

qam' (Bull Kelp) Restoration in səlilwət (Burrard Inlet):

Recommendations for Successful Project Implementation



Tsleil-Waututh Nation
PEOPLE OF THE INLET

 The Kelp Rescue
Initiative



Tsleil-Waututh Context

səlilwətał (Tsleil-Waututh) are the “People of the Inlet,” we have used and occupied the lands and waters of **səlilwəł** (Burrard Inlet) and surrounding watersheds since time out of mind. Tsleil-Waututh holds a deep, ancient and ongoing connection to Burrard Inlet. Tsleil-Waututh’s Creation Story occurs here: the genesis of the first Tsleil-Waututh woman stems from Burrard Inlet, when the sediment of Burrard Inlet was transformed into the first tsleilwautt grandmother. Tsleil-Waututh maintain a sacred and reciprocal relationship with the lands, waters, air, and resources in the territory, and all its relations therein. The Tsleil-Waututh Nation Declaration states that Tsleil-Waututh have always been here and we will always be here. Our people are here to care for our land and water. It is our obligation and birthright to be the caretakers and protectors of our Inlet.

Our Elders say, referring to the historical natural abundance of our territory, “When the tide went out, the table was set.” Over 90% of the protein in ancestral Tsleil-Waututh diets was harvested from Burrard Inlet and came from abundant marine foods such as *sce:łtən* (salmon), *słewəł* (herring), shellfish, and birds (Efford et al., 2024). The waterways of Burrard Inlet acted as the first highways for our Ancestors to paddle throughout our territory, yet paddling is more than a mode of transportation to Tsleil-Waututh:

“When we pick up the paddle, we hear our Ancestors’ voices. We are always close to them – in ceremony, in the canoe, and on our land and waters.”

– Tsleil-Waututh Nation Elected Chief and Council

qam (Kelp) was used during a variety of practices including both harvesting and paddling, as it was used in the preparation and preservation of food and to help paddlers read the water currents. Kelp forests in Burrard Inlet have seen declines since European contact; however, Nation members can still remember a time when the water was so thick with kelp that it was difficult to paddle through. Consequently, kelp forests play a key role in the Nation’s collective understanding of its territory: kelp is part of what makes *səlilwəł* home for Tsleil-Waututh.





Executive Summary

Project Overview

This document offers strategic recommendations developed through a partnership between the Tsleil-Waututh Nation and the Kelp Rescue Initiative to support the restoration of bull kelp (*Nereocystis luetkeana*) in Burrard Inlet. As part of Tsleil-Waututh Nation's 2017 Burrard Inlet Action Plan to revitalize environmental health in their traditional, unceded territories, this initiative focuses on restoring a species critical to marine biodiversity, fisheries, and food sovereignty. In response to the global decline of kelp forests driven by warming oceans, habitat loss, and grazing pressure, we tested restoration methods in Burrard Inlet across 2023 and 2024. This guidance summarizes our findings and offers practical, place-based recommendations for future kelp restoration in the region. It is an invitation to learn more rather than a comprehensive 'how to' guide.



Key Recommendations

- Coordinate restoration efforts with Indigenous communities to strengthen cultural and ecological outcomes. In this project, Tsleil-Waututh Nation's extensive place-based knowledge was critical to successful site selection and resulting project outcomes.
- Conduct pre-restoration site assessments and ongoing environmental and biodiversity monitoring to identify stressors, inform site selection, and guide adaptive management.
- Use kelp-seeded tiles bolted to concrete blocks as the primary method for restoration, due to their high persistence and reproductive success, particularly in high-current areas.
- Target restoration depths that balance light availability in turbid waters with minimizing thermal stress, as both factors influence kelp survival.
- Incorporate future policy updates from the Province of BC into project design and permitting.

Introduction - Why Kelp Restoration?

Bull kelp is a foundational marine species that supports biodiversity, stabilizes shorelines, and contributes to food security and carbon cycling. In Burrard Inlet, kelp forests have declined due to habitat loss from development, rising sea temperatures, and marine heatwaves. Nation members can still remember a time when the water was so thick with kelp that it was difficult to paddle through. Restoring these ecosystems provides cultural, ecological, and economic benefits.



