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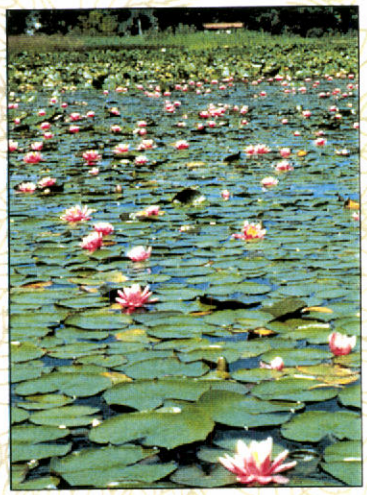
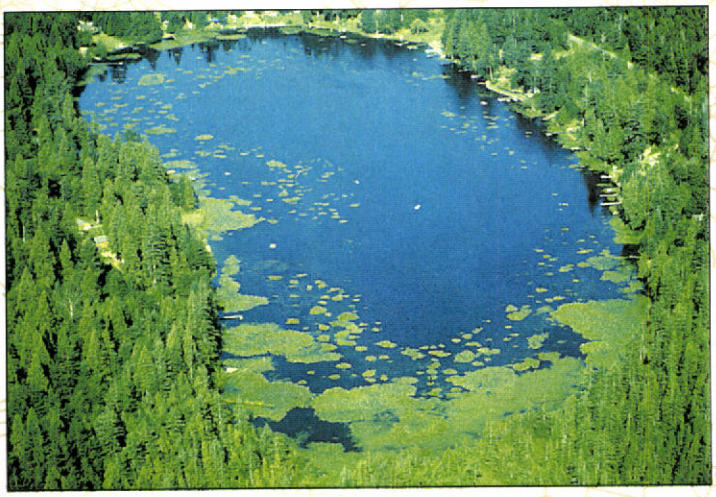


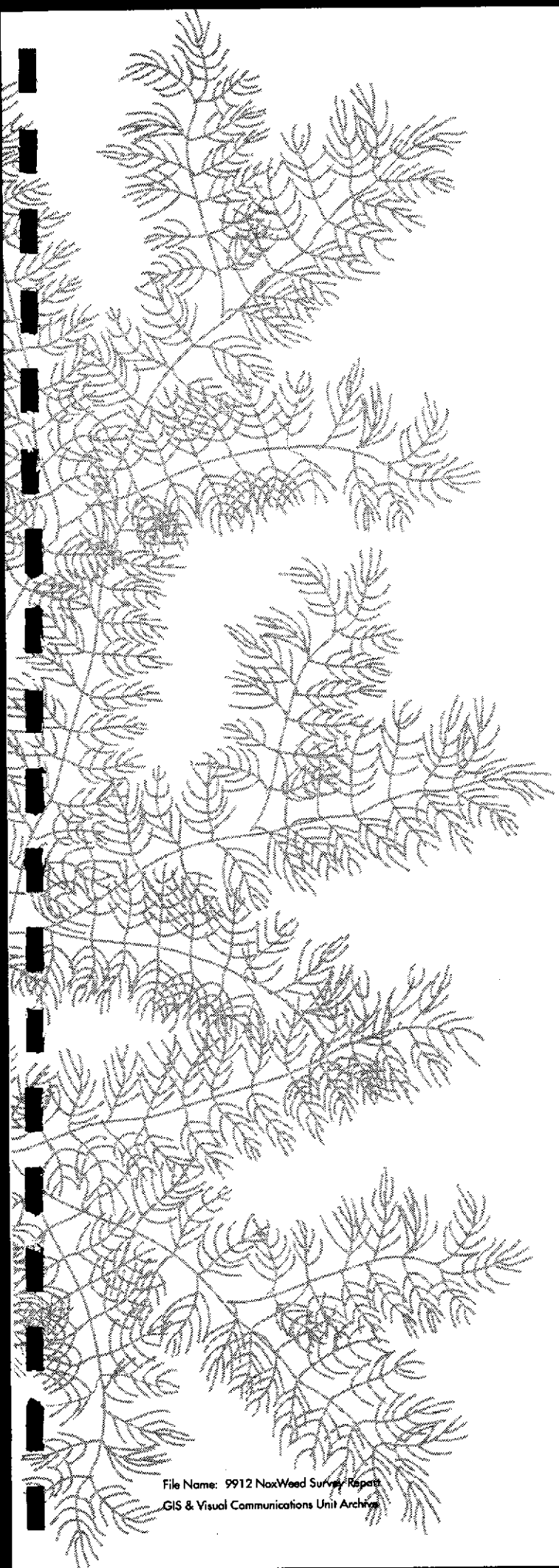
Noxious Weed Survey
for Five King County Lakes



FINAL REPORT
For the King County
Noxious Weed Board

December 1999

KING COUNTY
Department of Natural Resources



Noxious Weed Survey
For Five King County Lakes

FINAL REPORT
For the King County Noxious Weed Board

December 1999

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Funded by the King County Noxious Weed Board

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- GPS–Rob Blomquist and Jeff Kirtland;
- Herbarium–Wendy Cooke;
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- Gary Rauen (Joy);
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Summary

This report represents the results of the 1999 noxious weed mapping project for five King County lakes. The Department of Natural Resources completed this project through the Water and Land Resource (WLR) Division's Lake Stewardship Program. In turn, the project was funded by the King County Noxious Weed Board.

The primary goal of the project was to survey five lakes for noxious aquatic weeds. Typically, diverse plant communities provide variation in physical structure and food source for the variety of aquatic organisms that utilize aquatic plants in their lifecycle. However, many noxious weeds, including *Lythrum salicaria* and *Myriophyllum spicatum*, form dense monotypic stands which reduce the habitat and recreational value of impacted areas. Noxious weed control becomes very important for preserving quality aquatic and terrestrial habitats.

The target lakes, which ranged in size from 10 to 107 acres, included Burien, Haller, Joy, Leota, and Marcel. To characterize the aquatic plant and weed communities, a combination of field and aerial survey methods were used at the five lakes.

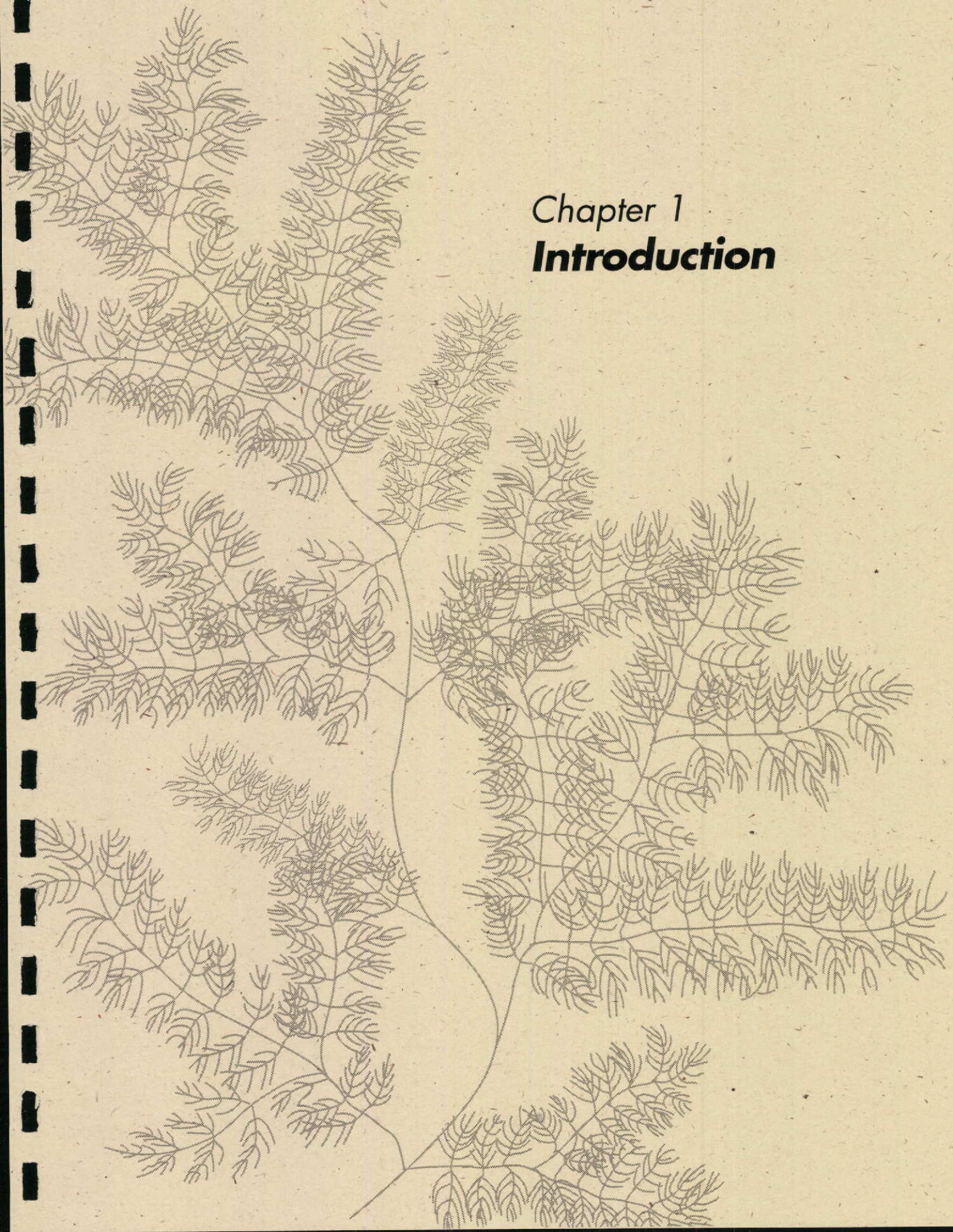
For the five lakes, thirty-three plant species were identified. These plants included eighteen emergent, three floating, and twelve submergent species and/or genera. The most frequently occurring emergent species included *Iris pseudacorus, Spiraea douglasii*, and *Typha latifolia. Nymphaea odorata* was the most common floating plant and *Elodea canadensis* and *Potamogeton pusillus* were the most common submergent plants.

Four noxious weeds were recorded: *Lythrum salicaria, Lysimachia vulgaris, Phalaris arundinacea* and *Polygonum cuspidatum.* Both *Lythrum salicaria* and *Polygonum cuspidatum* were found in three lakes while *P. arundinacea* was found in four lakes. *Lysimachia vulgaris* was found only in Lake Burien.

With this survey information, both the Lake Stewardship and Noxious Weed Programs can extend technical assistance and jointly develop effective outreach programs to address noxious aquatic weed control. This technical assistance and associated programs should emphasize weed control and removal techniques as well as support the replanting of affected shoreline areas with native species to minimize shoreline erosion and protect lake water quality from residential activities.

