

TAIGA WETLANDS WORK PLAN

GREEN LAKE FLOATING ECOSYSTEM DEMONSTRATION PROJECT



Prepared by
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Funded by the Seattle Neighborhoods Neighborhood Matching Fund
and Generous Donations



Built by Biomatrix Water
Support by Seattle Parks and Recreation,
Herrera Environmental Consultants, and Go Natives! Nursery



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Appendix A

Design and Implementation Guidance

1. INTRODUCTION

Friends of Green Lake (FOGL) is a non-profit association in Seattle, Washington, whose mission is to support projects and activities that benefit both recreation and wildlife in Green Lake and the surrounding park. FOGL is currently registered with the Internal Revenue Service as a 501(c)(3) organization (EIN 33-1212539) and conducts business in accordance with bylaws that were first adopted on April 18, 2006. Membership consists of individuals with an interest in sustaining the mission of FOGL on a volunteer basis, and our membership is open to all regardless of race, color, gender, creed, or handicap.

In 2018, FOGL received a large donation in memory of Taiga Hinkley, who was a valued employee at the Greenlake Boathouse Center but tragically did not survive an evening paddle on the lake. FOGL evaluated potential projects and selected the floating wetland project to best represent Taiga's interest in protecting lake water quality and wildlife habitat. To supplement this and other donations with additional funds, FOGL applied for a Seattle Neighborhoods Matching Fund grant in September 2020 and won a \$50,000 grant with our second application in September 2021. In addition to our well-planned design of exciting environmental restoration technology, keys to our grant success include first obtaining support from Seattle Parks and Recreation (SPR) and the Hydraulic Project Approval (HPA) permit from the Washington Department of Fish and Wildlife (WDFW).

Under the leadership of FOGL President Rob Zisette, we carefully assembled a project leadership team of a dozen highly qualified volunteers to further develop the project design and plans, solicit proposals from two highly qualified floating wetland vendors, and select Biomatrix Water in Scotland to finalize the design and supply the Taiga Wetlands. The Taiga Wetlands design consists of two, 650-square-foot islands that will be permanently anchored west of Duck Island (Appendix A). The Duck Island location was selected over other locations because it provided the best habitat for native birds, which is our primary environmental objective. At this location, Taiga Wetlands will also function to sequester nutrients from the lake for uptake by the plants and, more importantly, the thick microbial biofilm growth on the plant roots, supporting a diverse macroinvertebrate community and fish habitat. In addition, this location provides good viewing of the wetlands from our education sign to be installed on the west shore and this more remote area of the lake reduces the potential for vandalism.

The project goal is to demonstrate and educate how floating wetlands are an effective tool for restoring impacted aquatic habitats in urban waters within the Puget Sound region. FOGL prepared this Taiga Wetlands Implementation Plan to be included with our application to Seattle Parks and Recreation for a Revocable Use Permit. The plan will be updated as needed based on feedback from SPR and the project team. The plan includes installation, planting, and monitoring and maintenance plans.

2. INSTALLATION AND PLANTING PLAN

The Installation and Planting Plan covers all aspects of the wetland installation from delivery to anchoring in Green Lake. The design drawings and installation instructions from Biomatrix Water are in Appendix A.

2.1. INSTALLATION SCHEDULE

The planned installation schedule is provided in the following table. The target delivery and installation dates may vary depending on shipping constraints. The project team will coordinate with SPR on proposed changes to the planned dates and verify they are acceptable and will not interfere with SPR activities or public use of the lake.

Item/Source	Planned Delivery Location	Target Delivery Date	Target Installation Date
Wetland modules, hardware, fencing in a shipping container from Biomatrix Water	Densmore Maintenance Yard	Friday 5/5/2022	Saturday and Sunday 5/28 and 29/2022
Wetland plants and media (gravel and wood chips) purchased by planting team from Go Natives! Nursery	West Beach Parking Lot	Saturday 5/28/2022	
Anchoring hardware purchased by anchoring team from local suppliers TBD and installed using Herrera's 12-foot inflatable motor boat	West Beach Parking Lot	Saturday 5/28/2022	

2.2. INSTALLATION TEAM RESPONSIBILITIES AND CONTACTS

The project installation team members and responsibilities are listed in the following table for the following three project teams:

- Wetland module procurement and assembly
- Plant and gravel procurement and planting
- Anchoring equipment procurement and island anchoring

Key contacts at SPR are included in the following table.

Team	Name/Email/Role
Wetland Assembly Team	Rob Zisette, rzisette@herrerainc.com , Safety, storage, transport (van), and assembly Pete Hinkley, petejh@q.com , Storage, transport, and assembly Monica Grafström Hinkley, mghinckley@gmail.com , Food and drink Jeff Howard, jeff@jeff-howard.com , Transport (pickup truck) and assembly Michael Spillane, mspillane@herrerainc.com , Transport (pickup truck and trailer) and assembly Brian DeLuca, ketone64@comcast.net , Assembly Martin Muller, martinmuller@msn.com , Bird house design and assembly Mason Bowles, mason.bowles@kingcounty.gov , Assembly Jo Sullivan, jo.sullivan@kingcounty.gov , Assembly Dylan Ahearn, dahearn@herrerainc.com , Assembly Rebecca Dugopolski, rdugopolski@herrerainc.com , Assembly Galen Fulford, galen@biomatrixwater.com , Assembly
Planting Team	Eliza Spear, espear@herrerainc.com , Planning, storage, transport (pickup truck), planting Shelby Petro, shelby.petro@gmail.com , Planning and planting Julia Munger, Julia.munger@seattle.gov , Planting Josh Wozniak, JWozniak@parametrix.com , Planting Scott Luchessa, Scott.Luchessa@seattle.gov , Planting Christina Merten, cmerten@herrerainc.com Adnan Khan adnanz.89@gmail.com , Planting and maintenance Neil Davis nesdavis@gmail.com , Planting and maintenance Jonathan Hallet beautiflier.la@gmail.com , Planting and maintenance Emily Zisette iloveplants206@gmail.com , Planting Sandy Shettler sshettler@msn.com , Planting
Anchoring Team	Rob Zisette, rzisette@herrerainc.com , Safety, storage, transport, and assembly Nick Bartish, nbartish@herrerainc.com , Boat operation and anchor placement Camryn Steiner csteiner@herrerainc.com , anchor design and placement Pete Hinkley, petejh@q.com , Storage, transport, and assembly Jeff Howard, jeff@jeff-howard.com , Anchor transport and assembly Brian DeLuca, ketone64@comcast.net , Anchoring material procurement Lauren Ode-Giles, lodegiles@herrerainc.com , Drone operations
SPR Contacts	Sean Hermes, Sean.Hermes@seattle.gov , Densmore Yard Storage and Staff Support Lead Fred Schauer, Fred.Schauer@seattle.gov , Densmore Yard Storage Karen O'Connor, Karen.OConnor@seattle.gov , Public Involvement Karen Selander, Karen.Selander@seattle.gov , Seattle Neighborhoods Grant Project Manager Carl Bergquist, Carl.Bergquist@seattle.gov , Event Scheduling David Graves, David.Graves@seattle.gov , Project Approvals and Primary Contact Jeanette Geiger, Jeanette.Geiger@seattle.gov , Revocable Use Permit Paula Hoff, Paula.Hoff@seattle.gov , Volunteer Agreement Colleen Hackett, colleen.hackett@seattle.gov , Project Support

2.3. EQUIPMENT

Delivery and storage of 40 wetland modules to include: 2 open modules, 4 tree modules, 2 submerged modules, and the rest standard floating (3D) modules with extra thick (3 mm) coated stainless-steel brackets at anchoring locations. Also including coated stainless steel fence posts and coated steel fencing 12 inches high with 4-inch gap at base spaced equally apart and covering half the length of the fence (see Appendix A).

Purchase, delivery, and storage of anchoring equipment and tools to include: 8 galvanized Danforth anchors with weights totaling 50 pounds for each anchor, 8, 50-foot lengths of 3/8-inch galvanized steel chain, 25 galvanized shackles (3/anchor), 8 buoys each with 50-foot lengths of nylon line, and tools (4-way podger wrench, rubber mallet, wrench set, pliers).

On arrival, check all bolts for tightness, as some may have travelled a considerable distance with long periods of vibration. Check the tightness of all bolts while an island is still on its pallet. Recheck at shoreline and on water, before and after installation. Recheck as part of scheduled periodic maintenance inspections.

2.4. TOOLS FOR ASSEMBLY AND ANCHORING

To perform an installation the following tools are suggested and should include some duplicate tools to speed up the installation:

2 x 17mm spanners	1 x pliers/grips
1 x 17mm socket wrench	2 x maul grips
1 x 10mm socket wrench	1 x hammer
1 X 19mm spanner	1 x adaptor to drive sockets, with drill
2 x 17mm scaffolders podgers	1 x mallet
2 x straight garden snips	1 x heavy duty wire cutters
1 x Stanley knife	1 x scissors
1 x tape measure	1 x shackle spanner

To anchor the wetlands in place the following tools are suggested:

- 2 x Safety Goggles
- 1 x Hammer Drill & Bits (12mm & 20mm SDS)
- 1 x 19mm spanner for 12mm bolts.
- 1 x 10mm deep wrench for wire rope grips (preferably with adaptor for cordless drill)
- 1 x Long tape measure

2.5. PLANTING PLAN

The planting plan is presented in the following table that lists the quantity of native plant species in each wetland. The actual species and quantities may vary depending on availability. Purchase, delivery, and storage of plants shall include approximately 160 emergent plants, 46 shrubs, and 5 trees.

Purchase, delivery, and storage of planting media shall include approximately 0.5 yards of gravel for plant media in two submerged modules and 1 yard of wood chips for covering of emergent and tree modules, as per the planting plan presented in the following section. Soil in plant pots will be used to fill tree modules but some extra soil may be purchased if needed.

Green Lake Floating Wetlands Project Plant List

Scientific Name	Common Name	Quantities			Size	Wetland	Notes
		Wet 1	Wet 2	Total			
Emergents							
<i>Alisma plantago aquatica</i>	common water-plantain	0	0	0	?	1,2	submerged module alternate
<i>Carex aquatilis</i>	water sedge	0	10	10	4 inch		growth like CAOB, submerged?
<i>Carex obnupta</i>	slough sedge	10	0	10	4 inch	1	winter cover, plant at edge
<i>Carex stipata</i>	sawbeak sedge	0	10	10	4 inch	2	
<i>Symphyotrichum erigeron</i>	beach aster	10	10	20	4 inch		less aggressive than douglas
<i>Juncus effusus</i>	soft rush	10	0	10	plug	1	winter cover
<i>Lupinus polyphyllus</i>	Large-leaf lupine	10	10	20	4 inch	1, 2	
<i>Lysichiton americanus</i>	Skunk cabbage	10	10	20	4 inch		alternate?
<i>Mimulus guttatus</i>		0	10	10	4 inch		non-competitive groundcover
<i>Polypodium glycyrrhiza</i>	Licorice fern	10	10	20	4 inch		tree pod wall
<i>Schoenoplectus acutus</i>	hardstem bulrush	10	10	20	plug	2	submerged module
<i>Scirpus microcarpus</i>	small-fruited bulrush	10	0	10	plug	1	
<i>Total Emergent Quantity</i>		80	80	160	-		-
Shrubs							
<i>Cornus sericea</i>	red-osier dogwood	5	0	5	1 gallon	1, 2	winter cover
<i>Lonicera involucrata</i>	twinberry	5	5	10	1 gallon	1, 2	
<i>Myrica gale</i>	Sweet gale	10	5	15	1 gallon		good alternate to dogwood
<i>Physocarpus capitatus</i>	ninebark	5	5	10	1 gallon	1, 2	winter cover
<i>Salix sitchensis</i>	sitka willow	0	10	10	Stake	1	
<i>Total Shrub Quantity</i>		25	25	50	-		-
Trees							
<i>Amelanchier alnifolia</i>	Serviceberry	0	0	0	1 gallon	1, 2	alternate
<i>Crataegus douglasii</i>	Black hawthorn	1	0	1	1 gallon	1	tree pod
<i>Malus fusca</i>	Western crabapple	0	1	1	1 gallon	2	tree pod
<i>Prunus emarginata</i>	Bitter Cherry	1	1	2	1 gallon	1, 2	tree pod
<i>Total Tree Quantity</i>		2	2	4	-		-
Total All Plants		107	107	214			

Wetland 1 - focus on species most likely to succeed with vigorous growth, but with potential for dominance

Wetland 2 - focus on high diversity and emphasis on aesthetic value in addition to restoration

2.6. STORAGE AND STAGING AREAS

Wetland modules, fencing, and hardware shipped by Biomatrix Water will be delivered in a truck to the SPR Densmore Maintenance Facility at 8037 Densmore Ave. N for short-term storage (approximately 3 weeks) prior to the installation date (see location and route in Figure 1 in Appendix A). Additional hardware and anchoring equipment also may be delivered by the installation team members to this facility for short-term storage. The storage area will be an uncovered area of approximately 15 by 50 feet. Storage area location and access will be coordinated with Sean Hermes and Fred Schauer of SPR. Plants will be transported from the supplier (Go Natives! Nursery) by the planting team on the morning of the first day of installation.

The installation team will transport materials from the storage area to the staging (off-load) area using pickup trucks. Wetland modules will be transported in a flatbed trailer towed by a pickup truck, and fencing and anchor materials will be transported by a second pickup truck. Only those materials needed for each installation day will be transported in the morning from the storage area to the staging area located in the southwestern portion of the West Beach parking lot (see Figure 2 in Appendix A). It is anticipated that the east island materials will be transported on the first day and west island materials will be transported on the second day, but it is possible that both islands will be installed on the first day.

The staging area will be coned off for installation team vehicle access and will allow for cones to allow public access to a path from the center of the staging area in the southwest corner of the parking lot. Plants and anchors will be off-loaded along the west edge and wetland modules and hardware will be off-loaded along the south edge of the lot. The team will include a pedestrian traffic control person who will make sure there is no blocking of public access from the lot to the trail at any time. No overnight parking or equipment storage is planned for the staging area.

Transport to the assembly area will be along the paved path (see Figure 2 in Appendix A) and over a small area of grass to the lake shore from the main lake path. The path is wide enough for a truck and it is anticipated that most materials will be transported directly from storage to the assembly area. Some materials may be temporarily stored in the staging area and transported to the assembly area using hand-pulled carts. An SPR staff person or assembly team member will serve as a pedestrian flagger for crossing the main path with carts as necessary.

The installation team will employ environmental BMPs to prevent damage to the paved path or grass area. The transport route will be inspected upon completion of the installation and damage, if any, will be promptly repaired as directed by SPR.

2.7. ASSEMBLY AREA

The wetland assembly area is located between main lake foot path and the lake at the sandy beach area northwest of Duck Island. Assembly instructions are provided by Biomatrix water in Appendix A. Assembly steps include:

1. Align and bolt together modules for east island into 3 segments: north 2 rows, center 2 rows, and south 2 rows. Use the podger to align bracket holes for bolt insertion and socket wrench to tighten bolts.
2. Attach fence posts and layout fencing on ground
3. Plant plants in all 3 segments.
4. Carry each segment into water and bolt them together going from north, to center, to south.
5. Attach submerged platform to submerged module and add gravel to depth of 6-8 inches.
6. Add woodchips to emergent and tree modules
7. Attach fencing to fence posts
8. Attach sign to fencing
9. Repeat for west island.

2.8. ANCHOR AREA

FOGL will obtain authorization from SPR to inflate and launch a 12-foot inflatable motorboat (4-cycle 9 hp motor) with an aluminum floor at the assembly area. The boat will be loaded with the anchors, weights, buoy lines, and shackles, and operated by two anchoring team members. The anchoring team will also launch a canoe to carry two other team members to assist the motorboat team with anchor installation and for safety. It is anticipated that the anchors will be installed first thing in the morning while the first island is being assembled and planted.

After an island is fully assembled and planted, the island will be carried into the lake. The upper and lower section of the anchor chain are connected by a shackle, the upper section is shackled to the appropriate wetland bracket, and the full length of anchor chain is placed on the edge of the wetland at the bracket location as that portion of the wetland is floated on the water.

Each wetland island will be towed into position by the boat and anchored using the following steps:

1. Tie a 50-foot line from the buoy to the anchor and back up to the buoy so the anchor can be released from the line when it is in its final position
2. Shackle the bottom of the anchor chain line to the anchor
3. Attach the weight(s) to the chain approximately 2 feet from the anchor
4. Boat away from the wetland to the anchor position and lower the anchor to the lake bottom using the line and floating the buoy on the lake surface.
5. Repeat steps 1-4 for the remaining three anchors.
6. Return to the first anchor, pull up the buoy line to lift the anchor off the lake bottom, boat further from the wetland to the final position to tighten the chain, and lower anchor to the lake bottom.
7. Repeat step 6 for the remaining three anchors and as needed until the anchor chains have a proper slope descending in the water from the island (approximately 45 degrees)
8. Untie one end of the buoy line from the buoy and pull on the other end to slip the line through the anchor shackle and remove the line and buoy.

2.9. SAFETY PLAN

All installation team members will attend a safety briefing meeting first thing each morning. Safety concerns and practices will be discussed. Safety practices will include but not be limited to use legs for proper lifting of equipment to prevent back injury, wearing high visibility vests to avoid pedestrian or vehicle impact, and wearing sturdy shoes to avoid slipping or foot injury.

The anchoring team will follow Federal US Coast Guard boating safety procedures that shall include but not be limited to: operate the motorboat and canoe only with trained operators who wear a Coast Guard approved personal floatation device PFD; be cautious of anchor line entanglement; and have an independent Safety Observer nearby on the water in a canoe to assist with recovery if needed. A detailed Boating Safety Plan is provided below in the Monitoring and Maintenance Plan.

3. MONITORING AND MAINTENANCE PLAN

The floating wetlands, plantings, and anchoring system are designed to require minimal maintenance. Monitoring and maintenance will be performed regularly to assess performance and identify and address conditions that could jeopardize the success of the floating wetlands. The wetlands will be monitored for condition and performance at least twice each year by two members of the maintenance team using a canoe, kayak, or a small motorboat on loan from the Greenlake Boathouse.

During each monitoring visit, any necessary maintenance activities will be identified and executed immediately when feasible. Additional maintenance activities will be implemented in a timely manner after completion of monitoring and identification of maintenance needs.

Typical monitoring and maintenance activities will include, but are not limited to, the following:

- Removal of trash and any other debris.
- Assessment of the health and survival of plantings.
- Installation of supplemental plantings suitable for site conditions.
- Removal of noxious weeds as defined by the most recent update to the King County Noxious Weed List.
- Assessment of any evidence of vandalism and execution of any necessary repairs or prevention efforts.
- Inspection of floating wetland structure and execution of any necessary repairs or maintenance.
- Documentation of wildlife observations, including fish.

