

# Licton Springs Park Vegetation Management Plan – 2007 Addendum

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**Prepared For: Friends of Licton Springs  
and  
The City of Seattle Department of Neighborhoods**

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## Executive Summary

The Licton Springs Vegetation Management Plan (VMP) was completed in 2001 by the Seattle Department of Parks and Recreation Urban Forestry Program. The purpose of the VMP was to describe existing vegetation conditions within Licton Springs Park, provide restoration guidance, and set a schedule for restoration activities within the park (Seattle Department of Parks and Recreation 2001). Since 2000, the Friends of Licton Springs (FoLS), a community group dedicated to the preservation and restoration of Licton Springs have conducted extensive restoration activities within the northern portion of Licton Springs. In 2006, FoLS and Seattle Urban Nature (SUN) obtained a grant from the City of Seattle Neighborhood Matching Fund Program to update the 2001 VMP. This report includes the following:

- A scientific inventory of forest resources present in restored areas.
- Documentation and evaluation of past restoration activities conducted in the park.
- Guidance for future restoration activities.

To study the current conditions in five areas where restoration activities have taken place, 17 transects were placed throughout these areas (see Map 3). All tree, shrubs, vines and herbaceous species that intersected the transects were recorded. This information was used to compare existing vegetation conditions to those recorded in the VMP in 2001. Important findings include:

- In areas where intensive restoration activities have taken place, cover of invasive species has substantially decreased and native plant diversity has increased. Across the four intensively restored areas (Zones 1, 2, 6 and 12 on Map 4), the diversity of native shrub species has increased from an average of three species in 2001 to eleven species in 2006. The diversity of herbaceous species has increased from an average of three species in 2001 to six species in 2006. The total average percent cover of invasive species in these five areas has decreased from 115% to 35%.
- Invasive trees are posing an increasing threat to Licton Springs. Seven different species of invasive trees compose the majority of all regeneration in the park. These species include: English holly (*Ilex aquifolium*), sweet cherry (*Prunus avium*), European mountain ash (*Sorbus aucuparia*), white poplar (*Populus alba*), cherry laurel (*Prunus laurocerasus*), and one-seed hawthorn (*Crataegus monogyna*) and Norway maple (*Acer platanoides*)
- Reed canarygrass (*Phalaris arundinacea*), Himalayan blackberry (*Rubus discolor*) and hedge-false bindweed (*Calystegia sepium*) are the dominant invasive species present in the sampled wetland and forested areas in Licton Springs.

Past restoration activities in the park involving many community groups were compiled, documented and mapped (see Map 2) to provide a record and timeline of projects conducted in each management zone.

Recommendations for future restoration activities include specific recommendations for each management zone as well as overall short-term, medium-term and long-term priorities for the entire park (see Management Recommendations section of the report).

## **I. INTRODUCTION**

### **Overview**

The Licton Springs Vegetation Management Plan (VMP) was completed in 2001 by the Seattle Department of Parks and Recreation Urban Forestry Program. The purpose of the VMP was to describe existing vegetation conditions within Licton Springs Park, provide restoration guidance, and set a schedule for restoration activities within the park (Seattle Department of Parks and Recreation 2001).

The Friends of Licton Springs, a community group dedicated to the preservation and restoration of Licton Springs, have undertaken a considerable amount of restoration activities within the park since the VMP was developed. Since 2000, the Friends of Licton Springs have held monthly work parties focusing on removing invasive plant species, revegetating with native species and conducting maintenance throughout the park. Through their efforts, numerous other groups have been involved in restoration activities in the park including EarthCorps, the Woodland Park ZooCorps, the University of Washington Restoration Ecology Network (UW-REN), Eagle Scouts, and the Seattle Department of Parks and Recreation Natural Area Crew. To date, the majority of restoration work has taken place in the north end of the park, and many areas have seen considerable transformations from the conditions described in the 2001 VMP.

### **Site Description**

Licton Springs Park is located in north-central Seattle and is bounded by North 97<sup>th</sup> Street to the north, Densmore Avenue North to the east and Ashworth Avenue North to the west (Map 1). The park is part of the Densmore drainage basin which is located in North Seattle and receives runoff from a large area of the city (Map 1). Licton Springs Park encompasses 9.1 acres which consists of the forested wetland area (4.3 acres), the pond (0.3 acres) and the open area (including the playground, landscaped area and trails network (4.5 acres). More information about the pre and post-European settlement history of the area is available within the 2001 VMP.

### **Project Goals**

The purpose of this report is to assist the planning efforts of the Friends of Licton Springs for the ongoing stewardship and maintenance of Licton Springs Park. The report consists of a scientific inventory of forest resources present on site and documents and evaluates past restoration activities conducted in the park. Current vegetation sampling data is compared to information presented in the 2001 VMP. This effort also contributes information with which future surveys and monitoring may be compared. Specific goals of the project are:

- 1) To update the existing VMP with vegetation information for areas which have had on-going restoration activities during the past five years;
- 2) To evaluate the effectiveness of restoration and management methods used in these areas;
- 3) To provide recommendations for future restoration actions in the park; and
- 4) To update the vegetation zone map for the park.

**Map 1. Licton Springs Drainage Basin and vicinity**

## II. ASSESSMENT METHODOLOGY

The 2001 VMP evaluated vegetation conditions within Licton Springs by establishing ten 1/10 acre plots throughout the park (Seattle Department of Parks and Recreation 2001). For this survey, Seattle Urban Nature (SUN) established linear transects stratified across the entire zone to capture the full variability of conditions throughout each sampled zone. The point-intercept method was used to evaluate vegetation conditions in Zones 1, 2, 4, 6/8 and 12 where intensive restoration activities have taken place (Map 2). A baseline was established running north to south across the entire length of each zone. Linear transects were established at set intervals along the baseline, running from east to west and spanning the entire zone (Map 3). Table 1 lists the number of transects established in each surveyed zone, distance between transects, transect bearing and GPS coordinates for the beginning point of each transect. For each transect, all species of overstory, midstory and regenerating trees, shrubs, vines and groundcovers were recorded where they intersected the transect tape. This data was converted to percent cover for each surveyed transect, and averaged to provide percent cover information for the entire zone.

Data collected in the original survey included percent cover of tree overstory, shrub and herbaceous layers. Therefore, the results from this survey should be relatively comparable to data collected during the 2001 survey. Zones where transects were not established were visually assessed and major differences in vegetation from the original survey were noted. Habitat types in the park are based on data from the 1999-2000 survey by Seattle Urban Nature (SUN 2000). These habitat types were updated by Seattle Urban Nature staff for the entire park during the course of this survey, which was performed in September and October, 2006.

<b>Zone</b>	<b>Transect Number</b>	<b>Transect Bearing</b>	<b>Transect Length (m)</b>	<b>Distance Between Transects</b>	<b>GPS Coordinates</b>
1	1	90	22		
1	2	90	30	20 meters	
1	3	90	30		
1	4	90	38		
2	5	90	20	5&6: 15 meters	
2	6	90	33		
2	7	90	42	6,7&8: 20 meters	
2	8	90	50		
4	9	270	11		
4	11	270	32	20 meters	
4	12	270	13		
6	13	270	14		
6	14	270	21	15 meters	
6	15	270	14		
12	16	90	9	16&17: 20 meters	
12	17	90	18		
12	10	90	39	16&10: 15 meters	

**Map 2. Areas of past restoration at Licton Springs**

**Map 3. Locations of linear transects sampled at Licton Springs**

**Map 4. Licton Springs management zone locations**

**Map 5. Licton Springs habitat types**

### III. RESULTS AND FINDINGS

#### Zone 1

Zone 1 is located in the northwestern portion of the park (Map 4). This zone is bounded by North 97<sup>th</sup> Street on the north side, Ashworth Avenue North on the west side, the playground and comfort station on the south side and a gravel trail running north through the park. The southeastern border is defined by a bridge crossing the wetland channel which drains this zone (Map 4). The majority of zone 1 is classified as a palustrine forested wetland, with the southeastern portion classified as a palustrine scrub-shrub wetland (Map 5). The area classified as a palustrine scrub-shrub wetland corresponds approximately to the area identified in the 2001 VMP as area III of zone 1.

In the 2001 VMP, zone 1 was characterized primarily by a red alder (*Alnus rubra*) overstory with a percent cover of 40%. The shrub layer was sparse, containing less than 5% of Himalayan blackberry (*Rubus discolor*), cherry laurel (*Prunus laurocerasus*) and salmonberry (*Rubus spectabilis*) (Table 2). The herbaceous layer had high amounts of invasive species such as field bindweed (*Convolvulus arvensis*) (45%), climbing nightshade (*Solanum dulcamara*) (27.5%), Japanese knotweed (*Polygonum cuspidatum*) (38.8%) and reed canarygrass (*Phalaris arundinacea*) (42.5%) (Table 2). Field bindweed, Japanese knotweed and reed canarygrass are considered to be Non-designated Noxious Weeds by the King County Noxious Weed Control Program (King County 2006). These are widespread invasive species for which control is recommended but not required in King County. Himalayan blackberry, cherry laurel and climbing nightshade are classified as Weeds of Concern by the King County Noxious Weed Control Program. These are widespread invasive species which threaten native ecosystems by displacing native vegetation and degrading wildlife and plant habitats. Control and containment of existing populations of these species is recommended (King County 2006).

#### Zone 1 Overstory and regenerating trees

The 2006 survey shows that the overstory continues to be dominated by red alder, with an average percent cover of 62% (Table 2). Four additional species were found in the overstory layer, of which two are native and two are non-native (Table 2). Native species present included Douglas fir (*Pseudotsuga menziesii*) (3%) and Western red cedar (*Thuja plicata*) (2.5%). White poplar (*Populus alba*) was found to be present at relatively low percent cover (3% cover). This species is considered to be an invasive species in the United States by the Plant Conservation Alliance, Alien Plant Working Group. Although this species does not currently have a legal designation from the King County Noxious Weed Control group.

A total of seven species were found in the midstory and regenerating tree layers, of which five are native and two are non-native (Table 2). European mountain ash (*Sorbus aucuparia*) and English holly (*Ilex aquifolium*) have the highest percent cover of all midstory and regenerating trees at a combined percent cover of 5%. No cherry laurel was recorded in this zone in 2006. Transect four (Map 3) ran through a considerable stand of European mountain ash, which had 16% cover on that transect. Both of these species are considered to be invasive and are widely distributed in natural areas in Seattle where seeds are dispersed by birds and other animals.

English holly is classified as a Weed of Concern by the King County Noxious Weed Program (King County 2006).

<b>Table 2. Overstory and regenerating tree species found in Zone 1 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover.</b>			
<b>Scientific Name<sup>1</sup></b>	<b>Common Name</b>	<b>2001 Survey Average Percent Cover</b>	<b>2006 Survey Average Percent Cover<sup>2</sup></b>
<b>OVERSTORY TREES (Percent Cover)</b>			
<i>Alnus rubra</i>	red alder	40%	62%
<b><i>Cedrus sp.</i></b>	cedar		1%
<b><i>Populus alba</i>**</b>	white poplar		3%
<i>Pseudotsuga menziesii</i>	Douglas fir		3%
<i>Thuja plicata</i>	western red cedar		2.5%
<b>MIDSTORY AND REGENERATING TREES (Percent Cover)</b>			
<i>Alnus rubra</i>	red alder		1%
<i>Fraxinus latifolia</i>	Oregon ash		T
<b><i>Ilex aquifolium</i>*</b>	English holly		2%
<i>Populus tremuloides</i>	aspen		T
<b><i>Prunus laurocerasus</i>*</b>	cherry laurel	0.5%	
<b><i>Sorbus aucuparia</i>**</b>	European mountain ash		3%
<i>Thuja plicata</i>	western red cedar		1%
<i>Tsuga heterophylla</i>	western hemlock		T

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006). Species denoted by \*\* are non-native invasive species which have not been given a legal designation at this time.

<sup>2</sup>T=Trace presence of species (less than 1%).

### Zone 1 Shrubs

The shrub layer in 2006 looks considerably different than it did in 2001. Species diversity is greatly increased, with 13 species currently present compared to three species in 2001 (Table 3). In addition, the aerial cover and complexity of the shrub layer has greatly increased from 3% cover to 59% cover. Of the 13 species recorded during the survey, only one, Himalayan blackberry, was non-native. Himalayan blackberry was present at a marginally higher percent cover during the 2006 survey than during the 2001 survey (5% as compared to 2.5% respectively).

Currently, the shrub layer is dominated by salmonberry (16% cover), with smaller amounts of Pacific willow (*Salix lucida ssp. lasiandra*) (8% cover) and vine maple (*Acer circinatum*) (6% cover). Other willow species make up 8% cover in this zone. Additional species with less than 5% cover include: red-osier dogwood (*Cornus stolonifera*), Pacific ninebark (*Physocarpus capitatus*), Indian plum (*Oemleria cerasiformis*) and high-bush cranberry (*Viburnum edule*) (Table 3).

