



Wetland and Wet Area Best Management Practices for Forest Stewards



Acknowledgements

This work was funded by Seattle Parks and Recreation (SPR) and a grant secured by Friends of Frink Park through the King Conservation District (KCD). Much of the content was developed by Natural Systems Design, a local ecological restoration consulting firm, with review and input provided by the GSP Field Committee and Seattle Parks and Recreation staff.

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Background

In 2015, Green Seattle Partnership (GSP) set out to improve and document our best management practices for working in wetlands and wet areas. Given the nature of GSP, the products of this work grew to include improvements to the GSP Professional Crew Specifications, the GSP Forest Steward Field Guide, as well as this stand-alone document, intended for use by volunteers, partners, and staff.

Wetland Regulations

GSP's restoration work is regulated under a variety of State and local regulations. The State Environmental Policy Act (SEPA) was used as the basis to assess potential environmental impacts of our restoration program and to issue project requirements that are embodied in the GSP Best Management Practices (BMPs). The City of Seattle has determined that if City staff, their contractors, and GSP volunteers comply with the BMPs, then we are in compliance with the regulations set forth in the City's Critical Areas Ordinances (CAO). Individual restoration efforts are assessed for compliance with the above regulatory framework but could also be subject to additional State and Federal regulations.



Photo credit: Andrea Mojzak

BMP Purpose

Defining BMPs for work in wetlands and wet areas will support more efficient and effective restoration. If your site has wet areas or designated wetlands, the restoration strategy you choose may differ from nearby upland areas in the following ways:

- Many wetlands will be too wet to work in during the winter and spring and should be avoided to minimize soil disturbance and damage to the roots of native plants.
- Some wetlands can support supplemental planting in late-spring or even summer, after the typical planting season has ended.
- Fragile soils in most wetlands are highly susceptible to soil compaction, so larger volunteer group events should be avoided when saturated soils are present.
- The use of wetlands by wildlife, especially birds and amphibians, might preclude larger volunteer events and may influence the overall approach (timing and possible phasing) for restoring the area.
- Wet or moist soils will make it easier for some weed plant fragments (roots and rhizomes, which are modified belowground stems) to re-root. Onsite composting of invasive plants, therefore, may need to follow a modified strategy.
- In wetter areas, the invasive species present can differ in how they establish and disperse.
- Mulch application around native plantings may not always be desirable, especially when the site remains moist within the root zone during the dry summer and/or when invasive regrowth pressure is low. It is important to use mulch that is free of weed seeds and invasive plant fragments.
- Care should be taken when considering restoration work on wet slopes of any gradient. These areas present serious challenges from erosion, which can lead to excessive sediment production or even landslides. Seattle Parks and Recreation Plant Ecologists may determine that work on a wet slope must be performed by SPR staff or a contracted professional crew. Further analysis by SPR Civil Engineer or another qualified professional may also be required prior to the start of restoration activities.

This document, along with information presented in the [GSP Forest Steward Field Guide](#) or [GSP Crew Specifications](#), will help you work more effectively and safely in sensitive wet areas in Seattle parks.

Site Assessment

GSP work occurs in many habitat types, such as shorelines, streams, wet ravines, or even around drainage structures. Determining if your site, or a portion of it, exhibits wetland conditions is an important step in effective restoration.

Wetlands, as legally defined in 1982 by the US Army Corps of Engineers, are, “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” In essence, wetlands are areas that are often wet long enough to create sub-surface anaerobic conditions that only certain plant and bacterial species have adapted to live in. The bacteria, which survive with the help of the plants, alter the chemistry, physical structure, and appearance of the soil. Signs of all three factors (water, altered soils, and hydrophytic plant species) are required to declare that a site is a wetland.

The formal process for determining if a wetland exists, and its size and shape, is based on the 1987 Army Corps of Engineers Wetland Delineation Manual and the 2010 Regional Supplement. During the formal delineation process, data points are established within and outside of the wetland and procedures are followed to examine if the soils, the hydrology, and the plant species taken together provide indications that the site is a wetland. In our region, there are 19 possible soil indicators, 27 possible hydrologic indicators, and three vegetation tests that can be performed. The site must exhibit at least one of the indicators for each parameter (soil, hydrology, and vegetation) in a manner that makes physiological sense.