3.1. PERFORMANCE GOALS

Performance goals for the floating wetlands include:

- Physical:
 - Remove any accumulated trash or debris and repair damage caused by vandalism.
 - Modify wetlands as necessary to reduce potential for public access and vandalism.

- Maintain education signage on each wetland and one shore location.
- Maintain sufficient buoyancy, a securely anchored position, and good physical conditions as designed to support diverse wetland plant growth and wildlife habitat.
- Vegetation:
 - Maintain native plant habitat with high plant cover at over 75 percent total plant cover in the fall of each year following the installation year.
 - Maintain a low abundance of noxious weeds at less than 10 percent cover.
- Fish and Wildlife:
 - Provide fish habitat and use by small fish
 - Provide good wildlife habitat and use by native birds, bats, butterflies, turtles, and amphibians.
 - Do not provide nesting or foraging habitat for Canada geese.
 - Obtain funding for installation and solar power operation of a wildlife camera with public access to a webcam of wildlife and fish uses of the wetlands.
- Water Quality:
 - Maintain abundant biofilm on plant roots during the summer algae growing season to reduce nutrient concentrations and increase zooplankton grazing of algae in adjacent lake waters.
 - Obtain funding for monitoring water quality benefits of the floating wetlands that may include:
 - Installation of sediment traps under each wetland and at nearby control stations within and outside dense aquatic plant growth to measure the sedimentation rates of total phosphorus, organic carbon, and microplastic particles.
 - Evaluating long-term trends in routine water quality data before and after wetland installation that focuses on total phosphorus, chlorophyll-a, and microcystin.

3.2. MONITORING SCHEDULE

Monitoring visits will occur a minimum of twice each year, with supplemental maintenance visits as necessary. Regularly scheduled monitoring events will occur in the late spring (May) and early fall (September) to encompass the primary plant and algae growing season and coincide with optimum periods of the year for supplemental plantings and wildlife uses. This frequency of monitoring has been shown to be sufficient at other floating wetland projects (e.g., Hicklin Lake in White Center and Charles River in Boston).

3.3. MONITORING TEAM RESPONSIBILITIES AND CONTACTS

The floating wetland monitoring team includes several members of our leadership team with wetland monitoring and maintenance experience, and that area also on our planting team for the installation. Monitoring team members and responsibilities are listed in the following table that also includes key contacts at SPR. The monitoring team will develop a monitoring schedule for each year to include two individuals for each monitoring event.

Team	Name/Email/Role
Wetland Monitoring Team	Rob Zisette, rzisette@herrerainc.com , Project Manager Eliza Spear, espear@herrerainc.com , Monitoring and maintenance Shelby Petro, shelby.petro@gmail.com , Monitoring and maintenance Martin Muller, martinmuller@msn.com , Monitoring and maintenance Adnan Khan adnanz.89@gmail.com , Monitoring and maintenance Neil Davis nesdavis@gmail.com , Monitoring and maintenance Jonathan Hallet beautifier.la@gmail.com , Monitoring and maintenance Sally Abella sally.abella@gmail.com , Monitoring and maintenance
SPR Contacts	David Graves, David.Graves@seattle.gov , Project Approvals and Primary Contact Jeanette Geiger, Jeanette.Geiger@seattle.gov , Revocable Use Permit Paula Hoff, Paula.Hoff@seattle.gov , Volunteer Agreement Colleen Hackett, colleen.hackett@seattle.gov , Park Activity Coordination Tamara Oki, tamara.oki@seattle.gov , Green Lake Small Craft Center Coordination

3.4. MONITORING PROCEDURES AND MAINTENANCE ACTIONS

Monitoring procedures and maintenance actions are described separately for each topic. The attached monitoring and maintenance checklist will be prepared for each site visit. Monitoring equipment required for each site visit includes:

- Monitoring checklist on waterproof paper on clip board with pencil
- Waterproof camera
- Underwater viewing scope.

3.4.1. Physical Condition

- Inspect conditions of the education sign at the shore location and on each wetland and recommend needed repairs or replacement.
- Take a photograph of each wetland looking east toward the west side of the west wetland and west toward the east side of the east wetland
- Record and photograph any apparent damage caused by vandalism, and recommend methods for repair of the damage and possible modifications to reduce public access.
- Remove any accumulated trash or debris and place in garbage bag for disposal in park garbage can.
- Inspect for sufficient wetland buoyancy and note any locations that are sitting unusually low in the water.
- Note the proper position of each wetland and inspect the four anchor lines to verify they are attached and secure.

3.4.2. Vegetation

- Estimate percent total plant cover for each wetland and identify areas of low cover if the total plant cover does not exceed 75 percent total plant cover.
- Identify general health of each planted plant species, record any observed dead individual but do not remove plants, and recommend additional plantings if needed.
- Identify condition and need for addition of gravel media in submerged modules, mulch in tree pods, and wood chips on standard emergent modules.
- Estimate percent cover of noxious weeds.
- Identify and pull noxious weeds to include roots, seeds, and all other plant parts, and place weed material in trash bag for disposal in a park garbage can (or offsite garbage if necessary).

3.4.3. Fish and Wildlife

- Quietly observe and record numbers of each bird species on each wetland using binoculars during approach. Also note the presence of bats and butterflies.

- Observe and record evidence of use by turtles and amphibians.
- Observe and record evidence of nesting or foraging by Canada geese.
- Use an underwater viewing scope to observe relative numbers, size, and species of fish two locations under the east and west edge of each wetland and within each of the four open water modules and two submerged modules.
- If funding is obtained and a solar-powered wildlife camera is installed, verify that the camera is operational and the live video is available for public viewing.

3.4.4. Water Quality

- Observe and record the water clarity and presence of blue-green algae scum in the immediate vicinity of the wetlands in reference to the shoreline in the boat launch area.
- Use the underwater viewing scope to observe the relative cover and thickness of biofilm on plant roots and relative abundance of zooplankton under the east and west edge of each wetland and within each of the four open water modules and two submerged modules.
- If funding is obtained for water quality monitoring, implement the water quality monitoring plan that may include but not be limited to:
 - The installation sediment traps under each wetland and at nearby locations within and outside dense aquatic plant growth, and collection of accumulated sediment from the traps for measuring accumulation rates of total phosphorus, organic carbon, and microplastic particles.
 - Evaluating long-term trends in routine water quality data before and after wetland installation that focuses on total phosphorus, chlorophyll-a, and microcystin.

3.5. MONITORING AND MAINTENANCE CHECKLIST

Date of Site Visit:	Time of Site Visit:
Name of Inspector:	Weather:
Others Present:	Boat Type:
<ul style="list-style-type: none"> • <i>Physical Conditions</i> <ul style="list-style-type: none"> <input type="checkbox"/> Inspect conditions of the education sign at the shore location and on each wetland and recommend needed repairs or replacement. <input type="checkbox"/> Take a photograph of each wetland looking east toward the west side of the west wetland and west toward the east side of the east wetland <input type="checkbox"/> Record and photograph any apparent damage caused by vandalism, and recommend methods for repair of the damage and possible modifications to reduce public access. <input type="checkbox"/> Remove any accumulated trash or debris and place in garbage bag for disposal in park garbage can. <input type="checkbox"/> Inspect for sufficient wetland buoyancy and note any locations that are sitting unusually low in the water. <input type="checkbox"/> Note the proper position of each wetland and inspect the four anchor lines to verify they are attached and secure. 	
<p><i>Observations:</i></p>	

- **Vegetation**
 - Estimate percent total plant cover for each wetland and identify areas of low cover if the total plant cover does not exceed 75 percent total plant cover.
 - Identify general health of each planted plant species, record any observed dead individual but do not remove plants, and recommend additional plantings if needed.
 - Identify condition and need for addition of gravel media in submerged modules, mulch in tree pods, and wood chips on standard emergent modules.
 - Estimate percent cover of noxious weeds.
 - Identify and pull noxious weeds to include roots, seeds, and all other plant parts, and place weed material in trash bag for disposal in a park garbage can (or offsite garbage if necessary).

Observations:

Item	East Wetland	West Wetland
% Plant cover		
Low cover areas		
Dead plants		
Added plants		
Gravel media		
Wood chips		
% Weed cover		
Weeds pulled		

- ***Fish and Wildlife***

- Quietly observe and record numbers of each bird species on each wetland using binoculars during approach. Also note the presence of bats and butterflies.
- Observe and record evidence of use by turtles and amphibians.
- Observe and record evidence of nesting or foraging by Canada geese.
- Use an underwater viewing scope to observe relative numbers, size, and species of fish two locations under the east and west edge of each wetland and within each of the four open water modules and two submerged modules.
- If funding is obtained and a solar-powered wildlife camera is installed, verify that the camera is operational and the live video is available for public viewing.

Observations:

Item	East Wetland	West Wetland
Bird species (no.)		
Bats/butterflies		
Turtles/amphibians		
Canada geese		
Fish species (no./size)	East edge: West edge: Open pools: Submerged:	East edge: West edge: Open pools: Submerged:
Camera		

- **Water Quality**

- Observe and record the water clarity and presence of blue-green algae scum in the immediate vicinity of the wetlands in reference to the shoreline in the boat launch area.
- Use the underwater viewing scope to observe the relative cover and thickness of biofilm on plant roots and relative abundance of zooplankton under the east and west edge of each wetland and within each of the four open water modules and two submerged modules.
- If funding is obtained for water quality monitoring, implement the water quality monitoring plan that may include but not be limited to:
 - The installation sediment traps under each wetland and at nearby locations within and outside dense aquatic plant growth, and collection of accumulated sediment from the traps for measuring accumulation rates of total phosphorus, organic carbon, and microplastic particles.
 - Evaluating long-term trends in routine water quality data before and after wetland installation that focuses on total phosphorus, chlorophyll-a, and microcystin.

Observations:

Item	East Wetland	West Wetland
Water clarity		
Blue-green algae		
Biofilm % cover and thickness (mm)	East edge: West edge: Open pools: Submerged:	East edge: West edge: Open pools: Submerged:
Zooplankton (high/med/low abundance)	East edge: West edge: Open pools: Submerged:	East edge: West edge: Open pools: Submerged:
Sediment trap or other monitoring		

3.6. BOATING SAFETY PLAN

This Boating Safety Plan (Plan) applies to, but is not limited to, fieldwork requiring use of waterborne watercraft, including rafts, canoes, or skiffs used by the Green Lake Floating Wetland Maintenance Team (Team).

3.6.1. Person-In-Charge

Use of waterborne vessel(s) will be supervised by a Project Manager (PM) or designate. It is the responsibility of the Person-in-Charge (Field Lead) to take all reasonable steps to ensure that:

- Each participant be informed of the known risks and physical requirements.
- Each participant be shown where the personal floatation devices (PFDs) are stowed.
- Each participant has read this Plan.
- The academic portion of the work is conducted safely.
- It has been determined what safety equipment and clothing are appropriate.
- All personal equipment taken into the field are thoroughly checked for safety by a qualified person before use.
- Each participant is instructed in safety, the wearing of safety clothing and the safe use of equipment.

3.6.2. Boat Safety Training and Boater Cards

The boat operator is encouraged but not required to take an approved boater education course and carry their Boater Cards while boating. Various online and in-person courses are available through the United States Coast Guard (USCG) and individual states at varied costs. A free training course that is available for each state (noted below) is the Boat U.S. Foundation Boating Safety Course at <https://www.boatus.org/>. A Washington State Boater Education Card is only required when operating a boat 15 horsepower (hp) or greater.

3.6.3. Boat Safety and Equipment Requirements

This section lists the minimum boat safety and equipment requirements in accordance with the USCG and Washington State waterborne vessel regulations. Other safety and equipment necessary to minimize accidents and personal injury during fieldwork requiring the use of waterborne vessels will be dictated by the knowledge or experience of the Person-in-Charge.

Boaters are encouraged to obtain and use the USCG Boating Safety App available at: <https://uscgboating.org/mobile/> that includes the following features:

- Find the latest safety regulations
- Request a vessel safety check
- Check your safety equipment
- File a float plan
- Navigation rules
- Find the nearest NOAA buoy
- Report a hazard
- Report pollution
- Report suspicious activity
- Request emergency assistance

3.6.4. Float Plan

Before leaving for work in the field, a member of the field crew must fill out the following Float Plan describing when and where the work will take place, what vessels will be taken, and who will be present during the field event. A copy of the Float Plan should be sent to the PM for reference in case of an emergency. Do not file this plan with the Coast Guard.

1. Person In Charge

Name _____ Phone _____

2. Description of Boat

Name _____
Registration/
Documentation No. _____ Length _____
Make _____ Type _____
Trim _____
Hull Color _____ Color _____
Fuel Capacity _____ Engine Type _____ No. of Engines _____
Distinguishing Features _____

3. Operator of Boat

Name _____ Phone _____

4. Survival Equipment (check as appropriate)

- | | | |
|---|-------------------------------------|---------------------------------|
| <input type="checkbox"/> # _____ PFDs | <input type="checkbox"/> Flares | <input type="checkbox"/> Mirror |
| <input type="checkbox"/> Smoke Signals | <input type="checkbox"/> Flashlight | <input type="checkbox"/> Food |
| <input type="checkbox"/> Paddles | <input type="checkbox"/> Water | <input type="checkbox"/> Anchor |
| <input type="checkbox"/> Raft or Dinghy | <input type="checkbox"/> EPIRB | |
| <input type="checkbox"/> Others | | |

5. Marine Radio

Yes No
Type _____ Freqs. _____
Digital Selective Calling (DSC) Yes No

6. Trip Expectations

Depart From _____
Departure Date _____ Time _____
Going To _____
Arrival Date _____ Time _____
If operator has not arrived/returned by:
Date _____ Time _____

Call the Coast Guard or local authority at the following number: _____

7. Vehicle Description

License No. _____ Make _____
Model _____ Color _____
Where is Vehicle Parked? _____

8. Persons on Board

Name: _____

9. Additional Information

3.6.5. Boat Safety Equipment

A qualified person must check all equipment taken for fieldwork before removal from the office, to ensure that it is in good condition, complete, and safe. Boat safety equipment shall include:

- One personal floatation device (PFD) of proper size that is USCG approved must be kept in an accessible location on board for each person that is present. If the vessel is longer than 16 feet, one additional throwable PFD must be immediately available for use. In a small boat (less than 16 feet in length), such as a raft, canoe, or kayak, PFDs must be always worn.
- A battery-operated or electric visual distress signal (VDS), such as a flashlight, must be present if the vessel is 16 feet or longer. A daytime VSD, such as an orange flag 3 feet by 3 feet with a black square above a black dot, must be present if the vessel is 16 feet or longer.
- In a motor boat, a USCG-certified fire extinguisher must be present in case there is a fire hazard due to the motor or fuel system of the vessel. It must be portable and have a specific marine-type mounting bracket. Look for "Marine Type USCG" on the label.

If equipment fails during fieldwork, its use must be discontinued; and the failure must be reported to the Person-in-Charge immediately. This equipment must not be used until satisfactory repairs have been completed. The responsibility for ensuring equipment is safe is vested in the Person-in-Charge.

3.6.6. General Vessel Safety Checklist

It is the responsibility of the boat operator (company employee or subcontractor) to check the vessel prior to departure to ensure that it is in good working condition. Regular maintenance and proper operation of the boat are the best defenses against injury, including carbon monoxide poisoning. The following items apply to power boats and should be checked before departure for each trip:

- Make sure all exhaust clamps are in place and secure.
- Look for exhaust leaking from the exhaust system components evidenced by rust and/or black streaking, water leaks, and corroded or cracked fittings.
- Inspect rubber exhaust hoses for burned or cracked sections. All rubber hoses should be pliable and free of kinks.
- Confirm that cooling water flows from the exhaust outlet when the engines and generator are started.

- Test the operation of each carbon monoxide detector by pressing the test button.

Do not operate the vessel if any of the above problems exist!

The following items apply to power boats and should be checked at least annually:

- Replace exhaust hoses if any evidence of cracking, charring, or deterioration is found.
- Inspect each water pump impeller and inspect the condition of the water pump housing. Replace if worn or cracked (refer to the engine and generator manuals for further information).
- Inspect each of the metallic exhaust components for cracking, rusting, leaking, or looseness. Pay particular attention to the cylinder head, exhaust manifold, and water injection elbow.
- Clean, inspect, and confirm the proper operation of the generator cooling water anti-siphon valve (if equipped).

APPENDIX A

Design and Implementation Guidance



Figure 1.
Site Access and Storage Area -
Green Lake Floating Wetlands
Project.



