

Chapter 4:

ASSESSMENT OF STORMWATER, CLEARING AND GRADING ORDINANCES

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Chapter 4: ASSESSMENT OF STORMWATER, CLEARING AND GRADING ORDINANCES

4.1 OVERVIEW OF PROPOSED STORMWATER ORDINANCE AND SURFACE WATER DESIGN MANUAL UPDATE

The proposed Stormwater Ordinance and related update to the King County Surface Water Design Manual (SWDM) will amend the surface and storm water runoff regulations for new development and redevelopment in unincorporated King County. These regulations establish the maximum allowed impacting impervious surface area, minimum requirements for the design of drainage facilities and the drainage planning requirements for review by King County as part of building permit review.

Drainage facilities include stormwater ponds and other devices that mitigate the increased runoff and pollution caused by development. The Stormwater Ordinance amends the County's stormwater code pertaining to these facilities, whereas the SWDM update amends the administrative rules and procedures for implementing the stormwater code.

The amendments proposed by the Stormwater Ordinance and to the SWDM are intended to increase the protection of water quality and fish habitat consistent with the following objectives for compliance with state and federal requirements:

- Achieve equivalency with the Washington State Department of Ecology (DOE) 2001 Stormwater Management Manual for Western Washington, a necessary step toward compliance with the federal Clean Water Act.
- Implement the County's salmon conservation strategy in response to the recent federal listings and prohibitions against take (harm) of chinook salmon and bull trout as threatened species under the Endangered Species Act.

Proposed Requirements

King County currently regulates stormwater through the stormwater code and the 1998 version of the Surface Water Design Manual. The stormwater code requires development proposals exceeding minimum thresholds to undergo drainage review and comply with the County's drainage requirements. The SWDM provides the details for how that review is conducted and how the drainage requirements are applied to specific development projects for the design and construction of stormwater flow control and water quality treatment facilities.

The changes proposed by the Stormwater Ordinance and Surface Water Design Manual updates will increase the standards for stormwater flow control design and construction, and water quality treatment facilities. This will bring King County's drainage requirements into equivalency with the Department of Ecology's 2001 Stormwater Management Manual and will improve protection of the County's aquatic resources. The most significant changes proposed by the ordinance/SWDM update affect drainage review thresholds, flow control requirements, and water quality treatment requirements. These changes are discussed in more detail in the proposed stormwater ordinance at <http://www.metrokc.gov/ddes/cao/> and in the draft revisions to the Surface Water Design Manual: <http://dnr.metrokc.gov/wlr/dss/Manual-Draft.htm>. In addition, an impacting impervious surface limit of 10 percent is proposed for projects on rural residential parcels. Impacting impervious surface is that portion of actual impervious surface from which runoff is not fully dispersed or infiltrated into the ground and thus, has an adverse effect on downstream flows. This limit is derived from studies of Puget Sound lowland streams and wetlands in which clearly degraded habitat conditions were detected in stream basins and wetlands as the amount of impervious surface in the basins approached 10 percent (Booth et al. 2002).

Drainage Review Thresholds

Drainage review thresholds are used to determine which development proposals are subject to drainage review by the County to ensure compliance with the County's drainage requirements specified in the stormwater code/SWDM. These thresholds determine which development proposals are subject to drainage review by the County to ensure compliance with the County's drainage requirements specified in the stormwater code/SWDM. The key changes to these thresholds are as follows:

- The impervious surface threshold for when drainage review is required of a development proposal is reduced from 5,000 square feet of added impervious surface to 2,000 square feet. For rural residential lots, the threshold is reduced to 500 square feet. This change is intended to capture smaller projects to which flow control best management practices (BMPs) will be applied to reduce runoff and pollution. Such BMPs are also known as "low impact development" BMPs. Because of this threshold change, the current 2,000-square-foot threshold for projects located within a Landslide Hazard Drainage Area are no longer needed and thus eliminated.
- There is a new threshold that requires drainage review if a development proposal involves 7,000 square feet or more of land disturbing activity. A similar limitation currently applies only to areas with clearing restrictions. This change is intended to capture smaller land disturbances to which erosion and sediment control measures will be applied to reduce pollution.
- The threshold for when drainage review is required of larger redevelopment projects is changed from one based on the total cost of proposed improvements (i.e., \$500,000 or more) to one based on the cost of proposed improvements exceeding 50% of the assessed value of existing improvements. This change is consistent with the threshold for redevelopment projects in the 2001 DOE Manual. It does not apply to transportation redevelopment projects.
- The threshold for Small Project Review, a simplified and less costly alternative to regular drainage review (i.e., Full Drainage Review), is changed from one in which only single

family residential projects with 10,000 square feet or less of added impervious surface can qualify to one that allows small agricultural projects as well. In addition, either type of project may exceed 10,000 square feet of added impervious surface if the total impervious area on the property is less than 4% of the property area subject to other restrictions that may apply as specified in the SWDM.

