

## INFORMATIONAL MEMORANDUM

**To:** Planning Commission

**From:** Director Public Works  
Director Community Development

**Date:** September 9, 2008

**Subject:** Proposed Shoreline Buffers

**Issue:**

What factors were considered in establishing the proposed 50-foot, 100-foot and 125-foot buffers?

**Regulatory Context:**

Under the Shoreline Management Act (SMA), the City is required to prepare a Shoreline Master Program (SMP) to regulate activities along the Green/Duwamish River and to establish development standards, including setbacks or buffers to protect the most sensitive areas of the shoreline from uses that would cause a net loss of ecological functions to the shoreline. The SMA defers to local jurisdictions to determine the most appropriate regulations in accordance with the Department of Ecology guidance. However, the Department of Ecology has the final say in approving the local SMP.

For areas that are unincorporated, King County has jurisdiction and establishes the regulations to govern uses in the shoreline. For areas that the City has annexed, but were not part of the City when it originally adopted its SMP in 1974, the City continues to administer King County's shoreline regulations. One advantage of the City's SMP Update will be to have one program that is administered for the entire City rather than two. King County's current shoreline regulations, like the City's, do not address the most recent Department of Ecology shoreline regulation requirements and if submitted to Ecology today, would not be approved. For example, King County's SMP Update is proposing a buffer width of 115-feet plus a 15-foot inspection width (Total of 130-feet) for urban areas. See accompanying chart, Attachment 1, comparing adjacent jurisdiction buffer widths. Tukwila's proposed buffer widths are generally in line with proposed buffer widths in King County and City of Seattle and existing buffer widths in Kent and Auburn.

Tukwila could adopt another jurisdictions' regulations; however, the City would need to document the basis for using those regulations rather than developing regulations itself.

## **Background:**

The Green River flows northwest about 93 miles from its headwaters in the Cascades to its outlet in Elliott Bay via the Duwamish River. The Green River basin drains 483 square miles and flows through several cities, primarily in its lower reaches, including Auburn, Kent, Tukwila, and Seattle. The lower Green River runs from Auburn down to River Mile 11 (just north of Fort Dent Park) and becomes the Duwamish River, which flows to the mouth of Elliot Bay.

The lower Green and Duwamish Rivers are almost entirely sand-and silt-bedded. In- river habitat is dominated by a single habitat type, and there has been extensive reduction and isolation of off-channel habitats, such as side channels, oxbows, and tributaries. There is extensive tidal influence from the mouth of Elliot Bay to River Mile 11. Levees and revetments severely limit the connectivity, amount, and diversity of riparian vegetation along the river. The existing riparian vegetation is dominated by invasive species.

The main period of runoff and major flood events on the Green River is from November through February. The lower Green and Duwamish levees and revetments form a nearly continuous bank protection and flood containment system. Farmers originally constructed many of these levees and revetments as the protection to the agricultural lands of the area and this original material is still in place as the structural core. In particular, these protection facilities typically have over-steepened banks, areas with inadequate rock buttressing at the toe, and a lack of habitat-enhancing features such as overhanging vegetation or in-water large woody debris. Because of these design and construction shortcomings, the river system has not always performed as intended.

In November 2006 the area experienced a severe winter storm. The Duwamish River had flows that exceeded 12,000 cubic feet per second, Flood Stage Three, and as a result, parts of the levee suffered extensive damage to its banks, levees, and streambed. The U.S. Army Corps of Engineers inspected the levee and revetments on November 16, 2006 and again in the early fall of 2007. The City was notified on February 5, 2008 that Tukwila's 205 Levee needed to be immediately repaired in order to provide adequate flood protection and retain its certification.

Since notification, the City, the Corps, and King County Flood Control District have diligently worked to create a design that would minimize the impact to the abutting property owners and reduce the need for continual repairs. The paramount criteria however has been to provide for:

1. Public Safety;
2. Maintaining levee certification;
3. Solutions that eliminate or correct factors that have caused or contributed to the need for the levee repair;
4. Levee maintenance needs; and
5. Environmental considerations.

Before arriving at the final design, the Corps analyzed 6 repair alternatives:

1. No Action Alternative;
2. Repair to Pre-Flood Condition Alternative;
3. Retaining Wall Alternative;
4. Remove and Repair with Geo-textile Wrap Wall Alternative;
5. Layback Levee Alternative; and
6. Non-structural Alternative.