The decision tree on the next page was developed to simplify the determination for our restoration efforts. It cannot replace a formal delineation, but it does provide a reasonable assessment that will help GSP volunteers, professional crews, and partner organizations identify the presence of a potential wetland to limit the impacts to these socially, economically, and biologically-important areas.

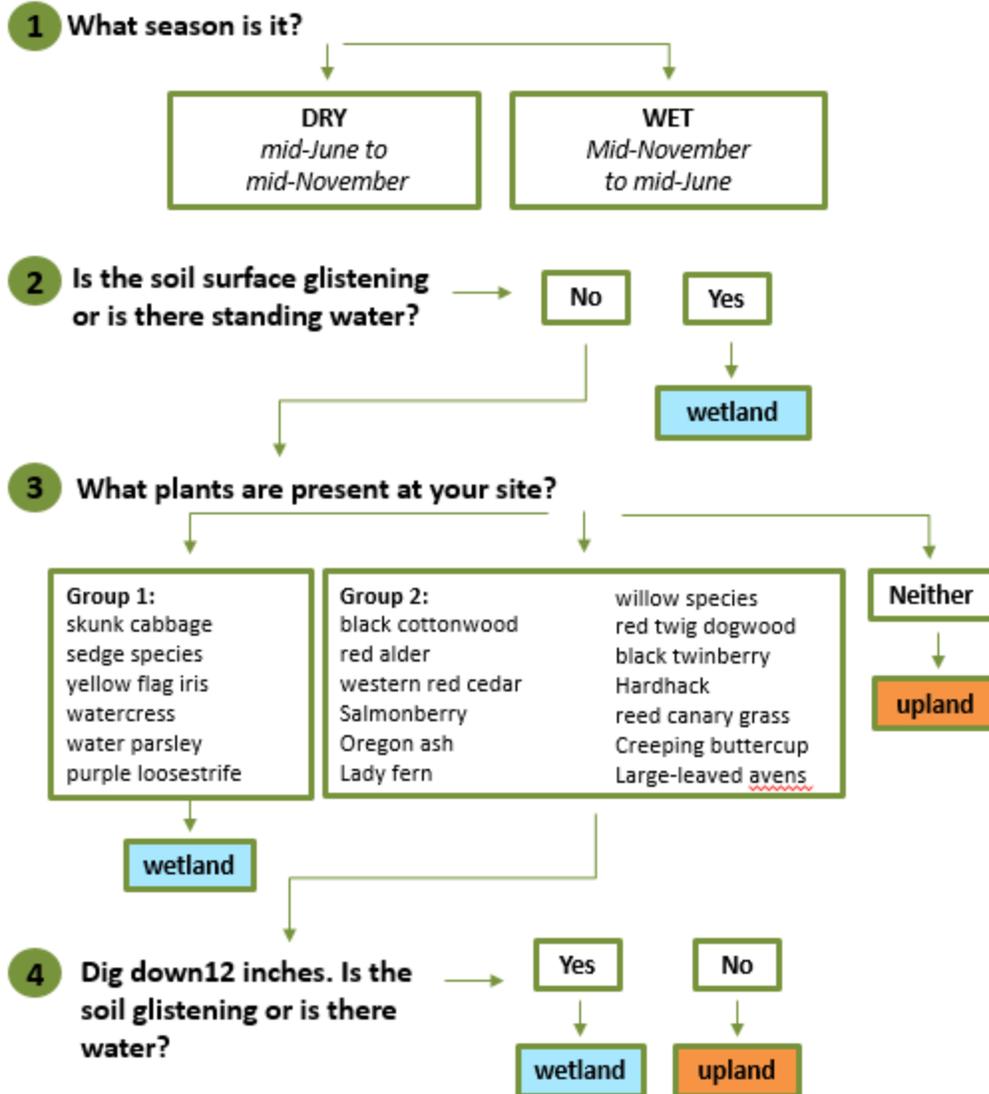
For additional information on mapped wetlands, refer to the [GSP Reference Map](#). The Designated Wetlands layer is a publicly-accessible polygon feature class managed by the City of Seattle Department of Construction and Inspection. Data was generated using aerial mapping technology and a portion of the wetlands were ground-truthed. Given the mapping methodology and the fact that wetlands can change size and move over time, the online map should only be used as a reference.

