

# Pipe and Lucerne Lakes 2006 Hydrilla Eradication Project Annual Report



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## **INTRODUCTION**

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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 through 2006. While different eradication methods have been used over the years, the extent of the infestation and the existence of a tuber bank have prevented total eradication to date.

In 2006, a very small hydrilla population continued to exist in the lakes. This was the fourth year of using a method that combines the use of slow release herbicide, hand-pulling and frequent diver and snorkel assessment. Unlike the previous two years, no tuber survey was done in 2006. Since no tubers were found in the previous two surveys, project managers determined that a third survey was not necessary. Herbicide and hand-pulling 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 ensure success. This document summarizes the 2006 treatment season.

## HISTORY OF TREATMENT

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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, a status that requires eradication of the weed. 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. (RMI has since changed its name to AquaTechnex.)

The 1995 herbicide treatments were successful in killing the portions of hydrilla plants that were visible above the sediment, 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, hiring a consultant only 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 three seasons, King County followed the same procedures in 2006. 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 hand pulled plants when appropriate.

Several King County staff members are involved in the hydrilla eradication project to ensure 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. Kristen Cash, an intern with King County Water and Land Resource Division, assisted in herbicide treatments, herbicide sampling and snorkel surveys.

## **TREATMENT AND PUBLIC INPUT**

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Both hand-pulling and herbicide were used in treating hydrilla. The herbicide, Sonar PR™, continued to be the control method used in the majority of the littoral zone in the lakes, and the hand-pulling was an excellent follow up to remove isolated, small areas of hydrilla. These treatment methods combined with frequent assessment are still proving to be effective in Pipe and Lucerne Lakes.

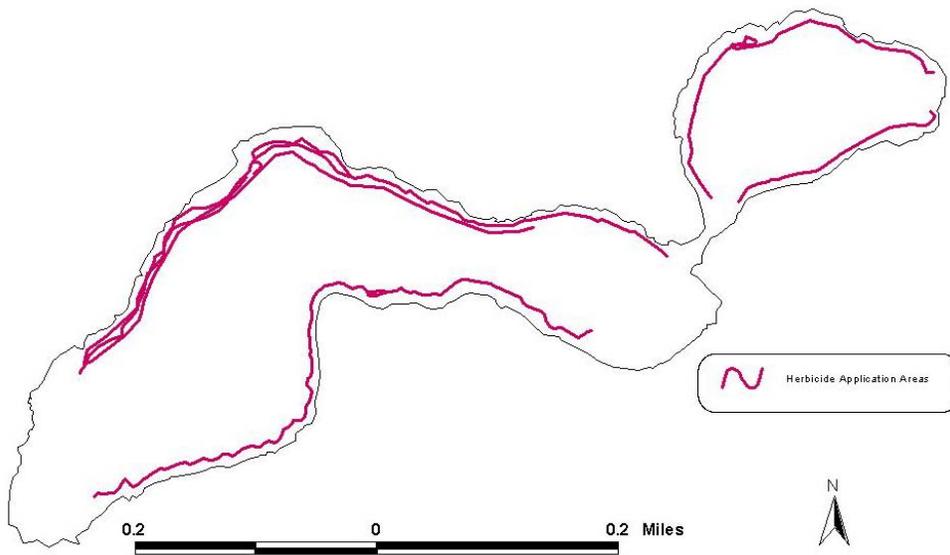
On April 20<sup>th</sup>, 2006 a public meeting was held to inform citizens about the program, what the goals were, and the treatment process for 2006. On November 6<sup>th</sup>, 2006 another public meeting was held to share results and answer questions. Citizens attended the meeting to learn about the 2006 findings.

### **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 of the right concentration of herbicide in the water on the plants. Herbicide application is currently the most successful option when eradication is the goal (Pipe Lake Integrated Vegetation Management Plan, 2004).

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 new noxious weed permit administered by Ecology was in effect in 2006, and it required notifying Ecology staff the week prior to each treatment and the Friday following each treatment.