Flow Control Requirements

These requirements currently specify when a flow control facility (e.g., a detention pond) is required and how it must be designed to meet one of three flow control performance standards (level 1, level 2, or level 3). Flow control facilities mitigate the increased runoff from new developments by storing and discharging the runoff at rates that occurred under predevelopment conditions. The extent to which all predevelopment discharge rates are matched is determined by the performance standard specified for a particular development proposal based on the protection needs of the area in which the proposal is located. Such areas are mapped in the SWDM.

The most significant changes to the flow control requirements are as follows:

- A new requirement is added mandating the application of flow control best management practices (BMPs) in addition to flow control facilities and in situations where flow control facilities are not practical or appropriate. Flow control BMPs are methods or designs for dispersing, infiltrating, or otherwise reducing or preventing development-related increases in runoff at or near the sources of those increases. These BMPs—also known as “low impact development BMPs”—include, but are not limited to, preservation and use of forested areas to soak up runoff; use of other vegetated areas to soak up runoff; use of gravel trenches to infiltrate roof runoff; storage of roof runoff for later use indoors, or outdoors for irrigation; vegetated roofs; pervious pavements; and reduction of impervious surface. Such BMPs are necessary to reduce development-related increases in runoff volume and loss of groundwater recharge, two significant types of impacts that are not possible to mitigate with flow control facilities in most cases.
- The threshold for the amount of impervious surface requiring a flow control facility or flow control BMPs is reduced from 5,000 square feet to 2,000 square feet. The clearing or alteration of 35,000 square feet or more of pervious land surface also requires a flow control facility or BMPs. These changes are intended to address those incremental increases in runoff created by smaller alterations of land and clearing activities. Such increases add up over time to cause significant cumulative impacts to fish habitat and water quality.
- The areas of the County currently mapped for application of the Level 1 Flow Control Standard will be re-mapped for application of the more stringent Level 2 Flow Control Standard. This will result in nearly all of unincorporated King County being mapped for application of the Level 2 standard consistent with the DOE Manual and the need to conserve salmon. All areas mapped for application of the Level 2 standard will be called “Conservation Flow Control Areas” to reflect the ESA meaning of conservation, which is to restore as well as protect existing fish habitat. When and if basin-specific plans or studies identify that Level 2 flow control protection is not needed to achieve ESA and Clean Water Act (CWA) compliance, these areas will be re-mapped as “Basic Flow Control Areas” for application of the Level 1 Flow Control Standard.
- In Conservation Flow Control Areas, for the purposes of designing required flow control facilities, the predevelopment condition of the land proposed for development or

redevelopment will be assumed to be that which existed historically (i.e., forested) rather than at the time of permit application as currently assumed. This will result in facilities with lower discharge rates and larger storage volumes. Over time, as land is developed and redeveloped, this change will result in progress made toward restoration of historic flow rates in streams.

- In Conservation Flow Control Areas, those redevelopment projects subject to drainage review will be required to provide flow control mitigation of both new impervious surface and existing impervious surface that is replaced by the project. Currently, redevelopment projects are only required to mitigate for new impervious surface. Over time, as land is redeveloped, this change will result in progress toward restoration of historic flow rates in streams.
- In Conservation Flow Control Areas, flow control facility requirements will apply to any existing impervious surface on the development site that was added on or after January 8, 2001 but was never mitigated by a flow control facility or BMP. January 8, 2001 is the effective date of the federal rule applying ESA take prohibitions (i.e., do no harm) to Puget Sound Chinook. This change is intended to ensure that all impervious surfaces added since that date are ultimately mitigated.

Water Quality Treatment Requirements

Water quality treatment requirements currently specify when a water quality treatment facility (e.g., a biofiltration swale or wetpond) is required and how it must be designed to meet one of four performance goals for pollutant removal. These four performance goals are: (1) basic, (2) resource stream protection, (3) sensitive lake protection, and (4) sphagnum bog protection. Water quality treatment facilities treat the runoff from pollution-generating developed surfaces by dispersing it through grass or other vegetation (biofiltration), retaining it in ponds (wetponds) to settle out pollutants, or filtering it through sand (sand filter) or other media. The extent to which pollutants are required to be removed is defined by the performance goal specified for a particular development proposal based on the protection needs of the area in which the proposal is located. The protection areas are mapped in the SWDM. The most significant changes to the water quality treatment requirements are as follows:

- The threshold for when water quality requirements apply to the clearing or alteration of pervious land surface is changed from one acre to 35,000 square feet to be consistent with the DOE Manual.
- The current exception for redevelopment projects that limits their treatment requirement to only the Basic water quality performance goal is eliminated to be consistent with the DOE Manual.
- The areas of King County currently mapped for application of the Basic water quality performance goal will be re-mapped for application of the more stringent Resource Stream Protection goal consistent with the DOE Manual and the need to conserve salmon. This will result in most of the unincorporated area being mapped for application of the Resource Stream Protection goal until such time as basin-specific plans or studies identify that such protection is not needed to achieve ESA and CWA compliance.
- In areas mapped for application of the Resource Stream Protection performance goal, this performance may be reduced to the Basic water quality goal for runoff that is infiltrated and for runoff from cleared/altered pervious land surface, residential subdivided land with a density of less than eight units per acre, and commercial development/road surfaces with low daily traffic counts.

