PEPÁḴEṈ HÁUTW̱ Foundation
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SṈIDȻEŁ Resiliency Project

Annual Report 2022

(Tod Inlet, Gowlland Tod Provincial Park)

Partnership Agreement Holder:	PEPÁḴEṈ HÁUTW̱ Foundation
Partnership Number (with BC Parks):	PA2019-13
Operating Year:	2023
Date completed:	Dec 15, 2022

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Part 1: Partnership Engagement Summary

Name of Agreement Holder: PEPÁḴEN̲ HÁUTW̲ Foundation

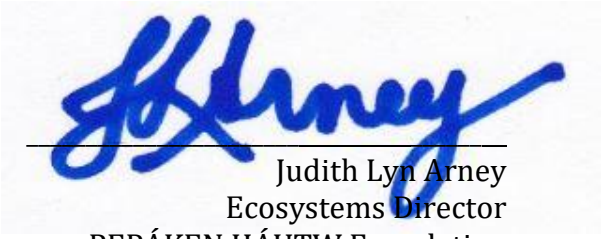
Contract number: PA2019-13

Date Form Completed: Dec 15 2022

Total number of individuals who performed Services during 2022 calendar year under age 85 and not "employees" of your organization.	Total number of hours of Services performed by all the individuals.
545	2009

I hereby confirm that the information contained in this Engagement Summary is true and correct as of the date this report was prepared.

Signed by an authorized representative of the Agreement Holder:



Judith Lyn Arney
Ecosystems Director
PEPÁḴEN̲ HÁUTW̲ Foundation
judithlynarney@gmail.com

Part 2: Key Personnel

Group Contacts:	Name	Position	Contact #
Main Contact	Judith Lyn Arney	PEPÁḴEN HÁUTW̱ Ecosystems Director	[redacted]
Alternate	Sarah Jim	PEPÁḴEN HÁUTW̱ Stewardship Coordinator	[redacted]
Alternate	Kyle Clarke	PEPÁḴEN HÁUTW̱ Stewardship Instructor	[redacted]

Key Personnel:	Duties / Responsibilities
Judith Lyn Arney	PEPÁḴEN HÁUTW̱ - BC Parks contact, SRP restoration planning, restoration, crew coordination, education
Sarah Jim	SRP restoration planning, restoration, education
PEPAḴIYE Cooper	PEPÁḴEN HÁUTW̱ Program Director, education
Earl Claxton Jr	PEPÁḴEN HÁUTW̱ Program Elder, education
Kyle Clarke	PEPÁḴEN HÁUTW̱ Stewardship Instructor, restoration, education

Part 3: 2022 Work Summary

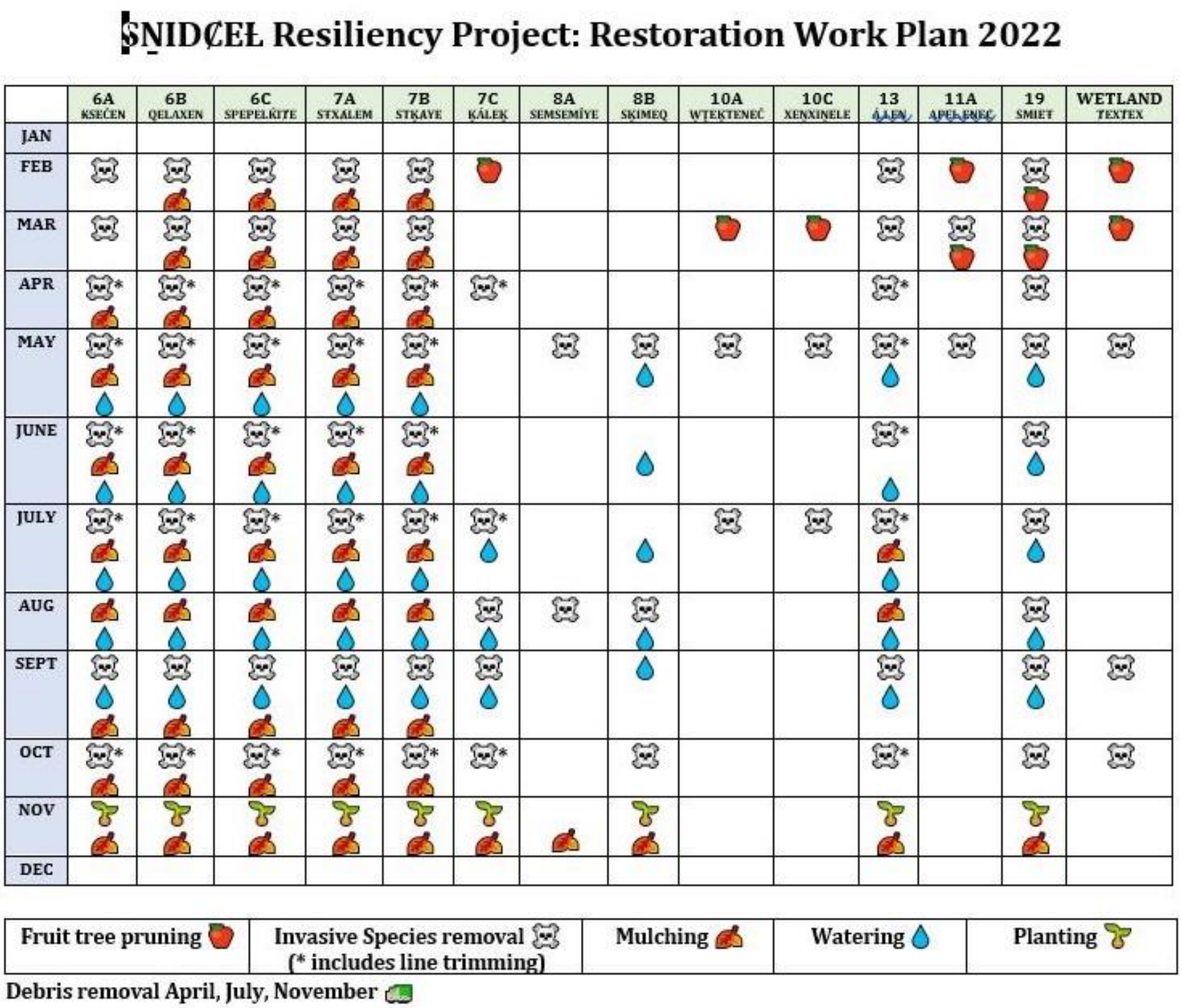
In 2022 we got back into the swing of things with volunteers and groups coming into SṈIDȻEŁ at pre-pandemic levels. As always, this infusion of energy and support is a huge benefit to our work on many levels. First, of course, the benefit to the ecosystems of SṈIDȻEŁ is clear as we can cover much more ground with a group of 10-30 people compared to a staff crew of 3 or 4. Additionally and importantly, connecting with student and volunteer groups gives us the opportunity to share and demonstrate the significance of cultural resurgence and ecosystem restoration work. We share specifically about this special place but also in the hopes that others are inspired to start or deepen their own learning journeys and take meaningful action in their home communities.

Our partners at the Compost Education Centre also continued on with the soil testing, monitoring and replanting the experimental soil remediation plots. Danielle Stevenson has provided a summary of 2022 activities as well as a document for supporting soil health and the safety of workers on site (see Appendices IV-VI).

With the support of Parks Enhancement Funds from BC Parks we were also able to add more plantings and protective split rail fencing at the back of the SÁSU (beach) and along the 'mural slope' (lower section of site 7c).

Finally, our PEPÁ<u>K</u>E<u>N</u> HÁUT<u>W</u> team grew in 2022! With the introduction of two new staff members, Kyle Clarke and Hannah Glass, we were able to steward our restoration sites much more comprehensively and keep up with many of our more demanding restoration priorities, especially in the summer.

3.1 Ecosystem Restoration



We were able to follow our work plan fairly closely this year, especially with the added support of student and volunteer groups. We had an excellent day with Lifecycles Project Society in early March taking care of some of our fruit trees. Starting line trimming earlier in the year was greatly beneficial to keeping invasive cover manageable during the warmer months of typically vigorous growth. We focussed our mulching efforts on sites exhibiting some poor soil characteristics in general (for example, much of the soil on 7B appears to be fill or at least have very little organic topsoil). Our mulching approach will be further explained in section 3.2 of this report on Soil Remediation.

Our watering system was greatly supported by the diligent efforts of our new staff. We had very few losses of planted species despite the summer heat and the long dry period from mid-summer to late autumn.

Our autumn plantings were concentrated in our pollinator beds and a handful of sites across SN̲IDȻEŁ, and supported by the construction of new split rail fencing. We barely had time to plant between the onset of late autumn rains and the early freezing temperatures and snow!

SN̲IDȻEŁ Plantings November 2022

site	qty	plantings
6b pollinator bed	seed	Large Leaved Lupine *Lupinus polyphyllus ssp. pallidipes*, Self Heal *Prunella vulgaris ssp lanceolata*
	2	California Aster *Symphyotrichum chilense*
	2	Pearly Everlasting *Anaphalis margaritacea*
6c	1	Sitka Willow *Salix sitchensis*
7a	1	Sitka Willow *Salix sitchensis*
	1	Black Cottonwood *Populus trichocarpa*
	1	Red Alder *Alnus rubra*
	1	Oceanspray *Holodiscus discolor*
7b	1	Black Cottonwood *Populus trichocarpa*
7c	4	Snowberry *Symphoricarpos albus*
	2	Thimbleberry *Rubus parviflorus*
	2	Oceanspray *Holodiscus discolor*
	1	Red Flowering Currant *Ribes sanguinem*
	3	Coastal Sage *Artemisia suksdorfii*
	1	Nootka Rose *Rosa nutkana*
8b pollinator bed	seed	Large Leaved Lupine *Lupinus polyphyllus ssp. pallidipes*, Self Heal *Prunella vulgaris ssp lanceolata*
	2	California Aster *Symphyotrichum chilense*

	2 3	Pearly Everlasting *Anaphalis margaritacea* Nodding Onion *Allium cernuum*
13	5 1 2 1 2 3 2	Oceanspray *Holodiscus discolor* Nootka rose *Rosa nutkana* Thimbleberry *Rubus parviflorus* Red Flowering Currant *Ribes sanguinem* Licorice Fern *Polypodium glycyrrhiza* Red Alder *Alnus rubra* Dull Oregon Grape *Mahonia nervosa*
19	4 1 1 1	Hardhack *Spirea douglasii* Red Elderberry *Sambucus racemosa* Slough Sedge *Carex obnupta* Pacific Ninebark *Physocarpus capitatus*
19 pollinator bed	seed	Satinflower's Sunny Wet Ecosystem blend: One-sided Sedge *Carex unilateralis*, Thick-headed Sedge *Carex pachystachya*, Mountain Sneezeweed *Helenium autumnale var. grandiflorum*, Western St.John's-wort *Hypericum scouleri*, Western Rush *Juncus occidentalis*, Graceful Cinquefoil *Potentilla gracilis var. gracilis*, Blue-eyed Grass *Sisyrinchium idahoense*, Canada Goldenrod *Solidago lepida*
SÁSU (beach)	seed 25 10 3 5	KEXMIN *Lomatium nudicaule* KEXMIN *Lomatium nudicaule* Entire leaved gumweed *Grindelia stricta* Sea Thrift *Armeria maritima* Dune Wildrye *Leymus Wildrye*

3.2 Soil Remediation

We moved forward with the soil remediation research and planning with Compost Education Centre (CEC) that we had planned in 2020, through the Geound Beneath Our Feet (GBOF) Pilot Project which is an extension of CEC's Healing City Soils project. Alexis Horgan, Danielle Stevenson and their colleagues from Royal Roads continued to test and monitor the soil plots on sites 7a and 7b. In 2021 CEC provided us with both the technical results of their work as well as a summary of what those results meant both in terms of soil contamination and safety protocols for our staff and volunteers (Appendices IV-VI). In brief, there were low to moderate levels of heavy metals found in the soil plots on sites 7a & 7b. These levels are not dangerous for people working on these sites provided they are not inhaling or ingesting the soils, however we are cautious not to include very young children in the work on these sites as direct ingestion of soil could be harmful. Volunteers and staff were informed of this risk when

we work on these sites; we have also included the statement of risk in our volunteer record book available every work day for anyone to review.

