Melissa Rijkers

ESCI 439

20 October 2020

Chuckanut Community Forest Restoration Design

The Chuckanut Community Forest is a widely-used system of interwoven trails in a secluded part of Bellingham, protected from development unlike many other natural areas. The wetlands in the CCF are only one important aspect of why this is such a special place in the hearts of many locals. However, over the years of use of this forest by hikers, bikers, and off-leash dogs, the trail system has become severely degraded and the integrity of the forest and wetlands has been called into question. In order to protect these natural areas, action must be taken to ensure trails do not widen and impede upon natural areas, to improve groundwater flow, and to reign in the number of trails used by visitors to the forest.

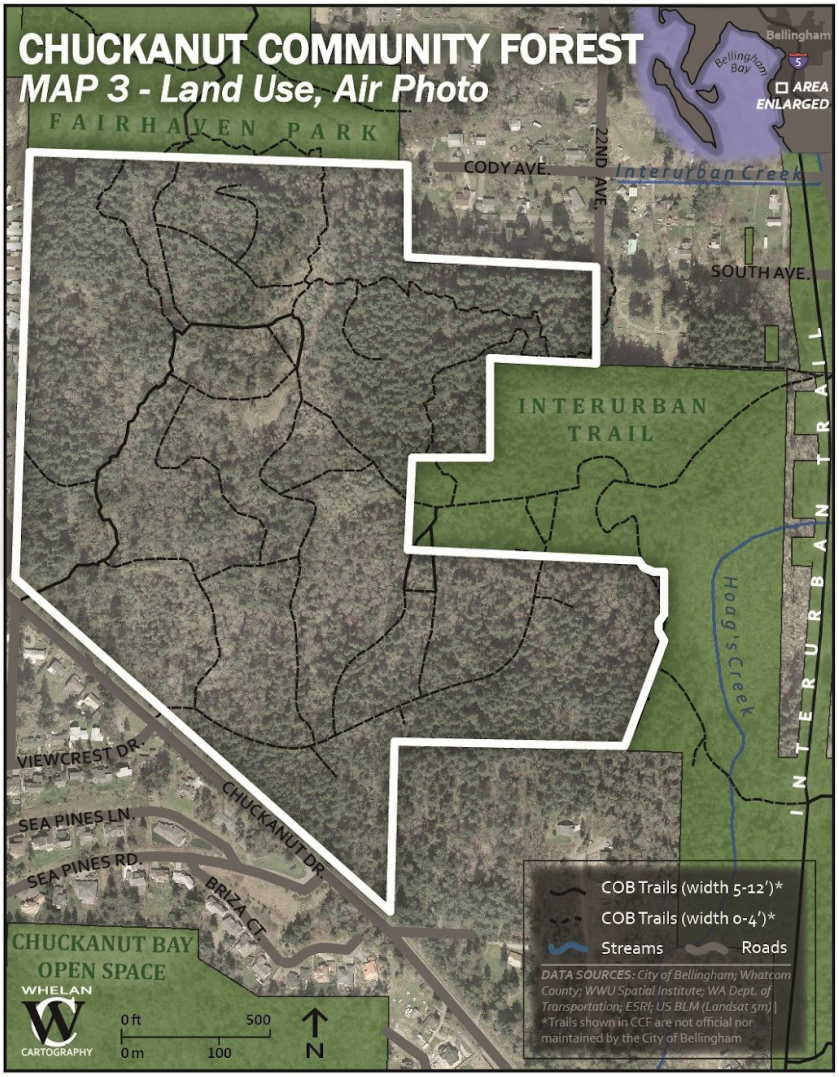

Figure 1: Map of Chuckanut Community Forest

https://www.chuckanutcommunityforest.com/learn/physical-features-map/

Restoring compacted soils where trails are to be removed or narrowed:

In order to restore compacted soils in areas where the trails have become too wide or must be removed, teams will be able to aerate the soil by hand with hand tools. While it may seem more efficient to use machinery in areas where the trails have widened considerably, the impact of moving heavy machines over the trail system would destroy even more of the natural vegetation surrounding these trails. Therefore, restoration teams should use small hand-held tools such as trowels or rolled aerators to loosen up the soil. In areas where the trails have become too wide, soil aeration should occur in all areas outside of the original 2-foot wide trails. These areas should be covered with rocks, sticks, and other obstacles to keep people from recompacting the soil there over time and encourage them to stay on the narrowed trail instead. Signage or fencing may be useful in reminding trail users to keep out of the restoration areas.

