Chapter 1:

INTRODUCTION

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1.1 INTRODUCTION

Best Available Science, Volume I: A Review of Science Literature is King County's report on scientific information applicable to critical areas protection under the proposed Critical Areas, Stormwater, and Clearing and Grading ordinances. This report is the companion to *Best Available Science, Volume II: Assessment of Proposed Ordinances.* In October 2003 a public review draft of these current reports was released in one volume: *Best Available Science: A Review of Literature and Assessment of the Proposed Critical Areas, Clearing and Grading, and Stormwater Ordinances*. The precursor to the October 2003 draft report was released for scientific peer review on February 14, 2003. Short papers of best available science for critical areas accompanied the December 10, 2002 first release of the proposed Critical Areas and Stormwater Ordinances. This Best Available Science (BAS) report, *Volume I: A Review of Science Literature*, and its companion, *Volume II: Assessment of Proposed Ordinances,* and the revised proposed ordinances were transmitted to the King County Executive in February 2004 and are available at **http://www.metrokc.gov/ddes/cao**.

The October 2003 *Best Available Science* Public Review draft report has been divided into two companion volumes for the Executive Reports. This was done to clarify the two distinct steps of first obtaining best available science and second, using this science to assess the consistency of the proposed regulations for critical area protection with BAS. Thus, the *Best Available Science, Volume I* report now contains only background scientific information involved in determining what is best available science for King County. The companion *Volume II*, *Assessment of Proposed Ordinances*, focuses on the assessment of the proposed King County standards, including the risk assessment process, and the policy group process. It is recommended that these two documents be used as one, as the foundation of the scientific information is integral to fully understand the assessment of the proposed standards.

This introduction chapter first explains the purpose and background to provide context for the critical areas chapters that follow. Second, additional context is provided through an overview of the laws, policies, programs, and landscape conditions that influence the selection of applicable scientific information. A final section briefly summarizes the overall content of the report.

1.1.1 Purpose and Background

The purpose of this report is to provide a compilation and review of the best available scientific information that is applicable to King County. This scientific information was selected to meet the Washington Administrative Code requirements given in WAC 365-195-900 to 925. The companion report, *Assessment of Proposed Ordinances*, discusses the State requirements to include best available science in the development of policies and regulations to protect critical areas.

Background

Washington State's response to rapid growth was the 1990 Growth Management Act (GMA), which required the largest and fastest growing counties and their cities to prepare comprehensive plans and development regulations. As part of GMA's 14 goals the comprehensive plans must manage growth to provide for the efficient provision of public services, and to protect natural resources, and critical areas. As defined in RCW 36.70A.030(5): "Critical areas" include five areas and ecosystems. These state defined critical areas have been further defined into twelve critical areas in the proposed Critical Area ordinance and then recombined into seven critical area chapters in this *Best Available Science* report (see Table 1.1).

Table 1.1 Critical Areas

Growth Management Act (RCW 36.70A.030(5)	Proposed Critical Areas Ordinance	Best Available Science Report – Executive Draft
Wetlands	Wetlands	Wetlands
Areas with a critical recharging effect on aquifers used for potable water	Critical aquifer recharge areas (CARA)	Critical Aquifer Recharge Areas (CARA)
Fish and wildlife habitat conservation areas	Aquatic areas	Aquatic Areas
	Wildlife Habitat Conservation Areas and Wildlife Habitat Networks	Wildlife Areas
Frequently flooded areas	Flood hazard areas	Flood Hazard Areas
	Channel migration zones (CMZ)	Channel Migration Zones (CMZ)
Geologically hazardous areas	Coal mine hazard areas	Geologic Hazard Areas ▪ Seismic hazard areas ▪ Erosion hazard areas ▪ Landslide hazard areas (includes steep slopes) ▪ Volcanic hazard areas ▪ Coal mine hazard areas
	Erosion hazard areas	
	Landslide hazard areas	
	Steep slope hazard areas	
	Seismic hazard areas	
	Volcanic hazard areas	

1.1.2 Overview of WAC 365-195-905 to 925

In 1995 a new State statute modified the Growth Management Act. One requirement was that

> "best available science to be used 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" (RCW 36.70A.172).
>
> Washington Administrative Code 365-195-900 gives the background and purpose of the best available science rule followed by five sections on criteria (WAC 365-195-905 to

925, Appendix A: Best Available Science Rule). The criteria provides guidance on how local governments should recognize and locate sources of valid scientific information and use that information in their decision-making processes. The criteria sections are given below with a brief description followed by a summary of how King County addressed them.