- In areas mapped for application of the Resource Stream Protection performance goal, water quality treatment facility requirements will apply to any existing pollution-generating impervious surface on the development site that was added on or after January 8, 2001 but was never mitigated by a water quality treatment facility or a flow control BMP that meets water quality requirements. January 8, 2001 is the effective date of the federal rule applying ESA take prohibitions (i.e., do no harm) to Puget Sound Chinook. This change is intended to ensure the treatment of runoff from all pollution-generating impervious surfaces added since that date.

4.2 OVERVIEW OF PROPOSED CLEARING AND GRADING ORDINANCE

The proposed Clearing and Grading Ordinance applies to new clearing and grading activities in unincorporated King County. These regulations establish the basic requirements for when clearing and grading requires a permit and the limitations on those activities.

Maximum clearing limits and minimum open space area are established on each parcel. Clearing that results in the conversion of native vegetated land surface to developed surface (e.g., impervious surface, pasture, or grassed surface) is limited to a total of 35 percent of rural residential lots. The restrictions would apply when an expansion or change of land use is proposed on RA-zoned parcels in the Rural Area (excludes unincorporated Urban Growth Areas, and Agricultural and Forest Productions Districts). When a change in land use is not proposed, a maximum clearing limit of 35 percent still applies, but the open space requirement only applies to area that has not been legally cleared beyond the 35 percent maximum. There is no requirement that the property owner plant vegetation on any areas that have already been cleared or converted. The intent of this requirement is to minimize the impact of rural development on aquatic resources and to protect existing wildlife habitat and use.

4.3 ASSESSMENT OF PROPOSED STORMWATER CONTROL ORDINANCE

Standard: 10 Percent Impervious Surface

An impacting impervious surface limit of 10 percent is proposed for projects on Rural Area zoned residential parcels. Impacting impervious surface is that portion of actual impervious surface from which runoff is not fully dispersed or infiltrated into the ground and thus, has an adverse effect on downstream flows.

Critical Aquifer Recharge Areas (CARA) Assessment:

The proposed stormwater ordinance and SWDM update *is consistent* with BAS for protecting the quantity and quality of groundwater. Increases in impervious surfaces can degrade water quality by mobilizing contaminants from pollution-generating areas, concentrating them, and transporting them to surface water bodies and groundwater. This mobilization / concentration

disrupts the natural infiltration of rainfall through soil, which would have filtered some of the contaminants before they reached the groundwater. By restricting the addition of new impervious surfacing, fewer contaminants will be mobilized and this will likely enhance water quality.

The addition of new impervious surface can also increase runoff from the site, resulting in a reduction of recharge to local aquifers. This standard restricts addition of impervious surface to 10 percent, which has been shown to eliminate most of the aquifer recharge losses (Burkey, 2003). It is important to note that this restriction on impervious surfacing applies to all rural residential properties, not just rural residential properties within a CARA. Since areas that have low susceptibility can still contribute a large amount of total recharge to an aquifer over a large areal extent, this inclusion of all properties follows the BAS on protecting the quantity of groundwater recharge.

Geologic Hazard Areas Assessment:

This standard is consistent with BAS. Limiting the increase of effective impervious surface to 10 percent will serve to mitigate for the increase in stormflow release and velocity that is typical of areas converted from a natural surface to an impervious surface. A reduction in release rate and velocity will tend to reduce the erosive potential of the flow, though there will be other factors at work. Another way to view this issue is that there will be less erosive potential from any given site if the impervious surface is limited to 10 percent rather than say, 30 percent. It should be understood, though, that a 10 percent increase on a sloping part of a site could be potentially more damaging for erosion, landslide, and steep slope critical areas than a larger area (e.g., 30 percent) impervious surface on a flat part of the same site.

Aquatic Areas Assessment:

The proposed stormwater ordinance and SWDM update is consistent with BAS. King County's proposed manual update, together with other stormwater-related changes in the Clearing and Grading Ordinance, is considered equivalent to, and in some ways more protective of habitat, than the latest Washington State Dept. of Ecology (WDOE) *Stormwater Management Manual for Western Washington*, published in August 2001 (WDOE 2001). Examples of more protective features include: (1) a proposed 35 percent clearing restriction standard to be applied in rural areas (a.k.a. 65 percent forest protection), (2) required use of full dispersion/infiltration measures to minimize impacting impervious surface (also known as effective impervious surface) on rural development sites, (3) required pipe conveyance of discharges through mapped landslide hazard areas and certain steep slope hazard areas, and (4) increased flow control required where severe flooding problems are known downstream.

