

To: Interested Parties
From: USGS, Western Ecological Research Center
Subject: Pre-restoration vegetation summary in the Nisqually Delta, Fall 2009

Pre-restoration vegetation surveys were conducted in the Nisqually Delta in Fall 2009, prior to dike removal. For the first time in over 100 years, tidal flow has been restored to over 300ha at the Nisqually National Wildlife Refuge. In combination with earlier estuarine restoration efforts by the Nisqually Indian Tribe on the east side of the Nisqually River, the Nisqually Delta Restorations represent the largest restoration of its kind in Puget Sound and the Pacific Northwest. USGS, Western Ecological Research Center, initiated a baseline pre-restoration monitoring program based on the Nisqually National Wildlife Refuge Restoration Monitoring Framework (Ellings 2008). Here we present summary graphs of the pre-restoration vegetation community.

In Fall 2009, vegetation sampling consisted of three different methods so that we can assess differences from rapid and intensive vegetation sampling: 40 m permanent transects with three quadrats, rapid presence with 100 m transects with 50m and 100m visually scanned buffers, and 100 m intensive transect of quadrats. Here we present summaries from the 40 m permanent transects with three quadrats.

Transects started at the slough/channel edge (as a continuation of channel cross sections ended) and headed into the marsh interior (aligned perpendicularly to the channel). Three vegetation transects were surveyed per transect (Figure 1). Along each transect, we conducted quadrat (0.5m x 0.5m) surveys at 0m 20m and 39.5m (for a total of 9 quadrats/unit). We surveyed for species composition, max height/spp, % cover by spp, and rooted densities/spp within the 0.25m² quadrat. Plant densities were extrapolated to m².

For this summary, we focus on the Refuge restoration (Units 1-4, restored in Fall 2009), the Tribe's restoration on the east side of Nisqually River (Phase 2, restored in 2006), and a Reference marsh east of Nisqually River and west of Red Salmon Slough that was not developed or farmed.

Species composition, percent cover, and density varied by species and site (Figures 1-6; Table 1). The invasive reed canary grass (RCG; *Phalaris arundinaceae*), dominated percent cover in the Refuge Units 1-4 prior to the restoration, while RCG was absent in Phase 2 restoration and Reference Marsh on the east side of the Nisqually River (Figure 2). The pre-restoration Units 1-4 were dominated by invasive species, predominately RCG and cattail (*Typha latifolia*), both of which are freshwater species not detected on the restored Phase 2 or Reference marsh.

Maximum height of plant species detected over all sites was the shrub red elderberry (*Sambucus racemosa*), followed by cattail, and RCG (Figure 3). Species height also varied by site (Figure 4), such that RCG heights were tallest in Unit 1 followed by Unit 2, Unit 4, and Unit 3. Salt grass (*Distichlis spicatum*) had the highest average density over all plant species detected amongst all sites (1,900 plants/m²; Figure 5), with the maximum average density at Reference site (2,943 plants/m²; Figure 6).

Figure 1. Pre-restoration vegetation sampling survey locations, Fall 2009.

