What is knotweed?

Knotweed is considered one of the world's worst invasive plants. Knotweed refers to four species of non-native, perennial rhizotomous (horizontal underground stems) plants invasive to British Columbia (B.C.): Japanese (*Reynoutria japonica*), giant (*Reynoutria sachalinensis*), bohemian (*Reynoutria x bohemica*), and Himalayan (*Koenigia polystachya*).

Why is knotweed a problem?

Knotweed readily establishes on stream banks, lakeshores, gravel bars, and other open areas displacing native vegetation, degrading water quality and fish habitat by eroding stream banks and reducing access to water for wildlife and recreation. Knotweed can compromise the integrity of above and below ground infrastructure (e.g. bridges, retaining walls, dikes) occurring within 20 metres.

Knotweed has numerous impacts on riparian and aquatic ecosystems such as:

- Reducing nutrient cycling by locking nutrients in its root system;
- Increasing sedimentation into streams and rivers via bank erosion;
- Altering drainage patterns and increasing the risk of flood by damaging infrastructure or obstructing flows; and
- Outcompeting riparian vegetation reducing plant diversity and altering the input of detritus (food for invertebrates) into water systems.

Sporadic occurrences of knotweed have already infested a 70 kilometer (km) stretch in and adjacent to the Nimpkish River. In the absence of treatment, knotweed has the potential to dominate gravel bars and riverbanks along the Nimpkish River to its estuary.

What does knotweed look like?

Knotweed species have hollow stems that can rapidly grow 1 to 6 meters (m) tall and form dense clusters resembling bamboo.

Young knotweed shoots appear similar to asparagus and can range from green with reddish-purple nodes and speckles to entirely reddish-purple. As they mature, leaves turn bright green before becoming yellow mid- to late fall. At the first hard frost, the aboveground parts of the plant die, leaving bare, grey-brown stalks while roots and rhizomes overwinter underground.

Knotweed's extensive network of roots and rhizomes can extend up to 20 m horizontally and reach depths of 3 m.

Knotweeds have smooth-edged leaves that vary in size and shape depending on the species. Giant knotweed leaves are distinctly heart-shaped and can reach lengths of up to 40 centimetres (cm), while Japanese knotweed leaves are truncate (straight across the base of the leaf), grow to 15 cm long, and taper sharply at the tip. Bohemian knotweed, being a hybrid of these two, can have leaves that mimic the shape and size of both. Himalayan knotweed has leaves that are lance-shaped, thin, and up to 20 cm long. Knotweeds develop small greenish-white, white or pinkish-white flowers in July to August; however, not all plants will produce flowers.

More information on how to identify knotweed can be viewed here:
https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/invasive-species/publications/key_to_identification_of_invasive_knotweeds_in_british_columbia.pdf

Where does knotweed grow?

Knotweeds thrive in roadside ditches, irrigation canals, and other water drainage systems. They are commonly found in riparian areas, along stream banks, and in other areas with high soil moisture, such as wetlands, forest edges, trails, and private gardens. It should be noted, knotweed can tolerate a wide range of site conditions and can also establish on disturbed, saline, shaded, rocky or paved areas.

Where is knotweed found in BC?

In B.C., knotweeds occur throughout the coastal area (Vancouver Island, Sunshine Coast and the Gulf Islands, Lower Mainland, Sea to Sky Corridor, Central Coast, North Coast and Haida Gwaii), Shuswap, Kitimat-Stikine, Cariboo, Fraser Canyon, Columbia, Okanagan, and Kootenay areas.

Where is knotweed found on the Nimpkish River?

Along the Nimpkish River system, knotweed is currently limited to a total area of 0.17 ha dispersed throughout a 70-kilometre length of the Upper Nimpkish River from Vernon Camp to 1.33 km upstream of Nimpkish Lake. Knotweed has not been detected in Nimpkish Lake or the lower section of the river.

How does knotweed spread?

Knotweed typically spreads via stem and root fragments, and in the case of Bohemian and Giant knotweed, by seed. Rapid spread of knotweed is due to its ability to sprout new plants from fragments as small as 5 cm in length. Local dispersal occurs mainly in water currents. Long distance dispersal is mainly through human dumping of garden waste or movement of knotweed infested soil. Knotweed reproductive plant parts (propagules) can also spread on clothing, boots, equipment, tools, machinery and vehicles.

Knotweed regrows vigorously following cutting, mowing, and digging, especially early in the growing season. Such treatments stimulate the production of new shoots from the root system.

