

Citations of Recommended Sources of Best Available Science



For Designating and
Protecting Critical Areas



Washington State

Office of Community Development

Providing financial and technical resources to build livable and sustainable communities.

Cover Photo

This publication will help local governments designate and protect critical areas in Washington State.

OCD Photo of Tieton River/Rita R. Robison

Citations of Recommended Sources of Best Available Science For Designating and Protecting Critical Areas

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Introduction

The Washington State Growth Management Act (GMA) requires every county and city in Washington to adopt policies and development regulations that designate and protect critical areas. Critical areas are defined as:

- (a) Wetlands
- (b) Areas with a critical recharging effect on aquifers used for potable water
- (c) Frequently flooded areas
- (d) Geologically hazardous areas
- (e) Fish and wildlife habitat conservation areas

While the GMA does not set specific state or regional development standards for critical areas protection, it requires local governments to designate them and protect them through the adoption of comprehensive plan policies and development regulations to carry out the plan policies.

In 1995 the Legislature added a new section to the GMA that raised the standard for designating and protecting critical areas and protecting anadromous fisheries. RCW 36.70A.172 clarifies the state's goals and policies for protecting critical areas' functions and values by requiring that local governments include the "best available science" when designating and protecting them.

The best available science or valid science is often represented as research conducted by qualified individuals using documented methodologies that lead to verifiable results and conclusions. It is important for elected officials to understand how to identify valid science and how best to integrate it into policymaking. The responsibility for including the best available science into GMA policies and development regulations rests with the legislative authority of the county or city. However, when feasible, counties and cities should consult with a qualified scientific expert or team of experts to help identify and determine the best available scientific information and assess its applicability to the relevant critical areas. State agencies can also assist local governments with guidance and identifying additional resources.

Best Available Science Guidance

The Washington State Office of Community Development (OCD) adopted administrative rule guidance in August 2000 (Chapters 365-195-900 through 925 WAC) to assist cities and counties in determining what is the best available science, where to obtain it, how to include it in land use management policies and regulations, and what to do if there is no available valid scientific information.

Scientific information can be produced only through a valid scientific process. To ensure that the best available science is being included in policies and regulations, a county or city should consider the "characteristics" of a valid scientific process and common sources of scientific information [see Chapter 365-195-905(5) WAC]. In the

context of critical areas protection, a valid scientific process is one that produces reliable information useful in understanding the consequences of a local government's regulatory decisions.

Chapter 365-195-905(2) WAC states that OCD will make available a list of resources that state agencies have identified as meeting the characteristics of the best available science. This publication, *Citations of Recommended Sources of Best Available Science for Designating and Protecting Critical Areas*, meets that requirement. However, because science is a dynamic process and new science and new interpretation of existing work occur continually, it is impossible to present all of the science in a single document that may be appropriate for use in decision making. This publication is the product of a multistate agency effort to provide current information that may be used as the best available science. OCD plans to update this information annually.

How to Use This Report

This report provides local governments with a list of valid scientific information that the state has identified to represent current sources of the best available science. As previously stated, when feasible, counties and cities should consult with qualified scientific experts or teams of experts to help identify and determine if more current valid scientific information exists and assess its applicability to the relevant issues. Local governments must substantively include the best available science in the process of developing their policies and regulations to protect the functions and values of critical areas. In addition, citations to the best available science must be presented in the record when local plans and regulations are being considered.

This report is organized into six sections and two appendices. Five sections cover the five critical areas topics and an additional section includes information on special consideration for anadromous fisheries that is useful for local planning and permitting efforts. Appendix A provides contact names from state agencies that may be helpful in providing additional localized information. Appendix B offers the relevant statutory and administrative codes for easy reference.

The citations are alphabetized by author's name and are not prioritized. They are not an exclusive list of all the best available science currently published, but offer a set of scientifically valid sources in one place. Other details about the citations are as follows:

- The critical areas information follows the topics provided in OCD's Minimum Guidelines to Classify Critical Areas, Chapter 365-190-080 WAC.
- The citations are organized into two general topic areas, critical areas classification information and critical areas guidance information.
- Much of the information relates to specific geographic areas and may not have applicability to other locations. OCD attempted to ensure that the citations met

characteristics of the best available science. Where data was outdated or was site specific, this was noted.

- If publications are available through the Internet, the hyperlink site is noted. State agency libraries or the Washington State Library can also be a source for these reports and studies.

Some critical area mapping information was developed for purposes other than land use planning. For example, information presented here for tsunami areas was developed primarily for emergency management preparation. Similarly, flood maps provided from the Federal Emergency Management Agency provide important information for planning flood hazard mitigation and receiving grants from the Flood Control Assistance Account Program, but do not address aquatic habitats or other ecological information about the value of riparian functions.

For your convenience, *Citations of Recommended Sources of Best Available Science for Designating and Protecting Critical Areas* is posted on the Web site:

<http://www.oecd.wa.gov/growth>

Section 1: Wetlands

The citations identified are not an exclusive list of all the best available science currently published on wetlands, but offer a principal source of scientifically valid information useful for local planning and permitting efforts. Local governments are encouraged to consult with qualified scientific experts or teams of experts to help identify and determine if more current valid scientific information exists and assess its applicability to the relevant critical areas.

Identification and Delineation

1. Washington Department of Ecology. 1997. Washington State wetlands identification and delineation manual. Publication #96-94.

The manual describes methods to be used for delineating the jurisdictional boundary of a wetland using the three parameters: water regime/hydrology, soils, and vegetation. It is required to be used by all state and local jurisdictions (RCW 36.70A.175) and produces the same boundary as the U.S. Army Corps of Engineers 1987 manual.

2. Washington Department of Natural Resources. Updated annually. GIS Data Set. Washington Natural Heritage Program.

This data set provides geographic information system (GIS) coverage available for licensed use. The Washington Natural Heritage Program GIS includes locations and information regarding mapping high-quality wetland ecosystems in Washington State. The Natural Heritage Information System functions as a central repository of information on high quality aquatic and wetland ecosystems.

Classification

3. Brinson, M. M. 1993. A hydrogeomorphic classification for wetlands. U.S. Army Engineer Waterways Experiment Station. Technical Report WRP-DE-4.

This publication describes a wetland classification system that is used to separate different wetland types for the purpose of assessing their functions. Wetlands are grouped into different categories based on their geomorphic setting, their water source, and differences in the fluctuations of water levels.

4. Cowardin, L. M., Carter, V., Golet, F. C., and LaRoe, E. T. 1979. Classification of wetlands and deepwater habitats of the United States. Office of Biological Services, U.S. Fish and Wildlife Service, U.S. Department of the Interior. FWS/OBS-79/31. 103 pp.

This publication describes classification of wetlands based on the types of plants present, soils, and frequency of flooding. It was developed by the U.S. Fish and Wildlife Service to inventory wetlands across the U.S. from aerial photographs.

5. Kunze, Linda M. 1994. Preliminary classification of native, low elevation, freshwater wetland vegetation in Western Washington. Washington Natural Heritage Program, Department of Natural Resources.

This study is a result of ten years of wetland inventory and a review of the literature. It classifies and describes native wetland plant community types, provides references, and includes an appendix translating it to the Cowardin et al. (1979) classification. This preliminary classification includes native, undisturbed wetlands found in the lowlands of Western Washington. It includes impounded, semi-impounded, and tidal freshwater wetland plant communities.

Rating System

6. Washington Department of Ecology. 1991. Washington State wetland rating system for Eastern Washington. Publication #91-58.

The Washington State wetland rating system is a method for grouping wetlands into one of four categories based on their sensitivity to disturbance, whether they can be easily replaced, the presence of highly valued characteristics (such as threatened and endangered species), and habitat structure. It is often used as the basis for setting buffer requirements when development occurs in, or near, wetlands. The rating system for Eastern Washington is intended to be used in wetlands on the east side of the Cascade crest.

7. Washington Department of Ecology. 1993. Washington State wetland rating system for Western Washington. Publication #93-74.

The Washington State wetland rating system is a method for grouping wetlands into one of four categories based on their sensitivity to disturbance, whether they can be easily replaced, the presence of highly valued characteristics (such as threatened and endangered species), and habitat structure. It is often used as the basis for setting buffer requirements when development occurs in, or near, wetlands. The rating system for Western Washington is intended to be used in wetlands on the west side of the Cascade crest.

Function Assessment

8. Bartoldus, C. C. 1999. A comprehensive review of wetland assessment procedures: A guide for wetland practitioners. Environmental Concern Inc., St. Michaels, Maryland. 196 pp.

This manual provides a compendium of current wetland assessment procedures that wetland practitioners can use to: (a) learn the steps, approaches, and terminology of a method, and (b) identify a procedure that meets their specific needs. A non-profit corporation devoted to wetlands research and restoration prepared this report.

9. Hruby, T. 1999. Assessments of wetland functions: What they are and what they are not. Environmental Management, vol. 23, pp. 75-85.

This scientific journal article describes the technical basis and limitations of current rapid methods for assessing wetland functions.

10. Washington Department of Ecology. 2000. Methods for assessing wetland functions volume II: Depressional wetlands in the Columbia Basin for Eastern Washington – parts 1 and 2. Publication #00-06-47.

The methods provide relatively rapid, scientifically valid procedures for assessing how well wetlands perform functions, such as improving water quality, reducing floods, and providing wildlife habitat. The methods described in this volume can be used in depressional wetlands of the Columbia Basin. The Washington Department of Ecology recommends that these methods be used only by people who have completed the five-day training workshop offered by Ecology.

11. Washington Department of Ecology. 1999. Methods for assessing wetland functions volume I: Riverine and depressional wetlands in the lowlands of Western Washington – parts 1 and 2. Publication #99-115.

The methods provide relatively rapid, scientifically valid procedures for assessing how well wetlands perform functions, such as improving water quality, reducing floods, and providing wildlife habitat. The methods described in this volume can be used in riverine and depressional wetlands in Western Washington that are in the lowlands and the foothills of the Olympic and Cascade Mountains. The Washington Department of Ecology recommends that these methods be used only by people who have completed the five-day training workshop offered by Ecology.

12. Washington State Department of Transportation. 2000. Wetland functions characterization tool for linear projects. Environmental Affairs Office. 28 pp. Available at:
<http://www.wsdot.wa.gov/eesc/environmental/programs/biology/docs/bpjtool.pdf>

The Washington State Department of Transportation's method is a qualitative tool designed for rapid documentation of functions present or absent in wetlands throughout the state. It uses the best professional judgment of the qualified user to characterize the functions provided by a wetland.

Mitigation

13. Kentula, M. E., et al. 1992. An approach to improving decision making in wetland restoration and creation. U.S. Environmental Protection Agency. EPA/600/R-92/150.

A summary of strategies that can be used by resource managers to determine the appropriate mitigation for wetland impacts. This is a technical document that addresses management concerns, such as site selection and how to develop design criteria.

14. National Research Council. 1996. Guidelines for the development of wetland replacement areas. National Cooperative Highway Research Program, Transportation Research Board. National Academy Press, Washington, D.C. Report 379.

This publication is a comprehensive review of wetland mitigation. It covers function assessment, setting goals and objectives, site selection, site design and construction, and developing conceptual and final mitigation plan. The appendices cover specific wetland elements (hydrology, soils, vegetation, and cost estimating) in more detail.

15. Washington Department of Ecology. 2000. Washington State wetland mitigation evaluation study, phase 1: Compliance. Publication #00-06-016.

A report that summarizes the results from visits to 45 wetlands that were created, restored, and/or enhanced in Washington to compensate for impacts to existing wetlands. This report from the first phase of the study assessed the compliance of the projects with the conditions in their development permits.

16. Washington Department of Ecology. 2001. Washington State wetland mitigation evaluation study phase 2: Success. Publication #02-06-09.

A report that summarizes the results from visits to 24 wetlands that were created, restored, and/or enhanced in Washington to compensate for impacts to existing wetlands. This second phase study assesses the overall success of compensatory mitigation projects in the state of Washington.

17. Washington Department of Ecology. 1994. Guidelines for developing freshwater wetlands mitigation plans and proposals. Publication #94-29.

This report provides guidance for those planning to undertake restoration, creation, or enhancement of freshwater wetlands to compensate for unavoidable impacts. It describes an outline that should be followed when submitting plans and proposals.

18. Washington Department of Ecology. 1992. Wetland mitigation replacement ratios: Defining equivalency. Publication #92-08.

The report summarizes and evaluates the information available before 1992 for setting the ratios needed to offset losses due to filling or other impacts to wetlands through compensatory mitigation.

Buffers

19. Desbonnet, A., Pogue, P., Lee, V., and Wolff, N. 1994. Vegetated buffers in the coastal zone: A summary review and bibliography. Coastal Resources Center, University of Rhode Island Graduate School of Oceanography, Narragansett, Rhode Island. Technical Report No. 2064. 72 pp.

This report summarizes the scientific literature up to 1994 on the effectiveness of different buffer widths at maintaining the functions of aquatic resources. It also summarizes the functions provided by different buffer widths.

20. McMillan, A. 2000. The science of wetland buffers and its implications for the management of wetlands. Master's Thesis. The Evergreen State College.

This report summarizes the scientific literature on wetland buffers up to 1999. It also explores the meaning of the phrase "best available science" found in the Growth Management Act, outlines the essential provisions in buffer regulation, and recommends specific regulatory language. For information on this report, contact the author, Andy McMillan, at (360) 407-7272.

21. Washington Department of Ecology. 1992. Wetland buffers: Use and effectiveness. Publication #92-10.

This report was developed to assist those developing policies and standards for wetland protection. Specifically, the report summarizes and assesses information available before 1992 related to the use and effectiveness of wetland buffers.

General Wetland Resources

22. Azous, A. L. and Horner, R. R., editors. 1997. Wetlands and urbanization: Implications for the future. Final report of the Puget Sound Wetlands and Stormwater Management Research Program. Available at: <http://splash.metrokc.gov/wlr/basins/weturban.htm>

Also published as: Amanda L. Azous and Richard R. Horner, editors. 2001. Wetlands and urbanization, implications for the future. Lewis Publishers, New York.

A compendium of research covering hydrology, water quality, soils, vegetation, invertebrates, and wildlife communities (amphibians, birds, and small mammals) in 19 wetlands carried out over a ten-year period. The report describes the research program and characterizes the baseline physical and chemical conditions and biological communities of these wetlands. The report further describes how these characteristics changed with differing intensities of urbanization. Guidelines for better management of wetlands to minimize detrimental impacts to the abiotic and biotic conditions from watershed development are also presented.

23. Mitsch, W. J. and Gosselink, J. G. 2000. Wetlands. 3rd ed. Van Nostrand Reinhold, New York.

This is the basic textbook on wetlands used by many colleges and universities. It provides a good summary of the chemistry, geology, hydrology, and biology of wetlands.

24. National Academy of Sciences. 1995. Wetlands: Characteristics and boundaries. National Research Council, Washington, D.C.

This book presents the results of a national scientific committee on the issues of defining wetlands, characterizing them, and delineating them. It contains information on the scientific basis of wetland delineation, the regulatory framework for managing wetlands, and wetland functions.

25. Schneider, C. B. and Sprecher, S. W. 2000. Wetlands management handbook. U.S. Army Engineer Research and Development Center. ERDC/EL SR-00-16.

This document addresses the wetlands facet of natural resource management from a U.S. Army Corps of Engineers perspective. The purpose is to provide land managers with general guidance on basic ecological and regulatory issues that must be considered in wetland protection and management.

Section 2: Critical Aquifer Recharge Areas

The citation identified is not an exclusive list of all the best available science currently published for critical aquifer recharge areas, but offers a source of scientifically valid information useful for local governments planning and permitting efforts. Local governments are encouraged to consult with qualified scientific experts or teams of experts to help identify and determine if more current valid scientific information exists and assess its applicability to the relevant critical areas.

Guidance

Washington Department of Ecology. July 2000. Guidance document for establishment of critical aquifer recharge area ordinance. Water Quality Program. Publication #97-30.

This document provides guidance on what is considered a technically valid delineation of a critical aquifer recharge area boundary and to what extent additional characterization should be required for a given land use activity once a jurisdiction makes an initial determination. This document is revised and updated as new scientific information is recognized.

Section 3: Frequently Flooded Areas

The citations identified are not an exclusive list of all the best available science currently published for frequently flooded areas, but offer a source of scientifically valid information useful for local governments planning and permitting efforts. Local governments are encouraged to consult with qualified scientific experts or teams of experts to help identify and determine if more current valid scientific information exists and assess its applicability to the relevant critical areas.

Floodplains

Classification

1. Federal Emergency Management Agency. Flood Insurance Rate Maps.

Federal Emergency Management Agency
130-228th S.W.
Bothell, WA 98021-9796
(425) 487-4678
Or
1-800-358-9616 for the FEMA map service center

Federal Emergency Management Agency (FEMA) flood maps (flood insurance rate maps) are a good resource that can help local governments classify and designate frequently flooded areas. These maps delineate the flood ways and the floodplains. These maps are used by a local government that participates in the National Flood Insurance Program (NFIP). Counties and cities must, at a minimum, include the 100-year floodplain designated by FEMA and the NFIP when designating floodways and floodplains. Maps identifying floodplains for most rivers and streams are available. The greatest detail is on the most developed or developing areas. The scale of the maps is as follows: cities (1:3,600 or 6,000); counties (1:12,000); rural areas (1:12,000). These maps show the elevation within the floodplain at which building is permitted. Local governments with shorelines should also evaluate the potential for flooding that can result from high tides combined with strong winds, tsunami resulting from oceanic seismic activity, and increases in sea level because of global warming.

Guidance

2. Bolton, S. and Shellberg, J. 2001. Ecological issues in floodplains and riparian corridors. Center for Streamside Studies, University of Washington. 150 pp.

This report, or white paper, addresses the state of the knowledge about impacts of development and land management activities on aquatic habitats including fish and shellfish habitats. This synthesis document focuses on the

comprehensive and effective management of activities affecting aquatic ecosystems in Washington State. It includes an overview and the assessment of the state of the knowledge on ecological issues in floodplain and riparian corridors, a summary of existing guidance, recommendations for future guidance documents, a glossary of technical terms, and a bibliography. Available at: <http://www.wa.gov/wdfw/hab/ahg/floodrip.htm>

3. Washington Department of Ecology. 1991. Comprehensive planning for flood hazard management. Publication #91-44. 106 pp.

