Newell Creek Watershed

Restoration and Conservation Strategy

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Executive Summary

Key Findings and Recommendations

Findings:

- Approximately 25% of the watershed is presently covered by impervious surface.
‘- (Build-out) under current zoning could increase this to 44%. This level of impervious surface is a clear threat to downstream habitat and water quality.
- Nearly 400 acres within the canyon are in public ownership
-Metro has invested over $6 million in public funds to acquire key areas, but has limited funding for further acquisition, management or restoration.
- Stream and riparian habitat in the central canyon is very high quality.
- A series of beaver dams in the upper canyon are likely playing a critical role in protection of habitat downstream.
- Significant weed infestations are found at the canyon rim, within parts of the closed canopy forest on the west side of the main stem, and in the vicinity of the beaver dams.
- There is a high risk of landslides at the canyon edge, exacerbated by past development.
- Existing trails are not suitable for public access or stewardship activities.
- Many public agencies have business in the watershed, but there is no official coordination.
- English ivy and Japanese knotweed are long term invasive threats to native habitat”
- Concern about the watershed is limited to a few public officials and citizen activists.
- There is very little grassroots awareness or involvement in the watershed.
- As citizens learn more, interest and involvement clearly increases.
- The main stem creek condition is not managed or monitored by any specific entity, though Oregon City Public Works is increasingly taking this role.

Recommendations

- Avoid creating additional effective impervious surface or adding any increased flows.
- Continue to build a multi-faceted program for managing stormwater, beyond “retention, to include intercept, silt catchment, wetland treatment etc.
- Pursue recommended opportunities for wetland treatment projects (Red Soils area, CCC campus, Pioneer Car Wash).
- Design and build an integrated trail network, with a rim trail on west, rail trail on the east, and finger trails into the canyon, staying clear of anchor habitats.
- Develop a permanent inter-agency team or have the new Watershed Council coordinate multiple activities and responsibilities”
- Develop and implement a long term public outreach & education program to increase local awareness and build citizen stewardship.
- Create a natural resource “steward” or ranger position, funded by multiple partners and grants.
- Develop a long-term restoration and management strategy that identifies and fairly divides responsibilities among agencies, citizen groups, and schools.
- Investigate the feasibility of installing or improving habitat underpasses at key points on Highway 213.
- Stabilize and begin to reduce invasive species populations, focusing initially on ivy and knotweed.
- Establish an urban forest program, either city wide or limited to the upper watershed, with a goal of increasing canopy cover over time.
- - Study the feasibility of implementing a downspout disconnect program in the upper watershed.

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2002 Aerial Photography

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Introduction

Introduction

This document was prepared to provide a conservation and restoration framework for managing the Newell Creek Watershed in Oregon City and Clackamas County. Newell Creek has been the subject of numerous studies and proposals over the past 15 years. The main stem of Newell Creek has some of the best remaining anadramous fish habitat in the Portland metropolitan area, while the canyon forest is one of the largest remaining natural areas in the south metro region.

Development that took place in the late 1980s and early 1990s in the upper watershed and along the canyon rim have reduced habitat, increased stormwater flows, and may have contributed to 1996 landslides. Since that time, Metro stepped in to purchase open space, and Oregon City has strengthened its stormwater and land planning regulations. The recommendations in this study are intended to help these and other agencies move forward with additional conservation measures, and to implement a long term strategy for watershed protection and restoration.

The development of this document and supporting material is the result of the efforts of many individuals and institutions. The City of Oregon City took the lead in initiating this endeavor by contracting with the Environmental Learning Center at Clackamas Community College. The U.S. Fish and Wildlife Service provided grant funding to support the organization of graduate courses through which students from the University of Oregon, Oregon State University, and Portland State University generated information about the watershed and developed management concepts.

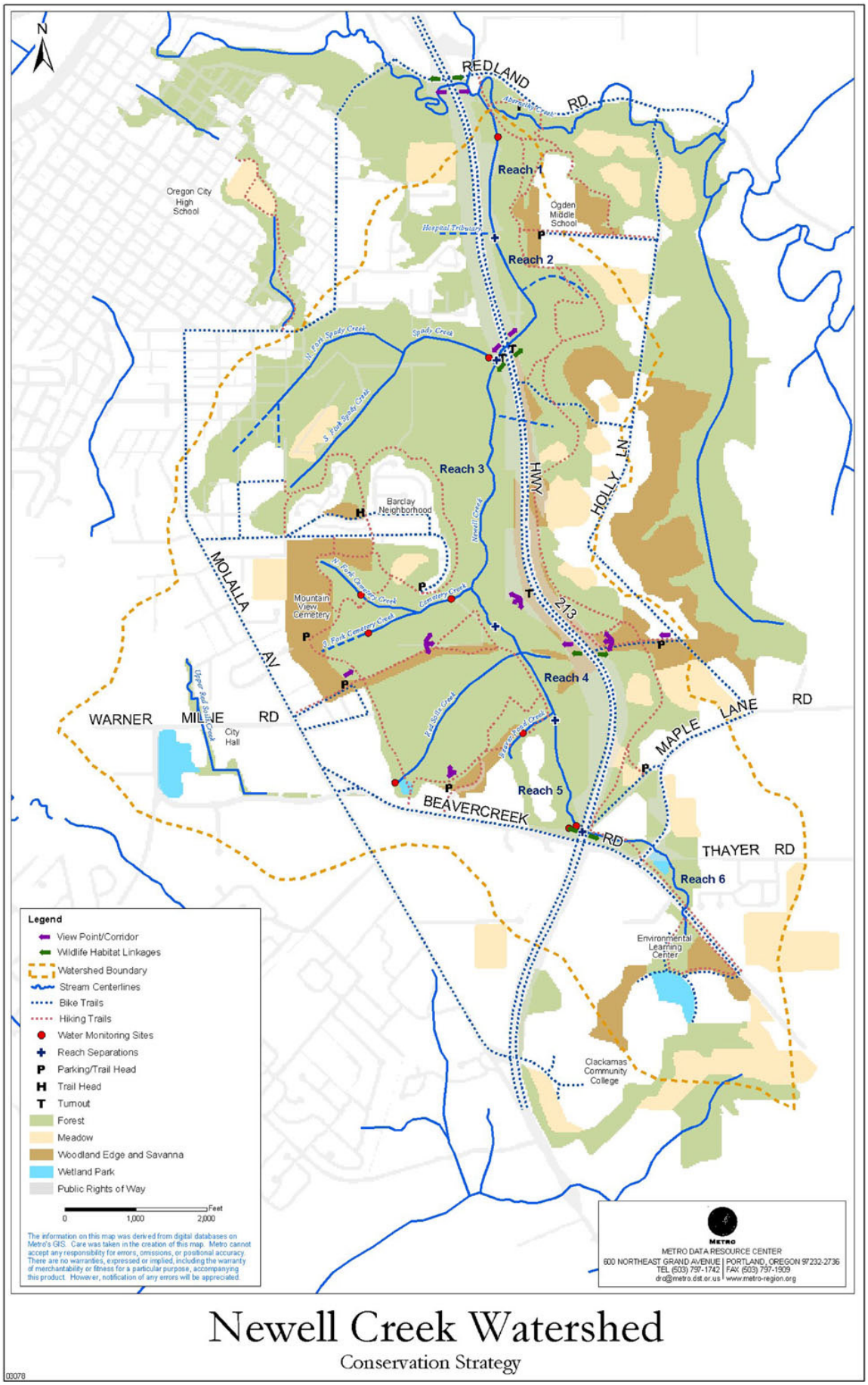
A technical advisory team composed of staff from many public agencies provided advice, data and project review. These include: U.S. Fish and Wildlife Service, USDA Natural Resource Conservation Service, Oregon Department of Transportation, Oregon Department of Environmental Quality, Metro, Clackamas County Natural Resources Department, Clackamas County Transportation and Planning Department, Clackamas County Soil and Water Conservation Service, and City of Oregon City. In addition, Metro provided staff support, and the Oregon State University Extension Service Sea Grant program provided technical assistance.

Portland State University geology students, under the direction of Professor Scott Burns, have continued to conduct long term monitoring of storm water flows within Newell Creek Canyon.

It is hoped that the public agencies with jurisdiction, land management or regulatory responsibilities in Newell Creek Watershed continue to build a collaborative approach, and will work with citizens, business property owners, and others to restore and protect this very valuable resource.

University students develop Newell Creek Restoration Strategy

Elected officials and other community members review student work



Newell Creek Watershed

Conservation Strategy

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Watershed Description

Watershed Description

Newell Creek Watershed is located in Clackamas County, Oregon along the eastern border of Oregon City. The 1800-acre watershed has two main headwater areas. The east headwater originates at Clackamas Community College near the softball fields just south of Douglas Loop. Rain that falls on the northeast side of the campus is captured in several storm drains and piped north into the Environmental Learning Center. These pipes spill their contents into a small channel that courses past shaded trails and below bridges on the ELC site.

The channel bypasses the ponds and leaves the campus through a culvert that runs below Beaver creek Road. Newell Creek emerges into daylight on the other side, where it flows through suburban backyards until reaching a pipe under Oregon State Highway 213. West of the highway, Newell Creek finds freedom, tumbling down a waterfall and into the wooded canyon below.

Eastern headwaters flow through the Environmental Learning Center at CCC.

The western headwaters originate on the north side of Warner Milne Road, just east of the St. John the Apostle Catholic Cemetery. Stormwater flows south through a culvert under the road, then through a ditched channel, past remnant wetlands, around an apartment complex and south of Danielson's Shopping Center. It disappears into a culvert that carries it under the intersection of Molalla Avenue and Beavercreek roads. Like its twin from the east, the west branch finally finds daylight at the forested canyon rim, this time behind the Pioneer Car Wash.

On its three mile northward journey, Newell Creek spills from these highlands above Oregon City to the Abernathy Creek flood plain below. As it leaves the red soils of the uplands, it meets soft clays, silts and gravels. Through this more pliable medium, the creek has carved a canyon that today embraces the largest

Mouth of Newell Creek where it flows into Abernethy near Redland Road.

intact greenspace in the southern Portland metropolitan area. Newell's waters blend gently into Abernethy Creek near Redland Road. Together they glide behind the Clackamas County government offices on Abernethy Road, re-enter the darkness of a culvert, and finally find freedom in the Willamette River.

Newell Creek has carved itself a rugged landscape. The soils of the canyon are largely of the Troutdale formation, deep and easily eroded. In places, the water table fluctuates some 30 feet. Dozens of seeps and springs along its route contribute to its flow and incise side canyons. Old timers with homes perched above or

Western headwaters flows through ditch from Warner Milne Rd. to Danielson's.

within the canyon walls walk their property pointing to slumps and slides, naming each one for the year when heavy rains tripped them and washed away their footing. Recent housing developments on the west canyon rim, despite their elaborate drainage systems, show signs of large-scale soil movement. Newell Creek Canyon remains a dynamic landscape.

Large wood Creates Habitat in Newell Creek Canyon

The walls of the canyon are steep and covered with heavy vegetation, making it difficult to access. The interior forest of Douglas fir, western red cedars, big-leaf maples and red alders, carpeted by sword ferns and wildflowers, awaits attack by the encircling foreign armies of Himalayan blackberry, English ivy, and Scots broom. Invasive exotic plants make yearly inroads into the canyon, choking out natives.

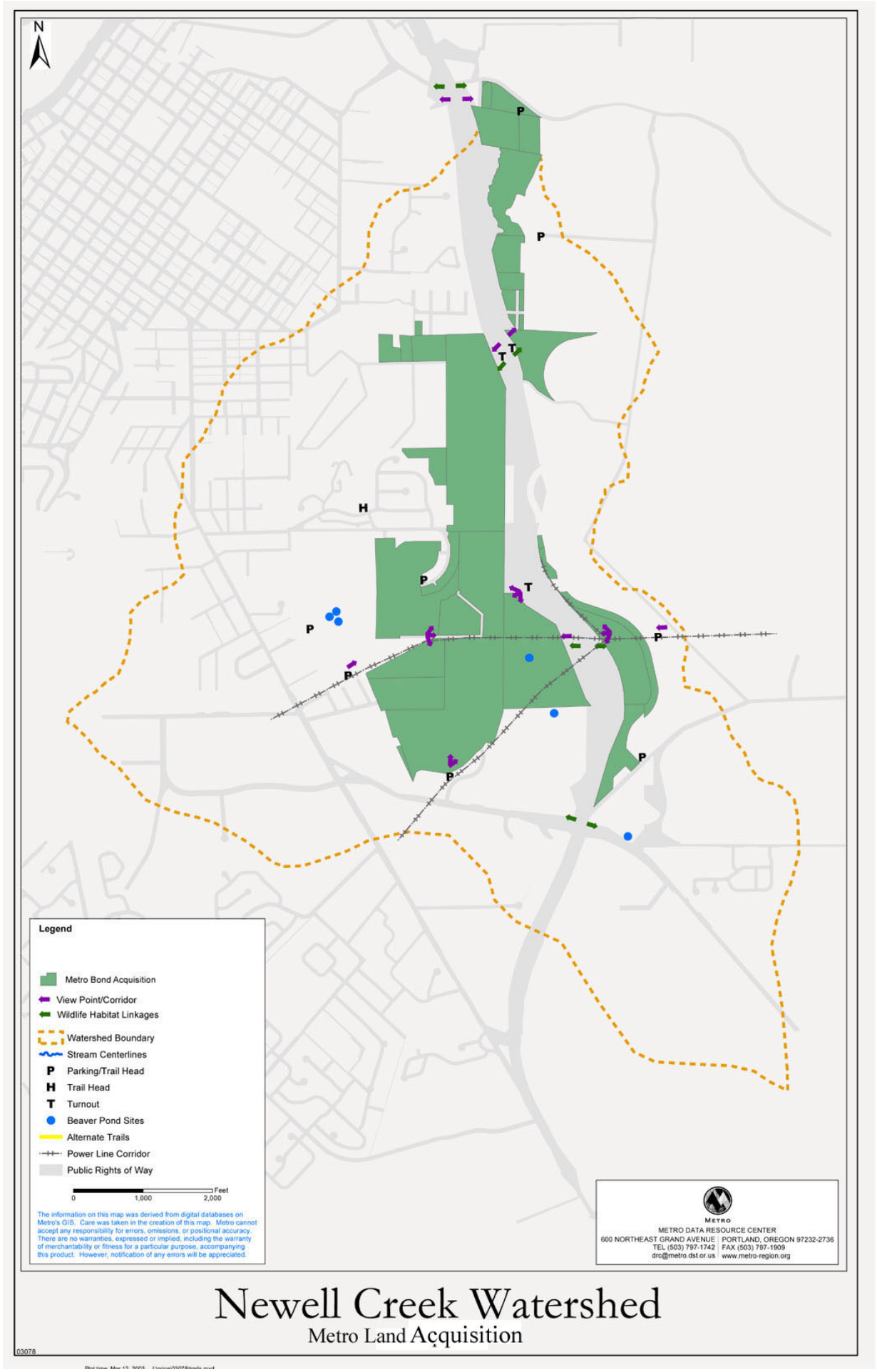
In May of 1995, voters approved purchased 279 acres of open space throughout the Portland metropolitan area. Newell Creek stood out as a large intact semi-natural area in jeopardy from encroaching development and degradation. To date, Metro Regional Government has purchased over 200 acres on both sides of the canyon. In addition, several large publicly owned tracts are managed by Oregon City and the Oregon Department of Transportation. Most of the watershed remains in private ownership.

