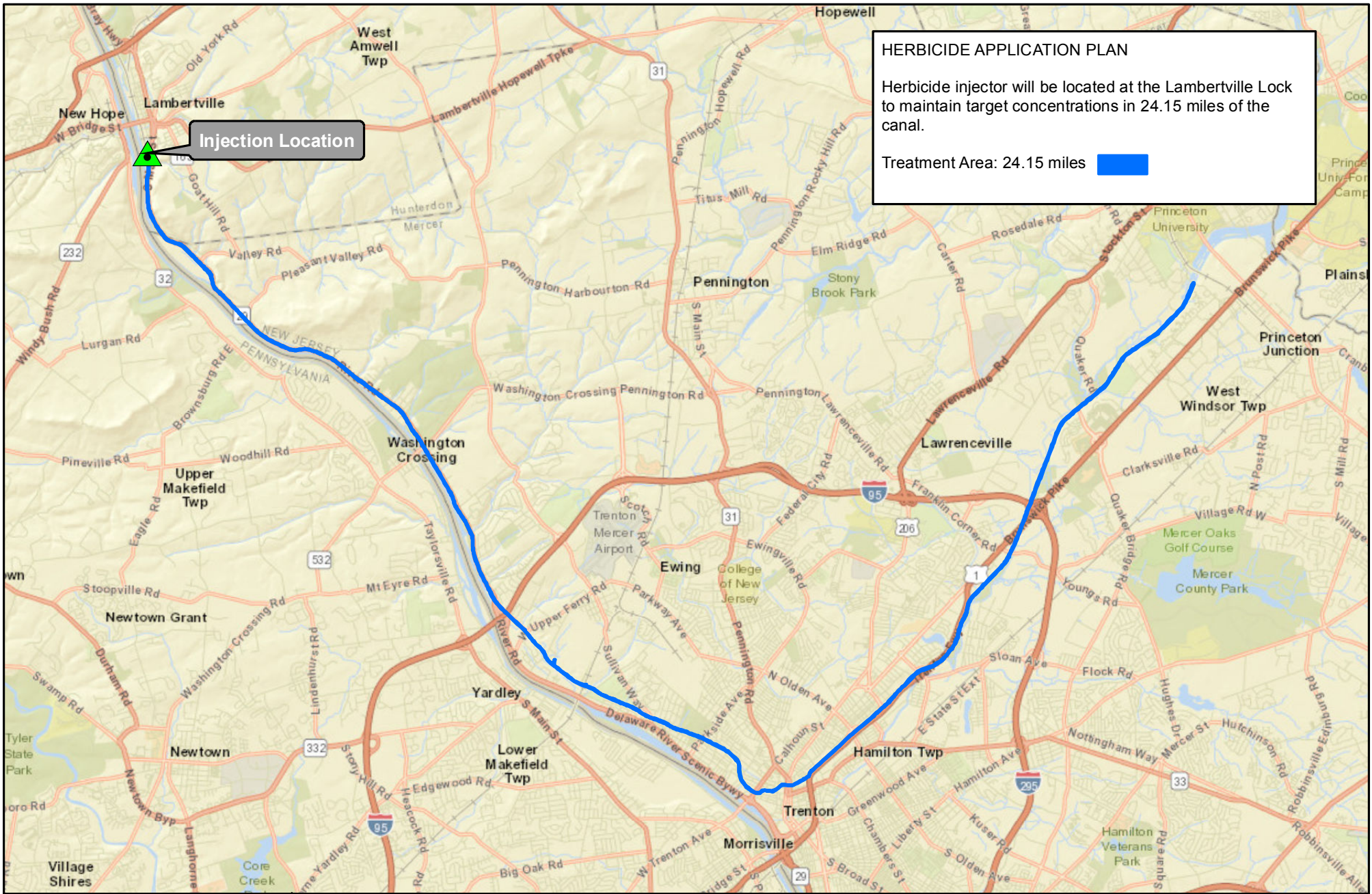
DELAWARE AND RARITAN CANAL

Canal Outflows/Spillways



0 1.75 3.5
Miles

Date: 5/1/17
File: DRCanal_Intake_SpillwaysMap.mxd
Prepared by: KM
Office: Hackettstown, NJ



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DELAWARE AND RARITAN CANAL



2017 Herbicide Application Plan



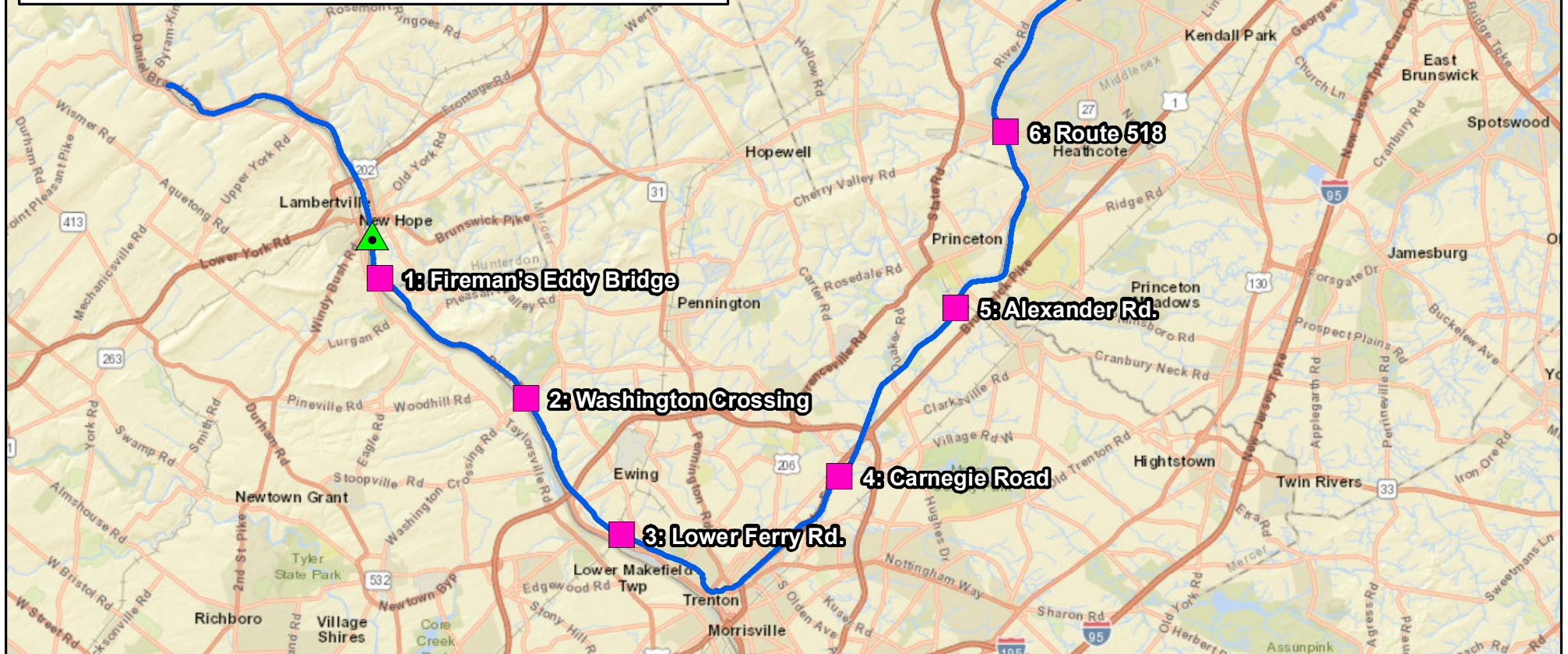
0 0.75 1.5
Miles

Date: 4/25/17
File: DRCanalTreatMap.mxd
Prepared by: KM
Office: Hackettstown, NJ

Injector and FastTest Locations

-  Injector
-  FastTest Station

Site	Name	Miles Below Injection	Latitude	Longitude
1	Fireman's Eddy Bridge	1.19 miles below injection	40.342148°	-74.940404°
2	Washington Crossing	6.34 miles below injection	40.29657°	-74.866841°
3	Lower Ferry Rd.	10.89 miles below injection (above TCC intake)	40.244801°	-74.819091°
4	Carnegie Road	18.63 miles below injection	40.267284°	-74.710417°
5	Alexander Rd.	24.17 miles below injection	40.331743°	-74.652397°
6	Route 518	29.88 miles below injection	40.39934°	-74.627538°
7	Canal Rd./Suydam Rd Lot	35.27 miles below injection (0.04 mi below intake)	40.461053°	-74.582085°
8	10 Mile Lock	41.84 miles below injection (above NJAW intake)	40.540679°	-74.568544°
9	Landing Lane	49.61 miles below injection (.25 miles above intakes)	40.507902°	-74.464024°



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DELAWARE AND RARITAN CANAL

FasTest Sampling Locations



0 1.75 3.5 Miles

Date: 5/1/17
File: DRCanal_FasTestLocMap.mxd
Prepared by: KM
Office: Hackettstown, NJ

APPENDIX C:

Fluridone Supporting Documentation

Fluridone Label

New Jersey Permit Copies

Eno River Report

Public Health Evaluations for Fluridone and Endothall Use



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

CHRIS CHRISTIE
Governor

*Division of Licensing Operations, Solid Waste & Pesticide
Enforcement*

BOB MARTIN
Commissioner

KIM GUADAGNO
Lt. Governor

*Bureau of Licensing & Pesticide Operations – MC 401-04E
PO Box 420
Trenton, NJ 08625-0420
Phone: (609)984-6507 Fax: (609)984-6555*

AQUATIC PESTICIDE GENERAL PERMIT

05/09/2017

For Aquatic Site

ID: 05049

Name: D&R CANAL - LAMBERTVILLE TO LAWRENCEVILLE

DEP Activity ID: APP170001

Permit Effective Date: 05/09/2017 Permit Expiration Date: 12/31/2018

The New Jersey Department of Environmental Protection hereby grants you a NJ Aquatic Pesticide Permit (NJAPP) for the site named above. This permit is the regulatory mechanism used by the Department to help ensure your application will not harm the environment. By complying with the terms and conditions specified, you are assuming an important role in protecting New Jersey's valuable water resources. Your acceptance of this permit is an agreement to conform with all of its provisions when applying aquatic pesticides to waters of the state, both public and private. If you have any questions about this document, please feel free to contact the Department's Aquatic Pesticide Permit representative. Your cooperation in helping us protect and safeguard our state's environment is appreciated.

Requirements Incorporated by Reference

The permittee shall comply with all conditions set forth in this permit and with all of the applicable requirements incorporated into this permit by reference. The permittee is required to comply with the regulations, including those cited below:

General Conditions

1. Penalties for Violations - N.J.A.C. 7:30-1-13 (found at www.pcpnj.org)
2. Incorporated by Reference:
 - Appendix A: Aquatic Pesticide Permit Conditions
 - Appendix B: Aquatic Pesticide Permit Restrictions
 - Appendix C: Aquatic Pesticide Record of Actual Treatment (BPO-03)

GENERAL REQUIREMENTS FOR AQUATIC PESTICIDE PERMIT

1. PURPOSE AND SCOPE

This permit operates under the premise that appropriate Best Management Practices (BMPs) are implemented prior to any aquatic pesticide application. If the application causes adverse environmental impacts to the site and or receiving waters, the application is in violation of this permit. The entity authorizing the activity and certifying compliance with the requirements of this general permit would then be subject to enforcement action. A representative from the Department's Bureaus of Pesticide Compliance and Pesticide Operations will be contacted if it is suspected that an application was not conducted in accordance with all requirements of this permit.

The certifying agent will be responsible for ensuring that the applications meet all of the applicable requirements of this general permit during the entire application.

CONDITIONS FOR APPROVAL UNDER THE NJAPP GENERAL PERMIT FOR AQUATIC PESTICIDE APPLICATIONS

Certification Requirements

A completed certified APP application form shall be submitted to the Department via DEP Online Aquatic Pesticide Permit service.

The permittee shall maintain records of application on a form provided by the Department, which is the RECORD OF ACTUAL TREATMENT (BPO -04).

This permit does not waive the requirement to obtain any other necessary Federal, State or Local government consents or approvals. No work shall be undertaken until such time as all other required approvals and permits have been obtained. As the responsible applicator for the permit, you are responsible for identifying and contacting any and all other agencies, including NJDEP that may need to be involved with or have interest in the aquatic site(s) you are proposing to treat:

NJDEP Fish and Wildlife (908-236-2118)
NJDEP Land Use Regulation (609-292-0060)
Lake Hopatcong Commission (973-601-1070)

Representatives of the Department shall have the right to enter and inspect any area associated with an aquatic pesticide permit approval.

The permittee shall take into account the outlet structure prior to application and shall ensure discharge downstream into the receiving water body is limited to none.

By using this permit, the authorized responsible pesticide applicator acknowledges the following:

"I certify under penalty of law that this Aquatic Pesticide Permit form and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for purposely, knowingly, recklessly, or negligently submitting false information."

APENDIX A – AQUATIC PESTICIDE PERMIT CONDITIONS

ACCORD: Only three treatments are allowed per treatment area during the proposed treatment period. Do not retreat the same treatment area with this product or any other herbicide for emergent weeds, herbaceous plants, or woody plants for at least 14 days. Do not use any other herbicide for emergent weeds, herbaceous plants, or woody plants in the same treatment area at the same time as this product.

ALGAE PRO: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed every 30 days is the amount of product equivalent to 2 treatments of 1/2 the aquatic site at the approved dosage rate. Do not retreat this aquatic site with this product or any other algaecide for at least 7 days. Do not use any other algaecide in the same treatment area at the same time as this product.

ALGIMYCIN PWF: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat this aquatic site with this product or any other algaecide for at least 7 days. Do not use any other algaecide in the same treatment area at the same time as this product.

AQUA-KLEEN: Full aquatic site treatments are only allowed when weed mass is sparse. The total amount of product allowed during the proposed treatment period is the amount of product equivalent to 2 full aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged weeds for at least 6 weeks. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

AQUACIDE PELLETS: Full aquatic site treatments are allowed. Whether applied in one treatment or multiple treatments, the total amount of product allowed during the proposed treatment period, is the amount of product equivalent to three full aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged weeds for at least 30 days. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

AQUACURE - ALGAECIDE: Only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed to each treatment area every 30 days during the proposed treatment period is the amount of product equivalent to two treatments of 1/2 of the aquatic site at the approved dosage rate. Do not retreat the same treatment area with this product or any other algaecide for at least 7 days. Do not use any other algaecide in the same treatment area at the same time as this product.

AQUACURE - HERBICIDE: Only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed to each treatment area every 30 days during the proposed treatment period is the amount of product equivalent to two treatments of 1/2 of the aquatic site at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for at least 7 days. Do not use any other herbicide in the same treatment area at the same time as this product.

AQUAMASTER: Only three treatments are allowed per treatment area during the proposed treatment period. The maximum amount of product allowed per treatment is the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for emergent weeds for at least 14 days. Do not use any other herbicide for emergent weeds in the same treatment area at the same time as this product.

AQUANEAT: Only three treatments are allowed per treatment area during the proposed treatment period. Do not retreat the same treatment area with this product or any other herbicide for emergent weeds, herbaceous plants, or woody plants for at least 14 days. Do not use any other herbicide for emergent weeds, herbaceous plants, or woody plants in the same treatment area at the same time as this product.

AQUAPIER: In a single operation, only partial treatments (up to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat the treatment area with this product or any other product for emergent vegetation for at least 10 days. Do not use any other product in the same treatment area at the same time as this product. Maximum treatment of 1.5 pounds of active ingredient per acre per year is allowed.

AQUAPRO: Only three treatments are allowed per treatment area during the proposed treatment period. Do not retreat the same treatment area with this product or any other herbicide for emergent weeds for at least 14 days. Do not use any other herbicide for emergent weeds in the same treatment area at the same time as this product.

AQUASHADE: Full aquatic site treatments are allowed. Whether applied in one treatment or multiple treatments, the total amount of product allowed every 30 days during the proposed treatment period is the amount of product equivalent to two full aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other algaecide for at least 30 days. Do not use any other algaecide in the same treatment area at the same time as this product.

AQUATHOL K: Full aquatic site treatments are allowed. Whether applied in one treatment or multiple treatments, the total amount of product allowed during the proposed treatment period is the amount of product equivalent to three full aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged weeds for at least 14 days. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

AQUATHOL SUPER K: Full aquatic site treatments are allowed. Whether applied in one treatment or multiple treatments, the total amount of product allowed during the proposed treatment period is the amount of product equivalent to three full aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged weeds for at least 14 days. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

AVAST: Full aquatic site treatments are allowed. Whether applied in one single treatment or multiple treatments, the total amount of product allowed during the proposed treatment period must comply with the following guidelines. For Ponds (aquatic site area is less than or equal to 10 acres): a single application rate cannot exceed 90 ppb, and for split or multiple applications the sum of all application rates cannot exceed 90 ppb. For Lakes & Reservoirs (aquatic site area is greater than 10 acres): a single application rate cannot exceed 150 ppb; and for split or multiple applications the sum of all application rates cannot exceed 150 ppb, where 75 ppb is the maximum rate at any time. When performing split or multiple treatments to the same treatment area with this product or any other herbicide for submerged weeds, a minimum of 7 days is required between treatments. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

CAPTAIN: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat this aquatic site with this product or any other algaecide for at least 7 days. Do not use any other algaecide in the same treatment area at the same time as this product.

CLEARCAST: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat this aquatic site with this product or any other herbicide for submerged/floating/weeds for at least 14 days. Do not use any other herbicide in the same treatment area at the same time as this product.

CLEARIGATE: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat this aquatic site with this product or any other algaecide for at least 7 days. Do not use any other algaecide in the same treatment area at the same time as this product.

CLIPPER: Full aquatic site treatments are only allowed when weed mass is sparse. The total amount of treatments is limited to six at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged, floating, and/or emerged weeds for 12 days. Do not use any other

herbicide for submerged, floating, and/or emerged weeds in the same treatment area at the same time as this product. Ensure that water pH is taken and complies with pH label mandates prior to any application.

CuSO₄: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat this aquatic site with this product or any other algaecide for at least 7 days. Do not use any other algaecide in the same treatment area at the same time as this product.

CUTRINE-PLUS : In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat this aquatic site with this product or any other algaecide for at least 7 days. Do not use any other algaecide in the same treatment area at the same time as this product.

EAGRE: Only three treatments are allowed per treatment area during the proposed treatment period. Do not retreat the same treatment area with this product or any other herbicide for emergent weeds for at least 14 days. Do not use any other herbicide for emergent weeds in the same treatment area at the same time as this product.

EARTHTEC: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed every 30 days is the amount of product equivalent to 2 treatments of 1/2 the aquatic site at the approved dosage rate. Do not retreat this aquatic site with this product or any other algaecide for at least 7 days. Do not use any other algaecide in the same treatment area at the same time as this product.

ELIMINATOR: Full aquatic site treatments are allowed. Whether applied in one treatment or multiple treatments, the total amount of product allowed during the proposed treatment period is the amount of product equivalent to three full aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged weeds for at least 14 days. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

FORMULA F30: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat this aquatic site with this product or any other algaecide for at least 10 days. Do not use any other algaecide in the same treatment area at the same time as this product.

GALLEON SC: Full aquatic site treatments are allowed. For lakes, ponds, and reservoirs, split or multiple applications may be conducted (150 ppb maximum at any one time), limited to a total of 150 ppb per annual growth cycle. When performing split or multiple treatments to the same treatment area with this product or any other herbicide for submerged weeds, a minimum of 7 days is required between treatments. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

GARLON 3A: This product is permissible to treat non-irrigation ditch banks, seasonally dry wetlands, and transitional areas between upland and lowland sites when surface water is not present except for in isolated pockets due to uneven conditions. **DO NOT APPLY** to open water. This product may be used with rates up to 8 quarts per acre per year on non-crop areas including rights-of-way including electrical power lines. Do not use any other herbicide for emergent weeds, herbaceous plants, or woody plants in the same treatment area at the same time as this product.

GLYPRO: Only three treatments are allowed per treatment area during the proposed treatment period. Do not retreat the same treatment area with this product or any other herbicide for emergent weeds, herbaceous plants, or woody plants for at least 14 days. Do not use any other herbicide for emergent weeds, herbaceous plants, or woody plants in the same treatment area at the same time as this product.

GREENCLEAN: In a single operation only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat the same treatment area with this product or any other algaecide for at least 4 days. Do not use any other algaecide in the same treatment area at the same time as this product. Dosage rates are limited to curative or preventative maintenance.

HABITAT: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat the treatment area with this product or any other product for at least 10 days. Do not use any other product in the same treatment area at the same time as this product.

HYDROTHOL-191: Full aquatic site treatments are allowed. Whether applied in one treatment or multiple treatments, the total amount of product allowed during the proposed treatment period is the amount of product equivalent to three full aquatic site treatments at the approved dosage rate. Do not apply any other pesticide to the same treatment area at the same time as this product. Do not retreat with this pesticide or apply any other pesticide to this treatment area for at least 14 days after treatment.

K-TEA: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed every 30 days is the amount of product equivalent to 2 treatments of 1/2 the aquatic site at the approved dosage rate. Do not retreat this aquatic site with this product or any other algaecide for at least 10 days. Do not use any other algaecide in the same treatment area at the same time as this product.

KNOCKOUT: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged weeds for at least 14 days. Total treatment area with this product and any other herbicide for submerged weeds (including algaecides) cannot exceed 1/2 of the aquatic site area within any 14 day period. Do not use any other herbicide for submerged weeds at the same time as this product. Outflow must be little to none for 5 days following treatment, or do not treat within 1,000 feet of this outlet. For water with an average depth (< or =) to 2 feet, dosage rate is restricted to 1 gal Knockout per surface acre.

KOMEEN: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed to each treatment area in a single operation is equivalent to treating 1/2 the aquatic site at the dosage rate. Do not retreat the same treatment area with this product for at least 12 weeks. Do not treat additional areas for 10-14 days. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

LESCO HYDRO BLOCK: Full aquatic site treatments are allowed. Whether applied in one treatment or multiple treatments, the total amount of product allowed every 30 days during the proposed treatment period is the amount of product equivalent to two full aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other algaecide for at least 30 days. Do not use any other algaecide in the same treatment area at the same time as this product.

LESCOCIDE-PLUS ALGAECIDE: Only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed to each treatment area every 30 days during the proposed treatment period is the amount of product equivalent to four 1/2 aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other algaecide for at least 7 days. Do not use any other algaecide in the same treatment area at the same time as this product.

LESCOCIDE-PLUS GRANULAR ALGAECIDE: Only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed to each treatment area every 30 days during the proposed treatment period is the amount of product equivalent to four half aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other algaecide for at least 7 days. Do not use any other algaecide in the same treatment area at the same time as this product.

NAUTIQUE: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed every 30 days is the amount of product equivalent to 2 treatments of 1/2 the aquatic site at the approved dosage rate. Do not retreat this aquatic site with this product or any other herbicide for

submerged weeds for at least 10 days. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

NAVIGATE: Full aquatic site treatments are only allowed when weed mass is sparse. The total amount of product allowed during the proposed treatment period is the amount of product equivalent to 2 full aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged weeds for at least 6 weeks. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

PAK 27 Algaecide: In a single operation only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat the same treatment area with this product or any other algaecide for at least 4 days. Do not use any other algaecide in the same treatment area at the same time as this product. Dosage rates are limited to curative or preventative maintenance.

PHYCOMYCIN: In a single operation only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat the same treatment area with this product or any other algaecide for at least 4 days. Do not use any other algaecide in the same treatment area at the same time as this product. Dosage rates are limited to curative or preventative maintenance.

PRENFISH TOXICANT: Full aquatic site treatments are allowed. Fish kills are expected at recommended rates. Use in fisheries management for the eradication of fish from lakes, ponds, and streams. Dosage is based on type of water body use (maximum of 5 ppm under any conditions), consult label for specific directions. If a detoxification procedure is necessary to neutralize the rotenone within the water, only potassium permanganate is allowed to be used per Prenfish label directions. Wait at least 2 weeks after treatment before attempting to restock water body.

POLARIS: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat the treatment area with this product or any other product for at least 10 days. Do not use any other product in the same treatment area at the same time as this product. Specific dosage rate is species-specific, as per label directions. MAX DOSAGE RATE = 0.75 GAL/SA.

RADIANCE: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed every 30 days is the amount of product equivalent to 2 treatments of 1/2 the aquatic site at the approved dosage rate. Do not retreat this aquatic site with this product or any other algaecide for at least 10 days. Do not use any other algaecide in the same treatment area at the same time as this product.

REDWING: In a single operation, only partial treatments (1/3 to 1/2 of the aquatic site) are allowed at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged weeds for at least 14 days. Total treatment area with this product and any other herbicide for submerged weeds (including algaecides) cannot exceed 1/2 of the aquatic site area within any 14 day period. Do not use any other herbicide for submerged weeds at the same time as this product. Outflow must be little to none for 5 days following treatment, or do not treat within 1,000 feet of this outlet. For water with an average depth less than or equal to 2 feet, dosage rate is restricted to 1 gallon per surface acre.

RENOVATE 3: Only partial treatments (1/3 to 1/2 of the aquatic site) are allowed. The total amount of product allowed to each treatment area during the proposed treatment period is the amount of product equivalent to two 1/2 aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged, floating, and/or emerged weeds for at least 10 days. Do not use any other herbicide for submerged, floating, and/or emerged weeds in the same treatment area at the same time as this product.

RENOVATE MAX G: Full aquatic site treatments are only allowed when weed mass is sparse. The total amount of product allowed during the treatment season is the amount of product equivalent to 2 full aquatic site treatments at the approved dosage rate (maximum of 93.7 pounds/acre foot per application). Only two treatments per season are allowed to target areas regardless of dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged, floating, and/or emerged weeds for at least 21 days unless conducting split treatments. Do not use any other herbicide for submerged, floating, and/or emerged weeds in the same treatment area at the same time as this product.

RODEO: Only three treatments are allowed per treatment area during the proposed treatment period. Do not retreat the same treatment area with this product or any other herbicide for emergent weeds for at least 14 days. Do not use any other herbicide for emergent weeds in the same treatment area at the same time as this product.

REWARD: In a single operation, only partial treatments ($\frac{1}{3}$ to $\frac{1}{2}$ of the aquatic site) are allowed at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged weeds for at least 14 days. Total treatment area with this product and any other herbicide for submerged weeds (including algaecides) cannot exceed $\frac{1}{2}$ of the aquatic site area within any 14 day period. Do not use any other herbicide for submerged weeds at the same time as this product. Outflow must be little to none for 5 days following treatment, or do not treat within 1,000 feet of the outlet. For water with an average depth less than or equal to 2 feet, dosage rate is restricted to 1 gal Reward per surface acre.

SCI-62: Only partial treatments ($\frac{1}{3}$ to $\frac{1}{2}$ of the aquatic site) are allowed. The total amount of product allowed to each treatment area every 30 days during the proposed treatment period is the amount of product equivalent to two treatments of $\frac{1}{2}$ the aquatic site at the approved dosage rate. Do not retreat the same treatment area with this product or any other algaecide for at least 10 days. Do not use any other algaecide in the same treatment area at the same time as this product.

SCULPIN G: Full aquatic site treatments are only allowed when weed mass is sparse. The total amount of product allowed during the proposed treatment period is the amount of product equivalent to 2 full aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged, floating, and/or emerged weeds for at least 3 weeks unless conducting split treatments. Do not use any other herbicide for submerged, floating, and/or emerged weeds in the same treatment area at the same time as this product.

SONAR: Full aquatic site treatments are allowed. For lakes and reservoirs, split or multiple applications may be conducted (90 ppb maximum at any one time), limited to a total of 150 ppb per annual growth cycle. For ponds, split or multiple applications may be conducted, limited to a total of 90 ppb per annual growth cycle. When performing split or multiple treatments to the same treatment area with this product or any other herbicide for submerged weeds, a minimum of 7 days is required between treatments. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

TAHOE 3A: This product is permissible to treat non-irrigation ditch banks, seasonally dry wetlands, and transitional areas between upland and lowland sites, and forestry sites associated with wetland areas. For such sites, in a single operation, full site treatments are allowed at the approved dosage rate. For forestry sites associated with wetlands, application is limited to 2 gallons of this product per acre per year. Do not use any other herbicide for emergent weeds, herbaceous plants, or woody plants in the same treatment area at the same time as this product.

TOUCHDOWN PRO: In a single operation, only partial treatments ($\frac{1}{3}$ to $\frac{1}{2}$ of the aquatic site) are allowed. Only three treatments are allowed per treatment area during the proposed treatment period. Do not retreat the same treatment area with this product or any other herbicide for emergent weeds, herbaceous plants, or woody plants for at least 14 days. Do not use any other herbicide for emergent weeds, herbaceous plants, or woody plants in the same treatment area at the same time as this product.

WEEDTRINE-D: Full aquatic site treatments are allowed. Whether applied in one treatment or multiple treatments, the total amount of product allowed during the proposed treatment period is the amount of product equivalent to three full aquatic site treatments at the approved dosage rate. Do not retreat the same treatment area with this product or any other herbicide for submerged weeds for at least 14 days. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

WHITECAP: Full aquatic site treatments are allowed. For lakes and reservoirs, split or multiple applications may be conducted (90 ppb maximum at any one time), limited to a total of 150 ppb per annual growth cycle. For ponds, split or multiple applications may be conducted, limited to a total of 90 ppb per annual growth cycle. When performing split or multiple treatments to the same treatment area with this product or any other herbicide for submerged weeds, a minimum of 7 days is required between treatments. Do not use any other herbicide for submerged weeds in the same treatment area at the same time as this product.

***SECTION 24(c) SPECIAL LOCAL NEED PESTICIDE PRODUCT CONDITIONS
24(c) FOR USE ON NATURAL-BOTTOM SWIMMING SITES***

AQUATIC PESTICIDE PERMIT CONDITIONS IN ADDITION TO SPECIAL LOCAL NEED (SLN) LABEL REQUIREMENTS. MAKE SURE YOU HAVE THE MOST UP-TO-DATE COPY OF THE SLN LABEL ON HAND TO REFER TO!

SODIUM HYPOCHLORITE

PRODUCTS: Use only a product specifically registered for the control of algae in natural-bottom swimming ponds and the one specified in this permit. The label of this product will be identified by the wording: "Section 24(c) Special Local Need Registration, EPA SLN NO. NJ-020001"

USE: Do not treat within close proximity to any outlet for surface water discharge. If a feeder device is used while the swimming area is in operation, the product must be fed into the pond over a minimum of five hours.

The maximum initial dosage rate to use is 11 ounces of product/10,000 gallons of pond water/day. The maximum dosage rate allowed at any time thereafter is 30 ounces of product/10,000 gallons of pond water/day.

The applicator is required to comply with all specifications and restrictions placed on this treatment program. Any change in the treatment plan, not accounted for in these conditions, requires a revised permit prior to application. The applicator can treat at a dosage rate less than the dosage rate approved by this permit, but cannot treat at a greater dosage rate than the maximum specified.

1. **POSTED NOTIFICATION:** Signs notifying swimmers and other persons having access to the natural-bottom swimming pond shall be posted and comply with specifications designated on page two of this aquatic permit.

2. **THM:** The level of total trihalomethanes (THM's) in the swimming pond water must not exceed the Drinking Water Quality Standards (DWQS) of 80 ppb as mandated by the USEPA. Analysis of the swimming pond water will be required, at a minimum, once each month during the swimming season. Samples shall be collected from the deepest part of the swimming pond during the middle of the month. If the analysis indicates a level of THM's above the DWQS, another sample for analysis must be collected immediately. If the sample results are again above the current DWQS, chlorination will immediately cease and will not resume without specific approval by the DEP, Pesticide Control Program. The results of any THM analysis must be forwarded to the DEP immediately after results are received. Failure to forward monthly (and additional) THM analysis will constitute a violation of the recordkeeping requirements of this permit (see below: RECORDKEEPING). A

laboratory certified for such work and using an analytical method approved for the monitoring of public drinking water shall perform all analyses for THM's.

3. CALIBRATIONS: All equipment/test kits used for required measurements must be properly maintained and calibrated, if so required, as per the manufacturers' instructions. All equipment used to introduce the pesticide product into the pond water must also be properly maintained and calibrated. Prior to the seasonal opening of the swimming pond, pumps, metering devices, flow rate controllers, etc. must be evaluated and calibrated using direct measurements, such as volume of water pumped, amount of pesticide (or surrogate) metered, actual flow rate through a controller, etc.

4. SECCHI DISK: Acceptable water quality is to be determined by secchi disk readings at the deepest part of the pond. The target secchi disk reading will be four feet. If the secchi disk readings fall below four feet, a dosage rate increase is permitted, but in no case shall the dosage rate used exceed 30 ounces of product/10,000 gallons of pond water/day. If secchi disk readings are five feet or more for three consecutive days, a dosage rate decrease of at least 10% is mandatory. Secchi disk readings are required to be taken and recorded every day the swimming area is in operation.

5. pH: The pH of the swimming pond water must be kept in the range of 7.2 to 7.8. Measurements of pH must be taken and recorded every day that the swimming area is in operation. Measurements of pH will be made utilizing a method that uses a phenol red indicator, on water collected from the deepest part of the pond. Any pH measurement out of the acceptable range will require a pH adjustment, using appropriate adjustment chemicals, at the close of operations of the day that the out-of-range measurement was recorded.

6. CHLORINE PRODUCED OXIDANTS (Total Chlorine): A measurement for total chlorine must be taken and recorded every day that the swimming area is in operation. The measurements of total chlorine must be made utilizing a chlorine test kit with a lower limit of detection of at least 0.1 ppm, for water collected from the deepest part of the pond. These measurements are to be taken at the same time and location as the required pH measurement.

7. SURFACE WATER DISCHARGE: There are to be no surface water discharges (SWD) while using this product and for at least 7 days after usage stops, unless under the following conditions:

A SWD prior to the 7-day period specified above shall only be allowed if the swimming pond water has a total chlorine value of 0.1 ppm or lower at the point of discharge. A chlorine test kit with a lower limit of detection of at least 0.1 ppm shall be used to make this measurement. Measurements of total chlorine value at the point of discharge must be taken and recorded every day there is a SWD. This measurement should occur prior to allowing any SWD to ensure compliance with stated total chlorine value restrictions. If a dechlorination agent is used to achieve the total chlorine value allowable for discharge, it must be used in accordance with all the manufacturer's instructions.

8. RECORDKEEPING: The applicator must maintain and submit, by November 15 of each treatment year, records of application and required measurements addressed above, for the use of this SLN product. The applicator must use the attached forms for record keeping. Note that no form is provided for THM measurements. The applicator may submit copies of the laboratory analysis sheets for the THM reporting requirement. The following information must be kept as part of the records of application:

- a. All required measurements or analytical results for secchi disk (in feet), pH, THM's and chlorine produced oxidants (total chlorine).
- b. The total amount of product, in gallons, used per day, the date applied, and the dosage rate used each day, expressed as ounces of product/10,000 gallons of pond water/day.
- c. If a pH adjustment is done, identify the date of adjustment, material used, and how much of it was used per day

- d. If a dechlorination agent is used, identify the date used, the agent used, and how much of it was used per day.
- e. Whether the discharge location is open or closed ("O" or "C") during every day the pool is in operation.

9. **SITE DRAINING:** Swimming ponds **MUST** be drained in the off-season for the purpose of bottom maintenance. The draining period must be of a sufficient amount of time to allow for the removal of as much organic matter as possible, as well as any infrastructure (pipes, pumps, etc) cleaning and repair.

The responsible pesticide applicator for this aquatic permit is responsible for performing the testing/sampling and recordkeeping required by this permit.

The DEP will be given access to the swimming pond during reasonable hours for confirmation sampling purposes. The DEP has the authority to revise or deny this permit at any time. The applicator is required to follow any revisions to this permit made by the DEP. This permit is approved for the use of Sodium Hypochlorite Solution, EPA Registration Number SLN NO. NJ-020001, for the control of algae only.

ACCU-TAB BLUE CALCIUM HYPOCHLORITE TABLETS: AQUATIC PESTICIDE PERMIT CONDITIONS IN ADDITION TO SPECIAL LOCAL NEED (SLN) LABEL REQUIREMENTS.

PRODUCTS: Use only a product specifically registered for the control of algae in natural-bottom swimming ponds and the one specified in this permit. The label of this product will be identified by the wording: "Section 24(c) Special Local Need Registration, EPA SLN NO. NJ-040003".

