Washington State Department of Transportation

I-405/SR 167 Program
777 108th Avenue NE, Ste. 800
Bellevue, WA 98004
206-410-0400
www.wsdot.wa.gov

June 13, 2025

Patrick Prendergast, P.E.
Vice President
Skanska USA Civil
18911 N Creek Pkwy
Bothell, WA 98011

WSDOT SL No. 9727-116

Reference: **Contract No. 9727**
I-405, Brickyard to SR 527 Improvement Project

Subject: **Interpretive Engineering Decision for Lateral Migration**

Mr. Prendergast:

Following up on the email transmitted 4/21/25 regarding Lateral Migration: As stated in the email and the conversation the prior weeks, the current Final Hydraulic Design (FHD) doesn't include the lateral migration as required by *RFP Chapter 2 Technical Requiremen*t, *Section 2.30, Water Crossings* (specifically section *2.30.5.2.1, Certain Structures and Channel Design Characteristics*). According to the Contract, "The Sammamish River 'not low' lateral migration determination discussed in the Sammamish River Migration Risk Assessment (Appendix H) shall apply to the new structures within the river flow limits defined by the 500-year flood elevation." In this statement, WSDOT stated that "not low" lateral migration shall apply within the 500-year flood elevation, thus not leaving the scale of lateral migration open to interpretation.

As presented in the Interpretive Engineering Decision regarding Lateral Migration (See Attachment 1), the current design, especially hydraulic and structural related to the Sammamish River, would have to be updated to include "not low" lateral migration conditions in conformance with the Contract Requirements.

If Skanska does not agree with the WSDOT Engineer's Written Determination, Skanska may pursue the protest procedures in accordance with RFP *Chapter 1 General Provisions, Section 1-04.5 Procedure, Protest, and Dispute by the Design-Builder*.

If you have any questions, please contact me at (425) 457-4679

Sincerely,

Evelyn C. Pao, P.E.
Project Director
ECP: DH

Enclosures: Interpretive Engineering Decision regarding Lateral Migration

cc: D. Case, L. Hodgson, R. Woeck, D. Holmquist, J. Slavicek, S. Berriz, B. Kane, M. Chong, N. Bergeman, R. Gehrlein, E-File

Issue:

The focus of this document is a review of the process for determining total scour for structures within the Sammamish River 500-year flood plain as required by the contract. RFP Section 2.30 *Water Crossings* defines the lateral migration risk for the Sammamish River and the requirements for development of the Final Hydraulic Design (FHD) that informs the bridge design. This document is intended to resolve an outstanding issue regarding the proper analysis of scour risk for the structures spanning the Sammamish River. I

WSDOT Contract information:

- RFP Chapter 2, *Section 2.30.5.2.1 Certain Structure and Channel Design Characteristics* states the following:

  "The Sammamish River "not low" lateral migration determination discussed in the Sammamish River Migration Risk Assessment (Appendix H) shall apply to the new structures within the river flow limits defined by the 500-year flood elevation."
  The "Not Low" standard is established here as a contract requirement.
- RFP Appendix H *Sammamish River Migration Risk Assessment* (a reference document) states the following:

  "The risk of channel migration within the vicinity of I-405 MP 24.4 is NOT LOW and therefore will require further analysis during final design as part of the Hydraulic Design Report for this water crossing."
  The further analysis mentioned here refers to the full scour assessment required in section 2.30.5.6 in light of the "Not Low" designation.
- RFP Chapter 2, Section 2.30.5.6 Scour Analysis, provided the requirement for scour analysis, states the following:

