

Pipe and Lucerne Lakes 2008 Hydrilla Eradication Project Annual Report



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INTRODUCTION

Pipe and Lucerne Lakes are located within the cities of Maple Valley and Covington in south King County. In 1994 hydrilla (*Hydrilla verticillata*), a Class A noxious weed, was discovered in the lakes, becoming the only known infestation in King County and the Pacific Northwest. The Washington State Department of Ecology (State) required immediate action to eradicate the weed, and work began in 1995, continuing to the present. While different eradication methods have been used over the years, it was not until the implementation of a combination of surveys and herbicide treatments in 2003 that the hydrilla plants and tuber bank have decreased to the point where eradication seems like a likely outcome.

In 2008, no hydrilla was found in the either Pipe Lake or Lake Lucerne. This was the second year of finding no hydrilla and was the fifth year of using a method that combines the use of a slow release herbicide and frequent diver and snorkel assessment. Herbicide directly affected the plant and its ability to thrive if it were present, whereas assessment helped King County and its contractors understand the infestation and how to best manage the project to insure success. This document summarizes the 2008 treatment season.

HISTORY OF TREATMENT

For several years in the early 1990s it was known that an unusual plant species inhabited Pipe and Lucerne Lakes, but at that time hydrilla (*Hydrilla verticillata*) was misidentified as *Egeria densa* (K. Hamel, pers. comm). In 1994, King County tentatively changed the plant identification to hydrilla, based on samples taken during the King County Aquatic Plant Mapping project done on over 36 area lakes.

In late May of 1995, the state confirmed that the plant was *Hydrilla verticillata*, considered to be one of the world's worst aquatic weeds. Steps were taken to have hydrilla listed as a Class A noxious weed in Washington State, which requires eradication measures. At that time the lakes were in unincorporated King County, so the County became the agency responsible for managing the eradication effort. In the summer of 1995, the County hired Resource Management Inc. (RMI) to apply the herbicide Sonar™ (active ingredient fluridone) to control the weed. RMI maintained herbicide levels from 10 to 20 ppb in the lakes over eight weeks in summer.

The hydrilla proved sensitive to the use of the herbicide, but based on advice from California, the County understood that the tubers were long-lived and did not necessarily germinate each year. This required a multi-year approach to eradication. Tubers have been known to be viable for up to ten years and are not necessarily affected by herbicides. Because of the tuber bank, one herbicide treatment was clearly not going to be sufficient for eradication, so the project was extended, and whole lake herbicide treatments were applied from 1995 to 2000. This action greatly reduced the weed throughout both lakes, although localized populations continued to exist.

In the late 1990s a lawsuit was filed in Oregon entitled 'Headwaters Inc. vs. Talent Irrigation District' that called into question whether aquatic herbicides were considered pollutants. In 2001 the Ninth Circuit Court of Appeals decided that in the Talent case aquatic herbicides should be considered pollutants and held to the standards of the National Pollution Discharge Elimination System (NPDES) permitting requirements under the Clean Water Act (CWA). Herbicide treatments were stopped during the summer, while the State put the appropriate permits in place.

During the 2001 season SCUBA divers surveyed the littoral zone of the two lakes for hydrilla, hand pulling plants as they were found. In 2002 the DOE set up an aquatic herbicide licensing system under NPDES, but diver hand-pulling was seen as an effective treatment in Pipe and Lucerne Lakes, so it was again the control method of choice in 2002. However, in October 2002 significant growth of hydrilla was found by the State, and the lake was spot treated by AquaTechnex with Aquathol Super K granular herbicide.

Initially, biological control in conjunction with herbicide application was considered as a method of treatment in 2003. However, Kathy Hamel from the State learned of an eradication technique that was successful in California. California used low levels of slow release granular herbicide with the active ingredient fluridone in lakes during the growing season for several years until no hydrilla was found for three years. At the beginning of the 2003 treatment season, King County and the State decided to adopt the California strategy. To monitor the success of this new plan, King County internalized the project, doing the

herbicide treatments and snorkel surveys using County staff, and hiring a consultant to perform the diver surveys. This allowed the County to create comprehensive maps and detailed reports about the patterns and locations of the hydrilla, as well as maintain control over the amount of herbicide used and the precise areas of coverage.