LAND AND WATER

The underlying geology, soils, and hydrology of Newell Creek Watershed have conspired with climate and vegetation to shape the basic contours of the land, which in turn have influenced human use.

Geology

There are two key geologic formations in Newell Creek --the relatively level “Boring” basalts of the upper terrace, and the cemented sands and gravels that form the architecture of the canyon. The Boring basalts are characterized by reddish colored soils with large, embedded boulders. Oregon City residents are familiar with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Wildlife Habitat Linkages
Watershed Boundary
Stream Centerlines
P Parking/Trail Head
H Trail Head
T Turnout
Beaver Pond Sites
Alternate Trails
Power Line Corridor
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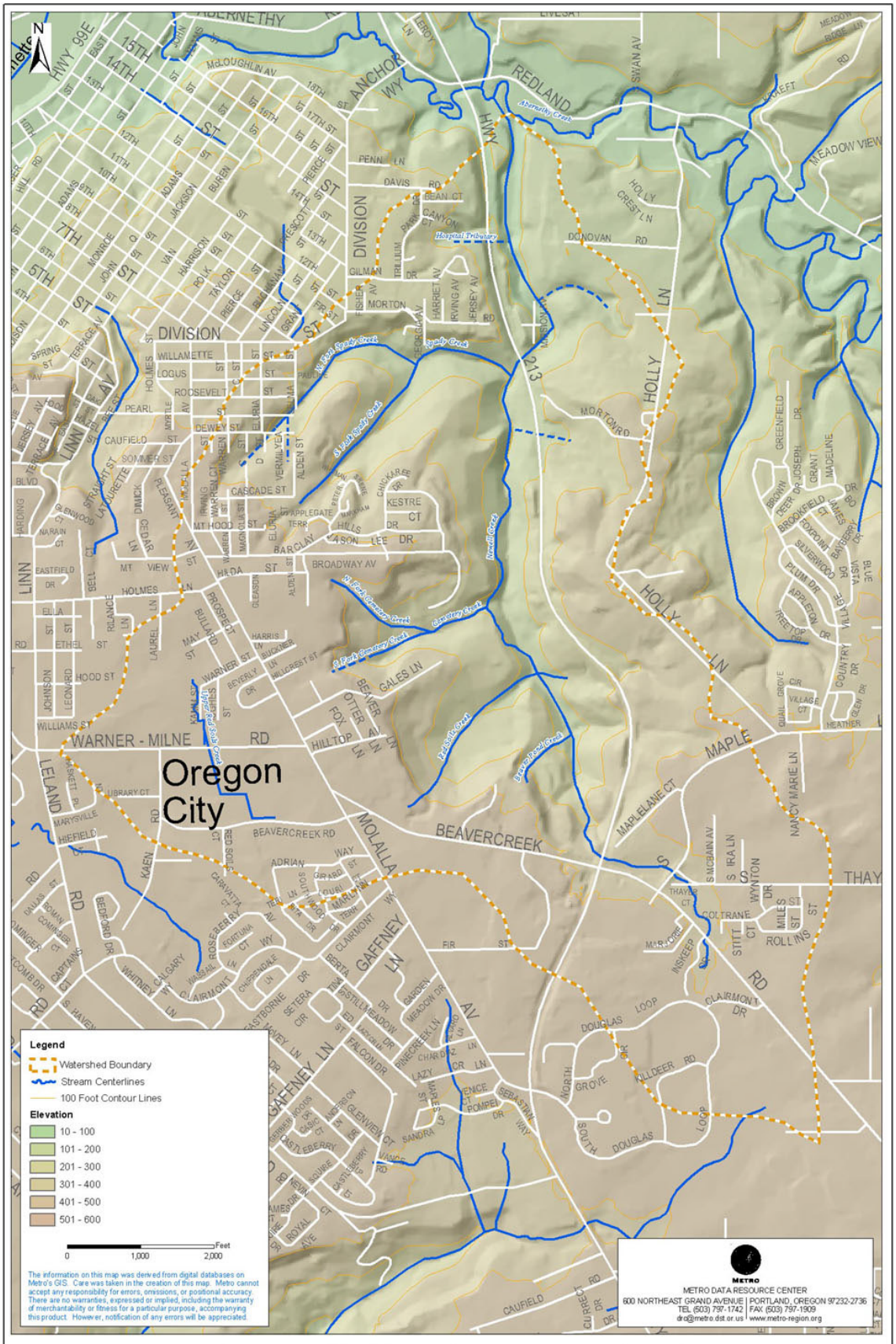

Newell Creek Watershed

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red soil exposed along road cuts. The clusters of boulders that decorate nearly every entry drive in the upper watershed have been excavated from this red soil matrix.

The sand and gravel layer is composed of Troutdale and Sandy River formations. These lie under the younger Boring basalt, and are exposed within Newell Creek Canyon. There are also older rocks that are buried under the entire watershed, known as Columbia River basalts. These are the base rocks for our entire region, having originated from a series of lava flows tens of millions of years ago. They are as much as 900 feet thick in places. These are the dark, sturdy rocks that form the bluffs along the Willamette River in Oregon City, and much of the Columbia River Gorge. Over time they were gently folded and faulted, resulting in topographic highs and lows. In some of these topographic lows, such as Newell Creek Canyon, thick sediments were deposited on top of the Columbia River basalt, filling in the depression.

Troutdale Formation visible in road cut below Mt. View Cemetery.

The Sandy River and Troutdale Formations consist of mudstone, siltstone, sand, and gravel. Both were laid down by the ancestral Columbia River, which once flowed far to the south of its present course, right through where Oregon City now stands. One can envision these formations as a layer cake, with some layers much denser than others. The dense layers made from fine sediments tend to block water from penetrating down. This results in local high water tables or springs.

The Troutdale Formation has two levels. The lower consists of gravel and sand derived from basalt pebbles and cobbles, but also including minor amounts of granite and quartzite. These cemented gravels are quite permeable, and can stand over 100 vertical feet. The upper consists of finer grained sands, silts, and clays that are from local volcanic debris, but also includes basalt gravel layers.

Soils

Earth scientists generally classify soils as either having formed in place (residual), or having been transported from some other location (alluvial or colluvial). Most of the Newell Creek Watershed has residual soils, formed by gradual weathering of the Boring lavas. In parts of the canyon, this soil is mixed with external sources, including deposits from the Missoula Floods dating from over 14,000 years ago. Thus the red colored soil at the top of the canyon gives way to tan colored, silty clays, which developed directly on the Sandy River and Troutdale formations. The contact zone between bedrock and soil is usually gradual rather than abrupt, and can be identified as a zone of weathered or soft bedrock. This contact point is of great importance because each soil layer has different strength, and many of the landslides appear to originate here.

The Natural Resources Conservation Service has divided soils of the watershed into five series: Bornstedt, Helvetia, Jory, Woodburn, and Xerochrepts/Haploxerolls. The first four soils are deep and moderately well drained. In most of the steeper portions of the canyon, the soils are colluvial, meaning they have been transported down slope from their place of origin. These are a mixture of the Boring Lava red clays, and gray Sandy River Mudstone/ Troutdale soils. They are generally thinner than the alluvial, or flood deposited soils, but sometimes appear as very deep blocks, indicating old landslides.

Much of the rim of the watershed has been developed, and therefore has been or is being re-contoured and surfaced with fill. The properties and thickness of this fill vary widely and are site-specific, generally composed of the local residual soil, basalt gravel, cobbles and sometimes bricks, organic debris, wood, concrete, and even garbage in some cases.

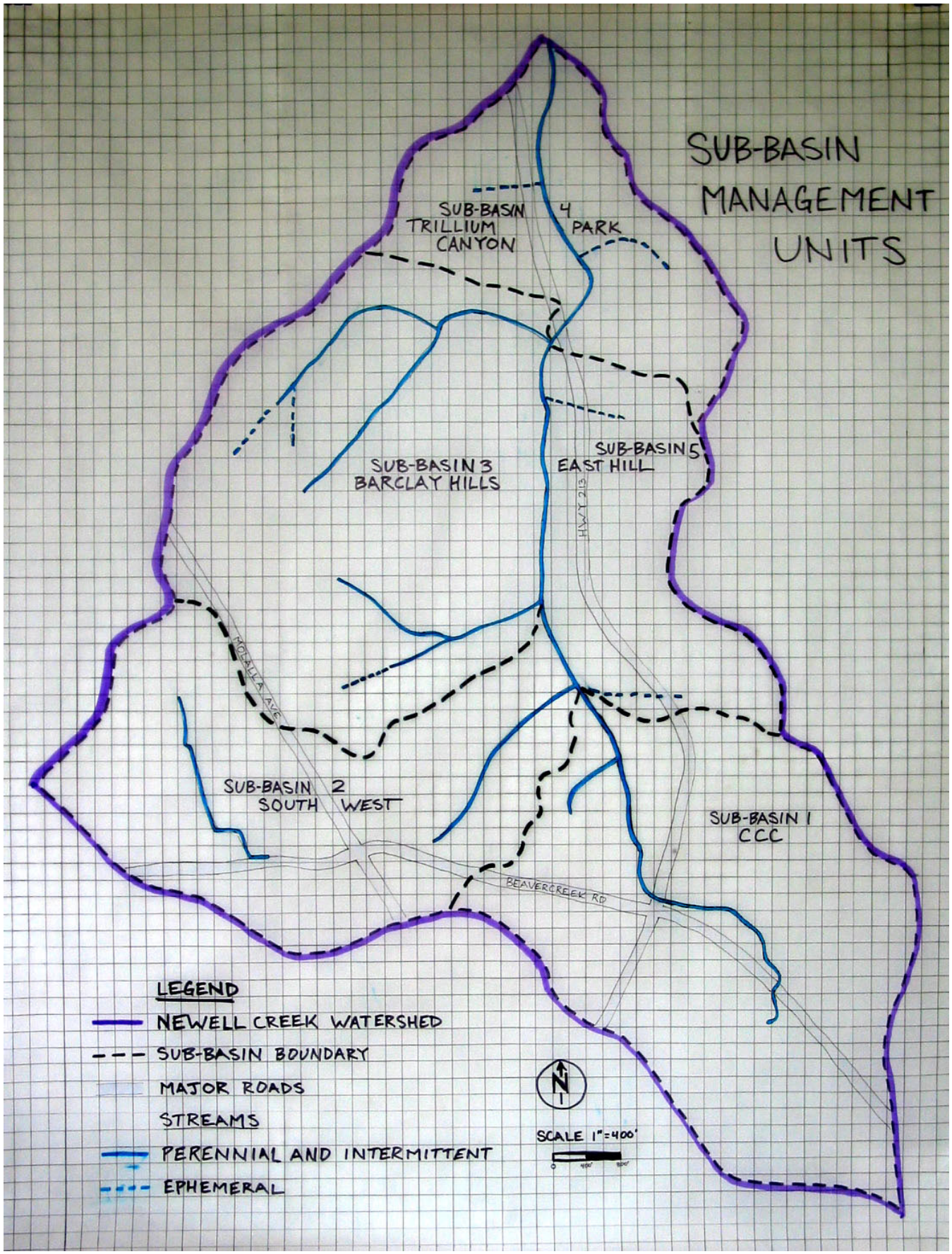
Hydrology

Newell Creek Watershed is low in elevation, and has thus been shaped largely by seasonally driven rainfall. The upper terrace that generally follows Beavercreek and Molalla Roads has no surface creeks. Historically rainfall was intercepted by forest cover, and water that reached the ground was held in place or allowed to slowly percolate to the groundwater table. Only a small amount ran off the surface in infrequent, large storms. A network of seven surface creeks emerges at the canyon edge. These have steep gradients until they reach the main stem in the canyon bottom. Numerous springs and seeps feed cool groundwater to Newell Creek throughout the year. There are six subbasins or small watersheds that feed Newell Creek.

The main seasonal flows come from two of these. Water originating in the southwest subbasin feeds a ditch informally named “Red Soils” Creek, which flows south past City Hall, turns east at Danielsons, disappears into a pipe and daylights above the canyon behind the Pioneer Car Wash. In the southeast, water from the new Oregon City High School campus and Clackamas Community College feeds a constructed channel that originates at the Environmental Learning Center, and then flows along Beavercreek Road, entering the canyon just west of Highway 213. These two tributaries represent approximately 75% of the total surface flow from all the creeks that feed Newell.

Landform

Newell Creek Watershed can be divided into two basic landform units. In the upper watershed, bounded roughly by Molalla Avenue in the west, Beavercreek Road in the south, and Holly Lane in the east, the topography is level or gently rolling. The divides that separate Newell Creek from Caufield and other adjacent watersheds are very subtle. This terrace is where berry farms once thrived, and suburban development now dominates. The second unit is the canyon, which has very steep slopes mantled in forest, and has had relatively little development until recent years.


SUB-BASIN MANAGEMENT UNITS
SUB-BASIN 4 TRILLIUM CANYON PARK
SUB-BASIN 3 BARCLAY HILLS
SUB-BASIN 5 EAST HILL
HWY 213
MOLALLA AVE
SUB-BASIN 2 SOUTH WEST
SUB-BASIN 1 CCC
BEAVERCREEK RD
LEGEND
NEWELL CREEK WATERSHED
SUB-BASIN BOUNDARY
MAJOR ROADS
STREAMS
PERENNIAL AND INTERMITTENT
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SCALE 1"=400'

Landslides

Newell Creek Canyon is well known as a place prone to landslides. All of the landform features associated with landslides are found in the canyon. These include: scarps, tension cracks, shear zones, and toes. Scarps are found near the top of a landslide, and generally begin at the surface as tension cracks. Tension cracks can be found throughout a landslide. Shear zones are located along the sides of landslides, while the toes are at the bottom.

Tension cracks are usually the first sign that a landslide might occur. The pattern of tension cracks can be used as a tool for analyzing stability of the surrounding area. In Newell Creek Canyon, tension cracks are mostly found above scarps and along the upper portions of the sides of active landslides. Tension cracks have openings from 5 to 30 centimeters wide. Local resident Sha Spady observed a tension crack 24 hours prior to the landslide that occurred on her property during the February 1996 rainstorm.

Sag ponds are found throughout the canyon on level benches that lie between major and minor scarps. They appear as shallow local depressions and seasonally fill with water, providing important habitat, particularly for amphibians. Shear zones can be noticed where mature forest vegetation lies alongside a brushy area. The abrupt change in the size or age of vegetation may indicate that the area that had been disturbed some years ago.

This sag pond provides habitat for amphibians.

Landslide toes appear as overly-steep slopes that have a concave shape when looking from above. Many of these lie parallel to creeks. In some cases the creeks have had to form a new path around the toe. Newell Creek landslides can be divided into three categories: active, inactive-young, and inactive-mature. It is common for large inactive-mature landslides to have smaller active or inactive-young slides located on the steep head scarps or toes due to undercutting of the toe by a stream.