In conjunction with weed removal, citizen volunteers can be trained in the identification of lake weeds of primary concern. These volunteers can, in turn, participate in regular lake surveys for weed species. Currently, the WLR Division's Lake Stewardship Program supports a waterweed survey program for lake residents.

And finally, ongoing surveys of new lakes should continue. Through ongoing surveys, the database for weed occurrence can be enhanced and technical assistance programs modified or developed to target the primary problematic species. Additionally, ongoing surveys support the detection of new infestations of potentially problematic aquatic species like *Cabomba caroliniana* (fanwort), *Hydrilla verticillata* (hydrilla), or *Myriophyllum aquaticum* (parrotfeather milfoil).



Chapter 1

Introduction

Chapter 1: Introduction

During 1999, the Department of Natural Resources Water and Land Resource (WLR) Division's Lake Stewardship Program surveyed aquatic and shoreline plant communities at five King County lakes (Figure 1) and identified noxious weed locations. The King County Noxious Weed Program, whose interests include locating new weed infestations and assisting property owners in weed control, funded the five lake survey. This report documents survey results for the five participating lakes: Burien, Haller, Joy, Leota, and Marcel.

Background

Increasingly, King County lakes are being impacted by excessive aquatic plant growth. This plant growth is fueled by the addition of nutrient-rich stormwater, soil erosion, domestic fertilizer use, and the introduction of noxious weed species. Noxious weeds often replace desirable native species, reducing plant diversity and thus, degrading aquatic habitat. As the region's population continues to grow, the transport of noxious weeds via boating, fishing, ornamental shoreline plantings, or neighboring water gardens is increasingly problematic.

Prior to the completion of the 36 lake survey (King County, 1996), data regarding plant species on King County lakes were 15 to 20 years old (Metro 1976, 1977, 1978, 1979, and 1980; King County, 1990). Although historical information is valuable for evaluating aquatic plant community compositional changes over time, current data provides information for developing effective technical assistance and outreach programs.

Through routine lake surveys, aquatic weed infestations can be identified early and location information added to the county's weed database. With this new information, King County can extend technical assistance and assist local communities in weed control and aquatic habitat restoration.

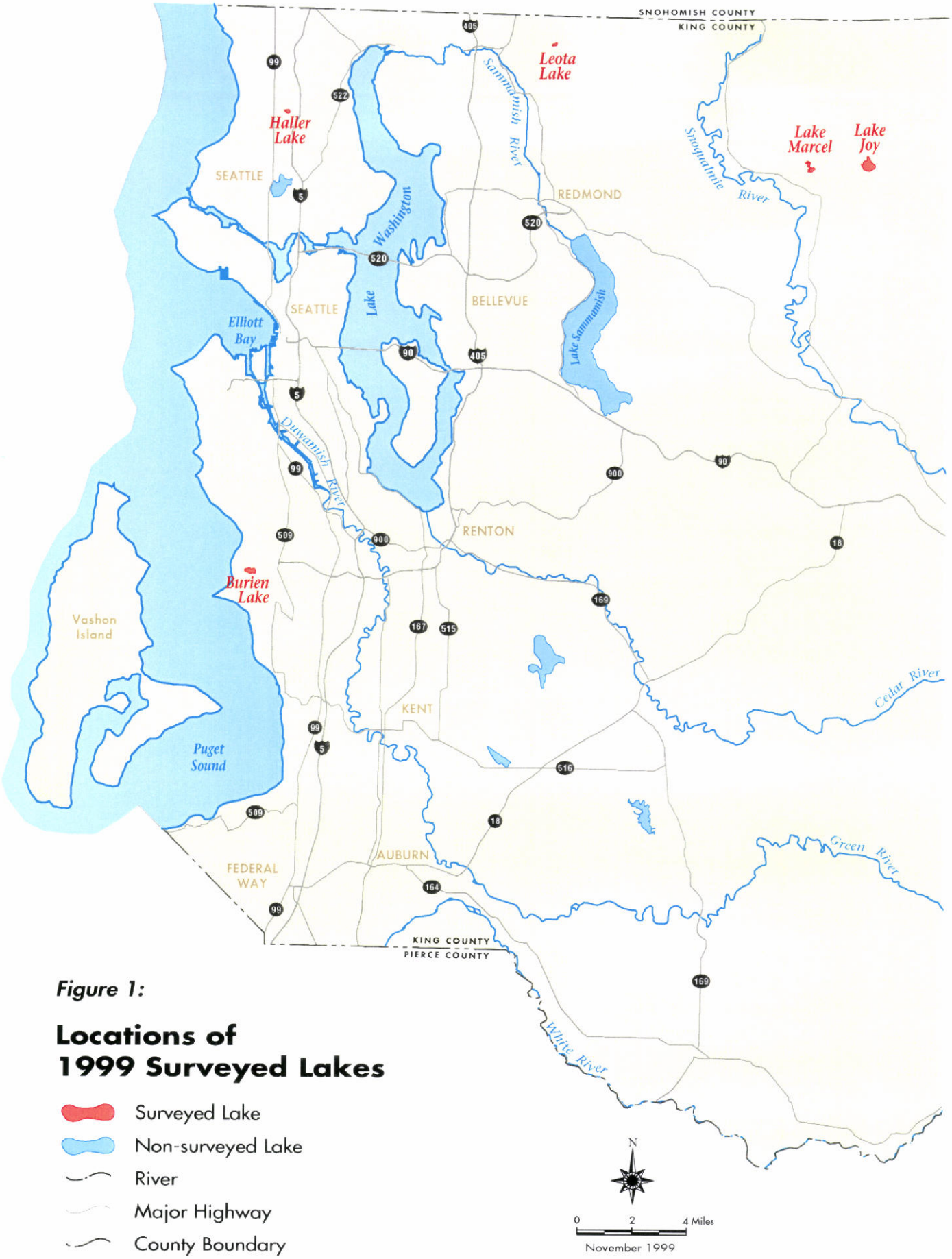


Figure 1:

Locations of 1999 Surveyed Lakes

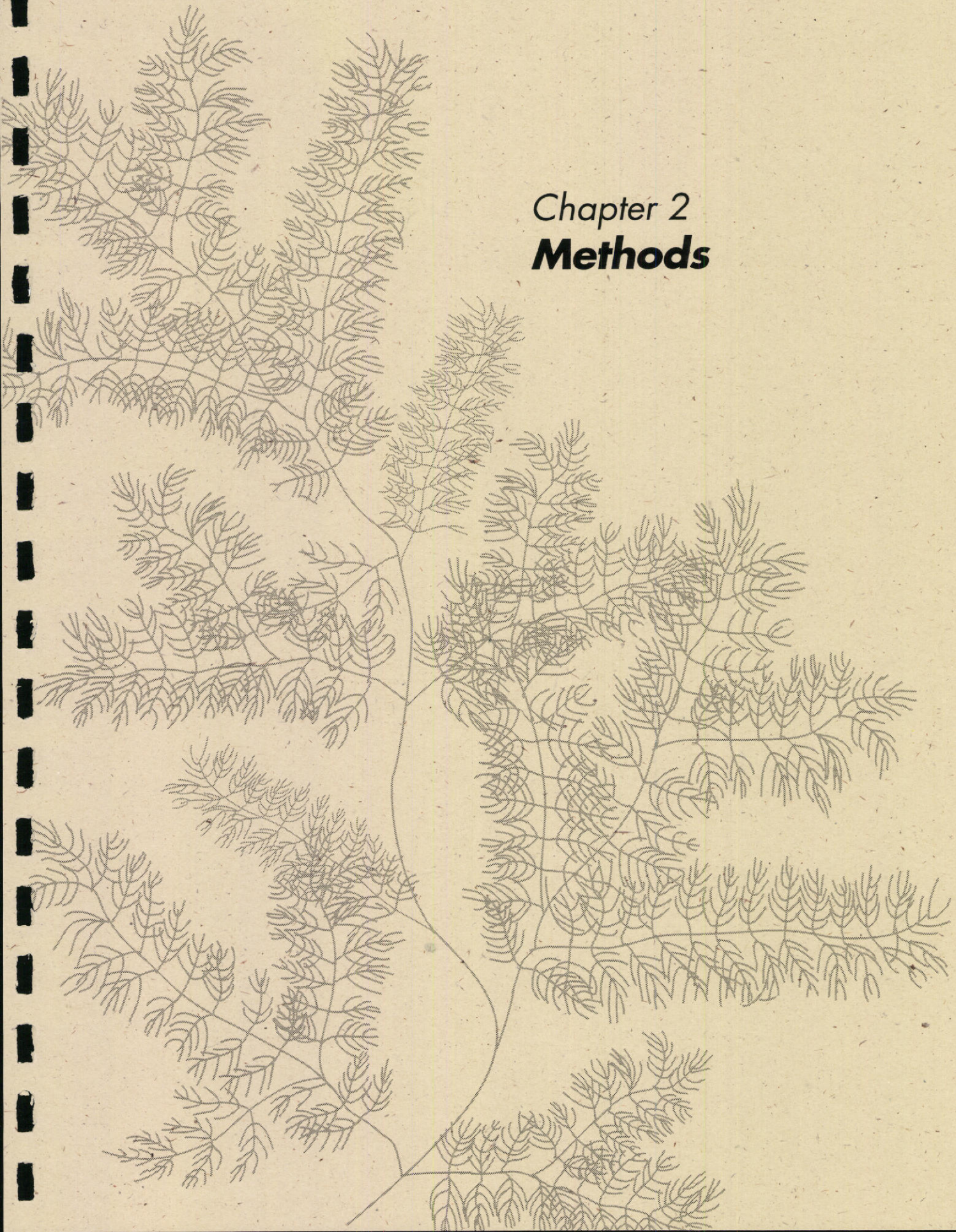
- Surveyed Lake
- Non-surveyed Lake
- River
- Major Highway
- County Boundary

Historical Information

For the five selected lakes, historical information on aquatic weed species is limited to the King County Wetlands Inventory (King County 1987 and 1990 update). Table 1 summarizes the historical wetland inventory information available for the five lakes surveyed by the WLR Division during 1999. Other historical information on aquatic plant and weed distribution for these selected lakes may reside with individual consultants, the University of Washington, or other agency lake management studies.