USE: Do not treat within close proximity to any outlet for surface water discharge. If a feeder device is used while the swimming area is in operation, the product must be fed into the pond over a minimum of five hours.

The maximum initial dosage rate to use is 0.16 pounds of product/10,000 gallons of pond water/day. The maximum dosage rate allowed at any time thereafter is 0.42 pounds of product/10,000 gallons of pond water/day.

The applicator is required to comply with all specifications and restrictions placed on this treatment program. Any change in the treatment plan, not accounted for in these conditions, requires a revised permit prior to application. The applicator can treat at a dosage rate less than the dosage rate approved by this permit, but cannot treat at a greater dosage rate than the maximum specified.

1. **POSTED NOTIFICATION:** Signs notifying swimmers and other persons having access to the natural-bottom swimming pond shall be posted and comply with specifications designated on page two of this aquatic permit.

2. **THM's:** The level of total trihalomethanes (THM's) in the swimming pond water must not exceed the Drinking Water Quality Standards (DWQS) of 80 ppb as mandated by the USEPA. Analysis of the swimming pond water will be required, at a minimum, once each month during the swimming season. Samples shall be collected from the deepest part of the swimming pond during the middle of the month. If the analysis indicates a level of THM's above the DWQS, another sample for analysis must be collected immediately. If the sample results are again above the current DWQS, chlorination will immediately cease and will not resume without specific approval by the DEP. The results of any THM analysis must be forwarded to the DEP immediately after results are received. Failure to forward monthly (and additional) THM analysis will constitute a violation of the recordkeeping requirements of this permit (see below: **RECORDKEEPING**). A laboratory certified for such work and using an analytical method approved for the monitoring of public drinking water shall perform all analyses for THM's.

3. **CALIBRATIONS:** All equipment/test kits used for required measurements must be properly maintained and calibrated, if so required, as per the manufacturers' instructions. All equipment used to introduce the pesticide

product into the pond water must also be properly maintained and calibrated. Prior to the seasonal opening of the swimming pond, pumps, metering devices, flow rate controllers, etc. must be evaluated and calibrated using direct measurements, such as volume of water pumped, amount of pesticide (or surrogate) metered, actual flow rate through a controller, etc.

4. **SECCHI DISK:** Acceptable water quality is to be determined by secchi disk readings at the deepest part of the pond. The target secchi disk reading will be four feet. If the secchi disk readings fall below four feet, a dosage rate increase is permitted, but in no case shall the dosage rate used exceed 0.42 pounds of product/10,000 gallons of pond water/day. If secchi disk readings are five feet or more for three consecutive days, a dosage rate decrease of at least 10% is mandatory. Secchi disk readings are required to be taken and recorded every day the swimming area is in operation.

5. **pH:** The pH of the swimming pond water must be kept in the range of 7.2 to 7.8. Measurements of pH must be taken and recorded every day that the swimming area is in operation. Measurements of pH will be made utilizing a method that uses a phenol red indicator, on water collected from the deepest part of the pond. Any pH measurement out of the acceptable range will require a pH adjustment, using appropriate adjustment chemicals, at the close of operations of the day that the out-of-range measurement was recorded.

6. **CHLORINE PRODUCED OXIDANTS (Total Chlorine):** A measurement for total chlorine must be taken and recorded every day that the swimming area is in operation. The measurements of total chlorine must be made utilizing a chlorine test kit with a lower limit of detection of at least 0.1 ppm, for water collected from the deepest part of the pond. These measurements are to be taken at the same time and location as the required pH measurement.

7. **SURFACE WATER DISCHARGE:** There are to be no surface water discharges (SWD) while using this product and for at least 7 days after usage stops, unless under the following conditions:

A SWD prior to the 7-day period specified above shall only be allowed if the swimming pond water has a total chlorine value of 0.1 ppm or lower at the point of discharge. A chlorine test kit with a lower limit of detection of at least 0.1 ppm shall be used to make this measurement. Measurements of total chlorine value at the point of discharge must be taken and recorded every day there is a SWD. This measurement should occur prior to allowing any SWD to ensure compliance with stated total chlorine value restrictions. If a dechlorination agent is used to achieve the total chlorine value allowable for discharge, it must be used in accordance with all the manufacturer's instructions.

8. **RECORDKEEPING:** The applicator must maintain and submit, by November 15 of each treatment year, records of application and required measurements addressed above, for the use of this SLN product. The applicator must use the attached forms for record keeping. Note that no form is provided for THM measurements. The applicator may submit copies of the laboratory analysis sheets for the THM reporting requirement. The following information must be kept as part of the records of application:

- a. All required measurements or analytical results for secchi disk (in feet), pH, THM's and chlorine produced oxidants (total chlorine).
- b. The total amount of product, in pounds, used per day, the date applied, and the dosage rate used each day, expressed as pounds of product/10,000 gallons of pond water/day
- c. If a pH adjustment is done, identify the date of adjustment, material used, and how much of it was used per day.
- d. If a dechlorination agent is used, identify the date used, the agent used, and how much of it was used per day.
- e. Whether the discharge location is open or closed ("O" or "C") during every day the pool is in operation.

9. SITE DRAINING: Swimming ponds MUST be drained in the off-season for the purpose of bottom maintenance. The draining period must be of a sufficient amount of time to allow for the removal of as much organic matter as possible, as well as any infrastructure (pipes, pumps, etc) cleaning and repair.

The responsible pesticide applicator designated on page 1 of this aquatic permit is responsible for performing the testing/sampling and recordkeeping required by this permit.

The DEP will be given access to the swimming pond during reasonable hours for confirmation sampling purposes. The DEP has the authority to revise or deny this permit at any time. The applicator is required to follow any revisions to this permit made by the DEP. This permit is approved for the use of Accu-Tab Blue Calcium Hypochlorite, EPA Registration Number SLN NO. NJ-040003, for the control of algae only.

APENDIX B - *AQUATIC PESTICIDE PERMIT RESTRICTIONS*

2,4-D: Do not apply Aqua Kleen, Navigate, Platoon or Sculpin G within 50 feet of any outlet if site is 5 acres or less. Do not apply Aqua Kleen, Navigate, Platoon or Sculpin G within 100 feet of any outlet if site is over 5 acres. Navigate/Sculpin g - residents may not swim in treated water for a minimum of 24 hours after application, so be sure to notify appropriate contacts and place appropriate postings around the entire area of the site. Residents must follow all water use restrictions for treated water as directed by the Navigate, Platoon and Sculpin G label. For Platoon, the minimum setback from a potable water intake is 600 feet.

ALGIMYCIN: If target species (genera) are identified, dosage rate must correspond to those specified in table #1 of Algimycin label directions.

AQUAPIER: Do not use water treated with Aquapier for irrigation purposes for 120 days after treatment or until residue levels are 1.0 ppb or less. Treatments must be kept 1/2 mile from potable water intakes.

AQUATHOL K: Do not apply Aaquathol k within 50 feet of any outlet if site is 5 acres or less. Do not apply Aquathol k within 100 feet of any outlet if site is more than 5 acres.

CLEARCAST: The maximum cumulative concentration of Clearcast cannot exceed 500 ppb per year. Do not apply Clearcast within 200 yards of any potable water intake. Water treated with Clearcast cannot be used for irrigation purposes.

CLIPPER: Treated water may not be used for irrigation purposes for a minimum of 5 days after application.

GARLON: This product has the potential to cause ground water contamination. Read product label directions carefully and use extreme caution when making applications to aquatic sites where water table is shallow and soil is permeable.

GREENCLEAN: Preventative maintenance dosage rate is a maximum 17 lbs per acre foot. Curative maintenance dosage rate is a maximum 170 lbs per acre foot.

GREENCLEAN LIQUID: Preventative maintenance dosage rate is a maximum 3.6 gals per acre foot. Curative maintenance dosage rate is a maximum 12 gals per acre foot.

GREENCLEANPRO: Preventative maintenance dosage rate is a maximum 9 lbs per acre foot. Curative maintenance dosage rate is a maximum 90 lbs per acre foot.

HABITAT: Water treated with habitat may not be used for irrigation purposes for 120 days after application. Do not apply habitat within one-half mile of an active potable water intake. Do not apply Habitat within one mile of an active irrigation water intake.

REWARD: Residents must follow all water use restrictions for treated water as directed by the Reward label, or keep 1,000 feet from the intake or use area. Reward dosage rate must not exceed 1 gallon per acre in all treatment areas with a depth of 2 feet or less.

RODEO: Residents must follow all water use restrictions for treated water as directed by the Rodeo label. Rodeo treatments must be kept 1/2 mile from potable water intake unless water intake can be shut off for at least 48 hours. Intake can be used prior to 48 hours if the concentration of glyphosate in treated water is less than 0.7ppm.

SONAR: Residents must follow all water use restrictions for treated water as directed by the Ssonar label. Sonar treatments must be kept 1/4 mile from potable water intake unless concentration of fluridone in the treated water is less than or equal to 0.02ppm.

TAHOE 3A: Treatments must be kept 1/2 mile from potable water intake. Intake must be shut off until triclopyr level in the intake water is 0.4 ppm.

WHITECAP: Residents must follow all water use restrictions for treated water as directed by the Whitecap label. Whitecap treatments must be kept 1/4 mile from potable water intake unless concentration of fluridone in the treated water is less than or equal to 0.02ppm.

AERIAL APPLICATIONS: No aerial application is to be made within 300 feet of occupied buildings and 100 feet of a private residence, public road or property line.

LAND USE PERMITS All treatments must be made in accordance with all DEP land use regulation program permits issued for this site, including NJ coastal zone management program federal consistency determinations or freshwater wetlands general permit #4. Failure to comply with such requirements is a violation of this permit.

USE OF MULTIPLE PRODUCTS:

Aquacure, Captain, Clearigate, Cutrine-plus, Cutrine ultra, Komeen, K-tea, Nautique or Radiance: only one of these products can be used per treatment.

CuSO₄ or Earthtec: only one of these products can be used per treatment.

Navigate, Aqua-kleen or Aquacide pellets: only one of these products can be used per treatment.

Whitecap, Sonar as, Sonar srp, Sonar pr or Sonar q: only one of these products can be used in a specific area per treatment date.

Aquaneat, Aquapro or Touchdown pro: only one of these products can be used per treatment.

MULTIPLE PERMITS/SITE: The applicator must coordinate all treatments under this permit with all treatments under any other approved/issued pesticide permit for same site to ensure compliance with conditions of this permit. The combination of applications under all permits cannot exceed the total amount of product allowed to each treatment area every 30 days during the proposed treatment period.

DROUGHT: Caution! Drought conditions across NJ may persist through the proposed treatment period. Use extreme caution and reduce dosage rates if necessary to account for decreased surface area & lower water depth.

TREATMENT OBJECTIONS: There can be no objections to lake treatments by lake property owners prior to applications.

SENSITIVE SPECIES: If the receiving water body was recently inventoried by DEP Fish and Wildlife and they found the presence of sensitive and rare native fish species, use extreme caution and perform minimal treatments when making applications.

PHRAGMITES: Glyphosate can only be applied at the maximum dosage rate of 6pts/A to green and tasseled phragmites plants. If the phragmites plant is green, short and/or not tasseled, the maximum dosage rate cannot exceed 4pts/A. If any other species besides phragmites australis is treated under this permit, the applicator must supply a detailed list with the records of actual treatment form explaining approximate acreage and pesticide use for each species treated.

RESERVOIRS: For Cu and CuSO₄ applications, when calculating the volume of water needing treatment, a maximum of 6 feet of water depth is to be used if the actual water depth is greater than 6 feet. Treatments can be made through December of the current permit year. All copper treatments must be based on laboratory algal identification and quantification results indicating that treatment is warranted. These results must be kept as part of the treatment records. Applicator must forward algae counts and contact the aquatic permits unit for approval when planning an out of season (January - March) algae treatment to a reservoir.

TROUT: If there is trout production or trout maintenance downstream, use caution. Cu must not exceed 0.125 ppm and CuSO₄ must not exceed 0.5ppm due to trout production or maintenance downstream. Do not apply Cu or CuSO₄ within 100 feet of any outlet if there is trout production or maintenance downstream. For treatments prior to June 15th, if trout stocked downstream, use caution. Cu must not exceed 0.125 ppm and CuSO₄ must not exceed 0.5ppm due to trout stocked waters. After June 15th, normal dosage rates can be used in trout stocked waters. If trout stocked within the waterbody, use caution. There can be no treatment with Cu or CuSO₄ on or before June 15th.

APPENDIX C - *Record of Actual Treatment (RAT)*

Visit the Bureau of Licensing and Pesticide Operations website at: **www.pcpnj.org**

Then click on Permits, Permit Application Form, Record of Actual Treatment. Follow the instructions.



2016 Sonar® Aquatic Herbicide treatment of the Eno River for the selective management of monoecious hydrilla

Final Report to the Eno River Hydrilla Management Task Force
August 26, 2016



Report Author: Mark A. Heilman, Ph.D. – Senior Aquatic Technology Leader

SePRO Project Team: Cody Hale – Research Technician, Jordan Rabby – Technical Specialist



Background and Management Protocol

In 2015, a 16-mile stretch of the Eno River (Orange and Durham Counties, NC) was managed for selective control of monoecious hydrilla using a sustained, low-level injection of Sonar® Genesis Aquatic Herbicide (0.5 lb/gal liquid formulation of fluridone). This work was contracted by the then North Carolina Department of Environment and Natural Resources (DENR) on behalf of the Eno River Hydrilla Management Task Force—a diverse group of state agency and local government representatives engaged to implement hydrilla management in the Eno. The 2015 management effort was part of a planned two-year evaluation to assess the performance of hydrilla management and inform development of a longer-term plan to address the scenic river's hydrilla problem. From late May to mid-July 2015, Sonar rates were applied via remote, cellular controlled injection from a location near Lawrence Rd east of Hillsborough. Injection rates targeting maintenance of 2 – 5 ppb at the Durham end of management zone (~8 – 11 ppb at Lawrence Rd injection point) were adjusted at least daily based on monitoring USGS real-time discharge data from stations located in Hillsborough and at Roxboro Rd. in Durham. With field support from NC Parks, FastEST® analytical monitoring of Sonar levels was conducted on a weekly basis. The 2015 treatment program was deemed very successful with excellent hydrilla control in the management zone. While native aquatic vegetation—specifically water-willow (*Justicia americana*)—showed some noticeable chlorosis during the warm, drier-than-normal two-month management period, the effects were temporary as was anticipated during the planning process. Limited hydrilla recovery from late-germinating tubers in the late summer suggested that an optimal Sonar treatment program would run longer into the summer.

In 2016, the second year of the two-year demonstration effort deployed two herbicide injection systems to reduce upstream concentration necessary for effective hydrilla control throughout the management zone. A new second injector placed at roughly the midpoint of the management zone (Pleasant Green access) was used for a 'booster' or 'bump' of Sonar levels. This approach projected to reduce applied concentrations at the original Lawrence Rd location and make for a more efficient and even implementation of the program based on 2015 monitoring and assessment. The 2016 Eno River hydrilla management program sought to maintain 2 – 5 ppb Sonar in the 16-mile management zone for up to 120 days in a window of May 1 – September 15 (~140-day total window). The program was again supported by routine field observations by SePRO, NC State University, and other Task Force partners and monitoring of herbicide concentrations using SePRO's FastEST® analytical method on water samples collected by NC Parks at weekly intervals. Along with assistance from staff with the Eno River State Park (Task Force contact: Keith Nealson), the 2016 program also benefited greatly from logistical support from NC Department of Agriculture and Consumer Services (Task Force contact: Bridget Lassiter).

Results and Discussion

Injection of Sonar commenced on the Eno River on May 8. The program concluded August 22 after an active management period of 106 days—a period firmly in a window of the planned 90 – 120-day treatment protocol. The Eno had well-above normal flow for the 2016 treatment (Figure 1 and Table 1). Average daily flow at Durham for May 8 to August 22 was 91.1 CFS, which translates to discharge above the 80th percentile versus the 51-year record of USGS data. Discharge was particularly high in June and July with flow approximately double the 75th percentile historical level. The Sonar treatment was implemented adaptively over the 15-week program to react and adjust to the above-average flow conditions. The Sonar injection systems were temporarily turned off remotely during the highest of flow events (2 days in late June and 4 days in late July).

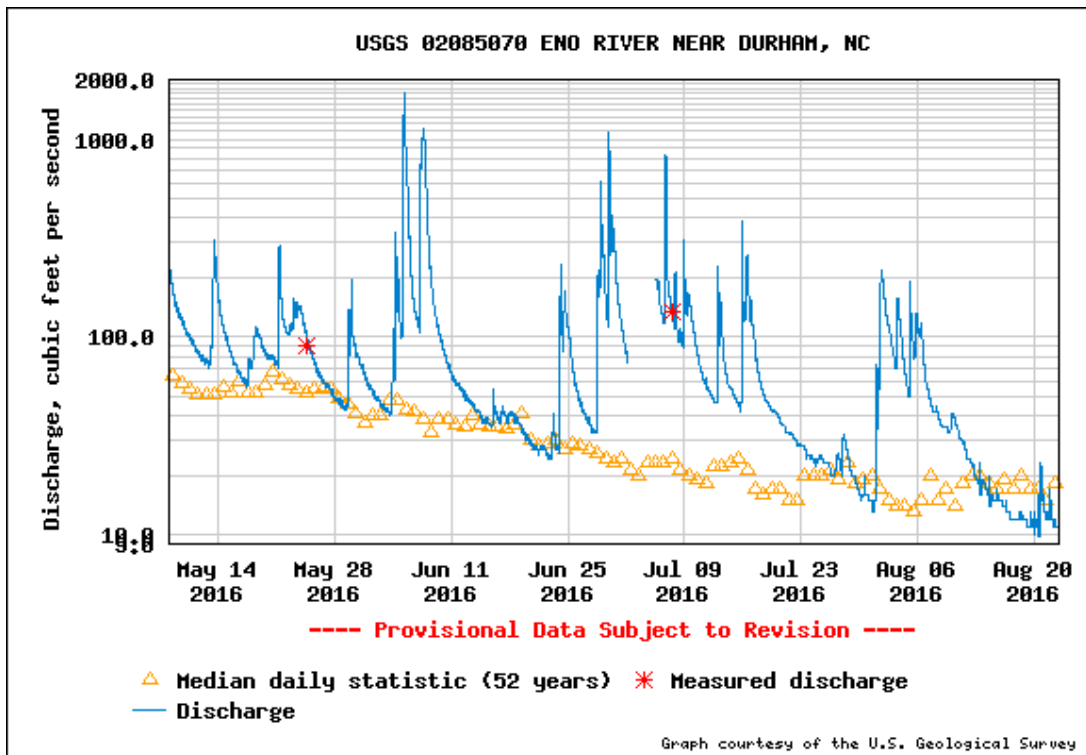
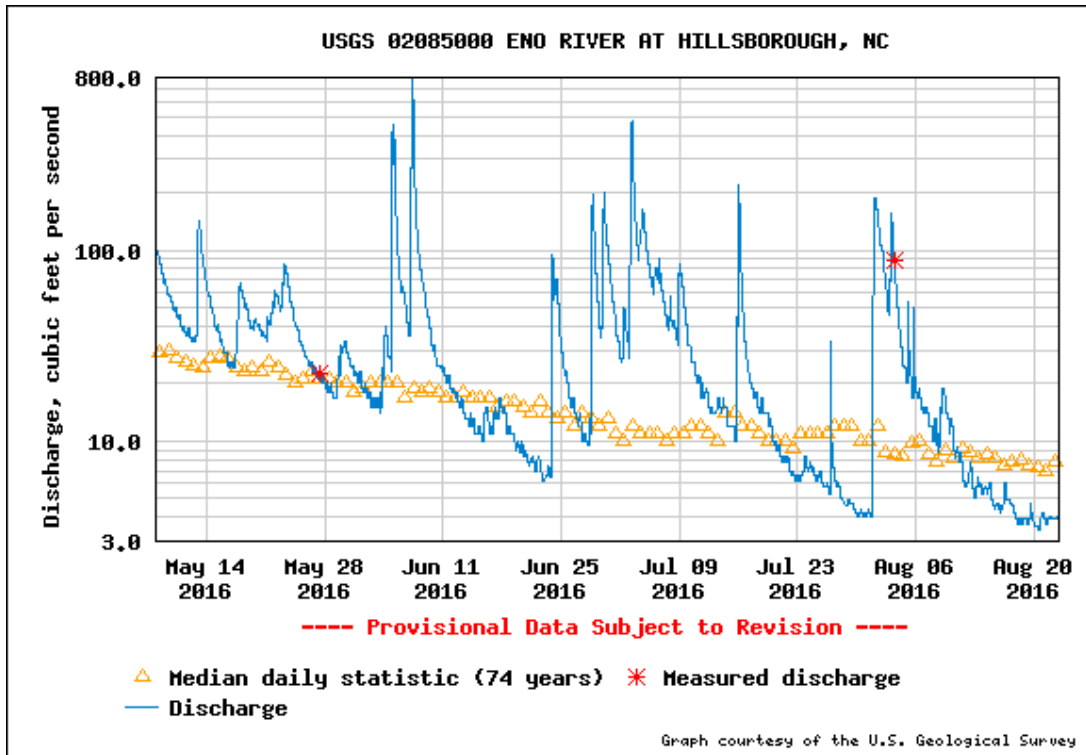


Figure 1. USGS discharge data for Hillsborough (top graph) and Durham (bottom graph) gages between May 8 and August 22, 2016.



TABLE 1. Eno River historical discharge at Durham (USGS #02085070) versus 2016 discharge measured for May 8 – August 22 period.

FULL PERIOD	PERCENTILE AVERAGE DAILY CFS (USGS DURHAM)				
<u>May 8 - Aug 22</u>	50th	75th	80th	90th	95th
1964 - 2015 AVG	31.0	62.5	76.7	155.0	376.2
2016 DAILY AVG	91.1				
BY MONTH	PERCENTILE AVERAGE DAILY CFS (USGS DURHAM)				
<u>1964 - 2015 AVG</u>	50th	75th	80th	90th	95th
May 8 - 31	53.7	96.1	115.5	234.0	508.1
June 1 - 30	34.6	63.7	76.5	149.1	393.6
July 1 -31	20.2	47.0	60.3	123.1	336.0
Aug 1 -22	16.8	45.9	58.1	122.0	265.3
<u>2016</u>	AVERAGE DAILY CFS (USGS DURHAM)				
May 8 - 31	95.1				
June 1 - 30	126.1				
July 1 -31	89.5				
Aug 1 -22	41.2				

Notes: Comparable historical percentile flows highlighted in yellow
2016 values positioned horizontally relative to historical percentile flows.

Average target Sonar rate for the program—not including periods of suspended injection due to high flow—was 3.7 ppb for the Lawrence Road injector and 1.9 ppb for the mid-zone ‘bump’ or ‘booster’ injection near Pleasant Green. FasTEST results showed that for the majority of the treatment program, Sonar levels were maintained between 1 and 3 ppb and averaged 1.9 ppb (Figure 2). In general, FasTEST collection events with <1 values were timed by chance during periods of high flow where briefly concentrations were diluted. It projected that for the bulk of the period of time around those weekly events, Sonar levels were higher due to quick restoration of herbicide concentrations on the ‘tail’ of flow pulses. 166 gallons of Sonar Genesis were applied to the river during the 2016 program (Table 2).

Overall, the Sonar program appears to have provided full control of early-stage hydrilla growth present at time of application start. Representative photos of river conditions during the 2016 Sonar program are included in the appendix of this report. NCSU (Shannon Auell) indicated that by mid-July that their surveys were not able to detect hydrilla in the treatment zone. Compared to 2015, hydrilla growth in untreated areas of the Eno immediately upstream of management zone (downtown Hillsborough) was apparently suppressed by higher turbidity and perhaps cooler water temperatures associated with elevated river flow in the May – July period. A survey conducted by SePRO on August 12 showed good hydrilla growth in untreated upstream areas but notably less than in early August 2015(photos in Appendix).



2016 Eno River FasTEST Summary

(ppb Sonar as fluridone; <1 results are given 0.5 values for calculating treatment averages)

Sampling Sites*	16-May	26-May	2-Jun	9-Jun	16-Jun	23-Jun	30-Jun	8-Jul	14-Jul	21-Jul	28-Jul	10-Aug	18-Aug
DUMONT	2.8	2.6	2.5	0.5	1.4	2.6	0.5	2.1	1.8	2.0	1.9	2.9	2.8
PLEASANT	2.2	2.3		0.5	1.6	0.5	0.5	1.4	1.3	2.1	1.4	1.1	1.7
COLE	2.4	3.5	4.0										
ROXBORO	1.2	3.5	3.1	0.5	1.5	2.6	0.5	1.3	1.6	1.3	1.5	2.1	2.3
Date Avg	2.2	3.0	3.2	0.5	1.5	1.9	0.5	1.6	1.6	1.8	1.6	2.0	2.3

* Injector @Lawrence Rd is 2.2 mi upstream of Dumont Rd access.

2nd Injector @ Pleasant Green is immediately downstream from sampling site, 7.3 mi downstream of Lawrence injector and 8.7 mi upstream of Roxboro Rd.

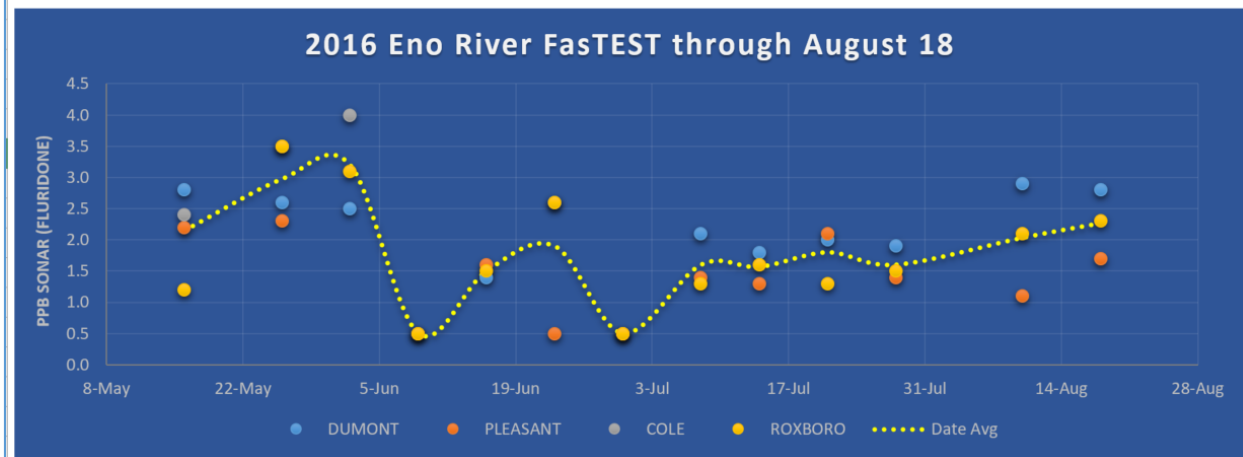


Figure 2. 2016 FasTEST measurements of Sonar concentrations maintained in the Eno River for the early-May to mid-August management program.

TABLE 2. Sonar Genesis injector loading and usage record for 2016 Eno River hydrilla treatment.

Sonar Genesis herbicide loading by injector			
Date	Lawrence Rd	Pleasant Green	Total
2-May	19	20	39*
16-May	20	5	25
25-May	25	18	43
3-Jun	15	20	35
15-Jun	1	9	10
23-Jun	0	1	1
8-Jul	6	2	8
3-Aug	6	5	11
TOTAL LOADED			172 gal
Remainder in injectors at end of program**			6 gal
TOTAL APPLIED			166 gal

* Note: 16 gal of 2015 herbicide were available at beginning of treatment. 23 gal were new material were initially loaded with this material to begin the 2016 program.

** The remaining herbicide will be available for 2017 use by the Task Force.



As of the date of this report, river flow has been below normal for most of August. These conditions and associated good water clarity may favor low-level hydrilla recovery from asynchronous, late germination of remaining hydrilla tubers in the management zone. However, general observations of hydrilla decline since 2015 in the treated area of the river suggests that there has been a strong reduction in tubers, which should greatly minimize possible regrowth for the remainder of the summer. Detection of new hydrilla growth should be a focus of assessment efforts in the management zone through September. A lack of observed growth would be a positive for projections of multi-year control success. In 2015, a shorter 60-day treatment program in a dry year resulted in some new hydrilla growth by the end of the summer. This presumably led to some limited new tuber deposition. In 2016, an absence of regrowth and possible new tuber development with a longer active treatment period would be a valuable observation for future planning of long-term hydrilla management approach in the Eno watershed. Regarding non-target plant effects, riffleweed appeared healthy and unaffected by management activities, and water willow stress was almost non-detectable. The minimal willow stress contrasts with the relatively strong chlorosis noted in mid-summer of a hot and dry 2015 when a single injector and associated higher injection rates were used versus the two units used this season with lower target herbicide levels in a higher flow year.

Overall, the 2016 Sonar treatment of the Eno River appears to have provided excellent, selective control of monoecious hydrilla in the 16-mile management zone. The 2016 program was modified from 2015 with the use of the second injection system, and the dual injection approach enhanced efficiency of herbicide use. The low but effective Sonar concentrations achieved by the 2016 program project to similar protocols for other infested areas of the river should the program be expanded to upstream areas in 2017 and beyond. The qualitative observations of strong reduction in hydrilla presence in treated areas over the last two years suggest a more rapid depletion of hydrilla tubers than observed in other infested lake and reservoir systems under sustained management in NC. The shallow, flowing conditions of the Eno may favor more complete germination of hydrilla each spring due to oxygenation of riverine sediments and other flow-related factors. As demonstrated over the last two years, a management program with Sonar that controls initially-germinating hydrilla tubers each spring and prevents regrowth for most or all of the growing season may have greater longer-term impact than a similar management program in a lake or reservoir. This hypothesis can be further assessed in the fall after review of final vegetation assessment results from NCSU, but if verified, it would bode well for longer-term management outcomes using Sonar to control hydrilla in the remainder of the watershed.

For questions regarding this report or other details of the 2015-2016 Eno River hydrilla management effort, please contact:

Mark Heilman, Ph.D., SePRO Corporation, Email: markh@sepro.com, Phone: (317) 775-3309

APPENDIX



April 26, 2016 - 2nd injector near Pleasant Green Access (left) and injection line entry point in the water (right)



April 26, 2016 – Early-stage growth of monoecious hydrilla at Pleasant Green access



June 10, 2016 – Sonar-injured hydrilla (left) and healthy riffleweed (right) at Pleasant Green access



August 12, 2016 - Panoramic photo of hydrilla-free conditions at Pleasant Green



August 12, 2016 – Healthy water-willow at Cole Mill access



August 12, 2016 - Healthy hydrilla growth in untreated section of river in Hillsborough (Weaver St.). Hydrilla biomass on the rock in right-hand photo was pulled up from a roughly 1 sq ft area of the bottom.



August 12, 2016 (left) versus August 4, 2015 (right) at walking trail bridge at Weaver St. in Hillsborough. August 2016 hydrilla coverage of the river bottom was high but plants were shorter and had less biomass versus 2015.



August 12, 2016 - Healthy hydrilla from untreated Hillsborough area. Plants show aggressive lateral growth.

Health Consultation

Public Health Evaluations for Potential Exposures to Fluridone or Endothall Used for Treatment of *Hydrilla verticillata* in the Eno River, Orange and Durham Counties, NC

ENO RIVER HYDRILLA MANAGEMENT PROJECT
ORANGE AND DURHAM COUNTIES, NC

**Prepared by the
North Carolina Division of Public Health**

MARCH 25, 2015

This report was supported by funds from a cooperative agreement with the Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services. This document has not been reviewed and cleared by ATSDR.

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

This report was supported by funds from a cooperative agreement with the Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services. This document has not been reviewed and cleared by ATSDR.

HEALTH CONSULTATION

Public Health Evaluations for Potential Exposures to Fluridone or Endothall Used for Treatment of *Hydrilla verticillata* in the Eno River, Orange and Durham Counties, NC

ENO RIVER HYDRILLA MANAGEMENT PROJECT ORANGE AND DURHAM COUNTIES, NC

Prepared By:

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North Carolina Department of Health and Human Services
Division of Public Health

Pat McCrory
Governor

Aldona Z. Wos, M.D.
Ambassador (Ret.)
Secretary DHHS

Daniel Staley
Acting Division Director

March 25, 2015

Mr. Rob Emens
Chairperson, Eno River Hydrilla Management Task Force
Division of Water Resources
1611 MSC
Raleigh, NC 27699-1611

Mr. Emens,

At the request of the Eno River Hydrilla Management (ERHM) Task Force, the N.C. Division of Public Health (DPH) Health Assessment, Consultation & Education (HACE) Program of the Occupational and Environmental Epidemiology Branch (OEEB) evaluated public health risks associated with use of two proposed herbicides to control *Hydrilla verticillata* in the Eno River. The HACE program evaluated potential exposure to the proposed herbicides in the Environmental Assessment provided by the ERHM Task Force and assessed public health risks associated with exposure to fluridone and endothall.

Attached to this letter you will find the complete evaluation, conclusions, and recommendations. It is the opinion of the OEEB that use of fluridone in the Eno River, even at maximum application rates, is unlikely to result in any adverse public health effects. Use of endothall at maximum application rates carries a small risk of adverse public health effects, especially if drinking water intakes are located downstream of the treatment area. N.C. DPH highly recommends the use of fluridone for hydrilla management over the use of endothall in the Eno River. If the ERHM Task Force chooses to use endothall, it is the recommendation of the N.C. DPH that application rates not exceed 3 mg/L, swimming is restricted during treatment, and downstream drinking water intakes are monitored daily to ensure endothall does not contaminate municipal drinking water.

We will continue to work with the ERHM Task Force to safeguard public health throughout the process of eradicating hydrilla from the Eno River. If you have specific questions about the report, please contact me via email (beth.dittman@dhhs.nc.gov) or by phone (919-707-5906).

Sincerely,

Beth Dittman, M.S.
Environmental Toxicologist, Health Assessor
Health Assessment, Consultation & Education (HACE) Program

www.ncdhhs.gov • www.publichealth.nc.gov

Tel 919-707-5000 • Fax 919-870-4829

Location: 5605 Six Forks Road • Raleigh, NC 27609

Mailing Address: 1931 Mail Service Center • Raleigh, NC 27699-1931

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Background and Statement of Issues

The Eno River (Figure 1) is a relatively shallow, swift flowing, Piedmont stream originating in northwest Orange County, North Carolina. From its origin to Falls Lake, the Eno flows through Orange and Durham Counties for approximately 28 miles and encompasses an approximately 150 square mile watershed area. The Eno River includes two drinking water reservoirs upstream of its confluence with the Flat River. The Eno River is regionally and nationally important for its ecological, recreational, and historical resources. Of ecological importance, the Eno provides habitat for sixteen aquatic animal species classified as special status. Additionally, the Eno is known for its biodiversity and good water quality. The Eno River is used extensively for recreational purposes, including an Eno River Festival held every summer. Recreational opportunities such as hiking, camping, paddling, picnicking, fishing, and nature study exist along the Eno River, with many of these opportunities located just outside municipal and developed areas.

The aquatic weed commonly known as hydrilla (*Hydrilla verticillata*) was first detected in the Eno River in 2005 by Eno River State Park staff. Over the next several years, multiple surveys assessed the extent of hydrilla infestation. An intensive survey was organized in the fall of 2013, which determined that roughly 25 miles of the river contained hydrilla with varying densities (ERHM Task Force 2015). Hydrilla is a federally listed and state listed noxious weed. Hydrilla can form extremely dense stands, filling the water column from the bottom to the surface, crowding and outcompeting native vegetation, as well as reducing habitat quantity and quality for native freshwater aquatic animals. The density of hydrilla mats can readily inhibit recreation, especially swimming, boating, and fishing, as well as clog water intakes for municipal and private entities. Additionally, hydrilla provides a habitat for mosquitoes, which can carry and spread human diseases such as West Nile Virus. Hydrilla has also been found to harbor a toxin-producing cyanobacterium associated with Avian Vacuolar Myelinopathy, a lethal disease that can affect plant eating waterfowl.

Control of hydrilla has proven to be difficult due to the fact that the weed has multiple reproductive pathways, including vegetative fragments, tubers, turions, and seeds. Tubers can remain viable in the hydrosol for seven years or longer. These reproductive abilities hinder removal of hydrilla from infested systems. Mechanical controls, such as cutters, cultivators, and dredges often create plant fragments that can spread the infestation, as well as significantly disturb sediments and indiscriminately remove benthic organisms and fish using the plants as habitats. The only proven biological control for hydrilla is the use of triploid grass carp¹, but these fish eat native submerged plants as well as hydrilla. It is also possible that the grass carp would migrate away from the target areas and significantly impact native aquatic plant populations in other areas of the river system. No physical control measures are feasible for use in the Eno River, largely due to ineffectiveness or negative impacts on native aquatic species.