This sign at the edge of the canyon reads, "Caution, Land Slides, Keep Back."

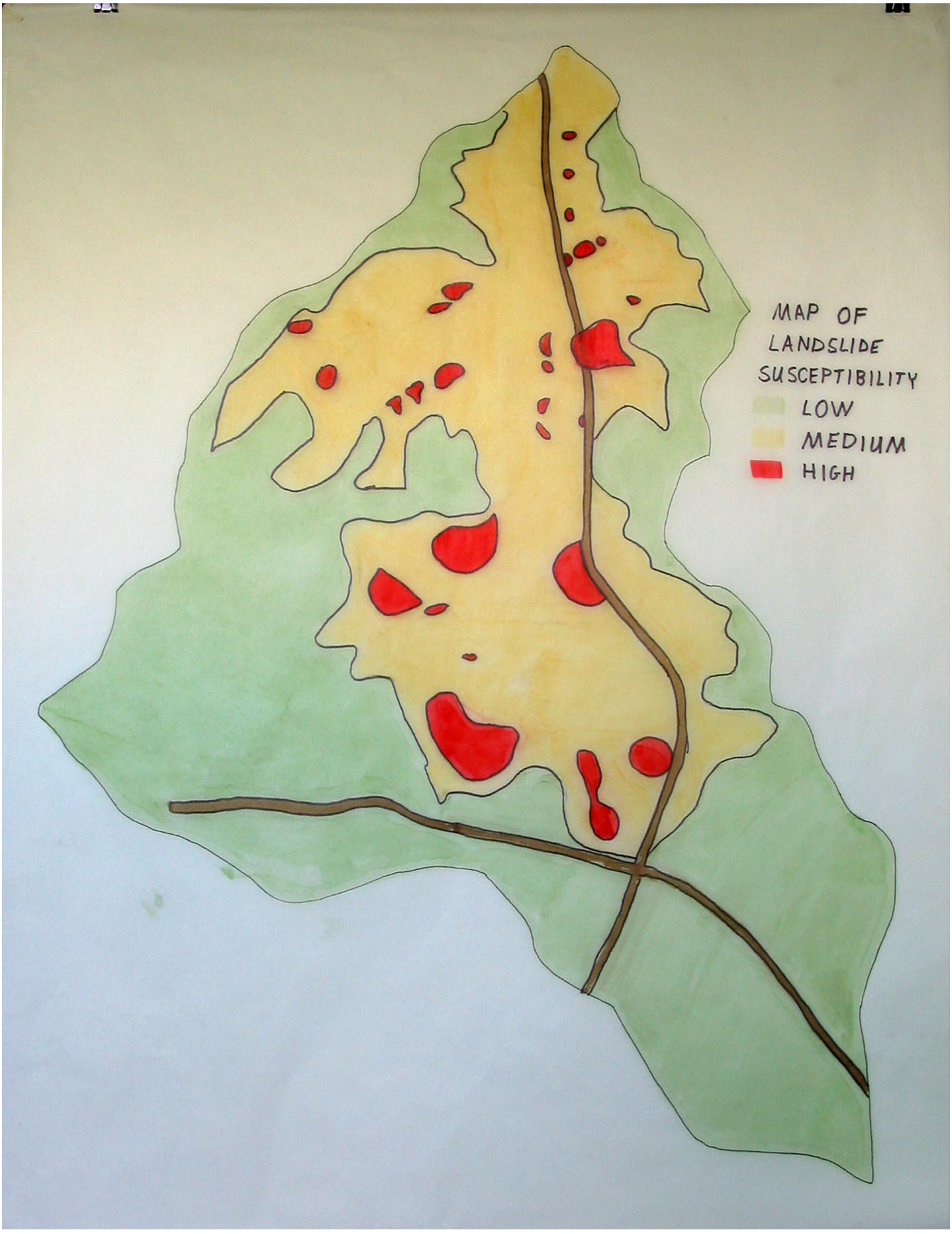
Any landslide that has moved within the past 100 years should be considered active, which means it has a strong potential for moving again. Landslides that are presently moving typically have fresh signs. There may be a fresh head scarp, often jagged, very steep, and unvegetated.

Landslides that have not moved within the past 100 years have more subtle features. Scarps become smoother due to erosion and are vegetated. Internal depressions begin to fill in and may appear as soggy areas rather than ponds. Slide toes that abut streams often erode back.

Overall, seventy-nine landslides have been identified within Newell Creek Canyon. Sixty-five of these are shallow-seated and fairly small. There are at least 14 large, deep-seated landslides.

Landslide scarps in the southern portion of the canyon, especially the deep-seated landslides, are located along the contact between the Troutdale/ Sandy River Mudstone Formation and the Boring Lavas. In the northern portion of the canyon, deep-seated landslides are generally located along the perimeter of the canyon where the slopes change from relatively flat to steep.

Most of the shallow-seated landslides occur along the locally steeper slopes of creek banks, in man-made fills, and on inactive-young and inactive-mature landslides scarps and toes. Most of the deep-seated landslides in the study area are believed to be inactive, and range from young to mature. Many of them date from long before the time of Euro-American settlement, and their causes were likely unrelated to human activity. These older slides can be reactivated at any time. The Spady and Dewey Street-Warren Street Landslides are recent and still active. Almost all of these deep-seated landslides have smaller, inactive-young and active, shallow-seated slides within their boundaries. Many of the shallow-seated slides are active and much younger than the deep-seated slides. These slides tend to be associated with cut slopes and fills from recent construction.


MAP OF
LANDSLIDE
SUSCEPTIBILITY
LOW
MEDIUM
HIGH

Landscape History

Newel Creek 1936

Newel Creek 1956

Newel Creek 1976

Newel Creek 2001

Landscape History

The area surrounding Willamette Falls, today known as Oregon City and West Linn, was for many centuries a significant gathering area for Indian people. Willamette Falls served as a physical challenge to migrating salmon, making it a productive fishing site, as it remains to this day. The confluence of the Clackamas and Willamette rivers lies just downstream of the falls. These features made the area attractive to several distinct Indian bands--the Clackamas, the Clowwewallas, the Nemalquinner band of the Multnomah, the Tualatin and possibly the Molalla. The rivers, as well as the surrounding grasslands and forest, provided a wide selection of foods, medicine, and materials for building, clothing and other needs.

Local Indians had already suffered severe population loss stemming from the introduction of European diseases by the time of their encounter with the Lewis and Clark expedition in 1806. Little information is available today concerning their use of specific areas around Oregon City, including Newell Creek. However, its steep terrain and dense conifer forest likely limited its appeal, since more abundant resources would be available along the main rivers and in oak woodlands to the south.

By the 1840s, Oregon City became the terminus for the Oregon Trail, one of the largest voluntary human migrations in history. One can imagine that every acre of ground surrounding the small settlement was quickly evaluated for potential settlement, building materials and farming. One small creek was named for Robert Newell, a mountain man and trapper who arrived in Oregon City in 1840. A self-taught backwoods healer, he was nicknamed “Doctor Newell.” He was instrumental in establishing Oregon statehood and was twice elected as Speaker of the House of Representatives.

One-hundred and fifty years ago, the Newell Creek Watershed was almost entirely a forest of conifers. The 1850s survey notes for the area surrounding Newell Creek Canyon make reference to patches of burned timber. Forests were seen as impediments to early settlement and were often cleared by burning. Settlers frequently lost control of these land-clearing blazes. There are no survey entries for the inner canyon, but it is likely that its year-round moist condition kept most fires at bay.

From the 1850s through the early 1900s, Newell Creek Watershed became a sparsely settled patchwork of woodlands and farms. Remains of old orchards and outbuildings speak to this early agricultural legacy. By 1900 a housing development called Knob Hill boasted Mt Hood view property along the rim of the canyon near today’s Willamette Falls Hospital

In 1916, just below Knob Hill, near Division Street and Morton Road, Charles Terrill discovered a vein of silica while excavating the basement of his new home. He developed a mining operation that lasted until 1948. Despite high hopes, extracting the mineral eventually proved unprofitable, so the mine was closed leaving a substantial portion of the vein untouched and buried.

Spring board notches in an old cedar stump.

By the early 1900s, logging had become a way of life in western Oregon. The steep muddy terrain of the canyon posed challenges to logging crews, but one can still find large stumps showing spring-board notches where hand sawyers perched while falling huge cedars and firs. Loggers made use of portable mills and built temporary plank roads.

In 1908, a Portland engineer envisioned a rail line connecting Oregon City to Molalla and Mt. Angel. Financed by local farmers, the Willamette Valley Southern line was completed in 1915, with a section running along the east side of Newell Creek Canyon. This spur line carried lumber, produce and passengers, later joining the extensive network of interurban electric trains. Local citizens jokingly called it the "three times a week" train because it rarely ran on time. Business was never good, although it was an important link from rural farms to Portland markets. The advent of the automobile cut into business, and a forest fire in 1929 reduced the harvestable timber that might have supported the rail line. The run was closed in 1933 and the line and equipment dismantled by 1938. Sections of the rail grade and berms are still visible at Clackamas Community College and on private property on the east side of the canyon from Maple Lane to Ogden Middle School.

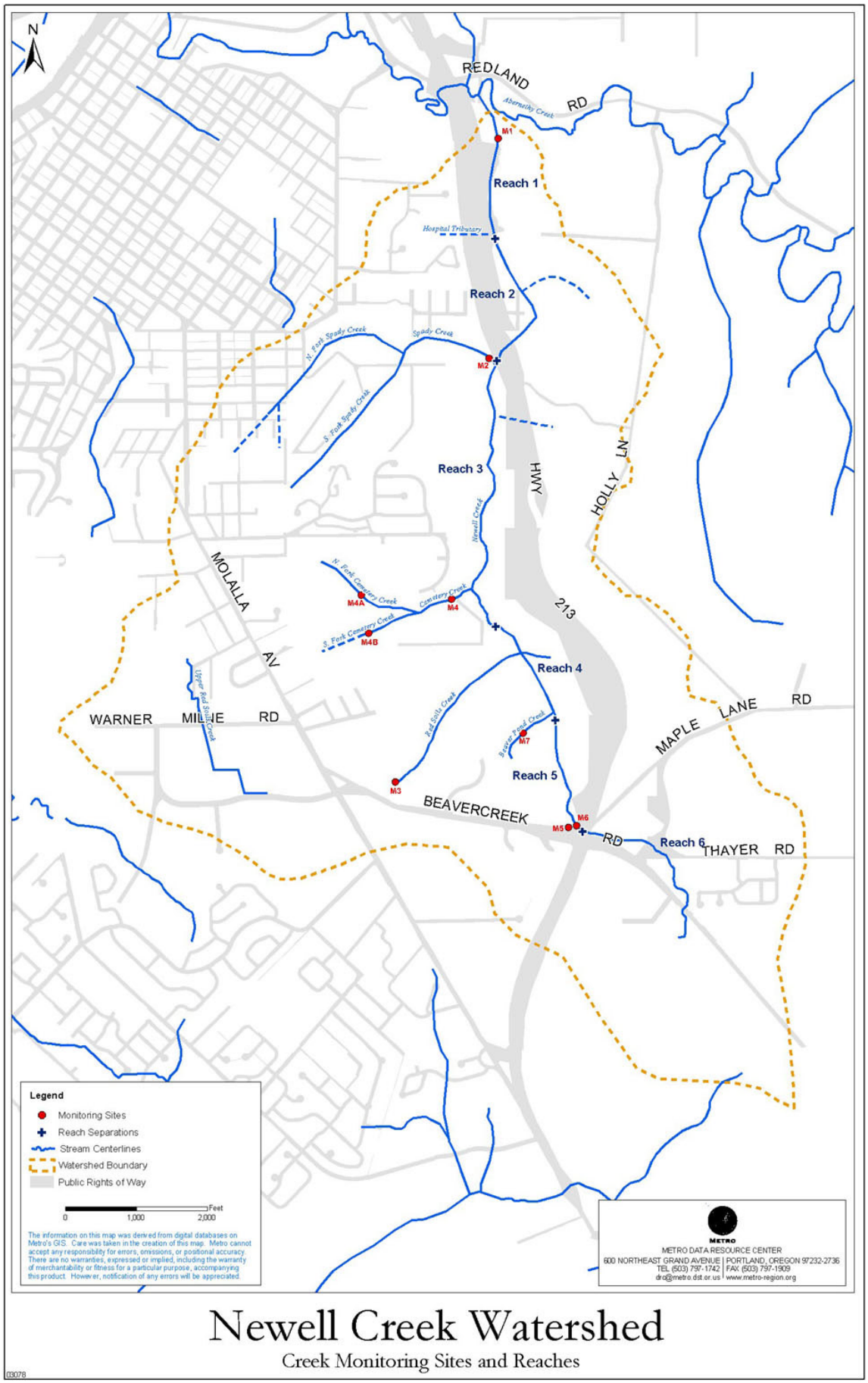
Logging continued on private property through the 1950s and 60s while the upper watershed sprouted houses. Local residents fished, swam, and picnicked in the creek. A go-cart track below Mt. View Cemetery was a popular recreation site. The eastern headwaters in the upper plateau were still covered with rows of berry vines and orchards. Cedar logs from Newell Creek Canyon were cut, split and sold to farmers for berry trellises. Many Oregon City residents recall their first paid jobs as teenagers picking raspberries in these fields. The berries were processed at the local Smuckers plant, now the site of the Environmental Learning Center.

By the 1960s, Clackamas Community College constructed its first campus buildings on farmland at the top of the watershed. Many of the farms were sold to developers and Smuckers moved on. The Smuckers settling ponds, excavated at Newell Creek's southeastern headwaters, were abandoned. A group of industrious students led by Jerry Herrmann launched the "ecology pond project" to reclaim the site. They transformed it into a park and nature center, later named the John Inskeep Environmental Learning Center. The name of the adjacent Berryhill Shopping Center recalls the area's agricultural legacy.

By the 1970s, the increase in traffic through Oregon City prompted talk of a bypass. A route was chosen through the heart of Newell Creek Canyon. Oregon Department of Transportation completed this section of the Cascade Highway 213 in 1989, locating it through some of the most unstable terrain in the region. This bypass proved to be one of ODOT's costliest endeavors, and brought significant changes to formerly peaceful Newell Creek Canyon. Over 40,000 motorists now travel this route on an average weekday.

In the 1980s and 1990s, Oregon City opened the doors to expansive development. The city envisioned apartment complexes and housing developments all along its eastern boundary on the rim and down the slopes of Newell Creek Canyon. Local activists protested these developments. In 1995, with funding from their greenspaces bond measure Metro purchased acreage in Newell Creek Canyon, focusing acquisition efforts on steep slopes destined for development.

Oregon City's population has nearly doubled since 1986. In response to rapid growth and concerns for natural resource protection, elected officials and city staff have improved city ordinances governing stormwater management and development on steep slopes In 2001-2003, Oregon City took part in a model project called NEMO-Non-point Education for Municipal Officials-which evaluated the city's policies as they relate to storm water management. In 2002, the city established a volunteer natural resources advisory committee. The City has provided funding to the Clackamas Soil and Water Conservation District to initiate formation of a watershed council to oversee conservation of Newell, Abernathy, and several other 'orphan" creeks in the Oregon City area.