Seasonal high-water events and floods sweep knotweed fragments into waterways, rafting them downstream to deposition points where these fragments root and form new colonies on banks and gravel bars. Since knotweed grows faster than most other plant species, it quickly out-competes beneficial vegetation.

What are the treatment options for controlling knotweed?

Mechanical Control:
Cutting, mowing, digging or grazing may be effective for new, isolated, and very small infestations of knotweed, if continually applied and properly monitored. In general, mechanical control on its own is not an effective management tool for knotweed species due to their massive root structure and ability to reproduce from small root and stem fragments. Manual control is only recommended under specific circumstances, for small, newly established sites and should be carried out with extreme caution due to the likelihood of spread. Material must be properly disposed of to prevent regrowth and spread.

Biocontrol:
Biological control, or biocontrol, is the use of an invasive plant's natural enemies - chiefly insects, parasites and pathogens - to reduce the plant population below a desired level. It is a long-term, self-sustaining treatment method for managing invasive plants that will not eradicate the target plant but will regulate the plant population and reduce impacts.

A sap sucker psyllid, *Aphalara itadori*, is being studied as a primary biological control agent in British Columbia and agent establishment is being undertaken and closely monitored in select locations.

Chemical Control:
Careful selection of suitable herbicides and application methods can result in chemical treatments providing effective, selective control of target plants with minimal to no impacts or disturbance to the surrounding environment and species. As with all methods, treatments should be monitored for efficacy and follow-up treatments may be needed to control re-growth or new growth. Herbicide treatments are most effective during active, maximum plant growth. Generally, herbicide treatments will significantly reduce a knotweed population within 3-5 years. The time required to eradicate a knotweed population will depend on the consistency of treatments and frequency of disturbance. For example, water flow may spread reproductive plant parts, prolonging the time required to eliminate a knotweed population.

Suitable herbicides must be absorbed by the knotweed plant and translocated into the root system achieve control and reduce the plant; they may be applied using a variety of application methods, including foliar (leaf) spray and stem injection, depending on the site and product being used. Herbicide use must be considered on a site-specific basis, and labels must be followed at all times. All applicators on public lands must be certified and follow the requirements found in the BC *Integrated Pest Management Act* (IPMA), federal regulations, and any relevant local bylaws.

What is the most effective way of controlling knotweed?

Control methods need to suit the specific characteristics of each knotweed occurrence. As mentioned above, mechanical methods such as digging, mowing, and cutting may be suitable only for very small, new, isolated patches if continually treated and properly monitored and disposed of. These methods are not feasible for large, well-established infestations because it is very difficult to reliably isolate and remove all reproductive plant parts, especially all root fragments. Partial mechanical treatments will encourage denser growth and spread. Mechanical treatments such as excavation are increasingly costly, cause significant disturbance, are not accessible in remote locations, and will not reliably isolate and remove all root fragments. Mechanical treatments also create a new risk of spread in transporting and properly disposing of removed plant material and knotweed infested soil.

The targeted application of a suitable herbicide is the most effective means of controlling knotweed and protecting the adjacent environment. Herbicide treatment methods have high efficacy ratings, translocating to the roots. A 2010 Oregon State University study demonstrated 80% control of Japanese knotweed after one year of herbicide foliar applications (Rudenko and Hulting). If viable reproductive plant parts remain in a location, consistent, ongoing monitoring and treatment of new growth (one to three times during a single growing season) is required to prevent re-establishment of the knotweed population.

Why is herbicide the preferred treatment method?

The Province and the Namgis First Nation cooperatively assessed the efficacy and suitability of all available treatment options for controlling knotweed on the Nimpkish River. It was determined that the targeted application of site suitable herbicides would be the most effective means of eliminating knotweed from the river system with minimal to no impacts to the surrounding environment and species.

Mechanical treatment is not a viable option to eradicate invasive knotweed on the Nimpkish River due to the size of infestation and risk of spread. Mechanical treatment can break up plants, leaving fragments to escape downriver and regrow, as well as increasing sedimentation in the river.

Herbicide has been demonstrated to provide the most effective control of knotweed infestations. A number of herbicides including imazapyr, glyphosate, triclopyr, and aminopyralid have proven efficacy in treating knotweed. However, glyphosate is the only herbicide active ingredient allowed for stem injection in B.C. Plant specific treatments can be applied through a variety of application methods such as foliar spray, stem injection, and wipe-on application. Herbicide treatments are less labour intensive and cause less site disturbance as they only require one or two site visits per year, whereas mechanical treatments often require many treatments per season for several years at each site.