Table 1: *Historical Aquatic Plant Data from the King County Wetlands Inventory for the Five Surveyed Lakes*

No.	*Lake Name*	*Wetland Class*	*Inventory Date*	*Notes*
1	Burien	2	8/18/81	*Iris pseudacorus, Nymphaea odorata* present
2	Haller	No data	No data	No data
3	Joy	1	7/13/81	*Nymphaea odorata* present
4	Leota	2	6/18/81	*Iris pseudacorus, Nymphaea odorata, & Phalaris arundinacea* present
5	Marcel	2	6/18/81	*Phalaris arundinacea* present



Chapter 2
Methods

Chapter 2: Methods

In this chapter, lake selection and survey methods are described. For the survey methods, both field and aerial mapping procedures were conducted. The field surveys were used to identify the species present, estimate their relative density, and assess the coverage of aquatic plants for the targeted lakes. To compliment the field surveys, an aerial survey was completed which provided an accurate delineation of lake shorelines and associated plant communities. Additionally, plant specimens were collected and an herbarium prepared for each lake.

Lake Selection

Five lakes ranging in size from 10 to 107 acres in size were mapped during 1999. Table 2 lists the location, physical characteristics, and public access status for these surveyed lakes. The King County Noxious Weed Board assisted in lake selection by providing guidelines to the WLR Division.

Based on the board's guidelines, previously surveyed lakes were excluded. New lakes were selected from a combination of city lakes and lakes outside the WLR Division service area. In the lake selection process, priority was also given to lakes with public access. Three city lakes (Burien, Haller, and Leota) and two lakes from outside the service area (Joy, and Marcel) were chosen.

Table 2: *Lake Location and Physical Characteristics of Surveyed Lakes*

No.	Lake Name	Location	Watershed (Acres)*	Lake Area (Feet)	Mean Depth (Feet)	Max. Depth Park	Public Park	Launch
1	Burien	Burien	250	40.8	13	29	yes	no
2	Haller	Seattle	—	13.6	—	—	yes	no
3	Joy	3.75 miles N of Carnation	486	107.3	23	50	yes	no
4	Leota	Woodinville	506	10.5	12	24	no	no
5	Marcel	3 miles N of Carnation	960	33.0	—	17	no	no

**Data Source 1999 Remetrix aerials, King County Water and Land Resource Division GIS Analysis*

Field Preparation

For each lake, a project file was created. The file included historical information (if available), physical characteristics of the lake (Table 2), and a base map. Prior to field surveying, base maps were developed for each of the lakes from digital aerial photographs. The aerial photograph was overlaid in Arcview® with Geographic Information System (GIS) based data including lake shoreline, parcel lines, and surface water features.

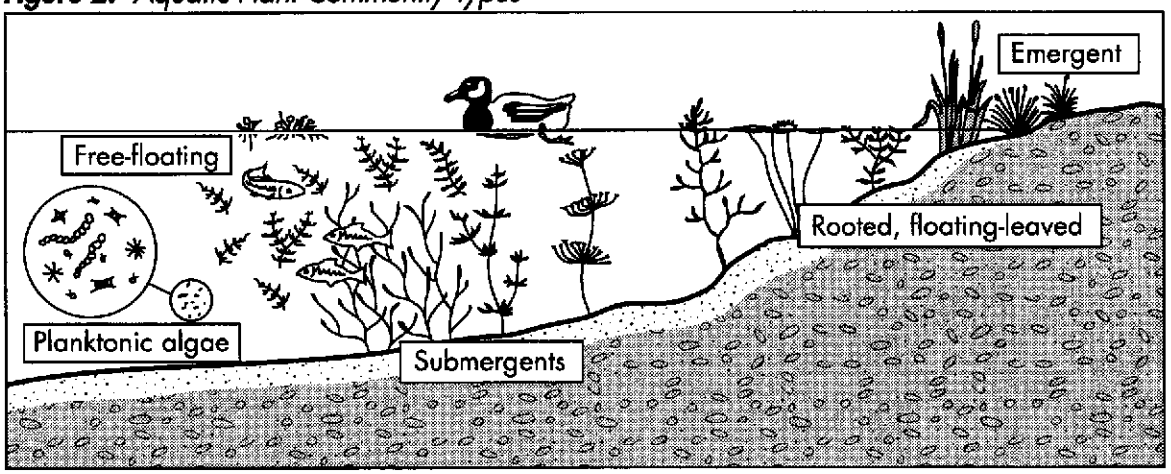
Field Surveying

All field surveys were conducted by boat using two staff plus a citizen volunteer when available. Field crews were equipped with mapping and sample collection materials. Additionally, to establish accurate position information on the lake, crews employed Global Positioning System (GPS) technology to mark section and transect boundary information.

Prior to the start of the field survey, the GPS unit was calibrated onsite and a position established at the boat launch or launch site to mark the beginning of the first lake shoreline section. A lake shoreline section was defined as the area between two chosen fixed shoreline points. The fixed shoreline points typically included the launch site and distinct shoreline features such as homes, docks, and geologic elements. After establishing visual endpoints for the shoreline section, a section number was assigned and recorded on the field notes prior to initiating the shoreline survey.

Each shoreline section was qualitatively characterized by community type, species present, percent cover of community type, and relative species density within a community type. To simplify the field survey, the community types used were reduced to emergent, floating, or submergent (Figure 2). Free-floating species such as bladderwort were

Figure 2: *Aquatic Plant Community Types*



WSDOE, 1994

characterized with the submergent community, while species like duckweed were included with the floating community.

Starting with the floating community, the beginning and ending depth for each community type was determined using a calibrated line and sounding lead, and recorded onto the field sheets. After identifying the species present within the community type, an estimate of percent cover was made for each community type. Three categories of percent cover (Figure 3), which included light (0-25% coverage), medium (25-75% coverage), and heavy (75-100% coverage), were used to describe the aquatic plant coverage. For each community type, species density was estimated to the nearest (ten percent) for the dominant species present (Figure 4).

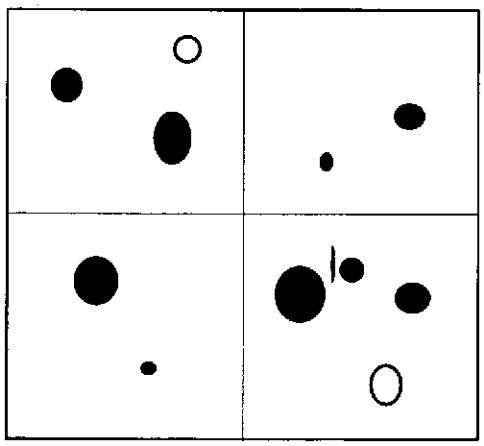
Plant communities were marked onto the laminated field maps using permanent markers. Multi-color hatching patterns were used to represent the three community types and three categories of percent cover (light, medium, and heavy). In addition to recording the locations of individual community types on the field map, the locations of all noxious weeds were specifically recorded.

The emergent and floating plant communities were easily characterized by visual observation from the surface. Submergent plants were identified through visual observation aided by using a viewing scope, and dragging a bow rake along the lake bottom to retrieve plant specimens. The bow rake was cast into increasingly greater depths to confirm the edge of the submergent macrophyte bed. A sounding lead was then used to estimate the ending depth of the bed.

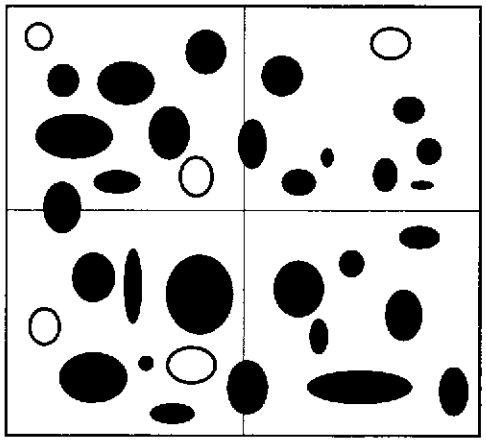
This qualitative mapping procedure was repeated for each shoreline section as the lake was circumnavigated. During the course of the mapping, Secchi depth was recorded and representative plant samples were collected. Three samples were collected for each specimen. An effort was made to obtain whole plants where practical, and included the collection of stems, leaves, flowers, and roots. In the field, plant samples were placed in a cooler and then refrigerated at the office until they were processed.

For plant samples that could not be identified in the field, additional samples were obtained and marked for later identification. These samples were numbered and recorded on the field sheets by designated number. In the office, field notes were updated with the proper identification information once unknown plant samples were properly identified.

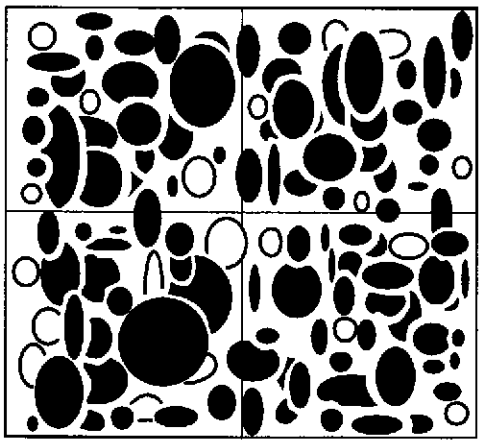
Figure 3:
Percent Cover Categories



Light (L): <25%

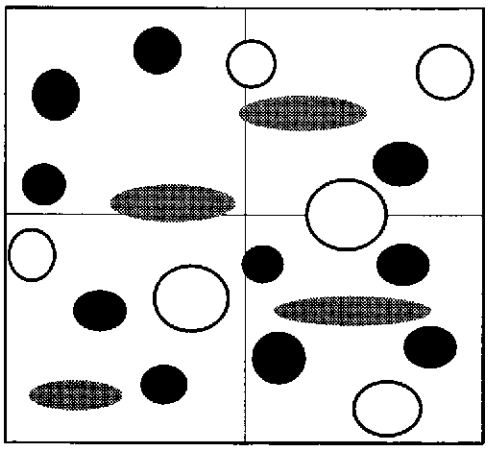


Medium (M): 25–75%



Heavy (H): >75%

Figure 4:
Species Density Determination Example



Species A: 30%

Species B: 50%

Species C: 20%

Transects

One or two representative locations were chosen for each lake to establish permanent transects for measuring changes in macrophyte community composition. Transects were established perpendicular to the shoreline using a 50–meter line. In areas where the macrophyte community extended beyond 50 meters, the line was extended to the edge of the submergent community. Using the sounding lead and GPS unit, the beginning and ending depths and location for each community type were recorded along the transect line.

Using the GPS system, the lake name, date, and sampler information was entered into a standard lake information file. For each community type along a transect, the reference section, transect number, beginning and ending depth, community type (emergent, floating, or submergent), percent cover, plant species, and density were recorded. For each additional community type, the process was repeated until all communities along the transect had been delineated.

