Crescent Valley Biodiversity Management Area (BMA) Stewardship Plan

Crescent Valley Alliance

Pierce County Biodiversity Alliance

PCBA

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Frequently Used Acronyms

BMA – Biodiversity Management Area
BWH – Backyard Wildlife Habitat
CLC – Cascade Land Conservancy
CVA – Crescent Valley Alliance
CWH – Community Wildlife Habitat
GIS – Geographic Information System
GPLC – Greater Peninsula Land Conservancy
NWF – National Wildlife Federation
PAC – Peninsula Advisory Commission
PCBA – Pierce County Biodiversity Alliance
PCCD – Pierce County Conservation District
PSAT – Puget Sound Action Team
PWU – Pierce County Public Works and Utilities
SMA – Shoreline Master Act

Frequently Used Acronyms Cont'd:
SMP – Pierce County Shoreline Master Program
SMR – Pierce County Shoreline Management Regulations
SYH – Schoolyard Habitats
TNC – The Nature Conservancy
TPCHD – Tacoma Pierce County Health Department
WDFW – Washington Department of Fish and Wildlife
WSU – Washington State University – Pierce County Cooperative Extension Office

Chapter I - Background

Creation of a Biodiversity Plan for Pierce County

The Washington Growth Management Act requires each of the state's 39 counties to address open space and environmentally sensitive areas in their comprehensive plans. Pierce County's open space planning process includes land areas with the greatest fish and wildlife biological diversity or "biodiversity". The planning method used to identify these biodiversity areas is called "GAP analysis."

GAP analysis is a process of identifying core habitat areas that contain the highest level of species richness and representation remaining across the landscape. The GAP analysis methodology uses the mapping technologies of satellite imagery and the Geographical Information System (GIS) to create a current vegetation map. From that, distribution of wildlife species is derived and areas of high biodiversity are identified. The map is refined or "ground-truthed" with any and all known plant community and wildlife occurrences from WDFW's Priority Habitats and Species and Streamnet databases, the Department of Natural Resources' Heritage and Sensitive Plant Species databases, county natural resource inventories, and local expert biological opinion. This process identified core habitat areas that, along with a surrounding ¼ mile buffer area, provided the framework for the creation of biodiversity management areas (BMAs). BMAs were then connected, often along watercourses, and the resulting coverage became the Biodiversity Network. This information was subsequently incorporated into Pierce County's Comprehensive Plan Open Space Corridors Map.

In January 2000, the first Biodiversity Plan for Pierce County was published[1]. The habitat types represented in the Pierce County Biodiversity Network include lowland riparian areas and wetlands, deciduous hardwoods, oak savannahs and prairies, deciduous old-growth forests, and alpine peaks and meadows. Many of these habitats contain imperiled species including Chinook Salmon, Western Gray Squirrel, Bald Eagle, Spotted Owl, Grizzly Bear, Gray Wolf, and Western Pond Turtle. In addition, the Pierce County GAP analysis was conducted using watershed boundaries, rather than jurisdictional boundaries; therefore the Pierce County Biodiversity Network extends into the adjacent counties of King, Kitsap, Thurston, Lewis and Yakima.

In 2003, Pierce County began a finer-level assessment of lands within the Biodiversity Network to provide a groundtruthing of the original network. This assessment included detailed review of each BMA and connecting corridors through the use of recent orthophotography and site visits conducted by a WDFW biologist. The predicted species lists were also updated to add all predicted species including butterflies and introduced species. The result of this assessment was unilateral removal of the ¼ mile buffer placed around the core habitat polygons and re-alignment of all the connecting corridors along watercourses. The final revised Biodiversity Network identifies 16 biologically rich areas and connecting corridors that cover 267,784 acres of land (see Figure 1 – County's Revised BMA network). In 2004, the County Council adopted the Pierce County Biodiversity Network Assessment Report[2], and modified the County's Comprehensive Plan Open Space Corridors Map to reflect this revised data set.

[1] Pierce County GAP Application Pilot Project: A Biodiversity Plan for Pierce County, Washington, January 2000.
[2] Pierce County Biodiversity Network Assessment, August 2004.

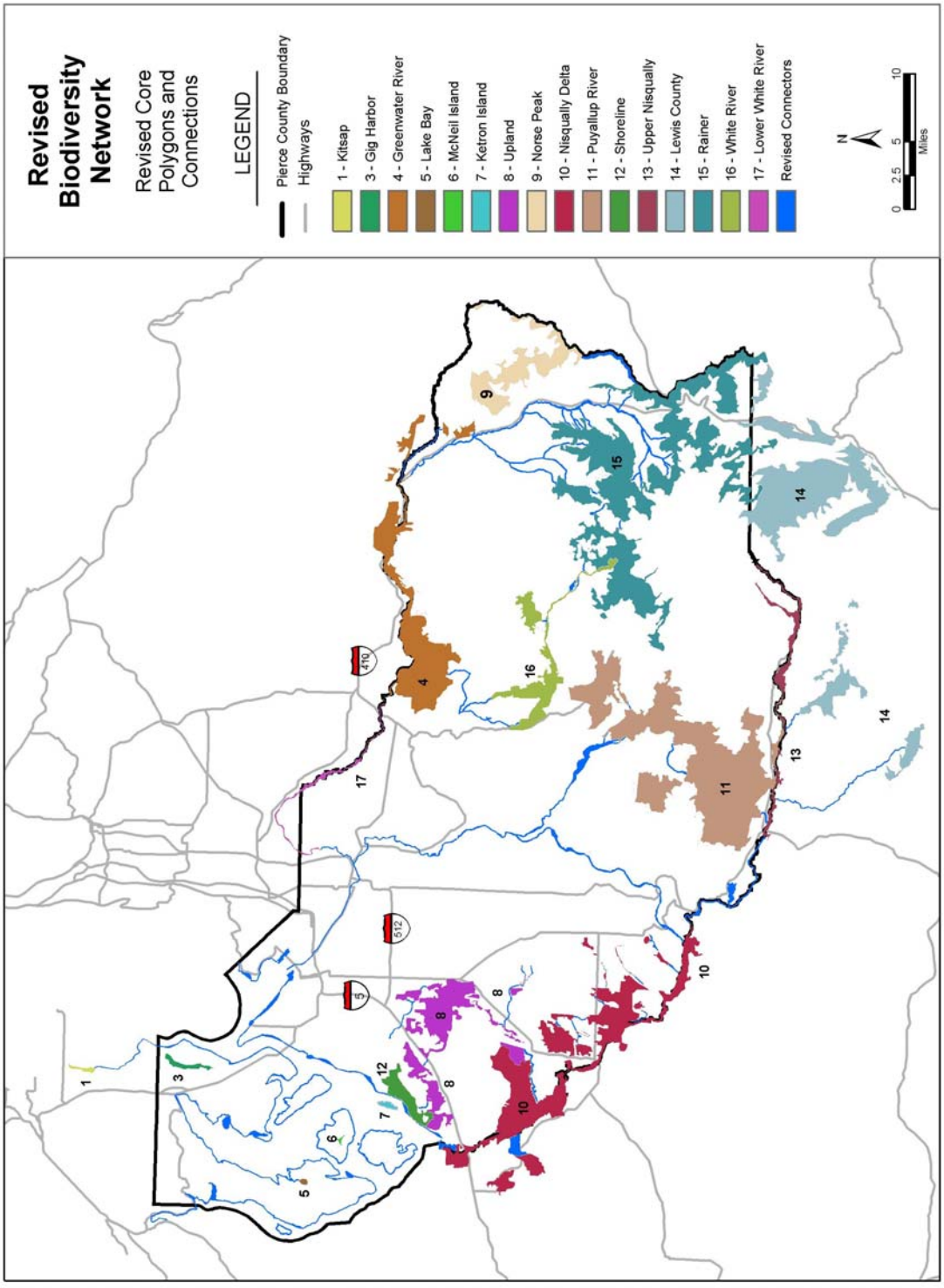

Figure 1. Revised BMA network

Implementation Strategies for the Biodiversity Network

Since adoption of the first Pierce County Biodiversity Plan, the County has been using this biodiversity information in relation to land use planning in a variety of ways. The Biodiversity Network coverage has been integrated into the County's Comprehensive Plan Open Space Corridors map. This map has been considered in many community planning processes and has served as the basis for the creation of lower density zones and the establishment of habitat conservation based design standards, such as low impact development techniques and minimum native vegetation retention. In addition, County regulations have been changed to recognize lands within the Biodiversity Network as a high priority for various incentive programs such as the Conservation Futures Program and Current Use Assessment Program.

This multi-pronged implementation strategy is putting emphasis on proactive conservation of multiple species, rather than on reactive restoration of individual threatened or endangered species. This approach helps guide county planners in directing more intense development away from identified bio-rich lands and can also guide private and public land conservation purchases or easements and restoration actions.

However, while some progress has been made at a countywide planning level, landscape scale planning documents often fail to implement on-the-ground land use actions that serve to promote long-term conservation in "bio-rich" areas. Thus, the ultimate strategy for implementation is to work directly within each BMA to conduct detailed inventories of the predicted species and habitat; meet with property owners to ascertain potential stresses to the system and sources of stress (collectively referred to as "threats") and identify a set of conservation strategies to abate these threats; and develop a set of prioritized actions to reduce or eliminate threats and restore habitat areas that will be implemented by a community group over time.

Pierce County Biodiversity Alliance

In order to accomplish the preservation of biodiversity within Pierce County's Biodiversity Network, a group of dedicated individuals has formed an alliance (referred to as the Pierce County Biodiversity Alliance). The Pierce County Biodiversity Alliance (PCBA) is comprised of a unique set of stakeholders, representing governmental, academic and non-profit agencies, who are interested in preserving the long-term biodiversity of Pierce County. Alliance members include Pierce County government; University of Washington - Cooperative Fish and Wildlife Unit; *NatureMapping* Program; Community Explorers; Washington Department of Fish and Wildlife; Metro Parks Tacoma; Tahoma Audubon Society; Friends of Pierce County; Pierce County Conservation District; Point Defiance Zoological Society; U.S.G.S. – National GAP Program, University of Puget Sound, National Wildlife Federation, Puyallup River Watershed Council; and The Nature Conservancy. And the PCBA is continuing to expand and partner with others who are also interested in protecting biodiversity within the Pierce County Biodiversity Network.

The main emphasis of the PCBA is non-regulatory in nature and instead focuses on public outreach to property owners within the Pierce County Biodiversity Network, providing education and incentive programs to maintain the habitats and biological diversity. The PCBA goal is to establish biological surveys and monitoring programs and facilitate the development of locally derived habitat conservation plans that will provide detailed information on habitat quality and species presence/viability, identification of threats, threat abatement strategies including restoration opportunities, and priorities for conservation and land acquisition for each BMA. And during this process, create a cohesive community group that can

work together towards long-term implementation of conservation strategies.

This endeavor advocates responsible land use and success will be achieved when each BMA and connecting corridor retains ecological function given the community's land-use objectives as outlined in the adopted Comprehensive Plan or community plan. The Crescent Valley BMA Stewardship Plan is the first of such efforts.

Project Description and Public Participation

The Crescent Valley BMA[3] is a special Puget Sound lowland environment comprised of Crescent Lake with an outlet into Crescent Creek, which traverses about three miles to deposit into the Gig Harbor Estuary. Crescent Creek supports several documented salmonid species including Chinook, Coho, Chum and Steelhead. This area is known locally as Crescent Valley.

In June 2005, the PCBA conducted an intensive 24-hour species verification survey (referred to as a "bioblitz") and community outreach efforts on private lands within the Crescent Valley BMA. Preparation for the bioblitz began with a *NatureMapping* workshop to train citizens and experts on data collection protocols[4]. Public outreach included direct mailing to all property owners within the BMA (see Figure 2) and follow-up telephone contacts. The event also received media coverage through WDFW's *Wild About Washington* and a Rainier Cable broadcast on the local government channel. Beginning in the afternoon of June 3rd bioblitz participants, lead by a Department of Fish and Wildlife staff biologist, utilized the *NatureMapping* Program's NatureTracker data collection and global positioning software to precisely identify where birds, mammals, amphibians, reptiles, insects, aquatic insects, and plants were found and accurately document what species was identified. The Masonic Hall on Crescent Valley Road served as science central headquarters. Thirty-four private landowners allowed access to their private property. A total of 35 experts, 13 citizen scientists, and 4 landowners observed 72% of the predicted bird species, 57% of the predicted amphibians, 32% of the predicted mammals, 40% of the predicted reptiles, 3 fish species, 148 invertebrate samples, and 169 plant species. This is the first bioblitz to be conducted in Washington and the first ever to be conducted on privately owned lands. The summer bioblitz was followed by a winter birding event in February 2006. An additional 14 new species were found and four species were also identified that were originally predicted but not confirmed during the summer 2005 bioblitz. An inventory was conducted in April 2007 as part of a *NatureMapping* workshop on property at the south end of Crescent Lake recently obtained by PenMet Parks and not previously inventoried during the previous surveys. Seven additional predicted species of vertebrates, 4 new plant species, and bog not previously recorded were found.

[3] The Pierce County Biodiversity Plan, January 2000 and the Pierce County Biodiversity Network Assessment, August 2004 refer to the Crescent Valley BMA as the Gig Harbor BMA because of its location on the Gig Harbor Peninsula. However this BMA is located within the Crescent Valley and the residents who live within that BMA prefer that the name be referenced as the Crescent Valley BMA.

[4] The *NatureMapping* Program trains teachers and individual citizens to conduct wildlife and habitat assessments, using standardized protocols and methodology, for integration into a statewide biological survey. All information is transmitted to a central database repository, located at the University of Washington, where it can be used by the public to make local policy and planning decisions regarding how resources may be managed.

The information gathered from the three field surveys will enable citizens to help establish a benchmark of current species located within the Crescent Valley BMA and will also contribute to long-term monitoring activity. Species observations recorded during this monitoring will be used to evaluate whether biodiversity conservation strategies are having positive and successful results. Landowners may also use this information when enrolling in Pierce County's Current Use Assessment tax incentive program or making application for a land acquisition using Conservation Futures funding.

Pierce County Biodiversity Alliance - BioBlitz 2005

June 3rd - June 4th

As a resident of Crescent Valley you appreciate living in a special place surrounded by natural beauty and wildlife. During a recent survey of Pierce County, Crescent Valley was recognized as one of the unique places that sustain healthy populations of fish, mammals, birds, reptiles, and amphibians. Pierce County Biodiversity Alliance needs your help to better understand the wildlife that lives in the Crescent Valley.

We are asking property owners to join fish and wildlife biologists and volunteers in a weekend BioBlitz of Crescent Valley from **3:00 p.m. Friday June 3rd through 3:00 p.m. Saturday June 4th.** Our goal is to inventory, over this 24-hour period, the variety of different animals and plants found in Crescent Valley. A similar project at a larger scale is taking place in Central Park, New York City. BioBlitzes across the U.S. reflect America's enthusiasm for the biological diversity of this nation. We need your help and knowledge to do this! Additionally, a wildlife assessment of your property would benefit property owners who wish to apply to the county's open space tax reduction program. If wildlife were found on your property, such an assessment would add points to an application and could increase the tax break.

Landowners in the Crescent Valley are encouraged to invite and accompany a team of biologists onto their property for inventory work or to allow team access. Biologists participating in this event are insured. All ages are welcomed. If you would like to help with the inventory or provide access, please complete and mail the attached form. Questions may be directed to 253-813-8906. Once the fish, wildlife, and habitat information has been gathered, it will be shared with you along with ideas about things we all can do to help wildlife and maintain our quality of life in this magnificent area.

----------Please Clip and Mail----------

BioBlitz 2005

Landowner Last Name:_____Parcel #:_____

Full Address:_____

Would you like to participate in the Gig Harbor BioBlitz 2005? : _____yes _____no

Do you grant permission for biologist to access your property for surveys: _____yes _____no

Will you be present during survey period but not assisting?: _____yes _____no

Comments:_____

_____

_____

_____

_____

_____

Figure 2. Mailing Notice for June 2005 Bioblitz Event in Crescent Valley BMA

A community meeting was held in October 2005 to present the results of the June bioblitz to the residents in the Crescent Valley BMA and solicit their help developing long-term biodiversity conservation strategies for this area. The citizens in that area were very excited and eager to form an advisory committee, referred to as the Crescent Valley Alliance (CVA), to accomplish this task. The PCBA led the first 9 community meetings over a course of 10 months helping the CVA to develop their stewardship plan. The meeting agendas and meeting summaries are attached as Appendix 1.

Implementation of the Crescent Valley BMA Stewardship Plan

The Crescent Valley BMA Stewardship planning process includes the development of implementation measures to conserve biodiversity. These measures include actions such as property owner enrollment in county tax reduction incentive programs (Current Use Assessment - Public Benefits Rating System) or permanent dedication or purchase of properties as open space (Conservation Futures Program); restoration of native vegetation in areas of degraded habitat (Landowner Incentive Programs, Washington Department of Fish and Wildlife's and National Wildlife Federation's Backyard Wildlife Sanctuary Programs, Pierce County Conservation District's Stream Team); and education on acceptable riparian/wetland land management.

Once the Crescent Valley BMA Stewardship Plan is developed the CVA will continue on as the oversight group responsible for full implementation of the plan including pursuing funding opportunities to complete action items. To that end the CVA has adopted the following Mission Statement:

> *CVA encourages responsible stewardship of Crescent Lake, Creek and Estuary through education, communication and cooperation. We strive to preserve and enhance the native biodiversity for ourselves and future generations.*

It is the goal that this process may eventually lead to certification of the Crescent Valley BMA and Watershed as a National Wildlife Federation - Community Wildlife Habitat.

National Wildlife Federation - Community Wildlife Habitat Program Certification

National Wildlife Federation's (NWF) community education programs empower homeowners, students, community leaders and businesses to preserve, restore and create sustainable landscapes that support a multitude of wildlife and native plants in their backyards, workplaces, places of learning and other community spaces. NWF supports these efforts through training, print and online resources and recognition through a formal certification process. To certify a habitat through NWF, individuals must provide local wildlife with four basic elements: food, water, cover and places for wildlife to raise their young. To date there are 2,325 certified Backyard Wildlife Habitat (BWH) sites, 50 Schoolyard Habitats (SYH) sites and two certified Community Wildlife Habitats (CWH) in Washington State.

The Community Wildlife Habitat program is critical to NWF's work in the Puget Sound as it takes the basic elements of the BWH program from the individual backyard to multiple locations throughout a community. Once a community is engaged and interested in taking action to promote healthy habitat, they form a habitat team and, with guidance from NWF staff, set achievable goals that reflect the size and needs of the community; at which point they become formally registered as a Community Wildlife Habitat site. The CWH certification system is points-based and each community earns a certain amount of points that fall within five categories (Registration, Habitat Certification, Education, Community

Projects and Administrative Goals).

On average, communities spend three to five years completing their certification goals during which time a certain number of residences, schools and businesses become certified backyard, schoolyard and workplace habitats. Community groups also design and implement an array of locally relevant, habitat-related projects within their communities. Projects include (but are not limited to): stream cleanups, invasive plant removal and native habitat restoration, plant and wildlife rescue, after-school ecology programs, the creation of educational outreach materials and community-sponsored events such as the Tukwila Backyard Wildlife Fair and the Lake Forest Park Dig It! Green Fair. Currently Tukwila and Camano Island are certified and the communities of Alki, Lake Forest Park, Bellingham and Anacortes are registered and working toward their certification goals.

Chapter II - Crescent Valley BMA Overview

General Description of Crescent Valley BMA

The Crescent Valley BMA is 800 acres (1.25 square miles) in size and is located in the Crescent Valley area of the Gig Harbor Peninsula. This BMA is situated along Crescent Creek and Crescent Valley Road between Crescent Lake and the Gig Harbor Estuary. This BMA is located within the Puget Trough ecoregion (Region 7) and the Puget Sound Douglas fir vegetation zone (Zone 31). The entire BMA is located within the Kitsap Water Resource Inventory Area (WRIA), Watershed #15 and the Crescent Valley Watershed Basin. Figure 3 depicts the BMA boundary and Crescent Creek Watershed Basin boundary overlain on ortho-photography mapping of the surrounding area and Figure 4 indicates the BMA boundary in relationship to the lot configurations and adjacent City of Gig Harbor jurisdictional boundary.

Figure 3. Crescent Valley BMA and Watershed Boundaries

The primary habitat within this BMA is riparian shoreline; dominated by hardwood trees and small shrubs with some conifer trees (primarily cedar and fir). The northern portion of this BMA, just south of Crescent Lake, is a mid-seral mixed forest dominated by conifers, especially cedar. Crescent Lake appears to be less than 50% developed along its shorelines, with significant portions on the southern end supporting native vegetation. As elevation increases on either side of Crescent Valley, the lowland vegetation transitions to a conifer forest habitat. The Crescent Creek riparian corridor meanders in and out of private property, with some areas cleared of native vegetation to the creek edge. This creek is fed by a large, complex system of wetlands, seeps and springs. Crescent Creek eventually deposits into Crescent Valley Estuary, which is experiencing rapid urbanization.

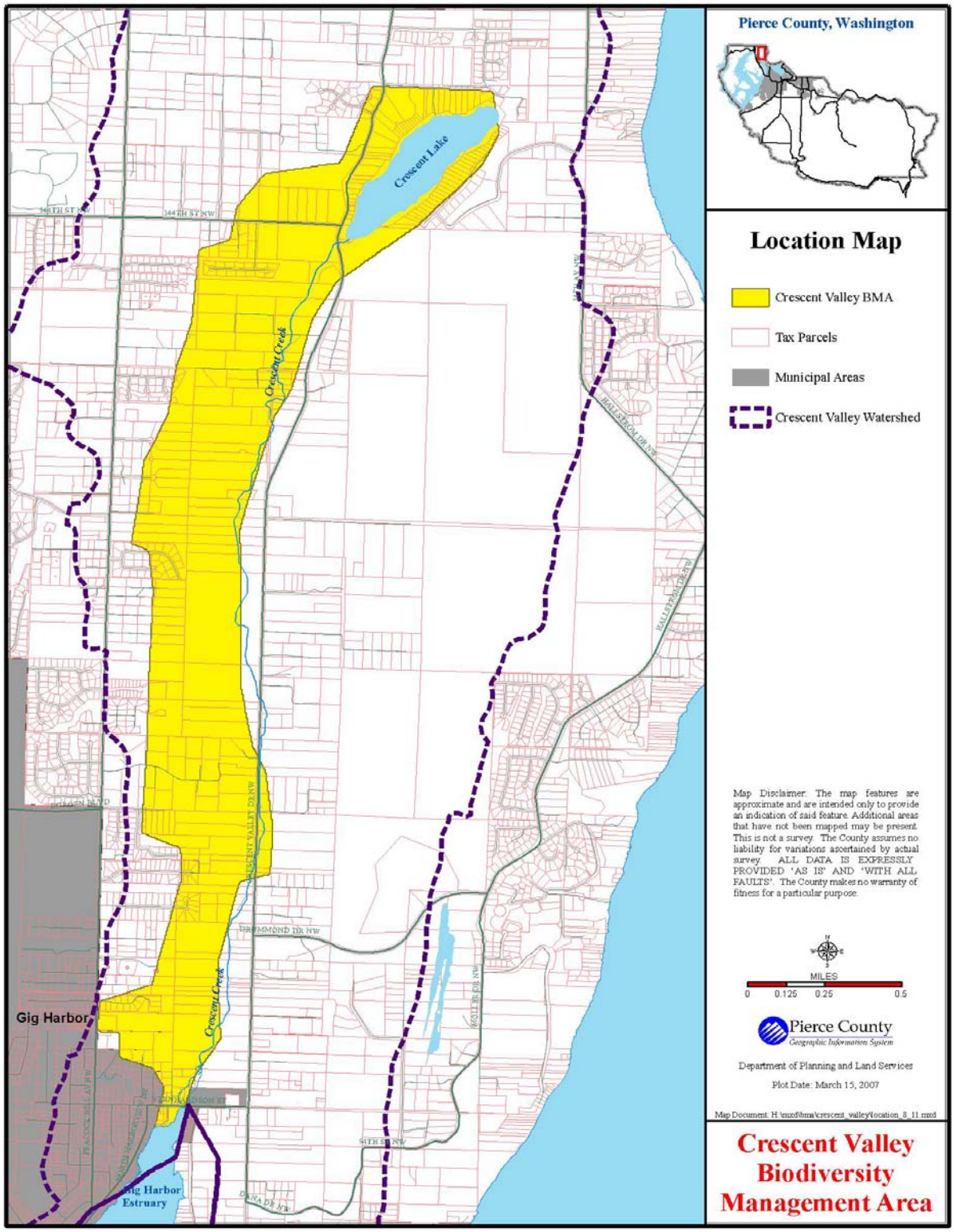

Figure 4. Crescent Valley BMA Location Map

The Gig Harbor Basin Plan[5] contains the following general description of the biological characteristics of the watershed basin, which also provides a good representation of the Crescent Valley, as follows:

> "Before the arrival of Euro-Americans, the Gig Harbor Basin was occupied by conifer forest dominated by western hemlock, western red cedar, and Douglas fir. Virtually all of the old growth forest was logged in the latter part of the nineteenth century, although a remnant remains on Swede Hill near the city of Gig Harbor. Now the basin is occupied by unvegetated surfaces and a mosaic of vegetation types including conifer forests of varying age, pasture, shrub-scrub, and non-native plantings around urban, suburban, and rural homes. The remaining forest is dominated by stands of less-than one-hundred-year-old Douglas firs, which if left undisturbed will be gradually replaced by western hemlock and western red cedar. Hardwoods are common on recently disturbed sites and in riparian areas. They include red alder, bigleaf maple, and willows. Common shrub species include Douglas maple, vine maple, Indian plum, gooseberry, huckleberry, and salmonberry. Salal, sword fern, deer fern, and Oregon grape are common low growing plant species.
>
> Most of the original fauna remains, although generally reduced in abundance except for those species that can tolerate or benefit from close association with humans and habitat fragmentation. Typical mammals are black bear, blacktail deer, coyote, raccoon, red fox, longtail weasel, deer mouse, and shrews. Common birds of the forest canopy include several species of flycatchers and wood warblers, black-capped and chestnut-backed chickadees, and red-breasted nuthatches. Song sparrows, fox sparrows, spotted towhees, American robins, and Swainson's thrushes are found in the shrub layer. House sparrows, house finches, European starlings, Brewer's blackbirds, and crows are found in open urban and suburban areas. The Washington Conservation Commission recently assembled information on the presence of salmonid species in the streams of the Gig Harbor Basin as part of an assessment of salmonid habitat in Water Resources Inventory Area (WRIA) 15. Coho salmon, chum salmon, and cutthroat trout are probably present in all major streams (i.e. streams surveyed by URS in May 2000). Barriers to fish passage prevent migratory species from entering these creeks, and the upstream reaches of the latter are probably too steep for cutthroat trout. Steelhead has been recorded in Crescent Creek."

Fish and Wildlife Resources

Predicted Wildlife Species

The Pierce County Biodiversity Assessment provides a detailed list of predicted species for each of the 16 biodiversity management areas in the biodiversity network. In the Crescent Valley BMA the Common Garter Snake is listed as the predicted trigger species. There are 3 predicted at-risk species, 14 state or federal-listed species and 17 PHS species. The predicted state and federal- listed species include the Red-Legged Frog (FCo), Western Toad (FCo, SC), Bald Eagle (FT, ST), Great Blue Heron (SM), Green Heron (SM), Olive-sided Flycatcher (FCo), Osprey (SM), Vaux's Swift (SC), Willow Flycatcher (FCo), Long-eared Myotis (FCo, SM), Long-legged Myotis (FCo, SM), Pacific Water Shrew (SM), Townsend's Big-eared Bat (FCo, SC), and Yuma Myotis (FCo). A total of 6 amphibians, 74 birds, 43 mammals, and 5 reptiles were predicted. (See Table 1 – Predicted and Confirmed Wildlife and Fish Species).

[5] "Gig Harbor Basin Plan" Pierce County Public Works and Utilities Department – Water Programs Division, Adopted July 26, 2005.