Wet Area Decision Tree

To use the decision tree, work through the questions beginning with number 1. It is set up to be initiated at any time of year. Keep in mind though that the more time you have to observe the site over the course of several seasons, the better understanding you will have of how your wet area functions and the more informed your restoration strategy will be.

KEY:

- you have a wetland area!
- you have an upland site!



Additional Considerations

- If plants at your site are in Group 2, but you use the decision tree during the dry season and you do not identify your site as a wetland, we recommend re-testing during the wet season to verify your outcome.
- If at any time of year, you observe standing water, it could be a number of situations (e.g. broken pipe, temporary standing water from recent rains, etc.). Look more closely to observe the species present and the degree of saturation.
- If you have questions, flag it, map it, and meet on site with your Plant Ecologist.

Basics of Working in Wet Areas

Volunteer Work Parties

Wet areas call for a different approach to volunteer work parties. Consider the following:

- Small work parties should be used when site conditions are at or near their driest. A “small work party” is when the group size is less than 30 people and everyone is closely supervised with no one working out of sight of knowledgeable, trained supervisors. A ratio of one lead to every five volunteers is a good rule of thumb.
- Large work parties should always be avoided due to the fragile soil structure. A “large work party” is when there are individuals often working unsupervised, out of sight of knowledgeable, trained supervisors.
- Some sites may ‘dry out’ where saturated soil surface conditions exist for only part of the year. Restoration activities (e.g. invasive removal, planting, and maintenance) should be scheduled during drier months whenever possible. Large work parties are allowed within these sites during the dry season as long as restoration activities end with the onset of the rainy season.
- On sites where saturated soil conditions persist year-round, access into and out of the site should be closely managed during the volunteer work party (see [Site Access and Stewards Paths](#) section).

Site Access and Stewardship Paths

To minimize disturbance, temporary access routes to restoration areas need to be carefully planned and laid out. Consider the following:

- Avoid establishing access paths in areas that may have running or standing water during the wet season. Look for signs of pooling or sediment movement if you are assessing the site during the dry season.
- Paths should be laid out where they will minimize impacts on soil and intact habitat patches. It is often best to put the stewardship path through the center of your restoration area.
- Use elevated planks (duck boards), coir fabric paths, or wood chips to create a protective surface on top of saturated soils where you need access. Remove planks when no active restoration is planned. Prior to removing coir or removing/redistributing wood chips, assess the potential impacts; leaving biodegradable material in place may result in the lowest impact.



Photo credit: Eric Sterner



Photo credit: Andrea Mojzak

Invasive Plant Management in Wet Areas

Integrated Pest Management

Seattle Parks and Recreation is committed to using the Integrated Pest Management (IPM) decision making process when developing invasive plant management programs. Within this context, GSP can consider and utilize a full range of management options for control and eradication of invasive weeds. Decisions are guided by weed biology, site constraints, as well as the appropriateness and/or anticipated availability of volunteers. A comprehensive IPM program is defined based on its likelihood for success within the bounds of Seattle Parks and Recreation's [Pesticide Reduction](#) policy and least toxic chemical options.

When deciding if an infestation can reasonably be removed manually, it is important to weigh the full impacts of manual removal against other methods. Disturbances that could negatively affect the site include:

- Damage to native vegetation;
- Soil displacement and compaction;
- The potential to scatter invasive plant fragments;
- The risk that composted materials could re-sprout in new locations;
- The impact of dragging and hauling vegetative material across a site;
- The potential to increase turbidity (sediments in water) in nearby water; and
- The impact to wildlife caused by one's presence at a site for long periods of time.

Manual removal can be effective in smaller infestations, but should not be used when other methods produce fewer negative impacts in areas of standing water or on steep slopes. A "small" infestation is an area from which you can effectively and reasonably remove all necessary plant material (usually all above

and below ground parts) given your available time, ability, and resources. This size will vary from person to person, by species, stand density, and by site conditions.