¹ Triploid grass carp are genetically modified to prevent reproduction.

The last option for hydrilla management is chemical control through the use of herbicides. Several types of herbicides are approved by the U.S. EPA for the treatment of hydrilla infested waters, and the Eno River Hydrilla Management (ERHM) Task Force has narrowed it down to two possibilities: fluridone (Sonar Genesis[®]), and endothall (Aquathol[®]). These herbicides have been demonstrated to be selective for hydrilla management at low concentrations (ERHM Task Force 2015).

Fluridone (Sonar Genesis[®]) is a systemic herbicide and approved for application concentrations up to 150 µg/L, but hydrilla is sensitive to concentrations as low as 3-5 µg/L. Since fluridone requires sustained contact with the plants, the herbicide is generally applied over a 45-90 day period. Endothall (Aquathol[®]) is a faster-acting contact herbicide, but may still require several weeks for hydrilla knock-down. Endothall is approved for an application concentration up to 5 mg/L, but is often applied at rates of 1-3 mg/L to ensure that the chemical is selective for reduction of hydrilla while minimizing negative effects to other aquatic vegetation. Both herbicides generally leave a viable portion of the lower part of the plant, including tubers and the root crown. For this reason, chemical treatments usually need to be repeated for several years for longer-term control of hydrilla.

The ERHM Task Force has already performed an environmental assessment for the prospective use of these two herbicides in the Eno River. The Health Assessment, Consultation & Education (HACE) Program within the NC Division of Public Health (DPH) undertook an assessment of potential public health effects from the proposed use of two herbicides, fluridone and endothall, in the Eno River. The results of that assessment are presented here.

Toxicology Assessment

Fluridone Toxicity

Fluridone is an herbicide approved by the U.S. EPA for the treatment of aquatic plant pest species, including *Hydrilla verticillata*. It requires prolonged contact time (≥ 45 days) to be effective, resulting in intermediate exposure scenarios, but these applications are usually repeated for several years, resulting in intermittent exposure. The acute toxicity of fluridone is “moderate to low” (EPA 2004). For intermediate length oral exposure studies, liver hypertrophy was seen in mice at the highest tested dose, 200 mg/kg/day, while no adverse health effects were seen in dogs at the same dose. Studies in rats showed maternal and developmental toxicity at 300 and 1000 mg/kg/day, respectively, while similar studies with rabbits indicated both maternal and developmental toxicity at 300 mg/kg/day. Chronic dietary experiments have shown decreased body weights, decreased eosinophil counts, and decreased liver and kidney weights in rats at 81 mg/kg/day. In dogs, chronic exposure resulted in increased liver weights and alkaline phosphatase activity at the highest tested dose, 400 mg/kg/day (Table 6). The U.S. EPA’s chronic reference dose (RfD) for fluridone was developed from a 2-year (chronic) dietary study on mice which showed an increase in alkaline phosphatase activity and hepatocellular hypoplasia

at 50 mg/kg/day. The no observed adverse effect level (NOAEL) for this study is 15 mg/kg/day (Table 6). The U.S. EPA applied a safety factor of 100 for inter- and intra-species variability, resulting in the 0.15 mg/kg/day RfD for chronic oral exposure to fluridone (EPA 2004).

The U.S. EPA Health Effects Division (HED) Cancer Assessment Review Committee evaluated the available data and concluded that the data did not provide evidence for the carcinogenicity of fluridone in either rats or mice.

Endothall Toxicity

Endothall is an herbicide approved by the EPA for the treatment of aquatic weeds, including *Hydrilla verticillata*. The EPA classifies endothall as a dermal irritant and sensitizer, although dermal and ocular effects are generally only observed after exposure to concentrated endothall products. In intermediate oral exposure tests, body weight gain effect NOAELs were determined to be 39 and 11.7 mg/kg/day for rats and dogs, respectively. In developmental toxicity studies in rats, maternal toxicity was not observed at 12.5 mg/kg/day, and no adverse developmental effects were seen at the highest tested dose of 25 mg/kg/day. In rat reproductive studies, proliferative lesions of the gastric epithelium were seen in the parents at 2 mg/kg/day, the lowest dose tested. Reproductive toxicity manifested as decreased pup weights was observed at 60 mg/kg/day, with the NOAEL determined to be 9.4 mg/kg/day. Gastric epithelial hyperplasia was observed in dogs in a chronic toxicity study at 6.5 mg/kg/day, the lowest dose tested. The EPA's chronic reference dose for endothall via ingestion was developed from the 2-generation reproduction toxicity study in rats that showed proliferative lesions of the gastric epithelium at 2 mg/kg/day (Table 9). The U.S. EPA applied a safety factor of 300 for extrapolation from lowest observed adverse effects level (LOAEL) to NOAEL as well as inter- and intra-species variation, resulting in the 0.007 mg/kg/day RfD for chronic exposure to endothall (EPA 2005).

In accordance with the 1999 Draft Guidelines for Cancer Risk Assessments, the Hazard Identification Assessment Review Committee (HIARC) within the EPA classified endothall as “not likely to be carcinogenic to humans” based on the lack of evidence of carcinogenicity in mice or rats.

Exposure Assessment for the Eno River

For all chemicals, exposure routes that were considered are incidental ingestion of river water and dermal contact while swimming, drinking municipal water contaminated with the herbicide, and ingesting fish caught from the treatment area (Table 1). Additionally, the following assumptions were made concerning the potentially exposed populations for all exposure scenarios (see also Table 3):

- Swimming frequency was assumed to be 3 hours per day, two days per week, for the duration of the treatment period (4 months for fluridone and 1.5 months for endothall).

- For incidental ingestion of water while swimming, the 95th percentile ingestion rate was used for each age group.
- For dermal exposure while swimming, the 95th percentile for skin surface area was used for each age group.
- For ingestion of tap water, the 95th percentile ingestion rate was used for each age group.
- For fish ingestion by adult consumers, an intake rate of 170 g/day was used, which is consistent with subsistence populations, not general anglers. This ingestion rate is consistent with the current N.C. DPH exposure parameters for health risk associated with fish ingestion.
- For fish ingestion by children, an intake rate of 16.5 g/day was used, which is consistent with the EPA's Exposure Factor Handbook (2011) 95th percentile intake rate for children aged 0-9 years.
- For all adult dose calculations, a body weight of 70 kg was used.
- Sensitive populations considered were pregnant females, bottle-fed infants from birth to <1 year old, and children aged 2 to <6 years old. Infants exposed via contaminated drinking water receive the maximum estimated dose of any age group due to their high ingestion rate relative to their small body size. The 2 to <6 year age range was chosen due to their smaller size and behavioral differences (i.e. higher incidental ingestion rates), which results in exposure dose estimates that are likely higher than those received by older children.
- Infants less than a year old were assumed to be exposed via the drinking water pathway only. Infants less than a year are unlikely to go swimming in a river system, and are unlikely to consume fish.

Note that these assumptions are health-protective in that they will likely result in an overestimate of dose received by the exposed populations. Equations used to calculate estimated doses can be found in Appendix A. Estimated doses were compared to the relevant EPA chronic reference dose (RfD) for each compound. The RfD is an estimate of daily exposures to a substance that is likely to be without a discernable risk of non-cancer adverse effects to the general human population, including sensitive subgroups, during a lifetime of exposure.

Fluridone exposure assessment

For fluridone dose calculations, the following chemical specific exposure scenario assumptions were made (see also Table 2):

- Concentration of fluridone in the water (both swimming and drinking) was assumed to be 150 µg/L, which is the maximum application rate. In reality, the target application rate is 30 times lower at 5 µg/L.
- For ingestion of tap water, fluridone concentration was assumed to be 150 µg/L. In reality, the maximum allowed application rate within 0.25 miles of a potable water intake is 20 µg/L, and the target application rate is 5 µg/L.

- For fish ingestion, the concentration in fish tissue was assumed to be 0.5 mg/kg, which is the residue tolerance level.

Assuming the highest application rate of the herbicide, in addition to assuming high ingestion rates of water and fish, result in what is likely to be a high overestimation of the dose of fluridone that the exposed populations receive. These assumptions were made in order to safeguard public health.

Recreational User Fluridone Exposure

For recreational users of the Eno River, the likely exposure routes would be incidental ingestion and dermal contact with the water while swimming and ingestion of fish caught in the Eno. Estimated exposure doses received via incidental ingestion while swimming in treated water range from 0.00004 to 0.0003 mg/kg/day. Estimated exposure doses via dermal contact while swimming range from 0.00002 to 0.00003 mg/kg/day. Consumption of fish caught in treated waters yields an estimated fluridone exposure dose of 0.0005 to 0.0012 mg/kg/day.

Cumulatively, the maximum estimated fluridone dose received by recreational users range from 0.0008 – 0.0013 mg/kg/day, which is 117-188 times lower than the EPA's chronic reference dose (RfD) of 0.15 mg/kg/day. It is important to note that the RfD is developed to consider daily doses over a lifetime of exposure that are anticipated to result in no adverse health effects.

Estimated exposure doses for recreational users exposed to the Eno River treated at the target fluridone application rate range from 0.0005 to 0.0012 mg/kg/day, 123-300 times lower than the RfD. We conclude that exposure to fluridone in the Eno River by recreational users is unlikely to result in adverse health effects.

Municipal Water User Fluridone Exposure

Municipal water users include people exposed via ingestion of tap water at their homes or businesses. The maximum estimated fluridone dose received by municipal water users range from 0.005-0.022 mg/kg/day, which is 7-28 times lower than the EPA's chronic RfD of 0.15 mg/kg/day. It is important to note that in order to remain health-protective in our assessment, these dose estimates were calculated assuming a fluridone concentration of 150 µg/L, which is much higher than both the allowable application rate near potable water intakes (20 µg/L) and the target application rate (5 µg/L). Estimated exposure doses at the target application rate range from 0.0002 to 0.0007 mg/kg/day, 210-845 times lower than the RfD, and the RfD is protective of daily lifetime exposure. We conclude that exposure to fluridone via municipal water drawn from the Eno River during treatment is unlikely to result in adverse health effects.

Aggregate Fluridone Exposure

In the unlikely scenario that a person is exposed to the maximum levels of fluridone through recreational activities as well as municipal water supplies, the total estimated dose received via all four pathways remains more than an order of magnitude lower than the EPA's chronic

reference dose (RfD) for daily lifetime exposure of 0.15 mg/kg/day (Table 4), with the exception of bottle-fed infants less than a year old. The estimated exposure dose for infants exposed to fluridone in drinking water at the maximum application rate remains below the RfD. Using the anticipated fluridone application rate of 5 µg/L, the total estimated dose received is 105-210 times lower than the RfD (Table 5). Removing exposure via fish ingestion, the estimated dose is 210-840 times lower than the RfD. We conclude that the use of fluridone in the Eno River at the recommended application concentration for the control of *Hydrilla verticillata* is unlikely to cause any negative health effects and thus does not pose a public health hazard.

Fluridone-related Chemical Exposure

Consideration was given to two other compounds associated with fluridone use: propylene glycol and N-methyl formamide (NMF). Propylene glycol is listed as an inert ingredient on the Sonar Genesis® label, and NMF is the primary degradation product of fluridone. Except for chemical specific parameters (Table 2), all other exposure parameters used for propylene glycol and NMF dose calculations were the same values used for fluridone dose estimates (Table 3), again resulting in a likely overestimation of exposure dose.

For propylene glycol, it was assumed that the product applied was 60% propylene glycol and 5% active ingredient, which yields a maximum application concentration of 1.8 mg propylene glycol/L. The maximum estimated aggregate doses of propylene glycol are 78-300 times lower than the RfD of 20 mg/kg/day. Using the anticipated application rate of the product (0.005 mg/L of active ingredient, yielding a propylene glycol concentration of 0.06 mg/L), total estimated doses are 2300-6000 times lower than the RfD.

For NMF analysis, the maximum daily fluridone to NMF conversion rate of 74% was assumed, resulting in a maximum NMF concentration of 19.91 µg/L after correcting for molecular weight. Using this concentration, calculated maximum estimated cumulative doses of NMF are 35-60 times lower than the RfD of 0.10 mg/kg/day. The anticipated application rate of the product (5 µg/L) yields a NMF concentration of 0.664 µg/L. With this more realistic concentration, total estimated doses of NMF received by populations exposed to treated water are 80-1000 times lower than the RfD.

We conclude that the use of fluridone in the Eno River at the recommended application concentration for the control of *Hydrilla verticillata* is unlikely to result in chemical exposures that have adverse public health consequences.

Endothall exposure assessment

For endothall dose calculations, the following chemical specific exposure scenario assumptions were made (see also Table 2):

- Concentration of endothall in the water (both swimming and drinking) was assumed to be 5 mg/L, which is the maximum application rate.
- For ingestion of tap water, endothall concentration was assumed to be 5 mg/L. In reality, the maximum contaminant level (MCL) is 0.1 mg/L.
- For fish ingestion, the concentration in fish tissue was assumed to be 0.1 mg/kg, which is the residue tolerance level.

Assuming the highest application rate of the herbicide, in addition to assuming high ingestion rates of water and fish, result in what is likely to be an overestimation of the dose of endothall that the exposed populations receive. These assumptions were made in order to safeguard public health.

Recreational User Endothall Exposure

For recreational users of the Eno River, the likely exposure routes would be incidental ingestion and dermal contact with the water while swimming and ingestion of fish caught in the Eno. Estimated exposure doses received via incidental ingestion while swimming in treated water range from 0.0005 to 0.003 mg/kg/day. Estimated exposure doses via dermal contact while swimming range from 0.000001 to 0.000002 mg/kg/day. Consumption of fish caught in treated waters yields an estimated fluridone exposure dose of 0.00009 to 0.0002 mg/kg/day. Cumulatively, the maximum estimated endothall dose received by recreational users of the Eno ranged from 0.0008-0.0038 mg/kg/day, which is 1.8-9 times lower than the EPA's chronic reference dose of 0.007 mg/kg/day. It is important to note that the RfD is developed to compare daily lifetime exposures to a chemical, whereas exposure to endothall in the Eno River is likely to occur only intermittently. We conclude that recreational users of the Eno River who do not drink municipal water drawn from the treatment area are unlikely to be at risk of adverse health effects from endothall exposure.

Municipal Water User Endothall Exposure

Municipal water users include people exposed via ingestion of tap water at their homes or businesses. The maximum estimated endothall dose calculated for municipal water users range from 0.177-0.713 mg/kg/day, which is 25-102 times higher than the chronic RfD. However, these doses were calculated using a water concentration of 5 mg/L, the maximum allowed application rate. The maximum contaminant level (MCL) for endothall is 0.1 mg/L, set by the EPA as an enforceable public drinking water regulation that is protective of public health while considering economic and technological constraints. Using a drinking water concentration of 0.1 mg/L, estimated endothall doses range from 0.0035-0.014 mg/kg/day. The estimated exposure dose for bottle-fed infants under the age of one is two times the RfD, indicating the possibility for adverse health effects for this population. We recommend that if endothall is used in the Eno River, downstream drinking water intakes should be frequently monitored (i.e. daily during treatment and 15 days post-treatment) to ensure that endothall is not present.

Aggregate Endothall Exposure

In the unlikely scenario that a person is exposed to the maximum levels of endothall through recreational activities as well as municipal water supplies, the total estimated dose received through all four pathways ranged from 0.18-0.71 mg/kg/day, which is 25-102 times higher than the EPA chronic RfD of 0.007 mg/kg/day (Table 7). It is important to note that the RfD is developed to compare daily lifetime exposures to a chemical, whereas exposure to endothall in the Eno River is likely to occur only intermittently.

A second endothall exposure scenario was considered to more accurately reflect the expected exposure conditions that will be experienced at the Eno River. In this scenario more realistic exposure concentrations of 3 mg/L in swimming water and 0.1 mg/L in drinking water were used. 3 mg/L is the application rate used by other entities for hydrilla management, and 0.1 mg/L is the MCL set by the EPA for endothall residues in drinking water. To remain health-protective, all other assumptions listed above were still used, including 95th percentile skin surface areas, 95th percentile water intake rates, fish ingestion rates by adults of 170 g/day, as well as a body weight of 70kg for adults. Using this more realistic, but still health protective, approach, the doses of endothall exposed populations are expected to receive range from 0.6-2 times the RfD of 0.007 mg/kg/day (Table 8). The highest estimated dose is 0.014 mg/kg/day, which is still likely to be an overestimate of the dose received by exposed populations due the conservative assumptions made regarding water ingestion rates. The RfD was developed considering a daily exposure to endothall over a lifetime, but the health effects seen in toxicity studies with rats occurred after an intermediate exposure period of 13 weeks. The estimated dose received by bottle-fed infants using municipal water from a source downstream of treatment represents a possible health risk.

We conclude that use of endothall in the Eno River for management of *Hydrilla verticillata* may have a small risk of resulting in negative public health effects, particularly for small children who may receive the highest dose, or for other subpopulations with particular susceptibilities such as pre-existing skin conditions or gastrointestinal issues. In addition, dogs show particular sensitivity to the adverse effect of endothall ingestion and their exposure may be a concern during the Eno River Festival or associated with nearby recreational areas. In order to consider a more accurate exposure scenario, we are requesting more information from the task force regarding the target application concentration, as well as application duration and frequency. We also request information regarding the river flow rate to determine the amount of time it will take endothall-treated water to flow from the application site to the nearest downstream drinking water intake in order to better estimate the drinking water concentration.

Child Health Considerations

The N.C. DPH recognizes there are unique exposure risks concerning children that do not apply to adults. Children are at a greater risk than are adults to certain kinds of exposures to hazardous

substances. Because they play outdoors and because they often carry food into contaminated areas, children are more likely to be exposed to contaminants in the environment. They are also smaller, resulting in higher doses of chemical exposure per body weight compared to adults. If toxic exposures occur during critical growth stages, the developing body systems of children can sustain permanent damage. Probably most important, however, is that children depend on adults for risk identification and risk management, housing, and access to medical care. Thus, adults should be aware of public health risks in their community, so they can guide their children accordingly. Child-specific exposure situations and health effects are taken into account in N.C. DPH health effect evaluations.

In this assessment, exposure dose estimates were calculated for infants and small children at an age range anticipated to experience the highest doses and to ensure that this population was not at an unacceptable risk level for exposure to the proposed herbicides. To remain health-protective of this population, 95th percentile or reasonable maximum exposure factors were used when estimating exposure doses to all chemicals (Table 3) (ATSDR 2014a; ATSDR 2014b; EPA 2011).

Conclusions

Conclusion 1: The use of fluridone in the Eno River, even at the maximum application rate, is unlikely to pose a risk to public health.

Basis for conclusion 1: Using an exposure scenario which likely overestimates the potential dose of fluridone received by exposed populations, including sensitive subpopulations, maximum exposure doses are nearly an order of magnitude lower than the RfD of 0.15 mg/kg/day (Table 4). Additionally, using the same health-protective exposure scenario, estimated doses of fluridone related chemicals (propylene glycol and N-methyl formamide) were 35-300 times lower than their respective RfD values.

Recommendation 1a: Drinking water intakes downstream from fluridone treatment should be frequently monitored to ensure that fluridone concentrations do not surpass label permitted application rates of 20 µg/L at potable water intakes, as drinking water accounted for the largest dose under most exposure scenarios considered. The ERHM Task Force has already stated a plan to sample near the start, middle, and end of the treatment zone every 1 to 2 weeks following more frequent testing during the first week of the treatment process.

Recommendation 1b: The ERHM Task Force should ensure that access is restricted to the herbicide drip infusion system. Restricting access will ensure that the general population is not exposed to the likely higher concentrations of herbicide located directly at the application point. Additionally, controlling access will prevent tampering with the drip infusion system. Any unauthorized tampering may result in unpredictable fluridone concentrations within the water body.

Recommendation 1c: The ERHM Task force should ensure that residents in homes near the drip infusion system are informed about the project, any potential risks, and how to reduce their exposure to the treated water. This includes advice to limit swimming and fishing immediately downstream from the system, not using treated water to irrigate home gardens, and using municipal water supplies for drinking, bathing, and cooking.

Conclusion 2: The use of endothall may pose a public health risk, especially for small children. Every effort should be made to ensure that drinking water sources are not contaminated with endothall. More information is needed from the task force on target concentrations and application duration and frequency.

Basis for conclusion 2: Using a conservative endothall exposure scenario and the maximum application rate, calculated exposure doses exceeded the RfD of 0.007 mg/kg/day, with the highest doses calculated for infants aged birth to <1 year old (Table 7). A more realistic scenario resulted in a maximum estimated dose two times higher than the RfD (Table 8), but assumptions were made regarding the application concentration and duration for this scenario. To ensure this scenario is realistic, confirmation of application rates is needed from the task force.

Recommendation 2a: Drinking water intakes downstream from endothall treatment should be frequently monitored to ensure that endothall is not in the municipal water, as this exposure route accounted for the largest dose under every exposure scenario considered. The ERHM Task Force has already stated a plan to sample near the start, middle, and end of the treatment zone every 1 to 2 weeks following more frequent testing during the first week of the treatment process. We recommend that the ERHM Task Force also coordinate with local water treatment plants to ensure proper monitoring and treatment plans are in place.

Recommendation 2b: Signs should be posted at popular recreational areas along the treated areas of the Eno River, warning of potential adverse health effects associated with endothall exposure. These signs may also include a warning for dog owners that dogs may be more sensitive to the effects of endothall ingestion. Other means to ensure that recreational users and subsistence fisher users of the Eno River are aware of the pesticide treatments should be made.

Recommendation 2c: Swimming should be restricted in the treatment areas for at least 24-hours after endothall application. The EPA identifies risk estimates on the day of application to be the key concern for recreational endothall exposure (EPA 2005). Additionally, a 24-hour swimming restriction is consistent with Special Local Need (SLN) labels for endothall use imposed by other states and will protect the public from exposures to the highest levels of the herbicide (NY 2008; Tomkins Co. 2013).

Recommendation 2d: The ERHM Task Force should ensure that access is restricted to the herbicide drip infusion system. Restricting access will ensure that the general population is not exposed to the likely higher concentrations of herbicide located directly at the application point. Additionally, controlling access will prevent tampering with the drip infusion system. Any

unauthorized tampering may result in unpredictable endotoxin concentrations within the water body.

Recommendation 2e: The ERHM Task force should ensure that residents in homes near the drip infusion system are informed about the project, any potential risks, and how to reduce their exposure to the treated water. This includes advice to avoid swimming and fishing immediately downstream from the system, not using treated water to irrigate home gardens, and using municipal water supplies for drinking, bathing, and cooking.

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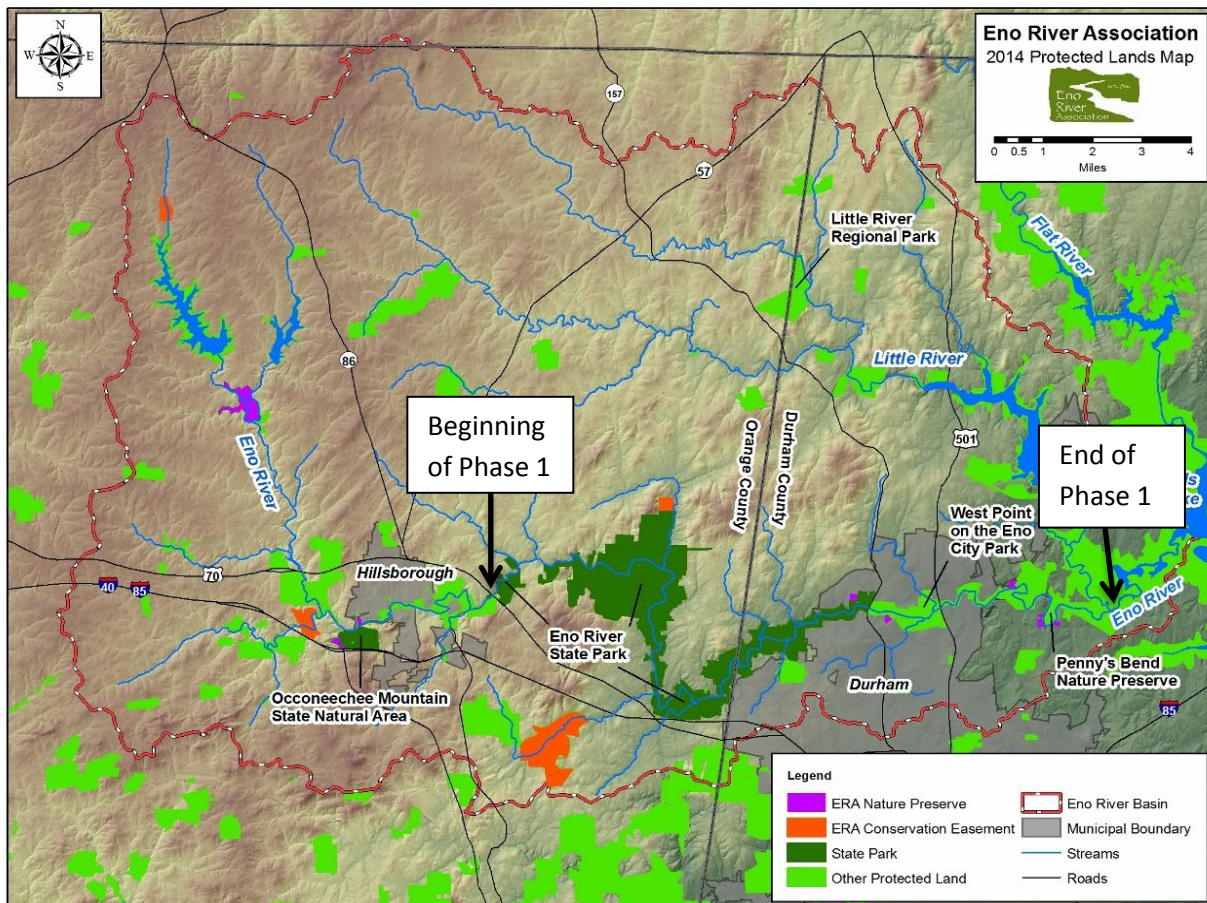


Figure 1. Map of the Eno River and the proposed treatment area (Hydrilla Task Force 2015).

Table 1. Conceptual site model for Eno River hydrilla management exposure pathways.

Source	Environmental medium and transport	Exposure point	Exposure route	Potentially exposed populations
Herbicide applied for hydrilla management	Water	Eno river water	Incidental ingestion	Swimmers – adult and child
			Dermal contact	
		Public water supply	Ingestion	Municipal residents
	Biota	Fish caught in river	Ingestion	Recreational and subsistence fishermen and their families

Table 2. Chemical specific exposure parameters used to calculate estimated exposure doses for Eno River Hydrilla management herbicides.

Chemical	Maximum application rate (mg/L) ^a	Anticipated application rate (mg/L) ^a	EPA maximum contaminant level (mg/L)	Application duration (months)	Fish residue tolerance level (mg/kg)	Permeability coefficient (K _p) (cm/hr)
Fluridone	0.15	0.005	NA ^b	4	0.5	0.0004
Endothall	5	3	0.1	1.5	0.1	0.000000882
N-methyl formamide ^c	0.0199	0.00066	NA	4	NA	0.00017
Propylene glycol ^d	1.8	0.06	NA	4	NA	0.0000948

Note: mg/L = milligram of compound per liter of water; mg/kg = milligram of compound per kilogram of fish tissue; K_p = partition coefficient for dermal exposure; cm/hr = centimeter per hour

- In text, fluridone application rates are given in µg/L. The conversion factor is 1000 µg/L = 1 mg/L.
- NA = Not applicable. MCL for that compound has not been set by the EPA
- NMF is the primary degradation product of fluridone. Application rates were calculated based on a maximum daily conversion rate of 74% and corrected for molecular weight.
- Propylene glycol is listed as an inert ingredient on the Sonar Genesis® label (fluridone). Application rates were calculated assuming the product was 5% active ingredient (minimum listed on label) and 60% propylene glycol (maximum listed on label).

Table 3. Population specific exposure parameters used to calculate estimated exposure doses of herbicides proposed for Eno River hydrilla management.

Population	Body weight (kg)	Drinking water ingestion rate (L/day) ^a	Swimming water ingestion rate (L/hr) ^a	Skin surface area (cm ²) ^b	Fish intake rate (g/day) ^c
Infants Birth to <1 year ^d	7.8	1.113	NA ^e	NA ^e	NA ^e
Children 2 to <6 years	17.4	0.977	0.12	9500	16.5
Adults	70	3.092	0.071	24300	170
Pregnant women	73	2.589	0.071	24300	170

Note: kg = kilogram; L/day = liters of water consumed per day; L/hr = liters of water ingested per hour of swimming; cm² = square centimeters of skin exposed during swimming; g/day = grams of fish consumed per day

- Reasonable maximum exposure value for age group (ATSDR 2014a).
- EPA Exposure Factors Handbook Table 7-9: 95th percentile value for age group (EPA 2011).
- EPA Exposure Factors Handbook Table 10-13: 95th percentile value for children aged 0 to <9 years old (EPA 2011).
- This age range represents the maximum dose levels for health risk assessment. Refers to bottle-fed infants only.
- Infant exposure was assumed to occur only through the drinking water pathway.

Table 4. Aggregate estimated fluridone dose for populations potentially exposed to the Eno River during treatment, assuming fluridone is present in water at the maximum application concentration of 0.15 mg/L. Values in bold represent the exposure pathway with the highest estimated dose for each age group.

Exposed Person	Incidental water ingestion dose (mg/kg/day)	Dermal exposure dose (mg/kg/day)	Drinking water ingestion dose (mg/kg/day)	Fish ingestion dose (mg/kg/day)	Total Estimated Dose (mg/kg/day)	RfD (mg/kg/day)	Hazard Quotient (HQ) (total dose/RfD)
Infants Birth to <1 year	NA ^a	NA ^a	2.14E-02	NA ^a	0.0214	0.15	0.1427
Child 2 to <6 years	2.95E-04	2.84E-05	8.42E-03	4.74E-04	0.0092	0.15	0.0632
Adult	4.33E-05	1.80E-05	6.63E-03	1.21E-03	0.0079	0.15	0.0527
Pregnant female	4.15E-05	1.66E-05	5.32E-03	1.16E-03	0.0065	0.15	0.0436

Note: mg/kg/day = milligram of compound per kilogram of body weight per day

- Infant exposure was assumed to occur only through the drinking water pathway.

Table 5. Aggregate estimated fluridone dose for populations potentially exposed to the Eno River during treatment, assuming fluridone is present in water at the target application concentration of 0.005 mg/L. Values in bold represent the exposure pathway with the highest estimated dose for each age group.

Exposed Person	Incidental water ingestion dose (mg/kg/day)	Dermal exposure dose (mg/kg/day)	Drinking water ingestion dose (mg/kg/day)	Fish ingestion dose (mg/kg/day)	Total Estimated Dose (mg/kg/day)	RfD (mg/kg/day)	Hazard Quotient (HQ) (total dose/RfD)
Infants Birth to <1 year	NA ^a	NA ^a	7.13E-04	NA ^a	0.0007	0.15	0.0048
Child 2 to <6 years	9.82E-06	9.46E-07	2.81E-04	4.74E-04	0.0008	0.15	0.0052
Adult	1.44E-06	6.01E-07	2.21E-04	1.21E-03	0.0014	0.15	0.0096
Pregnant female	1.38E-06	5.53E-07	1.77E-04	1.16E-03	0.0013	0.15	0.0090

Note: mg/kg/day = milligram of compound per kilogram of body weight per day

a. Infant exposure was assumed to occur only through the drinking water pathway.

Table 6. Summary of toxicity tests used by the EPA for the human health risk assessment portion of the pesticide reregistration process for fluridone and used for development of reference dose (EPA 2005). The EPA RfD for fluridone is 0.15 mg/kg/day.

Exposure route	Time course	Species	Endpoint	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Study Year
Dermal	Intermediate (3-weeks)	Rabbit	Decreased kidney weights	384	768	1981
Oral	Intermediate (90-day)	Mice	Increased centrilobular hypertrophy of the liver	15	25	1978
		Rat	Increased liver and kidney weights	25	44	1978
		Dog	No effects observed	>250	ND ^a	1978
	Chronic (2 - year)	Rat	Decreased body weights; increased liver and kidney weights	7.65	25.15	1980
		Mouse	Increase alkaline phosphatase activity; increased incidence of hepatocellular hyperplasia	15 ^b	50	1981-1982
	Chronic (1-year)	Dog	Increased liver weights; increased alkaline phosphatase activity	150	400	1981
	Chronic (3-generation)	Rat	Decreased pup weight	36	112	1980
			No parental, reproductive, or developmental effects observed	112	ND	

Note: mg/kg/day = milligram of compound per kilogram of body weight per day

a. ND = Not determined. The highest dose tested resulted in no observed effects.

b. Value for the most sensitive endpoint from studies and endpoint used to develop chronic reference dose (RfD).

Table 7. Aggregate estimated endothall dose for populations potentially exposed to the Eno River during treatment, assuming endothall is present in water at the maximum application concentration of 5 mg/L. Values in bold represent the exposure pathway with the highest estimated dose for each age group.

Exposed Person	Incidental water ingestion dose (mg/kg/day)	Dermal exposure dose (mg/kg/day)	Drinking water ingestion dose (mg/kg/day)	Fish ingestion dose (mg/kg/day)	Total Estimated Dose (mg/kg/day)	RfD (mg/kg/day)	Hazard Quotient (HQ) (total dose/RfD)
Infants Birth to <1 year	NA ^a	NA ^a	7.13E-01	NA ^a	7.13E-01	0.007	101.9
Child 2 to <6 years	3.68E-03	2.09E-06	2.81E-01	9.48E-05	0.285	0.007	40.65
Adult	5.42E-04	1.33E-06	2.21E-01	2.43E-04	0.222	0.007	31.66
Pregnant female	5.19E-04	1.22E-06	1.77E-01	2.33E-04	0.178	0.007	25.44

Note: mg/kg/day = milligram of compound per kilogram of body weight per day

a. Infant exposure was assumed to occur only through the drinking water pathway.

Table 8. Aggregate estimated endothall dose for populations potentially exposed to the Eno River during treatment, assuming endothall is present in swimming water at the anticipated application concentration of 3 mg/L and in drinking water at the MCL of 0.1 mg/L. Values in bold represent the exposure pathway with the highest estimated dose for each age group.

Exposed Person	Incidental water ingestion dose (mg/kg/day)	Dermal exposure dose (mg/kg/day)	Drinking water ingestion dose (mg/kg/day)	Fish ingestion dose (mg/kg/day)	Total Estimated Dose (mg/kg/day)	RfD (mg/kg/day)	Hazard Quotient (HQ) (total dose/RfD)
Infants Birth to <1 year	NA ^a	NA ^a	1.42E-02	NA ^a	1.42E-02	0.007	2.04
Child 2 to <6 years	2.21E-03	1.25E-06	5.61E-03	9.48E-05	7.92E-03	0.007	1.13
Adult	3.25E-04	7.95E-07	4.42E-03	2.43E-04	4.99E-03	0.007	0.71
Pregnant female	3.12E-04	7.31E-07	3.55E-03	2.33E-04	4.09E-03	0.007	0.58

Note: mg/kg/day = milligram of compound per kilogram of body weight per day

a. Infant exposure was assumed to occur only through the drinking water pathway.

Table 9. Summary of toxicity tests used by the EPA for the human health risk assessment portion of the pesticide reregistration process for endothall and used for development of reference dose (EPA 2005). The EPA RfD for endothall is 0.007 mg/kg/day.

Exposure route	Time course	Species	Endpoint	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Study Year
Dermal	Intermediate - 3 weeks	Rat	Decreased weight gain	ND ^a	30	1994
Oral	Intermediate – 90 days	Rat	Body weight deficits	39	118	1994
	Intermediate – 13 weeks	Dog	Decreased weight gain	11.7	27.5	1994
	Chronic (>1 year)	Rat	Maternal - Decreased weight gain	12.5	25	1993
			Developmental - no effects observed	25	ND	
			Parental - lesions of gastric epithelium	ND	2 ^b	1993 and 1995
			Reproductive - decreased pup weights	9.4	60	
		Dog	Gastric epithelial hyperplasia	ND	6.5	1987

Note: mg/kg/day = milligram of compound per kilogram of body weight per day

- a. ND = Not determined. Either the highest dose tested resulted in no observed effects, or the lowest dose tested caused adverse effects.
- b. Value for the most sensitive endpoint from studies and endpoint used to develop chronic reference dose (RfD).