Summary from Danielle Stevenson, December 2022:

The Ground Beneath Our Feet (GBOF) Pilot Project is an extension of the Healing City Soils project that provides free soil tests for heavy metals for people growing or harvesting food. The objectives of the GBOF pilot were to explore the effectiveness of three native plants, one non-native plant, arbuscular mycorrhizal fungi (AMF), and compost in reducing heavy metal concentrations in remediation plots at three sites with low, moderate and highly contaminated soils, including SNIDǴEŁ. 16 remediation plots were installed at SNIDǴEŁ in the winter of 2020 with different combinations of plants and amendments, along with a control plot. The native plants tested included woolly sunflower (*Eriophyllum lanatum var. leucophyllum*), stinging nettle (*Urtica dioica*), and coastal mugwort (*Artemisia suksdorfii*). Analysis of soil samples via XRF for SNIDǴEŁ indicated low to moderate levels of arsenic, chromium, copper, lead, nickel and zinc. Plants at the SNIDǴEŁ site accumulated arsenic, chromium, copper, mercury, zinc, and lead. The distribution of metals throughout the plants was largely inconsistent; however, it was found that a volunteer plant (sow thistle (*Sonchus spp*.)) consistently accumulated higher metal levels in the flowers than the stems and roots. Woolly sunflower appeared to do an exceptional job in phytoextraction, as leaves contained the highest degree of sequestered metal at the site including As, Cr, Cu, Pb and Zn. In fall of 2022, plants that grew over fall (2021) and spring (2022) were harvested and anaerobically digested in a garbage bin at the CEC, and only coastal mugwort and woolly sunflower were replanted in fall of 2022 with compost and AMF in the plots at SNIDǴEŁ to trial for another year in order to develop more datasets for comparison. We will also be taking more soil samples this fall for students to test in the spring, also adding to the pilot's datasets.

A detailed report for the soil remediation findings in 2022 can be found in Appendix IV.

At this time we believe our best option for soil remediation is to add mulch on top of contaminated soils. We understand from our colleagues at CEC that this method will help to bind and dilute the heavy metals in the soils at SNIDǴEŁ to prevent significant uptake by plants and support increased soil health in this area. We began mulching first around our planted species and also across particularly soil poor areas. Dark fish bark mulch from Macnutt is a close approximation to the soils of natural forest floor, though we are currently using a mix of compost and fir mulch from Peninsula Landscape Supply in other restoration areas and may switch to this mulch in 2023.

3.3 Fences & Protected Areas

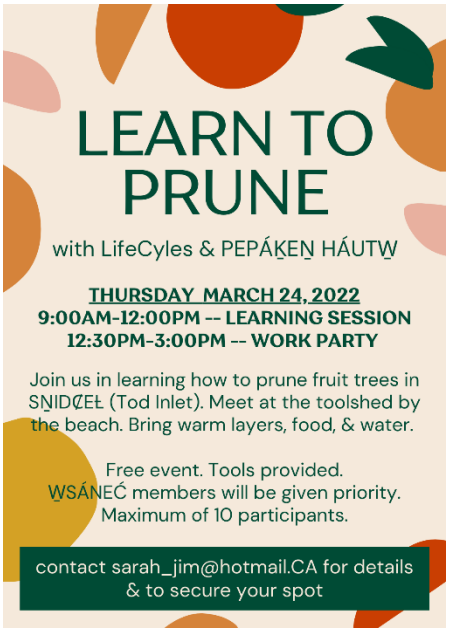
The split rail fencing we installed in autumn 2021 for the pollinator beds were quite effective in creating a functional work space and creating good visibility for these special areas. Our restoration sites are quite large, with many invasives on the herbaceous level while most of our planted species are at the shrub or tree level. The low fencing for the pollinator beds have provided the protection these small plants need to thrive and create a seed bank for the ecosystems at SṈIDȻEŁ.

We also extended the fencing at the SÁSU (beach) and along the 'mural slope' (the lower section of site 7c)! The beach area becomes extremely active over the year and sometimes park visitors do not respect the fenced areas as they seek out places to sit and enjoy the beach. Signage is our next priority for these areas.

3.4 Student & Volunteer Groups

We were so grateful for the amazing energy of student and volunteer groups joining us this year! In 2022 we have been able to connect with many different community members and groups from around the region. These include:

- Lifecycles Project Society
- Pacific Rim College
- Habitat Acquisition Trust
- Friends of North Saanich
- Montessori Academy
- Compost Education Centre
- World Fisheries Trust
- Where There Be Dragons
- Cedar Hill Middle School
- Camosun College Early Learning & Care program
- UVic Master of Global Business Program
- Torquay Elementary School
- CRFAIR
- Seedlings Forest Education School staff
- Tourism Cares
- St Margaret's School
- UVic Living with Climate Change program series
- BC Parks
- ŁÁU,WELNEW̱ Tribal School (through our program at the Tribal School)
- W̱SÁNEĆ Leadership Secondary School (through our program at the Tribal School)



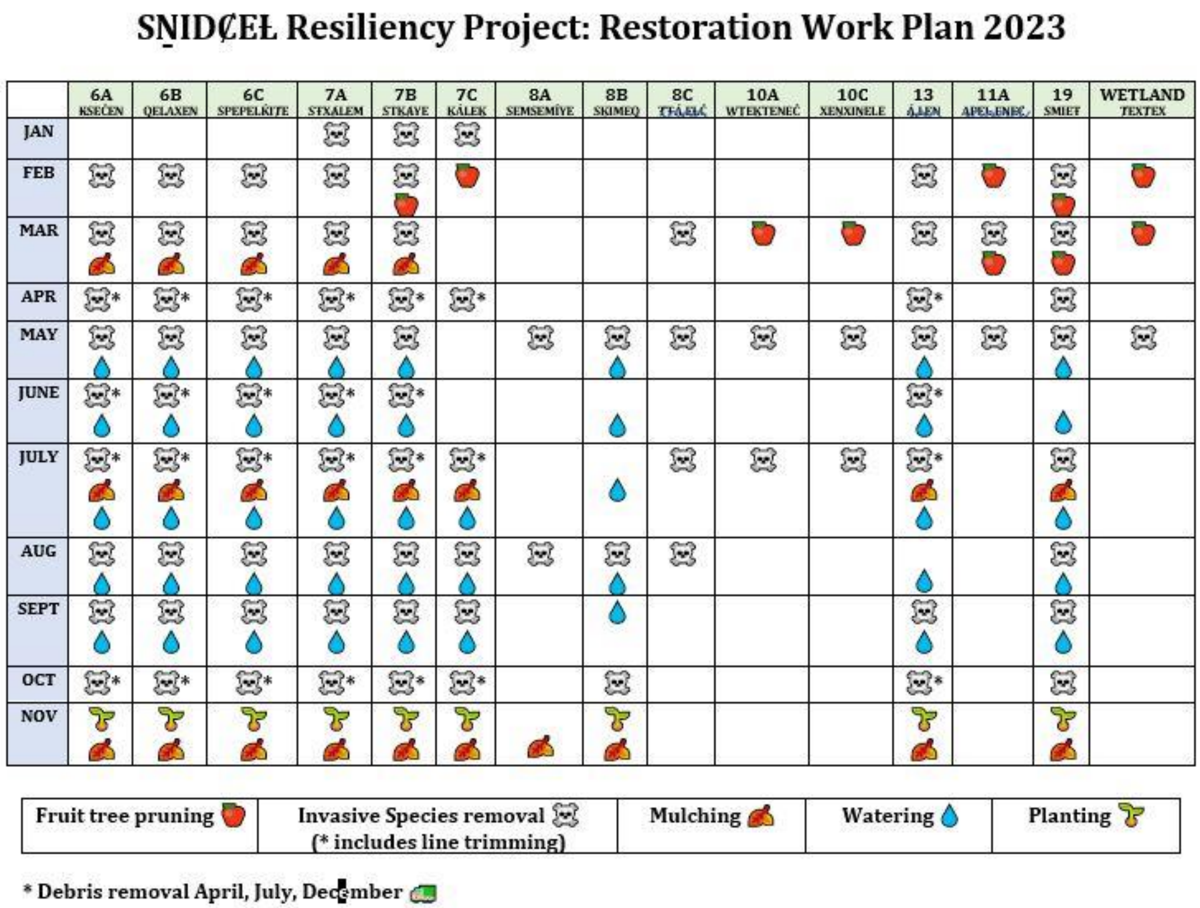
We had some wonderful collaborations this year! Lifecycles brought their fruit tree team led by Rowen Warrilow on a fantastic day of learning and practicing fruit tree pruning on the apple trees at SṈIDȻEŁ. We had seven amazing joint volunteer days with Hat over the course of 2022, which was a wonderful way to develop relationships between our two small organizations and set up a great routine for future years. We also had a number of incredible volunteers join us on our scheduled work days from February onwards through the year.

While our work on the land often appears to be focussed on the mechanics of ecosystem restoration, the layers run very deep as to what this work really means to people and place. The core tenets in our approach to ecosystem restoration involve supporting W̱SÁNEĆ cultural resurgence, building cultural awareness for both indigenous and non-indigenous peoples, analyzing privilege and positionality, and taking *action* to counter the devastating impacts of colonization and capitalism. Doing this in community has so much meaning. Frequently we hear people say that during a work day at SṈIDȻEŁ they really connected to the land, to their own sense of responsibility, to the depth of W̱SÁNEĆ connection to place, and finally to each other.

We are grateful to be able to support the many layers of change needed to truly heal the land in community.

Part 4: 2023 Work Plan

4.1 Ecosystem Restoration



INVASIVE REMOVAL
From February to May/June and September to November, invasive removal will generally consist of digging out invasive plants with the objective of removing as much of the whole plant (including roots) as possible. Each site will receive comprehensive 'sweeps' where the most aggressive invasive plants and patches are removed first, with an emphasis on clearing invasives away from the planted species. This process is greatly accelerated by volunteer groups and classes as well as concentrated crew hours.

During the summer months (June/July to August), the main objective is to prevent invasive species from flowering and protect planted species from being overtaken by invasive plants. Often the soil becomes too dry to effectively remove roots in summer, therefore every attempt will be made to simply remove as much of the invasive plant as possible and generally clear each site of vigorous invasive growth.

We've added site 8c to the 2023 work plan, which is the slope covered in English ivy between the Snoopy Tree (site 8b) and the inlet. We intend to free the bigleaf maple on this slope from the ivy; in future years we hope to fully clear this slope with an excavator and follow best practices for ensuring slope stability (for example, securing large logs across the bank and planting strategically with native plants with roots that grow quickly and deeply).

