ORENCO WOODS NATURE PARK

Approvals for Site Conservation Plan

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* Please redline any modifications

JAS 12-16-13 I think it can use 1 summary table of priority conservation actions for 1-5 yrs

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SITE CONSERVATION PLAN

Orenco Woods Nature Park



November 2013

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SECTION 1: INTRODUCTION

1.1 Context

The Orenco Woods Nature Park sits along Rock Creek, a major tributary to the Tualatin River that drains the Tualatin Mountains and much of the urban centers of Hillsboro and Beaverton in Washington County, Oregon. Despite being located in an urban area, Rock Creek provides important habitat for federal endangered species act-listed winter steelhead as well as other sensitive species such as lampreys and resident cutthroat trout. Rock Creek and its riparian habitats also provide habitat for western painted turtles, western pond turtles and numerous species of birds and mammals.

The Orenco Woods Nature Park Site Conservation Plan is a tool for assessing, protecting and enhancing the unique characteristics of the site while facilitating access by the public. This conservation plan has been developed by Metro and Hillsboro staff and includes an overview of the history, existing conditions, conservation targets and recreation and public access objectives for the site.

The master plan for the nature park was developed with extensive public input over a nine-month period, and was adopted in June 2013. The master plan describes in detail the access and recreation goals for the site. The plan is available from City of Hillsboro Parks and Recreation: http://www.ci.hillsboro.or.us/parksrec/.

1.2 Goal and objectives of the conservation plan

The goal of this conservation plan is to describe a course of action that will protect and enhance the area as an environmental and recreational resource for the City of Hillsboro and the Portland metropolitan region. The Orenco Woods Nature Park is designed as a nature park that will accommodate passive recreational uses while preserving and enhancing key natural resource areas for native wildlife habitat including riparian forest, Oregon white oak savanna, a salmon-bearing stream, wetlands and floodplains.

The majority of the park will be maintained and enhanced, to the extent possible, in a manner that is faithful to its original natural condition. The park development includes context-sensitive design that balances recreational opportunities with habitat protection and restoration of the site's natural areas. Developed recreational facilities are concentrated in the northwest portion of the site and include access and parking, picnic facilities, nature-based play areas and restrooms. A trail network provides for a regional trail connection as well as looped local trails throughout the park. The park will provide opportunities for environmental education and access to some of the habitat areas as learning stations. The conservation plan primarily addresses conditions, plans and activities for the natural areas portions of the site.

To achieve this goal, the conservation plan establishes a series of priority objectives, including:

- Restore and maintain oak Savanna, riparian floodplain/forest, upland forest and native fish habitat.

- Provide opportunities for research and education to local schools and the community
- Develop appropriate funding strategies to implement strategic restoration actions.

Metro's natural areas bond acquisition program and Orenco Woods

During the last 17 years, two voter-approved natural areas bond measures have allowed Metro to protect over 14,000 acres across the region – the equivalent of more than two Forest Parks, or nearly enough land to cover the city of Beaverton. Voters have protected 90 miles of river and stream banks, opened three major nature parks and supported hundreds of community projects. Metro continues to buy land in 27 key target areas, chosen for their water quality, wildlife habitat and outdoor recreation opportunities.

In 2011, the 42-acre Orenco Woods property was purchased through the collaborative efforts of Metro and the City of Hillsboro. Most of the funding to buy the land came from Metro's 2006 bond measure, including regional acquisition funds and part of Hillsboro's "local share" money. The purchase was negotiated by the Trust for Public Land, a national nonprofit that specializes in land conservation. As was anticipated during the purchase of the property, a small parcel in the southeast corner of the site will be sold for development, with proceeds going toward development of a nature park on the rest of the property. The jointly-owned parcel adjoins an 11-acre parcel purchased by Hillsboro for a neighborhood park. These two parcels make up the 53-acre Orenco Woods Nature Park. Approximately 38 of these acres will remain natural.

Additional information about Metro's 2006 natural areas bond measure and goals and objectives for the Rock Creek target area can be found on the Metro web site, www.oregonmetro.gov/naturalareas.

SECTION 2: PLANNING PROCESS SUMMARY

2.1 Planning area

This conservation plan addresses conditions, plans and activities for the site's 38 natural area acres. A map showing the planning area can be found as Map 1 later in this document. Map 2, shows ownership.

2.2 Planning process

Developing a useful site plan means adequately providing for a site's preservation, enhancement and management. The plan will build on previous restoration and management efforts while acknowledging that evolution of the ecosystem requires analysis of the site, meaningful engagement of stakeholders and integration of historical, current and future needs. The plan includes several important elements: development of conservation targets, identification of strategic restoration actions, and identification of project opportunities.

A two-tiered approach is used to improve natural resource conservation and integrate meaningful human experiences through physical and visual access. The recognizes that the conservation of species, habitat and natural features must occur simultaneously with the provision for limited human access to these natural systems. Education and exposure are the cornerstones for protecting the natural area for decades to come. This two-tiered approach also recognizes that conservation

and access have different stakeholders, different funding sources and different strategic approaches. Initially the plan reviewed the overarching project goals and objectives common to both conservation and access. The project team then developed conservation and access strategies independently. Conservation is discussed in Section 4 of this document. Access is discussed in Section 5.

2.3 Planning project goals

The planning goals for both the natural resource conservation and access portions of this plan are listed below.

Natural resource conservation

- Map and define major habitat types.
- Establish habitat and species conservation targets.
- Define key ecological attributes and analyze stresses and sources for the conservation targets.
- Establish strategies and actions to restore habitat.
- Identify actions and implement.

Access

- Summarize and build upon 2013 Orenco Woods Nature Park master plan.
- Coordinate access and recreation action with strategic restoration and stewardship actions at the site.

SECTION 3: EXISTING CONDITIONS

This section of the conservation plan provides background on existing conditions for the Orenco Woods Nature Park site.

Past land uses at the Orenco Woods Nature Park include a golf course and a large, historic single family residence, most recently used as a group home. Prior to the golf course, the site had been part of the estate of Malcolm McDonald, founder of the Oregon Nursery Company. In 2006, the site was sold for development as the Orenco Crossings residential subdivision. The development plans faltered after the economic downturn in 2008, and in 2011 the property reverted to bank ownership. In December 2011, the site was acquired by Metro and Hillsboro with assistance from the Trust for Public Land.

Existing development at the site include a paved access drive and parking lot, the McDonald House (on a separate tax lot), and a former golf course pro shop building. All of these are located in the northwestern corner of the site. There were seven existing bridges built to serve golfers, including five across Rock Creek and two across the tributary. Due to their poor condition, four of the bridges across Rock Creek were removed in spring 2013. Lands surrounding the Orenco Woods Nature Park are predominately residential. Orenco Elementary School is located adjacent to the northwest corner of the site, and the MAX light rail line borders the site to the north.

Rock Creek flows generally southwestward across the southern portion of the nature park. An unnamed perennial tributary flows southward from a culvert under the light rail tracks and

continues southward across the central portion of the site before flowing into Rock Creek in the south-central portion. Another unnamed intermittent stream is located in the northeastern corner. The topography of the natural area is generally rolling, with moderately steep hillsides rising above the floodplains of Rock Creek and the unnamed tributary that flows south across the site. Because the site was most recently used as a golf course, existing vegetation is characterized by open, grassy areas interspersed with scattered trees, groves of mature trees, and small patches of forest and shrub-dominated communities. The largest forest patches occur along the tributary stream in the north-central portion of the site as well as along the slopes bordering the floodplain of Rock Creek.

3.1 Streams and wetlands

Rock Creek is a large tributary of the Tualatin River. The main stem of Rock Creek is approximately 19.3 miles long, and it flows into the Tualatin River at river mile 38.1. The Rock Creek watershed comprises approximately 75.6 square miles in the mid-Tualatin basin. Rock Creek drains the Tualatin Mountains as well as portions of urbanized Hillsboro and Beaverton. The Orenco Woods Nature Park is located in the middle portion of the watershed.

The reach of Rock Creek that runs through the Orenco Woods Nature Park can be described as a low gradient (<1%-3%) floodplain channel. Throughout the site, Rock Creek is moderately incised, with banks that rise approximately three to four feet above the streambed. The substrate of the stream bed and banks is comprised primarily of silt and clay soils. Habitat within the on-site reach is relatively uniform; riffles are generally absent and accumulations of large wood are relatively infrequent. A low weir across the channel backs up water within the channel and hinders fish movement during periods of low flow. Vegetation within the Rock Creek floodplain consists of a mosaic of forest, shrub communities and open, grassy fields.

The unnamed tributary that flows south across the central part of the site begins at a culvert in the northern portion and is assumed to connect to a drainage located off-site and north of the light rail tracks. The tributary is located at the bottom of a ravine that ranges in elevation from 175 feet NGVD at the top to 155 NGVD at the bottom. The top of the bank and slopes along the northern half of the tributary are forested. The topography flattens out in the southern half of the tributary where there is a forested/scrub-shrub/emergent wetland on either side of the tributary.

The intermittent stream in the northeastern corner of the site begins west of an existing culvert under Cornelius Pass Rd. and continues for approximately 54 feet west before it converges with Rock Creek. The stream is approximately 4-6 feet wide, with an average width of approximately 4.5 feet.

Five other wetland areas are present on the floodplain terrace bordering Rock Creek. Many of these wetlands are mitigation areas constructed to offset adverse impacts to wetlands on the Orenco Elementary School located west of Orenco Woods Nature Park. This mitigation was authorized by permits from the Oregon Department of State Lands (DSL Removal Fill Permit 17062) and the U.S. Army Corps of Engineers (Corps Permit Number 99-472.). Streambank enhancement plantings along Rock Creek were also included as part of this mitigation effort.

Wetlands on the site contain a mix of forested, scrub-shrub, and emergent plant communities. Several of the wetlands are crossed by cart paths associated with the former golf course. One wetland on the west side of Rock Creek in the central portion of the site contains an area of open water that was used as an irrigation pond. Water from Rock Creek was diverted into the irrigation pond by a weir and used to water the golf course. Rough-skinned newts and Pacific chorus frogs occur within this pond, and although the pond provides potential breeding habitat for red-legged frogs, northwestern salamanders and other amphibians, these species are not known to occur within the pond.

Map 3, found later in this document, details the soils, topography, streams and wetlands of the Orenco Woods Nature Park.

3.2 Major habitat types

The Orenco Woods Nature Park can be characterized by four natural habitat types: riparian forest, Oregon white oak savanna, upland forest and native fish habitat. Map 4, found later in this document, shows areas of major vegetation habitat types at the site.

Riparian forest

Healthy riparian forests protect stream water quality and help keep nearby properties from flooding. Riparian forests also provide key corridors for wildlife movement. Riparian forests are adapted to seasonal flooding and are rich with insects, seeds and fruit.

All wildlife needs water, and many species depend primarily on riparian habitats to fulfill their life history requirements. More species in the Portland-Vancouver region are associated with riparian and open water habitats than any other habitat type (see species list in The Intertwine Alliance's *Biodiversity Guide*). At least 167 native wildlife species, excluding fish, are closely associated with these habitats and another 130 make use of them at some point in their lives.

Riparian habitat conditions are moderately to severely degraded within much of the region. Widespread development and land-use activity affect habitat quality and complexity, water quality and watershed processes in lower Willamette and Columbia tributaries. Stream habitat degradation is primarily due to past and current land-use practices that have affected properly functioning stream channels, riparian areas and floodplains, as well as watershed processes.

Key plants: Native forbs found in this habitat may include Pacific waterleaf, false hellebore, nodding beggartick and skunk cabbage. Sedge and rush species found in this habitat may include slough sedge, awl-fruited sedge, dewy sedge, slender rush, common rush and spreading rush. Shrubs and trees found in this habitat may include Oregon ash, willow, cottonwood, Oregon white oak, Pacific ninebark, red-osier dogwood, red elderberry, twinberry and Douglas' spiraea.

Key wildlife: Partners in Flight identifies the following focal species for riparian shrub and tree habitats: willow flycatcher, red-eyed vireo, yellow warbler, Swainson's thrush, downy woodpecker and yellow-billed cuckoo. Other birds utilizing this habitat may include green heron, great blue heron, Wilson's and other warblers, yellow-breasted chat, black-headed grosbeak, common yellowthroat, song sparrow, ruby-crowned kinglet, downy woodpecker and red-breasted

sapsucker. Some of the wildlife species that regularly use this habitat include Pacific tree frog, northern red-legged frog, various salamanders, common garter snake, black-tailed deer, coyote and fox. Both western pond turtle and western painted turtle are known to occur in the on-site Rock Creek riparian areas.

Current extent and attributes: Riparian forests within the Orenco Woods Nature Park have been fragmented by past land uses so that under existing conditions, approximately 14 acres of forested riparian habitat are present (Map 4). Ongoing plantings and invasive species control will help improve the site's habitat diversity and structure. Specific areas would benefit by plantings to eliminate gaps or widen riparian corridors.

Oak savanna

Oak habitats provide the best habitat in the Portland-Vancouver region for 38 native wildlife species and are used regularly by at least 148 other wildlife species (see Portland-Vancouver Regional Conservation Strategy species list). These include some of the region's most at-risk species such as white-breasted nuthatch, acorn woodpecker, western gray squirrel, and rare plants such as white rock larkspur. Oak is fire-resistant and is easily out-competed by Douglas fir when fire is suppressed. Less than 2 percent of Willamette Valley oak savanna habitat remains.

Prairie, savanna and rock outcrops in the region provide the best reproductive habitat for 18 wildlife species and are regularly used by at least an additional 120 wildlife species. Combined, oak-prairie habitats provide primary habitat for 52 native wildlife species, and are used by at least 156 more. The Willamette Subbasin Plan identified 19 focal species associated with these habitat types; for all of them, habitat loss was identified as a primary limiting factor (Northwest Power Planning Council 2005).

Oak savanna is essentially prairie with a few trees per acre. Savanna is characterized by widely spaced, open canopy trees dominated by Oregon white oak. In general, the understory is relatively open with shrubs, grasses and wildflowers. In healthy oak savanna habitat, total native woody cover is typically 5 to 30 percent, and canopy architecture represents an appropriate mix of large open grown oak trees and younger tree recruitment that will replace older trees when they die. In healthy native prairie/emergent wetland habitats, native herbaceous plant species (grass and wildflower) typically compose over 90 percent of the vegetation cover, with less than 5 percent cover of woody vegetation. Emergent wetland habitat has natural vegetation structure similar to prairie.

Key plants: Native forbs found in this habitat may include camas, brodiaea lily, Oregon sunshine, large rose mallow (Sidalcea), Oregon saxifrage, large leaf lupine, tarweed, collinsia, bracken fern and yampa. Native grass species found in this habitat may include Roemer's fescue, California oat grass, tufted hairgrass, slender hairgrass and blue wildrye. In wet areas sedges, rushes, wapato and other water-associated grasses and forbs are present. Shrubs found in this habitat may include poison oak, snowberry and Oregon grape.

Key wildlife: Partners in Flight identifies the following focal species occurring in our area for grassland or savanna habitats: western meadowlark, streaked horned lark, common nighthawk, American kestrel and northern harrier. Oak focal species include white-breasted (slender-billed)

nuthatch, acorn and downy woodpecker, western wood-peewee, bushtit, chipping sparrow, Bewick's wren and house wren. Other birds utilizing oak, savanna and emergent wetland habitats may include white-crowned sparrow, rufous hummingbird, western bluebird, lazuli bunting and red-tailed hawk, as well as waterfowl, rails, herons and shorebirds in wetter habitats. Other wildlife utilizing this mix of habitats may include Pacific tree and red-legged frogs, garter snake, rubber boa, butterflies, black-tailed deer, coyote, fox and various native rodents.

Current extent and attributes: Past land uses resulted in the elimination of oak savanna habitat on the site, but large Oregon white oak trees on adjacent properties immediately west of Orenco Woods Nature Park suggest that oak savanna habitat occurred on the hilltops in the northern portion prior to site clearing. A major part of restoration efforts will be the re-establishment of oak savanna habitats in these areas. Approximately 12 acres of forested savanna habitat (Map 4) are proposed to be restored.