Plant Pressing and Mounting

Collected plant specimens were sorted and three representative specimens were pressed for each species. Known samples were labeled by lake name only while being pressed. Depending upon the number of samples and time available at the time of sample collection, unknown samples were either identified prior to pressing or identified after mounting. For all unknown samples, the assigned sample's number and lake name were included with the plant specimen until identification was completed.

After samples were dried, the specimens were mounted to herbarium paper using glue or adhesive tape. All samples were labeled with the following information: location, lake name, Latin name, common name, date collected, and name of collectors.

The plant specimens are currently housed in the King County Department of Natural Resources Water and Land Resources Division. The specimens are available for viewing by appointment. The herbarium is designed to serve as a resource to citizens, botanists, aquatic plant managers, and other individuals interested in the identification of aquatic plants in King County. The herbarium specimens are intended to serve as a permanent record of the plant species found in individual lakes in King County.

Field Data Reduction

Field notes and species information were entered into an Access® database. The database was used to track species lists and print herbarium labels.

Aerial Mapping

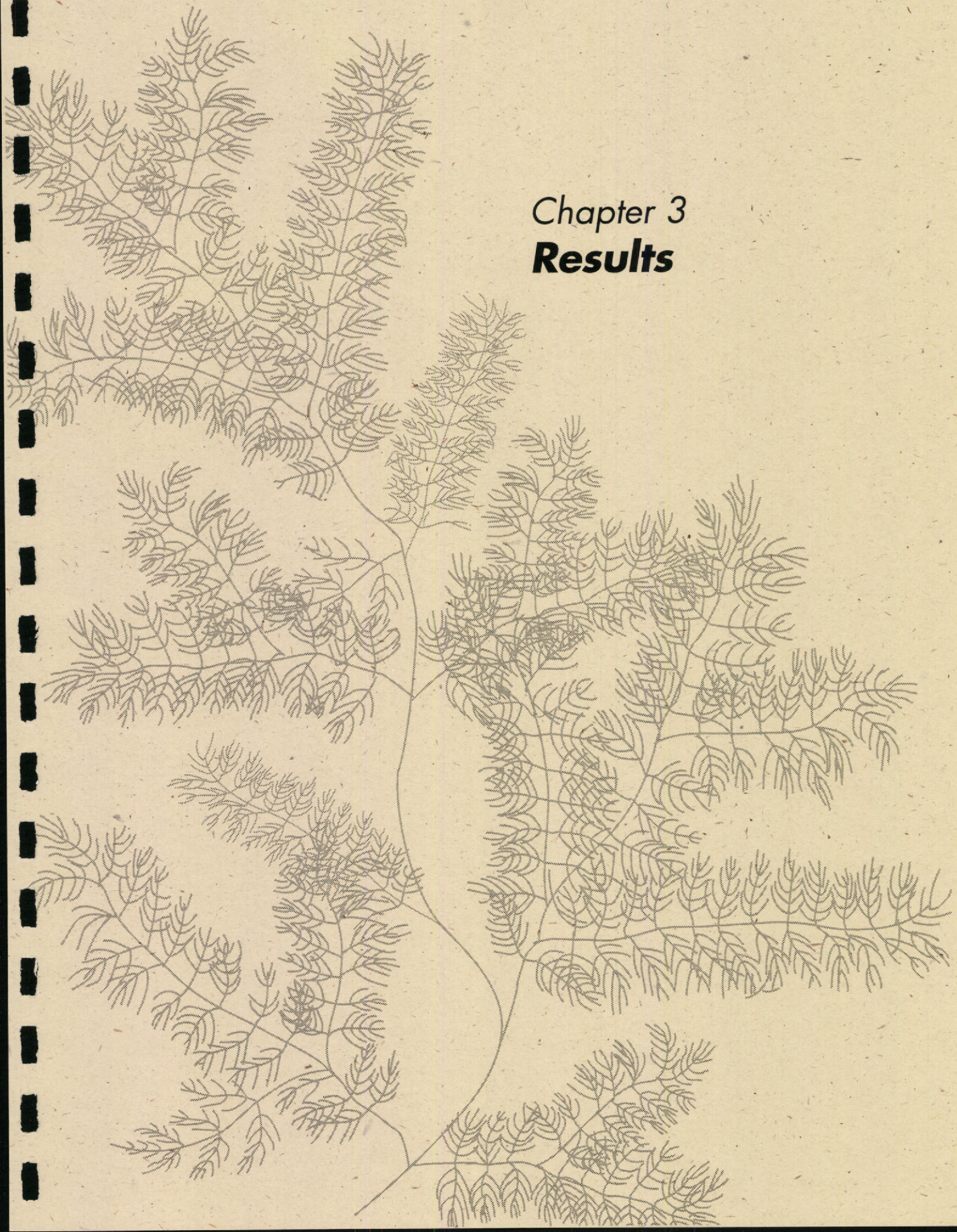
Aerial mapping methods are detailed in the consultant report (Remetrix, Inc. 1999) and are only briefly summarized in this section. The aerial images for each lake were collected using hyperspectral video and 35mm color imagery. The hyperspectral video camera system was calibrated to allow penetration of the target lake and the maximum separation of the submergent community based on water clarity.

The video and still photographic images collected by the consultant were converted to digital format and manipulated via computer to form scaled photo mosaics. These photo mosaics were used to delineate the shoreline, emergent, floating, and submergent plant communities and then digitized and converted to ArcInfo® GIS file format. The GIS files formed the digital base for the aquatic plant communities associated with the five mapped lakes.

WLR staff added shoreline section breaks, transects, and noxious weed location information from the field maps to these digital base maps. From GIS digital base files, the total acreage of the lake, and the emergent, floating, and submergent plant communities was calculated.

Final Maps/Plan Production

For the final report, the GIS map files were imported into Adobe Illustrator® to standardize formatting. The formatted maps were imported into PageMaker® and combined with MSWord® text for final plan production.



Chapter 3
Results

Chapter 3: Results

In this chapter, an overview of survey results is described with noxious weed species noted. Additionally, survey results are presented by individual lake and accompanied by detailed weed location information.

Summary

Five lakes were mapped for aquatic plants during 1999. Thirty-three species were identified at the five lakes. These plants included eighteen emergent, three floating, and twelve submergent species and/or genera (Table 3). The most frequently occurring emergent species included *Iris pseudacorus, Spiraea douglasii,* and *Typha latifolia. Nymphaea odorata* was the most common floating plant and *Elodea canadensis* and *Potamogeton pusillus* were the most common submergent plants.

During the surveys, four noxious weeds were recorded: *Lythrum salicaria, Lysimachia vulgaris, Phalaris arundinacea* and *Polygonum cuspidatum.* Both *Lythrum salicaria* and *Polygonum cuspidatum* were found in three lakes while *P. arundinacea* was found in four lakes. *Lysimachia vulgaris* was found only in Lake Burien.

Lake size and aquatic plant coverage by community type is summarized in Table 4. The smallest lake surveyed was Leota Lake at 10 acres while Lake Joy at 107 acres was the largest. The average size of the surveyed lakes was 41 acres. Plant coverage as a percentage of lake size was greater than 50 percent for all lakes except Lake Joy. Shallow lake depths support extensive submergent and floating aquatic plant growth as indicated by percent coverages greater than fifty percent.

Table 3: *Combined Species List for Five Surveyed Lakes*

Species Name	Species Code	Common Name	Community Type	Frequency
Alisma gramineum	Ag	Water Plantain	Emergent	2
Brasenia schreberi	Bs	Water Shield	Floating	1
Carex sp.	Ca	Sedge	Emergent	3
Ceratophyllum demersum	Cd	Coontail	Submergent	2
Chara sp.	Cs	Muskgrass	Submergent	3
Dulichium arundinaceum	Da	Three-way Sedge	Emergent	1
Eleocharis sp.	El	Spike Rush	Emergent	3
Elodea canadensis	Ec	Water Weed	Submergent	5
Fontinalis sp.	Fo	Water Moss	Submergent	2
Iris pseudacorus	Ip	Yellow Iris	Emergent	5
Juncus sp.	Ju	Rush	Emergent	4
Ledum groenlandicum	Lg	Labrador Tea	Emergent	2
Ludwigia palustris	Lp	False Loosestrife	Emergent	2
Lythrum salicaria	Ls	Purple Loosestrife	Emergent	3
Lysimachia vulgaris	Lv	Garden Loosestrife	Emergent	1
Mentha sp.	Mp	Mint	Emergent	2
Myriophyllum sp.	My	Milfoil	Submergent	1
Najas flexilis	Nf	Bushy Pondweed	Submergent	3
Nitella sp.	Ni	Stonewort	Submergent	4
Nuphar Lutea.	Nl	Yellow Pondlily	Floating	4
Nymphaea odorata	No	Fragrant White Pondlily	Floating	5
Phalaris arundinacea	Pd	Reed Canary Grass	Emergent	4
Polygonum cuspidatum	Pu	Japanese Knotweed	Emergent	1
Potamogeton amplifolius	Pa	Large Leafed Pondweed	Submergent	1
Potamogeton crispus	Pc	Curly Leafed Pondweed	Submergent	1
Potamogeton natans	Pn	Brown Leafed Pondweed	Submergent	1
Potamogeton pusillus	Pb	Small Pondweed	Submergent	5
Potentilla palustris	Pp	Marsh Cinquefoil	Emergent	4
Scirpus sp.	Sb	Bulrush	Emergent	2
Sparganium sp.	Sf	Bur Weed	Emergent	1
Spiraea douglasii	Sd	Hardhack	Emergent	5
Typha latifolia	Tl	Cat Tail	Emergent	5
Utricularia vulgaris	Uv	Bladderwort	Submergent	2

Table 4: *Aquatic Plant Coverage by Community Type*

Lake	Emergent Cover (Acres)	Floating Cover (Acres)	Submergent Cover (Acres)	Total* Cover (Acres)	Lake Size (Acres)	Percent* Coverage	Avg. Depth (Feet)	Avg. Depth (Feet)
Burien	0.2	0.3	30.8	31.3	40.8	77	29	13
Haller	—	3.3	10.3	13.6	13.6	100	36	—
Joy	0.2	2.5	33.7	36.2	107.3	34	50	23
Leota	—	2.4	8.1	10.5	10.5	100	24	12
Marcel	0.3	0.1	16.9	17.0	33.0	52	17	—

**Excludes Emergent Plant Coverage*

Data Source: 1999 Remetrix aerials, King County Water and Land Resource Division GIS Analysis

Results by Lake

Burien

Lake Burien was surveyed on August 12, 1999. Sky conditions were overcast and water clarity was good with a Secchi depth reading of 3.75 meters. Eighteen plant species were identified including twelve emergents, two floating types, and four submergent types (Table 5). Species present by lake section are listed in Table 6 while species found along each transect are summarized in Table 7.