With the success of the previous four seasons, King County followed the same procedures in 2008. The work was divided into assessment and treatment tasks; assessments were handled by county snorkelers and contracted SCUBA divers performing surveys. King County performed the snorkel survey in June and August in conjunction with the EnviroVision SCUBA divers who also performed a third survey in October with county support.

King County continued to use herbicide applications and hand pulling as the treatment methods for hydrilla control. The County performed herbicide treatments three times during the summer, starting in June. During the survey assessment, both snorkelers and divers were instructed to hand pull plants, if any plants were found.

Several King County staff members are involved in the hydrilla eradication project to insure its success. Sally Abella, King County Lake Stewardship Program Manager, acted as project manager: tracking the budget, and providing technical expertise. Beth Cullen, King County Water Quality Planner with the Lake Stewardship Program, acted as field manager, project coordinator, and licensed applicator for the treatments. Michael Murphy, also of the King County Lake Stewardship Program, assisted with the snorkel surveys. Jason Hesla, an intern with King County Lake Stewardship Program, assisted in herbicide treatments, herbicide sampling, and snorkel surveys.

TREATMENT AND PUBLIC INPUT

The herbicide, Sonar PR™, continued to be the control method used in the littoral zone of the lake and was the only one used in 2008 because no plants were found, so hand-pulling was not necessary. These treatment methods, combined with frequent assessment, are still proving to be very effective in Pipe and Lucerne Lakes.

On May 1st, 2008 a public meeting was held to update citizens on the eradication program, what the goals were, and the treatment process for 2008. Attendees were very appreciative of the time King County and the cities were spending on this project. On November 6th, 2008 another public meeting was held to prepare people for the upcoming 2009 treatment season and what it means to have found no hydrilla in the lakes during the 2008 treatment season. The public was very excited to hear that no hydrilla was found, but were concerned what it meant in terms of plants recolonizing the lakes and the potential infestation of other invasive weeds.

Herbicide

Herbicide treatments can be complicated and time-consuming events. However, they are the most effective option against hydrilla because of the ability to target all areas of infestation and the continual inhibitory effect on the plants. Herbicide application continues to be the most successful option when eradication is the goal.

As directed in the NPDES permit, a flyer went out to the community in the Pipe and Lucerne watershed three weeks prior to the first Sonar PR™ application, informing them of the treatment plan and the scheduled herbicide application dates. Within 24 hours before each herbicide application, every property on the lake was posted with signs announcing that the herbicide treatment would be occurring. Community properties were posted with three foot by two foot signs every 100 feet. A week prior to the treatment, the appropriate Ecology staff was notified about the occurrence of the treatment and a note was sent again to Ecology staff on the Friday following each treatment.

Using the 2006 hydrilla location map and 2007 concentration levels from the herbicide monitoring data, application areas and herbicide amounts were calculated for the first treatment. All areas that were known to have hydrilla in 2006 were treated again in 2008. According to the prescribed treatment method, areas will continue to be treated for three years after the last hydrilla plant is found in the lake. This year was the first one in which herbicide was not applied to Lake Lucerne. The last plant was found in the lake during 2004, which meant 2007 was the last year for treatment.

The goal of treatment was to ensure all potential sites of hydrilla were treated, and if new infestations were found through the season, treatment areas could be adjusted to include the new locations. No new infestations were found this year in either lake, so treatment areas were the same as the previous years for Pipe Lake while Lucerne did not receive any herbicide (Figure 1).