TABLE 1 - PREDICTED AND CONFIRMED WILDLIFE AND FISH SPECIES FOR THE CRESCENT VALLEY BMA

PREDICTED SPECIES Note: Species seen by not predicted are italicized	Bioblitz 2005 Survey	Winter 2006 bird survey	*NatureMapping* Workshop 2007
AMPHIBIANS			
Bullfrog[7,8]	X		
Ensatina	X		
Long-toed salamander			
Northwestern salamander	X	X	X
Pacific treefrog (Chorus frog)	X	X	
Red-legged frog [3]	X	X	
Roughskin newt	X		
Western toad [3,6]			
BIRDS			
American bittern			
American coot		X	
American crow	X	X	X
American goldfinch	X	X	
American robin	X	X	X
American wigeon		X	
Anna's hummingbird		X	X
Bald eagle [3,4,6]	X	X	X
Band-tailed pigeon [4]	X		
Barn swallow	X		
Barred owl[8]	X		
Barrow's goldeneye		X	
Belted kingfisher	X	X	
Bewick's wren	X	X	
Black-capped chickadee	X	X	
Black-headed grosbeak	X		
Black-throated gray warbler	X		
Brewer's blackbird			
Brown creeper[8]	X	X	
Brown-headed cowbird	X		
Bufflehead		X	
Bushtit	X		
Cackling Canada goose		X	
California quail			
Canada goose	X	X	
Caspian tern	X		
Cedar waxwing	X		
Chestnut-backed chickadee[8]	X	X	
Cinnamon teal			

PREDICTED SPECIES Note: Species seen by not predicted are italicized	Bioblitz 2005 Survey	Winter 2006 bird survey	*NatureMapping* Workshop 2007
BIRDS (Cont'd)			
Cliff swallow			
Common barn-owl			
Common goldeneye		X	
Common merganser			
Common nighthawk	X		
Common raven	X		
Common snipe			
Common yellowthroat	X		
Cooper's hawk [2]			
Dark-eyed junco[8]	X	X	X
Downy woodpecker	X	X	
European starling[7]	X	X	
Fox sparrow		X	
Glaucous-winged gull	X	X	
Golden-crowned kinglet[8]	X	X	
Great blue heron [3,4,6]	X		
Great horned owl			
Green heron (Green-backed) [3]	X		
Green-winged teal		X	
Hairy woodpecker[8]	X	X	
Hermit thrush		X	
Hooded merganser [4]			
Horned grebe		X	
House finch	X	X	
House sparrow[7,8]	X	X	
House wren[8]			
Hutton's vireo	X	X	
Killdeer	X	X	
Macgillivray's warbler			
Mallard	X	X	
Marsh wren			
Merlin		X	
Mew gull		X	
Mourning dove	X	X	
Northern flicker	X	X	
Northern harrier			
Northern oriole			
Northern rough-winged swallow			
Olive-sided flycatcher [3]			

TABLE 1 - PREDICTED AND CONFIRMED WILDLIFE AND FISH SPECIES FOR THE CRESCENT VALLEY BMA

PREDICTED SPECIES Note: Species seen by not predicted are italicized	Bioblitz 2005 Survey	Winter 2006 bird survey	*NatureMapping* Workshop 2007	PREDICTED SPECIES Note: Species seen by not predicted are italicized	Bioblitz 2005 Survey	Winter 2006 bird survey	*NatureMapping* Workshop 2007
BIRDS (Cont'd)				**BIRDS (Cont'd)**			
Osprey [3]	X	X		Wilson's warbler	X		
Pacific slope flycatcher (Western)	X			Winter wren[8]	X	X	X
Pied-billed grebe [4]		X		Wood duck [4]	X		
Pileated woodpecker[6,8]	X	X	X	Yellow warbler	X		
Pine siskin	X	X					
Purple finch	X	X		**MAMMALS**			
Purple martin[6]	X			Beaver			
Red crossbill	X			Big brown bat [4]	X		
Red-breasted merganser		X		Black bear			
Red-breasted nuthatch	X	X		Black rat[7]			
Red-breasted sapsucker	X	X		Black-tailed deer [4]	X		X
Red-tailed hawk	X	X		Bobcat			
Red-winged blackbird	X	X	X	California myotis [4]			
Ring-necked pheasant[8]				Coast mole		X	
Rock dove	X			Coyote			X
Ruby-crowned kinglet		X		Creeping vole			
Rufous hummingbird	X			Deer mouse	X		
Savannah sparrow				Douglas squirrel	X	X	X
Scrub jay	X			Dusky (Montane) shrew			
Song sparrow	X	X	X	Eastern gray squirrel	X		
Sora				Ermine			
Spotted sandpiper [4]		X		Hoary bat			
Spotted towhee (Rufous-sided)	X	X		Little brown myotis [4]	X		
Steller's jay	X	X	X	Long-eared myotis [3,4]	X		
Surf scoter		X		Long-legged myotis [3,4]			
Swainson's thrush	X			Long-tailed (Forest) deer mouse			
Townsend's warbler		X		Long-tailed vole			
Tree swallow				Long-tailed weasel			
Varied thrush		X		Mink [4]	X		
Vaux's swift [3,4,6]				Mountain beaver			
Violet-green swallow	X			Mountain lion			
Warbling vireo	X			Muskrat			
Western screech-owl				Northern flying squirrel			
Western tanager[8]	X			Norway rat[7]			
Western wood-pewee	X			Pacific jumping mouse	X		
White-crowned sparrow	X			Pacific water shrew [3]			
White-winged scoter		X		Porcupine			
Willow flycatcher [3]	X			Rabbit spp.	X		

TABLE 1 - PREDICTED AND CONFIRMED WILDLIFE AND FISH SPECIES FOR THE CRESCENT VALLEY BMA

PREDICTED SPECIES Note: Species seen by not predicted are italicized	Bioblitz 2005 Survey	Winter 2006 bird survey	*NatureMapping* Workshop 2007	PREDICTED SPECIES Note: Species seen by not predicted are italicized	Bioblitz 2005 Survey	Winter 2006 bird survey	*NatureMapping* Workshop 2007
MAMMALS (Cont'd)							
Raccoon	X	X					
Red fox							
River otter							
Shrew-mole							
Silver-haired bat [2]							
Southern red-backed vole							
Spotted skunk							
Striped skunk							
Townsend's big-eared bat [2,3,4]							
Townsend's mole							
Townsend's chipmunk	X						
Townsend's vole							
Vagrant shrew	X						
Virginia opossum[7]	X						
Yuma myotis [3,4]							
REPTILES							
Common garter snake [1]	X						
Northwestern garter snake	X						
Northern alligator lizard							
Painted turtle							
Rubber boa							
Western terrestrial garter snake							
FISH							
Chinook salmon							
Chum salmon							
Coho salmon	X						
Cutthroat trout							
Pumpkinseed	X						
Rainbow trout	X						
Steelhead salmon							

Footnotes:

1. Trigger Species - Species that needed additional mapped land cover units to ensure representation within the network
2. At-Risk - Washington Gap Analysis Project (WAGAP) selected species considered to be most as risk of continued or future population declines due to human activities
3. Listed (State or Federal) - Species listed as State endangered, threatened, sensitive, candidate or monitor, as well as species listed or proposed for listing by the U.S. Fish and Wildlife Service
4. PHS - a species defined as priority under the WDFW Priority Habitats and Species(PHS) Program
5. Included base d on species significance under the WDFW PHS/Heritage database, although not predicted to occur
6. Washington Comprehensive Wildlife Conservation Strategy (2005) species recommended for monitoring
7. Considered invasive or non-native species
8. These species were initially predicted but were erroneously left off the list included in the Pierce County Biodiversity Assessment Report, August 2004

Confirmed Fish and Wildlife Species and Habitats

During the bioblitz event of June 2005 and the winter birding event in February 2006 a variety of species were identified and confirmed within the Crescent Valley BMA (see Table 1 – Predicted and Confirmed Wildlife and Fish Species). Residents in that area have also provided accurate descriptions and photographs of birds and animals that they have seen within the BMA, such as a dead mink found beside Crescent Valley Road.

The confluence of Crescent Creek and Gig Harbor Bay (Gig Harbor Estuary) is identified as a WDFW priority habitat and medium quality nearshore salmon habitat. Fall Chinook Salmon (FT, SC), Winter Steelhead, Coho, Fall Chum, and resident Cutthroat fish species have been verified and/or known to occur in Crescent Creek[6]. In addition, WDFW annually stocks the lake with 3,000 rainbow trout for sport fishing. See Figure 5 - Fish and Wildlife Resources Map.

Eleven butterfly species have been confirmed[7] within the Crescent Valley BMA including Cabbage White, California Sister, Cedar Hairstreak, Clouded Sulphur, Echo Blue, Gray Hairstreak, Large Wood Nymph, Mourning Cloak, Painted Lady, Western Brown Elfin, and Western Tiger Swallowtail.

[6] Pierce County Fish Presence Data
[7] Washington State Butterfly Atlas

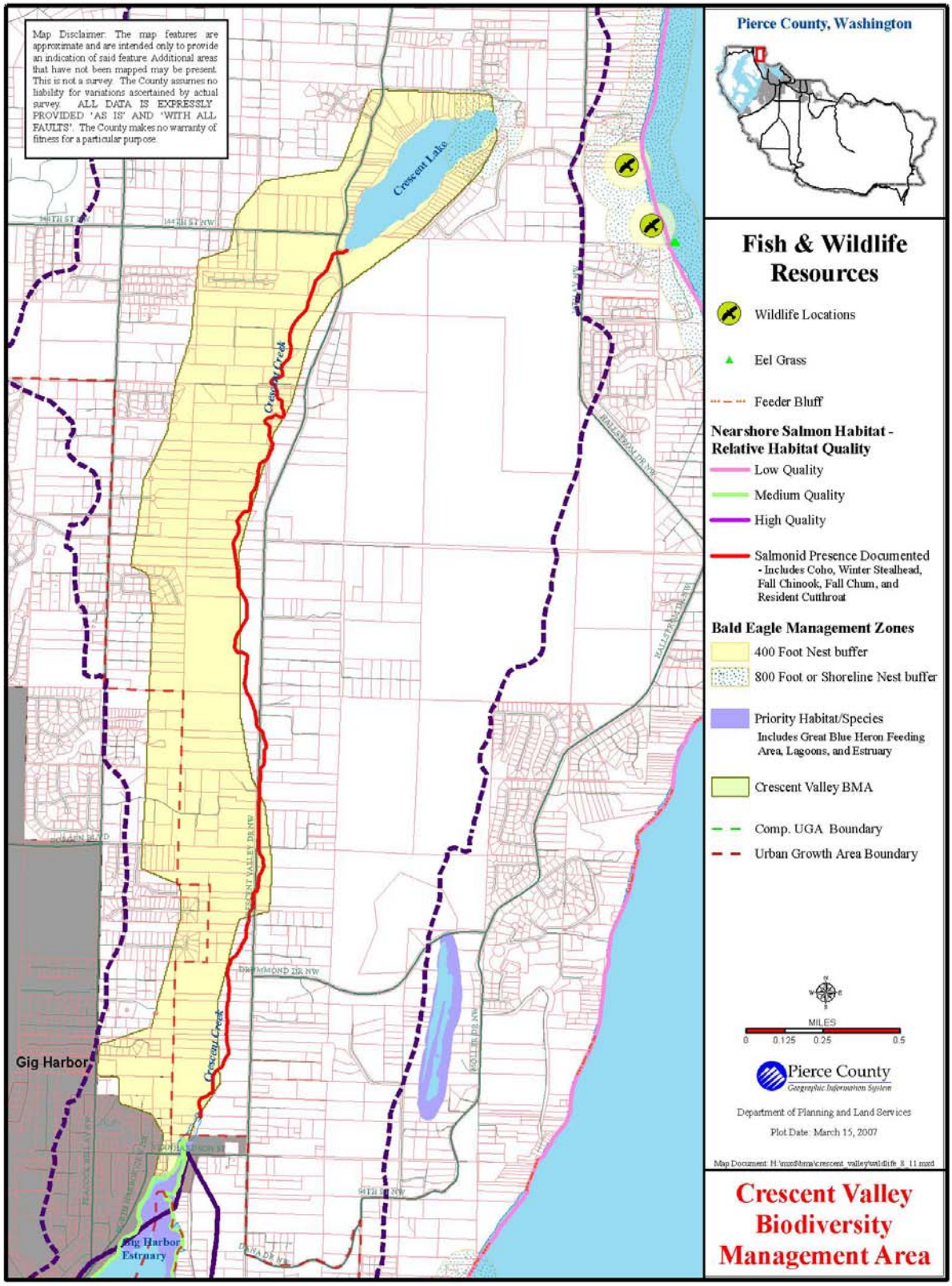

Figure 5. Fish and Wildlife Resources Map

Confirmed Invertebrate Species

The health of an aquatic ecosystem depends on the health of all its biological components, not just commercially or culturally important species such as salmon. Fish species are supported by the phytoplankton, zooplankton, insects, plants, bacteria, and fungi also inhabiting the waterway.

Benthic (bottom dwelling) invertebrates are effective indicators of the health of watercourses and watersheds. The term "benthic invertebrates" include animals such as aquatic insects (mayflies and stoneflies), snails, clams, crayfish, and aquatic worms. These species represent a diversity of morphological, ecological, and behavioral adaptations to surrounding natural environments (i.e. they have co-evolved with their surrounding ecosystems to preferred locations)[8]. Many factors can affect the types of benthic invertebrates in a system including riparian conditions, thermal regimes, discharge patterns, light penetration, channel gradients, sediment conditions, water, and sediment chemistry. Each location along the watercourse continuum will contain a variety of habitats, such as riffles, pools, sloughs, bars, and backwaters, which differ in respect to substrate type and stability, current velocity, and water depth. Each location in the watercourse has a range of natural conditions that, when coupled with environmental requirements of the invertebrate species, determine whether a given organism can live in a particular habitat at a particular point.

These patterns of species distribution are affected by actions that alter the landscape (e.g. wild fires, logging, earthquakes, agriculture, volcanic eruptions, and urbanization), modify hydrologic conditions (changes in evapotranspiration and runoff or construction of reservoirs and irrigation diversions), modify habitats (snagging operations, channel dredging, sedimentation, hurricanes), or add chemicals that are toxic or that elevate nutrient or organic loads. Organisms vary in their tolerance of degradation caused by human actions; some require clean, clear water while others occupy a wide range of conditions (i.e. generally tolerant of the effects caused by human alterations) [9]. As the natural environment is altered by human activities, changes start to occur in the type of benthic invertebrate species that inhabit a waterway Those less tolerant to human alterations begin to disappear and others that are more tolerant appear more abundantly or replace other species altogether. In an effort to understand the health of a particular waterway (e.g. creek, stream, river) benthic invertebrate samples are collected at various intervals along the reach to assess the quality of the system. Species are typically categorized in groups including:

- Group 1 - those organisms which are generally pollution intolerant and signify excellent-good water quality including riffle beetle, stonefly, caddisfly, mayfly, and snail;
- Group 2 – those organisms that exist in a wide range of water quality conditions including cranefly, dragonfly, crayfish, sowbug, filtering caddisfly, blackfly, scud, and dobsonfly; and
- Group 3 – those organisms that are generally tolerant of pollution and whose presence generally indicates fair-poor water quality conditions including midge, pouch snail and aquatic worm.

During the bioblitz event of June 2005 invertebrate species were collected within the BMA; including a sampling of the benthic invertebrates within Crescent Creek and estuary (See Figure 6 and Table 2). The bioblitz was the first time terrestrial and aquatic experts had to report their findings in a format to be used by *NatureMapping* and for general reporting purposes. Since then, these experts have worked with the

[8] Cuffney, T.F., Gurtz, M.E., and Meador, M.R., 1993, Methods for collecting benthic invertebrate samples as part of the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 93-406, 66 p.

[9] "Restoring Life in Running Waters," James R. Karr and Ellen W. Chu, 1998 and "Biological Assessment: Using Biology to Measure the Health of Watersheds," James R. Karr.

PCBA staff on additional bioblitzes to develop consistent reporting formats. However, the benthic invertebrates found in Crescent Creek indicate the water quality is good. There were also a variety of terrestrial invertebrates identified. The Gig Harbor Basin Plan process also included a sampling of benthic invertebrates which included Crescent Creek. Samples were collected on two occasions in May and September 2000. From this preliminary analysis, it appears that Crescent Creek has been impacted to some extent by human actions in the watershed. However, Crescent Creek was also found to support at least some taxa that are relatively intolerant to pollution. This indicates that general water quality in this stream is still relatively good. Sediment loading was found to be a problem during the fish habitat surveys and as such the reduced numbers of sensitive taxa in Crescent Creek may be related to high sediment loads.

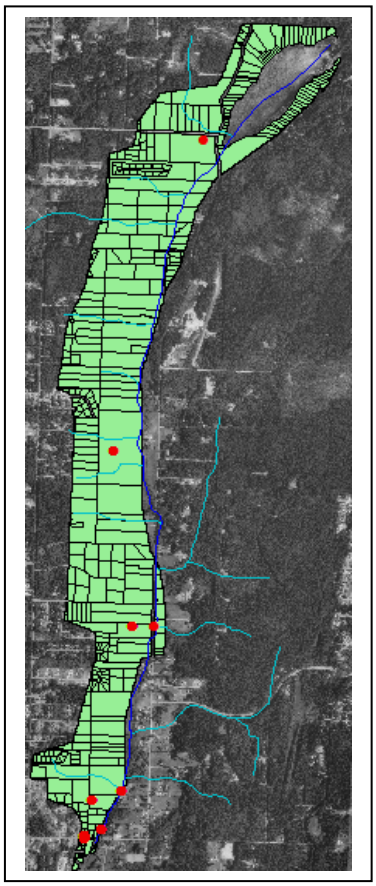

Figure 6. Invertebrate Sampling Locations in Crescent Valley BMA

TABLE 2 - CONFIRMED TERRESTRIAL AND AQUATIC INVERTEBRATES FOR THE CRESCENT VALLEY BMA

Class	Order	Family	Genus/Species	Common
Ants	Hymenoptera	Formicidae		
Ants	Hymenoptera	Formicidae	Formica dosuripes	
Bees	Hymenoptera	Apidae		
Beetles	Coleoptera	Carabidae		
Beetles	Coleoptera	Coccinellidae		
Beetles	Coleoptera	Curculionidae		
Beetles	Coleoptera	Dermestidae		
Beetles	Coleoptera	Elateridae		
Beetles	Coleoptera	Elmidae		
Beetles	Coleoptera	Elmidae	Narpus concolor	
Beetles	Coleoptera	Elmidae	Optioserivus	
Beetles	Coleoptera	Histeridae		
Beetles	Coleoptera	Lampyridae		
Beetles	Coleoptera	Lucanidae		
Beetles	Coleoptera	Mordellidae		
Beetles	Coleoptera	Ptiliidae		
Beetles	Coleoptera	Scalytidai		
Beetles	Coleoptera	Scarabaeidae		
Beetles	Coleoptera	Staphylinidae		
Butterflies/Moths	Lepidoptera	Arctiidae		
Butterflies/Moths	Lepidoptera	Microlepidoptera		
Caddisflies	Trichoptera	Brachucentusidae	Brachycentrus	
Caddisflies	Trichoptera	Glossosomaidae		
Caddisflies	Trichoptera	Limnephilidae	Discesmoecus	
Caddisflies	Trichoptera	Limnephilidae		
Caddisflies	Trichoptera	Limnephilidae	Oigochaeta	
Caddisflies	Trichoptera	Limnephilidae	Ono cosmoecus	
Caddisflies	Trichoptera	Limnephilidae	Turbellaria	
Caddisflies	Trichoptera	Nydiopsycheidae		
Caddisflies	Trichoptera	Rhyacophilidae	Rhyacophila betteni	
Caddisflies	Trichoptera	Sphaeriidae		
Caddisflies	Trichoptera	Unknown		
Caddisflies	Trichoptera		Brachycentrus	
Caddisflies	Trichoptera		Glossosomatidae	
Caddisflies	Trichoptera		Hydropsyche	
Caddisflies	Trichoptera		Lepidostoma	
Caddisflies	Trichoptera		Polycentropus	
Centipede	Myriopoda			Centipede
Crustacean	Crustacea	Isopoda		
Dragonflies	Odonata	Coenagrionidae		
Earwigs	Dermaptera	Forficulidae		
Flies	Diptera	Calicidae		
Flies	Diptera	Chironomidae		
Flies	Diptera	Chironomidae	Chironomidae	
Flies	Diptera	Culicidae		
Flies	Diptera	Dicranota		

TABLE 2 - CONFIRMED TERRESTRIAL AND AQUATIC INVERTEBRATES FOR THE CRESCENT VALLEY BMA

Class	Order	Family	Genus/Species	Common
Flies	Diptera	Dolichopadidae		
Flies	Diptera	Empididae		
Flies	Diptera	Glutops		
Flies	Diptera	Phoridae		
Flies	Diptera	Scathophagidae		
Flies	Diptera	Simuliidae	Simuliidae	
Flies	Diptera	Syrphidae		
Flies	Diptera	Thereridae?		
Flies	Diptera	Tipulidae		
Flies	Diptera	Tipulidae	Acari	
Flies	Diptera	Tipulidae	Dicranota	
Flies	Diptera		Acuri	
Flies	Diptera		Chironomidae	
Flies	Diptera		Collembola	
Flies	Diptera		Oligochaeta	
Flies	Diptera		Simuliidae	
Mayflies	Ephemereoptera	Baetidae	Baetis tricaudatus	
Mayflies	Ephemereoptera	Chloroperlidae	Sweltsa	
Mayflies	Ephemereoptera	Heptageniidae	Cimymula	
Mayflies	Ephemereoptera	Heptageniidae	Ephermerllidae	
Mayflies	Ephemereoptera	Leptophelbildae	Paraleptophledia	
Mayflies	Ephemereoptera		Ameletus	
Mayflies	Ephemereoptera		Buetistricaudatus	
Mayflies	Ephemereoptera		Cinygmula	
Mayflies	Ephemereoptera		Diphetor hageni	
Mayflies	Ephemereoptera		Paraleptophlebia	
Mayflies	Ephemeroptera	Ameletidae	Ameletus	
Mayflies	Ephemeroptera	Ameletidae	Nematoda	
Mayflies	Ephemeroptera	Baetidae	Diphetor nageni	
Millipedes	Diplopoda	Julida		Millipede
Millipedes	Diplopoda	Myriapods		Millipede
Millipedes	Diplopoda	Striaria	Caseyidae	Millipede
Millipedes	Diplopoda	Striaria	Striaridae	Millipede
Millipedes	Diplopoda	Styllomatophora	Octaglena anura	Millipede
Millipedes	Diplopoda		Diplopoda #1	Millipede
Millipedes	Diplopoda		Keypolydeshidae	Millipede
Millipedes	Myriapoda	Chilopoda		Millipede
Millipedes	Myriapoda	Diplopoda		Millipede
Mollusks	Mollusca	Basomatophora	Colomella edentula	
Mollusks	Mollusca	Paysidae		Freshwater snail
Mollusks	Mollusca	Styllomatophora	Ancotcema sportella	Beaded lancetooth
Mollusks	Mollusca	Styllomatophora	Ariolimax columbaius	Banana slug
Mollusks	Mollusca	Styllomatophora	Carychium occidentale	Western thorn
Mollusks	Mollusca	Styllomatophora	Eucomulus fulvus	Northern hive
Mollusks	Mollusca	Styllomatophora	Haplotcema vomavecense	Robust lancetooth
Mollusks	Mollusca	Styllomatophora	Hemphillia cf.burringtoni	Jumping-slug
Mollusks	Mollusca	Styllomatophora	Pcistaloma lansingi	Northern tightcoil

TABLE 2 - CONFIRMED TERRESTRIAL AND AQUATIC INVERTEBRATES FOR THE CRESCENT VALLEY BMA

Class	Order	Family	Genus/Species	Common
Mollusks	Mollusca	Styllomatophora	Penctium randolphi	
Mollusks	Mollusca	Styllomatophora	Planagyra clappi	
Mollusks	Mollusca	Styllomatophora	Psophysaon vannattae	Scarlet-mantled taildropper
Mollusks	Mollusca	Styllomatophora	Vertigo spp.	
Mollusks	Mollusca	Styllomatophora	Vespecicola columbiana	Northwest hesperan
Mollusks	Mollusca		Arion rufus	
Mollusks	Mollusca		Limax maximus	Leopard slug
Mollusks	Mollusca		Monadenia fidelis	Pacific sideband
Mollusks	Mollusca		Sphaefiidae	
Mollusks	Mollusca		Margaratifer falcda	
Mollusks	Mollusca		Arton sp. 1	
Mollusks	Mollusca		Arton sp. 2	
Mollusks	Mollusca		Peptysaon vannatlae	
Spiders	Arachnida	Acari		Ticks/Mites
Spiders	Arachnida	Araneae		Spiders
Spiders	Arachnida	Araneae-Agelinidae		Spiders
Spiders	Arachnida	Opiliones		Harvestmen spiders
Spiders	Arachnida	Opiliones	Opilione sp. 1	
Spiders	Arachnida	Opiliones	Opilione sp. 2	
Springtails	Collembola	Entomobryidae		
Springtails	Collembola	Poduridae		
Springtails	Collembola	Sminthuridae		
Stoneflies	Plecoptera	Nemouridae	Nemouridae	
Stoneflies	Plecoptera	Perlidae	Hesperopeila	
Stoneflies	Plecoptera	Perlodidae	Kogotus	
Stoneflies	Plecoptera	Perlodidae		
Stoneflies	Plecoptera	Unknown		
Stoneflies	Plecoptera		Swelitsa	
Stoneflies	Plecoptera		Zapada cinctipes	
Termites	Isoptera	Unknown		
Wasps	Hymenoptera	Braconidae		
Wasps	Hymenoptera	Ichneumonidae		
Wasps	Hymenoptera	Symphyta		
Wasps	Hymenoptera	Tenthredinidae		

Confirmed Plant Species

During the bioblitz event of June 2005 plant specialists collected a variety of native and introduced plant species within the Crescent Valley BMA. A complete listing of native plants is detailed in Table 3 and Table 4 provides a list of introduced plant species.