**Table 3. Shrub species found in Zone 1 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover.**

Scientific Name <sup>1</sup>	Common Name	2001 Survey Average Percent Cover <sup>2</sup>	2006 Survey Average Percent Cover <sup>3</sup>
<i>Acer circinatum</i>	vine maple		6%
<i>Cornus stolonifera</i>	red-osier dogwood		4.5%
<i>Oemleria cerasiformis</i>	Indian plum		3%
<i>Physocarpus capitatus</i>	Pacific ninebark		4%
<i>Ribes viscosissimum</i>	sticky currant	T	
<b><i>Rubus discolor</i>*</b>	Himalayan blackberry	2.5%	5%
<i>Rubus parviflorus</i>	thimbleberry		T
<i>Rubus spectabilis</i>	salmonberry	T	16%
<i>Salix sp.</i>	willow		4%
<i>Salix lucida ssp. lasiandra</i>	Pacific willow		8%
<i>Sambucus racemosa</i>	red elderberry		T
<i>Salix sitchensis</i>	Sitka willow		4%
<i>Spiraea douglasii</i>	hardhack		T
<i>Viburnum edule</i>	high-bush cranberry		3%

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006).

<sup>2</sup> and <sup>3</sup>T=Trace presence of species (less than 1%).

### Zone 1 Herbs

A total of 15 species were found in the herbaceous layer in 2006 compared to seven species in 2001. Of the 15 species recorded, eight are native, six are non-native and one could not be determined (Table 4). In 2001, 154% of the herbaceous layer was covered by invasive species such as field bindweed, reed canarygrass, Japanese knotweed and climbing nightshade. Values over 100% are possible due to overlapping strata. In 2006, invasive species covered an average of 28% of the zone, with Japanese knotweed and climbing nightshade showing the greatest reductions in cover (0% and 1% average cover respectively) (Figure 1).

Currently, the herbaceous layer is dominated by giant horsetail rush (*Equisetum telmateia*), with an average percent cover of 33.5%, increased from 2% in 2001 (Table 4). Reed canarygrass is the second most dominant species in Zone 1, with an average percent cover of 18%. Although it is greatly reduced from 42.5% in 2001, it is still quite abundant in this zone and has shown to be difficult to eradicate. Other abundant species include stinging nettle (*Urtica dioica*) (10%), small-seeded bulrush (7%), and hedge-false bindweed (*Calystegia sepium*), which is listed as a Weed of Concern by the King County Noxious Weed Program (2006). Hedge false bindweed is a very similar species to field bindweed and can be mistaken for the other. For this report, these two species will be treated in the same manner as they have similar growing habits, ecological impacts and management strategies. Cover of field bindweed was recorded at 45% in 2001 while hedge-false bindweed had a cover of only 7% in 2006. Even at its reduced average cover in zone 1, this invasive species continues to pose potential management difficulties.

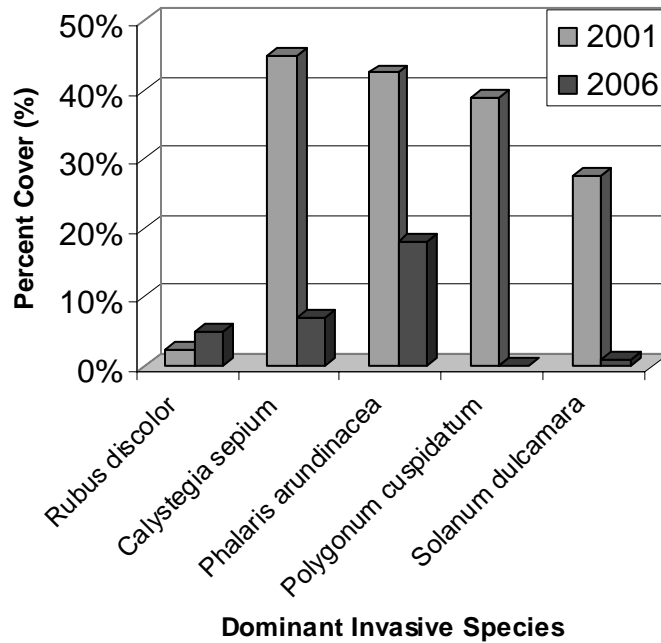
Two additional invasive species which were not recorded during the 2001 survey are now present in zone 1 in small amounts. Herb Robert (*Geranium robertianum*) is classified as a Non-designated Noxious Weed in King County (King County 2006) and was present at a percent cover of less than one percent. Creeping buttercup (*Ranunculus repens*) is an invasive species without a legal designation at this time, which is often present in wetland areas. This species was recorded at an average percent cover of 2%.

**Table 4. Herbaceous species found in Zone 1 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.**

Scientific Name	Common Name	2001 Survey Average Percent Cover <sup>2</sup>	2006 Survey Average Percent Cover <sup>3</sup>	Life Form
<i>Agrostis sp.</i>	bentgrass		1.5%	Grass
<i>Athyrium filix-femina</i>	ladyfern		T	Herb
	bare dirt		T	Other
<b><i>Convolvulus arvensis</i>*</b>	field bindweed	45%		Herb
<b><i>Calystegia sepium</i>*</b>	hedge false bindweed		7%	Herb
	coarse woody debris		7.5%	Other
<i>Epilobium ciliatum</i>	fringed willowherb		2.5%	Herb
<i>Equisetum telmateia</i>	giant horsetail rush	2%	33.5%	Herb
<b><i>Geranium robertianum</i>*</b>	herb Robert		T	Herb
	lawn		3%	Grass
	litter		18%	Other
<i>Lysichitum americanus</i>	skunk cabbage		T	Herb
<b><i>Mycelis muralis</i></b>	wall-lettuce		1%	Herb
<i>Oenanthe sarmentosa</i>	water parsley		1%	Herb
<b><i>Phalaris arundinacea</i>*</b>	reed canarygrass	42.5%	18%	Grass
<b><i>Polygonum cuspidatum</i>*</b>	Japanese knotweed	39%		Herb
<i>Polystichum munitum</i>	sword fern		1%	Herb
<i>Pteridium aquilinum</i>	brackenfern	T		Herb
<b><i>Ranunculus repens</i>**</b>	creeping buttercup		2%	Herb
<i>Scirpus microcarpus</i>	small-seeded bulrush		7%	Grass
<b><i>Solanum dulcamara</i>*</b>	climbing nightshade	27.5%	1%	Herb
<i>Urtica dioica</i>	stinging nettle	1%	10%	Herb

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006). Species denoted by \*\* are non-native invasive species which have not been given a legal designation at this time.

<sup>2</sup> and <sup>3</sup>T=Trace presence of species (less than 1%).



**Figure 1. Percent cover of dominant invasive species in 2001 and 2006 in Zone 1 in Licton Springs**

#### Zone 1 Past Restoration Efforts

Important features in Zone 1 include the capped iron spring in the eastern part of the zone, a spring flowing from a concrete pipe in the northernmost section of the zone and a recently rediscovered spring and cleared stream channel in the western part of the zone (Map 6).

The capped iron spring area was restored by University of Washington Restoration Ecology Network (UW-REN) program participants in 1999. The 1999 UW-REN team installed rocks for resting/sitting and native vegetation surrounding the spring source (personal communication, Liz Kearns 2006).

Intensive restoration efforts have been ongoing in Zone 1 since 2000. In 2000, volunteers from Tremendous Seattle (now joined with EarthCorps) removed and grubbed out roots of all invasive species, including Japanese knotweed, in the northern most section of Area 1 in Zone 1 (Map 2). In 2001, landscape fabric was placed in this section and native trees and shrubs were planted through the fabric. The following species were planted throughout the area: skunk cabbage (*Lysichiton americanum*), thimbleberry (*Rubus parviflorus*), salmonberry, spiny wood fern (*Dryopteris expansa*), snowberry (*Symphoricarpus albus*), sword fern (*Polystichum munitum*), red elderberry (*Sambucus racemosa*), western red cedar, Sitka Spruce (*Picea sitchensis*), oceanspray (*Holodiscus discolor*), red flowering currant (*Ribes sanguineum*), red osier dogwood, Pacific ninebark, vine maple and red huckleberry (*Vaccinium parvifolium*) (Seattle Department of Parks and Recreation 2001). The landscape fabric was removed in 2004 by Friends of Licton Springs (personal communication, Liz Kearns 2006).

In 2004, a team of students from the UW-REN program conducted a restoration project in the southeastern portion of Zone 1, which generally corresponds to area II of Zone 1 in the 2001 VMP (Map 2). The team removed invasive species including Himalayan blackberry, English holly, reed canarygrass, hedge false bindweed, and climbing nightshade (Boardman et al. 2004). During their project, they uncovered a lost spring (Map 6) and re-established the existing stream

**Map 6. Licton Springs hydrology and hummock locations**

channel. Blackberries, climbing nightshade and hedge false bindweed were removed with the roots from the stream banks and cardboard and mulch were applied to suppress invasive species growth. Reed canarygrass was dug out from the stream channel with hand tools. English holly was removed by the Seattle Parks Department in 2004 (Boardman et al. 2004). One hummock was installed on the project site (Map 6) and densely planted with Western hemlock (*Tsuga heterophylla*), Sitka spruce, Pacific ninebark, sword fern, salal (*Gaultheria shallon*) and red-osier dogwood. The following plant species were planted in the stream riparian area: slough sedge (*Carex obnupta*), sawbeak sedge (*Carex stipata*), dagger leaf rush (*Juncus ensifolius*), small-seeded bulrush (*Scirpus microcarpus*), lady fern (*Athyrium filix-femina*), water parsley (*Oenanthe sarmentosa*), red-osier dogwood, Pacific willow, Sitka willow (*Salix sitchensis*) and skunk cabbage (*Lysichiton americanus*). Species planted in the upland areas of the project site included: Deer fern (*Blechnum spicant*), sword fern, salal, Indian plum, baldhip rose (*Rosa gymnocarpa*), cascara (*Frangula purshiana*), big-leaf maple (*Acer macrophyllum*), red-osier dogwood, twinberry (*Lonicera involucrata*) and Sitka spruce.

In 2005, another team of UW-REN students conducted a restoration project immediately north of the one completed in 2004 (Map 2). The project involved removal of reed canarygrass, Himalayan blackberry and hedge false bindweed and planting of shrub and understory species. However, this project was not as successful as the others due to poor site preparation, inadequate invasive species removal and installation of very small plant material with low survival rates (personal communication, Liz Kearns 2006). No as built report was available at this time.

The Friends of Licton Springs supervise, maintain and regularly hand weed established planted areas in Zone 1.

### Zone 1 Recommendations

Specific restoration activities for this Zone in the 2001 VMP included removing invasive species and re-planting native species in Areas I and II of Zone 1. These activities have been accomplished to a large degree as a result of the restoration efforts conducted in this Zone. Recommendations for Area III of Zone 1 (palustrine scrub-shrub wetland) consisted of creating a pond in the depressional area to create wildlife habitat and suppress reed canarygrass. After consultation with biologists, it was decided to install a pond further downstream in Zone 2 (Blessing 2003). Suggestions for the upland areas of this zone included controlling reed canarygrass using mulch and cardboard in conjunction with native plantings (Seattle Department of Parks and Recreation 2001). Cardboard and mulch were installed in the upland areas in 2001 in conjunction with installation of native trees and shrubs including willows and red-osier dogwood. The Friends of Licton Springs have maintained these plantings on a regular basis since that time (Blessing 2003).

Even though a considerable amount of restoration has occurred in Area III, it is still heavily infested with reed canarygrass, particularly in the depressional areas along the stream channel. Transect four, which ran through this area showed that reed canarygrass had 55% cover in addition to 16% cover of European mountain ash. Current recommendations for Zone 1 include:

- Control of invasive tree species including European mountain ash and English holly and replanting with native species such as Sitka spruce, Oregon ash (*Fraxinus latifolia*), red alder, Western hemlock and Western red cedar. Monitoring of white poplar is also

recommended as this species is potentially invasive in Licton Springs. Removal of regenerating white poplar is encouraged whenever possible.

- Reed canarygrass is a significant problem in the palustrine scrub-shrub section of the zone. No canopy cover was recorded in this section during the survey. The following actions can be helpful in reducing the density and cover of reed canarygrass:
  - Establish conifer canopy cover to provide shade year-round. Trees can be planted in dryer areas that are not continuously inundated with water or in raised hummocks on the site. Recommended species include Western hemlock and Sitka spruce.
  - Several recent studies have found an inverse relationship between planted stem and shrub density and reed canarygrass density and biomass (Celedonia 2002, Kim et al. 2006). Suggested planted shrub density based on these two studies is 5,000 stems/acre or 3 feet on center. Existing plantings should be evaluated in this area and additional willow stakes or other shrub species can be installed in more sparse areas.
  - Where possible, shade cloth, cardboard and/or mulch is recommended to shade out the reed canarygrass. Small sections starting on the western edge of the reed canarygrass infestation can be treated in this manner, progressing further east when possible. This is a technique that has been used by the Friends of Licton springs with some success in the past.
  - A considerable amount of reed canarygrass in this area is very difficult to access as it is growing underneath and interspersed with the shrub layer. Studies have shown that targeted applications of aquatic approved herbicides can provide effective control of reed canarygrass (Tu, 2004). Herbicide should be applied in mid-summer or late fall (Tu, 2004). An herbicide that selectively targets only grass species should be used to prevent damage to shrubs and other non-grass species growing amid the reed-canarygrass. Herbicide applications must be performed by an applicator with a valid aquatic application license. This approach will not eliminate the seedbank and will require follow-up maintenance and weeding for a number of years. For further information about approved herbicides, contact the King County Noxious Weed Control Program.
- Continue to maintain of established plantings in the zone, particularly targeting Himalayan blackberry, hedge false bindweed and reed canarygrass. Long-term maintenance will be crucial to the success of the restoration project.