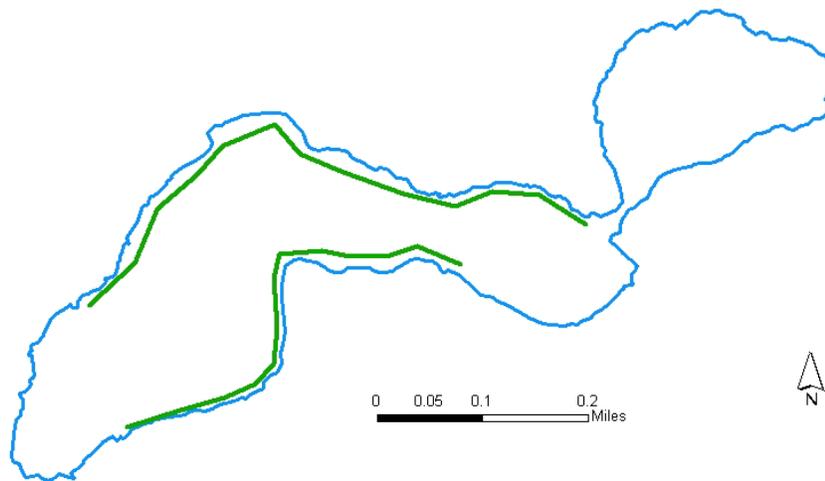


Figure 1: Herbicide Application 2008

Rates of application were calculated based on the acreage of hydrilla infestation, the amount of fluridone necessary to maintain a consistent concentration in the water column and the concentrations found during previous treatment seasons and the results of biweekly sampling for ambient concentrations. The herbicide threshold for the treatment season was 5 ppb of fluridone present in the water column throughout the summer, as it has been since 2003. Over the past five years fluridone levels have been adjusted so that herbicide levels are closer to the target. In 2008, ten acres were treated in Pipe and Lucerne was not treated.

The first treatment happened on June 5th, 2008, 36.7 ppb (24 lbs/acre) in Pipe was applied; the second treatment on June 24th was calculated at 36.7 ppb in Pipe (24 lbs/acre); the last treatment on July 15th released 36.7 ppb (24 lbs/acre) in Pipe. The total over the course of the summer was 110.1 ppb in Pipe, much less than the 150 ppb limit. Based on herbicide monitoring (FasTEST) results, the fourth treatment was cancelled in the lakes because fluridone levels remained above target.

To ensure accuracy, each treatment was mapped using GPS, converted into an ArcView map, and used as a guide for future treatments. As seen in Figure 1 the treatments are following the perimeters of the lakes generally over the littoral zone of the lake. In previous years hydrilla was spread along the perimeters of the lake at varying depths. The protocol states that hydrilla locations are to be treated for three years after the last plant is found in the lake.

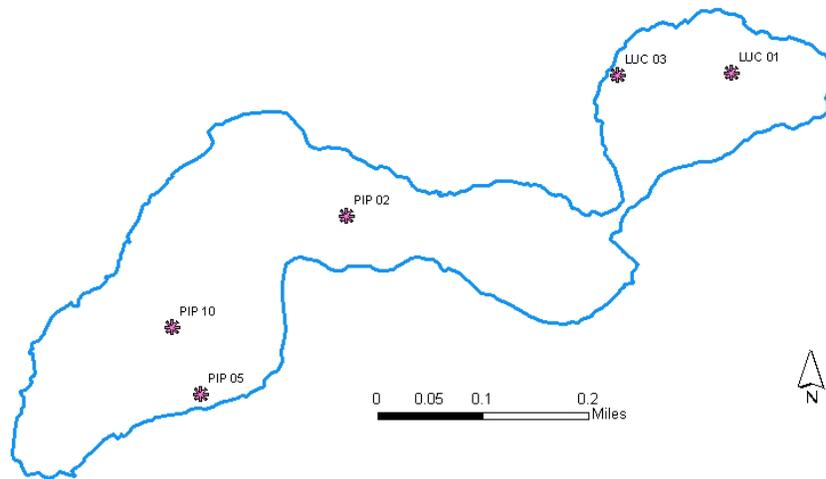


Figure 2. FasTEST Locations

The NPDES permit requires monitoring of herbicide levels in the lakes for the durations of the treatment period. Water samples were collected prior to herbicide application and then at approximately 14 day intervals after the first treatment. Samples were taken in treatment areas and in the middle of the lakes (Figure 2). Lucerne continued to be tracked because of the exchange of water between the two lakes. King County was interested to see how herbicide moved through the lake and if Lucerne was receiving very low doses of fluridone or if levels went to “no-detect”. After each sampling event, the frozen samples were shipped overnight to SePRO labs for analysis. Results from these tests allowed the County to track the herbicide levels and helped determine the locations and amounts of herbicide for subsequent applications.