The WDOE manual recently underwent a BAS evaluation by Washington State's Independent Science Panel (WISP 2003). The panel concluded that the WDOE did "a credible job of developing guidelines and standards" and that the manual was one of the most comprehensive in the United States and impressive in its scope, coverage and quality." Three concerns were expressed by WISP as follows: (1) a larger watershed scale perspective is needed to assure that desired goals are met, including goals for salmon; (2) monitoring is needed to assess implementation, effectiveness and validation both onsite and downstream and to help extrapolate procedures to other locations; and (3) an adaptive management plan should be instituted to assure timely correction of problems and to guide future management. The panel also noted that the

manual should help prevent further degradation of stream channels but that a reversal of declining trends in habitat conditions for salmon was not a specific goal of the manual and that “information needed to design adequate guidelines to prevent “fish kills” is generally lacking, especially for effects of interacting pollutants.” Although they raised a variety of technical concerns regarding specific standards or requirements, the panel felt the scientific issues were insufficient to preclude use of the manual.

Level of Risk to Functions and Values

The proposed stormwater manual changes will increase the mitigation measures applied to new development and redevelopment to further minimize flooding and erosion risks and increase protection of water quality, and salmonids and their stream habitat. As such, the changes to stormwater standards will generally increase protection above existing standards and are therefore considered relatively low risk to salmonids and most plants and animals that are directly associated with their habitats. For water quality, the resource stream protection water quality standard was previously applied only to Regionally Significant Resource Areas (RSRA). In the stormwater update, it will be called “enhanced basic” and will be applied countywide to those land uses that generate the highest concentrations of metals in stormwater runoff.

However, as noted earlier, the proposed changes are not a “no-impact” standard of mitigation and therefore some habitat will degrade and, as a result, some organisms may suffer. Classes of plants and animals that could experience moderate to high risk of impact are those that are extremely intolerant of even slight amounts of change from natural water flow fluctuations or high water quality and that are highly dependent on clean, stable, gravel-bedded channels for their persistence. The likelihood and degree of impact would be expected to be higher for steep, erosion prone stream channels. As noted earlier, amphibians, especially giant salamanders and tailed frogs, freshwater mussels and some long-lived species of insects (e.g., certain long-lived species of stoneflies) may be good examples of animals relatively intolerant of change.

Level of Uncertainty

Because the science is clear that proper stormwater controls are a valuable part of an aquatic habitat protection strategy in developing landscapes, there is generally low uncertainty about the risk and biological benefits of hydrologic aspects of the stormwater standard. There is also little doubt that treatment of stormwater for certain, well-studied, conventional pollutants can be effective. There is an emerging high uncertainty, however, about the efficacy of the proposed treatment for removing chemicals such as endocrine disrupters, which affect reproductive physiology of fishes.

Wetlands Assessment:

The use of 10 percent impervious surface as a threshold for estimating adverse impacts within watersheds and their basins represents the latest research findings on threshold values above which wetland (Reinelt et al. 1993; Arnold and Gibbons 1996), and aquatic areas (see Aquatic Areas Assessment above) protection declines. Therefore attempting to maintain 10 percent or less impervious surface represents BAS. Thresholds are controversial in that they are based on general relationships derived from complex watershed conditions and interactions. They are perfected as additional research findings become available. Nevertheless, scientific studies

evaluating wetland and stream health using physiochemical and biological criteria are remarkably consistent in finding deterioration at relatively low impervious surface area, which is between 10 and 20 percent.

King County's proposed thresholds however do not apply to urban areas, (nor can it because of historical development). As such, this may represent a departure from BAS in those watersheds and basins where such application is still possible and beneficial.

Level of Uncertainty

The 10 percent impervious area value has been identified through several correlative studies (Booth 2000) and represents a key environmental indicator, i.e., a "simple," one-factor index, accounting for functional losses in wetlands and streams. Moreover, not all-correlative studies are in agreement with these findings and therefore King County has added clearing restriction standards as well to reduce the uncertainty of using this single standard to protect wetland functions. It is clear that the distribution of impervious areas, in addition to overall extent of imperviousness, is important in determining the level of risk. Consequently, uncertainties for wetland protection remain because it is unclear where the 10 percent impervious surface will be located within watersheds, basins, or plats.

Standard – Stormwater Control Facilities:

See King County's Stormwater Design Manual at <http://dnr.metrokc.gov/wlr/dss/Manual-Draft.htm>

Stormwater control facilities (i.e., flow control and water quality treatment facilities/BMPs) are designed to maintain and help restore critical hydrologic and water quality characteristics in the post-development landscape.

