

# Pipe and Lucerne Lakes 2003 Hydrilla Eradication Project

## A n n u a l R e p o r t



Grant # - G0300219

Vendor: King County Water and Land Resources Division

Agency: Department of Water Quality Washington State Department of Ecology

January 29, 2004



**King County**

Department of Natural Resources and Parks

---

## **INTRODUCTION**

---

Pipe and Lucerne Lakes are located in the cities of Maple Valley and Covington in south King County. In 1994 hydrilla, a Class A noxious weed, was discovered in the lakes and became the only infestation in King County and the Pacific Northwest. The Washington State Department of Ecology required immediate action to eradicate the weeds and different eradication methods have been used over the years but have been successful only to a point.

In 2003, hydrilla populations continued to exist in the lakes. This year a new treatment method was used that included the use of herbicide, hand-pulling and frequent assessment. Herbicide and hand-pulling directly affected the plant and its ability to thrive, whereas assessment helped King County and its contractors to understand the problem and how to best manage the project to insure success. This document summarizes the 2003 treatment season and its initial successes.

## **HISTORY OF TREATMENT**

---

For several years hydrilla (*Hydrilla verticillata*) was misidentified as *Egeria densa* in Pipe and Lucerne Lakes (K. Hamel, pers comm). In 1994, King County tentatively changed the plant identification to hydrilla based on a King County Aquatic Plant Mapping project done on the lakes. In late May of 1995, the state confirmed that the plant was *Hydrilla*, a Class A noxious weed. At the time the lakes were located in an unincorporated area, so King County was responsible for managing the control effort. In the summer of 1995, the County hired Resource Management Inc. (RMI) to apply the herbicide Sonar<sup>®</sup> (active ingredient fluridone) to control the weed. RMI maintained herbicide levels from 10 to 20 ppb in the lakes over eight weeks. The hydrilla responded well to the use of the herbicide, but post-treatment SCUBA diver surveys uncovered a tuber bank.

Based upon current research, tubers can be viable for up to ten years and are not necessarily affected by herbicides. Because of the tuber bank, one herbicide treatment was not sufficient for eradication so whole lake 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 1990's a lawsuit was filed 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 aquatic herbicides are considered pollutants and are 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 lakes for hydrilla, hand pulling it as it was 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 continued in 2002. However, in the fall of 2002 significant growth of hydrilla was found by WDOE and spot treated by AquaTechnex with Aquathol Super K granular herbicide.

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

One of the first tasks the County did in the 2003 project season was to divide the work into assessment and treatment tasks. Assessments were handled by snorkeling surveys and SCUBA diving surveys. King County performed the snorkel surveys throughout the growing season, beginning in June and ending in September. Envirovision was hired to do three SCUBA surveys throughout the summer (June, July, and August).

Herbicide application and hand pulling were the chosen treatment methods for hydrilla control. King County performed the herbicide treatment four times during the summer. During the survey assessment, the snorkelers and divers did hand pulling when appropriate.

Several King County staff members were involved in the hydrilla eradication project to insure its success. Sally Abella, King County Lake Stewardship Program Manager acted as project manager, offering technical assistance when necessary. Beth Cullen, King County Water Quality Planner I, with the King County Lake Stewardship Program acted as field manager and project coordinator. Drew Kerr of the King County Noxious Weed Program helped with herbicide treatment and technical support. Michael Murphy and Katie Messick, also of the King County Lake Stewardship Program, assisted with the snorkel surveys. Curtis Clement, an intern with King County Water and Land Resource Division, assisted in herbicide treatments, water quality sampling and snorkel surveys. Two other interns, Deanna Matzen and Kari Moshenberg, also assisted with the snorkel surveys.

## **TREATMENT**

---

There were two parts to the treatment plan during the 2003 treatment season. The main treatment was the application of Sonar PR™, a slow release granular herbicide with the active ingredient fluridone. Diver hand-pulling was also used occasionally during the surveys. In the beginning of the 2003 season a public meeting was held to give citizens a chance to learn about the program, what the goals were, and the treatment process. After the season ended, another public meeting was held to transmit results.

### **Herbicide**

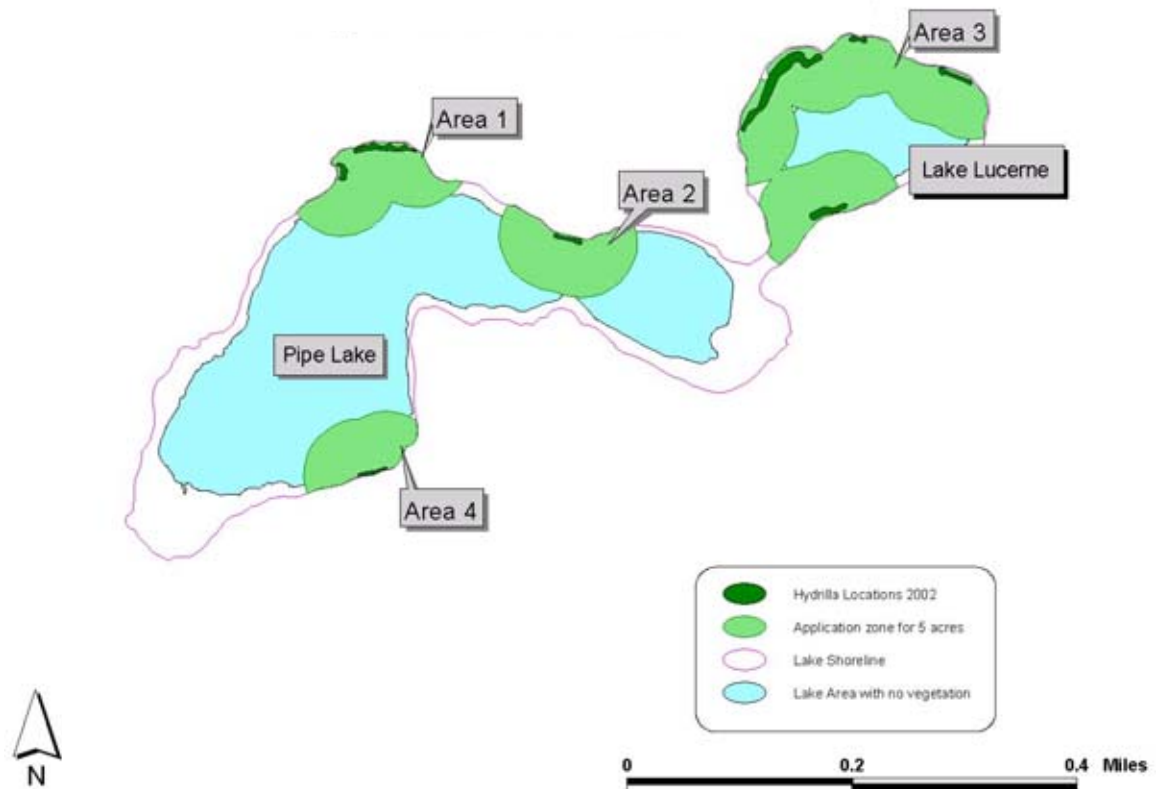
Three weeks prior to the first Sonar PR™ application, a flyer went out to the community in the Pipe and Lucerne watershed informing them of the treatment plan and herbicide application dates. Following the requirements of the NPDES permit process, within 24 hours prior to each herbicide application, the lake was posted with signs stating that herbicide treatment would be occurring the next day.

Prior to the first Sonar PR™ application, special equipment had to be purchased, which was found through Jeff Schardt, Plant Management Section Administrator, at the Florida State Department of Environmental Protection. He recommended using a machine called a “Gran-Blow”, which is a modified backpack herbicide spreader retrofitted for boat mounting. It has a 20-gallon hopper on the top of the motor and a hose that sprays the herbicide out into the lake over the bow of the boat (Figure 1). The applicator stands behind the machine and swivels the hopper from side to side, ensuring that the herbicide is evenly spread on either side of the boat. This machine was best suited for this situation as it allowed controlled, efficient, spreading of the herbicide with minimal contact to the applicator and other team members in the boat.



Figure 1: Gran-Blow

Using the 2002 hydrilla location map, application areas and herbicide amounts were calculated. Three-acre buffers were drawn around each infestation, ensuring that potential tubers dormant in surrounding sediments would come in contact with the herbicide as they sprouted (Figure 2). The goal was to make sure all potential areas of hydrilla were covered and as new infestations were found through the season, target areas were adjusted to include the new plants (Figure 3).