In 2008, the first herbicide treatment occurred in early June. Early June was chosen because it was thought that hydrilla would be killed by fluridone as it began sprouting. Again, there was residual fluridone in the lakes from the 2007 treatment, but levels were below 5ppb. Similar to last year, the stations fluridone levels did not rise to the target level as expected after the first treatment. There is some uncertainty as to why levels did not rise after the first application, possibly related to fluctuations of thermal stratification in the lake. During most of the summer, levels stayed between 5 ppb and 12 ppb in Pipe Lake and there were trace amounts of herbicide found in Lucerne suggesting that some herbicide is entering Lucerne from Pipe (Figure 3). Fluridone was found in moderate levels throughout Pipe lake, including water in areas that were not treated. This gave the County confidence that for all areas of the lake, any hydrilla sprouts would still come in contact with sufficient fluridone to kill them.

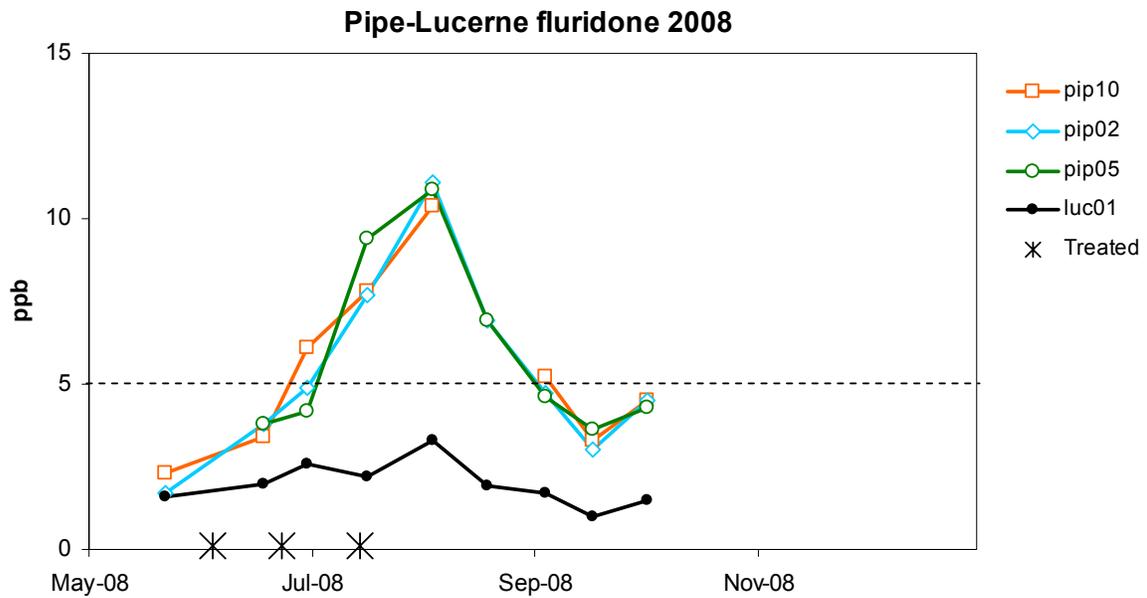


Figure 3: Herbicide Levels

It is known that plants have been found both in the epilimnion and hypolimnion. Therefore, it was imperative that the granular herbicide was applied over both the shallow and deeper water to insure all plants came into contact with the fluridone. This was done during the treatment applications by driving the boat first over the shallow margin and then driving a parallel route over the deeper areas while applying Sonar PR™.

Diver Hand-pulling

Had any hand-pulling of individual plants been required, it would have been done by the snorkelers and SCUBA divers during assessments; however, no hand-pulling was necessary this year as no hydrilla plants were found.

ASSESSMENT

Diver surveys are the most direct method to assess how herbicide treatments affect hydrilla and the other aquatic plants in the lakes. These assessments not only helped direct the treatments, but also collected important information for future treatment seasons.