The floating plant coverage totaled 0.3 acres while the submergent community comprised 30.8 acres. Submergent species were present to a depth of six meters with percent cover ranging from medium (25 to 75 percent) to high (greater than 75 percent) coverage. Submergent plants were uncharacteristically sparse in the shallow shoreline area. This sparse coverage probably indicated heavy management of local beach areas by residents. Noxious weeds present included *Lythrum salicaria, Lysimachia vulgaris,* and *Phalaris arundinacea.*

Table 5: *Lake Burien Species Present and Their Abbreviations*

Chara sp.	Cs	Nitella sp.	Ni
Eleocharis sp.	El	Nuphar lutea	Nl
Elodea canadensis	Ec	Nymphaea odorata	No
Iris pseudacorus	Ip	Phalaris arundinacea	Pd
Juncus sp. (two species)	Ju	Potamogeton pusillus	Pb
Ludwigia palustris	Lp	Scirpus sp.	Sb
Lysimachia vulgaris	Ls	Spirea douglasii	Sd
Lythrum salicaria	Lv	Typha latifolia	Tl
Mentha sp.	Mp		

Table 6: *Lake Burien Species Present in Each Section*

1 ..... Sb, Ju, Ip, Lv, Ls, Pb, Ni, Cs

2 ..... Ip, Lv, Ls, El, Ju, Tl, Lp, Mp, No, Pb, Ec, Cs, Ni

3 ..... Tl, Ls, Ip, Lv, Mp, Ju, Pd, Sd, Nl, No, Pb, Ec, Ni, Cs

Table 7: *Lake Burien Species Present in Each Transect*

A ..... Lv, Ls, Ip, Lp, Pd, Pb, Cs, Ni

B ..... Pb, Ni

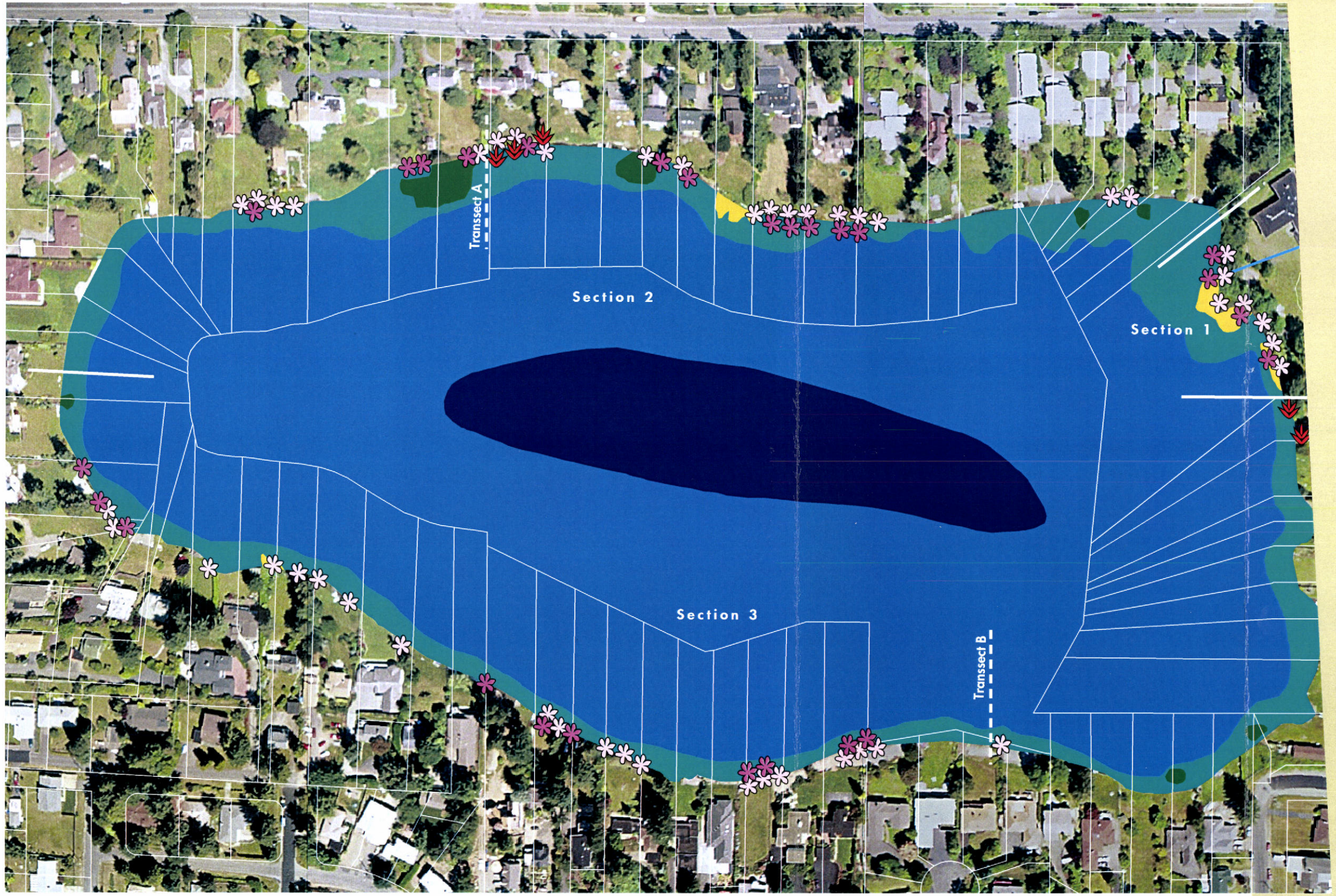


Figure 5:

Lake Burien

Weed Location Map

LEGEND

- *Lythrum salicaria* (Purple Loosestrife)
- *Lysimachia vulgaris* (Garden Loosestrife)
- *Phalaris arundinacea* (Reed Canary Grass)

- Stream
- Section boundary
- Transsect line
- Floating
- Emergent
- Submergent
- No plants or sparse
- No plants—deep
- Parcel boundary

N

0 100 200 300 Feet

October 1999

Produced by:
GIS/Visual Communications Unit, WLR
King County Department of Natural Resources

File Name: 9910 Burien AquaPlantMap.eps

Haller

Haller Lake was surveyed on August 10, 1999. Sky conditions were sunny and water clarity was low with a Secchi depth reading of 2.5 meters. Fifteen plant species were identified including one terrestrial weed, six emergents, one floating type, and seven submergent types (Table 8). Species present by lake section are listed in Table 9 while species found along each transect are summarized in Table 10.

The floating plant coverage totaled 3.3 acres while the submergent community comprised 10.3 acres. Submergent species were present to a depth of 4.5 meters with percent cover ranging from low (less that 25 percent) to medium (25 to 75 percent) coverage. Noxious weeds present included *Lythrum salicaria* and *Polygonum cuspidatum*.

Table 8: *Haller Lake Species Present and Their Abbreviations*

Carex sp.	Ca	Nitella sp.	Ni
Ceratophyllum demersum	Cd	Nymphaea odorata	No
Eleocharis sp.	El	Polygonum cuspidatum	Pu
Elodea canadensis	Ec	Potamogeton pusillus	Pb
Fontinalis sp.	Fo	Potentilla palustris	Pp
Iris pseudacorus	Ip	Spirea douglasii	Sd
Lythrum salicaria	Ls	Typha latifolia	Tl
Najas flexilis	Nf		

Table 9: *Haller Lake Species Present in Each Section*

1 ..... Ip, Ls, Sd, Pp, Tl, No, Nf, Cd, Fo, Pb, Ni, El
2 ..... Ip, Ls, Ca, No, Cd, Pb, Ec
3 ..... Pu, Sd, Ip, Ls, No, Cd, Pb, Ni, Ec

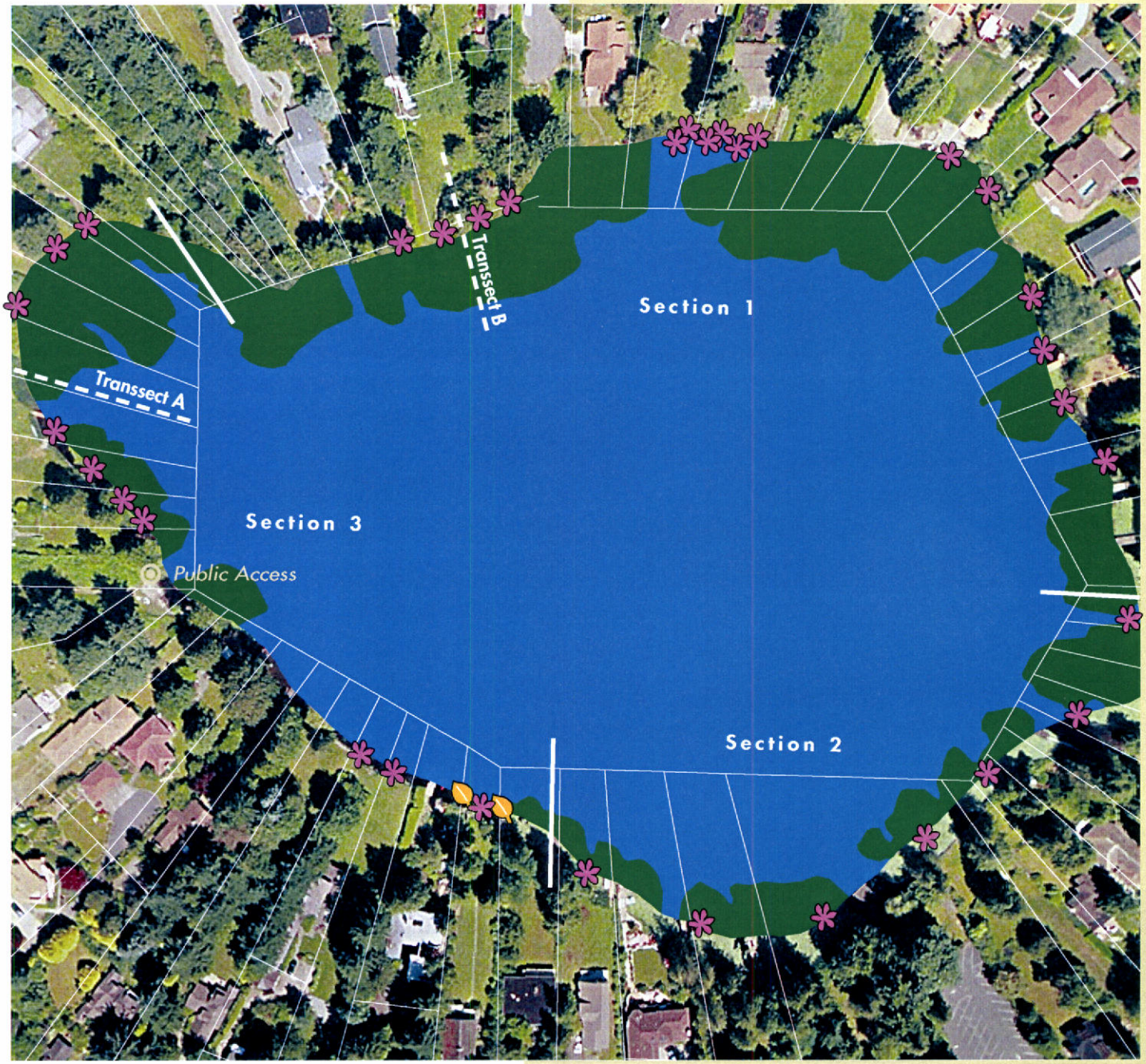
Table 10: *Haller Lake Species Present in Each Transect*