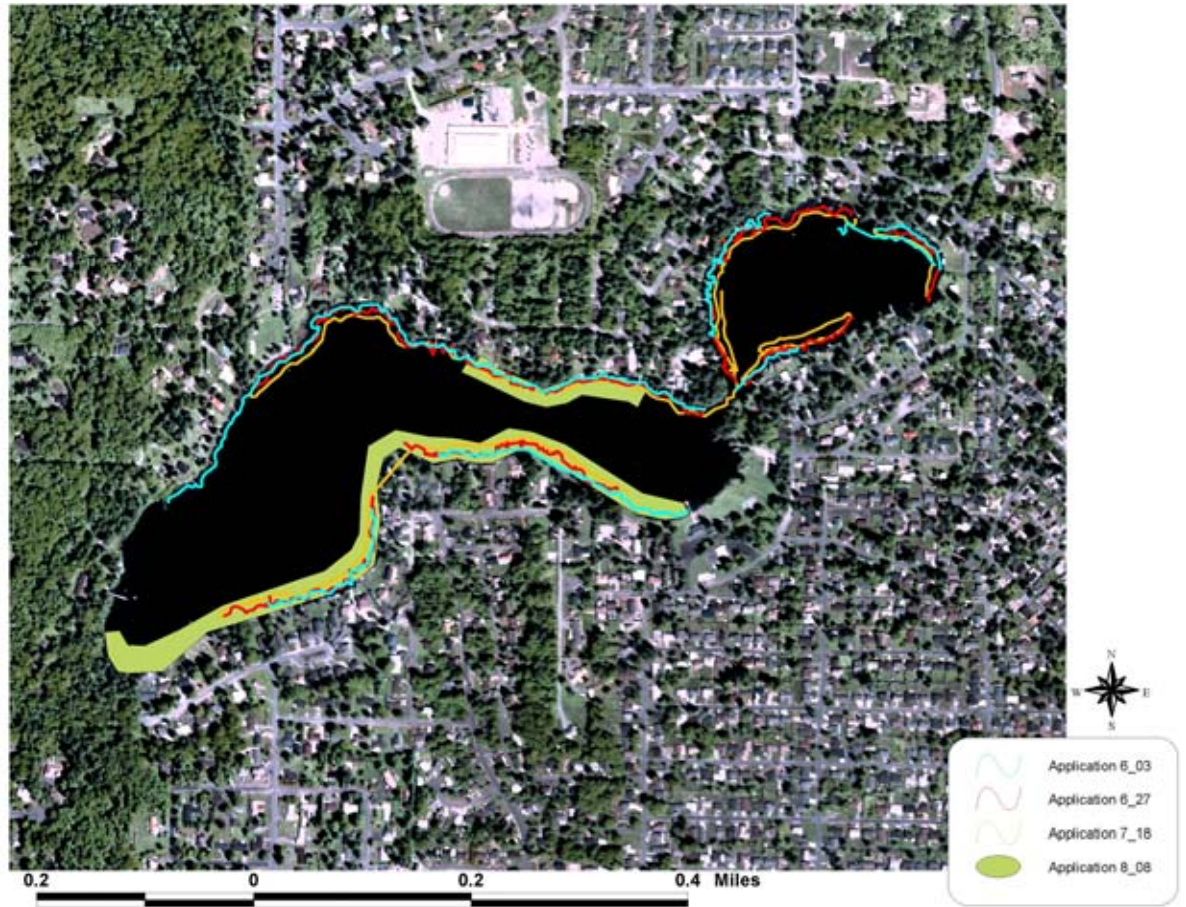
**Figure 2: Hydrilla locations in 2002 and initially projected areas of treatment in 2003.**

Rates of application were calculated based on the acreage of hydrilla infestation and the concentration of fluridone necessary to maintain a consistent level of fluridone in the water column. The herbicide target for the treatment season was 5 ppb of fluridone in the water column throughout the summer. The amount of herbicide used per acre was based on a simple calculation of average epilimnetic depth and the concentration of herbicide. No more than 150 ppb of fluridone could be applied to any one hydrilla location and the treatments were broken down accordingly. The first two treatments each spread coverage of 50 ppb and then the last two treatments were calculated at 25 ppb, totaling 150 ppb. The first two applications in Pipe Lake applied 32.4 lbs. of herbicide per acre over a total of 10 acres. Twenty-seven pounds per acre was applied in Lake Lucerne over a total of 5 acres. On the third and fourth treatments Pipe Lake received 15.1 lbs./acre over a total of ten acres. Lake Lucerne received 16.2 lbs./acre over five acres only on the third treatment. Based on herbicide monitoring (FastEST) results, a fourth herbicide treatment was cancelled in Lucerne because fluridone levels were higher than the target.

To insure accuracy maps, were made prior to each application event marking the treatment areas and the corresponding acreage. This made it easier during the



application to know the exact location and how much herbicide corresponded to that area. Each treatment was mapped using GPS, converted into an ArcView map, and used as a guide for future mapping.

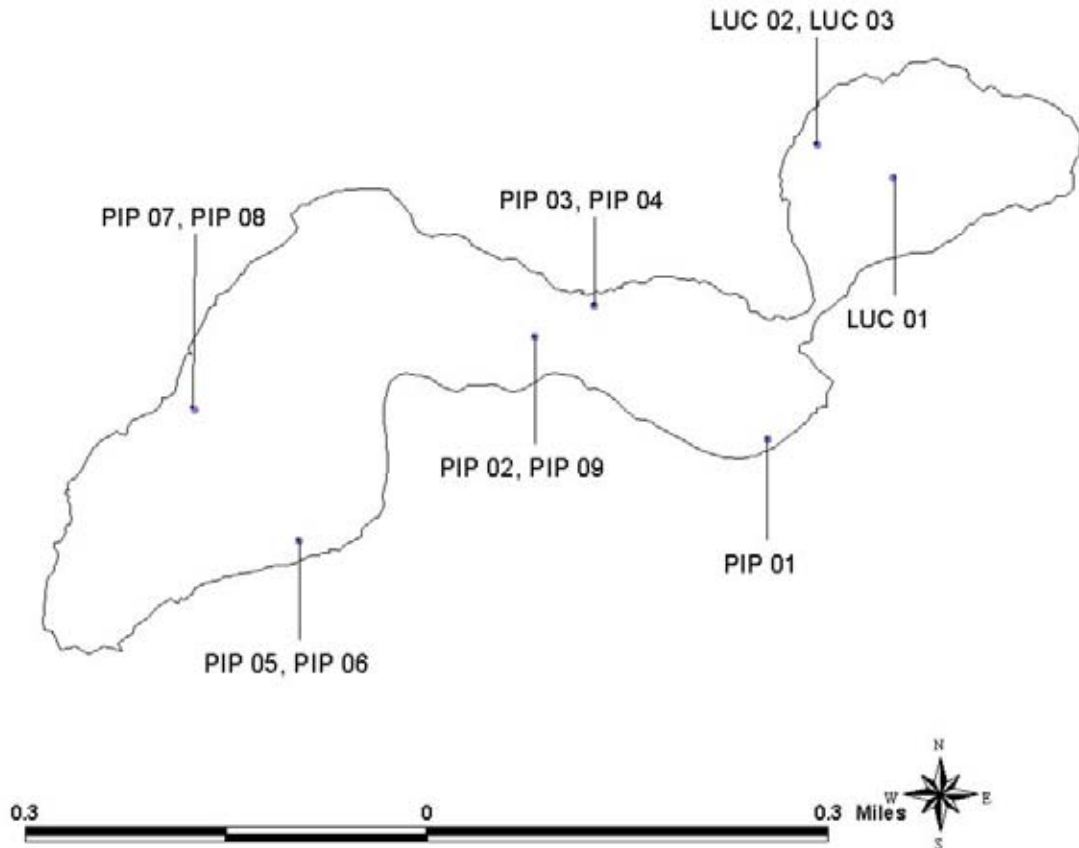


**Figure 3: Areas of Sonar PR™ treatment over the 2003 season**

The NPDES permit requires monitoring of herbicide levels in the lake after treatment. Samples were collected prior to the first treatment and then at 14 day intervals. Samples were taken in the treatment areas, middle of the lakes, and public use areas (Figure 4). Samples in the treatment zone were taken both at one meter deep and close to the bottom. Samples in the middle of the lake were taken at one meter deep and a one-time sample at seven meters deep to ensure the fluridone was reaching below the thermocline. After each sampling event, the samples were shipped overnight to SePRO labs for analysis. Results from these tests allowed the County to track the herbicide levels and helped to determine the locations and amounts of herbicide for subsequent applications.