## **Zone 2**

Zone 2 is located in the north central portion of the park (Map 4). It is bounded to the north by North 97<sup>th</sup> Street, to the west by a large mowed lawn adjacent to the gravel trail running north through the park, to the south by a pedestrian bridge connecting the eastern and western sides of the park and to the east by a recently restored and landscaped area (zone 12) adjacent to the eastern lawn (Map 4). The northern and eastern portions of this zone are classified as palustrine

forested wetland, with the lower central region classified as a palustrine scrub-shrub wetland (Map 5). There are two culvert outlets in the northern part of this zone emitting runoff from the neighborhoods north of the park. Water from these culverts flows year-round and is the source for the majority of the water present in Licton Springs Park. The source of this water comes mainly from outlets of Haller Lake and Bitter Lake to the north of Licton Springs, mixed with street runoff from the surrounding neighborhood (Seattle Department of Parks and Recreation 2001). See the Densmore Drainage Basin study and the 2001 VMP for more information.

In the 2001 VMP, zone 2 was characterized by a mostly red alder (*Alnus rubra*) overstory with a percent cover of 20%. The shrub layer contained 15% Himalayan blackberry and less than 1% of salmonberry (Table 5). The herbaceous layer had high amounts of invasive species such as reed canarygrass (72%), field bindweed (6%) and climbing nightshade (7.5%) (Table 5).

Zone 2 Overstory and regenerating trees

The 2006 survey shows that the overstory is still dominated by red alder, with a percent cover of 30%. Two additional overstory species were recorded in this zone, Douglas fir (5%) and Western red cedar (2%). Six species of midstory and regenerating trees were recorded during the survey, of which two are native and four are non-native. Native species were composed of Oregon ash (4% cover) and Western red cedar (1%). Non-native invasive species included English holly, white poplar, European mountain ash and cherry laurel, which made up a total of 11% cover combined.

<b>Table 5. Overstory and regenerating tree species found in Zone 2 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.</b>			
<b>Scientific Name<sup>1</sup></b>	<b>Common Name</b>	<b>2001 Survey Average Percent Cover</b>	<b>2006 Survey Average Percent Cover<sup>2</sup></b>
<b>OVERSTORY TREES (Percent Cover)</b>			
<i>Alnus rubra</i>	red alder	20%	30%
<i>Pseudotsuga menziesii</i>	Douglas-fir		5%
<i>Thuja plicata</i>	Western red cedar		2%
<b>MIDSTORY AND REGENERATING TREES (Percent Cover)</b>			
<i>Fraxinus latifolia</i>	Oregon ash		4%
<b><i>Ilex aquifolium</i>*</b>	English holly		5%
<b><i>Populus alba</i>**</b>	white poplar		1%
<b><i>Prunus laurocerasus</i>*</b>	cherry laurel		T
<b><i>Sorbus aucuparia</i>**</b>	European mountain ash		5%
<i>Thuja plicata</i>	Western red cedar		1%

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006). Species denoted by \*\* are non-native invasive species which have not been given a legal designation at this time.

<sup>2</sup> T=Trace presence of species (less than 1%).

## Zone 2 Shrubs

A total of 17 shrub species were present during the survey in 2006, compared to two species in 2001 (Table 6). Sixteen of the 17 recorded species are native and one is non-native. At the time of survey, the most dominant species was Himalayan blackberry, which was present at a percent cover of 17%. Dominant native species in Zone 2 included red elderberry (8% cover), Scouler's willow (*Salix scouleriana*) (7% cover), red-osier dogwood (7%) and vine maple (5%) (Table 6). However, shortly after this survey, a large area east of the stream channel was cleared of Himalayan blackberry and other species and is now covered by cardboard and mulch. This area will continue to change with future plantings.

**Table 6. Shrub species found in Zone 2 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.**

Scientific Name <sup>1</sup>	Common Name	2001 Survey Average Percent Cover <sup>2</sup>	2006 Survey Average Percent Cover <sup>3</sup>
<i>Acer circinatum</i>	vine maple		5%
<i>Cornus stolonifera</i>	red-osier dogwood		7%
<i>Gaultheria shallon</i>	salal		1%
<i>Lonicera involucrata</i>	twinberry		1%
<i>Mahonia aquifolium</i>	tall Oregon grape		T
<i>Mahonia nervosa</i>	low Oregon grape		T
<i>Oemleria cerasiformis</i>	Indian plum		T
<i>Physocarpus capitatus</i>	Pacific ninebark		1%
<i>Rosa nutkana</i>	Nootka rose		1%
<b><i>Rubus discolor</i>*</b>	Himalayan blackberry	15%	17%
<i>Rubus spectabilis</i>	salmonberry	T	2%
<i>Rubus ursinus</i>	creeping blackberry		T
<i>Salix lucida ssp. lasiandra</i>	Pacific willow		4%
<i>Sambucus racemosa</i>	red elderberry		8%
<i>Salix scouleriana</i>	Scouler's willow		7%
<i>Symphoricarpos albus</i>	snowberry		2%
<i>Vaccinium parvifolium</i>	red huckleberry		3%

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006).

<sup>2 and 3</sup> T=Trace presence of species (less than 1%).

## Zone 2 Herbs

The 2006 survey showed that 20 species were present in the herbaceous layer in Zone 2 compared to eight species in 2001 (Table 7). Of the 20 species recorded, 10 are native, eight are non-native and two are undetermined. Extensive restoration activities have occurred in this zone and are reflected by the high cover of mulch (21%) present throughout the four transects placed in the zone.

The greatest change is reflected in the increase in diversity in this zone from three to 10 native species, as well as the substantial decrease in reed canarygrass from 72% in 2001 to 33% in 2006

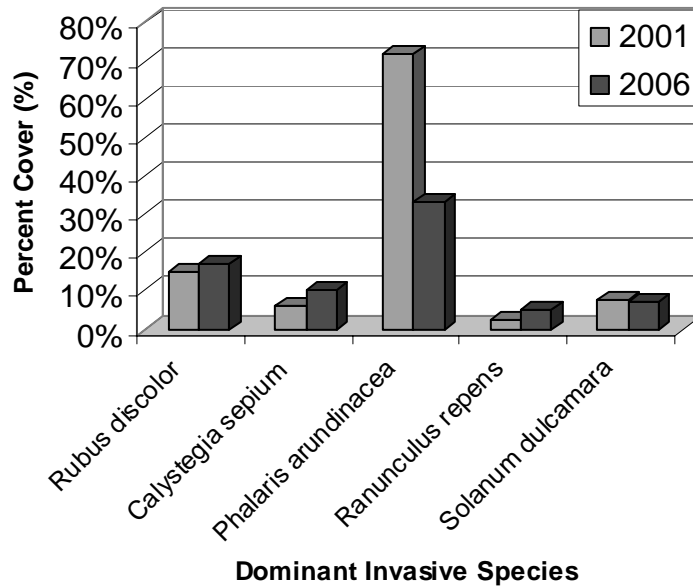
(Figure 2). At the time of this survey, the amounts of hedge false bindweed and climbing nightshade present in 2006 (10% and 7% respectively) were similar to the amounts present in 2001 (6% and 7.5% respectively) (Table 7). The amount of creeping buttercup has increased from 2001 to 2006 from 2.5% to 5% respectively. One new invasive species, English ivy (*Hedera helix*) was recorded during the survey at a cover of less than 1%. This species is listed as a Non-designated Noxious Weed in King County (King County 2006). Shortly after this survey was completed, a large area east of the stream channel was cleared of Himalayan blackberry and other species and is now covered by cardboard and mulch.

**Table 7. Herbaceous species found in Zone 2 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.**

Scientific Name <sup>1</sup>	Common Name	2001 Survey Average Percent Cover <sup>2</sup>	2006 Survey Average Percent Cover <sup>3</sup>	Life Form
<i>Agrostis sp.</i>	bentgrass		9%	Grass
<i>Athyrium filix-femina</i>	ladyfern	7%	2%	Herb
	bare dirt		3%	Other
<i>Blechnum spicant</i>	deerfern		T	Herb
<b><i>Calystegia sepium</i>*</b>	hedge false bindweed		10%	Herb
	coarse woody debris		1%	Wood
<b><i>Convolvulus arvensis</i>*</b>	field bindweed	6%		Herb
<i>Epilobium ciliatum</i>	fringed willowherb		T	Herb
<i>Equisetum telmateia</i>	giant horsetail rush	T	9%	Herb
	gravel		3%	Other
<b><i>Hedera helix</i>*</b>	English ivy		T	Herb
<b><i>Holcus lanatus</i></b>	velvetgrass		T	Grass
<i>Impatiens noli-tangere</i>	Western touch-me-not		T	Herb
<b><i>Lapsana communis</i></b>	nipplewort		2%	Herb
	litter		6%	Other
<i>Lysichitum americanus</i>	skunk cabbage	1%	3%	Herb
	mulch		21%	Other
<b><i>Mycelis muralis</i></b>	wall-lettuce		T	Herb
<i>Oenanthe sarmentosa</i>	water parsley		1%	Herb
	open water		1%	Other
<b><i>Phalaris arundinacea</i>*</b>	reed canarygrass	72%	33%	Grass
<i>Poa sp.</i>	bluegrass	1%	T	Grass
<i>Polystichum munitum</i>	sword fern		5%	Herb
<b><i>Ranunculus repens</i>**</b>	creeping buttercup	2.5%	5%	Herb
<i>Scirpus microcarpus</i>	small-seeded bulrush		3%	Grass
<b><i>Solanum dulcamara</i>*</b>	climbing nightshade	7.5%	7%	Herb
<i>Veronica americana</i>	American speedwell		1%	Herb

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006). Species denoted by \*\* are non-native invasive species which have not been given a legal designation at this time.

<sup>2 and 3</sup> T=Trace presence of species (less than 1%).



**Figure 2. Percent cover of dominant invasive species in 2001 and 2006 in Zone 2 in Licton Springs**

Zone 2 Past Restoration Efforts

Dominant features in Zone 2 include a stream flowing through the eastern portion of the zone, two culvert outlets, a small pond and seven vegetated hummocks (Map 6).

In 2003, a pond was installed in the southwestern portion of the zone by participants from the Woodland Park Zoo ZooCorps (Map 2). The pond is subjected to high amounts of runoff and does not adequately retain water (personal communication, Liz Kearns 2006). Various sedge species (*Carex spp.*) and native shrubs were planted along the margins of the pond (Blessing 2003). The area surrounding and upslope of the pond was covered with cardboard and mulch to suppress reed canarygrass. Plants were installed into the cardboard. Shadecloth was also used and is still located on the site (Blessing 2003).

The very southwestern portion of the zone which extends from the comfort station to the bridges has been altered in the past several years (Map 2). Seattle Parks and Recreation Department created a path and steps to connect the western portion of the park with the eastern portion. Friends of Licton Springs cleared the area of reed canarygrass and other invasive species, put down shadecloth and planted native species by the trails.

Emergent vegetation consisting of various sedge species was installed in the northern part of the zone adjacent to the northern hummocks. Native conifer and shrub species were also planted in the upland portions throughout the zone (Blessing 2003).

Seven hummocks were established by EarthCorps in 2002 (Map 6). These hummocks were densely planted with a mixture of conifer and native shrub species including salmonberry, salal, red-osier dogwood and red elderberry (Blessing 2003).

In the northwestern portion of the zone, a large patch of Himalayan blackberry was present adjacent to the lawn on the border of the forested area. This patch was cleared out in June 2006

by volunteers from the Windermere Realty and the Seattle Parks and Recreation Natural Area Crew (personal communication Liz Kearns 2006) (Map 2). Roots were removed and the area was mulched and planted with native species. Additional labor was provided by the Woodland Park Zoo ZooCorps.

In November 2006, a considerable amount of blackberry was removed in the eastern portion of the zone by the Conservation Corps (Map 2). This area was treated with cardboard and mulch and will be planted in the near future.

### Zone 2 Recommendations

In the 2001 VMP, recommendations for the upland areas focused on using cardboard, mulch and native plantings to suppress reed canarygrass. These recommendations have been enacted with some success. The northern portion of the zone is forested and has been planted with native tree and shrub species which are providing enough cover to reduce the percent cover of reed canarygrass in this area to 10%. However, a considerable amount of English holly (22% cover) and European mountain ash (19%) cover are present on Transect 8 in this portion of the zone (Map 3). Two other invasive tree species, cherry laurel and white poplar were recorded at covers of 1% and 5% respectively along Transect 8. English ivy was also present in small quantities (2% cover) in this area. Specific recommendations for the upland forest area include:

- Remove invasive tree species including English holly, European mountain ash, cherry laurel and white poplar and replanting with native species such as Western hemlock, Western red cedar or Sitka spruce.
- Maintain planted areas in the zone focusing on removal and monitoring of English ivy, reed canarygrass and invasive tree species.

The riparian section of the zone is located along the stream running through the east side of Zone 2 (Map 6). The northern riparian portion was covered with Himalayan blackberry at the time of the survey, which has since been removed. The southern riparian section is covered with reed canarygrass. Riparian vegetation should be established along both sides of the stream. Species that would do well here include willows, red-osier dogwood, salmonberry, Pacific ninebark, red alder, Oregon ash, Sitka spruce, vine maple, Douglas hawthorn (*Crataegus douglasii*), Oregon crabapple (*Malus fusca*) and twinberry.

