2014 Upland Forest Restoration Planting Project Plan and As-Built Report

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Background

The goal of the Upland Forest Restoration Planting Program is to diversify forest plant species composition, provide diverse wildlife habitat, and reestablish a resilient community of native species in the Cedar River Municipal Watershed (CRMW). Planting projects focus on areas where species diversity has been decreased by past clearcut timber harvest or other human activity, and/or where native species dispersal is limited. Planting projects use site-specific knowledge to identify priority areas and species for restoration work.

Planting projects are implemented that contribute to native ecosystem functioning. Planning considerations include:

- contribution of the plant species to the surrounding habitat
- current and ongoing successional processes
- presence/absence of appropriate seed source
- acquisition of appropriate plant material
- use of native vegetation to inhibit the spread of invasive species

This document describes 2014 upland forest planting projects, prescriptions, costs, plant materials, and future directions.

45 Road Supplemental Planting with Western White Pine

The thinning portion of the 45 Road Forest Habitat Restoration Project was completed in 2003 (Figure 1). The plan for the thinning is available on: http://www.seattle.gov/util/EnvironmentConservation/OurWatersheds/Habitat_Conservation_Plan/ManagingtheWatershed/UplandForestHabitatRestoration/Metrics/index.htm .

In 2004 approximately 7000 trees (western red cedar, western hemlock, big leaf maple and red alder) and 200 shrubs were planted throughout the site. An additional 300 trees and shrubs (big leaf maple, western red cedar, Pacific yew, Nootka rose, ocean spray, vine maple, and Lewis mock orange) were planted in 2005 to increase native species diversity.

This site was selected for supplemental western white pine planting for the following reasons:

- Trees growing in the 45/43 Road overstory are predominantly Douglas-fir with an understory of salal. The Douglas-fir is experiencing varying degrees mortality attributed to laminated root rot (*Phellinus sulphurascens*). There is little evidence of conifer understory regeneration occurring naturally in this area probably because of the abundance of salal and minimal exposed mineral soil available for germination.
- Planting western white pine in root rot mortality pockets provides an opportunity to improve tree species diversity and contribute to future wildlife habitat and ecological function.
- Western white pine may support future forest resilience, in that it is drought tolerant and not susceptible to the same suite of disease and pathogen organisms as Douglas-fir.