The levee on the west side of the Duwamish River was built in 1991 using the Corps' minimum design standards. This standard established the angle of the waterside slope at 2:1. Since being built, there has been over \$10,000,000 of repairs, including on-going efforts, required to correct damage.

The Corps rejected the *Repair to Pre-Flood Condition* Alternative because of the past history of repeated and costly repair projects. The Corps' Project Information Report states, "The repair to pre-flood condition is not acceptable since the scour<sup>1</sup> would occur again." [Note: Scour is the erosion of the river's soils and sediments that provide support for the banks and levees and when the support is lost sloughing occurs.] Other contributing factors are contained in the 2006 *King County Flood Hazard Management Plan*:

"Levee slope is extremely over-steepened at approximately 1.4H:1V to 1.8H:1V, and therefore lacks adequate structural stability to provide minimum factors of safety for several modes of failure. No toe buttress structure has ever been constructed in this sub-reach. The riverward slopes are largely dominated by invasive blackberries and reed canary grass,"

In other words, returning the levee to the *Pre-Flood Condition* using the Corps' minimum design standard would not solve the problem, result in a lower level of safety, and it would be just a matter of time before the levee would need more repairs. Further, machinery cannot reach from the top of the levee to the toe to perform periodic vegetative control maintenance, which has been repeatedly noted by the Corps in their annual inspection reports.

To overcome the existing problems and to reduce future maintenance and repair costs, the Corps chose to lessen the overall slope to a stable grade. See Attachment 2 - Profile. This selected method is consistent with recommendations set forth in the Corps of Engineers' Manual for Design and Construction of Levees (EM 1110-2-1913) for slope stability. It also is consistent with the levee rehabilitation project constructed on the nearby Briscoe School levee that has proven to be a very effective solution to scour problems – slows the river down, provides for vegetation, etc. The Corps, in a letter dated Sep 27, 2007, indicated that this type of profile would become the template for future levee repair and construction projects (Attachment 3). The City Council also reviewed all of the options and concurred with the Corps' decision. The City Council became involved because the ongoing levee repair project required the acquisition of additional land, a Tukwila responsibility resulting from the 1991 agreement between the Corps and the City.

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<sup>1</sup> Scour is the erosion of the river's soils and sediments that provide support for the banks and levees.

To minimize the levee footprint, the Corps, King County Flood Control Zone District, and the City also considered the following profile characteristics:

- Width of the levee top;
- Landward slope of the levee;
- Slope of the riverside launchable toe rock;
- Width of the mid-slope bench (needed for maintenance and lessening the effects from scour);
- Location of the “woody debris” and its associated anchor rock – environmental requirement;
- Width of the landward easement – needed for levee access and inspection.

### **Discussion:**

#### *Engineering Aspects*

Because of the similarities in the soil conditions and taking into consideration the tidal influence, we can divide the Green/Duwamish River into three areas – South of I-405; North of I-405; and areas around residential neighborhoods. Looking at the slope geometry and the difference in height between the ordinary high water mark and the 100-year flood elevation for these three areas, we find that 125-feet of setback distance (buffer) is needed to accommodate the “lay back” of the levee in the area south of I-405 and around Fort Dent Park. For areas north of I-405, a 100-foot setback distance is required. Within residential neighborhoods, a 50-foot setback is justified because of the less intense land use associated with single-family home construction.

Even though the buffer distance has been established using the levee as the example, the same problems exist where there are no levees. The river makes no distinction between an over-steepened slope associated with a levee or a riverbank. Scouring within the river will cause sloughing, property will be lost, and slope stability will be weakened. Specifically, the non-leveed riverbank can be more prone to these problems since they tend to be steeper and consist mainly of sand and silt. This makes them susceptible to erosion. Because the non-leveed riverbanks are for the most part privately owned, they are not actively monitored for damage. See attached photos, Attachment 4, of damage done to banks with over steepened slopes.

#### *Environmental Aspects*

In addition to engineering criteria for establishing the proposed buffer widths, shoreline ecological functions were also taken into account. The Shoreline Management Act and the Department of Ecology regulations require evaluation of ecological functions and that local SMPs ensure that the policies and regulations do not cause any net loss of shoreline ecological function. In addition, the SMP must identify mechanisms for restoration of lost ecological functions.