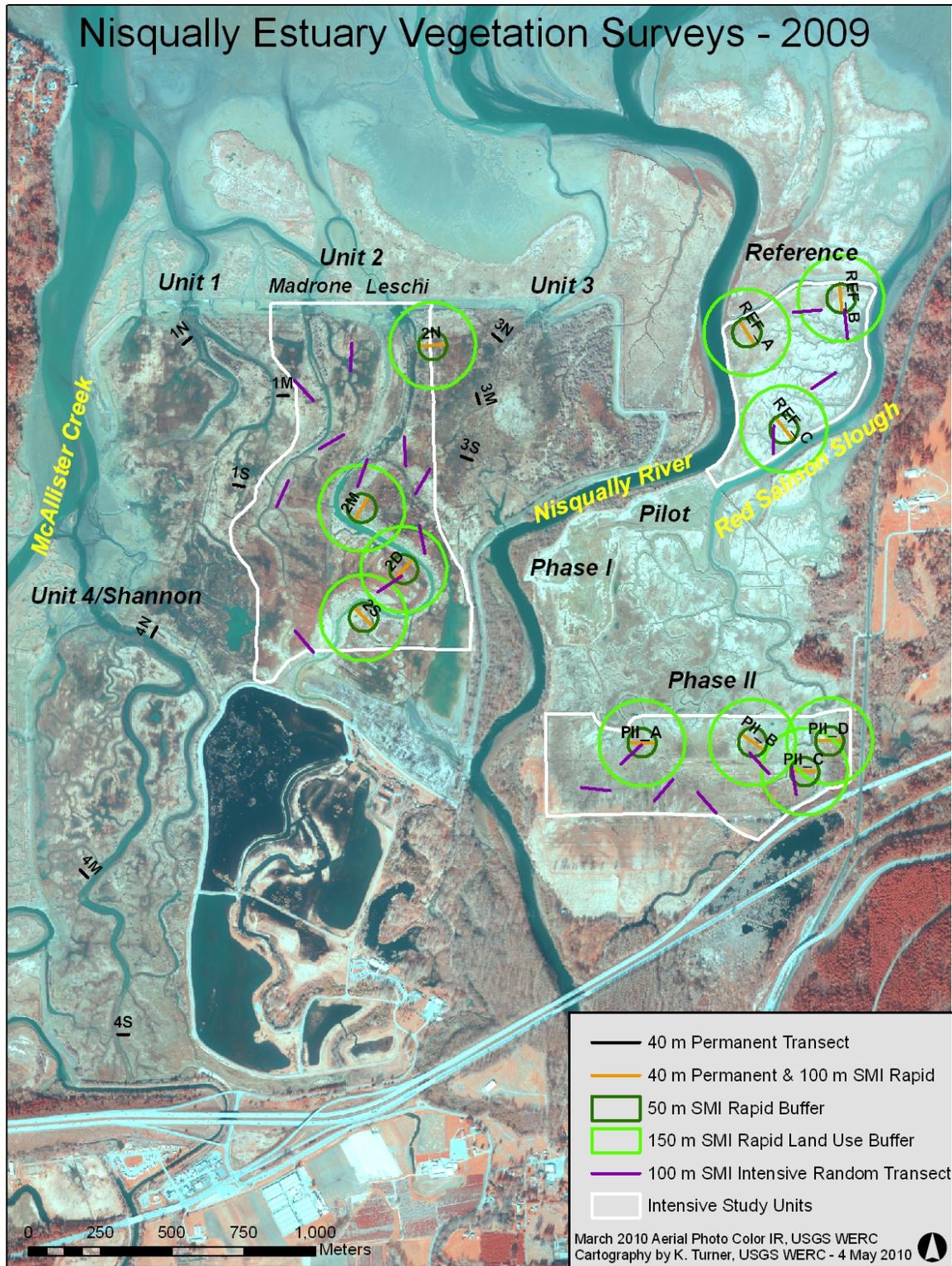


Figure 2. Percent cover from transect data. Species codes are listed in Table 1. Other includes: AGRO, ATPA, CIVU ELEO, ELPA, ELRE, Galium, GRIN, JUEF, PHPR, RUDI, RUMA.