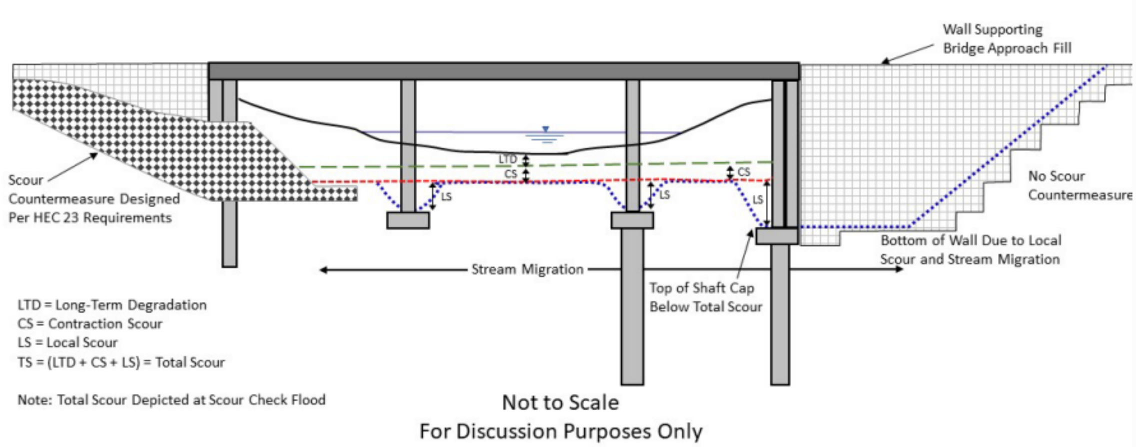
  "The Design-Builder shall perform a scour analysis that includes all habitat and stream restoration components in accordance with the Mandatory Standards and this Section. The analysis shall include the risk of Lateral Migration (Structural), potential for long-term degradation, and evaluation of Total Scour (long-term degradation, contraction scour, and local scour). The scour analysis shall include all elements of Total Scour as defined by HEC-18. Use the FHWA Hydraulic Toolbox for calculating various scour components (except long-term degradation)."
  This section provides the requirements for the scour analysis including lateral migration as required by section 2.30.5.2.1
- RFP Chapter 2, *2.30.3 Mandatory Standards* lists (in part) the following manuals as required standards for work in this section:
  - 1. WSDOT Hydraulics Manual M 23-03 (Appendix D)
  - 4. FHWA Evaluating Scour at Bridges (HEC-18) (Appendix H)
  - 5. FHWA Stream Stability at Highway Structures (HEC-20) (Appendix H)
  - 6. FHWA Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance Volume 1 and 2 (HEC-23) (Appendix H)
  - 11. WSDOT Bridge & Structures Office Design Memoranda (Appendix D)

- 12. WSDOT Bridge Design Manual LRFD M 23-50 (Appendix D)

In brief, the above mandatory standards include the following information:

1. *WSDOT Hydraulics Manual,* Chapter 7 *Water Crossing,* establishes the criteria for evaluating total scour and how to apply the total scour with and without consideration for lateral migration. The components of scour,
   - *Section 7-4.8 Total Scour* states:
     - All structures shall be designed for total scour, as defined by **HEC-18**, regardless of structure span. **Figure 7-6** illustrates the various total scour components—specifically, **long-term degradation, contraction scour, and local scour for a water crossing that has likelihood of channel migration** over the life of the structure. If no channel migration were expected to occur over the life of the structure, long-term degradation and contraction scour would be a uniform offset from the existing channel section.
     - *But channel migration is anticipated in this case because the risk is defined as "Not Low" and the last sentence does not apply.*
   - *Section 7-4.9 Channel Migration for Structural Design* states:
     - All structures shall be designed to account for the channel migration expected over the life of the structure. If there is an opportunity for channel migration to occur over the design life of the structure, the stream designer shall document in the specialty report the risk of channel migration at each pier and/or abutment and whether any scour countermeasures or increase in structure size are recommended. See **HEC-20** and **Sections 7-2.5.4** and **7-4.4.4** for additional guidance on assessing channel migration and maintaining continuity of channel processes, respectively
   - Figure 7-6 is detailed below. This shows the scour components and how to define the limits of total scour when there is a risk for lateral migration. Such a risk exists when the risk for lateral migration is determined to be "Not Low".