The crucial issue for the Green/Duwamish River is the presence of salmonids that are on the Endangered Species list. To protect and restore ecological functions related to these

species it is important to provide for the installation of native vegetation along the shoreline. Such vegetation provides shade for improving temperature conditions in the river and habitat for insects on which fish prey. Trees along the shoreline also provide a source of large woody debris (tree trunks, root wads, limbs, etc. that fall into the water), which in turn provides pooling and areas of shelter for fish and other animals. In order to allow for planting of native vegetation, banks need to be set back to allow for more natural slopes, so that they can be planted. The Corps of Engineers does not allow planting on levees unless they are set back to an average slope of 2.5:1 and constructed with a mid-slope bench. Plantings are allowed on the mid-slope benches and this is crucial for improving shoreline ecological functions that are needed in the river.

It is also important to note that under Tukwila's Sensitive Areas Ordinance, buffers for Type II watercourses (the Green/Duwamish is Type I – the highest quality of watercourse), are set at 100 feet and this was based on best available science. Therefore, the proposed buffers of 100 and 125 feet for the High Intensity and Urban Conservancy Environments are in line with best available science for protecting watercourses. The proposed buffer of 50 feet in the Shoreline Residential Environment, represents a compromise – 100 feet is not feasible due to the existing development pattern.

#### **Summary:**

Recommended buffer widths were primarily developed with sound engineering criteria, in order to protect property from damage due to scouring and sloughing of the riverbanks, as well as to protect or restore shoreline ecological functions.

#### **Attachments:**

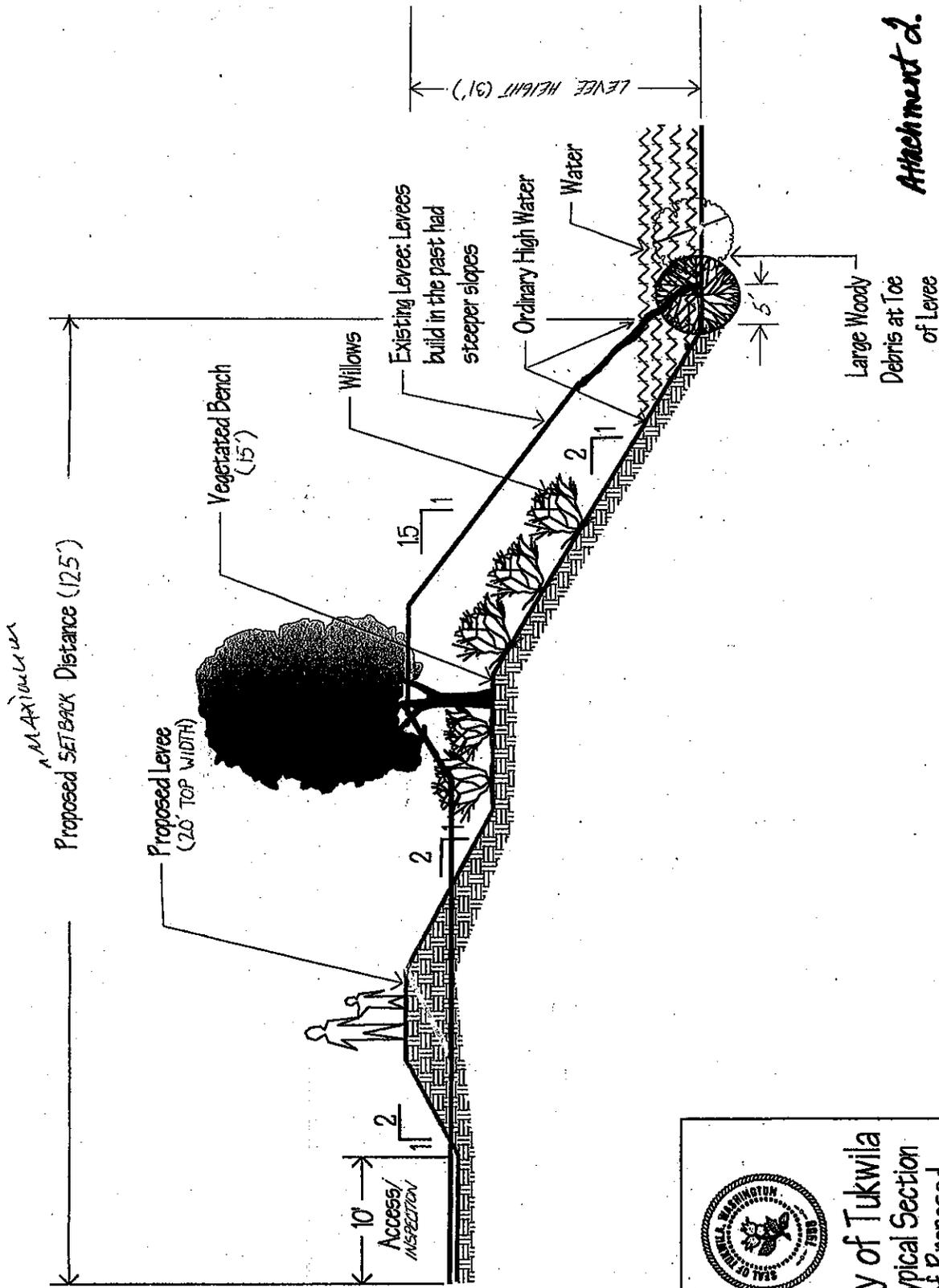
1. Comparison of Buffer Widths Between Jurisdictions
2. Typical setback profile
3. U.S. Army Corps of Engineers letter dated Sep 27, 2007
4. Photos of bank erosion