This guidebook assists local governments in preparing a comprehensive flood hazard management plan (CFHMP) to comply with state laws and to enable communities to receive grant funds through the Flood Control Assistance Account Program (FCAAP). The guidebook provides an introduction to FCAAP, discusses the process for initiating a FCAAP, discusses the elements of the comprehensive plan, presents recommendations in preparing a CFHMP, and includes an appendix of brief descriptions of regulatory reform programs.

4. Federal Emergency Management Agency. 1999. Executive summary: Riverine erosion hazard areas, mapping feasibility study. Technical Services Division, Hazard Study Branch. 11 pp.

The purpose of this study is to determine whether it is technologically feasible to map riverine erosion hazards areas. The study includes sections regarding riverine erosion, evaluation of channel changes, literature review, assessment of technical feasibility, cost, implementations, and conclusions. Available at: http://www.fema.gov/mit/tsd/ft_reha.htm

Increased Impervious Surfaces and Stormwater

1. Arnold, C. L. and Gibbons, C. J. 1996. Impervious surface coverage: The emergence of a key environmental indicator. Journal of the American Planning Association, vol. 62, no. 2, pp. 243-258.

This article documents the importance of impervious surface coverage as an environmental indicator and its usefulness in protecting the health of local water resources. The author explains the relationship between imperviousness and changes in hydrologic processes then provides a number of examples and alternative approaches for applying these principles.

2. Booth, Derek B. and Jackson, Rhett. 1997. Urbanization of aquatic systems: Degradation thresholds, stormwater detection, and the limits of mitigation. Journal of the American Water Resources Association, vol. 33, #5, pp. 1077-1090.

This paper focuses on the impact of urbanization on the hydrology and stability of stream channels and discusses the limited effectiveness of the traditional detention pond approach to solving those problems.

3. Horner, Richard R. 1999. Regional study supports natural land cover protection as leading best management practice for maintaining stream ecological integrity. Conference paper. Comprehensive Stormwater and Aquatic Ecosystem Management, First South Pacific Conference, Auckland, New Zealand. February 22-26, 1999. ISBN 1-877134-18-X. Vol. 1, pp. 233-247.

The study's intent was to produce a knowledge base for managing land with reference to ecological protection goals. The study conducted on streams in the Puget Sound region produced a set of conditions necessary to preserve the highest levels of biological integrity or avoid the lowest. A follow-up study is in progress to assess the influence of structural and non-structural best management practices on the same ecological communities. Results to date demonstrate that retention of a wide, nearly continuous riparian buffer in native vegetation has greater and more flexible potential than other options to uphold biological integrity when development increases. Upland forest retention also offers valuable benefits, especially in managing any development occurring in previously undeveloped or lightly developed areas. While circumstances differ in other settings, the methods used and general conclusions likely have wide applicability.

4. May, Christopher W., Welch, E. B., Horner, R. R., Karr, J. R., and Mar, B. W. 1997. Quality indices for urbanization effects on Puget Sound lowland streams. University of Washington, Civil Engineering Department, Water Resources Series, Technical Report No. 154.

This report examines the relationships between watershed urbanization and the physical, chemical, and biological characteristics of streams. The authors assess the conditions and factors involved in this relationship, including the importance of calculating total impervious area as a measure of urbanization and stream health. Although the research focuses on stream environments, the concepts linking development with the health of aquatic systems are transferable to shellfish watersheds and shoreline environments. Companion papers available at:

<http://www.stormwatercenter.net/Practice/18-Effects of Urbanization on Small Streams.pdf> and <http://pluto.apl.washington.edu/etg/chrisrdp.html>

5. Schueler, T. R. 1994. The importance of imperviousness. Watershed Protection Techniques, vol. 1, no. 3, pp. 100-111. Available at: <http://www.stormwatercenter.net/Practice/1 Importance%20of%20Imperviousness.pdf>

This article outlines the significance of impervious surfaces as a measure of the potential impact of land development on aquatic systems. Specifically, the article correlates changes in imperviousness with changes in the hydrology, habitat structure, water quality, and bio-diversity of aquatic systems, concluding that significant degradation occurs at relatively low levels of development. The article also outlines techniques for mitigating or avoiding these impacts.

6. Washington Department of Ecology. 2001. Stormwater management manual for Western Washington. Vols. I-V. Available at: <http://www.ecy.wa.gov/programs/wq/stormwater/index.html>

This manual establishes the technical standards and recommended practices for stormwater management in Western Washington. The standards and practices address both new development and redevelopment and aim to protect and restore aquatic habitats and natural hydrologic processes throughout the region.

Climate Change

1. Canning, D. J. 2001. Climate variability, climate change, and sea level rise in Puget Sound: Possibilities for the future. Puget Sound Action Team. Puget Sound Research, 2001 Proceedings.

This paper discusses historical sea level rise and possible anthropogenic climate changes as it relates to Puget Sound and climate variation due to El Nino and La Nina. It also reviews current scientific and management questions.

2. Craig, D. 1993. Preliminary assessment of the sea level rise in Olympia, Washington: Technical and policy implications. Policy and Program Development Division, Olympia Public Works Department.

This report examines the potential impact of sea level rise in the City of Olympia over the next 100 years. The document studies the increased risk of higher flood tides, higher water table, and diminished surface drainage. The focus of this paper is on Olympia's long-range planning for land uses and facilities. This document could be useful to low lying coastal communities in gaining a better understanding of potential impacts and possible responses to long-term sea level rise due to global warming.

Tsunami

Most of these documents regarding tsunami hazard areas are site specific and can be useful in critical area designation. Tsunami maps were designated to assist with emergency evacuation planning efforts.

1. Preuss, J. and Hebenstreit, G. T. 1998. Integrated tsunami-hazard assessment for a coastal community, Grays Harbor, Washington. In Rogers, A. M., Walsh, T. J., Kockelman, W. J., and Priest, G. R., editors. Assessing earthquake hazards and reducing risk in the Pacific Northwest. U.S. Geological Survey Professional Paper 1560, v. 2, pp. 517-536.
2. Walsh, T. J., Caruthers, C. G., Heinitz, A. C., Myers, E. P., III, Baptista, A. M., Erdakos, G. B., and Kamphaus, R. A. 2000. Tsunami hazard map of the Southern Washington coast – modeled tsunami inundation from a Cascadia subduction zone earthquake. Division of Geology and Earth Resources, Washington Department of Natural Resources. Geologic Map GM-49, 1 sheet, scale 1:100,000, p. 12.

Section 4: Geologically Hazardous Areas

The citations are not an exclusive list of all the best available science currently published for geologically hazardous areas, but offer a principal source of scientifically valid information useful for local governments planning and permitting efforts. Local governments are encouraged to consult with qualified scientific experts or teams of experts to help identify and determine if more current valid scientific information exists and assess its applicability to the relevant critical areas.

The following references can be useful in critical area mapping and designation, but some mapping information was designed for emergency management purposes and may have limited utility for land use planning.

General

1. King County Parks, Planning, and Resources Department. 1990. Sensitive areas map folio. King County. Vol. 1.
2. Manson, C. J., editor. 2001. Digital bibliography of the geology and mineral resources of Washington State, 1798-2000. Division of Geology and Earth Resources, Washington Department of Natural Resources. CD-ROM.

The file contains the citations and indexing for more than 35,000 items and includes both the items listed in the Department of Natural Resources' printed bibliographies and those non-Washington items located in its library. The CD-ROM disc contains search software and runs on Windows 3.1 or higher; it does not run on Macintosh computers or over a local area network (LAN). The software allows searching by author, date, title, publisher, county or formation name, call number, or subject, with Boolean combinations. Search results can then be sorted by any of the fields, and the user can print in several different report forms. The CD-ROM disc is updated every January and is free to local governments and educators in Washington State.

3. Washington Department of Ecology. 1978-1980. Slope stability maps and Coastal Zone Atlas. Vols. 1-12, maps, scale 1:24,000. Available at: <http://www.ecy.wa.gov/programs/sea/landslides/maps/maps.html>

These maps of Puget Sound coastal areas are intended to educate the public about Washington's shoreline and to guide regional land use decisions. The Washington Department of Ecology (Ecology) recommends that these maps should not be used as a substitute for site-specific studies carried out by qualified, licensed geologists and engineers.

This mapping represents conditions observed in the early and mid-1970s. Shorelines and steep slopes are dynamic areas and many landslides have

occurred since that time that are not reflected on these maps. Subsequent human activities may have increased or decreased the stability of some areas. Ecology can make no warranty of the accuracy, completeness, or fitness for use of this information.

Mapping in the Coastal Zone Atlas only extends 2000 feet inland from the shoreline. Mapping was carried out only in those areas under direct state shoreline jurisdiction and therefore did not include federal military installations or tribal jurisdictions.

4. Washington Department of Natural Resources. 2001. Publications of the Washington Division of Geology and Earth Resources. Division of Geology and Earth Resources. 38 pp. Available at:
<http://www.wa.gov/dnr/htdocs/ger/publist.htm>

This publication provides a list of publications available through the Washington Department of Natural Resources regarding Washington State earth resources. The publication includes: reports, bulletins, geologic maps, topographic maps, report investigations, information circulars, open file reports, miscellaneous publications, author index, subject index, and Washington geology article index.

Erosion Hazard Areas

- Federal Emergency Management Agency. 1999. Executive summary: Riverine erosion hazard areas, mapping feasibility study. Technical Services Division, Hazard Study Branch. 11 pp. Available at:
http://www.fema.gov/mit/tsd/ft_reha.htm

The purpose of this study is to determine whether it is technologically feasible to map riverine erosion hazards areas. The study includes sections regarding riverine erosion, evaluation of channel changes, literature review, assessment of technical feasibility, cost, implementations, and conclusions.

Landslide and Marine Bluff Hazard Areas

Most of these documents regarding landslide hazards areas are site specific and can be useful in critical area designation.

1. Baum, R. L., Harp E. L., and Hultman, W. A. 2000. Map showing recent and historic landslide activity on coastal bluffs of Puget Sound between Shilshole Bay and Everett, Washington. U.S. Geological Survey. Miscellaneous Field Studies Map MF-2346, 1 sheet, scale 1:24,000.

2. Deeter, J. D. 1979. Quaternary geology and stratigraphy of Kitsap County, Washington. Western Washington University Master of Science thesis, 175 pp., 2 plates.
3. Easterbrook, D. J. 1976. Map showing slope stability in Western Whatcom County, Washington. U.S. Geological Survey Miscellaneous Investigations Series Map I-854-C, 1 sheet, scale 1:62,500.
4. Gerstel, W. J. and Brunengo, M. J. 1994. Mass wasting on the urban fringe. Washington Geology, v. 22, no. 2, pp. 11-17.
5. Gerstel, W. J., Brunengo, M. J., Lingley, W. S., Jr., Logan, R. L., and Walsh, T. J. 1997. Puget Sound bluffs: The where, why, and when of landslides following the holiday 1996/97 storms. Washington Geology, vol. 25, no. 1, pp. 17-31.
6. King County Parks, Planning, and Resources Department. 1990. Sensitive areas map folio. King County. V 1.
7. Shipman, Hugh. 2001. Coastal landsliding on Puget Sound: A review of landslides occurring between 1996 and 1999. Washington Department of Ecology. Report #01-06-019. 87 pp.

The report provides documentation of major episodes of landsliding during the 1996-97 and 1998-99 winter seasons, and uses this information to better understand how local governments and agencies might reduce the risks from coastal landslides in the future.

8. Thorsen, G. W. 1989. Landslide provinces in Washington. In Galster, R. W., Chairman. Engineering Geology in Washington. Division of Geology and Earth Resources, Washington Department of Natural Resources. Bulletin 78, v. I, pp. 71-89.
9. Thom, Ronald M. and Williams, Gregory D. 2001. Marine and estuarine shoreline modification issues. Battelle Marine Sciences Laboratory, Sequim, Washington. 136 pp. Available at:
<http://www.wa.gov/wdfw/hab/ahg/marnsrc.htm>

The state-of-the-knowledge white paper on marine and estuarine shoreline modification addresses design and ecological considerations associated with hard and soft structural shoreline stabilization (bulkheads, rock revetments, groins, jetties, beach nourishment, and biotechnology), non-structural stabilization (setbacks, vegetation management, and ground/surface water management), estuary and shoreline restoration, tidegates, outfalls, and artificial reefs.

10. Tubbs, D. W. 1974. Landslides in Seattle. Division of Geology and Earth Resources, Washington Department of Natural Resources. Information Circular 52, 15 pp., 1 plate.
11. U.S. Geological Survey. 1975. Slope map of part of west-central King County, Washington. U.S. Geological Survey. Miscellaneous Investigations Series Map I-852-E, 1 sheet, scale 1:48,000.
12. Washington Department of Ecology. 1978-1980. Slope stability maps and Coastal Zone Atlas. Vols. 1-12, maps, scale 1:24,000. Available at: <http://www.ecy.wa.gov/programs/sea/landslides/maps/maps.html>

Mapping in the Coastal Zone Atlas only extends 2000 feet inland from the shoreline, and does not include tribal or federal jurisdictions.

These maps are intended to educate the public about Washington's shoreline and to guide regional land use decisions. The Washington Department of Ecology recommends that these maps should not be used as a substitute for site-specific studies carried out by qualified, licensed geologists and engineers.

Seismic Hazard Areas

Many of these documents regarding seismic hazard areas are site specific and can be useful in critical area designation.

1. Chleborad, A. F. and Schuster, R. L. 1998. Ground failure associated with the Puget Sound region earthquakes of April 13, 1949, and April 29, 1965. In Rogers, A. M., Walsh, T. J., Kockelman, W. J., and Priest, G. R., editors. Assessing earthquake hazards and reducing risk in the Pacific Northwest. U.S. Geological Survey Professional Paper 1560, vol. 2, pp. 373-440.
2. Dragovich, J. D. and Pringle, P. T. 1995. Liquefaction susceptibility for the Sumner 7.5-minute quadrangle, Washington, with a section on liquefaction by S. P. Palmer. Division of Geology and Earth Resources, Washington Department of Natural Resources. Geologic Map GM-44, 1 sheet, scale 1:24,000, p. 26.
3. Grant, W. P., Perkins, W. J., and Youd, T. L. 1998. Evaluation of liquefaction potential in Seattle, Washington. In Rogers, A. M., Walsh, T. J., Kockelman, W. J., and Priest, G. R., editors. Assessing earthquake hazards and reducing risk in the Pacific Northwest. U.S. Geological Survey Professional Paper 1560, pp. 441-473.
4. King County Parks, Planning, and Resources Department. 1990. Sensitive areas map folio – King County, December 1990. Vol. 1.

5. Kockelman, W. J. 1998. Techniques for reducing earthquake hazards. In Rogers, A. M., Walsh, T. J., Kockelman, W. J., and Priest, G. R., editors. Assessing earthquake hazards and reducing risk in the Pacific Northwest. U.S. Geological Survey Professional Paper 1560, vol. 2, pp. 479-496.
6. May, P. J. 1998. Earthquake risk-reduction prospects for the Puget Sound and Portland, Oregon, areas. In Rogers, A. M., Walsh, T. J., Kockelman, W. J., and Priest, G. R., editors. Assessing earthquake hazards and reducing risk in the Pacific Northwest. U.S. Geological Survey Professional Paper 1560, vol. 2, pp. 497-515.
7. Palmer, S. P. 1992. Preliminary maps of liquefaction susceptibility for the Renton and Auburn 7.5-minute quadrangles, Washington. Division of Geology and Earth Resources, Washington Department of Natural Resources. Open File Report 92-7, 24 pp., 2 plates.
8. Palmer, S. P. 1994. Revision to the 1994 Uniform Building Code seismic zone map for Washington and Oregon. Washington Geology, vol. 22, no. 2, p. 35.
9. Palmer, S. P., Schasse, H. W., and Norman, D. K. 1994. Liquefaction susceptibility for the Des Moines and Renton 7.5-minute quadrangles, Washington. Division of Geology and Earth Resources, Washington Department of Natural Resources. Geologic Map GM-41, 2 sheets, scale 1:24,000, p. 15.
10. Palmer, S. P., Walsh, T. J., and Gerstel, W. J. 1999. Geologic folio of the Olympia-Lacey-Tumwater urban area, Washington – Liquefaction susceptibility map. Division of Geology and Earth Resources, Washington Department of Natural Resources. Geologic Map GM-47, 1 sheet, scale 1:48,000, p. 16.
11. Palmer, S. P., Walsh, T. J., Logan, R. L., and Gerstel, W. J. 1995. Liquefaction susceptibility for the Auburn and Poverty Bay 7.5-minute quadrangles, Washington. Division of Geology and Earth Resources, Washington Department of Natural Resources. Geologic Map GM-43, 2 sheets, scale 1:24,000, p. 15.
12. Perkins, J. B. and Moy, K. K. 1998. Liability for earthquake hazards or losses and its impacts on the cities and counties of Washington. In Rogers, A. M., Walsh, T. J., Kockelman, W. J., and Priest, G. R., editors. Assessing earthquake hazards and reducing risk in the Pacific Northwest. U.S. Geological Survey Professional Paper 1560, vol. 2, pp. 543-545.

13. Rogers, A. M., Walsh, T. J., Kockelman, W. J., and Priest, G. R. 1996. Map showing known or suspected faults with quaternary displacement in the Pacific Northwest. In Rogers, A. M., Walsh, T. J., Kockelman, W. J., and Priest, G. R., editors. Assessing earthquake hazards and reducing risk in the Pacific Northwest. U.S. Geological Survey Professional Paper 1560, Plate 1, scale 1:2,000,000.
14. Rogers, A. M., Walsh, T. J., Kockelman, W. J., and Priest, G. R., editors. 1998. Assessing earthquake hazards and reducing risk in the Pacific Northwest. U.S. Geological Survey Professional Paper 1560, vol. 2, 545 pp., 6 plates.
15. Shannon & Wilson Inc. 1993. Evaluation of liquefaction potential Tacoma, Washington. Final technical report. Vol. 1.
16. Youd, T. L. 1996. Liquefaction hazard maps for the Portland quadrangle, Oregon, and comparison of hazard with performance during past earthquakes [abstract]. Geological Society of America Abstracts with Programs, vol. 28, no. 5, pp. 127-128.

Mine Hazard Areas

1. King County Parks, Planning, and Resources Department. 1990. Sensitive areas map folio – King County, December 1990. Vol. 1.
2. Walsh, T. J. 1994. Growth management planning for abandoned coal mines. Washington Geology, vol. 22, no. 2, pp. 33-34.
3. Walsh, T. J. and Bailey, M. J. 1989. Coal mine subsidence at Renton, Washington. In Galsters, R. W., chairman. Engineering Geology in Washington. Division of Geology and Earth Resources, Washington Department of Natural Resources. Bulletin 78, v. II, pp. 703-712.