Appendix A: Exposure Dose Equations

All equations used to estimate exposure dose for exposure to fluridone or endothall are shown below, and can also be found in the ATSDR Public Health Assessment Guidance Manual (ATSDR 2005). Chemical-specific values for use in these equations can be found in Table 2. Population-specific values for use in these equations can be found in Table 3 and are consistent with ATSDR guidance (ATSDR 2014a, ATSDR 2014b) and the EPA Exposure Factors Handbook (EPA 2011).

Ingestion of contaminants present in drinking water

Exposure doses for ingestion of contaminants present in drinking water are calculated using the maximum and anticipated concentrations of contaminants in milligrams per liter (mg/L). The following equation is used to estimate the exposure doses resulting from ingestion of contaminated drinking water:

$$ED_w = \frac{C \times IR \times EF}{BW}$$

Where:

ED_w = exposure dose water (mg/kg/day)
C = contaminant concentration (mg/L)
IR = intake rate of contaminated medium (liters/day)
EF = exposure factor (unitless) = 1 for drinking water
BW = body weight (kilograms)

Incidental ingestion of contaminants present in swimming water

Exposure doses for incidental ingestion of contaminants present in swimming water are calculated using the maximum and anticipated concentrations of contaminants in milligrams per liter (mg/L). The following equation is used to estimate the exposure doses resulting from incidental ingestion of contaminated water while swimming:

$$ED = \frac{C \times IR \times ET \times EF}{BW}$$

Where:

ED = exposure dose water (mg/kg/day)
C = contaminant concentration (mg/L)
IR = intake rate of contaminated medium (liters/hr)
ET = Event time (hours/day)
EF = exposure factor (unitless)
BW = body weight (kilograms)

Note:

$$EF = \frac{F \times ED}{AT}$$

Where:

F = Frequency of exposure (days/year)
ED = Exposure duration (years)
AT = Averaging time (ED x 365 days/year)

Note: In our fluridone exposure scenario, F = 34.64 days/year and ED = 7 years. For our endothall exposure scenario, F = 12.99 days/year and ED = 7 years.

Dermal contact with contaminants present in swimming water

Exposure doses for dermal contact with contaminants present in swimming water are calculated using the maximum and anticipated concentrations of contaminants in milligrams per liter (mg/L). The following equation is used to estimate the exposure doses resulting from dermal contact while swimming:

$$ED = \frac{C \times K_p \times SA \times ET \times CF}{BW}$$

Where:

- ED = exposure dose (mg/kg/day)
- C = contaminant concentration (mg/L)
- K_p = dermal permeability coefficient (cm/hr)
- SA = exposed body surface area (cm²)
- ET = exposure time (hours/day)
- CF = conversion factor (1 L/1000 cm³)
- BW = body weight (kg)

Note: ET = 0.866 hours/day for the purposes of this assessment.

Ingestion of contaminants present in biota (fish)

Exposure doses for ingestion of contaminants present in biota (specifically fish) are calculated using the tolerance residue level for fish tissue set by the U.S. EPA in units of milligram per kilogram (mg/kg). The following equation is used to estimate the exposure doses resulting from consumption of contaminated fish:

$$ED = \frac{C \times IR \times AF \times EF \times CF}{BW}$$

Where:

- ED = exposure dose (mg/kg/day)
- C = contaminant concentration (mg/kg)
- IR = intake rate of contaminated media (mg/day)
- AF = bioavailability factor (unitless)
- EF = exposure factor (unitless) = 1 for daily fish consumption
- CF = conversion factor (10⁻⁶ kg/mg)
- BW = body weight (kg)

Note: AF is assumed to equal 1 for the purposes of this assessment.

Appendix B: Glossary of Terms and Abbreviations

Absorption

The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute

Occurring over a short time [compare with chronic].

Acute exposure

Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Adverse health effect

A change in body function or cell structure that might lead to disease or health problems

Carcinogen

A substance that causes cancer.

Chronic

Occurring over a long time [compare with acute].

Chronic exposure

Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

cm/hr

Centimeter per hour. Unit used to express permeability coefficient (K_p)

Concentration

The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant

A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Dermal

Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact

Contact with (touching) the skin [see route of exposure].

Dose

The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Environmental media

Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism

Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA

United States Environmental Protection Agency.

Exposure

Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment

The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure pathway

The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

g/day

Grams per day. Unit used to express fish intake rate.

Hazard Quotient (HQ)

The ratio of an exposure level by a contaminant (e.g. maximum concentration or dose) to a screening value selected for the risk assessment for that substance (e.g. RfD, NOAEL, or LOAEL). If the

exposure level is higher than the toxicity value, then there is the potential for risk to the exposed population.

Ingestion

The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Intermediate duration exposure

Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

K_p

Dermal permeability coefficient of a compound in water. Expressed in units of centimeter of skin per hour of exposure time.

L/day

Liter per day. Unit used to express drinking water ingestion.

L/hr

Liter per hour. Unit used to express incidental ingestion of water while swimming.

Lowest-observed-adverse-effect level (LOAEL)

The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Maximum Contaminant Level (MCL)

The maximum level of certain contaminants permitted in drinking water supplied by a public water system as set by EPA under the federal Safe Drinking Water Act. MCLs ensure that drinking water does not pose either a short-term or long-term health risk. EPA sets MCLs at levels that are economically and technologically feasible.

mg/kg

Milligram (substance) per kilogram (tissue weight). Unit used to express contaminant concentration within an organism's tissue.

mg/kg/day

Milligram of substance per kilogram of body weight per day. Unit used to express exposure dose.

mg/L

Milligram (substance) per liter (water). Unit used to express contaminant concentration in water. 1 mg/L = 1000 µg/L.

No-observed-adverse-effect level (NOAEL)

The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

Point of exposure

The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population

A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Reference dose (RfD)

An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Route of exposure

The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Tolerance

Permissible residue level for pesticides in raw agricultural produce and processed foods. Whenever a pesticide is registered for use on a food or feed crop, a tolerance must be established. EPA establishes the tolerance levels, which are enforced by the Food and Drug Administration and the Department of Agriculture.

µg/L

Microgram (substance) per liter (water). Unit used to express contaminant concentration in water. $1000\ \mu\text{g/L} = 1\ \text{mg/L}$.

Uncertainty factor

Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

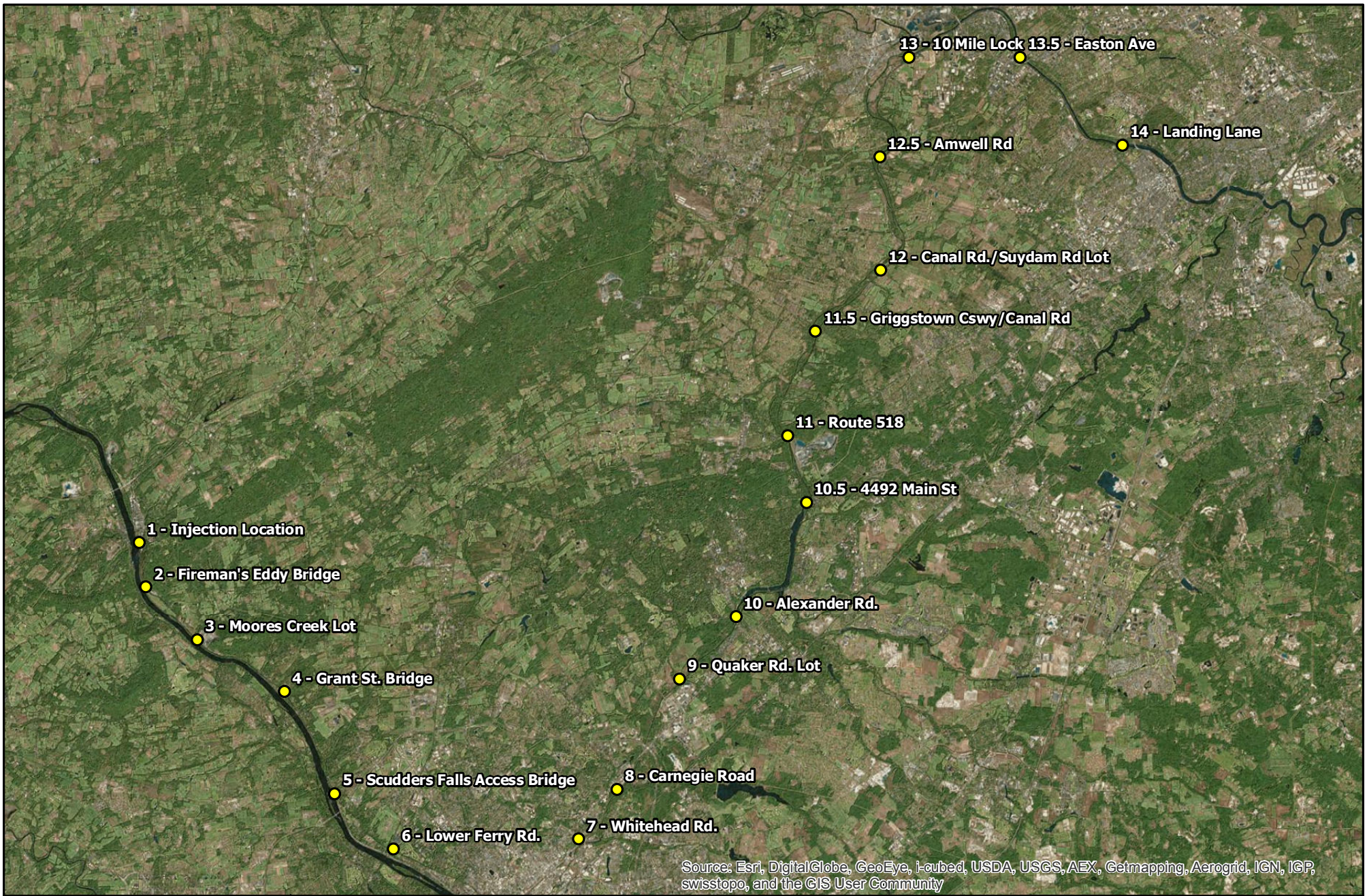
APPENDIX D:

2017 Dye Flow Study

2017 Dye Monitoring Sample Station Map

2017 Preliminary Dye Study Report

2017 Dye Results Map Compendium



SOLITUDE
LAKE MANAGEMENT

888.480.LAKE (5253)
www.solitudelakemanagement.com

D & R Canal Dye Study Monitoring Locations

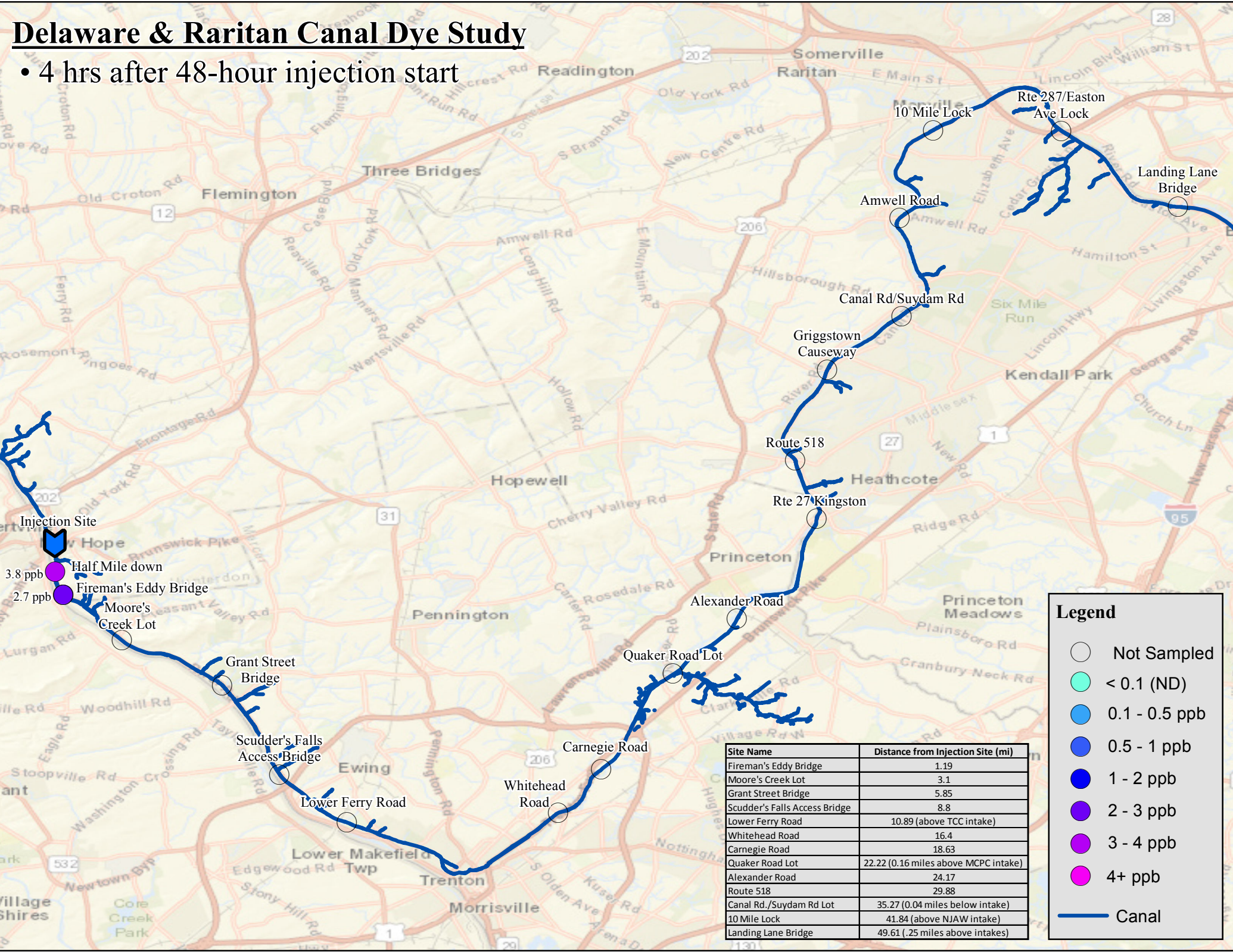


0 0.75 1.5 3
Miles

Date: 4/17/17, Rev 4/25/17
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Prepared by: KM
Office: Hackettstown, NJ

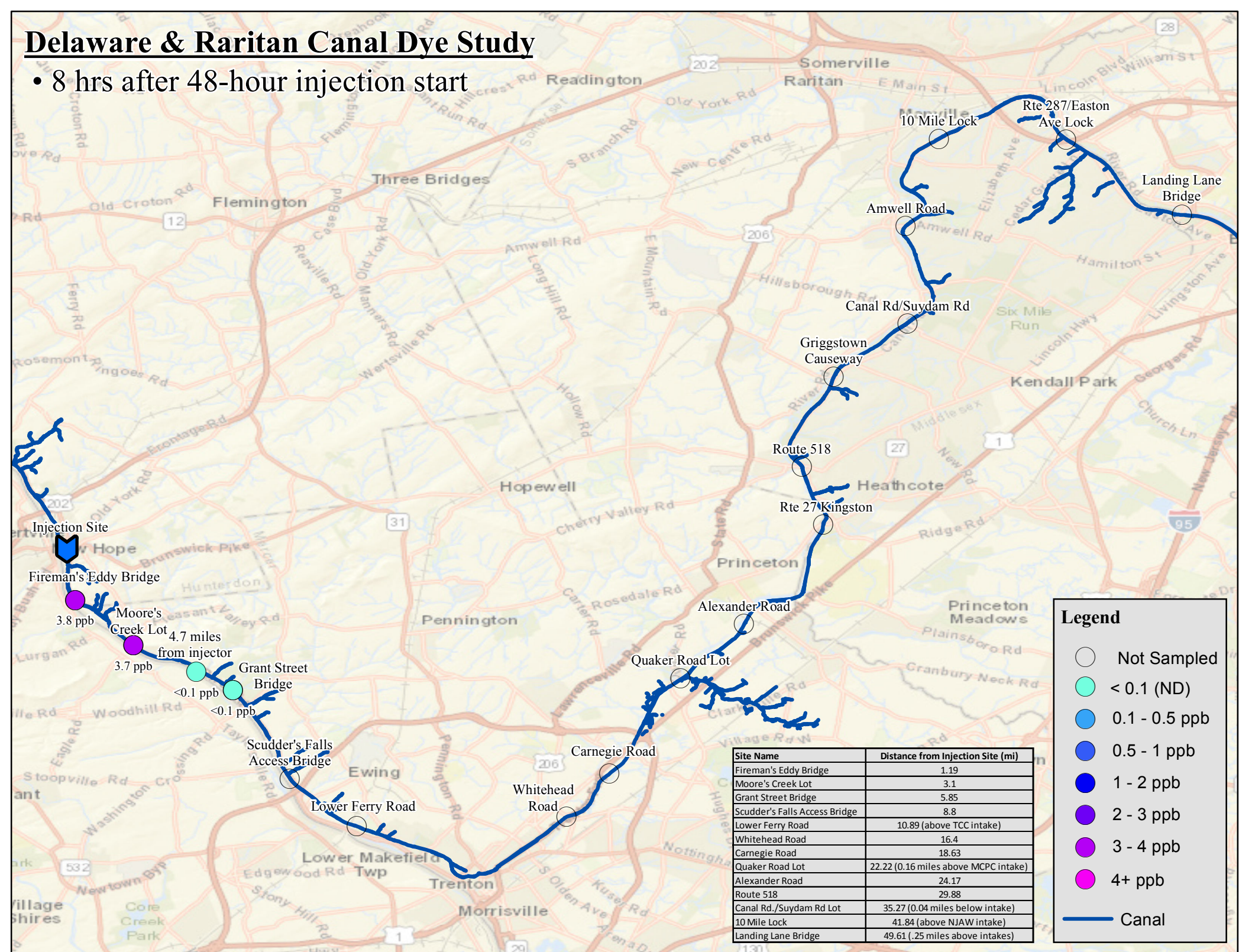
Delaware & Raritan Canal Dye Study

• 4 hrs after 48-hour injection start



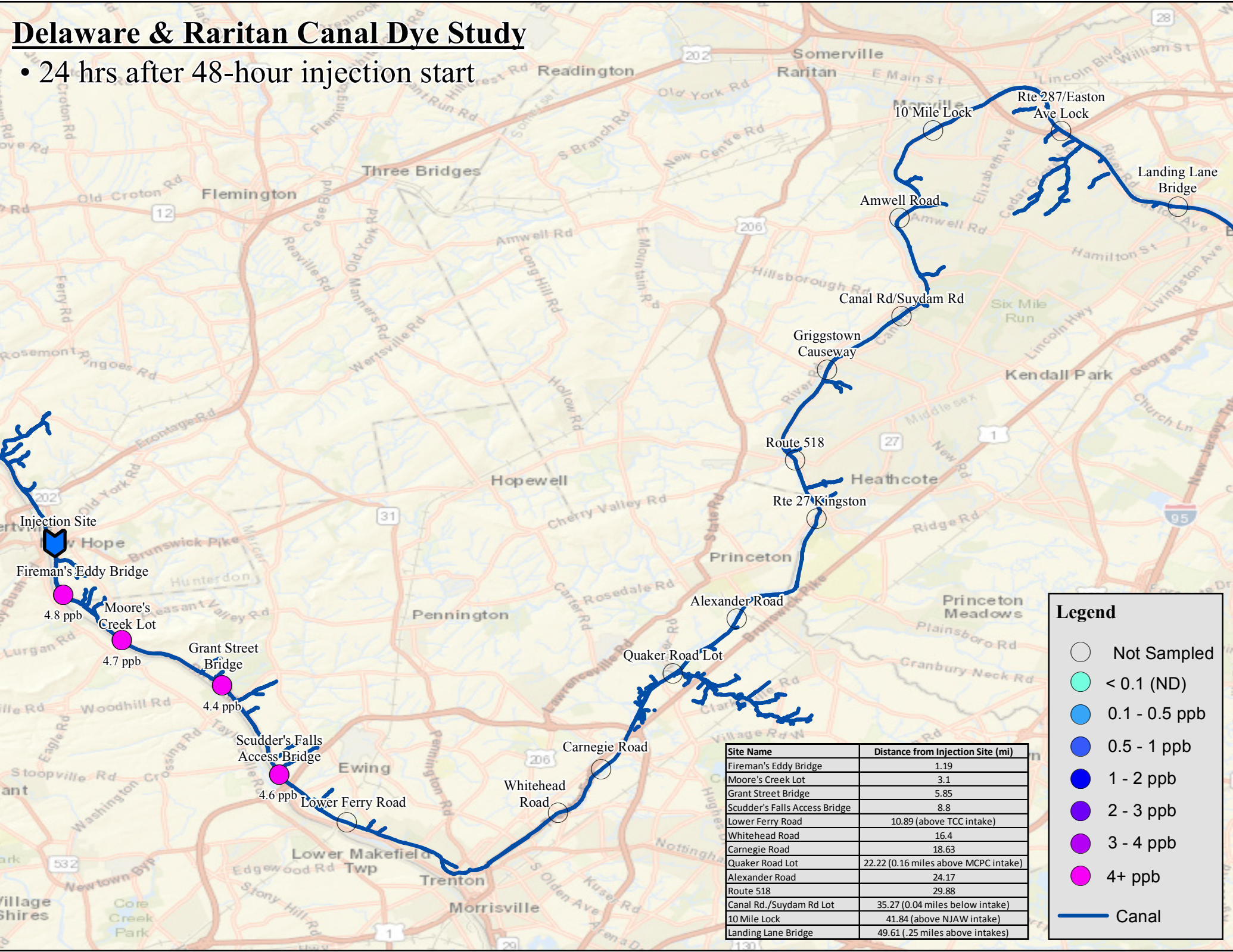
Delaware & Raritan Canal Dye Study

- 8 hrs after 48-hour injection start



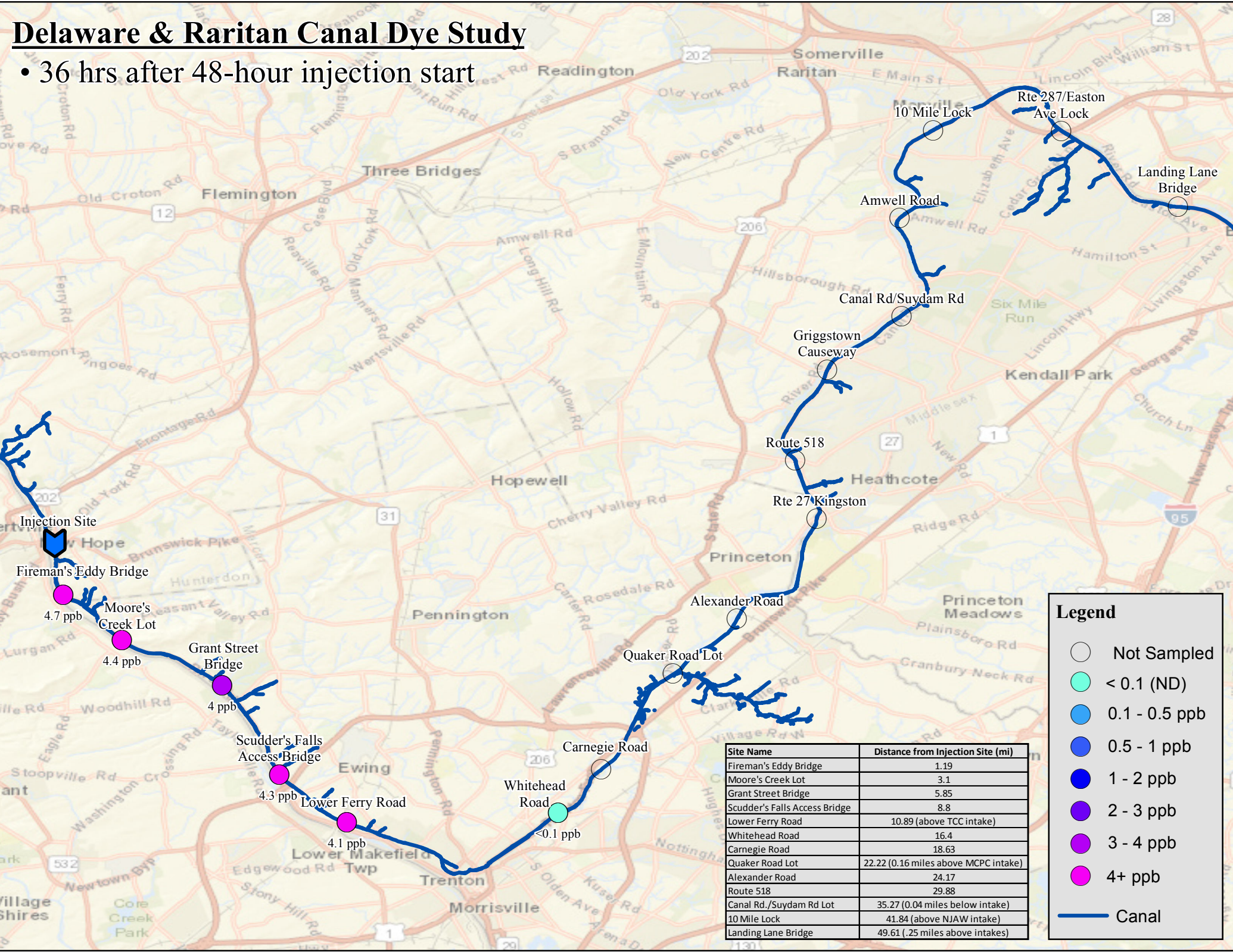
Delaware & Raritan Canal Dye Study

- 24 hrs after 48-hour injection start



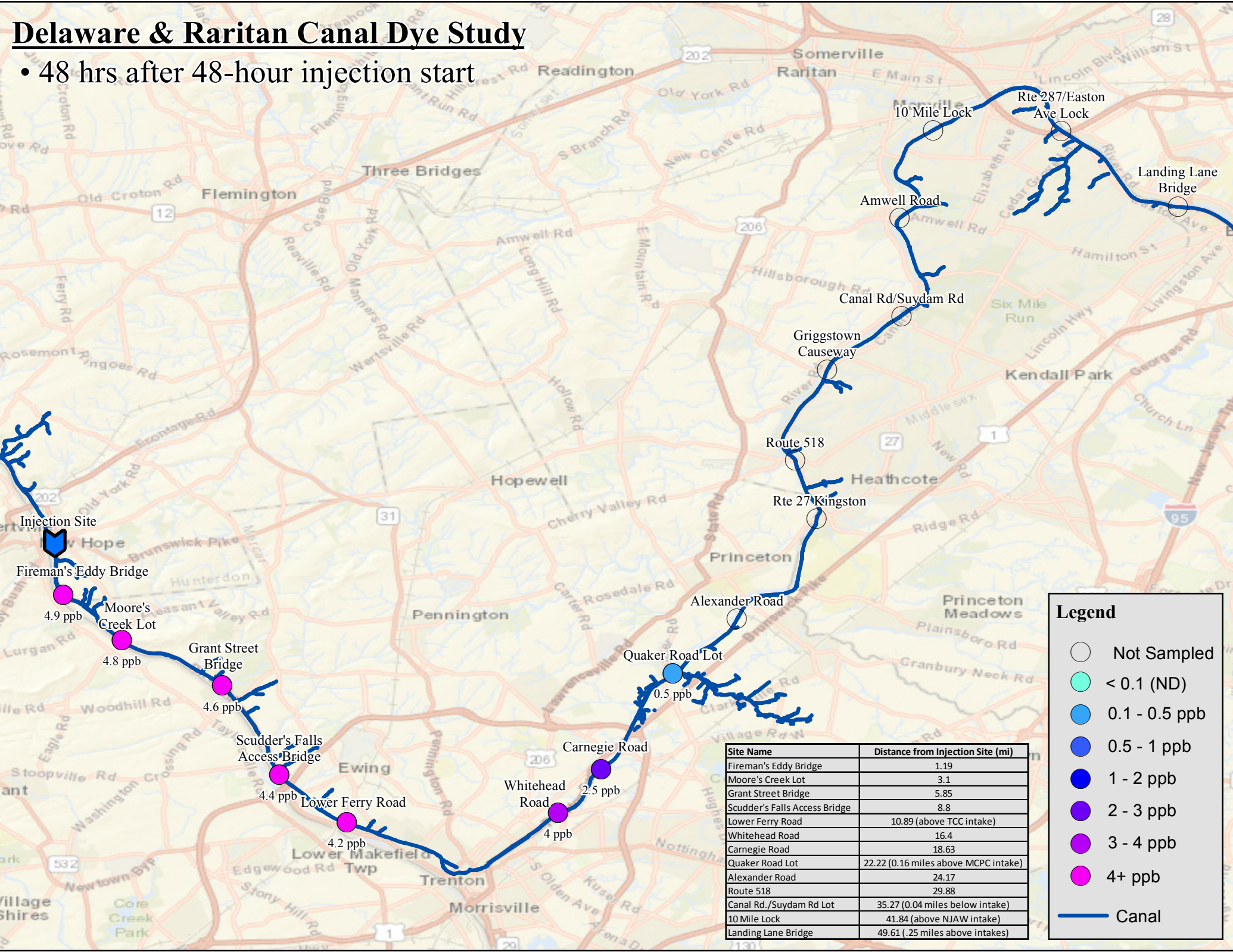
Delaware & Raritan Canal Dye Study

• 36 hrs after 48-hour injection start



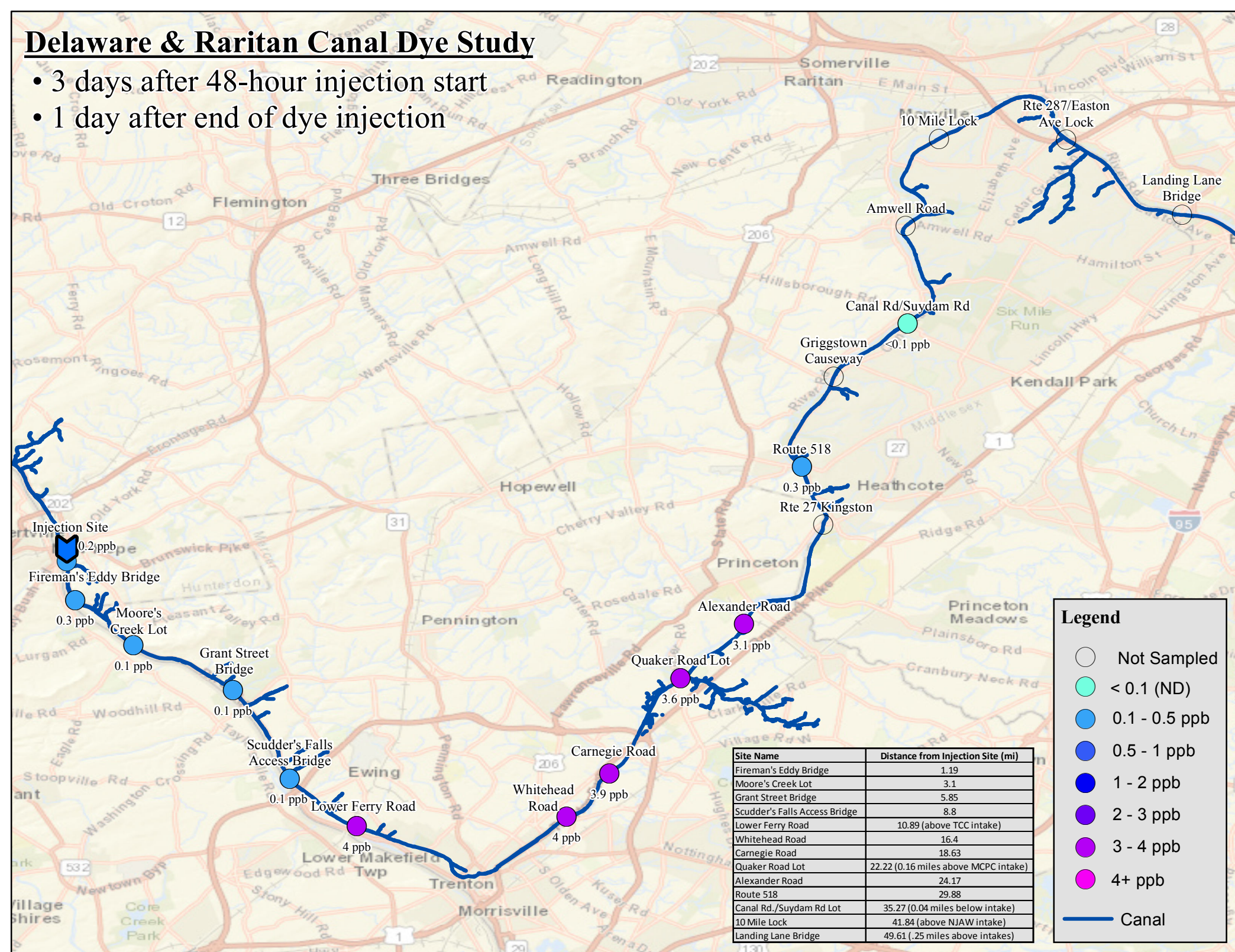
Delaware & Raritan Canal Dye Study

• 48 hrs after 48-hour injection start



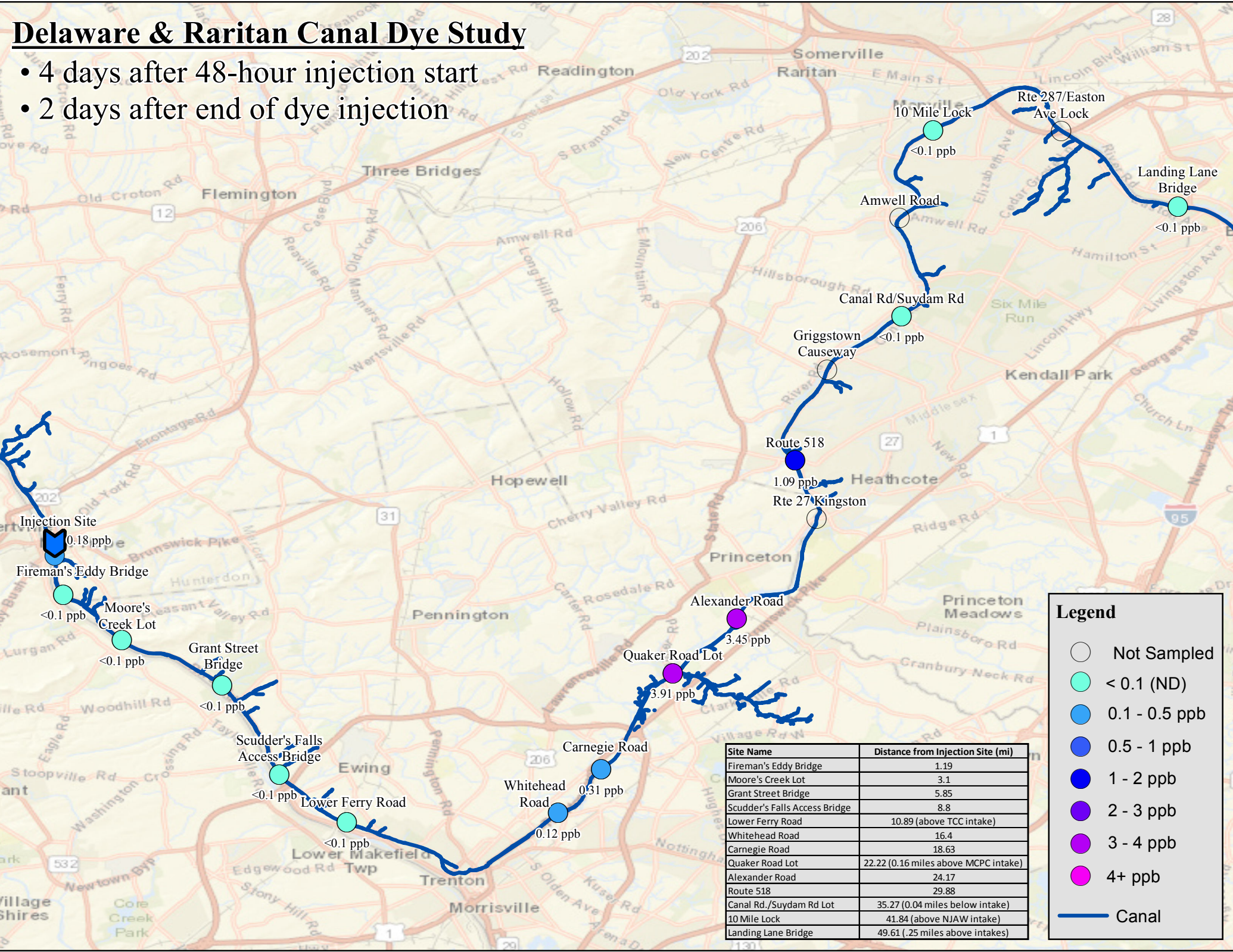
Delaware & Raritan Canal Dye Study

- 3 days after 48-hour injection start
- 1 day after end of dye injection



Delaware & Raritan Canal Dye Study

- 4 days after 48-hour injection start
- 2 days after end of dye injection

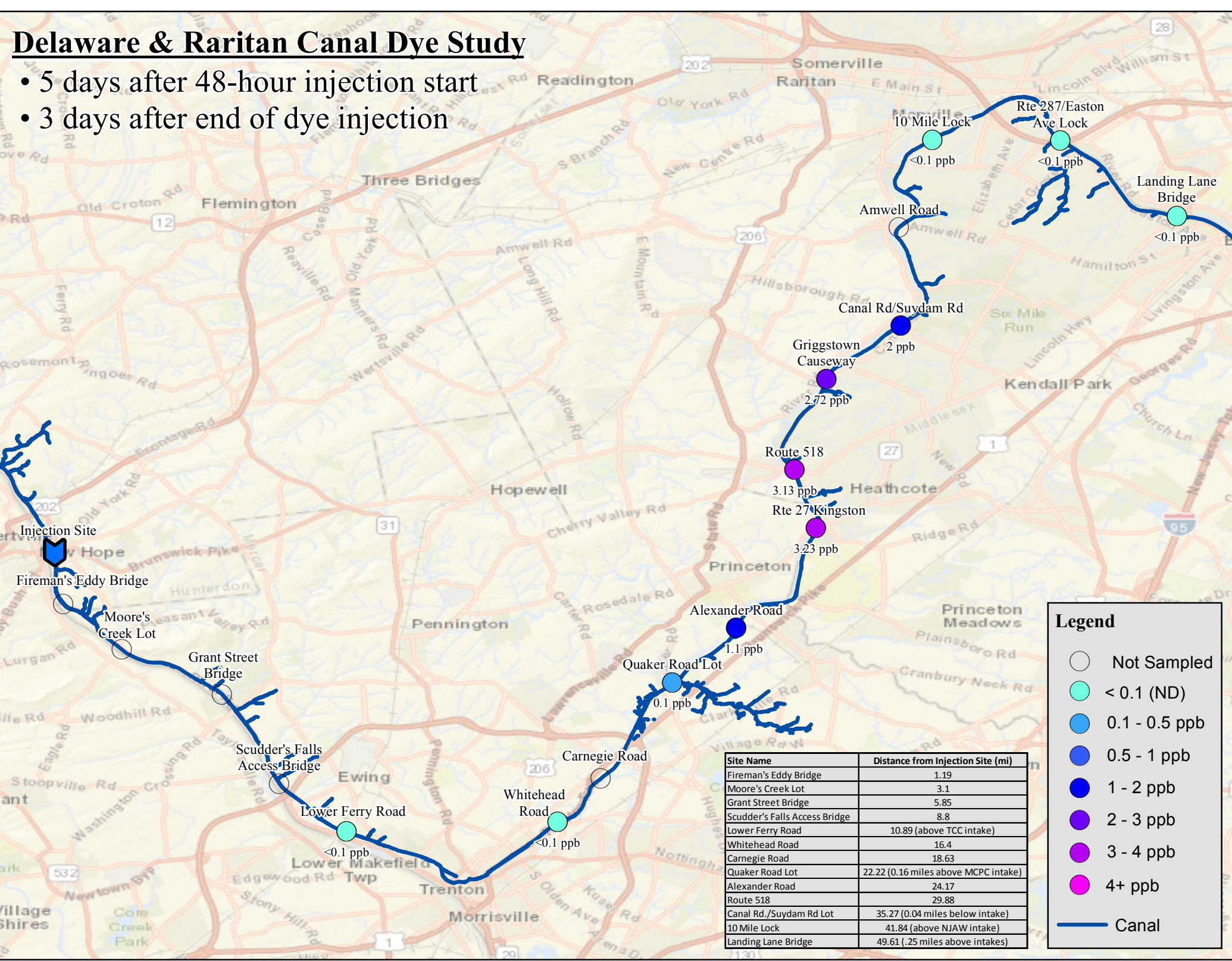


Legend

- Not Sampled
- < 0.1 (ND)
- 0.1 - 0.5 ppb
- 0.5 - 1 ppb
- 1 - 2 ppb
- 2 - 3 ppb
- 3 - 4 ppb
- 4+ ppb
- Canal