Herbicide is absorbed through foliage (leaves) or the stem where it is translocated throughout the plant, specifically to the roots. By working on the root system of knotweed, herbicides can target the growth-centre for the plant to provide effective long-term control.

What is the cost of doing nothing?

Invasive knotweed displaces natural vegetation, reduces water access and forage for wildlife species, limits nutrient cycling in aquatic ecosystems, degrades fish habitat, contributes to increased erosion, disrupt drainage patterns, and can lead to infrastructure damage for roads and bridges. These impacts also affect recreational activities through reduced environmental quality and access to and within the river.

If left unchecked, invasive knotweed will continue to spread along the Nimpkish River as fragments are moved by erosion and flooding to overtake new banks and gravel bars.

Currently, invasive knotweed is only located upstream from Nimpkish Lake; however, there is risk of it spreading along Nimpkish Lake and the Lower Nimpkish section if nothing is done.

What is the purpose and scope of the Pesticide Use Permit?

A Pesticide Use Permit (PUP) provides support for the use of integrated pest management principles for the purpose of controlling invasive knotweed under the B.C. *Integrated Pest Management Act and Regulation* (IPMA). Under the IPMA, a minimum 10 m pesticide-free zone (PFZ) must be maintained around and along bodies of water, dry streams, and classified wetlands on Provincial Public land. If using glyphosate for the management of invasive plants or noxious weeds, this PFZ may be reduced to 1 m above the high-water mark.

As most knotweed infestations on Victoria Lake occur below the PFZ and below the high-water mark on the exposed shoreline, a PUP is required to authorize treatment of knotweed in this area. An issued PUP is valid for 3 years.

The extent of knotweed adjacent to Nimpkish River is currently limited to a total area of 0.17 ha. The total area proposed for inclusion in the PUP is significantly larger at 7000 ha, including both Upper and Lower Nimpkish Rivers as well as Vernon and Nimpkish Lakes. The large PUP boundary will allow for the treatment of newly detected knotweed clones (new plants grown from a knotweed fragment) that may be introduced to Vernon and Nimpkish lakes or the Lower Nimpkish River as a result of high-water events or disturbance. The limit to total treatment area each year will not exceed 5 ha, however it is anticipated that the actual annual treatment area will be significantly less based on currently known knotweed locations.