Using the 2005 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 2005 were treated again in 2006. Even if hydrilla was not found in the pre-treatment 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 that area. The goal of treatment was to ensure all potential sites of hydrilla were covered, and if new infestations were found through the season, treatment areas could be adjusted to include the new locations. No new areas of infestation were found in 2006, so treatment areas were the same as the previous three years (Figure 1).



**Figure 1. Herbicide Application 2006**

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 2005 treatment season. The herbicide threshold for effective treatment is 5 ppb of fluridone present in the water column throughout the summer. Over the past three years fluridone levels have been adjusted so that herbicide levels are close to the target. In 2006, we followed the same treatment regimen as 2005. Ten acres were treated in Pipe and five acres were treated in Lucerne.

The first treatment on June 7, 2006 happened later than originally planned, due to the inability to get herbicide from the contracted provider. The delivery delay also caused the first treatment to occur with a smaller amount of herbicide than originally planned. Once application did occur on June 7<sup>th</sup>, 32.1 ppb (210 lbs/acre) in Pipe and 16 ppb (6 lbs/acre) in Lucerne was applied; the second treatment on June 30<sup>th</sup> was calculated at 37 ppb in Pipe (24 lbs/acre) and 32 ppb (12 lbs/acre) in Lucerne; the last treatment on July 21<sup>st</sup> 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 106.1 ppb in Pipe and 80 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. Hydrilla is 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 at that spot.