P:\Shoreline\PC Review\PC Agendas-Memos\infomemo91608 buffer widths.doc

## Comparison of Existing and Proposed Buffer Distances Green/Duwamish River

Jurisdiction / Regulation or Plan	Buffer or Setback Distance	Notes
Existing <b>Tukwila</b> SMP (1974; TMC 18.44)	40-ft (River Zone)	
<b>Tukwila</b> SAO (TMC 18.45)	100-ft for Type 2 streams	Buffer for Green/Duwamish defers to SMP
<b>Tukwila</b> SMP Update (File L06-088)	50-ft (Shoreline Residential); 100-ft (High Intensity, Urban Conservancy north of I-405); 125-ft (Urban Conservancy)	Proposed – not yet adopted
Existing <b>King County</b> SMP (Title 25 KCC; )	20-ft setback (residential); 50-ft (multi-family; commercial; industrial)	
<b>King County</b> CAO (Ord. 15051; 2004)	115-ft for "Type S" Shorelines of the State in urban areas plus 15 ft. building setback	
<b>King County</b> SMP Update (2008-ongoing)	115-ft (integrate CAO standards) plus 15 ft. building setback	Proposed - not yet adopted
<b>King County</b> Flood Hazard Management Plan (2006)	Levee design standards require new or repaired levees at 2.5H: 1V slope; Requires ~100-125 feet from toe of levee	Plan adopted and Flood Control Zone District created 2007
<b>Auburn</b> SMP (Ord. 6095; 2008)	100-ft (Shoreline Residential & Urban Conservancy); 200-ft (Natural)	Adopted June 2008; integrates CAO buffer
Existing <b>Kent</b> SMP (KCC 11.04; 1999)	100-ft (or 75-ft from centerline of dike) (residential); 200-ft (commercial)	Recently initiated SMP update; no specific proposed buffers
<b>Kent</b> CAO (KCC 11.06)	100-ft Type 2 Stream	Buffer for Green/Duwamish defers to SMP
Existing <b>Seattle</b> SMP (Ord. 11845; SMC 23.60; 1996)	25-75-ft (residential); 0-100-ft – variable setbacks specified by use	Recently initiated SMP update; no specific proposed buffers
<b>Seattle</b> ECA (Ord. 122050; 2006)	0-100-ft for Type 1 Shorelines of the State; defers to SMP	Recently updated; defers to SMP

# ATTACHMENT 1



Attachment 2.



City of Tukwila  
 Typical Section  
 of Proposed  
 Levee



REPLY TO  
ATTENTION OF

DEPARTMENT OF THE ARMY  
SEATTLE DISTRICT, CORPS OF ENGINEERS  
P.O. BOX 3755  
SEATTLE, WASHINGTON 98124-2255

RECEIVED

OCT 16 2007

TUKWILA  
PUBLIC WORKS

SEP 27 2007

Emergency Management Branch

Mr. James Morrow  
Director, Public Works  
City of Tukwila  
Tukwila, WA 98188

Dear Mr. Morrow

This letter is a follow up to our recent meeting regarding the Lower Green River Flood Damage Reduction Section 205 Levee Repair. The Corps has nearly completed evaluating the repair alternative for this levee and will be submitting a Project Information Report (PIR) to the City of Tukwila for review by 12 October, 2008.