The palustrine scrub-shrub section of the zone includes the central and southern area of Zone 2 (Map 5). Currently this section is heavily invaded by reed canarygrass and climbing nightshade. Transects 6 and 7 through this area had 78% and 42% cover of reed canarygrass and 13% and 10% of climbing nightshade respectively. The 2001 VMP recommended the installation of a small weir in the western-most section of the zone to dam up water in small depressions. The intent was to provide a constant water level to suppress reed canarygrass. A weir has not been installed to date, although one pond was created in the zone in 2003.

Restoration activities conducted in the scrub-shrub section of the zone have been conducted so as to meet social as well as ecological objectives. Currently the area is covered mainly with emergent vegetation and portions of the area do not have dense shrub cover. A view corridor in this area is desired by park users to provide views into the wetland. Minimizing transient encampments and illicit activities are also social goals. Restoration options for this area are

presented below as well as a discussion of the benefits and drawbacks associated with each option.

- **Option A:** Transform the area into a scrub-shrub wetland. This option would involve dense plantings of willows and other shrubs at a suggested density of 5,000 stems/acre or 3 feet on center. Although this would most likely reduce the biomass of reed canarygrass on site, it would result in a tall shrub layer that would not allow for a view corridor.
- **Option B:** Establish additional plant hummocks within the scrub-shrub wetland. The hummocks placed in this area in 2002 are well established and are beginning to provide cover to the surrounding area. Establishing additional hummocks and planting them with shrubs and conifers would potentially establish evergreen overstory cover in this area, which is currently sparse. Hummocks can be considered fill material in a wetland area and may require special permitting from the US Army Corps of Engineers. In addition, this solution would also create a tall shrub and tree layer that would not allow for a view corridor.
- **Option C:** Plant aggressive emergents and low-growing wetland shrub species. This option would involve establishing several test-plots with a combination of emergent and low-growing wetland shrub species and monitoring them over the course of several years (see Appendix B for details). Species that are shown to be most successful on the site after one or two years can be planted in appropriate areas of Zone 2. The benefits of this option, if successful, would be to preserve the view corridor in the wetland while potentially reducing biomass of reed canarygrass.
- **Option D:** Apply herbicides and aggressively re-plant emergent or low-growing wetland shrub species. Studies have shown that targeted applications of herbicides approved for use by Department of Ecology within aquatic areas can provide effective control of reed canarygrass (Tu, 2004). Herbicide should be applied in mid-summer or late fall (Tu, 2004). An herbicide that selectively targets only grass species should be used to prevent damage to shrubs and other non-grass species growing with the reed-canarygrass. Herbicide applications must be performed by an applicator with a valid aquatic application license. This approach will not eliminate the seedbank and will require follow-up maintenance and weeding for a number of years. For further information about approved herbicides, contact the King County Noxious Weed Control Program. If selected, this option can be combined with successful species selected from test-plots in the field trials documented in Appendix B.

### **Zone 3**

Zone 3 is located in the central portion of the park and is classified as a palustrine emergent wetland (Map 5). This zone is bounded by a trail to the north, a palustrine scrub-shrub area to the east (Zone 4), a palustrine forested wetland to the west (Zone 11) and extends just past a boardwalk to the south (Map 4). This zone has not had any considerable restoration activity apart from the construction of three plant hummocks within the zone. In 2001, the zone had a sparse overstory (20% canopy cover), consisting primarily of red alder on the boundary of the zone. The shrub layer consisted of several patches of blackberry and willow on the edge of the zone boundary. The interior of the zone was dominated by herbaceous species including reed

canarygrass (96% cover), climbing nightshade (45% cover) and smartweed (*Polygonum sp.*) (26% cover) in the southern portion of the zone. Although this zone was not surveyed using transects in 2006, observational data indicate that the species composition has remained fairly constant since 2001.

The three hummocks established in the zone were monitored during the course of this survey. The southern most hummock (Hummock 3) (Map 6) had the following species composition:

- Trees: Sitka spruce (three plants) between seven and nine feet tall, Oregon ash (one plant) seven feet tall and Western red cedar (one plant), seven feet tall.
- Shrubs: red-osier dogwood, Pacific willow, Pacific ninebark, salmonberry, Himalayan blackberry.
- Herbs: small-seeded bulrush, giant horsetail rush, water parsley, willowherb (*Epilobium sp.*), and smartweed. All species had less than 5% cover.

Hummock 2 (to the north of Hummock 3) (Map 6) had the following species composition:

- Trees: Western red cedar (seven feet tall) and Sitka spruce (three plants) between six and eight feet tall.
- Shrubs: red-osier dogwood, Pacific willow, red elderberry, salmonberry and Pacific ninebark
- Herbs: reed canarygrass, climbing nightshade, giant horsetail rush, hedge false bindweed, creeping buttercup and small-seeded bulrush were all present at less than 5% cover.

Hummock 1 (to the north of Hummock 2) (Map 6) had the following species composition:

- Trees: Western red cedar (three plants) between seven and nine feet tall and Sitka spruce (two plants) seven feet tall.
- Shrubs: red-osier dogwood, salmonberry, salal and Pacific ninebark
- Herbs: reed canarygrass, water parsley, small-seeded bulrush, hedge false bindweed and fringed willowherb (*Epilobium ciliatum*) were all present at less than 5% cover with the exception of small-seeded bulrush which was present at a cover of approximately 10%.

### Zone 3 Recommendations

Recommendations for this area are similar to those for the scrub-shrub area in Zone 2. This area is currently covered with emergent vegetation, consisting primarily of reed canarygrass.

Reducing reed canarygrass will improve the wetland characteristics, therefore control of reed canarygrass is the primary objective of the following recommendations.

- Establish a multi-layered forested community with a substantial conifer component surrounding the emergent wetland in this zone. Much of the forest surrounding the wetland in Zones 11 and 9 is primarily red alder, with a very small coniferous component. Establishing conifer cover and a multi-layered community will create year-round shade around the edge of the wetland to suppress reed canarygrass in those areas, and allow restoration efforts to expand further into the wetland from the edges. Appropriate conifer species in these areas include Western hemlock, Western red cedar and Sitka spruce.

Several options exist to control the reed canarygrass in this zone. Some recommendations will alter the current open character of this zone towards a more closed-canopy scrub-shrub wetland type:

- **Option A:** Transform the area into a scrub-shrub wetland. This option would involve dense plantings of willows and other shrubs at a suggested density of 5,000 stems/acre or 3 feet on center. Although this would most likely reduce the biomass of reed canarygrass on site, it would result in a tall shrub layer that would not allow for a view corridor.
- **Option B:** Establish additional plant hummocks within the scrub-shrub wetland. The hummocks placed in this area in 2002 are well established and are beginning to provide cover to the surrounding area. Establishing additional hummocks and planting them with shrubs and conifers would potentially establish evergreen overstory cover in this area, which is currently sparse. Hummocks can be considered fill material in a wetland area and may require special permitting from the US Army Corps of Engineers. In addition, this solution would also create a tall shrub and tree layer that would not allow for a view corridor.
- **Option C:** Plant aggressive emergents and low-growing wetland shrub species. A unique opportunity exists in this zone to establish test plots of emergent and low-growing shrub species and conduct monitoring with Friends of Licton Springs or a local school group to follow the test plots over at least two to three years (see Appendix B for details). These plots would provide site-specific information about which species combinations provide the greatest reed canarygrass suppression and which species exhibit the most vigor under the growing conditions in this zone. Species that are shown to be most successful on the site after one or two years can be planted in Zone 2 and expanded further in Zone 3. The benefits of this option, if successful, would be to preserve the view corridor in the wetland while potentially reducing biomass of reed canarygrass.
- **Option D:** Apply herbicides and aggressively re-plant emergent or low-growing wetland shrub species. Studies have shown that targeted applications of herbicides approved for use by Department of Ecology within aquatic areas can provide effective control of reed canarygrass (Tu, 2004). Herbicide should be applied in mid-summer or late fall (Tu, 2004). An herbicide that selectively targets only grass species should be used to prevent damage to shrubs and other non-grass species growing with the reed-canarygrass. Herbicide applications must be performed by an applicator with a valid aquatic application license. This approach will not eliminate the seedbank and will require follow-up maintenance and weeding for a number of years. For further information about approved herbicides, contact the King County Noxious Weed Control Program. If selected, this option can be combined with successful species selected from test-plots in the field trials documented in Appendix B.

## Zone 4

Zone 4 is located on the eastern side of the park and is bounded to the north by Zone 12, to the east by a large mown lawn, to the west by a palustrine emergent wetland (Zone 3) and to the south by a palustrine scrub-shrub wetland (Zone 5) (Map 4). This zone is classified as a palustrine forested wetland (Map 5).

An important feature in this zone is a pond that was installed by EarthCorps in 2003 (Blessing 2003). Since its installation, the pond has been almost completely filled in with sediment and emergent species, primarily water parsley. Three transects were established in this zone to measure current vegetation conditions, with one transect traversing the pond area (Map 3).

In the 2001 VMP, overstory in this zone consisted of 70% red alder canopy cover. English holly and cherry laurel were found in the regenerating layer at a percent cover of 4% and 2.5% respectively. The shrub layer consisted of Himalayan blackberry with 35% cover. The understory consisted of reed canarygrass (55%), field bindweed (27.5%) and a small amount of giant horsetail rush (5%) (Seattle Department of Parks and Recreation 2001).

### Zone 4 Overstory and regenerating trees

The 2006 survey shows that the overstory is still dominated by red alder, with a percent cover of 91% (Table 9). No other overstory species were recorded in this zone. Five species of regenerating trees were recorded during the survey, of which only one is native (Table 9). Grand fir (*Abies grandis*) was recorded in the regenerating layer at a percent cover of 2%. The remaining four species are considered to be invasive and include English holly, cherry laurel, sweet cherry (*Prunus avium*) and one-seed hawthorn (*Crataegus monogyna*), which made up a total of 18% cover combined. Sweet cherry and one-seed hawthorn are invasive species which are often present in natural areas and are dispersed by birds dropping seeds from surrounding horticultural plantings. These species have the ability to grow and reproduce in low-light forest conditions and can form dense thickets, preventing native species from establishing.

**Table 8. Overstory and regenerating tree species found in Zone 4 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.**

Scientific Name <sup>1</sup>	Common Name	2001 Survey Average Percent Cover	2006 Survey Average Percent Cover
<b>OVERSTORY TREES (Percent Cover)</b>			
<i>Alnus rubra</i>	red alder	70%	91%
<b>MIDSTORY AND REGENERATING TREES (Percent Cover)</b>			
<i>Abies grandis</i>	grand fir		2%
<i>Crataegus monogyna</i> **	one-seed hawthorn		3%
<i>Ilex aquifolium</i> *	English holly	4%	7%
<i>Prunus avium</i> **	sweet cherry		5%

<b>Table 8. Overstory and regenerating tree species found in Zone 4 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.</b>			
<b>Scientific Name<sup>1</sup></b>	<b>Common Name</b>	<b>2001 Survey Average Percent Cover</b>	<b>2006 Survey Average Percent Cover</b>
<b><i>Prunus laurocerasus</i>*</b>	cherry laurel	2.5%	3%

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006). Species denoted by \*\* are non-native invasive species which have not been given a legal designation at this time.

### Zone 4 Shrubs

A total of three shrub species were present during the survey in 2006, compared to one species in 2001 (Table 10). Two of the three recorded species are native and one is non-native. At the time of survey, the most dominant shrub species was Himalayan blackberry, which was present at a percent cover of 25%, indicating that blackberry continues to persist in this zone. Native species found in the zone included red-osier dogwood and salmonberry, which were present at 5% and 2% cover respectively.

<b>Table 9. Shrub species found in Zone 4 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.</b>			
<b>Scientific Name<sup>1</sup></b>	<b>Common Name</b>	<b>2001 Survey Average Percent Cover</b>	<b>2006 Survey Average Percent Cover</b>
<i>Cornus stolonifera</i>	red-osier dogwood		5%
<b><i>Rubus discolor</i>*</b>	Himalayan blackberry	35%	25%
<i>Rubus spectabilis</i>	salmonberry		2%

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006).

### Zone 4 Herbs

The 2006 survey showed that 13 species were present in the herbaceous layer in Zone 4 compared to three species in 2001 (Table 11). Of the 13 species recorded, four are native, eight are non-native and one is undetermined. Although there is a considerable amount of water parsley and giant horsetail rush in and around the pond area (15% and 16% cover respectively), the majority of this zone is covered by reed canarygrass (61% cover) and hedge false bindweed (22% cover) (Figure 3). This is similar to the 2001 survey which found that reed canarygrass had 55% cover in this zone and field bindweed had 27.5% cover in the zone (Table 11).

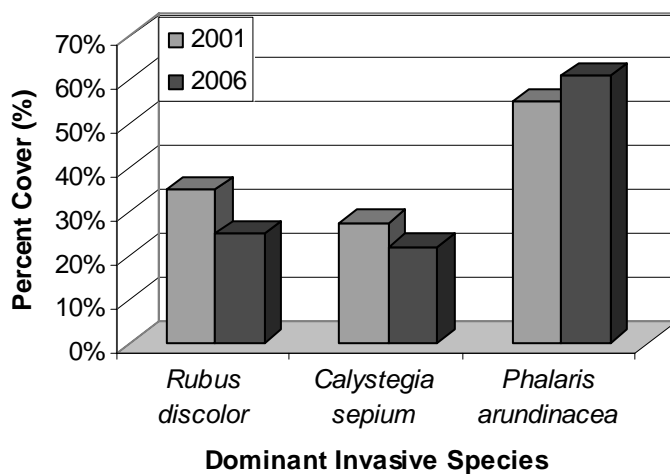
Small amounts of other invasive species were recorded which include herb Robert (less than 1% cover), English ivy (1% cover), creeping buttercup (less than 1% cover) and climbing nighshade (less than 1% cover).