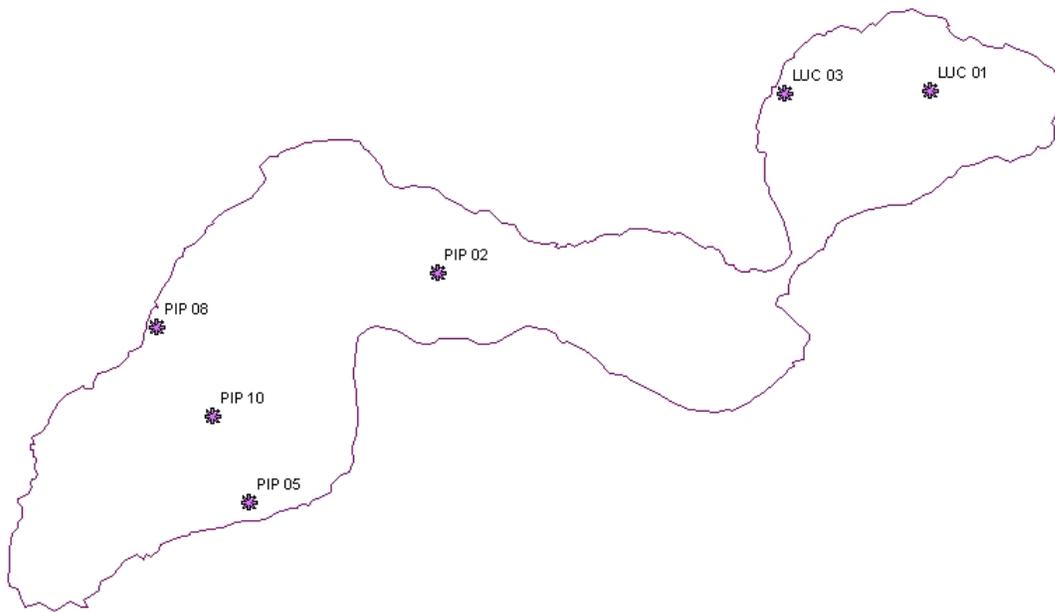
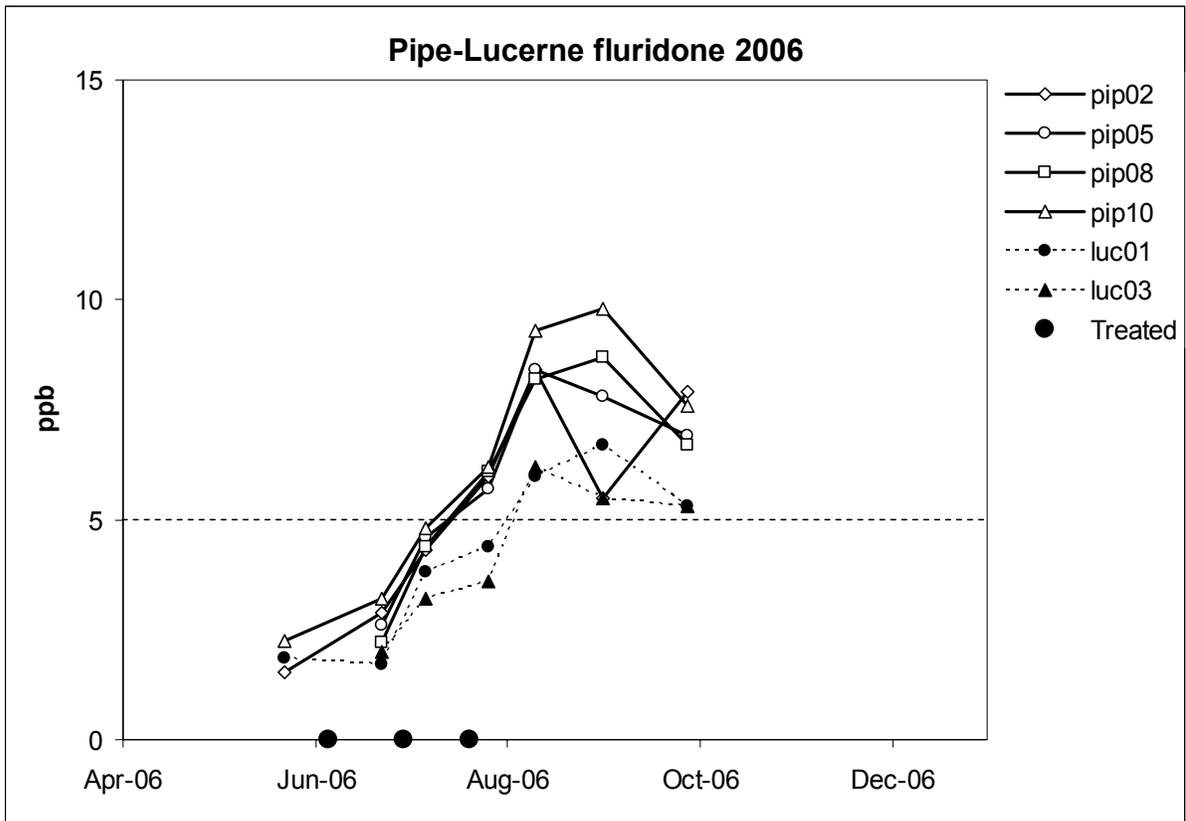


Figure 2. FastEST Locations

The NPDES permit requires monitoring of herbicide levels in the lake during the treatment. Water samples were collected prior to herbicide application and then at 14 day intervals after the first treatment. Samples were taken in treatment areas and the middle of the lakes (Figure 2). After each sampling event, the samples were frozen then 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 2006 the first herbicide treatment occurred in early June and, although that was later than originally planned, it is still assumed that the hydrilla would not have grown much and would come into immediate contact with fluridone upon application. As in the previous year, there was residual fluridone in the lakes left from the 2005 treatment season, but the levels were well below 5ppb. Also like last year, the fluridone levels did not rise to the target level as expected after the first treatment. That could be a side effect of the smaller amount of herbicide being applied. To remedy this, the amount applied in the second and third treatments was increased. During most of the summer, levels stayed between 5 ppb and 10 ppb in Pipe Lake and never exceeded 10 ppb (Figure 3). Fluridone was found in moderate levels throughout the lake, including areas that were not treated. This gave the County confidence that fluridone concentrations throughout the lake were high enough to kill any plants that may have been present, regardless of whether or not they were treated directly.