Figure 7-6 Total Scour Components with Channel Migration and Abutments



2. *FHWA Evaluating Scour at Bridges HEC-18,* indicates how to determine the scour values for long-term degradation, contraction scour, and local scour.
   - *Section 2.4 Detailed Procedures and Specific Design Approach* discusses the approaches for determining scour values through a six-step approach and references HEC-20:

     Step 1: collects information to inform the following calculations for the scour components.

     a. Boring logs to define geologic substrata at the bridge site,
     b. Bed material size, gradation, and distribution in the bridge reach,
     c. Existing stream and floodplain cross section through the reach,
     d. Stream planform,
     e. Watershed characteristics,
     f. Scour history from other bridges in the area,
     g. Slope of energy grade line upstream and downstream of the bridge,
     h. History of flooding,
     i. Location of bridge site with respect to other bridges in the area, confluence with tributaries close to the site, bed rock controls, man-made controls (dams, old check structures, river training works, etc.), and confluence with another stream downstream,
     j. Character of the stream (perennial, flashy, intermittent, gradual peaks, etc.),
     k. Geomorphology of the site (floodplain stream; crossing of a delta, youthful, mature or old age stream; crossing of an alluvial fan; meandering, straight or braided stream; etc.).
     l. Erosion history of the stream,
     m. Development history (consider present and future conditions) of the stream and watershed, collect maps, ground photographs, aerial photographs; interview local residents; check for water resource projects planned or contemplated,
     n. Sand and gravel mining from the streambed or floodplain up- and downstream from site
     o. Other unanticipated factors not included in the above discussion that could affect the bridge, and
     p. Make a qualitative evaluation of the site with an estimate of the potential for stream movement and its effect on the bridge.

     Step 2: determines the magnitude of long-term degradation or aggradation. This is completed using “historic records, observational data, or other empirical methods to determine the potential for long-term degradation”

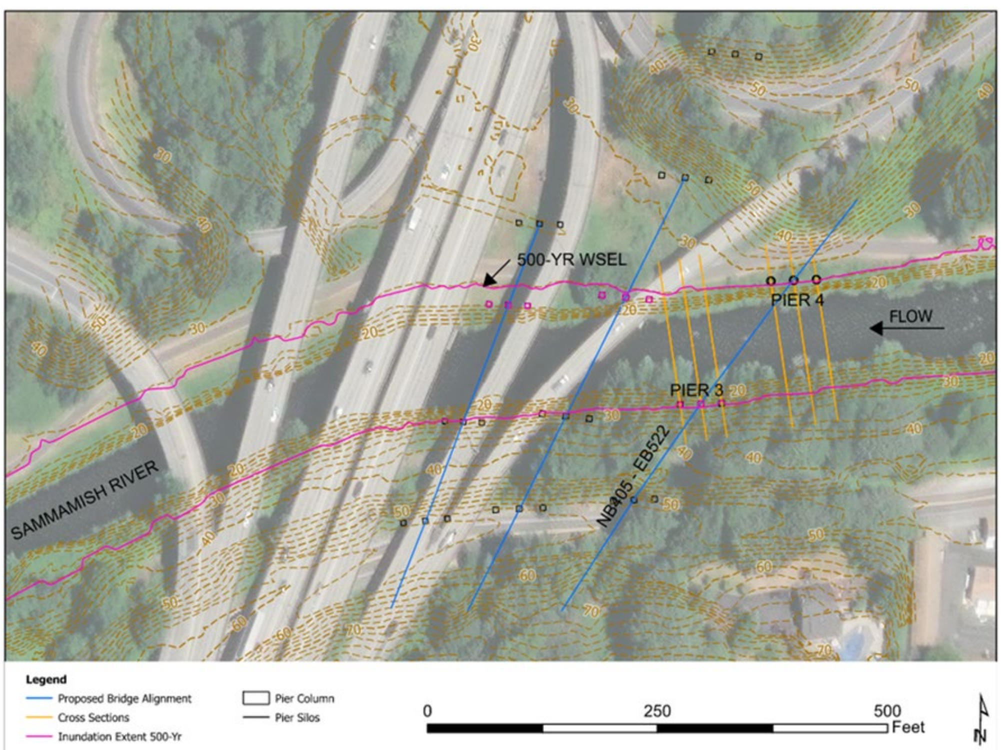
Step 3: computes the magnitude of contraction scour. Contraction scour uses equations in Chapter 6 of the manual.
Step 4: computes the magnitude of local scour at piers. Local pier scour uses equations in Chapter 7 of the manual.
Step 5: determines the foundation elevation for abutments based on chapter 8 and is used if appropriate based on abutment placement
Step 6: plots the total scour depths and evaluates the bridge design. This step details that degradation values are plotted first, then contraction scour, and then pier scour. This step uses 2.0 times the depth of local scour to estimate the scour hole width on each side of the piers. The next actions include evaluating the total scour depths, the magnitude of scour is greatly influenced by the inputs from a – j above. This section also discusses reevaluating the bridge design.