TABLE 3 - JUNE 3-4, 2005 GIG HARBOR BIOBLITZ PLANT INVENTORY (NATIVE PLANTS)		
Common name	**Hitchcock's name**	**Locations Found**
Alaska brome	*Bromus sitchensis*	Around house
American brooklime	*Veronica Americana*	Grazed Mixed Forest Lakeshore
American skunk cabbage	*Lysichitum americanum*	Grazed Mixed Forest
antifever fontinalis moss	*Fontinalis antipyretica*	Aquatic
bald-hip rose	*Rosa gymnocarpa*	Grazed Mixed Forest
bay forget-me-not	*Myosotis laxa*	Lakeshore
beaked hazelnut	*Corylus cornuta*	East Streambank
big-leaved maple	*Acer macrophyllum*	Grazed Mixed Forest Residential Lot Streambank
black cottonwood	*Populus trichocarpa*	Open forest edge
bracken fern	*Pteridium aquilinum*	East Streambank Forested Roadside Residential Lot Upland Pasture
broad-leaved starflower	*Trientalis latifolia*	East Streambank
bull thistle	*Cirsium vulgare*	Upland Pasture
California poppy	*Eschscholzia californica*	Around house
Cascara	*Rhamnus purshiana*	East Streambank Upland Pasture
Cattail	*Typha latifolia*	Aquatic
coastal hedge nettle	*Stachys cooleyae*	East Streambank Grazed Mixed Forest
common horsetail	*Equisetum arvense*	Lakeshore Streambank
common woodrush	*Luzula campestris*	Grazed Mixed Forest
common rush	*Juncus effuses*	Open Wetland West Streambank
common yellow oxalis	*Oxalis stricta*	Residential Lot
creeping blackberry/dewberry	*Rubus ursinus*	Forested Roadside Streambank
deer fern	*Blechnum spicant*	East Streambank Open forest edge
devil's club	*Oplopanax horridus*	Grazed Mixed Forest
Dewey sedge	*Carex deweyana*	Upland Pasture
Douglas fir	*Pseudotsuga menziesii*	Forested Roadside Grazed Mixed Forest Residential Lot Streambank
dull Oregon grape	*Berberis nervosa*	East Streambank Grazed Mixed Forest
enchanter's nightshade	*Circaea alpine*	Grazed Mixed Forest Residential Lot
evergreen huckleberry	*Vaccinium ovatum*	Forested Roadside Grazed Mixed Forest Residential Lot
false lily-of-the-valley	*Maianthemum dilatatum*	East Streambank Grazed Mixed Forest
Foamflower	*Tiarella trifoliata*	Grazed Mixed Forest
hardhack/Douglas' spiraea	*Spiraea douglasii*	Forested Roadside Lakeshore

TABLE 3 - JUNE 3-4, 2005 GIG HARBOR BIOBLITZ PLANT INVENTORY (NATIVE PLANTS)		
Common name	**Hitchcock's name**	**Locations Found**
		Upland Pasture
Indian plum	*Oemleria cerasiformis*	Forested Roadside Grazed Mixed Forest Residential Lot East Streambank
lady fern	*Athyrium filix-femina*	East Streambank Forested Roadside Grazed Mixed Forest
large-leaved avens	*Geum macrophyllum*	Grazed Mixed Forest Residential Lot West Streambank
licorice fern	*Polypodium glycyrrhiza*	East Streambank Open forest edge
Lyngby's sedge	*Carex lyngbyei*	Aquatic East Streambank
meadow barley	*Hordeum brachyantherum*	Upland Pasture
miners' lettuce	*Montia sibirica*	East Streambank Grazed Mixed Forest Residential Lot
Nootka rose	*Rosa nutkana*	East Streambank
northern starwort	*Stellaria calycantha*	East Streambank
Oceanspray	*Holodiscus discolor*	Residential Lot
Pacific madrone	*Arbutus menziesii*	Open forest edge Residential Lot Streambank
Pacific willow	*Salix lucida*	Forested Roadside Residential Lot
Pacific ninebark	*Physocarpus capitatus*	Residential Lot
Pacific silverweed	*Potentilla pacifica*	Aquatic
poverty rush	*Juncus tenuis*	Lakeshore
purple-leaved willowherb	*Epilobium ciliatum*	Grazed Mixed Forest Lakeshore Residential Street
red alder	*Alnus rubra*	East Streambank Forested Roadside Grazed Mixed Forest Lakeshore
red elderberry	*Sambucus racemosa*	Grazed Mixed Forest Streambank
red fescue	*Festuca rubra*	Upland Pasture
red huckleberry	*Vaccinium parvifolium*	East Streambank Forested Roadside Grazed Mixed Forest Residential Lot
red osier dogwood	*Cornus stolonifera*	Forested Roadside
Salal	*Gaultheria shallon*	East Streambank Forested Roadside Lakeshore
Salmonberry	*Rubus spectabilis*	Forested Roadside Grazed Mixed Forest Residential Lot
sea arrow-grass	*Triglochin maritimum*	West Streambank

TABLE 3 - JUNE 3-4, 2005 GIG HARBOR BIOBLITZ PLANT INVENTORY (NATIVE PLANTS)		
Common name	**Hitchcock's name**	**Locations Found**
seaside angelica	*Angelica lucida*	West Streambank
scented fringe-cup	*Tellima grandifolia*	East Streambank Grazed Mixed Forest
Scouler's willow	*Salix scouleri*	West Streambank
scouringrush horsetail	*Equisetum hyemale*	Forested Roadside Lakeshore
Sitka willow	*Salix stichensis*	Creek Edge Forested Roadside Residential Lot
slough sedge	*Carex obnupta*	Aquatic Creek Edge
small-flowered nemophila	*Nemophila parviflorum*	Grazed Mixed Forest
small-flowered woodrush	*Luzula parviflora*	East Streambank Grazed Mixed Forest
small-fruited bulrush	*Scirpus microcarpus*	Aquatic West Streambank
Stickywilly	*Galium aparine*	East Streambank Grazed Mixed Forest Residential Lot
stinging nettle	*Urtica dioica*	Grazed Mixed Forest
stink currant	*Ribes bracteosum*	Residential Lot
sweet-cicely	*Osmorhiza chilensis*	Grazed Mixed Forest
sweet-scented bedstraw	*Galium triflorum*	East Streambank Grazed Mixed Forest
sword fern	*Polystichum munitum*	Grazed Mixed Forest Residential Lot
tall trisetum	*Trisetum cernuum*	Grazed Mixed Forest
tapered rush	*Juncus tenuis*	Aquatic Lakeshore
Thimbleberry	*Rubus parviflorus*	Forested Roadside Streambank
Thistle	*Cirsium sp.*	East Streambank
thyme-leaved speedwell	*Veronica serpyllifolia*	Upland Pasture
tinker's penny	*Hypericum anagalloides*	Residential Lot
toad rush	*Juncus bufonius*	Lakeshore
Trailplant	*Adenocaulon bicolor*	Grazed Mixed Forest
Tule	*Scirpus lacustris*	Aquatic
Twinberry	*Lonicera involucrate*	Forested Roadside Residential Street
water horsetail	*Equisetum fluviatile*	Forested Roadside Open forest edge Streambank
water parsley	*Oenanthe sarmentosa*	Aquatic Lakeshore Streambank
western bleeding heart	*Dicentra Formosa*	East Streambank Grazed Mixed Forest Residential Lot
western buttercup	*Ranunculus occidentalis*	Streambank Upland Pasture
western dock	*Rumex occidentalis*	Lakeshore

TABLE 3 - JUNE 3-4, 2005 GIG HARBOR BIOBLITZ PLANT INVENTORY (NATIVE PLANTS)		
Common name	**Hitchcock's name**	**Locations Found**
western hemlock	*Tsuga heterophylla*	East Streambank Grazed Mixed Forest Residential Lot
western red cedar	*Thuja plicata*	Forested Roadside Grazed Mixed Forest Residential Lot Streambank
western skunk cabbage	*Lysichitum americanum*	East Streambank
western trillium	*Trillium ovatum*	Grazed Mixed Forest
western waterleaf	*Hydrophyllum tenuipes*	East Streambank Grazed Mixed Forest
white-bark raspberry	*Rubus leucodermis*	East Streambank
vanilla-leaf	*Achlys triphylla*	Grazed Mixed Forest
Yarrow	*Achillea millefolium*	Upland Pasture
yellow pond lily	*Nuphar polysepala*	Aquatic
youth-on-age; piggyback plant	*Tolmiea menziesii*	East Streambank Grazed Mixed Forest

TABLE 4 - JUNE 3-4, 2005 GIG HARBOR BIOBLITZ PLANT INVENTORY (INTRODUCED PLANTS)		
Common name	**Hitchcock's name**	**Locations Found**
ajuga/bugle	*Ajuga reptans*	Grazed Mixed Forest
annual bluegrass	*Poa annua*	Around house East Streambank Forested Roadside
barestem teesdalia	*Teesdalia nudicaulis*	Upland Pasture
black medick	*Medicago lupulina*	Residential Street Upland Pasture
bladder campion	*Lychnis alba*	Residential Street
Bugloss	*Anchusa sp.*	East Streambank
brome-grass	*Bromus sp.*	Grazed Mixed Forest
Canada thistle	*Cirsium arvense*	Upland Pasture
changing forget-me-not	*Myosotis discolor*	Grazed Mixed Forest
cherry laurel	*Prunus laurocerasus*	Residential Street
common chickweed	*Stellaria media*	Grazed Mixed Forest
common mallow	*Malva neglecta*	Upland Pasture
common plantain	*Plantago major*	Residential Lot Streambank Upland Pasture
common sowthistle	*Sonchus oleraceus*	Residential Street
common vetch	*Vicia sativa*	Open forest edge Residential Street
creeping buttercup	*Ranunculus repens*	Lakeshore Streambank Upland Pasture
curly dock	*Rumex crispus*	East Streambank Upland Pasture
cut-leaf blackberry	*Rubus laciniatus*	Residential Lot

TABLE 4 - JUNE 3-4, 2005 GIG HARBOR BIOBLITZ PLANT INVENTORY (INTRODUCED PLANTS)		
Common name	**Hitchcock's name**	**Locations Found**
		Streambank
early hairgrass	*Aira praecox*	Upland Pasture
English holly	*Ilex aquifolium*	Forested Roadside Grazed Mixed Forest Residential Lot Streambank
English ivy	*Hedera helix*	Forested Roadside Residential Lot Streambank
European mountain ash	*Sorbus aucuparia*	East Streambank
evergreen blackberry	*Rubus laciniatus*	Upland Pasture
dandelion	*Taraxacum officinale*	East Streambank Upland Pasture
dove's-foot geranium	*Geranium molle*	Upland Pasture
field pepperweed	*Lepidium campestre*	Upland Pasture
foxglove	*Digitalis purpurea*	Grazed Mixed Forest
ground ivy	*Glechoma hederacea*	Open forest edge
hairy cat's ear	*Hypochaeris radicata*	Forested Roadside
hedge bindweed	*Convolvulus sepium*	Forested Roadside Residential Street
hedge mustard	*Sisymbrium officinale*	Upland Pasture
Herb robert	*Geranium robertianum*	Grazed Mixed Forest
giant knotweed	*Polygonum sachalinense*	East Streambank
Japanese clover	*?*	Open Wetland Residential Lot
Himalayan blackberry	*Rubus discolor*	East Streambank Grazed Mixed Forest Residential Lot
Kentucky bluegrass	*Poa pratensis*	Upland Pasture
lambsquarters	*Chenopodium album*	Barnyard
lawn daisy	*Bellis perennis*	East Streambank Upland Pasture
lessor burdock	*Arctium minus*	Grazed Mixed Forest
little western bittercress	*Cardamine oligosperma*	Grazed Mixed Forest Residential Lot West Streambank
mouse barley	*Hordeum murinum*	Residential Lot
narrow-leaved plantain	*Plantago lanceolata*	East Streambank Residential Lot Upland Pasture
one-seed hawthorn	*Crataegus monogyna*	East Streambank Upland Pasture
orchard grass	*Dactylis glomerata*	East Streambank Forested Roadside Upland Pasture
oxeye daisy	*Chrysanthemum leucanthemum*	Upland Pasture
perennial ryegrass	*Lolium perenne*	East Streambank Upland Pasture
pineapple weed	*Matricaria matricarioides*	Around house
plum	*Prunus sp.*	Streambank

TABLE 4 - JUNE 3-4, 2005 GIG HARBOR BIOBLITZ PLANT INVENTORY (INTRODUCED PLANTS)		
Common name	**Hitchcock's name**	**Locations Found**
red clover	*Trifolium pratense*	Residential Street Upland Pasture
red stem stork's bill	*Erodium cicutarium*	Upland Pasture
reed canary grass	*Phalaris arundinacea*	Open wetland West Streambank
Scotch broom/Scot's broom	*Cytisus scoparius*	Grazed Mixed Forest Residential Street
self-heal	*Prunella vulgaris*	Grazed Mixed Forest
sheep sorrel	*Rumex acetosella*	Upland Pasture
shepherd's purse	*Capsella bursa-pastoris*	Upland Pasture
silver hairgrass	*Aira caryophyllea*	Upland Pasture
sixweeks fescue	*Festuca octoflora*	Upland Pasture
smooth hawksbeard	*Crepis capillaris*	Grazed Mixed Forest
soft brome	*Bromus mollis*	East Streambank Open forest edge
spotted ladysthumb	*Polygonum persicaria*	Streambank Upland Pasture
spring vernal grass	*Anthoxanthum odoratum*	Upland Pasture West Streambank
sticky chickweed	*Cerastium viscosum*	Residential Street Upland Pasture
sweet cherry	*Prunus avium*	East Streambank
tansy ragwort	*Senecio jacobaea*	Open forest edge
two-leaved peavine	*Lathrys latifolius*	Residential Street
velvetgrass	*Holcus lanatus*	Residential Lot Upland Pasture West Streambank
wall lettuce	*Lapsana communis*	Forested Roadside
wall speedwell	*Veronica arvensis*	Grazed Mixed Forest
Watercress	*Rorippa nasturtium-aquaticum*	Aquatic
western St. John's-wort	*Hypericum perforatum*	Residential Street
wheat	*Triticum aestivum*	Residential Street
white clover	*Trifolium repens*	East Streambank Upland Pasture
woodland forget-me-not	*Myosotis sylvatica*	Residential Street
yellow flag	*Iris pseudacorus*	Aquatic
yellow parentucellia	*Parentucellia viscosa*	Upland Pasture

Demographics, Land Use and Growth Potential

It has been recognized that land use is the primary driver of habitat loss, introduction of exotic species, environmental degradation, and increased runoff and pollutants. These effects are exacerbated in urbanizing landscapes such as Pierce County, Washington, where changes are both rapid and permanent. As such a discussion of the current land use trends within the Crescent Valley BMA is essential to understanding impacts to the feasibility of retaining biodiversity within this area.

Existing Land Use and Population

Currently there are 1,060 individual properties (tax parcels) located within the Crescent Valley BMA and according to year 2000 census data approximately 864 people live within this area. Table 5 provides a breakdown of existing land use on these parcels by categories such as residential, commercial, industrial, civic, and vacant lands. Land use within this BMA is predominately low density single-family residential (47%) with a few family farms (7%). Approximately ¼ of the BMA (24%) is vacant land. See Figure 7 for Existing Land Use Map.

County records indicate that 5 properties within the Crescent Valley BMA are currently enrolled in the County's Current Use Assessment Program, which provides a tax reduction for productive farm and agriculture activities. These five properties are situated on a total of 75.70 acres of land; however, only 59.60 acres of these properties are located within the BMA boundaries.

There are nine properties located within or partially within the BMA that are publicly owned by local and state governments. The City of Gig Harbor owns two properties including a park at the outlet of Crescent Creek into Gig Harbor Estuary and a vacant parcel to the north that is traversed by Crescent Creek. Pierce County owns approximately 48 acres of land on six parcels of land. The State of Washington owns just over an acres of land within the BMA which provides access to Crescent Lake. Table 6 provides a breakdown of publicly owned lands within the Crescent Valley BMA.

TABLE 5 – EXISTING LAND USES IN THE CRESCENT VALLEY BMA			
Land Use	**Acreage**	**Total Parcels**	**% of the BMA**
Residential			
Single-Family	381.90	271	47.72%
Duplex	0.74	11	0.09%
Triplex, Fourplex, Multi-Family (5 or more units)	0.00	0	0.00%
Mobile Homes	25.84	19	3.23%
Other Residential	13.08	307	1.64%
Total Residential	**421.56**	**307**	**52.68%**
Commercial	**1.01**	**1**	**0.13%**
Industrial	**0.00**	**0**	**0.00%**
Transportation/Communication /Utility	**5.22**	**8**	**0.65%**
Education (includes schools)	**0.00**	**0**	**0.00%**
Public & Quasi-Public Facility (includes public facilities, churches, and health services)	**0.00**	**0**	**0.00%**
Parks, Open Space, Recreation	**6.12**	**6**	**0.76%**
Natural Resource			
Mineral Extraction	0.00	0	0.00%
Forestry	0.00	0	0.00%
Agriculture	59.60	5	7.45%
Fishing	0.90	9	0.11%
Total Natural Resource	**60.50**	**9**	**7.56%**
Vacant	**193.87**	**111**	**24.23%**
Unknown	**34.90**	**18**	**4.36%**
Other (Water Bodies, Road Right-of-Way, etc.)	**77.06**	**-**	**9.63%**
TOTAL CRESCENT VALLEY BMA AREA	**800.24**	**1060**	**100%**

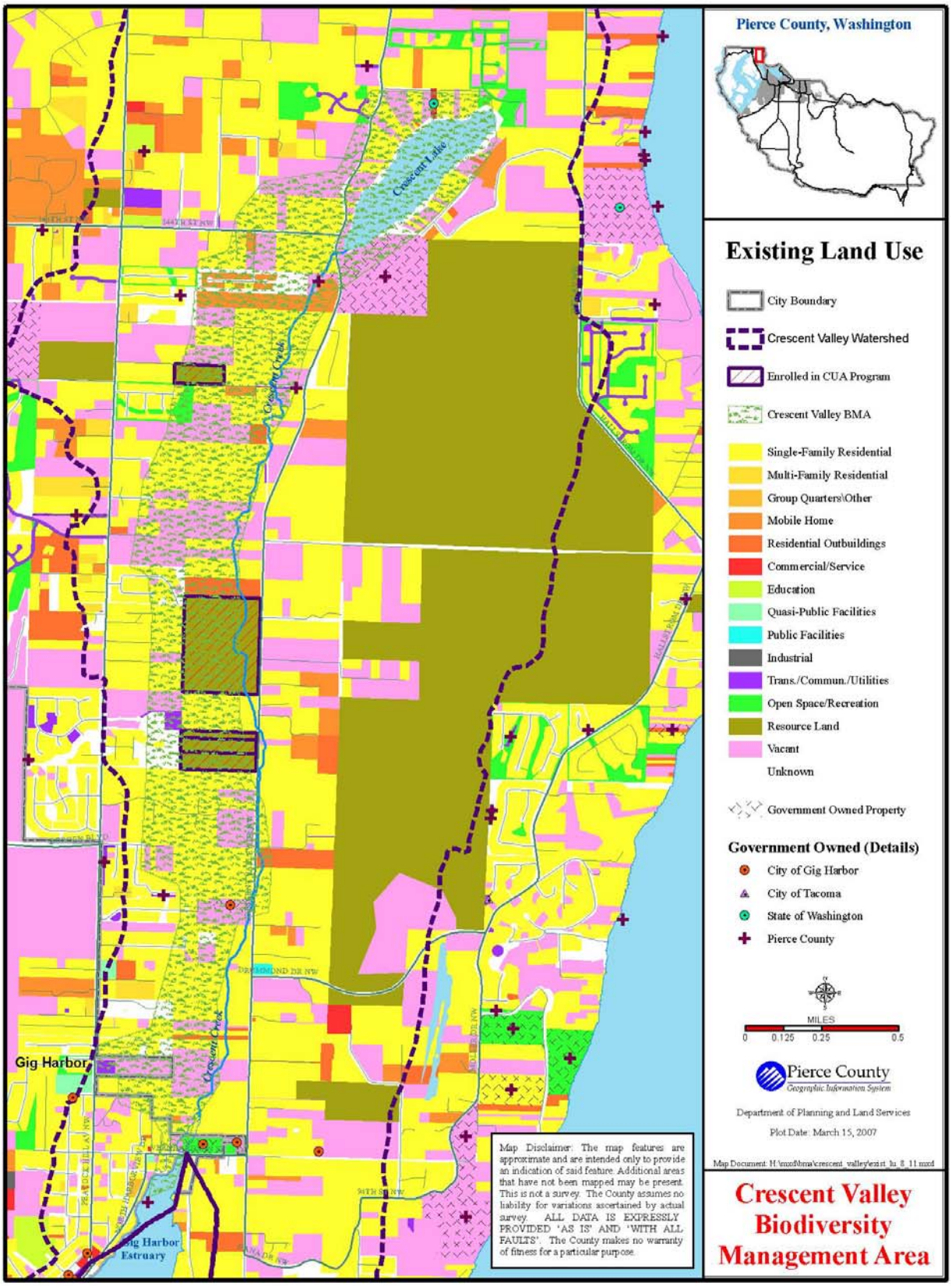

Figure 7. Existing Land Use Map

TABLE 6 - CRESCENT VALLEY BMA PUBLIC LANDS				
Parcel Number	**Total Area**		**Area Within BMA Only**	
	# Parcels	**Acres**	**# Parcels**	**Acres**
Pierce County				
0221052012	1	1.65	1	0.41
0222201013	1	0.16	1	0.16
0222201018	1	43.05	1	10.57
0222204018	1	0.15	1	0.06
3300000010	1	0.86	1	0.67
4001710161	1	2.61	1	2.61
Total Pierce County	**6**	**48.48**	**6**	**14.48**
City of Gig Harbor				
0222322080	1	3.89	1	3.89
0222323018	1	4.91	1	0.52
Total Gig Harbor	**2**	**8.80**	**2**	**4.41**
State of Washington				
222163010	1	1.17	1	1.01
Total Washington State	**1**	**1.17**	**1**	**1.01**
Totals	**9**	**58.45**	**9**	**19.90**

Current Zoning and Shoreline Environments

Zoning

A very small portion of the Crescent Valley BMA is located within the City of Gig Harbor and the remaining area is located in unincorporated Pierce County. Within unincorporated Pierce County, the BMA is predominately zoned Rural Sensitive Resource (RSR) with small areas zoned Reserve 5 (Rsv 5) and Single-Family (SF). One parcel within the BMA is zoned Moderate Density Single Family (MSF) and a small snippet of a parcel is zoned Agricultural Resource Land (ARL). See Figure 8 – Zoning Map. The RSR zone allows for densities of 1 dwelling unit (du) per 10 acres with a bonus density of 2 du/10 acres when 50% of the property is set aside as permanent open space. Lot sizes within the RSR zone must be a minimum of 1 acre in size. The Rsv 5 zoning is intended to be the first locations for expanding the County's Urban Growth Area (UGA) boundary out into the rural areas. This zone allows for 1 du/5 acres but also requires that lots that are created be no larger than 12,500 square feet in size with up to one residual parcel that may be larger in size. The SF and MSF zones are located within the County's UGA. The SF zone allows for densities of up to 4 dwelling units per acre and the MSF up to 6 du/acre when the site is served by sewer. The ARL is a resource lands zone that allows densities of 1 du/10 acres with minimum lot sizes of 10 acres. Table 7 provides a breakdown of the zones that apply within the BMA.

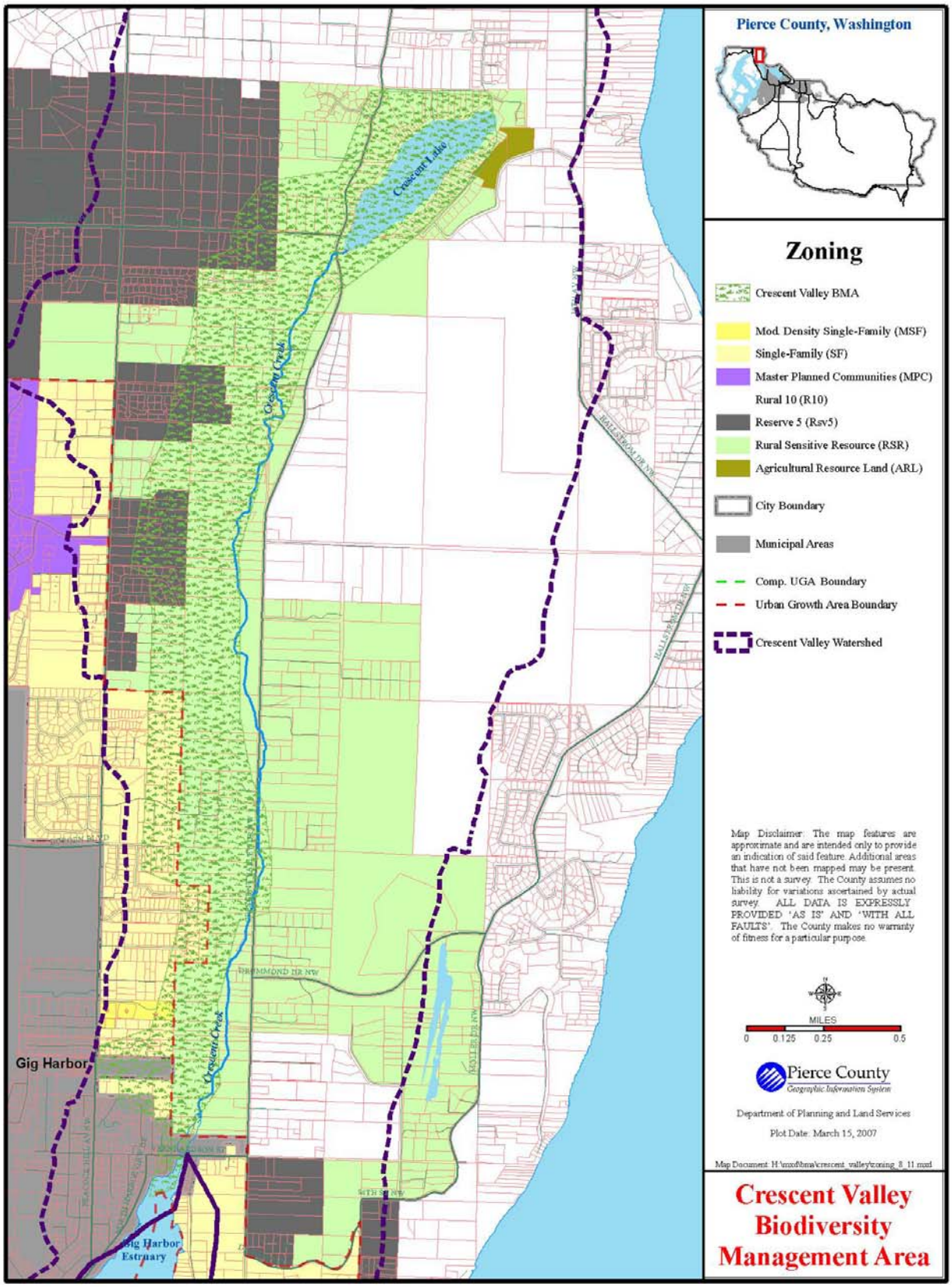

Figure 8. Zoning Map

TABLE 7 - ZONING CLASSIFICATIONS WITHIN THE CRESCENT VALLEY BIODIVERSITY MANAGEMENT AREA		
Zones	**Acreage**	**Percent of BMA**
Urban Zones		
Moderate Density Single-Family	2.36	0.30%
Single-Family	96.05	12.00%
Total Urban	**98.41**	**12.30%**
Rural Zones		
Rsv 5	86.11	10.76%
Rural Sensitive Resource	601.32	75.14%
Total Rural	**687.43**	**85.90%**
Natural Resource Zones		
Agricultural Resource Land	0.58	0.07%
Total Natural Resource	**0.58**	**0.07%**
TOTAL UNINCORPORATED	**786.42**	**98.27%**
City of Gig Harbor	**13.81**	**1.73%**
TOTAL	**800.23**	**100%**

Shoreline Environments

The Washington State Shoreline Management Act (SMA) provides for the management of water bodies or watercourses identified as "Shorelines of the State." Areas under jurisdiction of the SMA include water courses with a mean annual flow of 20 cubic feet (cf) per second, lakes greater than 20 acres in size and the shorelines of Puget Sound. All lands within 200 feet of the ordinary high water mark, and associated wetlands and floodplains, fall within the jurisdiction of Shorelines of the State. The Pierce County Shoreline Management Program (SMP) and companion Shoreline Management Regulations (SMRs) designate Shorelines of the State into five types of environments including Urban, Residential Rural, Rural, Conservancy, and Natural. These environments are similar to zoning designations allowing different land uses, densities and activities ranging from the most intensive uses (Urban) to very limited uses (Natural).

The only water body within the BMA classified as Shoreline of the State is Crescent Lake, which covers approximately 47 acres. The majority of the shorelines around Crescent Lake are classified as Rural Residential Environment, which allows for single family and some limited commercial uses. A small area of Crescent Lake around the outlet to Crescent Creek is classified as Conservancy Environment, which allows for low density residential, outdoor recreation and low intensity agricultural and forestry uses. Crescent Creek has not been identified as a Shoreline of the State because it has been determined to have a mean annual flow of less than 20 cf/second. However, the County is just beginning an update process to the SMP and SMRs and may re-evaluate the status of flows within Crescent Creek under the SMA criteria. See Figure 9 -Shorelines Environment Map.

Open Space Corridors

Pierce County identifies land areas most desirable for open space purposes (see Figure 10 - Open Space Corridors Map). These areas represent the highest priority for lands for conservation including creeks, wetlands, and fish and wildlife habitat areas. The Crescent Valley BMA is included within the County's Open Space Corridor map because of its status as a biodiversity management area and because of Crescent Creek. Identified open space corridor areas are used as the basis for application of the RSR zone (i.e. at least 50% of a parcel must fall within the open space corridor). In addition, extra points under the County's Current Use Assessment and Conservation Futures Programs are awarded to properties located within the open space corridor.

Future Growth Potential

Figure 11 – Potential Development Map indicates the parcels of land located within the Crescent Valley BMA that have a potential to subdivide and create additional lots. Each of these parcels is represented with an ID number. Table 8 provides a list of these parcels and indicates the parcel acreage, the potential total lots and the potential additional number of lots that may be possible given the RSR zones provision for a maximum of two dwelling units per 10 acres if 50% of the property is set aside as open space. Given the County's provision for rounding up to the next whole number for anything greater than .5 any parcel of land greater than 7.5 acres would be able to subdivide. There are currently 19 parcels of land within the Crescent Valley BMA that could be subdivided for a potential total of 34 additional new lots. Each of these lots could support a new residential home and associated driveways and accessory structures.