**Figure 3. Herbicide Levels**

This year no temperature data was taken since for the past 3 years lake temperature has followed a similar pattern. Since it is known that plants are found both in the epilimnion and hypolimnion, it was imperative that the granular herbicide was applied over both the shallow and deeper water to ensure 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**

All hand-pulling of individual plants was done by snorkelers and SCUBA divers during assessment surveys. Boat staff recorded the location with a GPS, and then the divers or snorkelers hand-pulled the plants and placed them in zip lock bags stored on the boat.

Hand-pulling can be time consuming and the tubers are difficult to remove in their entirety. Tubers are often rooted deep into the sediment and when plants are pulled, they can snap off at the stem, leaving the tubers behind. Divers pulled plants when they were found. Only two plants were found in the lakes this year, and both were pulled by divers with tubers attached.

## **ASSESSMENT**

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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. Hydrilla growth patterns in 2006 were similar to recent years, with only two plants were found through the entire season. No plants were found in either of the lakes during the June and August survey. In October, two plants were found at depths of 11 and 12 feet in Pipe Lake only.

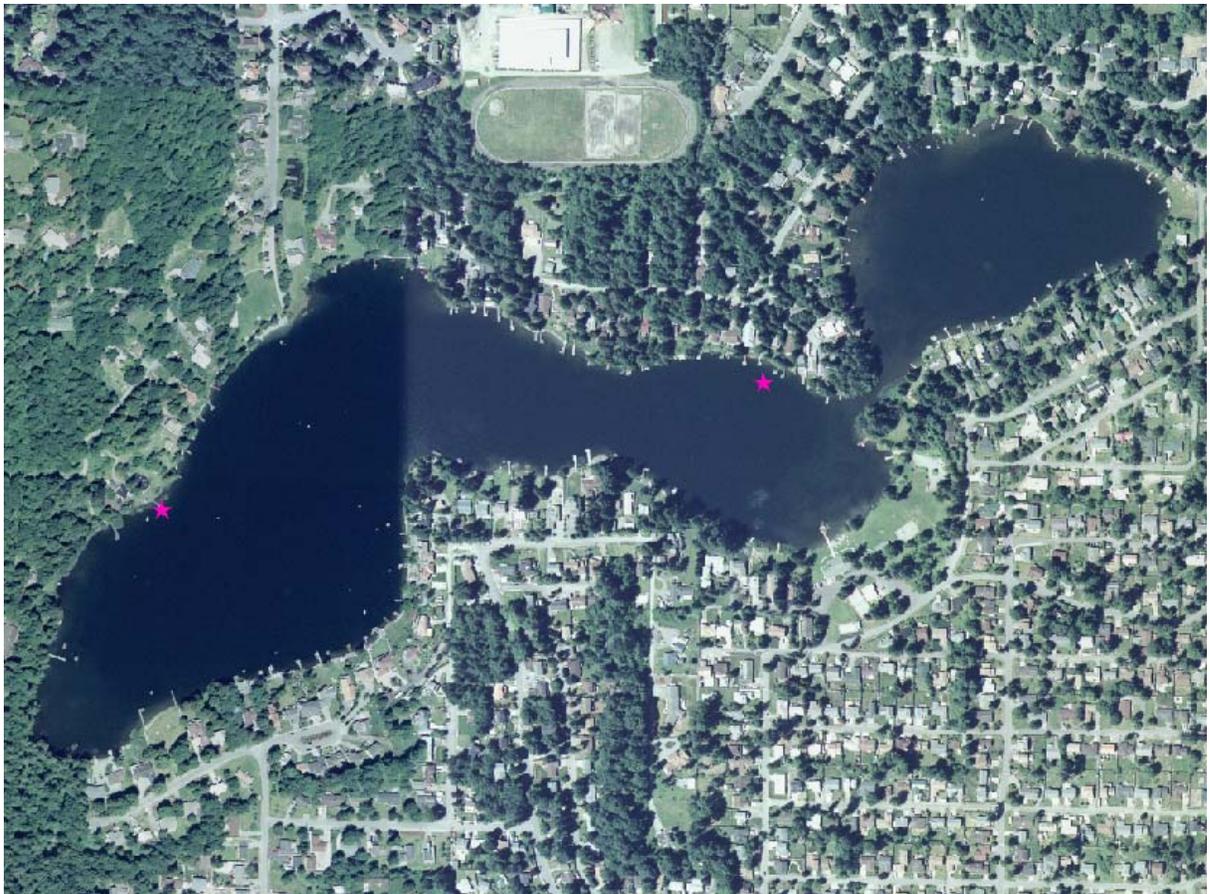


Figure 4. 2006 Hydrilla Locations

Only Pipe Lake had hydrilla in 2006. Lake Lucerne has been hydrilla-free for several years in a row. The one plant found on the northeast shoreline was located in an area where hydrilla has been found consistently for the past three years. The second plant, found on the northwest shoreline in the south end of Pipe Lake, was located in an area where hydrilla was found in the 2003 and 2004 treatment seasons. Based on the number of plants found this year, it is plausible that the tuber bank is finally reaching exhaustion. GPS points and notes were taken of the exact plant locations, allowing for easy illustration of hydrilla dispersal in the lakes (Fig. 4).