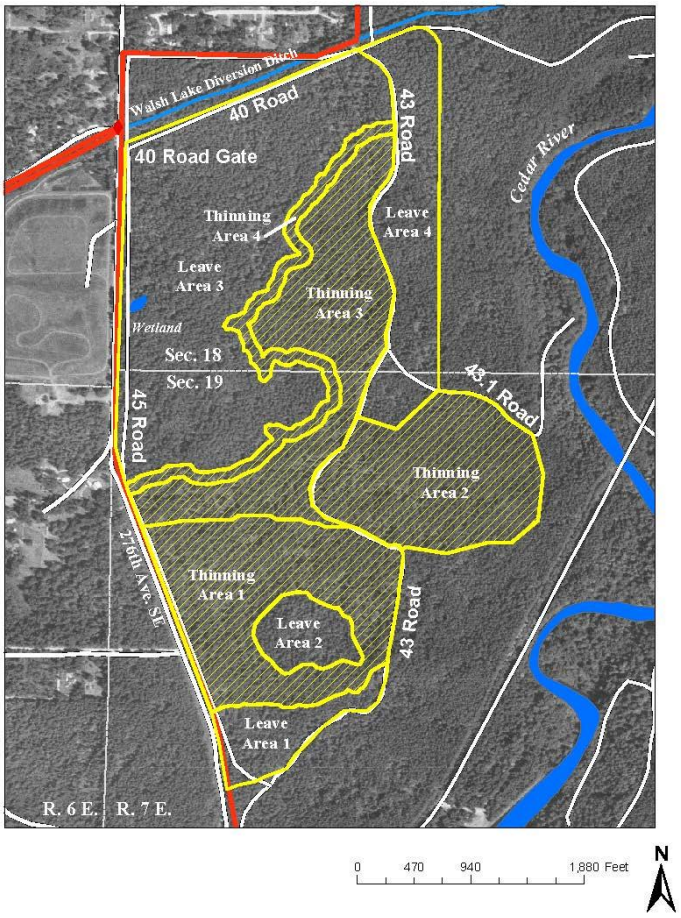

Figure 1. 45 Road Ecological Thinning Project, 2003

In February, 2014, a total of 800 western white pine seedlings were planted in four blow-down/root rot influenced canopy openings, three in Leave Area 3 and one in Thinning Area 2 (Figure 2). These sites were selected because of the root rot influence and lack of regeneration by native trees. All planting sites had a dense understory of salal. The planting prescriptions emphasized identifying the best available site for a seedling based on understory competition, soil, and sunlight conditions. The seedlings were planted approximately twenty feet apart within the four planting sites. Total area planted was approximately eight acres. Total cost, excluding staff labor, was approximately $900 (Table 1).

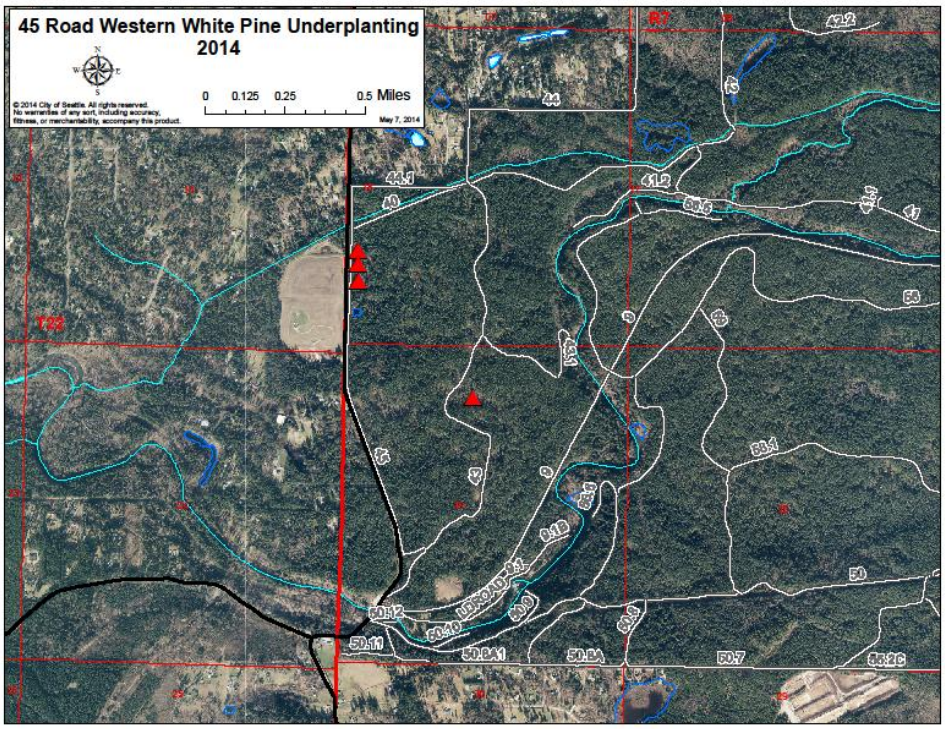

Figure 2. Location of the 2014 planting sites within the 45 Road Forest Habitat Restoration site

Table 1. Seedling and contract labor information, 45 Road supplemental planting.

Species	Number of Seedlings	Stock Type	Seedling Cost*	Seed Zone	Contracted Labor Cost	Total External Cost**
Western white pine	800	P+1	$427	all	$466	$893

*sales tax included in seedling cost
**exclusive of SPU internal costs (labor, vehicle, admin. etc.)