MULCHING

BARK MULCH

We hope to bring in 50-100 yards of mulch throughout the year to help suppress invasives from planted species and contribute to soil remediation efforts (see section 4.2 on Soil Remediation). This mulch will be applied around planted species first, ensuring the mulch does not touch or cover the stems of the plants. Then a broader layer of bark mulch can be applied across relevant sites to enrich poor or contaminated soils.

LEAF MULCH

Leaf mulching is an important part of restoring the microbiota of each restoration site. Specifically alder and maple leaves can be raked up from the roadways around the inlet in autumn and spread out over sites as thickly as possible given the amount of leaves available. Priority will be given to the newer sites with the most exposed soil (6c, 7a, 7b, 10c, 13, 19); if there are more leaves available the remaining sites can also receive a mulch layer. If leaf mulch is limited, concentrate the leaf mulch around the planted species.

FRUIT TREE PRUNING

We have a great interest in the fruit trees at SN̲IDȻEŁ. It seems they are mostly apple trees but we may have also seen some plum trees too. In spring 2018 we flagged all of the flowering fruit trees we could access in order to mark them for pruning in the late winter/early spring of future years. In Feb/March 2023 we will again have guests from the Lifecycles Project Society Fruit Tree Project visit us for pruning days so SN̲IDȻEŁ can benefit from their expertise regarding the care of these older fruit trees.

WATERING

We will continue to use our water system developed in 2020 (see Water Cistern & Watering System in 2020 Work Summary). Plants require watering for approximately 3 years after being planted on site. Although this is subject to annual weather conditions, generally watering begins in late May/early June and continues until early September, dependent upon seasonal temperatures and rainfall. In cool spring or autumn conditions, watering can be done on all sites once or twice a week, while in warm summer months watering will be done on all sites three times a week.

FLAGS
All plants which will require water through the spring and summer of 2023 are flagged in blue ribbon. Blue flagging indicates freshly planted species and plants that still need support as they struggle to get above the invasive cover. before 2020, many of which no longer require water but still need to be identified. Planted species that have grown tall enough to be seen above the dense invasive cover of spring and summer, and no longer require water, have their flags removed at the end of each autumn. Exceptions to this flagging system are the new beach and pollinator beds, which we will water lightly and monitor over the course of the year.

DEBRIS REMOVAL
The most convenient method for debris removal is to contact Brentwood Metal Salvage place on West Saanich Rd (adjacent to the Tribal School) 250-880-0963. Piles are currently near the shoreline across from site 7a and by the Benvenuto gate on site 19. Debris removal ideally takes place after each spring, summer and autumn restoration season.

Sometimes metal, recycling, and garbage is found on the restoration sites (especially site 19); this will be taken away by crew annually and disposed of at the Hartland facility, metal salvage yard or by residential municipal pickup after transport to a pickup location.

NATIVE PLANT PROPAGATION
We will be developing a propagation plan for SȻIDȻEŁ in January as we continue to add plants to the restoration sites. Cuttings will be done in the dormant season and seed collection through the summer and early autumn month for autumn seeding. Native plants we propagate of the SȻIDȻEŁ Resiliency Project will be cared for at the PEPÁḴEȻ HÁUTW̱ Native Plant Nursery (or another suitable location if our nursery is in transition) until they are planted at SȻIDȻEŁ.

TOOLSHED CLEANUP
At the end of each autumn work season, before the crew takes winter break, we do our best to give all of our tools and our toolshed a big cleanup. We sharpen and oil up all of our hand tools and recycle any broken tools left behind in the toolshed after a busy season on the land.

4.2 Soil Remediation

As mentioned in section 3.2, we determined with CEC that adding a mulch layer to these sites was the most practical and cost effective method to remediate the soils at this time. We plan to continuously bring in mulch over the course of the year and apply it in a thick layer across the contaminated sites over time.

CEC will be expanding the soil testing across SṈIDȻEŁ to determine the extent of the contamination across the area. Additionally, the soil plots set up by CEC staff will determine which native plants are best for removing heavy metals from the soil; the results of these findings may influence our remediation approach in future.

Since SṈIDȻEŁ has always been a place where W̱SÁNEĆ people gather native plants as food and medicines, we are also interested in testing the fruits and harvestable parts of plants in the area to understand more about how soil contamination may be affecting these traditional resources.

4.3 Signage

We would like to develop signage at SṈIDȻEŁ to increase education and awareness of the restoration work at SṈIDȻEŁ as well as the W̱SÁNEĆ connection here. We will be working through 2023 to design and print 5-10 signs that will promote a greater understanding by the public of our work and the importance of SṈIDȻEŁ to the W̱SÁNEĆ community. We will be consulting and collaborating with Tsartlip First Nation, W̱SÁNEĆ community members, and BC Parks on sign development.

4.4 Student & Volunteer Groups

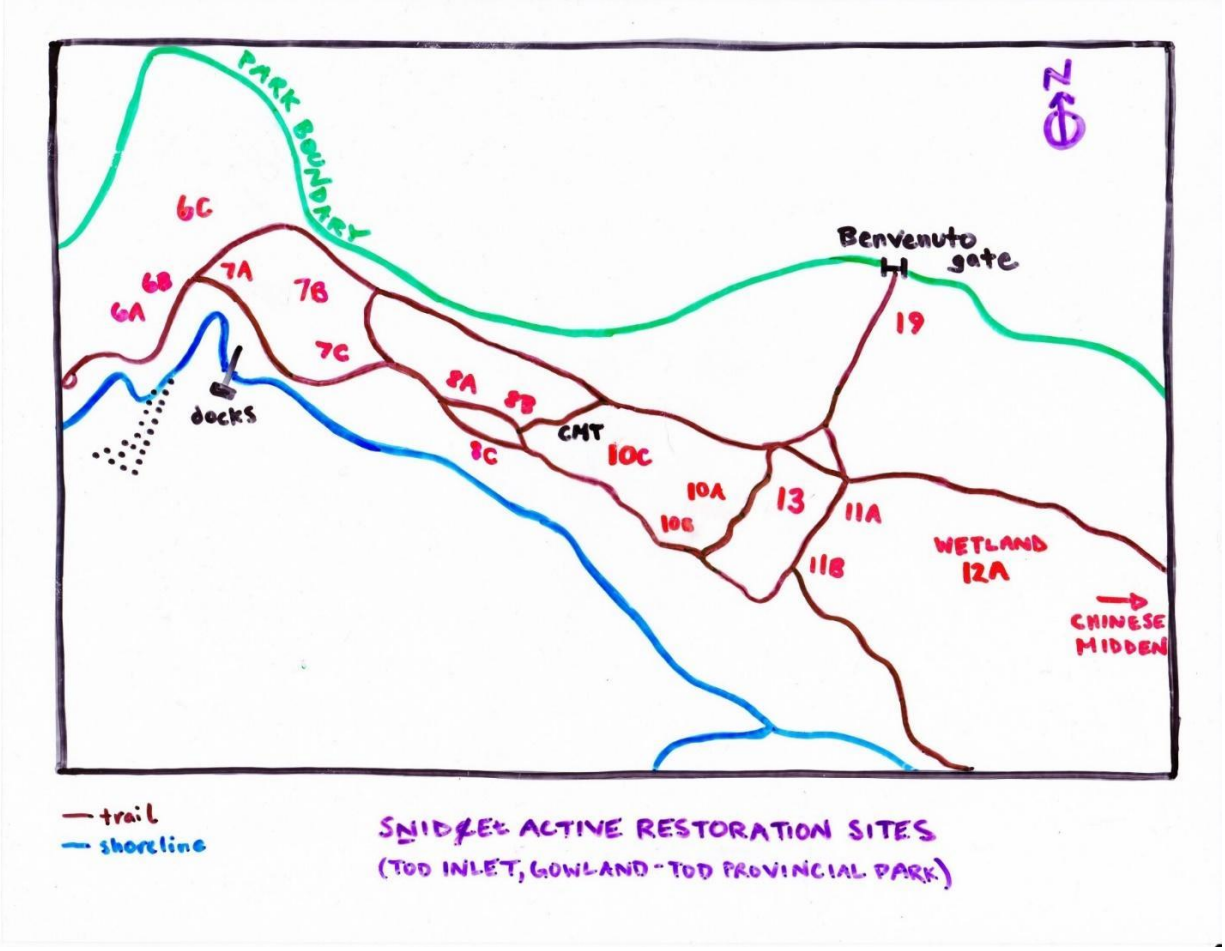
We look forward to inviting groups back again in 2023! We have regular classes scheduled through our PEPÁḴEṈ HÁUTW̱ Program from ŁÁU,WELṈEW̱ Tribal School and W̱SÁNEĆ Leadership Secondary School. We have already been contacted by a number of middle and secondary schools as well as adult volunteer groups and classes from local universities and colleges to book their groups in 2023.

We have program fees for our Learning on the Land programs on a conditional basis. Youth programs (middle and secondary school) will cost $200/2 hour program. Adult programs will cost $350/4 hour program. We will waive these fees for indigenous and volunteer groups without access to institutional financial support. These fees are to be paid directly to the PEPÁḴEṈ HÁUTW̱ Foundation.

Our programs begin with an opening circle where participants are welcomed according to W̱SÁNEĆ protocol, grounded in place and introducing

themselves, so we can start our work in a good way. Then we orient participants to the work of the day and spend our time together learning with each other and healing the land, which usually includes a lunch break at the beach or the Snoopy Tree. We finish our day with a closing circle in which participants share how the day impacted them. These closing connections are often very moving and we are very grateful to provide a space for deep levels of reflection.

Part 5: Restoration Site Descriptions



LOWER SITES

SITE 6A - ƘSEĆEN

Established 2006 by BCCC. This site requires ongoing clearing of invasives, especially in summer.

PLANTED	INVASIVE
Red-flowering currant *Ribes sanguinem* Tall Oregon-grape *Mahonia aquifolium* Bigleaf Maple *Acer macrophyllum* Nootka rose *Rosa nutkana* Western redcedar *Thuja plicata* Douglas fir *Pseudotsuga menziesii* Black cottonwood *Populus balsamifera ssp. Trichocarpa* Oceanspray *Holodiscus discolor* Swordfern *Polystichum munitum* Evergreen huckleberry *Vaccinium ovatum*	Broad-leaved peavine *Lathyrus latifolius* Butterfly bush *Buddleia* Clematis *Clematis armandi* Grass spp.

SITE 6B - QELAXEN

Established Feb 2011. This site was the dump site for the contaminated soil from the marine restoration project in Feb 2017. The open soil area was seeded with the seed mix provided by Saanich Native Plants; mostly yarrow and woolly sunflower remain. There has also been a pollinator plant bed planted at this site near the trail.

PLANTED	INVASIVE
Oceanspray *Holodiscus discolor* Thimbleberry *Rubus parviflorus* Arctic lupin *Lupinus arcticus* Yarrow *Achillea millefolium* Swordfern *Polystichum munitum* SNP seed mix (wildflower: yarrow, pearly everlasting, California brome, blue wildrye, fireweed, woolly sunflower, large-leaved avens, Canada goldenrod, Douglas' aster, graceful cinquefoil, great camas, self-heal) Pollinator bed: red columbine, KEXMIN, nodding onion, yarrow, seablush, spring gold, camas, California adter, douglas aster, pearly everylasting, large-leaved lupine	Broad-leaved peavine *Lathyrus latifolius* Himalayan blackberry *Rubus discolor* Queen Anne's Lace *Daucus carotus* Butterfly bush *Buddleia* Clematis *Clematis sp.* Grass spp.