VICINITY MAP

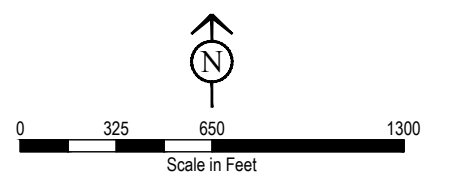
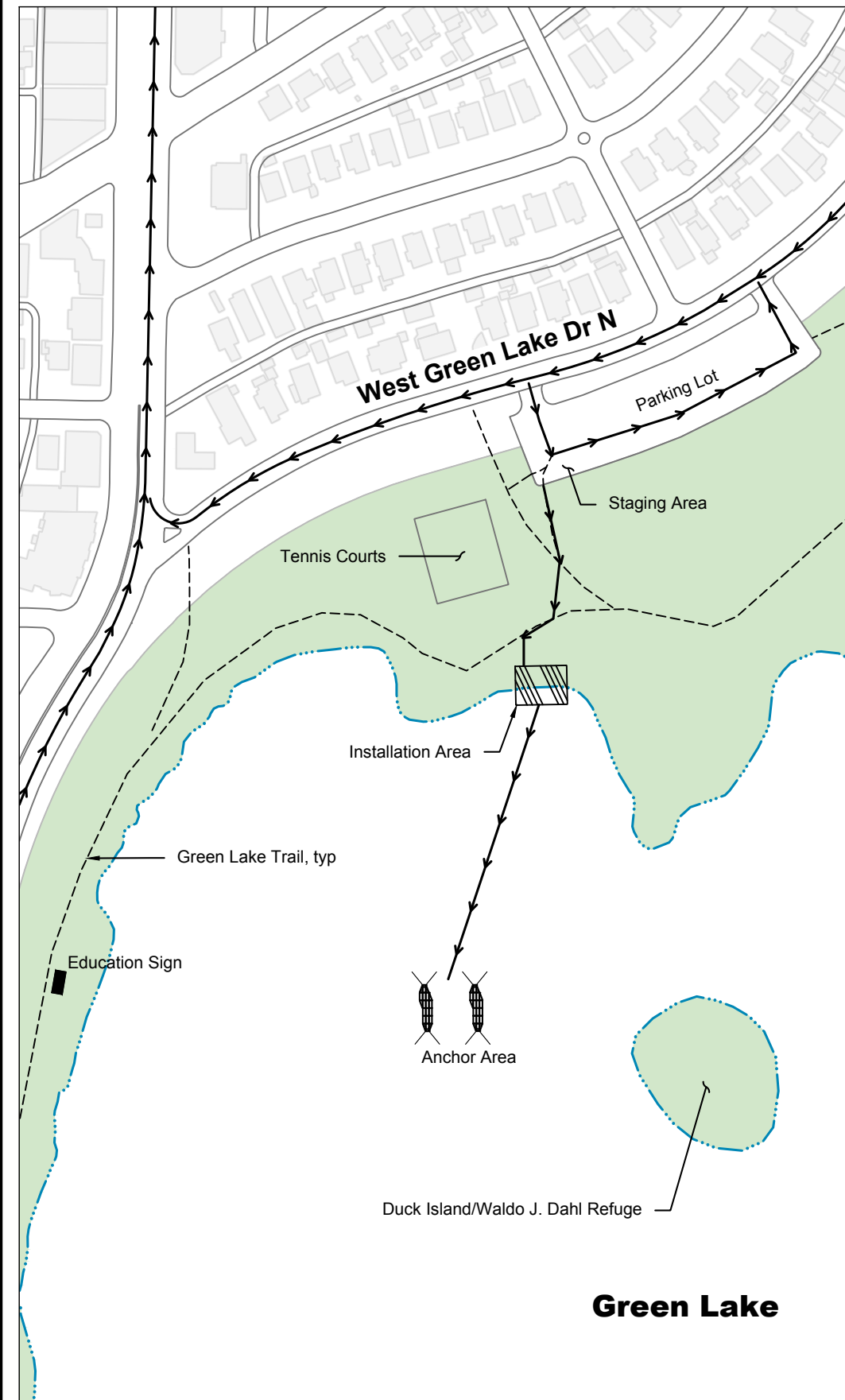
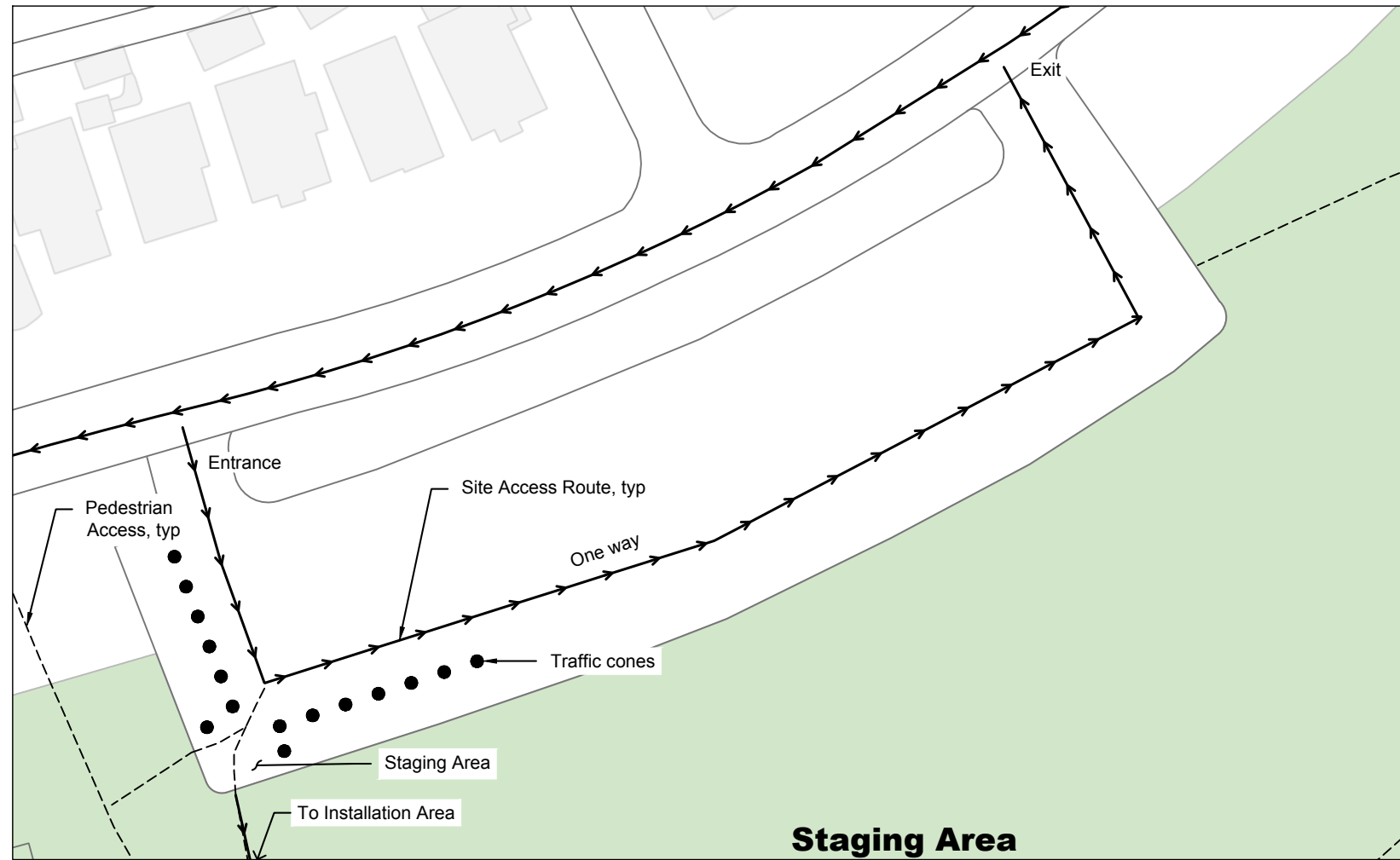


Figure 2.
Staging, Installation, and
Anchor Areas - Green Lake
Floating Wetlands Project.

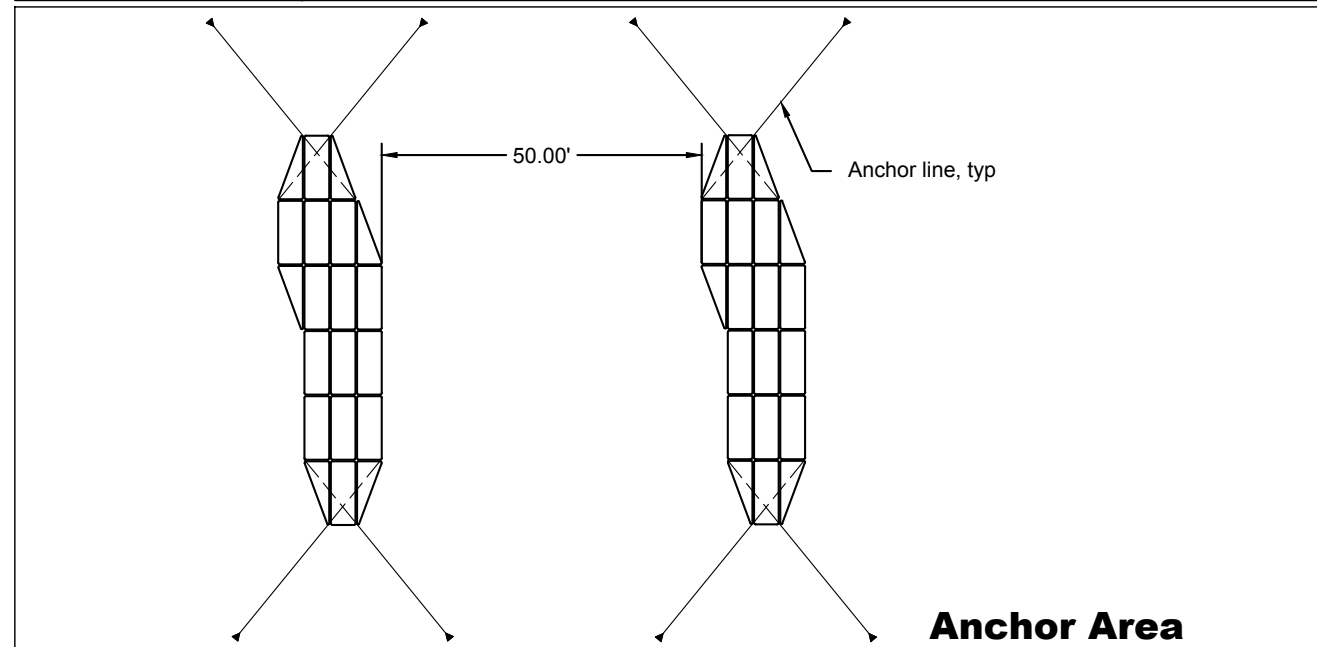


0 100 200 400
 Scale in Feet

0 30 60 120
 Scale in Feet



Staging Area

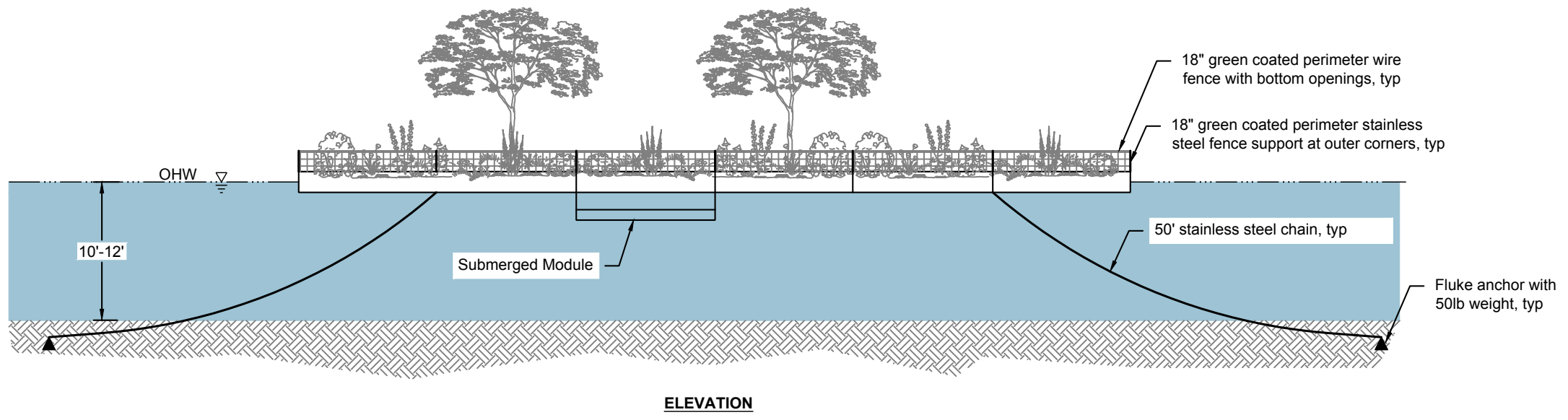
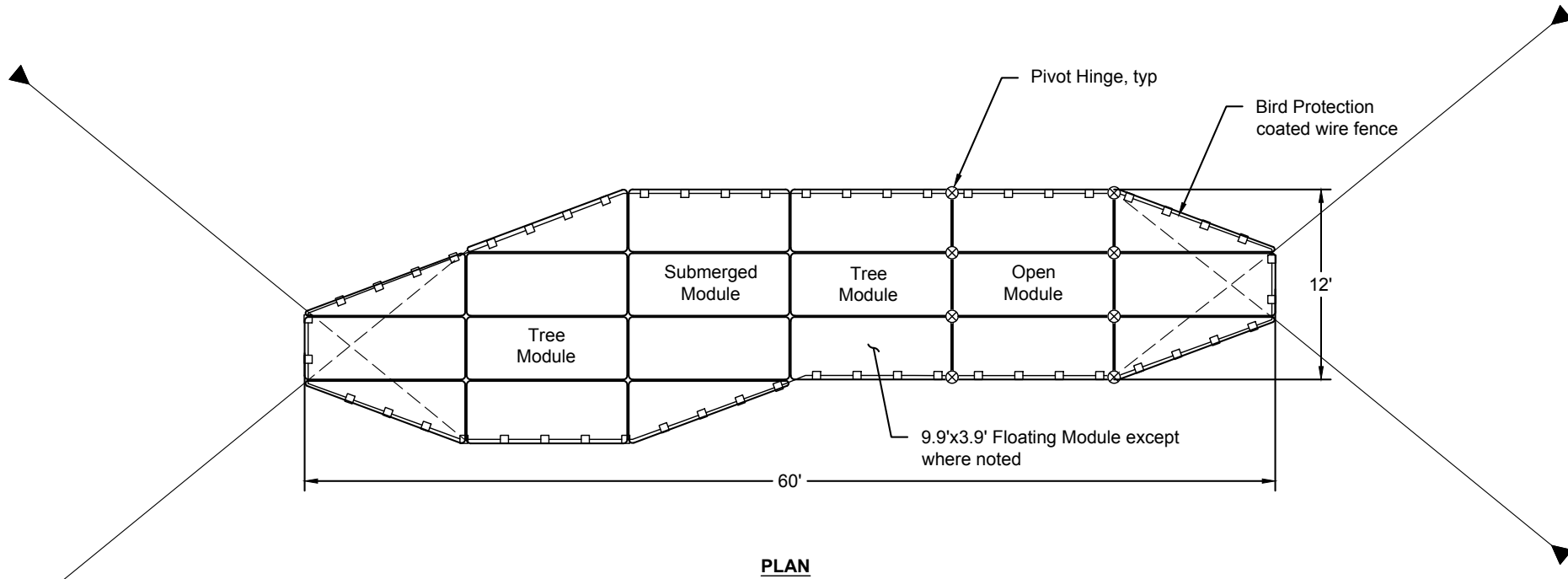


Anchor Area



C:\Users\emarsall\Desktop\TEMP\Greenlake floating wetlands\Site.dwg

Figure 3.
Floating Wetland Detail - Green
Lake Floating Wetland Project.



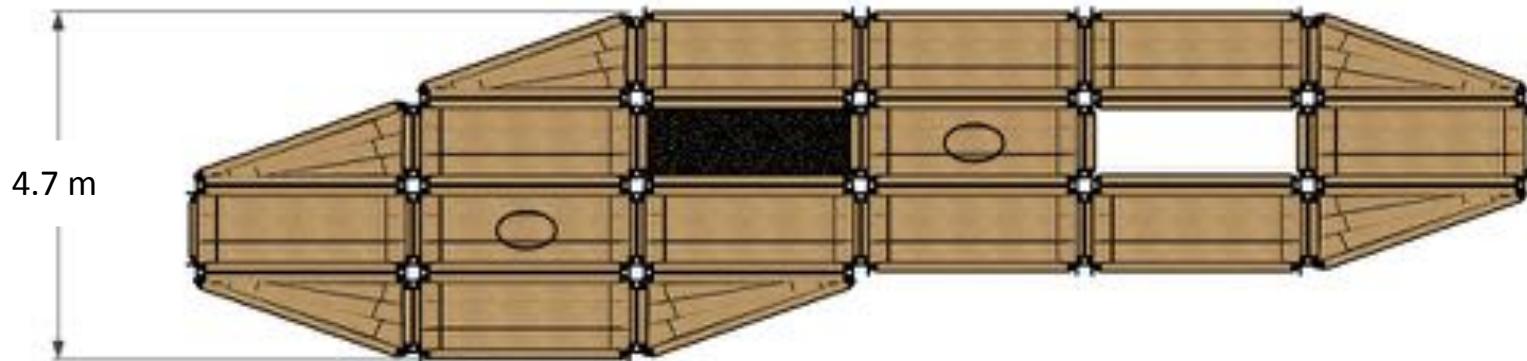
DETAIL - FLOATING WETLAND
 SCALE: 1"=10'

1
-

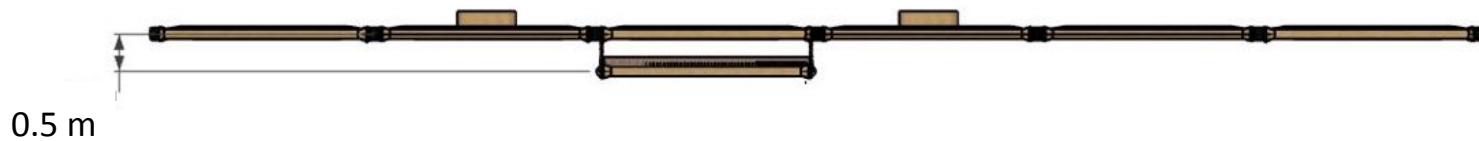
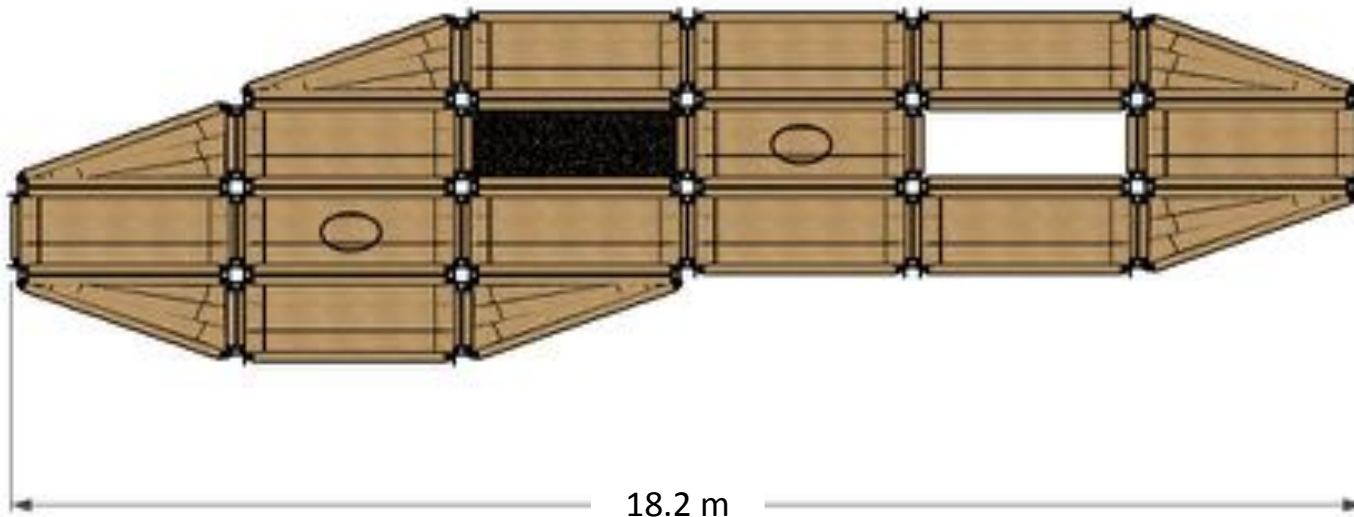