55 Road Ecological Thinning Project Planting

The 55 Road upland restoration planting project was part of the ecological thinning project completed in 2013 (see complete plan and as-built document on: http://www.seattle.gov/util/EnvironmentConservation/OurWatersheds/Habitat_Conservation_Plan/ManagingtheWatershed/UplandForestHabitatRestoration/Metrics/index.htm). The project in 50-80 year old Douglas-fir forest was designed to increase species diversity, improve structural diversity, increase individual tree resistance to disturbance, and improve landscape habitat connectivity. Planting a variety of trees and shrub species is intended to enhance future forest canopy diversity and wildlife nesting and foraging habitat. Some species were selected that typically thrive further south (Garry oak) and west (shore pine) to provide more resilience in the face of climate change.

The 55 Road project area is at an approximate elevation of 500 feet, occurring in eight dispersed planting units. The site is dominated by rocky glacial outwash soils (Barneston soil series), and so has generally low site productivity. However the site improves slightly from south to north, with the lowest productivity sites concentrated in the southerly units along the 55 and 50.4 roads on the CRMW ownership boundary. The ecological thinning portion of the project used ground based equipment, including a feller buncher and skidder. The understory vegetation was largely cleared where the skidder traveled. Where the skidder did not travel, understory is dominated by dense salal.

Planting was done in March 2014, approximately one year after thinning was completed. Planting was conducted in all eight units and encompassed a total of 87 acres. Each unit contained created canopy gaps (1/4 to ½ acre) and thinned areas with varying tree densities, ranging from 63 to 278 trees, or 80 to 140 square feet of basal area, per acre (Figure 3).

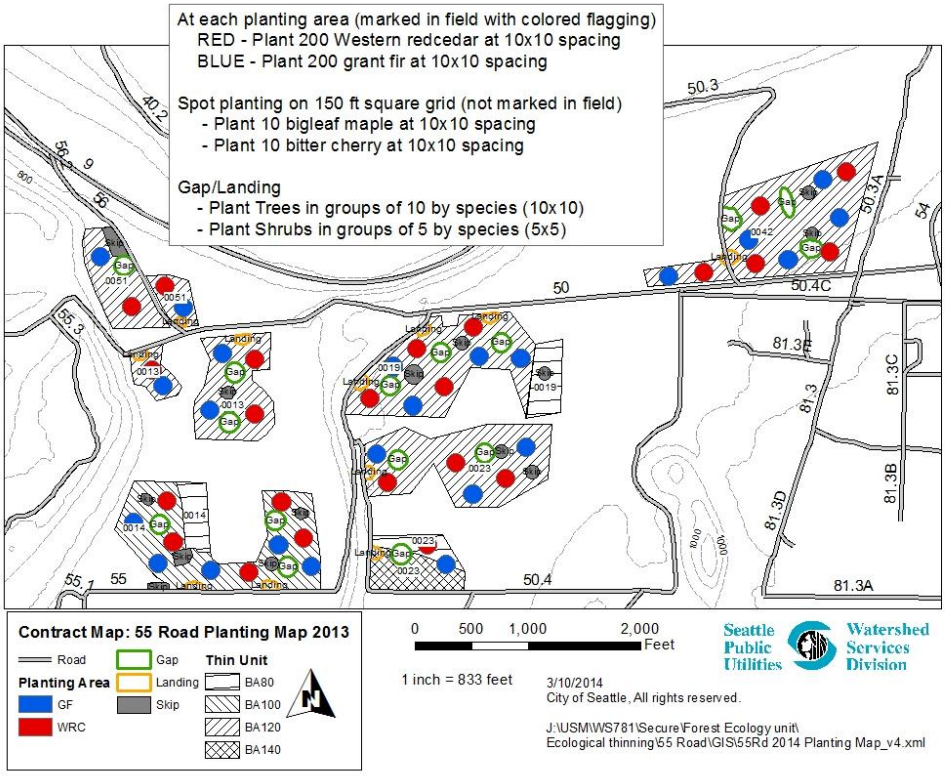

Figure 3. Planting sites within the 55 Road Ecological Thin project

The planting prescriptions varied by site and species, and are detailed by species or species group:

- Western red cedar: plant 200 seedlings, 10 x 10 foot spacing in each designated area within the unit. Designated areas range from 250 to 750 feet apart.
- Grand fir: plant 200 seedlings, 10 x 10 foot spacing in each designated area within the unit. Designated areas range from 250 to 750 feet apart.
- Big leaf maple: plant groups of 10 seedlings, 10 x 10 foot spacing approximately 150 feet apart throughout the units.