Upland forest

Upland coniferous and mixed conifer/deciduous forests are the dominant natural habitat of the region. Upland forest was historically common in the Rock Creek basin, but urbanization has fragmented and reduced the amount of this habitat.

Low-elevation Pacific Northwest old-growth forests typically are dominated by the conifers Douglas fir, western red cedar, and western hemlock, with grand fir and hardwood species also occurring. Under natural conditions, trees of many of the dominant species live to be 350 to 750 years old or older and frequently have diameters of eight feet or more. Plant and animal use of forests follows the changes in forests over time, with different suites of species dominating depending on forest age, canopy closure and site conditions. Biodiversity is higher in forests where some light reaches the forest floor and where standing and fallen dead wood is ample and of mixed age and size. Forests younger than 60 years dominate western Oregon due to current forestry practices, and old growth associated species' declines reflect these changes in overall forest structure across the region.

Stands of forest can be categorized by the age of trees, species and composition of understory species. Upland forests in the greater Portland-Vancouver region provide primary habitat for at least 94 species and are used by at least 129 more species (Appendix 2, Portland-Vancouver Biodiversity Guide 2012).

Key plants: Native forbs found in this habitat may include sword fern, licorice fern, false Solomon's seal, false lily of the valley, trillium, fairy bells, miner's lettuce, stinging nettle, hedge-nettle and heal-all. Shrubs and trees found in this habitat may include Pacific yew, Pacific madrone, bigleaf maple, red alder, Douglas fir, Grand fir, Western red cedar, black hawthorn, Western serviceberry, tall and dull Oregon grape, mock orange, blue and red elderberry, salal, red huckleberry, Indian plum and snowberry.

Key wildlife: Upland forest is especially important to migrating and nesting songbirds, woodpeckers, mammals such as Douglas squirrel and deer, and seasonal habitat for salamanders, frogs and turtles. Partners in Flight identifies the following focal species for coniferous forests in western Oregon: Vaux's swift, brown creeper, red crossbill, pileated woodpecker and varied thrush

(old growth and mature forests); hermit warbler, Pacific-slope flycatcher, Hammond's flycatcher, winter (Pacific) wren, black-throated gray warbler and Hutton's vireo (mature/young/pole forests); and olive-sided flycatcher, western bluebird, orange-crowned warbler and rufous hummingbird (young forests). Other birds utilizing this habitat may include Townsend's warbler, evening grosbeak, Swainson's thrush, Anna's hummingbird, cedar waxwing, bushtit, chestnut-backed and black-capped chickadee, American robin, Steller's jay, Bewick's wren, golden-crowned kinglet and Cooper's hawk. Other species may include Douglas' squirrel, common garter snake, rubber boa, elk, black-tailed deer, mountain lion, bobcat, coyote, fox, weasel and a variety of small mammals.

Current extent and attributes: The site includes 12 acres of upland forest habitat, with tree age in the range of two to 100+ years. Dominant trees in the on-site forests include Douglas-fir, big-leaf maple, western red cedar, red alder, Oregon white oak and bird cherry. The forest understory is generally well-developed with a mix of native and non-native species such as vine maple, tall Oregon grape, red elderberry, Indian plum, English hawthorn, California dewberry and Himalayan blackberry. Removal of invasive species, enhancement plantings, and reforestation of cleared areas will expand the acreage of on-site forest and increase the diversity and richness of existing forested areas.

Native fish habitat

Rock Creek has some water quality issues, including draft 2012 TMDL parameters for chlorophyll a and phosphorus. Water temperature is too warm, as documented in the Willamette Subbasin TMDL and the previous Tualatin TMDL documents. The identified beneficial uses under the Tualatin TMDL include salmon and trout rearing and migration, salmon and steelhead spawning use, and resident fish and aquatic life (Chapter 2, August 2012 draft, Tualatin Subbasin TMDL). However, Rock Creek still harbors several water quality sensitive fish species, including winter steelhead and resident cutthroat.

Key wildlife: Studies in lower and middle Rock Creek document the presence of steelhead, brook and Pacific lamprey, cutthroat and rainbow trout (Friesen 1996; Hawksworth 2001).

Current extent and attributes: The site includes 3,000 linear feet of Rock Creek, a perennial stream. Enhancing riffle-pool habitat, cobble substrate, providing some off-channel habitat and increasing woody debris all add to the site's value for native fish.

Biodiversity corridors

Native animals and plants require the ability to establish or re-establish in order to maintain healthy populations. In urbanized areas such as ours, where significant habitat fragmentation has occurred, relatively linear corridors can help meet these needs.

In 2010-2011, Metro hosted a series of biodiversity corridor workshops on behalf of The Intertwine Alliance. The results were compiled and made available to participants via a map server. The workshops gathered the opinions of wildlife and habitat professionals in the region; the results are best professional opinion only, are not meant to be property specific, and make no attempt to prioritize or assess on-the-ground issues such as barriers. Nonetheless, the information can provide valuable insight into existing and potential connectivity from Orenco Woods Nature Park to other

important habitat areas in the region. The map suggests relatively intact biodiversity corridors as follows:

- Rock Creek riparian corridor downstream to Noble Woods Park and Rood Bridge Park on the Tualatin.
- Rock Creek riparian corridor upstream to Orchard Park and the Tualatin Mountains.

Climate change adaptation considerations for Orenco Woods

At Orenco Woods Nature Park, stressors from climate change will likely derive primarily from increased competition from invasive species, intensified summer drought and altered hydrology. Prairie and savanna habitats are particularly at risk from invasive species. Altered hydrology may result in flashier streams and decreased dry-season flows, reducing or degrading native fish and riparian habitat. However, there could also be potential floodplain benefits from flashier streams – for example, larger floods could inundate floodplains for longer time periods. In forests, drier summer conditions could curtail tree growth and increase the risk of stand-replacing wildfires.

Metro and Hillsboro staff will need to be vigilant in Early Detection-Rapid Response (EDRR) activities, and more staff and financial resources may be needed to deal with invasives in the future. Establishing native plants where needed now can help defend against invasive species at Orenco Woods Nature Park. The potential for altered hydrology increases the importance of riparian forest health and width, as well as looking at the larger landscape for biological connectivity. Creating and enhancing in- and off-channel habitat in the near future, including increasing the resilience of such habitat elements against altered hydrology, can help enhance native fish habitat. These activities are addressed in this conservation plan and the related Site Stewardship Plan.

3.4 Existing trails and use by the public

The site had been a golf course with public access for more than 50 years. Since 2006, when the golf course closed, the site has experienced some informal use by the public on the fairways and old paths left from the golf course. The site is now posted as closed to public use; four of the old golf course bridges have been removed. There is probably some continued light public use of the site despite posted No Trespassing signs. Some youth environmental education programs were held on site in spring 2013, and additional supervised programs may occur as interim activities during site stabilization and prior to park development.

Orenco Elementary School

The Orenco Elementary School is located directly west of the park, so is ideally situated to utilize the park for school-based environmental education programs. In spring 2013, several school field trips were held in conjunction with insect study classes conducted by Hillsboro staff. The City of Hillsboro Parks and Recreation Department has extensive partnerships with the Hillsboro School District, including use of school facilities for after-school and summer enrichment programs such as day camps or special interest classes. There is great potential for youth and adult programs to utilize both the school and park facilities when the park is developed. Schools throughout the area are interested in the site for environmental educational programs. Both community and various school groups are interested in participating in stewardship activities at the site.

SECTION 4: CONSERVATION

This section of the conservation plan provides a comprehensive framework for the Orenco Woods Nature Park through conservation planning. This framework follows the Conservation Action Planning template (The Nature Conservancy 2007) and includes analyzing the site, establishing conservation targets, evaluating key ecological attributes for each conservation target, analyzing threats affecting conservation targets and developing action plans to abate serious threats. More detailed information is available in Appendix B.

4.1 Conservation targets

Conservation targets are composed of a suite of species, communities and ecological systems that represent and encompass the full array of native biodiversity of the site, reflect local and regional conservation goals and are viable or at least feasibly restorable (The Nature Conservancy 2007).

The methodology for determining conservation targets and key ecological attributes is discussed in detail in Appendix A.1, Conservation Targets, and Appendix A.2, Key Ecological Attributes. Using onsite natural habitat types and regional conservation planning efforts as guides, conservation targets were selected that encompass the site's biodiversity values and regional conservation targets. These conservation targets are:

- Oak savanna
- Riparian and floodplain forest
- Upland conifer hardwood forest
- Native fish habitat (Rock Creek and tributaries)

The habitat conservation targets represent the most regionally rare and threatened major habitat types present at the site, as well as patches of coniferous forest, one of the region's most representative habitats. The site's habitat diversity, connectivity at the landscape level and importance to anadromous fish can help conserve rare and at-risk species. More detail about each of these conservation targets can be found in Appendix A.1.

4.2 Key ecological attributes

Key ecological attributes (KEAs) are aspects of a conservation target's biology or ecology that, if missing or altered, would lead to the loss of that target over time (The Nature Conservancy 2007). KEAs define the conservation target's viability. They are the biological or ecological components that most clearly define or characterize the conservation target, limit its distribution or determine its variation over space and time. They are the most critical components of biological composition, structure, interactions and processes, and landscape configuration that sustain a target's viability or ecological integrity. KEAs are rated from poor to good. This rating helps establish the restoration goals and guide us in development of restoration actions for the conservation targets.

Appendix A.2 (Key Ecological Attributes) describes the site's KEAs and indicators for each of the five conservation targets in more detail.

4.3 Threats and sources

An effective conservation strategy requires an understanding of threats to targets and the sources of those threats. Adjacent development and subsequent disruption of natural systems place stress on the resource and its inhabitants and threaten the health of the greater ecosystem. More specifically, the following threats are evident:

- Increased competition (woody plant invasion of Savanna habitat and invasive species throughout the site; see Appendix A.3)
- Altered fire regime
- Altered vegetation structure
- Habitat conversion
- Human disturbance
- Altered hydrology

The methodology for defining threats and sources was established by The Nature Conservancy. It is a well-established, objective methodology with a scientific basis, and is described in more detail in Appendix B.3, Threats and Sources.

Information on Orenco Woods' conservation targets, KEAs, significant threats and management actions to address those threats is summarized in Table 1 below. More detailed information is available in Appendices A.1, A.2 and A.3, and in the Orenco Woods Stewardship Plan. The following section outlines short- and long-term management strategies for conservation targets.

Table 1: Orenco Woods conservation targets

Conservation target	Attributes of healthy habitat
Riparian forest	Includes the riparian and floodplain forest along Rock Creek and its tributaries, as well as associated wetlands. Riparian forests in this case are associated with streams and are relatively linear. Healthy riparian forests are relatively wide (100-200+ ft each side of stream) with few gaps and have a good mix of native trees and shrubs with good native species diversity in all layers. Downed wood and snags are important components. ***Current cover: approximately 14 acres.***
Oak savanna	Oak savanna is essentially prairie with a few trees per acre. Savanna is characterized by widely spaced, open canopy trees dominated by Oregon white oak. In general, the understory is relatively open with shrubs, grasses and wildflowers. In healthy oak savanna habitat, total native woody cover is typically 5 to 30 percent, and canopy architecture represents an appropriate mix of large open grown oak trees and younger tree recruitment that will replace older trees when they die. In healthy native prairie/ emergent wetland habitats, native herbaceous plant species (grass and wildflower) typically compose over 90 percent of the vegetation cover, with less than 5 percent cover of woody vegetation. ***Current cover: approximately 12 acres.***
Upland forest	An abundant natural habitat of the region, low-elevation Pacific Northwest old-growth forests are typically dominated by Douglas fir, western red cedar and western hemlock, with Willamette Valley ponderosa pine, grand fir and hardwood species also occurring. Plant and animal use of forests follows the changes in forests over time, with different suites of species dominating depending on forest age, canopy closure and site conditions. Biodiversity is higher in forests where some light reaches the forest floor and where standing and fallen dead wood is ample and of mixed age and size. The size of habitat (patch size) is a key consideration for wildlife diversity. ***Current cover: approximately 12 acres.***
Native fish habitat	Rock Creek provides important habitat to native salmonids and lamprey because the water quality is fairly good, the riparian area is relatively intact, and the flow regime is relatively unaltered as compared with many streams in the Portland region. Healthy native fish habitat includes riffle-pool sequences, off-channel habitat, gravel and rocky substrate and large wood in the stream. ***Current cover: approximately 3,000 linear feet, or 1/2 mile of stream reach.***

SECTION 5: STRATEGIC RESTORATION AND STEWARDSHIP

5.1 Restoration

This conservation plan outlines strategic actions to be carried out at the Orenco Woods Nature Park over the next 10 to 15 years. These actions are based on the short- and long-term goals for the conservation targets and enhancing the visitor experience. The strategic actions described here are general courses of action to achieve these objectives and are not highly prescriptive. Specific prescriptions will be developed by Metro staff to address site-specific conditions encountered in the areas targeted for restoration action.

Restoration efforts will occur throughout much of the 42-acre Orenco Woods Nature Park. This includes restoration of the riparian forest, oak savanna, upland forest and native fish habitat areas. The information below summarizes conservation targets' KEAs, significant threats to the habitat and strategic restoration and stewardship actions that can be taken to keep or bring the KEAs into the desired range.

Conservation target: riparian forest

Short-term goals 2013-2017:

- Increase percent cover of native tree and shrub (vegetation structure) and increase native tree and shrub richness in all riparian forest habitat areas.
- Remove invasive species.
- Eliminate gaps in woody vegetation.
- Increase floodwater access to the floodplain. Floodwaters should inundate the floodplain during moderate to high-flow events in the winter.
- Increase snags and large wood in riparian forest habitats.
- Create floodplain depressions to provide amphibian breeding habitat.

Long-term goal: The desired future condition is to have the majority of the key ecological attributes ranked as very good, thereby maintaining and restoring habitat suitable for riparian forest dependent wildlife species. Healthy riparian areas are also linked to native fish conservation goals and restoration actions listed below.

Key ecological attribute outside normal range of variation:

- Percent cover of native trees and shrubs: large areas of the on-site Rock Creek floodplain lack or otherwise have insufficient tree and shrub cover and are dominated by non-native herbaceous species such as reed canary grass, turf grasses and Canada thistle.
- Gaps in wood vegetation: numerous gaps in intact riparian vegetation exist.
- Standing and downed dead trees: lack of intact mature forest has resulted in limited quantities of downed wood.
- Floodwater access to the floodplain: floodwaters only inundate the floodplain during extreme high water events in the winter.

Critical threats very high and high range:

- Altered native species composition: non-native species out-compete native plant species.
- Altered hydrology: widespread altered hydrology leads to stream bank erosion, channel degradation and overall habitat simplification.
- Ecosystem degradation: historic clearing on the site (and upstream in the watershed) to accommodate past land uses reduced the extent of intact forests, resulting in insufficient downed wood in the system.

Strategic restoration and stewardship actions:

- Restoration actions will be initiated to control non-native invasive species and increase the cover of native trees and shrubs. This action is intended to meet Clean Water Services vegetated corridor requirements.
    - Native tree plantings should be focused in riparian areas that have less than 30 percent canopy cover.
    - Native shrub plantings should be focused in riparian areas that have less than 25 percent canopy cover.
    - Invasive species management of reed canary grass, Himalayan blackberry, Canada thistle and other common broadleaf weeds should be focused in areas of restoration plantings to abate threats tied to maintaining plantings.
- Early detection and treatment of invasive species should be targeted at garlic mustard, false brome and spurge laurel. Treatments would occur between 1 and 2 year intervals.
- Where they will not pose a safety threat to pedestrian trails, non-native trees should be girdled and left to die to provide snags and dead wood for habitat enhancement. Downed trees should be installed in riparian forest to enhance habitat value.
- Additional floodplain depressions will be created by minor grading in open areas to increase floodplain function and provide suitable habitat for reptiles, amphibians and other organisms.
- Wetland hydrology and connectivity will be enhanced by breaking/removing drainage tiles and removing former golf cart paths and the berms and culverts associated with them. Some paths may be retained and used for public access.