The results characterized herbicide distribution through the lakes, which guided subsequent applications. During most of the summer, levels stayed just above 5 ppb in Pipe Lake and never exceeded 15 ppb. All four herbicide treatments were performed in Pipe Lake; fluridone was found in moderate levels throughout the lake, including areas that were not treated. This gave confidence that areas that possibly had hydrilla

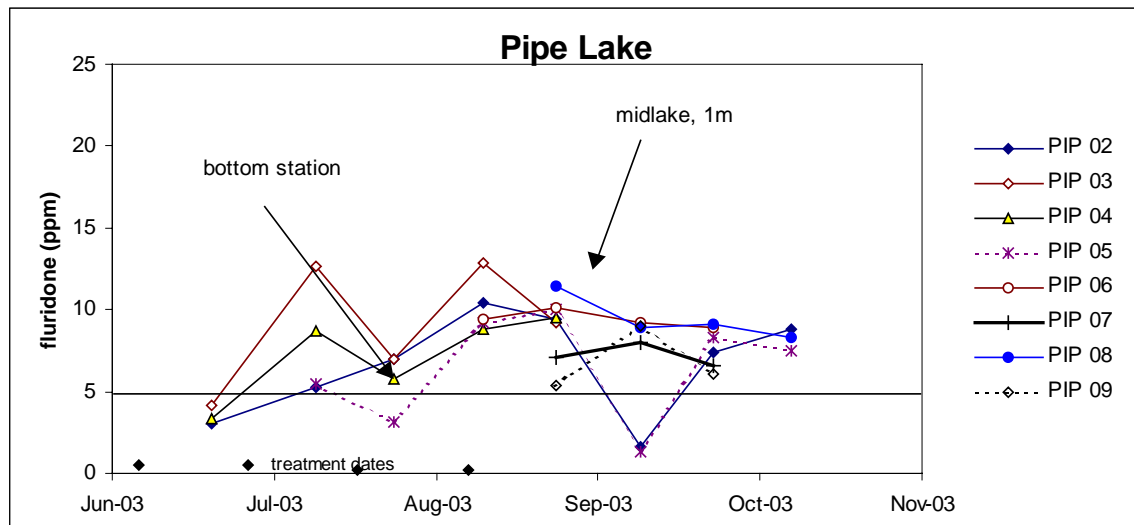
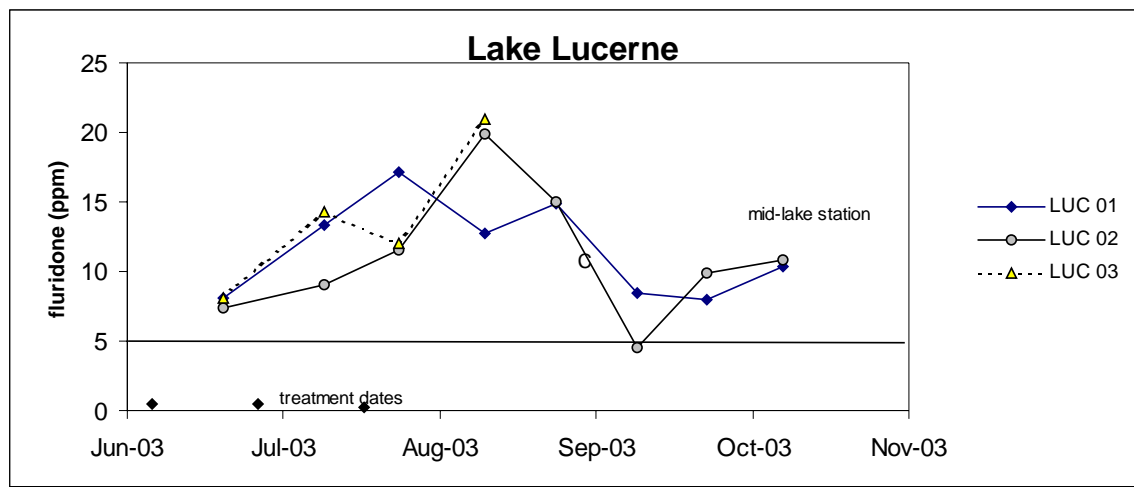
but were not treated still came in contact with the fluridone. Herbicide levels were moderate in the lake throughout the summer and degraded as expected but with the fall turn over of the lake, a slight increase in fluridone was seen (Figure 5).



**Figure 4: FasTest locations**

The channel between Pipe and Lucerne is narrow and very shallow, limiting water circulation between the two lakes. Lucerne is a smaller lake, with a smaller water volume. The only outlet to the lake is a storm channel, which is dry during the summer, so most of the fluridone is contained within the lake. Fluridone levels reached a maximum of 20 ppb. These high readings influenced the cancellation of the fourth treatment. The fluridone degraded overtime, but just like in Pipe, there was a slight increase in fall as the lakes turned over and the bottom water mixed with the top water.





**Figure 5: FastTest results**

Part of the water quality testing included collecting temperature profiles and Secchi depths for both lakes. Temperature data illustrated where stratification occurred in both lakes and suggested how the herbicide was distributed in the water column (see Appendix). Data showed that the lakes were stratified by late May, before the first treatment. This suggests that the fluridone did not mix between the epilimnion (top water) and the hypolimnion (bottom water). Since plants were found both in the epilimnion and hypolimnion, it was imperative that the granular herbicide was applied over both the shallow and deeper water to insure all plants were came into contact with the fluridone.

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

## **Diver Hand-pulling**

Hand-pulling of individual plants was done by snorkelers and SCUBA divers. When it was feasible, divers and snorkelers would hand-pull the plants and place them in plastic zip-lock bags to remove them from the lakes. Hand-pulling is time consuming and the tubers can be difficult to remove. The tubers are often rooted deep into the sediment and when the plant is pulled, it can snap off, leaving a potentially viable tuber behind. Divers pulled plants mostly in the beginning of the treatment season when herbicide effects were slight and there were fewer plants. As more plants sprouted and the herbicide damage was more severe, plants were left in the water, allowing the fluridone to eradicate the plant. In areas of heavy infestation hand-pulling was not done, as it was too time consuming and took away from the assessment goals of the dive.

## **Conclusions**

The 2003 treatment season of the hydrilla eradication project was instructive for the King County staff. It was the first year King County was involved directly in control activities, as well as the first time this herbicide assessment approach was implemented. The Sonar PR™ performed as we had expected. Hydrilla was the first plant to bleach, turning the plants a pinkish white color, making them easily identifiable against the green of the other plants.

The fluridone stayed in the water column for the entire growing season, even increasing in October due to lake turn over. The herbicide dispersed into all parts of the lake, including areas where herbicide was not applied. Later in the summer a new infestation was discovered in the northern shoreline water of Pipe Lake. This was not a targeted treatment area. However, when a FasTEST was taken nearby the fluridone level was between five and 10 ppb, suggesting the fluridone levels were sufficient at that location, even though it was not applied directly.

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 profound and easily spotted among the other plants.

Both hand-pulling and herbicide were used in treating hydrilla. The Sonar PR™ was the main control method covering the whole lake and the hand-pulling was an excellent follow up to remove isolated, small areas of hydrilla. These treatment methods combined with frequent assessment proved to be effective in the Pipe and Lucerne Lakes.