- Bitter cherry: plant groups of10 seedlings, 10 x 10 foot spacing approximately 150 feet apart throughout the units.
- Black cottonwood, Garry oak, western white pine, shore pine: plant seedlings in the gaps and landings in groups of 10 by species, 10 x10 foot spacing.
- Indian plum, cascara, red elderberry, snowbrush, beaked hazel, serviceberry, pacific crabapple: plant shrub species in the gaps and landings in groups of 5 by species, 5 x 5 foot spacing

Total external cost for the planting project, excluding staff labor, was approximately $19,000 (Table 2).

Table 2. Seedling and contract labor information, 55 Road planting project.

Species	Number of Seedlings	Stock Type	Seedling Cost*	Contracted Labor Cost	Total External Cost**
Big leaf maple	2,500		$1,425		
Bitter cherry	2,500		$1,205		
Beaked hazel	400		$428		
Cascara	700		$544		
Red elderberry	550		$392		
Garry oak	400		$428		
Black cottonwood	350		$249		
Indian plum	300		$305		
Snowbrush	100		$107		
Pacific crab apple	100		$95		
Serviceberry	100		$95		
Western white pine	1,500	P+1	$800		
Shore pine	300	2-0	$84		
Grand fir	4,500	2-0	$1,254		
Western red cedar	4,500	P+1	$2,226		
Totals	**18,800**		**$9,637**	**$9,492**	**$19,129**

*sales tax included in seedling cost
** exclusive of SPU internal cost (labor, vehicle, admin. etc.)

Restoration Planting the Decommissioned 815.5 Road

The 815.5 road runs through an old-growth forest, and terminates in a younger forest that was clearcut harvested in the 1980s and restoration thinned in 2013. Elevation is approximately 3,400 feet. The road was decommissioned in 2014, with the section that runs through the younger forest the focus of the restoration planting (approximately 1000 linear feet, Figure 4). As part of the decommissioning, that portion of the road surface was ‘ripped’ (i.e., the surface was machine-broken to allow for easier planting).