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

A key component of this criteria section is the guidance on who is a scientific expert and the characteristics of a valid scientific process. Best available science information can only be produced through a valid scientific process that generally contains peer review, clearly stated replicable methods, logical conclusions and reasonable inferences, quantitative analysis, and a proper context. Proper context is described as follows: "the assumptions, analytical techniques, data, and conclusions are appropriately framed with respect to the prevailing body of pertinent scientific knowledge" (WAC 365-195-905(5)(a)(5)).

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

This criteria section describes the different options for obtaining scientific information, such as through consultation with state and federal natural resource agencies, current State lists of best available science, or through a city or county's own efforts with state review and public participation.

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

The requirement to include best available science in the development of regulations and policies is guided by the criteria. Any departure from best available science requires a policy rationale.

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

Uncertainty in the scientific findings or gaps in the knowledge are guided by the "precautionary or a no risk approach, in which development and land use activities are strictly limited until the uncertainty is sufficiently resolved" (WAC 365-195-920). Adaptive management is given as an interim approach.

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

The final criteria section expands the protection for critical areas into a broader area of conservation, preservation, and enhancement for anadromous fisheries.

King County's Approach to Best Available Science

King County followed the criteria in WAC 365-195-910(2) for obtaining the best available science (BAS). A County internal team of science experts compiled scientific information through its own efforts and the additional assistance of qualified, external experts in consultation and peer review (Appendix C: Scientific Experts). Drafts of the best available science papers and reports were sent for State agency review and distributed as part of the Growth Management Act's required public participation process. Suggestions for any additional literature were welcome during peer and public review periods. Any additional scientific information that met the WAC criteria for best available science was incorporated into this revised draft BAS report.

An initial extensive review of scientific literature was conducted during autumn 2002 and winter 2003. The WAC criteria guided which "science", as in best available *science*, literature would be included in King County's Best Available Science report. The "best" scientific information closely met the WAC criteria. At times, two or more studies may be "best" but differ in viewpoint. These "best" studies are discussed for their strengths and weaknesses in the overall protection of the critical area. Some information may be better but it was not "available" within the time period mandated by the state GMA. Examples of not "available" information are monitoring studies that generally require multiple years of data. Also, the Water Resource Inventory Area (WRIA) plans, which are not complete, were not reviewed.

Information was primarily selected from refereed scientific journals and books that require a valid scientific process and use peer review to ensure that studies and findings are of high standards (WAC 365-195-905). Additional research studies or reports were included if conducted by qualified individuals using documented methodologies that lead to verifiable results and conclusions. Each critical area Literature Review section includes definitions, a description of functions and values of the critical area, and protection mechanisms suggested by scientific literature. The BAS information at times indicated a range in the recommendations, such as buffer widths for streams or wildlife protection. Finally, citations of supporting literature are included as part of the reference section.

1.2 CONTEXT

Determination of what is Best Available Science also considers the place or location where the science will be applied. Over the last 40 years the landscape of western King County has changed dramatically from historic resource-based activities to rapidly expanding urban and semi-rural communities**.** There is also the legal and institutional context that influences what scientific information will be included in the development of regulations. Information on the institutional context can be found in the companion report BAS *Volume II: Assessment of Proposed Ordinances*.

New and revised State and Federal legislation, as well as updates to King County's policies and programs, all influence the development and revisions of the proposed ordinances. Outlined below are the Endangered Species Act, the Clean Water Act, and the King County Comprehensive Plan. This legal context is followed by an overview of the County's

environmental landscape and its land uses. Many studies from other areas of the country, or even other countries, are applicable to King County because of similar soil types, percent and type of vegetation cover, rainfall, and other factors that influence the critical area and its function and values. These natural features are combined with the pattern of development and population growth to further determine which science findings constitute the best available science for King County.

Another reason for revisiting critical area, clearing and grading, and stormwater management protection regulations is the extensive advances in scientific knowledge in recent years. Critical areas are variable and dynamic and exist in the landscape because of integrated ecological processes. The current scientific paradigms that guide the management of fish and wildlife have shifted from a focus on species-specific and habitat-specific management to a view that includes assessment of processes that form and sustain conditions for species survival and productivity (Noss et al. 1997). New scientific understanding of the processes of river channel migration, aquifer recharge, and wetland science provide additional reason to update the critical areas regulations. Further information on the scientific approach used can be found in Chapter 2: Scientific Framework.

Overview of Laws, Policies, and Programs for Resource Conservation

The following discussion summarizes key state and federal legal requirements and the King County Comprehensive Plan.