Critical Aquifer Recharge Areas (CARA) Assessment:

This standard is *consistent* with BAS for protecting critical aquifer recharge areas. As a result, the enhancement of groundwater recharge through flow control BMPs (also called Low Impact Development BMPs), by definition, promotes the groundwater quantity aspect of CARA groundwater protection efforts. Design standards for stormwater control facilities, for both conveyance and infiltration, are tailored to CARA characteristics (soil properties), and assure adequate treatment for water quality before the stormwater reaches the watertable where it can be transported horizontally and become available for potable uses (or habitat).

Aquatic Areas Assessment:

Some of the concerns raised by the Washington State's Independent Science Panel (WISP) regarding the DOE manual are addressed in King County's version of the manual, especially those addressing the watershed perspective. The County's use of three different levels of stormwater flow control reflects experience gained from extensive basin planning by King County from the late 1980s through the 1990s. Some of the County's required levels of stormwater treatment are also applied by basin based on the protection needs of that basin. Locally and Regionally Significant Resource Areas are no longer used as a basis for mapping

flow control and water quality treatment standards. Instead, a more stringent flow control standard (forested Level 2) will be applied Countywide until future plans or studies indicates this level of protection is not needed.

Level of Risk to Function and Values

There are two principal risk concerns associated with the stormwater control proposal. The first is that it is not “no impact,” thus some degradation of stream channels and water quality above current levels is likely to occur even in rural areas where a 35 percent clearing restriction standard is proposed. Secondly, by not applying a 35 percent clearing restriction standard (beyond required critical area buffers) in those urban areas where significant forest cover remains, some additional loss of forest-based hydrology and water quality will occur. This will place greater reliance on artificial methods of control (e.g., detention facilities), which are not as effective as natural forests at protecting hydrology and water quality. The likely result will be some incremental degradation of habit (erosion, siltation, poorer water quality) with effects likely to be greater in urban than rural areas which will have forest retention requirements, but nonetheless occurring to some extent in both areas.

Level of Uncertainty

There is a high degree of uncertainty about whether the standard is sufficient to meet the salmonid protection objectives and even greater uncertainty about its effect on more highly sensitive, pollution-intolerant species. This is because the stormwater element is not a “no-impact” standard and its biological efficacy has not yet been fully evaluated. Similarly, while there is little doubt that cumulative effects of land use will be much less with this standard, the cumulative effect or value of allowing development to rely wholly (in urban areas) or in part (in rural areas) on engineered solutions such as detention ponds and bioswales is not well known, creating significant uncertainty that the standard will be effective over the long term.

Wetlands Assessment:

The hydrologic and water quality condition of wetlands may get increased protection from King County’s proposed stormwater drainage regulations as they represent the latest BAS. Specifically, these stormwater control actions may better protect hydrologic related functions (e.g., groundwater exchange, vegetation, aquatic wildlife), and other wetland functions necessary to support existing and designated uses. New stormwater protection procedures may also provide methods for determining pre-development wetland hydrology and designing surface water systems to maintain critical hydrologic characteristics in the post-development landscape, based on monitoring, and hydrologic simulation models incorporating flow and water level fluctuation data in the largest developments (e.g., UPDs). Notably, levels of analysis have been customized to wetlands of differing functions and therefore may better protect wetlands from runoff. Additionally, King County has adopted very stringent nutrient control, water quality treatment requirements for developments draining to sphagnum bogs.

Hydrology, groundwater exchanges, and water quality enhancement functions provided by wetlands are often determined by conditions in the adjoining area (e.g., aquifer recharge areas). Moreover, similar to hydrology, it is the geology, soil, and vegetative conditions within the watershed that determine infiltration and the subsequent ability of wetlands to provide this

function. The wetland sediment, morphometry, and other conditions further determine the interchange. The proposed regulations pose minimum risk to the wetlands themselves, and most likely could reduce any risks currently observed. Infiltration within wetland buffers may provide some recharge or discharge functions. Consequently the proposed wetland categorization system with wider buffers may protect this function in the immediate vicinity of the wetland and lower the risk of a wetland to perform this function. Buffer averaging and buffer reductions, with concomitant enhancement, can provide an increase in groundwater exchange function depending on wetland, buffer, and landscape condition if this function is specifically targeted for improvement. Replacement of groundwater functions at one wetland for improvement of groundwater functions at another, such as proposed by off-site enhancement, restoration, or the creation of a new wetland under mitigation banking may pose a high risk (i.e., certain risk) to the ground water function in the existing wetland and to other interdependent aquatic areas and aquifers. Moreover, there is considerable risk in achieving success in providing groundwater interchange function at the mitigated site.

Level of Risk to Function and Values

Detention facilities may not be as effective in controlling flow and pollutants as complex wetland vegetation thereby increasing the risk to wetlands within natural settings. In disturbed settings detention ponds could decrease these risks to wetlands. The risk to groundwater infiltration will be greatest if facilities are built in vegetated areas.