Conservation target: oak savanna

Short-term goals 2013-2017:

- Restore vegetation structure typical of oak savanna habitats.
- Increase presence of native grass and forb species in each of the oak savanna habitat areas.
- Reduce encroaching Douglas firs and other non-oak tree species.

Long-term goal: The long-term desired future condition is to restore oak savanna habitat structure to provide suitable habitat for Oregon white oak-dependent wildlife species such as acorn woodpecker and western gray squirrel.

Key ecological attributes outside normal range of variation:

- Native grass and forb species presence: The oak savanna areas are dominated by non-native trees and turf grasses typically planted on golf courses. Limited number of native plant species present.
- Canopy cover vegetation structure: Few native Oregon white oak trees are present under existing conditions and non-oak tree species encroaching into the area.
- Extent of oak savanna habitat: The acreage of potential oak savanna habitat at Orenco Woods Nature Park is too small to provide optimal habitat for grassland-dependent bird species.

Critical threats very high and high range:

- Altered native herbaceous species composition: Non-native species out-compete native grass and forb species.
- Altered fire regime: fire suppression promotes encroachment of woody shrub and tree vegetation, leading to lack of open structure and conversion to shrub.

Strategic restoration and stewardship actions:

- Control non-native invasive species and increase the cover of native forb and grass species.
    - Native herbaceous cover should be enhanced through a process of spraying to eliminate non-native golf course turf grasses, discing to break up sod and drain tiles, and reseeding with a mix of native grass and forb seeds.
    - Restoration plantings should only be initiated after a couple of years of invasive species control to increase the success of the native plantings.
- Restore/mimic the natural disturbance regime by implementing a mowing plan. Mowing should be conducted before March 1 or after August 15 to minimize the potential for disturbance to ground-nesting birds. Mowing would reduce cover of grass, shrubs and in turn release native herbaceous species. Mowing may occur on a yearly or bi-yearly basis.
- Plant clumps of native shrubs such as snowberry and Oregon grape throughout the savanna habitats and plant natural shrub buffers along transitions between savanna and other habitat types to provide habitat for pollinators.

Conservation target: upland forest

Short-term goals 2013-2017:

- Increase canopy cover of native tree and shrub cover to greater than 75% canopy cover.
- Increase native tree and shrub richness.
- Increase standing dead snags and downed wood in upland forest habitats.

Long-term goal: The desired future condition is to have all key ecological attributes ranked as good to very good thereby maintaining and restoring habitat suitable for upland forest-dependent wildlife species. This habitat type is mostly likely to see increase in use by mammals like black-tailed deer and coyote and by forest birds.

Key ecological attribute outside normal range of variation:

- Forest habitat patch size: On-site forests have been fragmented by past land uses.
- Standing and downed dead trees: most upland forest areas on the site lack dead wood.

Critical threats very high and high range:

- Altered native herbaceous species composition: non-native species, particularly Himalayan blackberry, English hawthorn and English ivy, out-compete native species.

Strategic restoration and stewardship actions:

- Restoration actions will be initiated to control non-native invasive species and increase the cover of native trees and shrubs.
    - Native tree and shrub plantings should be focused in areas that have less than 75 percent canopy cover.
    - Invasive species management of Himalayan blackberry, English ivy and other common broadleaf weeds should be focused in areas of restoration plantings.
    - Restore stand diversity and age structure by planting additional trees and shrubs in areas of invasive species removal to increase richness.
- Where they will not pose a safety threat to pedestrian trails, non-native trees should be girdled and left to decay to provide snags and dead wood for habitat enhancement. Downed trees should be installed in upland forest to enhance habitat value.
- Early detection and treatment of invasive species should be targeted at garlic mustard, false brome and spurge laurel. Treatments would occur between 1 and 2 year intervals.

Conservation target: native fish habitat

Short-term goals 2013-2017: Increase the complexity of in-stream habitat and number of key large wood pieces in Rock Creek and off channel habitat areas.

Long-term goal: The desired future condition is to have all key ecological attributes ranked as good to very good thereby maintaining and restoring habitat suitable for native fish species present in Rock Creek. More specifically, the long term goal is to support the recovery of ESA-listed winter steelhead populations.

Key ecological attribute outside normal range of variation:

- Complexity of habitat: Rock Creek lacks complex habitat that native fish require for spawning and rearing.
- Key pieces of large wood: historic clearing on the site (and upstream in the watershed) has reduced the number of key large wood pieces in the stream and off-channel habitats.

Critical threats very high and high range:

- Simplified stream structure: lack of side channel; sparse riffle-pool sequences, and limited large wood that provides complex habitat for fish.

Strategic restoration and stewardship actions:

- Restore complex habitat in Rock Creek by installing single or multi-piece, large log structures on the main channel of Rock Creek. Structures should be designed to restore long-term processes that develop and maintain complex habitats for native fish.
- Remove weir on mainstem of Rock Creek. This weir provides an obstacle to fish passage only during low-flow periods. This may require additional coordination with State of Oregon Water Resource Department for maintaining or retiring the in-stream water right.

5.2 Prioritizing strategic restoration and stewardship actions

It is important to prioritize restoration and stewardship activities for several reasons. Budgetary or time constraints are likely to limit how much work can be accomplished at a given site. Specific actions may rise to the top due to the scarce or unique nature of a habitat type or because abating a certain threat now will save time and money in the future. Table 2 assigns priority rankings to key actions; this does not mean that the other actions are not important, simply that they are not the most important actions within the next three to five years.

Table 2: Priority status for conservation targets

Conservation target	Priority
Savanna	Medium
Riparian forest	High
Upland forest	Low
Native fish	High

5.3 Ongoing stewardship and restoration programs

The following actions represent ongoing systems or programs that are in place and practices that will be continued and/or enhanced. These actions align with maintaining the conservation targets in good or very good condition.

Stewardship

Metro's and City of Hillsboro's natural areas programs are committed to long-term stewardship of Orenco Woods Nature Park. Staff will conduct multiple site walks per year to monitor natural resource condition and public use of the nature park. As determined necessary by staff, specific treatments or actions will be implemented to ensure that the health and condition of the nature park is maintained. Some periodic stewardship actions that are implemented by staff include visits to monitor for illegal use of the site, clean up of illegal dumping, mowing of buffer and roadside areas for fire safety, replacing signage and response to complaints. Table 3 describes high and medium priority maintenance action. Additional details about stewardship will be developed and incorporated into a stewardship plan.

Table 3: High and medium priority stewardship actions

Activity	Frequency/Duration	Priority
Site walk	4 times per year	High
EDRR (weed invasion treatments)	Every 1-3 years	High
trail inspections	1 time per year	Medium
Annual mowing in savanna	1-2 times per year	High
Entry/rule sign inspection	2 times per year	Medium

Invasive species management

Invasive plant species can impact the habitat values for which land is conserved. Natural lands are not fully protected unless they also are managed for the features that first motivated preservation. Invasive species can change community structure, composition and ecosystem processes on these lands in ways that may not be anticipated or desirable. Careful management can minimize these negative impacts. Metro has initiated an early detection and rapid response (EDRR) program for invasive species including false brome and garlic mustard, which have been documented in the area. EDRR species will be controlled by hand pulling or herbicide application as they are detected. Other invasive plant species will be controlled as part of restoration projects or ongoing management of habitat areas. See Appendix A.4 for a list of invasive species.

5.4 Long-term strategies

The following actions may be necessary to achieve the long-term goals of this conservation plan:

- Thinning in the upland and riparian forests habitat areas.
- Acquisition of fee title or conservation easements of adjoining private lands adjacent to riparian forest areas.

SECTION 6: RECREATION AND ACCESS

Next five years

There was strong public support for acquisition of the Orenco Woods property, advocacy for its design as a nature park, and desire to initiate park development as soon as practicable. With the master plan completed, the next steps will be to refine plans with design development, construction documents and secure required local, state and federal permits. During this time of refined planning, strategic restoration and stewardship action defined in the conservation target section of this plan will be implemented. Native tree and shrub plantings will be placed in areas not expected to be impacted by future development. Close coordination between planning for site development and restoration and stewardship work will ensure that these activities also address development mitigation requirements.

The goal is to initiate nature park development within the next five years. In the interim, public access will be very limited and may include volunteer assistance with restoration and stewardship activities and supervised environmental education programs. A map showing the Orenco Woods Nature Park master plan can be found as Map 5 later in this document.

6.1 Public access

Since 2006, when the golf course closed, the site has experienced some informal use by the public on the fairways and old paths left from the golf course. The site is now posted as closed to public use yet there is some continued use of the site despite the posted No Trespassing signs. Some youth environmental education programs are held on site, and periodically additional supervised education programs may occur.

6.2 Programmatic (education and volunteers)

Nature parks are created to intentionally give residents opportunities to enjoy, experience and understand the natural world. Both Hillsboro and Metro operate robust volunteer programs engaged in stewardship, involving schools, civic organizations and the general public. Both agencies provide programs for environmental education for people of all ages, from guided nature walks to programs on habitats and wildlife. Hillsboro operates after-school enrichment programs in all elementary and middle schools, and offers a variety of summer day camp programs for youth. With the Orenco Elementary School directly west of the park, there is an ideal opportunity for year-round programs utilizing the school and nature park. The public is likely to be involved in stewardship activities, including habitat restoration, in advance of the park development and also on an ongoing basis. Information on conservation education and other programs is available at www.hillsboro-oregon.gov and www.oregonmetro.gov.

The Orenco Woods site has rich cultural history and also offers opportunities for historic and cultural enrichment as a complement to environmental programs. The City of Hillsboro purchased the historic McDonald House in 2013. Home to the Oregon Nursery Company's founder, Malcolm McDonald, the 1912 craftsman-style building sits on a 0.7-acre lot surrounded by the nature park. The name "Orenco" comes from that of the former company, Oregon Nursery Company, and a town of that name developed west of the park. The former Orenco town site is now referred to as the Old Orenco neighborhood. Plans for the McDonald House have not yet been developed, but may include staff offices and space for environmental programs. No timetable has been set for the planning or rehabilitation of the house. Plans for the house will be carefully incorporated into the overall site plan for the park to ensure compatibility of uses and activities.

Volunteer program

Volunteers can be involved in many capacities at the site, ranging from assistance with habitat restoration activities to monitoring and educational programs. The primary goal of the volunteer program is to provide a variety of high-quality, meaningful volunteer opportunities that add value and capacity to the nature park. Through these opportunities, community members are able to learn about and enjoy Orenco Woods Nature Park, work alongside fellow community members, learn new skills or polish existing ones and gain the satisfaction of contributing to the long-term health and livability of their communities.

Wildlife monitoring volunteers: Volunteers with Metro's wildlife monitoring program provide valuable information about natural areas, especially through periods of restoration and enhancement. By focusing on indicator species, such as amphibians and birds, volunteers provide data to help gauge the progress of restoration efforts and track the effects of public use on wildlife.

Restoration volunteers: The restoration volunteer program focuses on providing groups of all kinds the opportunity to contribute to the health and vitality of our parks and natural areas. Primarily involving a short-term commitment of one day, restoration volunteers experience an engaging, hands-on learning opportunity with immediate, tangible results.

Volunteer site stewards: The natural area site steward volunteer program enhances parks and natural areas for community members and creates healthy habitat for fish and wildlife through

active monitoring of site conditions and use by both people and wildlife, and personal and group restoration, stewardship and educational activities. The steward program provides opportunities for committed volunteers to take an active, leadership role in natural areas. The steward engages in hands-on small restoration projects for the site as well as monthly monitoring. Stewards can take on crew leader roles with volunteer groups for restoration educational projects at the site.

Program assistant volunteers: There are opportunities for volunteers to assist with environmental education classes and programs. Volunteers will undergo training specific to the planned program so they can assist naturalists and teachers with activities at the site or in the classroom.

6.3 Site management

Management of the site will include enforcement of the posted rules to provide protection for wildlife, water quality and to protect the safety and enjoyment of any person visiting these facilities.

Special use permits

Special use permits are required for certain regulated and non-traditional uses of parks and natural areas to ensure public health and safety and to protect natural resources, properties and facilities. Special use permits are required for commercial film, video or photography; educational activities or educational events; festivals and organized sports activities; use of amplified sound; equipment or other elements posing a safety threat or public nuisance; concession services; site restoration or alteration, biological research, scientific collection (soil, wildlife or vegetation disturbance of any kind); any organized activity, event or gathering involving 25 or more people.

Archeological resources

Orenco Woods Nature Park site is steeped in history and may contain archeological resources. If any damage or unlawful use is identified, Metro and Hillsboro will work with the State Historic Preservation Office to address and, if possible, repair the damage. Local law enforcement may be involved in investigations of damage to property.

Dogs

One of the most difficult management issues for public access is the introduction of dogs by visitors. Research shows that even if dogs stay on the trails, they are perceived as predators by wildlife and their zone of influence can be several hundred feet on either side of a trail. Because of the potential disturbance to wildlife and wildlife habitat, dogs will not be permitted at Orenco Woods Nature Park with the exception of the regional trail as it passes through the site. Signage, self-policing and enforcement are all needed to effectively manage people with dogs. The City of Hillsboro plans to develop a small off-leash dog area about a half-mile west of the nature park. Orenco Woods Nature Park is in a densely developed urban area; many households have pets and there will be an ongoing need for education about restrictions on dogs in the park.

Signage

As part of the integration of people into the system the need for regulatory, wayfinding and interpretive signage becomes necessary. The development of this signage system will be addressed

over the next five years. As physical aspects of the system, such as new trails, gates, parking lots and access points are developed the signage can be added on a project-by-project basis.

Prior to integration of the signage, two critical steps must be accomplished: the graphic standard must be chosen and the content of each sign type must be articulated. Hillsboro and Metro will work in partnership to develop appropriate signage parameters. It is anticipated that the signage system will be based on three different types of signs: regulatory, wayfinding and interpretive. The name of the facility, the key agency, contact numbers and hours of operation will also be standardized.

6.4 Strategic actions (access and site management)

There are no proposed access and site management improvements over the life of this plan. Future actions will be coordinated with implementation of the park's master plan.

SECTION 7: COORDINATION

This conservation plan has laid out the history and context of Orenco Woods Nature Park, along with the stewardship and restoration actions for the next five years. For those projects to be realized, coordination will be needed on a number of fronts. Important coordination points include:

- Coordinating restoration actions with future development actions. It will be critical that restoration planting work not be completed in future trail or overlook areas.
- Monitoring restoration efforts to track effectiveness and make changes to the priorities and goals as needed.
- Coordinating with neighbors and local stakeholders to implement projects.
- Funding to realize the strategic restoration and access actions identified in this plan.

With these tools, the priorities established by this plan will be realized.

7.1 Monitoring framework

Monitoring at Orenco Woods Nature Park is an integral part of an adaptive management approach to restoration and stewardship. Based on the monitoring plan developed cooperatively by Metro and Hillsboro, a feedback loop is created between monitoring and management decisions. Monitoring will be done to evaluate habitat and, potentially, population responses to management action, as well as progress toward achieving habitat and population objectives.

The monitoring strategy is based on threats and key ecological attributes associated with the conservation targets. Generally the greatest threats to Orenco Woods Nature Park are traced to:

- Altered native plant species composition: non-native species out-compete native species.
- Ecosystem degradation: historic vegetation clearing on the site (and upstream in the watershed) to accommodate past land uses reduced the extent of intact forests and downed wood in the system.

Monitoring addresses threats directly and indirectly, by tracking changes in certain ecological attributes. It implements techniques that are well-established and continues many monitoring efforts already in place. Recent and current monitoring activities have included remote sensing/GIS, informal amphibian and bird surveys, and monitoring the success of revegetation efforts. The monitoring plan is likely to change over time, including KEA monitoring.

Monitoring techniques

Some monitoring techniques are used to monitor more than one conservation target. This discussion is intended to provide a general introduction but not detailed methods.