**Table 10. Herbaceous species found in Zone 4 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.**

Scientific Name <sup>1</sup>	Common Name	2001 Survey Average Percent Cover	2006 Survey Average Percent Cover <sup>2</sup>	Life Form
<b><i>Calystegia sepium</i>*</b>	hedge false bindweed		22%	Herb
	coarse woody debris		1%	Wood
<b><i>Convolvulus arvensis</i>*</b>	field bindweed	27.5%		Herb
<i>Equisetum telmateia</i>	giant horsetail rush	5%	16%	Herb
<b><i>Geranium robertianum</i></b>	herb Robert		T	Herb
<b><i>Hedera helix</i>*</b>	English ivy		1%	Herb
<i>Impatiens noli-tangere</i>	Western touch-me-not		1%	Herb
<b><i>Lapsana communis</i></b>	nipplewort		1%	Herb
	mulch		4%	Other
<i>Oenanthe sarmentosa</i>	water parsley		15%	Herb
<b><i>Phalaris arundinacea</i>*</b>	reed canarygrass	55%	61%	Grass
<i>Poa sp.</i>	bluegrass		1%	Grass
<b><i>Ranunculus repens</i>**</b>	creeping buttercup		T	Herb
<i>Scirpus microcarpus</i>	small-seeded bulrush		1%	Grass
<b><i>Solanum dulcamara</i>*</b>	climbing nightshade		T	Herb
<b><i>Taraxacum officinale</i></b>	dandelion		5%	Herb

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006). Species denoted by \*\* are non-native invasive species which have not been given a legal designation at this time.

<sup>2</sup> T=Trace presence of species (less than 1%).



**Figure 3. Percent cover of dominant invasive species in 2001 and 2006 in Zone 4 in Licton Springs**

#### Zone 4 Past Restoration Efforts

The only significant restoration effort undertaken in this zone was the creation of the pond in 2003 by EarthCorps and some removal of invasive species around the pond area at the time (Blessing 2003). The 2001 VMP calls for removal of invasive species in this zone and installation of native plantings. However, these activities have not been completed to date.

#### Zone 4 Recommendations

Specific recommendations in this zone are similar to those in the 2001 VMP.

- Remove invasive tree species including English holly, cherry laurel, sweet cherry and one-seed hawthorn.
- Establish a conifer component in the regenerating layer by including species such as Sitka spruce, grand fir, Western red cedar and Western hemlock. Deciduous species such as Oregon ash and big-leaf maple can also be included.
- Remove invasive shrubs and herbaceous species such as Himalayan blackberry, hedge false bindweed and others with the roots intact followed by an application of cardboard and mulch to the site (specific recommendations for various species are presented in the Recommendations section of the 2001 VMP).
- Establish a native shrub layer in the zone by including species such as red-osier dogwood, salmonberry, Pacific ninebark, vine maple, Douglas hawthorn, twinberry, Oregon crabapple, red flowering currant and snowberry.
- Conduct regular maintenance of the pond and surrounding area to remove invasive species and reduce siltation.
- Conduct regular maintenance activities to remove invasive species and protect plantings.

#### **Zone 5**

Zone 5 is located immediately to the south of Zone 4 and is bordered by a boardwalk to the south, a large lawn area to the east, a palustrine forested wetland to the north (Zone 4) and a palustrine emergent wetland to the west (Zone 3) (Map 4). This zone is classified as a palustrine scrub-shrub wetland (Map 5).

The 2001 VMP found Pacific and Scouler's willow in this zone with reed canarygrass in the understory (Seattle Department of Parks and Recreation 2001). This was still found to be true in 2006.

#### Zone 5 Past Restoration Efforts

The only restoration efforts in this zone occurred just north of the bridge (Map 2). In 2003, the ZooCorps cleared a small wetland area adjacent to the bridge and installed salvaged native plants in this area. From a visual inspection, the plants appear to be establishing well, especially the dogwoods, which are forming a very dense layer within the wetland area.

## Zone 5 Recommendations

A significant feature in this zone is a storm drain located on the eastern boundary. The VMP states that the drain's elevation was lowered in the 1990s to allow more water to drain. The VMP recommends inserting a log dam above the diversion to allow water to remain in the wetland. However, a high amount of runoff already flows through the wetland in the winter months and the dam might exacerbate this problem (personal communication, Liz Kearns 2006). This action has not been completed at this time. This zone is heavily influenced by persistent flooding from the storm drain channel. In the fall of 2006 when this survey was conducted, a considerable amount of erosion and undercutting was noted in this zone due to water runoff into and past the drain. The creation of numerous side channels in the area are causing considerable erosion, preventing vegetation growth and contributing to sedimentation.

If corrective action is not taken, the structural integrity of this zone will continue to be compromised. If water is diverted from the existing drain and back into the wetland as suggested in the 2001 VMP, dredging the large pond in the south end of the park (Zone 7) could provide additional water storage capacity in the winter months. Siltation issues throughout the park will need to be addressed for this to be a viable long-term solution. A more thorough study of the hydrology and sediment transport throughout the park is strongly recommended.

## **Zone 6 and Former Zone 8**

Zone 6 and former zone 8 are adjacent to each other and are located in the south central portion of the park. These zones are bordered to the east and south by a lawn area, to the north by a trail and to the west by a stream and southern pond (Map 4). These zones are classified as palustrine forested wetlands and have similar overstory and shrub composition (Map 5). During the 2001 survey, two vegetation plots were installed in these two zones. Both zones had considerable Himalayan blackberry cover (34% and 10% respectively). Zone 6 was dominated by reed canarygrass (72.5% cover), field bindweed (40% cover) and climbing nightshade (13% cover), although some native shrub and herbaceous diversity was present in the zone (Seattle Department of Parks and Recreation 2001). Zone 8 was dominated by English ivy (21%) and climbing nightshade (10%). A considerable amount of shrub and herbaceous diversity was also present in this zone (Seattle Department of Parks and Recreation 2001).

Since 2001, intensive restoration efforts have taken place in both of these zones focusing on the removal of invasive species and planting with natives. As a result, the boundary between these two zones is not readily apparent. Due to the similarities in forest structure, vegetation composition and management of these two zones, Seattle Urban Nature recommends combining these two areas into one zone and renaming it to Zone 6 (Map 4).

Three transects were established in Zone 6 (Map 3). Since these zones were surveyed separately in 2001, data from both survey plots were averaged for Tables 12, 13 and 14.

Zone 6 Overstory and regenerating trees

The 2006 survey shows that the overstory remains dominated by red alder, with a percent cover of 67% (Table 12). No other overstory species were recorded in this zone. Five species of regenerating trees were recorded during the survey, of which two are native (Table 12). Grand fir and Western red cedar were found in the regenerating layer at a percent cover of 2% and 13% respectively. The 2001 survey recorded Pacific dogwood (*Cornus nuttallii*) with 15% cover in Zone 6, but this species did not appear in any of the transects established in the 2006 survey. The remaining three regenerating species are considered to be invasive and included English holly, cherry laurel and sweet cherry, which made up a total of 22% cover combined.

**Table 11. Overstory and regenerating tree species found in Zone 6 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.**

Scientific Name <sup>1</sup>	Common Name	2001 Survey Average Percent Cover <sup>2</sup>	2006 Survey Average Percent Cover
<b>OVERSTORY TREES (Percent Cover)</b>			
<i>Alnus rubra</i>	red alder	50%	67%
<b>MIDSTORY AND REGENERATING TREES (Percent Cover)</b>			
<i>Abies grandis</i>	grand fir		2%
<i>Cornus nuttallii</i>	Pacific dogwood	7%	
<b><i>Ilex aquifolium</i>*</b>	English holly	T	13%
<b><i>Prunus avium</i>**</b>	sweet cherry		8%
<b><i>Prunus laurocerasus</i>*</b>	cherry laurel		1%
<i>Thuja plicata</i>	Western red cedar		13%

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006). Species denoted by \*\* are non-native invasive species which have not been given a legal designation at this time.

<sup>2</sup> T=Trace presence of species (less than 1%).

Zone 6 Shrubs

A total of nine shrub species were present during the survey in 2006, the same number of species found in 2001 (Table 13). In 2006, all except for one species were found to be native. The amount of Himalayan blackberry in this zone has been considerably reduced since the 2001 survey, from 22% to 7% presently. There is considerable native shrub diversity in this zone, with many native species showing an increase in percent cover over the past five years. Snowberry and salmonberry are the dominant shrub species, with percent covers of 24% and 21%, up from less than 1% and 7% in 2001 respectively. Beaked hazelnut (*Corylus cornuta*) has a percent cover of 7% in the zone. Smaller amounts (less than 5%) of vine maple, low Oregon grape (*Mahonia nervosa*), Indian plum, red-flowering currant and creeping blackberry (*Rubus*

*ursinus*) were recorded. Several species not seen in this survey but present in small amounts in the 2001 survey were red-osier dogwood, Douglas hawthorn, baldhip rose and Pacific willow (Table 13). This discrepancy is most likely due to slightly different areas of the zone being surveyed between the two efforts.

**Table 12. Shrub species found in Zone 6 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.**

Scientific Name <sup>1</sup>	Common Name	2001 Survey Average Percent Cover <sup>2</sup>	2006 Survey Average Percent Cover
<i>Acer circinatum</i>	vine maple	4%	2%
<i>Cornus stolonifera</i>	red-osier dogwood	T	
<i>Corylus cornuta</i>	beaked hazelnut		7%
<i>Crataegus douglasii</i>	Douglas hawthorn	T	
<i>Mahonia nervosa</i>	low Oregon grape		1%
<i>Oemleria cerasiformis</i>	Indian plum		2%
<i>Ribes sanguineum</i>	red-flowering currant		3%
<i>Rosa gymnocarpa</i>	baldhip rose	1%	
<b><i>Rubus discolor</i>*</b>	Himalayan blackberry	22%	7%
<i>Rubus spectabilis</i>	salmonberry	7%	21%
<i>Rubus ursinus</i>	creeping blackberry	T	2%
<i>Salix lucida ssp. lasiandra</i>	Pacific willow	4%	
<i>Symphoricarpos albus</i>	snowberry	T	24%

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006).

<sup>2</sup> T=Trace presence of species (less than 1%).

### Zone 6 Herbs

A total of five species were found in the herbaceous layer in 2006 compared to 13 species in 2001. Of the five species recorded, two are native and three are non native (Table 14). This zone has undergone considerable changes in the past five years and looks quite different than it did in 2001. Mulch has the highest percent cover of any understory species at 36%, a result of extensive restoration activities. An additional 11% of the zone is covered by a gravel path that was recently installed (Table 14).

In 2001, 79% of the herbaceous layer was covered by invasive species such as field bindweed, English ivy, reed canarygrass and climbing nightshade. In 2006, invasive species covered an average of 10% of the zone, and several species were not present at all (Figure 4). Field bindweed and climbing nightshade, which were present at 20.5% cover and 11.5% cover respectively, were not found during this survey. English ivy which was present at 11% cover in 2001 is currently down to 3% cover. Reed canarygrass was present at 36% cover and is now at 7% cover. Two additional invasive species, yellow flag iris (*Iris pseudacorus*) and common periwinkle (*Vinca minor*), which were both present at covers of less than 1% were also not found during the survey. Yellow flag iris is classified as a Non-designated Noxious Weed in King County (King County 2006). Yellow flag iris was observed during the 2006 survey along the western edge of this zone where it transitions to the pond area of zone 7.

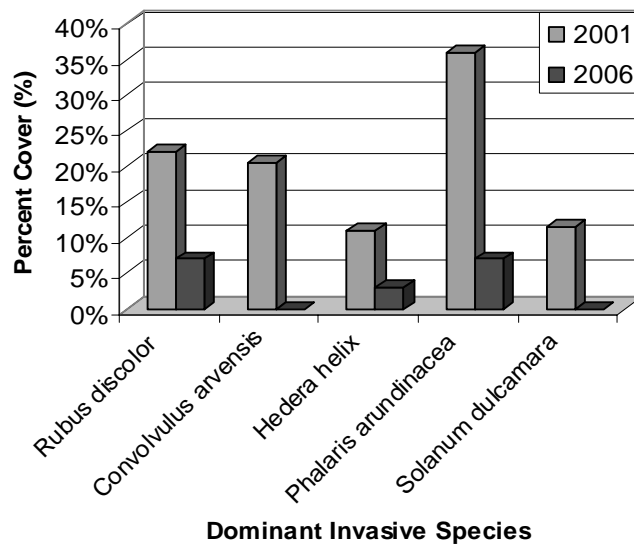
Currently, the herbaceous layer is dominated by mulch (36% cover), with smaller amounts of stinging nettle (7% cover) and sword fern (5% cover) (Table 14).