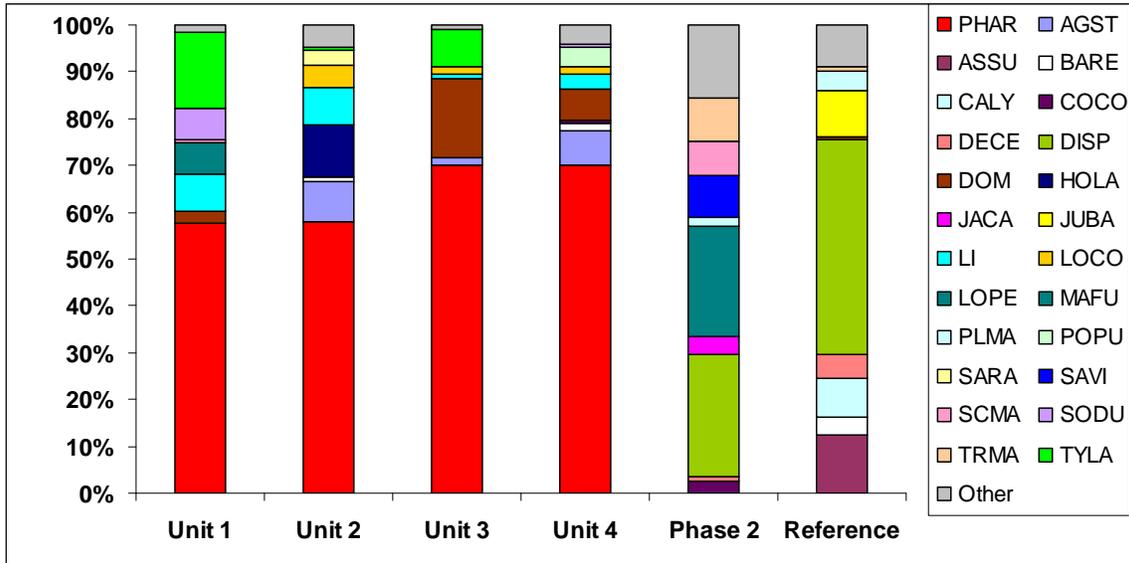


Figure 3. Mean maximum heights (cm) by species over all sites and quadrat data.

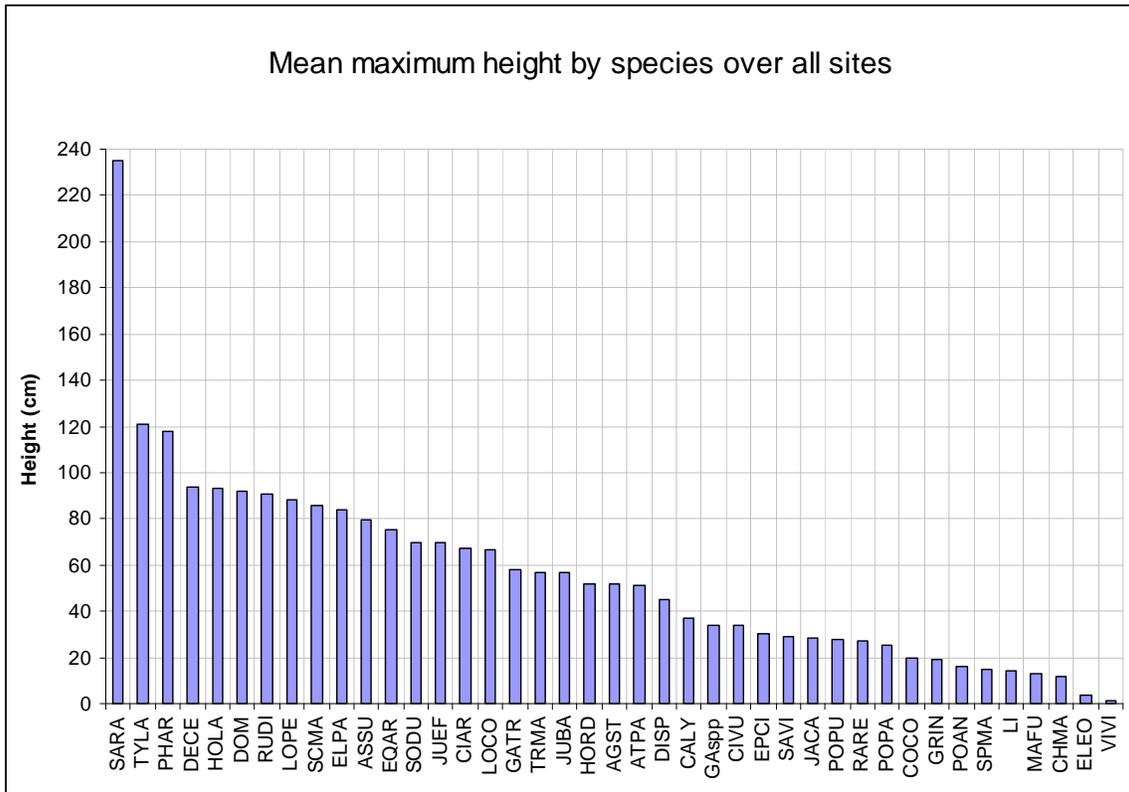


Figure 4. For some plant species mean maximum height (cm) varied by site (Unit 1-4), Phase 2, and Reference.