Note: The Division of Geology and Earth Resources, Washington Department of Natural Resources also maintains a large collection of maps showing the underground workings of Western Washington coal mines.

Volcanic Hazard Areas

The following documents provide general information on volcanic hazards in Washington.

1. Pringle, P. T. 1994. Volcanic hazards in Washington – A growth management perspective. Washington Geology, vol. 22, no. 2, pp. 25-33.
2. Waldron, H. H. 1989. Volcanic hazards in Washington. In Galster, R. W., chairman. Engineering Geology in Washington. Division of Geology and

Earth Resources, Washington Department of Natural Resources. Bulletin 78, vol. I, pp. 91-96.

Most of these documents regarding volcanic hazards are site specific and can be useful in critical area designation.

3. Gardner, C. A., Scott, K. M., Miller, C. D., Myers, B., Hildreth, W., and Pringle, P. T. 1995. Potential volcanic hazards from future activity of Mount Baker, Washington. U.S. Geological Survey. Open-File Report 95-498, 16 pp., 1 plate. Available at:
http://vulcan.wr.usgs.gov/Publications/hazards_reports.html
4. Hoblitt, R. P., Walder, J. S., Driedger, C. L., Scott, K. M., Pringle, P. T., and Vallance, J. W. 1998. Volcano hazards from Mount Rainier, Washington, revised 1998. U.S. Geological Survey. Open-File Report 98-428, 2 plates, 11 pp. Available at:
http://vulcan.wr.usgs.gov/Publications/hazards_reports.html
5. Hoblitt, R. P., Miller, C. D., and Scott, W. E. 1987. Volcanic hazards with regard to siting nuclear power plants in the Pacific Northwest. U. S. Geological Survey. Open-File Report 87-297. Available at:
http://vulcan.wr.usgs.gov/Publications/hazards_reports.html
6. Scott, W. E., Iverson, R. M., Vallance, J. W., and Hildreth, W. 1995. Volcano hazards in the Mount Adams region, Washington. U.S. Geological Survey. Open-File Report 95-492, 2 plates, p. 11. Available at:
http://vulcan.wr.usgs.gov/Publications/hazards_reports.html
7. U.S. Geological Survey. 1995. Washington State On-Line Spatial Data Sets – 1995. Available at:
<http://vulcan.wr.usgs.gov/Hazards/DataSets/Washington/framework.html>

These 1995 digital data sets provide Arc-Info Coverage of volcano hazards in Washington State. Twenty GIS data sets have been created that represent hazard information from the U.S. Geological Survey hazard assessments of Mount Adams, Mount Baker, Glacier Peak, Mount Rainier, and Mount St. Helens. Also available at:
http://vulcan.wr.usgs.gov/Publications/hazards_reports.html
8. Waitt, R. B., Mastin, L. G., and Beget, J. E. 1995. Volcanic-hazard zonation for Glacier Peak volcano, Washington. U.S. Geological Survey. Open-File Report 95-499, 2 plates, p. 9. Available at:
http://vulcan.wr.usgs.gov/Publications/hazards_reports.html
9. Wolfe, E. W. and Pierson, T. C. 1995. Volcanic-hazard zonation for Mount St. Helens, Washington, 1995. U.S. Geological Survey. Open-File Report 95-497, 1 plate, p. 12. Available at:
http://vulcan.wr.usgs.gov/Publications/hazards_reports.html

Tsunami Hazard Areas

1. Preuss, Jane and Hebenstreit, G. T. 1998. Integrated tsunami-hazard assessment for a coastal community, Grays Harbor, Washington. In Rogers, A. M., Walsh, T. J., Kockelman, W. J., and Priest, G. R., editors. Assessing earthquake hazards and reducing risk in the Pacific Northwest. U.S. Geological Survey, Professional Paper 1560, vol. 2, pp. 517-536.
2. Walsh, T. J., Caruthers, C. G., Heinritz, A. C., Myers, E. P., III, Baptista, A. M., Erdakos, G. B., and Kamphaus, R. A. 2000. Tsunami hazard map of the Southern Washington coast – modeled tsunami inundation from a Cascadia subduction zone earthquake. Division of Geology and Earth Resources, Washington Department of Natural Resources. Geologic Map GM-49, 1 sheet, scale 1:100,000, p. 12.

Guidance

3. Menashe, E. 1993. Vegetation management: A guide for Puget Sound bluff property owners. Shorelands and Coastal Zone Management Program, Washington Department of Ecology. Publication #93-31.

This booklet provides some general information concerning the use of existing vegetation on steep slopes around Puget Sound. The booklet discusses reducing soil mass surface and soil erosion by vegetation management. The booklet does not deal with issues such as shoreline armoring.

4. Myers, R. D., Michele, L., and Myers, J. N. 1995. Surface water and groundwater on coastal bluffs: A guide for Puget Sound property owners. Shorelands and Water Resources Program, Washington Department of Ecology. Publication #95-107.

This publication provides general information pertaining to water management techniques and drainage control programs on coastal slope areas.

Section 5: Fish and Wildlife Habitat Conservation Areas

The citations identified are not an exclusive list of all the best available science currently published for fish and wildlife habitat conservation areas, but offer a principal source of scientifically valid information useful for local planning and permitting efforts. Local governments are encouraged to consult with qualified scientific experts or teams of experts to help identify and determine if more current valid scientific information exists and assess its applicability to the relevant critical areas.

Endangered, Threatened, and Sensitive Species and Habitats

Classification

1. Cullinan, T. 2001. Important bird areas of Washington. Audubon Washington. 170 pp.

This publication presents the initial results or first phase of the Important Bird Area (IBA) program in Washington. It is intended to be updated as new information is submitted and scientifically reviewed using biological criteria and expert ornithologists' review for IBA status. IBAs represent both terrestrial and aquatic sites that are critically important to birds during breeding, wintering, and migration. Copies can be obtained by contacting Audubon Washington, P.O. Box 462, Olympia, Washington 98507.

2. Washington Department of Fish and Wildlife. Maps and digital information. Available at: <http://www.wa.gov/wdfw/hab/release.htm>

The Washington Department of Fish and Wildlife (WDFW) maintains a GIS database that contains information on important fish and wildlife species that can be useful in land use decisions and activities. WDFW provides maps and reports that answer the most common questions concerning the presence of important fish and wildlife species. The data available from WDFW documents include known important wildlife resources. The materials covered on the maps include information from several databases, including Priority Habitats and Species, Wildlife Heritage, National Wetlands Inventory, and the Washington Rivers Information System. Information on specific locations of some fish and wildlife species is considered sensitive and access to that information is restricted by WDFW policy.

Washington Department of Fish and Wildlife species of concern lists are available at: <http://www.wa.gov/wdfw/wlm/diversty/soc/concern.htm>

Washington Natural Heritage Program rare plant species lists are available at: <http://www.wa.gov/dnr/htdocs/fr/nhp/refdesk/fsrefix.htm>

3. Washington Department of Natural Resources. 1997. Endangered, threatened and sensitive vascular plants of Washington with working lists of rare non-vascular species. Washington Natural Heritage Program. 62 pp.

This publication reflects the most current information available on the rare plants of Washington. The information was compiled from amateur and professional botanists. The purpose of this publication is to promote the conservation of rare plant species in Washington by serving as the most current reference on the status of Washington's rare plant species; help focus conservation attention on those species most in need of special consideration; and assist land and resource managers and planners in determining which species of concern might occur within their management jurisdiction. Visit the Department of Natural Resources' Natural Heritage Program online reference desk at:

<http://www.wa.gov/dnr/htdocs/fr/nhp/refdesk/fsrefix.htm>

Guidance

4. Bolton, S. and Shellberg, J. 2001. White Paper: Ecological issues in floodplains and riparian corridors. Center for Streamside Studies, University of Washington. 150 pp.

This report on ecological issues in floodplain and riparian corridors addresses the current state of the knowledge of impacts of development and land management activities on aquatic habitat and identifies potential mitigation measures from these impacts. The focus of the document is to protect and promote fully functional fish and shellfish habitat through the comprehensive and effective management of activities affecting aquatic ecosystems in Washington State. It includes an overview of the guidelines project, an overview of the subject white paper, an assessment of the state of knowledge, a summary of existing guidance, recommendations for future guidance documents, a glossary of technical terms, and a bibliography. Available at: <http://www.wa.gov/wdfw/hab/ahg>

5. Carrasquero, J. 2001. White Paper. Over-water structures: Freshwater issues. Herrera Environmental Consultants. 116 pp.

This report on over-water structures and freshwater issues addresses the current state of the knowledge of impacts of development and land management activities on aquatic habitat and potential mitigation measures of these impacts. It includes an overview of the guidelines project, an overview of the subject white paper, an assessment of the state of knowledge, a summary of existing guidance, recommendations for future guidance documents, a glossary of technical terms, and a bibliography. The focus of the document is to protect and promote fully functional fish and

shellfish habitat through the comprehensive and effective management of activities affecting aquatic ecosystems in Washington State. Available at: <http://www.wa.gov/wdfw/hab/ahg>

6. Knutson, K. L. and Naef, V. L. 1997. Management recommendations for Washington's priority habitats: Riparian. Washington Department of Fish and Wildlife. 181 pp. Available at: <http://www.wa.gov/wdfw/hab/ripxsum.htm>

This synthesis from the Washington Department of Fish and Wildlife provides statewide riparian management recommendations based on the best available science. Riparian habitat provides a vital and important resource to Washington's fish and wildlife. This document presents a synthesis of more than 1,500 pieces of literature to develop land use recommendations that accommodate riparian-associated fish and wildlife.

7. Kondolf, Nathias G., Smeltzer, M., and Kimball, L. 2001. White Paper. Freshwater gravel mining and dredging issues. Prepared for the Aquatic Habitat Guidelines Steering Committee and jointly published by the Washington State Departments of Ecology, Fish and Wildlife, and Transportation. Available at: <http://www.wa.gov/wdfw/hab/ahg>
8. Larson, E. M. and Nordstrom, N., editors. 2000. Management recommendations for Washington's priority species, volume IV: Birds. Available at: <http://www.wa.gov/wdfw/hab/phs/vol4/birdrecs.htm>

This document provides information on each species' geographic distribution, habitat requirements, and limiting factors. A bibliography of literature and a summary of habitat requirements and management recommendations for each species are also provided.

9. Larson, E. M. and Morgan, J. T. 1998. Management recommendations for Washington's priority habitats: Oregon white oak woodlands. Washington Department of Fish and Wildlife. 37 pp. Available at: <http://www.wa.gov/wdfw/hab/oaksum.htm>

This document provides management recommendations for the priority habitat of the Oregon white oak woodlands. Oregon white oak woodlands supply a wide variety of habitats for many wildlife species. This document discusses definitions, rationale, distribution, habitat description, fish and wildlife use, impact of land use, and management recommendations.

10. Larson, E. M., editor. 1997. Management recommendations for Washington's priority species, volume III: Amphibians and reptiles. Washington Department of Fish and Wildlife. 122 pp. Available at: <http://www.wa.gov/wdfw/hab/vol3.htm>

This guidance document provides information on each organism's geographic distribution, habitat requirements, and limiting factors. A bibliography of literature and a summary of habitat requirements and management recommendations for each species are also provided.

11. Larson, E. M., Rodrick, E., and Milner, R, editors. 1995. Management recommendations for Washington's priority species, volume I: Invertebrates. Washington Department of Fish and Wildlife. 82 pp. Available at: <http://www.wa.gov/wdfw/hab/val1.htm>

The document contains species management recommendations and includes most terrestrial and freshwater invertebrates on the Priority Habitats and Species list. This guidance document provides information on each organism's geographic distribution, habitat requirements, and limiting factors. A bibliography of literature and a summary of habitat requirements and management recommendations for each species are also provided.

12. May, Christopher W. 2000. Kitsap Peninsula salmonid habitat refugia study. 282 pp.

This Kitsap County sponsored study provides a helpful watershed model for identifying and prioritizing areas for fish habitat conservation, enhancement, and restoration efforts at the water resource inventory area level. Available at: www.kitsapgov.com/download/Refugia_body.pdf

13. Miller, D. E., Skidmore, P. G., and White, D. J. 2001. White Paper. Channel Design. Inter-Fluve Inc. 109 pp.

This report on channel design addresses the current state of the knowledge of impacts of development and land management activities on aquatic habitat and potential mitigation measures of these impacts. It includes an overview of the guidelines project, an overview of the subject white paper, an assessment of the state of knowledge, a summary of existing guidance, recommendations for future guidance documents, a glossary of technical terms, and a bibliography. The focus of the document is to protect and promote fully functional fish and shellfish habitat through the comprehensive and effective management of activities affecting aquatic ecosystems in Washington State. Available at: <http://www.wa.gov/wdfw/hab/ahg>

14. Morgan, J. T. 1998. Annotated bibliography for Washington's priority habitats: Freshwater wetlands and fresh deepwater. Washington Department of Fish and Wildlife.

This document is an annotated bibliography from Washington Department of Fish and Wildlife Priority Habitats and Species (PHS) Program. The PHS

program develops management recommendations for the state's priority habitat and species through a review and synthesis of the best available science. The bibliography includes a wetlands bibliography and a bibliography reference organized by PHS headings that includes: definition, rationale, distribution, habitat description, fish and wildlife use, impact of land use, and management recommendations.

15. Nightingale, B. and Simenstad, C. 2001. White Paper. Over-water structures: Marine issues. Wetland Ecosystem Team, School of Aquatic and Fishery Sciences, University of Washington. 159 pp. Available at: <http://www.wa.gov/wdfw/hab/ahq>

This report on over-water structures addresses the current state of the knowledge of impacts of development and land management activities on aquatic habitat and potential mitigation measures of these impacts from over-water structures. It includes an overview of the guidelines project, an overview of the subject white paper, an assessment of the state of knowledge, a summary of existing guidance, recommendations for future guidance documents, a glossary of technical terms, and a bibliography.

16. Poston, T. 2001. White Paper. Treated wood issues associated with over-water structures in marine and freshwater environments. Battelle. 90 pp. Available at: <http://www.wa.gov/wdfw/hab/ahq>

This report on treated wood issues associated with over-water structures in marine and freshwater environments addresses the current state of the knowledge of impacts of development and land management activities on aquatic habitat and potential mitigation measures of these impacts. It includes an overview of the guidelines project, an overview of the subject white paper, an assessment of the state of the knowledge, a summary of existing guidance, recommendations for future guidance documents, a glossary of technical terms, and a bibliography.

17. Rodrick, E. and Milner, R., editors. 1991. Management recommendations for Washington's priority habitats and species. Wildlife Management, Fish Management, and Habitat Management Divisions, Washington Department of Fish and Wildlife.

This publication provides management recommendations for forest associated priority species. The recommendations are intended for site specific discussions with landowners to encourage retention of enhancement of suitable wildlife habitat. This guidance document provides information on each species' geographic distribution, habitat requirements, and limiting factors. A bibliography of literature and a summary of habitat requirements and management recommendations for each species are also provided.

18. Washington Department of Fish and Wildlife. 1999. Priority habitats and species list. Habitat Program. 32 pp.

This publication is a catalog of habitats and species considered to be priorities for conservation and management. This documents list 18 habitat types, 140 vertebrate species, 28 invertebrate species, and 14 species groups currently on the Priority Habitat and Species list. Priority species include state endangered, threatened, sensitive, and candidate species. Priority habitats include habitat types with unique or significant value to a wide range of species.

19. Williams, G. D. and Thom, R. M. 2001. White Paper. Marine estuarine shoreline modification issues. Battelle Marine Sciences Laboratory, Pacific Northwest National Laboratory. 121 pp.

This report on marine estuarine shoreline modification issues addresses the current state of the knowledge of shoreline structures and the impacts of development and land management activities on aquatic habitat and potential mitigation measures of these impacts. It includes an overview of the guidelines project, an overview of the subject white paper, an assessment of the state of the knowledge, a summary of existing guidance, recommendations for future guidance documents, a glossary of technical terms, and a bibliography. The focus of the document is to protect and promote fully functional fish and shellfish habitat through the comprehensive and effective management of activities affecting aquatic ecosystems in Washington State.

The following citations have not been annotated, but might be helpful references to species specific issues. Reports can be obtained through the Washington Department of Fish and Wildlife.

20. Almack, J. 1995. Washington Grizzly Bear and Gray Wolf Research Project 1981-1995. Vols. 1-6.
21. Dobler, F. C., Eby, J., Perry, C., Richardson, S., and Vander Haegen, M. 1996. Status of Washington's shrub steppe ecosystem: Extent, ownership, and wildlife/vegetation relationships.
22. Dunn, P. and Ewing, K., editors. 1997. Ecology and conservation of the South Puget Sound prairie landscape. The Nature Conservancy of Washington, Seattle, Washington, 289 pp.
23. Hallock, M. and Mongillo, P. E. 1998. Washington State status report for the pygmy whitefish. Washington Department of Fish and Wildlife.

24. Hayes, G. E. and Buchanan, J. B. 2001. Draft Washington State status report for the peregrine falcon. Washington Department of Fish and Wildlife. 108 pp.
25. Hays, D. 1997. Washington State status report for the Aleutian Canada goose. Washington Department of Fish and Wildlife.
26. Hays, D., McAllister, K. R., Richardson, S. A., and Stinson, D. W. 1999. Washington State recovery plan for the western pond turtle. Washington Department of Fish and Wildlife. 66 pp.
27. Hays, D., Tirhi, M., and Stinson, D. 1998. Washington State status report for the sharp-tailed grouse. Washington Department of Fish and Wildlife.
28. Hays, D., Tirhi, M., and Stinson D. 1998. Washington State status report for the sage grouse. Washington Department of Fish and Wildlife.
29. Johnson, D. H. and O'Neil, T. A., directors. 2001. Wildlife-habitat relationships in Oregon and Washington. Oregon State University Press, Corvallis, Oregon. 768 pp.
30. Lewis, J. C. and Stinson, D. W. 1998. Washington State status report for the fisher. Washington Department of Fish and Wildlife.
31. Littlefield, C. D. and Ivey, G. L. 2001. Draft – Washington State recovery plan for the sandhill crane. Washington Department of Fish and Wildlife. 62 pp.
32. McAllister, K. R. 1995. Distribution of amphibians and reptiles in Washington State. Northwest Fauna, No. 3. 81 pp.
33. McAllister, K. R. and Leonard, W. P. 1997. Washington State status report for the Oregon spotted frog. Washington Department of Fish and Wildlife.
34. Mongillo, P. E and Hallock, M. 1998. Washington State status report for the margined sculpin. Washington Department of Fish and Wildlife.
35. Potter, A., Fleckenstein, J., Richardson, S., and Hays, D. 1999. Washington State status report for the mardon kipper. Washington Department of Fish and Wildlife. 39 pp.
36. Pruitt, L. 2000. Loggerhead shrike status assessment. U.S. Fish and Wildlife Service, Bloomington, Indiana. 169 pp.
37. Richardson, S. and Allen, H. 2000. Draft – Washington State recovery plan for the sea otter. Washington Department of Fish and Wildlife. 67 pp.