Remote sensing/GIS: Several metrics for health of conservation targets relate to canopy cover and size of a habitat. Where a desired condition is a minimum canopy cover, it can be estimated with GIS software using current aerial photography. Similarly, important connections within the natural area and to off-site habitat can be inspected with aerial photographs.

Transects: These are lines or strips of ground along which measurements are made of plant species presence or absence. Permanent transects can be installed and tracked over the years to track progress toward goals. They are useful in tracking the cover and composition of native plants and invasive species in prairie and Oregon white oak savanna habitat areas.

Avian point counts: Avian (bird) surveys during breeding season follow an established and widely used protocol that allows data sharing with other scientists. By tracking changes in the bird community, Metro can detect changes in habitat function as restoration projects mature. The species present can indicate if a suitable habitat for sensitive species is present.

Ocular estimates: Ocular (visual) estimates can be used to determine the presence or absence of a species within a short timeline and at a very low cost. This method of monitoring is typically used to determine intervals for treatments or success of a planting.

Photos: Permanent photo points are established to provide long-term documentation of changes to habitats over time. Typically photo points are marked by a permanent landscape feature or metal stakes and photos are taken at a landscape scale over long term periods of time.

7.2 Funding

Costs in Tables 4 are general estimates for the purpose of understanding the magnitude of costs to implement the structural elements of the plan, as described in Sections 5. The costs are estimated on hiring contractors to complete the work and include a construction contingency for time and materials. In addition to these project implementation costs, we have included annual stewardship costs for Orenco Woods Nature Park in Table 5.

Site development and conservation strategy implementation will be funded in part from proceeds generated by the sale of the 10.3-acre development parcel south and east of the nature park. The intent to sell this portion of the site was part of the intergovernmental agreement between Hillsboro and Metro when the site was purchased in late 2011. Other possible funding sources

include Oregon Watershed Enhancement Board restoration grants and funding from the 2013 voter approved parks and natural areas levy.

Table 4: Conservation target strategic restoration action cost estimates

Strategic action	Cost
Savanna	
Disc and break drain tiles/sod from golf course	$15,000
Invasive species treatments and herbaceous plantings	$60,000
Riparian forest	
Construct floodplain depressions (wetlands) and break drainage tiles	$35,000
Plant native tree and shrubs + Invasive species treatments	$100,000
Upland forest	
Plant native tree and shrubs + Invasive species treatments	$20,000
Snags and downed wood	$7,500
Native fish	
Install log structures and remove weir in Rock Creek	$350,000
Total	**$587,500**

Table 5: Annual stewardship cost estimates

Annual stewardship*	Cost
Annual mowing (approximately 2 times per year)	$2,500
Mowing of trailside vegetation and treatment of invasive weeds	$1,500
EDRR surveys and invasive weed treatments (entire site)	$2,500
Total (per year cost)	**$6,500**

* Stewardship actions and costs are described in more detail in the Stewardship Plan

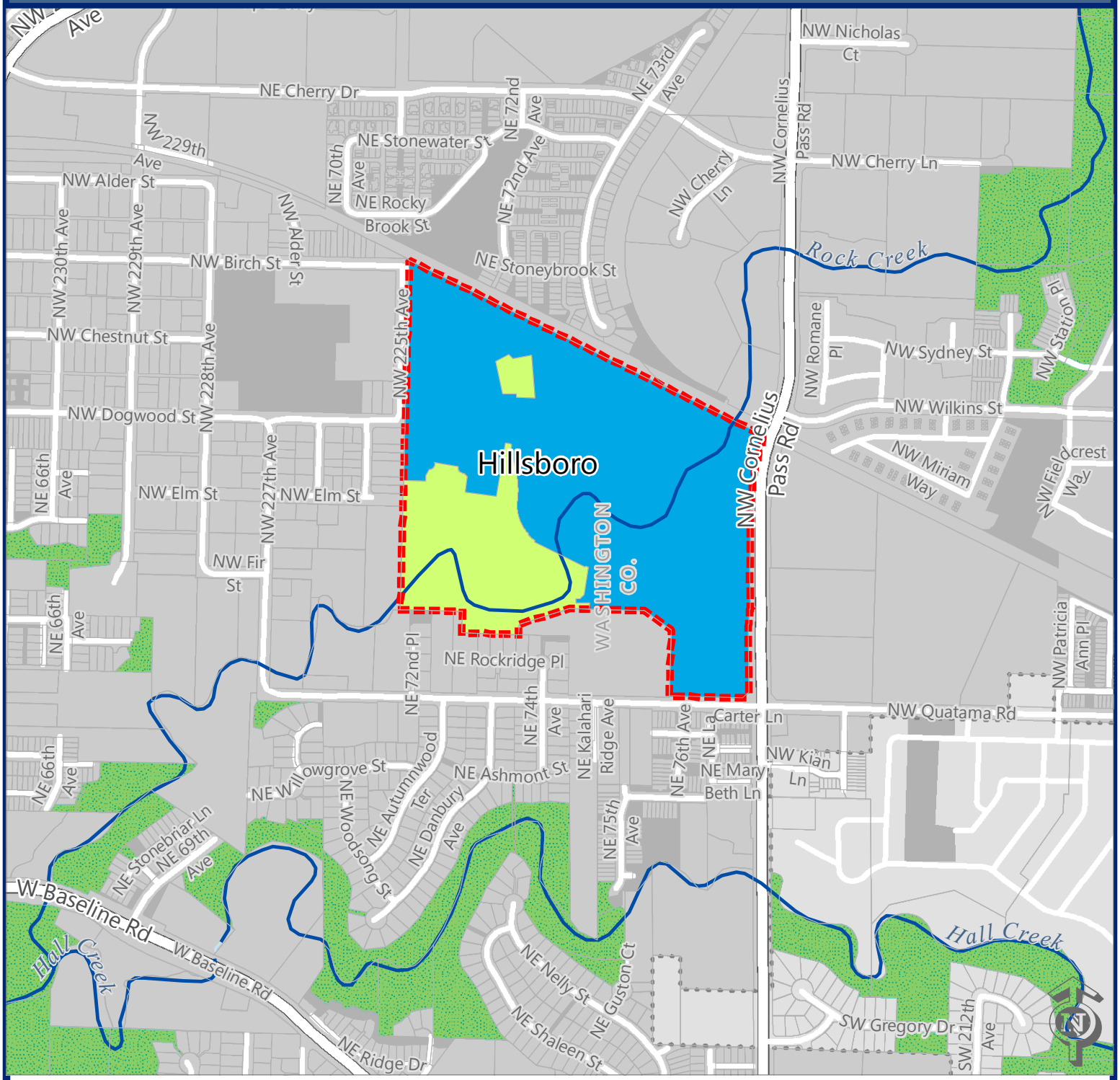
7.3 Public involvement

As projects are developed, Hillsboro and Metro will provide local stakeholders and residents near Orenco Woods Nature Park with pertinent information about the work before it is implemented. Project information may include background on the project, timing, cost, materials types and other information as necessary for the public to be aware of the project and its implications.

MAPS

Map 1

Planning Area



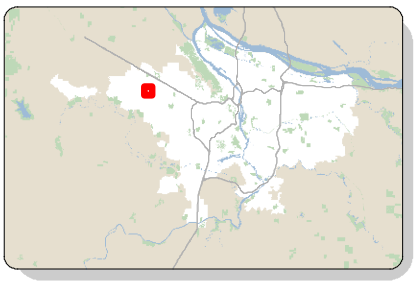
Sites

Bond Measure

- Metro-Hillsboro
- Hillsboro ownership
- Park and/or Natural Area

NHD Flowlines

- Intermittent stream
- Perenial stream
- Artificial Path



0 670 1,340 Feet

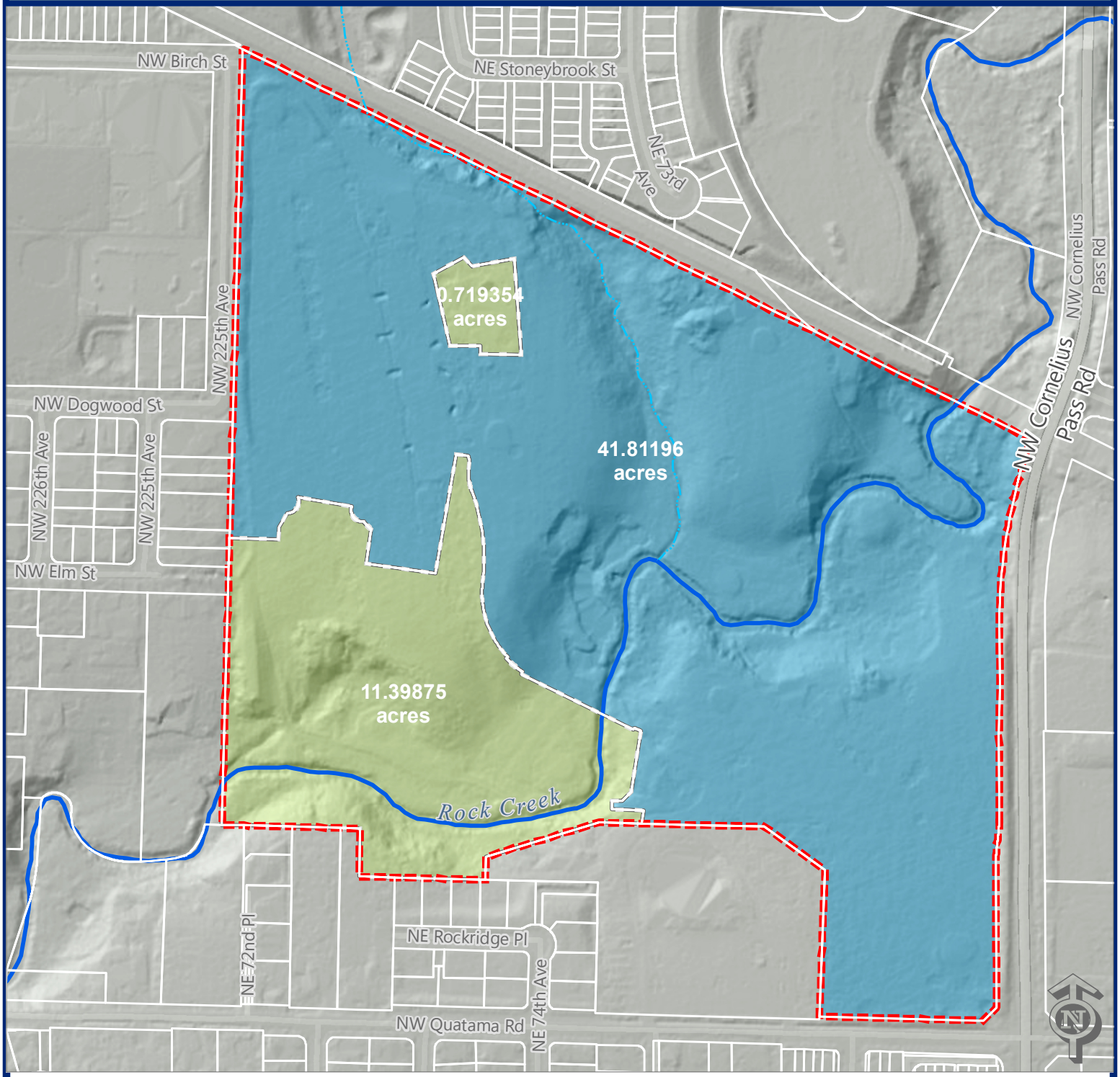
Metro

Orenco Woods Site Conservation Plan

map date: 9/26/2013

Site Ownership

Map 2



Sites

Hillsboro ownership

Bond Measure

Metro-Hillsboro

Streams (Dogami 2010)

Intermittent

Perennial

0 300 600 Feet

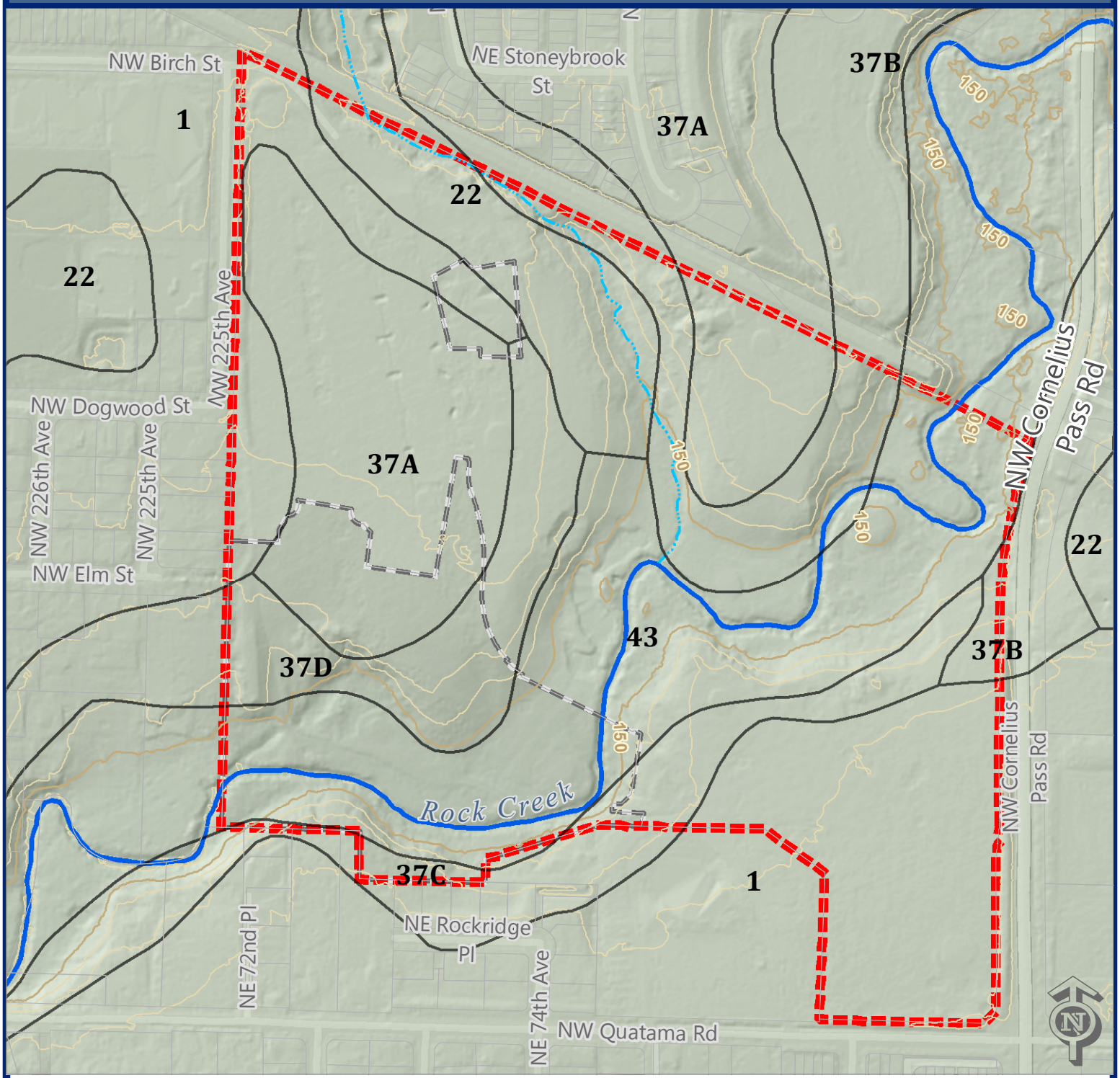
Metro

Orenco Woods Site Conservation Plan

map date: 9/26/2013

Map 3

Soils and Topography



NRCS Soils

Sites

City of Hillsboro

Streams (Dogami 2010)