Figure 2 (left): Map of planned trail closures developed by the Bellingham Department of Parks and Recreation (Potter 2020).

Description of approach to restoring vegetation, including targeted plant species or growth forms:

In terms of restoring vegetation, any trail that has been closed or narrowed will have its soil decompacted to allow for native species to grow there. Preference should be given to species that will naturally do well there (for example, do not plant shade-intolerant seedlings in a location where the canopy above is closed and will not allow for them to grow). Evaluate each trail site individually to determine if shade-tolerant or intolerant species would thrive there, and adjust accordingly. Naturally, species will spread and grow there over time regardless of whether other vegetation is planted, so we will use a two-phased approach: allow for parts of the trail to restore vegetation naturally (only some areas that are far from the trail junction and unlikely to be disturbed by wandering trail users), and in other areas encourage growth of specific species by planting them in places where they are likely to do well and are a good deterrent from the use of the closed trail. The focus should be on species such as native ferns and shrubs, or, in open canopy places, small trees or herbaceous plants. Near trail junctions or areas where visitors are likely to stray off the designated trails, larger shrubs such as salmonberry bushes would be a good deterrent because of their size and thorns, keeping people away. Areas away from trail junctions would do well with the planting of smaller plants such as sword fern, oregon grape, or salal. One factor to consider, however, is the influx of soil pathogens or other pests that come from bringing outside plants into the forest. Either these plants should be grown in soil from the forest itself, and we should minimize the amount of plants brought in from outside to minimize the impact this may have on the health of the soils and species in the area.

Structures or strategies to deter use of closed trails and to direct visitors to sanctioned trails:

As mentioned above, closed trails must deter people from using them and narrowed trails must be kept from widening once again. This can be done by using natural obstacles such as small to medium branches from native and local tree species, small rocks, and correct signage. Obstacles should be placed in any area where visitors are likely to deviate from the designated trails, and in places where large sections of widened trail have been narrowed, wood fencing may be useful in keeping both people and off-leash dogs on the narrowed portion of the trail. Signs in these areas should not only deter visitors from entering the restoration area, but also point towards designated trails that are open for use. Signs should be posted, if not permanently, only temporarily (until the public is used to the change in trails), to direct people to the proper trails. Such signs should state that this is a restoration area and that the trail has been made impassable. "Please stay on designated trails," along with directions to such a trail, is necessary to keep people from getting lost and using the closed trail anyways. Trails that are closed must have the soil decompacted and native vegetation planted (larger bushes and shrubs at trail junctions and smaller groundcover species further from junctions), and then made as impassable as can be using piles of loose tree branches to keep people away.

Structures or strategies to restrict visitors to narrowed trail treads:

As part of the trail-narrowing endeavor, obstacles such as branches or other small woody debris can be placed in the areas that have been decompacted by carrying nearby branches and placing them in a pile. This should be done along most of the narrowed trail sections. In places where there are too few branches to create a sufficient deterrent for trail users, wood fencing can be installed with correct signage stating that the widened portion of the trail is now a restoration

area. In places where perhaps the trail has become wide because of muddiness or groundwater flow, natural structures will be put into place (see the Hydrologic Connections paragraph below) to allow the water to flow freely between the forested wetlands.