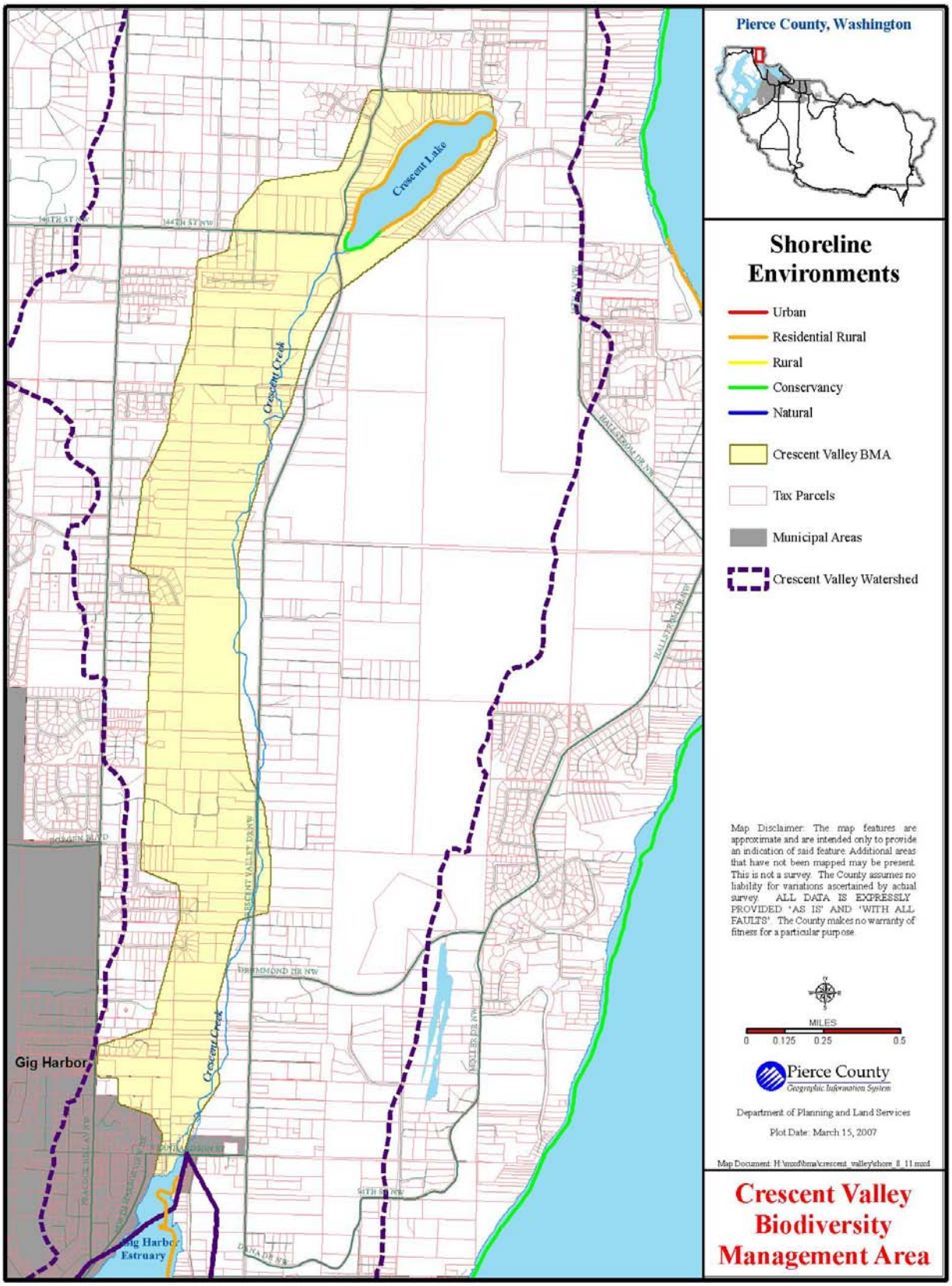

Figure 9. Shoreline Map

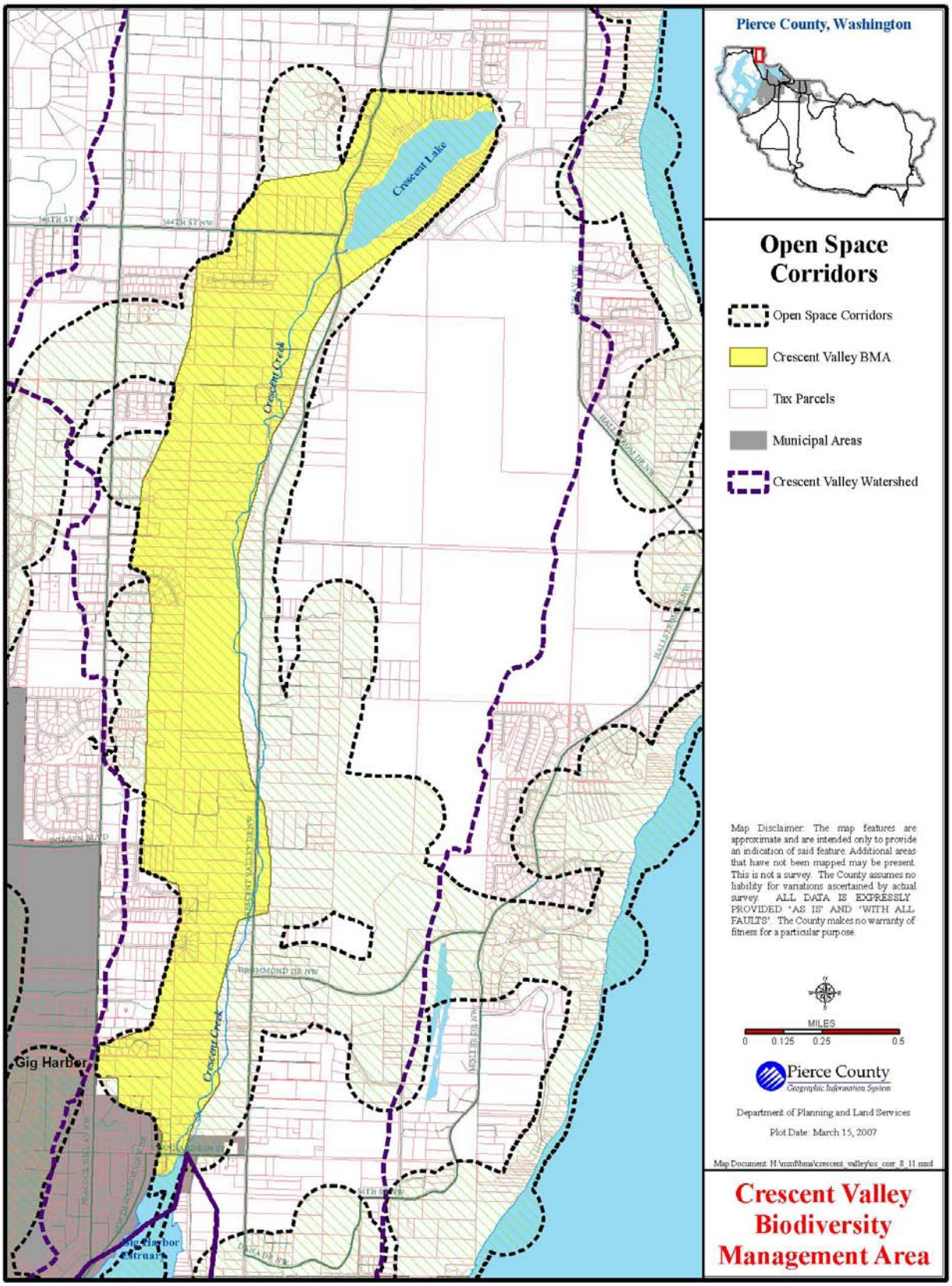

Figure 10. Open Space Corridor Map

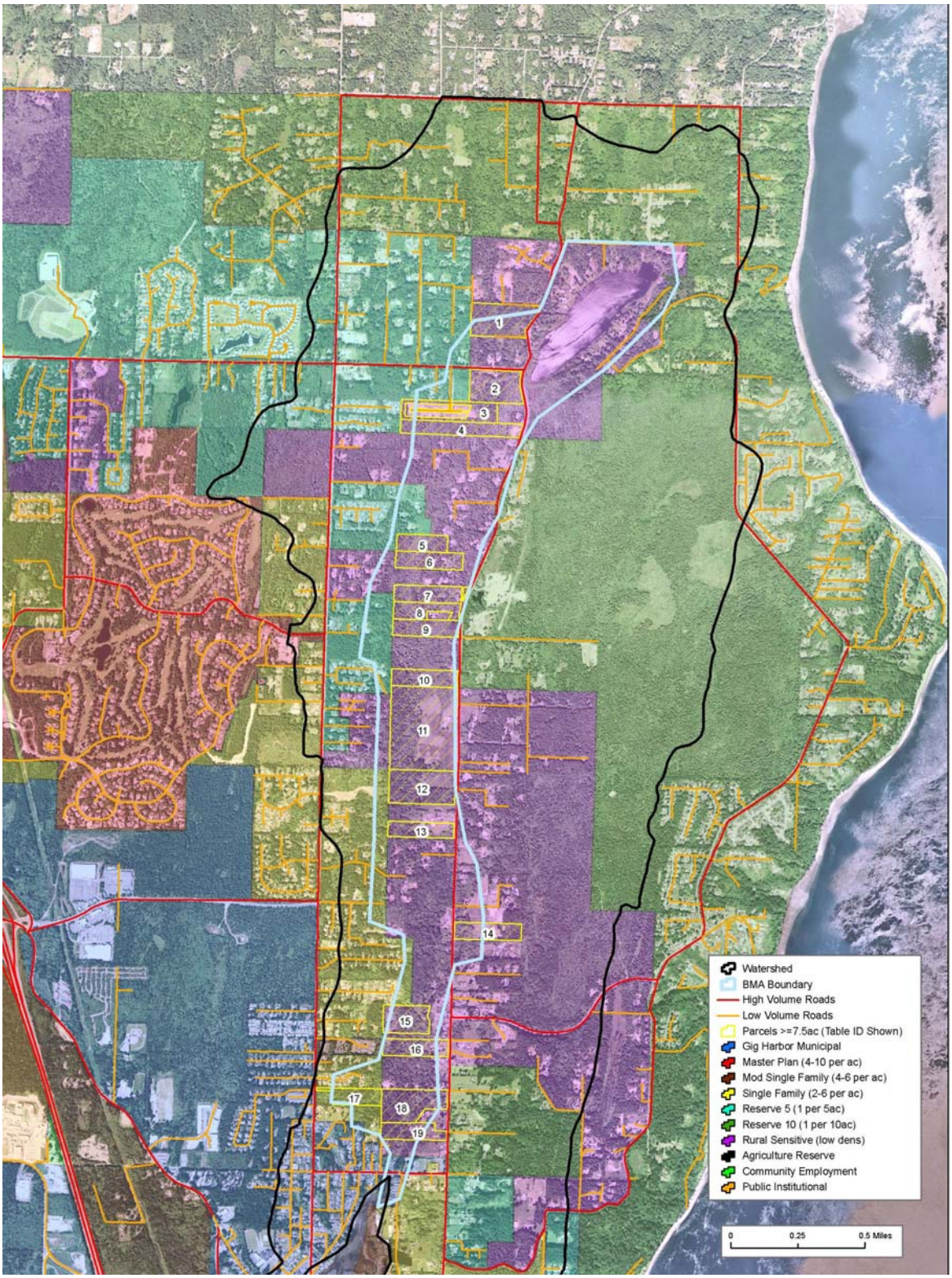

Figure 11. Potential Development Map

TABLE 8 – DEVELOPMENT POTENTIAL WITHIN CRESCENT VALLEY BIODIVERSITY MANAGEMENT AREA				
Map ID #	**Parcel #**	**Acreage**	**Potential # of Total Lots[1]**	**Potential # of Additional Lots**
1	0222174013	17.79	4	3
2	0222201001	15.05	3	2
3	4001710170	11.46	2	1
4	0222202039	14.64	3	2
5	0222203038	7.64	2	1
6	0222203006	10.11	2	1
7	0222203039	10.54	2	1
8	0222203012	8.31	2	1
9	0222203005	9.85	2	1
10	0222292003	9.90	2	1
11	0222292001	49.36	10	9
12	0222293036	19.77	4	3
13	0222293007	9.00	2	1
14	0222321001	10.04	2	1
15	0222322075	11.35	2	1
16	0222323000	9.87	2	1
17	0222323135	7.82	2	1
18	0222323003	16.28	3	2
19	0222327059	9.08	2	1
TOTALS		**257.86**	**53**	**34**
1 – The number of total lots is based on maximum development potential in cases where the property owner utilizes the bonus density of 2 dwelling units per 10 acres with 50% of the parcel set aside as open space.				

Impacts of Growth and Development on Habitat and Species Presence

The Crescent Valley BMA will only remain rich in species diversity if care is given to maintaining large enough habitat areas for species viability and good quality habitat conditions, including corridors for safe movement between primary and seasonal habitats. Stressors to habitat include a variety of factors such as:

- Fragmentation in habitat below the threshold for species viability due to land development, removal of vegetation, and roads
- Actions that change the hydrology within the watershed which especially affects amphibians and fish species
- Species mortality caused by vehicular traffic on roads and predation by non-native animals (cats, dogs, bullfrogs, non-native fish, etc.)
- Conversion of native vegetation to non-native and invasive plant species
- And other human actions that cause species mortality or negatively impact habitat

Stressors to the Crescent Valley BMA are discussed in greater detail in Chapter III. In addition, the

Washington Department of Fish and Wildlife (WDFW) conducted a wildlife analysis of the Crescent Valley BMA and watershed area[10]. The results of this analysis have been included as Appendix 2. This document identifies several focal species known or predicted to occur within the Crescent Valley BMA that are important for biodiversity, food sources for other species or are umbrella species for that species type (e.g. represent mid-to large sized wide-ranging mammals). Also included is a detailed analysis of habitat needs by species (including all aspects necessary in the full life-cycle of that species) and factors that stress the species and habitat, as well as recommendations for maintaining the biodiversity of fish and wildlife species within the area. Some species need larger core habitat areas (referred to as "patch size") and cannot tolerate higher densities and development. Examples of these species include the bobcat and Coopers hawk. As habitats become more fragmented those species less tolerant will begin to disappear and other species that are more tolerant will remain, thus resulting in a decline in species biodiversity.

[10] Schuett-Hames, J., Jacobson, J., and Tirhi M., 2007, Crescent Valley Biodiversity Management Area Wildlife Analysis: Washington Department of Fish and Wildlife Report, 19 p.

Chapter III - Conservation Targets and Threats

Overview of Conservation Targets and Threats

At a landscape level, conservation targets (systems) may include ecological systems, ecological communities, species, and other important natural resources. Ecological systems share common ecological processes (e.g. hydrology), environmental features (e.g. soil types), or environmental conditions (e.g. precipitation). Ecological communities have common or co-occurring features such as species or natural vegetation types. Other important factors in determining conservation targets include groundwater recharge, forest reserves, etc.[11]

Each conservation target has key ecological attributes that ensure the proper functioning of that systems occurrence in a landscape over the long-term. Key ecological attributes consist of size, condition (i.e. measure of the composition, structure and biotic interactions that characterize the occurrence), ecological processes (e.g. hydrologic regimes, fire regimes and other natural disturbances) and connectivity of target species to habitats and resources including dispersal or migration routes.

In an ideal situation, intact and properly functioning conservation targets are not significantly stressed. Stresses to a conservation target result in degradation and impairment of key ecological attributes and occur in a variety of ways from human impacts and other natural factors. The source(s) of the problem is what causes the stress to occur. Collectively stresses and sources of stress are referred to as threats to the system.

In the Crescent Valley BMA several conservation targets were selected to represent the key ecological functions occurring throughout the area. These conservation targets include Crescent Lake; Crescent Creek; wetlands, seeps and springs; Gig Harbor estuary; and conifer/deciduous mixed forest areas. Each of these conservation targets provides the systems that collectively create the rich variety of habitats necessary to foster a high level of biodiversity in that BMA. A detailed description of each conservation target and the threats to these systems follows. Conservation strategies to abate these threats are discussed in Chapter IV.

Crescent Lake

General Description of Crescent Lake

Crescent Lake, at approximately 47 acres, is the largest lake on the Gig Harbor Peninsula. Crescent Creek begins its flow southward towards the Gig Harbor estuary from the southern end of Crescent Lake. A culvert at the outlet of Crescent Lake, which was previously identified as a fish barrier, was replaced in 1999 with a "fish-friendly" culvert. WDFW annually stocks the Crescent Lake with 3,000 rainbow trout for sport fishing. It is unknown at this time if this fish stocking activity has any long-term negative

[11] The concept of identification of conservation targets and key ecological attributes, threats (stresses and sources of stress), and threat abatement strategies (referred to here as "conservation strategies" to abate threats) is derived from The Nature Conservancy (TNC) 5-S conservation action planning methodology. However, this method has been adapted to acknowledge the fact that the BMA was already identified utilizing the GAP methodology and as such the conservation targets were selected based on review of the key ecological attributes within the BMA.

impacts to the Crescent Lake system.

Water Quality of Crescent Lake

The U.S. Geological Survey (USGS) measured water temperature, pH, and fecal coliform concentrations in Crescent Lake in the early 1980s. At that time, water temperature and pH levels were in compliance with standards as were fecal coliform concentrations in the lake.

Development Around Crescent Lake

There are currently 79 individual parcels of land (approximately 113 acres) abutting Crescent Lake with 52% of these parcels (35 parcels containing approximately 59 acres) vacant. Much of this area has been developed with single family homes and as a result some of the natural vegetation around the Crescent Lake shoreline has been denuded.

Boating on Crescent Lake

Other human activities on the lake, such as motorized boating, also results in stresses to the proper functioning of the habitat and species that utilize this system. The Pierce County watercraft regulations classify Crescent Lake as a Class "C" Lake. Motorized boating is allowed on Crescent Lake with a maximum speed limit of 35 miles per hour between the hours of 11 a.m. and 7 p.m. (or legal sunset, whichever comes first) and five miles per hour the remaining hours during a 24-hour time period. Crescent Lake is a small lake with minimal boating activity compared to other bodies of water in Pierce County. Because of this and the vast number of lakes and area of Puget Sound in Pierce County and the Sheriff's Department's limited resources, the Sheriff's Department rarely conducts routine marine patrol on Crescent Lake. The Sheriff's Department has, over the past few years, asked the Auditor's Office to include a Pierce County Watercraft Regulations brochure with mailed vessel registration renewals and this has happened when a supply of brochures has been available.

Crescent Creek – Headwaters at Crescent Lake to Gig Harbor Estuary

General Description of Crescent Creek

Crescent Creek flows south, in a moderate to shallow gradient, from its headwaters at Crescent Lake, paralleling Crescent Valley Road and crossing under it three times before discharging to the bay at Gig Harbor. Several small springs and one major tributary, Salmonberry Creek, which enters Crescent Lake just north of its outlet to Crescent Creek, contribute water to this watercourse. Crescent Creek has variable riparian integrity, with many areas that are good, but overall the integrity does not meet a high quality condition. Riparian integrity is considered high if >70% of the corridor is wider than 100 ft, and <10% of the corridor is <35 ft, and there are <3 breaks (road crossings) in the corridor per stream mile. Streams meeting these conditions have greater potential for maintaining natural ecological functions. The mainstem of Crescent Creek between the lake and the estuary has 44% >100 ft wide forested or wetland riparian area. The tributaries have 56% of their length >100 ft wide. Figure 12 indicates portions of Crescent Creek where

Figure 12. Riparian Condition of Crescent Creek

intact riparian habitat exists. According to the Gig Harbor Basin Plan, Crescent Creek is composed of 62% good fish habitat, 17% fair fish habitat, and 21% poor fish habitat. Of the good fish habitat, 70% of it is located in the farthest upstream reach of the creek. The Basin Plan indicates that 62% of the riparian corridor is in good condition, 12% is in fair condition, and 26% is in poor condition and also notes that Crescent Creek has the highest percentage of poor quality riparian corridor of all the streams in the Gig Harbor Basin. A number of private homes are located near the stream and the condition of the stream depends to a large extent on how individual developers and homeowners have treated the riparian corridor, which in most cases has resulted in poor condition.

The Basin Plan also identifies one known barrier to fish passage on the main stem of Crescent Creek. A culvert under a private driveway, which carries Crescent Creek under 136th Street, is identified by Pierce County Conservation District (PCCD) as a fish passage barrier due to pipe separation and slope break within the pipe.

Water Quality of Crescent Creek

In the early 1980s, the U.S. Geological Survey measured water temperature, pH, and fecal coliform concentrations in Crescent Creek. At this time, water temperature and pH were in compliance with standards, however, fecal coliform concentrations in the creek were about five times higher than the standard. Water temperature was measured at several stations in Crescent Creek as part of a stream survey conducted by volunteers in the summer of 1998. Water temperature was in compliance with the standards at four stations but out-of-compliance at a single station just downstream of Crescent Lake. No flow was observed in the creek at this station and the temperature measurement was made in a stagnant pool.

As part of the Gig Harbor Basin Plan process, water quality surveys on Crescent Creek were conducted in June 2000, July 2001, March 2002, June 2002, and October 2002. Samples were taken and analyzed for water temperature, pH, turbidity, dissolved oxygen, nutrients, and fecal coliform content. Results from these samples indicate that water temperature, pH and dissolved oxygen content were in compliance with standards in the 2000 sampling. Fecal coliform concentration was approximately four times higher than the standard in the 2000 sampling. In the 2001 sampling, water temperature and pH were in compliance with standards but fecal coliform concentration was elevated slightly above the standard. All measurements conducted between May 2000 and December 2001 complied with temperature standards.

Crescent Creek has two sites that are currently being monitored for water quality standards. This data is uploaded onto The *NatureMapping* Program's website [12].

Both historic and more recent water quality sampling indicates a problem with fecal coliform concentrations in Crescent Creek. This is likely due to uncontrolled livestock access into Crescent Creek and/or inadequate vegetated buffer separation between livestock use areas and the creek.

Water Quantity in Crescent Creek

As part of the Gig Harbor Basin Plan process, devices that measure the water level or stage every 15 minutes were installed at a station on Crescent Creek in early May 2000. The data from the gauging

[12] Go to www.cbr.washington.edu/naturemapping and select register & view sites. Scroll to the bottom of the map and select by Waterbody…Crescent Creek.

devices was collected and measurements were taken from May 2000 through January 2002. During this time period, the stream velocity measurements ranged from a low of 1.4 cubic feet per second (cfs) in October 2001 to a high of 60.4 cfs in December 2001.

Wetlands, Seeps and Springs

The Crescent Valley watershed is a complex hydrologic system with wetlands and Crescent Creek in the valley and seeps and springs feeding into this wetland/riparian system from the adjacent hillsides. Figure 13 indicates wetland areas as identified in the National and County Wetland Inventory, potential wetlands, and hydric soils data layers. The wetland and riparian systems provide a rich habitat for a variety of fish, reptiles, amphibians, mammals and bird species. Certain wildlife species, such as pond breeding amphibians, are very dependent on the hydrology of an area for their life cycle needs. Appendix 2 – Crescent Valley BMA Wildlife Analysis contains additional information about the habitat needs related to amphibians.

Gig Harbor Estuary

At the northernmost portion of the Gig Harbor Bay is an estuary formed where Crescent Creek enters the bay. This area was rated in the KGI Nearshore Salmon Habitat Assessment[13] as having the highest quality habitat in Ecological Management Unit 2. At low tide a large mudflat extends out from the mouth of the estuary along the adjacent shorelines. The Pierce County nearshore habitat assessment identifies the Gig Harbor Estuary as having medium quality nearshore salmon habitat and is also identified as a WDFW Priority Habitats and Species (PHS) area (refer to Figure 5 – Fish and Wildlife Resources Map on page 16). The WDFW – PHS database provides information regarding the presence of habitats and species considered to be priorities for conservation and management including state endangered, threatened, sensitive, and candidate species; animals aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are vulnerable. Priority habitats are those habitat types or elements with unique or significant value to a diverse assemblage of species and may include areas with unique vegetation type or dominant plant species, a described successional stage, or a specific structural element.

Forest – Conifer/Deciduous Mixed Forest

The Crescent Valley BMA contains a patchwork of mixed lowland conifer/deciduous forest, punctuated with wetlands, riparian areas, pasture areas, and areas developed for single family residential uses. Along the adjacent hillsides the forest cover transitions to a predominately conifer forest habitat. On the eastern ridge is an area that contains over 1,000 of undeveloped forested land. Forested areas provide connectivity between the different habitat patches and also serve to maintain hydrologic cycles within a watershed. Best available science indicates that 75% forest cover within a watershed provides high quality hydrological function for wetland water level fluctuation and stream hydrology. The Crescent Valley watershed currently has about 80% forest cover. These forest areas are a necessary component in many terrestrial species lifecycles. Each species has their own unique needs for habitat patch size, which increases for mammals and birds with a sensitivity to patch size. This is very important for pond-breeding amphibians, and native fish species that utilize the stream, wetland, and lake systems in the watershed.

[13] Key Peninsula, Gig Harbor, and Islands Watershed Nearshore Salmon Habitat Assessment Final Report. Prepared for Pierce County Public Works and Utilities, Environmental Services, Water Programs. Dated July 3, 2003.