SITE 6C – SPEPELḰIṮE

Cleared by excavator Mar 2016. This site has an upper and lower section on either side of the mature cottonwood stand. The soil here is littered with cement chunks and some metal protruding from the ground so please take care when moving through this site. There are some very healthy willows at the back of the site which, together with the vigorous cottonwood, indicates a lot of moisture in the ground despite the craggy appearance of the soil here. This site must be consistently cleared of invasives, especially in the summer months.

PLANTED	INVASIVE
Black cottonwood *Populus trichocarpa* Red osier dogwood *Cornus stolonifera* Douglas fir *Psuedotsuga menziesii* Oceanspray *Holodiscus discolor* Bigleaf maple *Acer macrophyllum* Red alder *Alnus rubra* Thimbleberry *Rubus parviflorus* Snowberry *Symphoricarpus albus* Swordfern *Polystichum munitum* Pacific willow *Salix lasiandra* Sitka willow *Salix sitchensis*	Himalayan blackberry *Rubus discolor* Broad-leaved peavine *Lathyrus latifolius* Butterfly bush *Buddleia sp.* Canada thistle *Cirsium arvense*

SITE 7A – STXƛLEM

Cleared by excavator Feb 2016. *Please note the presence of poison hemlock on this site*. Poison hemlock is extremely toxic when ingested; it is distinguished from Queen Anne's lace by the purplish blotches on its stem. This plant must be removed wherever it is found especially before it goes to seed. The occurrence of poison hemlock is mostly near the foot bridge on the bottom section of the site and along the slope beside cottonwood grove. There are also lovely native horsetails (*Equisetum arvense*) growing in the section alongside the mature cottonwoods near the foot bridge. There is also clematis invasion near the top edge of the site (adjacent to the path).

PLANTED	INVASIVE
Black cottonwood *Populus trichocarpa*	Himalayan blackberry *Rubus discolor*
Red osier dogwood *Cornus stolonifera*	Broad-leaved peavine *Lathyrus latifolius*
Douglas fir *Psuedotsuga menziesii*	Butterfly bush *Buddleia sp.*
Oceanspray *Holodiscus discolor*	Clematis *Clematis sp.*
Red alder *Alnus rubra*	Canada thistle *Cirsium arvense*
Red flowering currant *Ribes sanguinem*	**Poison Hemlock *Conium maculatum****
Bigleaf maple *Acer macrophyllum*	Oxeye daisy *Leucanthemum vulgare*
Western redcedar *Thuja plicata*	
Thimbleberry *Rubus parviflorus*	
Snowberry *Symphoricarpus albus*	
Blackcap raspberry *Ribes leucodermis*	
Salmonberry *Rubus spectabilis*	
Grand fir *Abies grandis*	
Sitka Willow *Salix sitchensis*	

***poisonous, handle with caution**

ECOTONE SITES

SITE 7B – STḴAYE

Cleared by excavator Feb 2016. This site extends across the plateau of land above the docks and down the slope leading to the dock area. There is a lot of native trailing blackberry *(Rubus ursinus*) over by the slope towards the docks and spreading across the site which is nice, but will need to be pointed out to volunteer groups.

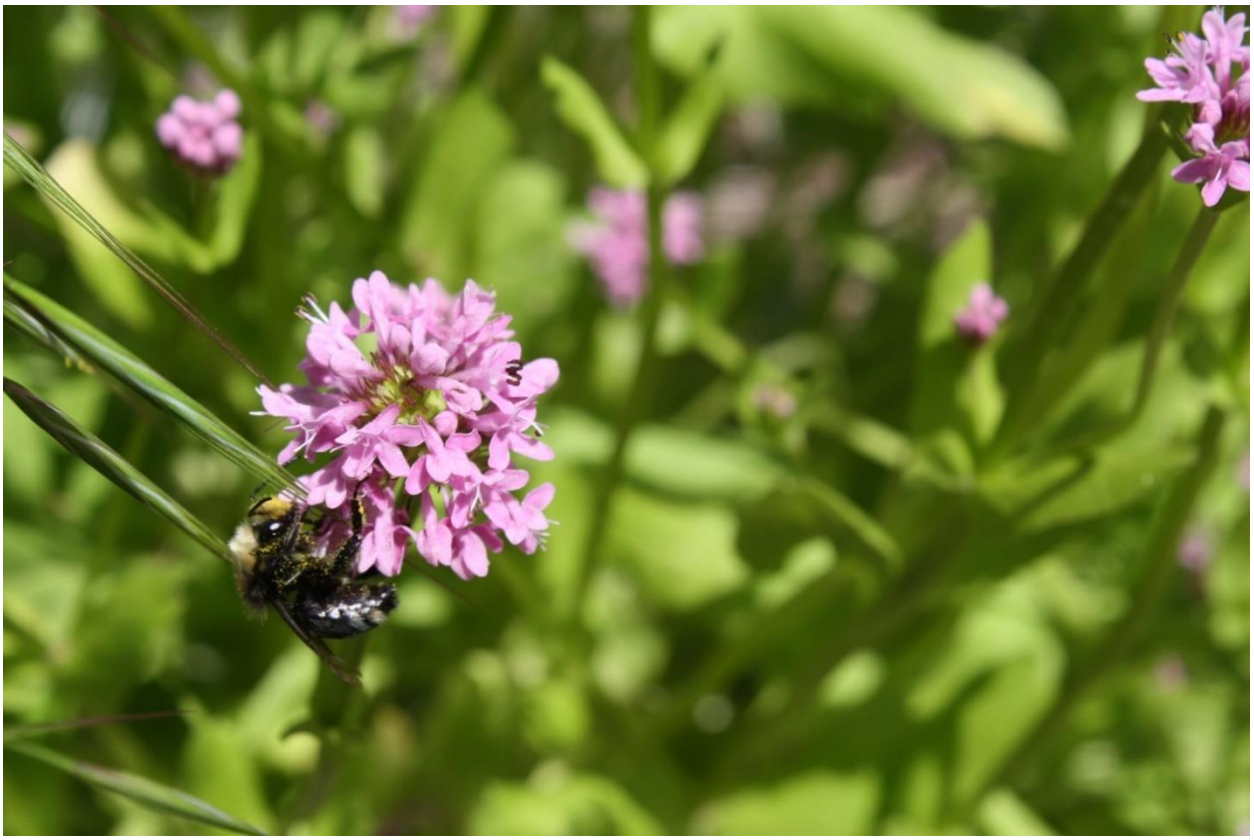
PLANTED	INVASIVE
Red osier dogwood *Cornus stolonifera*	Himalayan blackberry *Rubus discolor*
Douglas fir *Psuedotsuga menziesii*	Broad-leaved peavine *Lathyrus latifolius*
Oceanspray *Holodiscus discolor*	Butterfly bush *Buddleia sp.*
Red alder *Alnus rubra*	Clematis *Clematis sp.*
Red flowering currant *Ribes sanguinem*	Canada thistle *Cirsium arvense*
Bigleaf maple *Acer macrophyllum*	Oxeye daisy *Leucanthemum vulgare*
Swordfern *Polystichum munitum*	
Snowberry *Symphoricarpus albus*	
Red flowering currant *Ribes sanguinem*	
Black cottonwood *Populus trichocarpa*	
Pollinator bed: mock orange, cottonwood	

SITE 7C - ḴÁLEḴ

Established 2006 by BCCC. There were some meadow species planted before 2010 here, however the site is definitely an ecotone forest site. This site does not usually require much oversight, just sometimes planted species can be checked to make sure they are not being overwhelmed by invasive cover. The bank below this site, adjacent to the new mural site and between the roadway and the beach, is considered part of this site.

This site is also adjacent to the new toolshed location, to be built in January-February 2020. We may consider doing some plantings around the new toolshed in the autumn.

PLANTED	INVASIVE
Garry oak *Quercus garryana* (survival unlikely) Camas *Camassia spp.* Seablush *Plectritis congesta* Oceanspray *Holodiscus discolor* mural slope: Snowberry *Symphoricarpos albus* Thimbleberry *Rubus parviflorus* Oceanspray *Holodiscus discolor* Red Flowering Currant *Ribes sanguinem* Coastal Sage *Artemisia suksdorfii* Nootka Rose *Rosa nutkana*	Broad-leaved peavine *Lathyrus latifolius* Teasle *Dipsacus sp.* Grass spp. Himalayan blackberry *Rubus discolor*



SITE 8A – SEMSEMÍYE

Established 2006 by BCCC. The back of this site is vulnerable to invasion and can be monitored and invasive species removed, especially around planted species. Morning glory is particularly vigorous here and will wrap its way up plants; please remove morning glory from plants as often as

needed. There have been observations of active ground bee nests on this site in 2018 and 2019; please take good care when working around this section.

PLANTED	INVASIVE
Douglas fir *Psuedotsuga menziesii* Bigleaf maple *Acer macrophyllum* Red alder *Alnus rubra* Oceanspray *Holodiscus discolor* Western redcedar *Thuja plicata*	Himalayan blackberry *Rubus discolor* Broad-leaved peavine *Lathyrus latifolius* Morning glory *Convolvulus sepium* English bluebell *Hyacinthoides non-scripta* Common burdock *Arctium minus* Canada thistle *Cirsium arvense*

SITE 8B – SḴIMEQ

Established 2006 by BCCC. This site is similar to 8a in that it requires little maintenance, however the back of the site in particular is still vulnerable to invasion. This site has expanded to include the cleared sectio n on the other side of the path leading to the culturally modified trees (CMTs). This site can be kept clear of invasives especially around the planted species. Again morning glory is really pernicious especially at the back of the site and should be removed as much as needed. There is a pollinator bed planted at this site which will require watering through the summer months.

PLANTED	INVASIVE
Tall Oregon-grape *Mahonia aquifolium* Red alder *Alnus rubra* Bigleaf maple *Acer macrophyllum* Douglas maple *Acer glabrum* Red-flowering currant *Ribes sanguinem* Baldhip rose *Rosa gymnocarpa* Hybrid rose *Rosa sp.* Oceanspray *Holodiscus discolor* Garry oak *Quercus garryana* Douglas fir *Psuedotsuga menziesii* Hairgrass *Deschampsia cespitosa*	Himalayan blackberry *Rubus discolor* Broad-leaved peavine *Lathyrus latifolius* Morning glory *Convolvulus sepium* English bluebell *Hyacinthoides non-scripta* Common burdock *Arctium minus* Canada thistle *Cirsium arvense* Teasel *Dipsacus fullonum*

Pollinator bed: red columbine, KEXMIN, nodding onion, yarrow, seablush, spring gold, camas, california aster, douglas aster, pearly everlasting	

Sites 8A & 8B are on either side of the iconic bigleaf maple we call "the Snoopy Tree".

SITE 10A - W̱TE̱KTENEĆ

Established 2006 by BCCC. This site requires clearing invasive plants away from planted and volunteer native species. There is a good deal of Hardhack (*Spirea douglasii)* and fireweed (*Epilobium angustifolium*) on site, as well as trailing blackberry (*Rubus ursinus*). This site is one of few that has robust native species volunteering amongst the planted and invasive species so we encourage them wherever we can. This site could one day be developed into an interesting interpretive site due to numerous cement features such as staircases and foundations, in a similar manner as site 13. The priority for this site is to keep the invasive cover down and away from the small planted species (mainly three swordfern), especially at the back of the site.