38. Richardson, S., Hays, D., Spencer, R., and Stofel, J. 1997. Washington State status report for the common loon. Washington Department of Fish and Wildlife. 53 pp.
39. Ruggiero, L. F., Aubry, K. B., Buskirk, S. W., Koehler, G. M., Krebs, C. J., McKelvey, K. S., and Squires, J. R. 1999. Ecology and conservation of lynx in the United States. U.S. Forest Service, Rocky Mountain Research Station. GTR RMRS-GTR-30WWW.
40. Stinson, D. W. 2001. Washington State recovery plan for the lynx. Washington Department of Fish and Wildlife. 78 pp. plus five maps.
41. Stinson, D. W., Watson, J. W., and McAllister, K. R. 2001. Draft – Washington State status report for the bald eagle. Washington Department of Fish and Wildlife. 90 pp.
42. U.S. Fish and Wildlife Service. 2001. Western snowy plover (*Charadrius alexandrinus nivosus*). Pacific Coast population draft recovery plan. Portland, Oregon. 630 pp.
43. Vander Haegen, W. M., Dobler, F. C., and Pierce, D. J. 2000. Shrubsteppe bird response to habitat and landscape variables in Eastern Washington, U.S.A. *Conservation Biology*, vol. 14, pp. 1145-1160.
44. Richardson, S. 1997. Washington State status report for the gray whale. Washington Department of Fish and Wildlife.
45. Washington Department of Fish and Wildlife. 1995. Washington State recovery plan for the pygmy rabbit.
46. Washington Department of Fish and Wildlife. 1995. Washington State recovery plan for the upland sandpiper.
47. Washington Department of Fish and Wildlife. 1995. Washington State recovery plan for the snowy plover.
48. Washington Department of Fish and Wildlife. 1996. Washington State recovery plan for the ferruginous hawk.
49. Washington Department of Fish and Wildlife. 1993. Washington State status report for the steller sea lion.
50. Washington Department of Fish and Wildlife. 1993. Washington State status report for the larch mountain salamander.

51. Washington Department of Fish and Wildlife. 1993. Washington State status report for the Oregon silverspot butterfly.

Shellfish Areas

Shellfish Sanitation and Growing Area Designations

1. May, C. W., Horner, R. R., Karr, J. R., Mar, B. W., and Welch, E. B. 1997. Effects of urbanization on small streams in the Puget Sound lowland ecoregion. *Watershed Protection Techniques*, vol. 2, no. 4, pp. 483-494.

This article examines the relationships between watershed urbanization and the physical, chemical, and biological characteristics of streams. The authors assess the conditions and factors involved in this relationship, including the importance of calculating total impervious area as a measure of urbanization and stream health. Although the research focuses on stream environments, the concepts linking development with the health of aquatic systems are transferable to shellfish watersheds and shoreline environments. Companion paper available at:

<http://pluto.apl.washington.edu/etg/chrisrdp.html>

Also available at: <http://www.stormwatercenter.net/Practice/18-Effects%20of%20Urbanization%20on%20Small%20Streams.pdf>

2. Schueler, T. R. 1994. The importance of imperviousness. *Watershed Protection Techniques*, vol. 1, no. 3, pp. 100-111. Available at: <http://www.stormwatercenter.net>

Also available at: <http://www.stormwatercenter.net/Practice/1-Importance%20of%20Imperviousness.pdf>

This article outlines the significance of impervious surfaces as a measure of the potential impact of land development on aquatic systems. Specifically, the article correlates changes in imperviousness with changes in the hydrology, habitat structure, water quality, and bio-diversity of aquatic systems, concluding that significant degradation occurs at relatively low levels of development. The article also outlines techniques for mitigating or avoiding these impacts. Although the research focuses on stream environments, the concepts linking development with the health of aquatic systems are transferable to shellfish watersheds and shoreline environments.

3. U.S. Food and Drug Administration. 2000. National shellfish sanitation program model ordinance. 134 pp. Available at: <http://vm.cfsan.fda.gov/~ear/nsspotoc.html>

This document provides guidance and sets national standards on the safe and sanitary growing, processing, and shipping of molluscan shellfish.

4. Washington State Department of Health. 2001. 2000 annual inventory of commercial and recreational shellfish areas of Puget Sound. 30 pp. Available at: <http://www.doh.wa.gov/ehp/sf/sfpubs.htm>

This report provides general information on the state's shellfish resources and an overview of the Washington State Department of Health's shellfish programs. The report also includes an accompanying map of the state's shellfish growing areas.

5. Washington State Department of Health. 2001. Shellfish programs 2000 annual reports. 384 pp.

These annually updated assessments provide information on the location and status of all commercial shellfish growing areas in the state. The reports include maps of the classified growing areas and summary water quality data for all monitoring stations.

6. Washington State Department of Health and others. 1999. Public shellfish sites of Puget Sound. 41 pp. Available at: <http://www.doh.wa.gov/ehp/sf/sfpubs.htm>

This booklet provides advice on recreational shellfish harvesting plus maps and other information on the location of public beaches, access sites, and shellfish resources around Puget Sound.

7. Washington State Department of Health. 1990 to present. Shellfish growing area sanitary surveys.

These documents are prepared periodically for all commercial shellfish growing areas in the state (the survey data will be less than 12 years old). The surveys describe the sanitary conditions of the growing areas and provide the rationale for determining the appropriate classifications.

Water Quality and Habitat Protection

8. Aquatic Habitat Guidelines Project Web site is located at: <http://www.wa.gov/wdfw/hab/ahg>

This Web site contains a suite of state-of-the-knowledge white papers that synthesizes the scientific and technical literature on a variety of topics. The purpose of the papers is to provide a basis for development of future guidance materials for fisheries issues. The Aquatic Habitat Guidelines project is a joint venture of the Washington State Departments of Ecology,

Fish and Wildlife, and Transportation. In July 2001, the U.S. Army Corps of Engineers, Seattle District, joined the Aquatic Habitat Guidelines Steering Committee.

9. Arnold, C. L. and Gibbons, C. J. 1996. Impervious surface coverage: The emergence of a key environmental indicator. *Journal of the American Planning Association*, vol. 62, no. 2, pp. 243-258.

This article documents the importance of impervious surface coverage as an environmental indicator and its usefulness in protecting the health of local water resources. The author explains the relationship between imperviousness and changes in hydrologic processes then provides a number of examples and alternative approaches for applying these principles.

10. Bremerton-Kitsap County Health District. 1999. Manual of protocol: Fecal coliform bacteria pollution identification and correction projects. Version Eight. 24 pp.

This manual describes the local health department's techniques and standards for identifying and correcting nonpoint sources of fecal contamination in Kitsap County. The program serves as a model for resolving nonpoint pollution problems in shellfish watersheds.

11. Determan, T. 2001. Status and trends in fecal coliform pollution in Puget Sound embayments year 2000. A report for the Puget Sound Ambient Monitoring Program, Washington State Department of Health. 81 pp.

This report describes the status of fecal coliform pollution in 43 growing areas around Puget Sound (focusing on central Puget Sound and Hood Canal) from January 1999 through March 2000. The document provides a short summary for each of the 26 of the growing areas suffering significant pollution impact. Each summary includes fecal coliform trends and actions undertaken to protect and restore water quality.

12. Determan, T. 2000. 1999 status and trends in fecal coliform pollution in Puget Sound embayments. A report for the Puget Sound Ambient Monitoring Program, Washington State Department of Health. 104 pp.

This report describes the status of fecal coliform in 45 growing areas around Puget Sound (focusing on north Puget Sound and the Strait of Georgia) from January 1998 through March 1999. The document provides a short summary of each of the 19 growing areas suffering significant pollution impact. Each summary includes fecal coliform trends and action undertaken to protect and restore water quality. The report helps link water quality trends with changing conditions in the adjacent watersheds.

13. Determan, T. 1993. Nonpoint remedial action in Puget Sound watersheds: The effort to clean up contaminated shellfish beds, 1983 to 1990. Washington Department of Ecology. Publication #93-66. 46 pp.

This report assesses efforts to protect and restore water quality in seven Puget Sound watersheds between 1983 and 1990. Although slightly dated, the analysis outlines useful findings related to the control of pollution from agricultural sources and on-site sewage systems in rural and urbanizing watersheds.

14. Fletcher, M., Verity, P. G., Frischer, M. E., Maruya, K. A., and Scott, G. I. Not dated. Microbial indicators, phytoplankton, and bacterial communities as evidence of contamination caused by changing land use patterns. South Atlantic Bight Land Use Coastal Ecosystem Study (LUCES), South Carolina Sea Grant Consortium. Available at:
<http://inlet.geol.sc.edu/luces2/fletcher.html>

Information on LUCES available at:
http://www.baruch.sc.edu/luces2/luces/LUCES_1.HTML

This publication is a state-of-the-knowledge report of the LUCES. It examines the use of microbial, phytoplankton, and contaminant indicators and their relationship with land use practices in adjacent areas. The report lays a foundation for refining these indicators and improving their use in evaluating the impact of changing land uses on water quality in coastal areas.

15. Mallin, M. A., Williams, K. E., Esham, E. C., and Lowe, R. P. 2000. Effect of human development on bacteriological water quality in coastal watersheds. *Ecological Applications*, vol. 10, no. 4, pp. 1047-1056.

This article examines the effects of human development on water quality in five estuarine watersheds in North Carolina over a four-year period. The analysis identifies a strong correlation between levels of bacterial contamination and watershed populations and an even stronger correlation between contamination and percentages of developed lands within the watersheds. The authors conclude that health risks and environmental impacts can be reduced in urbanizing watersheds by using sound land use planning to minimize impervious surfaces while maximizing the passive water treatment function of natural and constructed wetlands, grassy swales, and other "green" areas. Abstract available at:
<http://www.esajournals.org/esaonline/?request=get-abstract&issn=1051-0761&volume=010&issue=04&page=1047>

16. May, C . W., Horner, R. R., Karr, James R., Mar, B. W., and Welch, Eugene B. 1997. Effects of urbanization on small streams in the Puget Sound lowland ecoregion. *Watershed Protection Techniques*, vol. 2, no. 4, pp. 483-494. This article examines the relationships between watershed urbanization and the physical, chemical, and biological characteristics of streams. The authors assess the conditions and factors involved in this relationship, including the importance of total impervious area as a measure of urbanization and stream health. Companion paper available at: <http://pluto.apl.washington.edu/etg/chrisrdp.html>

Also available at: <http://www.stormwatercenter.net/Practice/18-Effects%20of%20Urbanization%20on%20Small%20Streams.pdf>

17. Pacific Coast Shellfish Growers Association. 2001. Environmental codes of practice for the West Coast shellfish industry.

The codes serve as guidelines to ensure that shellfish operations are managed in ways that protect the natural marine environment. The document outlines objectives, strategies, and performance measures designed to address potential habitat, water quality, and other environmental changes associated with shellfish aquaculture. The document also provides the means for monitoring compliance in implementing the strategies. A comprehensive literature review and an evaluation of environmental regulations related to shellfish aquaculture are included.

18. Sargeant, D. 1999. Fecal contamination source identification methods in surface water. Washington Department of Ecology. Publication #99-345. 17 pp. Available at: <http://www.ecy.wa.gov/pubs/99345.pdf>

This literature review examines optional approaches and methods for identifying and differentiating sources of human and animal fecal contamination.

19. Schueler, T. R. 1994. The importance of imperviousness. *Watershed Protection Techniques*, vol. 1, no. 3, pp. 100-111. Available at: http://www.cwp.org/Articles/importance_of_imperviousness.htm

Also available at: <http://www.stormwatercenter.net/Practice/1-Importance%20of%20Imperviousness.pdf>

This article outlines the significance of impervious surfaces as a measure of the potential impact of land development on aquatic systems. Specifically, the article correlates changes in imperviousness with changes in the hydrology, habitat structure, water quality, and bio-diversity of aquatic systems, concluding that significant degradation occurs at relatively low

levels of development. The article also outlines techniques for mitigating or avoiding these impacts.

20. Schueler, T. R. 1999. Microbes and urban watersheds: Concentrations, sources, and pathways. *Watershed Protection Techniques*, vol. 3, no. 1, pp. 554-565. Available at: <http://www.stormwatercenter.net/Practice/17-Microbes%20in%20Urban%20Watersheds.pdf>

This article characterizes contamination problems associated with bacteria and other microorganisms in developed watersheds. Among other conclusions, the author points out that "it is exceptionally difficult to maintain beneficial uses of water in the face of even low levels of watershed development" and "if a watershed manager has a beach, shellfish bed, or drinking water intake to protect, they can expect that even a modest amount of development is likely to restrict or eliminate that use."

21. Scott, G. I. 1998. The impacts of urbanization on shellfish harvesting waters: Development of techniques to identify coliform pollution sources. Abstracts of Technical Papers presented at the International Conference on Shellfish Restoration, 1998. *Journal of Shellfish Research*, vol. 17, no. 4, pp. 1312-1313.

This abstract explains how urbanization in areas adjacent to estuarine ecosystems has resulted in significant bacterial and chemical contamination in the Southeastern United States. The author points out that these findings "clearly indicate that fecal coliform bacteria pollution is associated with urbanization and that closure of shellfish harvesting waters may be perhaps the most significant, quantifiable impact from urbanization."

22. University of Washington. 1998. Abstracts from the Salmon in the City Conference. Center for Urban Water Resources Management. 65 pp. Available at: <http://www.depts.washington.edu/cuwr/research/sitc.pdf>

These abstracts discuss the effects of urbanization on lowland streams and salmon habitat in the Puget Sound basin. Among the findings, the papers point out that streams are generally damaged at relatively low levels of development and impacts increase significantly at higher levels of impervious surface cover.

23. U.S. Environmental Protection Agency. 2000. Low impact development: A literature review. Office of Water. EPA-841-B-00-005, 35 pp. Available at: <http://www.epa.gov/owow/nps/lid.pdf>

This publication provides background information on key issues associated with low impact development (LID) and assesses available data and

literature describing the effectiveness of LID practices in controlling surface runoff and reducing pollution loadings to receiving waters.

24. Washington Department of Ecology. 2001. Stormwater management manual for Western Washington. Vols. I-V. Available at: <http://www.ecy.wa.gov/programs/wq/stormwater/index.html>

This manual establishes the technical standards and recommended practices for stormwater management in Western Washington. The standards and practices address both new development and redevelopment and aim to protect and restore aquatic habitats and natural hydrologic processes throughout the region.

25. Washington Department of Fish and Wildlife. 1999. Priority habitats and species list. 31 pp. Available at: <http://www.wa.gov/wdfw/hab/phslist.pdf>

This list identifies fish and wildlife resources, including shellfish species and habitats, that are priorities for management and conservation because of their population status, sensitivity to habitat alteration, or commercial, recreational, or tribal importance.

26. Washington Department of Fish and Wildlife. Not dated. Species of concern list. Available at: <http://www.wa.gov/wdfw/wlm/diversty/soc/soc.htm>

This list identifies fish and wildlife species that are designated by the state as either endangered, threatened, sensitive, or candidate, as well as species listed or proposed for listing by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

27. Washington State Department of Health. 2001. List of approved systems and products. 45 pp. Available at: http://www.doh.wa.gov/ehp/ts/Approved_Systems_List_May-2001.PDF

This document outlines the list of conventional, alternative, and proprietary on-site wastewater technologies approved for use in Washington State. Conditions for the use of these systems and products are described in the Recommended Standards and Guidance published by the Washington State Department of Health. The most recently published edition of these documents are available at:

<http://www.doh.wa.gov/ehp/ts/pubs.htm#wastewater>

28. Weiskel, P. K., Howes, B. L., and Heufelder, G. R. 1996. Coliform contamination of a coastal embayment: Sources and transport pathways. Environmental Science and Technology, vol. 30, no. 6, pp. 1872-1881.

This article documents the effects of bacterial contamination on a coastal embayment in Massachusetts.

Kelp and Eelgrass Beds

Classification

1. Berry, H. D., Harper, J. R., Mumford, Jr., T. F., Bookheim, B. E., Sewell, A. T., and Tamayo, L. J. 2001. The Washington State shorezone inventory user's manual. Nearshore Habitat Program, Washington Department of Natural Resources.
2. Nearshore Habitat Program. 2001. The Washington State shorezone inventory. Washington Department of Natural Resources. CD-ROM.

This CD-ROM disc is a good resource for designating near shore habitat. It characterizes many biotic and physical aspects of the shoreline over a large geographic area but is limited on site-specific uses. The inventory was collected by helicopter and was not designed to capture small features.

3. Dethier, Megan N. 1990. A marine and estuarine habitat classification system for Washington State. Washington Natural Heritage Program, Washington Department of Natural Resources.

Herring and Smelt Spawning Areas

Fact Sheets

1. Washington Department of Fish and Wildlife. Not dated. Washington State sand lance fact sheet. Forage Fish Unit. Available at:
<http://www.wa.gov/wdfw/fish/forage/forage.htm>
2. Washington Department of Fish and Wildlife. Not dated. Puget Sound herring fact sheet. Forage Fish Unit. Available at:
<http://www.wa.gov/wdfw/fish/forage/forage.htm>
3. Washington Department of Fish and Wildlife. Not dated. Washington State surf smelt fact sheet. Forage Fish Unit. Available at:
<http://www.wa.gov/wdfw/fish/forage/forage.htm>

Classification

4. Penttila, D. E. 2001. Documented spawning areas of the Pacific herring (*clupea*), surf smelt (*hypomesus*), and the Pacific sand lance (*ammodytes*) in Snohomish County, Washington. Marine Resource Division, Washington Department of Fish and Wildlife. Manuscript Report.