Newell Creek Watershed

Creek Monitoring Sites and Reaches

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STORMWATER

Stormwater Pipe to Culvert

New Clackamas County Administration Building in upper Newell Creek Watershed

STORMWATER

Background

When the Newell Creek Watershed was primarily forested, the mature tree canopy the mature tree canopy intercepted perhaps 30% of all but the largest rain storms. The soft duff layer and dense mat of roots below held most of the water that reached the ground, allowing gradual percolation into the water table. Only about 10-20% of total rainfall made its way directly into streams.

Euro-American pioneers gradually cleared forest from upland areas, tilled soils for crops, and dug ditches to drain off excess water. These activities resulted in more rapid runoff and significant delivery of sediments to the stream below. Logging of the upland and canyon forest, along with construction of skid roads, also contributed sediments, and may have opened up the riparian area to direct sunlight.

Roads and roofs cover land with waterproof "impervious" surface.

Newell Creek Watershed remained rural in character until the 1960s. The canyon forest had partially recovered from logging, and the undeveloped land absorbed most of the annual rainfall. Suburban development began to change that. New roads were built, existing ones widened, and buildings displaced farm fields.

Today, 25% of the watershed is covered by impervious surface, meaning surface such as pavement or roofs. According to the Environmental Protection Agency, research indicates that at about 10% impervious cover, sensitive stream elements are lost from the system. A second threshold appears to exist at around 25 to 30% impervious cover, where most indicators of stream quality consistently decline to a poor condition (e.g., diminished aquatic diversity, water quality, and habitat scores) due to a number of interrelated factors.

Water that would normally soak into the soil and recharge the groundwater aquifer instead passes over the surface. During rain storms, water runs off the land rapidly, is concentrated into pipes, and flushes forcefully

into streams. The result is that each storm produces higher concentrated volume and velocity called “bank full flows.” These flows have enough energy to erode stream banks and to cut the channel deeper. This in turns damages riparian vegetation and lowers water quality.

Stormwater flushes forcefully into Newell Creek each time it rains.

As conifer forests age, older trees die or are toppled by wind storms. These large logs help anchor hillsides and provide long lasting structure in creeks and streams. A complex of “large woody debris” is a significant component of healthy fish habitat. Over the past 100 years, woodlot owners routinely logged the largest and most valuable trees from their sites, removing the structural components so important to aquatic habitat. In addition, it was common practice until the late 1970s to clean out large logs from streams in order to keep water moving. Unfortunately this practice decreases habitat and the ability of the stream to moderate flows.

Stormwater catch-basin.

Conservation Recomendations-Stormwater

In several ways, we have been lucky in Newell Creek. Because much of the creek is within a steep-sided, inaccessible canyon, the riparian forest has remained in fairly good condition in comparison with other urban streams. While the canyon forests have been extensively logged, most was selective, focusing on large Douglas firs and hemlocks. Maple, alder, cottonwood, and many cedar trees were left behind. An extended family of beavers has taken up residence in the mainstem. Their assembly of dams has captured sediment from above, and moderated downstream flows. Additionally, there are a large number of springs that provide cool, high quality water to the creek in the summer. The well-shaded, north-facing canyon keeps this water cool, a condition critical for anadromous fish.

The result is that aquatic habitat in the central part of the canyon is in very good condition, particularly in light of the level of development in the upper watershed. Field studies concluded that there are a surprisingly high number of salmon and trout still present.

An aquatic inventory conducted by Adolfson and Associates for Metro in 2001 counted 381 total fish and 11 species, including cutthroat trout, rainbow trout, and coho. Metro has purchased 279 acres of openspace within the canyon, in part aimed at protecting creek habitat. Over 700 acres of the watershed are still forested. The City of Oregon City adopted stormwater management policies in the late 1990s that require detention of runoff from all new development, and has initiated several projects in the upper watershed to capture runoff from older projects.

Of the five subwatersheds that drain to Newell Creek, two appear to contribute most of the total stormwater flow. We are calling these CCC Creek, and Red Soils Creek. These are also the two subwatersheds that are the most heavily developed, and where future development pressure is likely to be greatest. According to the NEMO project findings, 25% of the entire watershed is estimated to be impervious surface as of 2002. Buildout under current zoning will raise this number to 44%. Clackamas County is developing a large campus in the Red Soils area, which is presently only lightly developed. Wallmart has proposed a large facility along the canyon rim, which if built will add as much as 9.3 acres of impervious surface,.

Our recommendations on stormwater management are intended to offer the best chance to preserve the high quality aquatic habitat that still exists within the canyon, even as future development continues. We have five key measures that should be implemented by Oregon City and Clackamas County, as follows:

1) Designate one entity to take responsibility for monitoring and managing stormwater flows within the entire watershed. At the present time, this responsibility is split between the county and the city, with the result that neither is responsible for impacts to habitat within the canyon. We recommend that Oregon City accept this responsibility. This means that projects initiated outside of the city limits, but draining to Newell creek, should be subject to review by Oregon City.

2) Develop and implement a strong tree conservation and urban forestry program for the watershed, with particular emphasis in urban upland areas. The first line of defense for the creek is the tree canopy in the upland. At present according to the NEMO study, the Oregon City portion of the watershed (over 1000 acres) has a tree canopy of less than 25%. The goal should be to have an effective urban canopy cover of at least 50% within 20 years. Metro has recently published an excellent guidebook series that details the value of urban tree cover, and provides analysis on the effectiveness of various tree species. A City of Portland study shows that a single

mature tree in our area can intercept 4600 gallons of water a year, and prevent it from entering the storm system. An American Forests study of the Metro area estimated that regional tree cover is worth millions of dollars in total avoided costs of stormwater management.

3) Reduce the amount of effective impervious surface in upland developed areas, defined as any impervious surface that is connected or has the effect of being connected directly to the downstream drainage system. In other words, pipes, outfalls or drains. This can be done by developing and implementing a range of measures recommended in the NEMO report, including:

- revised parking codes;
- building narrower streets;
- eliminating or revising design of curbs;
- shortening building setbacks (thus reducing length of driveways)
- use of bioswales instead of pipes;
- providing incentives for "eco-roofs"

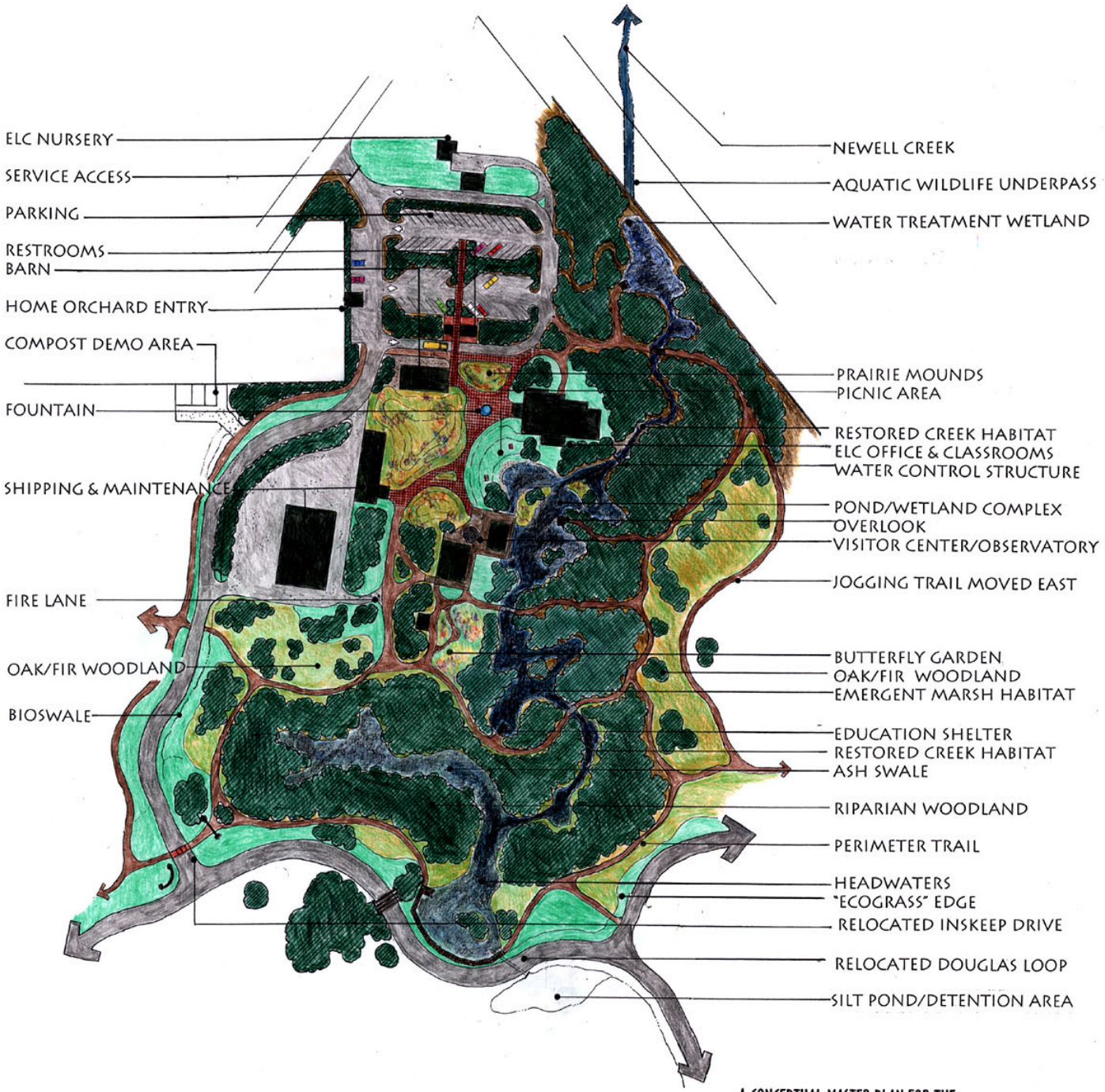
4) Establish a stormwater monitoring program, coordinated by Oregon City, but "staffed" by multiple partners, including PSU, CCC, and local middle and high schools.

5) We have identified three areas within the watershed that lend themselves to development of stormwater wetland "parks" which could provide several benefits; urban wildlife habitat, community recreation, interpretative information, and stormwater retention. These sites are: (1) the CCC campus ELC site; (2) the proposed County Administration Complex on Beavercreek Road near Warner Milne; and (3) an area behind the Pioneer Car Wash. These are identified on the conservation strategy map.

The CountyAdministrative Campus area includes a remnant wetland that could be improved for both habitat and to detain and treat stormwater . Ideally, improvements would include the sit of the Carpenter's Union Hall, which was built on a filled portion of the wetland. A constructed wetland could collect water from the ditch that originates near St. John the Apostle Catholic Cemetery. If the Carpenter's Hall cannot be purchased and removed, a smaller wetland could be designed to the south of the existing building by excavating an unused grassy area. Swales and silt/detention ponds are being built to capture and hold water at the County Administration complex. The existing wetland could filter excess runnoff from this area, and then slowly release water to a "restored" red soils creek, taking advantage of city-owned property behind the cinema complex.

The whole area could be designed for passive recreation with trails, boardwalks, overlooks, and environmental interpretation. Situated near the administrative offices of Clackamas County, Oregon City City Hall, combined offices of Clackamas County Soil and Water Conservation District and USDA Natural Resources Conservation Service, and near Clackamas County OSU Extension Service, this site offers outstanding partnership opportunities.

A second wetland park could be built at the CCC campus, using the Environmental Learning Center and adjacent swales. A conceptual master plan was completed in 2000 and is presently being updated and refined.



A CONCEPTUAL MASTER PLAN FOR THE
JOHN INSKEEP

ENVIRONMENTAL LEARNING CENTER

at CLACKAMAS COMMUNITY COLLEGE

DEAN APOSTOL, LANDSCAPE ARCHITECT & DAVID GORMAN, WATER RESOURCE MANAGEMENT
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Parking lots

Surface parking lots may be the greatest amount of impervious surface within the watershed. Design standards for parking lots need to be improved in order to reduce stormwater impacts. We recommend six key changes:

- Limit the total amount of parking allowed.
- Limit the total footprint of parking areas.
- Intercept water flows by using curb cuts and paving breaks.
- Direct water to bioswales and landscaped areas.
- Use permeable paving for portions of lots.
- Require a 30% tree canopy cover within 10 years of development.

Impervious Road Serface

Parking Swale

Bioswales or Infiltration Trenches

A key tool in managing urban stormwater is finding ways to allow water to filter pollutants and soak into the ground. Bioswales and infiltration trenches are two valuable design tools, which can be located in or at the edge of parking lots. Curbs can still be placed for safety, but have cutouts to allow surface runoff to enter the swale and percolate into the soil. They are can be designed as attractive landscaping features. New parking lots should be designed with these techniques, and older parking lots retrofitted wherever possible. The new County Administration parking lot has included these design features, as illustrated below.

Parking Swale and Drain

Roof Drains to Infiltration Area

Ecoroofs

Ecoroofs are a green alternative to conventional roofing materials. A layered roofing system is constructed and covered with shallow soil and drought-tolerant vegetation. Ecoroofs capture rainfall, some of which evaporates, while the rest is slowly released. While ecoroofs are initially more expensive than conventional roofs they have a longer life span They also add insulation, reducing heating and cooling costs, and thus save energy.

Ecoroofs are also attractive. Oregon City has two unique features that make installation of ecoroofs especially appealing. First, the city is constructed on three levels over a steep canyon landscape. This provides visitors in the upper terraces with vistas of flowering rooftops.

Second, there is a native scabland plant community that is ideally adapted to warm, exposed, shallow soil conditions like those found on ecoroofs. The scabland prairie at the Nature Conservancy's Camassia site in West Linn is a perfect example of this community of drought tolerant mosses, camas, rosy plectritis, and other

Hawthorn International Youth Hostel- Green roof
Portland Oregon

Buckman Terrace Apartments-Green roof
Portland, OR

Downtown Portland

Natural Meadows of Camassia Preserve

blooming perennials that are stunningly beautiful. Over 300 plants thrive in the site's thin topsoil over bedrock. Ecoroofs in Oregon City could help reestablish this rare plant community.

Oregon City should provide incentives for developers to install ecoroofs by allowing credits on stormwater system development charges that reflect expected decreased flows. The results could be stunning and provide a rare local attraction.

Downspout disconnections

Roof downspouts can be disconnected from stormwater pipes, with water directed to landscaped areas. This is another method for encouraging groundwater infiltration and relieving stormwater discharge. Soils inside the canyon rim are too unstable for this technique to be safely applied. However, where soil stability and percolation rates allow in the upper watershed, selective disconnects can be used along with other techniques, such as dry wells and bog gardens.