FOGL
Green Lake, Seattle
Ecosystem Design Pack
March 11, 2022

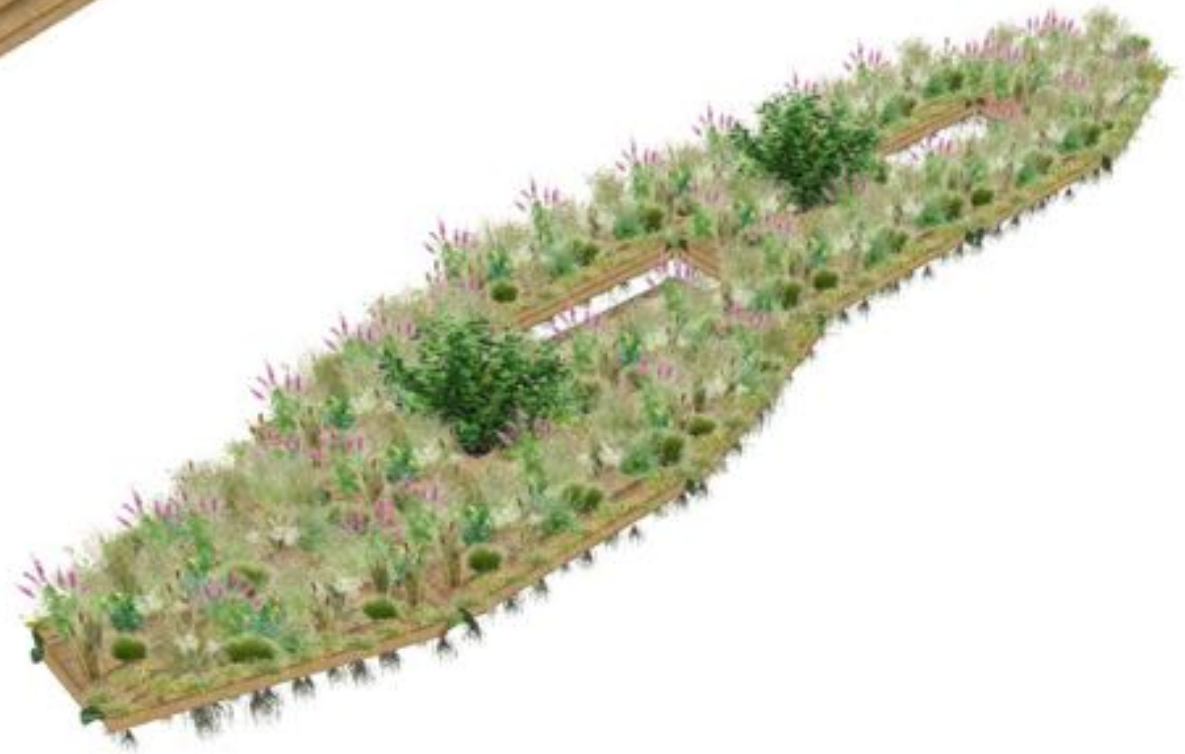
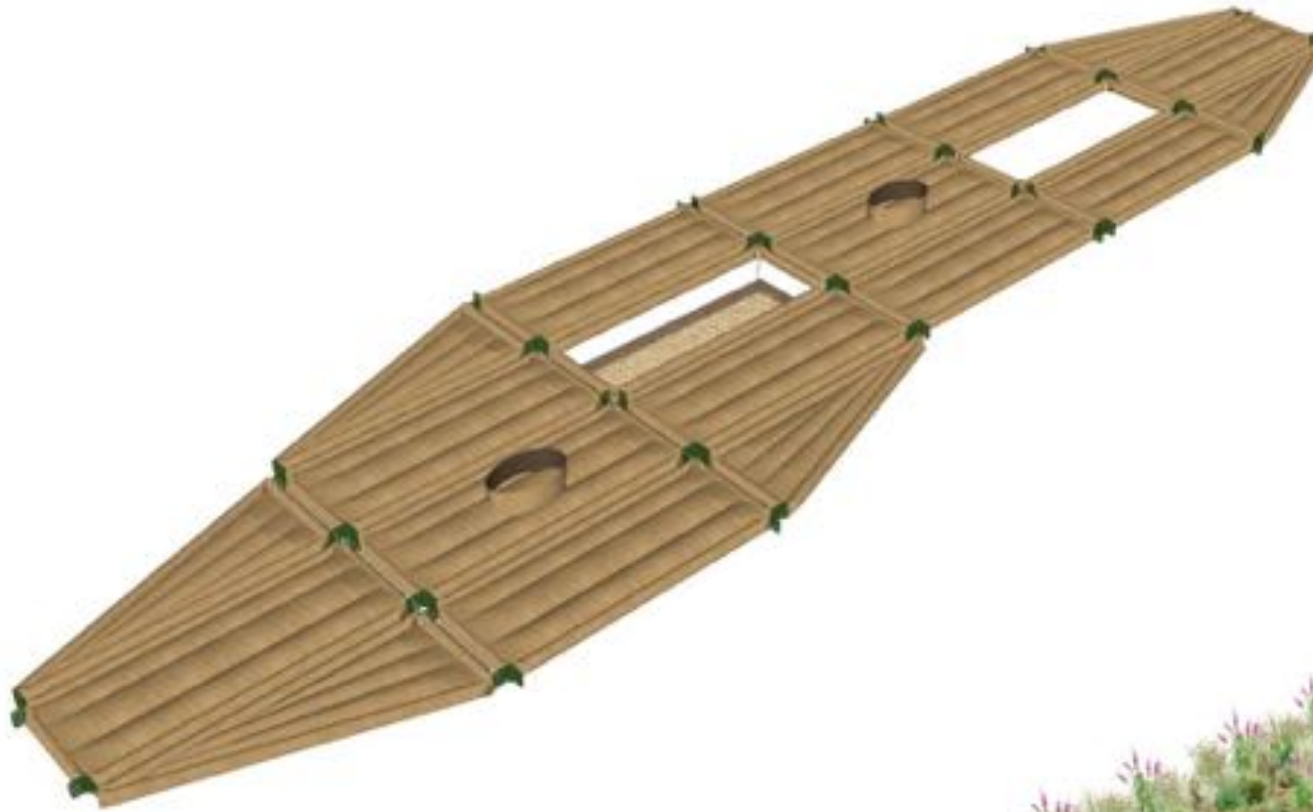




Plan view



Side view



DESIGN NUMBER: 854.1
LOCATION: Green Lake Seattle
SCALE: NTS

Green Lake
Floating Ecosystems
Island surface

ISSUE DATE: 11/03/22
Drawn By: George Olley

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The Enterprise Park, Forres, Moray,
Scotland IV36 2AB,
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www.biomatrixwater.com





DESIGN NUMBER: 854.1

LOCATION: Green Lake Seattle

SCALE: NTS

Green Lake
Floating Ecosystems
Submerged and open units

ISSUE DATE: 11/03/22

Drawn By: George Olley

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DESIGN NUMBER: 854.1

LOCATION: Green Lake Seattle

SCALE: NTS

Green Lake
Floating Ecosystems
Island underside

ISSUE DATE: 11/03/22

Drawn By: George Olley

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Notes:

- Acces openings in base of perimeter fencing provided. Suggested opening size reduce to 4" in height, as Geese may enter under if 6". Gao length ~ 20"
- Total bird fence height is approximately 16"
- The fencing is secured to the module with cable ties to allow removal once the plants are mature as well as the up right fence posts as seen in the pictures.



Submerged modules, top support frame, and internal submerged tray. Note Submerged tray is buoyant until loaded with gravel, in order to offset weight. SS Adjustable chain connection provided between top from and submerged tray.



DESIGN NUMBER: 854.1
LOCATION: Green Lake Seattle
SCALE: NTS

Green Lake
Floating Ecosystems
Submerged module detail

ISSUE DATE: 11/03/22
Drawn By: George Olley

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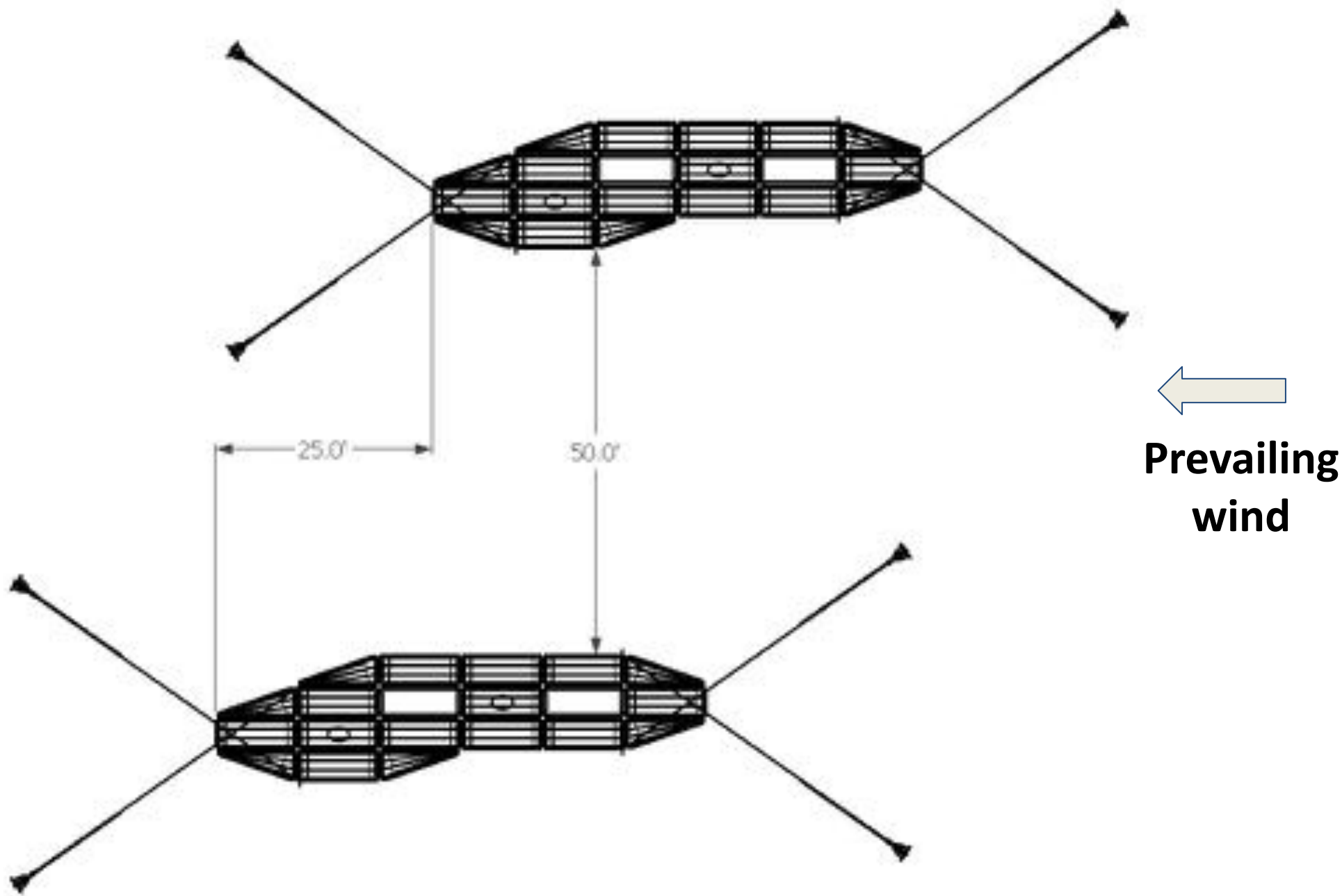


Tree basket construction comprises of:

- 2" 10 gauge green coated wire mesh
- ½" brown PE mesh
- Top edge polyhemp Green geotextile liner
- Coir matt

Standard 3D /4D island build up,

- HDPE Tough Float
- SS Hardware and Connections
- PP mesh
- Geotextile underlay,
- Coir overlay,
- SS C ring connections throughout.



DESIGN NUMBER: 854
 LOCATION: Seattle
 SCALE: NTS

Green Lake
 Floating Ecosystems
 Relative island locations

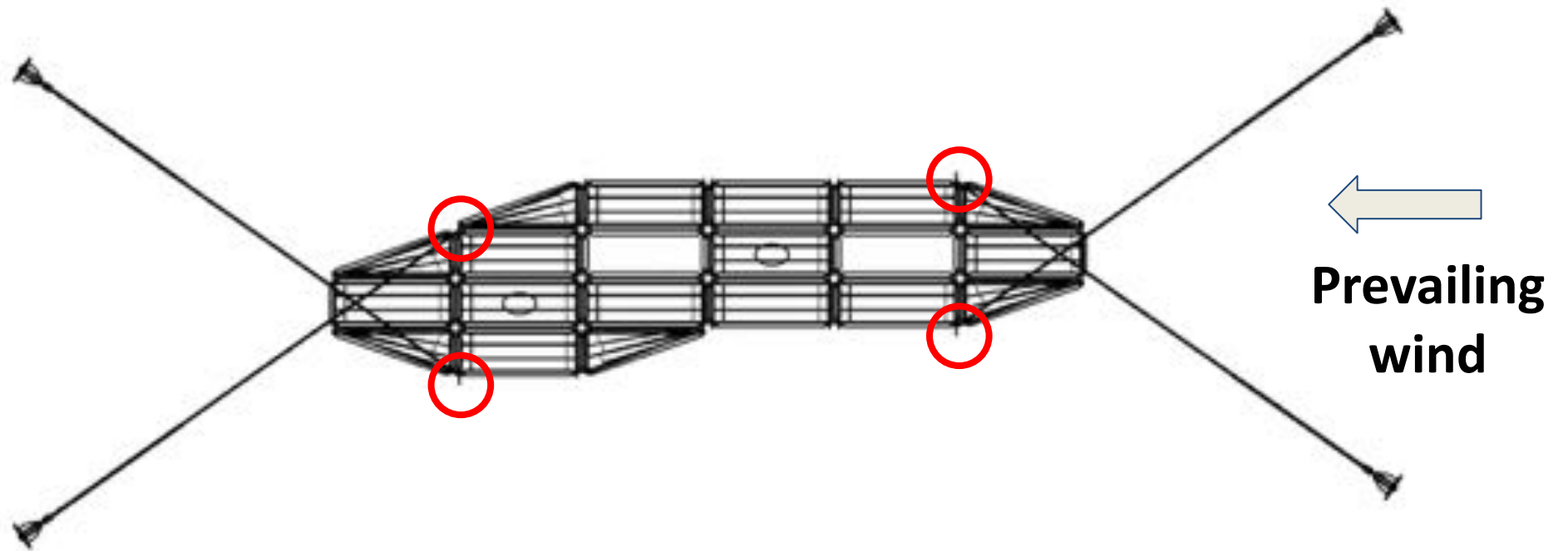
ISSUE DATE: 09/03/22
 Drawn By: GO

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Anchor locations



Note: Secured to pre installed 3 mm flanges

DESIGN NUMBER: 854
LOCATION: Seattle
SCALE: NTS

Green Lake
Floating Ecosystems
Anchor locations

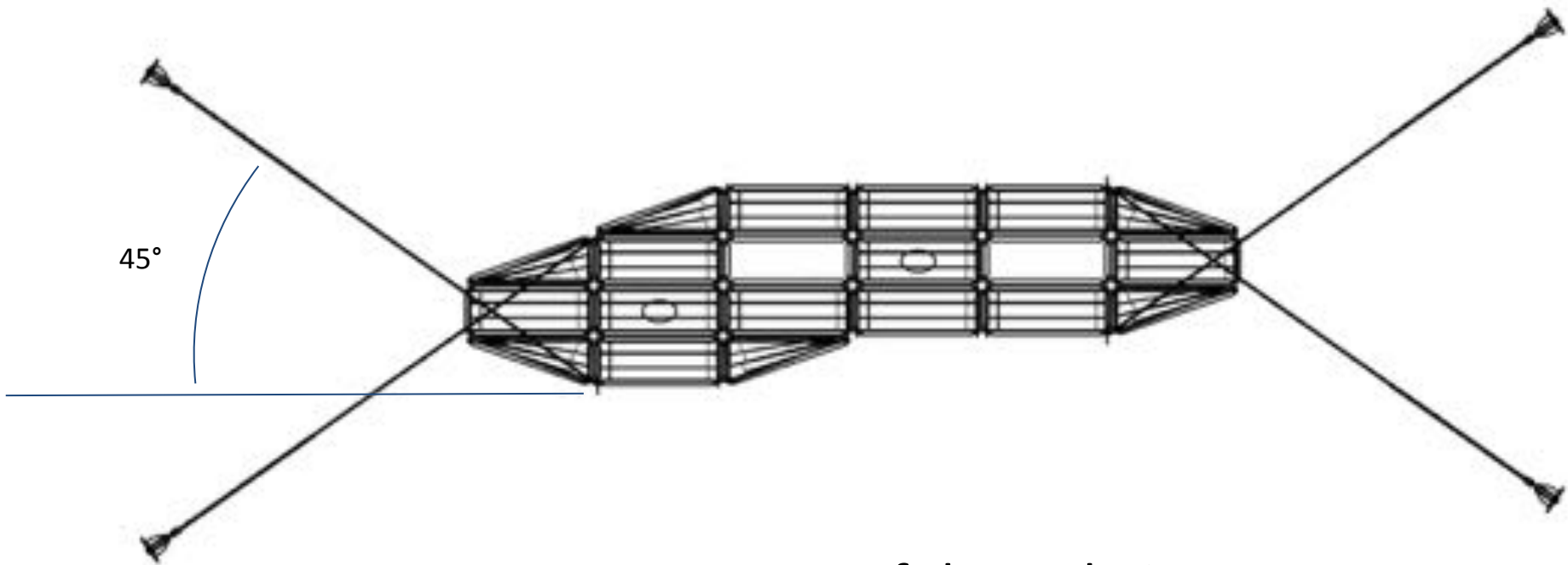
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Chain recommendations