**Table 13. Herbaceous species found in Zone 6 in Licton Springs during the 2001 and 2006 surveys. Values represent percent cover of each species.**

Scientific Name	Common Name	2001 Survey Average Percent Cover <sup>2</sup>	2006 Survey Average Percent Cover <sup>3</sup>	Life Form
<b><i>Convolvulus arvensis</i>*</b>	field bindweed	20.5%		Herb
<i>Dryopteris expansa</i>	wood fern	2%		Herb
<i>Equisetum hyemale</i>	horsetail rush	3%		Herb
<b><i>Hedera helix</i>*</b>	English ivy	11%	3%	Herb
<b><i>Iris pseudacorus</i>*</b>	yellow flag iris	T		Herb
<b><i>Lapsana communis</i></b>	nipplewort		T	Herb
<i>Lysichitum americanus</i>	skunk cabbage	T		Herb
	mulch		36%	Other
	gravel		11%	Other
<b><i>Phalaris arundinacea</i>*</b>	reed canarygrass	36%	7%	Grass
<i>Poa sp.</i>	bluegrass	3%		Grass
<i>Polystichum munitum</i>	sword fern	T	5%	Herb
<b><i>Solanum dulcamara</i>*</b>	climbing nightshade	11.5%		Herb
<i>Tellima grandiflora</i>	fringecup	T		Herb
<b><i>Vinca minor</i>**</b>	common periwinkle	T		Herb
<i>Urtica dioica</i>	stinging nettle	T	7%	Herb

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006). Species denoted by \*\* are non-native invasive species which have not been given a legal designation at this time.

<sup>2</sup> and <sup>3</sup>T=Trace presence of species (less than 1%).



**Figure 4. Percent cover of dominant invasive species in 2001 and 2006 in Zone 6 in Licton Springs**

### Zone 6 Past Restoration Efforts

Work in this zone was initiated by a volunteer who wanted to restore an area of the park as part of a birthday celebration. This zone was selected by the Friends of Licton Springs as a good candidate for this effort. A gravel path was installed in this zone in 2005 as an Eagle Scout Project. Additional maintenance, weeding and plant installations were performed by Windermere realty in 2004 (Map 2). Since that time, maintenance has been performed by the Friends of Licton Springs.

### Zone 6 Recommendations

Specific recommendations in this zone include.

- Remove invasive tree species including English holly, cherry laurel and sweet cherry.
- Continue regular maintenance and weeding of Himalayan blackberry, English ivy and other invasive species.
- Plant native species throughout cleared areas.

### **Zone 7**

Zone 7 is located in the southwestern corner of the park (Map 4). This zone is classified as palustrine emergent wetland (Map 5) and contains a 2500 square foot pond, which was installed in 1974. A rock weir controls the water level and forms the outlet of the pond. Water overflow is channeled into a large storm drain (Seattle Department of Parks and Recreation 2001). Over time, the pond has silted in and is overgrown with vegetation. No restoration activities have taken place in this area aside from a one-time effort to remove yellow flag iris from the pond.

In 2001, this zone had a 20% overstory canopy of red alder surrounding the pond. The shrub layer consisted of Pacific willow (14%), and salmonberry (1%). The herbaceous layer contained reed canarygrass, yellow flag iris (13%), giant horsetail rush (5%), field bindweed (2.5%), climbing nightshade (1%), horsetail rush (less than 1%), various sedge species (less than 1%), and common cattail (*Typha latifolia*) (less than 1%) (Seattle Department of Parks and Recreation 2001). Observational data from 2006 confirm the presence of these species and a possible increase in the yellow flag iris cover.

### Zone 7 Recommendations

Recommendations from the VMP include dredging the pond, removing yellow flag iris and augmenting native species plantings surrounding the pond. None of these recommendations have been implemented at this time. Yellow flag iris is a highly invasive species in wetland environments. It reproduces through rhizomes as well as seed and is very difficult to control once it escapes into the natural environment. Currently, yellow flag iris is present in the pond area and the surrounding forest and has not yet escaped into the adjacent wetland areas (Zone 3). It is highly recommended that this species be removed before it invades other areas of the park.

Several issues surround the potential dredging of the pond. It is unknown what materials have accumulated over the past 30 years and it is possible that some toxins or hazardous materials may exist in the sediment. Testing of the sediment within the pond is recommended to provide

information to the parks department and the community of possible contamination. Following testing, the pond should be dredged if feasible. Cleaning and dredging of the pond will allow for improved function as a water catchment during high flow events. The removal of vegetation from the surface will also encourage wildlife use of the pond.

### **Zone 8**

This zone was merged with Zone 6 during the course of this survey.

### **Zone 9**

Zone 9 is located on the western side of the park directly to the north of Zone 7. It is bounded on the south side by the southern pond (Zone 7), on the west side by a large lawn area, to the north by a bridge, and to the east by a stream (Map 4). This zone is classified as a palustrine forested wetland (Map 5). No transects were sampled in this zone during the 2006 survey.

In 2001, the overstory in this zone was dominated by red alder (70% cover) with English holly (5%) and cherry laurel (less than 1%) in the understory. The shrub layer consisted of salmonberry (13%), beaked hazelnut (1%) and snowberry (less than 1%). The herbaceous layer consisted of giant horsetail rush (46%), field bindweed (15%), bluegrass (15%), yellow flag iris (11%), and climbing nightshade (10%) (Seattle Department of Parks and Recreation 2001). Observations in 2006 indicate that the current species composition is similar to that reported in the 2001 VMP. It was noted however, that the amount of yellow flag iris in this zone appears to have increased.

### Zone 9 Recommendations

- Remove invasive tree species including English holly and cherry laurel.
- Establish a conifer component in the regenerating layer by including species such as Sitka spruce, grand fir, Western red cedar and Western hemlock, particularly on the edge of the emergent wetland (Zone 3).
- Increase the cover and diversity of the shrub layer in the zone by planting additional native species such as red-osier dogwood, beaked hazelnut, Pacific ninebark, vine maple, Douglas hawthorn, twinberry, Oregon crabapple, red flowering currant and snowberry.
- Remove and control the yellow flag iris infestation in this zone before it spreads into the adjacent wetland (Zone 3). Small stands, such as the one currently present in this zone can be manually removed by digging out and removing the rhizome completely. All dug-up rhizomes should be removed from the site to avoid re-rooting. Seedlings can be hand-pulled in early spring. Areas where control has been carried out should be monitored for several years and any remaining plants pulled or dug up (King County, 2007). For more information, a draft of the King County Noxious Weed Program yellow flag iris BMP is included in Appendix A.
- Remove invasive herbaceous species such as hedge false bindweed and climbing nightshade by removing as much of the roots as possible followed by an application of cardboard and mulch to the site (see the Recommendations section for specific recommendations for hedge false bindweed and climbing nightshade).
- Conduct regular maintenance activities to remove invasive species and protect plantings.

## **Zone 10**

In the 2001 VMP, zone 10 was located on the eastern edge of zones 6 and 8. This zone was described as a landscaped area made up mostly of lawn and three planted Western red cedars. This area is an extension of the large outer core of the park which is composed of mowed lawn. Although the 2001 VMP suggested transforming this section into a forested stream buffer, this has not been completed at this time. Current vegetation in Zone 6 extends to the western side of the stream but does not continue past the stream channel on the eastern side. There is a small patch of salmonberry east of the channel just south of bridge, which could be extended south along the stream with additional plantings.

Management of this zone as a landscaped lawn area is expected to continue in the future. Seattle Urban Nature suggests that this zone be moved to the southwestern section of the park, adjacent to Zones 7 and 9, where recent restoration activities have taken place (Map 4).

### Zone 10 Past Restoration Efforts and Recommendations

Restoration activities in this area in late 2006 consisted of removing a large section of Himalayan blackberry and Rugosa rose (*Rosa rugosa*), mulching, and replanting mainly with vine maple and Sitka spruce. Some Himalayan blackberry still remains extending into the forested portion of Zone 9 and will need to be removed. Additional plantings in this area are recommended to increase species diversity and density of planted shrubs and trees.

## **Zone 11**

Zone 11 is located on the western edge of the park adjacent to the playground (Map 4). This zone is classified as a palustrine forested wetland (Map 5). The 2001 VMP states that this zone is dominated by a red alder canopy. However no formal vegetation surveys or descriptions were conducted at the time due to the small size of the zone (Seattle Department of Parks and Recreation 2001). No transects were sampled in this zone during the 2006 survey. In 2006, this zone was dominated by young alders with an overstory canopy cover of greater than 70%. Several Western red cedars and Douglas-firs were also present in this zone. Regenerating tree species included English holly, sweet cherry, cherry laurel, and a small patch of small diameter Norway maple (*Acer platanoides*) directly east of the comfort station near the path.

The shrub component was made up of red elderberry, beaked hazelnut, snowberry and vine maple. Several stands of Himalayan blackberry were also present in this zone. The herbaceous layer was composed of creeping blackberry, sword fern and giant horsetail rush. Invasive species included reed canarygrass, common periwinkle and climbing nightshade.

### Zone 11 Recommendations

Recommendations for this zone include:

- Remove invasive tree species including English holly, sweet cherry, cherry laurel, and Norway maples.

- Establish a conifer component in the regenerating layer by including species such as Sitka spruce, grand fir, Western red cedar and Western hemlock, particularly on the edge of the emergent wetland (Zone 3).
- Remove Himalayan blackberry and invasive herbaceous species from zone, apply cardboard and mulch to cleared areas and replant with native species.
- Conduct regular maintenance activities to remove invasive species and protect plantings.

## Zone 12

Zones 12 and 12A are located on the northeastern perimeter of the forested area in the park (Map 4). In 2001, these areas were heavily infested with Himalayan blackberry. No vegetation data were collected in these zones during the 2001 survey due to their small size and lack of vegetative diversity (Seattle Department of Parks and Recreation 2001). In 2006, three transects were established in these zones as extensions of transects that originated in zones 2 and 4 (Map 3).

### Zone 12 Overstory and regenerating trees

The 2006 survey shows that the overstory is dominated by red alder, with a percent cover of 61% (Table 15). No other overstory species were recorded in this zone. Eight species of regenerating trees were recorded during the survey, of which three are native and five are non-native (Table 15). Western red cedar, Sitka spruce and Douglas-fir were found in the regenerating layer at a percent cover of 13%, 3% and 1% respectively. The remaining five regenerating species are considered to be invasive and included English holly, white poplar, cherry laurel, sweet cherry and European mountain ash which made up a total of 8% cover combined (Table 15).

**Table 14. Overstory and regenerating tree species found in Zones 12 and 12a in Licton Springs during the 2006 survey. Values represent percent cover of each species.**

Scientific Name <sup>1</sup>	Common Name	2006 Survey Average Percent Cover <sup>2</sup>
<b>OVERSTORY TREES (Percent Cover)</b>		
<i>Alnus rubra</i>	red alder	67%
<b>MIDSTORY AND REGENERATING TREES (Percent Cover)</b>		
<b><i>Ilex aquifolium</i>*</b>	English holly	T
<i>Picea sitchensis</i>	Sitka spruce	3%
<b><i>Populus alba</i>**</b>	white poplar	3%
<b><i>Prunus avium</i>**</b>	sweet cherry	3%
<b><i>Prunus laurocerasus</i>*</b>	bay laurel, cherry laurel	1%
<i>Pseudotsuga menziesii</i>	Douglas-fir	1%
<b><i>Sorbus aucuparia</i>**</b>	European mountain ash	T
<i>Thuja plicata</i>	western red cedar	13%

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006). Species denoted by \*\* are non-native invasive species which have not been given a legal designation at this time.

<sup>2</sup> T=Trace presence of species (less than 1%).

## Zone 12 Shrubs

A total of eight shrub species were present during the survey in 2006 (Table 16). All except for one species are native. The amount of Himalayan blackberry in this zone has been considerably reduced from 2001 to 3% presently. There is considerable native shrub diversity in this zone, with many native species planted in the past several years. Snowberry is the most dominant shrub species, with a percent cover of 11%. Smaller amounts (less than 5% cover) of vine maple, red-osier dogwood, twinberry, salmonberry, creeping blackberry and red elderberry were also recorded (Table 16).

<b>Scientific Name<sup>1</sup></b>	<b>Common Name</b>	<b>2006 Survey Average Percent Cover<sup>2</sup></b>
<i>Acer circinatum</i>	vine maple	2%
<i>Cornus stolonifera</i>	red-osier dogwood	3%
<i>Lonicera involucrata</i>	twinberry	1%
<b><i>Rubus discolor</i>*</b>	Himalayan blackberry	3%
<i>Rubus spectabilis</i>	salmonberry	1%
<i>Rubus ursinus</i>	creeping blackberry	T
<i>Sambucus racemosa</i>	red elderberry	1%
<i>Symphoricarpos albus</i>	snowberry	11%

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006).

<sup>2</sup> T=Trace presence of species (less than 1%).

## Zone 12 Herbs

A total of nine species were found in the herbaceous layer in 2006, of which three are native and six are non-native (Table 17). Mulch and litter dominate the understory with percent covers of 36% and 21% respectively. Sword fern has the highest percent cover of herbaceous species with a percent cover of 15%. Smaller amounts of cleavers (*Galium aparine*) (5% cover) and giant horsetail rush (4% cover) were also present in this zone (Table 14). Invasive species are still present in this zone, including hedge false bindweed (5% cover), English ivy (1% cover), reed canarygrass (8%) and creeping buttercup (11%) (Table 17). However, a considerable amount of native diversity has been established and should provide adequate cover to begin shading out undesirable species within the next five years.