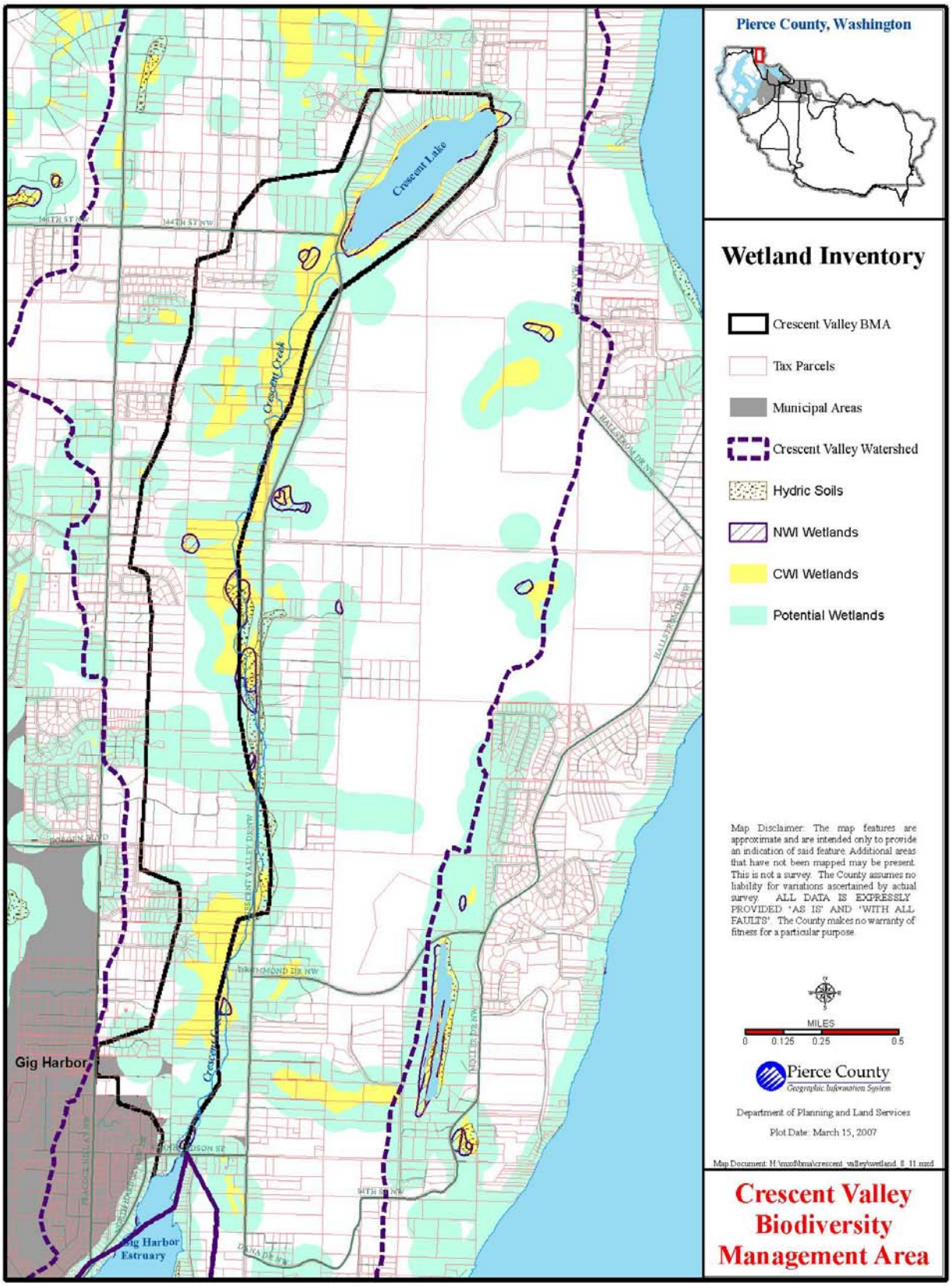

Figure 13. Wetland Inventory Map

Threats to Conservation Targets

During meetings with the Crescent Valley residents, stresses and sources of stress (threats) to each of the conservation targets was discussed. The main threats that are or may potentially be occurring to conservation targets include:

- Habitat conversion and fragmentation due to development, removal of native vegetation and roads
- Poor water quality caused by residential use of fertilizers, domestic animal feces, septic tank leakage, spraying of herbicides along public roads, and road runoff
- Disturbance on and along the lake from motorized watercraft activities, cleaning of boats in Crescent Lake (especially when pulled out of saltwater) and people and domestic animal usage during sensitive breeding and nesting times
- Disturbing cavity nesting ducks (e.g., wood ducks) on Crescent Lake by removal of native vegetation, displacement by introduced species, boating activity, and domestic animals preying on birds and babies
- Introduction of invasive, exotic, non-native species including plant species, wildlife species (e.g. bullfrogs and turtles), stocking of non-native fish species (WDFW fish stocking and local residents dumping aquarium fish into the lake and Crescent Creek)
- Fish passage blockage from culverts
- Wildlife movement blockages from roads, driveways and fencing
- Erosion and damage of nearshore habitat in Gig Harbor estuary from hard armoring bulkhead systems
- Predation of native species by domestic cats and dogs
- Siltation of Crescent Creek and Gig Harbor Estuary from development
- Draw down and water fluctuations in hydrology due to storm drains redirecting water flow into the estuary and not into wetlands, development drawing from ground water and stormwater from development
- Pollution caused by dumping of trash and debris

Chapter IV - Conservation Strategies

Overview of Conservation Strategies

To achieve long-term health of a conservation target, threats must be abated to ensure viable, functioning systems. There are two approaches to lessen the stress and enhance or maintain the viability of the conservation target. The first is to abate the sources that are causing the stresses, under the assumption that the stress will subside if the source is removed. The second is to directly abate the stresses that may persist once the source is removed.

Conservation strategies are developed and implemented to (1) abate the critical sources of stress (i.e., threat abatement); and (2) directly restore altered key attributes of the systems (i.e., restoration). Threat abatement may involve a number of approaches including direct actions (e.g. removal of a culvert blocking a creek) or public education and outreach (e.g. educating property owners on the negative impacts of removing native vegetation that provides habitat). Restoration actions may include replanting native vegetation that is appropriate to the underlying soils and indigenous plant communities that historically thrived in a given location.[14]

In the Crescent Valley BMA planning process each of the conservation targets described in the previous chapter were reviewed in detail and potential threats identified. During this process Crescent Valley residents also identified conservation strategies to ascertain the level or severity of a potential threat, directly abate known threats, or identify restoration opportunities where degradation has occurred. Some threats applied to multiple conservation targets and as such the conservation strategies have been grouped under the following categories, which have been stated as a positive outcome:

- Reduce Habitat Conversion and Fragmentation (due to development and human activity)
- Enhance Water Quality
- Decrease Disturbances on Crescent Lake
- Eliminate Invasive and Introduced Species
- Remove Fish and Wildlife Movement Blockages
- Control Erosion and Siltation
- Halt Predation by Domestic Animals
- Minimize Water Fluctuation and Draw Down

The discussion below provides recommended conservation strategies for each stress and source of stress to the conservation targets.

[14] TNC 5-S conservation action planning methodology.

Reduce Habitat Conversion and Fragmentation

Source of Stress: Development, Vegetation Removal and Deforestation

Conservation Strategies

1. Adjust the Crescent Valley BMA boundary as recommended in Appendix 2, Figure 11, to better represent lands necessary for the long-term persistence of aquatic species, as well as other birds, mammals, amphibians, and reptiles.
   a. Work with Pierce County Planning and Land Services Department to adopt the Crescent Valley BMA Stewardship Plan and companion amendments to the Crescent Valley BMA boundary as depicted in Appendix 2, Figure 11.
   b. Integrate the revised Crescent Valley BMA boundary into the Pierce County Comprehensive Plan Open Space Corridors Map.
   c. Apply the Rural Sensitive Resource zoning to the tax parcels located within the revised Open Space Corridors Map.

2. Utilize Low Impact Development techniques within the BMA.
   d. Work with the County, PCCD and other interested agencies to educate property owners on LID techniques.
   e. Work with the County, City of Gig Harbor and State Agencies to promote the use of LID on public properties.

3. Continue to apply native vegetation retention and critical area buffer regulations to environmentally sensitive areas within BMA and enforce any violations to these regulations.
   a. During review of development proposals work with the County and Peninsula Advisory Commission (PAC) in the design of projects that maintain the core habitat values and ensure mitigation efforts are appropriate and relevant to the development impacts.
   b. Enforcement of potential violations to existing regulations should receive a higher priority. Work with the County Council to provide adequate staffing resources for this purpose.

4. Provide increased education and outreach to property owners, developers and real estate agents regarding impacts of vegetation removal and fish and wildlife habitat stewardship actions.
   a. Provide landscape consultation and on-going workshops (with guest speakers) to homeowners.
   b. Provide homeowners with literature on how to be a shoreline steward [Puget Sound Action Team (PSAT) has great materials already developed].
   c. Create realtor packets with materials on shoreline stewardship to be given to new residents of shoreline properties.
   d. Present project at realty offices to get them to pass out realtor packets and educate on unique ecological characteristics of community.
   e. Contact developers and alert them on community project and their role in transforming ideology around selective cutting vs. clear cutting a property.
   f. Create homeowner information packets that describe the location and importance of corridors. Include all certified backyard habitats/sanctuaries to help inspire people to get involved.

5. Participate in local land use advisory meetings regarding proposed developments that affect the BMA
   a. Attend PAC meetings to provide input into development proposals.
   b. Create a phone tree (provide agency numbers of enforcement for community) to contact

community members when a proposed development is being reviewed by the County.
   c. Have group placed on interested parties list for notification by the County of any development proposals within or adjacent to the BMA.
   d. Advocate for conditions that eliminate or minimize threats to the conservation targets.
   e. Work with developers to try and come up with a "win-win" solution (i.e. utilizing density bonus for open space and where best to locate open space areas in relation to the BMA and adjacent wildlife habitat areas).

6. Work with the County to continue to apply the Rural Sensitive Resource (RSR) zoning within the BMA.
   a. Any future updates to the Gig Harbor Community Plan should include a review of additional habitat areas for inclusion within the BMA and RSR zone.
   b. Support the bonus density for dedication of at least 50% of the property as permanent open space within the Rural Sensitive Resource zone.

7. Work with the County, PAC and developers to locate open space set aside areas in contiguous tracts or within contiguous conservation easements located in such a manner as to promote connectivity and proximity to the conservation targets including:
   a. Identify the best locations for designated open space areas during the development proposal review process.
   b. High priority open space set aside areas are along watercourses, water bodies and Puget Sound.
   c. New development in forested areas should provide their open space dedications adjacent to the BMA as first priority, including areas in the 1,000 acre woods.
   d. Establish connectivity and habitat zones around wetlands and Crescent Creek and adjacent forest areas which provide habitat.
   e. Apply Washington Department of Fish and Wildlife (WDFW) Planning Metrics for guidance to help maintain fish and wildlife habitat including:
      i. Maintain habitat connectivity within the BMA and adjacent habitat areas through corridors and permeable landscape mosaics.
      ii. Proactively address wildlife and road issues by routing traffic through less sensitive wildlife areas, locate development with road placement and traffic intensity issues for wildlife in mind, and provide connectivity linkages across roads that intersect habitat patches or corridors.
      iii. Rectify existing road conditions that cause wildlife mortality at important crossing areas such as in connective corridors, or amphibian crossing locations, through road and wildlife planning approaches.
      iv. Maintain larger habitat areas to support development sensitive species.
      v. Preserve rare landscape elements and associated species and connected areas with critical habitats.
      vi. Retain large contiguous or connected areas that contain state Priority Habitats and Species and species of Local Importance.
      vii. Preserve large habitat areas and sensitive locations through land use planning mechanisms like outright purchase, purchase of development rights, conservation easements, and transfer of development rights.
      viii. Maintain natural hydrologic conditions and minimize surface runoff using low-impact site design principles and the retention of natural forest and wetland cover throughout the watershed.
      ix. Protect water quality using a combination of innovative treatment BMPs and aggressive,

comprehensive source controls.

x. Maintain watershed processes (e.g., delivery and routing of water, sediment, nutrients/toxicants/bacteria, large wood, heat, forest succession, and upland disturbance regimes).
xi. Protect in-stream habitat and natural channel morphological conditions through the control of storm-water inputs and bank-full flows.
xii. Protect the stream-riparian ecosystem corridor, channel migration zone (CMZ), and floodplain.

f. Develop and implement community/school education programs (1) to prevent the introduction of nonnative species such as bullfrogs and fish, and (2) to encourage wildlife friendly, responsible pet ownership.
g. Place open space areas in such a manner as to create a transition area of native plants/vegetation to between developed and non-developed areas thus reducing the edge effect.

8. Maintain or restore at least 65% native vegetation throughout Crescent Lake/Creek watershed to maintain normal hydrological functions, as well as connectivity for wildlife. This can be done per residence, and can be boosted by keeping some large habitats in natural condition.
   a. Provide educational materials to homeowners in the Crescent Lake/Creek watershed, and especially to property owners within the BMA and along the shorelines of Crescent Lake, Crescent Creek and the Gig Harbor Estuary, on the importance of retaining native vegetation and forest cover.
   b. Work with developers/ identify developers that can be worked with to identify best locations for native vegetation retention and open space set asides.
   c. Work with property owners to plant, retain, and restore buffers around Crescent Lake, Crescent Creek and wetlands.
      i. Organize work parties as an annual or biannual native vegetation planting event. Consider partnering with local Boy Scout or Girl Scout troops, schools, or other environmental or civic organizations for volunteers.
      ii. Target identified restoration areas for native vegetation planting events.
      iii. Pursue grant programs to help fund the purchase of native plant materials or work with local plant nurseries, Pierce County Conservation District, developers or other potential sources to obtain native plant supplies.
   d. Conduct monthly seminars on various components of creating wildlife habitats.

9. Encourage targeting the purchase of land within the Crescent Valley for wildlife habitat.
   a. Work with property owners located within the BMA to identify parties who are interested in selling their property or a portion of their property for permanent open space or passive recreation.
   b. Compile a list of willing selling property owners or other properties within the BMA that are a high priority for acquisition as permanent open space.
   c. Work with Peninsula Metropolitan Park District (PenMet Parks) and Great Peninsula Land Trust to promote purchase or transfer of high priority open space properties within the BMA.
   d. Submit applications to the Pierce County Conservation Futures Program for acquisition of high priority open space properties.

10. Apply for National Wildlife Federation – Community Habitat Program certification and conduct public education and outreach efforts to property owners to participate in this program and certify their property as backyard wildlife sanctuaries.

Source of Stress: Roads and Driveways

11. Work with the County and the PAC on the placement of new public and private roads that bisect and fragment the BMA considering the following criteria:
    a. Consider first the expansion of existing roads located outside or on the fringe of the BMA and install wildlife mitigation measures with the road expansion project.
    b. If a new road is the only feasible option, construct the roadway with wildlife mitigation measures.
    c. Avoid new roads that bisect open space set aside areas and that cross Crescent Creek.
    d. Utilize the new WDFW – PHS guidance document to help plan where roads should go based on fish and wildlife information.

12. Work with the County on any proposed widening of Crescent Valley Road. If Crescent Valley Road is identified for a road widening project then suggest constructing the roadway improvements with wildlife mitigation measures.

13. Work with the County to install signage along Crescent Valley Road that indicates the motorist is traveling through a "sensitive wildlife area" and that this road is a "wildlife crossing area". Signage should include a caution statement to watch out for and avoid wildlife that may be crossing the road.

14. Work with the County to maintain lower speed limits on Crescent Valley Road (i.e. no greater than 35 miles per hour) in order to help minimize conflicts between motor vehicles and wildlife.

15. Work with the County, PAC and developers to locate new roads and driveways in such a manner as to not bisect intact habitat areas. Seek to identify alternative driveway access points rather than introduce new stream crossings.

Enhance Water Quality

Source of Stress: Application and Spraying of Fertilizers, Pesticides and Herbicides

Conservation Strategies

1. Evaluate the impacts to Crescent Lake, Crescent Creek, and groundwater supplies resulting from the use of fertilizers, pesticides and herbicides on properties within the BMA.
    a. Collect water quality data over a five year time period.
    b. Work with the Tacoma Pierce County Health Department (TPCHD), Pierce County Public Works and Utilities (PWU), Pierce County Conservation District (PCCD) or a local water steward group to identify testing sites, gain access to monitoring equipment, etc.
    c. Acquire commitment from the TPCHD, PWU or PCCD for sampling kits and lab costs to establish water quality information in Crescent Lake and Crescent Creek. At a minimum, water quality testing should determine if eutrophication is occurring in Crescent Lake due to runoff or restriction of recharge from groundwater and identify any other contaminants or water quality problems in these waters.
    d. Educate property owners within the BMA on the importance of having their well water tested on a regular basis. Utilize this information to determine if any of the well water supplies are contaminated from the use of fertilizers, pesticides or herbicides or other toxins.
    e. Partner with local Boy Scout or Girl Scout troops, schools, or other environmental or civic

organizations to conduct monitoring and sampling of Crescent Lake and Crescent Creek. Consider creation of a booklet produced by students about the water quality monitoring in Crescent Valley and how the testing results impact the biodiversity in the BMA. Teachers and biologists could work with students to create booklet.

2. Replace the use of chemical fertilizers, pesticides and herbicides with natural, organic and permaculture methods.
   a. Provide increased education and outreach to property owners regarding negative impacts of using non-organic pesticides and fertilizers and demonstrate natural alternatives (such as the use of biological pest control).
   b. Provide this information as one of the community workshop topics or hold a Community Education Day to walk the neighborhood to distribute literature.
   c. Work with PCCD, WSU – Pierce County Cooperative Extension Office (WSU) or other sources to identify natural methods now available.

3. Eliminate/discontinue the spraying of herbicides within the public right-of-ways and public owned land within the BMA.
   a. Property owners can install "no-spray" signs on their properties along public right-of-ways.
   b. Park and road maintenance crews can alter spraying practices within BMA area and should consider utilizing Integrated Pest Management systems as an alternative to the use of chemicals.
   c. Property owners can provide education and outreach to public agencies on why pesticide-free parks are beneficial.

4. Plant, retain, and restore buffers to prevent runoff from reaching the creek.

<u>Source of Stress: Domestic Animal Feces</u>

Conservation Strategies

5. Acquire commitment with county/TPCHD for fecal coliform sampling kits and lab costs.
   a. Collect fecal coliform water quality data for five years through local monitoring group.

6. Develop a pet waste education program as outlined in the KGI (Key Peninsula-Gig Harbor-Islands) Watershed Action Plan (#10-13).

7. Clean up after pets and livestock through community composting.
   a. Provide property owners with educational information/materials on why this is so important (i.e. impacts associated with waste)
   b. Work with local nurseries to institute a community compost program.

8. Use fencing to create a buffer between riparian (i.e. the lake, creek and estuary) and wetland areas and livestock pasture areas.
   a. Encourage property owners with livestock to develop farm management plans.
   b. Provide property owners with livestock educational materials on cost-share programs to install fencing between pasture areas and riparian and wetland areas.

Source of Stress: Septic Tanks

Conservation Strategies

9. Work with property owners to test all the septic tanks for possible contamination into the system.
   a. Explore available Pierce County or Tacoma-Pierce County Health Department programs to check septic tanks.
   b. Explore any available incentive programs to help homeowners pay for this.
10. Collect fecal coliform water quality data within water bodies and watercourse for five years.

11. Develop and/or distribute informational packets about septic tanks that go out to all residents.

Source of Stress: Runoff from Roads

Conservation Strategies

12. Review County planning documents to determine if any storm water drains in the BMA area discharge directly into a water body, watercourse or wetland. If this information is not available then work with the County or PCCD to conduct an inventory to determine if any such stormwater drains exist. If there are any stormwater drains that discharge directly into a water body, watercourse or wetland then develop a community drain stenciling event to mark these drains to prohibit discharge into them.

13. Plant native vegetation along roads and driveways to filter road runoff pollutants.

14. Work with local jurisdictions to apply new road maintenance standards to public right-of-way areas to reduce harmful impact from runoff from roads.

15. Identify culverts and ditches that deposit road runoff directly into a waterbody, watercourse or wetland. If this information is not available then work with the county or PCCD to conduct an inventory to determine if any such culverts or ditches exist. If there are any culverts or ditches that discharge directly into a waterbody, watercourse or wetland than work with the local jurisdiction to apply mitigation measures for pre-treatment prior to discharge. Consider applying low impact development techniques for mitigation measures.

Source of Stress: Trash/Garbage

Conservation Strategies

16. Develop a trash pickup campaign along roadways.
   a. Work with local schools, neighborhood associations and local property owners to participate in an Adopt-a-road program to pick up trash and garbage.

17. Organize garbage cleanup days and/or educate property owners on need to keep garbage and pollutants out of habitat areas.

19. Create a watchdog team for development to report garbage dumping. When appropriate utilize the Pierce County Responds Program to report garbage dumping in the area.

Decrease Disturbance on Crescent Lake

Source of Stress: Boating Activity

Conservation Strategies

1. Work with Pierce County to increase enforcement of the currently established boating hours on Crescent Lake.
   a. Work with County to increase signage about the watercraft regulations that apply to the lake, especially in close proximity to the boat ramp.
   b. Work with County to mail out brochures with the licensing renewals and to the lakefront residents about the watercraft regulations on Crescent Lake.
   c. Develop a community lake watch group.
   d. Work with County to increase Pierce County Sheriffs presence on the lake.

2. Request the County, TPCHD or State agency to initiate a study/planning process for Crescent Lake which should:
   a. Evaluate the impact of boating activities on water quality and habitat areas. Boating activity use includes pollution from engines, people cleaning their boats (especially when pulled out of saltwater), wake, etc.
   b. Address management of boating activities to mitigate for any identified impacts such as minimizing boating activity during sensitive times and areas, restricting engine size and speed, etc.
   c. Include an analysis comparing boating activity by landowners versus visitors to the lake.
   d. Identify what waterfowl are currently using Crescent Lake for habitat and what waterfowl historically were seen on the lake but are no longer using the lake potentially due to motorized boating activities.

3. Provide educational materials to boat owners on the impacts associated with cleaning their boats on the lake.
   a. Create a flyer just on the condition of the lake and that describes the negative impacts associated with cleaning boats on the lake and suggested alternatives.

Source of Stress: Vegetation and Habitat Removal

Conservation Strategies

4. Retain and/or replant native trees and shrubs along the lake edges in the nearshore environment.
   a. Provide educational materials to lakefront property owners about the negative impacts associated with native vegetation removal along the lake edge.
   b. Work with lakefront property owners to help them replant native vegetation, where native vegetation has been removed. Consider planting work parties utilizing Pierce County Conservation District, schools, Boy Scout troops, or other local volunteers.

5. Promote shoreline dependent species through nest box placement (e.g., wood ducks) and monitor to see if this strategy is effective.

Eliminate Invasive and Introduced Species

Source of Stress: Introduced Plant Species and Weeds

Conservation Strategies

1. Conduct a detailed inventory of the plants within the BMA to identify the density of invasive species and determine target areas for non-native/invasive plant removal and replanting of native vegetation.

2. Provide educational information to property owners and plant nurseries regarding the impact of spartina and other local non-native and invasive plant species.
   a. Get list of different removal techniques for spartina – The Nature Conservancy (TNC) could be a potential resource for spartina removal techniques.
   b. Develop or obtain a booklet of invasive local weeds and mail to local property homeowners. Booklet should include the following information: list of undesirable non-native and/or invasive plant species; methods of removal; native plants that can be used to revegetate; wildlife benefits of native plants; etc.
   c. Contact local nurseries to discuss the impacts of non-native/invasive plant species on habitat areas and the potential to limit or eliminate the sales of non-native or invasive plant species and increase the sales of native plant species.
      i. Explore the possibility for local nurseries to host monthly education community meetings
      ii. Request local nurseries to distribute brochures on the benefits of utilizing native plant species
      iii. Work with local nurseries to host native plant sales in conjunction with BMA events
      iv. Request local nurseries to label invasive plant species

3. Work with local property owners and municipal jurisdictions to remove non-native and invasive plant species within the BMA.
   a. Organize a "Weed Walkabout" workshop for the community.
   b. Organize weed cleanup activities utilizing PCCD, schools, Boy Scout troops, or other local volunteers.
   c. Contact Pierce County and City of Gig Harbor Public Works and Parks Departments about removal of invasive species within the road right-of-way and public properties.

Source of Stress: Introduced Non-Native Fish and Wildlife Species

Conservation Strategies

4. Work with Washington Department of Fish and Wildlife to conduct a study to determine if stocking of non-native fish into Crescent Lake is harming the lakes' native species.
   a. If non-native fish is harming the lake's native fish species, then work with WDFW to get them to cease stocking non-native fish and replace with native fish species.

5. Educate the homeowners and pet stores on the damage that is done when they turn loose non-native fish and wildlife species into Crescent Lake, Crescent Creek and other habitat areas within the BMA.
   a. Include this information as part of lake information packet or fact sheet that should be developed for distribution to area property owners.
   b. Species that should be listed in the information packet include but are not limited to turtles, frogs, and aquarium fish.
   c. Contact local pet stores to discuss the impacts of non-native/invasive fish and wildlife species on

habitat areas and the potential to limit or eliminate the sales of non-native fish and wildlife species.
   d. Contact WDFW enforcement if non-native species are being sold.

6. Collect and destroy bullfrog egg masses.
   a. Establish a bullfrog eradication program that lasts a minimum of 3 years, which could be part of a whole wildlife monitoring plan and/or water monitoring program.

7. Fence livestock out of creeks and wetland and their associated buffer areas.
   a. Partner with PCCD staff to educate and work with property owners to help develop farm management plans and with funding for fencing to keep livestock out of stream.
   b. Provide educational materials to property owners with livestock on negative impacts associated with unrestricted access to creeks and wetland areas and incentive/grant programs to help defray the cost of fencing.

Remove Fish and Wildlife Movement Blockages

Source of Stress: Culverts

Conservation Strategies

1. Work with the County, City of Gig Harbor, PCCD and homeowners to replace existing culverts that are causing fish blockages.

Source of Stress: Roads and Driveways

Conservation Strategies

2. Monitor road kills and develop strategy for better wildlife crossings where most of the kills take place. Employ different strategies for the various species based upon their needs such as:
   a. Amphibians may need crossings under roads.
   b. Mammals need speed limit reduction, better signage, and connective corridors linking areas throughout the watershed with the large forest patch to the east. Also consider how linkage to other locations on the Kitsap Peninsula might occur.

3. Work with the County to establish signage along Crescent Valley Road that indicates this is a "sensitive wildlife area" and to drive with caution.

4. Encourage the development of a booklet for county, developers, park districts to explain the history and conservation efforts of CVA. Put on multiple websites to keep everyone aware of progress.

5. Provide education to landowners regarding the importance of maintaining vegetation corridors along roadways and driveways so that wildlife can have alternative movement corridors.

6. Work with the County, PAC and developers to design new roadways within BMA to be wildlife friendly. Roads should not create barriers, such as cement curbs, that may prevent small animals (e.g. salamanders) from crossing.

Source of Stress: Fencing

Conservation Strategies

7. Utilize fencing that does not block wildlife movement from occurring.
   a. Avoid solid board on board fencing in wildlife movement corridors.
   b. Utilize smooth (as opposed to barbed) wire fencing for livestock that minimizes potential for injuring wildlife. An example is New Zealand smooth wire fencing.

Control Erosion and Siltation

Source of Stress: Bulkheads

Conservation Strategies

8. Work with the County and City of Gig Harbor to replace hard armoring bulkheads in Gig Harbor estuary with some type of soft armoring system that is less impactive on fish habitat.
   a. The City of Gig Harbor park bulkhead, which was installed in 1953 and has now failed, should be replaced with a soft armoring system.

   b. Explore the opportunity of obtaining funding from Puget Sound Action Team (PSAT), PCCD, Russell Family Foundation or other grant opportunities to help fund these projects.

9. Conduct public education and outreach to property owners along marine waters on the negative impacts of hard armoring along shorelines and alternative methods that are less impactive to the nearshore habitat.
   a. Work with County and other governmental or non-profit staff to conduct workshops on this topic.
   b. Provide educational brochures to shoreline property owners on this topic.

10. Replant shoreline areas with native plant species and remove non-native and invasive species.
    a. Organize plant removal and replanting work parties with local property owners and interested non-profit agencies, schools, Boy Scout troops, etc.

Source of Stress: Development

Conservation Strategies

11. Monitor new construction activities to ensure that erosion control measures are properly installed and functioning from preventing erosion into ditch systems, watercourse, wetland and estuary areas.
    a. Local residents should call Pierce County Planning and Land Services Department with any potential violations of erosion control measures.

Halt Predation by Domestic Animals

Source of Stress: Cats and Dogs Allowed Unconstrained Access to Outdoors

Conservation Strategies

1. Provide educational materials to property owners and residents on keeping domestic pets away from nesting areas and habitat areas during breeding season.
   a. Distribute handouts on keeping cats and dogs indoors (Seattle Audubon has good handouts on

this).
b. Address this issue as part of backyard habitat seminars.

Minimize Water Fluctuation and Draw Down

Source of Stress: Water Fluctuation

Conservation Strategies

1. Work with the County and City of Gig Harbor to maintain buffers around wetlands to reduce major water fluctuation in the seeps, springs, wetlands and Crescent Creek.

2. Work with the County City of Gig Harbor and property owners to maintain or restore ≥65% natural vegetation throughout Crescent Creek watershed to maintain normal hydrological functions (including water level fluctuation in wetlands), as well as connectivity for wildlife. This can be done per residence, and can be boosted by keeping some large patches in natural vegetation.
   a. Work with property owners within BMA to leave portions of the property in native vegetated condition. This can be done in conjunction with backyard wildlife sanctuary program.
   b. Organize native planting work parties with local property owners and interested non-profit agencies, schools, Boy Scout troops, etc.

Source of Stress: Draw down

Conservation Strategies

3. Conduct a review of adopted stormwater and watershed plans, or if necessary work with the County and City of Gig Harbor to conduct a new analysis, to determine if any storm drains are directing water flow into the Gig Harbor estuary, Crescent Lake, Crescent Creek, or wetlands.

4. Work with the City of Gig Harbor and the County to redirect any public storm water drains that discharge directly into a water body or water course into a pre-treatment facility that is designed to slowly infiltrate the water back into the aquifer (e.g. Low Impact Development facility).

5. Encourage property owners to leave properties in an open space condition and, as an incentive, enroll their properties in the County's Current Use Assessment Program (Public Benefit Rating System) to reduce taxes.

6. Encourage property owners to conserve water and when possible, reuse water.
   a. Provide educational materials to property owners regarding reuse of grey water and rainwater for watering plants; use of native plant species that require less water; best times for watering vegetation (i.e. not in the heat of the day when large amount of water is lost to evaporation); etc.

7. Work with TPCHD, the County and City of Gig Harbor water department and compare with planned development to identify where all of the current water sources are and future planned water sources.