Overall, hydrilla has decreased every year since the current treatment plan began: 474 plants found in the lakes in 2003, 146 plants in 2004, 23 plants found in 2005, and two plants found in 2006. In 2003 and 2004 each hydrilla plant was counted as an individual and sometimes where the densities of plants were high, no hand-pulling occurred. It is possible this led to double counting which could have inflated the number of plants present in 2003 and 2004, but there is still a steep decrease in the amount of plants found between then and 2006.

Assessment results show that the treatment methods used over the last four years have been very effective. Based on the original 474 plants documented in 2003, there has been over a 99% reduction of the population to date. No plants were found in Lucerne in 2005-2006, and only one plant was found in 2004. The number of single plant locations has decreased measurably as well, with 74 single plants being found in 2003 and two being found in 2006.

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 2006.

**Table 1. Aquatic plants and macro algae in the lakes**

List of submersed and emergent aquatic plants and macroalgae observed at Pipe/Lucerne Lakes	
Scientific Name	Common Name
<b>EMERGENT PLANTS</b>	
<i>Iris pseudacorus</i>	Yellow-flag iris
<i>Isoetes spp.</i>	Quillworts
<i>Juncus spp.</i>	Rushes
<i>Polygonum hydropiperoides</i>	Waterpepper
<i>Scirpus</i>	Bulrushes
<i>Solanum dulcamara</i>	Bittersweet, nightshade
<i>Typha spp.</i>	Cattails
<b>FLOATING-LEAVED PLANTS</b>	
<i>Ludwigia palustris</i> *	Water pusland
<i>Nymphaea odorata</i>	Fragrant waterlily
<b>SUBMERSED PLANTS</b>	
<i>Hydrilla verticillata</i>	Hydrilla
<i>Potamogeton robbinsii</i>	Fern-leaf pondweed
<i>Potamogeton spp.</i>	Thinleaf pondweed
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed
<i>Spirea spp.</i>	Spirea
<i>Utricularia spp.</i>	Bladderworts
<b>ALGAE</b>	
<i>Chara</i>	Muskgrass, stonewort
<i>Nitella spp.</i>	Nitella

\*Present in Lucerne Lake this year and not in previous years

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 2004. Nitella (*Nitella spp.*) was found in shallower waters of six or seven foot depths. There were also dense mats of macroalgae in several areas of both lakes, which obscured 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. This was not done in 2006, but it is anticipated that comprehensive plant surveys will begin again when herbicide treatments have ceased and native plants begin to repopulate the lakes.