All invasive plant removal efforts should take into account information presented in the [Wildlife Habitat Considerations](#) section. Limiting impacts on bird nesting and amphibian reproduction is critical.



Erosion Control

It's important for our restoration sites and our entire watershed that we keep soil in place. Consider the following before invasive plant removal:

- Volunteers are prohibited from working on slopes greater than 40%. Steep slope work will be coordinated by Seattle Parks and Recreation staff and accomplished by professional crews.
- Wet slopes with seeps or perched wetlands present specific challenges, including an increased likelihood of soil erosion and the possibility of more slope stability problems. Seattle Parks and Recreation staff will help determine if wet slopes under 40% will need professional crew attention.
- During the wet season, bare soils susceptible to erosion must be covered within 5 days of being exposed. This is an important requirement of our GSP programmatic SEPA. Leaves, downed wood or twigs, blackberry canes (cut to 2 ft. length), forest duff, burlap, and wood chip mulch can all be used to cover soils.
- If your site is close to a lake, stream, wetland or drainage structure, erosion barriers may be needed during invasive plant removal efforts. Seattle Parks and Recreation staff can provide recommendations, materials (like coir logs or erosion blankets), and crew support, if needed.
- Use wood debris from your site and lay/stake it parallel to the contours of the slope to provide some additional stability.
- Flag areas to be cleared to avoid impacting sensitive areas, especially during larger volunteer events.
- To reduce the chance of erosion in wet areas, follow the explanation above for using stewardship paths and duck boards to access your site.

Weed Hygiene

Avoid moving weeds on tools, materials, boots and clothing within a restoration site or from site to site. To reduce the potential for moving weeds, employ basic hygiene precautions prior to and after entering the field. Ensure equipment, vehicles and clothing are free of seeds and soil, including:

- Clean all soil from tools while still on site using a stiff brush.
- Remove and wash/brush boots that are potentially carrying soil and seeds.
- Wash clothing that is potentially carrying soil and seeds, and.
- Do not to park in areas that have soil or seed sources in close proximity.



Photo credit: Sasha Shaw

Composting

If you are working in a wet area, or on soils that you expect will become saturated later in the season:

- Locate compost piles where soils can freely drain all year. This will help minimize the likelihood that plant fragments will re-root from the compost pile.
- Water can aid dispersal. When removing invasive species adjacent to a waterway (lakes, streams, wetlands) use a barrier to prevent sediment or any part of the plant that may regenerate (flower heads, seed heads, roots, and stem and leaf tissue from many species) from getting into the watercourse. Barriers may include burlap, tarp, or cardboard.

Species-Specific Information

The following species are commonly found in wet areas. Considerations for manual removal are summarized below. Additional species-specific best management practices can be found in the Forest Steward Field Guide. Where available, links are provided to the King County Noxious Weeds fact sheets.

[Reed canary grass](#) (*Phalaris arundinacea*)

- Manual removal is not practical except for the smallest patches (1-4 sq. ft.). Hand dig when the ground is soft to be sure to remove all roots and rhizomes (belowground stems) because any left in the soil will re-sprout. Monitor the site for regrowth.
- Reed canary grass roots produce extensive rhizomes that should be composted on site away from wet areas and not in contact with the soil.
- For areas where reed canary grass is dominant, one long-term control strategy is to shade it out. Shade production won't eradicate the species, but it will control it and allow for a more structurally and genetically diverse site. The initial task is to use sheet mulch with several layers of cardboard or burlap and 6 inches of wood chip mulch. Do not sheet mulch in areas where standing water will achieve a depth of more than 6 inches. Leave in place for at least one growing season. Monitor the edges for shoots coming up from lateral growth of rhizomes. Efficacy can be increased by removing above ground plant material at or just after flowering with hand tools

prior to laying down sheet mulch. Any above ground material not yet gone to seed (leaves, blades, or stems) that are removed prior to sheet mulching, can be left on site where it falls.