PLANTED	INVASIVE
Tall Oregon-grape *Mahonia aquifolium* Bigleaf maple *Acer macrophyllum* Indian plum *Oemleria cerasiformis* Red-flowering currant *Ribes sanguinem* Douglas fir *Pseudotsuga menziesii* Western redcedar *Thuja plicata* Swordfern *Polystichum munitum* Grand fir *Abies grandis* Oceanspray *Holodiscus discolor* Red alder *Alnus rubra*	Himalayan blackberry *Rubus discolor* Broad-leaved peavine *Lathyrus latifolius* Morning glory *Convolvulus sepium* English bluebell *Hyacinthoides non-scripta*

SITE 10C – XE̱NXIṈELE

Cleared by excavator Feb 2016. This site was planted by W̱SÁNEĆ Leadership Secondary School students in April 2016 and April 2017. Due to its relative shade, the plants at this site are less vulnerable to drought than the more open sites. The priority at this site is the removal of invasives, especially around planted species; thistles can be pulled out and blackberry sprouts can be dug or cut just underneath the surface of the soil.

PLANTED	INVASIVE
Red alder *Alnusrubra* Indian plum *Oemlaria cerasiformis*	Himalayan blackberry *Rubus discolor* Broad-leaved peavine *Lathyrus latifolius*

Red osier dogwood *Cornus stolonifera*	Morning glory *Convolvulus sepium* English bluebell *Hyacinthoides non-scripta*

SITE 11A – APEL,ENEȻ

Established 2006 by BCCC. This site borders the wetland area at SN̓IDȻEŁ and has an interesting mix of native species with the old apple trees planted by the settler residents of Tod Village. This site requires very little maintenance but benefits greatly from at least one sweep of invasive removal per year. Note the planted blackcap raspberry on the trailside between the apple trees so it doesn't get lost.

PLANTED	INVASIVE
Red-flowering currant *Ribes sanguinem* Red osier dogwood *Cornus stolonifera* Red alder *Alnus rubra* Swordfern *Polystichum munitum* Nootka rose *Rosa nutkana* Douglas fir *Psuedotsuga menziesii* Western redcedar *Thuja plicata* Salmonberry *Rubus spectabilis* Trailing blackberry *Rubus ursinus* Blackcap raspberry *Rubus leucodermis*	Himalayan blackberry *Rubus discolor* Morning glory *Convolvulus sepium* Lemon balm *Melissa officianalis* Canada thistle *Cirsium arvense* Common hawthorn *Crataegus monogyna* Creeping buttercup *Ranunculus repens* Grass spp.

SITE 13 – Á,LEN

Cleared by excavator April 2013. This site had previously been totally invaded by Himalayan blackberry, the removal of which uncovered a number of concrete foundations of former residences dating back to the cement plant era. The southwest corner of this site has a vigorous invasion of creeping St John's wort that has been dug out. We have been experimenting with different plantings on this section; red flowering currant has done relatively well so we have planted with associated species this autumn, as well as added some fine fir mulch to improve the soil quality.

This site is also seeing natural regeneration of native species such as thimbleberry (*Rubus parviflorus*) and woodland violet (*Viola odorata*). Please take good care of these little volunteer native plants.

The priority of this site is the removal of invasives. The alder sections and inside the central foundations can be cleared with a blade trimmer, however the more densely planted areas with smaller planted species need to be cleared of invasives by hand.

PLANTED	INVASIVE
Western redcedar *Thuja plicata* Douglas fir *Pseudotsugamenziesii* Salal *Gaultheria shallon* Trailing blackberry *Rubus ursinus*	Himalayan blackberry *Rubus discolor* Broadleaved peavine *Lathyrus latifolia* Morning glory *Convolvulus sepium* Canada thistle *Cirsium arvense*

Red alder *Alnus rubra* Oceanspray *Holodiscus discolor* Swordfern *Polystichum munitum* Gummy gooseberry *Ribes lacustre* Blackcap raspberry *Rubus occidentalis* Red flowering currant *Ribes sanguinem* Pacific willow *Salix lasiandra* Red osier dogwood *Cornus stolonifera* Oregon grape *Mahonia aquifolia* Snowberry *Symphoricarpus albus* Licorice Fern *Polypodium glycyrrhiza* Dull Oregon Grape *Mahonia nervosa*	Lemon balm *Melissa officianalis* English ivy *Hedera helix* Creeping St. John's Wort *Hypericum calycinum*

MATURE FOREST SITES

SITE 19 - SMIEŦ

Cleared by excavator December 2017. This site is our newest and largest site to date. Similar to site 13, there were numerous foundations of staff residences found on these sites underneath the invasive cover. There was also some evidence of squatter activity in the northeast section, and possibly a grow op in the eastern forested section (numerous garden pots, bags of soil and assorted debris was found as we cleared the area by hand).

The soils here are quite healthy and rich compared to some of the modified soils closer to the old industrial areas near the docks. Some of the site is extremely wet in the winter months and the most saturated areas were marked in blue flags in order to guide our planting plan for this site in autumn. We have already planted devil's club in the deepest and most wet section of the site (autumn 2018). The hydrology of this site is affected by the old system of ceramic pipes leading from the spring or associated waterways into the old residences form the cement plant and "Tod Inlet Village" era. We have endeavoured to track the hydrology here as best as we can given the unknown nature of this pipe system.

There are a lot of volunteer maples, oceanspray, thimbleberry, and trailing blackberry on this site, especially across the northmost section. It is great to point these ones out to volunteers.

The southwest corner of this site at the road junction has a lot of English ivy cover spreading into the forest. This ivy section has been a good site for the young ŁTS students as they can see their progress there over time. There is also a lot of periwinkle near the gate.

This site is right on the edge of the actively restored areas at SN̓IDȻEŁ, ideally in the coming years we have the capacity to push the restoration efforts from this site eastward towards the last swath of major invasive cover at SN̓IDȻEŁ in the wetland section.

PLANTED	INVASIVE
Bigleaf maple *Acer macrophyllum* Red alder *Alnus rubra* Oceanspray *Holodiscus discolor* Snowberry *Symphoricarpus albus* Red elderberry *Sambucus racemose* Evergreen huckleberry *Vaccinium ovatum* Swordfern *Polystichum munitum* Devil's club *Oplopanax horridus* Red osier dogwood *Cornus stolonifera* Western redcedar *Thuja plicata* Red flowering currant *Ribes sanguinem* Pacific ninebark *Physocarpus capitatus* Hardhack *Spirea douglasii* Slough Sedge *Carex obnupta* SNP seed mix (forest: Dewey's sedge, Siberian miner's lettuce, blue wildrye, large-leaved avens, fringecup, self-heal)(on designated site near central cedar) pollinator bed: Satinflower's Sunny Wet Ecosystem blend: One-sided Sedge *Carex unilateralis*, Thick-headed Sedge *Carex pachystachya*, Mountain Sneezeweed *Helenium autumnale var. grandiflorum*, Western St.John's-wort *Hypericum scouleri*, Western	Himalayan blackberry *Rubus discolor* Broadleaved peavine *Lathyrus latifolia* Morning glory *Convolvulus sepium* Canada thistle *Cirsium arvense* English ivy *Hedera helix* Creeping buttercup *Ranunculus repens* Periwinkle *Vinca minor* Teasel *Dipsacus fullonum*

Rush *Juncus occidentalis*, Graceful Cinquefoil *Potentilla gracilis var. gracilis*, Blue-eyed Grass *Sisyrinchium idahoense*, Canada Goldenrod *Solidago lepida*	

The Beach - SÁSU

After the significant marine restoration work done by SeaChange Marine Conservation Society in 2017, we began planning backshore restoration plantings. SeaChange did some plantings of entire leaved gumweed (*Grindelia stricta*) with a school group in November 2019. In November 2020, our staff planted 3 flats of KEXMIN (*Lomatium* nudicaule) behind the driftwood border between the main beach and the cottonwood stand, which seems to be damaged over the year by human and dog traffic on the beach. After our new fencing was installed at the back of the beach, we planted more KEXMIN and gumweed as well as sea thrift (*Armeria maritima*) and black twinberry (*Lonicera involucrata).* In 2022 we planted SŁE,QÁI (dunegrass or *Leymus mollis*) across the backshore in autumn 2022, and added to the fencing to protect these plants. In future, signage will be important to improve public awareness of this area. There is also a great aster flourishing on this site and may indicate other associated plants that will thrive here.

PLANTED	INVASIVE
KEXMIN *Lomatium nudicaule* Entire leaved gumweed *Grindelia stricta* Sea Thrift *Armeria maritima* Dune Wildrye *Leymus Wildrye*	Himalayan blackberry *Rubus discolor* Broadleaved peavine *Lathyrus latifolia* Canada thistle *Cirsium arvense*

OTHER RESTORATION SITES

These restoration sites are included in this document because they are part of the landscape restoration plan at SN̲IDȻEŁ, though they are not as active as the other sites.

SITE 12A: Wetland - ŦEXŦEX

There was a student project completed in December 2013 about the wetland northeast of site 13. The Creatures of Habitat program has also cleared a nice portion of the wetland area leaving an open space on its way to being populated by stinging nettle (*Urticia dioica*) going to seed on site.

We hope to build on the efforts in the wetland area on both sides of the trail; its related corridor ecosystem along the waterway (through sites 11a and 11b) is also of interest in our long term restoration efforts. This site could potentially be opened up as a major restoration area when funding and time permits.

Chinese Midden

The slope above the Chinese midden (as it connects to the main trail) has been cleared in April 2013 and 2014 by students in the Creatures of Habitat program. In spring 2014 volunteers also planted swordfern on this site in order to prevent

slope erosion and stabilize the bank. In spring 2015 the site was also planted with about 25 young salal (*Gaultheria shallon*) by Green Teams and SeaChange volunteers. This area is named the 'Chinese Midden' as removal of invasive species from this site inevitably unearths many artifacts from these workers' lives such as bottles and old boots. Some of these artifacts can be seen where they have been stacked along the lower walking trails running beside WEĆEĆE (Tod Creek).

Part 6: Safety Plan

A. Emergency Protocols (Appendix I) and Safety Orientation (see Appendix II)

- Shared with all staff prior to each working season and posted in the staff toolshed for quick reference. Shared with all volunteers prior to any volunteer event.
- Additional Information: site work at SṈIDȻEŁ will be cancelled in the event of high winds (over 50km/hr) or any extreme weather deemed high risk. Fire protocols will be updated for 2022.

B. Public Safety Considerations

- Additional Information: all key personnel are notified by phone when there is a public safety concern

C. Closures (trails or areas of a park): all key personnel are notified by phone or email by BC Parks

D. Accident and Emergency Management

- A First Aid Kit and a person with a current First Aid certification will be present at all projects and events.
- At least one person will have a cell phone or radio and an emergency contact list at all projects and events.