This document depicts all currently known spawning areas for the Pacific herring, surf smelt, and Pacific sand lance within the area of Snohomish County, Washington. These type of forage fish species are an important part of the local marine nearshore food web. The spawning beaches designated in these documents include: the Kayak Point areas, Southern Port Gardner, the Picnic Point area, the Edmonds-Richmond Beach area, and the Tulalip Bay area.

Guidance

5. Lemberg, N. A., O'Toole, M. F., Penttila, D. E., and Stick, K. C. 1997. 1996 forage fish stock status report. Washington Department of Fish and Wildlife.

This 1994 report provides the status of marine forage fish stocks in Washington which include the Pacific herring (*clupea*), surf smelt (*hypomesus*), Pacific sand lance (*ammodytes*), and northern anchovy (*engraulis mordax*).

6. Penttila, D. E. and Moulton, L. L. 2001. Field manual: For sampling forage fish spawn in intertidal shore regions. First edition.

This is a field manual for sampling forage fish spawn in intertidal shores regions within San Juan County. This document was development as part of the San Juan Forage Fish Assessment Project and includes sections on study design descriptions, assessment, quality assurance, quality control, data reporting, and references.

7. Penttila, D. E. 2000. Documented spawning areas of the Pacific herring (*clupea*), surf smelt (*hypomesus*), and the Pacific sand lance (*ammodytes*) in East Jefferson County, Washington. Marine Resource Division, Washington Department of Fish and Wildlife. Manuscript Report.

This document charts all the known spawning grounds and beaches of the Pacific herring, surf smelt, and Pacific sand lance within Jefferson County and was compiled from various Washington Department of Fish and Wildlife reports from 1995-1999.

8. Penttila, D. E. 2000. Documented spawning areas of the Pacific herring (*clupea*), surf smelt (*hypomesus*), and the Pacific sand lance (*ammodytes*) in Skagit

County, Washington. Marine Resource Division, Washington Department of Fish and Wildlife. Manuscript Report.

This paper documents the spawning beaches areas of the Pacific herring, surf smelt, and Pacific sand lance in Skagit County, Washington.

9. Penttila, D. E. 1999. Documented spawning beaches of the surf smelt (*hypomesus*) and the Pacific sand lance (*ammodytes*) in Hood Canal, Washington. Marine Resource Division, Washington Department of Fish and Wildlife. Manuscript Report.

This 1999 paper documents all known spawning beaches of the surf smelt and Pacific sand lance in the Hood Canal region.

10. Penttila, D. E. 1999. Documented spawning beaches of the surf smelt (*hypomesus*) and the Pacific sand lance (*ammodytes*) in Clallam County, Washington. Marine Resource Division, Washington Department of Fish and Wildlife. Manuscript Report.

This 1999 document charts all the known spawning beaches of the surf smelt and Pacific sand lance within Clallam County, including the La Push area, the Deep Creek area, the Twin Rivers area, the Lyre River area, Dungeness Bay, Port Angeles Harbor, Sequim Bay, and Discovery Bay.

11. Penttila, D. E. 1999. Documented spawning areas of the Pacific herring (*clupea*), surf smelt (*hypomesus*), and the Pacific sand lance (*ammodytes*) in Island County, Washington. Marine Resource Division, Washington Department of Fish and Wildlife. Manuscript Report.

This 1999 paper documents the spawning beaches within Island County for the Pacific herring, surf smelt, and Pacific sand lance.

12. Penttila, D. E. 1999. Documented spawning areas of the Pacific herring (*clupea*), surf smelt (*hypomesus*), and the Pacific sand lance (*ammodytes*) in San Juan County, Washington. Marine Resource Division, Washington Department of Fish and Wildlife. Manuscript Report.

This 1999 paper charts the spawning beaches of the Pacific herring, surf smelt, and Pacific sand lance in San Juan County.

13. Penttila, D. E. 1996. Documented spawning beaches of the surf smelt (*hypomesus*) and the Pacific sand lance (*ammodytes*) in Whatcom County, Washington. Marine Resource Division, Washington Department of Fish and Wildlife. Manuscript Report. Revised, 1997.

This document depicts all currently known spawning areas for the surf smelt and Pacific sand lance within Whatcom County, Washington. These type of forage fish species are an important part of the local marine nearshore food web. The spawning beaches designated in this document include: Point Roberts Peninsula, the Semiahmoo Bay area, the Birch Point area, the Point Whitehorn area, Cherry Point, the Portage Bay area, the Southern Bellingham Bay area, and the Northern Bellingham area.

14. Penttila, D. E. 1995. Baitfish resource and habitats of Fidalgo Bay, Skagit County, Washington. Baitfish Unit, Washington Department of Fish and Wildlife. Manuscript Report.

This report reviews studies conducted in and around Fidalgo Bay between 1972-1995. It summarizes the local life histories and spawning habitats and ecology. The report also includes other marine resources observed during the study.

15. Penttila, D. E. 1995. Known spawning beaches of the surf smelt (*hypomesus*) and the Pacific sand lance (*ammodytes*) in Southern Puget Sound, Washington (Pierce, Thurston, and Mason Counties), as of March 1995. Marine Resource Division, Washington Department of Fish and Wildlife. Manuscript Report. Charts updated and revised, 1999.

This document depicts all currently known spawning areas for the surf smelt and Pacific sand lance within Southern Puget Sound including Pierce, Thurston, and Mason Counties. These type of forage fish species are an important part of the local marine nearshore food web.

16. Penttila, D. E. 1995. Spawning areas of the Pacific herring (*clupea*), surf smelt, (*hypomesus*), and Pacific sand lance (*ammodytes*) in Central Puget Sound, Washington. Marine Resource Division, Washington Department of Fish and Wildlife. Manuscript Report. Charts updated and revised. 1999.

This document depicts all currently known spawning areas for the Pacific herring, surf smelt, and sand lance within Central Puget Sound. The report summarizes pertinent Pacific elements of the life history of baitfish species in the marine waters north from the Tacoma Narrows Bridge to a line connecting Edmonds and Kingston, including the inlet systems on the east shore of the Kitsap Peninsula.

17. Penttila, D. E. 1995. Effects of shading upland vegetation on egg survival for summer spawning surf smelt on upper intertidal beaches in Puget Sound. Marine Resources Division, Washington Department of Fish and Wildlife. CD-ROM.

This study investigates how shading effects surf smelt mortalities in the northern Puget Sound.

18. Washington Department of Fish and Wildlife. 1998. Forage fish management plan: A plan for managing the forage fish resources and fisheries of Washington.

Adopted by the Washington Fish and Wildlife Commission on January 24, 1998, this document contains a plan for the management of forage fish resources and fisheries in Washington State. This guidance document is used to guide resource management decisions and establish priorities regarding forage fish, such as Pacific herring, eulachon, northern anchovy, Pacific sand lance, surf smelt, sardine, and longfin smelt.

19. Washington Department of Fish and Wildlife. 1999. Documented spawning beaches of the surf smelt (*hypomesus*) and Pacific sand lance (*ammodytes*) in Hood Canal, Washington.

This briefing report documents surf smelt spawning seasons throughout the Puget Sound basin. The entire surf smelt spawning habitat survey record of the Washington Department of Fish and Wildlife, 1972-1999, was examined and spawning dates of individual broods of eggs estimated.

Naturally Occurring Ponds (Under 20 Acres)

Guidance

- Morgan, J. T. 1998. Annotated bibliography for Washington's priority habitats: Freshwater wetlands and fresh deepwater. Washington Department of Fish and Wildlife.

This document is an annotated bibliography from the Washington Department of Fish and Wildlife Priority Habitats and Species (PHS) Program. The PHS program develops management recommendations for the state's priority habitat and species through a review and synthesis of the best scientific information available. The bibliography includes a wetlands bibliography and a bibliography reference organized by PHS headings that includes: definition, rationale, distribution, habitat description, fish and wildlife use, impact of land use, and management recommendations.

Waters of the State

Classification

Washington, State of. WAC 222-16-030 defines water types and a water typing system.

Waters of the state are defined in Title 222 WAC, the forest practices rules and regulations. Counties and cities should use the classification system established in WAC 222-16-030 to classify waters of the state. Waters of the state are to be classified according to the new Department of Natural Resources stream typing method (Type S, F, and N waters), in cooperation with the Departments of Ecology and Fish and Wildlife and in consultation with affected tribal governments. The mapping is based on a multi-parameter, field-verified GIS logistic regression model. This model is habitat-driven and uses geomorphic parameters. Until these water type maps are available, an interim five stream typing system should be used. Fish habitat water types are to be updated every five years based on observed field conditions. Chapter 365-190-080(5)(vi) WAC describes how jurisdictions may consider further factors when classifying waters of the state as fish and wildlife habitats.

Water, Including Lakes, Ponds, Streams, and Rivers Where Finfish Have Been Released and Lands Where Shellfish Have Been Planted

Local governments should consult with the local tribal entity and the Washington Department of Fish and Wildlife for the latest finfish release information.

Northwest Indian Fisheries Commission
6730 Martin Way E.
Olympia, WA 98512
(360) 438-1180

Columbia River Intertribal Fisheries Commission
729 N.E. Oregon, Suite 200
Portland, OR 97232
(503) 238-0667

Washington Department of Fish and Wildlife, Fish Program
600 Capital Way N.
Olympia, WA 98501-1091
(360) 902-2700

Designation

1. Washington Department of Fish and Wildlife. 2001. Spring hatchery trout stocking plan for Washington lakes and streams – Annual Report. #FPA 01-02.

This publication is helpful to anglers who are looking for information on trout planting in the state and where the best opportunities for catching fish might be. Annually updated, this report can be obtained by calling the Washington Department of Fish and Wildlife at (360) 902-2700.

2. Washington Department of Fish and Wildlife. 2000. Steelhead harvest summary report.

This annually updated report offers the previous year's planting data for steelhead in the state of Washington. This report gives anglers information on where steelhead are being planted and caught in the previous year.

Guidance

3. Morgan, J. T. 1998. Annotated bibliography for Washington's priority habitats: Freshwater wetlands and fresh deepwater. Washington Department of Fish and Wildlife.

This document is an annotated bibliography from the Washington Department of Fish and Wildlife Priority Habitats and Species (PHS) Program. The PHS program develops management recommendations for the state's priority habitat and species through a review and synthesis of the best scientific information available. The bibliography includes a wetlands bibliography and a bibliography reference organized by PHS headings that includes: definition, rationale, distribution, habitat description, fish and wildlife use, impact of land use, and management recommendations.

State Natural Areas Preserves and Natural Resources Conservation Areas

1. Washington Department of Natural Resources. 2001. State of Washington natural heritage plan. Washington Natural Heritage Program. Available at: www.wa.gov/dnr/htdocs/fr/nhp

As required by Chapter 79.70 RCW, this plan presents the criteria for the selection and approval of natural areas and lists the natural heritage resources to be considered for protection. In addition, the plan identifies priorities for protection and the roles for various agencies and groups in natural area protection.

Washington Natural Heritage Program

Washington Department of Natural Resources
1111 Washington Street S.E.
P.O. Box 47014
Olympia, WA 98504-7014

2. Washington Department of Natural Resources. 1997. Endangered, threatened, and sensitive vascular plants of Washington with working lists of rare, non-vascular species. Washington Natural Heritage Program. 62 pp.

This publication reflects the most current information available on the rare plants of Washington. The information was compiled by amateur and professional botanists. The purpose of this publication is to promote the conservation of rare plant species in Washington by serving as the most current reference on the status of Washington's rare plant species; help focus conservation attention on those species most in need of special consideration; and assist land and resource managers and planners in determining which species of concern might occur within their management jurisdiction.

3. Washington Department of Natural Resources. 1992. State of Washington natural resources conservation areas: Statewide management plan. 33 pp.

The Natural Resources Conservation Areas Statewide Management Plan guides the management of conservation areas within Washington State, based upon Chapter 79.71 RCW. Currently there are 27 natural resource conservation areas that total more than 85,000 acres statewide. Conservation areas are designated to maintain, enhance, or restore ecological systems and habitat for threatened, endangered, and sensitive plants and animals, while providing opportunities for education and low impact use. Maintaining exceptional scenic landscapes is also a high priority. The statewide plan sets the standard for a program that will combine site protection and low impact public use.

4. Natural area preserves publications are available through Natural Areas Program, Washington Department of Natural Resources. Additional Information about Natural Area Preserves and Natural Resource Conservation Areas is available by contacting:

Natural Areas Program
Lands and Resources Division
Washington Department of Natural Resources
P.O. Box 47016
Olympia, WA 98504-7016
(360) 902-1340

For a list of individual region Natural Areas managers in seven statewide offices, call the number listed above or consult the Washington Department of Natural Resources Web site at:

<http://www.wa.gov/dnr/base/execfone.htm>

Section 6: Special Consideration For Anadromous Fish Life Cycles

The citations listed are not an exclusive list of all the best available science currently published on anadromous fish, but offer a source of scientifically valid information useful for local planning and permitting efforts. Local governments are encouraged to consult with qualified scientific experts or teams of experts to help identify and determine if more current valid scientific information exists and assess its applicability to the relevant critical areas.

Special Consideration for Anadromous Fisheries

1. Aquatic Habitat Guidelines Project Web site: <http://www.wa.gov/wdfw/hab/ahg>

This Web site contains a suite of state-of-the-knowledge white papers that synthesize the scientific and technical literature on a variety of topics. The purpose of the papers is to provide a basis for development of future guidance materials for salmon issues. The Aquatic Habitat Guidelines project is a joint venture of the Washington Departments of Ecology, Fish and Wildlife, and Transportation. In July 2001, the U.S. Army Corps of Engineers, Seattle District, joined the Aquatic Habitat Guidelines Steering Committee.

2. Cederholm, C. J., Johnson, D. H., Bilby, R. E., Dominguez, L., G., Garrett, A. M., Graeber, W. H., Greda, E. L., Kunze, M. D., Marcot, B. G., Palmisano, J. F., Plotnikoff, R. W., Percy, W. G., Simenstad, C.A., and Trotter, P. C. 2000. Pacific salmon and wildlife-ecological contexts, relationships, and implications for management. Special Edition Technical Report, Prepared for D. H. Johnson and T. A. O'Neil, Wildlife-Habitat Relationships in Oregon and Washington. Washington Department of Fish and Wildlife.

This special edition technical report synthesizes fundamental and crucial information linking salmon and wildlife species and the broader aquatic and terrestrial realms in which they co-exist. Readers will find that this report will greatly strengthen the collective understanding of the role that salmon play in the populations of Pacific Northwest wildlife species and the ecology of freshwater ecosystems, and how management activities – such as hatcheries – and harvest can impact this. Copies of this report can be acquired by contacting:

David H. Johnson
Washington Department of Fish and Wildlife
Habitat Program
600 Capitol Way N.
Olympia, WA 98501-1091

3. Spence, B. C., Lomnický, G. A., Hughes, R. M., and Novitzki, R. P. 1996. An ecosystem approach to salmonid conservation. ManTech Environmental Research Services Corporation. TR-4501-96-6057.

Available from the National Marine Fisheries Service, Portland, Oregon.
Available at:

<http://www.nwr.noaa.gov/1habcon/habweb/ManTech/front.htm#References>

This document provides the technical basis from which government agencies and landowners can develop and implement an ecosystem approach to habitat conservation planning, protection, and restoration of aquatic habitat on nonfederal lands. The report also describes a process for developing, approving, and monitoring habitat conservation plans, pre-listing agreements, and other conservation agreements for nonfederal lands to be consistent with the mandates of applicable legal requirements. An appendix lists information resources that landowners and agencies may find useful in developing and evaluating habitat conservation plans. More than 1,100 sources are cited in this document.

4. National Research Council. 1996. Upstream: Salmon and society in the Pacific Northwest. Committee on Protection and Management of Pacific Northwest Anadromous Salmonids, National Academy of Science. 472 pp.

This publication can be viewed and purchased through National Academy of Science publication Web site at:

<http://www.nap.edu/books/0309053250/html/index.html>

The report deals with anadromous forms of the seven species of the genus *Oncorhynchus*, including: chinook, chum, coho, pink, and sockeye salmon and the anadromous forms of rainbow and cutthroat trout – steelhead and sea-run cutthroat. The Committee on Protection and Management of Pacific Northwest Anadromous Salmonids was asked to “evaluate options for improving the prospects for long-term sustainability of the stocks, and to consider economic and social implications of such changes.” They were asked to perform the following tasks: assess the status of the salmon stocks, analyze the causes of declines, and analyze options for intervention. The committee considered all stages of salmon life histories and options for intervention and likely effectiveness.

5. Washington Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. Washington State Salmon and Steelhead Stock Inventory (SASSI). Washington Department of Fish and Wildlife. 212 pp.

SASSI is now called Salmon Stock Inventory (SaSI). The Salmon Stock Inventory is a standardized, uniform approach to identifying and monitoring the status of Washington's salmonid fish stocks. The inventory is a compilation of data on all wild stocks and a scientific determination of each stock's status as: healthy, depressed, critical, unknown, or extinct. SaSI thus is a basis for prioritizing recovery efforts and for measuring the results of future recovery actions. SaSI is a cooperative product of the Washington Department of Fish and Wildlife and the tribal co-managers.

To learn more about the SaSI program, contact:

<http://www.wa.gov/wdfw/fish/sassi/intro.htm>

6. Washington State Conservation Commission. Salmonid habitat limiting factors reports.

These individual watershed-scaled reports are available at:

<http://www.conserver/prg/salmon/index.phps>

Habitat limiting factors reports are developed for each water resource inventory area (WRIA) in Washington State. Check the referenced Web site for a current listing of completed reports. The reports identify habitat conditions that limit the ability of habitats to fully sustain populations of salmonids. The results of assessing habitat-limiting factors will be used to help develop strategies for salmon recovery and identify gaps in existing information. Maps illustrating the known extent of salmonid distribution in individual streams are included at a scale of 1:24,000.

7. Washington Department of Fish and Wildlife. Salmon and Steelhead Habitat Inventory and Assessment Program (SSHAP). Available at: <http://www.wa.gov/wdfw/hab/sshiap/>
8. Washington Department of Fish and Wildlife. Salmon and Steelhead Statistical Inventory (SASSI). Available at: <http://www.wa.gov/wdfw/hab/release.htm>
9. Washington Department of Fish and Wildlife. Information about requesting maps from WDFW. Available at: <http://www.wa.gov/wdfw/hab/release.htm>
10. Joint Natural Resources Cabinet. 2001. Guidance on watershed assessment for salmon. 54 pp. Available at: <http://www.governor.wa.gov/esa/watershed/watershed.htm>

While this guidance document focuses on salmon habitat, the key activities and products discussed have a broader utility to other initiatives, such as water quality and water supply assessments.