## **ASSESSMENT**

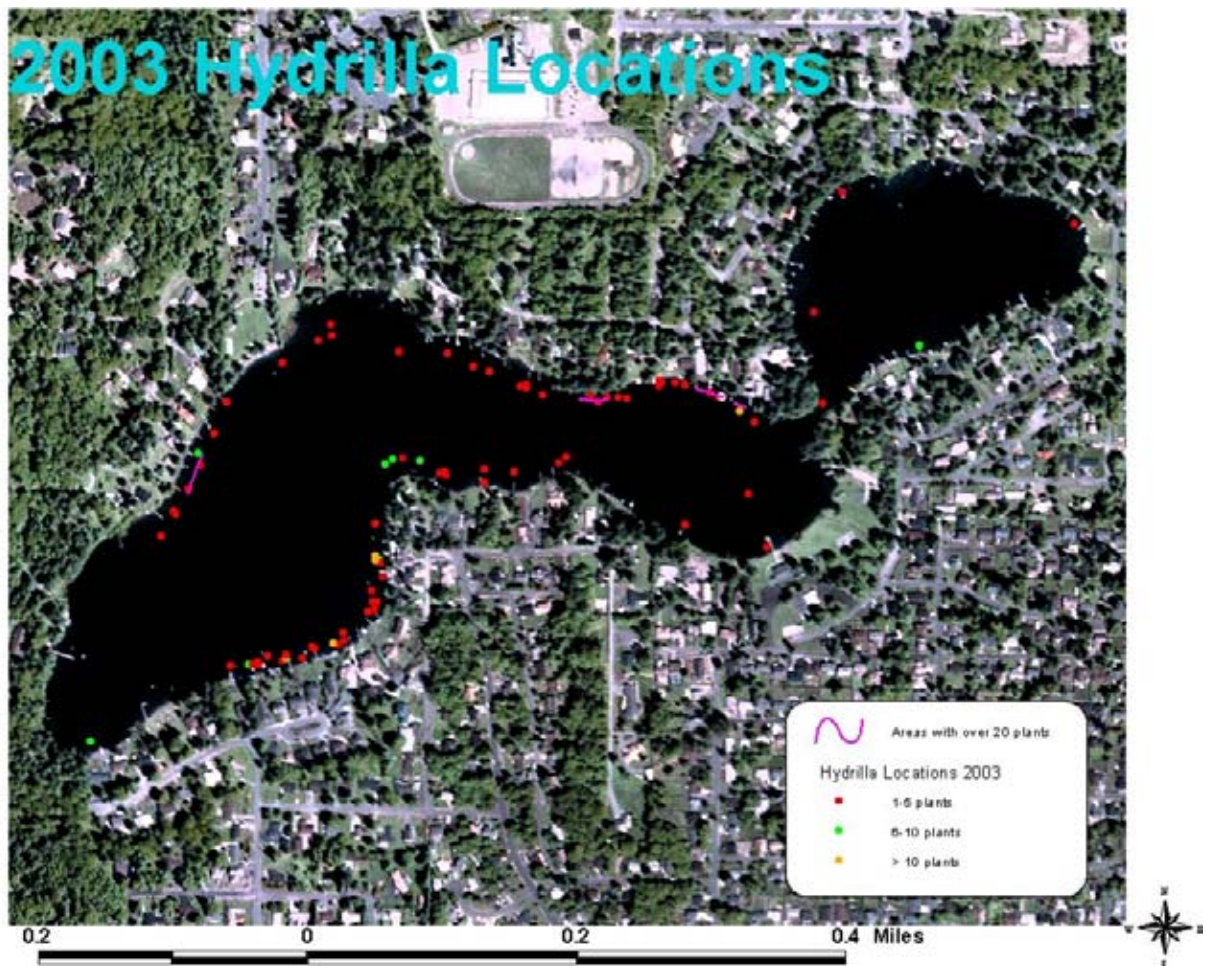
---

Assessment throughout the growing season was a critical part of this project. The surveys were performed two ways 1) snorkel surveys and 2) SCUBA diver surveys. These surveys assessed the entire littoral zone of Pipe and Lucerne lakes every month during the growing season, divers were able to see to what extent the herbicide was affecting hydrilla, where the plants were growing and at what time during the season (Figure 6).

The assessment portion of the hydrilla project was necessary for successful eradication. Without constantly looking at how the plants are being affected by treatment methods, there is no way to gauge success. This year a pattern in hydrilla growth was detected: in the late spring, early summer hydrilla was found in clumps of one to seven plants in the shallow water. Snorkelers had the best access to early plants since they could swim in shallow water to locate plants that were mainly two to four feet deep. As the summer progressed, more plants were discovered in deeper water (approximately 10 feet) and in larger patches (20 – 50 plants). By July snorkelers were finding no plants and the divers were finding large groups. Most of the plants were easily located due to the bleaching action of the fluridone. If the plants had not bleached, they would have been very difficult to find.

Pipe Lake was the most severely infested, with most of the northern and southern shorelines producing plants. The coves in the east and west had a few plants in the early summer but as the summer progressed, no plants were found. This is most likely due to the shallow water, since the late summer plants were found in deep water. Infestations were denser in the late summer at 10 to 14 feet deep and came up in much larger patches. This is critical to note because it suggests that herbicide must be applied in the deeper waters so that these plants come in contact with the fluridone.

Lucerne provided a much different case. Early in the treatment season, Lucerne had the most plants. Hydrilla was located shallow at about six feet and one area had 10 to 15 plants. As the summer progressed and the herbicide levels rose, much less hydrilla was discovered in the lake. By the end of the summer only one plant was found in all of Lucerne.



**Figure 6: 2003 hydrilla locations**

Surveys are the most direct method to assess how the treatments were affecting the hydrilla. Maps and notes were taken of the exact locations making it easily illustrated the dispersal of hydrilla in the lakes and how effective our methods were. These assessments not only helped direct the treatments but also collected important information for future treatment methods.

After each assessment a complete summary of the task was submitted to the Project Manager. These summaries have been attached to the appendix of this report for a detailed account of each assessment event in Pipe and Lucerne lakes.

## BUDGET

---

<b>Table 1. Hydrilla Eradication Project Budget</b>		
<b>Task</b>	<b>Costs 2003</b>	<b>Est 2004 costs</b>
<b>Project Management</b>	13,311.96	13,225.00
<b>Treatment</b>	43,888.53	47,351.00
<b>Snorkeling and Dive Assessment</b>	34,282.70	37,892.00
<b>Total</b>	<b>91,483.19</b>	<b>98,468.00</b>
<b>Washington State Department of Ecology</b>	83,615.63	TBD
<b>Cities Match</b>	7,867.55	TBD

In 2003 the WDOE awarded a grant in the amount of \$104,638 to King County to perform the hydrilla eradication work. A budget was constructed breaking the money into three major tasks, project management, treatment and assessment. Project management included tasks such as report writing, budget, and project organization. Treatment included all aspects of herbicide treatment in the lake, purchasing equipment and herbicide, creating treatment maps, and the herbicide application. The final task is Snorkeling and Dive Assessment, which included staff time spent surveying the lake, writing reports and creating survey maps.

Table 1 shows the total spent for each task. This year a total of \$106,497 was spent by King County of which \$91,483 was 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 \$7,867. The table also includes the estimated costs for the 2004 treatment year.



## **FUTURE**

---

It is not anticipated that the treatment strategy will change in the near future. The 2004 and 2005 hydrilla eradication treatment methods will likely stay essentially the same. Slow release granular Sonar PR™ will be the herbicide used. The application rates of fluridone will most likely decrease in Lucerne because of the 5 ppb exceedance this year. Pipe Lake will most likely remain the same; fluridone levels did not exceed 5 ppb for any great length of time. Diver surveys and snorkel surveys will be done in conjunction with each other to coordinate the surveys of both the shallow and deep areas of the lakes at once.

For most aquatic plant control projects the WDOE requires an Integrated Aquatic Vegetation Management Plan (IAVMP) be written. This document characterizes the Lakes and assesses all alternatives for aquatic plant control. The IAVMP helps make predictions on how the project might progress or change over the years, in treatment strategies and budget requirements. The IAVMP is the most comprehensive look at any particular aquatic plant project and ensures the best and most practical control method is chosen for the particular project.

The hydrilla infestation is a major concern of the state and once it was discovered treatment began immediately to prevent the spread to other area lakes. Since hydrilla was seen as the states number one priority for eradication, an IVAMP was not written or required. In 2004 and IAVMP for the project is required to ensure that the best treatment method is used and all alternatives being considered. By the beginning of the 2004 treatment season, an IAVMP will be completed for the hydrilla eradication project.