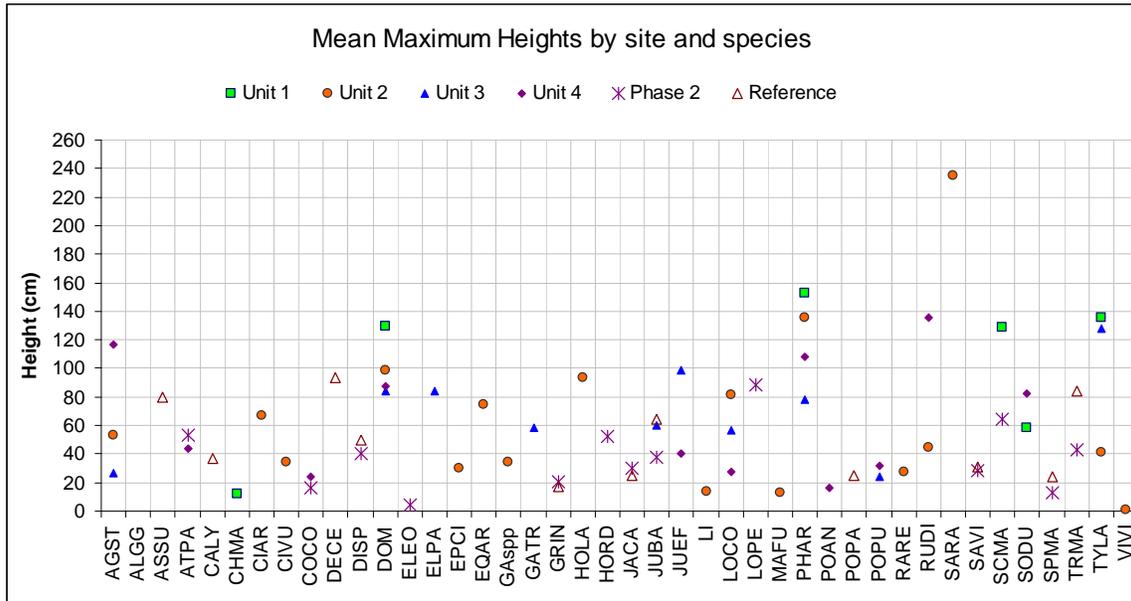


Figure 5. Overall mean density of individuals by species from quadrat data. Survey quadrat data was extrapolated to m². Note: the highest densities were from graminoids.