For further updated information, contact:

Governor's Salmon Recovery Office
P.O. Box 43135
Olympia, WA 98504-3135
(360) 902-2231

Appendix A: State Agency Contacts

Agency	Name	Title	Work Phone	Fax Number	E-mail Address	Region/ Specialty	Counties
Department of Ecology							
Department of Ecology, Shorelands and Environmental Assistance	Adelsman, Hedia	GMA Coordinator	(360) 407-6222	(360) 407-6902	hade461@ecy.wa.gov	Statewide	Statewide
Department of Ecology, Shorelands and Environmental Assistance	Boeholt, Ann	Environmental Specialist	(360) 407-6221	(360) 407-6305	aboe461@ecy.wa.gov	Wetlands, Critical Area Ordinances	Clallam, Jefferson, Mason, Pierce, Thurston
Department of Ecology, Shorelands and Environmental Assistance	Canning, Doug	Environmental Specialist / Geologically Hazardous Areas, Regulation, and Technical Support	(360) 407-6781	(360) 407-6902	dcan461@ecy.wa.gov	Statewide	Statewide
Department of Ecology, Shorelands and Environmental Assistance	D'Acci, Tim	Floodplain Lead, Policy and Regulations / Floods, Policy, Regulations	(360) 407-6796	(360) 407-6902	tdac461@ecy.wa.gov	Statewide	Statewide
Department of Ecology, Shorelands and Environmental Assistance	Driscoll, Lauren	Environmental Specialist / Mitigation Banking	(360) 407-6861	(360) 407-6902	ldri461@ecy.wa.gov	Statewide	Statewide
Department of Ecology, Shorelands and Environmental Assistance	Granger, Teri	Environmental Planner / Best Available Science, Project Coordinator	(360) 407-6857	(360) 407-6902	tgra461@ecy.wa.gov	Statewide	Statewide

Agency	Name	Title	Work Phone	Fax Number	E-mail Address	Region/ Specialty	Counties
Department of Ecology, Shorelands and Environmental Assistance	Hruby, Tom	Senior Ecologist / Best Available Science	(360) 407-7274	(360) 407-6902	thru461@ecy.wa.gov	Statewide	Statewide
Department of Ecology, Shorelands and Environmental Assistance	Keys, Penny	Environmental Technician / GMA Document Coordinator	(360) 407-6927	(360) 407-6902	pkey461@ecy.wa.gov	Statewide	Statewide
Department of Ecology, Shorelands and Environmental Assistance	Lund, Perry	Section Manager	(360) 407-7260	(360) 407-6305	plun461@ecy.wa.gov	Wetlands, Critical Area Ordinances	Grays Harbor, Pacific
Department of Ecology, Shorelands and Environmental Assistance	McMillan, Andy	Policy Lead / Wetlands Policy and Regulation, Best Available Science	(360) 407-7272	(360) 407-6902	anmc461@ecy.wa.gov	Statewide	Statewide
Department of Ecology, Shorelands and Environmental Assistance	Merker, Chris	Environmental Specialist	(509) 456-6174	(509) 456-6175	cmer461@ecy.wa.gov	Wetlands, Critical Area Ordinances	Adams, Asotin, Columbia, Garfield, Grant, Ferry, Franklin, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman
Department of Ecology, Shorelands and Environmental Assistance	Meyer, Susan	Environmental Specialist	(425) 649-7168	(425) 649-7098	sume461@ecy.wa.gov	Wetlands, Critical Area Ordinances	Island, Skagit, Whatcom
Department of Ecology, Shorelands and Environmental Assistance	Murphy, Brad	Environmental Specialist	(360) 407-7273	(360) 407-6305	bmur461@ecy.wa.gov	Wetlands, Critical Area Ordinances	Clark, Cowlitz, Lewis, Skamania, Wahkiakum

Agency	Name	Title	Work Phone	Fax Number	E-mail Address	Region/ Specialty	Counties
Department of Ecology, Shorelands and Environmental Assistance	Olson, Ted	Environmental Engineer / Floodplain Issues	(509) 456-2862	(509) 456-6175	tols461@ecy.wa.gov	Eastern Regional Office	Adams, Asotin, Columbia, Garfield, Grant, Ferry, Franklin, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman
Department of Ecology, Shorelands and Environmental Assistance	Reed, Catherine	Environmental Specialist	(509) 575-2616	(509) 575-2809	craj461@ecy.wa.gov	Wetlands, Critical Area Ordinances	Benton, Klickitat, Kittitas, Yakima
Department of Ecology, Shorelands and Environmental Assistance	Schuppe, Mark	Environmental Specialist	(509) 575-2384	(509) 575-2809	msch461@ecy.wa.gov	Wetlands, Critical Area Ordinances	Chelan, Douglas, Okanogan
Department of Ecology, Shorelands and Environmental Assistance	Sokol, Dan	Environmental Planner / Floodplain Issues	(360) 407-7253	(360) 407-6305	dsok461@ecy.wa.gov	Southwest Regional Office	Benton, Chelan, Clallam, Clark, Cowlitz, Douglas, Grays Harbor, Jefferson, Klickitat, Kittitas, Lewis, Mason, Okanogan, Pacific, Pierce, Skamania, Thurston, Yakima
Department of Ecology, Shorelands and Environmental Assistance	Steele, Chuck	Environmental Planner / Floodplain Issues	(425) 649-7139	(425) 649-7098	chst461@ecy.wa.gov	Northwest Regional Office	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom
Department of Ecology, Shorelands and Environmental Assistance	Stockdale, Erik	Environmental Specialist	(425) 649-7061	(425) 649-7098	esto461@ecy.wa.gov	Watershed Planning and Technical Assistance	Northwest Region
Department of Ecology, Shorelands and Environmental Assistance	Suggs, Sarah	Environmental Specialist	(425) 649-7124	(425) 649-7098	ssug461@ecy.wa.gov	Wetlands, Critical Area Ordinances	King, Kitsap, San Juan, Snohomish

Agency	Name	Title	Work Phone	Fax Number	E-mail Address	Region/ Specialty	Counties
Department of Ecology, Water Quality Program	Morgan, Laurie	Hydrogeologist / Aquifer Recharge Areas	(360) 407-6483		lmor461@ecy.wa.gov	Statewide	Statewide
Department of Fish and Wildlife							
Department of Fish and Wildlife, Habitat Program	Azerrad, Jeff	PHS/GMA Biologist / Fish and Wildlife	(509) 456-4079	(509) 456-4071	azerrjima@dfw.wa.gov	Eastern (Region 1 – Spokane)	Ferry, Stevens, Pend Oreille, Lincoln, Spokane, Whitman, Walla Walla, Columbia, Garfield, Asotin
Department of Fish and Wildlife, Habitat Program	Baxter, Bruce	Area Habitat Biologist / Fish and Wildlife	(360) 249-1228	(360) 664-0689	baxterbab@dfw.wa.gov	Coastal (Region 6 - Montesano)	Grays Harbor
Department of Fish and Wildlife, Habitat Program	Byrnes, Chris	Area Habitat Biologist / Fish and Wildlife	(360) 417-1426	(360) 417-3302	byrneccb@dfw.wa.gov	Coastal (Region 6 - Montesano)	Clallam, Jefferson
Department of Fish and Wildlife, Habitat Program	Carnevali, Debbie	Area Habitat Biologist / Fish and Wildlife	(360) 264-5148	(360) 664-0689	carneddc@dfw.wa.gov	Coastal (Region 6 - Montesano)	Pierce, Thurston
Department of Fish and Wildlife, Habitat Program	Davis, Jeff	Area Habitat Biologist / Fish and Wildlife	(360) 895-3965	(360) 876-1894	davisjpd@dfw.wa.gov	Coastal (Region 6 - Montesano)	Kitsap, Mason, Pierce
Department of Fish and Wildlife, Habitat Program	Goldsmith, Mark	PHS/GMA Biologist / Fish and Wildlife	(425) 379-2308	(425) 338-1066	goldsmfg@dfw.wa.gov	North Puget Sound (Region 4 - Mill Creek)	Whatcom, Skagit, Snohomish, King, San Juan, Island
Department of Fish and Wildlife, Habitat Program	Manlow, Steve	Regional Habitat Program Manager / Fish and Wildlife	(360) 906-6731	(360) 906-6776	manloswm@dfw.wa.gov	Southwest Region (Region 5 - Vancouver)	Clark, Cowlitz, Klickitat, Lewis, Skamania, Wahkiakum
Department of Fish and Wildlife, Habitat Program	March, Katherine	PHS/GMA Biologist / Fish and Wildlife	(509) 754-4624	(509) 754-5257	marchkcm@dfw.wa.gov	North Central (Region 2 - Ephrata)	Okanogan, Chelan, Douglas, Grant, Adams

Agency	Name	Title	Work Phone	Fax Number	E-mail Address	Region/ Specialty	Counties
Department of Fish and Wildlife, Habitat Program	McMurry, Key	Area Habitat Biologist / Fish and Wildlife	(360) 249-4628	(360) 664-0689	mcmurklm@dfw.wa.gov	Coastal (Region 6 - Montesano)	Pacific, Grays Harbor
Department of Fish and Wildlife, Habitat Program	Nauer, Don	Area Habitat Biologist / Fish and Wildlife	(253) 863-7979	(253) 863-7979	nauerdcn@dfw.wa.gov	Coastal (Region 6 - Montesano)	King, Pierce
Department of Fish and Wildlife, Habitat Program	Rogers, Gloria	Area Habitat Biologist / Fish and Wildlife	(360) 495-3068	(360) 664-0689	rogerqsr@dfw.wa.gov	Coastal (Region 6 - Montesano)	Grays Harbor, Mason
Department of Fish and Wildlife, Habitat Program	Schirato, Margie	Area Habitat Biologist / Fish and Wildlife	(360) 427-2179	(360) 432-8707	schirmms@dfw.wa.gov	Coastal (Region 6 - Montesano)	Mason, Thurston (marine waters only)
Department of Fish and Wildlife, Habitat Program	Shaffer, Anne	Area Habitat Biologist / Fish and Wildlife	(360) 457-2634	(360) 417-3302	shaffjas@dfw.wa.gov	Coastal (Region 6 - Montesano)	Clallam, Jefferson (marine waters only)
Department of Fish and Wildlife, Habitat Program	Small, Doris	Area Habitat Biologist / Fish and Wildlife	(360) 895-4756	(360) 876-1894	smalldjs@dfw.wa.gov	Coastal (Region 6 - Montesano)	Kitsap, Mason
Department of Fish and Wildlife, Habitat Program	Teske, Mark	PHS/GMA Biologist / Fish and Wildlife	(509) 962-3421	(509) 925-4702	teskemst@dfw.wa.gov	South Central (Region 3 - Yakima)	Kittitas, Yakima, Benton, Franklin
Department of Fish and Wildlife, Intergovernmental Policy	Deusen, Millard	Land Use Policy Coordinator / Fish and Wildlife	(360) 902-2562	(360) 902-2947	deusemsd@dfw.wa.gov	Statewide	Statewide
Department of Natural Resources							
Department of Natural Resources	Kurowski, Stan	Project Section Manager	(360) 856-3500	(360) 856-2150	stanley.kurowski@wadnr.gov	Northwest Region	Snohomish, Skagit, Whatcom, San Juan, Island

Agency	Name	Title	Work Phone	Fax Number	E-mail Address	Region/ Specialty	Counties
Department of Natural Resources, Asset Management and Protection	Sharar, Anne	Environmental Planner	(360) 902-1739	(360) 902-1776	anne.sharar@wadnr.gov	Headquarters	Statewide
Department of Natural Resources, Aquatic Resources Division	Flores, Hugo	Environmental Planner / Shoreline Management Act	(360) 902-1126	(360) 902-1786	hugo.flores@wadnr.gov	Headquarters	Statewide – Aquatic Resources
Department of Natural Resources, Growth Management Program	Huestis, Roger	Growth Management Coordinator	(509) 684-7474	(509) 684-7484	roger.huestis@wadnr.gov	Northeast Region	Okanogan, Ferry, Stevens, Pend Oreille, Spokane
Department of Natural Resources, Growth Management Program	Wedin, Dick	Growth Management Coordinator	(509) 925-8510	(509) 925-8522	dick.wedin@wadnr.gov	Southeast Region	Chelan, Douglas, Kittitas, Klickitat, Yakima, Skamania (part), Grant, Benton, Franklin, Lincoln, Adams, Walla Walla, Garfield, Asotin, Whitman, Columbia
Department of Natural Resources, Public Lands	Johnson, Bob	District Manager	(360) 748-2383	(360) 274-4196	johnson.bob@wadnr.gov	Central	
Department of Natural Resources, State Lands	Hotvedt, Jim	State Land Assistant Regional Manager	(360) 740-6803	(360) 748-2387	jim.hotvedt@wadnr.gov	Central	Grays Harbor, Pacific, Lewis, Thurston
Department of Natural Resources, State Lands	McClelland, Douglas	Asset Operations Manager	(360) 825-1631	(360) 825-1672	doug.mcclelland@wadnr.gov	South Puget Sound Region	King
Department of Natural Resources, Washington Natural Heritage Program	Caplow, Florence	Rare Plant Botanist	(360) 902-1793	(360) 902-1789	florence.caplow@wadnr.gov	Statewide	
Department of Natural Resources, Washington Natural Heritage Program	Chappell, Chris	Vegetation Ecologist	(360) 902-1671	(360) 902-1789	chris.chappell@wadnr.gov	Western Washington	

Agency	Name	Title	Work Phone	Fax Number	E-mail Address	Region/ Specialty	Counties
Department of Natural Resources, Washington Natural Heritage Program	Crawford, Rex	Vegetation Ecologist	(360) 902-1749	(360) 902-1789	rex.crawford@wadnr.gov	Eastern Washington	
Department of Natural Resources, Washington Natural Heritage Program	Farone, Steve	Information Manager	(360) 902-1349	(360) 902-1789	steve.farone@wadnr.gov	Statewide	
Department of Natural Resources, Washington Natural Heritage Program	Fleckenstein, John	Zoologist / Rare Bats and Butterflies	(360) 902-1674	(360) 902-1789	john.fleckenstein@wadnr.gov	Statewide	
Department of Natural Resources, Washington Natural Heritage Program	Gamon, John	Program Leader / Lead Scientist	(360) 902-1661	(360) 902-1789	john.gamon@wadnr.gov	Statewide	
Department of Natural Resources, Washington Natural Heritage Program	Hallock, Lisa	Herpetologist	(360) 902-1670	(360) 902-1789	lisa.haddock@wadnr.gov	Statewide	
Department of Natural Resources, Washington Natural Heritage Program	Swope Moody, Sandy	Environmental Review Coordinator / Information Requests	(360) 902-1667	(360) 902-1789	sandra.moody@wadnr.gov	Statewide	
Office of Community Development							
Office of Community Development, Growth Management Services	Andersen, David	Senior Planner	(360) 725-3049	(360) 753-2950	davida@cted.wa.gov	N/A	Chelan, Douglas, Ferry, Grant
Office of Community Development, Growth Management Services	Babineau, Patrick	Senior Planner	(360) 725-3045	(360) 753-2950	patrickb@cted.wa.gov	N/A	Island, Mason, Pacific
Office of Community Development, Growth Management Services	Caputo, Dee	Senior Planner	(360) 725-3068	(360) 753-2950	deeca@cted.wa.gov	N/A	Columbia, Garfield, Kittitas, Spokane, Walla Walla, Pend Oreille
Office of Community Development, Growth Management Services	Gadbaw, Holly	Senior Planner and Review Manager	(360) 725-3048	(360) 753-2950	hollyg@cted.wa.gov	N/A	Clark, Whatcom

Agency	Name	Title	Work Phone	Fax Number	E-mail Address	Region/ Specialty	Counties
Office of Community Development, Growth Management Services	Gage, Ted	Senior Planner	(360) 725-3049	(360) 753-2950	tedg@cted.wa.gov	N/A	Adams, Benton, Cowlitz, Franklin, Okanogan, Stevens, Yakima
Office of Community Development, Growth Management Services	Nwankwo, Ike	Senior Planner and Technical and Financial Assistance Programs Manager	(360) 725-3056	(360) 753-2950	iken@cted.wa.gov	N/A	King, Pierce
Office of Community Development, Growth Management Services	Ojennus, Matt	Assistant Planner	(360) 725-3057	(360) 753-2950	matthewo@cted.wa.gov	N/A	Thurston
Office of Community Development, Growth Management Services	Parsons, Chris	Senior Planner	(360) 725-3058	(360) 753-2950	chrisp@cted.wa.gov	N/A	Skagit, Kitsap
Office of Community Development, Growth Management Services	Peters, Doug	Senior Planner	(360) 725-3046	(360) 753-2950	douglasp@cted.wa.gov	N/A	Clallam, Jefferson
Office of Community Development, Growth Management Services	Riley, Peter	Senior Planner	(360) 725-3067	(360) 753-2950	peterr@cted.wa.gov	N/A	Snohomish, San Juan, Lewis
Puget Sound Water Quality Action Team							
Puget Sound Water Quality Action Team	Broadhurst, Ginny	Local Liaison	(360) 738-6122	(360) 736-6122	gbroadhurst@psat.wa.gov	N/A	San Juan
Puget Sound Water Quality Action Team	Cambalik, John	Local Liaison	(360) 582-0575	(360) 582-0575	jcambalik@psat.wa.gov	N/A	Kitsap, Jefferson, Clallam

Agency	Name	Title	Work Phone	Fax Number	E-mail Address	Region/ Specialty	Counties
Puget Sound Water Quality Action Team	Drinkwin, Joan	Local Liaison	(360) 848-0924	(360) 848-0924	jdinkwin@psat.wa.gov	N/A	Island, Snohomish
Puget Sound Water Quality Action Team	Glascoe, Stuart	Local Liaison	(360) 407-7319	(360) 407-7333	sglascoe@psat.wa.gov	N/A	Whatcom, Skagit
Puget Sound Water Quality Action Team	Ransom, Tim	Local Liaison	(360) 407-7323	(360) 407-7333	transom@psat.wa.gov	N/A	Thurston, Mason
Puget Sound Water Quality Action Team	Taylor, Kathy	Local Liaison	(253) 333-4920	(360) 407-7333	ktaylor@psat.wa.gov	N/A	King, Pierce

Appendix B: Statutory and Administrative Code References

GROWTH MANAGEMENT ACT – RCW 36.70A

References to Critical Areas Policies and Development Regulations

RCW § 36.70A.020. Planning goals

The following goals are adopted to guide the development and adoption of comprehensive plans and development regulations of those counties and cities that are required or choose to plan under RCW 36.70A.040. The following goals are not listed in order of priority and shall be used exclusively for the purpose of guiding the development of comprehensive plans and development regulations:

- (1) Urban growth. Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner.
- (2) Reduce sprawl. Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development.
- (3) Transportation. Encourage efficient multimodal transportation systems that are based on regional priorities and coordinated with county and city comprehensive plans.
- (4) Housing. Encourage the availability of affordable housing to all economic segments of the population of this state, promote a variety of residential densities and housing types, and encourage preservation of existing housing stock.
- (5) Economic development. Encourage economic development throughout the state that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens of this state, especially for unemployed and for disadvantaged persons, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the state's natural resources, public services, and public facilities.
- (6) Property rights. Private property shall not be taken for public use without just compensation having been made. The property rights of landowners shall be protected from arbitrary and discriminatory actions.
- (7) Permits. Applications for both state and local government permits should be processed in a timely and fair manner to ensure predictability.
- (8) Natural resource industries. Maintain and enhance natural resource-based industries, including productive timber, agricultural, and fisheries industries. Encourage the conservation of productive forest lands and productive agricultural lands, and discourage incompatible uses.