- After at least one growing season, the area should be planted with native species. Plant layout should be dense (see the plant spacing table on page 30 of the Forest Steward Field Guide for examples of “dense”) over the entire site or in a clump-gap or row pattern. The latter two patterns would allow City staff or contractors to mow the areas (the gaps or areas between rows) between native plants for 1 to 2 seasons. Consider installing fast growing species adapted to wet areas such as black cottonwood, red alder, and willow species. Once they become established, a second planting of shade tolerant species such as western redcedar, thicket-forming species like red-twigged dogwood, snowberry, and Nootka rose; and fast-growing conifers like Douglas-fir and grand fir (placed along southerly and westerly edges) should be planted.

Yellow flag iris (*Iris pseudacorus*)

- Manual removal can be effective for small infestations, especially for very young plants not yet established. Manual removal of larger plants requires special attention to remove the rhizome. The rhizome is tough and may require heavier tools, such as pickaxes or saws. If you do not get the rhizome, the plant will likely reproduce from fragments. Monitor the location after you have removed the plants; new leaves will show you where you missed any sections of rhizome.
- When removing manually, precautions should be taken to protect the skin. Resins in the leaves and rhizomes can cause irritation.
- Use barriers to prevent sediment and vegetative debris from entering the water system when carrying out removal of vegetation near streams and wetlands. See [Erosion Control](#) section for more information.
- If composting rhizome fragments, be sure to compost away from wet sites. If this is unfeasible, then securely bag and arrange for trash disposal.
- If manual rhizome removal is impractical, cutting and bagging seed heads before seed drop will slow the spread of the infestation.
- For larger or more established infestations where manual removal is impractical, consult with GSP Staff for options. In most cases, controlling this species will require multiple methods over several years, potentially including cutting and herbicide by professional crews.

Purple Loosestrife (*Lythrum salicaria*) and **Garden Loosestrife** (*Lysimachia vulgaris*)

- NOTE: Under the Washington State *Lythrum* quarantine (WAC 16.752.400-415), it is illegal to transport, buy, sell, offer to sell, or to distribute plants, plant parts or seeds of purple loosestrife into or within the state of Washington. However, by following the recommendations in the Best Management Practices document linked above, you are covered under the King County Noxious Weed Control Program’s permit to transport purple loosestrife for the purpose of taking it to a transfer station or landfill.
- Hand pulling is recommended for young plants or older plants in sandy, mucky, moist, or loose soil. This may be impractical to impossible when trying to remove hardy, woody roots in compacted soils.
- If the plants are in flower or in seed, cut off and securely bag all flower heads. Pulling plants in seed will disperse the small, lightweight seeds. Cut plants may continue to produce flowers later in the season; these sites will have to be consistently and regularly monitored until frost to cut and remove any subsequent flowers. Cutting purple loosestrife is only a short-term control method until more effective control measures can be accomplished.
- Care should be taken to minimize erosion when digging in saturated soils on shorelines. When removing vegetation on shorelines (by lakes, streams and wetlands) use barriers to prevent

sediment and vegetative debris from entering the water system. See [Erosion Control](#) section for more information.

- All parts of the purple loosestrife plant, including flowers, seed heads, stems, leaves and roots must be securely bagged, and discarded in the trash or taken to a transfer station. Do not compost or place in yard waste. Plants may regenerate in compost.
- For larger or more established infestations where manual removal is impractical, consult with GSP Staff for options. In most cases, controlling this species will require multiple methods over several years, potentially including cutting and herbicide by professional crews.

[Bittersweet nightshade](#) (*Solanum dulcamara*)

- Hand-pull the stem close to the ground and pull or dig up the roots, taking care not to break the slender roots. This method is most effective with young plants and small infestations. Manual control works best after rain or in loose soils. Tools that work include shovels, spades, and hand-tillers to loosen soil.
- When manual removal is used in wet areas, take care to prevent soil erosion. See Erosion Control section for more information.
- Bittersweet nightshade is toxic to people, pets, and livestock. Wear gloves when handling. Fruiting plants and roots should be collected and discarded with the trash or taken to a transfer station for disposal. Composting roots is not recommended. Stems can be left on site to dry out and decompose if they are in a dry area where they will not move into waterways or re-root into moist soil.