A ..... Ip, Ls, No, Cd, Pb, Nf, Ec
B ..... Ip, Ls, Sd, No, Cd, Pb, Ec

Figure 6:

Haller Lake

Weed Location Map



N

0 100 200 Feet

November 1999

Produced by:
GIS/Visual Communications Unit, WLR
King County Department of Natural Resources
File Name: 9910 Haller AquaPlantMap.eps

LEGEND

Lythrum salicaria
(Purple Loosestrife)

Polygonum cuspidatum
(Japanese Knotweed)

Floating

Submergent

Parcel boundary

Section boundary

Transect line

Joy

Lake Joy was surveyed on August 25, 1999. Sky conditions were partly cloudy. No Secchi depth was taken but water clarity was greater than 2.0 meters. Twenty-four plant species were identified including one terrestrial weed, sixteen emergents, three floating types, and four submergent types (Table 11). Species present by lake section are listed in Table 12 while species found along each transect are summarized in Table 13.

The floating plant coverage totaled 2.5 acres while the submergent community comprised 33.7 acres. Submergent species were present to a depth of six meters with percent cover ranging from absent to light (less that 25 percent) coverage. Noxious weeds present included *Lythrum salicaria, Phalaris arundinacea,* and *Polygonum cuspidatum.*

Table 11: Lake Joy Species Present and Their Abbreviations

Alisma gramineum	Ag	Najas flexilis	Nf
Brasenia schreberi	Bs	Nuphar lutea	Nl
Carex sp. (2 sp.)	Ca	Nymphaea odorata	No
Dulichium arundinaceum	Da	Phalaris arundinacea	Pd
Eleocharis sp.	El	Potamogeton amplifolius	Pa
Elodea canadensis	Ec	Polygonum cuspidatum	Pu
Iris pseudacorus	Ip	Potamogeton pusillus	Pb
Juncus sp.	Ju	Potentilla palustris	Pp
Ledum groenlandicum	Lg	Scirpus sp.	Sb
Ludwigia palustris	Lp	Spirea douglasii	Sd
Lythrum salicaria	Ls	Typha latifolia	Tl
Mentha sp.	Mp		

Table 12: *Lake Joy Species Present in Each Section*

1 ..... Sd, Ls, Tl, Ca, Ju, Ip, Pd, El, Da, Pp, Lp, Sb, Pu, No, Nl, Bs, Ec, Nf,

2 ..... Sd, Ip, Pp, Pd, Ca, Ls, Da, Lp, Ag, Sb, No, Nl, Bs, Pa, Nf, Ec, Pb

3 ..... Pu, Pd, Ls, Sd, Ip, Ca, Da, Lp, Pp, Ju, Sb, Ag, Lg, Mp, No, Bs, Nl, Ec, Nf

Table 13: *Lake Joy Species Present in Each Transect*

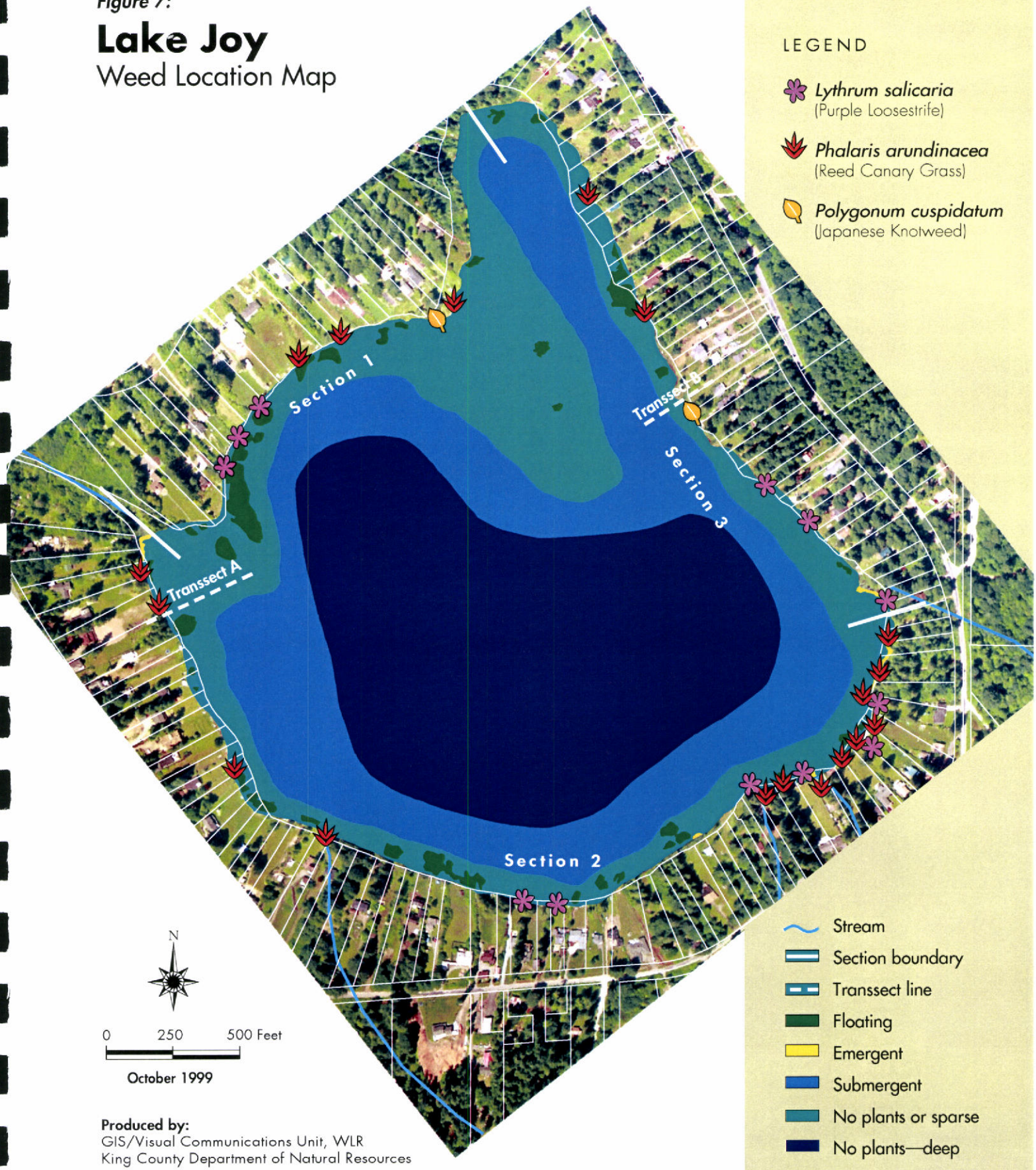
A ..... Tl, Pp, Ju, Pb, Ip, No, Nl, Ec, Nf

B ..... Sb, Da, Pp, Ip, Sd, Ls

Figure 7:

Lake Joy

Weed Location Map



October 1999

Produced by:
GIS/Visual Communications Unit, WLR
King County Department of Natural Resources

File Name: 9910 Joy AquaPlantMap.eps

LEGEND

- *Lythrum salicaria* (Purple Loosestrife)
- *Phalaris arundinacea* (Reed Canary Grass)
- *Polygonum cuspidatum* (Japanese Knotweed)

- Stream
- Section boundary
- Transsect line
- Floating
- Emergent
- Submergent
- No plants or sparse
- No plants—deep
- Parcel boundary

Leota

Lake Leota was surveyed on August 24, 1999. Sky conditions were sunny and water clarity was low with a Secchi depth reading of 2.25 meters. Nineteen plants species were identified including one terrestrial weed, seven emergents, two floating types, and nine submergent types (Table14). Species present by lake section are listed in Table 15 while species found along each transect are summarized in Table 16.

The floating plant coverage totaled 2.3 acres while the submergent community comprised 8.1 acres. Submergent species were present to a depth of 2.75 meters with medium (25 to 75 percent) coverage present throughout the lake. Noxious weeds present included *Phalaris arundinacea* and *Polygonum cuspidatum*.

Table 14: *Lake Leota Species Present and Their Abbreviations*

Ceratophyllum demersum	Cd	Nuphar lutea	Nl
Chara sp.	Cs	Nymphaea odorata	No
Elodea canadensis	Ec	Phalaris arundinacea	Pd
Fontinalis sp.	Fo	Polygonum cuspidatum	Pu
Iris pseudacorus	Ip	Potamogeton pusillus	Pb
Juncus sp.	Ju	Potentilla palustris	Pp
Ledum groenlandicum	Lg	Spirea douglasii	Sd
Myriophyllum sp.	My	Typha latifolia	Tl
Najas flexilis	Nf	Utricularia vulgaris	Uv
Nitella sp.	Ni		

Table 15: *Lake Leota Species Present in Each Section*

1 ..... Ip, Sd, Tl, Pp, Lg, Pd, Ju, No, Nl, Uv, Nf, Ec, Cd, Pb, Fo, Pu

2 ..... Ip, Pd, Pp, Sd, Tl, No, Nl, Cd, Ec, Cs, Ni, Uv, Nf, Pb, My, Pu

Table 16: *Lake Leota Species Present in Each Transect*

A ..... Sd, Ip, Pd, No, Nl, Fo, Nf, Cd, Uv, Pb, Ni

B ..... Ip, Tl, Pp, Nl, Uv, Cd, Ni, Ec

Figure 8:

Lake Leota

Aquatic Plant Locations Map

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King County Department of Natural Resources

File Name: 9910LeotaAquaPlantMap.eps

October 1999

Marcel

Lake Marcel was surveyed on August 3, 1999. Sky conditions were initially sunny with a storm arriving mid-day. Water clarity was good with a Secchi depth reading of 3.25 meters. Eighteen species were identified including nine emergents, two floating types, and seven submergent types (Table 17). Species present by lake section are listed in Table 18 while species found along each transect are summarized in Table 19.