Chapter V - Prioritization of Conservation Strategies

Short-Term Actions (1 year)

1. Work with Pierce County Planning and Land Services Department during the year 2009 Comprehensive Plan amendment cycle to:
   a. Adopt the Crescent Valley BMA Stewardship Plan as a Title 19D document
   b. Amend the Pierce County Comprehensive Plan Open Space Corridors Map and Biodiversity GIS layer to incorporate the revised Crescent Valley BMA boundary as depicted in Appendix 2, Figure 11.
   c. Revise the Gig Harbor Peninsula zoning to apply the RSR zoning to tax parcels located within the expanded BMA boundary.

2. Apply for National Wildlife Federation – Community Habitat Program. *(Registered)*
   a. Set participation goals for the 454 landowners in the BMA.
   b. Conduct public education and outreach efforts to property owners to participate in this program and certify their property as backyard wildlife sanctuaries.
   c. Establish a 65% native vegetation and forest cover goal for the entire BMA.

3. Conduct surveys and collect 'best science' information about the Crescent Valley riparian system.
   a. Encourage members to participate in the *NatureMapping* Program.
   b. Work with school-related and other citizen projects in surveying the area.
   c. Collect latest information on how to keep private property and the riparian system healthy.

4. Provide increased education and outreach to property owners, developers and real estate agents regarding impacts of vegetation removal and earth moving. Create and dispense educational materials concerning fish and wildlife habitat stewardship actions.
   a. Maintain signage along Crescent Valley Road that indicates the motorist is traveling through a "sensitive wildlife area" and that this road is a "wildlife crossing area". Signage should include a caution statement to watch out for and avoid wildlife that may be crossing the road.
   b. Create homeowner information packets that describe the location and importance of corridors. Include all certified backyard habitats/sanctuaries to help inspire people to get involved. Provide homeowners and developers with literature on how to be a shoreline steward.
   c. Create realtor packets with materials on shoreline stewardship and on unique ecological characteristics of community to be given to new residents of shoreline properties.
   d. Provide landscape consultation and on-going workshops (with guest speakers) to homeowners and others.

5. Participate in local land use decisions regarding proposed developments that affect the BMA. Advocate for conditions that eliminate or minimize threats to habitat fragmentation.
   a. Create a phone tree (provide agency numbers of enforcement for community) to contact community members when a proposed development is being reviewed by the County.
   b. Have group placed on interested parties list for notification by the County of any development proposals within or adjacent to the BMA.
   c. Work with the Peninsula Advisory Commission (PAC) and developers to

help identify the best locations for designated open space areas during the development proposal review process. Try and come up with a "win-win" solution (i.e. utilizing density bonus for open space and where best to locate open space areas in relation to the BMA).

Mid-Term Actions (2-3 years)

1. Organize volunteer work parties. Partner with local Boy or Girl Scout troops, schools, or other environmental or civic organizations for volunteers.
   a. Sponsor annual or biannual native vegetation planting event.
   b. Sponsor invasive species eradication events.
   c. Sponsor volunteer "bio-blitz" activities led by professional experts.
   d. Consider a project with the PenMet Parks to create a demonstration project on park land at south end of lake, cooperating with Pierce County Conservation District, Master Gardeners, schools, Boy Scout troops, or other local volunteers. And use the site to promote shoreline dependent species through nest box placement (e.g., wood ducks) and monitor to see if this strategy is effective.

Long-Term Actions (3-5 years)

1. Conduct surveys and collect 'best science' information about the Crescent Valley riparian system.
   a. Arrange for Stream Team assistance in collection information on water quality and flow for the next five years.

Chapter VI - Conclusions

General Overview
The availability of lowland deciduous, riparian, estuarine and upland coniferous habitats along the Crescent Valley contributes to this BMAs ecological richness. Most of the at-risk, listed, and/or priority species predicted or confirmed within this BMA have a primary association with water for either all or part of their life cycle. Water quality within Gig Harbor Bay, its estuaries, Crescent Creek, and Crescent Lake should not be compromised as it contributes foremost to the presence of the species predicted within.

Older, fallow farmlands and pasturelands along Crescent Valley continue to collect water and could be targeted for wetland restoration sites by willing sellers. In their present state, they may provide breeding locations for amphibians. Sections of Crescent Creek located on private property, where native vegetation has been removed to the creek edge, should be targeted for habitat restoration. Future land development should not allow removal of native vegetation along the creek within a defined buffer. Culverts along the creek should be assessed for blockage to fish movement and the community should work with the City of Gig Harbor and Pierce County to correct these blockages and identify other target areas for restoration and protection. Landowners along Crescent Creek and Crescent Lake, and within defined buffers of the Crescent Valley, should be educated on maintaining the integrity of the riparian corridors. Education should focus on vegetation retention and restoration, retaining in-stream flows to Crescent Lake, and the biological importance of the Crescent Valley corridor. The Crescent Valley BMA would benefit by the application of WDFW PHS Riparian Habitat Guidelines on privately owned riparian lands and by enforcing county regulations for development along riparian corridors. WDFW PHS recommendations for salmonids and county critical area ordinance standards should also be applied in consideration of salmonid presence.

The community should continue to monitor wildlife species within and adjacent to the BMA. This can be accomplished through participation in the *NatureMapping* Program and Tahoma Audubon birding events.

Certification Through Wildlife Habitat Programs
The CVA should pursue certification in the NWF-CWH program. As of the writing of this plan, the CVA has already submitted their application for registration (November, 2006). The CVA should also continue to promote property owner participation in the WDFW-BWH program.

Pursuing Conservation Strategies
The conservation strategies outlined in Chapter IV provide a framework for abating threats to the Conservation Targets and conducting restoration of degraded habitat areas. The CVA should work towards accomplishing the conservation strategies outlined in this plan.

Funding Options
The National Wildlife Federation Community Habitat Program has provided an initial grant (via The Russell Family Foundation) to the CVA to install signage and conduct training. In addition, the NWF also has grant monies available for schools to assist in native vegetation planting and monitoring for Crescent Creek-Gig Harbor Estuary. The CVA should also consider pursuing funding opportunities through state and local agencies, the PCCD, and environmental foundations.

Appendices

Appendix 1 Planning Process Meeting Agendas and Meeting Summaries
Appendix 2 Crescent Valley BMA Wildlife Analysis

Crescent Valley Biodiversity and Natural Areas
Community Workshop #1
Wednesday, October 19, 2005
6:30 p.m. to 8:30 p.m.
Gig Harbor Masonic Hall
3025 96th St NW, Gig Harbor

6:30 – 6:40 p.m.	Welcoming Comments
6:40 – 7:20 p.m.	Biodiversity introduction, history and results of BioBlitz
7:20 – 7:30 p.m.	Audience discussion (Questions and Answers)
7:30- 8:00 p.m.	Importance of protecting biodiversity in Crescent Valley Biodiversity Management Area (BMA) and how you can help: • Backyard Sanctuary Program • Incentive Programs (Public Benefit Rating System, Conservation Easements, Wetland Reserve, etc.) • Monitoring through *NatureMapping*
8:00 – 8:30 p.m.	BMA Planning Process - Who will help design their community's future? Sign up for committee.
8:30 p.m.	Adjourn

Pierce County Biodiversity Alliance Members: *Washington Department of Fish and Wildlife, Pierce County, Nature Mapping Program, Point Defiance Zoo and Aquarium, Northwest Trek Wildlife Park, Tacoma Nature Center, University of Washington and Friends of Pierce County.*

Next Meeting - November 16, 2005, 6:30 p.m. Gig Harbor Masonic Hall

Crescent Valley Biodiversity and Natural Areas
Community Workshop #2
Wednesday, November 16, 2005
6:30 p.m. to 8:30 p.m.
Gig Harbor Masonic Hall
3025 96th St NW, Gig Harbor

6:30 – 6:40 p.m.	Welcoming comments
6:40 – 7:00	Cascade Land Conservancy overview and information on 1,000 acre property - Ryan Dicks
7:00 – 7:30	Biodiversity function • key ecological concepts of a system – what does this mean?
7:30 – 7:35	Break time
7:35 – 8:15	Group discussion • stresses to the system • sources of stress
8:15 – 8:30	Public discussion • Outstanding issues • Topics for future meetings (see questionnaire)
8:30	Adjourn

Next Meeting –January 18, 2006, 6:30 p.m. Gig Harbor Masonic Hall

Meeting Minute Notes (54 people in attendance)

Ryan Dicks (www.cascadeland.org)

- Described his organization and how they work with smaller land trusts
- 1,000 acre forest has been evaluated but the purchase cost is too high

Kathryn Brooks, Karen Dvornich, Michelle Tirhi

- Handed out the Crescent Valley Community Stewardship Planning handout and explained why the Gig Harbor BMA was selected
- Summarized the June, 2005 bioblitz data
- Described and defined key ecological attributes in the Crescent Valley
- What the stressors were to the attributes and began describing them in language the public could understand.
- Participants began adding stressors to the list; more will be added at the next meeting
- The *NatureMapping* Program's website will have a reference page for the community to find links, such as King County's noxious weed site, agendas and minutes of the community meetings.

Crescent Valley Biodiversity and Natural Areas
Community Workshop #3
January 18, 2006
6:30 p.m. to 8:30 p.m.
Gig Harbor Masonic Hall

6:30 – 6:35 p.m.	Welcoming comments
6:35 – 7:05	Geology of shorelines - Harriet Beale PSAT
7:05 - 8:00	Conservation targets (continued from last meeting) • Estuary, Wetlands, Forest
8:00 – 8:10	Property status in programs • Current Use Assessment • Backyard wildlife habitat sanctuary • Conservation easements • Stream Team restoration and monitoring sites
8:10 – 8:30	Public discussion • *NatureMapping* and Winter Bird Walk – Workshop Feb. 18th from 9 a.m. to 4 p.m. at Tacoma Nature Center in Tacoma and on Feb 25th Gig Harbor Masonic Hall from 9:00 to 4:00 p.m. • Outstanding issues
8:30	Adjourn

Next Meeting –February 15, 2006, 6:30 p.m. Gig Harbor Masonic Hall

Meeting Minute Notes (20 people in attendance)

Harriet Beale-Puget Sound Action Team (www.psat.wa.gov)

- Conifer needles take in 30-40% of precipitation
- Near shore is the shore where the depth that light reaches the bottom and to the beach – near shore area is the "feeder" area. Herring and others small fish will lay eggs in the upper near shore and get scoured out if bulkheads exist
- Impacts of bulkheads – sediment supply cut off
- Habitats are simplified or lost
- Scouring - You can remove bulkheads and replant the area and have the beach back…bulkheads cause the beach to disappear.

Michelle Tirhi's update:

Washington Department of Fish and Wildlife Backyard Habitat Program – 2 people within Crescent Valley
We don't have the number of conservation easements yet
There is one stream team group collecting data….set up stream team presentation at one of our meetings
The group continued to list stresses and stressors of estuary and wetlands/springs/seeps.

- Could add more wildlife if nest boxes were added.
- Crescent creek landowner had wood ducks coming in, mergansers used to come too.
- Siltation – runoff from dirt roads – some people wanted to know what they could do…plants along sides of road, stream part of Low Impact Development (LID) information
- Check to see if we have LID on our speaker list
- Storm drains are taking away water that would be going into a wetland
- We will get a map made of all known seeps and springs by county, have community add to the map.
- Regulations state that water runoff goes into drains rather than onsite detention – not mandatory
- City made it harder to put water into wetland rather than storm drains.
- Check to see if the community plan can be changed. & bring maps of surveys that have been done for next meeting

Crescent Valley Biodiversity and Natural Areas
Community Workshop #4
February 15, 2006
6:30 p.m. to 8:30 p.m.
Gig Harbor Masonic Hall

6:30 – 6:35 p.m.	Welcoming comments
6:35 – 7:00	Guest Pierce County Councilman Terry Lee
7:00 – 7:15	GIS Overview – Where are you in the watershed?
7:15 - 8:30	Identify strategies for conservation targets - Audience participation mapping • Crescent Lake • Crescent Creek • Gig Harbor Estuary • Wetlands, springs, seeps • Forest
8:30	Adjourn

Reminder: *Nature Mapping and Winter Bird Walk – Workshop Feb. 18th from 9 a.m. to 4 p.m. at Tacoma Nature Center in Tacoma and on Feb 25th Gig Harbor Masonic Hall from 9:00 to 4:00 p.m.*

Next Meeting – March 15, 2006, 6:30 p.m. Gig Harbor Masonic Hall

Meeting Minute Notes (8 people in attendance)

Pierce County Councilman Terry Lee

- Gave input on the 1000 acres. Mr. Lee suggested that group coordinate with Metro Parks on a plan.
- Critical Areas Ordinance update, county enlarged wetland buffers and protected shorelines after appeal by environmental groups.
- Transportation issues discussed. Road through Crescent Valley, on county's 20 year plan.
- Reported that $20 million is available from surface water funds (Capital Improvement Program). Requested that group identify high priority habitats and ask County to acquire the properties in the fall. Provide a list to him.
- Suggested that group bring Gig Harbor City Council into loop before any future Comprehensive Plan amendments come before them and Pierce County. Express to them how important this area is to biodiversity.

Washington Department of Fish and Wildlife, Michelle Tirhi's update:

- Significance of 1000 acre property to the connectivity of wildlife habitats.
- Strategies for shoreline conversions were discussed. Create educational materials for neighbors (existing and future), a homeowners guide for good stewardship. It was suggested that local realtors be involved and help distribute information.

University of Washington and *NatureMapping*, Karen Dvornich's update:

- The *NatureMapping* workshop will be held 2/18 at The Nature Center and 2/25 at the Masonic Hall. A group of bird experts will conduct a winter bird survey (8-4) on lands previously ok'd for the bioblitz but never accessed. The *NatureMapping* participants will meet with them and inventory a landowner's property as a large team.
- Still collecting GIS (Geographic Information Systems) maps to show the group.
- Will print a color aerial photo of landowners properties if they are interested (all wanted a map)
- Will list all the repeating stressors for each of the ecological attributes we are working on and will print a working copy for the next meeting

Crescent Valley Biodiversity and Natural Areas
Community Workshop #5
March 15, 2006
6:30 p.m. to 8:30 p.m.
Gig Harbor Masonic Hall

6:30 – 6:35 p.m. Welcoming comments

6:35 – 7:05 Guest Joanne Schuett-Hames Washington Department of Fish and Wildlife, Analyzing Crescent Valley with Wildlife Metrics

7:05 – 7:30 GIS Overview – Where are you in the watershed? Review maps collected for Crescent Creek and give out aerial photos to the participants

7:30 - 8:00 Review and prioritize stressors for the following conservation targets:

- Crescent Lake, Crescent Creek, Gig Harbor Estuary, Wetlands, Springs, Seeps, Forest

8:00 – 8:30 List action items for above, see following example for lake:

Conservation Target	Stress	Source	Action Item	Entity/Funding	Needs of the team to complete item
Crescent Lake	Habitat Conversion	Home Building	Require some level of LID	PALS	Require what is minimum LID standards to get incentive or results (contact PALS/DOE/WSU)

8:30 Adjourn

Next Meeting –April 19, 2006 at 6:30 p.m. Gig Harbor Masonic Hall

Meeting Minute Notes (19 people in attendance)

Joanne Schuett-Hames with WDFW presented Wildlife metrics and spoke of the challenges to protect species. She provided the indicators (see handout for more details) for current conditions in the Crescent Valley area for:

Patch size - > 800 acres needed to retain bobcat, >100 acres for large birds, >10 for moderate sized birds. These patch sizes exist in the Crescent Cr. watershed

Forest cover – measured at 80% range (good)

Development density - >1 du/acre effects many species

Road density – measured at 1.5 miles of road/square mile, for road planning <0.6 mi/sq.mi is recommended

Habitat Connectivity – Three main areas in Crescent Valley have a lot of wildlife movement capability. These areas overlap. Ranges from 60%, to 75%, and 80%. Road crossing areas exist, but fragmentation is extensive

Roads and habitat connectivity and mammals – value not measured

Non-native species – bullfrogs and non-native fish present

Riparian Integrity - wider than 100 ft (30 m); % corridor < 35 ft (10 m) wide; # breaks in the corridor, approximately 50% of the mainstem is >100 ft

Washington Department of Fish and Wildlife, Michelle Tirhi's update:

- Group should request rediversion of water into Winchester Swap to restore wetland, along with dredging vegetation into county's Capital Facilities Plan.

University of Washington and *NatureMapping*, Karen Dvornich's update:

- Presented results of Winter Bird Walk revealing 67 species, 14 new species, and 7 birds that were not seen in June BioBlitz sampling.
- Stressors and action items by habitat type were handed out to group. They were asked to rank their top five action items and add any additional ones before the next meeting and return to Marian to compile results.
- Provided group GIS overview for their locations in the watershed.

Isabel Ragland with Pierce County Stream Team update:

- Asked for volunteers to sample creek water quality. Kit drop off location is at the Peninsula Library.
- Potential for lake sampling kit. Local jurisdiction pays for the sampling kit and lab results.

Crescent Valley Biodiversity and Natural Areas
Community Workshop #6
April 26, 2006
6:30 p.m. to 8:30 p.m.
Gig Harbor Masonic Hall

6:30 – 6:35 p.m.	Welcoming comments
6:35 – 6:45	Current Use Assessment program, average yearly savings – Pierce County
6:45 – 7:45	Review stressors from last meeting and finish process for: • Wetlands, springs, seeps • Forest
7:45 - 8:10	GIS Overview – Karen • Land owner location maps • Species overlays and habitat connectivity
8:10 – 8:30	Plan discussion on final meeting in May and presentation of draft plan at June 21 meeting *Question – Would you like to have your names and addresses in plan appendix or other document to remain connected after meetings end?*
8:30	Adjourn

Tonight: We will provide showing of June BioBlitz, interested persons can stay after meeting and watch it.

Next Meeting –May 17, 2006 at 6:30 p.m. Gig Harbor Masonic Hall

Meeting Minute Notes (12 people in attendance)

Kathryn Brooks, Pierce County Planning and Land Services:

- Provided discussion on how the plan has many education issues vs regulations
- Boating and zoning modifications would require changing regulations
- If more regulations, there will need to be more public involvement
- LID is not required under Chapter 10 stormwater regulations. Gig Harbor Comp Plan has it though. Question – is the lake already protected by LID in Gig Harbor Comp plan for Rural Resource Areas? Buffers currently on the lake are 35'.
- Group needs to decide n what we agree on in the draft documents
- Hope is to prioritize action items at the next meeting and have an Open House on June 21 to present the draft plan.
- Discussion on amending boundaries of BMA to include 1,000 acre forest. Apply Rural Resource zoning to 1,000 acre forest. Forest was not picked for BMA because it did not contain the best habitat for target species. * See comments from Michelle below.

Michelle Tirhi, Washington Department of Fish and Wildlife:

- Told the group that the plan should be implemented with action items rather than "feel good" items.
- *Richness of Crescent Valley habitat is from hydrology, not the 1,000 acre forest. Most wildlife would not be in this area if not for stream and wetlands. Landowners in these areas have a bigger stake at protecting biodiversity than the 1,000 acre owner.
- Study how many people use lake and conflicts with wildlife. Cats Indoors Program was mentioned.
- WDFW owns the boat launch (built for fishing) and can close it.

Karen Dvornich, University of Washington:

- Led the group in Community Planning document discussion on Crescent Lake stressors and action items.
- Revised the table based on group input and feedback.

Next tasks:

1. Group will be emailed the table to note what was missing, prioritize their action items, agree/disagree
2. Ask Councilman Lee to attend the June 21 meeting

Crescent Valley Biodiversity and Natural Areas
Community Workshop #7
May 10, 2006
6:30 p.m. to 8:30 p.m.
Gig Harbor Masonic Hall

6:30 – 6:35 p.m.	Welcome
6:35 – 6:55	National Wildlife Federation, Community Wildlife Habitats – Gretchen Muller
6:55 – 7:35	Review stressors and finish: • Wetlands, Springs, Seeps, Forest
7:35 – 8:25	Prioritize action items
8:25 – 8:30	Discussion on next meeting tasks and guest presentation
8:30	Adjourn

Next Meeting –May 24, 2006 at 6:30 p.m. Gig Harbor Masonic Hall

Meeting Minute Notes (8 people in attendance)

Gretchen Muller with NWF provided information on Backyard Habitat Program .

- State and Federal join application will be available soon through pilot project.
- Community habitat program enables people to work toward common goal.
- There are no restrictions to program for property owners. Just need to provide four basic needs (food, water, safety places and nesting habitat).
- Points for certification are not based on parcel size.
- How to start it? Call community meeting, fill out registration forms, set goals and submit form. Planning process in this area puts CV group ahead.

Pierce County, Katherine Brooks:

- Discussed zoning regulations vs. planning document - Zoning is required and Plan is desired.
- Question – How willing is County to enforce its regulations? Problem land owner was discussed. Katherine promised to look into issue.
- RSR zone requires Low Impact Development.
- Single Family (SF) developments are allowed to do more than what is restricted for subdivisions. For example, SF are exempt from vegetation retention. In Critical Areas Ordinance however, SF is not exempt from regulations.
- Suggests that CV plan be placed onto docket for Gig Harbor Community Plan update (in one year).
- Plan will probably be done by June 21. Meetings can continue.

Washington Department of Fish and Wildlife, Michelle Tirhi:

- Discussed two items to change under action items (prohibiting new roads in the BMA and lake restriction). Suggested that a wildlife survey be conducted instead to assess impacts to wildlife from boating activity.
- Group as asked to docket enforcement items.
- Housing density and septic systems and all associated development reduces wildlife once you hit 1 unit/10 acres.
- Density –group asked to vote on this (1 unit per 10 acres or 2 units per 10 acres)?
- Under action plans for Crescent Creek, add certify a predetermined amount of homes under the Back Yard Habitat program.
- It was noted by Liz Lathrop that Pierce County is purchasing riparian areas under stormwater fees.

Next tasks:

1) Scientifically adjust BMA based on life cycle studies. Is there a state law to restrict livestock from creek? (Michelle).
2) BMA maps & how many lots in BMA are big enough to divide for 2 homes? (Katherine). .
3) Obtain farm plan language on livestock from PCCD (Marian).

Crescent Valley Biodiversity and Natural Areas
Community Workshop #8
May 24, 2006
6:30 p.m. to 8:30 p.m.
Gig Harbor Masonic Hall

6:30 – 6:35 p.m.	Welcome
6:35 – 6:55	Crescent Creek Restoration Project – Friends of Pierce County, sign up for planting party in September
6:55 – 7:35	Revision of BMA boundary based on life cycles – Washington Department of Fish and Wildlife, John Jacobson and Joanne Schuett-Hames
7:35 – 8:25	Finish: • Creek (left off "Explore the possibility of using hot water spraying to kill weeds instead of herbicides" on page 13) • Wetlands, springs, seeps, forest
8:25 – 8:30	Next steps
8:30	Adjourn

Next Meeting – June 21 at 6:30 p.m.

Meeting Minute Notes (8 people in attendance)
Marian Berejikian, Friends of Pierce County: provided information on restoration efforts at Crescent Creek Park.
JoAnne Schuett-Hames and John Jacobson, Washington Department of Fish and Wildlife: After meeting with Michelle Tirhi and discussing habitat patches and connectivity, it was decided that BMA boundary was important for maintaining hydrologic function. Areas along large farm and 1000 acres showed connectivity and provide interior habitat patch. Wildlife need 80% of vegetation on both sides of road so they will cross. It is better to have larger buffers in the interior areas to allow connectivity between habitats from creek and lake, through forested areas along to marine shoreline. Amphibians can move up to half mile during summer when they leave breeding habitat.

Buffer up to 300 feet in wetlands (encourage people to leave 50 – 80% native vegetation. Riparian corridors are best with 100 feet on each side of stream with 50% of vegetation intact. How could zoning meet objective of plan? Figure what parts of the 1000 acres could be protected with science. Katherine could set up development parameters in plan.

A patch on Peacock Hill (near headwaters of stream) was shown to be a good quality for birds (which need 100 acres). It was noted that Pierce County owns 40 acres of tax title land which is in the Pen Met Parks long range plan.
University of Washington, Karen Dvornich: Plan could be used at public hearings to back up group showing that there is science to support their request for protection.
Told group that PCBA grant was extended to June 2007 so meetings could continue. Explained how habitat patches could fit in with 1000 acres using Spanaway Marsh example. This case stood up in court because it was flagged as a high biodiversity area. Karen guided meeting attendees through table (starting on page 14 invasive species in Creek) to page 17 (Erosion and bulkheads for estuary).
Next tasks-

4) Revised BMA maps (Karen).
5) John Jacobson will provide group maps showing habitat patches (boundaries in yellow).
6) List of native invasive species (Five from BioBlitz) – Karen.
7) Which culverts were most critical for fish blockages? John Jacobson WDFW.
8) How are speed limits established? Inventory estuary plants? (Marian).
9) Create a list of agency and local experts in field (Karen). CVA Committee will update once established.
10) Next meeting June 21, finish estuary (page 17 to 18).

Crescent Valley Biodiversity and Natural Areas
Community Workshop #9
June 21, 2006
6:30 p.m. to 8:30 p.m.
Gig Harbor Masonic Hall

6:30 – 6:35 p.m. Welcome

6:35 – 6:45 Follow-up from last meeting

- Revised BMA maps
- Maps showing habitat patches
- List of native invasive species (Five from BioBlitz)
- Which culverts were most critical for fish blockages?
- How are speed limits established?
- Inventory estuary plants.
- List of agency and local experts in field.

6:45 – 8:25 Finish:

- Estuary (starting on page 17), Wetlands, Springs, Seeps, Forest

8:25 – 8:30 Next steps

8:30 Adjourn

Next Meeting – September 21?

Meeting Minute Notes (12 people in attendance)
Marian Berejikian, Friends of Pierce County: Reported on how speed limits were established, by driver behavior (85% of those sampled). Also told of upcoming event from Gretchen Muller Community Wildlife Habitat Workshop, June 24, 2006 Distributed survey for meeting participants to comment on workshops.
Karen Dvornich, University of Washington: Starting on page 17 estuary, led group through rest of the table. Removing non-native plants at the estuary was highest priority. Marian will hire horticulturist to compile list. Pierce County has noxious weed program. Enlist their help. Forest – Add WDFW PHS landscape study into plan. Other:

- Suggested Pierce County remove non-native plants along Crescent Valley Drive Right-of Way.
- Send a message to County Council that enforcement should receive as high a priority as processing applications.
- Crescent Valley group should get on County's Interested Party list for project notification.
- Kitsap County has requirement for keeping livestock from streams. This was repealed by Pierce County (Burley Minter Sensitive Area Plan).
- Redirect storm drains into Open Space on Gig Harbor Side.
- For garbage dumping, residents should contact Pierce County Responds.
- Do we amend the BMA to include Rural Sensitive Resource Zone? This is no different than the R-10 zone as far as density goes. There are LID requirements in the RSR zone. In appendix, show loss if built out e.g. at 1 unit/5 acres, 50% of species is lost. Residents would like to amend BMA boundary to take in habitat patches discussed at last month's meeting.
- There is some benefit to having bonus density in RSR zone. Don't change it.
- Open Space dedicated in this area needs to be contiguous, request this in plan.
- There were 10,000 building lots in R-10 zone 10 years ago, now there are 2,000. Restrict zoning to deal with this.
- It was noted that no roads cross Crescent Creek as shown on maps. Maps need to be corrected.

Next tasks:

- Marian schedules next PCBA meeting for **September 20**, invites Terry Lee, send Lucinda email addresses for people attending meetings
- Karen will check with Camano Island (pg 19) group's work to establish connectivity and habitat zones around wetlands working with developers, bring maps showing habitat patches from last month's meeting.
- Katherine will check on the number of vested parcels in the BMA.

May 2007

CRESCENT VALLEY BIODIVERSITY MANAGEMENT AREA WILDLIFE ANALYSIS

Joanne Schuett-Hames, John Jacobson, and Michelle Tirhi
Washington Department of Fish and Wildlife

This analysis focuses on an area containing biological diversity and richness in a rapidly urbanizing setting—the Crescent Valley watershed, and the included Gig Harbor Biodiversity Management Area (BMA), (Pierce County Biodiversity Alliance 2004, Figure 1). This area is located within Pierce County, in western Washington. In the analysis we utilize metrics and mid-scale fish and wildlife mapping approaches to develop information for local community decision-making.