Level of Uncertainty

Stormwater ponds will alter natural water flows to wetlands in that they capture and regulate surface water through outflows rather than enabling water to recharge groundwater and simulate pre-development flows to wetlands. This is offset in part by flow control BMPs (a.k.a. low impact development techniques) that are required in addition to flow control facilities. These flow control BMP's will help reduce changes in water level fluctuations by infiltrating more runoff from impervious surfaces into the ground at or near the source of that runoff. The uncertainty of this, however, is that some of the BMPs may not be retained or sufficiently maintained by individual lot owners. Well-designed storm water control facilities may provide considerable floodwater protection to downstream wetlands under modeled and prescribed storm conditions. For storms beyond design thresholds, however, ponds may not function as expected and consequently will overflow discharging water and pollutants into wetlands. There is a high level of certainty that sediment and sediment borne pollutants, as well as some dissolved pollutants, are effectively treated by the proposed designs. However, some dissolved pollutants, including herbicides, pesticides, and potential pathogens, may ultimately drain into wetlands and have an impact on overall functions.

4.4 ASSESSMENT OF CLEARING RESTRICTIONS

Standard: 35 Percent Clearing Restriction

Clearing shall be limited to a maximum of 35 percent of the development proposal site. The restrictions would apply when an expansion or change in land use is proposed on RA-zoned parcels in the Rural Area (excludes unincorporated UGA, APD, and FPD). When a change

in land use is not proposed, a maximum clearing limit still applies, but the open space requirement only applies to area that has not been legally cleared beyond the 35 percent maximum.

Overview: This standard would restrict clearing to a maximum of 35 percent of the development proposal site. The restrictions would apply when an expansion or change in land use is proposed on RA-zoned parcels in the Rural Area (excludes unincorporated UGA, APD, and FPD). Small lots (generally < 0.5 acre) and industrial and commercially zoned lots would not be subject to this restriction. However, these lands constitute a small percentage of the area (< 5 percent) while rural residential parcels > 0.5 acre constitute around 85 percent of the land base, thus most rural residential land would be subject to this restriction. When a change in land use is not proposed, a maximum clearing limit still applies, but the open space requirement only applies to area that has not been legally cleared beyond the 35 percent maximum.

Critical Aquifer Areas (CARA) Assessment:

This standard *is mostly consistent* with BAS for protecting critical aquifer recharge areas. Under certain conditions (mainly in outwash soils, which are not near as prevalent as till soils in King County), removal of the natural vegetation can actually increase the quantity of aquifer recharge since plants extract a high quantity of the water in transition down to the aquifers and distribute part of it to the atmosphere (through evapotranspiration). Preserving tree cover, however, does preserve the natural access to groundwater and maintains a spongy upper soil layer that can capture and store a greater part of the precipitation, which allows infiltration of the stored water throughout the year. This factor likely offsets the loss of potential recharge due to evapotranspiration. In the parts of King County where there are highly impermeable till soils, there is likely to be a net loss of groundwater recharge with the removal of forest cover.

Geologic Hazard Areas Assessment

This standard is mostly consistent with BAS in that it proposes to limit clearing on sites that may contain Landslide/Steep Slope Hazard Areas. It is well documented that clearing in these areas can lead to instability if proper steps are not taken to limit the instability. Further restrictions found in the proposed Critical Areas ordinance and Clearing and Grading ordinance, such as the Allowed Alterations table and development standards for Landslide/Steep Slope Hazard Areas, are consistent with BAS in that they limit clearing and grading in these areas and require special study of these areas prior to development. These restrictions and requirements provide a measure of safety in slide-prone areas because they limit clearing and grading that may otherwise lead to slope instability.

Aquatic Areas Assessment:

This Clearing and Grading ordinance standard is mostly consistent with BAS for aquatic Critical Areas because it strives to protect natural hydrology at the landscape scale and at the level recommended by the literature to protect hydrology. The standard is not consistent with BAS for aquatic Critical Areas because it: (1) doesn't emphasize protection of hydrologically mature

forest and (2) doesn't require contiguity of preserved vegetation with riparian buffers or upland wildlife habitat.

Level of Risk to Functions and Values

Risk to hydrology and sediment functions is considered low for most situations. Risk may rise to a moderate level when the standard is applied in steep sub-basins with high amounts of glacial till, which would tend to increase potential for erosion caused by relatively small changes in peak flows and durations. This clearing restriction standard was derived from the 65/10 stormwater standard, originally developed for the Issaquah Basin using empirical information on stream conditions and level of development from that basin. Thus, it is most applicable for watersheds with rainfall, vegetation, soil, and topography similar to the Issaquah Basin. Where watersheds are similar or less sensitive to change (e.g., less steep channels, less rainfall, less glacial till) than Issaquah Basin, downside risk of applying the 35 percent clearing restriction standard is considered low.