## APPENDIX

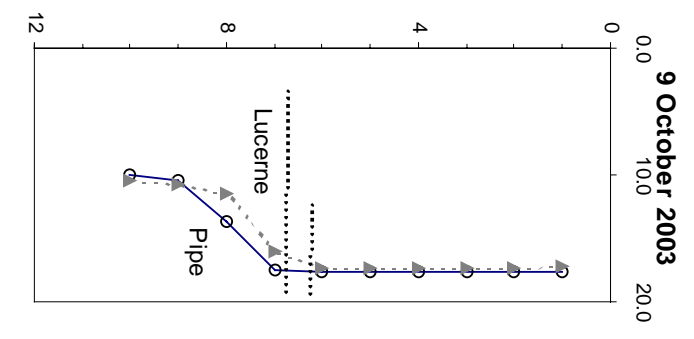
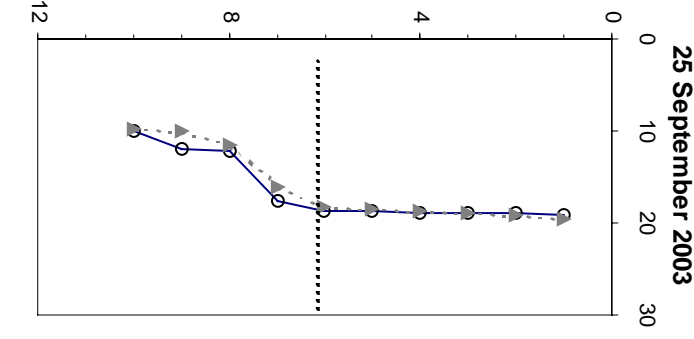
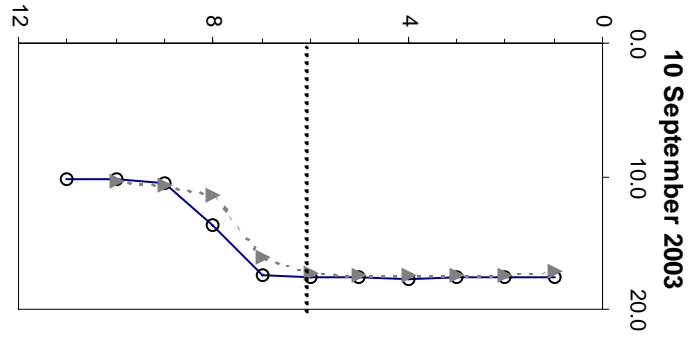
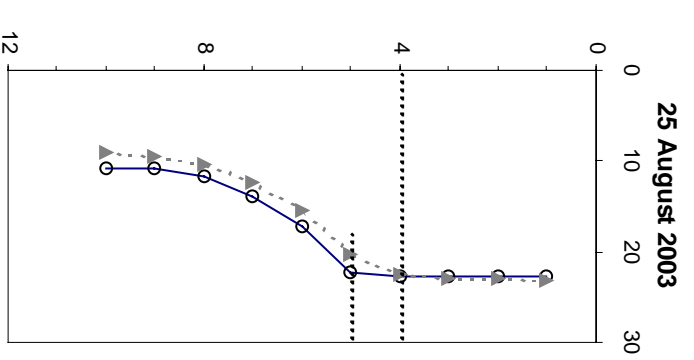
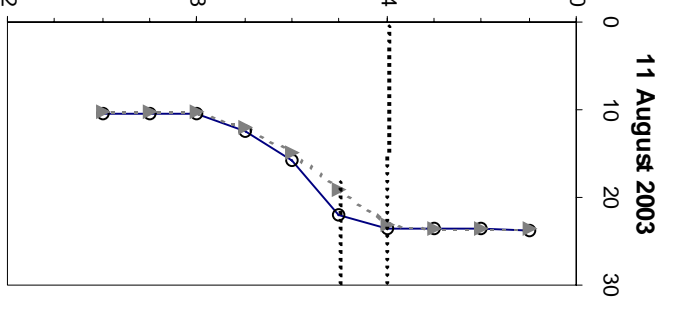
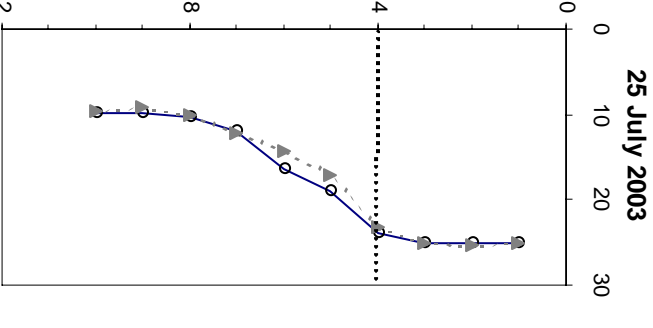
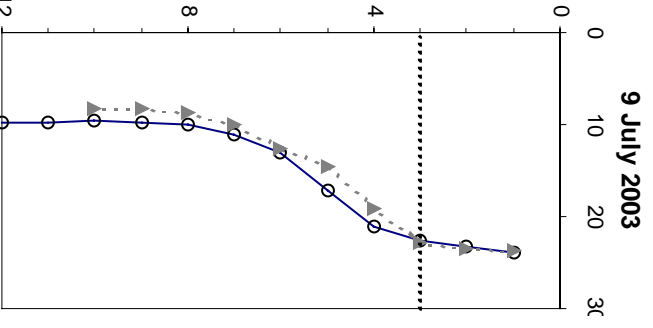
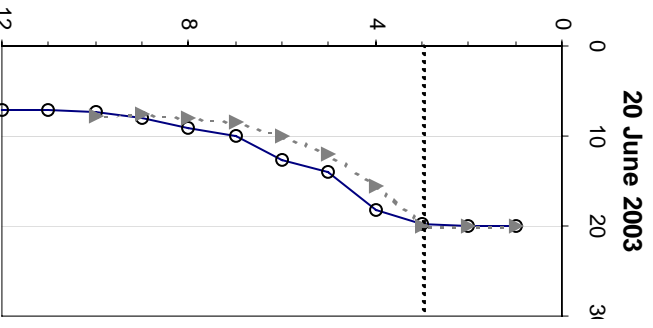
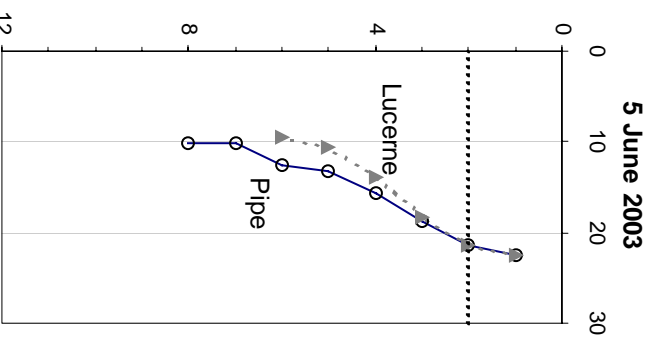
---

This page left blank.

## FastEST Locators

<b>P-BCK-01</b>	<b>Boat launch, 20 yds off</b>	<b>surface</b>
<b>PIP-CIT-01</b>	<b>Cherokee Bay Swimming Dock. Taken for Citizen</b>	<b>surface</b>
<b>LUC-CIT-01</b>	<b>Off Mylo's dock</b>	<b>surface</b>
<b>PIP-01-02</b>	<b>Cherokee Bay Swimming Dock</b>	<b>surface</b>
<b>PIP-02-02</b>	<b>Middle of Lake</b>	<b>1 m</b>
<b>PIP-03-02</b>	<b>treatment area on N. side / brown dock</b>	<b>inches from bottom</b>
<b>PIP-04-02</b>	<b>treatment area on N. side / brown dock</b>	<b>1 m from surface</b>
<b>PIP-05-02</b>	<b>treatment area on S. side / hobie cats</b>	<b>surface</b>
<b>PIP-06-04</b>	<b>South side of Pipe / hobie cats</b>	<b>inches from bottom</b>
<b>PIP-07-05</b>	<b>wake board bench</b>	<b>4 meters</b>
<b>PIP-08-05</b>	<b>wake board bench</b>	<b>1 meter</b>
<b>PIP-09-05</b>	<b>middle of lake</b>	<b>7 meters</b>
<b>LUC-01-01</b>	<b>Middle of Lake</b>	<b>surface</b>
<b>LUC-02-01</b>	<b>Chocolate Dock</b>	<b>1 m</b>
<b>LUC-03-01</b>	<b>Chocolate Dock</b>	<b>inches from bottom</b>

# Thermocline Data for Pipe and Lucerne Lakes



# Pipe and Lucerne Lakes Hydrilla Eradication Project Snorkel Survey #1

## **Introduction**

King County Lake Stewardship Program is working at Pipe and Lucerne Lakes to eradicate hydrilla, a Class A noxious weed. Part of the effort includes extensive hydrilla surveys that will be conducted throughout the growing season to locate, track, and eradicate the plant from both lakes. Two different survey methods will be employed throughout the summer: a consulting firm, Envirovision, will perform SCUBA diver surveys, and the King County Lake Stewardship Program will perform snorkel surveys.

The first snorkeling survey was conducted July 7<sup>th</sup> through July 9<sup>th</sup>, 2004. At this time two herbicide treatments and one SCUBA diving survey had occurred in the lakes. The first SCUBA diving survey located areas where hydrilla was found and marked those spots with stakes. The goal of the snorkel survey was to find these sites and determine the condition of the plants, assessing the effectiveness of the herbicide, Sonar PR, has been on the plants. An additional objective was to find, assess, stake, and GPS new infestations. The surveys are designed to cover the entire littoral zone of both lakes, where the plants have been found historically. The SCUBA surveys allowed for deeper water surveys, whereas the snorkel surveys focused on the shallow water in which the SCUBA divers were less effective.

Only depths of approximately 10 feet and less were surveyed by the snorkelers due to equipment limitations. During the snorkel surveys, two types of transects were used. Where the shallow areas extended far into the lake, transects were run perpendicular to the shoreline. Two snorkelers would start at the maximum depth (approximately 10 feet) and swim side by side, arms-length apart to the shoreline. Upon reaching the shoreline, they would swim parallel to it for a small distance and then turn back and swim to the deeper part. This insured that the extensive shallow areas were surveyed completely. In the littoral areas where the depth increased quickly, surveyors would swim parallel to the shoreline, arms length apart, thus covering the entire littoral zone.

## **Day 1 - July 7, 2003**

Staff: Michael Murphy, Curtis Clement, Beth Cullen

Weather: sunny, no rain in the previous 24 hours

### **Section 4 - Lucerne**

Murph and Curtis began snorkeling in Lucerne, Section 4, at 10:06 AM. Transects perpendicular to the shoreline were run in this section. At 11:20 AM Murph relocated a patch of hydrilla discovered by the SCUBA divers, on the east side of the Fitzpatrick's dock. Two more plants were found on the east side of the dock and a new stake was placed to make sure the next herbicide application targets that problem area. All plants were showing signs of herbicide damage. Total time in Section 4 took 90 minutes.