(9) Open space and recreation. Encourage the retention of open space and development of recreational opportunities, conserve fish and wildlife habitat, increase access to natural resource lands and water, and develop parks.

(10) Environment. Protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water.

(11) Citizen participation and coordination. Encourage the involvement of citizens in the planning process and ensure coordination between communities and jurisdictions to reconcile conflicts.

(12) Public facilities and services. Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.

(13) Historic preservation. Identify and encourage the preservation of lands, sites, and structures, that have historical or archaeological significance.

RCW § 36.70A.050. Guidelines to classify agriculture, forest, and mineral lands and critical areas

(1) Subject to the definitions provided in RCW 36.70A.030, the department shall adopt guidelines, under chapter 34.05 RCW, no later than September 1, 1990, to guide the classification of: (a) Agricultural lands; (b) forest lands; (c) mineral resource lands; and (d) critical areas. The department shall consult with the department of agriculture regarding guidelines for agricultural lands, the department of natural resources regarding forest lands and mineral resource lands, and the department of ecology regarding critical areas.

(2) In carrying out its duties under this section, the department shall consult with interested parties, including but not limited to: (a) Representatives of cities; (b) representatives of counties; (c) representatives of developers; (d) representatives of builders; (e) representatives of owners of agricultural lands, forest lands, and mining lands; (f) representatives of local economic development officials; (g) representatives of environmental organizations; (h) representatives of special districts; (i) representatives of the governor's office and federal and state agencies; and (j) representatives of Indian tribes. In addition to the consultation required under this subsection, the department shall conduct public hearings in the various regions of the state. The department shall consider the public input obtained at such public hearings when adopting the guidelines.

(3) The guidelines under subsection (1) of this section shall be minimum guidelines that apply to all jurisdictions, but also shall allow for regional differences that exist in Washington State. The intent of these guidelines is to assist counties and cities in

designating the classification of agricultural lands, forest lands, mineral resource lands, and critical areas under RCW 36.70A.170.

(4) The guidelines established by the department under this section regarding classification of forest lands shall not be inconsistent with guidelines adopted by the department of natural resources.

RCW § 36.70A.060. Natural resource lands and critical areas – Development regulations

(1) Each county that is required or chooses to plan under RCW 36.70A.040, and each city within such county, shall adopt development regulations on or before September 1, 1991, to assure the conservation of agricultural, forest, and mineral resource lands designated under RCW 36.70A.170. Regulations adopted under this subsection may not prohibit uses legally existing on any parcel prior to their adoption and shall remain in effect until the county or city adopts development regulations pursuant to RCW 36.70A.040. Such regulations shall assure that the use of lands adjacent to agricultural, forest, or mineral resource lands shall not interfere with the continued use, in the accustomed manner and in accordance with best management practices, of these designated lands for the production of food, agricultural products, or timber, or for the extraction of minerals. Counties and cities shall require that all plats, short plats, development permits, and building permits issued for development activities on, or within five hundred feet of, lands designated as agricultural lands, forest lands, or mineral resource lands, contain a notice that the subject property is within or near designated agricultural lands, forest lands, or mineral resource lands on which a variety of commercial activities may occur that are not compatible with residential development for certain periods of limited duration. The notice for mineral resource lands shall also inform that an application might be made for mining-related activities, including mining, extraction, washing, crushing, stockpiling, blasting, transporting, and recycling of minerals.

(2) Each county and city shall adopt development regulations that protect critical areas that are required to be designated under RCW 36.70A.170. For counties and cities that are required or choose to plan under RCW 36.70A.040, such development regulations shall be adopted on or before September 1, 1991. For the remainder of the counties and cities, such development regulations shall be adopted on or before March 1, 1992.

(3) Such counties and cities shall review these designations and development regulations when adopting their comprehensive plans under RCW 36.70A.040 and implementing development regulations under RCW 36.70A.120 and may alter such designations and development regulations to insure consistency.

(4) Forest land and agricultural land located within urban growth areas shall not be designated by a county or city as forest land or agricultural land of long-term commercial significance under RCW 36.70A.170 unless the city or county has

enacted a program authorizing transfer or purchase of development rights.

RCW § 36.70A.160. Identification of open space corridors – Purchase authorized

Each county and city that is required or chooses to prepare a comprehensive land use plan under RCW 36.70A.040 shall identify open space corridors within and between urban growth areas. They shall include lands useful for recreation, wildlife habitat, trails, and connection of critical areas as defined in RCW 36.70A.030. Identification of a corridor under this section by a county or city shall not restrict the use or management of lands within the corridor for agricultural or forest purposes. Restrictions on the use or management of such lands for agricultural or forest purposes imposed after identification solely to maintain or enhance the value of such lands as a corridor may occur only if the county or city acquires sufficient interest to prevent development of the lands or to control the resource development of the lands. The requirement for acquisition of sufficient interest does not include those corridors regulated by the interstate commerce commission, under provisions of [16 U.S.C. Sec. 1247\(d\)](#), [16 U.S.C. Sec. 1248](#), or [43 U.S.C. Sec. 912](#). Nothing in this section shall be interpreted to alter the authority of the state, or a county or city, to regulate land use activities.

The city or county may acquire by donation or purchase the fee simple or lesser interests in these open space corridors using funds authorized by RCW 84.34.230 or other sources.

RCW § 36.70A.170. Natural resource lands and critical areas – Designations

(1) On or before September 1, 1991, each county, and each city, shall designate where appropriate:

(a) Agricultural lands that are not already characterized by urban growth and that have long-term significance for the commercial production of food or other agricultural products;

(b) Forest lands that are not already characterized by urban growth and that have long-term significance for the commercial production of timber;

(c) Mineral resource lands that are not already characterized by urban growth and that have long-term significance for the extraction of minerals; and

(d) Critical areas.

(2) In making the designations required by this section, counties and cities shall consider the guidelines established pursuant to RCW 36.70A.050.

RCW § 36.70A.172. Critical areas – Designation and protection – Best available science to be used

(1) In designating and protecting critical areas under this chapter, counties and cities shall include the best available science in developing policies and development regulations to protect the functions and values of critical areas. In addition, counties and cities shall give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries.

(2) If it determines that advice from scientific or other experts is necessary or will be of substantial assistance in reaching its decision, a growth management hearings board may retain scientific or other expert advice to assist in reviewing a petition under RCW 36.70A.290 that involves critical areas.

Review of Policies Relating to RCW 36.70A.172 can be found in the following Court of Appeals case and in the Law Review Article:

If a city or county chooses to adopt critical areas policies, the board has jurisdiction, pursuant to RCW 36.70A.280, to review such policies, but only for purpose of determining whether the policies are in compliance with the requirement of this section to include the best available science in the process of developing a policy. Honesty in [Envtl. Analysis & Legislation v. Central Puget Sound Growth Mgt. Hearings Bd., 96 Wn. App. 522, 979 P.2d 864 \(1999\).](#)

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Including best available science in the designation and protection of critical areas under the growth management act. [23 Seattle U. L. Rev. 97 \(1999\).](#)

**CHAPTER 190. MINIMUM GUIDELINES TO CLASSIFY AGRICULTURE, FOREST, MINERAL LANDS AND CRITICAL AREAS
PART THREE GUIDELINES**

WAC § 365-190-080 (2001)

WAC 365-190-080. Critical areas.

(1) Wetlands. The wetlands of Washington State are fragile ecosystems which serve a number of important beneficial functions. Wetlands assist in the reduction of erosion, siltation, flooding, ground and surface water pollution, and provide wildlife, plant, and fisheries habitats. Wetlands destruction or impairment may result in increased public and private costs or property losses.

In designating wetlands for regulatory purposes, counties and cities shall use the definition of wetlands in RCW 36.70A.030(22). Counties and cities are requested and encouraged to make their actions consistent with the intent and goals of "protection of wetlands," Executive Orders 89-10 and 90-04 as they exist on

September 1, 1990. Additionally, counties and cities should consider wetlands protection guidance provided by the department of ecology including the model wetlands protection ordinance.

(a) Counties and cities that do not now rate wetlands shall consider a wetlands rating system to reflect the relative function, value, and uniqueness of wetlands in their jurisdictions. In developing wetlands rating systems, counties and cities should consider the following:

(i) The Washington State four-tier wetlands rating system;

(ii) Wetlands functions and values;

(iii) Degree of sensitivity to disturbance;

(iv) Rarity; and

(v) Ability to compensate for destruction or degradation.

If a county or city chooses to not use the state four-tier wetlands rating system, the rationale for that decision must be included in its next annual report to department of community development.

(b) Counties and cities may use the National Wetlands Inventory as an information source for determining the approximate distribution and extent of wetlands. This inventory provides maps of wetland areas according to the definition of wetlands issued by the United States Department of Interior – Fish and Wildlife Service, and its wetland boundaries should be delineated for regulation consistent with the wetlands definition in RCW 36.70A.030(22).

(c) Counties and cities should consider using the methodology in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, cooperatively produced by the United States Army Corps of Engineers, United States Environmental Protection Agency, United States Department of Agriculture Soil Conservation Service, and United States Fish and Wildlife Service, that was issued in January 1989, and regulatory guidance letter 90-7 issued by the United States Corps of Engineers on November 29, 1990, for regulatory delineations.

(2) Aquifer recharge areas. Potable water is an essential life sustaining element. Much of Washington's drinking water comes from ground water supplies. Once ground water is contaminated it is difficult, costly, and sometimes impossible to clean up. Preventing contamination is necessary to avoid exorbitant costs, hardships, and potential physical harm to people.

The quality of ground water in an aquifer is inextricably linked to its recharge area. Few studies have been done on aquifers and their recharge areas in Washington

State. In the cases in which aquifers and their recharge areas have been studied, affected counties and cities should use this information as the base for classifying and designating these areas.

Where no specific studies have been done, counties and cities may use existing soil and surficial geologic information to determine where recharge areas are. To determine the threat to ground water quality, existing land use activities and their potential to lead to contamination should be evaluated.

Counties and cities shall classify recharge areas for aquifers according to the vulnerability of the aquifer. Vulnerability is the combined effect of hydrogeological susceptibility to contamination and the contamination loading potential. High vulnerability is indicated by land uses that contribute contamination that may degrade ground water, and hydrogeologic conditions that facilitate degradation. Low vulnerability is indicated by land uses that do not contribute contaminants that will degrade ground water, and by hydrogeologic conditions that do not facilitate degradation.

(a) To characterize hydrogeologic susceptibility of the recharge area to contamination, counties and cities may consider the following physical characteristics:

(i) Depth to ground water;

(ii) Aquifer properties such as hydraulic conductivity and gradients;

(iii) Soil (texture, permeability, and contaminant attenuation properties);

(iv) Characteristics of the vadose zone including permeability and attenuation properties; and

(v) Other relevant factors.

(b) The following may be considered to evaluate the contaminant loading potential:

(i) General land use;

(ii) Waste disposal sites;

(iii) Agriculture activities;

(iv) Well logs and water quality test results; and

(v) Other information about the potential for contamination.

(c) Classification strategy for recharge areas should be to maintain the quality of the

ground water, with particular attention to recharge areas of high susceptibility. In recharge areas that are highly vulnerable, studies should be initiated to determine if ground water contamination has occurred. Classification of these areas should include consideration of the degree to which the aquifer is used as a potable water source, feasibility of protective measures to preclude further degradation, availability of treatment measures to maintain potability, and availability of alternative potable water sources.

(d) Examples of areas with a critical recharging effect on aquifers used for potable water, may include:

(i) Sole source aquifer recharge areas designated pursuant to the Federal Safe Drinking Water Act.

(ii) Areas established for special protection pursuant to a ground water management program, chapters 90.44, 90.48, and 90.54 RCW, and chapters 173-100 and 173-200 WAC.

(iii) Areas designated for wellhead protection pursuant to the Federal Safe Drinking Water Act.

(iv) Other areas meeting the definition of "areas with a critical recharging effect on aquifers used for potable water" in these guidelines.

(3) Frequently flooded areas. Floodplains and other areas subject to flooding perform important hydrologic functions and may present a risk to persons and property. Classifications of frequently flooded areas should include, at a minimum, the 100-year floodplain designations of the Federal Emergency Management Agency and the National Flood Insurance Program.

Counties and cities should consider the following when designating and classifying frequently flooded areas:

(a) Effects of flooding on human health and safety, and to public facilities and services;

(b) Available documentation including federal, state, and local laws, regulations, and programs, local studies and maps, and federal flood insurance programs;

(c) The future flow floodplain, defined as the channel of the stream and that portion of the adjoining floodplain that is necessary to contain and discharge the base flood flow at build out without any measurable increase in flood heights;

(d) The potential effects of tsunamis, high tides with strong winds, sea level rise resulting from global climate change, and greater surface runoff caused by increasing impervious surfaces.

(4) Geologically hazardous areas.

(a) Geologically hazardous areas include areas susceptible to erosion, sliding, earthquake, or other geological events. They pose a threat to the health and safety of citizens when incompatible commercial, residential, or industrial development is sited in areas of significant hazard. Some geological hazards can be reduced or mitigated by engineering, design, or modified construction or mining practices so that risks to health and safety are acceptable. When technology cannot reduce risks to acceptable levels, building in geologically hazardous areas is best avoided. This distinction should be considered by counties and cities that do not now classify geological hazards as they develop their classification scheme.

(b) Areas that are susceptible to one or more of the following types of hazards shall be classified as a geologically hazardous area:

(i) Erosion hazard;

(ii) Landslide hazard;

(iii) Seismic hazard; or

(iv) Areas subject to other geological events such as coal mine hazards and volcanic hazards including: Mass wasting, debris flows, rockfalls, and differential settlement.

(c) Counties and cities should classify geologically hazardous area as either:

(i) Known or suspected risk;

(ii) No risk;

(iii) Risk unknown – data are not available to determine the presence or absence of a geological hazard.

(d) Erosion hazard areas are at least those areas identified by the United States Department of Agriculture Soil Conservation Service as having a "severe" rill and inter-rill erosion hazard.

(e) Landslide hazard areas shall include areas potentially subject to landslides based on a combination of geologic, topographic, and hydrologic factors. They include any areas susceptible because of any combination of bedrock, soil, slope (gradient), slope aspect, structure, hydrology, or other factors. Example of these may include, but are not limited to the following:

(i) Areas of historic failures, such as:

(A) Those areas delineated by the United States Department of Agriculture Soil Conservation Service as having a "severe" limitation for building site development;

(B) Those areas mapped as class u (unstable), uos (unstable old slides), and urs (unstable recent slides) in the department of ecology coastal zone atlas; or

(C) Areas designated as quaternary slumps, earthflows, mudflows, lahars, or landslides on maps published as the United States Geological Survey or department of natural resources division of geology and earth resources.

(ii) Areas with all three of the following characteristics:

(A) Slopes steeper than fifteen percent; and

(B) Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and

(C) Springs or ground water seepage;

(iii) Areas that have shown movement during the holocene epoch (from ten thousand years ago to the present) or which are underlain or covered by mass wastage debris of that epoch;

(iv) Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials;

(v) Slopes having gradients steeper than eighty percent subject to rockfall during seismic shaking;

(vi) Areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action;

(vii) Areas that show evidence of, or are at risk from snow avalanches;

(viii) Areas located in a canyon or on an active alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding;

(ix) Any area with a slope of forty percent or steeper and with a vertical relief of ten or more feet except areas composed of consolidated rock. A slope is delineated by establishing its toe and top and measured by averaging the inclination over at least ten feet of vertical relief.

(e) Seismic hazard areas shall include areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction, or surface faulting. One indicator of potential for future earthquake

damage is a record of earthquake damage in the past. Ground shaking is the primary cause of earthquake damage in Washington. The strength of ground shaking is primarily affected by:

- (i) The magnitude of an earthquake;
- (ii) The distance from the source of an earthquake;
- (iii) The type of thickness of geologic materials at the surface; and
- (iv) The type of subsurface geologic structure.

Settlement and soil liquefaction conditions occur in areas underlain by cohesionless soils of low density, typically in association with a shallow ground water table.

(f) Other geological events:

(i) Volcanic hazard areas shall include areas subject to pyroclastic flows, lava flows, debris avalanche, inundation by debris flows, mudflows, or related flooding resulting from volcanic activity.

(ii) Mine hazard areas are those areas underlain by, adjacent to, or affected by mine workings such as adits, gangways, tunnels, drifts, or air shafts. Factors which should be considered include: Proximity to development, depth from ground surface to the mine working, and geologic material.

(5) Fish and wildlife habitat conservation areas. Fish and wildlife habitat conservation means land management for maintaining species in suitable habitats within their natural geographic distribution so that isolated subpopulations are not created. This does not mean maintaining all individuals of all species at all times, but it does mean cooperative and coordinated land use planning is critically important among counties and cities in a region. In some cases, intergovernmental cooperation and coordination may show that it is sufficient to assure that a species will usually be found in certain regions across the state.

