

Pipe and Lucerne Lakes 2007 Hydrilla Eradication Project Annual Report



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Department of Natural Resources and Parks
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Lake Stewardship Program

201 South Jackson Street, Suite 600

Seattle, WA 98104

email: sally.abella@kingcounty.gov

<http://dnr.metrokc.gov/wlr/waterres/smlakes/index.htm>

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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 2007, no hydrilla was found in the either Pipe Lake or Lake Lucerne. This was the fifth year of using a method that combines the use of a slow release herbicide and frequent diver and snorkel assessment. Unlike the previous years, no tuber survey was done in 2007 since the two tuber surveys done in 2004 and 2005 did not yield results warranting more surveys. Herbicide directly affected the plant and its ability to thrive, 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 2007 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 State and spot treated by AquaTechnex with Aquathol Super K granular herbicide.

Initially, biological control in conjunction with herbicide 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 2007. 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 May. During the survey assessment, both snorkelers and divers would 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. Bryan Ishida, 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 the only one used in 2007 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, 2007 a public meeting was held to give citizens a chance to learn about the program, what the goals were, and the treatment process for 2007. Four people attended the meeting and were very appreciative of the time King County and the cities were spending on this project. On December 6th, 2007 another public meeting was held to prepare people for the upcoming treatment season and what it means to have found no hydrilla in the lakes during the 2007 treatment season. Five people attended the meeting and were 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 stating that the herbicide treatment would be occurring. 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 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 2007. Even if hydrilla was not present during surveys, the areas were still treated. 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. 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, so treatment areas were the same as the previous years (Figure 1).

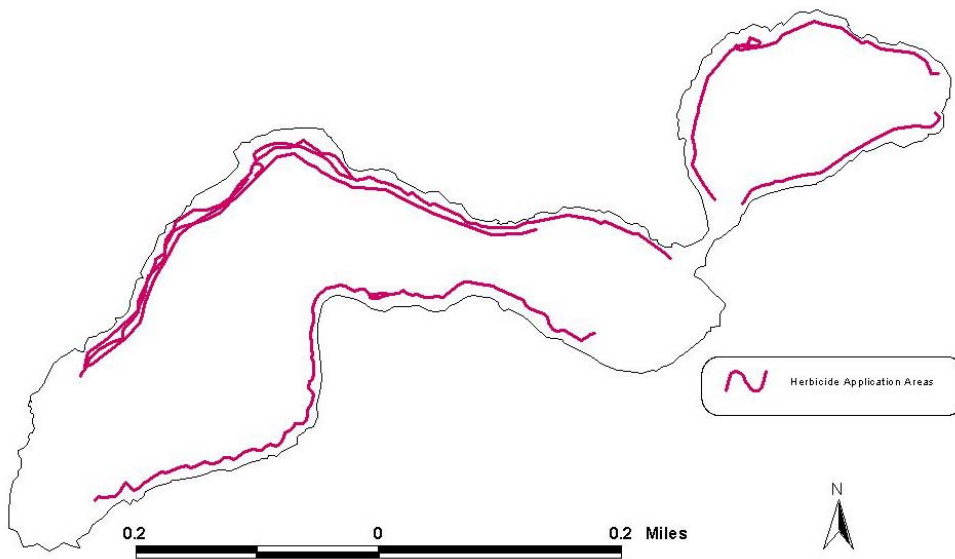


Figure 1: Herbicide Application 2007

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 the 2006 treatment season. The herbicide threshold for the treatment season was 5 ppb of fluridone present in the water column throughout the summer. Over the past five years fluridone levels have been adjusted so that herbicide levels are closer to the target. In 2007, we followed the same treatment regimen as previous years. Ten acres were treated in Pipe and five acres were treated in Lucerne.

The first treatment happened on May 17, 2007, 39.05 ppb (25.5 lbs/acre) in Pipe and 23.78 ppb (1.5 lbs/acre) in Lucerne was applied; the second treatment on June 14th was calculated at 37 ppb in Pipe (24 lbs/acre) and 32 ppb (12 lbs/acre) in Lucerne; the last treatment on July 13th released 37 ppb (24 lbs/acre) in Pipe and 32 ppb (12 lbs/acre) in Lucerne. The total over the course of the summer was 113 ppb in Pipe and 88 ppb in Lucerne, 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 mostly over the littoral zone of the lakes. In previous years hydrilla was spread along the perimeters of the lake at varying depths and the protocol states that hydrilla locations are to be treated for three years after the last plant is found in the lake.