### **Section 3 - Lucerne**

Curtis and Beth surveyed section 3, beginning at 12:10; at 12:40 the team changed to Beth and Murph. Perpendicular transects were run in the northern part of this section, the eastern side of Lucerne had a quick drop off and parallel transects were run to the end. No hydrilla was found in this area. Total time in Section 3 took an hour.



## **Section 2 - Lucerne**

Murph and Beth continued snorkeling into Section 2 beginning at 13:10, parallel transects were used in the northeastern part of this section and then switched to perpendicular transects in the south eastern part where the water is very shallow. Perpendicular transects were used until reaching the channel that connects Pipe and Lucerne lakes.

A SCUBA survey stake was located in the south eastern side of this section and three to five plants were seen around the stake. A stake marking one plant was also found in the east side of the channel at 13:34. All plants were showing signs of herbicide damage. Total time in Section two was 24 minutes.

## **Section 5 – Pipe Lake**

Curtis and Beth continued the survey in Section 5 beginning at 14:35. Depths drop off quickly on the north side of Pipe Lake so transects ran parallel to the shoreline. Two SCUBA survey stakes were found in Section 5 but neither stake had any plants near them.

Neighbors to the red house in Section 5 mentioned that the owners had spent the weekend (July 5<sup>th</sup> and 6<sup>th</sup>) tearing out the dilapidated dock associated with the house. Total time in Section 5 was 10 minutes

## **Section 6 – Pipe Lake**

Curtis and Beth began Section 6 at 14:45. Parallel surveys were run along the shoreline; no hydrilla plants or stakes were found in this section.

The day was finished at the end of Section 6 at the dock with the gray planter box. The snorkel team returned to the boat dock at 15:00. Total snorkel time for the day was six hours.

## **Day 2 – July 8, 2003**

Curtis Clement, Beth Cullen, and Katie Messick  
Overcast weather

## **Section 1 – Pipe Lake**

Curtis and Beth began the survey with perpendicular transects at 10:30. Several areas in this section have tall weed growth, which makes it difficult to see the bottom and identify hydrilla. Most of the weeds are concentrated around 6 feet deep and 20 yards off the Cherokee Bay Swim dock.

One new hydrilla plant was found on the south side of the swimming dock. Katie took a GPS position and Curtis staked the plant. The plant was showing signs of herbicide damage. Total time in section 1 took an hour

## **Section 14 – Pipe Lake**

Curtis and Beth surveyed this section using parallel transects beginning at 11:30. No plants or previous stakes were found in this section. Total time in this section was one hour.

## **Section 13 – Pipe Lake**

Katie and Beth began surveying at 12:20 and ran parallel transects in this area.

Two SCUBA survey stakes were found at the east side of the dock with the wooden dive platform (not to be confused with the neighboring wooden dive platform). A few plants were found and were skeletal white. Total time in Section 13 was 30 minutes.

### **Section 12 – Pipe Lake**

Beth and Katie continued to run parallel transects and began Section 12 at 12:50.

A SCUBA survey stake was located at the dock with the “Nyman Marine” ladder and overturned gray boat. No plants were seen near the stake. At 13:04 Beth found a new plant at the dock south of the one with the SCUBA survey stake. Curtis took GPS coordinates and Beth staked the plant. Total snorkeling time in section 12 was twenty minutes.

### **Section 11 – Pipe Lake**

Katie and Beth began Section 11 at 13:12 and continued running parallel transects. Based on the SCUBA survey this area had the highest infestation of hydrilla. During the snorkel survey SCUBA survey stakes were found along the docks but no plants were located near the stakes.

A new plant was found underneath the dock with a blue diving board and two paddleboats. The new plant was staked and GPS position was taken. Total time in 15 minutes in section 11.

Day 2 ended with the completion of Section 11 and the team returned to the swim dock at 13:25; 3 hours was the total time of Day 2.

## **Day 3**

Curtis Clement, Beth Cullen, Deanna Matzen  
Sunny and warm

Curtis and Deanna began by the Hobie Cats in Section 11 at 10:11, to double-check the hot spot areas in this section. Parallel transects were performed. Two diver stakes were located by the yellow house with an overturned blue paddleboat. The patch of hydrilla by the stakes is bleached, showing signs of herbicide damage.

### **Section 10 – Pipe Lake**

Curtis and Deanna entered Section 10 at 10:30. Beyond the community swim beach on the south shore of Pipe Lake, they began running perpendicular transects due to the shallowness of the south west side of the lake.

At 11:00 Curtis located a patch of seven plants on top of a weed barrier by the last house on the south west shoreline before the youth camp. The plants were all bleached and showing signs of herbicide damage. This was a surprise as this area was not directly treated, and the SCUBA survey did not find any plants in this area. The area was staked and documented with a GPS.

Total time in Section 10 was an hour and 17 minutes.

### **Section 9, 8, and 7 – Pipe Lake**

In section 9, Deanna and Beth ran perpendicular transects in this section and did not find any SCUBA diver stakes or new hydrilla infestations. The section took 20 minutes.

In Section 8 the surveyors switched to performing parallel transects, starting at 12:30 and lasting 20 minutes. No new hydrilla infestations or SCUBA stakes were found in this section.

Section 7 began at 12:50 and transects were run perpendicular to the shoreline. No diver stakes or new hydrilla infestations were found in this section. The section took 30 minutes and the survey was completed at 13:20.

Day 3 took a total of 3 hours.

### **Conclusion**

The diver survey was an important addition to the hydrilla work this summer, adding information to that collected by the SCUBA divers, in particular from areas difficult for the SCUBA staff to inspect effectively. The snorkeling allowed King County staff to get in the water and see exactly where the hydrilla is located and how the herbicide affects the targeted plants, as well as in the rest of the lake system. The results and methods of this survey complemented the SCUBA survey, and the additional information will prove valuable in modifying the treatment zones through the summer.

Three new areas of plants were found in Pipe Lake, and no new ones were found in Lucerne. The locations of the newly discovered plants will affect areas treated in the next herbicide application, in order to make sure all areas are receiving appropriate treatment.

# Pipe and Lucerne Lakes Hydrilla Eradication Project Snorkel Survey #2

## **Introduction**

The second snorkeling survey on Pipe and Lucerne Lakes was conducted on August 4<sup>th</sup> through August 6<sup>th</sup>, 2003. By this time three herbicide treatments with Sonar PR and one SCUBA diving survey, done by the consulting firm Envirovision, had occurred in the lakes. There were three goals for the second snorkel survey: (1) to relocate stakes, which mark previously found areas of hydrilla, and then determine the long-term effectiveness of the herbicide (Sonar PR) treatment on the plants; (2) to find, assess, stake, and GPS any new hydrilla infestations; and (3) to assess the effects of the herbicide on other aquatic plants in the lakes. The surveys were designed to cover the entire littoral zone of both lakes, where the plants have been found historically. The SCUBA surveys allowed for deeper water surveys, whereas the snorkel surveys focused on the shallow water in which the SCUBA divers were less effective.

## **Methods**

Due to equipment limitations, only depths of approximately 10 feet and less were surveyed. As in the first snorkel survey, two types of transects were used. Where the shallow areas extended far into the lake, transects were run perpendicular to the shoreline. Two snorkelers started at the maximum depth (approximately 10 feet) and swam side by side, arms-length apart to the shoreline. Upon reaching the shoreline, they would swim parallel to it for a small distance and then turn back and swim to the deeper part. This insured that the extensive shallow areas were surveyed completely. In the littoral areas where the depth increased quickly, surveyors would swim parallel to the shoreline, arms length apart, thus covering the entire littoral zone.

## **Day 1 – August 4th, 2003**

Staff: Curtis Clement, Beth Cullen, Kari Moshenberg

Weather: sunny, no rain in the previous 24 hours

### **Section 11 – Pipe Lake**

Kari and Curtis begin in Section 11 (by the Hobie Cats) at 10:50. Curtis noted that the visibility in the lake was very clear and excellent conditions for snorkeling. No hydrilla has ever been found in this area in 2003. Total time to survey this section was 30 minutes.

### **Section 10 – Pipe Lake**

Kari and Curtis started Section 10 at 11:20; they ran perpendicular transects because of the very shallow waters in the southwestern section of Pipe Lake. Curtis relocated a previously documented infestation of seven plants in the southwest corner of the lake at 11:35. There were only 3 plants left; one was just a stalk with no leaves and turning brown, the second was very tiny and bleached, the third was fuller with developed leaves, but was pink and white, showing signs of bleaching. Section 10 was completed at 12:30; total time for this section was one hour. No new plants were found.