(a) Fish and wildlife habitat conservation areas include:

(i) Areas with which endangered, threatened, and sensitive species have a primary association;

(ii) Habitats and species of local importance;

(iii) Commercial and recreational shellfish areas;

(iv) Kelp and eelgrass beds; herring and smelt spawning areas;

(v) Naturally occurring ponds under twenty acres and their submerged aquatic beds that provide fish or wildlife habitat;

(vi) Waters of the state;

(vii) Lakes, ponds, streams, and rivers planted with game fish by a governmental or tribal entity; or

(viii) State natural area preserves and natural resource conservation areas.

(b) Counties and cities may consider the following when classifying and designating these areas:

(i) Creating a system of fish and wildlife habitat with connections between larger habitat blocks and open spaces;

(ii) Level of human activity in such areas including presence of roads and level of recreation type (passive or active recreation may be appropriate for certain areas and habitats);

(iii) Protecting riparian ecosystems;

(iv) Evaluating land uses surrounding ponds and fish and wildlife habitat areas that may negatively impact these areas;

(v) Establishing buffer zones around these areas to separate incompatible uses from the habitat areas; and

(vi) Restoring of lost salmonid habitat.

(c) Sources and methods

(i) Counties and cities should classify seasonal ranges and habitat elements with which federal and state listed endangered, threatened, and sensitive species have a primary association and which, if altered, may reduce the likelihood that the species will maintain and reproduce over the long term.

(ii) Counties and cities should determine which habitats and species are of local importance. Habitats and species may be further classified in terms of their relative importance.

Counties and cities may use information prepared by the Washington department of wildlife to classify and designate locally important habitats and species. Priority habitats and priority species are being identified by the department of wildlife for all lands in Washington State. While these priorities are those of the department, they and the data on which they are based may be considered by counties and cities.

(iii) Shellfish areas. All public and private tidelands or bedlands suitable for shellfish harvest shall be classified as critical areas. Counties and cities should consider both commercial and recreational shellfish areas. Counties and cities should at least consider the Washington department of health classification of commercial and recreational shellfish growing areas to determine the existing condition of these areas. Further consideration should be given to the vulnerability of these areas to contamination. Shellfish protection districts established pursuant to chapter 90.72 RCW shall be included in the classification of critical shellfish areas.

(iv) Kelp and eelgrass beds; herring and smelt spawning areas. Counties and cities shall classify kelp and eelgrass beds, identified by department of natural resources aquatic lands division and the department of ecology. Though not an inclusive inventory, locations of kelp and eelgrass beds are compiled in the *Puget Sound Environmental Atlas, Volumes 1 and 2*. Herring and smelt spawning times and locations are outlined in WAC 220-110-240 through 220-110-260 and the *Puget Sound Environmental Atlas*.

(v) Naturally occurring ponds under twenty acres and their submerged aquatic beds that provide fish or wildlife habitat.

Naturally occurring ponds do not include ponds deliberately designed and created from dry sites, such as canals, detention facilities, wastewater treatment facilities, farmponds, temporary construction ponds (of less than three years duration), and landscape amenities. However, naturally occurring ponds may include those artificial ponds intentionally created from dry areas in order to mitigate conversion of ponds, if permitted by a regulatory authority.

(vi) Waters of the state. Waters of the state are defined in Title 222 WAC, the forest practices rules and regulations. Counties and cities should use the classification system established in WAC 222-16-030 to classify waters of the state.

Counties and cities may consider the following factors when classifying waters of the state as fish and wildlife habitats:

(A) Species present which are endangered, threatened or sensitive, and other species of concern;

(B) Species present which are sensitive to habitat manipulation;

(C) Historic presence of species of local concern;

(D) Existing surrounding land uses that are incompatible with salmonid habitat;

(E) Presence and size of riparian ecosystems;

(F) Existing water rights; and

(G) The intermittent nature of some of the higher classes of waters of the state.

(vii) Lakes, ponds, streams, and rivers planted with game fish.

This includes game fish planted in these water bodies under the auspices of a federal, state, local, or tribal program or which supports priority fish species as identified by the department of wildlife.

(viii) State natural area preserves and natural resource conservation areas. Natural area preserves and natural resource conservation areas are defined, established, and managed by department of natural resources.

Statutory Authority: RCW 36.70A.050. 91-07-041, § 365-190-080, filed 3/15/91, effective 4/15/91.

GROWTH MANAGEMENT ACT – PROCEDURAL CRITERIA FOR ADOPTING COMPREHENSIVE PLANS AND DEVELOPMENT REGULATIONS PART FOUR INVENTORIES AND REVIEWS

WAC 365-195-410. Critical areas.

(1) *Requirements.* Prior to the development of comprehensive plans, cities and counties ought to have designated critical areas and adopted regulations protective of them. Such areas are defined to include:

(a) Wetlands;

(b) Areas of critical recharging effect on aquifers used for potable water;

(c) Fish and wildlife habitat conservation areas;

(d) Frequently flooded areas; and

(e) Geologically hazardous areas.

The previous designations and regulations shall be reviewed in the comprehensive plan process to ensure consistency.

(2) *Recommendations for meeting requirements.* Much of the analysis which is the basis for the comprehensive plan will come later than the initial identification and regulation of critical areas. The result may be plan features which conflict with the previous critical area provisions.

(a) The department has issued guidelines for the classification of critical areas

which are contained in chapter 365-190 WAC.

(b) Critical areas should be designated and protected wherever the applicable natural conditions exist, whether within or outside of urban growth areas.

(c) The review of existing designations should, in most cases, be limited to the question of consistency with the comprehensive plan, rather than a revisiting of the entire prior designation and regulation process. However, to the extent that new information is available or errors have been discovered, the review process should take this information into account.

(d) In connection with critical area protection, the department recommends that planning jurisdictions identify the policies by which decisions are made on when and how police powers will be used (regulation) and when and how other means will be employed (purchases, development rights, etc.).

Statutory Authority: RCW 36.70A.190 (4)(b). 92-23-065, § 365-195-410, filed 11/17/92, effective 12/18/92.

PROCEDURAL CRITERIA FOR ADOPTING COMPREHENSIVE PLANS AND DEVELOPMENT REGULATIONS

PART NINE DEVELOPMENT REGULATIONS

WAC 365-195-900. Background and purpose.

(1) Counties and cities planning under RCW 36.70A.040 are subject to continuing review and evaluation of their comprehensive land use plan and development regulations. Every five years they must take action to review and revise their plans and regulations, if needed, to ensure they comply with the requirements of the Growth Management Act. RCW 36.70A.130.

(2) Counties and cities must include the "best available science" when developing policies and development regulations to protect the functions and values of critical areas and must give "special consideration" to conservation or protection measures necessary to preserve or enhance anadromous fisheries. RCW 36.70A.172(1). The rules in WAC 365-195-900 through 365-195-925 are intended to assist counties and cities in identifying and including the best available science in newly adopted policies and regulations and in this periodic review and evaluation and in demonstrating they have met their statutory obligations under RCW 36.70A.172(1).

(3) The inclusion of the best available science in the development of critical areas policies and regulations is especially important to salmon recovery efforts, and to other decision-making affecting threatened or endangered species.

(4) These rules are adopted under the authority of RCW 36.70A.190 (4)(b) which

requires the department of community, trade, and economic development (department) to adopt rules to assist counties and cities to comply with the goals and requirements of the Growth Management Act.

WAC 365-195-905. Criteria for determining which information is the "best available science."

- (1) This section provides assessment criteria to assist counties and cities in determining whether information obtained during development of critical areas policies and regulations constitutes the "best available science."
- (2) Counties and cities may use information that local, state, or federal natural resource agencies have determined represents the best available science consistent with criteria set out in WAC 365-195-900 through 365-195-925. The department will make available a list of resources that state agencies have identified as meeting the criteria for best available science pursuant to this chapter. Such information should be reviewed for local applicability.
- (3) The responsibility for including the best available science in the development and implementation of critical areas policies or regulations rests with the legislative authority of the county or city. However, when feasible, counties and cities should consult with a qualified scientific expert or team of qualified scientific experts to identify scientific information, determine the best available science, and assess its applicability to the relevant critical areas. The scientific expert or experts may rely on their professional judgment based on experience and training, but they should use the criteria set out in WAC 365-195-900 through 365-195-925 and any technical guidance provided by the department. Use of these criteria also should guide counties and cities that lack the assistance of a qualified expert or experts, but these criteria are not intended to be a substitute for an assessment and recommendation by a qualified scientific expert or team of experts.
- (4) Whether a person is a qualified scientific expert with expertise appropriate to the relevant critical areas is determined by the person's professional credentials and/or certification, any advanced degrees earned in the pertinent scientific discipline from a recognized university, the number of years of experience in the pertinent scientific discipline, recognized leadership in the discipline of interest, formal training in the specific area of expertise, and field and/or laboratory experience with evidence of the ability to produce peer-reviewed publications or other professional literature. No one factor is determinative in deciding whether a person is a qualified scientific expert. Where pertinent scientific information implicates multiple scientific disciplines, counties and cities are encouraged to consult a team of qualified scientific experts representing the various disciplines to ensure the identification and inclusion of the best available science.
- (5) Scientific information can be produced only through a valid scientific process. To ensure that the best available science is being included, a county or city should

consider the following:

(a) *Characteristics of a valid scientific process.* In the context of critical areas protection, a valid scientific process is one that produces reliable information useful in understanding the consequences of a local government's regulatory decisions and in developing critical areas policies and development regulations that will be effective in protecting the functions and values of critical areas. To determine whether information received during the public participation process is reliable scientific information, a county or city should determine whether the source of the information displays the characteristics of a valid scientific process. The characteristics generally to be expected in a valid scientific process are as follows:

1. *Peer review.* The information has been critically reviewed by other persons who are qualified scientific experts in that scientific discipline. The criticism of the peer reviewers has been addressed by the proponents of the information. Publication in a refereed scientific journal usually indicates that the information has been appropriately peer-reviewed.
2. *Methods.* The methods that were used to obtain the information are clearly stated and able to be replicated. The methods are standardized in the pertinent scientific discipline or, if not, the methods have been appropriately peer-reviewed to assure their reliability and validity.
3. *Logical conclusions and reasonable inferences.* The conclusions presented are based on reasonable assumptions supported by other studies and consistent with the general theory underlying the assumptions. The conclusions are logically and reasonably derived from the assumptions and supported by the data presented. Any gaps in information and inconsistencies with other pertinent scientific information are adequately explained.
4. *Quantitative analysis.* The data have been analyzed using appropriate statistical or quantitative methods.
5. *Context.* The information is placed in proper context. The assumptions, analytical techniques, data, and conclusions are appropriately framed with respect to the prevailing body of pertinent scientific knowledge.
6. *References.* The assumptions, analytical techniques, and conclusions are well referenced with citations to relevant, credible literature, and other pertinent existing information.

(b) *Common sources of scientific information.* Some sources of information routinely exhibit all or some of the characteristics listed in (a) of this subsection. Information derived from one of the following sources may be considered scientific information if the source possesses the characteristics in Table 1. A county or city may consider information to be scientifically valid if the source possesses the

characteristics listed in (a) of this subsection. The information found in Table 1 provides a general indication of the characteristics of a valid scientific process typically associated with common sources of scientific information.

Table 1

	CHARACTERISTICS					
	Peer Review	Methods	Logical conclusions and reasonable inferences	Quantitative analysis	Context	References
<u>SOURCES OF SCIENTIFIC INFORMATION</u>						
A. Research. Research data collected and analyzed as part of a controlled experiment (or other appropriate methodology) to test a specific hypothesis.	x	x	x	x	x	x
B. Monitoring. Monitoring data collected periodically over time to determine a resource trend or evaluate a management program.		x	x	y	x	x
C. Inventory. Inventory data collected from an entire population or population segment (e.g., individuals in a plant or animal species) or an entire ecosystem or ecosystem segment (e.g., the species in a particular wetland).		x	x	y	x	x
D. Survey. Survey data collected from a statistical sample from a population or ecosystem.		x	x	y	x	x
E. Modeling. Mathematical or symbolic simulation or representation of a natural system. Models generally are used to understand and explain occurrences that cannot be directly observed.	x	x	x	x	x	x
F. Assessment. Inspection and evaluation of site-specific information by a qualified scientific expert. An assessment may or may not involve collection of new data.		x	x		x	x
G. Synthesis. A comprehensive review and explanation of pertinent literature and other relevant existing knowledge by a qualified scientific expert.	x	x	x		x	x
H. Expert Opinion. Statement of a qualified scientific expert based on his or her best professional judgment and experience in the pertinent scientific discipline. The opinion may or may not be based on site-specific information.			x		x	x

x = characteristic must be present for information derived to be considered scientifically valid and reliable

y = presence of characteristic strengthens scientific validity and reliability of information derived, but is not essential to ensure scientific validity and reliability

(c) *Common sources of nonscientific information.* Many sources of information usually do not produce scientific information because they do not exhibit the necessary characteristics for scientific validity and reliability. Information from these sources may provide valuable information to supplement scientific information, but it is not an adequate substitute for scientific information. Nonscientific information should not be used as a substitute for valid and available scientific information. Common sources of nonscientific information include the following:

(i) Anecdotal information. One or more observations which are not part of an organized scientific effort (for example, "I saw a grizzly bear in that area while I was hiking").

(ii) Nonexpert opinion. Opinion of a person who is not a qualified scientific expert in a pertinent scientific discipline (for example, "I do not believe there are grizzly bears in that area").

(iii) Hearsay. Information repeated from communication with others (for example, "At a lecture last week, Dr. Smith said there were no grizzly bears in that area").

(6) Counties and cities are encouraged to monitor and evaluate their efforts in critical areas protection and incorporate new scientific information, as it becomes available.

WAC 365-195-910. Criteria for obtaining the best available science.

(1) Consultation with state and federal natural resources agencies and tribes can provide a quick and cost-effective way to develop scientific information and recommendations. State natural resource agencies provide numerous guidance documents and model ordinances that incorporate the agencies' assessments of the best available science. The department can provide technical assistance in obtaining such information from state natural resources agencies, developing model GMA-compliant critical areas policies and development regulations, and related subjects. The department will make available to interested parties a current list of the best available science determined to be consistent with criteria set out in WAC 365-195-905 as identified by state or federal natural resource agencies for critical areas.

(2) A county or city may compile scientific information through its own efforts, with or without the assistance of qualified experts, and through state agency review and the Growth Management Act's required public participation process. The county or city should assess whether the scientific information it compiles constitutes the best available science applicable to the critical areas to be protected, using the criteria set out in WAC 365-195-900 through 365-195-925 and any technical guidance provided by the department. If not, the county or city should identify and assemble

additional scientific information to ensure it has included the best available science.

WAC 365-195-915. Criteria for including the best available science in developing policies and development regulations.

(1) To demonstrate that the best available science has been included in the development of critical areas policies and regulations, counties and cities should address each of the following on the record:

(a) The specific policies and development regulations adopted to protect the functions and values of the critical areas at issue.

(b) The relevant sources of best available scientific information included in the decision-making.

(c) Any nonscientific information – including legal, social, cultural, economic, and political information – used as a basis for critical area policies and regulations that depart from recommendations derived from the best available science. A county or city departing from science-based recommendations should:

(i) Identify the information in the record that supports its decision to depart from science-based recommendations;

(ii) Explain its rationale for departing from science-based recommendations; and

(iii) Identify potential risks to the functions and values of the critical area or areas at issue and any additional measures chosen to limit such risks. State Environmental Policy Act (SEPA) review often provides an opportunity to establish and publish the record of this assessment.

(2) Counties and cities should include the best available science in determining whether to grant applications for administrative variances and exemptions from generally applicable provisions in policies and development regulations adopted to protect the functions and values of critical areas. Counties and cities should adopt procedures and criteria to ensure that the best available science is included in every review of an application for an administrative variance or exemption.

WAC 365-195-920. Criteria for addressing inadequate scientific information.

Where there is an absence of valid scientific information or incomplete scientific information relating to a county's or city's critical areas, leading to uncertainty about which development and land uses could lead to harm of critical areas or uncertainty about the risk to critical area function of permitting development, counties and cities should use the following approach:

(1) A "precautionary or a no risk approach," in which development and land use activities are strictly limited until the uncertainty is sufficiently resolved; and

(2) As an interim approach, an effective adaptive management program that relies on scientific methods to evaluate how well regulatory and nonregulatory actions achieve their objectives. Management, policy, and regulatory actions are treated as experiments that are purposefully monitored and evaluated to determine whether they are effective and, if not, how they should be improved to increase their effectiveness. An adaptive management program is a formal and deliberate scientific approach to taking action and obtaining information in the face of uncertainty. To effectively implement an adaptive management program, counties and cities should be willing to:

(a) Address funding for the research component of the adaptive management program;

(b) Change course based on the results and interpretation of new information that resolves uncertainties; and

(c) Commit to the appropriate timeframe and scale necessary to reliably evaluate regulatory and nonregulatory actions affecting critical areas protection and anadromous fisheries.

WAC 365-195-925. Criteria for demonstrating "special consideration" has been given to conservation or protection measures necessary to preserve or enhance anadromous fisheries.

(1) RCW 36.70A.172(1) imposes two distinct but related requirements on counties and cities. Counties and cities must include the "best available science" when developing policies and development regulations to protect the functions and values of critical areas, and counties and cities must give "special consideration" to conservation or protection measures necessary to preserve or enhance anadromous fisheries. Local governments should address both requirements in RCW 36.70A.172(1) when developing their records to support their critical areas policies and development regulations.

(2) To demonstrate compliance with RCW 36.70A.172(1), a county or city adopting policies and development regulations to protect critical areas should include in the record evidence that it has given "special consideration" to conservation or protection measures necessary to preserve or enhance anadromous fisheries. The record should be developed using the criteria set out in WAC 365-195-900 through 365-195-925 to ensure that conservation or protection measures necessary to preserve or enhance anadromous fisheries are grounded in the best available science.

(3) Conservation or protection measures necessary to preserve or enhance

anadromous fisheries include measures that protect habitat important for all life stages of anadromous fish, including, but not limited to, spawning and incubation, juvenile rearing and adult residence, juvenile migration downstream to the sea, and adult migration upstream to spawning areas. Special consideration should be given to habitat protection measures based on the best available science relevant to stream flows, water quality and temperature, spawning substrates, instream structural diversity, migratory access, estuary and nearshore marine habitat quality, and the maintenance of salmon prey species. Conservation or protection measures can include the adoption of interim actions and long-term strategies to protect and enhance fisheries resources.

Statutory Authority: RCW 36.70A.190 (4)(b). 00-16-064, § 365-195-925, filed 7/27/00, effective 8/27/00.