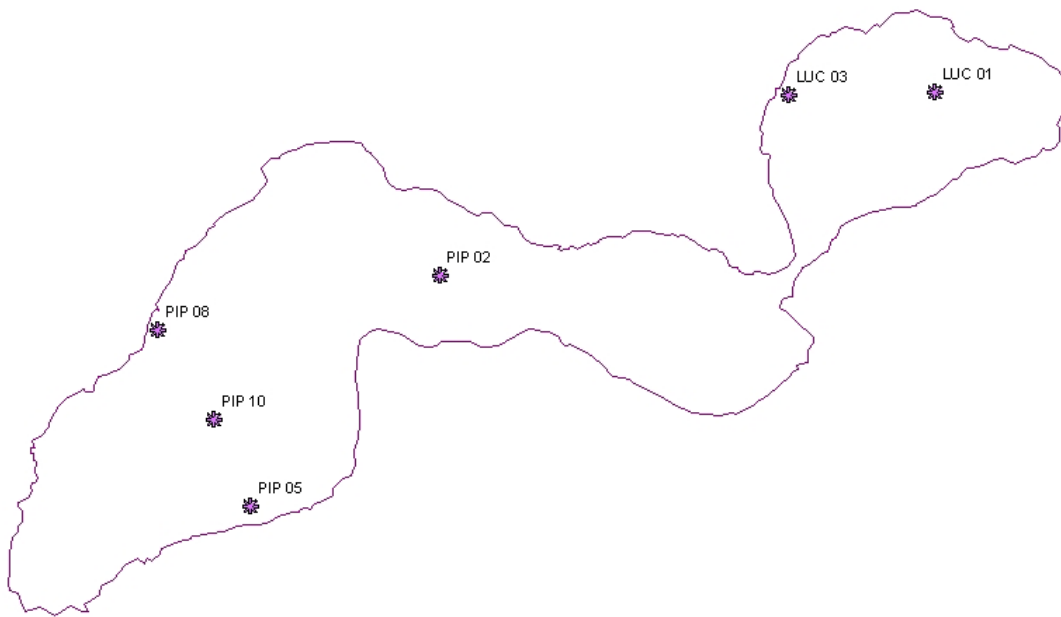


Figure 2. FasTEST Locations

The NPDES permit requires monitoring of herbicide levels in the lakes during the treatment. 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). 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 2007 the first herbicide treatment occurred in late May. Early treatment 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 2006 treatment, but levels were below 5ppb. Similar to last year, at several stations the 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 never exceeded 12 ppb (Figure 3). Fluridone was found in moderate levels throughout the lake, including water in areas that were not treated. This gave the County confidence that in all areas of the lake, hydrilla sprouts would still come in contact with sufficient fluridone to kill them.