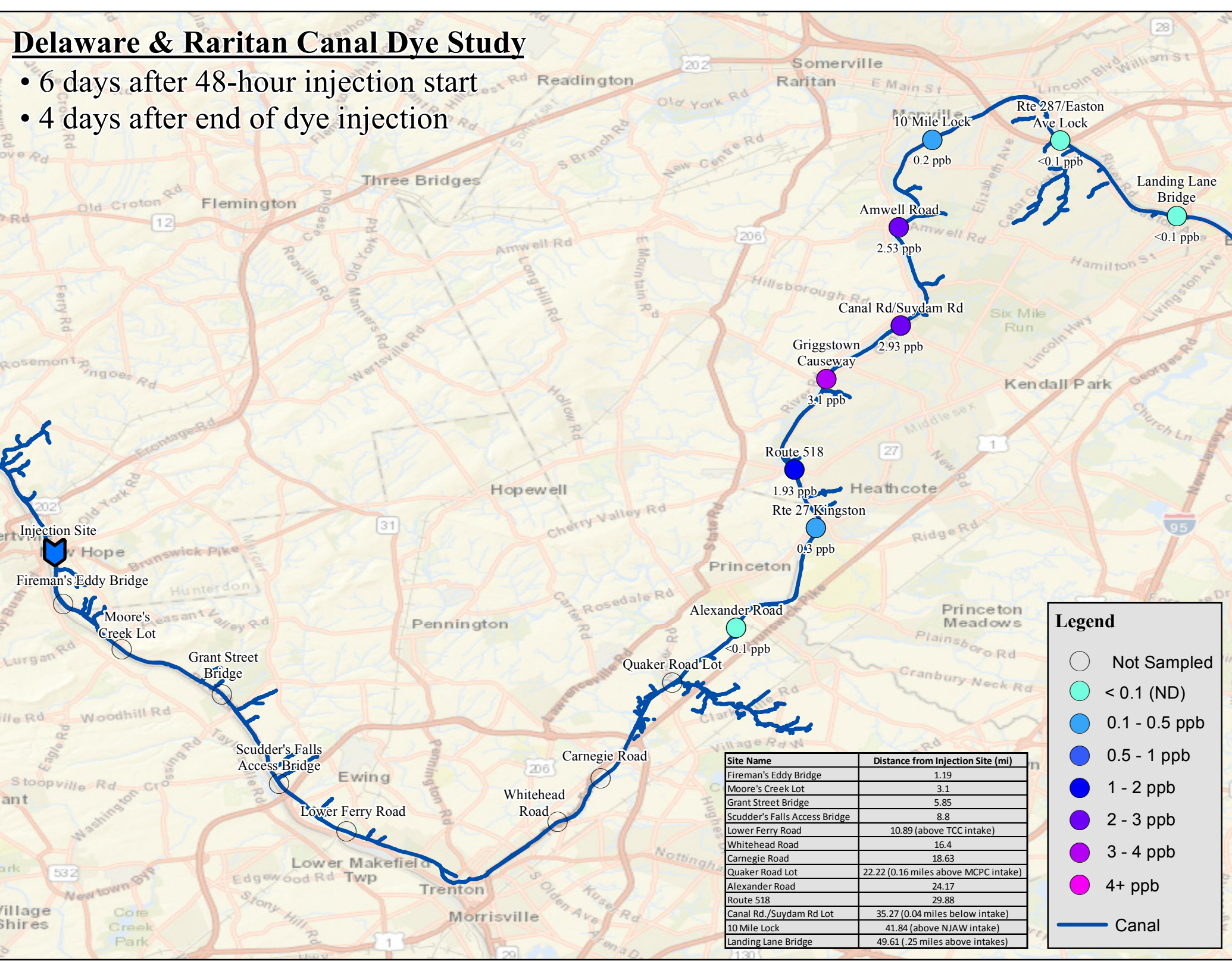
Delaware & Raritan Canal Dye Study

- 5 days after 48-hour injection start
- 3 days after end of dye injection



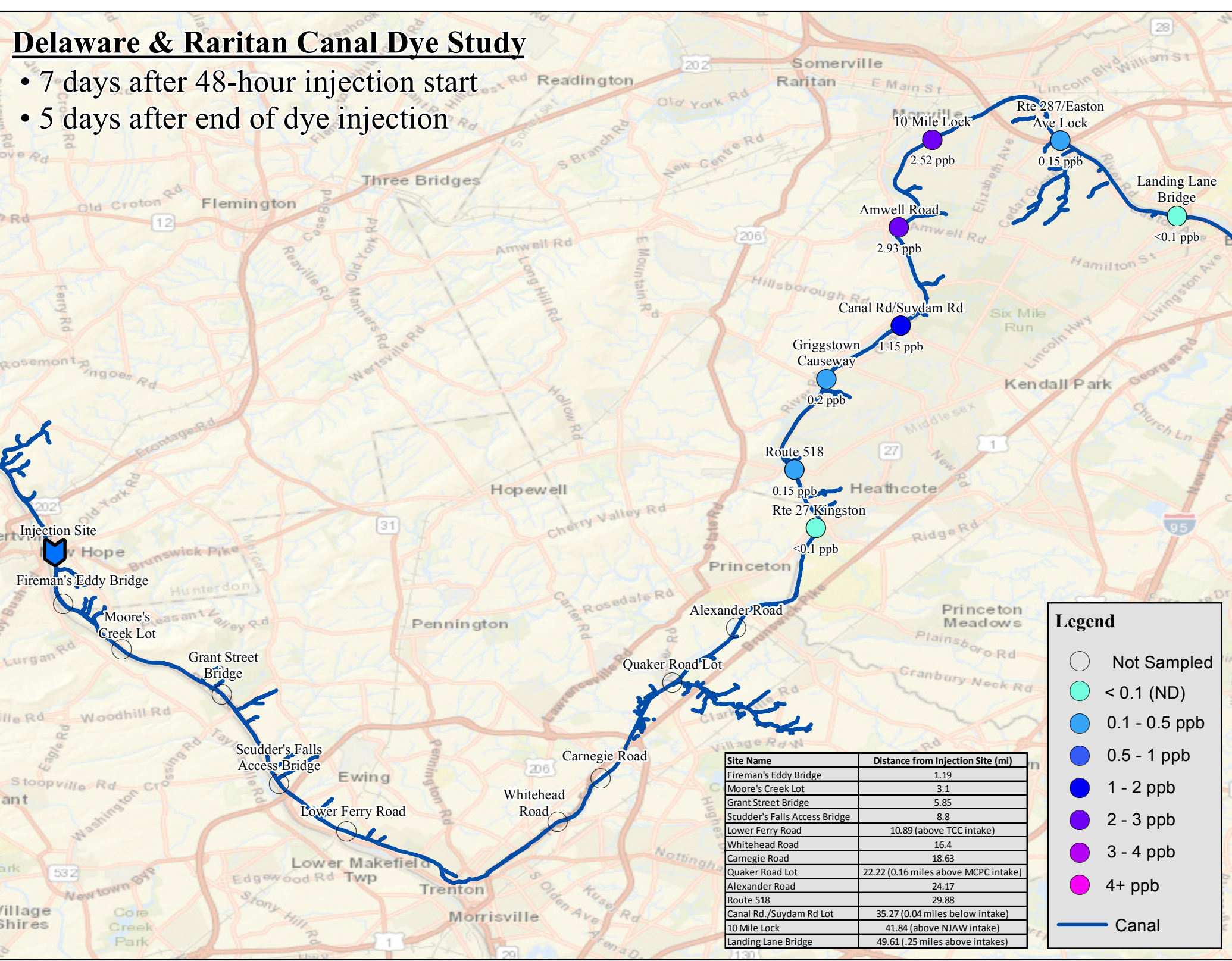
Delaware & Raritan Canal Dye Study

- 6 days after 48-hour injection start
- 4 days after end of dye injection



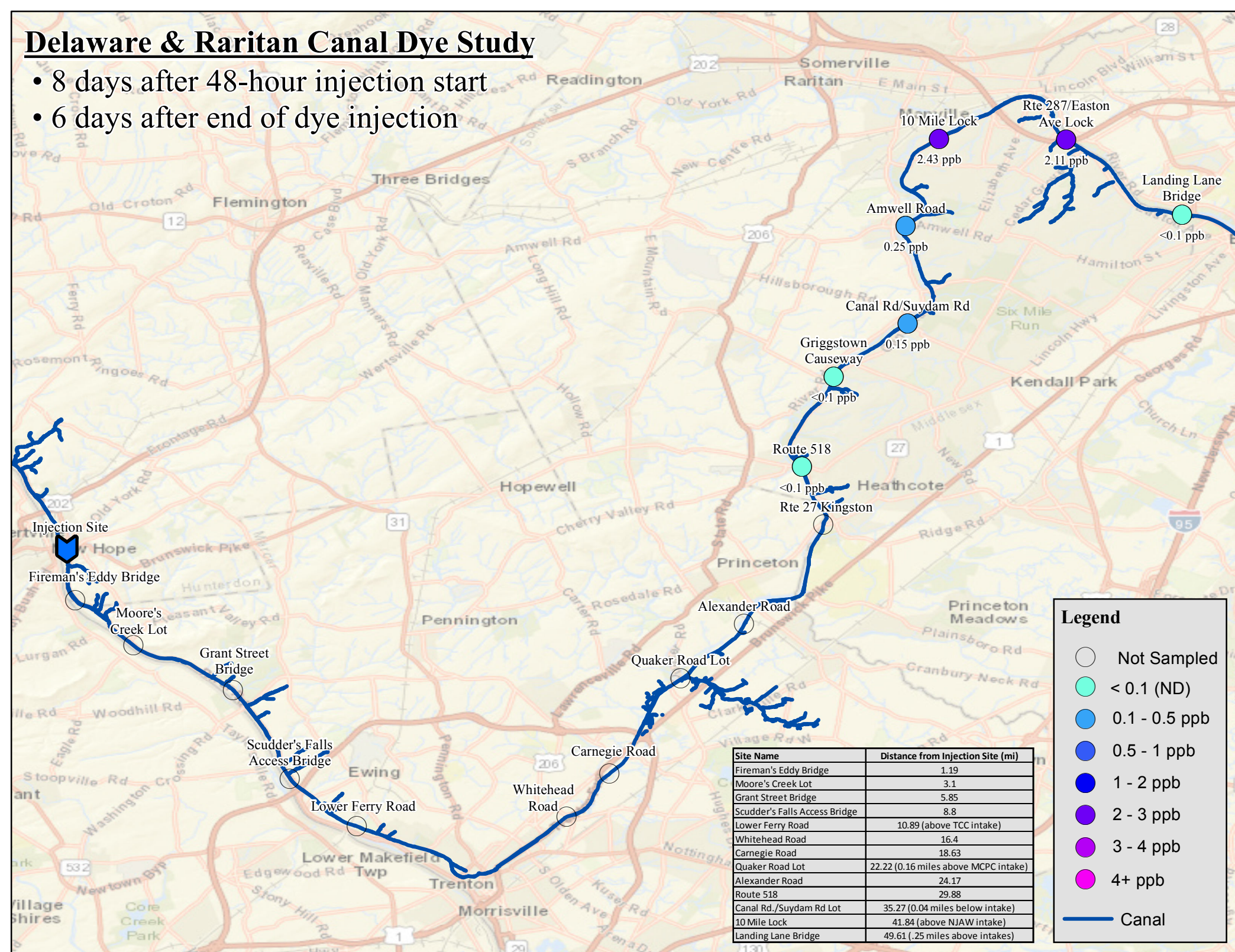
Delaware & Raritan Canal Dye Study

- 7 days after 48-hour injection start
- 5 days after end of dye injection



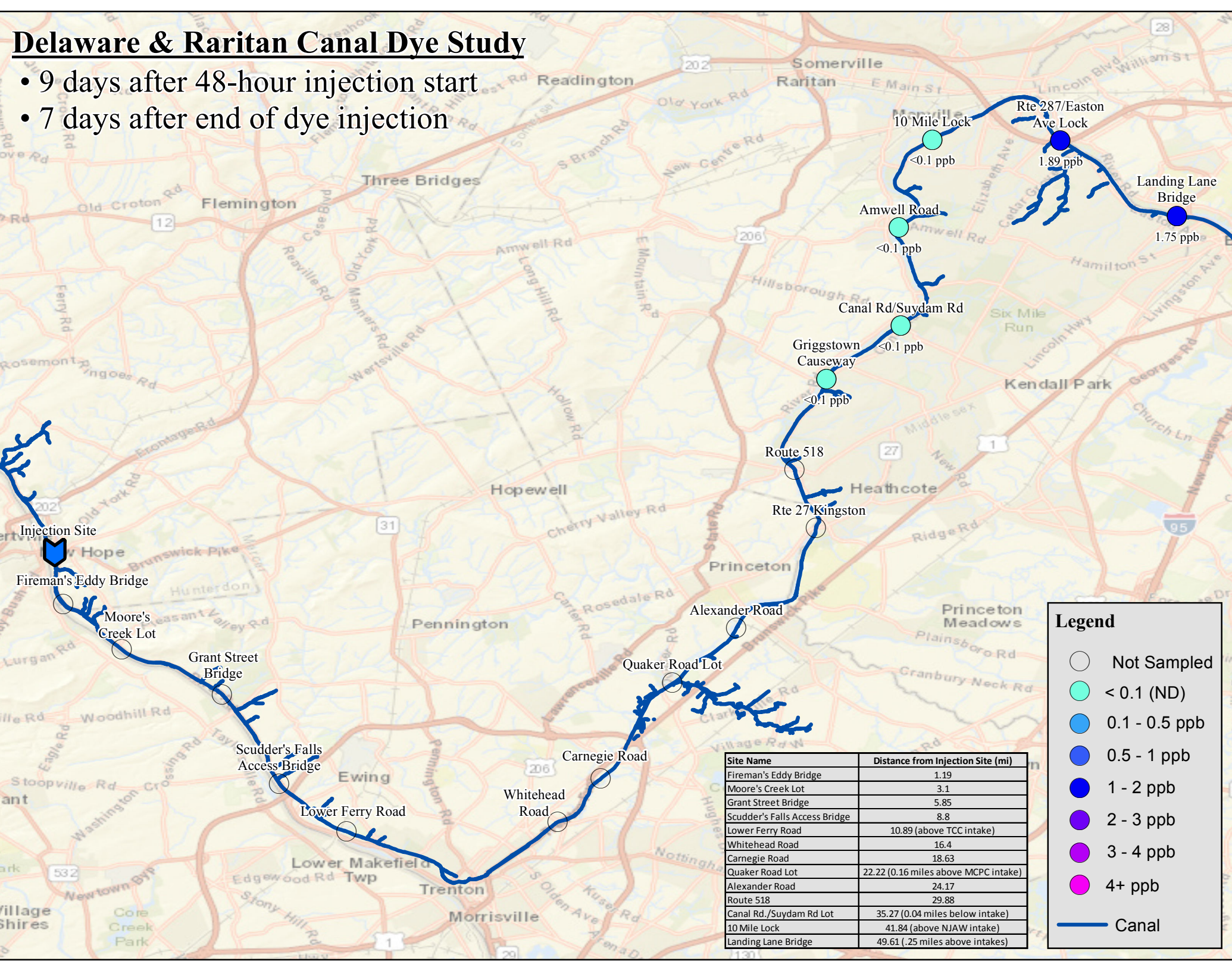
Delaware & Raritan Canal Dye Study

- 8 days after 48-hour injection start
- 6 days after end of dye injection



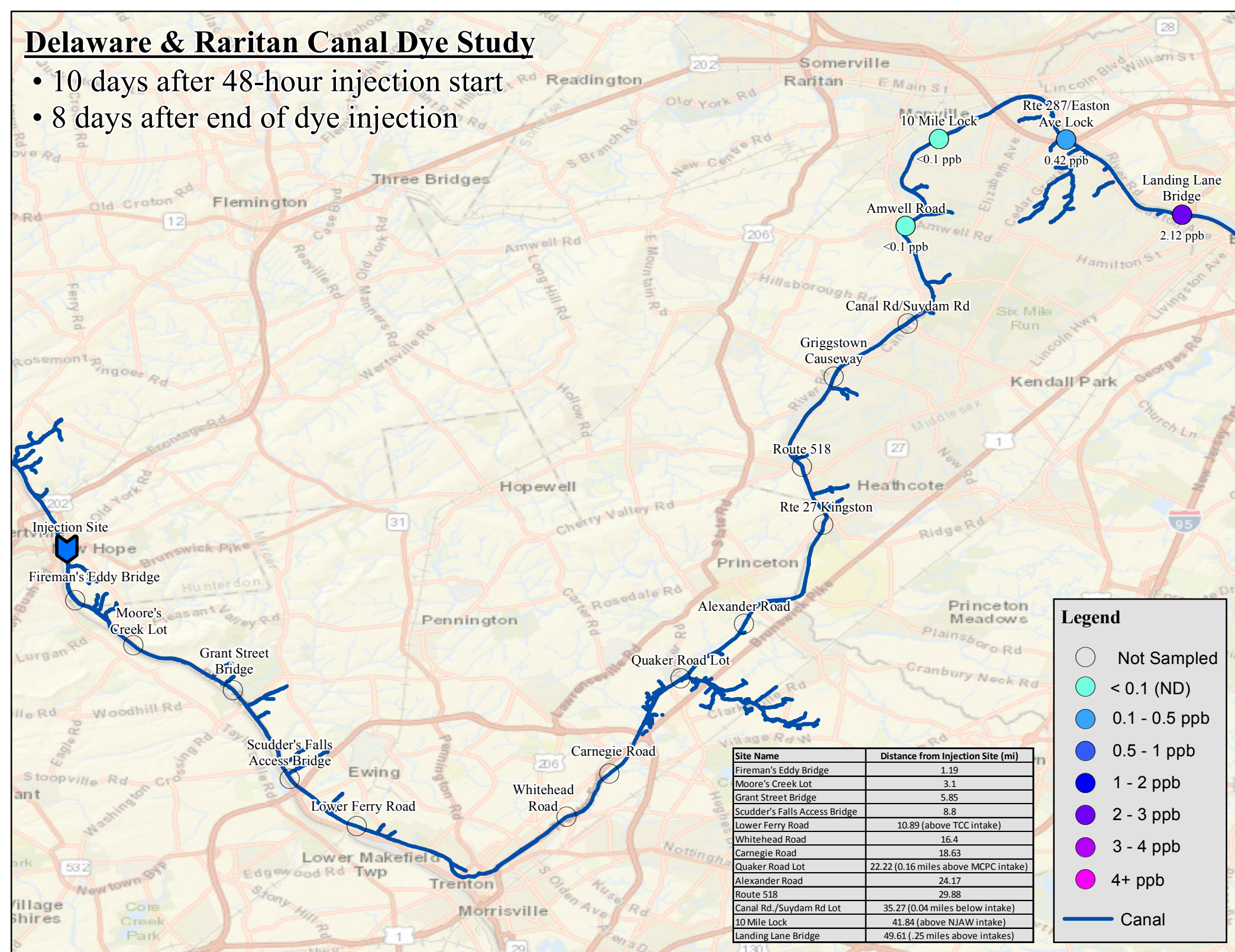
Delaware & Raritan Canal Dye Study

- 9 days after 48-hour injection start
- 7 days after end of dye injection



Delaware & Raritan Canal Dye Study

- 10 days after 48-hour injection start
- 8 days after end of dye injection



APPENDIX E:

Additional Aquatic Herbicide Labels

Endothall

Nautique

Komeen

Harpoon

Current

Sonar[®] Genesis

Aquatic Herbicide

SPECIMEN



AN HERBICIDE FOR MANAGEMENT OF FRESHWATER AQUATIC VEGETATION IN PONDS, LAKES, RESERVOIRS, POTABLE WATER SOURCES, DRAINAGE CANALS AND IRRIGATION CANALS.

For use in New York State, comply with Section 24 (C) Special Local Need Labeling for Sonar Genesis, SLN NY120006.

Active Ingredient

fluridone: 1-methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1H)-pyridinone

6.3%

Other Ingredients 93.7%

TOTAL 100.0%

Contains 0.5 pounds active ingredient per gallon.

Keep Out of Reach of Children DANGER / PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

Refer to the inside of the label booklet for additional precautionary information and Directions for Use including Storage and Disposal.

NOTICE: Read the entire label before using. Use only according to label directions. Before buying or using this product, read *Terms and Conditions of Use, Warranty Disclaimer, Inherent Risks of Use and Limitation of Remedies* inside label booklet.

Sonar is a registered trademark of SePRO Corporation.

SePRO Corporation 11550 North Meridian Street, Suite 600
Carmel, IN 46032 U.S.A.

EPA Reg. No. 67690-54
FPL20121219

Concentrated Formulation

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Corrosive. Causes irreversible eye damage. Harmful if swallowed. Avoid contact with skin. Do not get in eyes or on clothing. Wear protective eyewear (goggles, face shield, or safety glasses). Wear long-sleeved shirt and long pants, socks, shoes, and chemical resistant gloves. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse.

KEEP OUT OF REACH OF CHILDREN DANGER / PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID	
If in eyes	<ul style="list-style-type: none"> Hold eye open and rinse slowly and gently with water for 15 to 20 minutes. Remove contact lenses, if present, after the first 5 minutes; then continue rinsing eye. Call a poison control center or doctor for treatment advice.
If swallowed	<ul style="list-style-type: none"> Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person.
If on skin or clothing	<ul style="list-style-type: none"> Take off contaminated clothing. Rinse skin immediately with plenty of water for 15 to 20 minutes. Call a poison control center or doctor for treatment advice.
NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.	
HOTLINE NUMBER	
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In case of emergency endangering life or property involving this product, call INFOTRAC at 1-800-535-5053.	

ENVIRONMENTAL HAZARDS

Do not apply to water except as specified on the label. Do not contaminate water by disposal of equipment washwaters. Lowest rates should be used in shallow areas where the water depth is considerably less than the average depth of the entire treatment site, for example, shallow shoreline areas. Trees and shrubs growing in water treated with Sonar Genesis aquatic herbicide may occasionally develop chlorosis. Follow use directions carefully so as to minimize adverse effects on non-target organisms.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Read all Directions for Use carefully before applying.

DO NOT apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your state or tribe, consult the agency responsible for pesticide regulation.

Ensure spray drift to nontarget susceptible species does not occur.

DO NOT apply Sonar Genesis Aquatic Herbicide in any manner not specifically described in this label.

Observe all cautions and limitations on this label and on the labels of products used in combination with Sonar Genesis. **DO NOT** use Sonar Genesis other than in accordance with the instructions set forth on this label. Keep containers closed to avoid spills and contamination.

IN CASE OF EMERGENCY

In case of large-scale spillage regarding this product, call INFOTRAC at 1-800-535-5053.

In case of medical emergency regarding this product, call:

- Your local doctor for immediate treatment
- Your local poison control center (hospital)
- INFOTRAC: 1-800-535-5053

Steps to be taken in case material is released or spilled:

- Dike and contain the spill with inert material (sand, earth, etc.) and transfer liquid and solid diking material to separate containers for disposal.
- Remove contaminated clothing, and wash affected skin areas with soap and water.
- Wash clothing before reuse.
- Keep the spill out of all sewers and open bodies of water.

PRODUCT INFORMATION

Sonar Genesis is a selective systemic aquatic herbicide for management of freshwater aquatic vegetation in ponds, lakes, reservoirs, drainage canals and irrigation canals, including dry or de-watered areas of these sites. Sonar Genesis is absorbed from water by plant shoots and from hydrosol by the roots of aquatic vascular plants. For in-water treatments, it is important to maintain the specified concentration of Sonar Genesis in contact with the target plants for a minimum of 45 days. Rapid water movement or any condition which results in rapid dilution of Sonar Genesis in treated water will reduce its effectiveness. In susceptible plants, Sonar Genesis inhibits the formation of carotene. In the absence of carotene, chlorophyll is rapidly degraded by sunlight. Herbicidal symptoms of Sonar Genesis appear in seven to ten days and appear as white (chlorotic) or pink growing points in many susceptible plant species. Under optimum conditions, a minimum of 30 to 90 days may be required before the desired level of aquatic plant management is achieved. Plant species susceptibility to Sonar Genesis may vary depending on time of year, stage of growth, and water movement. For best results, apply Sonar Genesis prior to initiation of weed growth or when weeds begin active growth. Application to mature target plants may require an application rate at the higher end of the specified rate range and may take longer to control.

Sonar Genesis is not corrosive to application equipment.

This label provides recommended recommendations on the use of a laboratory analysis for the active ingredient. SePRO Corporation recommends the use of high-performance liquid chromatography (HPLC) for the determination of fluridone concentrations in water. It is recommended to contact SePRO Corporation for the incorporation of this test, known as a FastEST, in a treatment program. FastEST is referenced in this label as the preferred method for the rapid determination of the active ingredient in water. Other proven chemical analyses for the active ingredient may also be used.

Application rates and calculations of Sonar Genesis are provided to achieve a desired concentration of fluridone in parts per billion (ppb). The maximum application rate or sum of all application rates is 90 ppb in ponds and 150 ppb in lakes, reservoirs and static canals per annual growth cycle. For purposes of Sonar Genesis labeling, a pond is defined as a body of water 10 acres or less in size. A lake or reservoir is greater than 10 acres. This maximum concentration is the amount of product calculated as the target application rate, NOT determined by testing the concentration of fluridone in the treated water.

Use Restrictions and Precautions

- Obtain Required Permits:** Consult with appropriate state or local pesticide and/or water authorities before applying this product in or around public waters. Permits and posting or treatment notification may be required by state or local public agencies.
- Chemigation:** Do not apply Sonar Genesis through any type of irrigation system.
- Hydroponic Farming:** Do not use Sonar Genesis treated water for hydroponic farming unless a FastEST has been run and confirmed that concentrations are less than 1 ppb.
- Greenhouse and Nursery Plants:** Consult with SePRO Corporation for site-specific recommendations prior to any use of Sonar Genesis treated water for irrigating greenhouse or nursery plants. Without site-specific guidance from SePRO, do not use Sonar Genesis treated water for irrigating greenhouse or nursery plants unless a FastEST has been run and confirmed that concentrations are less than 1 ppb.
- Water Use Restrictions Following Applications With Sonar Genesis (Days)**

Application Rate	Drinking [†]	Fishing	Swimming	Livestock/Pet Consumption	Irrigation ^{††}
Maximum Rate (150 ppb) or less	0	0	0	0	See irrigation instructions below

[†] Note below, under *Potable Water Intakes*, the information for application of Sonar Genesis within ¼ mile (1,320 feet) of a functioning potable water intake.

^{††} Note below, under *Irrigation*, specific time frames or fluridone concentrations that provide the widest safety margin for irrigating with treated water.

- Potable Water Intakes:** In lakes and reservoirs or other sources of potable water, do not apply Sonar Genesis at application rates greater than 20 ppb within one-fourth mile (1,320 feet) of any functioning potable water intake. At application rates of 4 to 20 ppb, Sonar Genesis may be applied where functioning potable water intakes are present. **NOTE:** Existing potable water intakes which are no longer in use, such as those replaced by potable water wells or connections to a municipal water system, are not considered to be functioning potable water intakes.
- Irrigation:** Irrigation from a Sonar Genesis treated area may result in injury to the irrigated vegetation. Follow these precautions and inform those who irrigate from areas treated with Sonar Genesis of the irrigation time frames or FastEST requirements presented in the table below. Follow the following time frames and assay directions to reduce the potential for injury to vegetation irrigated with water treated with Sonar Genesis. Greater potential for crop injury occurs where Sonar Genesis treated water is applied to crops grown on low organic and sandy soils.

Application Site	DAYS AFTER APPLICATION		
	Established Tree Crops	Established Row Crops/Turf/Plants	Newly Seeded Crops/Seedbeds or Areas to be Planted Including Overseeded Golf Course Greens
Ponds and Static Canals [†]	7	30	Assay required
Canals	7	14	Assay required
Lakes and Reservoirs ^{††}	7	14	Assay required
Dry or De-watered Canals ^{†††}	0	0	†††

[†] For purposes of Sonar Genesis labeling, a pond is defined as a body of water 10 acres or less in size. A lake or reservoir is greater than 10 acres.

^{††} In lakes and reservoirs where one-half or greater of the body of water is treated, use the pond and static canal irrigation precautions. When applying Sonar Genesis to exposed sediments of aquatic sites such as lakes and reservoirs, follow these time frames prior to using water for irrigation once sites are reflooded.

¹¹¹ When Sonar Genesis is applied to exposed sediments of dry or de-watered irrigation canals, treatments must be made at least 2 weeks prior to when the canals are to be refilled, and allow canals to refill for a minimum of 24 hours before using water for irrigation.

Where the use of Sonar Genesis treated water is desired for irrigating crops prior to the time frames established above, the use of FastEST analysis is recommended to measure the concentration of fluridone in the treated water. Where a FastEST has determined that the fluridone concentrations are less than 10 parts per billion, there are no irrigation precautions for irrigating established tree crops, plants, row crops or turf. For tobacco, tomatoes, peppers or other plants within the Solanaceae Family and newly seeded crops or newly seeded grasses such as overseeded golf course greens, do not use Sonar Genesis treated water if measured fluridone concentrations are greater than 5 ppb. Furthermore, when rotating crops, do not plant members of the Solanaceae family in land that has been previously irrigated with fluridone concentrations in excess of 5 ppb in the previous year without direct consultation with a SePRO Aquatic Specialist. It is recommended that a SePRO Aquatic Specialist be consulted prior to commencing irrigation of these sites.

PLANT CONTROL INFORMATION

Sonar Genesis selectivity is dependent upon dosage, time of year, stage of growth, method of application and water movement. The following categories, controlled and partially controlled are provided to describe expected efficacy under ideal treatment conditions using higher to maximum label rates. Use of lower rates will increase selectivity of some species listed as controlled or partially controlled. Additional aquatic plants may be controlled, partially controlled, or tolerant to Sonar Genesis. It is recommended to consult a SePRO Aquatic Specialist prior to application of Sonar Genesis to determine a plant's susceptibility to the planned treatment.

Vascular Aquatic Plants Controlled by Sonar Genesis:

Submersed Plants:

bladderwort (*Utricularia* spp.)
common coontail (*Ceratophyllum demersum*)
common elodea (*Elodea canadensis*)
egria, Brazilian elodea (*Egeria densa*)
fanwort, cabomba (*Cabomba caroliniana*)
hydrilla (*Hydrilla verticillata*)
naiad (*Najas* spp.)
pondweed (*Potamogeton* spp., except Illinois pondweed)
watermilfoil (*Myriophyllum* spp., including *M. spicatum* x *sibiricum* hybrids)

Emerged Plants:

spatterdock (*Nuphar luteum*)
water-lily (*Nymphaea* spp.)
watershield (*Brasenia schreberi*)

Floating Plants:

common duckweed (*Lemna minor*)
Salvinia (*Salvinia* spp.)

Vascular Aquatic Plants Partially Controlled by Sonar Genesis:

Submersed Plants:

Illinois pondweed (*Potamogeton illinoensis*)
limnophila (*Limnophila sessiliflora*)
tapegrass, American eelgrass (*Vallisneria spiralis*)

Emerged Plants:

alligatorweed (*Alternanthera philoxeroides*)
American lotus (*Nelumbo lutea*)
cattail (*Typha* spp.)
creeping waterprimrose (*Ludwigia peploides*)
parrotfeather (*Myriophyllum aquaticum*)
smartweed (*Polygonum* spp.)
spikerush (*Eleocharis* spp.)
waterpurslane (*Ludwigia palustris*)

Floating Plants:

common watermeal (*Wolffia columbiana*)¹

Shoreline Grasses:

barnyardgrass (*Echinochloa crusgalli*)
giant cutgrass (*Zizaniopsis miliacea*)
reed canarygrass (*Phalaris arundinacea*)
southern watergrass (*Hydrochloa carolinensis*)
torpedograss (*Panicum repens*)

¹ Consult with a SePRO Aquatic Specialist about techniques to enhance efficacy of watermeal, including incorporation of Galleon S.C. Aquatic Herbicide into a Sonar Genesis treatment program, in difficult to control sites.