Assessment throughout the growing season was a critical part of the project. The surveys were performed two ways: (1) snorkeling, and (2) SCUBA diving. SCUBA divers carried out three surveys this year in June, August, and October. Snorkel surveys were done in conjunction with the June and August SCUBA surveys.

The assessment portion of the hydrilla project evaluated the success of eradication efforts. Without consistently checking the plants for herbicide damage and gauging the extent of populations, there is no way to measure the effects of treatments. This year, no plants were found in either lake. This is the fourth year the Lake Lucerne has been hydrilla free and the second year Pipe Lake has had no hydrilla.



Figure 4: 2008 Hydrilla Locations

Based on the fact that no plants were found this year, it seems likely that the tuber bank has finally reached exhaustion.

Overall, hydrilla has decreased from 474 plants found in the lakes in 2003, 146 plants in 2004, 23 plants found in 2005, two plants found in 2006 and zero found in 2007 and 2008. In 2003 and 2004 each hydrilla plant was counted as an individual in each survey, and sometimes, where the densities of plants were high, no hand-pulling occurred. It is possible this led to double counting when the survey plants were summed, which could have inflated the number of plants present in 2003 and 2004, but because no plants were found this year, eradication is within reach.

Assessment results show that the treatment methods used over the last four years have been very effective. While plants in Pipe Lake decreased progressively, the last hydrilla plant in Lake Lucerne was found in 2004.

The herbicide treatment also has had an effect on the native aquatic plant populations in the lake. The EnviroVision SCUBA team recorded other submerged aquatic plants observed during the hydrilla surveys. Table 1 is a list of all aquatic plants and macro algae that have been documented in the lakes in 2008.

Table 1: Aquatic plants and macro algae found in Pipe and Lucerne Lake 2008.

Scientific Name	Common Name
EMERGENT PLANTS	
<i>Iris pseudacorus</i>	Yellow-flag iris
<i>Juncus sp.</i>	Rushes
<i>Menthe spp.</i>	Mint
<i>Myosotis scorpiodes</i>	Common forget-me-not
<i>Polygonum hydropiperoides</i>	Waterpepper
<i>Scirpus</i>	Bulrush
<i>Solanum dulcamara</i>	Bittersweet, nightshade
<i>Spirea spp.</i>	Spirea
<i>Typha Angustifolia</i>	Narrowleaf cattails
<i>Typha Latifolia</i>	Broadleaf cattail
FLOATING-LEAVED PLANTS	
<i>Ludwigia palustris</i>	Water purslane
<i>Nymphaea odorata</i>	Fragrant waterlily
SUBMERSED PLANTS	
<i>Ceratophyllum demersum</i>	Coontail
<i>Potamogeton robbinsii</i>	Fern-leaf pondweed
<i>Potamogeton spp</i>	Thin-leaf pondweed
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed
<i>Utricularia spp.</i>	Bladderwort
MACROALGAE	
<i>Chara</i>	Muskgrass, stonewort
<i>Nitella spp.</i>	Nitella

The divers observed that the native plant populations have remained very low in both lakes and show signs of herbicide bleaching. There is no discernable difference between the level of damage observed in treated versus untreated areas. It was noted by the divers that the macroalgae appeared to have increased since this project started in 2003. There were dense mats of macroalgae in several areas of the lakes, which can obscure the divers' vision when searching for hydrilla.

In previous years a comprehensive plant survey was done along reference transects to survey what other plants were in the lake and the level of herbicide damage. That was not done in 2008, and it is anticipated that comprehensive plant surveys will begin again when herbicide treatments have ceased.

After each assessment a complete report of the diver survey was submitted by the consultant. These summaries are available upon request.

CONCLUSIONS

The 2008 treatment season of the hydrilla eradication project was the culmination of six years of hard work with the most positive outcome occurring during the 2007 treatment season, extending into 2008. This was the sixth year King County was directly involved in control activities, and it was instructive to see how all the seasons compared. It is encouraging that each year hydrilla plants have been found in decreasing numbers and 2008 marked the second year that no hydrilla was found in either Pipe or Lucerne Lakes.