Where watershed characteristics are more sensitive to change (steeper, more rainfall, more till) than in the Issaquah Basin, the standard is not likely to achieve its goal and habitat and species will be at higher risk. It is expected that these areas would generally be small steep drainages with limited direct use by salmonids other than cutthroat trout (due to the propensity for them to occupy small steep streams). The larger concern is that these smaller steep streams may be important to downstream areas and if destabilized by the effects of rural development may deliver excessive sediment or polluted water to those downstream aquatic habitats.

The proposed clearing restriction is based on the protection of salmonids and their stream habitat. As such, it is considered relatively low risk to salmonids and most classes of plants and animals that are directly associated with their habitats. However, the standard is not a "no-impact" standard and therefore habitat will degrade and some species may suffer. Classes of plants and animals that could experience moderate to high risk of impact, depending on steepness and sensitivity of habitat to erosion, are those that are either extremely intolerant of even slight amounts of change and/or those that are highly dependent on stable channels, low levels of silt and fine sediment and high water quality for their persistence. As noted earlier, amphibians, especially giant salamanders and tailed frogs, freshwater mussels and some long-lived species of insects (e.g., certain species of stoneflies) may be good examples of animals relatively intolerant of change.

Level of Uncertainty

Because the science is clear that protection of native vegetation (especially older, hydrologically mature forests) is a valuable part of an aquatic habitat protection strategy, there is low uncertainty about the risk to functions and generally about biological benefits as well. However, there is a high degree of uncertainty about whether the standard is sufficient to provide substantial protection for highly sensitive, pollution-intolerant species. This is because the standard is not no impact and has not been adequately evaluated for its biological effectiveness in Bear and Issaquah creeks, which is where it has been implemented. There is little doubt that the cumulative effects of land use will be much less with this standard, but the cumulative effects of allowing landscapes with greater than 65 percent forest cover to degrade to 65 percent is not well known. This creates uncertainty on whether the standard will be effective over the long term.

Wildlife Areas Assessment :

The converse of the 35 percent clearing restriction is that 65 percent or more of a given development site will remain in native vegetation (forest or otherwise). It is assumed that retention of 65 percent of the landscape, notwithstanding the fragmentation of that 65 percent across the landscape, will help conserve biodiversity in King County by protecting foraging and other important habitats and the connections between them for various species.

Some exceptions to the 35 percent maximum clearing restriction are allowed, including exceptions that are intended to protect priority habitats. Certain wildlife habitats are identified in the Comprehensive Plan as priority habitat types that should be protected in the County. These “priority habitats” are habitat types with unique or significant value to many wildlife (and plant) species. Landowners may take advantage of additional clearing incentives (up to 50 percent clearing versus the 35 percent maximum) if the following priority habitats are protected: mature forest, old growth forest, snag-rich areas, caves, and talus slopes. King County also allows greater clearing when local wildlife corridors are protected, as well as when foraging habitat is protected for any species listed in the Comprehensive Plan. Whenever these priority habitats are protected, it is assumed that wildlife species benefit (see “Priority Habitats” in Section 1 of this chapter).

The local wildlife corridors (in combination with the Wildlife Habitat Network) are intended to preserve dispersal habitat and emigration and immigration avenues for species between priority and other important habitats throughout the region. The wildlife corridors are intended to connect patches of important wildlife habitat at a local scale (on an individual’s property): whereas the Wildlife Habitat Network has been mapped across King County and is intended to provide connectivity at a larger scale.

Protection of foraging areas for those species listed in the Comprehensive Plan is a further means of conserving the life needs of the species. Both of these types of protections are integral pieces of a large puzzle that aims towards conservation of biodiversity at a landscape level (see BAS report Volume I, Chapter 2: Scientific Framework).

Because voluntary procedures for protecting priority habitats do not guarantee any level of protection, it is not possible to determine the level of risk to the functions and values of these habitats. However, the possibility of clearing additional native vegetation does raise some concerns. Allowing additional clearing could result in a reduced amount of overall terrestrial area left intact. For example, if a cave is protected, a greater amount of forest on a given parcel may be cleared. The benefits in habitat value associated with protecting some wildlife habitat at the expense of others cannot be determined. It is assumed that overall benefit to wildlife area functions and values by the protection of priority habitats will exceed any negative impacts from the loss of native vegetation.

One recent study indicated that no more than 52 percent of an urbanizing landscape should be cleared in order to conserve some forest-dependent wildlife (see reference to Marzluff and Donnelly (2002), Chapter 8 Wildlife Areas, BAS report Volume I). However, those proportions are calculated for entire landscapes, not at the parcel scale. It is uncertain how much of the total landscape will be cleared in the long term, and it is also uncertain how many priority habitats occur on the landscape and how many of those ultimately will be protected.

Another primary concern associated with greater clearing allowances is the increase in “edge” of residual priority habitats, such as mature and old growth forest and wildlife corridors. Edge effect can negatively impact residual priority habitats by altering their microclimate by increasing sunlight and temperature of these areas. These alterations will raise soil temperatures and decrease soil moisture, and these changes may in turn alter the character of priority habitats by altering the vegetation species compositions. Along with vegetation alterations, edge effect may change wildlife species compositions in residual habitats by providing habitat for edge-associated species and diminishing habitat available for forest interior species. In addition, fragmentation and increased edge habitat may provide opportunities for the invasion of natural vegetation by weedy species, and such invasions diminish habitat quality.