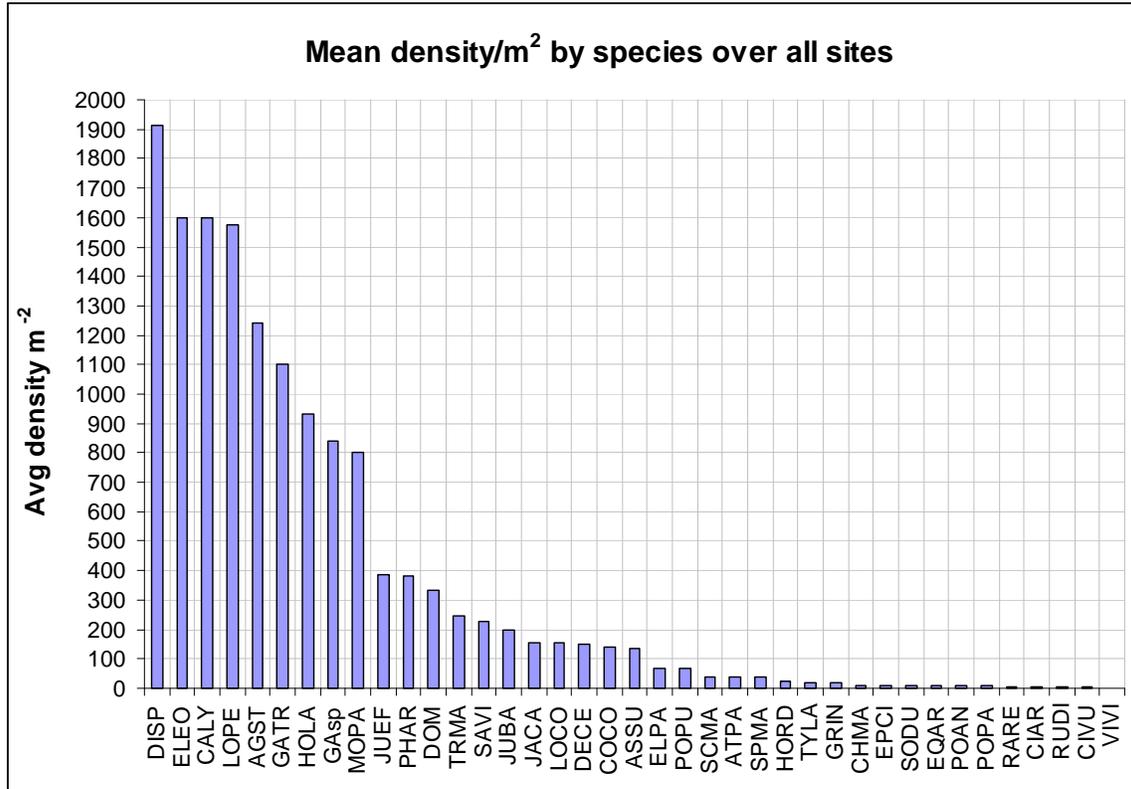


Figure 6. For some plants, mean densities/m² varied by site (Unit 1-4), Phase 2, and Reference.

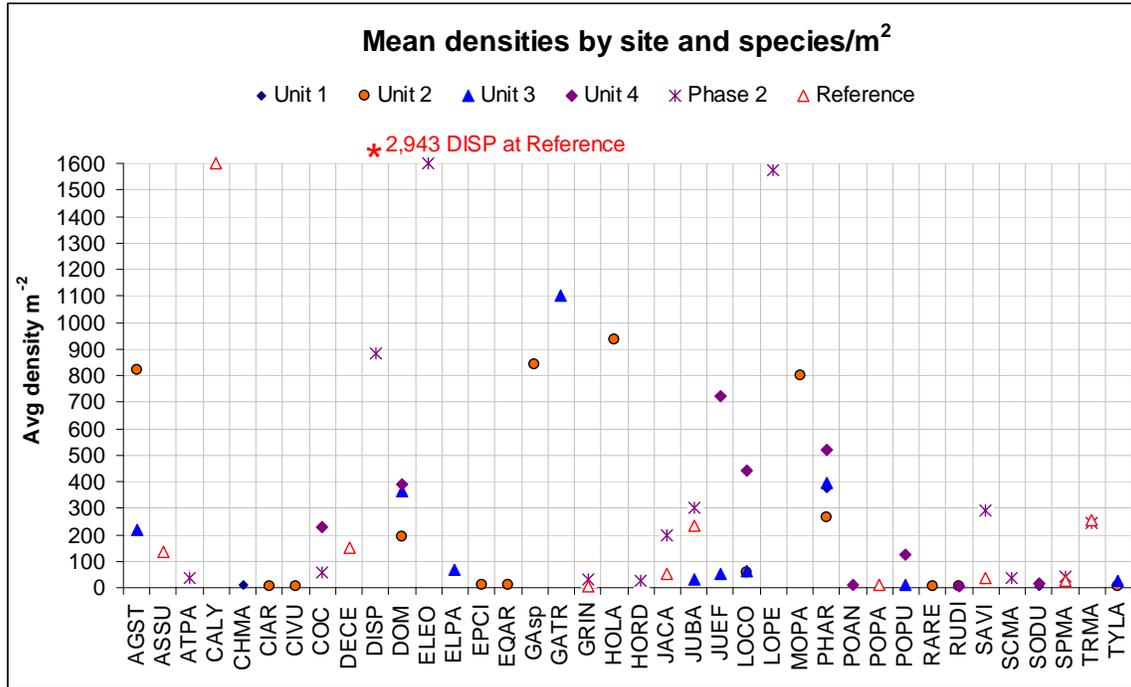


Table 1. Pre-restoration plant species lists, species code, common and scientific names.