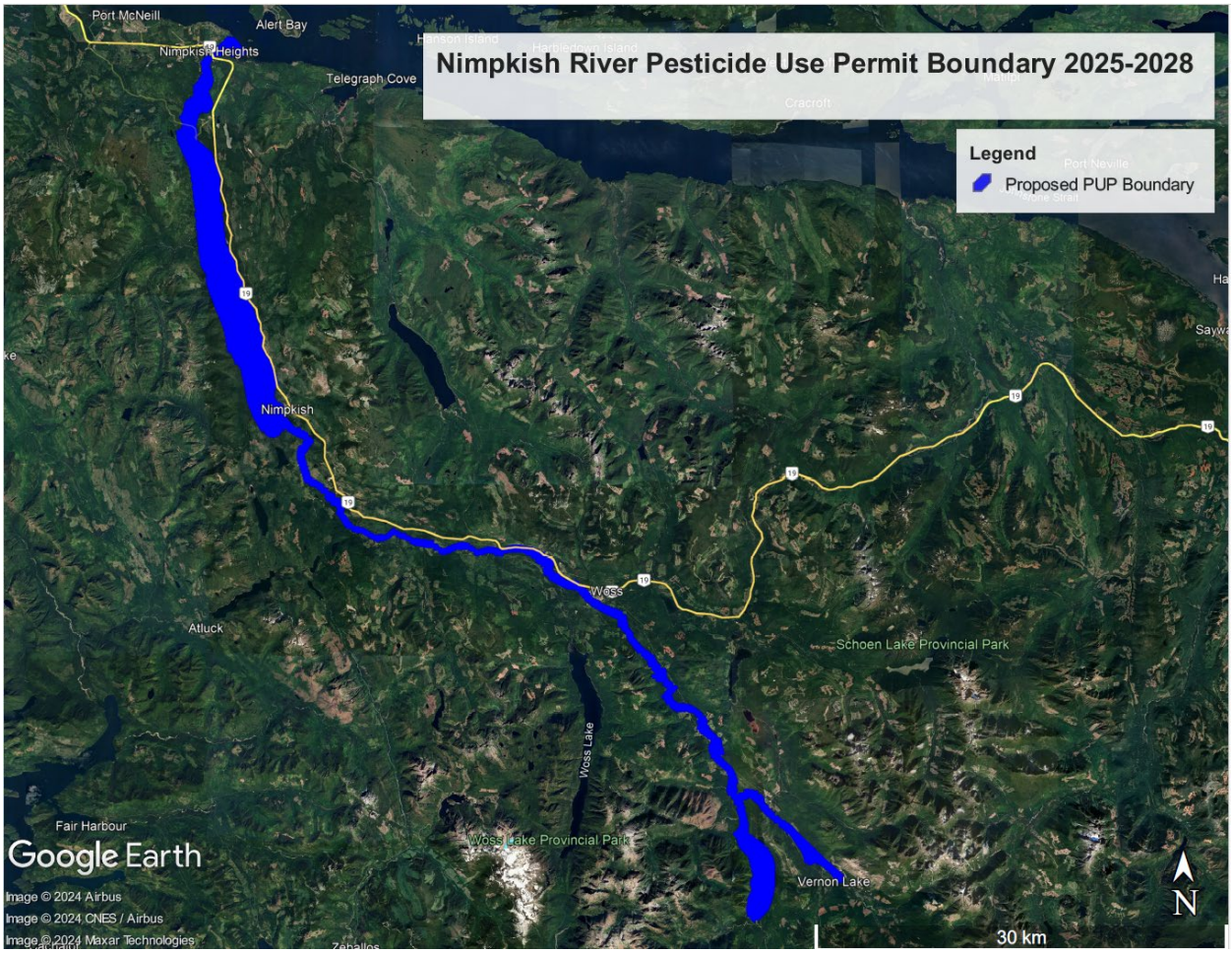

Figure 1- Knotweed Pesticide Use Permit Boundary for Nimpkish River System 2025-2028

The 2025 to 2028 PUP will use both Roundup WeatherPro (a.i. glyphosate) and the aquatic herbicide Habitat Aqua (a.i. imazapyr). This PUP proposes to treat all knotweed clones detected growing in or adjacent to Upper and Lower Nimpkish Rivers, as well as Vernon and Nimpkish Lake to protect the Nimpkish River system. Wherever feasible, foliar application methods will be used to limit the volume of herbicide entering the environment. Stem injection using Roundup WeatherPro may be required in

some instances if the knotweed foliage cannot be effectively accessed using foliar application. Habitat Aqua is specifically formulated for use in and adjacent to aquatic environments and will be the preferred product for knotweed treatments during the 2025 to 2028 treatment period. These treatments will occur as foliar applications. The addition of Habitat Aqua to the PUP will also limit the risk of knotweed developing herbicide resistance, as Habitat Aqua chemistry and modes of action are different from that of the glyphosate products. In addition, Habitat Aqua is well-suited for knotweed treatments not only to water's edge but also emergent, wetted plant applications. All foliar treatment applications will be made as targeted spot treatments with the intention of limiting drift and non-target vegetative damage.

When will treatments occur?

Treatments are scheduled to occur in July, August, and possibly September during seasonal low water levels. This provides best access to sites and reduces the risk of contact with water as water levels are below site treatments areas, as well as occurring outside of spring hatching and fall spawning of fish. There is also less recreational use of the river during these months.

Has the Nimpkish River Knotweed Management been effective?

2024 marks the seventh year of the Nimpkish River knotweed management project, which has demonstrated excellent success since its inception in 2018. Since the first year of full season management and peak knotweed abundance in 2019, the total impacted area and knotweed extent has declined by approximately 90% from 1.65 ha in 2019 to 0.1704 ha in 2024.

Annual herbicide use of Roundup WeatherMAX (a.i. glyphosate) from 2019 to 2021 declined by 96% from 65.54 L in 2019 to 2.96 L in 2021. Higher herbicide usage in 2018 and 2019 is due to stem injection being used as the primary treatment method and higher levels of knotweed abundance. In 2020, foliar backpack applications became the primary treatment method and that, combined with reduced knotweed abundance resulted in lower herbicide usage. This herbicide usage further declined from 2022 to 2024, where foliar backpack applications of Habitat Aqua (a.i. imazapyr) were the primary treatment methods and herbicide usage declined by 84% from 4.83 L in 2022 to 0.77 L in 2024.

Who can I contact regarding this project?

For more information contact – BC Ministry of Forests, Invasive.plants@gov.bc.ca

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