Endangered Species Act

Chinook salmon and bull trout were proposed for listing as threatened species under the Endangered Species Act (ESA) in May 1999 and December 1999 by National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service, respectively. NMFS listed chinook salmon as threatened in January 2001. The federal agencies responsible for the listings have adopted rules that prohibit the take of these species[1]. This prohibition applies to individuals, businesses, and local governments, such as King County. In addition, coho salmon, Lake Sammamish kokanee, steelhead, and sea-run cutthroat trout have come under scrutiny for potential listing under the ESA.

King County participated in the Tri-County Salmon Conservation Coalition to develop a regional response to the ESA listings. The *Tri-County Model 4(d) Rule Response Proposal*, released by Tri-County in May 2000, provides guidance that local governments may use in their development of Critical Areas Ordinances[2]. King County has referred to the Tri-County Model as it developed

[1] "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct" in the ESA.

[2] The *Tri-County Model 4(d) Rule Response Proposal*, developed by the Tri-County Salmon Conservation Coalition, includes six programs to guide local governments in protecting chinook salmon and bull trout habitat.

draft critical area regulations. The proposed ordinance has been developed to protect habitat in conformance with the Growth Management Act, in lieu of seeking a take limit under the federal 4(d) rule for chinook salmon. Protection requirements for streams and wetlands will help protect chinook salmon and bull trout habitat, and these protections should reduce the danger that those parties engaging in development activities will cause harm to listed species in violation of the Endangered Species Act.

Clean Water Act

The broad objectives of the Clean Water Act (CWA) include the restoration and maintenance of the chemical, physical, and biological integrity of lakes, wetlands, streams and rivers, and marine waters, such as Puget Sound. To accomplish these objectives, the Clean Water Act employs numerous strategies, including the National Pollutant Discharge Elimination System (NPDES) permitting program. King County is required to obtain NPDES permits for discharges to the water resources listed above. The permitting program regulates a variety of point sources, which include wastewater treatment plants and industries, construction sites, and municipal stormwater facilities, such as roadside ditches and storm sewers. Non-point sources are also regulated through municipal stormwater permits.

The CWA mandates that municipal stormwater permits require controls, also known as best management practices, to reduce the discharge of pollutants to the maximum extent practicable. Included in King County's municipal permit are requirements that the County control runoff from new development, redevelopment, and construction sites and treat and control the addition of pollutants to runoff. King County has developed a Stormwater Management Program that guides the County's compliance with its permit requirements. King County's proposed Critical Areas Ordinance, including buffers to protect critical areas, is one of the permit requirements. Buffers help reduce the volume of pollutants, including sediment, that reaches streams and wetlands in runoff from development, redevelopment, and construction sites.

King County Comprehensive Plan

King County comprehensive planning dates back to 1964. The County's first Comprehensive Plan under the GMA was adopted in 1994, and the first major update was adopted in 2001. The King County Countywide Planning Policies, updated November 2002, set the framework for comprehensive planning throughout the County and provides goals for reducing urban sprawl, protecting rural areas, providing affordable housing throughout the County, and protection of rural resource lands and critical areas. In addition, among the countywide planning goals is direction to coordinate the protection of critical areas across jurisdictions.

King County's Comprehensive Plan states the following goals in Chapter 4 on the Environment: "environmental quality and important ecological functions shall be protected and hazards to health and property shall be minimized through development reviews and implementation of land use plans…." The Plan also encourages the use of "incentives to protect and restore the natural environment whenever practicable." The current effort to revise the proposed critical areas regulations is to implement the policies and objectives of the County Comprehensive Plan

through land use regulations to protect and conserve resources critical to public safety and to environmental conservation.

The Comprehensive Plan addresses species listed as endangered or threatened under the ESA and other species of concern including some on State list. Besides directing the County to continue participating in the Tri-County Salmon Conservation Coalition, the Comprehensive Plan states the County's intention to update regulatory and incentive programs to contribute to the conservation and recovery of local, state and federally listed species.

Landscape and Population Overview

Within the County's 2,130 square miles there is a very diverse mix of land use and land cover types. Land use types include: residential, commercial/industrial, and resource lands (agriculture, forestry, or mining; see King County Comprehensive Plan for additional land-use information). Land cover types include built or altered land surfaces, and extensive natural lands of forest, shrub, grass, rock, or water. Water is an important feature with over 700 lakes and reservoirs that cover a minimum of 43,200 acres, 100 nautical miles of Puget Sound shoreline, and 6 major salmon-bearing river systems with approximately 3,000 total stream miles. All of these lands are home to people (population over 1.7 million), 233 terrestrial species of wildlife, and numerous species of aquatic wildlife – some threatened or endangered as a result of increasing human use of the land.