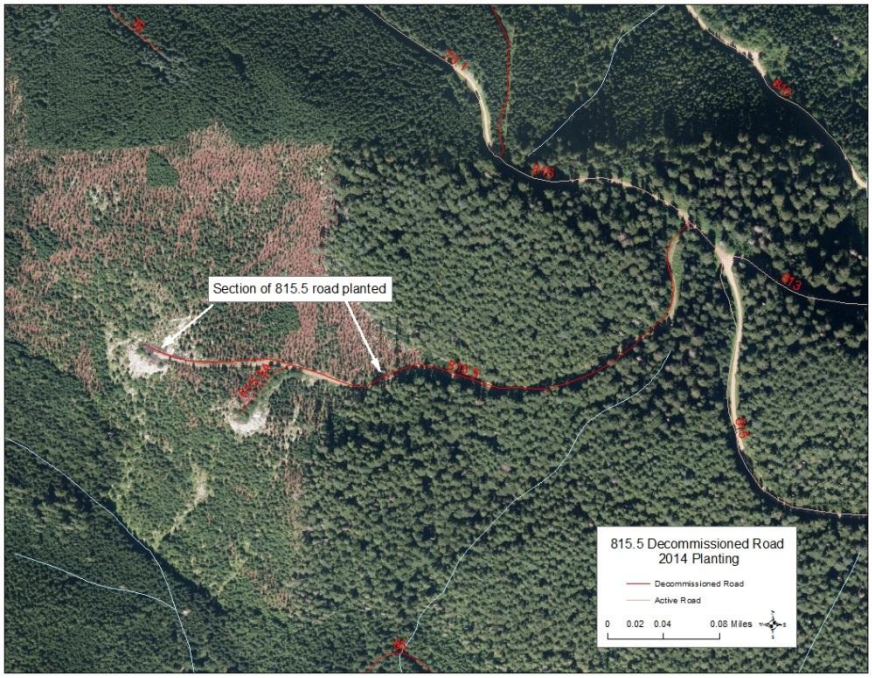

Figure 4. 815.5 decommissioned road planting section

There is both yellow (*Hieracium caespitosum*) and common (*H. lachinalii*) hawkweed present on the ripped portion of the road surface. These hawkweed species are classified as King County Class B regulated weeds, with control legally required. Conifer tree seedlings were planted as a long-term strategy to control the existing population and future spread of these shade-intolerant noxious weeds.

Noble fir (plug-1 potted stock) and Douglas-fir (plug, 3,000-4,000') were planted in October 2014. Noble firs were planted on the main section of the road bed at a linear spacing of approximately 12' apart (68 total potted stock). Douglas firs were planted on the main section of the road bed at a linear spacing of approximately 8 feet apart and 8 feet away from the planted noble fir (100 total plugs). Additionally, a 250 foot long spur was planted with Douglas firs at a linear spacing of approximately 3 feet apart (100 total plugs), for total area planted about 0.4 acre. The planting was done by a four person contract crew. The seedlings were purchased from DNR's Webster nursery (Table 3).

Table 3. Seedling and labor summary, decommissioned 815.5 road planting

Species	Stock information	Elevation (ft)	Number Seedlings	Seedling Cost*	Contracted Labor Cost	Total External Cost**
Noble fir	Plug-1 potted	4,000	68	$300		
Douglas fir	plug	3,000-4,000	200	$340		
Totals			**269**	**$640**	**$918**	**$1558**

*sales tax included in seedling cost

** exclusive of SPU internal cost (labor, vehicle, admin. etc.)

Resilience Trial Supplemental Planting

The Planting for Forest Resilience Trial was installed in 2011 (view full report on http://www.seattle.gov/util/EnvironmentConservation/OurWatersheds/Habitat_Conservation_Plan/ManagingtheWatershed/HabitatResearch-UplandForest/RestorationMonitoring/index.htm). The objective was to evaluate selected tree species from southern seed zones for their ability to grow and reproduce in glacial outwash soils under conditions expected with global climate change. Sites consisted of 20 to 75 year old Douglas-fir dominated stands with salal understory (Figure 4). Experimental design consisted of three sites, each with three replicates. Trees were cut and forwarded from each 0.9-acre replicate, then shrubs and remaining saplings were grubbed out around each planting row and a 3-foot radius circle was cleared for each planting spot. The sites were planted with Douglas-fir from seed zones in the Willamette Valley in Oregon and from Washington, western red cedar, western white pine, and shore pine and Garry oak from the Garry oak woodlands of the southern Puget Sound lowlands.