**Table 16. Herbaceous species found in Zone 12 and 12a in Licton Springs during the 2006 survey. Values represent percent cover of each species.**

Scientific Name	Common Name	2006 Survey Average Percent Cover <sup>3</sup>	Life Form
<b><i>Calystegia sepium</i>*</b>	hedge false bindweed	5%	Herb
	coarse woody debris	T	Other
<i>Equisetum telmateia</i>	giant horsetail rush	4%	Herb
<i>Galium aparine</i>	cleavers	5%	Herb
<b><i>Hedera helix</i>*</b>	English ivy	1%	Herb
<b><i>Lapsana communis</i></b>	nipplewort	1%	Herb
	litter	21%	Other
	mulch	36%	Other
<b><i>Phalaris arundinacea</i>*</b>	reed canarygrass	8%	Grass
<i>Polystichum munitum</i>	sword fern	15%	Herb
<b><i>Ranunculus repens</i>**</b>	creeping buttercup	11%	Herb
<b><i>Taraxacum officinale</i></b>	dandelion	T	Herb

<sup>1</sup> Species in bold are non-native species. Species denoted by \* are non-native invasive species which have been given a legal designation by the King County Noxious Weed Program (King County 2006). Species denoted by \*\* are non-native invasive species which have not been given a legal designation at this time.

<sup>2</sup> and <sup>3</sup>T=Trace presence of species (less than 1%).

#### Zone 12 Past Restoration Efforts

Restoration efforts began in 2002 and consisted of removing Himalayan blackberry, applying cardboard and mulch to the areas and replanting with native species (Blessing 2003).

#### Zone 12 Recommendations

Specific recommendations in this zone include.

- Remove invasive tree species including English holly, white poplar, cherry laurel, sweet cherry and European mountain ash.
- Continue regular maintenance and weeding of Himalayan blackberry, reed canarygrass, creeping buttercup and other invasive species.

### **IV. MANAGEMENT RECOMMENDATIONS**

Licton Springs Park is a historic landmark with a rich and diverse history of use by Native Americans and early settlers. The formal construction of the park in 1974 preserved the remaining natural vegetation and excavated the southern spring into a small pond (<http://www.lictonsprings.org>). At this time, the areas surrounding the wetlands were developed into a formal park setting with ornamental plants and wide lawns. In urbanized Seattle, natural areas with wetland habitat are increasingly rare. This park provides an important opportunity for the community to participate in restoring and shaping the future of this unique habitat.

## Past Restoration History

Little effort was made to maintain or enhance the natural areas of the park until approximately seven years ago. As a result, there was high cover of invasive species and little native diversity throughout much of the park. Since the formation of the Friends of Licton Springs in 2000, intensive efforts by a number of groups and individuals have transformed many areas of the park. Specific groups have included EarthCorps, the Woodland Park ZooCorps, the University of Washington Restoration Ecology Network (UW-REN), Eagle Scouts, and the Seattle Parks and Recreation Natural Area Crew. These restoration efforts have drastically reduced the impact of invasive species and contributed to an increased diversity of native plant species important for wildlife throughout the park.

Although much work has been accomplished, considerable effort will be required to restore and maintain the park into the future. The areas that have been recently planted will require ongoing maintenance and upkeep until they reach maturity. Only through continued dedication by all stakeholders will these efforts succeed. Table 18 gives a brief outline of the work that has been completed at each of the general restoration sites shown in Map 2.

<b>Site #</b>	<b>Zone</b>	<b>Date</b>	<b>General Description</b>	<b>Collaborating Partners</b>
1	1	2000-2001	Invasive species/Japanese knotweed removal and native planting	Friends of Licton Springs, Treemendous
2	1	2005	Invasive species removal and native planting	UW-REN
3	1	2004	Invasive species removal and native planting	UW-REN
4	1	2004	Invasive species removal and native planting	Friends of Licton Springs
5	2	2006	Blackberry removal, cardboard and mulch	Windermere Realty, Seattle Parks Natural Area Crew, ZooCorps
6	2	2002	7 vegetation hummocks installed	EarthCorps
7	2	2006	Blackberry removal, cardboard and mulch	Conservation Corps, Seattle Parks Department (SPD), Seattle Public Utilities (SPU)
8	12	2005	Blackberry removal, cardboard and mulch, native planting	Golds Gym and Friends of Licton Springs
9	2	2003	Pond installation, cardboard and mulch, native planting	ZooCorps
10	2	2005	Invasive removal, cardboard and mulch, native planting	Friends of Licton Springs, SPD
11	12	2004	Blackberry removal, cardboard and mulch, native planting	Friends of Licton Springs

**Table 17. Former restoration activities at Licton Springs.**

<b>Site #</b>	<b>Zone</b>	<b>Date</b>	<b>General Description</b>	<b>Collaborating Partners</b>
12	4	2003	Pond installation, invasive species removal	EarthCorps
13	5	2003	Invasive species removal and native planting of salvaged plants	ZooCorps
14	10	2006	Blackberry/rose removal, cardboard and mulch	Eagle Scout Project, SPD
15	6	2004	Invasive species removal and native planting	Volunteer, Friends of Licton Springs, Windermere
16	6	2005	Gravel path installed	Eagle Scout Project

### **Evaluation of Past Restoration Methods**

A variety of restoration methods have been used over the past seven years to manage the invasive species in Licton Springs. Data collected during the survey and a compilation of the restoration history of each zone in the park (Table 18) allows a general evaluation of the success of various restoration methods for some of the key species present.

#### Field bindweed and climbing nightshade

These two species have been managed mostly by hand-pulling and applying cardboard and mulch over the cleared areas. This was followed by planting with native trees and shrubs. Although this process is time and labor intensive as the re-sprouts must be repeatedly pulled out, it has proven very successful in areas where regular weeding occurs.

#### Himalayan blackberry

The main method of fighting Himalayan blackberry has involved removing the plants, digging out roots and covering the area with layers of cardboard and mulch, followed by planting native trees and shrubs. This tactic has been highly successful at removing the blackberry and preventing its return. Regular maintenance by the Friends of Licton Springs by hand-weeding resprouting blackberry over a number of years has been instrumental at preventing reinfestation.

#### Japanese knotweed

A large patch of Japanese knotweed was present in the northwestern portion of the park (Zone 1) in 2000. The plants were manually removed and much of the root system was dug up. Landscape fabric was then laid down in the area and was kept in place for four years. Native trees and shrubs were planted through the landscape fabric. Although the landscape fabric was difficult to remove in 2004, it successfully prevented a reinfestation of Japanese knotweed in the area. Hand weeding of newly germinating Japanese knotweed has kept the cover of the plant down to almost nothing.

#### Reed canarygrass

Reed canarygrass poses one of the most significant management challenges in Licton Springs due to the widespread invasion of all of the wetland areas in the park. The Friends of Licton

Springs have tried several techniques to combat reed canarygrass, and have met considerable success in the forested portions of the park. However, many of the scrub/shrub and emergent areas still have a significant reed canarygrass problem. Below is a discussion of the various methods used in the past:

- *Cardboard and mulch*: This technique involves applying a thick layer of cardboard and mulch on top of reed canarygrass to shade it out, followed by planting trees and shrubs through the cardboard. New layers of cardboard and mulch are replaced each year as previous layers decompose. This method is effective, but very labor intensive as hand weeding must occur regularly to keep the reed canarygrass from regrowing until the seed bank and roots are exhausted.
- *Weedcloth*: This method has met with partial success in the wetlands. In areas where there is little sediment deposition, this method has proved effective if the weedcloth is kept in place for a number of years. However, there are several areas in the wetlands that are subject to high levels of sediment deposition and where weed barrier has not been successful as it gets covered quickly and provides new substrate for reed canarygrass infestation. One drawback to this method is the difficulty of removing the weedcloth after a number of years in the ground, although this could potentially be overcome by using a biodegradable barrier that does not need to be removed.
- *Tree islands*: A number of tree islands have been established in the wetlands over the past five years. These islands are raised beds made of coir logs and densely planted with tree and shrub species. Regular maintenance including thinning shrubs and weeding have allowed all the tree islands to establish successfully and they are now beginning to provide cover to the surrounding areas. The installation of these hummocks has also succeeded in increasing the structural complexity of the wetland areas.
- *Shrub planting*: A dense stand of willows was planted along the riparian area in Zone 1 and is adjacent to a dense natural stand of salmonberry in the riparian corridor. Although both the willows and salmonberry are very thick and provide almost contiguous canopy cover, there is a considerable amount of reed canarygrass growing beneath the shrub layer at this time. This is most likely due to the deciduous nature of the canopy which does not provide continuous canopy cover over the entire year.

## **Overall Park Priorities**

Management recommendations for Licton Springs have been separated into three categories:

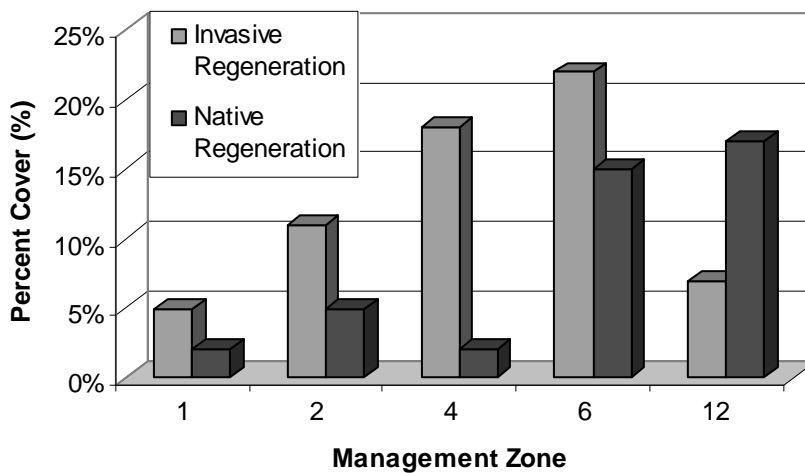
- Short-term priorities. These are actions that are of high importance and could be completed within the next year
- Medium-term priorities. These are actions that will take planning to complete and could be completed within the next two to three years
- Long-term priorities. These are on-going activities that will take many years to accomplish.

### Short-term priorities

1. Maintain and plant recently cleared areas (Zones 2, 10 and 12) and planting sites.
2. Monitor newly established field test-plots in Zone 3. Maintenance of this area should include hand-weeding of reed canarygrass from the non-control treatment if possible. Monitoring of species composition and plant mortality should take place twice a year in

the summer and fall for at least two years following planting. After this period it will be possible to evaluate the success of the planted species.

3. Establish a riparian vegetation buffer in Zone 2 along the stream bank. This is further discussed in specific recommendations for Zone 2.
4. Remove yellow flag iris from Zones 7 and 9 in the southern portion of the park before it spreads further and escapes into adjacent wetland areas (see more information about Best Management Practices in Appendix A). Removal of yellow flag iris from Zone 7 may require dredging of the pond, which is addressed in mid-term priorities.
5. Remove regenerating invasive tree species such as English holly, cherry laurel, European mountain ash, and white poplar. Figure 5 shows the percent cover of invasive and native trees recorded in the regeneration layer during the survey. Only Zone 12 had more native trees regenerating than invasive trees.



**Figure 5. Percent cover of invasive and native regenerating trees recorded in Zones 1, 2, 4, 6 and 12 during the 2006 survey in Licton Springs.**

Medium-term priorities

6. Work with Seattle Public Utilities (SPU) to study the current hydrology, and to develop a long term plan to mitigate existing erosion and sedimentation problems within the park. Initial steps include:
  - a. Test sediment within the southern pond to determine whether contamination has occurred
  - b. Dredge southern pond to improve water catchment and wildlife use
  - c. Clarify desired drainage routes and existing stream channel locations with specific strategies to appropriately divert water during high flow events
  - d. Address existing erosion problems, especially in Zones 2 and 5
7. In collaboration with SPU, local schools and community groups, develop a water quality and sediment monitoring program for the park. Specific steps include:
  - a. Develop a sediment monitoring program within the park to obtain information about sediment loads and transport within the wetland areas of the park

- b. Develop a water quality monitoring program to obtain information about the quality of the water entering the park through the drainage system, what types and concentrations of pollutants are present and how they are dispersed throughout the wetland
- 8. Continue removal of reed canarygrass from Zones 1 and 2 to reduce seed source to downstream areas of the park. Specific recommendations for these areas include:
  - a. Establish conifer overstory and a dense shrub layer around emergent wetland areas in Zones 1 and 2 to reduce reed canarygrass
  - b. Increase shrub density in Zone 1 and continue to utilize the cardboard/mulch method followed by hand weeding in restored areas
- 9. Establish conifer overstory and a dense shrub layer in forested areas surrounding Zone 3 to provide shade to Zone 3. These forested zones include Zones 4, 9 and 11.
- 10. Develop a long term strategy to reduce the reed canarygrass from Zones 2, 3, 4, 5 and 7. This strategy can include results from the established test-plots, if successful, to manage some areas as low-shrub wetlands. Specific reed canarygrass recommendations are available below. During the creation of the plan, stakeholders and participants should decide what successional stage or habitat type to manage each wetland area in the park for, and select appropriate methods from the options available below as well as methods that have been used in the past.
- 11. Continue regular maintenance of previously restored areas.

#### Long-term priorities

- 12. Implement long term plan to mitigate existing erosion and sedimentation problems within the park (See Priority 6).
- 13. Implement reed canarygrass plan (See Priority 9).
- 14. Continue maintenance of previously restored areas.
- 15. Expand restoration activities into the southern portion of the park including Zones 3, 4, 7 and 9.

### **Reed Canarygrass Recommendations**

One of Licton Springs greatest management concerns is the widespread invasion of reed canarygrass throughout much of the wetland areas of the park. While efforts have reduced the cover of this aggressive species in the northern portion of the park, the central and southern wetlands remain heavily infested. Reed canarygrass suppresses native plant growth and establishment and creates dense monocultures that provide little value for wildlife (Washington State Department of Ecology, 2006). These infestations may also have a detrimental effect on the hydrology of the system by increasing siltation within the wetland.