### **Section 9 – Pipe Lake**

Curtis and Beth began section 9 at 13:05 and ran parallel transects. No hydrilla has ever been found in this section. Total time in this section was 20 minutes.

### **Section 8 – Pipe Lake**

Curtis and Beth began running parallel transects in Section 8 at 13:25. No plants were found in this area, and total time spent in this section was 40 minutes.

### **Section 7 – Pipe Lake**

Curtis and Beth began Section 7 at 14:08. Perpendicular transects were run because of shallow water. There were dense algae mats in this section that obscured the bottom of the lake. No hydrilla was found in this section. Cattails (*Typha latifolia*) were showing signs of herbicide damage along the shoreline, especially

Section 7 was completed by 14:40, totaling 32 minutes. After surveying this section the swimmers returned to the dock. Snorkeling on the first day took a total of three hours and twenty minutes.

## **Day 2 – August 5<sup>th</sup>, 2003**

Staff: Curtis Clement, Beth Cullen, and Deanna Matzen

Weather: sunny, turning to showers in afternoon

### **Section 1 – Pipe Lake**

At 10:15 Deanna and Curtis began running perpendicular transects. The only hydrilla plant found in by the Cherokee Bay swimming dock was removed by Curtis on July 25<sup>th</sup>. There were algae mats in the section, obscuring the view of the bottom. There were also large dense patches of small pondweed (*Potamogeton zostriformus*) starting at about six feet of depth, making it difficult to locate any new hydrilla plants in the area. No new hydrilla plants were found in this section. Total time in Section 1 took 50 minutes.

### **Section 14 – Pipe Lake**

Curtis and Deanna surveyed this section using parallel transects beginning at 11:05. No plants or previous stakes were found in this section. Total time in this section was one hour.

### **Section 13 – Pipe Lake**

Curtis and Beth began running parallel transects in this section at 12:12 PM. At 12:18 it began to rain slightly.

At 12:23 at the end of Section 13 one SCUBA diver stake was found by the wooden diving platform but no plants were located. According to the previous snorkel survey, there was another SCUBA stake located in this area but it was not found. It was noted that water clarity was not as good as the previous snorkeling event. It was difficult to see the bottom deeper than seven feet. Hydrilla was not observed in this section. Non-native water lilies (*Nymphaea odorata*) in this section are decaying although a few flowers remain. Total time for Section 13 was 11 minutes.

### **Section 12 – Pipe Lake**

Curtis and Beth began running parallel transects in this section at 12:28.

A SCUBA survey stake was found near the Nyman Marine ladder at 12:32. No plants were found around the stake. A second survey stake could not be relocated. No hydrilla was found and the total survey time in this section was ten minutes.

### **Section 11 – Pipe Lake**

Curtis and Beth began running parallel transects in Section 11 at 12:39.



At the beginning of the section, a stake was located but no hydrilla was around the stake. On the eastside of the dock with the rainbow pinwheel one stake was located but there was no hydrilla. On the west side of the same dock there was another stake with two bleached hydrilla plants. Two docks east of the dock with the Hobie Cats, a stake was located with one plant near it. It was approximately nine inches tall (the tallest hydrilla plant found thus far) and very white. There were approximately five branches off this one plant. Another stake was located by the next dock to the west, but no hydrilla was found.

Section 11 was completed at 12:52 PM; total time for this section was 17 minutes.

### **Section 6 – Pipe Lake**

Because there was time to continue snorkeling on the second day, the shallow zone of Pipe Lake was completed by surveying the northern lake edge, Sections 6 and 5.

Curtis and Beth began surveying section 6 at 13:05 with parallel transects. There were no stakes or new hydrilla plants located in this section. Total time in this section was ten minutes.

### **Section 5 – Pipe Lake**

Curtis and Beth began parallel transects in section 5 at 13:16. By the fading blue dock, a SCUBA survey stake was located. There were no plants near the stake. The second stake in this section could not be relocated, nor was hydrilla found during this survey. It began raining at this time.

The survey ended at 13:30 and the swimmers headed back to the dock. Total time in this section took 14 minutes. Day 2 was completed in three hours 15 minutes.

## **Day 3**

Staff: Curtis Clement, Beth Cullen, Michael Murphy

Weather: overcast, rain the night before

### **Section 4 – Lake Lucerne**

Murph and Beth began running perpendicular transects at 9:59. Visibility in this section was poor; swimmers were unable to see the bottom around seven feet.

One diver stake was found 20 yards off the tire retaining wall. No hydrilla was found at that spot. A second stake was found on the west side of the Fitzpatrick's dock. Two plants were located at the stake; they were both pulled, one with a tuber attached and one without. On the east side of the same dock, was the location of the largest patch of hydrilla found to date in 2003 in Lake Lucerne. During this survey only a few plants were located. One plant with five branches was pulled with the tuber attached. All the plants were very brown instead of the previously observed bleached pink and white.

Non-native water lilies, found just north of the Fitzpatrick's dock, have been killed by the herbicide treatment. At this time, no flowers were seen on any of the plants.

Time in Section 4 totaled one hour

### **Section 3 – Lake Lucerne**

Murph and Beth continued to run perpendicular lines until 11:17. Murph switched into the boat and Beth and Curtis began parallel transects at 12:20.

No stakes or hydrilla were found in this area. Total time for this section was 20 minutes.

## **Section 2 – Lake Lucerne**

Beth and Curtis continued into Section 2 at 12:40.

Two stakes were found along the southern shore, but there were no hydrilla plants. A stake was relocated in the channel, and while there was no apparent hydrilla, there was a thin brown “twig like” thing near the stake and it was speculated that this could be a dead hydrilla plant.

The cattails lining the eastern channel were bleached at the stems, showing signs of herbicide damage.

The snorkel survey completed at 13:08, total time in section 2 was 20 minutes.

Day 3 took 3 hours.

## **Conclusion**

The second snorkel survey was helpful in seeing the effects of the Sonar PR on the lake ecosystem. Hydrilla has definitely been affected by the herbicide and other aquatic plants are also showing signs of herbicide damage, even some emergent plants such as water lilies and cattails have shown damage (as mentioned above). It was also apparent during the survey that water clarity in the lakes, especially Lucerne, has decreased over the course of the month and that algae blooms have become more prominent. No conclusions can be made at this time concerning whether the change in water quality is due to the herbicide application or natural seasonal patterns of algae in the lake.

The survey results indicated that Sonar PR is having a significant effect on the hydrilla in the lake. Some of the plants that were identified in previous surveys by their bleached white/pink color have turned to a brown “twig-like” color. Leaves are no longer apparent on many of the plants, and it is often hard to distinguish the plant from other debris in the lake. If it were not for the previous staking of the plants, it would be very difficult to identify a hydrilla plant in this condition. Several of the stakes used to mark areas of hydrilla have been removed; this could be a result of people removing them. With stakes missing, it was hard to relocate some of the recorded areas of hydrilla. However, it can be reasonably assumed that the unlocated plants would have reacted similarly to the other plants and either decomposed or turned brown, becoming hard to distinguish.

No new infestations of hydrilla were found in either Pipe or Lucerne Lakes. It is clear that the hydrilla that was identified earlier in the season has been greatly affected by the Sonar PR, with a majority of plants dying off and no longer able to be relocated.

# Pipe and Lucerne Lakes Hydrilla Eradication Project Snorkel Survey #3

## **Introduction**

The third snorkeling survey on Pipe and Lucerne Lakes was conducted from September 15<sup>th</sup> through September 16<sup>th</sup>, 2003. The final herbicide treatments were on August 8th, ending with four treatments in Pipe Lake and three treatments in Lake Lucerne. The consulting firm, Envirovision, had completed two SCUBA diving surveys by this time and joined this snorkel survey for one day to help identify the areas of serious hydrilla infestation.

Evidence from the second SCUBA survey suggested that hydrilla was showing up in deeper water, most consistently in areas about 10 feet deep, with some plants also being found both shallower and deeper than that (between 8 – 14 feet). Snorkeling allowed the crew to survey very shallow water, but the deepest depth for easy identification was found to be approximately six feet. This was a problem later in the season for coverage by snorkeling, as the majority of the plants were being found in water deeper than that limit. The SCUBA survey team from Envirovision joined the third snorkel survey in order to do a thorough survey of both the shallow and deep areas of Pipe Lake (where the majority of hydrilla is found). There were three goals for the third snorkel survey: (1) to relocate survey stakes, which marked hydrilla presence, and then determine the long-term effectiveness of the herbicide (Sonar PR) treatment on the plants; (2) to find, assess, and GPS any new hydrilla infestations; and (3) decipher any patterns in the growth of the hydrilla. The snorkel surveys were designed to cover the entire littoral zone of both lakes; however, SCUBA surveys were done only in the deeper waters in Pipe because no new plants were being found in Lake Lucerne.