Intermittent

Perennial

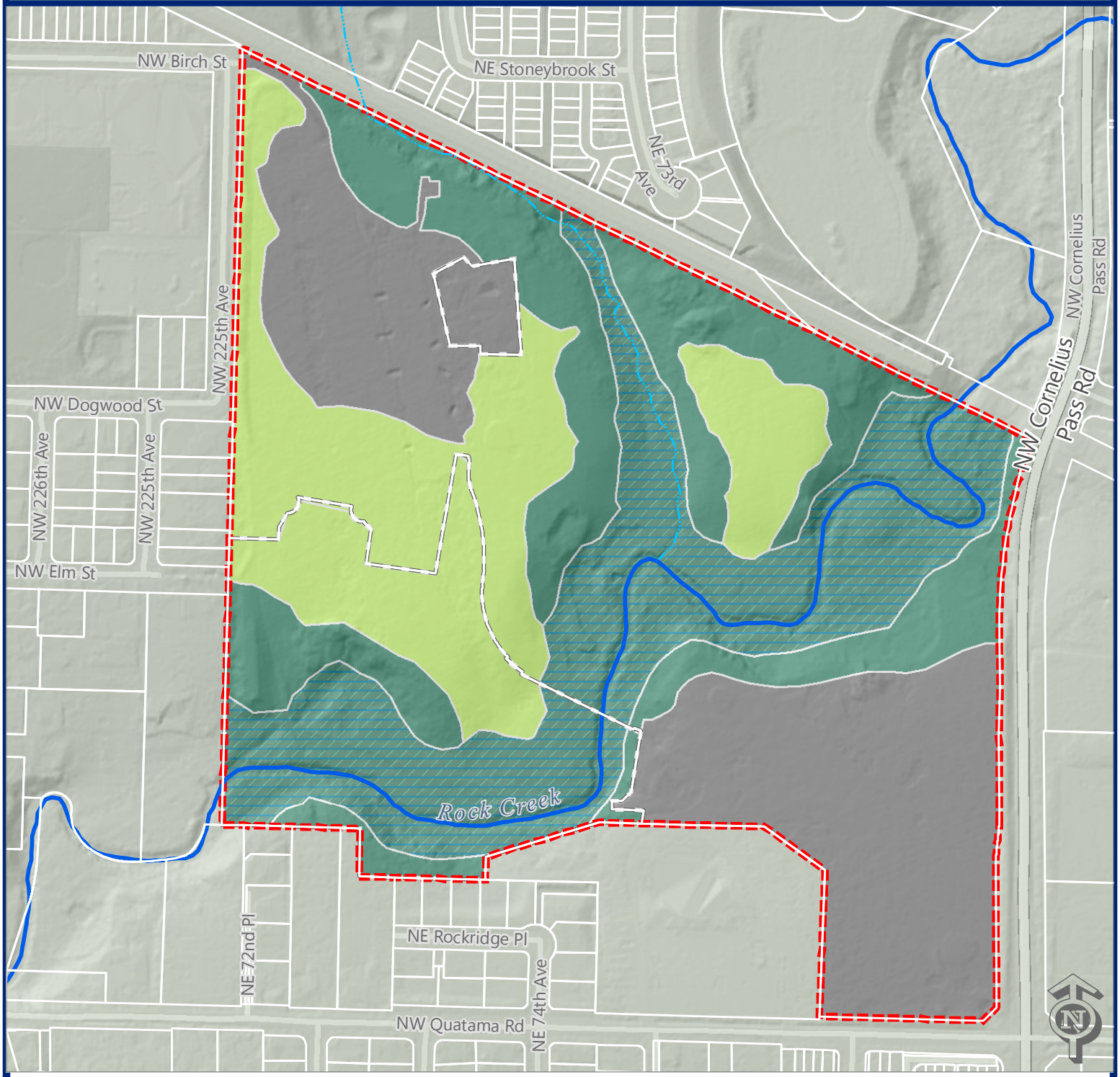
0 300 600 Feet

Metro

map date: 9/26/2013

Map 4

Vegetation Habitat Types



Sites
City of Hillsboro

Developed
Riparian Forest
Savanna
Upland Forest

Streams (Dogami 2010)
Intermittent
Perennial

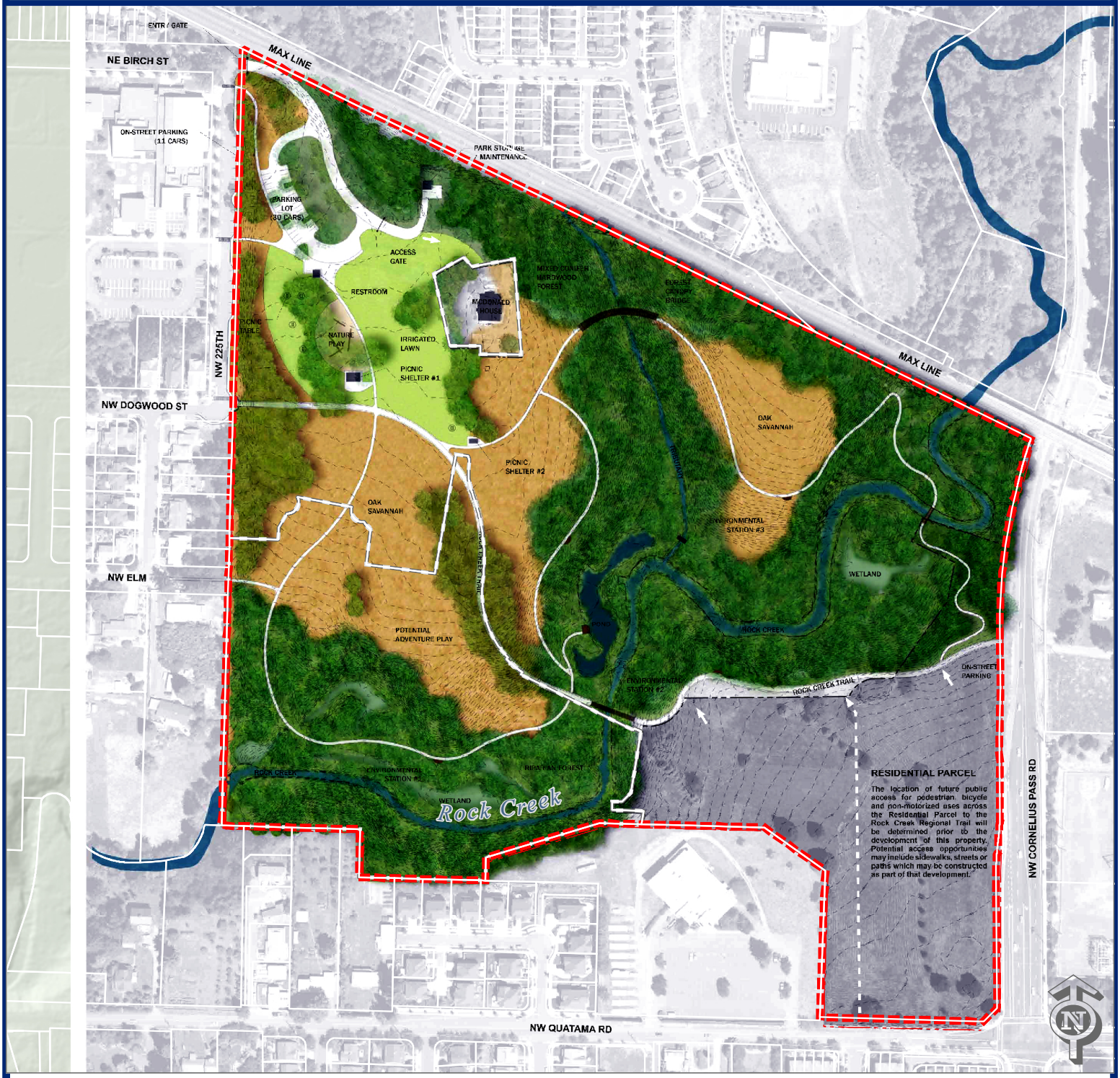
0 300 600 Feet

Metro

map date: 9/26/2013

Map 5

Access & Recreation



Sites

City of Hillsboro

Approved Masater Plan

0 300 600 Feet

Metro

Orenco Woods Site Conservation Plan

map date: 9/26/2013

APPENDICES

APPENDIX A-1 | CONSERVATION TARGETS

Introduction

Conservation targets are composed of a suite of species, communities and ecological systems that represent and encompass the full array of native biodiversity of the site; reflect local and regional conservation goals; and be viable or at least feasibly restorable (TNC 2007). Priority conservation targets represent species or habitats that are the conservation focus for a given area or management unit.

Conservation targets establish the basis for setting goals, carrying out conservation actions, and measuring conservation effectiveness. They are the foundation of conservation planning. Key ecological attributes (KEAs) for each conservation target will be evaluated. KEAs are aspects of a conservation target's biology or ecology that, if missing or altered, would lead to the loss of that target over time (TNC 2007). Viability of the conservation target is inferred by the condition of the KEAs. Analysis of threats affecting conservation targets inform the development of action plans to abate serious threats and monitoring plans to gauge success of the action plans. Conservation targets then should consist of species or communities that will provide the focus of management actions and monitoring. Species or communities that for whatever reason are too expensive to manage or monitor are not good candidates for conservation targets.

Background

Historically, the Willamette Valley was dominated by extensive wet and dry prairie, oak savanna and woodland habitats totaling approximately 2 million acres that supported a wide diversity of plant and animal species, including several endemic to the Willamette Basin (Floburg et al 2004). These habitats were primarily maintained by Native American-ignited fires. The Tualatin River's meandering pathway and many tributaries also provided extensive riparian habitats, bottomland forest and wetlands. Agricultural and residential development in the Willamette Subbasin and the cessation of widespread prescribed fires has resulted in a substantial loss of native habitat especially at the lowest elevations, leaving less than 2 percent of all historic prairies and 7 percent of oak habitat extant today.

According to a Willamette Valley study by Titus et. al {1829}, for wetland communities, greatest losses since Euroamerican settlement have occurred in prairie, followed by bottomland forest, and then emergent wetlands. The greatest number of rare plants occurs in wet prairie remnants, followed by emergent wetlands, and then bottomland forest. In contrast, the greatest number of rare wetland animals occurs in emergent wetlands, followed by bottomland forest and prairie.

Methods

Regional conservation plans were referenced to align the conservation goals of the Orenco Woods Nature Park Site Conservation Plan (see Table 1). These plans included the Oregon Department of Fish and Wildlife's Oregon Conservation Strategy (ODFW 2006), The Nature Conservancy's Ecoregional Assessment of the Willamette Valley – Puget Trough-Georgia Basin (Floburg et al 2004), the Northwest Power and Conservation Council's Willamette Subbasin Plan (Primozich

2004), and Partners in Flight's Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington (Altman 2000). These plans identify both focal habitats and focal species as conservation targets.

Results

Using onsite habitat types and regional conservation planning efforts as guides, conservation targets were selected that encompass the site's most threatened biodiversity values as well as regional conservation targets (Table 1). Each of the conservation targets are represented in one or more of the regional conservation plans listed in Table 1.

The Orenco Woods Nature Park's identified conservation targets are:

- Riparian forest
- Oak savanna
- Upland forest
- Native fish habitat

Table 1: Orenco Woods Nature Park conservation targets and relationships to other conservation strategies

Orenco Woods Nature Park conservation targets	**Oregon Conservation Strategy** *(ODFW 2006)*	**Willamette Basin Subbasin Plan** *(Primozich 2004)*	**Landbird Conservation Strategy** *(Altman 1999, 2000)*	**Ecoregional Assessment** *(Floburg et al 2004)*
Savannah	Grasslands and oak habitats are priorities for the Willamette Valley	Upland and wet prairie	Grassland – savanna	Upland and wet prairie; savanna
Riparian forest	Freshwater aquatic, riparian and wetland habitats are all priorities for the Willamette Valley	Basinwide priority	Riparian	Riparian forests and shrublands
Upland conifer-hardwood forest	Late successional conifer forests	Old growth conifer forest	Low elevation western hemlock/western redcedar	Douglas fir-western hemlock-western redcedar forests
Native fish habitat	All are strategy species in the Willamette Valley ecoregion[1]	Anadromous fish species and their habitats are basin-wide priorities	N/A	Ecoregional target species

[1] Coho salmon Oregon Coast ESU not native above Willamette Falls.

Habitat descriptions

The Orenco Woods Nature Park can be characterized by four natural habitat types: riparian forest, Oregon white oak savanna, upland forest and native fish habitat. Map 4, found later in this document, shows area of major vegetation habitat types at the site.

Riparian forest

Healthy riparian forests protect stream water quality and help keep nearby properties from flooding. Riparian forests also provide key corridors for wildlife movement. Riparian forests are adapted to seasonal flooding and are rich with insects, seeds and fruit.

All wildlife needs water, and many species depend primarily on riparian habitats to fulfill their life history requirements. More species in the Portland-Vancouver region are associated with riparian and open water habitats than any other habitat type (see species list in The Intertwine Alliance's *Biodiversity Guide*). At least 167 native wildlife species, excluding fish, are closely associated with these habitats and another 130 make use of them at some point in their lives.

Riparian habitat conditions are moderately to severely degraded within much of the region. Widespread development and land use activity affect habitat quality and complexity, water quality and watershed processes in lower Willamette and Columbia tributaries. Stream habitat degradation is primarily due to past and current land-use practices that have affected properly functioning stream channels, riparian areas and floodplains, as well as watershed processes.

Key plants: Native forbs found in this habitat may include Pacific waterleaf, false hellebore, nodding beggartick and skunk cabbage. Sedge and rush species found in this habitat may include slough sedge, awl-fruited sedge, dewy sedge, slender rush, common rush and spreading rush. Shrubs and trees found in this habitat may include Oregon ash, willow, cottonwood, Oregon white oak, Pacific ninebark, red-osier dogwood, red elderberry, twinberry and Douglas' spiraea.

Key wildlife: Partners in Flight identifies the following focal species for riparian shrub and tree habitats: willow flycatcher, red-eyed vireo, yellow warbler, Swainson's thrush, downy woodpecker and yellow-billed cuckoo. Other birds utilizing this habitat may include green heron, great blue heron, Wilson's and other warblers, yellow-breasted chat, black-headed grosbeak, common yellowthroat, song sparrow, ruby-crowned kinglet, downy woodpecker and red-breasted sapsucker. Some of the wildlife species that regularly use this habitat include Pacific tree frog, northern red-legged frog, various salamanders, common garter snake, black-tailed deer, coyote and fox. Both western pond turtle and western painted turtle are known to occur in the on-site Rock Creek riparian areas.

Current extent and attributes: Riparian forests within the Orenco Woods Nature Park have been fragmented by past land uses so that under existing conditions, approximately 14 acres of forested riparian habitat are present (Map 4). Ongoing plantings and invasive species control will help improve the site's habitat diversity and structure. Specific areas would benefit from plantings to eliminate gaps or widen riparian corridors.

Oak savanna

Oak habitats provide the best habitat in the Portland-Vancouver region for 38 native wildlife species and are used regularly by at least 148 other wildlife species (see Portland-Vancouver Regional Conservation Strategy *Biodiversity Guide* species list). These include some of the region's most at-risk species such as white-breasted nuthatch, acorn woodpecker, western gray squirrel, and rare plants such as white rock larkspur. Oak is fire-resistant and is easily out-competed by

Douglas fir when fire is suppressed. Less than 2 percent of Willamette Valley oak savanna habitat remains.

Prairie, savanna and rock outcrops in the region provide the best reproductive habitat for 18 wildlife species and are regularly used by at least an additional 120 wildlife species. Combined, oak-prairie habitats provide primary habitat for 52 native wildlife species, and are used by at least 156 more. The Willamette Subbasin Plan identified 19 focal species associated with these habitat types; for all of them, habitat loss was identified as a primary limiting factor (Northwest Power Planning Council 2005).

Oak savanna is essentially prairie with a few trees per acre. Savanna is characterized by widely spaced, open canopy trees dominated by Oregon white oak. In general, the understory is relatively open with shrubs, grasses and wildflowers. In healthy oak savanna habitat, total native woody cover is typically 5-30 percent, and canopy architecture represents an appropriate mix of large open grown oak trees and younger tree recruitment that will replace older trees when they die. In healthy native prairie/emergent wetland habitats, native herbaceous plant species (grass and wildflower) typically compose over 90 percent of the vegetation cover, with less than 5 percent cover of woody vegetation. Emergent wetland habitat has natural vegetation structure similar to prairie.