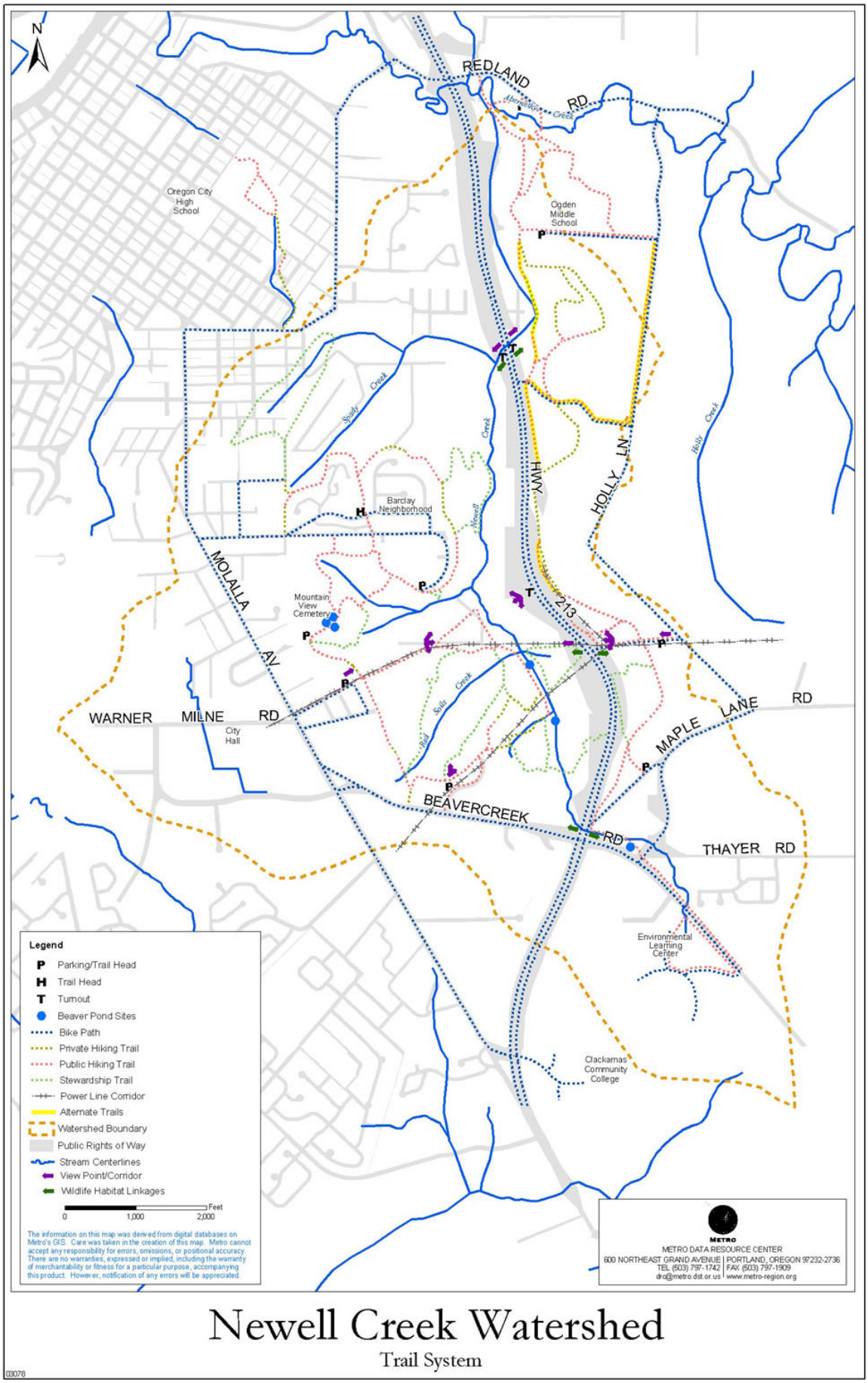
Rainwater collection

Capturing rainwater for domestic or irrigation use is another method for mitigating stormwater impacts. If the water is to be used for drinking, it must be filtered and treated. If it is used only for showers, toilets, and laundry, then filtering alone is adequate. The City of Oregon City should consider establishing codes that allow or even encourage residents and businesses to capture and use rainwater. This achieves both stormwater management and municipal water conservation objectives.

There are two key challenges to rainwater collection and re-use. The first is storage capacity. One inch of rain falling on a 1000 square foot roof yields 500 gallons of water. Thus, in a normal rain year, the roof of a modest sized building might collect some 20,000 gallons. Storing this quantity is generally not feasible, so some continuous use of the water during the rainy season is needed. Additionally, home or business owners who install rainwater systems must maintain gutters, clean tanks and change filters. Nevertheless, this is a promising tool that can solve both stormwater and domestic water problems at the same time

County Building Downspout onto rock swale

Rainwater Downspout- Designed by Murase Landscape Architectute



Newell Creek Watershed

Trail System

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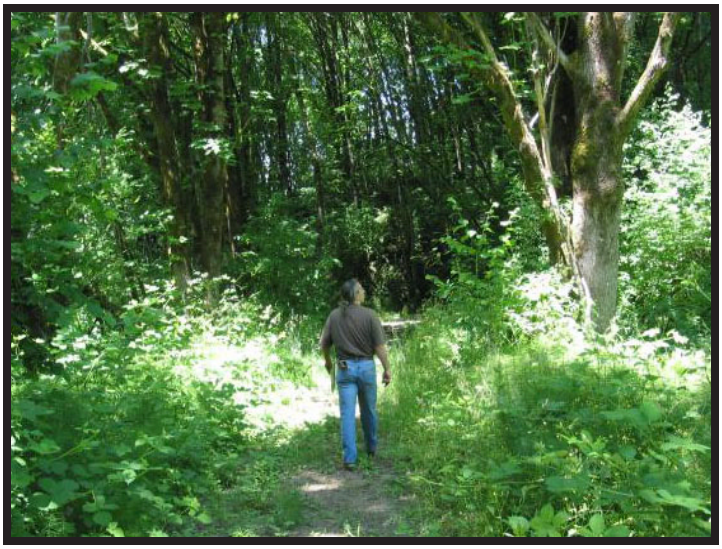
Trails and Access



Trails and Access

One of the key challenges and opportunities in the Newell Creek Watershed is the design and development of an integrated trail access system within the canyon. Land purchases by Metro, combined with existing public land ownership, have resulted in nearly 300 acres of public open space near the heart of Oregon City. But at present, this land is all but inaccessible. Trail access throughout the watershed and canyon is random and disconnected. There are no developed trailheads that offer access to destination points. Existing trails do not connect with each other, or with public lands outside of the canyon (e.g. the CCC campus). Several trails cross back and forth between public and private lands.

Poorly sited trails are steep and slipperyStewardship access is essential

Boardwalk in need of repair

Stewardship access is essential

An integrated trail system is needed for several reasons. First, according to results of the Newell Creek Views survey circulated to watershed property owners in May 2002, citizens want primitive recreational access to the canyon. Second, urban natural areas have a number of stewardship issues, including monitoring, fire management, and control of invasive species. Third, in the absence of organized access, there will likely be disorganized access. People will take it upon themselves to build trails in the wrong places. Homeless camps have already appeared in Newell Creek Canyon.

Existing Access

Newel Creek Canyon presently has several trails and access routes. Local schools, concerned citizens and others have either established or improved routes in a number of areas.

Typically, existing trails are poorly located and constructed. They often lead from one destination point to another in the most direct fashion regardless of the topography or other features. This has led to soil erosion and may be contributing silt to the streams. Existing trails are difficult to negotiate, particularly when the surface is wet, slippery gumbo. Remnants of homestead access, logging roads, and even an abandoned railroad bed still are identifiable under the dense vegetative cover in areas. In some cases, existing trails use these remnants and are in reasonably good condition. The railroad grade on the east side of the canyon has been identified by Metro as part of a future regional trail network, though in places it is disconnected due to construction of Highway 213.

Trail Concept

In recognition of the importance of trails, a key objective of this project was to develop a long term trail plan for Newell Creek Canyon, tied to its surrounding neighborhood. What follows are a set of integrated recommendations for trail location and development.

1. Development of a hiking trail system along the west side of the canyon, anchored by a "rim" trail that follows the canyon edge, linked to spur trails along the power line corridors that lead to viewpoints. Several short and two longer loops are included. By developing a rim trail, we can avoid entering anchor habitats in the inner canyon and facilitate maintenance along the ecological edge zones, where invasive species are most abundant.

2. Development of the railroad grade as a hiking trail that links to the regional trail system. The railroad grade is discontinuous, in part due to construction of Highway 213, and in part because it crosses private land. The trail design concept identifies reconnection alternatives at key points.

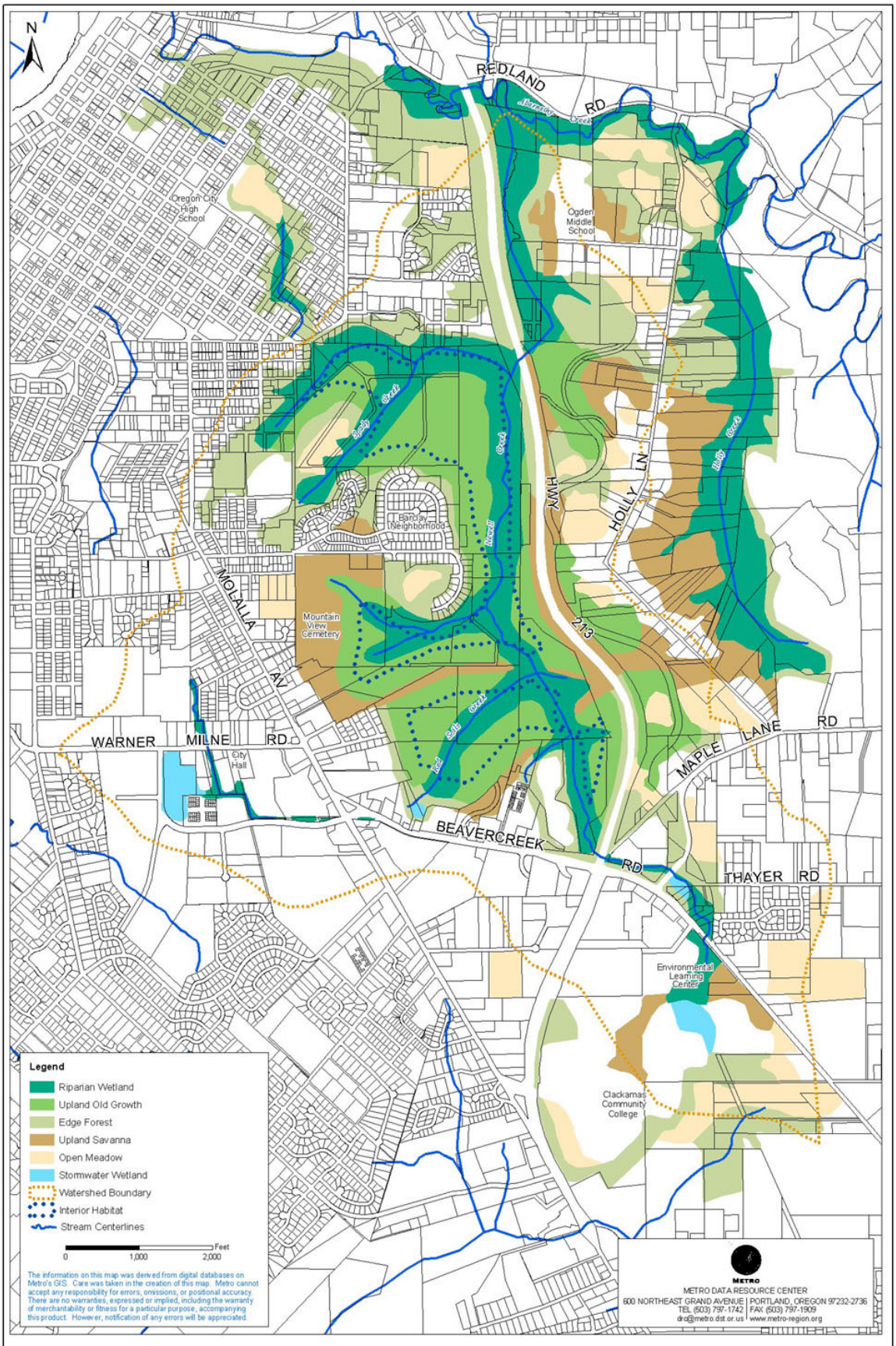
3. Designation of a bicycle route system that goes around the outside edge of the watershed, using Holly Lane on the east and several local streets on the west. In addition, there could be improvements made to the bicycle route along Highway 213, possibly including landscape separation in some areas. The bicycle route system connects with the CCC campus.

4. Consideration for creating a stewardship trail network to provide access to sites for water quality monitoring, habitat improvements, and vegetation management. This network, while linked to the recreation trails, should be designed in a way that obscures entry points. It could include "private trail," or "trail closed" signs to discourage un-authorized use. Generally, stewardship trails go deeper into the canyon, and allow access to streams and ponds. We included several stewardship access points along Highway 213 in order to facilitate water quality and quantity testing. These sites may require steps to negotiate steep highway embankments

We recommend that the west side rim trail network be a high priority for development, perhaps through an Oregon City and Metro joint ventureship. This area has poorly built existing "demand" trails, and will draw use by area. Public land purchases are nearly complete, and rim development proposals offer opportunities to create initial access points.

Existing Newell Creek Trails

Vegetation Management



Newell Creek Watershed

Vegetation Management

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Vegetation Management

Background

Historically the canyon appears to have been primarily old growth conifer forest, dominated by Douglas fir and western red cedar. There was likely a significant hardwood component that included big leaf maple, red alder, and black cottonwood trees. Hardwoods were most likely found along streams and wet areas, and in areas of recent disturbance, such as debris flows. Big-leaf maple is shade tolerant, and probably grew underneath taller Douglas fir, western hemlock, and western red cedar. Years of logging, road construction, agriculture, power line location, and urban development along the canyon rim have gradually taken a toll on the native forest. At present, the canyon is still mostly forested, but the trees are much smaller, and hardwoods are dominant over conifers. Red alder may be the most abundant and widespread tree. Douglas firs are scattered in several locations. Western hemlock is hard to find. Western red cedars are still abundant in the lower canyon, near the main stem of Newell Creek, but there are few large trees. A few rare Pacific yew trees stand proudly along trails, possibly the last of their kind in the canyon.

Invasive weeds are abundant, particularly along forest edge areas and the highway corridor. English ivy is found throughout the canyon, but appears to be most abundant in the northwest area. Newell Creek has all of the "top five" invasive weeds found in metro area urban watersheds. These include: English ivy, Himalayan blackberry, Scots broom, Reed canarygrass and Japanese knotweed.

Trillium in Newell Creek

This patch of knotweed is on city property just outside the watershed.

Managing Plant Community Succession

Because of past disturbances and the presence of invasive species, forest successional pathways are quite uncertain. If managers leave the forest alone, it may or may not grow and develop in ways that optimize wildlife habitat, recreation, and public safety. If managers choose to intervene, it is important to set clear goals and treat projects within an adaptive management framework.

Wildlife Habitat

Wildlife in urban natural areas have diverse habitat needs. Some species need dense shrub cover for nesting. Others need relatively open habitats for foraging. Standing dead trees, or "snags" and down logs provide critical nesting space for many species.