## **Methods**

Due to the equipment and method limitations, snorkelers surveyed in depths of approximately eight feet and less. As in previous snorkel surveys, two types of transects were used. Where the shallow areas extended far into the lake, transects were run perpendicular to the shoreline. Two snorkelers started at the maximum depth (approximately six feet) and swam side by side, arms-length apart to the shoreline. Upon reaching the shoreline, they would swim parallel to it for a small distance and then turn back and swim to the deeper part. This insured that the extensive shallow areas were surveyed completely. In the littoral areas where the depth increased quickly, surveyors would swim parallel to the shoreline, at arms length apart.

On day one, SCUBA divers were used in Pipe Lake. Two divers surveyed the areas between 8 and 15 feet in the entire lake. In most instances, the divers swam side by side, surfacing only to tell the boat crew when hydrilla was found.

## **Day 1 – September 15, 2003**

Staff: Curtis Clement, Beth Cullen, Michael Murphy

Contractors: Dave VanderMeulen, Arlene Fulerton

Weather: cloudy, in the 50's, potential rain

## **Section 5 – Pipe Lake**

The SCUBA divers and snorkelers started at 9:00. Arlene and Dave swam in 10 – 15 feet water while Curtis and Murph swam parallel to shore. Dave found three plants at 11 feet at the beginning of this section that were pink but had green tips. Scattered hydrilla plants were found along the 10-foot depth

contour. The plants were bleached from the Fluridone and were pink with pale green tips. As the dive team tried to pull the plants, it was noted that the tubers were about six to eight inches deep in the sediment and were located right above the hardpan. Over 20 plants were found in this section by the SCUBA divers.

Snorkel surveyors did not locate any hydrilla in the shallow waters. Total time in this section was 45 minutes.

#### **Section 6 – Pipe Lake**

The survey team started this section at 9:45. It was noted by the SCUBA divers that the infestation was bigger and more spread out. The plants were bleached and scattered within the littoral zone, between the depths of 9 and 12 feet. Hydrilla was found in chara beds, and the divers noted that, if the plants were not bleached by the herbicide, they would blend into the mass and never be found among the other foliage. The snorkel survey in the shallow areas did not find any hydrilla. Total time for this section was 30 minutes.

#### **Section 7 – Pipe Lake**

This section was started at 10:29. Beth and Murph swapped snorkeling positions. Snorkel transects were run perpendicular to shore. SCUBA divers did not do this section due to the shallow depths. No hydrilla was found in this section, total time in Section 7 was 20 minutes.

#### **Section 8 – Pipe Lake**

Section 8 began at 10:48. SUBA divers found several plants in this section between the depths of 10 and 13 feet. Moving west in Section 8, larger infestations were found. One was at 14 feet with 15-20 plants and another infestation consisting of >30 plants scattered between 10 and 15 feet. This section is one of the most infested areas in Pipe Lake.

It was reiterated that if the hydrilla plants were green, it would be extremely difficult to find them in the chara and nitella beds. Snorkel surveyors did not find any hydrilla in the shallow regions of this section. A total of 30 minutes was spent in this section

#### **Section 9 – Pipe Lake**

This section began at 11:16. Arlene stated that divers covered ground in the 8 to 14 feet of water and found a steady trail of plants at 10 feet depth. As the divers moved into the west cove, plant density dropped off significantly, and none were seen west of the mid-section of Section 9. Total time in this section was 45 minutes.

#### **Section 10 – Pipe Lake**

Murph and Curtis switched positions; Beth and Murph began section 10 at noon and found no hydrilla in the cove. It was too shallow for SCUBA coverage, so the divers continued their survey in Section 11.

#### **Section 11 – Pipe Lake**

SCUBA divers surveyed the southern edge of Pipe Lake moving east to west. Again, several plants were found at the 10-foot depth. Most of the plants were scattered along the length of the shore and no major infestations were located. Snorkel swimmers did not find any hydrilla in this area.

#### **Section 12 – Pipe Lake**

Divers and snorkelers entered Section 12 at 12:40. Scattered plants were found between the depths of 10 and 14 feet. Only a handful of plants were found in this area and none were found in the shallow waters. This section took a total of 35 minutes.

### **Section 13 – Pipe Lake**

The survey began at 13:15 in this section, moving from east to west. 15 plants were found in this section ranging between 12 and 14 feet. No hydrilla was found in shallow waters. A total of 18 minutes was spent in this section.

### **Section 14 – Pipe Lake**

Section 14 began at 13:33 and hydrilla was found neither by the SCUBA divers nor by the snorkeling swimmers.

### **Section 1 – Pipe Lake**

Section 1 began at 13:45 and was completed up to the Cherokee Bay Swim Dock. Three new plants were found right at the border of Section 14, at approximately 13 feet depth. No plants were previously seen at this location throughout the summer.

Day 1 was completed at 14:00. Total survey time for Day 1 was five hours.

## **Day 2 – September 16, 2003**

Staff: Curtis Clement, Beth Cullen, and Deanna Matzen

Weather: rainstorm

### **Section 1 – Pipe Lake**

Deanna and Curtis swam the eastern cove beginning at 10:00. There were chara and filamentous algae blanketing the bottom of this cove, making it difficult to see any other plant life. They did not re-survey any of the area done on Day 1 by the SCUBA divers. Section 1 was complete in 45 minutes.

### **Section 4 – Lake Lucerne**

Curtis and DeAnna began Section 4 at 10:45 and ran perpendicular transects. Curtis found three plants under the Fitzpatrick's dock, this area being the main infestation in Lake Lucerne. Two plants were small and bleached, while the third plant was taller with three fuller stalks. This section took 50 minutes.

### **Section 3 – Lake Lucerne**

Deanna and Curtis continued into Section 3 at 11:35 and ran parallel transects. The non-native water lilies next to the Fitzpatrick's dock were gone and the typha stands along the edge of the lakeshore were showing signs of herbicide damage. This section took a total of 20 minutes.

### **Section 2 – Lake Lucerne**

Deanna and Curtis continued into this section at 11:55 and found a June locator stake with one very damaged plant; it was brown and resembled a twig. No other plants were found in this section.

The snorkel survey concluded at 12:05, total time for Day 2 was two hours and five minutes.

## **Conclusion**

The snorkel surveys were very informative in demonstrating how hydrilla progressed over the season. In the first snorkel survey the majority of the plants were found in the shallow water. Early in the season, snorkel surveys located plants that the SCUBA divers did not because the majority of plants were located in shallow water and underneath docks. As the season progressed, the hydrilla began to be found deeper and deeper, especially in Pipe Lake. By the third snorkel survey, it was apparent that new hydrilla plants were no longer being found in the shallow areas, and only the SCUBA divers were

finding the new infestations. In contrast, in Lake Lucerne only a few plants were found throughout the season and the majority of them were at shallow depths. This is likely due to the relatively high levels of fluridone maintained in the lake over the summer. Twenty-ppb was the highest concentration found in Lake Lucerne versus 12 ppb being the highest level recorded in Pipe Lake. As the hydrilla came up in Lake Lucerne, it was in contact with much higher levels of herbicide.

A month after the last herbicide treatment the hydrilla was still showing signs of herbicide damage. Plants were pink and white, sometimes with pale green tips. Even with the herbicide in the water the plants apparently had enough energy to produce some biomass above the lake sediment. However, since the hydrilla was still being bleached by the herbicide, it may be possible that the tubers were supplying the energy necessary for growth and that serious damage was done to the tuber bank by the sprouting. The pink or white coloration was also very important to the monitoring effort, since the discoloration of the plant was the main way that plants were initially spotted. If any hydrilla plants were green, it would be very difficult to find them among the other plants and algae.

The hydrilla definitely grew throughout the summer season. And it is noteworthy that larger numbers of plants were found later in the season than earlier. SCUBA divers located several new plant infestations at deeper water levels that could not be seen by the snorkelers. It was very helpful to have the SCUBA divers and snorkel swimmers work in tandem. The SCUBA divers did not have to work in shallow waters and were able to focus on the deep areas and the snorkelers were able stay in the areas where visibility was good, thus able to locate any shallow plants. It became apparent during this survey that a fourth snorkel survey would not be a good use of field time and resources, as no hydrilla was located in the areas where the snorkel surveys have proved useful.

At this time, the growing season is finishing and the surveys for the year have been completed. Based on what was found this year detailed and specific treatment plan will be drafted for the 2004 season. Surveys proved to be an essential part of the treatment, assessing the locations of hydrilla found and mapping out the general pattern of hydrilla distribution over time in both Pipe and Lucerne Lakes.