Key plants: Native forbs found in this habitat may include camas, brodiaea lily, Oregon sunshine, large rose mallow (Sidalcea), Oregon saxifrage, large leaf lupine, tarweed, collinsia, bracken fern and yampa. Native grass species found in this habitat may include Roemer's fescue, California oat grass, tufted hairgrass, slender hairgrass and blue wildrye. In wet areas sedges, rushes, wapato and other water-associated grasses and forbs are present. Shrubs found in this habitat may include poison oak, snowberry and Oregon grape.

Key wildlife: Partners in Flight identifies the following focal species occurring in our area for grassland or savanna habitats: western meadowlark, streaked horned lark, common nighthawk, American kestrel and northern harrier. Oak focal species include white-breasted (slender-billed) nuthatch, acorn and downy woodpecker, western wood-peewee, bushtit, chipping sparrow, Bewick's wren and house wren. Other birds utilizing oak, savanna and emergent wetland habitats may include white-crowned sparrow, rufous hummingbird, western bluebird, lazuli bunting and red-tailed hawk, as well as waterfowl, rails, herons and shorebirds in wetter habitats. Other wildlife utilizing this mix of habitats may include Pacific tree and red-legged frogs, garter snake, rubber boa, butterflies, black-tailed deer, coyote, fox and various native rodents.

Current extent and attributes: Past land uses resulted in the elimination of oak savanna habitat on the site, but large Oregon white oak trees on adjacent properties immediately west of Orenco Woods Nature Park suggest that oak savanna habitat occurred on the hilltops in the northern part of the site prior to site clearing. A major part of site restoration efforts will be the re-establishment on oak savanna habitats in these areas. Approximately 12 acres of forested savanna habitat are proposed to be restored at the site (Map 4).

Upland forest

Upland coniferous and mixed conifer/deciduous forests are the dominant natural habitat of the region. Upland forest was historically common in the Rock Creek basin, but urbanization has fragmented and reduced the amount of this habitat.

Low-elevation Pacific Northwest old-growth forests typically are dominated by the conifers Douglas fir, western red cedar and western hemlock, with grand fir and hardwood species also occurring. Under natural conditions, trees of many of the dominant species live to be 350 to 750 years old or older and frequently have diameters of 8 feet or more. Plant and animal use of forests follows the changes in forests over time, with different suites of species dominating depending on forest age, canopy closure and site conditions. Biodiversity is higher in forests where some light reaches the forest floor and where standing and fallen dead wood is ample and of mixed age and size. Forests younger than 60 years dominate western Oregon due to current forestry practices, and old growth associated species' declines reflect these changes in overall forest structure across the region.

Stands of forest can be categorized by the age of trees, species and composition of understory species. Upland forests in the greater Portland-Vancouver region provide primary habitat for at least 94 species and are used by at least 129 more species (Appendix 2, Portland-Vancouver *Biodiversity Guide* 2012).

Key plants: Native forbs found in this habitat may include sword fern, licorice fern, false Solomon's seal, false lily of the valley, trillium, fairy bells, miner's lettuce, stinging nettle, hedge-nettle and heal-all. Shrubs and trees found in this habitat may include Pacific yew, Pacific madrone, bigleaf maple, red alder, Douglas fir, Grand fir, Western red cedar, black hawthorn, Western serviceberry, tall and dull Oregon grape, mock orange, blue and red elderberry, salal, red huckleberry, Indian plum and snowberry.

Key wildlife: Upland forest is especially important to migrating and nesting songbirds, woodpeckers, mammals such as Douglas squirrel and deer, and seasonal habitat for salamanders, frogs and turtles. Partners in Flight identifies the following focal species for coniferous forests in western Oregon: Vaux's swift, brown creeper, red crossbill, pileated woodpecker and varied thrush (old growth and mature forests); hermit warbler, Pacific-slope flycatcher, Hammond's flycatcher, winter (Pacific) wren, black-throated gray warbler, and Hutton's vireo (mature/young/pole forests); olive-sided flycatcher, western bluebird, orange-crowned warbler and rufous hummingbird (young forests). Other birds utilizing this habitat may include Townsend's warbler, evening grosbeak, Swainson's thrush, Anna's hummingbird, cedar waxwing, bushtit, chestnut-backed and black-capped chickadee, American robin, Steller's jay, Bewick's wren, golden-crowned kinglet and Cooper's hawk. Other species may include Douglas' squirrel, common garter snake, rubber boa, elk, black-tailed deer, mountain lion, bobcat, coyote, fox, weasel and a variety of small mammals.

Current extent and attributes: The site includes 12 acres of upland forest habitat, with tree age in the range of 2-100+ years. Dominant trees in the on-site forests include Douglas-fir, big-leaf maple, western red cedar, red alder, Oregon white oak and bird cherry. The forest understory is generally

well-developed with a mix of native and non-native species such as vine maple, tall Oregon grape, red elderberry, Indian plum, English hawthorn, California dewberry and Himalayan blackberry. Removal of invasive species, enhancement plantings and reforestation of cleared areas will expand the acreage of on-site forest and increase the diversity and richness of existing forested areas.

Native fish habitat

Rock Creek has some water quality issues, including draft 2012 TMDL parameters for chlorophyll a and phosphorus. Water temperature is too warm, as documented in the Willamette Subbasin TMDL and the previous Tualatin TMDL documents. The identified Beneficial Uses under the Tualatin TMDL include salmon and trout rearing and migration, salmon and steelhead spawning use, and resident fish and aquatic life (Chapter 2 in the August 2012 draft, Tualatin Subbasin TMDL). However, Rock Creek still harbors several water quality sensitive fish species, including winter steelhead and resident cutthroat.

Key wildlife: Studies in lower and middle Rock Creek document the presence of steelhead, brook and Pacific lamprey, cutthroat and rainbow trout (Friesen 1996; Hawksworth 2001).

Current extent and attributes: The site includes 3,000 linear feet of Rock Creek, a perennial stream. Enhancing riffle-pool habitat, cobble substrate, providing some off-channel habitat and increasing woody debris all add to the site's value for native fish.

APPENDIX A-2 | KEY ECOLOGICAL ATTRIBUTES

Key ecological attributes (KEAs) are aspects of a conservation target's biology or ecology that, if missing or altered, would lead to the loss of that target over time (The Nature Conservancy 2007). KEAs define the conservation target's viability. They are the biological or ecological components that most clearly define or characterize the conservation target, limit its distribution or determine its variation over space and time. They are the most critical components of biological composition, structure, interactions and processes, and landscape configuration that sustain a target's viability or ecological integrity. For each KEA, one or more indicators were selected to assess the health of the KEA.

Indicators are measurable entities related to the condition of the KEA (The Nature Conservancy 2007). A good indicator should be:

- **Biologically relevant:** The indicator should represent an accurate assessment of target health.
- **Sensitive to anthropogenic stress:** The indicator should be reflective of changes in stress.
- **Measurable:** The indicator should be capable of being measured using standard procedures.
- **Cost-effective:** The indicator should be inexpensive to measure using standard procedures.
- **Anticipatory**: The indicator should indicate degradation before serious harm has occurred.
- **Socially relevant:** The indicator's value should be easily recognizable by stakeholders.

Key ecological attribute indicators were categorized by type: size, condition or landscape context:

- **Size:** A measure of the area or abundance of the conservation target's occurrence.
- **Condition:** A measure of the biological composition, structure and biotic interactions that characterize the occurrence.
- **Landscape context:** An assessment of the target's environment including ecological processes and regimes that maintain the target occurrence such as flooding, fire regimes and many other kinds of natural disturbance, and connectivity such as species targets having access to habitats and resources or the ability to respond to environmental change through dispersal or migration.

The status of an indicator will vary over time either within an acceptable range of variation that sustains the conservation target or beyond a critical threshold that threatens the viability of the conservation target. The range is described as very good, good, fair or poor. The very good and good ratings mean that the indicator is functioning within its acceptable range of variation. Fair and poor ratings mean an indicator is outside its acceptable range of variation. When information was lacking to define all four categories then only a subset of the four categories was defined.

Definitions for the four categorizes follow those used by The Nature Conservancy:

- **Very Good**: The indicator is functioning within an ecologically desirable status, requiring little human intervention for maintenance within the natural range of variation (i.e., is as close to "natural" as possible and has little chance of being degraded by some random event).

- **Good:** The indicator is functioning within its range of acceptable variation, although it may require some human intervention for maintenance.
- **Fair:** The indicator lies outside of its range of acceptable variation and requires human intervention for maintenance. If unchecked, the target will be vulnerable to serious degradation.
- **Poor:** Allowing the indicator to remain in this condition for an extended period will make restoration or prevention of extirpation of the target practically impossible (e.g., too complicated, costly and/or uncertain to reverse the alteration).

Key ecological attributes and their indicators for the Orenco Woods Nature Park conservation targets are provided in the following tables.

Table 1: Key ecological attributes for riparian forest (streams or small rivers)

Category	KEA	Indicator	---------- Indicator rating ----------				Current Rating	DFC* for this SCP	Long term DFC	Comments
			Poor	Fair	Good	Very good				
Size	Riparian forest width	Average width of riparian forest	<15 m (50 ft) each side of stream	15-30 m (50-100 ft) each side of stream	30-61 m (100-200 ft) each side of stream	>61 m (200 ft) each side of stream	Poor	Good	Good	Total width, both sides of stream. Estimate using GIS. Riparian forest width positively correlates with water and wildlife habitat quality, including biodiversity corridors. Width includes both sides of stream or one side for larger rivers (effective wildlife movement corridor). Title 13 Class I riparian, which accounts for five primary ecological functions, is typically within 30-61 m (100-200 ft) on either side of the stream; steep slopes are encompassed in the wider distances. Optimum width won't always be achievable; e.g., could interact with other priority habitats such as prairie. (Environmental Law Institute 2003; Metro's *Technical Report for Fish and Wildlife* Habitat, 2005; Hennings and Soll 2010; Shandas and Alberti 2009; Cole and Hennings 2006)
Condition	Vegetative structure: shrub layer	% native shrub cover	<10% cover	10-25% cover	25-50% cover	>50% cover	Fair	Good	Very Good	Estimate via site walk. Indicator categories based on data from local study at 54 riparian study sites. Abundance and richness of many bird and mammal species is associated with native shrub cover and woody vegetation volume. Puget Sound studies suggest that the fragmentation of upland vegetation and the total amount of riparian vegetation explain the greatest amount of variability in riparian bird communities. (Carey and Johnson 1995; Hennings 2001; Hagar 2003; Shandas and Alberti 2009; Hagar 2011)
Condition	Vegetative structure: tree layer	% native tree canopy cover	<20% cover	20-30% cover	30-40% cover	40% or more	Fair	Good	Very Good	Estimate via site walk. Based on data from local study at 54 riparian study sites. In these sites, the best mix of native tree and shrub cover occurred when both were in the 40-60 percent range. Tree cover In this tended to support healthy shrub communities and helped control European starlings. Note that some species, such as yellow-breasted chat, rely on native shrub habitat rather than forest, therefore if specific species are involved separate KEAs should be developed. (Hennings 2001)
Condition	Native herbaceous layer richness	# native species of grasses, herbs, forbs and ferns; at least half are riparian-associated	<5 species	6-12 species	12-18 species	>18 species	Fair	Good	Very Good	Per acre; estimate via site walk. Species numbers based on field experience of Marsha Holt-Kingsley and Lori Hennings; currently using species list from McCain and Christy 2005, Technical Paper R6-NR-ECOL-TP-01-05.
Condition	Native tree and shrub richness	# native tree and shrub species	<5 species	5-10 species	10-15 species	>15 species	Good	Good	Very Good	Per acre; estimate via site walk. Some studies show that native wildlife species diversity (particularly Neotropical migratory songbirds) is associated with native deciduous shrub diversity. (Muir et al. 2002; Hagar 2003; Hagar 2011)
Condition**	Riparian habitat continuity	Gaps in woody vegetation	1 or more gaps >50 m OR 2 or more 25-50 m gaps	1, 25-50 m gap OR 2 or more gaps between 15-25 m	0 or 1, 15-25 m gap	No gaps in woody vegetation >15 m	Poor	Good	Good	Estimate via GIS, per km stream length. Riparian contiguity for water quality and wildlife. Puget Sound studies suggest that the fragmentation of upland vegetation and the total amount of riparian vegetation explain the greatest amount of variation in aquatic conditions. Studies document that some birds and small mammals are unwilling to cross vegetation gaps, with the most typical threshold being 50 m. (Hennings and Soll 2010)
Condition	Standing and downed dead trees	Average # snags and large wood (> 50 cm, or 20 inches, DBH) per acre	< 5 snags and <5% down wood	5-11 snags and 5-10% down wood	12-18 snags and 10-20% down wood with moderate variety of size and age classes	> 18 snags and >20% cover down wood in a good variety of size and age classes	Poor	Good	Very Good	Per acre; estimate via site walk. Rankings distilled from multiple references and particularly from *Habitat Conservation for Landbirds in Lowlands and Valleys of Western Oregon and Washington* (Altman and Alexander 2012) and DecAID results for species' use of dead wood in Westside Lowland Conifer-hardwood forests.
Condition	Floodwater access to the floodplain	Degree of connection between stream/ floodplain during high water events	Extensively disconnected by channel incision, dikes, tide gates, elevated culverts, etc.	Moderately disconnected by channel incision, dikes, tide gates, elevated culverts, etc.	Minimally disconnected by channel incision, dikes, tide gates, elevated culverts, etc.	Completely connected (backwater sloughs, channels)	Fair	Very Good	Very Good	Measure based on field walk, aerials. Adapted from Washington DNR's *Ecological Integrity Assessment for North Pacific Lowland Riparian Forest and Shrubland*, "Hydrologic Connectivity (Riverine)." Added channel incision. Not appropriate for higher gradient streams. (Stanford et al. 1996; Rocchio 2011)
Landscape context	Offsite riparian habitat condition	% rating at least "fair" for both width and gaps (see above), within 2.5 km up- and down-stream of property	0-25%	25-50%	50-75%	75-100%	Good	Good	Good	Measure using aerial photos for 2.5 km stream length, up- and downstream. Several studies suggest the importance of riparian buffer contiguity to water quality, fish and benthic organisms. A 2006 study in and near Damascus, OR found that benthic biotic integrity was significantly correlated with percent forested area for 1,500 m upstream at 50, 100, and 200-m wide. Ontario researchers found that the combination of percent of forested stream bank and forest width within 2.5 km upstream of a site accounted for 90 percent of the observed variation in water temperatures. (Barton et al. 1985; Wang et al. 2001; Cole and Hennings 2006; Freeman et al. 2007; Olsen et al. 2007)

Table 2: Key ecological attributes for oak savanna

Category	KEA	Indicator	Indicator rating				Current rating	DFC* for this SCP	Long term DFC	Comments
			Poor	Fair	Good	Very good				
Size	Western Meadowlark and grassland bird habitat (prairie)	Number of potential male meadowlark territories (20 acre, or 8 ha units)	<40 contiguous acres of mix of suitable habitat such as prairie and degraded prairie, savanna or appropriate pasture habitat; i.e. insufficient habitat for two male meadow-lark territories.	40-119 acres of contiguous prairie or other suitable habitat; i.e. enough for 2 to 5 male meadowlark territories.	120-399 acres of suitable contiguous/con nected habitat; i.e. enough for 6 to 20 male territories. Alternatively, three patches of closely associated suitable habitat, each >40 acres in size.	> 400 acres of suitable contiguous or connected habitat; i.e. enough for >20 male meadow-lark territories. Alternatively, three patches of suitable contiguous or connected habitat, each >140 acres in size.	Poor	Poor	Poor	Estimate via GIS. Western meadowlark territories used as a surrogate for all grassland birds specifically and prairie and savanna system size in general. Literature territory size range average 14 acres (6 ha), range 5-35 acres (2-14 ha). Can be a mixture of upland prairie, wet prairie, and possibly suitable savanna habitat as well. The ratings are aimed at improving population viability, but do not necessarily ensure the specified level of viability, as larger areas may be needed if other habitat features are less suitable (Vesely and Rosenberg 2010; Alverson 2009).
Condition	Native forb and grass abundance	Percent cover native forbs and grasses	<20%	20-30%	30-50%	>50%	Poor	Fair	Very Good	Good prairie habitats are covered >50% by native species. *Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington* (USFWS 2010).
Condition	Vegetation structure	Canopy cover (5-30%) and architecture of woody vegetation	Woody vegetation is invading savanna habitat and total native woody cover is acceptable (5-30%) over less than 50% of the area being managed for savanna.	Woody vegetation is invading savanna habitat but total native woody cover is acceptable (5-30%) over 50-90% of the area being managed for savanna.	Woody vegetation is invading savanna habitat but total native woody cover is acceptable (5-30%) over at least 90% of the area being managed for savanna.	Total native woody cover is acceptable (5-30%) over at least 90% of the area being managed for savanna, and canopy architecture represents an appropriate mix of large open grown trees and younger tree recruitment that will replace older trees when they die.	Poor	Fair	Fair	Estimate based on site walk or aerial photos when trees are leafed out. If cover is estimated from aerial photography threshold cover categories should be increased by at least 5-10 percentage points. (Alverson 2009)
Landscape context	Proximity (distance) to other target habitat patches	Number of habitat patches $\geq$ 40 (16 ha) acres within 2 km (1.25 miles)	No patches within 2 km	One patch within 2 km	Two patches within 2 km	At least three patches within 2 km	Poor	Poor	Poor	This KEA covers the issue of meta-populations and value of having other patches of target habitat within dispersal/ pollinator distance. The 2 km distance may be greater than dispersal of many prairie species, and should be modified when specific dispersal distances for species of interest can be identified (Alverson 2009).