MIXING AND APPLICATION DIRECTIONS

The aquatic plants present in the treatment site should be identified prior to application to determine their susceptibility to Sonar Genesis. It is important to determine the area (acres) to be treated and the average depth in order to select the proper application rate. Do not exceed the maximum labeled rate for a given treatment site per annual growth cycle.

Sonar Genesis may be applied or metered directly into the treated area or diluted with water prior to application. Add the specified amount of Sonar Genesis to water in the spray tank during the filling operation. Surface and subsurface application of the spray can be made with conventional spray equipment. Sonar Genesis can also be applied near the surface of the hydrosol using weighted trailing hoses. A minimum spray volume of 5 to 100 gallons per acre may be used. Sonar Genesis may also be directly metered into the pumping system where it is diluted with water.

Tank Mix Directions

Sonar Genesis may be tank mixed with other aquatic herbicides and algaecides to enhance efficacy and plant selectivity provided that this label does not prohibit such mixing. When tank mixing, read and follow the labeled precautionary statements, directions for use, weeds controlled, and other restrictions for each tank mix product. Use in accordance with the most restrictive label limitations and precautions of the products used in the tank-mix. No labeled rate or dose should be exceeded. To ensure compatibility, a jar test is recommended before field application of any tank mix combination. It is recommended to consult with SePRO Corporation for latest tank mix recommendations.

NOTE: Tank mixing or use of Sonar Genesis with any other product which is not specifically and expressly authorized by the label shall be at the exclusive risk of the user, applicator and/or application adviser, to the extent allowed by applicable law.

Application Rate Calculation

The amount of Sonar Genesis to be applied to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:

Sonar Genesis gallons required per treated surface acre = surfaces acres X average water depth of treatment site (feet) x desired ppb concentration of active ingredient x 0.0054.

For example, the amount per acre of Sonar Genesis required to provide a concentration of 30 ppb of active ingredient in a 1 acre pond with an average depth of 5 feet is calculated as follows:

$$1 \text{ acre} \times 5 \text{ feet} \times 30 \text{ ppb} \times 0.0054 = 0.81 \text{ gallons per treated surface acre}$$

or

$$0.81 \text{ gallons} \times 4 \text{ quarts/gallon} = 3.2 \text{ quarts per treated surface acres}$$

or

$$0.81 \text{ gallons} \times 128 \text{ ounces/gallon} = 104 \text{ ounces per treated surface acre}$$

Application to Ponds

Sonar Genesis may be applied to the entire surface area of a pond. For single applications, rates may be selected to provide 30 to 90 ppb to the treated water. Use the higher rate within the rate range where there is a dense weed mass, when treating more difficult to control species, and for ponds less than 5 acres in size with an average depth less than 4 feet. Application rates necessary to obtain these concentrations are shown in the following table. For additional application rate calculations, refer to the *Application Rate Calculation* section of this label. Split or multiple applications may be used to control more difficult target plants and/or where dilution of treated water is anticipated; however, the sum of all applications must not exceed a total of 90 ppb per annual growth cycle.

Average Water Depth of Treatment Site (feet)	Gallons of Sonar Genesis per Treated Surface Acre ¹	
	30 ppb	90 ppb
1	0.16	0.48
2	0.32	0.97
3	0.48	1.45
4	0.64	1.94
5	0.81	2.43
6	0.97	2.91
7	1.13	3.40
8	1.29	3.88
9	1.45	4.37
10	1.62	4.86

¹ To calculate the number of quarts of Sonar Genesis required, use the calculation as follows:
gallons per surface acre x 4 quarts/gallon = quarts per surface acre

For example: targeting a concentration of 30 ppb in a one acre pond with average depth of 5 feet would require 0.81 gallons or 3.2 quarts.

Application to Lakes and Reservoirs

The following treatments may be used for treating both whole lakes or reservoirs and partial areas of lakes or reservoirs (bays, etc.). For best results in treating partial lakes and reservoirs, Sonar Genesis treatment areas should be a minimum of 5 acres in size. Treatment of areas smaller than 5 acres or treatment of narrow strips such as boat lanes or shorelines may not produce satisfactory results due to dilution by untreated water. Rate ranges are provided as a guide to include a wide range of environmental factors, such as, target species, plant susceptibility, selectivity and other aquatic plant management objectives. Application rates and methods should be selected to meet the specific lake/reservoir aquatic plant management goals.

A. Whole Lake or Reservoir Treatments (Limited or No Water Discharge)

Single Application to Whole Lakes or Reservoirs

Where single applications to whole lakes or reservoirs are desired, apply Sonar Genesis at an application rate of 10 to 90 ppb. Application rates necessary to obtain these concentrations in treated water are shown in the following table. For additional rate calculations, refer to the *Application Rate Calculation* section of this label. Choose an application rate from the table below to meet the aquatic plant management objective. Where greater plant selectivity is desired such as when controlling Eurasian watermilfoil and curlyleaf pondweed, choose an application rate lower in the rate range. For other plant species, it is recommended to contact a SePRO Aquatic Specialist for determining when to choose application rates lower in the rate range to meet specific plant management goals. Use the higher rate within the rate range where there is a dense weed mass or when treating more difficult to control plant species. Retreatments may be required to control more difficult to control species or in the event of a heavy rainfall event where dilution of the treatment concentration has occurred. In these cases, a second application or more may be required; however, the sum of all applications cannot exceed 150 ppb per annual growth cycle. Refer to the section of this label entitled, *Split or Multiple Applications to Whole Lakes or Reservoirs*, for guidelines and maximum rate allowed.

SINGLE APPLICATION OF Sonar Genesis		
Average Water Depth of Treatment Site (feet)	Gallons of Sonar Genesis per Treated Surface Acre to Achieve ¹	
	10 ppb	90 ppb
1	0.05	0.48
2	0.10	0.97
3	0.16	1.45
4	0.21	1.94
5	0.27	2.43
6	0.32	2.91
7	0.37	3.40
8	0.43	3.88
9	0.48	4.37
10	0.54	4.86

¹ To calculate the number of quarts of Sonar Genesis required, use the calculation as follows:
gallons per surface acre x 4 quarts/gallon = quarts per surface acre

For example: targeting a dose of 10 ppb in a 20 acre lake with average depth of 5 feet would require 0.27 gallons per surface acre or 1.0 quarts.

Split or Multiple Applications to Whole Lakes or Reservoirs

To meet certain plant management objectives, split or multiple applications may be desired in making whole lake treatments. Split or multiple application programs are desirable when the objective is to use the minimum effective dose and, through the use of a water analysis, e.g. FastEST, add additional Sonar Genesis to maintain this lower dose for the sufficient time to ensure efficacy and enhance selectivity. Water may be treated at an initial application concentration of 4 to 50 ppb. Additional split applications should be conducted to maintain a sufficient concentration for a minimum of 45 days or longer. In controlling Eurasian watermilo and curlyleaf pondweed and where greater plant selectivity is desired, choose an application rate lower in the rate range. For other plant species, it is recommended to contact a SePRO Aquatic Specialist for assistance in selecting the appropriate concentrations and timing of application to meet specific plant management goals. When utilizing split or multiple applications of Sonar Genesis, the utilization of FastEST is strongly recommended to determine the actual concentration in the water over time. For split or multiple applications, the sum of all applications must not exceed 150 ppb per annual growth cycle.

NOTE: In treating lakes or reservoirs that contain functioning potable water intakes and the application requires treating within ¼ mile of a potable water intake, no single application can exceed 20 ppb. Additionally, the sum of all applications cannot exceed 150 ppb per annual growth cycle.

B. Partial Lake or Reservoir Treatments

Where dilution of Sonar Genesis with untreated water is anticipated, such as in partial lake or reservoir treatments, split or multiple applications may be used to extend the contact time to the target plants. The application rate and use frequency of Sonar Genesis in a partial lake is highly dependent upon the treatment area. An application rate at the higher end of the specified rate range may be required and frequency of applications will vary depending upon the potential of untreated water diluting the Sonar Genesis concentration in the treatment area. Use a rate at the higher end of the rate range where greater dilution with untreated water is anticipated.

Treatment Areas Greater Than ¼ Mile from a Functioning Potable Water Intake

For single applications, apply Sonar Genesis at application rates from 30 to 150 ppb. Split or multiple applications may be made; however, the sum of all applications cannot exceed 150 ppb per annual growth cycle. Split applications should be conducted to maintain a sufficient concentration in the target area for a period of 45 days or longer. The use of a FastEST is recommended to maintain the desired concentration in the target area over time.

Treatment Areas within ¼ Mile of a Functioning Potable Water Intake

In treatment areas that are within ¼ mile of a potable water intake, no single application can exceed 20 ppb. When utilizing split or multiple applications of Sonar Genesis for sites which contain a potable water intake, a FastEST is required to determine the actual concentration in the water. Additionally, the sum of all applications cannot exceed 150 ppb per annual growth cycle.

Application to Sediments of Dry or De-Watered Aquatic Sites

For application of Sonar Genesis to sediments of dry or de-watered aquatic sites, including exposed sediments of lakes or reservoirs, irrigation canals, non-irrigation canals and drainage canals, apply a maximum of 4 gallons of Sonar Genesis per surface acre per annual growth cycle. Apply Sonar Genesis evenly to the sediment surface, with a minimum spray solution of 30 to 100 gallons per surface acre. High levels of organic matter in treated sediments may reduce efficacy. Sonar Genesis may be applied with other aquatic herbicides labeled for this use. It is recommended that a SePRO Aquatic Specialist be consulted for further use recommendations.

Direct foliar application to floating, topped-out and emerged aquatic vegetation

For application of Sonar Genesis to floating, topped-out and emerged aquatic vegetation in ponds, lakes, reservoirs, drainage canals and irrigation canals, including dry or de-watered areas of these sites, apply a maximum of 4 gallons of Sonar Genesis per surface acre per annual growth cycle. Apply Sonar Genesis evenly to the treatment area using properly calibrated broadcast equipment in a minimum spray solution of 20 to 100 gallons per surface acre. For treatment of vegetation in or on water, do not exceed a water concentration of 150 ppb. Spot treatments can be made with up to 5% Sonar Genesis by volume when application rate does not exceed 4 gallons Sonar Genesis per surface acre. It is recommended that a SePRO Aquatic Specialist be consulted for site specific recommendations.

Application to Drainage Canals and Irrigation Canals

Static Canals:

In static drainage and irrigation canals, apply Sonar Genesis at the rate of 30 to 150 ppb per treated surface acre. The maximum application rate or sum of all application rates cannot exceed 150 ppb per annual growth cycle.

Moving Water Canals:

In slow moving bodies of water use an application technique that maintains a concentration of 10 to 40 ppb in the target area for a minimum of 45 days. Sonar Genesis can be applied by split or multiple broadcast applications or by metering in the product to provide a uniform concentration of the herbicide based upon the flow pattern. The use of a FastEST is recommended to maintain the desired concentration in the target area over time.

Static or Moving Water Canals Containing a Functioning Potable Water Intake

In treating a static or moving water canal which contains a functioning potable water intake, applications of Sonar Genesis greater than 20 ppb must be made more than ¼ mile from a functioning potable water intake. Applications less than 20 ppb may be applied within ¼ mile from a functioning potable water intake; however, if applications of Sonar Genesis are made within ¼ mile of a functioning potable water intake, a FastEST analysis must be utilized to demonstrate that concentrations do not exceed 150 ppb at the functioning potable water intake.

Application Rate Calculation — Moving Water Drainage and Irrigation Canals

The amount of Sonar Genesis to be applied through a metering system to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:

1. Average flow rate (feet per second) x average canal width (ft.) x average canal depth (ft.) = CFS (cubic feet per second).
2. CFS x 1.98 = acre feet per day (water movement)
3. Acre feet per day x desired ppb x 0.0054 = Gallons Sonar Genesis required per day

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Pesticide Storage: Keep from freezing. Store in original container only. Do not store near feed or foodstuffs. In case of leak or spill, use absorbent materials to contain liquids and dispose as waste.

Pesticide Disposal: Wastes resulting from use of this product may be used according to label directions or disposed of at an approved waste disposal facility.

Container Handling

Nonrefillable Container. DO NOT reuse or refill this container. Triple rinse or pressure rinse container (or equivalent) promptly after emptying; then offer for recycling, if available, or reconditioning, if appropriate, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures approved by state and local authorities.

Triple rinse containers small enough to shake (capacity ≤ 5 gallons) as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank, or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times.

Triple rinse containers too large to shake (capacity > 5 gallons) as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank, or store rinsate for later use or disposal. Repeat this procedure two more times.

Pressure rinse as follows: Empty the remaining contents into application equipment or mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank, or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container and rinse at about 40 PSI for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

Refillable Container. Refill this container with pesticide only. **DO NOT** reuse this container for any other purpose. Triple rinsing the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller.

Triple rinse as follows: To clean the container before final disposal, empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10% full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times.

When this container is empty, replace the cap and seal all openings that have been opened during use; return the container to the point of purchase or to a designated location. This container must only be refilled with a pesticide product. Prior to refilling, inspect carefully for damage such as cracks, punctures, abrasions, worn-out threads and closure devices. Check for leaks after refilling and before transport. **DO NOT** transport if this container is damaged or leaking. If the container is damaged, or leaking, or obsolete and not returned to the point of purchase or to a designated location, triple rinse emptied container and offer for recycling, if available, or dispose of container in compliance with state and local regulations.

TERMS AND CONDITIONS OF USE

If terms of the following *Warranty Disclaimer, Inherent Risks of Use and Limitation of Remedies* are not acceptable, return unopened package at once to the seller for a full refund of purchase price paid. Otherwise, to the extent consistent with applicable law, use by the buyer or any other user constitutes acceptance of the terms under *Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies*.

WARRANTY DISCLAIMER

SePRO Corporation warrants that the product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. **TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, SEPRO CORPORATION MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.**

INHERENT RISKS OF USE

It is impossible to eliminate all risks associated with use of this product. Plant injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of SePRO Corporation or the seller. To the extent consistent with applicable law, all such risks shall be assumed by buyer.

LIMITATION OF REMEDIES

To the extent consistent with applicable law, the exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories) shall be limited to, at SePRO Corporation's election, one of the following:

- (1) Refund of purchase price paid by buyer or user for product bought, or
- (2) Replacement of amount of product used.

To the extent consistent with applicable law, SePRO Corporation shall not be liable for losses or damages resulting from handling or use of this product unless SePRO Corporation is promptly notified of such losses or damages in writing. In no case shall SePRO Corporation be liable for consequential or incidental damages or losses.

The terms of the *Warranty Disclaimer, Inherent Risks of Use and this Limitation of Remedies* cannot be varied by any written or verbal statements or agreements. No employee or sales agent of SePRO Corporation or the seller is authorized to vary or exceed the terms of the *Warranty Disclaimer* or this *Limitation of Remedies* in any manner.

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SePRO Corporation
11550 North Meridian Street, Suite 600
Carmel, IN 46032



SePRO Corporation
11550 North Meridian Street, Suite 600
Carmel, IN 46032, U.S.A.



AQUATHOL® K

AQUATIC HERBICIDE

For aquatic plant control in quiescent, slow moving,
and flowing water aquatic sites.

ACTIVE INGREDIENT:

Dipotassium salt of endothall* 40.3%

OTHER INGREDIENTS: 59.7%

TOTAL 100.0%

Contains 4.23 lbs. dipotassium endothall* per gallon

*7-oxabicyclo [2.2.1]heptane-2,3-dicarboxylic acid equivalent 28.6%

KEEP OUT OF REACH OF CHILDREN

DANGER PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.

(If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID

IF IN EYES:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.
- Call a poison control center or doctor for treatment advice.

IF SWALLOWED:

- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told by a poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

IF ON SKIN OR CLOTHING:

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

IF INHALED:

- Move person to fresh air.
- If person is not breathing, call 911 or ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER: Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 866-673-6671 (Rocky Mountain Poison Control Center) for emergency medical treatment information.

See inside for additional precautionary statements.

NOTE TO PHYSICIAN: Measures against circulatory shock, respiratory depression, and convulsion may be needed.

EPA Registration No. 70506-176

Batch/Lot No.: _____

Net Contents: _____



United Phosphorus, Inc.

630 Freedom Business Center, Suite 402

King of Prussia, PA 19406

1-800-438-6071

PRODUCT INFORMATION

Aquathol K is a liquid concentrate soluble in water which is effective against a broad range of aquatic plants. Dosage rates indicated for the application of Aquathol K are measured in parts per million (ppm) of dipotassium endothall.

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS DANGER

CORROSIVE. CAUSES IRREVERSIBLE EYE DAMAGE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING. AVOID BREATHING VAPORS OR SPRAY MIST. PROLONGED OR FREQUENTLY REPEATED SKIN CONTACT MAY CAUSE ALLERGIC REACTIONS IN SOME INDIVIDUALS.

Personal Protective Equipment (PPE)

Mixers, Loaders, Applicators and other handlers must wear:

- Long-sleeved shirt and long pants,
 - Shoes and socks,
 - Chemical-resistant gloves made of any waterproof material,
 - Protective eyewear,
 - NIOSH-approved respirator with a dust/mist filter with MSHA/NIOSH approval number prefix TC-21C or any N, R, P, or HE filter.
- Exception: During application, the respirator need not be worn, provided that the pesticide is applied in a manner (such as direct metering or subsurface application from the rear of a vessel that is moving into the wind) such that the applicator will have no contact with the pesticide.

See Engineering Controls for additional requirements.

User Safety Requirements:

Follow the manufacturers' instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.

Engineering Controls:

When mixers and loaders use a closed system designed by the manufacturer to enclose the pesticide to prevent it from contacting handlers or other people AND the system is functioning properly and is used and maintained in accordance with the manufacturers written operating instructions, the handlers need not wear a respirator, provided the required respirator is immediately available for use in an emergency such as a spill or equipment breakdown.

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations

User should:

- Wash hands thoroughly after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

Do not contaminate water by cleaning of equipment or disposal of equipment washwaters.

This pesticide is toxic to mammals.

Treatment of aquatic plants can result in oxygen loss from decomposition of dead plants. This loss can cause fish suffocation. Water bodies containing very high plant density should be treated in sections to prevent suffocation of fish.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift.

- For quiescent or slow moving water treatments: Waters treated with Aquathol K may be used for swimming, fishing, and irrigating turf, ornamental plants and crops immediately after treatment. Do not use treated water for animal consumption within the following periods:

0.5 ppm dipotassium salt – 7 days after application

4.25 ppm dipotassium salt – 14 days after application

5.0 ppm dipotassium salt – 25 days after application

- For flowing water treatments: Waters treated with Aquathol K may be used for swimming, fishing, irrigating turf, ornamental plants and crops and for livestock watering immediately after treatment.
- Phytotoxicity is not expected on plants or crops irrigated with Aquathol K treated water, however, all species and cultivars (varieties) have not been tested.
- Undiluted Aquathol K may be injurious to crops, grass, ornamentals, and other foliage.
- Do not use Aquathol K treated water for chemigation as interactions between Aquathol K and other pesticides and fertilizers are not known.
- Do not use Aquathol K in brackish or saltwater.
- Wash out spray equipment with water after each operation.
- Avoid contact of spray concentrate (product) directly or by drift with non-target plants or crops as injury may result.
- United Phosphorus, Inc. recommends not reducing Aquathol K rates below those specified within this label, when using Aquathol K in a treatment combination, or as a tank mix, with product(s) containing ALS inhibitor active ingredients, unless specified otherwise on this label or a United Phosphorus, Inc. supplemental label.

HOW TO APPLY:

Aquathol K is a contact herbicide; consequently, apply when target plants are present.

Aquathol K should be sprayed on the water or injected below the water surface. It may be applied as a concentrate or diluted with water depending on the equipment.

In instances where the plant(s) to be controlled is an exposed surface problem (i.e., some of the broad-leaved pond weeds), coverage is important. For best results, apply the concentrate with the least amount of water compatible with the application equipment.

Drinking Water (Potable Water)

Consult with appropriate state or local water authorities before applying this product to public waters. State or local agencies may require permits.

The drinking water (potable water) restrictions on this label are to ensure that consumption of water by the public is allowed only when the concentration of endothall acid in the water is less than the MCL (Maximum Contamination Level) of 0.1 ppm. Applicators should consider the unique characteristics of the treated waters to assure that endothall acid concentrations in potable drinking water do not exceed 0.1 ppm at the time of consumption.

For Lakes, Ponds, and other Quiescent Water Bodies:

- For Aquathol K applications, the drinking water setback distance from functioning potable water intakes in the treated water body must be greater than or equal to 600 feet.
- Note: Existing potable water intakes that are no longer in use, such as those replaced by a connection to a municipal water system or a potable water well, are not considered to be functioning potable water intakes.

For Flowing Water Bodies:

- Applicator is responsible to assure that treated water exceeding the MCL of 0.1 ppm does not enter potable water intakes. For Aquathol K applications, potable water intakes must be closed when treated water exceeding the MCL of 0.1 ppm is present at the intake. In the event the water intake cannot be closed (when treated water is present that exceeds 0.1 ppm), treatments must only be made downstream from the intake in order to assure Aquathol K treated water above 0.1 ppm does not enter the potable water system.

QUIESCENT OR SLOW MOVING WATER TREATMENTS: **SURFACE OR INJECTED APPLICATIONS**

For aquatic plant control in quiescent or slow moving water, Aquathol K use rates can be found in the following chart. Since the active ingredient is water soluble and tends to diffuse from the treated area, select the dosage rate applicable to the area to be treated. Marginal treatments of large bodies of water require higher rates as indicated.

Use higher labeled rates of Aquathol K when making treatments to small areas with an increased potential for rapid dilution or when treating narrow areas such as boat lanes or shoreline treatments where dilution may reduce the exposure of plants to Aquathol K.

Use lower labeled rates of Aquathol K for large contiguous treatment blocks or in protected areas such as coves where reduced water movement will not result in rapid dilution of Aquathol K from the target treatment area or when treating entire lakes or ponds.

PLANTS CONTROLLED AND AQUATHOL K DOSAGE RATES FOR SURFACE OR INJECTED APPLICATION IN QUIESCENT OR SLOW-MOVING WATER

	APPLICATION RATE			
	Entire Pond/Lake or Large Area Treatment		Spot or Lake Margin Treatment	
	ppm Dipotassium Endothall	gallons Aquathol K per Acre Ft.	ppm Dipotassium Endothall	gallons Aquathol K per Acre Ft.
Aquatic Plant				
Coontail, <i>Ceratophyllum</i> spp.	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Horned Pondweed, <i>Zannichellia palustris</i>	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Sago Pondweed, <i>Stuckenia pectinata</i>	1.0-2.0	0.6-1.3	2.0-5.0	1.3-3.2
Hydrilla, <i>Hydrilla verticillata</i>	1.0-4.0	0.6-2.6	2.0-5.0	1.3-3.2
Hygrophila ^a , <i>Hygrophila polysperma</i>	4.0-5.0	2.6-3.2	5.0	3.2
Milfoil, <i>Myriophyllum</i> spp.	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Naiad, <i>Najas</i> spp.	2.0-4.0	1.3-2.6	3.0-5.0	1.9-3.2
Pondweed, <i>Potamogeton</i> spp.	0.75-3.0	0.45-1.9	1.5-5.0	1.0-3.2
Including:				
American, <i>P. nodosus</i>	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Largeleaf (Bass Weed), <i>P. amplifolius</i>	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Curlyleaf, <i>P. crispus</i>	0.75-1.5	0.45-1.0	1.5-5.0	1.0-3.2
Flatstem, <i>P. zosteriformis</i>	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Floating-leaf, <i>P. natans</i>	1.0-2.0	0.6-1.3	2.0-5.0	1.3-3.2
Illinois, <i>P. illinoensis</i>	1.5-2.5	1.0-1.6	2.5-5.0	1.6-3.2
Narrowleaf, <i>P. pusillus</i>	1.0-2.0	0.6-1.3	2.0-5.0	1.3-3.2
Threadleaf, <i>P. filiformis</i>	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Variable Leaf, <i>P. diversifolius</i>	1.0-2.0	0.6-1.3	2.0-5.0	1.3-3.2
Parrotfeather, <i>Myriophyllum aquaticum</i>	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Water Stargrass, <i>Heteranthera</i> spp.	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2

^a Suppression only

The following charts indicate the quantity of Aquathol K to be applied.

Gallons of Aquathol K to Treat One Acre-Foot of Water

	Rate (ppm)						
	0.75	1.0	1.5	2.0	3.0	4.0	5.0
1 acre ft.	gallons/A-ft.						
	0.45	0.6	1.0	1.3	1.9	2.6	3.2

Fluid Ounces of Aquathol K to Treat 1,000 Square-Feet per Foot of Depth

	Rate (ppm)						
	0.75	1.0	1.5	2.0	3.0	4.0	5.0
1,000 ft. ²	fl. oz./1,000 ft. ²						
	1.4	1.9	2.8	3.8	5.7	7.6	9.4

FLOWING WATER TREATMENTS (WITH THE EXCEPTION OF IRRIGATION CANALS): DRIP OR METERING SYSTEM APPLICATIONS

For aquatic plant control in flowing water, Aquathol K use rates can be found in the following chart. Apply Aquathol K in a manner to achieve the desired rate and adequate mixing so product is distributed throughout the entire water column. Adequate concentration (rate) and exposure time (length of treatment) will impact Aquathol K efficacy on the target plant species. Although Aquathol K is a contact herbicide adequate exposure time is critical. The following rate chart has been developed based on Concentration Exposure Time (CET) data for Aquathol K. The CET concept allows rates and the length of exposure to be adjusted for different treatment scenarios.

AQUATHOL K APPLICATION RATES FOR DRIP OR METERING APPLICATION SYSTEMS IN FLOWING WATER

Plant Species	Length of Treatment (hours)							
	6	8	12	18	24	36	48	72
	Rate (ppm)							
Pondweeds (<i>Potamogeton</i> spp.) Sago Pondweed (<i>Stuckenia pectinata</i>)	4.0-5.0	3.0-4.0	2.0-3.0	1.5-2.5	1.0-2.0	0.75-1.5	0.5-1.0	0.5
Milfoil (<i>Myriophyllum</i> spp.) Parrotfeather (<i>Myriophyllum aquaticum</i>) Coontail (<i>Ceratophyllum</i> spp.) Horned pondweed (<i>Zannichellia</i> spp.) Hydrilla (<i>Hydrilla verticillata</i>) Naiad (<i>Najas</i> spp.) Water Stargrass (<i>Heteranthera</i> spp.)	5.0	4.0-5.0	3.0-4.0	2.0-3.0	1.5-2.5	1.0-2.0	0.75-1.5	0.5-1.0

NOTE: Hygrophila (*Hygrophila polysperma*) may be suppressed at the higher application rates listed in this table.

Restrictions: Do not apply more than 30 ppm per growing season, not to exceed 5 ppm per application. Do not apply more than a total of 5 ppm within a 7-day interval.

Note: There is no Pre-harvest Interval (PHI) for crops irrigated with treated water.

To calculate the amount of Aquathol K required for a particular treatment use the following formula:

[Cubic Feet per Second (CFS) X Length of Treatment (hrs.) X Rate (ppm)] x 0.052947 = Gallons of Aquathol K Needed for Treatment

To calculate the amount of Aquathol K to be applied per hour use the following formula:

Gallons of Aquathol K per Hour = Total Gallons of Aquathol K / Length of Treatment (hrs.)

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

Pesticide Storage: Store in the original container. Do not store in a manner where cross-contamination with other pesticides, fertilizers, food or feed could occur. Storage at temperatures below 32°F may result in the product freezing or crystallizing. Should this occur the product must be warmed to 50°F or higher and thoroughly agitated. In the event of a spill during handling or storage, absorb with sand or other inert material and dispose of absorbent in accordance with the Pesticide Disposal instructions listed below.

Pesticide Disposal: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Handling:

(for Nonrefillable containers)

Nonrefillable container. Do not reuse or refill this container. Triple rinse or pressure rinse container (or equivalent) promptly after emptying.

For containers 5 gallons or less:

Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times.

Or

Pressure rinse as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 PSI for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

For containers more than 5 gallons:

Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times.

Or

Pressure rinse as follows: Empty the remaining contents into application equipment or a mix tank. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 PSI for at least 30 seconds. Pour or pump rinsate into application equipment or rinsate collection system. Drain for 10 seconds after the flow begins to drip.

Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

(Refillable containers)

Refillable container. Refill this container with pesticide only. Do not use this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10 percent full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times. Then offer for recycling if available or reconditioning if appropriate or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

EMERGENCY TELEPHONE NUMBERS

CHEMTREC: (800) 424-9300

MEDICAL: (866) 673-6671 Rocky Mountain Poison Control Center

**IMPORTANT INFORMATION
READ BEFORE USING PRODUCT**

CONDITIONS OF SALE AND LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read the entire Directions for Use and Conditions of Sale and Limitation of Warranty and Liability before buying or using this product. If the terms are not acceptable, return the product at once, unopened, and the purchase price will be refunded.

The Directions for Use of this product reflect the opinion of experts based on field use and tests, and must be followed carefully. It is impossible to eliminate all risks associated with the use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as manner of use or application, weather or crop conditions, presence of other materials or other influencing factors in the use of the product, which are beyond the control of United Phosphorus, Inc. or Seller. Handling, storage, and use of the product by Buyer or User are beyond the control of United Phosphorus, Inc. and Seller. To the extent consistent with applicable law, all such risks shall be assumed by Buyer and User, and Buyer and User agree to hold United Phosphorus, Inc. and Seller harmless for any claims relating to such factors.

TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, UNITED PHOSPHORUS, INC. AND SELLER MAKE NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ON THIS LABEL.

To the extent consistent with applicable law, United Phosphorus, Inc. or Seller shall not be liable for any incidental, consequential or special damages resulting from the use or handling of this product and **THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE EXCLUSIVE LIABILITY OF UNITED PHOSPHORUS, INC. AND SELLER FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT OR, AT THE ELECTION OF UNITED PHOSPHORUS, INC. OR SELLER, THE REPLACEMENT OF THE PRODUCT.**

United Phosphorus, Inc. and Seller offer this product, and Buyer and User accept it, subject to the foregoing conditions of sale and limitations of warranty and of liability, which may not be modified except by written agreement signed by the duly authorized representative of United Phosphorus, Inc.

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Nautique®

Aquatic Herbicide

SPECIMEN



For use in still or flowing aquatic sites such as potable water sources, lakes, rivers, reservoirs, and ponds, slow-flowing or quiescent water bodies, crop and non-crop irrigation and drainage systems (canals, ditches, and laterals), fish, golf course, ornamental, swimming, and fire ponds and aquaculture including fish and shrimp.

Active Ingredients

Copper Ethylenediamine Complex* (CAS# 13426-91-0) 13.2%
Copper Triethanolamine Complex* (CAS# 82027-59-6) 14.9%

Other Ingredients 71.9%

TOTAL 100.0%

*Metallic Copper equivalent = 9.1%

Keep Out of Reach of Children

DANGER / PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

Refer to inside of label booklet for additional precautionary information and *Directions for Use* including *First Aid* and *Storage and Disposal*.

NOTICE: Read the entire label before using. Use only according to label directions. Before buying or using this product, read *Terms and Conditions of Use*, *Warranty Disclaimer*, *Inherent Risks of Use* and *Limitation of Remedies* inside label booklet. If terms are unacceptable, return at once unopened.

*Nautique and *Littora are registered trademarks of SePRO Corporation

SePRO Corporation

11550 North Meridian Street, Suite 600

Carmel, IN 46032, U.S.A.

EPA Reg. No. 67690-10

FPL20131205

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

DANGER / PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

Corrosive. Causes irreversible eye damage. Causes skin burns. May be fatal if absorbed through skin. Harmful if swallowed. Harmful if inhaled. Do not get in eyes, on skin or on clothing. Avoid breathing spray or mist vapor. When handling, wear protective eyewear, clothing and chemical-resistant gloves as described under the section of this label pertaining to Personal Protective Equipment (PPE). Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Wash skin thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing before reuse.

For applications in waters destined for use as drinking water, those waters must receive additional and separate potable water treatment. Do not apply more than 1.0 ppm as metallic copper in any waters.

FIRST AID

If in eyes	• Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15 - 20 minutes. • Call a poison control center or doctor for treatment advice.
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. • Call a poison control center or doctor for further treatment advice.
If swallowed	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything to an unconscious person.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In case of emergency endangering health or the environment involving this product, call INFOTRAC at 1-800-535-5053.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Some materials that are chemical-resistant to this product are barrier laminate, butyl rubber ≥14 mils, or nitrile rubber ≥14 mils. If you want more options, follow the instructions for category A on an EPA chemical-resistant category selection chart.

Mixers, loaders, applicators and other handlers must wear the following:

- Coveralls (such as Tyvek suit or similar) worn over long-sleeved shirt and long pants;
- Socks and chemical resistant footwear;
- Chemical-resistant gloves (such as nitrile or butyl rubber);
- Protective eyewear such as goggles, safety glasses, or face shield; and
- A chemical-resistant apron when mixing and loading or cleaning equipment.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry. Discard clothing and other absorbent material that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.

USER SAFETY RECOMMENDATIONS

Users should:

- Wash the outside of gloves before removing.
- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling Nautique. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and aquatic invertebrates. Waters treated with this product may be hazardous to aquatic organisms. Treatment of aquatic weeds and algae can result in oxygen loss from decomposition of dead algae and weeds. This oxygen loss can cause fish and invertebrate suffocation. To minimize this hazard, do not treat more than ½ of the water body to avoid depletion of oxygen due to decaying vegetation. Wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Consult with the State or local agency with primary responsibility for regulating pesticides before applying to public waters, to determine if a permit is required.

Certain water conditions including low pH (<6.5), low dissolved organic carbon (DOC) levels (3.0 mg/L or lower), and "soft" waters (i.e. alkalinity less than 50 mg/L), increases the potential acute toxicity to non-target aquatic organisms. Do not use in waters containing trout or other fish species that are highly sensitive to copper if the alkalinity is less than 50 ppm. Fish toxicity generally decreases when the hardness of water increases. This product must not be used in ornamental ponds containing Koi.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Read all directions for use carefully before applying this product. Use only according to label directions.

Do not apply this product in a way that concentrate will contact workers or other persons, either directly or through drift; only protected handlers may be in close proximity to the mixing area or application equipment while in use.

Obtain Required Permits: Consult with appropriate state or local pesticide and/or water authorities before applying this product in or around public waters. Permits and posting or treatment notification may be required by State, Tribal or local public agencies.

PRODUCT INFORMATION

Nautique controls a variety of submersed, floating, and emergent aquatic weed species in still or flowing aquatic sites such as potable water sources, lakes, rivers, reservoirs, and ponds, slow-flowing or quiescent water bodies, crop and non-crop irrigation and drainage systems (canals, ditches, and laterals), fish, golf course, ornamental, swimming, and fire ponds and aquaculture including fish and shrimp.

Nautique is formulated with dual chelating agents. This aids in copper uptake by aquatic plants and reduces the precipitation of copper with carbonates and bicarbonates in the water. Nautique has a broad spectrum of activity to weed species that are susceptible to copper.

Treatment Notes

Performance of Nautique is enhanced under certain conditions. It is recommended to consult a SePRO Aquatic Specialist for guidance in implementing a treatment program to achieve optimal results. The following apply to the use of Nautique to achieve optimum effectiveness:

- Treat when growth first begins to appear (if possible) or when target vegetation is actively growing.
- Apply in a manner that will ensure even distribution of the chemical within the treatment area.
- Aquatic weeds typically drop below the surface within 3 to 14 days after treatment. The complete results of treatment will be observed 1 to 4 weeks post-treatment in most cases.
- In heavily infested areas a second application may be necessary. Retreat areas if regrowth begins to appear and seasonal control is desired. Repeating application of Nautique too soon after initial application may have no effect.

Precautions and Restrictions

- Do not apply Nautique directly to, or otherwise permit it to come into contact with any desirable plants as injury may result. Do not apply in such a way that concentrated Nautique comes in contact with crops, ornamentals, grass or other desirable plants.
- Wash spray equipment thoroughly before and after each application.

Spray Drift Management

A variety of factors including weather conditions (e.g., wind direction, wind speed, temperature, relative humidity) and method of application (e.g., ground, aerial, airblast, chemigation) can influence pesticide drift. The applicator must evaluate all factors and make appropriate adjustments when applying this product.