[Policeman's helmet](#) (*Impatiens glandulifera*) and **[Jewelweed](#)** (*Impatiens capensis*)

- Manual removal is effective for small infestations. Pull or dig up plants in the spring or early summer when the soil is still moist and before the plant develops seed capsules.
- Cut and bag all flower heads before seed formation (occurs mid-summer) using sturdy plastic bags. Dispose as garbage, not in yard waste or compost bins. Stems can be left on site to be composted, but only if they are first crushed and dried out thoroughly. Do not let plant fragments get into waterways.

[Yellow archangel](#) (*Lamium galeobdolon*)

- Manual removal is generally not effective. Plants grow densely, sprout from root or stem fragments, grow easily among desirable vegetation, and is labor intensive to hand pull.
- For very small populations (less than 10 sq. ft.), try continuous hand-pulling. Be careful to remove all root and stem fragments by sifting through the soil. This is easiest to do fall through early spring.
- Dense infestations can be controlled by sheet-mulching. It is crucial to control any escaping plants and regularly check for holes in the covering material.
- Stem fragments and roots can re-sprout if left in contact with wet ground. Plant material may be composted on site if thoroughly dried out. Do not let plant fragments get into waterways.

Planting in Wet Areas

Planting Timing

When should you plant in a wetland? There is no simple rule, but work through the following questions to find the best approach for your wet area:

- Do the soils dry out during part of the year? If so, plant during the wet season. Choose either the fall, (as soon as the soils become wet again), or in the spring (after soils have dried enough that you can access the area but several months before the beginning of the dry period).
- Are the soils within the plant's root zone saturated all year? Saturated soils will glisten, but you may have to dig a few inches to find them. If soils are saturated in the summer, they may become inundated, or flooded in the winter and spring. If so, prime planting time is usually between late spring and early fall, when the soil is not inundated. To ensure plant establishment, do not plant within the 2 months prior to site flooding as plants can float out of their holes. Avoid planting a site if it is inundated with water.
- If your site has standing open water at a depth of at least 10 cm between Dec 1 and June 1, then avoid work during this period as it may impact breeding and developing amphibian species. Some native amphibian species will continue to breed into mid-summer (i.e. Pacific chorus frog).



Plant Selection

There are several good references online that can help you select the right plant for the right place.

- In the [Forest Steward Field Guide](#) refer to Appendix C: Native Plant Chart for species-specific soil moisture preferences, as well as a list of emergent species appropriate for GSP restoration sites.
- Our [Green Seattle Partnership](#) webpage on plant selection provides information on your park's Target Ecosystems and Target Forest Types.
- [King County Native Plant Guide](#) provides planting information on common native species, as well as easy-to-use planting lists based on soil and light conditions.
- [Washington Native Plant Society's](#) Native Plants for Western Washington Gardens and Restoration Projects provides plant lists by habitat types, moisture preference, soil type, etc.
- [Sound Native Plants](#) provides species descriptions and educational bulletins.

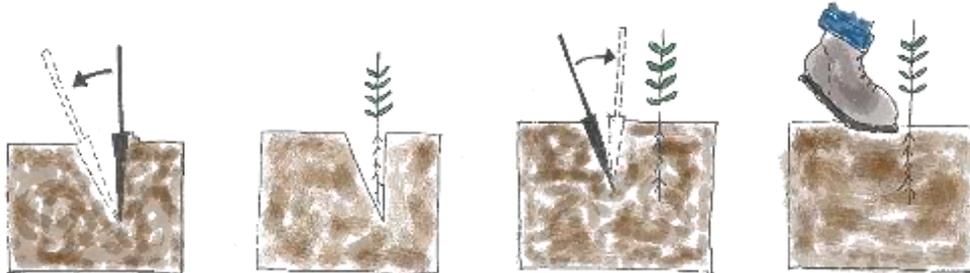
Plant Installation

The following installation explanation covers emergent plugs. For more information on other stock types (container plants and live stakes), see the section Phase 2: Planting and Installation in the [Forest Steward Field Guide](#).

- When planting emergent bareroot plugs, the most common method is to use a dibble tool or narrow-bladed shovel to open a hole in soft saturated soil. Keep plugs in their packaging until just before

planting. Make a slit in the soil, levering back and forth to open the slit to fit the plug. Alternatively, make a pilot hole with a rock bar or a piece of re-bar that is larger than the diameter of the plug.