50ft long chain

Upper section - 30 ft of $\frac{1}{2}$ " SS chain

Lower section - 20 ft of $\frac{3}{4}$ " SS chain

DESIGN NUMBER: 854
LOCATION: Seattle
SCALE: NTS

Green Lake
Floating Ecosystems
Anchor chain concept

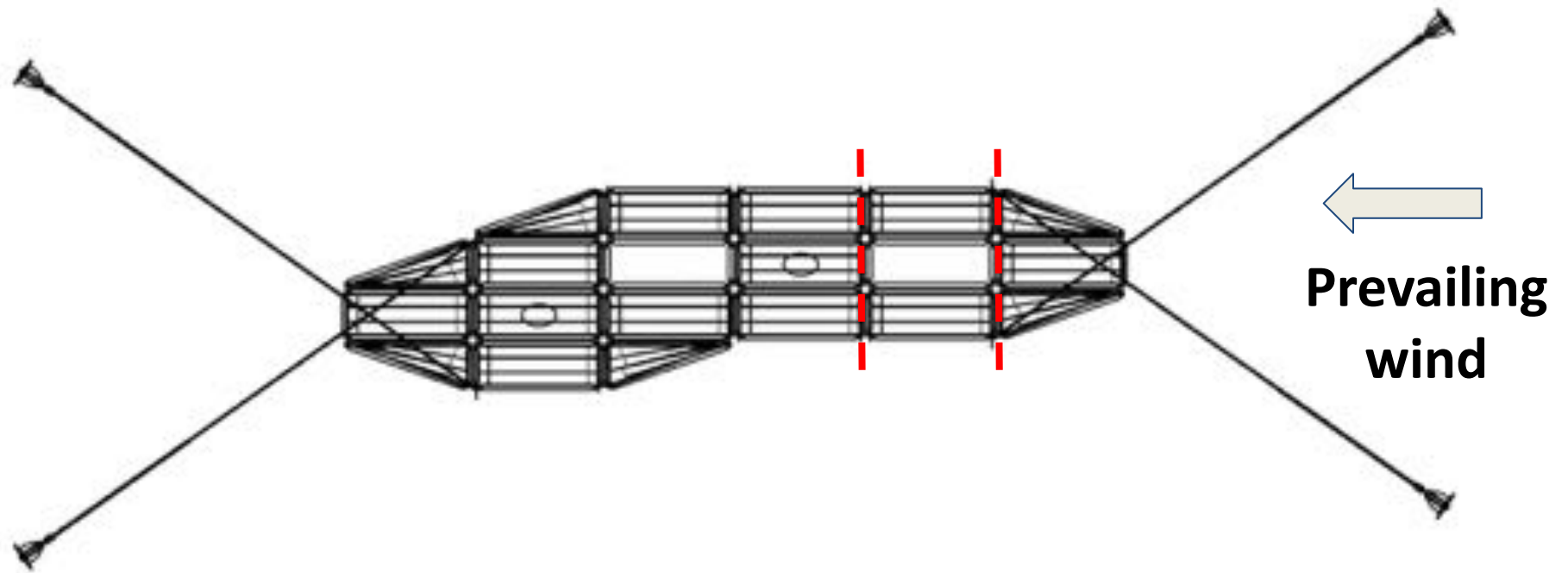
ISSUE DATE: 09/03/22
Drawn By: GO

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Pivot Hinges



DESIGN NUMBER: 854
LOCATION: Seattle
SCALE: NTS

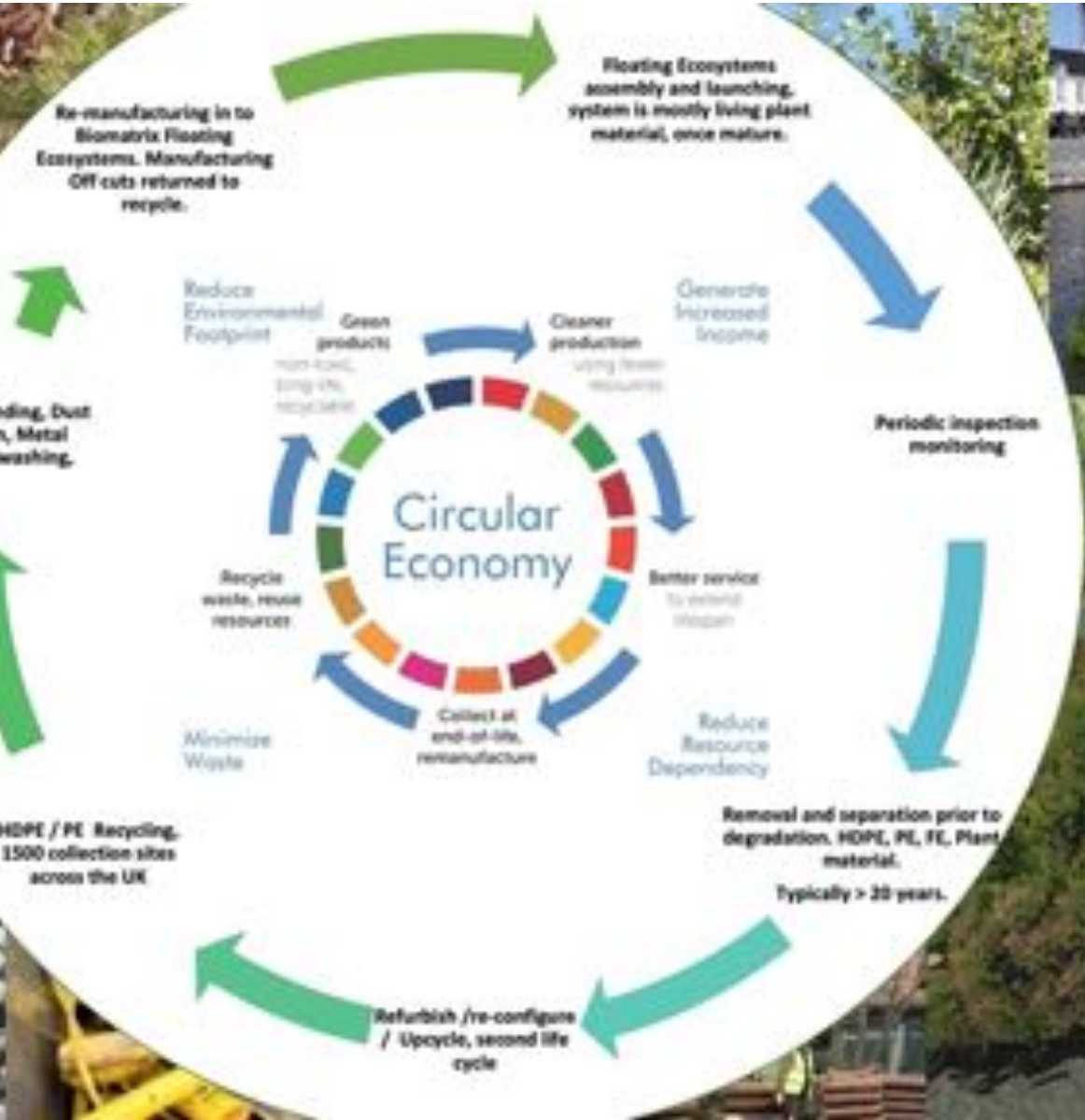
Green Lake
Floating Ecosystems
Pivot hinge locations

ISSUE DATE: 09/03/22
Drawn By: GO

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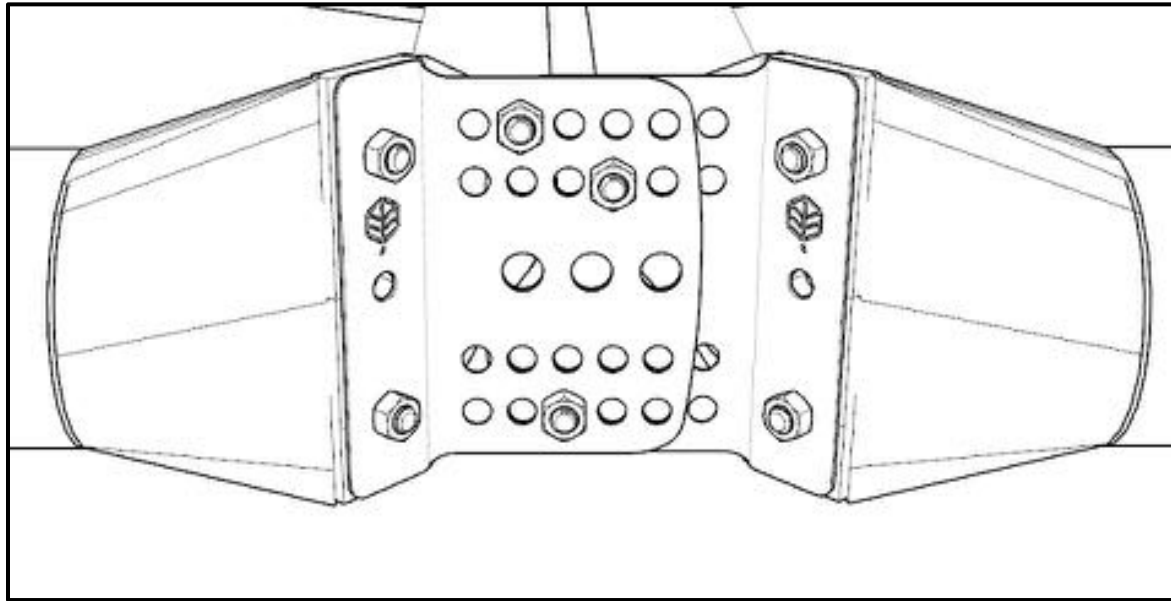




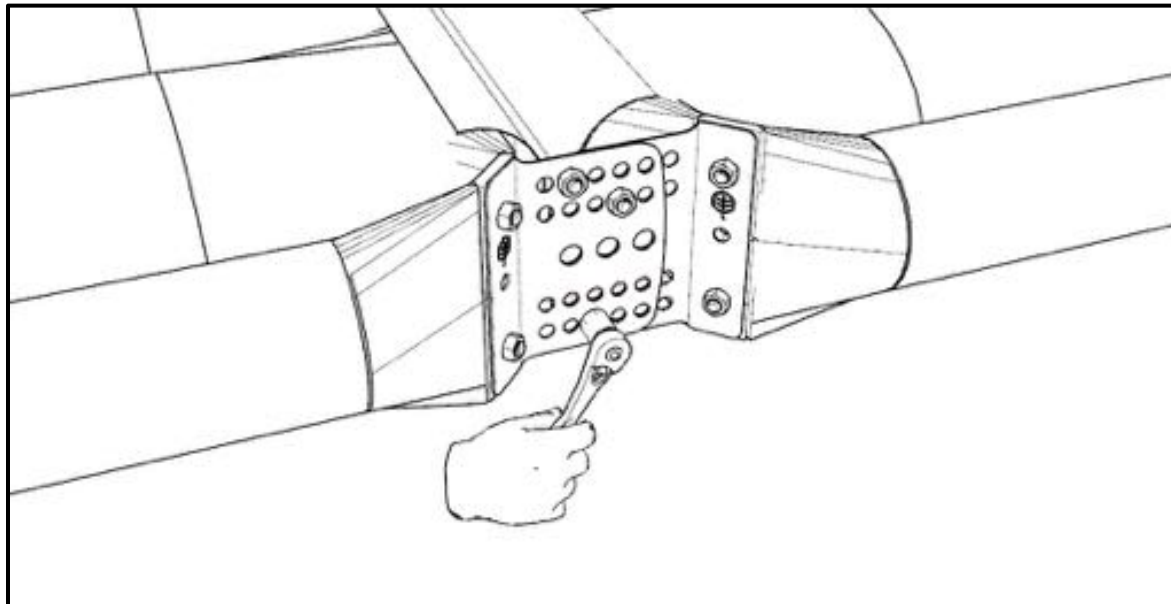
ECOSYSTEM PLANTING & CONSTRUCTION

Biomatrix modules are simple to assemble and provide a versatile interlocking system which can be configured to fit site conditions





Biomatrix Floating Ecosystems are connected with 2/3mm stainless steel flange plates capable of withstanding over 4 tonnes of pull apart pressure.



Connecting another section of islands as part of a second phase of works is a simple task of lining up the new section of islands with the existing and bolting them together.



ECOSYSTEM PLANTING & CONSTRUCTION

Plants are laid across the islands ready for planting by seasoned professionals, left, or younger ecologists, below, who can create and watch their own ecosystems grow







Reference Images



 **BIOMATRIX**
BRINGING WATER TO LIFE







06/03/20

Biomatrix Water Solutions

Floating Ecosystems

Standard Installation Guidance



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1. Installation manual

This document provides general guidance on the typical installation of Biomatrix Water Floating Ecosystems. Most projects involve a degree of custom design and each installation location is different. Accordingly, this guidance document should be read taking into account the particulars of your specific project and specific project installation location.

2. Health & Safety

Before starting an installation, do make sure all H&S appliances are in order.

1. Make sure you have a Risk Assessment and Method Statement in place prior to the works.
2. Perform a general site inspection to investigate any potential Risks & Hazards.
3. If any are discovered, please act to prevent or minimize the likelihood and severity.
4. Make sure instructions are given accordingly to all involved during the installation.
5. Have proper precautionary measures in place, such as life vest, throwing lifeline, gloves, hi-vis, anti-bacterial gel, safety shoes etc.

3. Tools

Make sure to check before installation whether you have a full installation Tool kit available. Please see Tool Kit list.

4. Toolkit list

To perform an installation the following tools are suggested. It is advised to have some duplicate tools to help speeding up the installation.

Tools For Assembly

2 x 17mm spanners	1 x pliers/grips
1 x 17mm socket wrench	2 x maul grips
1 x 10mm socket wrench	1 x hammer
1 X 19mm spanner	1 x adaptor to drive sockets, with drill
2 x 17mm scaffolders podgers	1 x mallet
2 x straight garden snips	1 x heavy duty wire cutters
1 x Stanley knife	1 x scissors
1 x tape measure	1 x shackle spanner

Tools For Anchoring:

2 x Safety Goggles
1 x Hammer Drill & Bits (12mm & 20mm SDS)
1 x 19mm spanner for 12mm bolts.
1 x 10mm deep wrench for wire rope grips (preferably with adaptor for cordless drill)
1 x Long tape measure

Other tools, if available, can always be of use in certain situations and you may need other special tools for your particular site conditions.

5. Arrival of Floating Ecosystem

Upon arrival of the Floating Ecosystem make sure you have a safe place to offload and store them. If there is no forklift available, do make sure you have a team of a minimum 2 persons to offload the islands. Modules are heavy, particularly 3D, 4D and high buoyancy models and it will take at least two people to move each module.

A laminated Layout Drawing is usually provided showing your island configuration with each module numbered if the project has been built to a specific design. For most projects each piece will typically have a numbered tag corresponding to the Layout Drawing. If you have enough space on land you can layout the modules or sections of modules in the position they will be installed in. Once laid out on land, check to ensure that all connecting flanges are in the correct location to connect to each other. Flanges can be changed, but sometimes the stainless steel can bind so it is best to minimise flange adjustments as much as possible.

It is a good idea to check all bolts for tightness, on arrival as some may have travelled a considerable distance with long periods of vibration. Often you can check the tightness of all bolts while the island is still on the pallet.

6. Planting

Planting is easiest on land, section by section. Planting on the water is possible, but a bit more challenging.

3D & 4D Spec

1. For 3D and 4D planting, lay the plants out on the islands in the planting layout / design and planting density.
2. Once all the plants have been laid out in the right density remove the plants from their pots one at a time and push into the planting lane with a rolling action.
3. Typical planting density is 10-12 plants per m². Or about 25 plants per R-2.3 rectangle and 35 plants per R-3 Rectangle
4. In general, Low spreading plants can be planted along the two edge planting lanes, (Caltha Pulastrus, Lysimachia Numelaria, Myasotis Scorpiodes etc.) and taller more vertical plants should be planted in the two central planting lanes. (Juncus Inflexus, Lythrum Salicaria, Iris Pseudocorus etc.)

5. Some larger robust plants, such as 1 and 2 litre Juncus and Carex can sometimes be split into two plants for more even coverage.
6. See Biomatrix's planting guidelines for more info about planting and planting structure.



2D Spec

With 2D specification floating ecosystems, the pre-planted coir mat can simply be placed onto the ecosystem module. If placing on a triangle, the coir matt can be cut using a heavy-duty pair of garden shears, and large pair of scissors. In wavy locations the Coir matts can be cable tied down, as needed until the plant roots are established.

7. Assembling Modules

Modules can be assembled on land if space is available or on the water. If the ground is relatively flat it is often considerably easier to assemble in sections on land however there will be a limit to the number of pieces which can be assembled together on land, before they become too heavy to launch with our available launching equipment and people. Most projects are assembled in sections on land, and these sections are then assembled together into the complete project on the water. Consider your available lifting person power and plan your sections accordingly. It would typically require 2 people per module to launch, unless you have a smooth gradual slope in to the water.

Assembly of sections involves lining up the holes in the flanges and bolting together, with 20mm or 40mm Stainless steel bolts, There are four rows of bolts and multiple positions which the changes can be connect in, however the typical positioning is with the three large holes in the middle of each flange lining up to the three large holes in the subsequent flange.

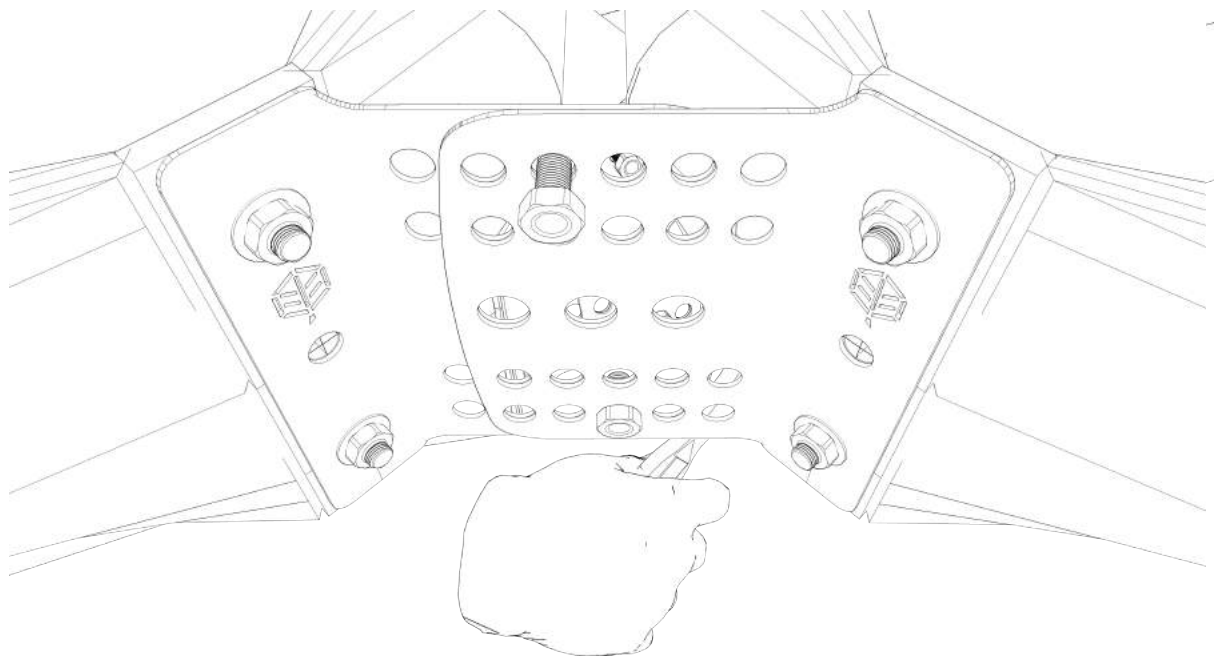
There are two types of connections, Pivot & Rigid, and the spike end of the 17mm Scaffolders Podger can be very helpful in lining up flanges.