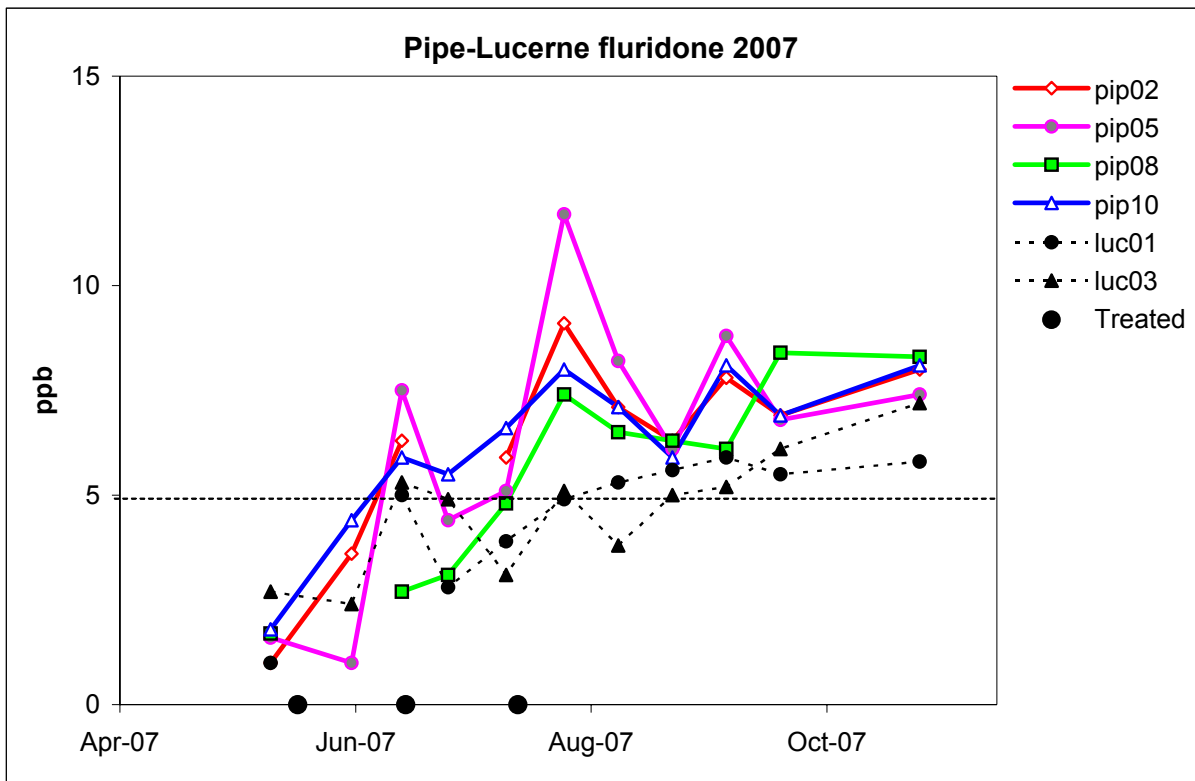


Figure 3: Herbicide Levels

This year no regular temperature data was taken since over the past four years lake temperature has followed a similar pattern. However, our fluridone results were atypical compared to previous years. Several temperature profiles were taken in late season; but this data did not provide any insight.

It is known that plants have been found both in the epilimnion and hypolimnion. There fore, 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 areas and then driving over the deeper areas while applying the 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 but 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 third year the Lake Lucerne has been hydrilla free and the first year that Pipe Lake has had no hydrilla.



Figure 4: 2007 Hydrilla Locations

Based on the fact that no plants were found this year, it is very possible that the tuber bank has 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. 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 2007.

Table 1: Aquatic plants and macro algae in the lakes

Table List of submersed and emergent aquatic plants and macroalgae observed at Pipe/Lucerne Lakes in 2007.	
Scientific Name	Common Name
EMEREGENT PLANTS	
<i>Iris pseudacorus</i>	Yellow-flag iris
<i>Juncus spp.</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 spp.</i>	Cattails
FLOATING LEAVED PLANTS	
<i>Ludwigia Palustris</i>	Water Purslane
<i>Nymphaea odorata</i>	Fragrant waterlily
SUMBERSED PLANTS	
<i>Potamogeton robbinsii</i>	Fern-leaf pondweed
<i>Potamogeton spp.</i>	Thinleaf 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 remain 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 2007, 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 have been attached as an appendix to the report (Appendix C).

CONCLUSIONS

The 2007 treatment season of the hydrilla eradication project was the culmination of five years of hard work with the most positive outcome occurring during the 2007 treatment season. This was the fifth year King County was directly involved in control activities, and it was instructive to see how all the seasons compared. It was positive that each year the hydrilla plants were found in decreasing numbers and that 2007 marked the first year that no hydrilla was found in either Pipe or Lucerne Lakes. It is great to see that the theories of the tuber bank becoming depleted due to herbicide exposure have proven to be true.

The over winter persistence of the fluridone was a surprise, as residual herbicide was not anticipated to linger in the system. It was 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 treatment but the second treatment in June brought the fluridone to the target level. The herbicide levels fluctuated throughout the season but they remained above the target level. A slightly larger amount of herbicide was used in 2007 to try and boost the initial levels of fluridone up in the system, although that did not seem to work as planned. Regardless, a full herbicide treatment will be done in the beginning of the 2008 to bump fluridone levels to the target 5 ppb.

No hydrilla plants were found this year in either lake. Even the highest infestation areas in Pipe Lake were hydrilla free. Although no plants were found this year, King County will continue to treat both Pipe and Lucerne Lakes for the 2008 year and possibly just Pipe Lake during the 2009 growing season. Diver surveys will continue to be done over the next several years to insure that hydrilla is eradicated. If any hydrilla plants show up in future, the process will begin again from the beginning. If no plants are found for three years hydrilla is then considered to be officially eradicated.

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 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 macroalgae may make it difficult to spot hydrilla if it recovers.

BUDGET

Table 2: Hydrilla Eradication Project Budget

Hydrilla Eradication G0300219		
2007 to-date (December)		
Task	2007 cost	Est 2008 cost
#1 Project Mgmt	\$ 6,106.25	\$ 7,500.00
#2 Treatment	\$ 36,501.01	\$ 40,000.00
#3 Monitoring and Assessment	\$ 22,524.07	\$ 25,000.00
Total	\$ 65,131.33	\$ 72,500.00
WDOE share	\$ 59,595.17	TBD
Cities match	\$ 5,536.16	TBD

In 2007 the State awarded 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 November 2007 a total of \$65,131.33 was spent by King County, of which \$59,595.17 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 \$5,536.16. The table also includes the estimated costs for the 2008 treatment year.

FUTURE

The 2008 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 2007. 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. Lucerne was hydrilla free this year, but herbicide application will continue in the lake to ensure that all plants are eradicated. This is a great success in five years and it is hoped that Pipe and Lucerne Lakes remain hydrilla free in the future.

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