The floating plant coverage totaled 0.1 acres while the submergent community comprised 16.9 acres. Submergent species were present to a depth of six meters and their percent cover ranged from medium (25 to 75 percent) to high (greater than 75 percent) coverage. *Phalaris arundinacea* was the only noxious weed.

Table 17: *Lake Marcel Species Present and Their Abbreviations*

Alisma gramineum	Ag	Phalaris arundinacea	Pd
Carex sp.	Ca	Potamogeton crispus	Pc
Chara sp.	Cs	Potamogeton pusillus	Pb
Elodea canadensis	Ec	Potamogeton natans	Pn
Iris pseudacorus	Ip	Potentilla palustris	Pp
Juncus sp.	Ju	Spirea douglasii	Sd
Nitella sp.	Ni	Sparganium sp.	Sf
Nuphar lutea	Nl	Typha latifolia	Tl
Nymphaea odorata	No	Utricularia vulgaris	Uv

Table 18: *Lake Marcel Species Present in Each Section*

1 ..... Ju, Pd, Sd, Ag, No, Nl, Ec, Cs, Ni, Pc, Pb
2 ..... Ca, Pp, Tl, Ju, Sd, Ip Ag, No, Cs, Ec, Ni, Uv
3 ..... Pd, Ju, Pp, Tl, Nl, Cs, Ec, Uv
4 ..... Pd, Tl, Ju, Ca, Nl, Ec, Pc, Cs
5 ..... Pd, Sd, Ju, Tl, Sf, Ca, Nl, No, Cs, Ec, Ni, Pn
6 ..... Sd, Pd, Ju, Tl, Ec, Cs, Ni
7 ..... Pd, Tl, Sd, Nl, Ec, Cs, Ni

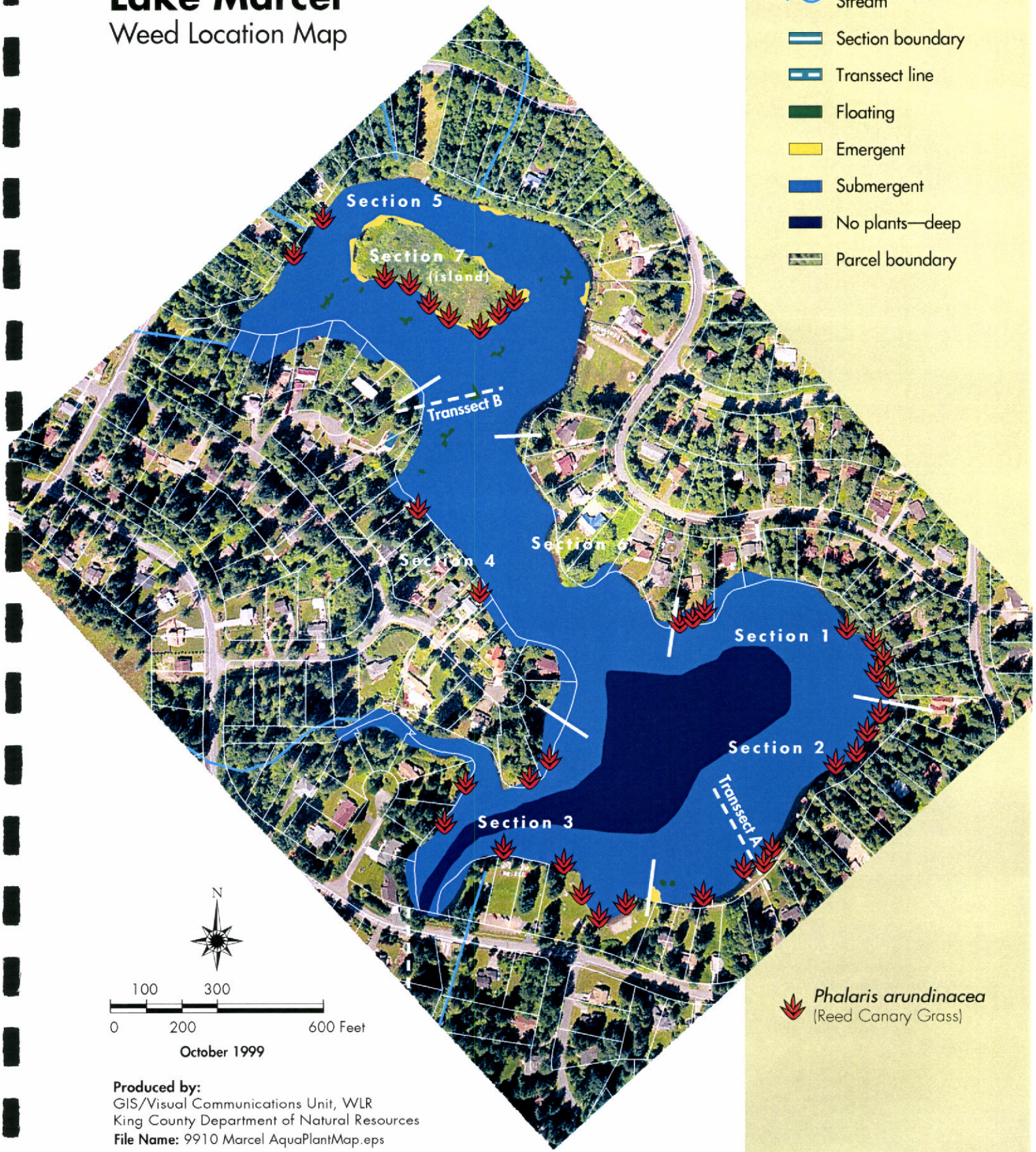
Table 19: *Lake Marcel Species Present in Each Transect*

A ..... Ju, Tl, Pd, Ca, Ec, Cs, Ni
B ..... Sd, Tl, Pd, Ju, Nl, Ec, Cs, Ni

Figure 9:

Lake Marcel

Weed Location Map



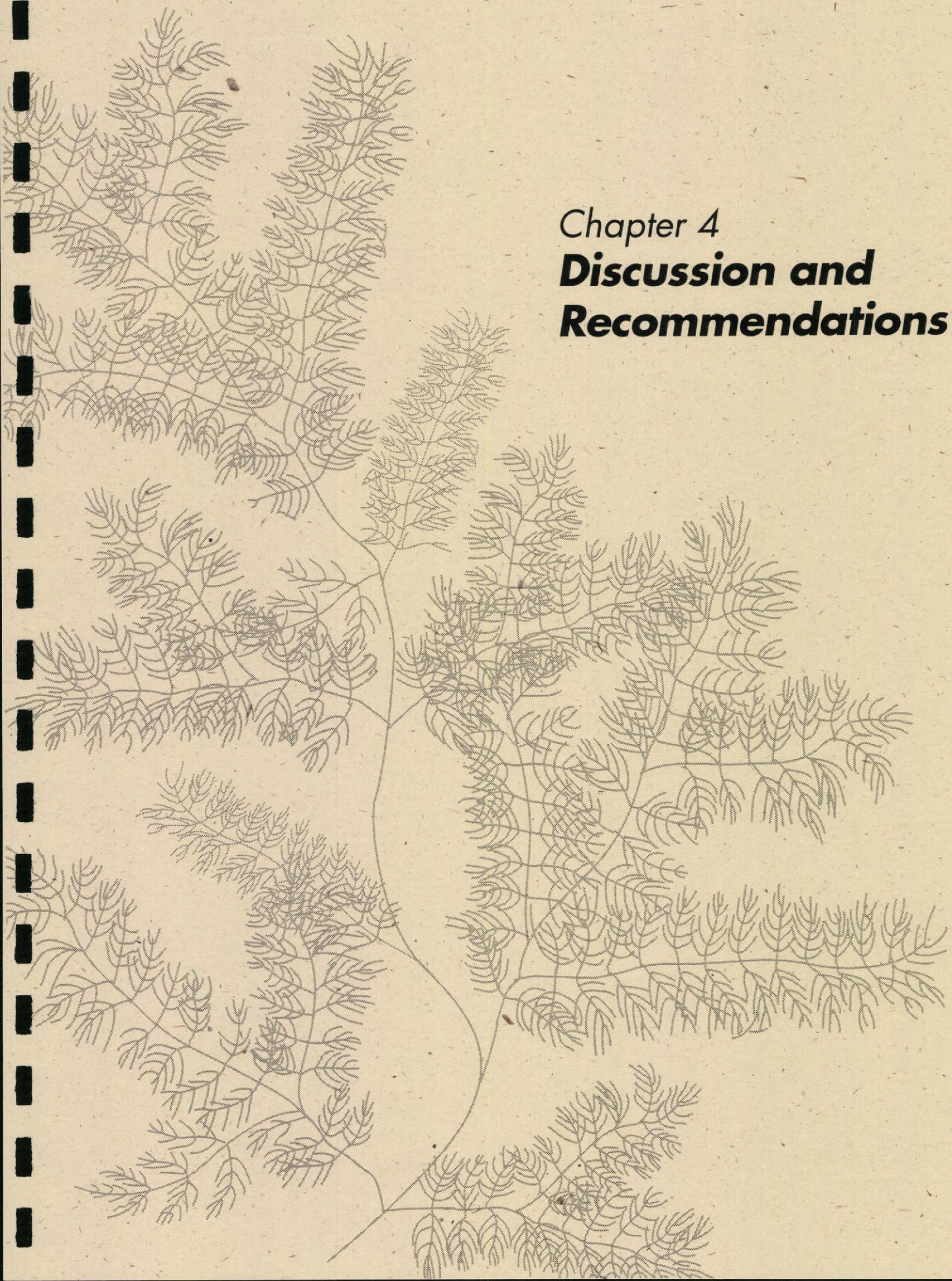
LEGEND

- Stream
- Section boundary
- Transsect line
- Floating
- Emergent
- Submergent
- No plants—deep
- Parcel boundary

Phalaris arundinacea
(Reed Canary Grass)

October 1999

Produced by:
GIS/Visual Communications Unit, WLR
King County Department of Natural Resources
File Name: 9910 Marcel AquaPlantMap.eps



Chapter 4

Discussion and Recommendations

Chapter 4: Discussion and Recommendations

The distribution of noxious weeds in King County's lakes is described here beginning with an overview of the problems associated with noxious weeds. The chapter concludes with recommendations for weed control and ongoing surveying.