Pivot connection is for wave absorption and rigid connection is for flat water canal, river, or pond locations.

Flanges can be connected in pivot configuration with one large 16mm pivot bolt in the central holes provided.

Flanges can be connected in rigid configuration with two or three bolts between the flange top and bottom providing a more rigid connection. This involves 10mm Bolts, and you will need your 17mm wench and 17mm socket.

A row of modules can be made to curve, around a riverbank for example, by connecting flanges with the closest holes on one side and further out holes on the other. In this way the angle of module connections is adjusted.



To facilitate the easiest connection of assembled sections it is important to make sure the flanges all line up to the next section, before it is launched on the water.

For example, you may have assemble an island six pieces wide, and be ready to then assemble a second section to connect to the first, before the first is launched, line up the two sections and adjust flange angle as needed to achieve the best line up possible.

Flange angel can be adjusted with a mallet, or with a large pair of needle nose maul grips. For some projects, utilising a 40mm long connection bolt as your first bolt can help to bring the flanges closer together to allow the subsequent 20mm bolts to be secured. Utilise your scaffolders poger to help align the flange holes. 2 bolts per flange is acceptable for flat water installations, but for locations with currents or waves, 3 bolts are preferable.

8. Assembly on the water.

Assembling sections of islands on the water is best done from a boat or with waders, provided the conditions are safe for wading. Once you're ready to get the modules or

Leaning over the edge of the boat to install the connection bolts, it is useful to fasten tools to your buoyancy aid via a tether in case of droppage. You will typically need access to both sides of a section in order to secure it together. If assembling large sections on the water, the use of a long scaffolding boards is recommended so that island sections can be accessed without pushing them too far down in the water.

When assembling a section where four *corners* come together in the middle of an island, the two bolts to connect the flanges can be installed at the top with a space of at least two holes between them rather than at the top and bottom as they should be along the outer perimeter of the island.

9. Entering Water

Once you're ready to get the modules or sections in the water make sure you have a rope attached to the sections or someone in the water guiding, placing or securing them.



Bird Post & Fencing

Bird fencing is often required to discourage grazing by large wildfowl such as geese or swans while plants are becoming established. Bird fencing can be carried out once the whole section is assembled and on the water, or per pre-sections pre-assembled on land with a join in the fencing to connect on the water.

Bird Fencing Posts

Bird posts are installed with a hammer or mallet. The bottom of the bird posts is hooked behind the bottom bolt of the flange connection, tilted into a vertical position with the base remaining hooked behind the bottom bolt at its spacing washer. A hammer or a mallet can

then be used to tap them down to lock the post into a vertical position. At each connection of island components only one post is required, accordingly post spacing is typically 2.3m or 3m. Where possible, install bird posts so the hooks, point outwards perpendicular to the island structure.



Bird Fencing

Fencing is cut into rolls to provide a height of 30, 45, or 50 cm above the water surface, with 45cm being typical.

The bird posts have hooks on them set approximately at the spacing of the fencing openings. The hooks can help to position the fencing, but it is not essential to have all hooks connected as holes are also provided to cable tie the mesh to the posts. cable tied down to the island mesh, as needed in the middle between posts.

Once rolling the fencing to the next post make sure you pull the fence tight and hook them again in a few hooks. Once the fencing is placed as intended, finish this fixing with zip-ties typically with two cable ties per island section.

Rolls of fencing mesh can be linked/spliced together by cutting and wrapping over the ends to secure one roll of fencing material to the next.

The main threat to young plants is geese or swans, and we often are happy to have smaller waterfowl on board. In order to allow small birds such as ducks and coots access in and out of the islands we typically cut a small opening (about 3 squares by 3 squares) every other mo. We call these “Duck Doors” These are also important for allowing chicks from nesting birds out to the water and back again. It is important to note that the fencing is a deterrent, not a complete exclusion, and geese and swans will sometimes find their way on, and in these events, some re-planting may be necessary.

10. Anchoring

Anchoring is typically project specific.

11. Finishing Inspection

Once all anchors and sections are in place do make sure to do a final inspection to see whether there are any final adjustments to be made.

12. Indicative Project Completion Check List

1. All plants are planted to a depth that their roots are wet
2. Anchor bolts and hardware are double checked and secure
3. Island module connections are secure
4. Bird fencing is secure at the bottom and fence posts
5. Duck Doors have been cut into bird fencing / edging to allow small and baby birds ingress & egress
6. Any zip ties used are pinched tight and cut back with all trimmings recycled
7. Before and after installation photos logged
8. The site is clean, and ecosystems ready to grow!

13. Care and Maintenance

Project care and maintenance is typically suggested according to the particulars of each location with most projects entailing periodic checks but minimal actual work. A more detailed guide on the care and maintenance can be found in the downloads section on the Biomatrix Website. Each project may have its specific maintenance recommendations, contact Biomatrix for the latest version.

<http://www.biomatrixwater.com/wp-content/uploads/2019/03/Floating-Ecosystems-Maintenance-2018.pdf>

CONTACT: Should you have any questions about the care and maintenance of your new floating ecosystem, don't hesitate to be in touch with the team at Biomatrix, we are here to help, and like to keep in touch with projects as they grow and mature.

BIOMATRIX WATER Ecosystem-Infrastructure
Horizon Scotland,
The Enterprise Park Forres,
Moray,
Scotland
IV36 2AB

Front Desk: +44 (0) 1309 678100
solutions@biomatrixwater.com
www.biomatrixwater.com

FLOATING ECOSYSTEM PROJECT MONITORING, MAINTENANCE & ENGAGEMENT

Floating Ecosystems provide a low maintenance approach to revitalise and bring opportunities for wildlife to waterbodies. Other key benefits include amenity value, aesthetic value, ecological value and the use of the ecosystems as an educational resource. The monitoring operations and maintenance of the floating ecosystems is typically minimal and can be compared to a typical natural landscape installation and pontoon system.

Our floating islands mimic naturally occurring riparian wetland biomes. One of the main benefits of these units is that they require no watering and nature tends to be very effective at managing itself once we provide the floating structures. Systems can be left wild and natural or can involve additional plant care for a more managed visual aesthetic.

Monitoring can provide an opportunity to get the most out of your Floating Ecosystems installation. Periodic reporting on biodiversity, water quality, and habitat establishment can be coupled with community engagement, educational and teambuilding activities. Reporting can incorporate written updates and data as well as photography, including waterscape, macro, and underwater images; and video formatted for sharing with project stakeholder groups.

The frequency of monitoring varies from site to site and a schedule can be put into place to match the site conditions and project objectives. Monitoring can be provided by Biomatrix Water or Biomatrix can provide Monitoring Training so that this may be carried out by local stakeholders and volunteers.

Project monitoring can involve activities related to environmental monitoring, plant care, anchoring, bird fencing, ecosystem structure, and litter collection.

Monitoring plans typically decrease over time, often with a set period, and followed by review and less frequent monitoring or monitoring on an as needed basis. Once plants are established the ecology will typically continue to thrive with minimal intervention.

For specific sites, monitoring plans can be set out according to the number of visits per year. Each activity may take place over a series of years. For example (2) in the activity row for trimming plants in column Y-1 (year one) indicates that the plants shall be trimmed twice in the first year from project installation. See pages 5-7 below for more details.

MAINTENANCE & MONITORING ACTIVITIES

Maintenance visits shall include the following activities:

Plant Care

- Typically, selective spot trimming of annual plants in autumn, or spring once per year, using hand tools or strimmer, removing some plant material and re-incorporating some of the trimmed plant material in to the planting lanes for 3D islands or laying down between plants on 2D islands, to maintain planting media structure. Generally removing as little plant material as possible.
- Removal of undesirable plants, as needed. Occasional spot planting of target desirable species.

Floating Ecosystem Structure

The floating Ecosystems structure is robust and constructed from durable materials, to limit maintenance requirements. As general good practice, it is useful from time to time to visually inspect the system for any wear and tear. It is good practice to have your installation inspected and monitored every 1-4 years, according to site conditions.

Anchoring

Anchor inspection typically involves the inspection of hardware where it connects to the islands, and anchor cable/anchor ropes / cables / guides and a general check of the overall anchoring system as would be carried out with a typical pontoon mooring system.

Ecosystem Structure

Connection flanges and bolts can be observed as well as anchoring hardware and floats. Maintenance is only required on these elements in the event of specific wear and tear or when damage from external factors is observed.

Litter removal

In areas where windblown or washed down litter is present litter removal is suggested as needed to maintain a clean and natural ecosystem.

ENVIRONMENTAL MONITORING:

Environmental monitoring provides a great opportunity to observe your ecosystems development and to document and share its progress with others.

Environmental Monitoring can include the following as desired:

- Macrophyte diversity reporting
- Invertebrate diversity and indicator species reporting
- Water Chemistry, P, N, TSS, Secchi depth
- Written and photographic reporting for media
- Waterscape photography
- Macro species photography
- Underwater photography and video

ENGAGEMENT & EDUCATION

The opportunity for wider stakeholders to benefit from the maintenance and monitoring program is significant. Local schools, NHS service users, staff from local businesses, local residents etc. can all get involved with programs parallel to the ongoing management of the floating ecosystems.

We welcome one-off events as well as ongoing interaction with the islands. In the past we have collaborated with musicians and artists for concerts and symphonies composed and dedicated to the plants and performed on the water.

Our staff are well versed in both economic and ecological botany and are always interested in sharing their knowledge. We always like to discuss with the stakeholder groups involved to ensure our engagements are as context specific as possible but some of our best are:

- Species Identification Classes
- Habitat Design Workshops
- Edible Plants and their Historic Uses
- Water quality and monitoring



Critter Making Workshop at Southmere Lake, London

CONTACT:

Should you have any questions about the care and maintenance of the floating ecosystem, don't hesitate to get in touch with the team at Biomatrix, we like to keep in touch with projects as they grow and mature.



BIOMATRIX WATER

Ecosystem-Infrastructure

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solutions@biomatrixwater.com

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PLANT CARE:

Suggested plant care activities, to achieve different aesthetics as suggested are as follows.

Wild / Native Aesthetic:	Y-1	Y-2
1. Generally, allow the planting to grow and evolve as they would in a wild context, observation but minimal to no intervention.		

Semi-Wild Aesthetic:	Y-1	Y-2
1. Typically, selective spot trimming of annual plants in autumn or spring once per year, using hand tools or a strimmer, removing some plant material and re-incorporating some of the trimmed plant material in to the planting lanes for 3D islands or laying down between plants on 2D islands, to maintain planting media structure. Generally removing as little plant material as possible.		
2. Removal of undesirable plants as needed. Occasional spot planting of target desirable species.		
3. General trimming as desired.		

Ornamental Aesthetic:	Y-1	Y-2
1. Typically, selective spot trimming of annual plants in autumn, or spring once per year, using hand tools or strimmer, removing some plant material and re-incorporating some of the trimmed plant material in to the planting lanes for 3D islands or laying down between plants on 2D islands, to maintain planting media structure. Generally removing as little plant material as possible.		
2. Check for trees taking root, once every 1-2 years, and remove, except where planted in High Buoyancy Planters.		
3. Removal of undesirable plants as needed.		
4. Occasional, spot planting of target species, seasonal ornamental, etc. as you would with a land based ornamental garden.		
5. General trimming as desired.		
6. Wood chips are a common mulching and planting media in landscaping projects. They can be used with good effect on Floating Ecosystem within the planting lanes on 3D and 4D systems and with the planting bed on 2D systems. From time to time, wood chips can be added as desired.		

FLOATING ECOSYSTEM STRUCTURE:

The floating ecosystems structure is robust and constructed from durable materials, to limit maintenance requirements. As general good practice, it is useful from time to time to visually inspect the system for any potential wear and tear. It is good practice to have your installation inspected and monitored by an experienced installer every 1-4 years, according to site conditions.

Anchoring:	Y-1	Y-2
Anchor inspection typically involves the inspection of hardware where it connects to the islands, and anchor cable_anchor ropes / cables / Guides and a general check of the overall anchoring system as would be carried out with a typical pontoon or mooring system.		
Litter Removal:	Y-1	Y-2
In areas where windblown or washed down litter is present litter removal is suggested as needed to maintain a clean and natural ecosystem. Biomatrix can provide a maintenance service or training following installation as well as periodic inspections as needed if required.		
Ecosystem Structure:	Y-1	Y-2
Connection flanges and bolts can be observed as well as anchoring hardware and floats. Maintenance is only required on these elements in the event of specific wear and tear, or when damage from external factors is observed.		

Engagements

Stakeholders engaging in activities are coordinated by the client. We find the projects with greater involvement from local communities at the start have more public buy-in and the wider health and wellbeing benefits are increased.

Volunteer Assisted installation	Y-1	Y-2
Stakeholders help with planting, assembling and launching the ecosystem modules. Volunteers will have a great time learning the names of the different species planted and what kinds of habitat they offer.		N/A
Creative Workshops	Y-1	Y-2
Anything from plant illustration to help with identification to wildlife photography. We have a large creative collaborator network and we love discussing how best local stakeholders can engage with their local ecosystems.		
Local Stakeholder Collaboration	Y-1	Y-2
We have numerous projects in which we have a strong relationship with local canoeing companies and have entered into discussions with chefs that want to use produce grown on our islands. Do you know of any business' that may find our islands to be an interesting resource?		

ENVIRONMENTAL MONITORING:

Environmental monitoring provides a great opportunity to observe your ecosystems development and to document and share its progress with others.

<u>Environmental Monitoring can include the following as desired.</u>		
	Y-1	Y-2
1. Macrophyte diversity reporting		
2. Invertebrate diversity and indicator species reporting		
3. Water chemistry, P, N, TSS, Secchi depth		
4. Written and photographic report, for media		
5. Waterscape Photography		
6. Macro species photography		
7. Underwater photography and video		

CONTACT:

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HYDRAULIC PROJECT APPROVAL

Washington Department of
Fish & Wildlife
PO Box 43234
Olympia, WA 98504-3234
(360) 902-2200

Issued Date: October 13, 2021
Project End Date: December 31, 2022

Permit Number: 2021-4-754+01
FPA/Public Notice Number: N/A
Application ID: 25316

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
Friends of Green Lake ATTENTION: Rob Zisette 3519 Burke Ave N Seattle, WA 98103	

Project Name: Floating Wetlands Project - Friends of Green Lake

Project Description: The Friends of Green Lake (FOGL) is a grass roots organization of citizens devoted to maintaining a healthy lake that formed in response to toxic algae blooms and have been instrumental in water quality improvements and shoreline restoration. FOGL recently assembled a leadership team of experts for the design, purchase, planting, installation, and maintenance of constructed floating wetlands in the lake for improvement of native bird habitat, fish habitat, water quality, aesthetic value, and wetland education. Constructed floating wetlands mimic natural floating bog mats and enhance functional values at a relatively low cost because they do not require land purchase or excavation. Herrera teams with Biomatrix Water for floating wetland projects because they have proven to make the best engineered wetlands in the world with HDPE tubing for exceptional durability and longevity, natural coir fiber matrix for excellent plant support, modular units of varied shapes with quick-connect stainless steel corners, submerged media columns for increased biofilm, tree pods for three-dimensional structure, wave barriers for protection in high wake areas, submerged platforms for protected juvenile fish foraging habitat, and clip on fencing for protection from grazing Canada geese. The goal of this project is to demonstrate this unique and cost-effective restoration approach at a highly visible location for many Seattle residents in hope of promoting more constructed floating wetlands in our region. The project team has developed a work plan and preliminary design to maximize the site-specific function and benefit of the floating wetlands. The current concept is for two, 680-square-foot islands with a curvilinear shape to be anchored next to each other in an isolated area near a national refuge with a focus on native bird habitat while also benefiting fish and water quality.

PROVISIONS

TIMING - PLANS - INVASIVE SPECIES CONTROL

- 1. TIMING LIMITATION:** You may begin the project on October 13, 2021 and you must complete the project by December 31, 2022.
- 2. APPROVED PLANS:** You must accomplish the work per plans and specifications submitted with the application and approved by the Washington Department of Fish and Wildlife, except as modified by this Hydraulic Project Approval. You must have a copy of these plans available on site during all phases of the project construction.
- 3. INVASIVE SPECIES CONTROL:** Follow Method 1 for low risk locations (i.e. clean/drain/dry). Thoroughly remove visible dirt and debris from all equipment and gear (including drive mechanisms, wheels, tires, tracks, buckets, and undercarriage) before arriving and leaving the job site to prevent the transport and introduction of invasive species. For contaminated or high risk sites please refer to the Method 2 Decontamination protocol. Properly dispose of any water



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and chemicals used to clean gear and equipment. You can find this and additional information in the Washington Department of Fish and Wildlife's "Invasive Species Management Protocols", available online at <https://wdfw.wa.gov/species-habitats/invasive/prevention>.

NOTIFICATION REQUIREMENTS

4. NOTIFICATION: You, your agent, or contractor must contact the Washington Department of Fish and Wildlife by e-mail at HPAapplications@dfw.wa.gov; mail to Post Office Box 43234, Olympia, Washington 98504-3234; or fax to (360) 902-2946 at least three business days before starting work. The notification must include the permittee's name, project location, starting date, and the Hydraulic Project Approval permit number.

5. PHOTOGRAPHS: You, your agent, or contractor must take photographs of the job site before the work begins and after the work is completed. You must upload the photographs to the post-permit requirement page in the Aquatic Protection Permitting System (APPS) or mail them to Washington Department of Fish and Wildlife at Post Office Box 43234, Olympia, Washington 98504-3234 within 30-days after the work is completed.

6. FISH KILL/ WATER QUALITY PROBLEM NOTIFICATION: If a fish kill occurs or fish are observed in distress at the job site, immediately stop all activities causing harm. Immediately notify the Washington Department of Fish and Wildlife of the problem. If the likely cause of the fish kill or fish distress is related to water quality, also notify the Washington Military Department Emergency Management Division at 1-800-258-5990. Activities related to the fish kill or fish distress must not resume until the Washington Department of Fish and Wildlife gives approval. The Washington Department of Fish and Wildlife may require additional measures to mitigate impacts.

STAGING, JOB SITE ACCESS, AND EQUIPMENT

7. Establish staging areas (used for equipment storage, vehicle storage, fueling, servicing, and hazardous material storage) in a location and manner that will prevent contaminants such as petroleum products, hydraulic fluid, fresh concrete, sediments, sediment-laden water, chemicals, or any other toxic or harmful materials from entering waters of the state.

8. Check equipment daily for leaks and complete any required repairs in an upland location before using the equipment in or near the water.

9. If needed use environmentally acceptable lubricants composed of biodegradable base oils such as vegetable oils, synthetic esters, and polyalkylene glycols in equipment operated in or near the water.