Cultural and Ecological Significance

Restoration sites like Whey-ah-Wichen, an important Tsleil-Waututh village site, hold deep cultural importance. Stewardship here connects the community to restoration in addition to addressing environmental and ecological goals outlined in the Burrard Inlet Action Plan and Tsleil-Waututh Nation's Stewardship Policy.

Healthy kelp forests contribute to marine biodiversity, fisheries productivity, shoreline protection, and eco-tourism. Restoration also enhances ecosystem resilience under climate change. For example, herring, juvenile salmon, crabs and sea stars all rely on kelp at various life stages for habitat, food, or shelter. In Burrard Inlet, where high-value habitat is limited by urbanization and industrialization, kelp restoration can create critical refuge areas and support the recovery of key marine species. Kelp restoration is one component of many initiatives to restore the health of Burrard Inlet, and thus, improve the health of the Tsleil-Waututh People.

Restoration Techniques - What Worked Best

To guide restoration in a heavily urbanized environment, different kelp restoration methods were tested over two seasons. Test trials included outplanting kelp-seeded ceramic tiles – bolted to concrete blocks or attached with epoxy – as well as cobble and gravel. **Ultimately bolted tiles are the recommended approach due to high kelp persistence and reproductive success.**



Kelp-seeded Ceramic Tiles (bolted)

Advantages: High kelp persistence and reproductive success; effective for buoyant canopy kelp species (bull kelp) and in high current areas; works well for small- to medium scale applications (10s-100s m²).

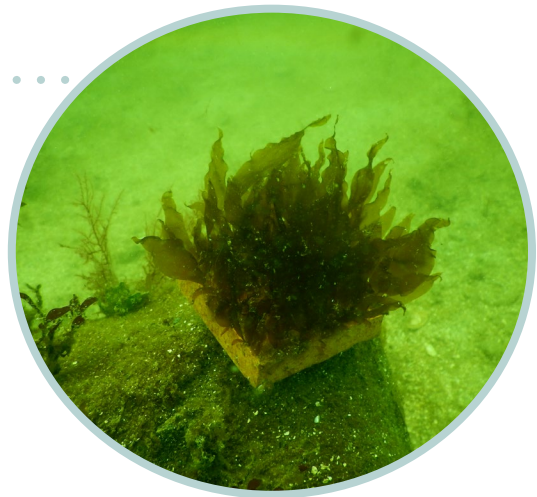
Considerations: Requires installation on natural rock or concrete blocks; heavier logistics; can be installed with or without scuba divers.

Approach: Baby kelp are attached to the surface of ceramic tiles, which are then grown in a nursery until they can be placed in the ocean by bolting the ceramic tile onto a concrete block.

Kelp-seeded Ceramic Tiles (glued)

Limitations: Lower durability; prone to detachment; scuba divers needed for installation.

Approach: Baby kelp are attached to the surface of ceramic tiles, which are then grown in a nursery until they can be placed in the ocean by glueing the ceramic tile onto a natural boulder



Cobble and Gravel

Limitations: Low persistence due to abrasion and movement of rocks; less suitable for floating canopy kelp (bull kelp) in high-current areas in Burrard Inlet.

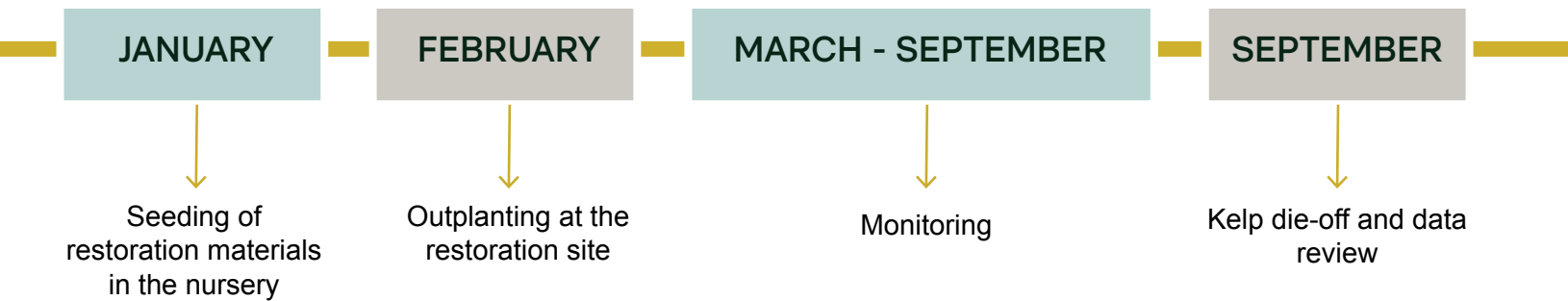
Approach: baby kelp are attached to the surface of rocks of different sizes (cobble or gravel), which are then grown in a nursery until they can be placed in the ocean.