E. COVID 19 Protocols (Appendix III): to be in effect for the duration of the pandemic

EMERGENCY CONTACTS	
Police / Fire/ Ambulance Emergency	**911**
BC Hydro (Emergencies)	1-888-769-3766
RAPP (Report All Poachers and Polluters)	1-877-952-7277
Report a Forest Fire	1-800-663-5555
Air or Marine Emergency	1-800-567-5111
Poison Control Centre	1-800-567-8911
Nearest Hospital: Saanich Peninsula Hospital	1-250-544-7676
Non-Emergency Contacts	
BC Parks Staff: Katy Fulton	[redacted]
Park Facility Operator: RLC Park Services	1-250-474-1336
Local RCMP Detachment:	1-250-652-4441

Part 7: Proposed Additional Contractors

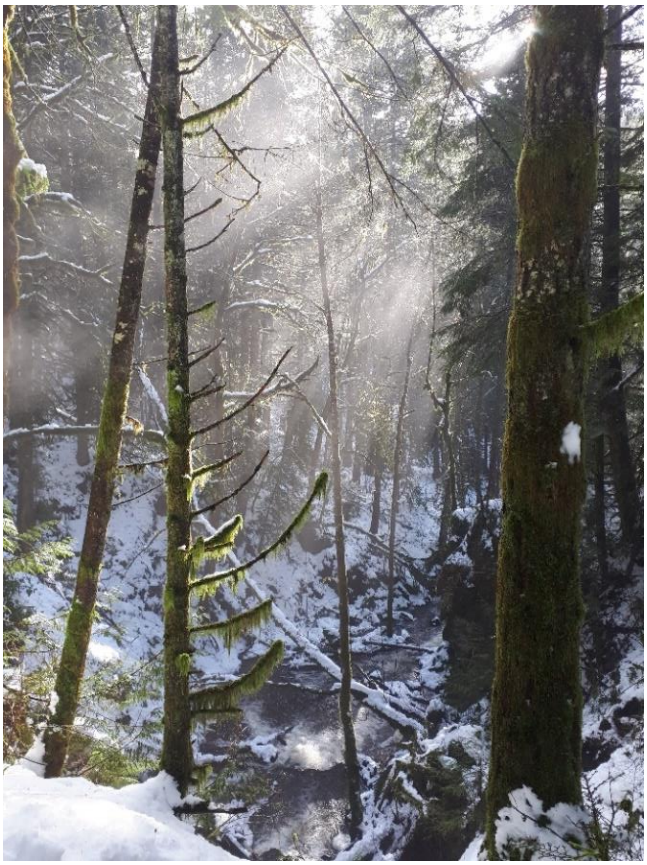
Name	Contact Information	Project	Experience
Compost Education Centre (Alexis Hogan & Danielle Stevenson)	office@compost.bc.ca	Soil Remediation	10 years soil remediation

Part 8: Acknowledgements

We are grateful to work in community to accomplish our work at SḴIDȻEŁ! We are in partnership with Tsartlip First Nation and BC Parks. The W̱SÁNEĆ School Board supports our work bringing W̱SÁNEĆ youth down to SḴIDȻEŁ to learn about restoration and cultural practices of this special place. Victoria Foundation, ŚW̱,ȻENEḴITEL Indigenous Foods Initiative, Habitat Conservation Trust Fund
and the Living Lab Network have all provided funding for this project. BC Parks provided a Parks Enhancement Fund in November 2022.

The SḴIDȻEŁ Resiliency Project was first initiated under SeaChange Marine Conservation Society back in 2011 and came under the official stewardship of PEPÁḴEḴ HÁUTW̱ Foundation in 2019. The photos in this report were all taken at SḴIDȻEŁ by the PEPÁḴEḴHÁUTW̱ team.

We raise our hands to the many generations of W̱SÁNEĆ peoples who stewarded this special place since time immemorial and continue to call SḴIDȻEŁ home.



Appendix I: Emergency Protocols

EMERGENCY PROTOCOL

for

SN̲IDȻEL

(Tod Inlet, Gowlland Tod Provincial Park, BC)

In case of MINOR INJURY (injuries that can be treated by the First Aid person or, if further medical attention such as stitches or x-ray is needed, do not require an ambulance):

1. Stop work and observe tool safety
2. Notify First Aid person
3. Provide First Aid and document the injury

In case of SERIOUS INJURY (any injury that requires ambulance services):

1. Call 911
2. Notify First Aid Person

3. Send someone to the Benvenuto gate to meet ambulance Assure entry of ambulance and provide guidance to the location of injured person/people
4. Support administration of emergency first aid until Emergency Services arrive

IN CASE OF FIRE:
1. Call 911
2. Send someone to the Benvenuto gate (or nearest safe location) to meet Emergency Services vehicles. Assure entry of emergency vehicles and provide guidance to the location of fire or any injured people
3. Notify as many people in the area as possible
4. Evacuate the area

Safety is our first priority!
Anyone who sees anything unsafe has a responsibility to correct the hazard if possible and report the hazard or incident to staff and appropriate authorities such as 911 or the Coast Guard. Tsartlip First Nation and BC Parks must also be notified if necessary.

Appendix II - Safety Orientation Checklist

SAFETY ORIENTATION CHECKLIST	
Project: SṈIDǴEŁ Resiliency Project	
Location:SṈIDǴEŁ (Tod Inlet, Gowlland Tod Provincial Park)	
Date: Click here to enter a date	
---- Discuss with all volunteers before work begins ----	✓
Project Leader:	
First Aiders:	
Location of First Aid Kit:	
Cell phone service:	
Weather:	
Emergency vehicle access:	
Location of and quickest route to the nearest hospital:	
Check in / check out procedure:	
Working alone procedure:	
Appropriate clothing and footwear for terrain, tools and weather:	
Any injuries **must** be reported to BC Parks on the day of their occurrence	
Right to refuse unsafe work	
Hand tools in good working order	
Review safe use of hand tools	
Public Safety Concerns and Closures:	
Identify hazards, possibilities, solutions	

Appendix III: Volunteer Record Form

VOLUNTEER RECORD FORM			
Project: SN̲IDǾEŁ Resiliency Project		Date:	
Name/Group Name	contact information	emergency contact	# of hours
		Total Volunteer Hours	

Appendix IV: Ground Beneath Our Feet Remediation Pilot Project 2022 Summary Report for SN̓IDȻEŁ

The Ground Beneath Our Feet Remediation Pilot Background and Objectives

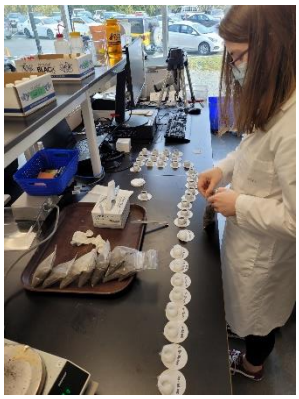
The Ground Beneath Our Feet (GBOF) Pilot Project is an extension of the Healing City Soils project that provides free soil tests for heavy metals for people growing or harvesting food. The objectives of the GBOF pilot were to explore the effectiveness of three native plants, one non-native plant, arbuscular mycorrhizal fungi (AMF), and compost in reducing heavy metal concentrations in remediation plots at three sites with low, moderate and highly contaminated soils, including SN̓IDȻEŁ. The hypothesis of this study was that the experimental plants would be able to remove heavy metals from the soil, and that the compost and AMF would increase accumulation of heavy metals in the plant stems, leaves, and roots. This project aims to contribute to local phytoremediation research and encourage individuals and communities to garden with a good understanding of their soil health (for info on phyto and bioremediation, see https://compost.bc.ca/wp-content/uploads/2021/04/19-Bioremediation_no-image.pdf).

Why is SN̓IDȻEŁ Contaminated?

In the early 1900s, settlers turned SN̓IDȻEŁ into the site of a Portland cement factory which contaminated the land and waters. The Vancouver-based company Pacific Coast Portland Cement, manufacturers of Portland cement and lime, began construction in June 1904. As limestone deposits at Tod Inlet were used up, by June 1921, the Tod Inlet cement plant and quarries closed (Gray, 2020). Pollution from the plant was predominantly airborne, which was observed as a fine dust spewing from the chimney stacks; a product of grinding and burning coal, limestone, clay and gypsum (Gray, 2020). This would settle on the forest floor and the accumulation of cement dust from the plant, mixing with rainwater, has resulted in a thin coating of concrete over large areas of ground. As moss and vegetation has grown over the cement covering, it is not immediately obvious that the ground is in fact covered in concrete (Gray, 2020). Although remediation has occurred in the seabed at SN̓IDȻEŁ, contamination still exists in the soil in the form of elevated levels of heavy metals, such as lead and arsenic.

Installation of Remediation Plots at SN̓IDȻEŁ

16 remediation plots were installed at SN̓IDȻEŁ in the winter of 2020 (see map of plot locations to the right), with different combinations of plants and amendments, along with a control plot. The native plants tested included woolly sunflower (*Eriophyllum lanatum var. leucophyllum*), a relative to the common sunflower (Helianthus annuus), which is a known phytoremediator, stinging nettle (*Urtica dioica*), which studies have shown it to be an accumulator of Cu, Zn, Pb, Cd, and Hg (Shams et al., 2010), and coastal mugwort (*Artemisia suksdorfii*), also a relative of sunflower, and other Artemisia species have proven to be efficient at phytoextraction (Rebele & Lehmann, 2011).



In Fall of 2021, soil and plant samples were collected from each site to have concentrations quantitatively determined using x-ray fluorescence (XRF) (see picture of student with soil samples for XRF below) and inductively coupled plasma-mass spectrometry (ICP-MS). Metal concentration data for soil samples from were assessed to determine if levels exceeded the Canadian Council of Ministers of the Environment (CCME) Agricultural Soil Quality guidelines as there is the potential for human consumption of plants grown in the soil analysed. In spring of 2022, the three plants and two amendments were re-sowed in their assigned plots after each harvest. Before sowing the plant seeds, any weeds and grasses present in the plot were removed and recorded. The plants were then harvested, placed in paper bags for drying and stored for later analysis (see processed plants to the right).

The soil was levelled and raked if needed. Soil samples were obtained from each plot for pH, XRF, and ICP-MS analysis. Due to the heat dome that had occurred in June 2021, the majority of intentionally planted species were decimated. Re-planting occurred in fall of 2022.

Findings in 2022

Soil metal concentrations

Analysis of soil samples via XRF for SNIDCEŁ indicated low to moderate levels of arsenic, chromium, copper, lead, nickel and zinc. Arsenic, lead and zinc were distributed fairly evenly amongst plots 7A and 7B, while higher levels of chromium, copper and nickel were 73 predominantly found in 7B plots. ICP-MS analysis indicated metals were not as bioavailable as initially expected, with the exception of copper, which is subject to instrumental error (e.g. contamination). Soil appeared alkaline, with a mean pH of 8.01. This may be due in part to the historic presence of cement dust, which is largely made up of calcium oxide. When mixed with water, calcium hydroxide is produced, which is extremely alkaline. Coastal soil characteristics such as mineral type and content may also impact regional soil pH.

Table 3. Summary statistics for soil heavy metal levels at the SNIDCEŁ site.