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

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The 2006 treatment season of the hydrilla eradication project proved to have very positive results. This was the fourth year King County was directly involved in control activities, and it was instructive to see how all the seasons compared. The over winter persistence of the fluridone was a surprise, as residual herbicide was not anticipated to linger in the system. However, this may have been a boon this year as the delivery of herbicide was delayed this year and less herbicide was used in the first treatment. The fluridone levels did not come up to the targeted 5 ppb in the anticipated two week time frame and the second treatment in June brought the fluridone almost to the target level and then the treatment season followed much the same pattern as the previous three years. A smaller amount of herbicide was used in 2006 and the level remained above target, which means the County will follow the same pattern for the 2007 treatment season, although a full herbicide treatment will be done in the beginning to bump fluridone levels to the target 5 ppb.

Fewer hydrilla plants were found this year than last year (146 in 2004 and 23 in 2005). Two plants were found in Pipe Lake during the October survey. No plants were found in Pipe in the June and August survey. The tubers apparently persist in the deeper waters, between nine to 13 feet deep. No hydrilla was found in shallow water this year. The highest infestation areas continue to be “hot spots” in Pipe Lake. However, each year the densities appear to be decreasing. No plants at all were found in Lucerne during the 2006 treatment season.

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

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**Table 2. Hydrilla Eradication Project Budget**

<b>Hydrilla Eradication Budget (as of December 2006)</b>		
<b>Task</b>	<b>Cost: 2006</b>	<b>Est. 2007 Costs</b>
Task 1: Project Mangement	\$8,385.74	\$13,100.00
Task 2: Treatment	\$40,178.80	\$40,000.00
Task 3: Monitoring and Assessment	\$22,011.14	\$39,500.00
<b>Total</b>	<b>\$70,575.68</b>	<b>\$92,600.00</b>
Washington Department of Ecology (July 2006 - November 2007)	\$89,761.50	TBD
Cities Match	\$8,338.50	TBD

In 2006 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 December 2006 a total of \$70,575.68 was spent and considered eligible for grant reimbursement, 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 \$8,338.50. The table also includes the estimated costs for the 2007 treatment year.

## **FUTURE**

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The 2007 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 2006 although the amount of herbicide was decreased slightly. Both SCUBA and snorkeling surveys will continue to make sure that the lakes are being surveyed as comprehensively as possible.

A tuber survey and a comprehensive plant survey will not be done in 2007. The comprehensive plant survey will not be done until herbicide treatments are terminated and the re-growth of the native plants will be tracked.

Hydrilla has decreased from 474 plants found in 2003 to 146 plants in 2004 to 23 plants in 2005 and only two plants in 2006. Lucerne was hydrilla free this year, but herbicide application will continue in the lake to ensure that all plants are eradicated. This is a significant decrease in two years and it is hoped that Pipe Lake is not far from being hydrilla-free as well.

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## APPENDIX A

Appendix A includes a description of the FasTEST locations and at what level the water samples were taken.

<b>FasTest Locations</b>		
PIP 02	Middle of Pipe Lake	surface
PIP 05	Treatment area on south side Pipe Lake	surface
PIP 08	Treatment area on north side of Pipe Lake	surface
PIP 10	Middle of west cove Pipe Lake	surface
LUC 01	Middle of Lake Lucerne	surface
LUC 02	West side of Lake Lucerne	surface

Raw data values for FasTests in ppb

<b>date</b>	<b>pip02</b>	<b>pip10</b>	<b>pip08</b>	<b>pip05</b>	<b>luc01</b>	<b>luc03</b>
23-May	1.52	2.24			1.84	
23-Jun	2.90	3.20	2.20	2.60	1.70	2.00
7-Jul	4.30	4.80	4.40	4.60	3.80	3.20
27-Jul	6.00	6.20	6.10	5.70	4.40	3.60
11-Aug	8.40	9.30	8.20	8.40	6.00	6.20
1-Sep	5.50	9.80	8.70	7.80	6.70	5.50
28-Sep	7.90	7.60	6.70	6.90	5.30	5.30