Kelp Culturing

Select resilient local kelp populations for nursery propagation, sourcing parent plants from near the restoration target site. Sori (reproductive tissue) is collected in late summer, followed by gametophyte culturing in the fall and early winter. Outplanting success depends on careful gametophyte culturing and seeding, as well as maintaining viable nursery conditions.

Restoration Timeline

The timeline below reflects the general timing of our restoration project. We recommend kelp to be outplanted in the winter, and by mid-March at the latest.



Considerations for Site Selection

- **Accessibility & Feasibility:** Restoration sites should balance cultural importance and ecological potential with logistical accessibility (e.g., proximity to shore or marina, and ease of deployment). In Burrard Inlet, restoration efforts near shore are also limited to areas zoned for recreation and conservation as per Vancouver Fraser Port Authority's Land Use Plan. Working in areas with different land use designations would likely require a multi-year permitting and approval process, which should be considered early in project planning.
- **Physical Conditions:** Pre-restoration efforts must identify sites that meet the physical requirements for bull kelp growth.
 - **Thermal Stress and Environmental Conditions:** Monitoring indicates that Burrard Inlet sites, such as New Brighton and Whey-ah-Wichen, can still support kelp growth. However, damage or die-offs should be expected from heat stress during marine heatwaves. As climate change progresses, increasing focus on heat resilient strains for restoration is needed.
 - **Substrate Requirements:** Bull kelp in Burrard Inlet often grow well in relatively high current environments, as increased water motion facilitates nutrient uptake and gas exchange. Consequently, large substrate (i.e., cobbles and boulders) is required to sufficiently 'anchor' adult bull kelp. Sites with sufficiently large substrate should be targeted for restoration efforts.
 - **Depth Considerations:** Kelp growth is limited by light availability in high-turbidity areas where suspended solids reduce underwater light penetration. In these areas, restoration efforts should focus on shallower zones where light is less limiting. However, thermal stress and bleaching can also limit kelp survival in shallower waters. As a result, both light limitation and temperature stress should be considered when selecting outplanting depths.
- **Grazing (Biological) Pressure:** While sea urchin populations remain low in Burrard Inlet, other grazers (e.g., kelp crabs, snails) can affect juvenile kelp. Pre-restoration surveys are recommended to assess local grazer populations. Outplant timing and size of kelp outplants could be adjusted in areas with higher observed pressure.



Regulatory Guidance

Restoration projects must comply with applicable marine-use regulations. Although this project did not require food harvest permits, future efforts should be aware of and align with emerging provincial restoration policies. It is also important to ensure that agreements with Indigenous Nations are established and that required event notices, such as those to the Port of Vancouver, are submitted before fieldwork begins.

Permits that are required for kelp restoration depends on the project context and purpose:

First Nations	■ Early Engagement. Reach out to all Nation whose territories the project is situated on as early as possible asking for permission/about their preferred process for asking permission. This is also a good moment to ask if there's interest in collaboration. ■ Project Referral. Relevant project information should be sent to all Nations whose territories the project is situated on early in the planning process to allow for adequate review and opportunity for collaboration.
Vancouver Fraser Port Authority Permits	■ Marine Event Permit. Required for fieldwork. ■ Project Environmental Review. Could be required depending on project scope and should be determined early in the planning process.
Municipal Notification	■ Inform the upland lease holder of the project to determine if there are any additional requirements.
Provincial Permits	■ Harvest Plan Proposal ■ Aquatic Plants Permit. Not required unless intended for human consumption. ■ Upland Culture Licence ■ Be aware of evolving provincial legislation, as new regulations may introduce additional permitting requirements for kelp restoration and culture activities.
Relevant Federal Legislation - DFO	■ There are no federal permits specific to kelp restoration; however, all work must comply with and follow the notification and review process outlined in the <i>Fisheries Act</i>.