Eradication is within reach of the project, but the work cannot be considered to be complete until each lake has been hydrilla free for some years after herbicide application has ceased and the native aquatic plants begin to recolonize the littoral zones. The current grant agreement expired on November 15, 2008 and negotiations for a new grant agreement are underway. It is anticipated that eradication will be declared at the end of the next grant agreement, and a final report for the project will be prepared and submitted at that time.

The winter persistence of fluridone was a surprise, as residual herbicide was not anticipated by the manufacturers to linger in the system. It was also odd to see the fluridone results vary as much as they did. The fluridone levels did not come up to the targeted 5 ppb in the anticipated two week time frame after the first or second treatment, and it wasn't until the third treatment in July that all stations reached just above target level. The herbicide levels fluctuated throughout the season, but they remained above the target level. This leads us to plan for a full herbicide treatment at the beginning of the 2009 to increase fluridone levels to the threshold of 5 ppb.

No hydrilla plants were found this year in either lake. Even the areas of highest infestation found in Pipe Lake were hydrilla free. However, although no plants were found this year, King County will continue to treat Pipe Lake in the 2009 season. Diver surveys will continue for the next several years to insure that hydrilla is eradicated. If any hydrilla plants show up in future, the process may need to begin again. If no plants are found for three years after treatment, hydrilla may be considered officially eradicated, depending on the State's assessment.

Throughout the summer, other plants such as *Typha* spp., *Nymphaea odorata*, and other submerged aquatic weeds also showed signs of herbicide damage. However, the bleaching of hydrilla was the most profound and easily spotted among the other plants. Divers noted the increase of macroalgae in the system. Dense mats of algae can obscure divers' vision and mask hydrilla. While fluridone is in the water column this is not a major concern but when treatment stops, the strong growth of macroalgae may make it difficult to spot hydrilla if any sprouts in the lake.

BUDGET

Table 2: Hydrilla Eradication Project Budget

Hydrilla Erradication G0300219 2008 to date (December 23rd, 2008)		
Task	2008 Cost	2009 Projected
# 1 Project Management	\$ 3,949.08	\$ 5,750.00
# 2 Treatment	\$ 29,006.23	\$ 28,500.00
# 3 Monitoring and Assessment	\$ 23,586.18	\$ 26,950.00
Total	\$ 56,541.48	\$ 61,200.00
WDOE Share	\$ 51,678.91	TBD
Cities Match	\$ 4,862.57	TBD

In 2008 the State continued funding a grant to King County to perform the hydrilla eradication work (Table 2). The work was divided into three major tasks: project management, treatment and assessment. Project management included tasks such as report writing, financial tracking, public outreach, and project organization. Treatment included all aspects of herbicide treatment in the lake, such as purchasing equipment and herbicide, creating treatment maps, herbicide application and concentration assessments. The third task was snorkeling and diver assessment, which included staff time spent surveying the lake, writing reports and creating survey maps.

By the end of December 2008 a total of \$56,541.48 was spent by King County, of which \$51,678.91 was considered eligible for grant reimbursal, due to differing third burden rates between King County and Ecology. The cities of Maple Valley and Covington contributed the necessary matching funds to the grant for a total of \$4,862.57.

Ecology aquatic weed fund grant G0300219 ended November 15, 2008. However, because eradication is close but not yet considered complete, negotiations have begun between Ecology and King County to continue the last stages of the project under a new grant agreement, which will begin in 2009 and continue for 4 -5 years. Table 2 also includes the estimated costs for the 2009 treatment year.

FUTURE

The 2009 hydrilla eradication treatment methods will stay essentially the same as the past years. Slow release granular Sonar PR™ will be the herbicide used and rates of application will most likely remain the same. The fluridone concentrations stayed well within target range in 2008. Both SCUBA and snorkeling surveys will continue to make sure that the lakes are being surveyed as comprehensively as possible.

Hydrilla has decreased from 474 plants found in 2003 to 146 plants in 2004 to 23 plants in 2005, two plants in 2006 and none in 2007 or 2008. This is a great success in six years and it is hoped that Pipe and Lucerne Lakes remain hydrilla free in the future.

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