The following is a summary of possible efforts that can be utilized to reduce the current impact of reed canary grass infestations throughout the park. It is recommended that these prospective treatments be tested for viability and used in combination throughout different areas of the park where deemed appropriate. For more details, see the recommendations discussion for zone 3 in this report.

- Continue with current efforts to cover small areas with cardboard and mulch, followed by hand weeding. This method has worked fairly well in the past (see Evaluation of Past Restoration Methods section above), although it is time and labor intensive. Weeding and maintenance activities such as applying more cardboard and mulch need to be conducted on a regular basis, at least once yearly.
- Transform the area into a scrub-shrub wetland by planting willows and other shrubs at a suggested density of 5,000 stems/acre or 3 feet on center.
- Establish additional tree/shrub hummocks with a conifer component within the scrub-shrub wetlands to provide year-round shade.
- Use herbicides in conjunction with aggressive re-planting of emergent or low-growing wetland shrub species in areas that have been treated.
- Plant aggressive emergents and low-growing wetland shrub species throughout infested areas (pending the results of field-trials) (see Appendix B for more information).

### **Deadly Nightshade and Hedge False Bindweed Recommendations**

These two species are similar in growing habit and are often found in similar habitats, i.e. disturbed wetland and riparian areas. Both species easily re-sprout from roots and root fragments and require similar management techniques. Manual control involves removing as much of the root as possible either by pulling or digging. Because the plants can re-root if they are left lying on the soil, it is important to remove the plant material from the site. It is unlikely that a single treatment will control the population entirely, and therefore additional removal will be necessary over several years. If the site is not too wet, cardboard or mulch can be applied to suppress further growth (King County 2000). For information about chemical control, please see the specific “Bittersweet Nightshade” and “Field Bindweed” information in Appendix A.

### **Native Plant Recommendations**

A palette of native plant species to plant in Licton Springs was recommended in the 2001 VMP (Seattle Department of Parks and Recreation 2001). Additional plant species have been suggested in this addendum. However, there is no one definitive list of plants that can be compiled to meet every possible scenario. Plants in the park can be selected based on numerous criteria such as their usefulness in restoration situations, for wildlife value, for biodiversity, for aesthetic reasons, and many others. Many good resources are available that provide guidance for selecting appropriate native plants. A short resource list is available below:

- S.S. Cooke. 1997. *A Field Guide to the Common Wetland Plants of Western Washington and Northwestern Oregon*. Seattle Audubon Society, Seattle, WA.
- A.R. Kruckeberg. 1996. *Gardening with Native Plants of the Pacific Northwest*. Second Edition. University of Washington Press, Seattle, WA.
- R. Link. 1999. *Landscaping for Wildlife in the Pacific Northwest*. University of Washington Press, Seattle, WA.
- Pojar J. and A. MacKinnon. 1994. *Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia and Alaska*. Lone Pine Publishing, Renton, WA.

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- Celedonia, Mark T. 2002. Establishing Appropriate Benchmarks for Site Development by Documenting Successional Characteristics, Phase 2. Washington State Department of Transportation, Roadside and Site Development Unit, Olympia, WA.
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- Kearns, Liz. 2006. Friends of Licton Springs, Licton Springs Community Council. Personal communication, Seattle, WA.
- King County Noxious Weed Control Program. 2007. Best Management Practices: Yellow-flag iris (*Iris pseudacorus*)- Draft version. Seattle, WA.
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- Seattle Urban Nature. 2000. Citywide Survey of Habitats on Public Land in Seattle. Seattle, WA.
- Tu, M. 2004. Reed canarygrass (*Phalaris arundinacea*) control and management in the Pacific Northwest. The Nature Conservancy. 12pp. <http://tncweeds.ucdavis.edu/moredocs/phaaru01.pdf>
- Washington State Department of Ecology, Water Quality Program. 2006. Technical Information about *Phalaris arundinacea* (Reed Canarygrass). <http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua011.html>

**Appendix A. Best Management Practice information for selected invasive species present in Licton Springs**

1. Reed canarygrass (*Phalaris arundinacea*)  
<http://tncweeds.ucdavis.edu/moredocs/phaaru01.pdf>
2. Bittersweet nightshade (*Solanum dulcamara*).  
<http://dnr.metrokc.gov/wlr/lands/weeds/nightshade.pdf>
3. Field bindweed (*Convolvulus arvensis*)  
[http://dnr.metrokc.gov/wlr/lands/weeds/field\\_bindweed.pdf](http://dnr.metrokc.gov/wlr/lands/weeds/field_bindweed.pdf)
4. Yellow-flag iris (*Iris pseudacorus*) (Draft version)















## Appendix B. Description of test-plots set up in Zone 3 in Licton Springs

The purpose of conducting field trials in Licton Springs is to see whether low-growing wetland shrub and emergent species can successfully compete with reed canarygrass, and to gather site specific information about success of particular species. Several recent studies have found an inverse relationship between planted stem and shrub density and reed canarygrass density and biomass (Celedonia 2002, Kim et al. 2006). However, most of the species tested in published studies have been tall shrubs such as willows. Very little published information is available about the effectiveness of using low-growing shrubs or emergent species to combat reed canarygrass.

Five species of wetland shrubs and seven species of emergent plants were tested using an experimental design in Licton Springs. Plots were set up on March 10, 2007 as part of a Friends of Licton Springs work party led by Seattle Urban Nature. The plots were located in Zone 3 (Figure 6) in an area dominated by reed canarygrass.

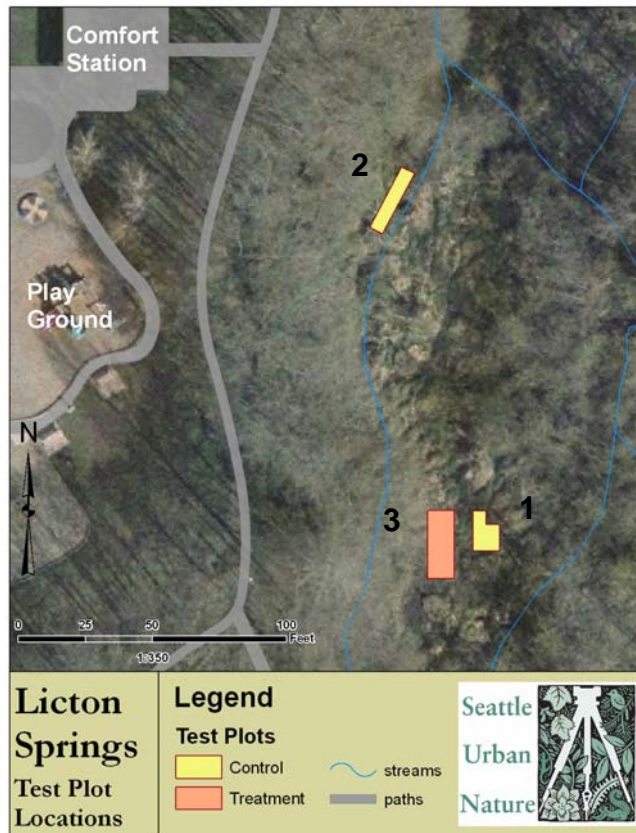
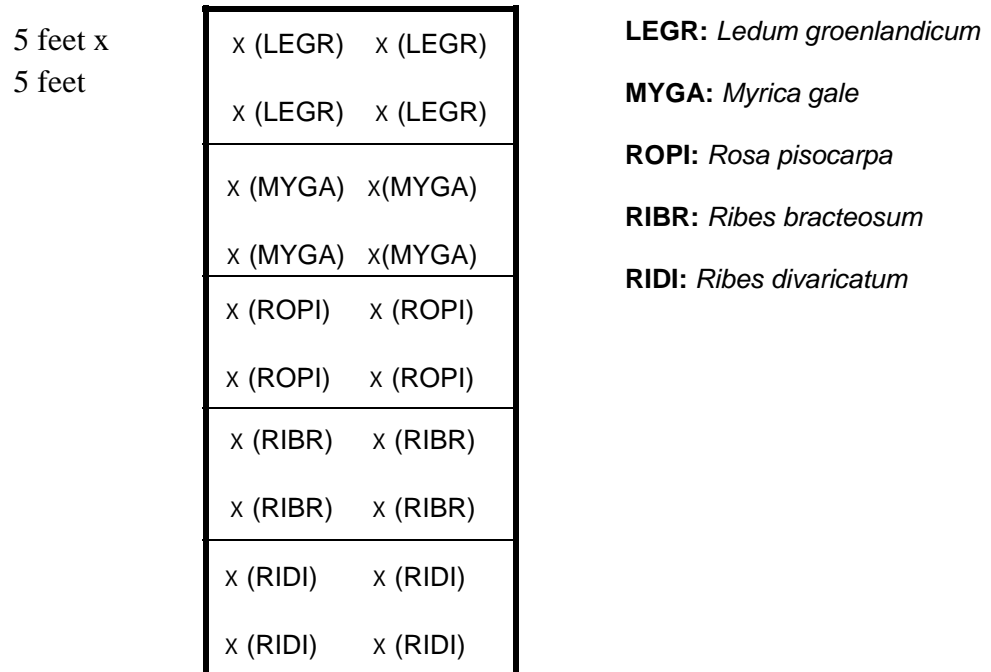


Figure 6. Approximate locations of test plots in Zone 3 in Licton Springs.

Two treatments were tested: one control treatment where plants were planted directly into flattened reed canarygrass, and a second treatment where reed canarygrass roots were dug out and the plants were planted into a layer of biodegradable weed barrier fabric.

Three plots were established, consisting of two control plots and one treatment plot (Figure 6):

Plot 1 is a control plot containing five 5 foot x 5 foot subplots located in the southeastern part of Zone 3 (Figure 6). Each subplot consists of four individuals of a single species of wetland shrub installed directly into reed canarygrass that had been flattened with a heavy board. No other site preparation occurred on this site. Figure 7 shows the approximate layout of shrubs within each subplot.



**Figure 7. Layout of experimental design for field trials of shrub plots consisting of five shrub species in Licton Springs.**

Plot 2 is a control plot, containing five 5 foot x 5 foot subplots, located in the northwestern corner of Zone 3 (Figure 6). This plot consists of a mixed shrub and herb planting installed directly into reed canarygrass that had been flattened with a heavy board. No other site preparation occurred on this site. Figure 8 shows the approximate layout of subplots, keeping in mind that although each subplot contains the same species composition, the exact location of each species is different in each subplot.

5 feet x 5 feet	x (LEGR) * (CAKE/CAOB)	x (MYGA) * (ELPA/JUPA)
	x (ROPI) * (SALA)	x (RIBR) * (SCAC/SCMI)
5 feet x 5 feet	x (LEGR) * (CAKE/CAOB)	x (MYGA) * (ELPA/JUPA)
	x (ROPI) * (SALA)	x (RIBR) * (SCAC/SCMI)
5 feet x 5 feet	x (LEGR) * (CAKE/CAOB)	x (MYGA) * (ELPA/JUPA)
	x (ROPI) * (SALA)	x (RIBR) * (SCAC/SCMI)
5 feet x 5 feet	x (LEGR) * (CAKE/CAOB)	x (MYGA) * (ELPA/JUPA)
	x (ROPI) * (SALA)	x (RIBR) * (SCAC/SCMI)
5 feet x 5 feet	x (LEGR) * (CAKE/CAOB)	x (MYGA) * (ELPA/JUPA)
	x (ROPI) * (SALA)	x (RIBR) * (SCAC/SCMI)

**X** = shrub  
**LEGR:** *Ledum groenlandicum*  
**MYGA:** *Myrica gale*  
**ROPI:** *Rosa pisocarpa*  
**RIBR:** *Ribes bracteosum*  
**RIDI:** *Ribes divaricatum*

\* = herbaceous plant  
**CAKE:** *Carex kelloggii*  
**CAOB:** *Carex obnupta*  
**ELPA:** *Eleocharis palustris*  
**JUPA:** *Juncus patens*  
**SALA:** *Sagittaria latifolia*  
**SCAC:** *Scirpus acutus*  
**SCMI:** *Scirpus microcarpus*

**Figure 8. Layout of experimental design for field trials of mixed plots consisting of five shrub and seven herbaceous species in Licton Springs.**

Plot 3 is a treatment plot, consisting of ten 5 foot x 5 foot subplots located in the southwestern portion of Zone 3 (Figure 6). This area was cleared of reed canarygrass and the rhizomes were dug out. A biodegradable weed cloth was placed on top of the cleared area and one half was planted with five shrub subplots as described for Plot 1 and Figure 7. The other half was planted with a mix of shrubs and herbaceous plants as described in Plot 2 and Figure 8. A silt fence was installed surrounding the perimeter of this plot to act as a root barrier from surrounding reed canary grass and also to prevent silt from accumulating on top of the fabric. Approximately two inches of wood chips were placed on top of the fabric to provide mulch to the plantings.

This experiment will allow the Friends of Licton Springs to monitor the growth and size of each species and select ones that are the most successful for future plantings. The mixed shrub and herbaceous plots should provide both shading and competition to reduce the cover of reed canarygrass. Monitoring both the growth of plants and the amount of reed canarygrass in these plots will give a clear idea of whether this combination of species can effectively compete with reed canarygrass.