Public recreation and safety

Hiding cover for wildlife can also be hiding cover for illegal activities. Generally, people feel safer in and more attracted to woodlands with large, widely spaced trees and open understories, like forest glades, as compare with very dense forests. Wild land fire in urban areas is an increasing concern. Are there ways to reduce fire risk and improve the attractiveness of Newell's forest while also enhancing habitat?

Recommendations

We recommend that public land managers take an active role in directing plant community succession and development within Newell Creek Canyon, and in selected public lands elsewhere in the watershed. Within the canyon, we suggest that Metro take the lead role, given its trained natural resource staff and responsibility for most of the public land area. The Clackamas County Natural Resource program can assist Metro in providing labor to carry out vegetation management projects. In the upper watershed, the City of Oregon City, Clackamas County and Clackamas Community College all should play key roles.

We have identified six vegetation "patch types" that can be templates for directing plant succession. The map shows a conceptual plan for the distribution of each type. This map is intended as a guide, and the lines between zones are not rigid. The central idea is to have a mental picture of the desired future condition of the landscape within different parts of the watershed. Our proposed six patch types are decribed bellow.

Riparian Woodland

This is a mixed deciduous and evergreen forest with occasional canopy openings along the canyon bottom, wet meadows and scrub-shrub communities. The canopy structure should be highly variable, generally with a multi-story canopy.

Composition includes: Big-leaf maple, Douglas fir, western red cedar, black cottonwood, Oregon ash, red alder, vine maple, willows, salmonberry, red osier dogwood, and ninebark.

Management strategies: This community is mostly self-regulating. The main attention should be to eliminating or reducing the spread of reed canarygrass, possibly by planting willows and cottonwoods in existing meadows. This work may have an added benefit of providing food for the beaver colony, thus enhancing aquatic habitats.

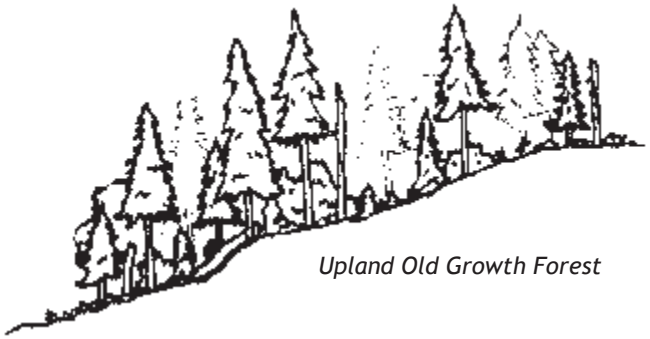
Riparian woodland

Another important activity is attacking and eliminating outlier populations of English ivy, blackberry, and other invasives.

Upland Old Growth Forest

Given the wet, shaded, north-facing orientation of much of the canyon, we believe it is possible and desirable to work towards establishment of classic old growth conifer forest. We have identified several "patches" where old growth would be an appropriate goal, for the most part on the west side of the canyon, between the riparian areas and edge woodlands.

Composition: This zone should be dominated by Douglas fir, western red cedar, and western hemlock in the overstory, with abundant big leaf maple below. Understory habitats will vary from dense shrub to fairly open



Upland Old Growth Forest

herbaceous cover, depending on soil fertility and shade.

Management strategies: Removing or reducing English ivy, underplanting alder stands with hemlock and red cedar, and planting Douglas fir in canopy gaps.

Edge Forest

The forest in Newell Creek canyon is in effect an island surrounded by developed lands, resulting in a high amount of ecological edge. Edge zones are transitions between open areas and forest. They are more subject to higher winds, weed invasions, fire, and illegal activities than is the interior forest. Consequently, management of the edge zone should reflect these challenges.

Edge Forest

Composition and Structure:

We envision a mixed deciduous and evergreen forest with a fairly open understory. Bigleaf maple, red alder, and Douglas fir should be the dominant trees. Retaining at least 50% deciduous trees will keep fire risk down. Low shrubs and herbaceous vegetation will dominate the understory, with scattered clumps of taller shrubs or small trees such as vine maple.

Management strategies: We recommend active management of this zone, including: frequent patrol and removal or containment of invasive species, thinning of very dense alder stands, cutting of tall brush, and planting of low growing native shrubs and herbs.

Open Meadow

Open Meadow

Parts of the watershed are still managed as small scale agriculture, primarily non-native grasslands (pastures, hay fields). These are important landscapes that offer cultural, aesthetic, and wildlife habitat benefits. They are found on private lands along the east side of the watershed, the edge of Highway 213, and in a few locations on the west side.

Composition and Structure: While predominately non-native grasses, these areas could be naturalized over time by adding native herbaceous species that can co-exist with non-natives. Lupine, California poppy, yarrow, goldenrod, and checker mallow are all native plants that can enhance existing meadows by providing food for pollinators, and increasing diversity. Adventurous landowners or managers could even attempt establishment of native bunchgrasses in order to emulate native prairies. These grasses include Romer's fescue, Blue wildrye, and California oatgrass.

Management strategies: Managing meadows requires one or two annual cuttings, possibly combined with an occasional (once every 5-10 years) controlled burn. If grazed, some native wildflowers, such as lupine and larkspur, should not be introduced since these are toxic to herbivores.

Stormwater Wetland Park

We have identified four potential locations for stormwater wetland "parks" within Newell Creek watershed. The first of these, northeast of the intersection of Highway 213 and Beavercreek Road, is already being developed by the City of Oregon City. A second one has been proposed at the Clackamas Community College campus, using a softball field and the Environmental Learning Center. A third is at the proposed Clackamas County administration campus in the red soils area along Warner-Milne Road. And a fourth could be developed north of the Pioneer Car Wash, or elsewhere along Beavercreek Road.

Design and Composition: We see these stormwater parks as multi-purpose facilities. First, they need to be designed to capture and retain sediments. These sediments contain the bulk of organic and inorganic pollutants. Second, they should detain stormwater flows, and allow infiltration to the extent possible. Third, they should create pockets of upland habitat for herptiles, birds, and small mammals. Fourth, they should have trails, overlooks, and offer environmental education. Designs for each park must be site specific, but could include a maintainable silt capture area, emergent (grassy) wetlands, ponds, shrub (willow/dogwood,) and forested wetlands.

Stormwater Wetland Park

Management Strategies: We view these as components in the city's stormwater and open space network. Oregon City should take a lead role in working with CCC, Clackamas County, and other agencies in securing grant funding, and on site maintenance.

Upland Savanna

A savanna is usually defined as grassland with scattered trees. Oak savannas were widespread in the central Willamette Valley prior to European-American settlement. As far as we know, there were no savannas in the Newell Creek watershed, although there were oak woodlands.

We believe that active restoration and management of oak savannas in some parts of the watershed makes sense, given that landscape conditions have permanently changed. For example, the Highway 213 and power line corridors must remain open. Clackamas Community College, Ogden Middle School and Mt. View Cemetery also are designed and managed as open, grassy landscapes with scattered trees, essentially providing similar ecological characteristics as savannas.

Composition: Open canopy consisting of Oregon white oak, Ponderosa pine, Douglas fir, madrone, bigleaf maple, oceanspray, serviceberry, camas, hazelnut, vine maple and bunchgrasses.

Management strategy: Mowing, brush cutting, planting and aggressive, sustained control of invasive plants.

Upland Savanna

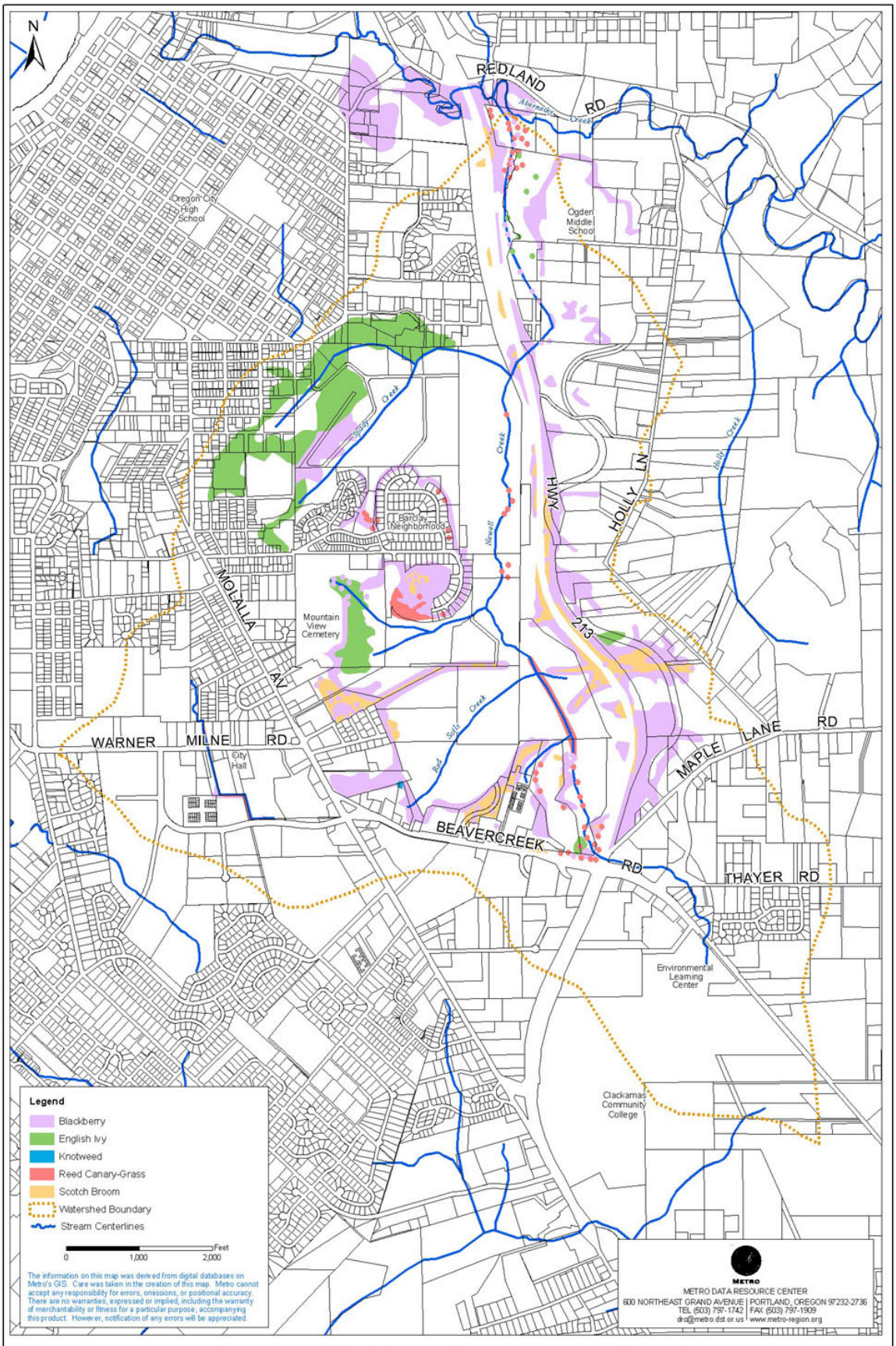
Urban Forest Canopy

Protection and expansion of an urban forest canopy over much of the upland watershed is a key element to the health of Newell Creek. As we have pointed out in the stormwater section of this report, a tree canopy is the first line of defense for moderating stormwater flows. Tree canopies are very helpful in capturing, holding, and decreasing runoff from rain storms up to 1 inch over a 24 hour period.

At present, the urban forest canopy in Newell Creek is quite sparse. The NEMO project determined that the tree cover is less than 25% in the urbanized parts of the watershed. We recommend that an appropriate target for an urban tree canopy is 50% cover, with about 1/2 deciduous and 1/2 evergreen (conifer and/or broadleaf).

Composition and Structure:An urban forest canopy can be a mixture of native and non-native trees. It can and should also include trees with varying heights, crown widths, and leaf densities. Metro has recently published Trees for Green Streets, which can be used as a guide for developing an urban canopy strategy. Generally, the urban canopy should be thought of as a green cover for parking lots, streets, and other hard surface areas.

At least three elements are needed to develop and retain a 50% urban forest canopy. First, Oregon City is the entity that must take the lead role. Second, the city needs new ordinances that protect existing trees. Third, a tree planting program should be initiated that includes a design and implementation component. Friends of Trees in Portland is a potential resource that could be a partner in this effort.



Newell Creek Watershed

Invasive Vegetation

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Invasive Plant Management

Invasive plants are those that originated outside of our region that have the ability to naturalize, spread rapidly, and in many cases out compete native plants. In most cases, they enter the ecosystem through disturbances like land clearing, logging, road construction, and farming. Some are introduced to the area deliberately, for gardening, erosion control, or as agricultural crops. Invasive plants are one of the most critical threats to the ecosystem of Newell Creek Canyon. It has all of the "top five" invasive weeds found in the Portland urban watersheds. These include: English ivy (Hedera helix), Himalayan blackberry (Rubus discolor), Scot's broom (Sarothamnus scoparius), Reed canarygrass (Phalaris arundinacea) and Japanese knotweed (Polygonum cuspidatum).

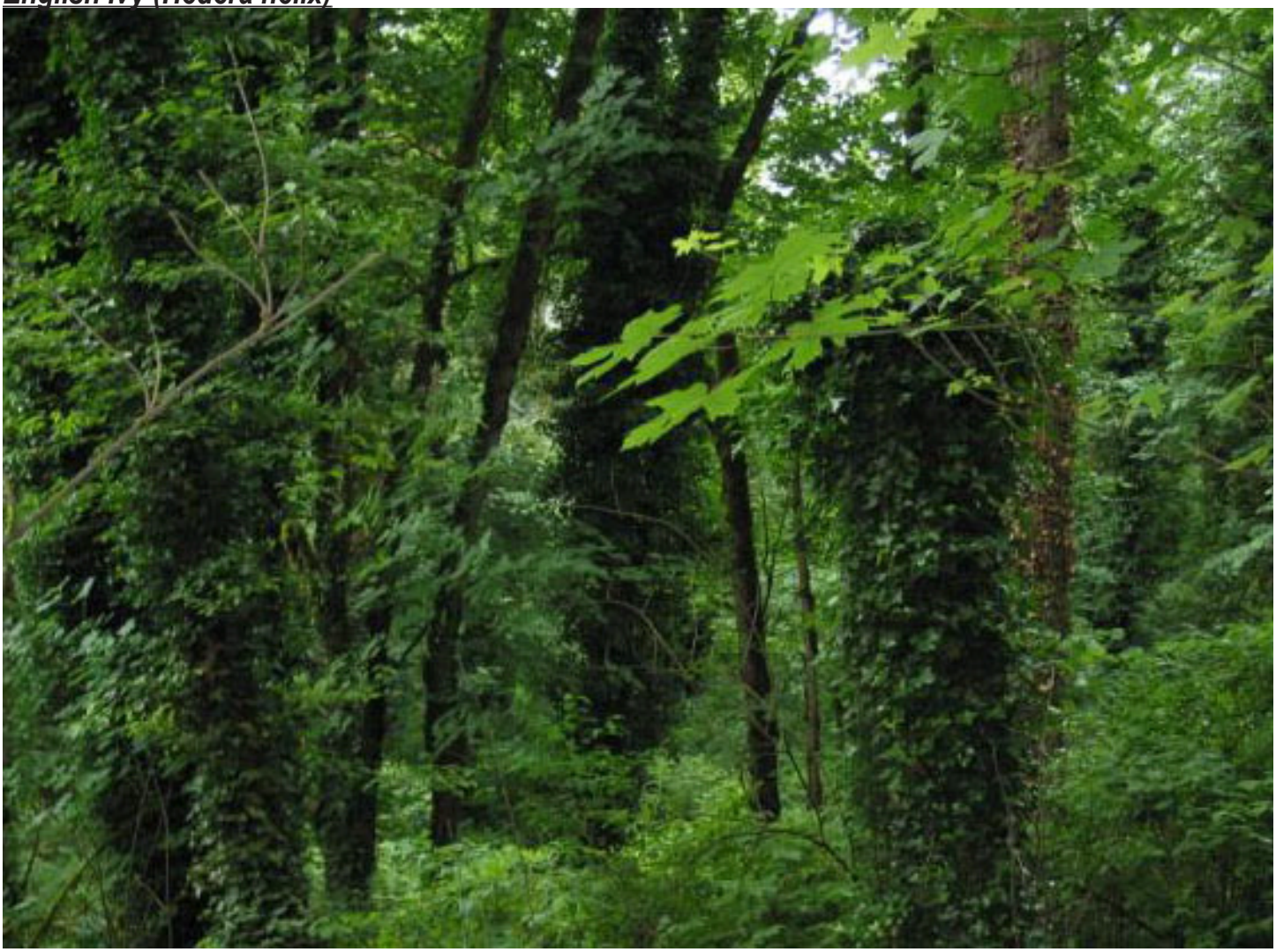
The map on the preceding page shows a generalized invasive species distribution. We did not gain access to all parts of the canyon, but this map provides a reasonable estimate of where invasive species are concentrated. The upland edge zones appear to have the highest concentrations of blackberry and Scots broom. This is not surprising, in that they are sun loving plants that thrive on disturbance. The power line corridors are almost completely dominated by these species.