SNIDCEL	Metal						
	As	Cr	Cu	Hg	Ni	Pb	Zn
Minimum	5.91	5.86	46.40	2.64	9.30	26.66	86.63
1st Quartile	10.16	20.02	56.20	2.76	39.57	50.56	159.46
Median	14.34	36.05	76.40	2.88	46.81	74.17	218.31
Mean	13.79	42.48	81.46	3.11	51.82	78.24	215.96
3rd Quartile	16.88	65.75	103.49	2.93	66.15	83.58	252.41
Maximum	23.20	83.43	144.88	7.07	98.40	227.95	424.99
Standard Error Mean	1.13	6.24	7.80	0.27	5.84	11.88	19.59
Standard Deviation	4.54	24.95	31.21	1.06	23.37	47.53	78.37
Number of Plots	16	16	16	16	16	16	16
Plots Below LOD	0	1	0	15	1	0	0
CCME Guideline	12	64	63	6.6	45	70	250
Number of plots over CCME Guideline	9	6	10	1	9	9	4

At the SNIDCEŁ site, arsenic, chromium, copper, lead, nickel, and zinc exceeded CCME agricultural guidelines (See Figure 6 below). Nine plots exceeded the CCME arsenic guideline of 12 ppm. Six plots exceeded the CCME chromium guidelines of 64 ppm. Ten plots exceeded the CCME copper guideline of 63 ppm. Nine plots exceeded the CCME lead guideline of 70 ppm. Nine plots exceeded the CCME nickel guideline of 45 ppm. Five plots exceeded the CCME zinc guideline of 250 ppm.

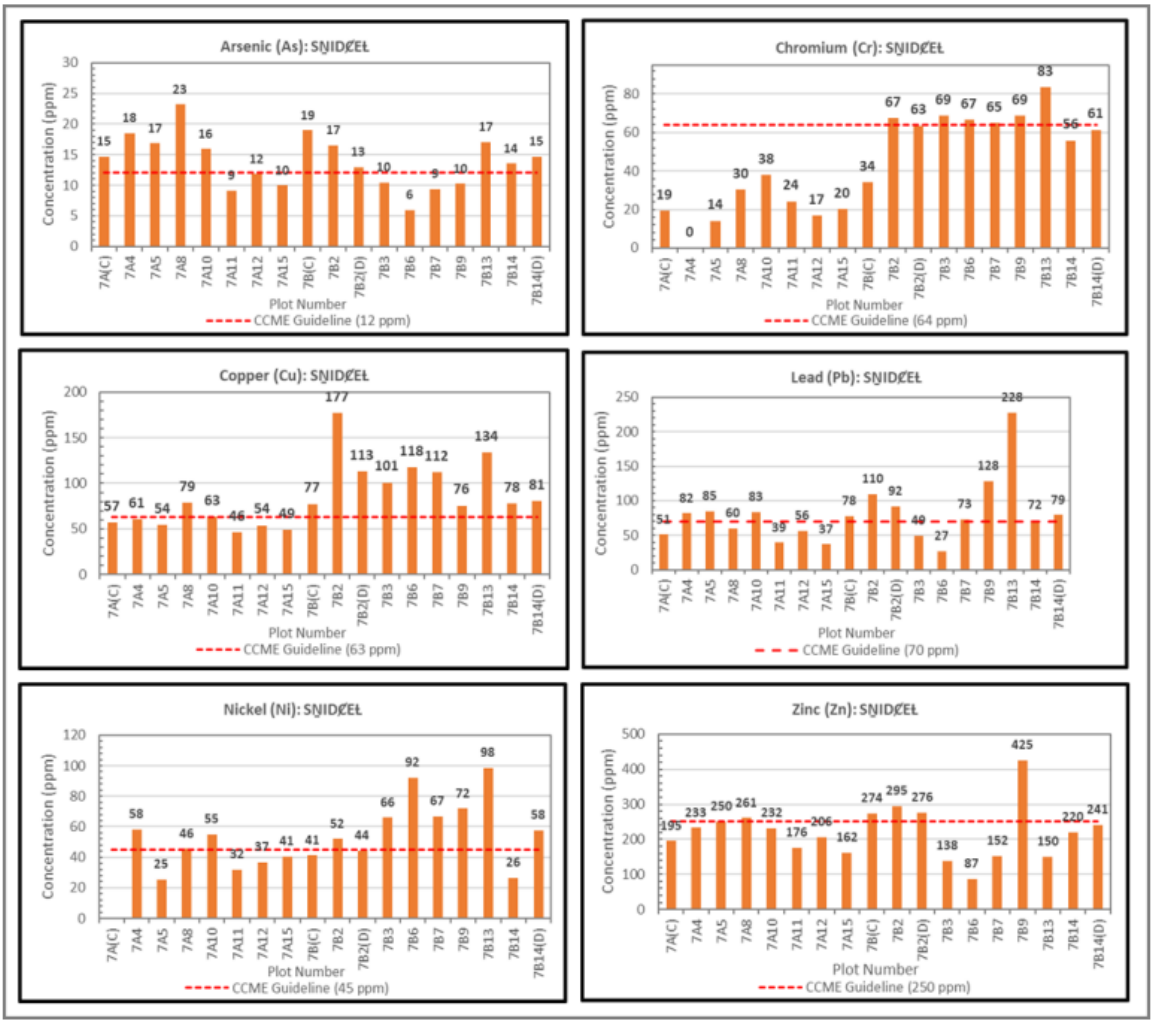


Figure 6. *Plots for arsenic, chromium, copper, lead, nickel, and zinc concentrations exceeding the CCME soil quality guideline for agricultural land use at the SNIDƛEŁ site.*

Cd and Hg were not included, as a large majority of the plots measured below the level of detection (LOD) and confidence in these values are very low. For values below the LOD, the LOD was halved to provide an assumed value for the tables. This becomes an issue when the CCME Agricultural Soil Quality Guideline for the Protection of Environmental and Human Health is below the LOD of the measurement device, which was the case for Cd; for this reason Cd was not included in the summary tables, as the values would be misleading.

The SNIDƛEŁ site had the only Hg soil measurement of all sites that was above the LOD, measuring 7.07 ppm; 7.1% higher than the CCME guideline. At this site, 9 out of 16 plots had As levels above the standard with the mean level being 14.9% higher, and the maximum level being 93.3% higher. For Cr, 6 out of 16 plots exceeded the standard with the maximum measuring 30.4% higher than the standard. For Cu, 10 out of 16 plots exceeded with the mean level being 29.3% higher than the standard and the maximum level being 130.0% higher. Ni and Pb both had 9 out of 16 plots exceeding the standards, with the mean Ni level being 15.1% higher than the standard and the maximum Ni level being 118.7% higher, while the mean Pb level was 11.8% higher and the maximum Pb level was 225.6% higher than the standard. Zn had 4 out of 16 plots exceeding the standard with the maximum being 70.0% higher.

Plant metal uptake

Plant samples from the SNIDǾEL site (both 7A and 7B) consisted of coastal mugwort, woolly sunflower, and thistle. Plants at the SNIDǾEŁ site accumulated arsenic, chromium, copper, mercury, zinc, and lead. The distribution of metals throughout the plants was largely inconsistent; however, it was found that a volunteer plant (sow thistle (*Sonchus spp*.)) consistently accumulated higher metal levels in the flowers than the stems and roots (See Figure 13 below). Only thistle was available for sampling at SNIDǾEL 7A as intended experimental plant species failed to grow in the initial planting. In lieu of native plants, volunteer thistle from plot 7A was analyzed. Interestingly, copper and chromium tended to heavily accumulate in thistle flowers, indicating the potential for adverse health effects for pollinators. Mercury appeared to translocate to stems, zinc to leaves, and lead was found in all plant components. The application of amendments had no discernible impact on heavy metal uptake by thistle.

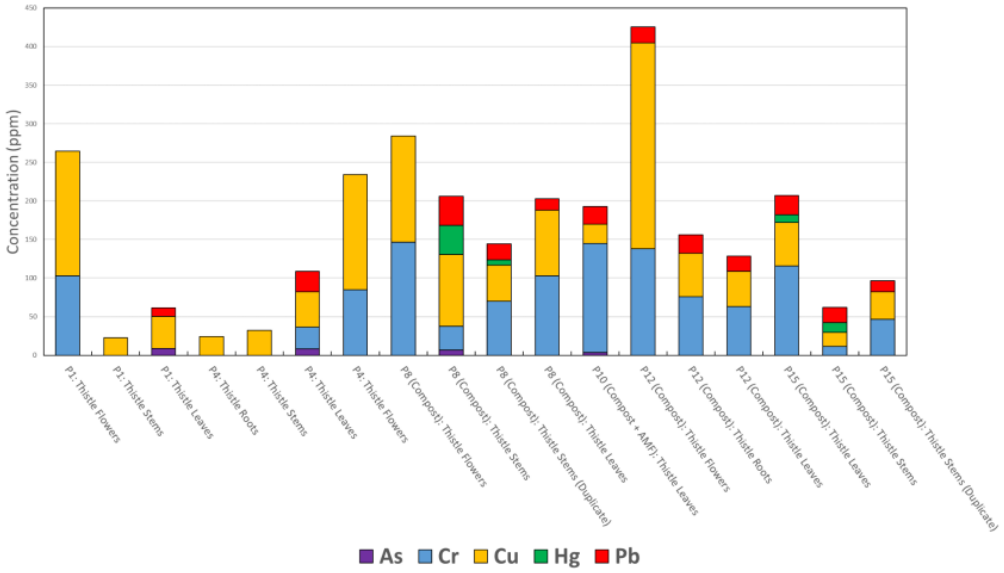


Figure 13. Metal (arsenic, chromium, copper, mercury, and lead) concentrations in SNIDǾEŁ 7A plant samples for varying parts of each plant (roots, shoots, leaves, flowers).

While impact of amendments could not be formally assessed, plot 7B did provide insight on the efficacy of woolly sunflower and coastal mugwort. These observations may be important for comparison of 2022/2023 analysis of these plants, as site monitoring observations have noted successful establishment and growth thus far. Woolly sunflower appeared to do an exceptional job in phytoextraction, as leaves contained the highest degree of sequestered metal at the site. As, Cr, Cu, Pb and Zn had BCFs of 2.62, 5.12, 1.97, 1.55 and 2.59, respectively, for woolly sunflower inoculated with AMF. These values greatly exceed that of the roots. Further, coastal mugwort leaves (no treatment) had BCFs of 1.20, 2.41, 1.35, 0.54 and 1.33 for the same metals, respectively. Similar to 7A, thistle in 7B exhibited notable overall accumulation. Uptake of nickel was not observed in either 7A or 7B.

Copper levels ranged from approximately 20 ppm to 290 ppm for all plant samples. Chromium ranged from approximately 10 ppm to 360 ppm, and was found in all plant types, although distribution in the

plant itself varied with plot ID. Mercury uptake ranged from approximately 10 ppm to 50 ppm and was found in: thistle stems, leaves, and roots; coastal mugwort stems and leaves; the U.V. composite; and, woolly sunflower leaves and roots. Lead uptake ranged from 10 ppm to 140 ppm, and was found in all plant types; however, distribution in plants varied with plot ID. Lastly, arsenic uptake ranged from approximately 10 ppm to 20 ppm and was found in: thistle stems and leaves; coastal mugwort stems and leaves; the U.V. composite; and, woolly sunflower stems and leaves.

SN̲IDȻEŁ Figure 15 shows uptake of metals in coastal mugwort and woolly sunflower at the SN̲IDȻEŁ site. Significant observations include accumulation of all metals greater than 60% in woolly sunflower leaves whose plot had compost treatment (compared to accumulation of all metals only greater than 40% in woolly sunflower leaves whose plot had AMF treatment), and accumulation of all metals greater than 45% in coastal mugwort leaves with and without AMF.