Down logs are not listed in the Clearing and Grading Ordinance as a priority habitat; however, they are important to many wildlife species. The effect on wildlife species of not protecting down logs is unknown, but is presumed to have a negative impact.

Cliffs are not listed in the code as priority habitats to be protected through incentives. It is assumed that cliffs are inclusive in steep slope hazard areas (K.C.C. 21A.24.310, Section 41). If cliffs are protected only as steep slope hazard areas, the size of a buffer or setback from a cliff will be determined in order to “eliminate or minimize the risk of property damage, death or injury resulting from landslides caused in whole or in part by development, based upon a critical area report prepared by a geotechnical engineer or geologist.” If a critical area report is not submitted, the minimum buffer will be 50-100 feet. If one is submitted, buffers and setbacks could be lesser or greater. It is unknown if this level of protection will be adequate to protect cliff-dwelling species, including golden eagles (a shall-protect species) and mountain goats (a should-protect species).

Wetland Assessment:

This standard represents the BAS for providing wetland protection by protecting larger areas for maintaining ecological processes. Specifically, the 35 percent clearing restriction addresses the protection of wetland hydrological, groundwater interchange, and fish habitat functions at the watershed and landscape scale. It may additionally provide valuable wildlife functions if the 35 percent clearing restriction is contiguous to wetlands, thereby supplying additional acreage for the protection of microclimatic conditions, native plant species, and essential habitat beyond the buffer. A strategically targeted location of the 35 percent restricted area may also bridge gaps between wetlands, or between wetlands, and important upland areas thereby providing protected habitat for wildlife populations to reach critical non-wetland habitat, utilize seasonal and yearly traditional home ranges, and to disperse.

The 35 percent clearing restriction represents BAS for protecting wetlands at the watershed scale. It does not apply to the urban areas, which is a departure from BAS because ecological processes are not constrained to zoning or other jurisdictional boundaries. Moreover, some watersheds may be highly developed so the 35 percent clearing restriction may not provide benefits. Finally, the 35 percent clearing restriction is proposed in order to leave 65 percent vegetation that, according to BAS, is characterized as “hydrologically mature forest”, the vegetation stage that first provides ecological benefits to aquatic systems. Watersheds however may not currently exhibit this age structure and therefore little water-related benefits to wetlands will accrue for many years until this target age structure is reached.

Level of Risk to Function and Values

The 35 percent clearing restriction may or may not benefit wetland functions depending on site-specific watershed, geology, soils, and current vegetation condition. These data are currently unavailable. Consequently, if watersheds exhibit steep slopes, surface bedrock, and shallow soils, or are considerably below recommended vegetation cover, the mechanisms of attaining additional wetland functional protection may not be realized at all, or will take many years to develop. If watershed conditions are favorable (i.e., appropriate geology, topography, soils) the 35 percent clearing restriction may significantly improve protection for all wetlands outside the UGA. Wetlands within the UGA may indirectly benefit by this landscape and watershed approach if protection occurs up slope of a wetland's watershed regardless of its jurisdictional location.

If the wetland, adjoining area, and watershed exhibit favorable conditions, the 35 percent clearing restriction will significantly lower the risks of losses to all wetland functions. Specifically it will lower the risk to hydrological functions, ground water recharge function, water quality, and fish and wildlife habitat function directly tied to wetland condition and not obtained through fixed and variable buffer protection mechanisms previously discussed. The 35 percent clearing restriction also has the ability to reduce risk to wetland wildlife functions by protecting additional upland habitat. The risk will decrease most dramatically if the 35 percent clearing restriction standards are strategically applied to lands adjoining wetlands and to lands linking wetlands to other important wildlife habitats. Specifically, 35 percent clearing restrictions could be located adjacent to existing buffers to increase their width and prevent threats from: (1) edge effects (e.g., microclimate); and (2) external effects (pollutants, fires, diseases and exotic species). Such practices would reduce the risk to wildlife and overall declines in biodiversity within the County. The 35 percent clearing restriction standard could also provide linkages between wetlands exceeding the 500-ft wetland complex distance and between wetlands and essential upland habitats thereby minimizing the risk of fragmentation.

Level of Uncertainty

BAS suggests that applying a 35 percent clearing restriction standard most likely will provide important wetland protection benefits to hydrology, groundwater interchange and other functions influenced by infiltration and runoff. Unfortunately, for wetland wildlife populations we do not yet know the minimum critical size and ecosystem areas required for preserving wildlife characteristics, species diversity and composition (Noss and Harris et al. 1986) and, therefore cannot determine the extent of benefits implementation of the proposed 35 percent standard may have.

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