CONSTRUCTION-RELATED SEDIMENT, EROSION AND POLLUTION CONTAINMENT

10. Stop all hydraulic project activities except those needed to control erosion and siltation, if flow conditions arise that will result in erosion or siltation of waters of the state.

11. Prevent project contaminants, such as petroleum products, hydraulic fluid, fresh concrete, sediments, sediment-laden water, chemicals, or any other toxic or harmful materials, from entering or leaching into waters of the state.

12. Deposit waste material from the project, such as construction debris, silt, excess dirt, or overburden, in an upland area above the limits of anticipated floodwater unless the material is approved by the Washington Department of Fish and Wildlife for reuse in the project.

CONSTRUCTION MATERIALS

13. Do not use wood treated with oil-type preservatives (creosote, pentachlorophenol) in any hydraulic project. You may use wood treated with waterborne preservatives (ACZA, ACQ) provided the wood is approved by the Western Wood Preservers Institute for use in the aquatic environment. Any use of treated wood in the aquatic environment must follow guidelines and best management practices available at www.wwpinstitute.org.

DEMOBILIZATION AND CLEANUP

14. Upon completion of the project, remove all materials or equipment from the site and dispose of all excess spoils and waste materials in an upland area above the limits of anticipated floodwater.



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Issued Date: October 13, 2021
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Permit Number: 2021-4-754+01
FPA/Public Notice Number: N/A
Application ID: 25316

LOCATION #1:	Site Name: Green Lake Park 7201 East Green Lake Dr N, Seattle, WA 98115					
WORK START:	October 13, 2021			WORK END:	December 31, 2022	
<u>WRIA</u>	<u>Waterbody:</u>			<u>Tributary to:</u>		
08 - Cedar - Sammamish	Green Lake			6823		
<u>1/4 SEC:</u>	<u>Section:</u>	<u>Township:</u>	<u>Range:</u>	<u>Latitude:</u>	<u>Longitude:</u>	<u>County:</u>
SE 1/4	06	25 N	04 E	47.679668	-122.343868	King
<u>Location #1 Driving Directions</u>						
From I-5N, take exit 170. Continue onto 8th Ave NE. Slight left onto NE Ravenna Blvd. Turn right after Starbucks on the right. Turn left at Latona Ave NE.						

APPLY TO ALL HYDRAULIC PROJECT APPROVALS

This Hydraulic Project Approval pertains only to those requirements of the Washington State Hydraulic Code, specifically Chapter 77.55 RCW. Additional authorization from other public agencies may be necessary for this project. The person(s) to whom this Hydraulic Project Approval is issued is responsible for applying for and obtaining any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

This Hydraulic Project Approval shall be available on the job site at all times and all its provisions followed by the person (s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work.

This Hydraulic Project Approval does not authorize trespass.

The person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work may be held liable for any loss or damage to fish life or fish habitat that results from failure to comply with the provisions of this Hydraulic Project Approval.

Failure to comply with the provisions of this Hydraulic Project Approval could result in civil action against you, including, but not limited to, a stop work order or notice to comply, and/or a gross misdemeanor criminal charge, possibly punishable by fine and/or imprisonment.

All Hydraulic Project Approvals issued under RCW 77.55.021 are subject to additional restrictions, conditions, or revocation if the Department of Fish and Wildlife determines that changed conditions require such action. The person(s) to whom this Hydraulic Project Approval is issued has the right to appeal those decisions. Procedures for filing appeals are listed below.



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MINOR MODIFICATIONS TO THIS HPA: You may request approval of minor modifications to the required work timing or to the plans and specifications approved in this HPA unless this is a General HPA. If this is a General HPA you must use the Major Modification process described below. Any approved minor modification will require issuance of a letter documenting the approval. A minor modification to the required work timing means any change to the work start or end dates of the current work season to enable project or work phase completion. Minor modifications will be approved only if spawning or incubating fish are not present within the vicinity of the project. You may request subsequent minor modifications to the required work timing. A minor modification of the plans and specifications means any changes in the materials, characteristics or construction of your project that does not alter the project's impact to fish life or habitat and does not require a change in the provisions of the HPA to mitigate the impacts of the modification. If you originally applied for your HPA through the online Aquatic Protection Permitting System (APPS), you may request a minor modification through APPS. A link to APPS is at <http://wdfw.wa.gov/licensing/hpa/>. If you did not use APPS you must submit a written request that clearly indicates you are seeking a minor modification to an existing HPA. Written requests must include the name of the applicant, the name of the authorized agent if one is acting for the applicant, the APP ID number of the HPA, the date issued, the permitting biologist, the requested changes to the HPA, the reason for the requested change, the date of the request, and the requestor's signature. Send by mail to: Washington Department of Fish and Wildlife, PO Box 43234, Olympia, Washington 98504-3234, or by email to HPAapplications@dfw.wa.gov. You should allow up to 45 days for the department to process your request.

MAJOR MODIFICATIONS TO THIS HPA: You may request approval of major modifications to any aspect of your HPA. Any approved change other than a minor modification to your HPA will require issuance of a new HPA. If you originally applied for your HPA through the online Aquatic Protection Permitting System (APPS), you may request a major modification through APPS. A link to APPS is at <http://wdfw.wa.gov/licensing/hpa/>. If you did not use APPS you must submit a written request that clearly indicates you are requesting a major modification to an existing HPA. Written requests must include the name of the applicant, the name of the authorized agent if one is acting for the applicant, the APP ID number of the HPA, the date issued, the permitting biologist, the requested changes to the HPA, the reason for the requested change, the date of the request, and the requestor's signature. Send your written request by mail to: Washington Department of Fish and Wildlife, PO Box 43234, Olympia, Washington 98504-3234. You may email your request for a major modification to HPAapplications@dfw.wa.gov. You should allow up to 45 days for the department to process your request.

APPEALS INFORMATION

If you wish to appeal the issuance, denial, conditioning, or modification of a Hydraulic Project Approval (HPA), Washington Department of Fish and Wildlife (WDFW) recommends that you first contact the department employee who issued or denied the HPA to discuss your concerns. Such a discussion may resolve your concerns without the need for further appeal action. If you proceed with an appeal, you may request an informal or formal appeal. WDFW encourages you to take advantage of the informal appeal process before initiating a formal appeal. The informal appeal process includes a review by department management of the HPA or denial and often resolves issues faster and with less legal complexity than the formal appeal process. If the informal appeal process does not resolve your concerns, you may advance your appeal to the formal process. You may contact the HPA Appeals Coordinator at (360) 902-2534 for more information.

A. INFORMAL APPEALS: WAC 220-660-460 is the rule describing how to request an informal appeal of WDFW actions taken under Chapter 77.55 RCW. Please refer to that rule for complete informal appeal procedures. The following information summarizes that rule.



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A person who is aggrieved by the issuance, denial, conditioning, or modification of an HPA may request an informal appeal of that action. You must send your request to WDFW by mail to the HPA Appeals Coordinator, Department of Fish and Wildlife, Habitat Program, PO Box 43234, Olympia, Washington 98504-3234; e-mail to HPAapplications@dfw.wa.gov; fax to (360) 902-2946; or hand-delivery to the Natural Resources Building, 1111 Washington St SE, Habitat Program, Fifth floor. WDFW must receive your request within 30 days from the date you receive notice of the decision. If you agree, and you applied for the HPA, resolution of the appeal may be facilitated through an informal conference with the WDFW employee responsible for the decision and a supervisor. If a resolution is not reached through the informal conference, or you are not the person who applied for the HPA, the HPA Appeals Coordinator or designee may conduct an informal hearing or review and recommend a decision to the Director or designee. If you are not satisfied with the results of the informal appeal, you may file a request for a formal appeal.

B. FORMAL APPEALS: WAC 220-660-470 is the rule describing how to request a formal appeal of WDFW actions taken under Chapter 77.55 RCW. Please refer to that rule for complete formal appeal procedures. The following information summarizes that rule.

A person who is aggrieved by the issuance, denial, conditioning, or modification of an HPA may request a formal appeal of that action. You must send your request for a formal appeal to the clerk of the Pollution Control Hearings Boards and serve a copy on WDFW within 30 days from the date you receive notice of the decision. You may serve WDFW by mail to the HPA Appeals Coordinator, Department of Fish and Wildlife, Habitat Program, PO Box 43234, Olympia, Washington 98504-3234; e-mail to HPAapplications@dfw.wa.gov; fax to (360) 902-2946; or hand-delivery to the Natural Resources Building, 1111 Washington St SE, Habitat Program, Fifth floor. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, you may request a formal appeal within 30 days from the date you receive the Director's or designee's written decision in response to the informal appeal.

C. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS: If there is no timely request for an appeal, the WDFW action shall be final and unappealable.

Habitat Biologist Stewart.Reinbold@dfw.wa.gov
Stewart Reinbold 425-301-9081

 for Director
WDFW

WASHINGTON STATE

Standard Hydraulic Project



AGENCY USE ONLY

Date Received: 2021-09-08

Application ID :25316

Online Submission

Application submitted with attachments and fee

01. Application Information	* Application Type: Standard * Are you applying for a long-term HPA for agricultural irrigation or stock watering purposes under RCW 77.55.021 (9)(c)? No
02. Project Identification	* Project Name (A name for your project that you create. Examples: Smith's Dock or Seabrook Lane Development) Floating Wetlands Project - Friends of Green Lake * NonSimplified Project Type(s) (check all that apply): Habitat
03. Applicant	* Business Name (if applicable) Friends of Green Lake * First Name Rob * Last Name Zisette * Address 1 3519 Burke Ave N * City Seattle * State/Province WA * Zip Code (12345 or 12345-1234) 98103 * Country United States * Primary Phone No (555-555-5555 Ext.) 206-930-6585 * Email rzisette@herrerainc.com
04. Applicant Account Type	* Please select one applicant account type Non-Profit Group

05. Authorized Agent or Contact

*** No agent will be acting on behalf of the Applicant**

Yes

*** Business Name (if applicable)**

Friends of Green Lake

*** First Name**

Rob

*** Last Name**

Zisette

*** Address 1**

3519 Burke Ave N

*** City**

Seattle

*** State/Province**

WA

*** Zip Code (12345 or 12345-1234)**

98103

*** Country**

United States

*** Primary Phone No (555-555-5555 Ext.)**

206-930-6585

*** Email**

rzisette@herrerainc.com

06. Property Owner(s)

*** Business Name (if applicable)**

City of Seattle Parks and Recreation

*** First Name**

David

*** Last Name**

Graves

*** Address 1**

100 Dexter Ave N

*** City**

Seattle

*** State/Province**

WA

*** Zip Code (12345 or 12345-1234)**

98109

*** Country**

United States

*** Primary Phone No (555-555-5555 Ext.)**

206-684-4075

*** Email**

david.graves@seattle.gov

07. Project Location

*** Location**

Site Name: Green Lake Park

Work Start Date: April 1, 2022 Work End Date: December 31, 2022

Address: 7201 East Green Lake Dr N, Seattle, King, WA 98115, United States

Latitude: 47.679668 Longitude: -122.343868

Township: 25 N Range: 04 E Section: 06 Quarter Section: SE 1/4

WRIA: 8 Stream Number: 6015 Stream Name: Green Lake

Parcel No: 062504HYDR 100 Year Flood: No

Drive Direction: From I-5N, take exit 170. Continue onto 8th Ave NE. Slight left onto NE Ravenna Blvd. Turn right after Starbucks on the right. Turn left at Latona Ave NE.

08. Project Description

*** Will you be operating equipment in water?**

No

*** Type of equipment used**

N/A - Floating wetlands will be assembled on land and in the dry. Non-motorized boats will be used to place the floating structures.

*** Summarize the overall project.**

The Friends of Green Lake (FOGL) is a grass roots organization of citizens devoted to maintaining a healthy lake that formed in response to toxic algae blooms and have been instrumental in water quality improvements and shoreline restoration. FOGL recently assembled a leadership team of experts for the design, purchase, planting, installation, and maintenance of constructed floating wetlands in the lake for improvement of native bird habitat, fish habitat, water quality, aesthetic value, and wetland education. Constructed floating wetlands mimic natural floating bog mats and enhance functional values at a relatively low cost because they do not require land purchase or excavation.

Herrera teams with Biomatrix Water for floating wetland projects because they have proven to make the best engineered wetlands in the world with HDPE tubing for exceptional durability and longevity, natural coir fiber matrix for excellent plant support, modular units of varied shapes with quick-connect stainless steel corners, submerged media columns for increased biofilm, tree pods for three-dimensional structure, wave barriers for protection in high wake areas, submerged platforms for protected juvenile fish foraging habitat, and clip on fencing for protection from grazing Canada geese.

The goal of this project is to demonstrate this unique and cost-effective restoration approach at a highly visible location for many Seattle residents in hope of promoting more constructed floating wetlands in our region. The project team has developed a work plan and preliminary design to maximize the site-specific function and benefit of the floating wetlands. The current concept is for two, 680-square-foot islands with a curvilinear shape to be anchored next to each other in an isolated area near a national refuge with a focus on native bird habitat while also benefiting fish and water quality.

*** Describe how you plan to construct each project element. Include specific construction methods and equipment to be used. Identify where each element will occur in relation to the nearest waterbody. Indicate which activities are within the 100-year flood plain.**

No project activities are anticipated to occur within the 100-year floodplain.

Each 680-square foot island will be constructed, including the installation of plantings, prior to installation in the lake. A team of volunteers will pull each unit into place by towing the islands from the shore via nonmotorized boat and dropping anchors to hold them at the desired installation location.

*** Requested Project Start Date:**

04/01/2022

09. Waterbodies (other than wetlands): Impacts and Mitigation	* Requested Project End Date:
	12/31/2022
	* Describe how the project is designed to avoid and minimize adverse impacts to the aquatic environment.
	Floating wetland ecosystems (floating wetlands) are engineered, vegetated rafts made of natural or inert materials that mimic floating bog mats. The floating wetlands for this project are designed to provide valuable habitat for fish and wildlife, and water quality improvement and are thus not anticipated to cause adverse impacts to the aquatic environment. Friends of Green Lake's team of scientists consulted with the design team to use minimally invasive and long-lasting anchors.
	* Will your project impact a waterbody or the area around a waterbody?
	No
	* Have you prepared a mitigation plan to compensate for the project's adverse impacts to non-wetland waterbodies?
	NA
	* Have you prepared a mitigation plan to compensate for the project's adverse impacts to non-wetland waterbodies?
	There are no adverse impacts anticipated to result from the project. Shading created by the floating wetlands will improve habitat conditions for aquatic organisms.
* Describe the source and nature of any fill material, amount (in cubic yards) you will use, and how and where it will be placed into the waterbody.	
There will be no fill material. Anchors will account for less than 1 cubic yard of material and will ameliorated by the creation of new aquatic and wetland habitat. Anchor materials consist of concrete. Materials floating at the water surface (not fill) will consist of coconut coir, live plants, polypropylene mesh (non-toxic), stainless steel hardware and media core, recycled polyethylene, and polyethylene dynamic media fiber. All materials are either biodegradable or fully recyclable.	
* For all excavating or dredging activities, describe the method for excavating or dredging type and amount of material you will remove, and where the material will be disposed.	
There will be no excavating or dredging.	
10. SEPA Compliance	* Compliance with the State Environmental Policy Act (SEPA). For more information about SEPA, go to "http://www.ecy.wa.gov/programs/sea/sepa/e-review.html"
	This project is exempt. I will upload, mail, or deliver a draft of the SEPA Letter of Exemption as part of this application.
	* Choose Type Of Exemption.
	Other
	* Provide explanation for Other exemption.
See SEPA Letter of Exemption	



Seattle Parks & Recreation

healthy people healthy environment strong communities

Date: June 25, 2021
To: File
From: David Graves, AICP, Strategic Advisor
Subject: Green Lake Floating Wetlands; Exemption from SEPA Threshold Determination

Background

Green Lake Park is a 320-acre park located in north Seattle. The lake and surrounding green space in the center of a dense urban neighborhood draw thousands of people daily from all over the city. The 2.8-mile asphalt path around the lake provides a recreational spot for runners, cyclists, skaters and walkers and the adjacent 3.2 gravel mile trail is used by runners and walkers as well. Many others use the athletic fields or visit the park for boating, picnics and swimming.

The park serves as a natural preserve for hundreds of species of trees, plants and birds. Green Lake is used by resident and migratory waterfowl for resting and feeding as well as an area for active recreation. The Washington State Department of Fish and Wildlife stocks the lake with trout and there are other species of fish present in the lake.

Seattle Parks and Recreation (SPR) partners with many citizen groups and organizations at parks throughout the system. At Green Lake, SPR has a long history of partnership with the Friends of Green Lake. The Friends of Green Lake (FOGL) is a non-profit organization whose mission is to ensure a healthy lake for wildlife and recreation. FOGL has long focused on the water quality at Green Lake and efforts to control algae blooms and Eurasian milfoil in the lake. They are seeking grant funds and if successful, with partner with SPR to install a pair of floating wetlands in the lake to provide water quality treatment and habitat. Floating islands are not a new technology, but they have not been used very often in the Pacific Northwest due to concerns associated with the predation of ESA listed juvenile salmonids.

Floating treatment wetland systems (floating wetlands) are engineered, vegetated rafts made of natural or inert materials that mimic floating bog mats. Root systems of the planted vegetation extend deep into the water and become covered with a biofilm comprised of a variety of microbes (algae, bacteria, fungi, and protozoans). The biofilm grows rapidly, taking nutrients and other pollutants from the water, improving water quality by reducing the nutrient supply for phytoplankton growth and hence reducing algae blooms. The biofilm also readily adsorbs toxic pollutants dissolved or suspended in the water. Ultimately, the biofilm sloughs and becomes incorporated into lake sediments. Some nutrients (approximately 20%) are also incorporated into the planted vegetation during active growth that become incorporated into the wetland media. Floating wetlands also reduce high water temperatures by shading the water below. The degree of water quality improvement depends primarily on the floating wetland area in relation to the water body area, but also depends on nutrient concentrations, water currents, temperature, and dissolved oxygen.

Floating wetlands also provide valuable habitat for fish and wildlife, particularly in urban water bodies lacking natural shoreline vegetation. Small fish seek refuge from predators and feed extensively on insects and other invertebrates that populate the underlying biofilm. Floating wetlands can be designed for waterfowl access using ramps, or for waterfowl exclusion using perimeter netting to protect planted vegetation and/or using plant species that are not a preferred waterfowl food source. The Green Lake floating wetlands would be constructed to benefit water quality, fish, and native waterfowl, and to educate the public on their functional value.

Summary of Proposed Project

FOGL, in partnership with SPR, is proposing to install two floating wetlands in Green Lake, between Duck Island and the Northwest corner of the lake, in approximately eight to ten feet of water. The floating wetland will be in a linear, angled shape, comprised of connected Biomatrix Water Floating Ecosystems™ modules. The two floating wetlands would each be approximately 66-feet long and 7.5-feet wide, each covering approximately 510 sq.ft.