King County's 39 cities cover 383 square miles (18 percent of the County's total land area). Most of the urban areas are in the incorporated western quarter of the County with eastward trending Urban Growth Areas surrounding existing towns and incorporated cities. Unincorporated King County comprises 1,747 square miles (82 percent) of the County's land area (King County 2002). The eastern half of the County is primarily forest lands in timber production, managed according to State rules and regulations, and in State and Federal wilderness lands. Between the western urbanized lands and the eastern forest lands lies a central band that is predominately zoned for agricultural, forestry, and rural residential land use This is where the majority of unincorporated King County lands are found (Map 1. Unincorporated King County Major Land Use).

Unincorporated King County

Between 1990 and 2000, population statistics changed by 160,000, a 31 percent decline, as a result of incorporation and annexation of unincorporated King County into cities inside Urban Growth Areas (UGAs). In 2000 a population of 352,800 (19 percent of the County's total population) resided primarily near the UGAs in unincorporated areas. In the coming decade, the unincorporated population should continue to decrease as more annexations occur. Most of the urban areas targeted to accommodate growth are within incorporated King County, but the unincorporated Urban Growth Areas are also zoned for higher residential densities. Residential land use thus falls into one of three categories: rural, urban reserve, or urban residential. The latter two categories are within the UGAs. Most of the commercial and industrial land uses (neighborhood, community, or regional businesses, office, and industrial use) are also within the UGA.

Rural Area is a designated land use and is comprised of all the lands outside of the designated Urban Growth Areas and Forest and Agricultural Production Districts. Low-density residential is the predominant land use, currently occupying approximately 85 percent of the land.

1.3 REVIEW OF CONTENTS

This report is organized into the following chapters:

Chapter 1 Introduction

The purpose and background for the compilation and review of best available science is provided. Key criteria sections of the Washington Administrative Code (WAC 365-195-900 to 925) are summarized and discussed in terms of King County's approach to BAS. Context is provided through laws, policies, programs, and land use.

Chapter 2 Scientific Framework

Describes the overarching scientific framework and organizing principles for King County's approach to environmental management. Discussion covers principles of conservation, context, complexity, and connectivity. The effects of development and landscape change are also illustrated in a brief discussion.

Chapters 3 through 9 each contain the following sections: (1) introduction (2) a review of the scientific literature, which includes a discussion of functions and values of the critical areas, (3) conclusions, and (4) literature references. Section 2: Literature Review summarizes a considerable amount of the most applicable scientific and technical literature. It is presumed that the primary audience is non-technical (i.e., citizens, elected officials, policy and management staff). This document has been written to satisfy scientists as well, although the latter may wish for more detail in certain sections. It is recommended that readers obtain and read the cited references if they desire a more comprehensive or detailed treatment of the concepts, functions, and processes described in this document.

Chapter 3	Flood Hazard Areas
Chapter 4	Channel Migration Zones
Chapter 5	Geologic Hazard Areas: Seismic Hazard Areas, Erosion Hazard Areas, Landslide Hazard Areas (including Steep Slopes Hazard Areas), Volcanic Hazard Areas, and Coal Mine Hazard Areas.
Chapter 6	Critical Recharge Aquifer Areas
Chapter 7	Aquatic Areas
Chapter 8	Wildlife Areas
Chapter 9	Wetlands

Appendix A Best Available Science Rule – WAC 365-195-900 to WAC 365-195-925 provides the background, purpose, and various criteria for determining best available science.

Appendix B Stormwater and Clearing and Grading: Key Science Concepts

Appendix C Scientific Experts – Qualifications of the authors of this report are provided along with a listing of the scientific experts that provided a peer review of the precursor to the October Public Review Draft Best Available Science report.

1.4 REFERENCES

Endangered Species Act Listing Documents and Rules: www.nwr.noaa.gov , www.fws.gov , www.salmoninfo.org/tricounty.htm .

King County, The 2002 King County Annual Growth Report, http://www.metrokc.gov/budget/agr/agr02/

King County, 2002 Benchmarks Report, 2002a

King County Comprehensive Plan, update 2002b http://www.metrokc.gov/ddes/compplan

National Pollution Discharge Elimination System (NPDES): www.metrokec.gov/wlr/stormwater/NPDESCompliance.htm .

Noss, R.F., M.A. O'Connell and D.D. Murphy. 1997. *The Science of Conservation Planning, Habitat Conservation under the Endangered Species Act.* Washington, D.C., Island Press.

Revised Code of Washington (RCW) 36.70A.172 http://www.leg.wa.gov/rcw/index.cfm

Washington Administrative Code (WAC) 365-195-900 to 925.