Code	Common Name	Scientific Name
AGRO	Quackgrass	<i>Agropyron</i>
AGST	Creeping bentgrass	<i>Agrostis stolonifera</i>
ASSU	Douglas' aster	<i>Aster subspicatus</i>
ATPA	Patent saltbush	<i>Atriplex patens</i>
CALY	Lynby's sedge	<i>Carex lyngbyei</i>
CHMA	Largeseed goosefoot	<i>Chenopodium macrospermum</i>
CIAR	California thistle	<i>Cirsium arvense</i>
CIVU	Bull thistle	<i>Cirsium vulgare</i>
COCO	Brass buttons	<i>Cotula coronopifolia</i>
DECE	Tufted hairgrass	<i>Deschampsia cespitosa</i>
DISP	Salt grass	<i>Distichlis spicata</i>
ELEO	spikerush	<i>Eleocharis</i>
ELPA	Creeping spikerush	<i>Eleocharis palustris</i>
ELRE	Quackgrass	<i>Elymus repens</i>
EPCI	Northern willow herb	<i>Epilobium ciliatum</i>
EQAR	Field horsetail	<i>Equisetum arvense</i>
GAsp	Bedstraw	<i>Galium spp.</i>
GATR	Threepetal bedstraw	<i>Galium trifidum</i>
GRIN	Entire-leaved gumweed	<i>Grindelia integrifolia</i>
HOLA	Velvet grass	<i>Holcus lanatus</i>
HORD	Barley	<i>Hordium ssp.</i>

Code	Common Name	Scientific Name
JACA	Salmarsh daisy	<i>Jaumea carnosa</i>
JUBA	Baltic rush	<i>Juncus balticus</i>
JUEF	Common rush	<i>Juncus effusus</i>
LASE	Wild lettuce	<i>Lactuca serriola</i>
LOCO	Birdfoot trefoil	<i>Lotus corniculatus</i>
LOPE	Perennial rye grass	<i>Lolium perenne</i>
MAFU	Crab apple	<i>Malus fusca</i>
MOPA	Reed canary grass-mowed	<i>Phalaris arundinacea-mowed</i>
PHAR	Reed canary grass	<i>Phalaris arundinacea</i>
PHPR	Timothy grass	<i>Phleum protense</i>
PLMA	Sea plantain	<i>Plantago maritima</i>
POAN	Silverweed	<i>Potentilla anserine</i>
POPA	Marsh cinquefoil	<i>Potentilla palustris</i>
POPU	Dotted smartweed	<i>Polygonum punctatum</i>
RARE	Creeping buttercup	<i>Ranunculus repens</i>
RUDI	Himalayan blackberry	<i>Rubus discolor</i>
RUMA	Golden dock	<i>Rumex maritimus</i>
SAPA	Pickleweed	<i>Sarcocornia pacifica</i>
SARA	Red elderberry	<i>Sambucus racemosa</i>
SAVI	Common pickleweed	<i>Salicornia virginica, syn Sarcocornia pacifica</i>
SCMA	Seacoast bullrush	<i>Scirpus maritimus, syn Schoenoplectus maritimus</i>
SODU	European bittersweet	<i>Solanum dulcamara</i>
SPAR	Spurrey	<i>Sperugula arvensis</i>
SPMA	Sand spurrey	<i>Spergularia macrotheca</i>
TRMA	Sea arrow-grass	<i>Triglochin maritimum</i>
TYLA	Broadleaf cattail	<i>Typha latifolia</i>
VIVI	Hairy vetch	<i>Vicia villosa</i>
ALGB	Unidentified brown algae	
ALGG	Unidentified green algae	
BARE	Bare ground	
DOM	Dead & standing organic matter	
LI	Litter (dead & not standing)	

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