The Corps of Engineers investigated and evaluated at least 3 alternatives for each site. These alternatives include:

1. Repair back to pre-flood condition.
2. Replace the landward slope of the levee with a flood wall.
3. Lay back the levee slopes to a stable grade.

The recommendation from the evaluation team for both damage sites is to lay back the levee slopes to a stable grade. The attached drawings show the proposed recommended repair alternative. This alternative provides the highest level of safety and reduces future maintenance and repair costs for the levee. The levee footprint for this alternative extends beyond the existing levee footprint and will require the City to obtain the necessary real estate interests. Our Real Estate Division staff will be working with you on the specific types of rights and interest necessary for successful project certification.

The team concluded that the pre-flood riverward slopes at both damage locations were 1.5 Horizontal to 1 Vertical or steeper. Repairing back to the pre-flood condition will result in a lower level of safety and will likely have higher maintenance and repair costs in the future.

The team also evaluated replacing the landward slope of the levee with a flood wall. This allows the riverward slope to be re-graded to a stable slope without changing the overall levee footprint. This alternative was not recommended due to the following negative impacts:

1. The flood wall alternative could increase the likelihood of seepage problems.
2. Access for maintenance and emergency response would be difficult.
3. This alternative would have increased Engineering and Construction costs over the other alternatives.
4. Future maintenance costs are anticipated to be higher for this alternative.

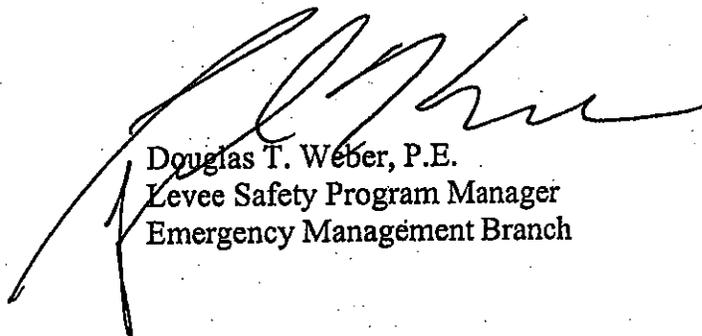
The selected repair alternative is consistent with recommendations set forth in the Corps of Engineers' Manual for Design and Construction of Levees (EM 1110-2-1913) for slope stability.

**ATTACHMENT 3**

This alternative is also consistent with the levee rehabilitation project currently under construction on the nearby Briscoe School levee and this type of alternative is anticipated to be used as a template for future levee repair and construction projects. Please note that the attached drawings are conceptual at this time with the intent to provide the City with an outline of the proposed levee footprint. Design changes and refinements such as the incorporation of habitat features may occur during the Engineering and Design phase of the project. The City will be provided with a fully developed levee footprint and design for review, comment, and concurrence prior to final plan approval for construction.

If you have any additional questions please contact Laura Orr, Project Manager at (206) 764-3575 or email [Laura.A.Orr@USACE.ARMY.MIL](mailto:Laura.A.Orr@USACE.ARMY.MIL) so, do not hesitate to contact me at (206) 764-3406 or email me at [Douglas.T.Weber@USACE.ARMY.MIL](mailto:Douglas.T.Weber@USACE.ARMY.MIL).

Sincerely,



Douglas T. Weber, P.E.  
Levee Safety Program Manager  
Emergency Management Branch

**Copy Furnished:**

Steve Bleifuhs, Manager  
River and Floodplain Management Unit  
Water and Land Resources Division  
King County Department of Natural Resources & Parks  
201 S. Jackson St., Ste. 600  
Seattle, WA 98104

# Attachment 4



Levee Repair – Site 5

8/8/2008



Levee Repair – Site 5

8/8/2008



Levee Repair – Site 3, scour location

8/8/2008



Bank Scour – Across from Site 3 Levee Repair, West Valley Highway

8/8/2008



Levee Repair – Site 3

8/8/2008



Bank Sloughing – Private property along Interurban

8/8/2008



Bank Sloughing – Private property along Interurban, bank condition  
8/8/2008



Riverbank Slough, Tukwila Commerce Park

8/8/2008



Riverbank Slough, Tukwila Commerce Park

8/8/2008



Levee Cracking- Lower Green River (Kent)

2006



Slope Erosion and slumping failure

2006