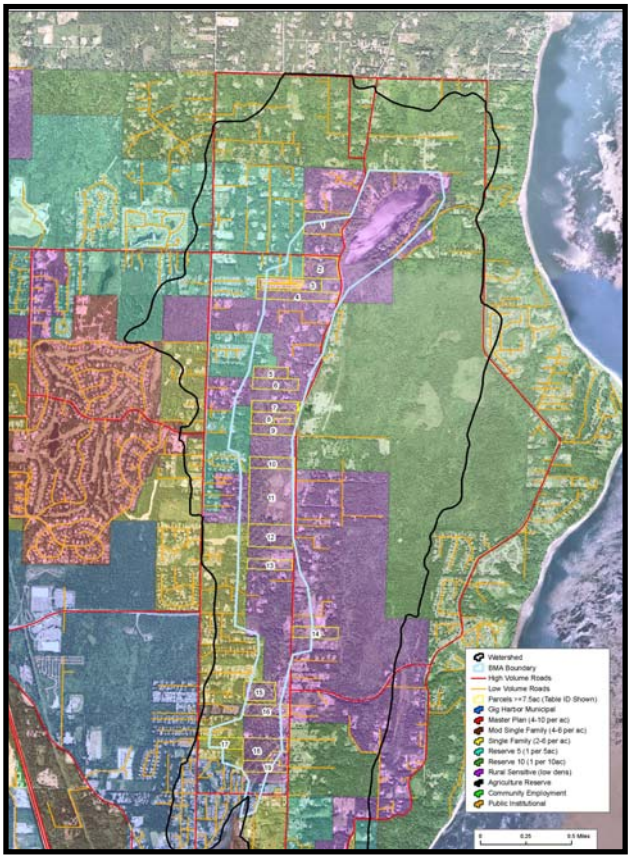

Figure 1. The boundaries for the Gig Harbor Biodiversity Management Area (blue), and the Crescent Valley watershed (black).

There are three predicted at-risk species, 14 state or federal-listed species and 17 Washington Department of Fish and Wildlife (WDFW) priority species in the BMA. The Common Garter Snake (*Thamnophis sirtalis*), was a trigger species[1]. Six amphibians, 74 birds, 43 mammals, and five reptiles are predicted to inhabit this area, and 11 butterfly species have been confirmed. The confluence of Crescent Creek and Gig Harbor Estuary is a WDFW priority habitat; shorelines associated with the estuary are rated high quality, and Chinook Salmon (*Oncorhynchus tshawytscha*, FT, SC) occur in Crescent Creek.

As more people move to Crescent Valley, some species such as the American Robin (*Turdus migratorius*), Raccoon (*Procyon lotor*), and Pacific Treefrog (*Hyla regila*) will continue to thrive, but many more sensitive species will only be retained if care is given to factors such as maintaining large enough patch sizes, and habitat conditions that allow safe movement between patches and seasonal habitats.

Planning Context

- Pierce County has adopted a biodiversity network into open-space classification (http://www.co.pierce.wa.us/pc/services/home/property/pals/other/biodiversity.htm).

[1] Habitat needs for common garter snake and reptiles in general were assured within the Gig Harbor BMA, making this a "trigger species".

- The Gig Harbor Biodiversity Management Area is a specific area within the network.
- Residents from the local community have developed a plan to retain the area's biodiversity with the assistance of Friends of Pierce County, and The Pierce County Biodiversity Alliance.
- The information provided in this chapter was developed to assist the local community with their biodiversity planning.

Focal Species and Response Groups

WDFW Priority Habitats and Species data, species lists within the network document (Pierce County 2004), and additional data from a bioblitz held June 3-4, 2005, provided information on species expected or verified to be present. Through consideration of this information, we chose the following species and groups for analysis:

- Common Garter Snake, based on importance to the biodiversity network,

- Northern Red-legged Frog (*Rana aurora*), based on importance as a food source to the Common Garter Snake, and as an umbrella species to other amphibians,

- Bobcat (*Lynx rufus*)and Coyote (*Canis latrans*), umbrella species for mid-to large sized wide-ranging mammals,

- Bird development response groups based on patch sizes and dwelling density sensitivities.

Stressors to Evaluate

Table 1 provides an overview of development stressors associated with these species/groups.

Table 1. Development response groups, focal/umbrella species, housing density sensitivity, and primary stressors to wildlife to address for the Crescent Valley biodiversity management area.

Development Response Group	Focal/or Umbrella Species	Housing Density Sensitivity	Primary Stressors to Address					
			Habitat Composition	Habitat Configuration	Habitat Connectivity	Roads	Hydrology	Non-Native Species
Terrestrial reptiles, aquatic and terrestrial habitat, extensive spatial scales, live birth	Common garter snake	Moderate sensitivity (expected persistence at ≤1du/10ac)	- natural habitat	- breeding and active-season habitat different	- extensive movement by ground	- road mortality	- changes to hydrology	- domestic cats
Pond-breeding amphibians, intermediate movement scale, require breeding habitats with long hydroperiods	Northern red-legged frog	High sensitivity (expected persistence at ≤1du/20ac)	- natural habitat	- breeding and active-season habitat different	- extensive movement by ground	- road mortality	- changes to hydrology - need longer hydroperiod ponded habitat	- bullfrogs non-native fishes - dogs
Mid-sized mammals with moderate movement capability, moderate fragmentation tolerance	Bobcat	Moderate sensitivity (expected persistence at ≤1du/10ac)	- patch size	- wide ranging	- patch isolation	- road density -road mortality		
Large-sized mammals with extensive movement capability, highly fragmentation tolerant	Coyote	Very low sensitivity (expected persistence at ≤1du/2.5ac)				- road density -road mortality		
Birds, high tolerance for development, moderate to high (or unknown) sensitivity to patch area	Suite of bird species[a]	Low sensitivity (expected persistence at ≤1du/5ac)	need: - patch size >12ac - well developed shrub layer - older conifer nest trees or snags	- patch shape				- domestic cats
Birds, low tolerance for development, moderate sensitivity to patch area	Suite of bird species[b]	Very high sensitivity (expected persistence at ≤1du/20ac)	need: - patch size >12ac - need riparian, conifer, hardwood, wetlands	- patch shape				- domestic cats

[a]Incuding: band-tailed pigeon (*Columba fasciata*), ruby-crowned kinglet (*Regulus calendula*), Cooper's hawk (*Accipiter cooperii*).

[b]Incuding: MacGillivray's warbler (*Oporornis tolmiei*), brown creeper (*Certhia americana*), red-eyed vireo (*Vireo olivaceus*), northern saw-whet owl (*Aegolius acadicus*).

Indicator Metrics for Stressor Analysis

Based on stressors in Table 1, and available metrics and narrative parameters we use these parameters to evaluate current conditions for fish[1] and wildlife in Crescent Valley:

- Dwelling unit densities,
- Watershed hydrology,
- Riparian integrity (to support various aspects of habitat and hydrological function),
- Patch size for mammals,
- Patch size for birds,
- Habitat composition, connectivity and configuration (necessary for those animals with moderate to extensive movement, that must move along the ground),
- Roads (for traffic and amphibians; also road density and crossing issues for mammals), and,
- Non-native animals (bullfrogs, fish, cats, dogs).

Evaluation of Metrics and Narrative Criteria

In this section for each parameter noted above, we show the questions we asked to guide the stressor analyses. We additionally include the applicable metric(s) or narrative parameters, measured results, and examples of the GIS maps produced.

We utilize the watershed boundary for these analyses; the BMA is focused on aquatic/wet environments which necessitate watershed-wide protection for hydrological integrity, and to meet life history needs for animals that utilize the aquatic environments, but must range over larger areas.

Zoning and Dwelling Unit Densities (Figures 2a-d).

Questions:

- What is the existing zoning?
- Are there in-congruencies between existing zoning, and the needs of focal species and development response groups?

Applicable wildlife metrics:

- Coyote has expected persistence at dwelling unit (du) densities of ≤1du/2.5 acres,
- Birds - high development tolerance with >12 acre patch size have expected persistence at ≤1du/5 acres,
- The Common Garter Snake, and Bobcat have expected persistence at ≤1du/10 acres, and
- The Northern Red-legged Frog, and birds - low tolerance for development with >12 acre patch size have expected persistence at ≤1du/20 acres.

Measured values: Much of the watershed is zoned for maximum densities of 1du/5ac or 1/du/10ac. RSR and R10, both 1/10 acres, allow for a density of 1du/5 when 50% of the property is set aside as open space. No areas are zoned for 1du/20ac or less.

[1] Although we don't explicitly evaluate parameters for fish, watershed hydrology and riparian integrity function as important parameters for fish

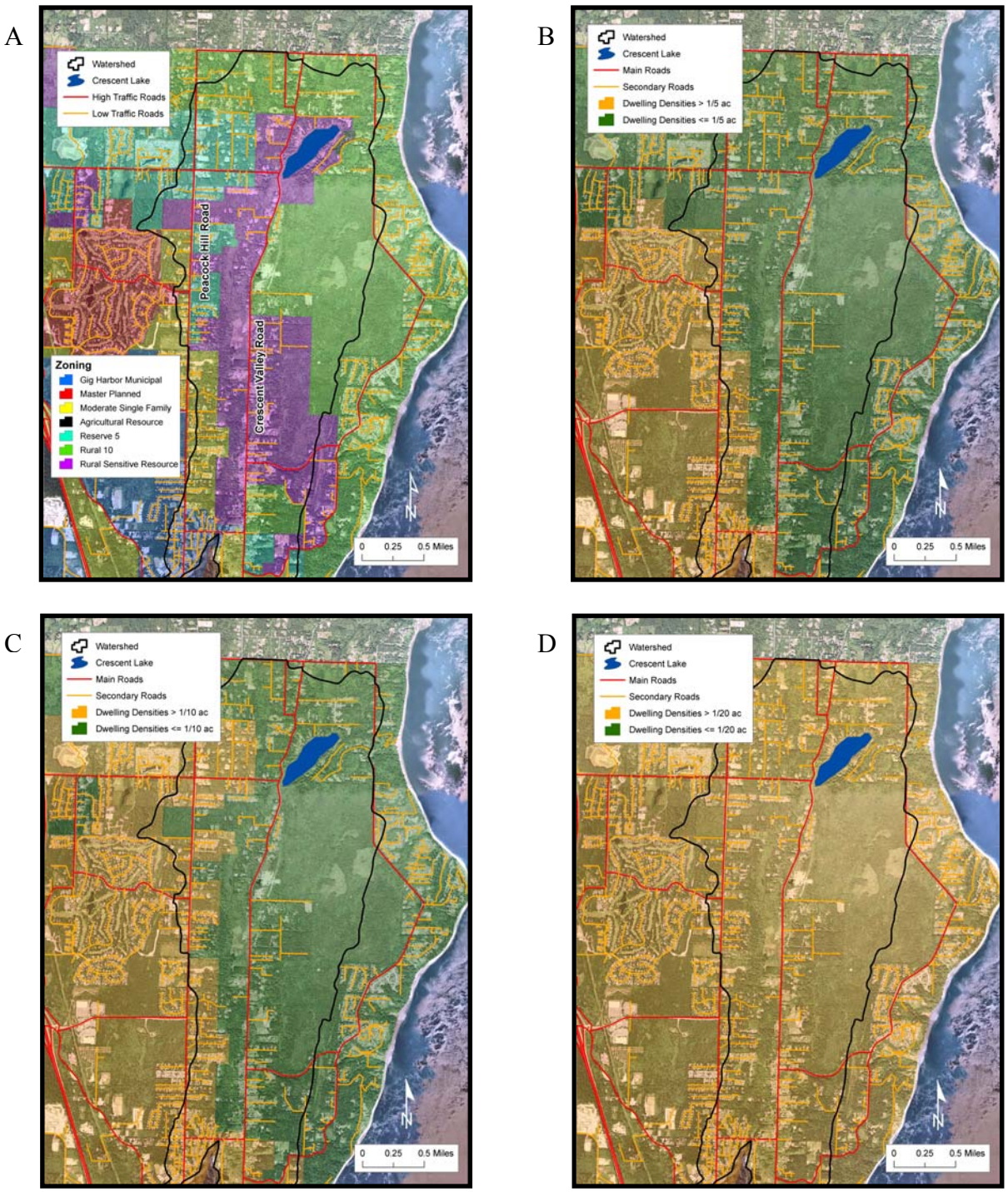

Figure 2 (A-D). A. Zoning designations for the Crescent Creek drainage basin and surrounding areas. B. Dwelling densities that meet the persistence needs of Coyote and birds with high development tolerance (≤1du/5 acres; in green). C. Dwelling densities that meet the persistence needs of Common Garter Snake and Bbobcat (≤1du/10 acres; in green). D. Dwelling densities that meet the persistence needs of the Northern Red-legged Frog, and birds with low tolerance for development (≤1du/20 acres; no green indicates dwelling densities are not expected to be suitable without special measures).

Crescent Valley Watershed Hydrological Integrity (Figure 3)

Question: Does the watershed have enough natural vegetation to protect watershed hydrological function?

Applicable metric: % natural vegetation in watershed.

Measured value: 80% .

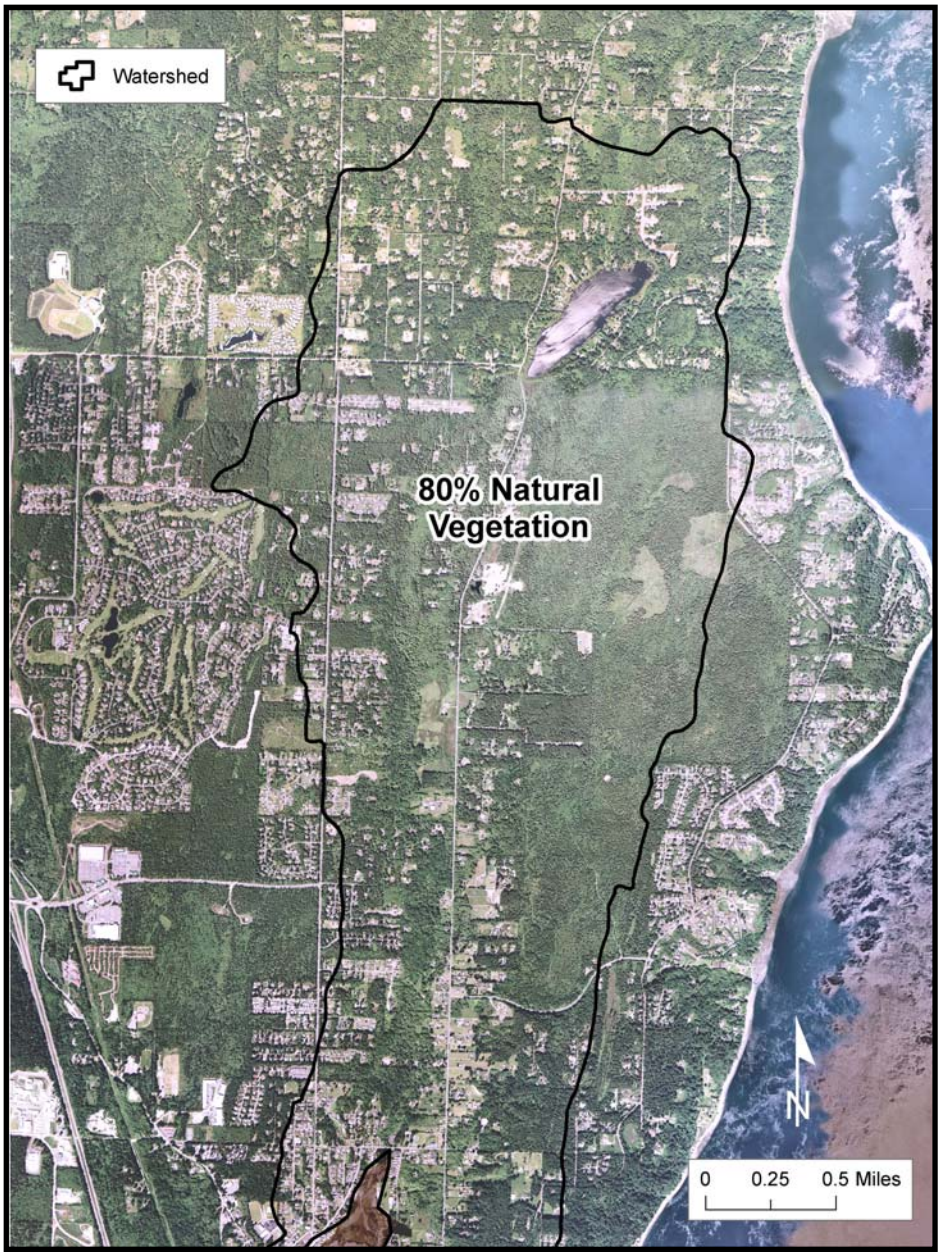

Figure 3. Percent natural vegetation (shades of green in aerial photo) within the Crescent Creek watershed, is analyzed as an indicator of hydrological function.

Crescent Valley Riparian Habitat Integrity (Figure 4)

Questions:

- Do streams have enough intact riparian vegetation to protect water quality and provide riparian habitat for fish and wildlife?
- Where are locations where riparian restoration is needed?

Applicable metrics:

- % riparian corridor >100 ft wide & <35 ft wide,
- Number of road, utility, and path crossings in the corridor per mile.

Measured values: Mainstem Crescent Creek between the lake and the estuary has 44% >100ft and 20% <35ft wide forested or wetland riparian area. The tributaries have 56% >100 ft wide and 21% < 35ft wide forested or wetland riparian area.

There are two road breaks/stream mile along the mainstem, and one break/stream mile along the tributaries.

Figure 4. Riparian areas in the Crescent Valley stream network that meet the criteria for >100 ft riparian

Crescent Valley Mammal and Bird Patch Sizes (Figure 5)

Questions:

- How fragmented is the natural vegetation, and where are the patches of natural vegetation located?
- What size are the remaining patches?

Applicable metrics:

- Patches of natural vegetation 12-100 acres, and >100 acres for birds with sensitivity to patch size,
- Patches of natural vegetation >800 acres to support three female bobcats' persistence.

Measured value: Although the watershed is extensively fragmented by roads, homes, and associated clearings, there still exist large patches and opportunity to plan for the retention of wildlife. There is one patch large enough for three female bobcats on the east side of the watershed (1221 ac); in addition, there are four patches >100 acres, and 12 patches 12-100 acres meeting the requirements for birds with sensitivity to patch size.

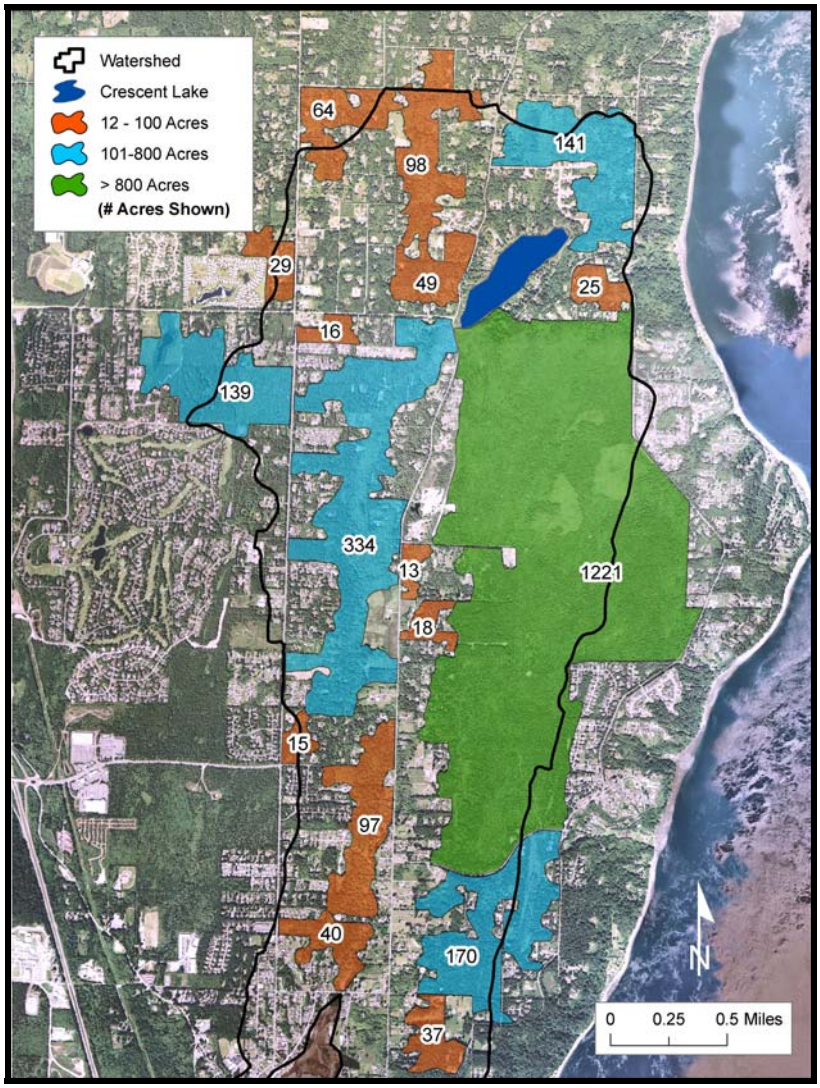

Figure 5. Natural vegetation patches 12-100 acres and >100 acres (for birds with sensitivity to patch size), and >800 acres (for bobcat); that intersect or exist within the Crescent Creek watershed.

Crescent Valley Habitat Composition, Connectivity, and Configuration for Amphibians and Reptiles (Figures 6,7)

Questions:

- Where are palustrine wetlands and how are they spatially distributed?
- What are patterns of connectivity between wetlands, and between wetland habitat and terrestrial habitat (including streams) utilized by amphibians and reptiles during their seasonal cycles?

Applicable metrics:

- Connectivity and habitat zone (CHZ) radius from wetland,
- CHZ % forest/natural vegetation.

Measured values: Percent natural vegetation within the three CHZ components is variable, but overall ranges from approximately 75% to 90%. The three CHZ components each have an approximately 0.5 mi radius (low protective level), however the distance along the valley cumulatively is approximately 3 mi and therefore provides a higher protective level.

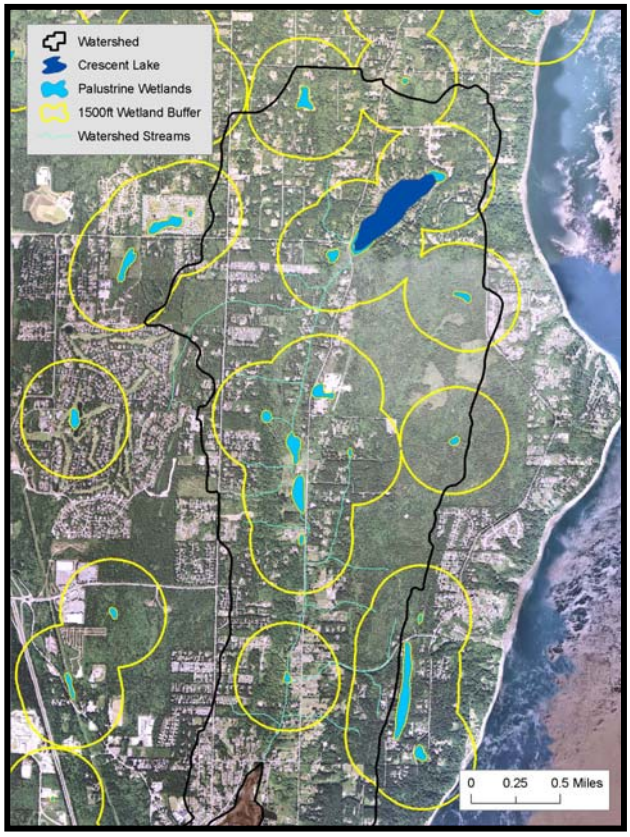

Figure 6. Crescent Valley wetlands and connectivity patterns. This depiction utilizes a radius of 0.3 mi to highlight wetland habitat and potential connectivity patterns for pond-breeding amphibians.

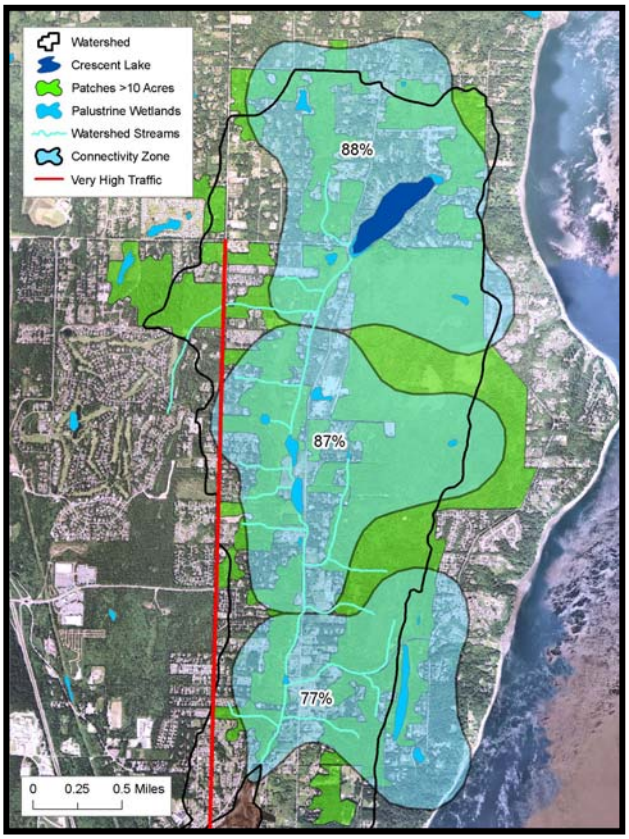

Figure.7. In this depiction, we have broadened the connectivity patterns to indicate linkages between areas along the riparian zone of Crescent Creek, and overlaid this pattern onto the patch map.

Roads (Figure 8)

Questions:

- What are potential road concerns for mammals, amphibians and reptiles?
- Are there suitable numbers of crossing areas for mammals, and how are they spatially distributed?

Applicable metrics:

- Traffic intensity: average daily vehicles per hour,
- Road density,
- Roads and habitat connectivity: locations with natural habitat on both sides of road.

Measured values:

- The overall density within the Crescent Valley Watershed is 5.9 mi of road/mi^2, 1.9 mi of high volume traffic roads/mi^2.
- Crossing areas exist, fragmentation is extensive.

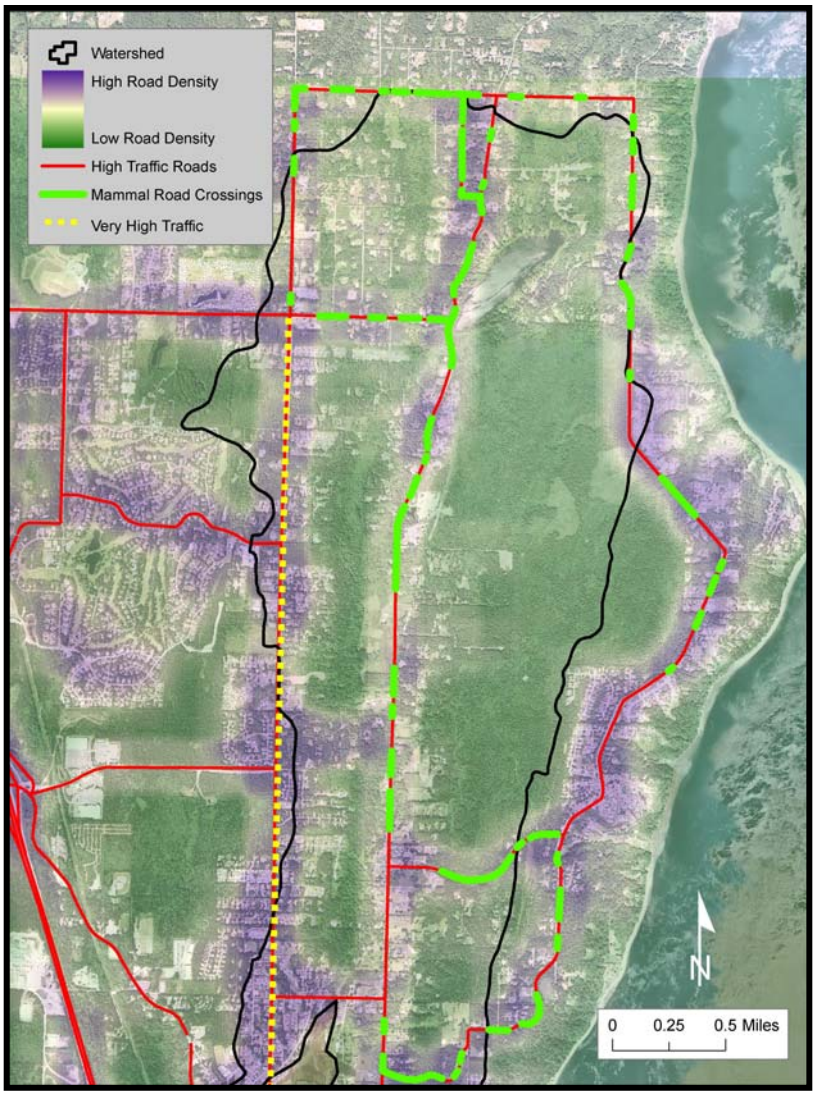

Figure 8. Road traffic volume, relative road density, and expected mammal crossing areas within Crescent Valley watershed and surrounding areas.