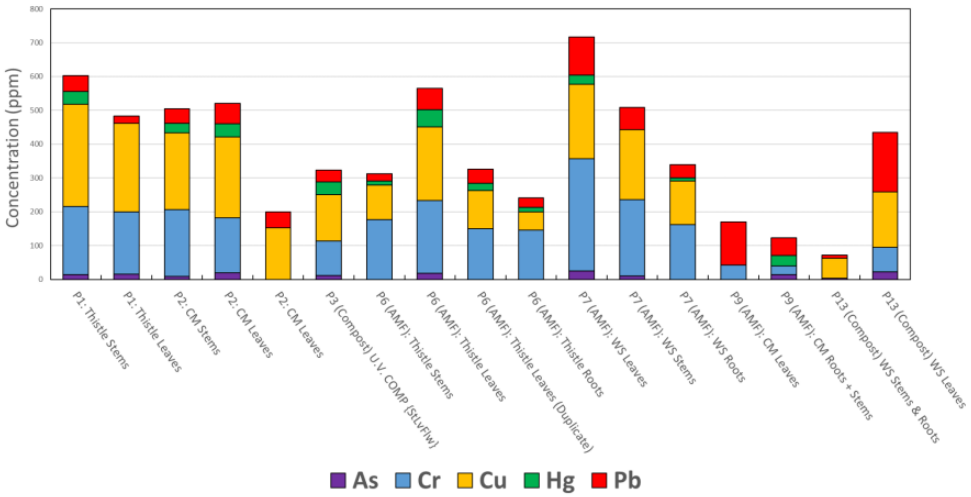


Figure 15. Metal (arsenic, chromium, copper, mercury, and lead) concentrations in SN̲IDȻEŁ 7A plant samples for varying parts of each plant (roots, shoots, leaves, flowers).

Plan for GBOF remediation pilot in 2023

Plants that grew over fall (2021) and spring (2022) were harvested and anaerobically digested in a garbage bin at the CEC, and only coastal mugwort and woolly sunflower were replanted in fall of 2022 with compost and AMF in the plots at SN̲IDȻEŁ to trial for another year in order to develop more datasets for comparison. We will also be taking more soil samples this fall for students to test in the spring, also adding to the pilot's datasets.

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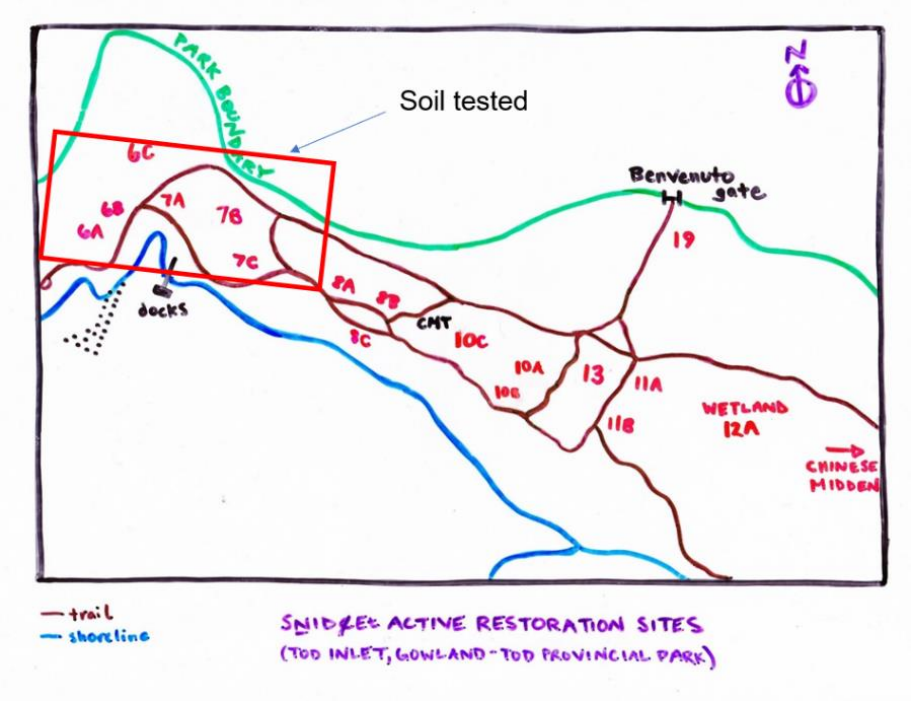
Appendix V: Summary of Soil Test Results 2021

Summary of technical findings from preliminary soil testing

Soil testing in the western portion of this site found concentrations of lead and arsenic, two heavy metals, slightly higher than recommended guidelines for soil under agricultural and residential use. Specifically, the soils in areas 6 and 7 (shown in the map below) were tested. Lead concentrations between 26 ug/g and 274 ug/g were found, including some samples with concentrations above the limit of 100 ug/g for agricultural and residential soils. Arsenic concentrations between 3 and 33 ug/g were found, including some soil samples with concentrations above guidelines of 15 ug/g.



These guidelines for soils are set by the Canadian Council of Ministers of the Environment for the protection of human health. Although the concentrations of lead and arsenic found in this area of the site are not much higher than the recommended soil levels, because these metals can be hazardous if humans ingest them, especially young children (younger than five years old), we wanted to share this summary of findings and information about actions we are taking to reduce the risk of exposure to metals through engaging in ecological restoration activities, learning activities and/or harvest of plants for food and medicine from this site.

Key terms

Exposure Pathways: the ways that contaminants can potentially harm people.

Direct exposure: The three main exposure routes are ingestion, inhalation, dermal.

Indirect exposure: consumption of plants with contaminated soil adhered to the surface.

Food-chain transfer: the movement of contaminants from soil to food plants and the subsequent transfer of contaminants into humans through food consumption

How people might be exposed to metals on this site specifically

Since these metals are not absorbed through the skin, the two ways people might be exposed to metals on this site are:

- Ingestion of soil accidentally (i.e.- working in soil and touching mouth; or children getting soil in their mouth)
- Consuming plants that have taken up the metals

Neither of these potential routes of exposure are very likely given how low the concentrations are in the soil. Generally, the reproductive parts of plants (fruits, seeds, nuts) are the least likely to contain metals, and plants do not uptake metals unless the concentrations are very high in the soil, which they aren't on this site.

Precautions and actions we are taking

Nonetheless, we have identified actions we will take to further reduce the possibility of any exposure occurring:

[1] a statement of risk from engaging in ecological restoration activities on site has been prepared for review and signing by volunteers and other individuals working on site for informed consent and protection of human health. At a minimum, gardening gloves should be worn and hands washed after gardening, and shoes worn while working on site should not be worn in the home.

[2] public signage has been installed with information about the soil test results and safety recommendations

[3] biological remediation of the contaminated area is underway (area 6+7)

[4] thick mulch will be applied to cover soils across the site to prevent people from coming into direct contact with the soil and reduce the likelihood that metals will move from the soil to the water or into edible plants

[5] the soil and edible and medicinal plants will be tested and monitored for metal content on a seasonable basis to ensure they are safe for people to harvest. If any are found to contain metals, the information will be shared with the community via signs and notices. Rosehip, cottonwood, yarrow, nettles and woolly sunflower are plants that will be tested.

For more information:

About soil contamination and best practices for healthy gardening: https://compost.bc.ca/healing-city-soils/

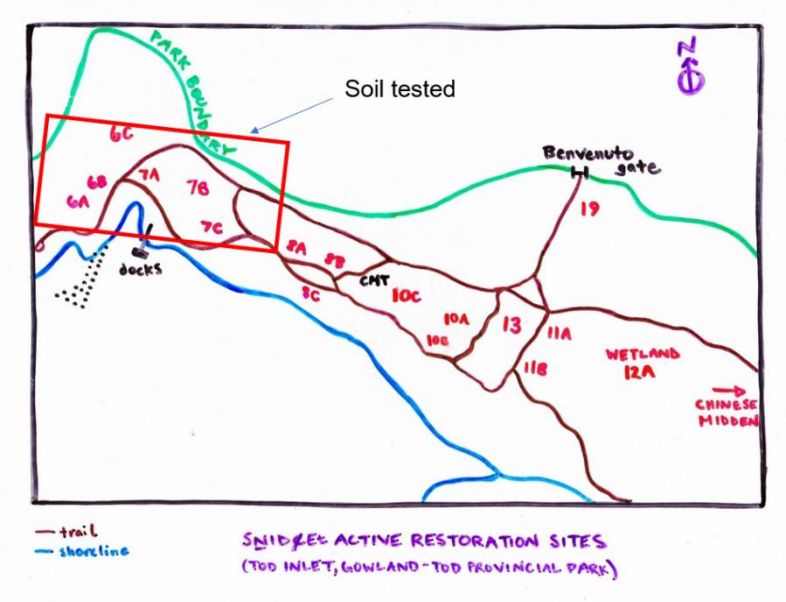
For more information about lead and arsenic toxicity: https://www.atsdr.cdc.gov/ (search each metal in their database for ToxFAQ's)

Soil metal guidelines for Canada: https://ccme.ca/en/current-activities/canadian-environmental-quality-guidelines

Appendix VI: Statement of Risk re Contaminated Soils

Statement of Risk from Engaging in Ecological Restoration Activities on this site

Soil testing in the western portion of this site found concentrations of lead and arsenic, two heavy metals, slightly higher than recommended guidelines for soil under agricultural and residential use. Specifically, the soils in areas 6 and 7 (shown in the map below) were tested. Lead concentrations between 26 ug/g and 274 ug/g were found, including some samples with concentrations above the limit of 100 ug/g for agricultural and residential soils. Arsenic concentrations between 3 and 33 ug/g were found, including some soil samples with concentrations above guidelines of 15 ug/g. These guidelines for soils are set by the Canadian Council of Ministers of the Environment for the protection of human health. Although the concentrations of lead and arsenic found in this area of the site are not much higher than the recommended soil levels, we wanted to offer more information about safety while engaging in activities on this site because these metals are highly toxic to humans.



How you may be exposed to metals through working on this site

The primary exposure risk to these metals through gardening/ ecological restoration activities on this site is through ingestion of contaminated soil particles. This is not a concern for adults, because it is uncommon for adults to ingest soil during gardening, but may be a concern for children. For children this risk is a concern during gardening due to potential direct exposure to contaminated soils. Exposure to even small amounts of lead is not safe for children, especially children under the age of 5 years old. Exposure is unlikely to occur through inhalation, and metals are not absorbed through your skin.

Key terms

Exposure Pathways: the ways that contaminants can potentially harm people.

Direct exposure: The three main exposure routes are ingestion, inhalation, dermal.

Indirect exposure: consumption of plants with contaminated soil adhered to the surface.

Food-chain transfer: the movement of contaminants from soil to food plants and the subsequent transfer of contaminants into humans through food consumption.

How to prevent exposures and protect yourself while on site

Although the risk of exposure to metals is low, and risks from exposure are low for this site (i.e.- you would need to be eating large amounts of soil over a long period of time), especially for adults, to avoid health risks, we advise you protect yourself from accidentally ingesting soil, either during gardening, by tracking soils into the home, or by eating soil particles stuck to plants by taking these precautionary steps while working on this site:

- Wear gloves while gardening
- Wash hands after gardening
- Wash plants that you harvest from the site before consuming for food or medicine
- Do not track soil from the site into your house: remove work boots or shoes before walking through your house
- Monitor young children while on site to prevent them from ingesting soil in areas 6 and 7.

For more information:

About soil contamination and best practices for healthy gardening: https://compost.bc.ca/healing-city-soils/

For more information about lead and arsenic toxicity: https://www.atsdr.cdc.gov/ (search each metal in their database for ToxFAQ's)

Soil metal guidelines for Canada: https://ccme.ca/en/current-activities/canadian-environmental-quality-guidelines