Wetland mitigation structures and trail closures

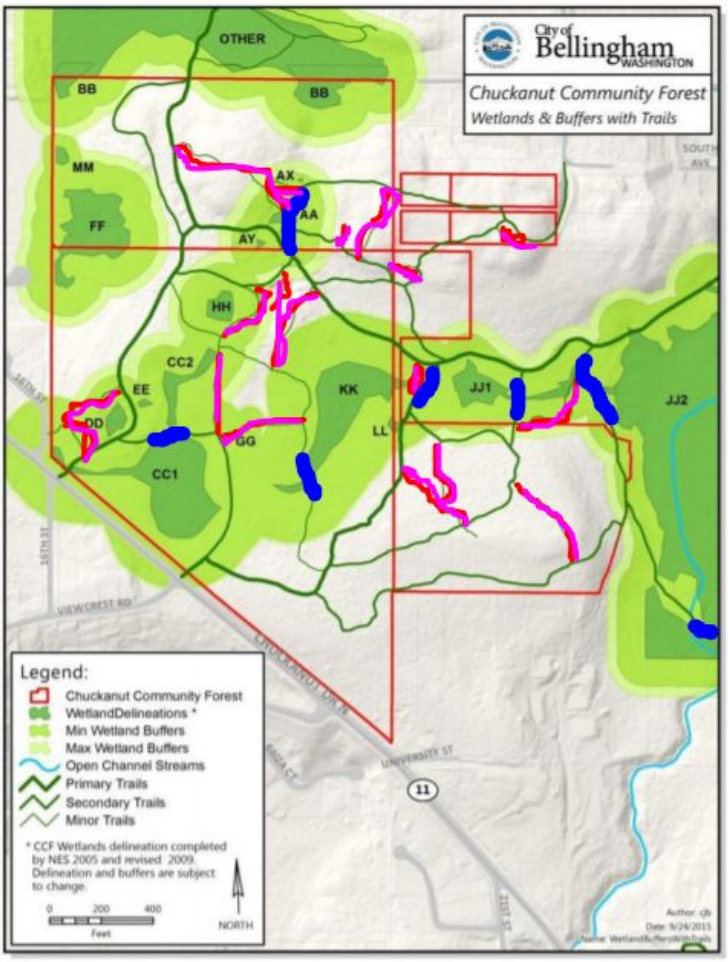

Figure 3 (left): Map of trails to be closed and where wetland mitigations structures are to be installed. Closed trails are marked in pink. Assume any newer trails not on this map are to be closed as well. Wetland mitigation structures are marked in blue. In areas where the trail crosses a wetland or visible connection between wetlands, boardwalks are to be installed and the soil in those areas decompacted. Original map from Eissinger (2017).

Restoring hydrologic connections between wetlands:

In order to restore hydrologic connections (groundwater flow) between wetlands, any impeding trails or old roads must allow for such a flow through them. While building a bridge may be most effective, it would also be most expensive. Rather than undertaking this endeavor, hydrologic connections can also be restored by building a smaller, low-to-the-ground wooden boardwalk, in compliance with ADA standards with regards to width and steepness. With the soil as compacted as it is, it would be helpful to aerate the soil around and beneath the trail, as deep as it takes to get rid of all the compacted soil. To test the compaction of the soil, use the porosity test (see section on evaluating the restoration effort, below) until no discernible difference is seen between the newly uncompacted section and a naturally uncompacted soil area. Then the boardwalk can be installed, ending at least six feet beyond the area of flow between wetlands. This would allow for free flow between wetlands and deter use and widening of a muddy trail.

Monitoring and evaluating effectiveness of the restoration effort:

To assess the effectiveness of this design, several measures must be made before the plan is put into place. This includes groundwater flow, water quality, vegetation amount/types, etc. (see Table 1 below). Crews must measure water turbidity, total dissolved solids (TDS), and pH to determine the state of the wetlands before the restoration. Vegetation and compactness levels of closed and restored trails will also be measured, using a measure of percent cover and vegetation type. To measure soil compactness, a porosity test can be conducted, where teams dig a small hole with a hand tool, about six inches deep, in both the compacted and the uncompacted areas. To compare porosity, water must be poured into these two holes and the drainage of the hole timed to compare the two locations. In areas that have been restored, holes should be

compared to a previously-uncompacted soil area, as well as a fully compacted area. These same variables will then be tested one, five, and ten years after the project is completed to evaluate the effectiveness of the design. This process can be applied to several areas of interest in the Chuckanut Community Forest to compare the impact in different parts of the forest and assess where restoration efforts have been successful.

Measurement	Before Restoration	1 year	5 years	10 years
pH				
TDS				
Turbidity (NTU)				
Soil compactness				
Vegetation type				
Vegetation cover (%)				

References:

Eissinger A. 2017. Chuckanut Community Forest Baseline Documentation Report. prepared for Chuckanut Community Forest Park District, Bellingham, WA. [online] http://www.chuckanutcommunityforest.com/files/CCF-Baseline-Documentation-Report-Final-5-8-17.pdf

Potter, L. 2020. Fairhaven Park Draft Trail Plan. Department of Parks & Recreation, City of Bellingham, WA.

https://www.chuckanutcommunityforest.com/learn/physical-features-map/