Non-Native Species (Figure 9)

Question: Are there issues that should be addressed related to bullfrogs, non-native fish, cats, and dogs?

Applicable narrative parameters:

- Bullfrogs and non-native fish - presence or absence and relative amount,
- Cats and dogs are expected where homes exist.

Measured values: Abundant non-native fish and bullfrogs were found in Crescent Valley during the 2005 Bioblitz.[1]; cats and dogs are expected especially near homes.

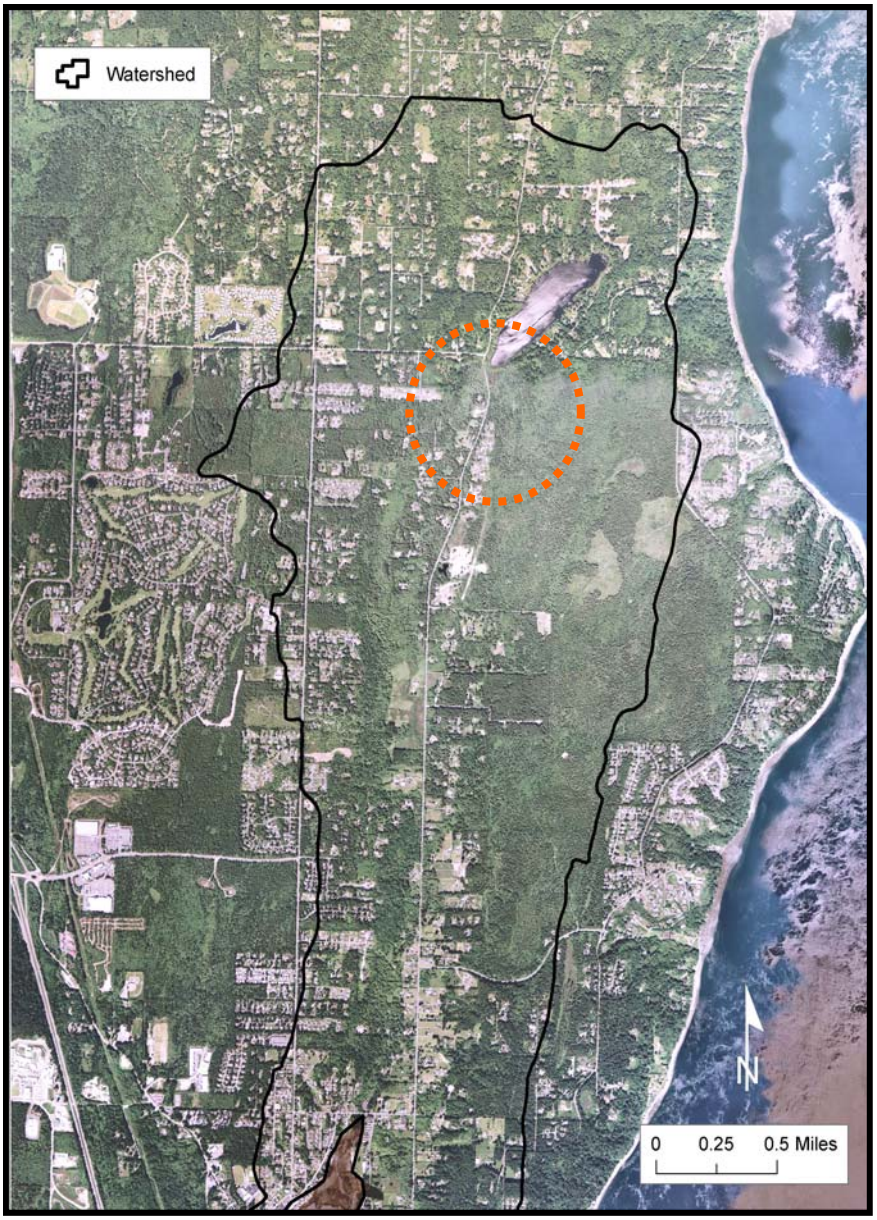

Figure 9. Non-native fish and bullfrogs were found during the 2005 bioblitz in two locations within the area of the dashed circle.

[1] The bioblitz did not undertake a full inventory of areas that might include these species.

Summary of Analysis Information

Discussion and recommendations based on the analyses are presented in Table 2.

Table 2. Summary wildlife metrics/parameters analyses and results for the Gig Harbor Biodiversity Management Area.

Analysis Parameter	Indicator	Crescent Creek Watershed	Discussion	Recommendations for Fish and Wildlife
Dwelling Unit Density	Zoning	Substantial areas are zoned for 1 du/5 and 1du/10 acres; some areas are zoned for higher densities, including Gig Harbor municipal	Both the coyote, and birds with high development tolerance, have zoning compatible with their needs throughout much of the Crescent Valley watershed. However, the lowest dwelling densities of 1 du/5 acres and 1 du/10 acres may be too dense to support the persistence of many: birds with low development tolerance, mammals, amphibians, and reptiles .	Adjusting zoning or obtain conservation easements or similar approaches to better meet the needs of the more sensitive species. Take into account locations of important patches, amphibian connectivity and habitat zone(s), and corridors or connective linkages.
Watershed Hydrology	% forest/natural vegetation in contributing watershed	Approximately 80%	Maintaining the aquatic habitat, water quality, and fish and wildlife species in streams and wetlands within Crescent Valley into the future will depend on maintaining ≥ 65% to 90% forest within the watershed. The current level of 80% forest cover provides for high quality hydrologic function for both wetland water level fluctuation and for stream hydrology. Important for pond breeding amphibians, and reptiles such as the Common garter snake that depend on the amphibians for food; also important for native fish species that utilize the stream, wetland and lake systems.	Maintain ≥65% to 90% natural vegetation throughout the Crescent Creek watershed, and use LID (low impact development) techniques for new development.
Riparian Integrity	% riparian corridor wider than 100 ft ; % corridor < 35 ft wide; number of breaks (road crossings) in the corridor	Crescent Cr. between the lake and estuary has 44% >100ft and 20% <35ft wide forested/wetland riparian area; tributaries have 56% >100 ft wide and 21% < 35ft wide forested/wetland riparian area. There are two road breaks/stream mile along the mainstem, and one break/stream mile along the tributaries.	Riparian integrity is high if >70% of the corridor is wider than 100 ft (each side of stream), and <10% of the corridor is less than 35 ft; and, there are <3 breaks in the corridor/stream mile. Streams with higher levels of riparian integrity have a greater potential for maintaining natural ecological functions (hydrology, bird, mammal, amphibian and reptile habitat, and natural corridor functions). Crescent Valley has variable riparian integrity, with many areas that are good, but overall the integrity does not meet a high quality condition. The mainstem is also impacted by Crescent Valley Road as it is located parallel to Crescent Creek within the riparian area for about 1/3 mile.	Maintain riparian integrity by keeping the riparian corridor intact, and maintaining <3 breaks in the corridor per stream mile. Restore the riparian corridor where opportunities exist. WDFW PHS Riparian Recommendations (Knudsen & Neaf 1997) recommend 150 to 250 feet wide riparian zones; based on this, maintaining or restoring riparian zones wider than 100 feet is recommended. Locations that provide connectivity between patches are a top priority for restoration.
Patch Size: Mammals	Patch size ≥800 acres (based on habitat for 3 female bobcats)	One patch this size exists in Crescent Creek watershed	This patch size indicates habitat needs may be met for mid-size wide-ranging mammals such as the bobcat. This large patch also provides habitat for species such as the long-tailed weasel, mink, and Western spotted skunk.	Maintain a large core patch without development or roads, minimize fragmentation and habitat loss within this patch, join patch to linkage areas that connect patch to interior of valley (first priorty), and to external areas such as the sound, and the penninsula to the north. Encourage development along the east-side of the patch, instead of the west-side or internally.
Patch Size: Birds	Patch sizes 12 to 100 acres, and >100 acres	These patch sizes exist in the Crescent Creek watershed	Crescent Valley includes a rich diversity of birds. Some examples of birds that are sensitive to patch sizes and require larger patches are the brown creeper, band-tailed pigeon, Cooper's hawk, MacGillivray's warbler, northern saw-whet owl, red-eyed vireo, and ruby-crowned kinglet.	Maintain patches 12 to 100, and >100 acres scattered throughout the watershed. Keep patches connected to other habitat areas to increase benefits to wildlife.

Table 2. Continued.

Indicator	Crescent Creek Watershed	Discussion	Recommendations for Fish and Wildlife
% forest/natural vegetation in amphibian and reptile connectivity and habitat zone	88% (upper area), 87% (mid-sections), and 77% (lower section)	Amphibians and reptiles move widely through the Crescent Valley watershed to utilize seasonal habitats (e.g., pond breeding habitat and upland distant summer habitat) and will be at significant risk from loss of habitat and connectivity as the area continues to develop. The measured values indicate connectivity is generally good, although at values below 80% careful attention is needed to ensure patches of habitat are connected. This is particularly evident in the lower CHZ where much of the development is clumped near the stream potentially creating a barrier effect.	Maintain a broad area within the Crescent Valley watershed as a connectivity and habitat zone (CHZ), where animals can easily move through to necessary habitats. Retaining or restoring 50 to 80% natural vegetation (good condition); >80% (best condition) will provide both habitat and connectivity to habitat. Below 80% natural vegetation careful attention to how natural habitat is located is important. Include careful consideration of roads and traffic levels.
Traffic intensity: daily vehicles per hour (v/hr): <15v/hr for amphibian persistence	Information is needed	Traffic levels greater than approximately 15 v/hr are expected to impact amphibian population persistence. Extensive literature indicates a strong relationship between traffic intensity, or road density out past 1 mile from breeding ponds, and amphibian and reptile species richness. In the Crescent Valley, main roads such as the Crescent Valley Road are likely to be impacting amphibian survival due to road crossing mortality. As traffic increases over time, this road could potentially become a complete barrier to movement.	Use traffic softening methods (e.g., lower speed limits) to limit through traffic on Crescent Valley Road which runs through the heart of important wildlife habitat. Locate new development to minimize traffic in the interior areas of Crescent Creek watershed. Underpassings along Crescent Valley Road may be needed for amphibians. Peacock Valley Road is very busy, further from wetland stream systems, and nearer the urban growth boundary. This road appears to be a better choice for higher traffic volumes.
Road density: threshold value = 1mi road/sq mi	The overall density within the Crescent Valley Watershed is 5.9 mi/sq mi overall, and 1.9 mi/sq mi of high traffic roads	Good conditions for mammals are predicted at <1 mi/sq mi; between 1 and 2.4 mi/sq mi special focus is needed to assure adquate conditions for mammals; at >2.4 mi/sq mi, extensive focus and planning will be necessary. The roads of highest concern will be those that carry high traffic loads. Roads are a significant issue for mammals due to direct mortality, noise related impacts, and causing movement barriers.	Minimize the building of new roads.
Roads and habitat connectivity: ca. 165 ft forest along road for mammal crossings	Road crossing areas exist, but fragmentation is extensive	Forest must exist on both sides of road for distances of ca. 165 ft. Note that this habitat needs to be linked up with other habitat blocks (see connective linkages above). Importance is very high for mammals that must cross roads.	Maintain or restore forest and natural habitat along roads. Pay special attention to connective linkages. Sign important areas where wildlife cross roads.
Presence of non-native species	Present	Abundant non-native fish and bullfrogs were found in the biodiversity management area during the 2005 Bioblitz. Non-native fish and bullfrogs can cause reduced abundance and decreased population persistence for pond breeding amphibians and species such as the common garter snake that depend upon the pond-breeding amphibians for food. Dogs and cats that are untended may kill large numbers of wild animals; and dogs running in the edges of ponds when there are developing amphibian egg masses may cause mortality through disturbance.	Utilize signs and other educational opportunities to address these issues. Undertake additional survey effort to determine how extensive the spread of the bullfrogs and non-native fish has been within Crescent Valley. Consider opportunities and methods for removal of the non-native fish and bullfrogs.

Synthesis Questions

Here we ask specific questions to better understand how recommendations for different species or issues might work together for planning purposes.

Patches, connectivity and habitat zone, and riparian areas:

- Where are commonalities between patch needs for mammals and birds, and where do these overlap with stream/riparian areas, and amphibian connectivity and habitat zone (CHZs) components?
- Considering the commonalities, where are priority areas to maintain patches and to refine boundaries for the CHZ?
- Where are priority areas for restoring riparian areas?

Roads:

- How do roads affect conditions in important patches, CHZs, and riparian areas?
- What specific road planning measures are needed?

Corridors and connective linkages:

- Where do connective linkages or corridors need to be maintained to ensure movement capability for mammals, amphibians, and reptiles, between patches within the watershed, and to external areas?
- What are the recommendations for retaining or restoring movement capability within the corridors or linkages?

Hydrological function:

- How do maintaining wildlife patches, riparian areas, and habitat within the CHZs interact with hydrological function for Crescent Valley watershed?
- What are additional needs for retaining hydrological functioning in the watershed?

Dwelling densities:

- Where are zoning densities incompatible with maintaining species in the identified CHZs, habitat patches, and other important locations within the watershed?
- What are recommendations for areas where zoning densities may be incompatible?

Planning Recommendations Summary

Based on consideration of the synthesis questions and recommendations from Table 2, planning recommendations for maintaining fish and wildlife in Crescent Valley are presented below. Note that because the BMA (i.e., the central portion of the valley, see Figure 1) is focused on aquatic/wet environments, a hydrological, watershed-based set of recommendations is provided.[1] Figure 10 indicates one approach to visualize how some of the recommendations may work together.

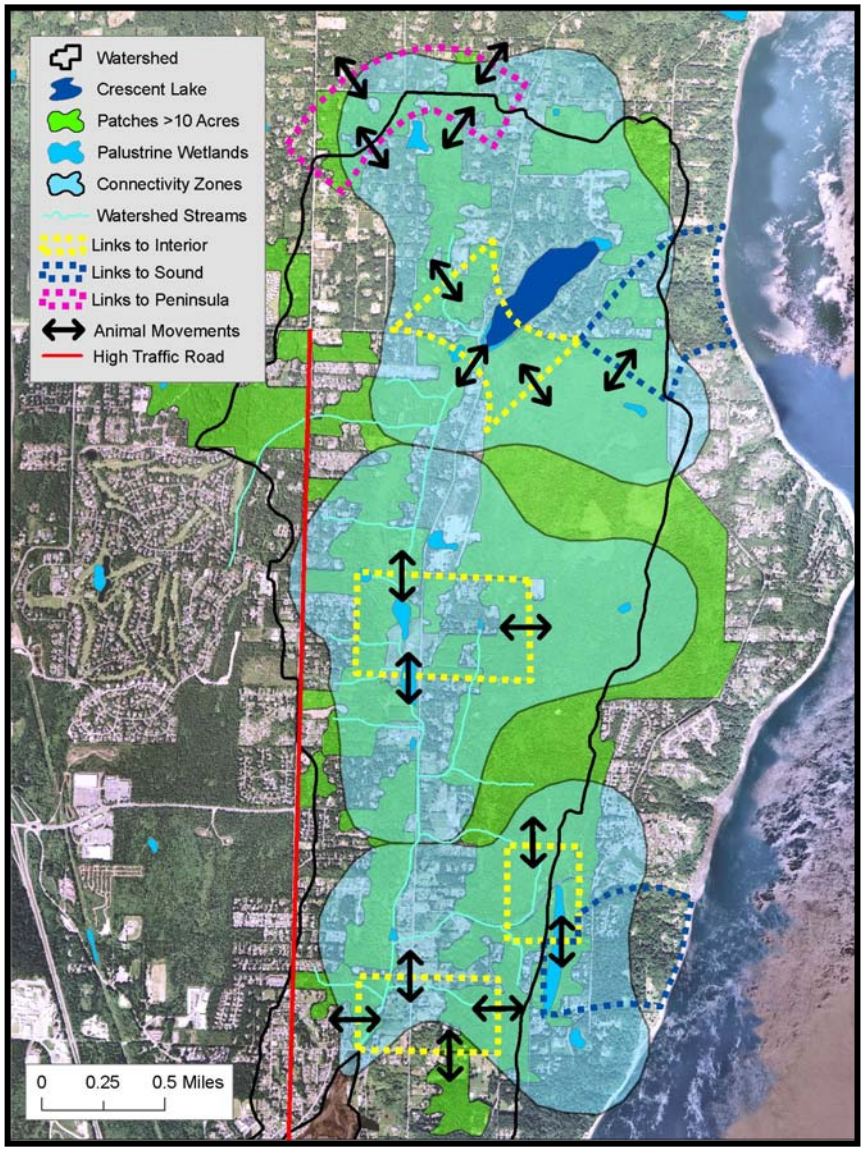

Figure 10. Summary overlay map indicating patches (green), amphibian and reptile connectivity and habitat zones (light blue), the Crescent Creek stream system, and a series of linkage areas to maintain connectivity between patches, and to external areas such as terrestrial areas to the north, and to Puget Sound to the east.

[1] With the best of stewardship solely within the BMA boundaries, much of the fish and wildlife that make this area special would be expected to be poorly retained over time.

Dwelling unit densities:

- Adjusting zoning or obtain conservation easements (or other approaches) to better meet needs of the more sensitive species. Take into account locations of important patches, amphibian connectivity and habitat zone(s), and corridors or connective linkages.

Hydrological function:

- Maintain ≥65% (65 to 90%) natural vegetation throughout the Crescent Valley watershed, and use LID (low impact development) techniques for new development.

Riparian integrity:

- Maintain existing areas of high integrity by keeping the riparian area intact, and by maintaining <3 breaks in the riparian area per stream mile. Restore the riparian area where opportunities exist; locations within connective linkages are a top priority for restoration.

Patches for birds and mammals:

- Birds: maintaining a variety of patch sizes (i.e., 12- 100 acres, and >100 acres) throughout the watershed will benefit many bird species. Keep patches connected to other habitat areas to increase benefits to wildlife.
- Mammals/Bobcats: maintain a large core patch without development or roads, minimize fragmentation and habitat loss within this patch, join the patch to linkage areas that connect the patch to the interior of the valley (first priority), and to external areas such as the sound, and the peninsula to the north. Encourage development along the east-side of the patch, instead of the west-side or internally.

Habitat connectivity zone for amphibians and reptiles:

- Maintain a broad area within the Crescent Valley watershed as a connectivity and habitat zone (CHZ) where animals can easily move through to necessary habitats. Retaining or restoring 50 to 80% natural vegetation (good condition), and >80% (best condition), will provide both habitat and connectivity between habitat patches. At levels <80% natural vegetation, attention to where natural vegetation is located is necessary. Include careful consideration of roads and traffic levels.

Roads:

- Use traffic softening methods (e.g., lower speed limits) to limit through traffic on Crescent Valley Road which runs through the heart of important wildlife habitat. Locate new development to minimize traffic in the interior areas of Crescent Creek watershed. Underpassings along Crescent Valley Road may be needed for amphibians. Peacock Valley Road is very busy, further from wetland stream systems, and nearer the urban growth boundary. This road appears to be a better choice for higher traffic volumes.
- Minimize the building of new roads.
- Maintain or restore forest and natural habitat along roads. Pay special attention to connective linkages. Sign important areas where wildlife cross roads.

Corridors and Connective linkages:

- Maintain linkages with ≥80% natural vegetation. Give special attention to road crossings in linkages: preserve forest/undeveloped habitat on both sides of road, route traffic away from

linkages, sign for wildlife crossing and lower speed limits. Throughout the rest of the CHZ, retain >50% natural vegetation (>80% is best).

Non-native animals:

- Utilize signs and other educational opportunities to address these issues.
- Undertake additional survey effort to determine how extensive the spread of the bullfrogs and non-native fish has been within Crescent Valley.
- Consider opportunities and methods for removal of the non-native fish and bullfrogs.

BMA boundary adjustment:

As described above, the current BMA boundary is not watershed-based and thus does not provide for the long-term persistence of included aquatic species. One approach to rectify this would be to expand the boundary of the BMA to include more of the watershed. Figure 11 depicts an example approach for revised boundaries that takes into consideration the wildlife analyses for birds, mammals, amphibians and reptiles, the hydrological boundary of the watershed, the very busy north/south road on the west, and the large intact parcels of land along much of the east side of the valley.

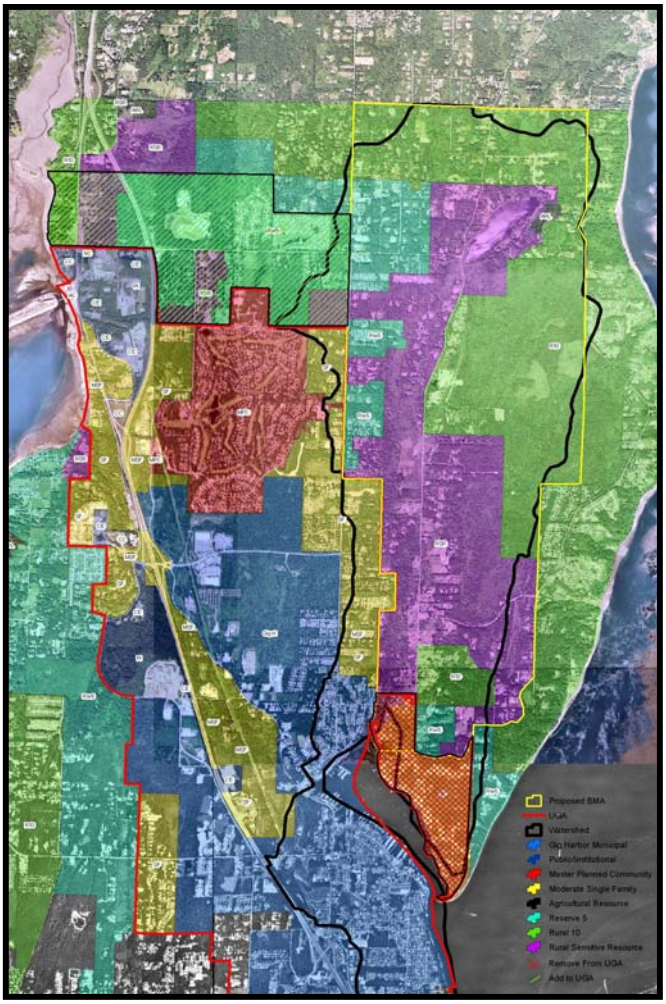

Figure 11. An example of adjusting the biodiversity management area boundary (yellow line) to better include lands necessary for the long-term persistence of aquatic species, as well as other birds, mammals, amphibians and reptiles.

We encourage readers to learn more about the Pierce Biodiversity Network , and the Crescent Valley Alliance. Information is available on the Pierce Biodiverstiy Alliance website: (http://www.fish.washington.edu/naturemapping/pierce_county.html).

Attachment: GIS Mapping Methods for the Crescent Valley Study

Attachment: GIS Mapping Methods for the Crescent Valley Case Study

Zoning and Dwelling Unit Densities (Figures 2a-d). Utilize GIS zoning maps to depict zoning for the planning area. Make additional maps that portray where specific zoning densities meet the persistence metrics for the focal species and groups.

Watershed Hydrological Integrity (Figure 3). Obtain the most recent digital landcover layer that has classes that can be grouped into a "Natural Vegetation" class. Using the watershed boundary layer as a clipping layer, determine the area of natural vegetation values that exist within the watershed boundary. The ratio of area of natural vegetation to the area of the entire watershed will provide the percent natural vegetation.

Riparian Habitat Integrity (Figure 4). Obtain the most spatially accurate digital layer depicting the stream network, and the most current digital orthophotograph. Use the GIS to buffer the streams out 100ft, and display the buffer boundary over the digital photograph. Interpret where riparian vegetation extends the width of the 100ft buffer, and digitize a line along the stream representing the length of those riparian areas. The ratio of the length of the stream segments of 100ft width riparian areas to the total stream length will provide the percent of riparian habitat integrity at a 100ft buffer width. Conduct a similar process for a 35ft buffer width.

To determine breaks/mile, visually observe where breaks exist, and average the number of breaks over the length of the channel section being analyzed.

Mammal and Bird Patch Sizes (Figure 5). Obtain the most current digital landcover layer or digital orthophotographs for your area of interest. If natural vegetation patches are well defined and separated from one another, a GIS could be used with a landcover layer to define patches with good success. However, if the landscape is fairly fragmented as is often the case in an urbanizing environment, a GIS has difficulty identifying spatially distinct patches. The GIS might automatically combine patches because of small areas of 'connectors' between larger area patches. Therefore, you often have to manually determine the patches by conducting on-screen digitizing using digital orthophotographs. (Fragstats can also be used to identify and determine patch characteristics.)

Habitat Composition, Connectivity, and Configuration for Amphibians and Reptiles (Figures 6,7). Obtain the National Wetland Inventory (NWI) digital data layer, and within the GIS extract all of the palustrine type wetlands, as those are the most typically utilized by still-water breeding amphibians during the breeding interval.

Use the GIS to buffer out from the palustrine wetlands at various distances to visualize where; 1) seasonal upland habitats surrounding the wetlands are likely to exist, and 2) wetlands may be near enough to each other to facilitate movement between wetlands by amphibians.

Using on-screen digitizing, draw polygonal boundaries to define CHZs using the wetland buffer boundaries as guides. Note that in Crescent Valley the stream corridor is a connectivity feature along most of the watershed, but we identify three descrete CHZs within the valley for analysis

of % natural habitat to determine if specific areas along the valley have disparate connectivity characteristics.

Obtain the most recent digital landcover layer that has classes that can be grouped into a 'Natural Vegetation' class. Using the CHZs boundary layers as clipping layers, determine the area of natural vegetation values that exist within each CHZ. The ratio of area of natural vegetation to the area of each CHZ will provide the percent natural vegetation for each CHZ.

The CHZs can be shaded based on the percent natural vegetation as follows:

Dark Green = >80%
Light Green = 50 to 80%
Yellow = 40 to < 50%
Tan = 30 to <40%
Dark Orange = <30%

This gradient of colors indicates a spectrum of where the best to least opportunities for connectivity and habitat are likely to exist**.**

Roads (Figure 8). Obtain a current digital vector format road layer and identify the high traffic roads and the lower traffic roads, and weight each road as a value 2 (high) or 1 (low). Create a raster data layer from the vector layer using the weight value attribute, and process the data with a summation GIS function using a 1mi by 1mi analysis 'window' that moves across the entire road data layer. This provides a data layer whose values when divided by 5,280 ft represent the number of linear road miles per square mile, relative to the weighting by traffic road type.

Non-Native Species (Figure 9). Known locations of non-native amphibians and fish can be mapped. In the case of Crescent Valley, the bioblitz identified two locations. Cats and dogs are not mapped in this example, but should be expected most places where there are homes.

Summary Map (Figure 10). This map is largely an overlay map. Connective linkages were located and added to the map based on visual identification of locations where connectivity appeared to currently exist, and to consider maintaining connectivity between patches that would appear otherwise in danger of becoming isolated. We additionally focused on suggestions for connectivity within Crescent Valley in the lower, mid, and upper sections, and to external locations as well.

BMA Example Boundary Map (Figure 11). The purpose for this map is to provide an example for how the BMA boundary might be changed to reflect the broader watershed areas necessary for retaining species within the current BMA. To do this, locations of large patches, dense development, busy roads, and the watershed boundary, along with the suite of mapping results were collectively considered.