Future Directions

- Improve efforts to conserve and protect existing Bull Kelp within Burrard Inlet.
- Scale the use of bolted tile methods while exploring additional methodologies to increase community involvement.
- Expand partnerships to promote regional kelp restoration and cross-Nation learning.
- Continue kelp restoration research to improve methodology and long-term outcomes, such as:
 - Innovation and integration of climate resilient restoration approaches,
 - Refinement of new methodologies (i.e., direct seeding and seeded lines), and
 - Exploration of grazer impacts at early life stages.



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Artwork featured in this document was created by **Christopher Overes**.

For additional resources, technical appendices, or monitoring templates, please contact the **Kelp Rescue Initiative**.

Schuster, J.M., Good, C., Benjamin-Carey, R. 2025. q̓am̓ (Bull Kelp) Restoration in səliłwət (Burrard Inlet): Recommendations for Successful Project Implementation. Tsleil-Waututh Nation & Kelp Rescue Initiative. Bamfield, BC, Canada.

Further Reading

- Efford, M., de la Puente, S., George, M., George, M., Testani, A., Taft, S., Morin, J., Hilsden, J., Zhu, J., Chen, P., Paskulin, L., Toniello, G., Christensen, V., & Speller, C. (2024). A Fish-Focused Menu: An Interdisciplinary Reconstruction of Ancestral Tsleil-Waututh Diets. *Journal of Ethnobiology*, 44(3), 247-263. <https://doi.org/10.1177/02780771241261235> (Original work published 2024)
- Eger, A. M., Layton, C., McHugh, T. A., Gleason, M., and Eddy, N. (2022). Kelp Restoration Guidebook: Lessons Learned from Kelp Projects Around the World. The Nature Conservancy, Arlington, VA, USA.
- Eger, A. M., Bauer-Civeillo, A., Bernal, B., Bohachyk, S., Janke, D., Arroyo, N. L., Schreider, M., and Earp, H. S., (2024). Monitoring Kelp Forest Ecosystems: A Guidebook to Quantifying Biodiversity, Ecosystem Health, and Ecosystem Benefits. Kelp Forest Alliance, Sydney, NSW, Australia
- Fredriksen S., Filbee-Dexter K., Norderhaug K. M., Steen H., Bodvin T., Coleman M. A., et al. (2020). Green gravel: A novel restoration tool to combat kelp forest decline. *Sci. Rep.* 10, 3983. doi: 10.1038/s41598-020-60553-x
- Gleason M.G., J.E. Caselle, W.N. Heady, V.R. Saccomanno, J. Zimmerman, T.A. McHugh, and N. Eddy. 2021. A structured approach for kelp restoration and management decisions in California. The Nature Conservancy, Arlington, Virginia. 54pp. © 2021 The Nature Conservancy.
- Good, C. B. (2024). Collaborative exploration of novel bull kelp (*Nereocystis luetkeana*) restoration techniques in an urban ecosystem. Master's project thesis, Simon Fraser University and British Columbia Institute of Technology. <https://summit.sfu.ca/item/38155>.
- Morris, R. L., Hale, R., Strain, E. M., Reeves, S. E., Vergés, A., Marzinelli, E. M., ... & Swearer, S. E. (2020). Key principles for managing recovery of kelp forests through restoration. *Bioscience*, 70(8), 688-698.
- Tsleil-Waututh Nation. (2017). Burrard Inlet Action Plan. Tsleil-Waututh Nation. Available at: <https://twnsacredtrust.ca/burrard-inlet-action-plan/>
- Tsleil-Waututh Nation. (2021). Tsleil-Waututh Nation Stewardship Policy. Tsleil-Waututh Nation. Available at: <https://twnation.ca/our-departments/treaty-lands-resources/>