The modules would be shipped to Green Lake and then planted with bare-root native plants from a local source, placed in shallow water and connected at the corners with stainless steel cotter pins. The floating wetlands would then be towed by canoe to the site for anchoring with heavy-duty buoy lines and anchors (cinder block or other similar solid concrete weight). FOGL would provide weeding and other maintenance of the floating wetlands with Green Lake Stewards and other interested volunteers. The project would include signs for educating Green Lake visitors about the Floating Wetland Project.

SEPA Determination

Pursuant to SMC 25.05.800.Y *Natural resources management*, specified activities within subsection Y are exempt from threshold determination and environmental impact statement requirements under SEPA including forest practices, the placement of mooring buoys, the development of recreational sites, periodic use of chemical or mechanical means to maintain public park and recreational land, and the establishment of natural area preserves. While the installation of floating wetlands is not specifically listed in the activities exempted under natural resource management, the potential environmental impacts of the floating wetlands are similar to or less than any of the listed activities and should be considered a natural resource management activity that is exempt from threshold determination and environmental impact statement requirements under SEPA.

The floating wetlands are considered overwater coverage. However, they provide significant habitat benefits. They shade the water below, they add oxygen to the system through the plantings within the wetland, the plants within the floating wetland also remove nutrients from the surrounding water which reduces the potential for algae blooms in the immediate vicinity. There will be insect life associated with the plants which in turn can be a food source for fish and other aquatic species that may take refuge in, under and around the floating wetlands. There are no ESA listed fish species in Green Lake so the concern that the floating wetlands would attract juvenile salmonid predators is nonexistent. The floating wetlands will be located in an area of the lake that is sheltered from the broader expanse and receives less human activity. They will be visible from the lake and the shore and there will be signage to educate the public as to the benefits of the floating wetlands. They will be planted on land and rafted together in

shallow water to minimize the potential for silt or other water quality impacts associated with their construction and then they will be placed by hand to minimize the potential for disruption of the lake environment.

Conclusion

Seattle Parks and Recreation, as the Lead Agency for this project, has determined that the proposed installation of two 510 sq.ft. floating wetlands at Green Lake is *natural resources management* as outlined in SMC 25.05.800.Y., and is **exempt** from threshold determination and environmental impact statement requirements under SEPA.



WASHINGTON STATE Aquatic Protection Permitting System (APPS)

Consent of Property Owner

Use this attachment only if the applicant is not the property owner. Complete one attachment for each property owner impacted by the project. Upload completed form(s) in APPS or mail to the WDFW address provided by APPS during your application process.

AGENCY USE ONLY

Date received:

APPS ID #:

My project occurs on public lands (Complete only items #1 and #2 below).

1. APP ID# (See APPS application receipt)			
25316			
2. Business or Government Agency Name (if applicable)			
City of Seattle - Seattle Parks and Recreation			
3. First Name	4. Middle Name	5. Last Name	
6. Address 1			
7. Address 2			
8. City	9. State	10. Zip	
11. Primary Phone	12. Ext.	13. Mobile Phone	14. FAX
()		()	()
15. E-mail			
16. Signature of Property Owner			
I consent to Washington Department of Fish and Wildlife staff entering the property where the project is located to inspect the project site or any work related to the project.			
Printed Name		Signature	
Date Signed:			

Figure 1.
Friends of Green Lake and City of
Seattle Floating Wetlands Project.

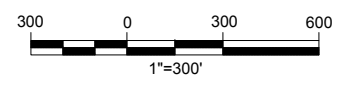
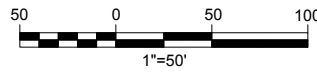
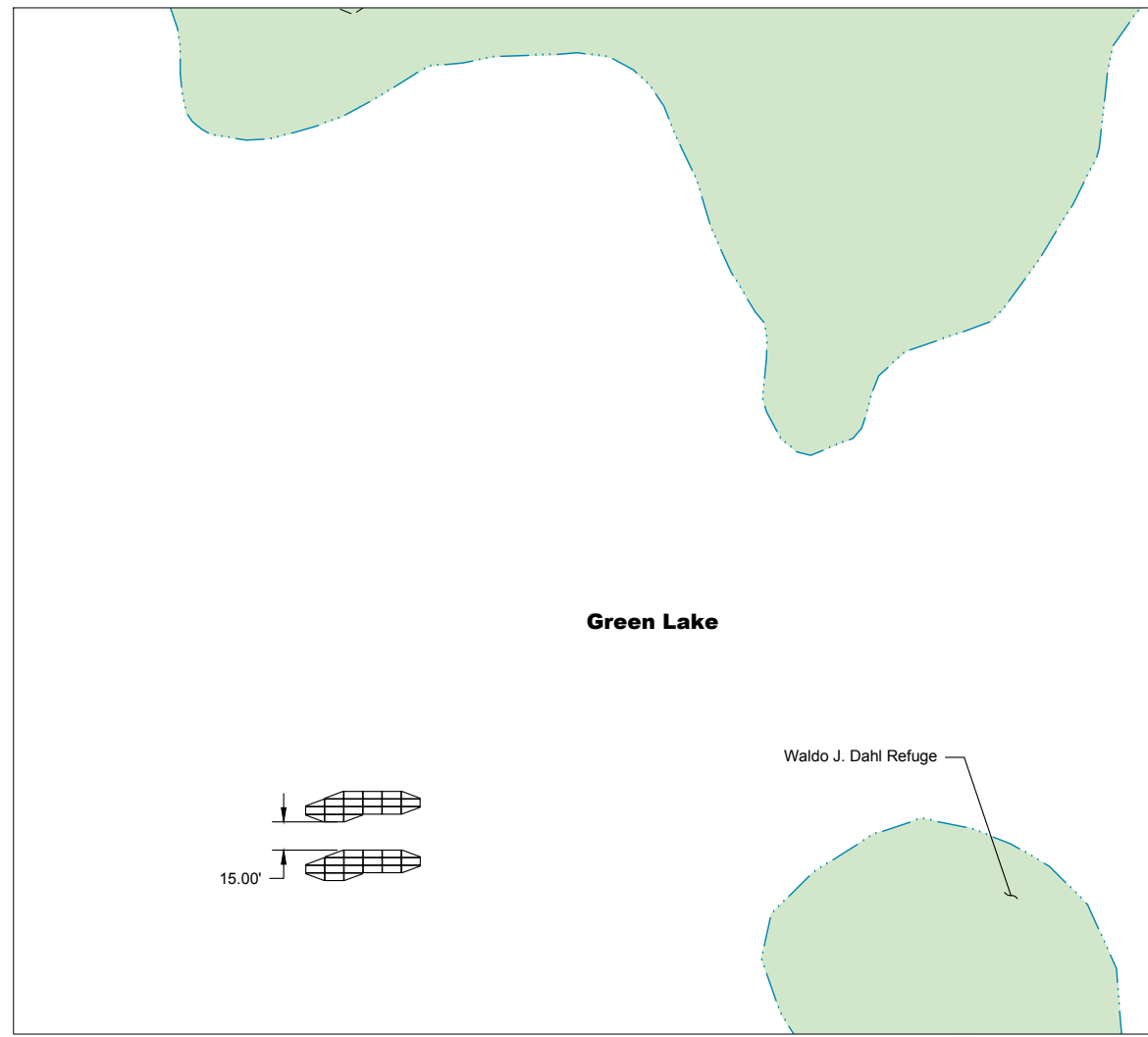
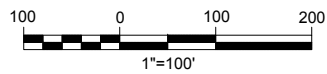
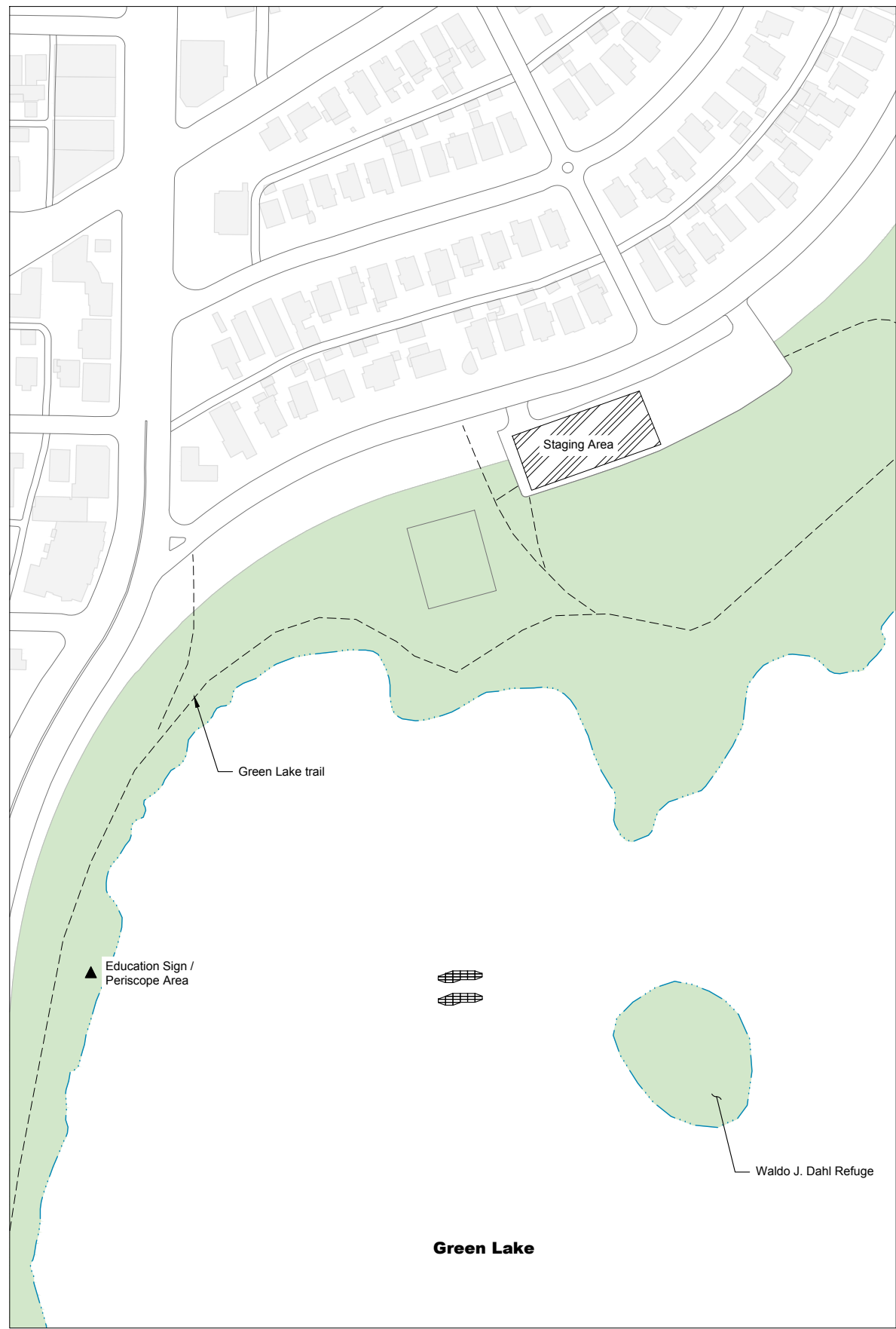
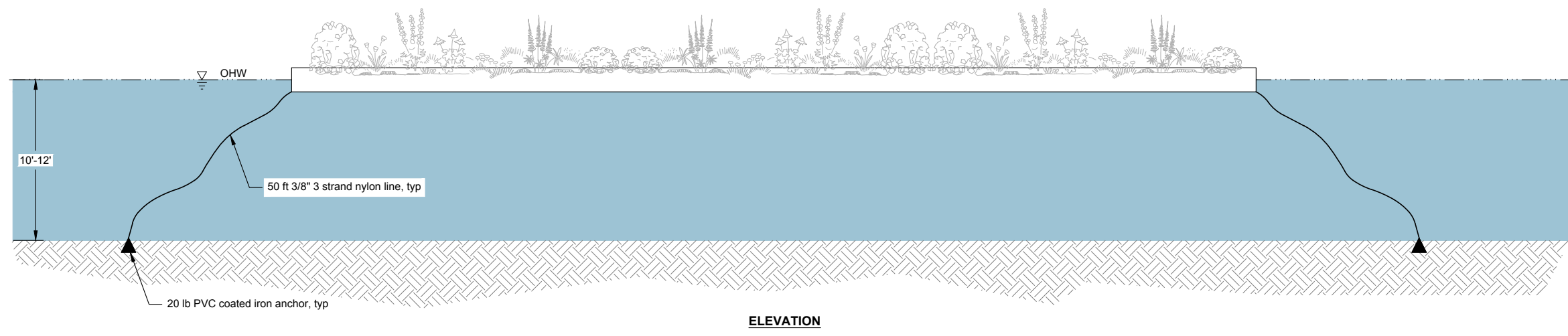
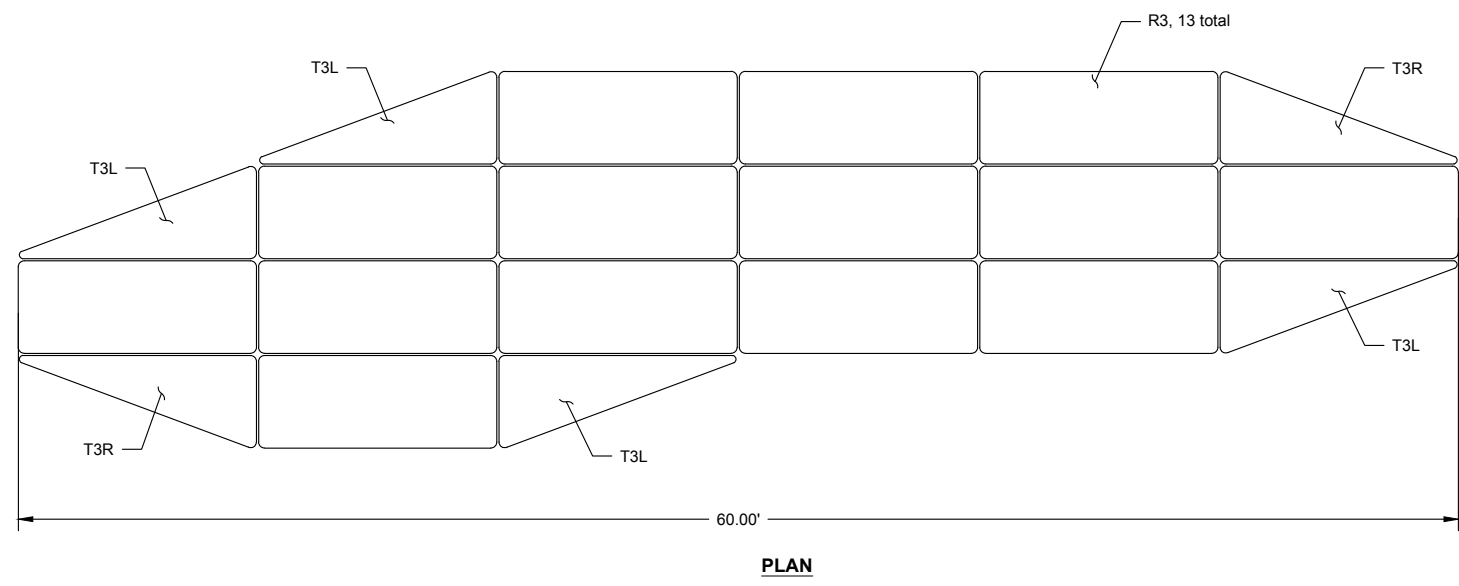


Figure 2.
Staging Area and Installation
Site for the Friends of Green Lake and
City of Seattle Flating Wetlands Project.



A north arrow pointing upwards is located in the top right corner. Below it is the logo for "HERRERA", which features a stylized green and blue water drop icon next to the company name in a bold, blue, sans-serif font.









Figure 3.
Floating Wetlands Plan View
and Detail.



DETAIL - FLOATING WETLAND
SCALE: NTS

1



Friends of Green Lake Floating Wetland Island Structure and Components							
Item Picture	Item Name	Unit Length (ft)	Unit Width (ft)	Unit Area (ft ²)	Units/ Island	Total Area/ Island (ft ²)	Total Area for 2 Islands (ft ²)
Island Structure							
	Standard Rectangle	9.9	3.9	38.3	10	383	766
	High Buoyancy Tree Pod	9.9	3.9	38.3	2	77	153
	Open Pool Rectangle	9.9	3.9	38.3	2	77	153
	Right Hand Triangle	9.9	3.9	19.1	2	38	76
	Left Hand Triangle	9.9	3.9	19.1	4	76	153
Subtotals					20	651	1302
Components							
	Coated Stainless Fence Posts	1.5 H	-	-	28 ea		56 ea
	Bird Protection Mesh (10 guage)	1.0	-	-	85 ft		170 ft
	Coated Iron Anchors (30 lbs)	-	-	-	4 ea		8 ea
	Nylon Line (5/8-inch)	1.0	-	-	100 ft		200 ft
Details							
Tree Pod				Fence Post/Mesh		Anchor/Line	
							

Plant List for the Friends of Green Lake and City of Seattle Floating Wetlands Project		
Species	Common Name	Ind
<i>Emergents</i>		
Scirpus microcarpus	small-fruited bulrush	OBL
Schoenoplectus acutus	hardstem bulrush	OBL
Carex stipata	sawbeak sedge	OBL
Juncus effusus	soft rush	FACW
Carex obnupta	slough sedge	OBL
Alisma plantago aquatica	common water-plantain	OBL
Athyrium filix femina	lady fern	OBL
<i>Shrubs</i>		
Cornus sericea	red-osier dogwood	FACW
Salix sitchensis	Sitka willow	FACW
Rosa pisocarpa	peafruit rose	FAC
<i>Trees</i>		
Salix lasiandra	Pacific willow	FACW
Fraxinus latifolia	Oregon ash	FACW

Authorization of Agent

I hereby authorize the agent named below to act on my behalf in matters related to acquiring and executing activities associated with a Hydraulic Project Approval (WDFW permit).

Application ID: 25316

Agent Contact Information

Name: Rob Zisette (please print)

Business Name: Friends of Greenlake (if applicable)

Email: rzisette@herrerainc.com

Phone: 206-930-6585

Applicant Contact Information

Name: David Graves (please print)

Business Name: City of Seattle Parks and Recreation (if applicable)

Email: david.graves@seattle.gov

Phone: ~~206-684-4075~~ (206) 684-7048

Signature: *David Graves* Date: August 27, 2021

If you do not want to upload this document to APPS, you need to submit this form to the following address:

Washington Department of Fish and Wildlife
PO Box 43234
Olympia WA 98504-3234