Droplet Size

Apply only as a medium or coarser spray (ASAE standard 572) or a volume mean diameter of 300 microns or greater for spinning atomizer nozzles.

Wind Speed

Do not apply at wind speeds greater than 15 mph. Only apply this product if the wind direction favors on-target deposition (approximately 3 to 10 mph), and there are no sensitive areas within 250 feet downwind.

Temperature Inversions

If applying at wind speeds less than 3 mph, the applicator must determine if a) conditions of temperature inversion exist, or b) stable atmospheric conditions exist at or below nozzle height. Do not make applications into areas of temperature inversions or stable atmospheric conditions.

Other State and Local Requirements

Applicators must follow all state and local pesticide drift requirements regarding application of copper compounds. Where states have more stringent regulations, they must be observed.

Equipment

All aerial and ground application equipment must be properly maintained and calibrated using appropriate carriers or surrogates.

Additional requirements for aerial applications:

- The boom length must not exceed 75% of the wingspan or 90% of the rotor blade diameter.
- Release spray at the lowest height consistent with efficacy and flight safety. Do not release spray at a height greater than 10 feet above the crop canopy unless a greater height is required for aircraft safety.
- When applications are made with a crosswind, the swath must be displaced downwind. The applicator must compensate for this displacement at the up and downwind edge of the application area by adjusting the path of the aircraft upwind.

Additional requirements for ground boom application:

Do not apply with a nozzle height greater than 4 feet above the crop canopy.

APPLICATION INFORMATION

For aquatic weed control (including vascular plants and algae), do not exceed a concentration of 1.0 ppm copper during any single application. Wait at least 10 to 14 days between treatments. When treating aquaculture ponds when fish are present, do not exceed a concentration of 0.4 ppm during any single application when targeting nuisance algae; wait a minimum of 10 days between retreatments.

Target Species

Nautique is a chelated copper formulation that provides effective control of floating, submersed, and emergent aquatic plants having sensitivity to copper including:

Brazilian elodea (<i>Egeria densa</i>)	Pondweed spp. (e.g., sago, American) ¹
Coontail	Salvinia spp. (e.g. giant and common)
Curlyleaf pondweed	Starry stonewort ¹
Duckweed	Thinleaf pondweed
Elodea	Watermillfoil, Eurasian ¹
Eelgrass (<i>Vallisneria</i>) ¹	Water hyacinth
Horned pondweed ¹	Water lettuce
Hydrilla	Widgeon grass
Naiad	

¹ Variable control may be obtained, especially in waters with higher alkalinity, and repeat applications may improve control.

Application Methods

Nautique can be applied directly as a surface spray, subsurface through trailing weighted hoses, by aerial application, or in combination with other aquatic herbicides and algaecides. Surfactants, sinking agents, polymers (except CA), penetrants, or other adjuvants may be combined with Nautique to improve the retention time, sinking, and distribution of the herbicide. Nautique inverts easily using either tank mix or multi-fluid mixer techniques. For submersed plants, invert applications should be made through weighted hoses dragged below the water surface; for heavy infestations, direct application is preferable.

When treating moving water, apply the spray solution counter to the flow of water (unless metering Nautique into flowing water – see the *Flowing Water Treatment* section of this label). Nautique can be applied diluted or undiluted, whichever is most suitable to insure uniform coverage of the area to be treated. Dilution with water may be necessary at the lower application rates and when targeting floating or emergent vegetation. Dilute the required amount of Nautique with enough water to ensure even distribution in the treated area with the type of equipment being used. For best results, dilute Nautique in water to provide a minimum spray mix of 20 to 50 gallons per acre; in areas with heavy weed infestations, a total tank mix of > 50 gallons per acre may be necessary.

For effective control, proper Nautique concentrations should be maintained for a minimum of three (3) hours. The rates in Table 1, *Nautique Application Rates*, are based on static or minimal flow situations. Where significant dilution occurs from untreated waters or loss of water within a three (3) hour period, Nautique may have to be metered in (refer to the *Flowing Water Treatment* section of this label).

Use the lower rates for treating soft water (less than 50 ppm alkalinity) or when targeting species with greater susceptibility to Nautique. Use the higher rates for treating less susceptible species, heavier infestations, and/or treating hard water (above 50 ppm alkalinity). Surface applications may be made from shore into shallow water along the shoreline.

Application Rates

Application rates in Table 1 are based on minimal water flow in ponds, lakes, reservoirs, and irrigation conveyance or drainage systems. Treatments that extend chemical contact time with target vegetation will generally result in improved efficacy. In conveyance systems where significant water flow results in rapid off-site movement of Nautique, consult Table 2 and the *Flowing Water Treatment* section of this label for application instructions.

Application rates are calculated by using the following formula to obtain the appropriate Nautique dose/rate:

$$\text{Gallons of Nautique per surface acre} = \text{desired concentration of metallic copper (ppm)} \times \text{average depth of water (feet)} \times 3.0$$

TABLE 1 Nautique Application Rates									
Relative Plant Density	ppm copper	Gallons Per Surface Acre				Liters Per Surface Hectare			
		Depth in Feet [†]				Depth in Meters [†]			
		1	2	3	4	0.5	0.75	1.0	1.25
Low Density	0.5	1.5	3.0	4.5	6.0	12.0	24.1	36.1	48.2
	0.6	1.8	3.6	5.4	7.2	14.9	29.8	44.7	59.6
Medium Density	0.7	2.1	4.2	6.3	8.4	17.2	34.4	51.6	68.8
	0.8	2.4	4.8	7.3	9.6	19.5	39.0	58.5	78.0
High Density	0.9	2.7	5.4	8.1	10.8	21.8	43.6	65.4	87.2
	1.0	3.0	6.0	9.0	12.0	24.1	48.2	72.3	96.4

[†] For depths greater than 4 feet (1.25 meters) add rates given for the sum of the corresponding depths in the chart

Free-Floating Plants

Apply Nautique using a foliar spray at a rate of 8 - 12 gallons/acre for control of water hyacinth, duckweed, and salvinia, and up to 4 - 6 gallons/acre for control of water lettuce (do not exceed 3 gallons/acre foot). Add Nautique and the appropriate surfactant to a minimum of 20 to 50 gallons per acre with water. Use an adequate spray volume to ensure good coverage of the plant. Apply Nautique to the area where the greatest concentration of foliage is located in a manner that will optimize herbicide contact on leaf surfaces.

Tank Mix

Nautique may be mixed with other herbicides or algaecides registered for aquatic use provided that no labeling prohibits such mixing. Do not exceed labeled rate or dose of any of the products in the combination. Observe the most restrictive of the labeling limitations and precautions of all products used in mixtures. To ensure compatibility, a jar test is recommended before field application of any tank mix combination. It is recommended to consult with SePRO Corporation for latest tank mix recommendations.

NOTE: Tank mixing or use of Nautique with any other product which is not specifically listed on the Nautique label shall be at the exclusive risk of the user, applicator and/or application adviser, to the extent allowed by applicable law.

- **Nautique + Sonar[®] A.S. Tank Mix (Except California)** - Nautique can be mixed with Sonar A.S. to broaden the submersed weed control spectrum of either product alone and be applied as a uniform surface spray or injected under the water's surface. For best results, apply this tank mix at a minimum of 0.5 ppm Nautique and 0.03 ppm (30ppb) Sonar A.S. Lower concentrations may be effective on more susceptible species.
- **Nautique + Diquat Tank Mix** - For best results, apply Nautique/diquat (e.g. Littora[®]) combinations in a 2:1 ratio of Nautique:Diquat (e.g. 4 gallons Nautique and 2 gallons Littora[®] per acre in waters with average depth of 4 feet). Do not exceed maximum labeled rates for any product. For hydrilla control and control of other species with high sensitivity to copper, lower rates of Nautique may also enhance the activity of diquat. Nautique must be applied at a minimum of 0.1 ppm in combination with diquat. Higher rates may be needed in areas with dense weeds.
- **Nautique + Endothall Tank Mix** - For best results apply Nautique in combination with endothall (e.g. dipotassium salt of endothall; Aquathol[®] K - 4.23 lbs salt/gallon) at a minimum rate of 1 gallon Nautique per acre foot and 0.75 gallons Aquathol[®] K per acre foot.

Nautique may be applied as a tank mix or simultaneously injected or used with the dipotassium salt of endothall (e.g. Cascade[®]) or the mono (N,N-dimethylalkylamine) salt of endothall (e.g. Teton[®]) to broaden the weed control spectrum and/or reduce injection times or rates in canals, ditches, and laterals. In flowing canals, apply Nautique via drip or injection at a typical use rate of 0.1 to 1.0 ppm in conjunction with Teton (0.05 - 2.0 ppm) or Cascade (0.35-3.0 ppm) for a minimum of one hour.
- **Tank Mix Adjuvants/Surfactants** - The addition of a surfactant is recommended to improve efficacy on floating and emergent plants. Silicone surfactants are not recommended for floating plants as they generally can cause the plant to sink causing the spray solution to be washed off the plant. Observe all cautions and restrictions on the labels of both products used in this mixture. Adjuvants/surfactants may also enhance performance on other species. Consult manufacturer recommendations.

Flowing Water Treatment

Drip System or Metering Pump Application for Canals, Ditches, and Laterals
For optimal control, Nautique should be applied as soon as submersed macrophytes or algae begin active growth or interfere with normal delivery of water (clogging of lateral head gates, suction screens, weed screens, and siphon tubes). Delaying treatment could perpetuate the problem causing massing and compacting of plants. Heavy infestations and low flows may result in pooling or uneven product distribution resulting in unsatisfactory control. Under these conditions repeated applications or increasing the water flow rate during application may be necessary.

To achieve desired control with Nautique herbicide in flowing waters, a minimum exposure period of three hours should be maintained at a concentration of 0.5 to 1.0 ppm. Other factors to consider include: plant species and density of infestation and water temperature and hardness. Longer contact times and the highest rates may be required for less susceptible species and in difficult treatment conditions (e.g. less susceptible weed species, dense weed beds, hard water).

1. Treatment with Nautique requires accurate calculations of water flow rates. Devices that provide accurate flow measurements such as weirs or orifices are the preferred method; however, the volume of water to be treated may also be estimated using the following formula:

$$\text{Cubic feet per second (cfs)} = \text{average width (feet)} \times \text{average depth (feet)} \times \text{average velocity (feet/second)} \times 0.9$$

The velocity can be estimated by determining the length of time it takes a floating object to travel a defined distance. Divide the distance (feet) by the time (seconds) to estimate velocity (feet/seconds). This measure should be repeated 3 times at the intended application site and then calculate the average velocity.

2. After accurately determining the water flow rate in cubic feet per second(s) (cfs) or gallons/minute, find the corresponding drip rate in Table 2. For flow rates not listed in the table, multiply the flow rate by the recommended amount of Nautique in 1 cfs for application rates or use the below formula.

$$\text{cfs} \times \text{desired concentration of metallic copper (ppm)} = \text{quarts/hour of application}$$

TABLE 2 Nautique Application Drip or Injection Rates For Flowing Water				
Water Flow Rate		PPM Copper	Nautique Drip Rate	
cfs	gal/min.		Quart/ hr	ml / min
1	450	0.5 - 1.0	0.5 - 1.0	7.9 - 15.7
2	900	0.5 - 1.0	1.0 - 2.0	15.7 - 31.5
3	1,350	0.5 - 1.0	1.5 - 3.0	23.6 - 47.3
4	1,800	0.5 - 1.0	2.0 - 4.0	31.5 - 63.0
5	2,250	0.5 - 1.0	2.5 - 5.0	39.4 - 78.8
10	4,500	0.5 - 1.0	5.0 - 10.0	78.8 - 157.7
100	45,000	0.5 - 1.0	50 - 100	789 - 1,577

Calculate the amount of Nautique needed to maintain the drip rate for a treatment period of 3 hours by multiplying quart(s)/hour by 3 or milliliters/minute by 180. For longer injection periods, multiply dosage rate by desired time in minutes or hours as appropriate.

Rates will target up to 1.0 ppm copper concentration in the treated water for the treatment period. Lower concentrations may be used on susceptible plant species or if longer exposure/injection times are maintained. Introduction of Nautique should be made in the channel at weirs or other turbulence-creating structures to promote the dispersion of the chemical.

Use a drum or tank equipped with a valve or other volume control device that can be calibrated to maintain a constant drip rate. Use a stopwatch and appropriate measuring container to set the desired drip rate. Readjust accordingly if the canal flow rate changes during the treatment period. A small pump or other metering device may be used to meter Nautique into the water more accurately. Application can be made using diluted or undiluted material.

Results can vary depending upon species and density of vegetation, desired distance of control and flow rate, and impact of water quality on Nautique and efficacy. Periodic maintenance treatments may be required to maintain seasonal control (every 2 to 6 weeks). In addition, Nautique can be used in a rotational program with other herbicides labeled for flowing water for an integrated management approach. It is recommended to consult a SePRO Aquatic Specialist to determine optimal use rate location of treatment stations and duration of treatment period under local conditions.

Irrigation Ponds or Reservoirs

When applying to irrigation ponds or reservoirs, it is best to hold water for a minimum of 3 hours before irrigating to ensure proper exposure of Nautique at targeted rates to plants. If water is to be continually pumped from the treated system during application, application techniques (drip, injection, or multiple spray applications) should be made to compensate for dilution of Nautique within the targeted area.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

Pesticide Storage: Store in a cool dry place. Do not store near feed or foodstuffs. In case of leak or spill, use absorbent materials to contain liquids and dispose in a manner consistent with the pesticide disposal instructions.

Pesticide Disposal: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance. Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Nonrefillable Container Handling (rigid, 5 gallons or less): Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank, treatment area, or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat the procedure two more times. Then offer for recycling (if available) or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Nonrefillable Container Handling (rigid, larger than 5 gal): Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank, treatment area, or store rinsate for later use or disposal. Repeat this procedure two more times. Then offer for recycling (if available) or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Refillable Container Handling (rigid, larger than 5 gal): Refill this container with pesticide only. Do not reuse this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal, empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10 percent full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment, rinsate collection system, or treatment area. Repeat this rinsing procedure two more times. If returning container, seal all openings which have been opened during use. Return the empty container to a collection site designated by SePRO Corporation. If the container has been damaged and cannot be returned according to the recommended procedures, contact SePRO Corporation at 1-800-419-7779 to obtain proper handling instructions.

Container Handling (bulk): Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

TERMS AND CONDITIONS OF USE

If terms of the following *Warranty Disclaimer*, *Inherent Risks of Use* and *Limitation of Remedies* are not acceptable, return unopened package at once to the seller for a full refund of purchase price paid. Otherwise, to the extent consistent with applicable law, use by the buyer or any other user constitutes acceptance of the terms under *Warranty Disclaimer*, *Inherent Risks of Use*, and *Limitation of Remedies*.

WARRANTY DISCLAIMER

SePRO Corporation warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, SEPRO CORPORATION MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

INHERENT RISKS OF USE

It is impossible to eliminate all risks associated with use of this product. Plant injury, lack of performance, or other unintended consequences may result because of such factors as use of this product contrary to label instructions (including conditions noted on the label, such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of SePRO Corporation or the seller. To the extent consistent with applicable law, all such risks shall be assumed by the buyer.

LIMITATION OF REMEDIES

To the extent consistent with applicable law, the exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories) shall be limited to, at SePRO Corporation's election, one of the following:

- (1) Refund of purchase price paid by buyer or user for the product bought, or
- (2) Replacement of amount of the product used.

To the extent consistent with applicable law, SePRO Corporation shall not be liable for losses or damages resulting from handling or use of Nautique unless SePRO Corporation is promptly notified of such losses or damages in writing. In no case shall SePRO Corporation be liable for consequential or incidental damages or losses.

The terms of the *Warranty Disclaimer*, *Inherent Risks of Use*, and this *Limitation of Remedies* cannot be varied by any written or verbal statements or agreements. No employee or sales agent of SePRO Corporation or the seller is authorized to vary or exceed the terms of the *Warranty Disclaimer* or this *Limitation of Remedies* in any manner.

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SePRO Corporation
11550 North Meridian Street, Suite 600
Carmel, IN 46032, U.S.A.

Komeen®

Aquatic Herbicide

SPECIMEN



For use in slow-moving or quiescent bodies of water including: golf course, ornamental, fish, and fire ponds; fresh water lakes, fish hatcheries, and potable water reservoirs.

Active Ingredient

Copper ethylenediamine complex¹ (CAS# 13426-91-0)22.9%

Other Ingredients77.1%

TOTAL100.0%

¹Metallic copper equivalent = 8%

Keep Out of the Reach of Children

WARNING / AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

Refer to inside of label booklet for additional precautionary information and directions for use including first aid and storage and disposal.

Notice: Read the entire label before using. Use only according to label directions. Before buying or using this product, read *Terms and Conditions of Use*, *Warranty Disclaimer*, *Inherent Risks of Use* and *Limitation of Remedies* inside label booklet.

EPA Reg. No. 67690-25

FPL20130326

Komeen is a registered trademark of SePRO Corporation.

SePRO Corporation 11550 North Meridian Street, Suite 600 Carmel, IN 46032 U.S.A.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

KEEP OUT OF THE REACH OF CHILDREN

WARNING / AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

May be fatal if swallowed. May be fatal if inhaled. Do not breathe vapor or spray mist. Harmful if absorbed through skin. Causes Moderate eye irritation. Avoid contact with skin, eyes or clothing. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

For applications in waters destined for use as drinking water, those waters must receive additional and separate potable water treatment. Do not apply more than 1.0 ppm as metallic copper in any waters.

FIRST AID

If swallowed	<ul style="list-style-type: none">• Call a poison control center or doctor immediately for treatment advice.• Have person sip a glass of water if able to swallow.• Do not induce vomiting unless told to do so by a poison control center or doctor.• Do not give anything to an unconscious person.
If inhaled	<ul style="list-style-type: none">• Move person to fresh air.• If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.• Call a poison control center or doctor for further treatment advice.
If on skin or clothing	<ul style="list-style-type: none">• Take off contaminated clothing.• Rinse skin immediately with plenty of water for 15 - 20 minutes.• Call a poison control center or doctor for treatment advice.
If in eyes	<ul style="list-style-type: none">• Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.• Call a poison control center or doctor for treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In case of emergency endangering health or the environment involving this product, call INFOTRAC at 1-800-535-5053.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Some materials that are chemical-resistant to Komeen are barrier laminate, butyl rubber ≥14 mils, or nitrile rubber ≥14 mils. If you want more options, follow the instructions for category A on an EPA chemical-resistant category selection chart.

Mixers, loaders, applicators, and other handlers must wear the following:

- Long-sleeve shirt and long pants;
- Shoes plus socks; and
- Chemical-resistant gloves (such as nitrile or butyl rubber).

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry. Discard clothing and other absorbent material that have been drenched or heavily contaminated with the Komeen's concentrate. Do not reuse them.

USER SAFETY RECOMMENDATIONS

Users should:

- Wash the outside of gloves before removing.
- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling Komeen. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and aquatic invertebrates. Waters treated with this product may be hazardous to aquatic organisms. Treatment of aquatic weeds and algae can result in oxygen loss from decomposition of dead algae and weeds. This oxygen loss can cause fish and invertebrate suffocation. To minimize this hazard, do not treat more than 1/2 of the water body to avoid depletion of oxygen due to decaying vegetation. Wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Consult with the State or local agency with primary responsibility for regulating pesticides before applying to public waters, to determine if a permit is required.

Certain water conditions including low pH (<6.5), low dissolved organic carbon (DOC) levels (3.0 mg/L or lower), and "soft" waters (i.e. alkalinity less than 50 mg/L), increase the potential acute toxicity to non-target aquatic organisms. Do not use in waters containing trout or other fish species that are highly sensitive to copper if the alkalinity is less than 50 ppm. Fish toxicity generally decreases when the hardness of water increases. Komeen must not be used in ornamental ponds containing Koi.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Read all directions for use carefully before applying this product. Use only according to label directions.

Do not apply Komeen in a way that will contact workers or other persons, either directly or through drift; only protected handlers may be in close proximity to the mixing area or application equipment while in use. For any requirements specific to your State or Tribe, consult the State or Tribal agency responsible for pesticide regulation.

PRODUCT INFORMATION

Komeen controls many submersed and floating aquatic plant species including hydrilla (*Hydrilla verticillata*), Brazilian elodea (*Egeria densa*), naiad (*Najas* spp.), coontail (*Ceratophyllum demersum*), elodea (*Elodea canadensis*), water lettuce (*Pistia stratiotes*), water fern (*Salvinia* and *Azolla* spp.), duckweed (*Lemna* and *Landoltia* spp.), water hyacinth (*Eichhornia crassipes*) and other submersed and floating aquatic weed species that are sensitive to copper. Under certain water quality conditions, such as low water hardness, Komeen may also control Eurasian watermilfoil (*Myriophyllum spicatum*), sago pondweed (*Potamogeton pectinatus*) and American pondweed (*Potamogeton nodosus*).

Apply when weeds are actively growing. The most copper sensitive weed species require a minimum of three (3) to twenty-four (24) hours of contact with Komeen in order to provide effective control. Less susceptible species may require longer contact time or higher doses. Significant water movement may result in dilution of the treated water and reapplication may be necessary. Susceptible aquatic weeds will generally drop below the surface of the water within 3 to 14 days after treatment. If this effect is not

observed, Komeen may be re-applied after a minimum of 10 to 14 days after the initial application. Once weeds drop below the surface, it can take up to 6 weeks to realize the full effect of the treatment.

Komeen may be applied by aircraft, sprayer or spray boat as a surface spray, as a subsurface application through weighted hoses, or mixed with adjuvants, a polymer (except CA), or surfactants as appropriate. As a surface or subsurface application, Komeen may be applied diluted or undiluted, whichever is most suitable to ensure uniform coverage of the treated area. Apply Komeen to the area where the greatest concentration of foliage is located in a manner that will deposit the herbicide on leaf surfaces.

Dilution with water may be necessary at the lower application rates to ensure uniform coverage of the treated area. Dilute the required amount of Komeen with enough water to ensure even distribution with the type of equipment being used.

Precautions and Restrictions

- Do not enter or allow others to enter until application is complete.
- Do not apply Komeen directly to, or otherwise permit it to come into contact with any desirable plants as injury may result.
- Do not apply in such a way that concentrated Komeen comes in contact with crops, ornamentals, grass or desirable plants.
- Wash spray equipment thoroughly before and after each application.

Spray Drift Management

A variety of factors including weather conditions (e.g., wind direction, wind speed, temperature, relative humidity) and method of application (e.g., ground, aerial, airblast, chemigation) can influence pesticide drift. The applicator must evaluate all factors and make appropriate adjustments when applying this product.

Droplet Size

Apply only as a medium or coarser spray (ASAE standard 572) or a volume mean diameter of 300 microns or greater for spinning atomizer nozzles.

Wind Speed

Do not apply at wind speeds greater than 15 mph. Only apply this product if the wind direction favors on-target deposition (approximately 3 to 10 mph), and there are no sensitive areas within 250 feet downwind.

Temperature Inversions

If applying at wind speeds less than 3 mph, the applicator must determine if a) conditions of temperature inversion exist, or b) stable atmospheric conditions exist at or below nozzle height. Do not make applications into areas of temperature inversions or stable atmospheric conditions.

Other State and Local Requirements

Applicators must follow all state and local pesticide drift requirements regarding application of copper compounds. Where states have more stringent regulations, they must be observed.

Equipment

All aerial and ground application equipment must be properly maintained and calibrated using appropriate carriers or surrogates.

Additional requirements for aerial applications:

- The boom length must not exceed 75% of the wingspan or 90% of the rotor blade diameter.
- Release spray at the lowest height consistent with efficacy and flight safety. Do not release spray at a height greater than 10 feet above the crop canopy unless a greater height is required for aircraft safety.
- When applications are made with a crosswind, the swath must be displaced downwind. The applicator must compensate for this displacement at the up and downwind edge of the application area by adjusting the path of the aircraft upwind.

Additional requirements for ground boom application:

Do not apply with a nozzle height greater than 4 feet above the water.

APPLICATION INFORMATION

In lakes, reservoirs, and ponds, the application site is defined by this label as the specific location where Komeen is applied. Use the lower listed rate in soft water (less than 50 ppm alkalinity), for light infestations and less mature plants; use the higher concentration in hard water (above 50 ppm alkalinity), for dense infestations and when targeting more mature vegetation.

For aquatic weed control (including vascular plants and algae), do not exceed 1.0 ppm metallic copper during any single application; wait a minimum of 14 days between treatments, except for algae control in aquaculture ponds when fish are present. In that case, do not exceed a concentration of 0.4 ppm during any single application and wait a minimum of 10 days between treatments.

When treating slow-moving water, apply the spray solution counter to the flow of water.

TABLE 1
Application Concentrations For Submersed Aquatic Weed Control

Weed Species	Metallic Copper Level Required For Control (ppm)
American pondweed (<i>Potamogeton nodosus</i>) †	0.75 - 1.0
Brazilian elodea (<i>Egeria densa</i>)	0.50 - 1.0
Coontail (<i>Ceratophyllum demersum</i>)	0.50 - 1.0
Elodea (<i>Elodea canadensis</i>)	0.50 - 1.0
Eurasian watermilfoil (<i>Myriophyllum spicatum</i>) †	0.75 - 1.0
Hydrilla (<i>Hydrilla verticillata</i>)	0.75 - 1.0
Naiad (<i>Najas</i> spp.)	0.50 - 1.0
Pondweed spp. (<i>Potamogeton</i> spp.)	0.75 - 1.0
Sago pondweed (<i>Potamogeton pectinatus</i>) †	0.50 - 1.0
Other susceptible submersed species	0.75 - 1.0

† Control generally only in low water hardness.

Komeen can be effective on species of algae with a high sensitivity to copper at concentrations ranging from 0.2 to 1.0 ppm.

TABLE 2
Foliar Application Rates For Floating Aquatic Weed Control†

Weed Species	ppm
Duckweed (<i>Lemna</i> , <i>Landoltia</i> , and <i>Spirodela</i> spp.)	0.75 - 1
Water fern (<i>Salvinia</i> and <i>Azolla</i> spp.)	0.75 - 1
Water hyacinth (<i>Eichhornia crassipes</i>)	0.75 - 1
Water lettuce (<i>Pistia stratiotes</i>)	0.5 - 0.75

† The addition of a surfactant is recommended to improve efficacy on floating plants. Follow surfactant product labeling instructions for application rates and use directions. Add Komeen and appropriate surfactant to a recommended minimum of 50 gallons of spray solution per surface acre. Use an adequate spray volume to ensure good coverage of the plant. Do not exceed 3.34 gallons of Komeen per acre foot.

Application Rate Calculation

For large bodies of water, determine the size (in acres) and the average depth (in feet) of the area to be treated. Application rates are calculated by using the following formula to obtain the appropriate copper concentration:

$$\text{Desired concentration of copper (ppm)} \times \text{Average depth of water (feet)} \times 3.34 = \text{Gallons of Komeen per surface acre}$$

To calculate the area and average depth of a lake or pond, use the following formulas and conversion factors. All measurements (length, width, radius, depth) should be in feet.

Formulas

- Area of a square or rectangle (ft²) = length x width
- Area of a circle (ft²) = radius x radius x 3.14
- Average depth (ft) = sum of all depth measurements ÷ number of measurements (The more measurements taken, the more accurate the average depth will be.)

Conversion Factors

- 1 gallon = 4 quarts or 8 pints or 16 cups or 128 fluid ounces
- 1 quart = 2 pints or 4 cups or 32 fluid ounces
- 1 acre = 43,560 square feet
- 1 acre-foot = 43,560 cubic feet = 325,762 gallons = 2,720,000 pounds

TABLE 3

Average Water Depth of Treatment Site (feet)	Gallons of Komeen per Surface Acre to Achieve the Desired Copper Concentration [†]		
	0.5 ppm	0.75 ppm	1.0 ppm
1	1.7	2.5	3.3
2	3.3	5.0	6.6
3	5.0	7.5	10.0
4	6.7	10.0	13.3
5	8.4	12.5	16.7
6	10.0	15.0	20.0
7	11.7	17.5	23.3
8	13.4	20.0	26.7
9	15.0	22.5	30.0
10	16.7	25.1	33.4

[†] For surface applications, dilute Komeen with water in a minimum ratio of 4:1 (Komeen:water). For subsurface applications, no dilution is required.

For smaller bodies of water, determine the size (in square feet) and the average depth (in feet) of the area to be treated.

TABLE 4

Average Water Depth of Treatment Site (feet)	Fluid Ounces ¹ of Komeen per 1,000 ft ² to Achieve the Desired Copper Concentration ²		
	0.5 ppm	0.75 ppm	1.0 ppm
1	5.0	7.3	9.7
2	9.8	14.7	19.3
3	14.7	22.1	29.0
4	19.6	29.4	39.0
5	24.5	36.8	49.0
6	29.4	44.2	58.7
7	34.4	51.5	68.4
8	39.3	58.9	78.4
9	44.2	66.2	88.1
10	49.1	73.6	98.1

¹ When treating low volumes and measurements in tablespoons is desired, multiply the volume in fluid ounces by 2 to get the volume in tablespoons (one fluid ounce contains two tablespoons).

² For surface applications, dilute Komeen with water in a minimum ratio of 4:1 (Komeen:water). For subsurface applications, no dilution is required.

METHODS OF APPLICATION

Surface Application

Spray Komeen from shore or boat across the surface of the targeted area. Surface applications generally are recommended near shorelines and in shallower waters, and may be made from shore into shallow water.

Subsurface Application

In deeper water, it is recommended to make a subsurface application of Komeen at listed rates through weighted trailing hoses in order to deliver spray mix to the water depth of target vegetation. Do not drag hoses on the bottom. Do not exceed 3.34 Gallons of Komeen per acre foot.

Adjuvants/Surfactants

Adjuvants or surfactants may be added to Komeen or to a Komeen/water premix to improve efficacy. Silicone surfactants are not recommended for use on floating plants as they generally can cause the plant to sink causing the spray solution to be washed off the plant. Adjuvants/surfactants may also enhance performance on other species. Consult the manufacturer's recommendations regarding the use of these products for improved control.

Aerial Application

Dilute Komeen with water in a minimum ratio of 4:1 (Komeen:water). Apply the listed rate of Komeen in a recommended minimum of 10 gallons of total spray solution per surface acre. Add the listed rates of a drift control or sinking agent to the spray solution. Maintain constant agitation during addition of a polymer (except CA – polymers not approved for use with Komeen) and continue throughout the application.

Tank Mix

Komeen may be tank mixed with other herbicides for control of a broader weed spectrum. Do not mix concentrates in tank without first adding water. To ensure compatibility, a jar test is recommended before field application. Komeen must not be mixed with any product containing a label prohibition against such mixing and must be used in accordance with the more restrictive of the label limitations and precautions. Do not exceed any label dosage rates.

- **Komeen + Sonar® A.S. Tank Mix** - Komeen can be mixed with Sonar A.S. and applied as a uniform surface spray or injected under the water's surface to enhance the submersed weed control spectrum. For best results, apply Komeen/Sonar A.S. combinations in a 20.4 :1 ratio of Komeen:Sonar A.S. and at a minimum of 0.5 ppm Komeen and 0.03 ppm (30 ppb) Sonar A.S. (e.g. 6.8 Gallons Komeen and 0.324 Gallons Sonar A.S. per acre in waters with average depth of 4 feet). Do not exceed maximum labeled rate for any product. Lower concentrations may be effective on more susceptible species and under certain conditions.
- **Komeen + Diquat Tank Mix** - Komeen can be mixed with diquat (diquat dibromide) for enhanced control of certain weed species including bladderwort, curlyleaf pondweed, leafy pondweed, Richardson pondweed, small pondweed, cattail, elodea, duckweed, water lettuce, Eurasian watermilfoil, floatingleaf pondweed, coontail, salvinia, naiad, sago pondweed, pennywort, hydrilla and water hyacinth. For best results, apply Komeen/diquat (e.g. Littora®, Reward) combinations in a 2:1 ratio of Komeen:Diquat (e.g. 4 gallons Komeen and 2 gallons Littora® per acre in waters with average depth of 4 feet). Do not exceed maximum labeled rates for any product. For hydrilla control and control of other species with high sensitivity to copper, lower rates of Komeen may also enhance the activity of diquat. Komeen must be applied at a minimum of 0.1 ppm in combination with diquat. Higher rates may be needed in areas with dense weeds.
- **Komeen + Endothall Tank Mix** - Komeen can be mixed with dipotassium salt of endothall and be applied as a uniform surface spray or injected under the water's surface for control of species including naiad, curlyleaf pondweed, elodea, coontail, watermilfoil, water stargrass, eelgrass, *Cladophora*, *Pithophora*, *Spirogyra*, *Chara*, American pondweed and sago pondweed. For best results, apply Komeen/endothall combinations at a minimum rate of 4 gallons Komeen and 3 gallons dipotassium endothall (i.e., Aquathol K, 3 lbs ai/gal/A).

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

Pesticide Storage: Store in a cool dry place. Do not store near feed or foodstuffs. In case of leak or spill, use absorbent materials to contain liquids and dispose in a manner consistent with the pesticide disposal instructions.

Pesticide Disposal: Pesticide wastes are acutely hazardous.

Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance. Wastes resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

Nonrefillable Container Handling (rigid, 5 gallons or less): Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank, treatment area, or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat the procedure two more times. Then offer for recycling (if available) or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

(continued)

STORAGE AND DISPOSAL (continued)

Nonrefillable Container Handling (rigid, larger than 5 gal): Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank, treatment area, or store rinsate for later use or disposal. Repeat this procedure two more times. Then offer for recycling (if available) or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Refillable Container Handling (rigid, larger than 5 gal): Refill this container with pesticide only. Do not reuse this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal, empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10% full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment, rinsate collection system, or treatment area. Repeat this rinsing procedure two more times. If returning container, seal all openings which have been opened during use. Return the empty container to a collection site designated by SePRO Corporation. If the container has been damaged and cannot be returned according to the recommended procedures, contact SePRO Corporation at 1-800-419-7779 to obtain proper handling instructions.

TERMS AND CONDITIONS OF USE

If terms of the following *Warranty Disclaimer, Inherent Risks of Use* and *Limitation of Remedies* are not acceptable, return unopened package at once to the seller for a full refund of purchase price paid. Otherwise, to the extent consistent with applicable law, use by the buyer or any other user constitutes acceptance of the terms under *Warranty Disclaimer, Inherent Risks of Use*, and *Limitation of Remedies*.

WARRANTY DISCLAIMER

SePRO Corporation warrants that the product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, SEPRO CORPORATION MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

INHERENT RISKS OF USE

It is impossible to eliminate all risks associated with use of this product. Plant injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of SePRO Corporation or the seller. To the extent consistent with applicable law, all such risks shall be assumed by the buyer.

LIMITATION OF REMEDIES

To the extent consistent with applicable law, the exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories) shall be limited to, at SePRO Corporation's election, one of the following:

- (1) Refund of purchase price paid by buyer or user for product bought, or
- (2) Replacement of amount of product used.

To the extent consistent with applicable law, SePRO Corporation shall not be liable for losses or damages resulting from handling or use of this product unless SePRO Corporation is promptly notified of such losses or damages in writing. In no case shall SePRO Corporation be liable for consequential or incidental damages or losses.

The terms of the Warranty Disclaimer, Inherent Risks of Use and this Limitation of Remedies cannot be varied by any written or verbal statements or agreements. No employee or sales agent of SePRO Corporation or the seller is authorized to vary or exceed the terms of the Warranty Disclaimer or Limitations of Remedies in any manner.

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SePRO Corporation
11550 North Meridian Street, Suite 600
Carmel, IN 46032, U.S.A.

AQUATIC HERBICIDE

HARPOON[®]

GRANULAR

GENERAL INFORMATION

Harpoon Granular is a chelated copper formulation that effectively controls Hydrilla, Egeria (Brazilian Elodea), Naiads, Coontail, Elodea, Water Lettuce, Water Hyacinth, Giant Salvinia, and other species having a sensitivity to copper absorption. In waters with low alkalinity (hardness), Harpoon may also control Eurasian Watermilfoil and Horned, Sago, American, Curly-leaf, & Floating-leaf Pondweeds. Harpoon Granular may be applied to slow moving or quiescent bodies of water, including lakes, fish hatcheries, potable water reservoirs, golf courses, and ornamental, fish and fire ponds.

Areas treated with Harpoon Granular Aquatic Herbicide may be used for fishing and swimming immediately after treatment.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Read entire label and use strictly in accordance with precautionary statements and directions.