Category	KEA	Indicator	---------- Indicator rating ----------				Current rating	DFC* for this SCP	Long term DFC	Comments
			Poor	Fair	Good	Very good				
Landscape context	Degree of alteration of surrounding landscape	Percentage of landscape within 2 km (1.25 mile) distance of edge of habitat patch in urban or agricultural categories	Surrounding landscape has >50% urban alteration OR >10% urban alteration combined with >50% agricultural alteration other than field crops (e.g., pastures, hayfields, grass seed, etc. that may provide "degraded prairie" habitat).	Urban alteration 10-50% of landscape OR non-field crop agricultural alteration can be ≤ 90% if urban alteration is <10%.	Urban alteration 5-10% of landscape. Non-field crop agricultural alteration ≤ 50%.	Urban alteration < 5%; non-field crop agricultural alteration < 10%	Poor	Poor	Poor	Estimate based on aerial photos. Adapted from TNC (Alverson 2009). TNC chose 2km based on estimation of travel and dispersal by Fender's blue butterfly. Semi-natural vegetation includes non-target native dominated systems, e.g. conifer or hardwood forest or plantation. Agriculture refers to lands actively cropped, excludes lands that may have been cropped formerly. "Urban alteration" includes footprint of residential and industrial development. Assume 2 acre (0.8 ha) footprint per parcel for rural residential development (Alverson 2009).
Landscape context	Edge condition	Percentage of edge bordered by natural habitats and/or managed for conservation	Patch surrounded by non-natural habitats (0-25% natural habitat).	25%+ of patch bordered by natural habitats.	50-75% of patch bordered by natural habitats, or 25-50%, but managed for conservation.	75-100% of patch bordered by natural habitats or 50% but managed for conservation.	Fair	Good	Good	Assess via aerial photographs. The intactness of the edge can be important to biotic and abiotic aspects of the site. Derived from Washington DNR's *Ecological integrity assessment: North Pacific dry Douglas-fir forest and woodland* (Crawford 2011).

*Desired future condition

Table 3: Key ecological attributes for upland forest

Category	KEA	Indicator	---------- Indicator rating ----------				Current status	DFC* for this SCP	Long term DFC	Comments
			Poor	Fair	Good	Very good				
Size	Forested habitat patch size	Patch size (includes native shrub patches or natural clearings)	< 12 ha (30 acres)	12-40 ha (30-100 acres)	40-61 ha (100-150 acres)	>61 ha (150 acres)	Poor	Fair	Good	Calculate by delineating forest patch in GIS. If more than one patch present, rank based on a composite. In the Puget Sound, most native forest birds were present in patches ≥ 104 acres. Local studies suggest a lowest threshold for birds and mammals of about 30 acres. (Environmental Law Institute 2003; Donnelly and Marzluff 2004; Soll and Hennings 2010)
Condition	Native tree and shrub richness	Number of native tree and shrub species per acre	<5 species per 0.4 ha (1 acre)	5-8 species 0.4 ha (1 acre)	8-12 species per 0.4 ha (1 acre)	>12 species per 0.4 ha (1 acre)	Fair	Good	Very Good	Estimate overall via site walk. Native wildlife species diversity is associated with native vegetation. A diversity of shrubs is more likely to provide food and shelter for species over the seasons. Shrub diversity is particularly important to pollinators and songbirds. (Hagar 2003; Hennings 2006; Burghardt et al. 2009).
Condition	Vegetative structure: native tree and shrub layer	Percentage native tree and shrub canopy cover (combined)	<25% cover	25-50% cover	50-75% cover	>75% cover	Fair	Good	Very Good	Estimate overall via site walk. Native bird species richness is associated with the amount of native shrub cover. (Hagar 2003; Hennings 2006). Numbers based on data analysis from local studies at 54 riparian study sites (Hennings 2001). Native shrub cover was as high as ~60%, with highest native shrub cover in the 50-60% tree canopy cover range.
Condition	Mature trees	Number and size (dbh) of species such as Douglas fir, western red cedar, western hemlock and grand fir	Mature trees lacking	<3 per acre with dbh >24 inches	3-5 per acre with dbh >24 inches	>5 per acre with dbh >24 inches	Good	Good	Very Good	Recruitment of native trees necessary for long-term health of upland forests. Saplings are < 2m tall. Based on PIF (2000) biological objective for WV large-canopy trees in riparian deciduous woodland.
Condition	Standing and downed dead trees	Average number of snags and large wood (> 50 cm, or 20 inches, DBH) per acre	< 5 snags and <5% down wood	5-11 snags and 5-10% down wood	12-18 snags and 10-20% down wood with moderate variety of size and age classes	>18 snags and >20% cover down wood in a good variety of size and age classes	Fair	Good	Good	Per acre; estimate via site walk. Rankings distilled from multiple references and particularly from *Habitat Conservation for Landbirds in Lowlands and Valleys of Western Oregon and Washington* (Altman and Alexander 2012) and DecAID results for species' use of dead wood in Westside Lowland Conifer-hardwood forests.

Category	KEA	Indicator	---------- Indicator rating ---------- Poor	Fair	Good	Very good	Current status	DFC* for this SCP	Long term DFC	Comments
Landscape context	Edge condition	Percentage of edge bordered by natural habitats and/or managed for conservation	Patch surrounded by non-natural habitats (0-25% natural habitat)	25%+ of patch bordered by natural habitats	50-75% of patch bordered by natural habitats, or 25-50%, but managed for conservation	75-100% of patch bordered by natural habitats or 50% but managed for conservation	Fair	Good	Good	Assess via aerial photographs. The intactness of the edge can be important to biotic and abiotic aspects of the site. Derived from *Ecological integrity assessment: North Pacific dry Douglas-fir forest and woodland* (Crawford/WDNR 2011).

*Desired future condition

Table 4: Key Ecological Attributes for Native Fish Habitat (instream)

Category	KEA	Indicator	---------- Indicator rating ---------- Poor	Fair	Good	Very good	Current rating status	DFC* for this SCP	Long term DFC	Comments
Condition	Complexity of habitat	# of different stream habitat units per 1,000 foot (305 m) reach	Less than 2 habitat units	Between 2-5 habitat units	Between 5-10 habitat units	Greater than 10 habitat units	Fair	Good	Good	The number of different habitat units indicates the complexity of the stream reach. Complex stream reaches provide high quality habitat for all life stages of native fish. Habitat units may include glides, riffles, runs, pools, step pools, alcoves, side channels, etc. (Independent Multidisciplinary Science Team, 2002, *Recovery of Wild Salmonids in Western Oregon Lowlands*).
Condition	Key pieces and # of pieces of large wood in wetted areas of the stream and adjacent streambank	# key pieces and large wood per 1,000 foot (305 m) reach	<10 large wood pieces and 0-1 key pieces	10-20 large wood pieces and 2-5 key pieces	20-40 large wood pieces and 6-10 key pieces	>40 large wood pieces and >10 key pieces	Poor	Good	Good	Large wood is defined as logs greater than 18 inches diameter and 20 feet (46 cm x 6 m) in length. Note that optimum diameter and length depends on bankfull width; see DSL/ODFW's 2010 *Guide to Placement of Wood, Boulders and Gravel for Habitat Restoration*. Key pieces resist downstream transport as well as anchor and retain other pieces of large wood.
Landscape context	Fish passage	Fish able to move to and from mainstem and tributaries	Complete blockage	Blocked more than half the year	Blocked less than half the year	Passage open year-round	Good	Very Good	Very Good	*Could be adjusted for seasonal movement.*

*Desired future condition.

APPENDIX A-3 | THREATS AND SOURCES

Introduction

A stress is the "impairment or degradation of the size, condition and landscape context of a conservation target, and results in reduced viability of the target," (The Nature Conservancy 2007) or, in other words, a degraded key ecological attribute (KEA) that is outside its acceptable range of variation. Stresses may also reduce the viability of nested conservation targets such as grassland birds. A source of stress is an extraneous factor, either human (e.g., policies, land use) or biological (e.g., non-native species) that infringes upon a habitat or species target in a way that results in stress. Put together, stresses and their sources constitute a threat.

Analysis of threats to conservation targets at Orenco Woods Nature Park involves three parts:

- Identify stresses and apply stress-rating criteria.
- Identify sources of stress, rank and assign threat-to-system rank.
- Assign overall threat rank.

Background on methods

Identify stresses and apply stress-rating criteria

In identifying stresses, we applied the concept that a stress is any alteration of a KEA that can result or has resulted in a KEA declining below a "good" rating. For each conservation target, KEA indicators with ratings of "poor" or "fair" were analyzed by asking the question "*What types of destruction, degradation or impairment are responsible for the 'poor' or 'fair' rating?*" We also considered those KEA indicators with "good" and "very good" ratings but are likely to degrade to "poor" or "fair" if no management actions are taken.

Stresses are ranked according to two criteria: **severity** and **scope** of the anticipated damage.

Severity: The level of damage to the conservation target that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

- **Very high:** The threat is likely to destroy or eliminate the conservation target over some portion of the target's occurrence at the site.
- **High:** The threat is likely to seriously degrade the conservation target over some portion of the target's occurrence at the site.
- **Medium:** The threat is likely to moderately degrade the conservation target over some portion of the target's occurrence at the site.
- **Low:** The threat is likely to only slightly impair the conservation target over some portion of the target's occurrence at the site.

Scope: The geographic extent of impact on the conservation target at the site that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

- **Very high:** The threat is likely to be widespread or pervasive in its scope and affect the conservation target throughout the target's occurrences at the site.
- **High:** The threat is likely to be widespread in its scope and affect the conservation target at many of its locations at the site.
- **Medium:** The threat is likely to be localized in its scope and affect the conservation target at some of the target's locations at the site.
- **Low:** The threat is likely to be very localized in its scope and affect the conservation target at a limited portion of the target's location at the site.

Once severity and scope ratings are determined, they are combined to develop a stress ranking using the following stress ranking table (The Nature Conservancy 2007).

Table 1: Stress ranking

	---------- SCOPE ----------			
Severity	**Very high**	**High**	**Medium**	**Low**
Very high	Very high	High	Medium	Low
High	High	High	Medium	Low
Medium	Medium	Medium	Medium	Low
Low	Low	Low	Low	Low

Identify sources of stress and apply threat to system rank

Sources of stresses are the proximate cause of the stress. A source of stress may be either human activities or biological (e.g., non-native species). Sources of the stress are rated in terms of **contribution** and **irreversibility** as defined below (The Nature Conservancy 2007):

Contribution: The expected contribution of the source, acting alone, under current circumstances (i.e., given the continuation of the existing management/conservation situation).

- **Very high:** The source is a very large contributor of the particular stress.
- **High:** The source is a large contributor of the particular stress.
- ***Medium:*** The source is a moderate contributor of the particular stress.
- ***Low:*** The source is a low contributor of the particular stress.

Irreversibility: The degree to which the effects of a source of stress can be restored.

- **Very high:** The source produces a stress that is irreversible (e.g., wetlands converted to a shopping center).
- **High:** The source produces a stress that is reversible, but not practically affordable (e.g., wetland converted to agriculture).
- **Medium:** The source produces a stress that is reversible with a reasonable commitment of resources (e.g., ditching and draining of wetland).
- **Low:** The source produces a stress that is easily reversible at relatively low cost (e.g., off-road vehicles trespassing in wetland).

The contribution and irreversibility of each source across all the stresses to each conservation target is ranked using Table 2, resulting in a source of stress rank for each contribution/ irreversibility combination (The Nature Conservancy 2007).

Table 2: Source ranking

	---------- CONTRIBUTION ----------			
Irreversibility	**Very high**	**High**	**Medium**	**Low**
Very high	Very high	High	High	Medium
High	Very high	High	Medium	Medium
Medium	High	Medium	Medium	Low
Low	High	Medium	Low	Low

In a similar fashion stress and source rankings are combined to develop a threat ranking specific to that conservation target (Table 3).

Table 3: Threat ranking

	---------- CONTRIBUTION ----------			
Stress	**Very high**	**High**	**Medium**	**Low**
Very high	Very high	Very high	High	Medium
High	High	High	Medium	Low
Medium	Medium	Medium	Low	Low
Low	Low	Low	Low	low

Threat-to-system rank

A threat-to-system rank is a summary ranking for all threats associated with a particular source of stress to a conservation target. Where multiple threats related to the same source of stress occurred, the threat-to-system rank is adjusted by using the "3-5-7" rule (The Nature Conservancy 2000) as follows:

- Three high rankings equal a very high.
- Five medium rankings equal a high.
- Seven low rankings equal a medium.

Table 4 illustrates the threat-to-system ranking.

Table 4: Conservation target A

	Stress 1	**Stress 2**	**Stress 3**	**Threat to system rank**
Stress rank	High	Medium	Medium	
Source A rank	High	Medium	N/A	*High**
Source B rank	Low	N/A	Medium	*Medium***

N/A = Not applicable: stress/source combination does not affect conservation target
*, ** - See Table4

Overall threat rank

The last step in the process is to summarize threats across the system and apply an overall threat rank to each threat (source/stress combination). Overall threat ranks are determined by combining threat-to-system ranks across all system/targets affected by that threat. For each threat, DEA will

combine the threat-to-system ranks across all conservation targets into an overall threat rank of very high, high, medium, or low as determined by the "2 Prime" rule which is as follows:

- Two very high threat rankings yield an overall threat rank of very high.
- One very high or two high threat rankings yield an overall threat rank of high.
- One high or two medium threat rankings yield an overall threat rank of medium.
- Less than two medium threat rankings yield an overall threat rank of low.

The overall threat rank represents the degree to which a particular source causes stress to the conservation target.

Table 5: Overall threat rank

	Target 1	Target 2	Target 3	Overall threat rank
Threat A	*High**	Very high	High	High
Threat B	*Medium***	Medium	High	Medium
Threat C	N/A	Medium	Low	Low

*, ** - from Tables 5,6

Threats and source analysis for the Orenco Woods Nature Park

Threats for the Orenco Woods Nature Park conservation targets are listed in the tables below.