English ivy, by contrast thrives in shady areas. It appears to be able to spread into formerly undisturbed locations as a consequence of birds eating their seeds. We found areas with very high concentrations of ivy, particularly at the Spady property in the northwest part of the canyon. Sha Spady is taking measures to control ivy, but the extent of the problem is likely far beyond her ability to get ahead of it without outside help. We also found "outliers" of ivy deep into the canyon.

Reed canarygrass is limited to sunny, wet areas. We found large monocultures in meadows behind the beaver dams along the main stem of Newell Creek. Canarygrass spreads into disturbed and undisturbed open habitats. Its seeds are carried by water. It is very difficult to eliminate or control. Japanese knotweed is found in only a few locations along the canyon rim. This is also a very difficult species to get rid of once it is established. We also found English holly scattered in the forest understory. While this is considered an invasive species, it is less threatening than the others listed.

Control Strategies

English Ivy (Hedera helix)



English ivy blankets shady portions of Newell Creek Canyon.

The information below comes mostly from Nature Conservancy sources. English Ivy (Hedera helix) is an aggressive, climbing vine native to Europe. It was brought to North America in colonial times, and has been widely planted in the Northwest as an ornamental plant. Ivy has become widespread in urban woodlands, in part due to planting and in part as a result of birds eating seeds and dispersing it. Once established, it smothers native groundcovers, climbs trunks, and spreads throughout canopies, often resulting in the toppling over of trees. Left alone, it has the ability to completely transform woodland ecosystems, and has been called the "kudzu" of the Northwest. Many thousands of trees in the Portland area alone may be lost to ivy if it is left unchecked, and the Newell creek canyon is clearly at risk. English ivy grows easily in many types of soil and in sun or shade and is fairly drought tolerant once established.

Ivy transforms natural areas into near monocultures, which are poor habitat for wildlife. Areas dominated by ivy typically have lower diversity of birds, mammals, and amhibians, yet provide good habitat for invasive Norway rats. Most native birds do not eat ivy berries, though introduced English starlings do. Contrary to popular opinion, ivy is a poor choice for erosion control on steep slopes. It is shallow rooted and prone to failure at the contact zone.

English ivy ground hugging immature stage.

English ivy in mature fruiting stage.

English ivy can be effectively controlled and eliminated by proven techniques, including manual, chemical, and biological. Manual techniques include hand pulling, chopping, and digging. Experience shows that manual control takes 300 to 1300 hours of hand work per acre on heavily infested areas. Thus either substantial numbers of volunteers or quite a sum of money is required for manual control. A conservative estimate would be that Newell Canyon has 100 acres with partial or complete ivy cover. Thus 30,000 volunteer hours or $200,000 would be needed, at the low end, to substantially eliminate ivy. A first “attack” can reduce ivy from 80% cover to around 5%, with a second attack (20-60 hours labor) getting cover down to 1%.. There are many variables in how manual ivy removal is done, depending on the character of the site, and the presence or absence of native plants.

The Nature Conservancy has found that chemical control, done during sunny periods in winter, can be quite effective, inexpensive, and gentle on nearby native plants. Glyphosate (Roundup or Rodeo) and Triclopyr are both effective. December to late January is the best time to apply herbicides on ivy in the Portland area. One can expect a 95% kill rate from a single application. It takes 2-4 hours, and costs $100-$500 per acre.

After initial treatment,, periodic monitoring and removal of sprouts is recommended. It will take several years of work to completely eradicate ivy from an area.

Himalayan Blackberry (Rubus mneriacus, R.discolor)

Blackberries are delicious but expand infestations when scattered by birds.

Himalayan blackberry is sprawling, hardy, semi-evergreen shrub related to the rose. Blackberry can form impenetrable prickly thickest in open areas, including; river flats, former pastures, power line corridors, roadsides, ditches, and fence lines. Himalayan blackberry actually originates from Europe, and was introcuded to North America in 1885 as a cultivated berry crop. It became naturalized in the Northwest in the mid 20th century. Once established, it easily spreads and can form permanent thinckets that prevent establishment of native trees and shrubs. Blackberry needs full sunlight to become established, flower, and fruit, and can persist in partial shade.

Blackberry plants form viable seed in the second spring after they begin. They can spread from root canes by layering; from stem cuttings; and from seed dispersal. The seeds are dispersed in a number of ways, dropping to the ground from the cane in the general area by wind or other disturbance, eaten by omnivores or eaten by birds. Seeds passing through the digestive tracts of birds may have the highest potential for successful germination.

There are many methods for removing blackberries, depending on site conditions, budget, and available labor. On relatively flat sites a tractor with a rake attached can be dragged through fields of blackberry. This will remove the plant structure and pull some of the rhizome balls to the surface. The clippings should be piled and burned on site if possible. Hand removal of rhizome balls and other plant remnants should follow the tractor work. Once blackberry is completely removed, it is important to replant the area with suitable native vegetation. If vigorous resprouting occurs, periodic mowing or intensive grazing by goats or donkeys will keep it from forming thickets and fruiting. Mowing or grazing for several years will exhaust the food supply of the root system.

On slopes too steep for tractors, more hand labor is required. A mechanical weed eater can be used to mow down blackberry thickets, which can be followed by digging or hoeing of rhizome balls. Also, well-timed herbicide applications may be used to spray on the base of root canes or on re-sprouts. Ultimately, the goal is to remove or kill all of the root crowns in a given area, follow up to eliminate re-sprouting from leftover pieces, and revegetation with fast growing native plants that will produce shade to discourage further blackberry invasion. Costs of blackberry control are as follows:

- Broadcast herbicide: $250-300 per acre
- Tractor clearing: $250-500 PA
- Spot herbicide: $250-500 PA
- Hand did root crowns: 300- 1000 hours per acre
- Weed eater clearing: $1000 per acre
- Youth crew hand clearing: $1000 per acre

Scots Broom

Scots Broom (Cytisus scoparius)

Scots broom is a perennial shrub of the pea family. It is known to Oregonians for its profuse, bright yellow flowers, which bloom between April and June. It grows in open, sunny areas, particularly along roadsides and in powerline corridors. It also inhibits reforestation in clearcuts, and invades pastures, meadows, and remnant bunchgrass prairies. Scots broom is native to the British Isles and much of Europe. Broom is very aggressive, spreads rapidly from seed, and grows dense and tall. Seeds can remain viable for up to 80 years. It prefers dry sandy soils in full sunlight. Native wildlife suffers as a result of Scots broom because it shades out understory forbs and reduces foraging opportunities. In Newell Creek, Scots broom is primarily found in power line corridors, along the roadside of Highway 213; and along disturbed edge zones in the upper part of the canyon.

Scots broom can be successfully controlled with hand labor, machinery, grazing animals, herbicides, or combinations of these. As is the case with ivy and blackberry, choice of method depends on site conditions and budget. The long-lived nature of the seeds means that in areas where brooms have existed for some time, a long term commitment to control is needed. Broom plants up to about 3 feet tall can fairly easily be pulled froom moist soil by hand. Larger plants can be extracted using a weed wrench or grubbing tools. In cases where plants are large, cutting first with chain saws, brush cutters, or clippers helps clear space for digging. Cutting done during the dry season prevents most re-sprouting. Once broom has been puled from an area, plan on at least two seasons of follow up in May-June to remove newly sprouted plants before they can set seed. Hand cutting and clearing works best in areas where there are competing native plants that can be released.

In areas with gentle topography, pure broom and no native plants, tractor mowing done repeatedly can be effective. The best time to mow is when the plants are setting flower.

Prescribed buring can be effective at broom removal, particularly when combined with follow up herbicide and/or hand pulling. Burning stimulates the seed bank, so expect a sea of young broom the year after the first burn. Herbicides can be effective in killing broom, but glyphosate (roundup), is not very useful.

Grazing is generally not a good way to control broom, since it is unpalatable to most livestock. Angora and Spanish goats have proved to be effective in eating young broom in California, but desirable native plants must be protected. Chickens have also proved effective in smaller areas (less than one acre) of infestation.

Cultivating a forest to grow over the top and shade out broom is considered to be an effective method of control. Salal may inhibit broom growth by releasing chemicals into the soil that broom does not tolerate. Costs of broom control are similar to those for blackberry.

Reed Canarygrass (Phalaris arundinacea)

Reed canarygrass is a perennial grass that forms dense, persistent, thick sods in open wetlands, moist meadows and riparian areas. It is native to Europe and some river systems in the Rocky Mountains. The canarygrass that has become established and invasive in the Northwest is a European cultivar bred for its aggressive growth habit. It reproduces through the spreading root system, or by seed. The foot thick sod layer found in reed canarygrass meadows crowds out most native plants, and provide little value to wildlife.

Extensive reed canarygrass meadows in Newell Creek Canyon have benefited the stream ecosystem in the sense that they have captured and held silt, but the displacement of riparian native plants is problematic for wildlife, and will continue to inhibit the development of riparian forest if left untreated.

Reed canarygrass is difficult, but not impossible to control and eliminate from an area, but it takes 5-10 years of continuous effort to be successful. A five step method is recommended, as follows:

1. Kill and remove existing reed canary plants, including the root/rhizome system.
2. Exhaust the seed bank
3. Replant if the site has had canarygrass for more than 5 years. If less, then natural regeneration of native plants will probably be sufficient.
4. Prevent new canarygrass from extablishing
5. Monitor and treat as needed.

Small patches of canarygrass can be dug by hand though plants must be disposed of to prevent re-sprouting. Repeated mowing to prevent flowering, followed by herbicide treatment, can eliminate canarygrass from larger areas. Tillage, followed by flooding, is effective where water levels can be controlled. Solarization, where the grass is covered by black and then clear plastic, is effective at canarygrass elimination. Shade cloth can be used instead of plastic. Herbicides are effective on canarygrass, but since these are wetland sites, care must be taken to only use chemicals approved for aquatic systems.

Reed cnarygrass can be shaded out with densely planted, fast growing hardwoods where the goal is to establish forest or woodland. Alder and cottonwood appear best suited for this purpose. Dense native grassland vegetation can prevent canarygrass from re-colonizing. In areas submerged for much of the year, canarygrass is at a disadvantage to native emergent wetland plants.

Japanese Knotweed (Polygonum cuspidatum)

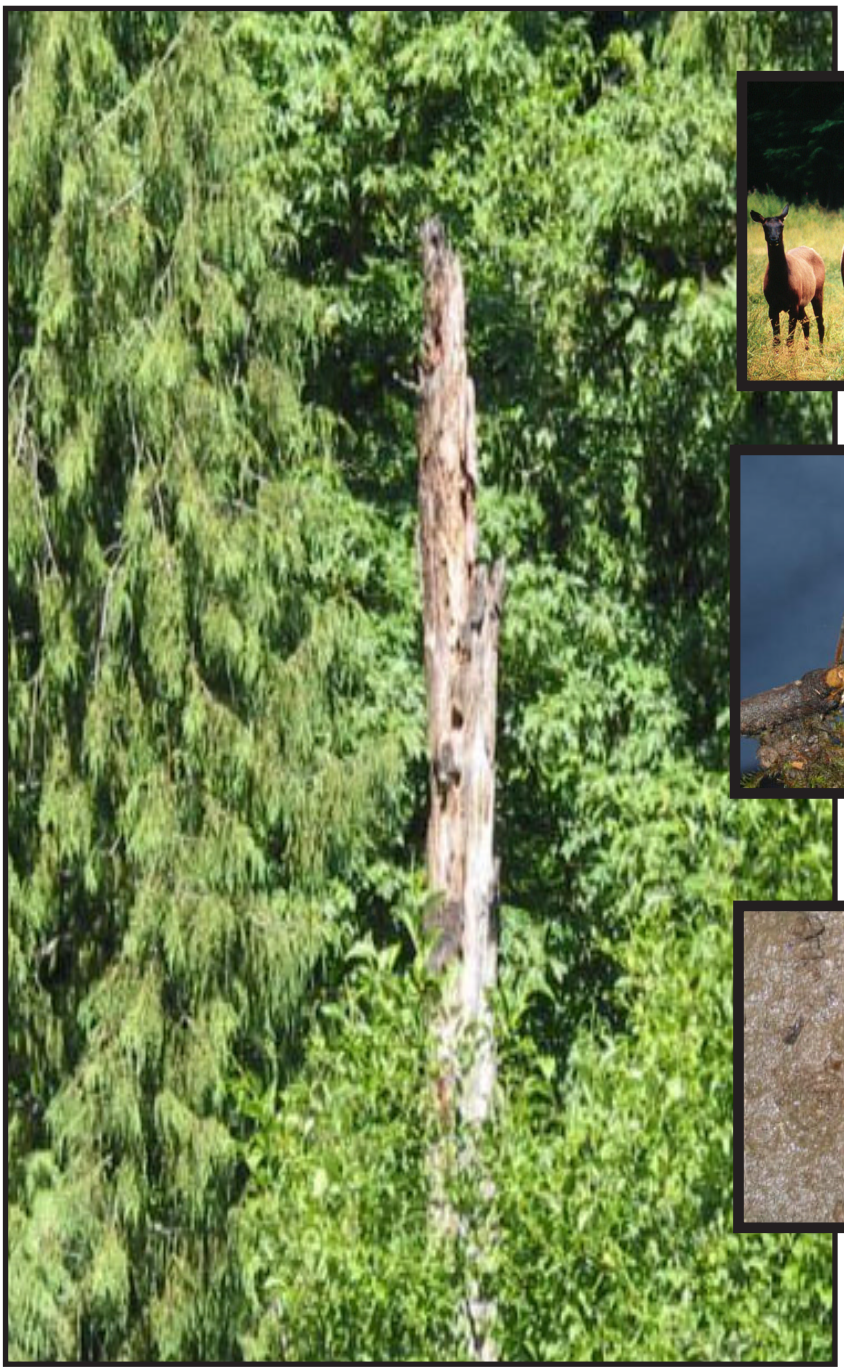
Japanese knotweed thicket in Upper Canyon

Japanese knotweed

Japanese knotweed is an herbaceous perennial that forms large clumps 1-5 meters high. Its stout stems are hollow and bamboo-like and contribute to the plants arcing form. Knotweed can reproduce by seed or large rhizomes which may reach a length of 5-6 meters. The knotweed forms a monotypic stand, which can take over native plant areas and reduce wildlife habitat. It dies back to the ground with the first frost, leaving a thicket of dead stems behind.