HERBICIDE APPLICATION Quiescent or Slow Moving Water

A. LARGE AREA TREATMENT (over 5,000 sq. ft.)

1. Identify form(s) of targeted submersed aquatic plants.
2. Estimate the targeted Plant Growth Height (in ft.) in the water column. This would be the distance from the base to the top of plants.
3. Calculate surface area (acres) of the treatment area (area of infestation) using the following formula:

$$\frac{\text{Length (ft.)} \times \text{Width (ft.)}}{43,560} = \text{Surface Acre(s)}$$
4. Refer to Table 1 to determine lbs. of Harpoon Granular to apply per Surface Acre based upon Plant Growth Height.

Table 1 Pounds of Harpoon Granular to Apply per Surface Acre*

Submersed (Target) Species (In water of medium to high hardness)	ppm copper	Plant Growth Height (from bottom)		
		1 ft.	2 ft.	3 ft.
<i>Hydrilla verticillata</i> (Hydrilla)	0.75 - 1.0	60 - 80	120 - 160	180 - 240
<i>Egeria densa</i> (Brazilian Elodea)	0.50 - 0.75	40 - 60	80 - 120	120 - 180
<i>Najas</i> sp. (Southern/Northern Naiads)	0.50 - 1.0	40 - 80	80 - 160	120 - 240
<i>Ceratophyllum demersum</i> (Coontail)	0.50 - 1.0	40 - 80	80 - 160	120 - 240
<i>Elodea canadensis</i> (Common Elodea)	0.50 - 1.0	40 - 80	80 - 160	120 - 240

The following plants should only be treated in water where calcium carbonate hardness is less than 150 ppm

<i>Myriophyllum spicatum</i> (Eurasian Watermilfoil)	0.75 - 1.0	60 - 80	120 - 160	180 - 240
<i>Potamogeton pectinatus</i> (Sago Pondweed)	0.75 - 1.0	60 - 80	120 - 160	180 - 240
<i>Potamogeton nodosus</i> (American Pondweed)	0.75 - 1.0	60 - 80	120 - 160	180 - 240

*Select low range rate for Light to Moderate Growth and upper range rate for heavy infestations. Light to Moderate Growth is defined as a treatment area where submersed plants have not reached the water surface ("topped out") and less than 65% of the bottom or water surface (in the case of floating plants) is covered with target plants. Heavy infestations are areas where submersed vegetation growth has reached the water surface and/or bottom growth cover more than 65% of the treatment area. Do not apply more than 1.0 ppm copper.

B. SMALL AREA (SPOT) TREATMENT (under 5,000 sq. ft.)

For treatment around small areas such as docks, rafts, water intakes, etc., apply product uniformly at the rate of 2.0 pounds (29 oz.) per 1,000 square feet for each foot of plant growth height (for example, use 4 lbs per 1,000 sq. ft. if plants are 2 foot tall). Note: In areas less than 1 ft. deep, reduce dosage by 2.4 oz. per inch of water per 1,000 sq. ft. so as to not exceed 1.0 ppm total copper.

GENERAL APPLICATION RESTRICTIONS

Do not apply this product in a way that will contact adults, children, or pets, either directly or through drift. Some states may require permits for the application of this product to public waters. Check with your local authorities. Do not enter or allow others to enter until application of product has been completed in the area.

PRE-TREATMENT CONSIDERATIONS

Injury may occur if concentrated Harpoon granules or treated water concentrations above 1.0 ppm of copper comes in contact with ornamentals, crops, grass, or other foliage. Do not exceed 1.0 ppm total copper in treated water.

OTHER TREATMENT CONSIDERATIONS

Confirm that target plants are either listed on this label or related to the listing provided. Not all aquatic plants are sensitive to Harpoon Granular.

It may be necessary to test water hardness if there are trout. Minimum water hardness is 50 ppm. Apply early in the day under calm, sunny conditions. Harpoon Granular works best when water temperatures are at least 60°F.

Treat when and where growth first begins to appear or create a nuisance. Apply in a manner that will ensure even distribution of the chemical within the treatment area. Re-treat areas if re-growth begins to appear and seasonal control is desired. Allow one to two weeks between consecutive treatments. Allow seven to ten days to observe the effects of treatment (bleaching and breaking apart of plant material). Under conditions of heavy infestation, treat only 1/3 to 1/2 of the water body at a time to avoid fish suffocation caused by oxygen depletion from decaying algae.

Algae growth on and around target plants may interfere with the uptake of Harpoon Granular. Pre-treat these areas with Cutrine®-Plus algaecide. Do not exceed 1.0 ppm of total copper when using Harpoon Granular in combination with copper-based algaecides.

FOR USE IN SLOW MOVING OR QUIESCENT BODIES OF WATER, INCLUDING GOLF COURSES, ORNAMENTAL, FISH AND FIRE PONDS; FRESH WATER LAKES, FISH HATCHERIES AND POTABLE WATER RESERVOIRS.

ACTIVE INGREDIENT:

*Copper Ethylenediamine Complex
(CAS# 13426-91-0).....9.87%
INERT INGREDIENTS.....90.13%
TOTAL.....100.00%

*Harpoon contains 3.41% elemental copper equivalent to 1.7 lbs. per 50 lbs. of product.

KEEP OUT OF
REACH OF CHILDREN

**DANGER/
PELIGRO**

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand label, find someone to explain it to you in detail.)

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Manufactured for:
Applied Biochemists
W175N1163 Stonewood Drive
Suite 234,
Germantown Wisconsin 53022
1-800-558-5106
www.appliedbiochemists.com
EPA Reg. No. 8959-55
EPA Est. No. 42291-GA-1



This specimen label is intended as informational purposes only and not for use as container labeling.

FIRST AID

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15 -20 minutes. Remove contact lenses, if present, after the first five minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center. Do not give anything by mouth to an unconscious person.

IF INHALED: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15 - 20 minutes. Call a poison control center or doctor for treatment advice.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. **Have the product container or label with you when calling a poison control center or doctor, or going for treatment.** If a medical emergency arises contact Arch Chemicals Emergency Action Network in the US call 1-800-654-6911 or outside the US call 423-780-2970. For help with a spill, leak, fire or exposure involving this material call CHEMTREC 1-800-424-9300.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Corrosive. Causes irreversible eye damage. Harmful if swallowed. Do not get in eyes or on clothing. Wear protective eyewear (goggles, face shield, or safety glasses). Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove and wash contaminated clothing before reuse. Wear: Long-sleeved shirt and long pants, socks, shoes, and gloves. For applications in waters destined for use as drinking water, those waters must receive additional and separate potable water treatment. Do not apply more than 1.0 ppm as metallic copper in these waters.

Personal Protective Equipment (PPE): Mixers, Loaders, Applicators, and Other Handlers must wear the following: Long-Sleeve Shirt, Long Pants or Coveralls, Shoes and Socks, Chemical Resistant Gloves made out of any waterproof material, Goggles or Face Shield. User Safety Requirements: Follow manufacturer's instructions for cleaning/ maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry. Discard clothing and other absorbent material that have been drenched or heavily contaminated with the product's concentrate. Do not reuse them.

User Safety Recommendations: Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet. Users should remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Users should remove PPE immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing. Wash outside of gloves before removing.

ENVIRONMENTAL HAZARDS: This pesticide is toxic to fish and aquatic invertebrates. Water treated with this product may be hazardous to aquatic organisms. Treatment of aquatic weeds and algae can result in oxygen loss from decomposition of dead algae and weeds. This oxygen loss can cause fish and invertebrate suffocation. To minimize this hazard, do not treat more than 1/2 of the water body to avoid depletion of oxygen due to decaying vegetation. Wait 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Consult with the State or local agency with primary responsibility for regulating pesticides before applying to public waters, to determine if a permit is required.

Certain water conditions including low pH (≤ 6.5), low dissolved organic carbon (DOC) levels (3.0 mg/L or lower), and "soft" waters (i.e., alkalinity less than 50 mg/L), increases the potential acute toxicity to non-target aquatic organisms.

Harpoon Granular may be hazardous to aquatic organisms. This product may be toxic to trout and other species of fish. Fish toxicity is dependent upon the hardness of water. Do not use in water containing trout if the carbonate hardness of water does not exceed 50 ppm. Do not use in waters containing Koi and hybrid goldfish. Not intended for use in small volume, garden pond systems.

Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

STORAGE & DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Keep container closed when not in use. Keep pesticide in original container. Do not store or transport near feed or food.

PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Open dumping is prohibited. Improper disposal of excess pesticide or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: Completely empty liner or bag by shaking sides and bottom to loosen clinging particles. Empty residue into application equipment, then dispose of liner in a sanitary landfill or by incineration, if allowed by State and local authorities. If drum is contaminated and cannot be reused, dispose of in same manner.

WARRANTY

To the extent consistent with applicable law neither the manufacturer nor the seller makes any warranty, expressed or implied concerning the use of this product other than indicated on the label. To the extent consistent with applicable law buyer assumes risk of use of this material when such use is contrary to label instructions. Read and follow the label directions.

Harpoon® and Cutrine® are registered trademarks of Arch Chemicals, Inc.

102213/ESL081210

Current[®]

For use in Fresh Water Lakes, Potable Water Reservoirs, Ponds (including Golf Course Ponds), Fish Hatcheries, and Other Such Slow Moving or Quiescent Bodies of Water

Water treated with Current may be used immediately after treatment for recreational activities.

ACTIVE INGREDIENT

Copper sulfate pentahydrate (CAS No. 7758-99-8) 31.27%*

OTHER INGREDIENTS 68.73%

TOTAL 100.00%

*8.0% elemental copper

One Gallon Contains 0.8 Pounds of Elemental Copper

KEEP OUT OF REACH OF CHILDREN
WARNING/AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID

IF SWALLOWED:	<ul style="list-style-type: none">• Call a poison control center or doctor immediately for treatment advice.• Have person sip a glass of water if able to swallow.• Do not induce vomiting unless told to do so by a poison control center or doctor.• Do not give anything by mouth to an unconscious person.
IF IN EYES:	<ul style="list-style-type: none">• Hold eye open and rinse slowly and gently with water for 15 to 20 minutes.• Remove contact lenses, if present, after the first five minutes, then continue rinsing eye.• Call a poison control center or doctor for treatment advice.
IF ON SKIN OR CLOTHING:	<ul style="list-style-type: none">• Take off contaminated clothing.• Rinse skin immediately with plenty of water for 15 to 20 minutes.• Call a poison control center or doctor for treatment advice.
IF INHALED:	<ul style="list-style-type: none">• Move person to fresh air.• If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible.• Call a poison control center or doctor for further treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. For medical emergencies involving this product, contact the Rocky Mountain Poison Control Center at 1-866-673-6671.

FOR CHEMICAL EMERGENCY: Spill, leak, fire, exposure, or accident, call CHEMTREC 1-800-424-9300.

United Phosphorus, Inc.
630 Freedom Business Center, Suite 402
King of Prussia, PA 19406 • 1-800-438-6071

EPA Reg. No. 70506-248

AH **AQUATIC
HERBICIDE**

NET CONTENTS: 2.5 Gallons

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
WARNING

May be fatal if swallowed. Harmful if absorbed through skin. Harmful if inhaled. Causes moderate eye irritation. Avoid contact with skin, eyes or clothing. Avoid breathing vapor or mist. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Mixers, loaders, applicators, and other handlers must wear the following:

- Long-sleeved shirt and long pants,
- Shoes and socks, and
- Chemical-resistant gloves made of barrier laminate, nitrile rubber, neoprene rubber or viton.

USER SAFETY REQUIREMENTS

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Discard clothing and other absorbent material that have been drenched or heavily contaminated with the product's concentrate. Do not reuse them.

USER SAFETY REQUIREMENTS

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and aquatic invertebrates. Waters treated with this product may be hazardous to aquatic organisms. Treatment of aquatic weeds and algae can result in oxygen loss from decomposition of dead algae and weeds. This oxygen loss can cause fish and invertebrate suffocation. To minimize this hazard, do not treat more than 1/2 of the body of water to avoid depletion of oxygen due to decaying vegetation. Wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Consult with the State or local agency with primary responsibility for regulating pesticides before applying to public waters, to determine if a permit is required.

Certain water conditions including low pH (< 6.5), low dissolved organic carbon (DOC) levels (3.0 mg/L or lower), and "soft" waters (i.e., alkalinity less than 50 mg/L), increases the potential acute toxicity to non-target aquatic organisms.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage and disposal.

PESTICIDE STORAGE: Store in a cool, dry place.

PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER HANDLING: Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds after the flow begins to drip. Repeat this procedure two more times.

NONREFILLABLE CONTAINER: Do not reuse this container to hold materials other than pesticides or dilute pesticides (rinsate). After emptying and cleaning, it may be allowable to temporarily hold rinsate or other pesticide-related materials in the container. Contact your state regulatory agency to determine allowable practices in your state. Offer for recycling, if available or puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

SPRAY DRIFT MANAGEMENT

A variety of factors including weather conditions (e.g., wind direction, wind speed, temperature, relative humidity) and method of application (e.g., ground, aerial, airblast, chemigation) can influence pesticide drift. The applicator must evaluate all factors and make appropriate adjustments when applying this product.

Droplet Size

Apply only as a medium or coarser spray (ASAE standard 572) or a volume mean diameter of 300 microns or greater for spinning atomizer nozzles.

Wind Speed

Do not apply at wind speeds greater than 15 mph. Only apply this product if the wind direction favors on-target deposition (approximately 3 to 10 mph), and there are no sensitive areas within 250 feet downwind.

Temperature Inversions

If applying at wind speeds less than 3 mph, the applicator must determine if a) conditions of temperature inversion exist, or b) stable atmospheric conditions exist at or below nozzle height. Do not make applications into areas of temperature inversions or stable atmospheric conditions.

Other State and Local Requirements

Applicators must follow all state and local pesticide drift requirements regarding application of copper compounds. Where states have more stringent regulations, they must be observed.

Equipment

All aerial and ground application equipment must be properly maintained and calibrated using appropriate carriers or surrogates.

Additional requirements for aerial applications:

- The boom length must not exceed 75% of the wingspan or 90% of the rotor blade diameter.
- Release spray at the lowest height consistent with efficacy and flight safety. Do not release spray at a height greater than 10 feet above the crop canopy unless a greater height is required for aircraft safety.
- When applications are made with a crosswind, the swath must be displaced downwind. The applicator must compensate for this displacement at the up and downwind edge of the application area by adjusting the path of the aircraft upwind.

Additional requirements for ground boom application:

- Do not apply with a nozzle height greater than 4 feet above the crop canopy.

PRODUCT INFORMATION

Current may be applied to fresh water lakes, potable water reservoirs, ponds (including golf course ponds), fish hatcheries and other such slow moving or quiescent bodies of water.

Weeds Controlled:

Brazilian Elodea (*Egeria densa*), Common Elodea (*Elodea canadensis*), Coontail (*Ceratophyllum demersum*), Hydrilla (*Hydrilla verticillata*), Southern/Northern Naiads (*Najas* sp.), Water Lettuce (*Pistia stratiotes*), and Water Hyacinth (*Eichhornia crassipes*).

Additional Weeds Controlled in Soft Waters:

Eurasian Watermilfoil (*Myriophyllum spicatum*), Sago Pondweed (*Potamogeton pectinatus*), and American Pondweed (*Potamogeton nodosus*).

Unless specifically prohibited by the mix partner label, Current may be tank mixed with fluridone, diquat and endothall, as part of a broader spectrum weed control program (specific instructions for tank mixes are given in the directions for use). If a product is tank mixed with Current, the most stringent requirements of the Current and mix partner labels must be met.

Because Current works through absorption into the plant, it must be applied in a way that maximizes contact with the target aquatic weeds. Apply Current during periods of active weed growth to the leaf surfaces in areas of dense weed foliage. Algae and silt in the water column, or on the weed surfaces, will reduce the herbicidal effect of Current by competitively removing the product from the water column. Interference with Current's activity due to the presence of algae can be mitigated by tank mixing Current, with a copper based algaecide, such as Symmetry, or pre-treating the area with Symmetry. Surface applications of Current may be made using a land-based sprayer, or spray boat. Weighted trailing hoses are recommended for subsurface applications. Where appropriate, Current can be applied as an invert emulsion, or as an admixture with a suitable polymer, (see specific instructions, and only select adjuvants approved for application in food crop production). In order to assure uniform coverage of the treated area, the applicator may use Current as an undiluted product or may make an initial dilution prior to application.

Because it must be adsorbed into the plant to be effective, applications of Current should be made when contact times of at least 12 to 24 hours can be obtained. Effective treatment is indicated by the submergence of target vegetation 3 to 7 days after treatment. If necessary, repeat applications of Current may be made. Applicator should wait 14 days before re-treatment. The full effect of the treatment will require up to six weeks after the initial effect is observed.

Solutions of Current with cupric ion concentrations in excess of 1.0 ppm may cause non target plant injury. Do not allow sprays to drift over crops, ornamentals, grass or other desirable plants. Observe all label restrictions.

Decomposition of dead plant material can result in dissolved oxygen depletion and subsequent fish kill. High water temperatures and dense weed infestation are exacerbating factors. To avoid excessive oxygen depletion and fish kill, treat no more than 1/2 of the water body at one time. Do not apply more Current than required for the treatment area, and allow 10 to 14 days before making application to the remaining portion of the water body. Avoid trapping fish between the shoreline and treatment areas by treating from the shore outward toward deeper, untreated water.

WATER USE RESTRICTIONS

For applications in waters destined for use as drinking water, those waters must receive additional and separate potable water treatment. Do not apply more than 1.0 ppm as metallic copper in these waters.

Application Rates for Aquatic Weed Control or Suppression in Quiescent or Slow Moving Water*

Hydrilla verticillata (Hydrilla) is controlled at application rates equivalent to 0.75 – 1.0 ppm Cu⁺⁺.

Weeds suppressed at application rates ranging from 0.50 to 1.0 ppm Cu⁺⁺ are: *Egeria densa* (Brazilian Elodea), *Najas* sp. (Southern/Northern Naiads), *Ceratophyllum demersum* (Coontail), and *Elodea canadensis* (Common Elodea).

Weeds suppressed at application rates ranging from 0.75 to 1.0 ppm Cu⁺⁺ are: *Eichhornia crassipes* (Water Hyacinth), *Myriophyllum spicatum*** (Eurasian Watermilfoil), *Pistia stratiotes* (Water Lettuce), *Potamogeton nodosus*** (American Pondweed), and *Potamogeton pectinatus*** (Sago Pondweed).

* Light weed infestation allows use of lower rate, and high weed density requires higher rate.

** Control can be obtained in low hardness waters.

	Maximum per Application Rate (lbs Cu ²⁺ /A)	Maximum Annual Rate (lbs Cu ²⁺ /A)	Minimum Retreatment Interval	Notes
Algae, cyanobacteria, aquatic weeds (<i>Elodea</i> spp., hydrilla, <i>Potamogeton</i> spp., irrigation canal weed, annual naiads) for all aquatic applications	1 ppm	N/A	14 days	No more than 1/2 of the water body may be treated at one time. If the treated water is to be used as a source of potable water, the metallic copper concentration must not exceed 1 ppm.
Algae control in aquaculture when fish are present	0.4 ppm	N/A	N/A	

APPLICATION RATE CALCULATION

For large treatment areas it is most convenient to determine the surface area in acres and the average depth in feet.

The average depth is defined as the cumulative total of a series of depth measurements divided by the number of measurements made. The accuracy of the average will increase with increasing measurements.

The area of a rectangular treatment area is its length in feet times its width in feet, and the area of a circular treatment is the square of its radius (in feet) that is then multiplied by 3.14. The result of either calculation is area in square feet. This result is divided by 43,560 to give the area in acres.

The amount of material to be applied to this multi-acre site is calculated by using the following formula and the desired copper concentration:

$$\text{Target [Cu}^{++}\text{] (ppm)} \times \text{Ave. Depth (feet)} \times \text{Surface Area (acres)} \times 3.34 = \text{Gallons of Current}$$

Table 1 provides the results of this calculation on a per acre basis for 1 to 10 foot average water depths in 1 foot increments for target copper concentrations of 0.5, 0.75, and 1.0 ppm.

Table 1. Application Rate Data for Large Treatment Areas

Average Water Depth of Treatment Site (feet)	Gallons of Current per Surface Acre to Achieve the Desired Copper Concentration		
	0.5 ppm	0.75 ppm	1.0 ppm
1	1.7	2.5	3.3
2	3.3	5.0	6.7
3	5.0	7.5	10.0
4	6.7	10.0	13.4
5	8.4	12.5	16.7
6	10.0	15.0	20.0
7	11.7	17.5	23.4
8	13.4	20.0	26.7
9	15.0	22.5	30.1
10	16.7	25.1	33.4

For smaller treatment areas it is more convenient to calculate the amount of Current necessary in terms of ounces per 1,000 square feet.

The raw surface area in square feet is divided by 1,000 to give the number of thousand square foot increments and this value is entered into the following calculation.

$$\text{Target [Cu}^{++}\text{] (ppm) } \times \text{ Ave. Depth (feet) } \times \text{ Surface Area (1,000 sq. ft.) } \times 10 = \text{Ounces of Current}$$

Table 2 provides the results of this calculation on a per 1,000 square feet basis for 1 to 10 foot average water depths in 1 foot increments for target copper concentrations of 0.5, 0.75, and 1.0 ppm.

Table 2. Application Rate Data for Smaller Treatment Areas

Average Water Depth of Treatment Site (feet)	Fluid Ounces of Current per 1,000 Square Feet to Achieve the Desired Copper Concentration		
	0.5 ppm	0.75 ppm	1.0 ppm
1	5.0	7.5	10.0
2	10.0	15.0	20.0
3	15.0	22.5	30.0
4	20.0	30.0	40.0
5	25.0	37.5	50.0
6	30.0	45.0	60.0
7	35.0	52.5	70.0
8	40.0	60.0	80.0
9	45.0	67.5	90.0
10	50.0	75.0	100.0

METHODS OF APPLICATION

SPRAY BOAT

Surface Application: Surface applications are appropriate for shallow depths of 4 feet or less.

Subsurface Application: Subsurface applications of Current are recommended for water depths exceeding 4 feet. Weighted trailing hoses should be set to deliver the recommended rate of Current over the leaf surfaces in zones containing dense foliage. Subsurface application can be used for direct or invert applications of Current. Avoid dragging the hoses on the bottom.

Invert Application: Tank mix or bi-fluid mixer techniques can be used to produce inverts with Current. Inverts are not suited for surface application and should only be applied subsurface through submerged, weighted trailing hoses. Do not drag hoses on the bottom.

The invert emulsion disperses into tiny adherent droplets which will deposit on submerged leaf surfaces and over time these droplets will break to release the herbicide in close proximity to the plant. The ideal invert emulsion will be heavier than water and will have a thick viscous consistency. It will deliver the product quickly enough to allow absorption, but not so fast as to be carried away from the application site.

Choose approved adjuvants before producing an invert emulsion with Current. Example invert preparations are provide below to serve as a guide only. Test the system to be used prior to application to ensure good results. The properties of the invert system can be modified through small adjustments to the component ratios.

Table 3. Approximate Invert System Ratios

Mixer System	Water (gallons)	Invert Oil (gallons)	Current (gallons)
Tank Mix	80	3	8
Bi-Fluid	60	3	16

Direct application of Current is preferable to invert application in areas of dense weed populations as a streaking effect may be observed following invert application in such cases. This effect is a result of localized control along the paths taken by the weighted hoses. Allow adequate time for Current to work, immediate reapplication of Current may not increase effectiveness.

Polymer Application (Except CA): Spray sinking, deposition, and retention may be improved by addition of a polymer to Current itself or to a dilution of Current in water. Follow the recommendations on the polymer product label governing the use of that product in aquatic weed control.

SPRAY EQUIPMENT

Surface Application: Surface applications are appropriate for shallow depths of 4 feet or less.

Polymer Application (Except CA): Use the recommended rate of sinking agent in spray solution of Current plus water. Make up the spray solution so as to apply Current at the recommended rate in a total volume of 100 to 400 gallons per acre. Agitation must be initiated prior to the addition of the polymer and maintained throughout the application. The polymer-Current mixture will have a stringy constancy and will cling to the aquatic weed surfaces. Applications to slow moving water should be made to the densest mass of foliage at a speed of 4 to 5 mph in a direction opposite to the water flow.

TANK MIXING

Unless specifically prohibited by the mix partner label, Current may be tank mixed with products containing the active ingredients fluridone, diquat and endothall, as part of a broader spectrum aquatic weed control program. If a product is tank mixed with Current the more stringent requirements of the Current and mix partner labels must be met. Algae on plant surfaces will interfere with the action of Current aquatic herbicide. Improved control can be obtained in such cases by prior application of Symmetry. Table 4 gives example directions for tank mixes of Current with fluridone, diquat and endothall based products.

Table 4. Example Tank Mixes for Current and Diquat, Endothall, and Fluridone Products

Mix Partner	Amount of Mix Partner	Amount of Current	Amount of Water	Additive	Rate	Application Method
1. Diquat (35.3%)	10 gal	20 gal	100 gal	2 gal Nalquatic®	20 gal/A	Surface spray or subsurface injection
2. Endothall (40.3%)	15 gal	20 gal	100 gal	N/A	20 gal/A	
3. Fluridone (41.7%)	1.5 qt	20 gal	100 gal	N/A	20 gal/A	

Notes:

- 1: Weeds controlled by this tank-mix are: Bladderwort, Cattail, Common Elodea, Common Salvinia, Coontail, Curlyleaf Pondweed, Duckweed, Eurasian Watermilfoil, Floatingleaf Pondweed, Hydrilla, Leafy Pondweed, Pennywort, Richardson Pondweed, Sago Pondweed, Slender Naiad, Small Pondweed, Southern Naiad, Water Hyacinth, and Water Lettuce.
- 2: Weeds controlled by this tank-mix are: American Pondweed, Chara, Cladophora, Coontail, Najas Elodea, Pithophora, Potamogeton, Sago Pondweed, Spirogyra, Vallisneria, Watermilfoil, and Zannichellia.
- 3: Weeds controlled by this tank-mix are American Pondweed, Bladderwort, Brazilian Elodea, Common Duckweed, Common Elodea, Coontail, Fanwort (Cabomba), Naiad, Najas Elodea, Paragrass, Sago Pondweed, Spatterdock, and Watermilfoil.

**IMPORTANT INFORMATION
READ BEFORE USING PRODUCT**

CONDITIONS OF SALE AND LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read the entire Directions for Use and Conditions of Sale and Limitation of Warranty and Liability before buying or using this product. If the terms are not acceptable, return the product at once, unopened, and the purchase price will be refunded.

The Directions for Use of this product reflect the opinion of experts based on field use and tests, and must be followed carefully. It is impossible to eliminate all risks associated with the use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as manner of use or application, weather or crop conditions, presence of other materials or other influencing factors in the use of the product, which are beyond the control of United Phosphorus, Inc. or Seller. Handling, storage, and use of the product by Buyer or User are beyond the control of United Phosphorus, Inc. and Seller. To the extent consistent with applicable law, all such risks shall be assumed by Buyer and User, and Buyer and User agree to hold United Phosphorus, Inc. and Seller harmless for any claims relating to such factors.

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To the extent consistent with applicable law, United Phosphorus, Inc. or Seller shall not be liable for any incidental, consequential or special damages resulting from the use or handling of this product and **THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE EXCLUSIVE LIABILITY OF UNITED PHOSPHORUS, INC. AND SELLER FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT OR, AT THE ELECTION OF UNITED PHOSPHORUS, INC. OR SELLER, THE REPLACEMENT OF THE PRODUCT.**

United Phosphorus, Inc. and Seller offer this product, and Buyer and User accept it, subject to the foregoing conditions of sale and limitations of warranty and of liability, which may not be modified except by written agreement signed by the duly authorized representative of United Phosphorus, Inc.

Current and Symmetry are registered trademarks of United Phosphorus, Inc.

Nalquatic is a registered trademark of Nalco Corporation.

70506-248(032513-4495)

APPENDIX F:

Public Outreach

Herbicide Notification Signage

Letter to Municipalities

Friends Organizations

PESTICIDE TREATED WATER

AREAS OF THIS CANAL ARE BEING TREATED WITH SONAR GENESIS (FLURIDONE) FOR UP TO 120 DAYS TO CONTROL AQUATIC VEGETATION. WATER USE RESTRICTIONS ARE AS FOLLOWS FROM _____ / _____ UNTIL THE TREATMENT IS COMPLETED.
DATE TIME

**FISHING/FISH CONSUMPTION AND WATER CONSUMPTION:
NO RESTRICTION**

IRRIGATION:

DO NOT USE HERBICIDE-TREATED WATER DIRECTLY FROM THE CANAL FOR IRRIGATION of nursery or greenhouse plants and hydroponic farming until fluridone concentrations are less than 1 ppb.

DO NOT USE HERBICIDE-TREATED WATER DIRECTLY FROM THE CANAL FOR IRRIGATION of tobacco, tomatoes, peppers or other plants within the Solanaceae Family and newly seeded crops or grasses (such as overseeded golf course greens) until fluridone concentrations are less than or equal to 5 ppb.

For fluridone test results or a copy of the product label visit: WWW.NJWSA.ORG/hydrilla.html

National Pesticide Information Center: 800-858-7378

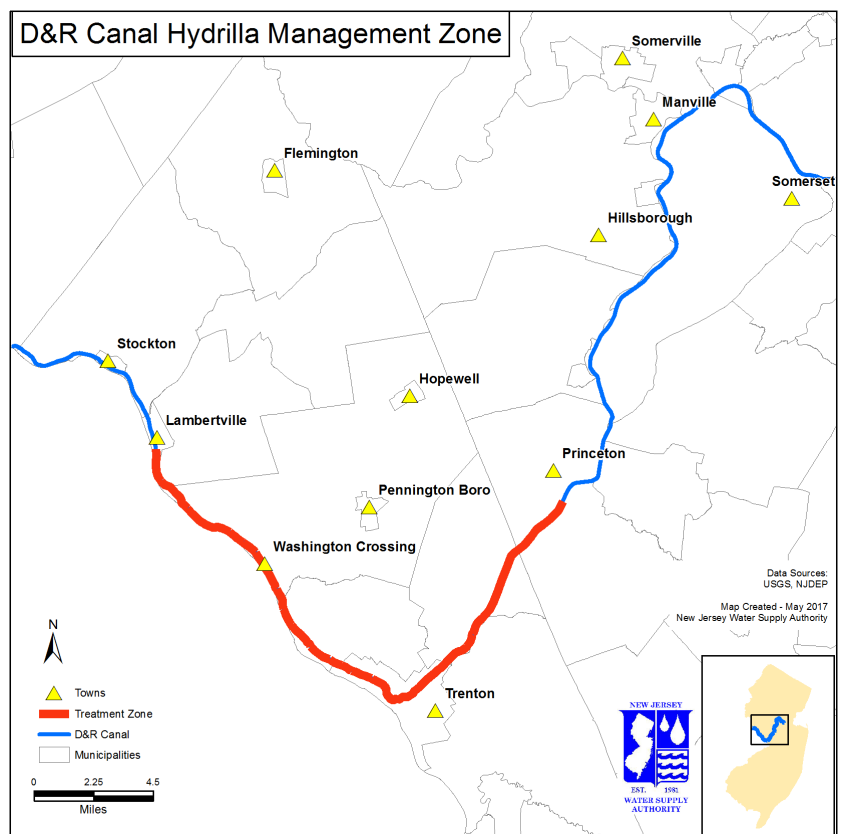
PLEASE BE AWARE THE AQUATIC WEED

HYDRILLA

IS IN

THE D&R CANAL

- **Hydrilla** is a **fast spreading invasive** aquatic weed that can be controlled IF we act promptly
- Hydrilla out-competes native vegetation, and has the potential to significantly restrict flow through the Canal and damage the natural ecology
- Hydrilla is an **emerging threat** in New Jersey and is not yet well-established
- It is critical that we **STOP THE SPREAD**



**STOP AQUATIC
HITCHHIKERS!**

Prevent the transport of nuisance species.
Clean all recreational equipment.
www.ProtectYourWaters.net



Aquatic Vegetative Management is underway targeting **Hydrilla**
That includes a safe and effective low dose herbicide treatment
For More Information

VISIT: WWW.NJWSA.ORG/hydrilla.html

The presence of **hydrilla** in the D&R Canal will accelerate its spread throughout
New Jersey if not controlled

Dear Local Officials and Stakeholders,

The New Jersey Water Supply Authority (NJWSA) maintains and operates the D&R Canal (Canal) as part of the Raritan Basin Water Supply system. This system serves approximately 1,500,000 residents of central New Jersey. The NJWSA is working cooperatively with NJDEP, the D&R Canal Commission and a variety of Canal interest groups to implement a comprehensive plan designed to contain the spread of Hydrilla. Hydrilla is an invasive aquatic weed that is an emerging threat in New Jersey. It has been found in the Canal but is not yet well-established in the State. If the hydrilla infestation is not contained, it has the potential to reduce water flow in the Canal by up to 85%, thereby jeopardizing the Canal's effectiveness as a water supply system and its use for recreation. The spread of hydrilla also poses significant harmful ecological consequences due to its negative effects on water quality.

As part of a three-year management plan, the NJWSA has determined that it is necessary to initiate a low dose, 120-day exposure, injection of a herbicide called Solar Genesis (EPA # 67690-54, active ingredient: fluridone) into the Canal. SOLitude Lake Management, the Authority's contractor, will start treatments approximately mid-May subject to receiving all necessary approvals. Spot hydro-raking will also be utilized as needed. The herbicide will not harm people, animals or fish in the low concentrations that are being introduced into the water (<5ppb). There will be no water use restrictions for water consumption, fishing, fish consumption or swimming. Some irrigation restrictions will be imposed for nursery and greenhouse plants as well as specific crops and newly seeded areas.

Signage will be posted at access areas along the Canal's entire length to alert the public of the threat posed by hydrilla and to inform them about the herbicide treatment. Additional information is available at <http://www.njwsa.org/hydrilla.html>. A monthly conference call will be convened during the management season to discuss progress and technical issues specific to Hydrilla management in the Canal. If you or a representative of your municipality/county would like to participate, please let me know.

I am attaching an FAQ that might be helpful in answering questions should you get them. I am also attaching the signs that area residents and visitors will see when using the D&R Canal State Park. If you have any questions, you may reach us either through our website at info@njwsa.org or hydrilla@njwsa.org, or you may contact me, Ken Klipstein, Heather Desko or Marc Brooks directly at the above email addresses.

Thank you.

Beth Gates
Executive Director

Attachments: FAQ
Hydrilla access point signs

D&R Canal Friends Organizations

(source: D&R Canal Commission website)

Blackwell's Mills Canal House Assoc.
598 Canal Road
Somerset, New Jersey 08873
Phone: 908-369-0357
E-Mail: barbara@dellaperuta.net
President: *Barbara Della Peruta*

Friends of Princeton Nursery Lands
PO Box 113
Kingston NJ 08528-0113
E-Mail: karenlinder@fpnl.org
President: Karen Linder

www.fpnl.org

Canal Society of New Jersey
P.O. Box 737
Morristown, New Jersey 07963
Phone: 973.292.2755
E-Mail: macgraphics1@verizon.net
President: *Joseph Macasek*

www.canalsocietynj.org

Griggstown Historical Society
E-Mail: john.thallemer@gmail.com
President: *John Thallemer*

Delaware & Raritan Canal Watch
P.O. Box 2
Rocky Hill, New Jersey 08553
Phone: 908.240.0488 (c); 908.722.7428 (h)
E-Mail: barthlinda123@aol.com
President: *Linda Barth*

www.canalwatch.org

Kingston Greenways Association
PO Box 391
Kingston NJ 08528-0391
Email: tari@kingstongreenways.org
President: Tari Pantaleo

www.kingstongreenways.org

Delaware River Mill Society
P.O. Box 298
Stockton, New Jersey 08559
Phone: 609.397.3586
E-Mail: drms.director@gmail.com
Executive Director: *Colby Smith*

www.prallsvillemills.org

Kingston Historical Society
P.O. Box 323
Kingston, New Jersey 08528
E-Mail:
rvonzumbuscharch@verizon.net
President: *Robert von Zumbusch*

Lawrence Historical Society
P.O. Box 6025
Lawrenceville, New Jersey 08648
Phone: 609.895.1728
E-Mail: webmaster@thelhs.org
President: *Laura Nawrocik*

www.thelhs.org