The Problems with Noxious Weeds

For management purposes, plants are divided into two categories: (1) native species; and (2) non-native (noxious or exotic) species. Native plants are those that have evolved and adapted naturally to an area. Moreover, native species usually do not become problematic because of the natural checks and balances present in the environment.

Non-native plants or noxious weeds, on the other hand, have not evolved here and often become problematic because they have no natural checks (i.e., insects, fungus, and bacteria) which would serve to control their numbers. *Lythrum salicaria* (purple loosestrife) and *Myriophyllum spicatum* (Eurasian watermilfoil) are two examples of noxious weeds that have become established in King County lakes and wetlands. These plants are problematic because of their ability to reproduce very successfully and out compete existing native populations.

Typically, diverse plant communities provide variation in physical structure and food source for the variety of aquatic organisms that utilize aquatic plants in their lifecycle. Many noxious weeds, including *L. salicaria* and *M. spicatum,* form dense monotypic stands which reduce the habitat and recreational value of these impacted areas.

Noxious Weed Classification

In Washington State, the management of noxious weeds is governed by RCW 17.10. This law defines a noxious weed as "any plant which when established is highly destructive, competitive, or difficult to control by cultural or chemical practices." Each year, the Washington Noxious Weed Control Board adopts a weed list for control. Similarly, local boards, such as King County's Noxious Weed Board, adopt county weed lists that target state-wide and regional species of concern.

Both state and local weed lists categorize species into three major classes: A, B, and C. Class A weeds are non-native species with limited distribution in Washington. For Class A weeds, preventing new infestations and eradicating existing infestations is the highest priority. Moreover, the weed law requires affected property owners to eradicate Class A species.

Class B weeds are non-native species which are limited in distribution to portions of Washington state. These species are designated for control in regions where they have not become widespread. For local weed boards, preventing new infestations in affected areas remains a high priority. In regions where a Class B species is already established, control is decided on a local level, with containment as the main goal.

Class C weeds are non-native species that have become widespread in the state. Control of these species is designated at the local level with control programs typically established to emphasize containment and partial control.

Noxious Weed Distribution

Each surveyed lake had one or more noxious weeds present. Weed occurrence by lake is lised in Table 20. Noxious weed distribution was limited to emergent or terrestrial types. In total, four noxious weed species were observed during the summer surveys: *Lythrum salicaria* (Class B), *Lysimachia vulgaris* (Class B), *Phalaris arundinacea* (Class C statewide, weed of concern locally), and *Polygonum cuspidatum* (Class C state wide, weed of concern locally). Two non-native invasive perennials, *Iris pseudacorus* and *Nymphaea odorata,* were also found at all five lakes. No submergent weed species were noted at the five lakes.

Table 20: *Noxious Weeds* Occurrence on Five Lakes*

Lake	Lythrum salicaria	Lysimachia vulgaris	Phalaris arundinacea	Polygonum cuspidatum
Burien	X	X	X	
Haller	X			X
Joy	X		X	X
Leota			X	X
Marcel			X	

**From the 1999 adopted King County Noxious Weed List*

Previous Aquatic Weed Surveys

For the five target lakes, the survey results are in marked contrast to those recorded for a 1994-95 survey of 36 King County lakes (King County, 1996). In this larger survey, the submergent weed species *Myriophyllum spicatum* and *Hydrilla verticillata* were found. *M. spicatum* is particularly problematic for county lakes, affecting over 50 percent of the lakes surveyed in 1994-95 (King County, 1996). Figure 10 provides an updated map of lakes affected by *M. spicatum.*

The absence of *M. spicatum* from the five surveyed lakes may, in part, be attributed to the limited public access at these lakes. Without heavy boat traffic, the opportunity of submergent weed introduction may be more limited.

The frequency of *Lythrum salicaria's* occurrence in the five lakes surveyed was notably higher at 60 percent versus 33 percent for the 36 lake survey (King County, 1996). Similarly, the occurrence of *Phalaris arundinacea* was higher for the five lakes survey occurring in 80 percent of the lakes while in only five percent for the 36 lake survey (King County, 1996). The lower observation of *P. arundinacea* for the 36 lake survey is likely due to the reduced emphasis on non-emergent species associated with that specific project.

Recommendations

Survey results for these five lakes suggest local lake residents need assistance in identifying and removing weed species from the lake shoreline. All five lake shorelines were affected by noxious weeds. When working with shoreline residents on weed removal, technical assistance should emphasize the importance of replanting the shoreline with native species to minimize shoreline erosion and to protect lake water quality from residential activities.

After weed removal has occurred, citizen volunteers can be trained in the identification of lake weeds of primary concern. These volunteers can, in turn, participate in regular lake surveys for weed species. Currently, the WLR Division's Lake Stewardship Program supports a waterweed survey program for lake residents.

And finally, ongoing surveys of new lakes should continue. Through ongoing surveys, the database for weed occurrence can be enhanced and technical assistance programs modified or developed to target the primary problematic species. Additionally, ongoing surveys support the detection of new infestations of potentially problematic aquatic species like *Cabomba caroliniana* (fanwort), *Hydrilla verticillata* (hydrilla), or *Myriophyllum aquaticum* (parrotfeather milfoil).

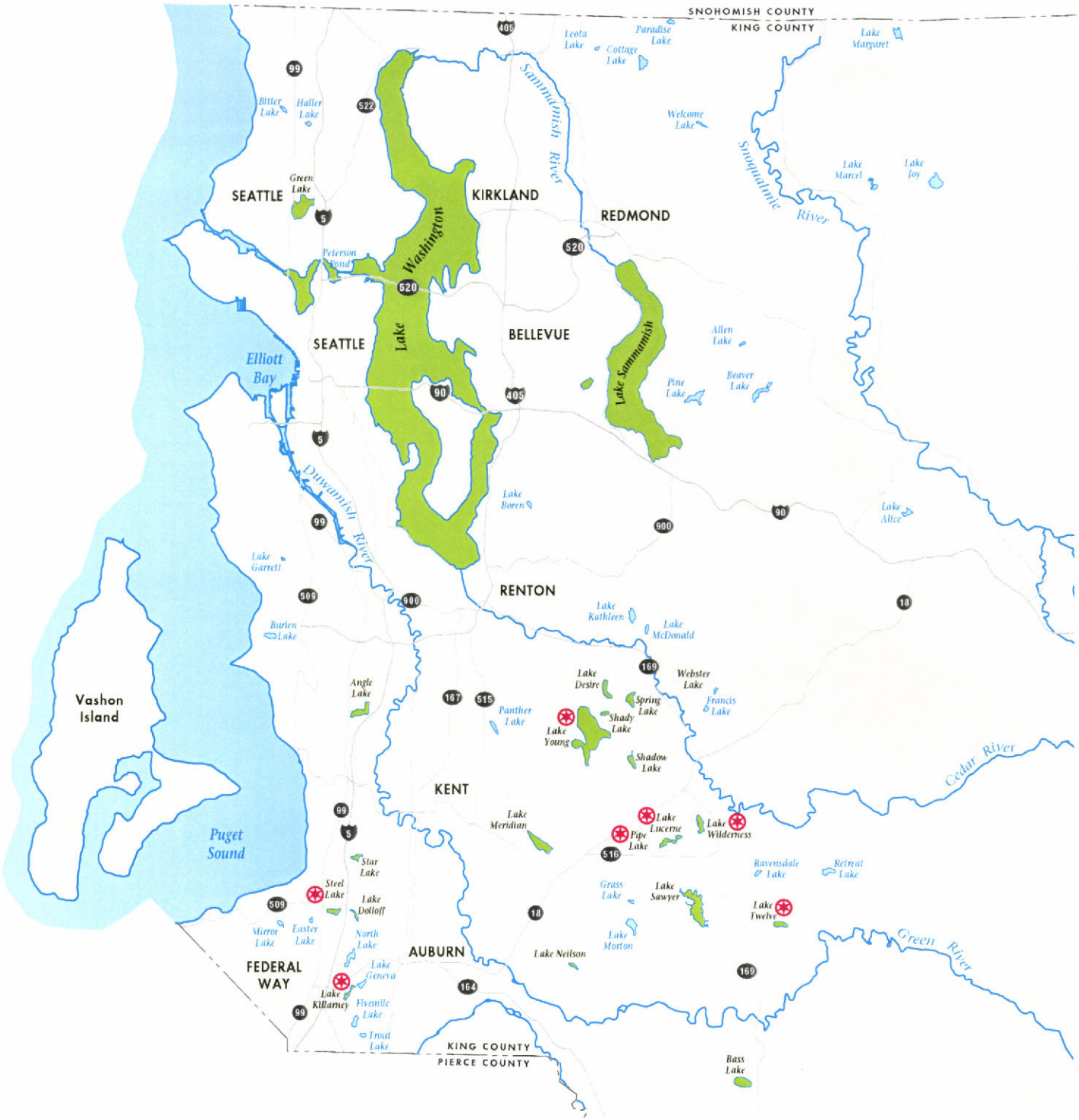


Figure 10:

Locations of *Myriophyllum spiculatum* in King County Lakes

- Lake - Myriophyllum spicatum not present
- Lake - Myriophyllum spicatum present*
- Myriophyllum spicatum eradicated presently or under monitor status
- River
- Major Highway

N

0 2 4 Miles

November 1999

**Based on King County, 1996 and Washington State Dept. of Ecology, 1999 survey information; and 1999 King County Surveys*

File Name: 9911 NWS-Fig10 LocMS.eps

References

Metro, 1976. *A Baseline Survey of Aquatic Plants in Selected Lakes of King County.* Water Quality Division.

Metro, 1977. *A Baseline Survey Study of the Composition, Growth, and Distribution of Aquatic Macrophytes in Fourteen Lakes and Bays of King County.* Water Quality Division.

Metro, 1978. *Aquatic Plants in Selected Waters of King County: Distribution and Community Composition of Macrophytes.* Water Quality Division.

Metro, 1979. *Aquatic Plants in Selected Waters of King County: Distribution and Community Composition of Macrophytes.* Water Quality Division.

Metro, 1980. *Aquatic Plants in Selected Waters of King County: Distribution and Community Composition of Macrophytes.* Water Quality Division.

King County, 1990. *Wetlands Inventory, Volumes 1-3. Department of Parks, Planning, and Recreation,* Environmental Division.

King County, 1996. *Aquatic Plant Mapping for 36 King County Lakes.* Department of Public Works, Surface Water Management Division.

King County, 1999. *1999 King County Noxious Weed List.* Department of Natural Resources, Water and Lake Resource Division.

Remetrix, Inc., 1999. *Aquatic Plant Mapping of Five King County Lakes.* Consultant report to King County, Department of Natural Resources, Water and Lake Resource Division.