Japanese knotweed is very difficult to control or eliminate, particularly without herbicides. Cutting back the stems has proven to be ineffective, unless done on a monthly basis for up to 3 years. Covering and solarization techniques do not work well on knotweed, since it grows up through the cover. Smal patches can be dug out, though expect multiple efforts to be needed, since even the smallest root fragments left behind wil sprout.. Herbicides can be effective, particularly when applied to freshly cut stems. No matter what method is used, knotweed control will require multiple passes and long term monitoring.

Managing Wildlife Habitat



Managing Wildlife Habitat

Background

The Newell Creek Watershed offers a relatively high quality habitat, given its urban context. With nearly 700 acres of mixed evergreen and deciduous woodland, there are a large number of wildlife species that can find food and shelter. These potentially include: 18 amphibians, 149 birds, 76 mammals and 21 reptiles associated with urban woodlands.

There is limited data regarding species use of Newell Creek Watershed. Local residents have shared their observations from direct sightings or signs. These indicate that the canyon has black bear, elk, deer, cougar, bald eagles, and pileated woodpeckers at least as visitors if not residents. City Commissioner Doug Neeley has seen red legged frogs as well as Pacific giant salamander, a species that indicates very high quality stream habitat. OSU students did an amphibian study of a few sag ponds, which confirm that red-legged frogs are present.

In summer 2001, Adolfson and Associates conducted a survey of fish habitat and species presence within the main stem of Newell Creek. 381 fish were detected, including 11 species. Of these, there were three species of native salmonids:

- 48 Cutthroat Trout (Oncorhynchus clarki)

- 43 Rainbow Trout / Steelhead (Oncorhynchus mykiss)

- Coho (Oncorhynchus kisutch)

The greatest number were found in the middle section of Newell Creek.

These observations demonstrate that conservation of wildlife habitat is a legitimate and important goal in the future management of Newell Creek Watershed. In the following pages we recommend specific objectives in managing and restoring habitats in Newell Creek Canyon, and elsewhere in the watershed.

Central reach of main stem Newell Cree displays high quality habitat

Anchor Habitat Areas

Initial conservation efforts should be focused on three "anchor habitats." Anchor habitats are those areas with the highest qualities, or that represent rare features. The three anchor habitats are:

1. The middle section of Newell Creek and its associated riparian zone
2. The beaver ponds and associated meadows and thickets
3. Sag ponds (wetlands) along the base of the west escarpment

The central creek and sag pond habitats are relatively pristine, and should be protected from human intrusion or disturbance. The sag ponds are located near where trails are recommended. If the rim trail is built, it should be elevated as a boardwalk as it crosses along sag ponds. The central creek area has been protected through Metro land acquisition. The trail plan calls for keeping and keeping recreational trails away from this area. The beaver ponds and meadows are subject to invasive weed encroachment and may require a degree of active management. Alder, cottonwood, and willow planting in the canarygrass meadows is recommended, in part to provide food for the beavers.

Raccoon tracks in the middle reach.

Bobcat tracks in the middle reach.

Key Habitat Linkages

Habitat linkages are narrow zones that allow wildlife to expand their range, aggregate several habitat patches, or disperse to new areas. In the absence of habitat linkage, the forest in Newell Creek is in danger of becoming an island with limited capability to support large mammals or to allow genetic replenishment for multiple species. We have identified six key habitat linkage points within or adjacent to the canyon, noted on the conservation strategy map).

These linkage points are:

1. The confluence of Newell and Abernethy Creeks.
2. The 14 foot Newell Creek culvert under Highway 213.

3&4 Two places along Holly Lane where woodland cover nearly links a parallel riparian area

5. The culvert at Highway 213 that leads to the creek branch from the Environmental Learning Center.
6. A gap in forest canopy between the canyon and Singer Park in the northwest part of the watershed.

This culvert under Highway 213 is a critical link across the canyon.

Each of these linkage points has different characteristics, and there are several measures that could improve the function of these wildlife linkage points, as follows:

1. Install a light shaft in the 14 foot culvert. Research shows that animals need to be able to see to through the other side of culverts and passages to use them.
2. Improve habitat adjacent to this culvert by reducing invasive blackberries and establishing "edge" forest.
3. Consider installation of fencing at both ends of crossings to guide wildlife away from the highway and through the culvert.
4. Work with County planners and local property owners along Holly Lane to find ways to retain woodland character at key points.
5. Replace the Beavercreek Road Newell creek culvert just north of the ELC to better facilitate habitat linkage

Additional Linkage recommendations:

1. Establish a new wildlife crossings at Highway 213, about 1/8 mile nirth of the Beavercreek Road intersection.
2. Develop a monitoring system for major wildlife crossings in order to document crossing usage and to collect data for future projects (partner with school).
3. Use natural bottoms for new culverts utilized for wildlife and stream crossings. "Floor" material should be chosen with respect to adjacent natural conditions.
4. Protect surrounding habitat leading up to crossings from noise, road dust, and headlights to the extent possible by use of earth berms and plantings.
5. In areas where individual wildlife crossings are located, provide fencing at both ends in a wing pattern to guide wildlife into crossing.

Herptiles

Reptiles and amphibians face daunting challenges in migrating from one area of the watershed to another. Roads, particularly Highway 213, present significant barriers to their movement. While salmon are the focus of legal protection, it is important that upland creatures as well as aquatic be given consideration. The migration needs of herptiles should be factored into any highway construction or repair. In addition to improved culverts, migration tunnels could be bored under the highway at key locations.

This is a turtle-eye view of Highway 213

Culvert at Highway 213 and Beavercreek Road could provide Herptile passage

Habitat Improvement Projects

The most effective habitat improvements in Newell Creek Watershed will be a result of vegetation management and stormwater recommendations found earlier in this report. By focusing attention on invasive species control, gradual development of old growth forest structure, forest edge, and oak woodland plant communities, land managers will be improving habitat for many wildlife species.

Given that the central section of Newell Creek is at present in good condition, the main issue is securing protection. This means public ownership of as much of the area as possible, keeping recreation trails away, and taking measures to prevent future stormwater impacts.

High school student cutting ivy

Streambed in upper reach showing little woody structure.

Once the habitat in the central canyon is better secured, then efforts to expand aquatic habitat downstream and up should be initiated. Placement of large wood or simulated large wood could be combined with riparian improvements. The confluence of Abernethy and Newell creeks is an area that could benefit from wetland and floodplain restoration, if public ownership is secured. Wetland improvements at the CCC campus and at the County Administration site will improve local habitats away from the canyon, as will development of an urban forest canopy.

Beaver as a Keystone Species

The presence of beavers is strongly linked to conservation of anadromous fish in Newell Creek. The Adolfson field study identified multiple beaver dams directly upstream from the creek's highest quality fish habitat. It is likely that these dams have trapped silt and moderated storm water flows, thus protecting downstream habitat.

Students from PSU and UO confirmed the presence of beaver dams, noting a total network of nine in the upper mainstem.. A recent field study by Metro shows that one or more of these dams has been lost, but several remain active.

Beavers are a “keystone species” because they create or maintain habitats for other species that would not exist in their absence. Brian Vaughn, from the Wetland’s Conservancy, is conducting a field study of the role of beavers in sustaining wetlands in the Portland area. His field work will include Newell Creek. Recent Forest Service research shows that steams with active beaver populations and dams have larger summer rearing coho populations. Downstream sediment loads can be reduced by 90%. Since beavers haul their food to their dens, and only eat a small portion of what they cut, they end up contributing a large amount of wood to the aquatic ecosystem. Portions of the stems they cut may embed in banks, take root, and then generate new stands of willow, poplar, aspen, or alder. Willow dominated habitats, which are common near beaver ponds, have small mammal densities 3 times higher than in nearby, non-willow habitats.

Providing Large Wood

Numerous studies by ecologists point to the important role of large wood in sustaining stream and upland ecosystems. Within streams, Large wood dissipates erosive energy, stores sediment and nutrients, and forms critical habitat features. A diversity of wood size and shape (e.g. branches, trunks, root wads) creates debris dams and pools, log jams, and bank features. Large wood helps a stream create and maintain pools, riffles, eddies, side channels, meanders, and areas of habitat cover. Together, these features represent habitat complexity and are critical for trout and salmon at all life stages. In addition to creating habitat, large wood controls the way water flows through streams, deposits sediment, dissipates overall water energy, guards stream banks, and stabilizes stream beds by preventing downcutting.

The central reach of main stem Newell Creek has significant amounts down woody debris, but this is not true for the rest of the stream, nor the upland of the canyon. In upland areas, the lack of large standing and down dead trees is a result of past logging, which took the biggest trees for lumber. The absenceof large trees and snags (standing dead) limits the amount of cavity nesting space for birds and mammals. Clearly, large trees are a feature only time can provide. As an interim measure, large woody debris can be added to the creek at some expense. In the upland areas, snags can be created by girdling trees, particularly hardwoods, thus opening space for conifer regeneration. Standing dead trees or "snags" are important habitat for cavity-nesting birds, bats and many other creatures.

"Epifaunal substrate" otherwise known as wood in the stream.

STEWARDSHIP

STEWARDSHIP

Background

This section will address the question of responsibility for recommended conservation and restoration activities. Watershed conservation is still a very new activity in our region. While there is a great deal of interest in protecting and restoring watersheds, we still do not have the political and financial measures in place that would more easily support these efforts. Consequently, we need a strategy that harnesses dispersed community and governmental resources towards common objectives.

The Challenge

The 1800 acre Newell Creek Watershed lies partly within Oregon City, and wholly within Clackamas County. Metro has the largest amount of publicly owned land. The Oregon Department of Transportation manages the facility that has the greatest environmental impact-Highway 213. Oregon City manages the urban stormwater that is the greatest threat to the creek. The majority of the land area is owned by private parties. Three local schools and one college are wholly or partly within the watershed. The Clackamas County Natural Resource program has skills and labor that can help manage forest vegetation, but has no land base in the watershed.

City of Oregon City

Recommendations:

In order to conserve and restore Newell Creek, all of these agencies, local schools, and interested landowners will need to share responsibilities. We have developed a conceptual stewardship matrix that suggests who might take on aspects of work in the watershed. We view this as a starting point for discussion. We tried to match available skills and interests with the tasks that are needed. We did not attempt to break these tasks down into work programs or budgets. Each entity needs to evaluate whether they are willing and able to take on any particular task.

One of our key recommendations is that the City of Oregon City establish a natural resource staff position, and that one responsibility of this position would be to coordinate watershed conservation efforts. We know that the city is experiencing budget problems, but we believe that a well-designed natural resource position could be at least partly funded through grants and partnerships.

Over the years, citizens and professionals who have expressed interest in Newell Creek have suggested developing a watershed council. Newell Creek Watershed is much smaller than watersheds sanctioned under Oregon Watershed Enhancement Board. As an alternative, the Clackamas soil and Water Conservation District has initiated efforts at establishing a "Greater Oregon City Watershed Council", including Abernathy, Beaver, and Parrot Creeks. Once established, this Council may be able to assist in conservation efforts, including monitoring, volunteer projects, and coordination of agency activities.

A further option would be to identify or establish a non-profit organization for oversight of Newell Creek that could formalize partnerships between various interests and engage the community in watershed education and activities. As the future of the Environmental Learning Center is evaluated by Clackamas Community College Administration, this potential role should be given strong consideration. Oregon City, Metro, and Clackamas Community College have much to gain and clear incentives for exploring this option collaboratively.

Stream Monitoring

Educational Outreach

Newell Creek Canyon offers many outstanding hands on educational opportunities for local schools. Initially, students might concentrate on invasive weed removal, species (plant and animal) inventories, restoration projects and water quality and quantity monitoring.

Local Schools of Interest:

- Portland State University
- Clackamas Community College
- Rex Putnam High School
- Oregon City High School
- North Clackamas Christian High School
- Ogden Middle School
- Gardiner Middle School
- Gaffney Lane Elementary School
- Mt. Pleasant Elementary School
- St. John The Apostle Elementary School
- North Clackamas Christian Elementary School

Community Volunteers Remove an abandoned Car from Newell Creek

Report Summary

This document has been written to pull together known information about the Newell Creek Watershed, and to suggest an initial strategy for conservation and restoration of key natural resources, particularly forest habitat and streams. It is not intended as the "final word" on this issue, nor is it intended as a "master plan." The authors intent is that this information serve as an owners manual , like the one that comes with a major appliance or automobile. It identifies the main parts, and provides a troubleshooting and maintenance schedule of sorts. But unlike an appliance, the Newell creek Watershed is a complex and dynamic ecosystem that will continue to grow, develop, and change with or without the direct intervention and stewardship of the government agencies, educational institutions, residents, and businesses who have ultimate responsibility for the condition of the area.

Though Newell Creek has been where it is for many thousands of years, in a sense the surrounding community is only beginning to discorvert, exploret, learn about, and take responsibility for it. There are a number of signs of hope that the various parties who have taken an interest in the area are beginning to form a team.

· Oregon City is now keenly aware of the urban stormwater issue, and is very active in devising strategies for preventing future impacts, and fixing some existing problems that developed prior to recent protective measures were enacted.

· Metro has completed its land acquisition in the canyon, and has begun active stewardship of aquatic and forest habitats, including weed bashing and planting of native trees.

· Clackamas Community College, Portland State University, and some local schools have initiated ecosystem monitoring, including water quality and quantity, and the role of beavers in aquatic health.

· The Clackamas Soil and Water Conservation District has initiated efforts to form a local watershed council that will include Newell Creek.

· Some landowners have initiated stewardship on their own properties, particularly weed bashing. In addition, other Oregon City residents are pitching in with volunteer efforts.

There is much more to be done. Oregon Department of Transportation and PGE need to do more to control invasive plants within their right of ways. Oregon City should develop an urban forest program for the upper watershed. Clackamas Community College needs to implement the stormwater strategy for the Inskeep Learning Center area. A trail network needs to be built in order to generate more community interest in conservation of the canyon. We are confident that these and other measures will be undertaken in due time. The value of the forest, creeks, and open space will only grow as the years pass.

Appendix

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