Table 6: Riparian forest

Stress	Stress rank	Source	Source rank	Threat rank	Comments
Increased competition from invasive species	High	Extensive non-native grasses, broadleaf weeds; limited invasive woody vegetation	High	High	Non-native broadleaf weeds include Himalayan blackberry, Scots broom, English ivy, Canada thistle and foxglove. Tied to native vegetation and structure KEAs.
Lack of down and standing dead wood	High	Previous land management practices and altered hydrology	Medium	Medium	Due to previous land use (golf course) altered hydrology (see related stress), which can erode streambanks and near-stream plants and remove sources of dead wood. Tied to dead wood KEAs.
Altered hydrology	Very High	Primarily land management and development in upstream portions of the watershed	High	Very High	Widespread altered hydrology leads to stream bank erosion, riparian vegetation loss, channel damage, loss of gravel and cobble substrate, and overall habitat simplification.
Human disturbance (recreational activities)	High	Demand trails, dogs	Medium	Medium	Demand trail users trample vegetation, spread invasive weed; humans and dogs disturbing ground-nesting birds. Tied to structure, native plant KEAs.

Table 7: Oak Savannah

Stress	Stress rank	Source of stress	Source rank	Threat rank	Comments
Increased competition from invasive species	High	Extensive non-native grasses and broadleaf weeds	High	High	Non-native broadleaf weeds include Himalayan blackberry, English ivy and Canada thistle. Tied to native species abundance and richness KEAs.
Altered fire (disturbance) regime	High	Lack of regular fires	High	High	Lack of natural disturbance regime promotes invasive species and conifer encroachment and increases risk of a high intensity fire. Tied to native species abundance, richness, and woody species KEAs.
Human disturbance (recreational activities)	High	Demand trails, dogs	Medium	Medium	Demand trail users trample vegetation, spread invasive weed; humans and dogs disturb ground-nesting birds and small mammals. Tied to vegetation structure, native grass and forb KEAs.

Table 8: Upland Forest

Stress	Stress rank	Source	Source rank	Threat rank	Comments
Increased competition from invasive species	High	Encroachment of non-native invasive species	Medium	Medium	Extensive invasive grasses and broadleaf weeds, especially reed canarygrass, non-native turf grasses and Canada thistle, and invasive shrubs such as Himalayan blackberry. Tied to native species KEAs.
Habitat conversion	High	Conversion from natural forest, prairie or savanna to single age young forest	Medium	Medium	Tied to native plant and vegetative structure KEAs.
Lack of downed and standing dead wood	High	Previous forest management practices	Medium	Medium	Snags and down wood are critical habitat elements used by more than 150 species of wildlife in Northwest conifer forests (Hagar 2007). Tied to dead wood KEAs.
Altered fire regime	Medium	Suppression of fire frequency outside natural range of variation	Medium	Low	Increased risk of stand-replacing fires in Douglas-fir forest, where a build up of fuels would increase risk of a high intensity fire. Tied to all KEAs.
Human disturbance (recreational activities)	Medium	Demand trails, dogs	Medium	Low	Stress to wildlife species utilizing this habitat. Potential loss of habitat and vegetation structure by escaped fire. Disturbance reduces habitat value. Tied to structure/patch size (interior habitat) KEAs.

Table 9: Native fish habitat

Stress	Stress rank	Source	Source rank	Threat rank	Comments
Simplified stream structure, sparse side channel refugia and riffle-pool sequences	Very High	Altered hydrology, channel morphology due to previous land use and upstream development	High	Medium	Salmon require off-channel habitat for rearing. Adult salmon need riffle-pool habitat for spawning, refugia, prey habitat and water oxygenation. Tied to all but fish passage KEAs.
Lack of logs and dead wood in streams	High	Previous forest management practices; narrow riparian buffer in most areas	Medium	Medium	Large logs are critical for juvenile fish and form the matrix of large wood jams and structure that provides stream complexity. Tied to habitat complexity and large wood KEAs.
Impaired fish passage	Medium	Manmade structures that block fish migration including: dams, weirs, culverts	Low	Low	A low weir on Rock Creek provides an obstacle to fish movement only during periods of very low flows. Fish passage barriers exist upstream and should be addressed to improve native fish habitat in the system.

APPENDIX A-4 | INVASIVE SPECIES

The table below summarizes a preliminary list of invasive plants requiring control in all or parts of Orenco Woods Nature Park, including focus areas and timing for control. Invasive species, with the exception of Early Detection Rapid Response (EDRR) species, will be controlled as part of restoration projects or ongoing management of habitat areas. Photos of EDRR species for identification are listed below. A list of noxious weeds for Oregon, including descriptions and photos, can be found at: www.oregon.gov/ODA/PLANT/WEEDS/statelist2.shtml.

Table 1: Working list of priority non-native species for control at Orenco Woods Nature Park (EDRR species common names are bolded in red)

Genus	Species	Common name	Focus area for detection/control	Control timing
Allarium	*petiolata*	**Garlic Mustard**	All	Spring
Brachypodium	*sylvaticum*	**False Brome**	All	Spring/Fall
Centaurea	*pratensis*	**Meadow knapweed**	Savannah	Summer
Cirsium	*arvense*	Canada thistle	Savannah	Spring
Clematis	*vitalba*	Old man's beard	Upland forest	Spring/Fall
Conium	*maculatum*	Poison hemlock	Savannah	Spring
Crataegus	*monogyna*	Common hawthorn	Prairie	Fall
Cytisus	*scoparius*	Scotch broom	Prairie	Fall
Daphne	*laureola*	**Spurge Laurel**	All	Spring/Fall
Dipsacus	*fullonum*	Teasel	All	Spring
Hedera	*Helix*	English Ivy	All	Winter
Hypericum	*perforatum*	St John's wort	Savannah	Spring
Ilex	*aquifolium*	Holly	Upland forest	Fall
Iris	*pseudacorus*	Yellow iris	Forested wetland	Fall
Lunaria	*Annua*	Money Plant	Savannah	Spring
Lythrum	*salicaria*	**Purple loosestrife**	Forested wetland	Summer
Mentha	*pulegium*	Pennyroyal	Savannah	Summer
Phalaris	*arundinacea*	Reed canarygrass	Savannah, Forested Wetland	Fall
Polygonum	*cuspidatum*	Japanese knotweed	All	Summer
Robinia	*pseudoacacia*	Black locust	savannah	Fall
Rubus	*armenianus*	Himalayan blackberry	All	Fall
Solanum	*dulcamara*	Bittersweet nightshade	All	Spring

Photo 1: Garlic mustard


Images courtesy of Glenn Miller, Oregon Dept. of Agriculture

Photo 2: False brome


Images courtesy of Glenn Miller, Oregon Dept. of Agriculture

Photo 3: Meadow knapweed


Images courtesy of Dan Sharratt, Oregon Department of Agriculture

Photo 4: Purple Loosestrife


Images courtesy of Bonnie Rasmussen (left) and Eric Coombs (right), Oregon Dept. of Agriculture

Photo 5: Spurge Laurel


Images courtesy of *Randy Westbrooks* (left) and King County noxious weed program (right)

APPENDIX B | REFERENCES AND ADDITIONAL RESOURCES

References and additional resources

Altman B, Alexander JD. 2012. Habitat conservation for landbirds in coniferous forests of western Oregon and Washington. Version 2.0. Oregon-Washington Partners in Flight (www.orwapif.org) and American Bird Conservancy and Klamath Bird Observatory.

Altman B. 1999. Status and conservation of state sensitive grassland bird species in the Willamette Valley. Corvallis, OR, Oregon Department of Fish and Wildlife.

Altman B. 2000. Conservation strategy for landbirds in lowlands and valleys of western Oregon and Washington. Version 1.0. Corvallis, OR, Oregon-Washington Partners in Flight and the American Bird Conservancy.

Alverson E. 2009. Key ecological attributes and indicators for Willamette Valley prairie and oak systems. Excel spreadsheet. Eugene, OR, The Nature Conservancy.
Ref Type: Generic

Barton DR, Taylor WD, Biette RM. 1985. Dimensions of riparian buffer strips required to maintain trout habitat in southern Ontario streams. North American Journal of Fisheries Management 5:364-378.

Bauer S, Salminen E, Runyon J. 2005. Clackamas River Basin Action Plan. Clackamas, OR, Clackamas River Basin Council.

Burghardt KT, Tallamy DW, Shriver WG. 2009. Impact of native plants on bird and butterfly biodiversity in suburban landscapes. Conservation Biology 23:219-224.

Carey AB, Johnson ML. 1995. Small mammals in managed, naturally young, and oldgrowth forests. Ecological Applications 5:336-352.

Cole MB, Hennings LA. 2006. Baseline assessment of stream habitat and macroinvertebrate communities in and adjacent to the Damascus area urban growth boundary expansion, Oregon. Portland, OR, Metro Regional Government.

Crawford R. 2011. Ecological integrity assessment: North Pacific dry Douglas-fir forest and woodland. Olympia, WA, Washington Department of Natural Resources, Natural Heritage Program.

Donnelly R, Marzluff JM. 2004. Importance of reserve size and landscape context to urban bird conservation. Conservation Biology 18:733-745.

Environmental Law Institute. 2003. Conservation thresholds for land use planners. ELI project code 003101, Washington, D.C., Environmental Law Institute.

Floberg J, Goering M, Wilhere G, MacDonald C, Chappell C, Rumsey C, Ferdana Z, Holt A, Skidmore P, Horsman T, Alverson E, Tanner C, Bryer M, Iachetti P, Harcombe A, McDonald B, Cook T, Summers M, Rolph D. 2004. Willamette Valley - Puget Trough - Georgia Basin Ecoregional Assessment. The Nature Conservancy, with support from the Nature Conservancy of Canada, Washington Department of Fish and Wildlife, Washington Department of Natural Resources (Natural Heritage and Nearshore Habitat programs), Oregon State Natural Heritage Information Center and the British Columbia Conservation Data Centre.

Foster SC, Stein CH, Jones KK. 2001. A guide to interpreting stream survey records. Portland, OR, Oregon Department of Fish and Wildlife. Aquatic Inventories Project, Natural Production Program.

Freeman MC, Pringle CM, Jackson CR. 2007. Hydrologic connectivity and the contribution of stream headwaters to ecological integrity at regional scales. Journal of the American Water Resources Association 43:5-14.

Gerig AJ. 1985. Soil survey of Clackamas County area, Oregon. Natural Resource Conservation Service.

Goklany ME, Johnson BR, Tomaszewski T, Pfeifer-Meister L, Bridgham SC. 2011. How will climate change affect the physiology, productivity, and fitness of the invasive grass, *Agrostis capillaris* L., in Pacific Northwest prairies? Program for 96th ESA Annual Meeting (August 7-12, 2011)

Hagar J. 2003. Functional relationships among songbirds, arthropods, and understory vegetation in Douglas-fir forests, western Oregon. Corvallis, OR, Oregon State University.

Hagar JC. 2007. Key elements of stand structure for wildlife in production forests west of the Cascade Mountains. Harrington TB, Nicholas GE, editors. PNW-GTR-695. Portland, OR, USDA Forest Service, Pacific Northwest Research Station.

Hagar JC. 2011. Partial harvesting can enhance foraging habitat for birds associated with understory vegetation in western Oregon forests. Jones SL, editor. Biological Technical Publication BTP-R1014-2011. Washington, DC, US Department of the Interior, Fish and Wildlife Service.

Hawksworth J.T. 2001. Middle Tualatin-Rock Creek Watershed Analysis. BLM/OR/WA/PT-00/015+1792. Tillamook, OR, USDA Bureau of Land Management, Salem District Office.

Hennings LA, Soll J. 2010. Wildlife corridors and permeability. A literature review. Portland, OR, Metro.

Hennings LA. 2001. Avian communities in riparian reserves in an urban landscape. M.S. thesis, Oregon State University, Corvallis, OR.

Hennings, LA. 2006. State of the watersheds monitoring report. Portland, OR, Metro Regional Government.

Independent Multidisciplinary Science Team. 2002. Recovery of wild salmonids in western Oregon lowlands. Technical Report 2002-1 to the Oregon Plan for Salmon and Watersheds. Salem, OR, State of Oregon, Governor's Natural Resources Office.

Lower Columbia Fish Recovery Board. 2004. Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan.

Lower Columbia Fish Recovery Board. 2010. Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (updated from 2004 draft).

McCain C, Christy JA. 2005. Field guide to riparian plant communities in northwestern Oregon. Technical Paper R6-NR-ECOL-TP-01-05. Portland, OR, USDA Forest Service, Pacific Northwest Region.

Metro Regional Government. 2005. Metro's Technical Report for Fish and Wildlife Habitat. Exhibit F, Ordinance No. 05-1077C, Attachment 2. Portland, OR, Metro Regional Government.

Moore K, Jones K, Dambacher J, Stein C et al. 2012. Methods for stream habitat surveys. Corvallis, OR, Oregon Department of Fish and Wildlife, Conservation and Recovery Program. Aquatic Inventories Project.

Muir PS, Mattingly RL, Tappeiner JC II, Bailey JD, Elliott WE, Hagar JC, Miller JC, Peterson EB, Starkey EE. 2002. Managing for biodiversity in young Douglas-fir forests of western Oregon. USGS/BRD/BSR-2002-0006. Corvallis, OR, US Department of the Interior, US Geological Survey, Forest and Rangeland Ecosystem Science Center.

Olson DH, Anderson PD, Frissell CA, Hartwell HW Jr., Bradford DF. 2007. Biodiversity management approaches for stream–riparian areas: Perspectives for Pacific Northwest headwater forests, microclimates, and amphibians. Forest Ecology and Management 246:81-107.

Oregon Department of Fish and Wildlife. 2006. Oregon Conservation Strategy. Salem, OR, Oregon Department of Fish and Wildlife.

Oregon Department of State Lands, Oregon Department of Forestry, Oregon Watershed Enhancement Board, and Oregon Department of Fish and Wildlife. 2010. Guide to placement of wood, boulders and gravel for habitat restoration. Final draft January 1, 2010. Portland, OR, Oregon Department of Forestry and Oregon Department of Fish and Wildlife.

Primozich, D, Bastasch R. Draft Willamette Subbasin Plan. 2004. Portland, OR, Northwest Power and Conservation Council (prepared by the Willamette Restoration Initiative).

Rocchio J. 2011. Ecological integrity assessment: North Pacific lowland riparian forest and shrubland. Olympia, WA, Washington Department of Natural Resources.

Runyon J, Salminen E. 2005. Clackamas basin summary fish populations and aquatic riparian habitat. Boise, ID, Watershed Professionals Network, prepared for the Clackamas River Basin Council.

Salminen E. 2005. Clackamas Basin summary watershed overview. Clackamas, OR, Clackamas River Basin Council.

Shandas V, Alberti M. 2009. Exploring the role of vegetation fragmentation on aquatic conditions: Linking upland with riparian areas in Puget Sound lowland streams. Landscape and Urban Planning 90:66-75.

Stanley AG, Kaye TN, Dunwiddie PW. 2008. Regional strategies for restoring invaded prairies: Observations from a multi-site, collaborative research project. Native Plants Journal 9:247-254.

The Intertwine Alliance. 2012. Biodiversity guide for the greater Portland-Vancouver region. Portland, OR, The Intertwine Alliance.

The Intertwine Alliance. 2012. Regional Conservation Strategy for the Greater Portland-Vancouver Region. Portland, OR, The Intertwine Alliance.

The Nature Conservancy. 2003. The Five-S Framework for site conservation. Third edition.

The Nature Conservancy. 2007. Conservation action planning handbook. Arlington, VA, The Nature Conservancy.

Thom BA, Kavanagh PS, Jones KK. 2000. Reference site selection and survey results 2000, Oregon Plan for Salmon and Watersheds. Monitoring Report No. OPSW-ODFW-2001-6. Portland, OR, Oregon Department of Fish and Wildlife. Aquatic Inventories Project.

US Fish and Wildlife Service. 2010. Recovery plan for the prairie species of western Oregon and southwestern Washington. Portland, OR, US Fish and Wildlife Service.

Vesely DG, Rosenberg DK. 2010. Wildlife conservation in the Willamette Valley's remnant prairie and oak habitats: A research synthesis. Corvallis, OR, Oregon Wildlife Institute.

Wang L, Lyons J, Kanehl P, Bannerman R. 2001. Impacts of urbanization on stream habitat and fish across multiple spatial scales. Environmental Management 28:255-266.

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