- Carefully install the plug and then compact the surrounding soil to remove large air pockets, but do not over compact. Like other stock types, install the bare-root plug so that the soil surface of the plug matches the height of the surrounding soil surface.



Using Mulch

- When applying mulch near a stream bank, do not apply material below the ordinary high water mark (OHWM). This is the elevation to which stream flows regularly rise. It can be estimated by locating exposed woody roots along the stream bank where soils have been scoured away or by identifying where herbaceous plants do not grow. Mulch placed below the OHWM has a high chance of washing away during a rain event.
- When mulch is used in wet areas and wetlands, it should be free of weed seed and invasive plant fragments. It should only be used in wetlands that dry out during summer and early fall months or where invasive regrowth pressure is high.



Wildlife Habitat Considerations

Wetlands are sensitive places rich in birds and amphibians. The hydro-period, or the wetland's seasonal pattern of fluctuating water levels, and the presence of breeding bird and amphibians during portions of the year contribute to a series of timing constraints that make restoration in and near wetlands challenging.

Birds

- Whenever possible, conduct the majority of restoration work between August 1 and January 31 to avoid and minimize negative effects on bird breeding.
- During the early and primary bird-nesting season (February 1 to July 31), avoid large-scale invasive removal activities in wetlands and their vegetated buffers, particularly large-scale removal of invasive thickets and small trees. Wildlife that are attracted to wetlands use the vegetation surrounding the wetland to search for food, build nests and other dwellings, mate and seek protection. As a general rule, limit removal to $\frac{1}{4}$ of the area annually in a 75' buffer surrounding the wetland or wet area. Formally delineated wetlands may have buffer widths that are larger than 75'.
- If there is open water in your restoration site, watch for duck nests along shorelines after March 1st. They tend to nest earlier than other birds. Avoid nests if found.
- Use the [Forest Parkland Restoration Planning related to Breeding Birds in Seattle](#) (GSP Bird BMPs) for additional information on assessing bird nesting at your site, reducing impacts, and improving bird habitat.

Amphibians

- Pacific chorus frogs, red legged frogs, northwestern salamanders, long-toed salamanders, ensatinas, and western red backed salamanders are very common in Seattle wetlands. The first five of these species breed in standing water and the last two breed terrestrially.
- If your site has standing open water at a depth of at least 10 cm between December 1 and June 1, then avoid work during this period as it may impact breeding and developing amphibian species. Some native amphibian species will continue to breed into mid-summer (i.e. Pacific chorus frog). Signs that active breeding is occurring include the presence of nighttime mating calls especially during the months February to April and egg clusters attached to submerged vegetative debris in shallow water during the spring. Keep in mind that not all species present obvious indicators that breeding activity is occurring.
- Amphibian species richness in a wetland to a considerable extent depends on adjacent land use - more adjacent land in undeveloped forest usually



means greater potential for species richness. It is therefore important to consider areas adjacent to wetlands (the buffers) when planning and scheduling your project. Buffer integrity, meaning both the width of the buffer and its structural complexity are important design factors. A phased approach to restoration within the wetland and in the buffer as well, minimizes negative impacts to amphibians.

- Bullfrogs are a non-native invasive species that can impact native amphibians and ecosystems. Washington Invasive Species Council is actively tracking locations. See the [Invasive Species Council](#) webpage on bullfrogs for additional background, management considerations, and to report bullfrog sightings.

Reducing Dog Access

Besides wildlife, wet areas also attract thirsty and curious dogs.

- Where appropriate, block entry to stewardship paths. In some areas, you may temporarily leave a thicket of invasive species near the access entrance or along the project area perimeter to act as a barrier. Removal of a full or partial perimeter of invasive vegetation can be phased out once the interior of the site is established.
- Vegetative debris (logs, slash, boughs, and branches) can also be concentrated into small piles or windrows near the stewardship access trail entrance and be used to block access to the restoration site. Keep in mind that any barrier that looks obviously out of place will attract curious humans. Try to make a barrier that is physically effective but visually blends in with the existing vegetation.

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