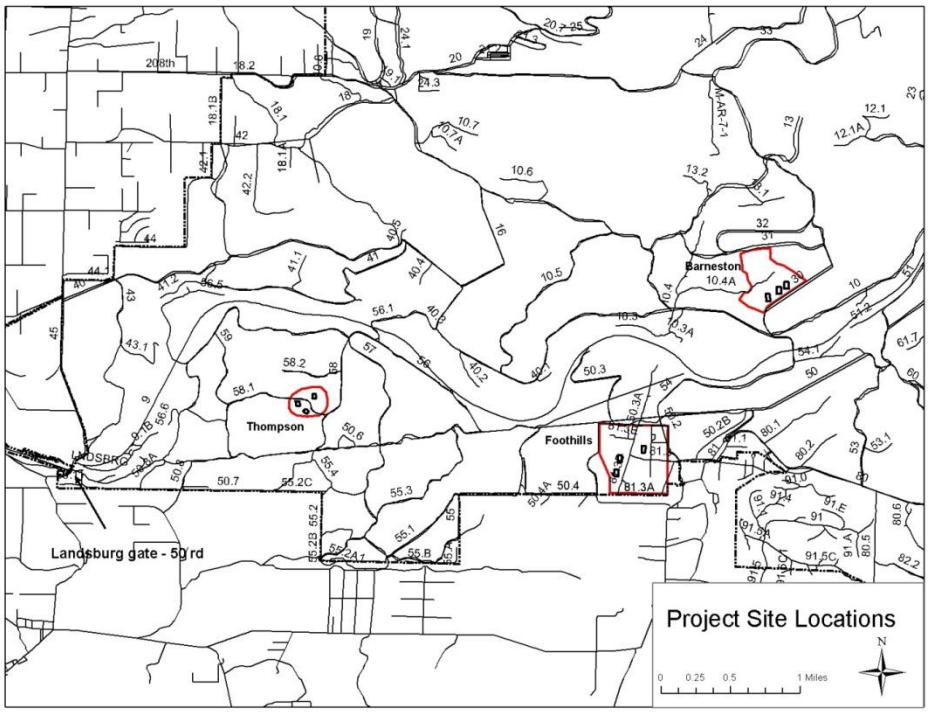

Figure 4. Location of the three resilience planting sites in the lower CRMW

The forest openings created by the site preparation may have created increased deer and elk forage habitat. Although browse and antler rub was limited in 2012 and 2013, by 2014 extensive antler rub damage to the taller shore pine had occurred, with over half of the seedlings having resultant growth deformities or killed. In addition, there was significant damage to many of the 14 gage wire fencing cages installed as browse protection around the western red cedar and Garry oak seedlings.

Because of the extensive seedling damage and experimental value in minimizing variation between seedlings, in March 2014 all the original shore pine were removed and replaced with new shore pine seedlings planted in the same locations. All wire fencing was removed from around the cedar and Garry oak, and replaced with 4-foot tall cages made of geogrid, a somewhat flexible polymer mesh which may provide better protection. The geogrid cages were also installed around all newly planted shore pine and all western white pine, which may be vulnerable to antler rub in the future.

Additionally, big leaf maple seedlings were added to the experimental design in a similar spacing linear pattern, in all the experimental installations (20 seedlings per replicate). The big leaf maple seedlings were individually flagged for ease of location for future monitoring.

Costs for the repair and replanting was approximately $6,200 (Table 4).

Table 4. Seedling and contract labor information.

Species	Number of Seedlings	Stock Type	Seedling Cost*	Contracted Labor Cost	Supplies	Total external cost**
Shore pine	200	2+0	$56	$2,821		
Big leaf maple	200	6-12"	$123			
Totals	**400**		**$179**	**$2,821**	**$3,166**	**$6,166**

*sales tax included in seedling cost
** exclusive of SPU internal cost (labor, vehicle, admin. etc.)
***caging material = geogrid mesh and T-posts

Future Opportunities

There are many opportunities for future upland forest restoration planting work in the CRMW:

- Continue evaluating restoration planting as a compliment to HCP road decommissioning, utilizing the restoration planting flow chart as a decision making tool.
- Continue evaluating and implementing restoration planting as a compliment to ecological thinning.
- Continue to utilize planting as a tool to control existing invasive species and minimize invasive species expansion.
- Explore opportunities for contract growing and utilization of plant material using seed collected from the CRMW.
- Explore opportunities for contract growing and utilization of 'double plugs". Double plugs will be more robust (larger caliper, healthy root system) than a typical plug and also more expensive that a typical plug. Plug-grown stock provides more flexibility for fall planting. Additionally, larger plugs may provide higher survival rates for fall planting in the higher elevation areas and decommissioned roadbeds in the CRMW.
- Explore opportunities for enhancing mycorrhizae populations in disturbed areas with nearby native material, in conjunction with planting. Design a trial utilizing native mycorrhizae and purchased mycorrhizae in combination with planting. A good location may be a decommissioned road bed where the assumption is that beneficial mycorrhizae populations are minimal or absent.

- Continue western white pine blister rust resistant seedling relationship with US Forest Service Dorena nursery. Incorporate western white pine seedlings in annual planting installations where appropriate.
- Continue seedling survival surveys and evaluations. Supplement plantings where appropriate and utilize adaptive management principles in future installations.