- *Section 3.2 Total Scour* discusses the three types of scour and states:
    - These three scour components are added to obtain the total scour at a pier or abutment.

The Draft Final Hydraulic Design (FHD) prepared by Design Builder:

Dated Feb. 2025 for the Sammamish River (Raheem, AECOM 2025) identifies the following:

- Page 77 of the Draft FHD identify the piers that are within the 500-year flood elevation, as shown in the graphic below:



- Analysis of Total Scour
    - Long-Term Degradation
        - Guidance provided in HEC-20 was used to estimate long-term degradation
        - Estimated 1.8 feet
    - Contraction Scour
        - FHWA hydraulic toolbox was used and included in Appendix K.1
        - No contraction scour is anticipated.
        - The sediment size distribution is an important parameter for contraction scour – the information on grain size analysis was taken from borehole NE-19p-19.
    - Local Scour
        - Estimated using HEC-18 pier scour equations for both live-bed and clear-water pier scour conditions for wide piers in shallow flow.
        - The pier scour is summarized below for each pier in the 500-year floodplain

Table 7-23 Condition 2: Local pier scour summary

Bridge	Pier	10-year Scour Depth (ft)	50-year Scour Depth (ft)	100-year Scour Depth (ft)	500-year Scour Depth (ft)	2080 100-year Scour Depth (ft)	Max Local Pier Scour (ft)
Ramp Bridge	3 (South Bank)	0.4	0.8	1.1	1.4	1.4	**1.4**
	4 (North Bank)	0.0	0.0	0.0	0.8	0.9	**0.9**
Mainline	3 (South Bank)	0.4	0.9	1.2	1.4	1.7	**1.7**
	4 (North Bank)	0.5	3.0	4.3	4.7	5.5	**5.5**
Direct Access	3 (South Bank)	0.0	1.2	1.5	2.6	3.4	**3.4**
	4 (North Bank)	0.0	0.7	0.8	1.4	2.1	**2.1**

    - Total Scour
        - The total scour is presented below

Table 7-24. Total scour summary for the proposed Sammamish River bridges

Bridge	Pier	Long-term degradation (ft)	100-year Scour Depth (ft)*	500-year Scour Depth (ft)*	2080 100-year Scour Depth (ft)*	Total Scour Depth (ft)
Ramp Bridge	3 (South Bank)	1.8	1.1	1.4	1.4	**3.2**
	4 (North Bank)	1.8	0.0	0.8	0.9	**2.7**
Mainline	3 (South Bank)	1.8	1.2	1.4	1.7	**3.5**
	4 (North Bank)	1.8	4.3	4.7	5.5	**7.3**
Direct Access	3 (South Bank)	1.8	1.5	2.6	3.4	**5.2**
	4 (North Bank)	1.8	0.8	1.4	2.1	**3.9**

*The scour design flood as defined by the WSDOT Hydraulics Manual (2022) is the greater of the 100-year or projected 2080 100-year discharge, which is the projected 2080 100-year. Similarly, the scour check flood is the greater of the 2080 100-year or 500-year, which is also the projected 2080 100-year event.

- Lateral Migration
  - Lateral migration is summarized in section 9.1 of the Draft FHD. Here the report states:

    "Following the general solution procedure presented in HEC-20, the lateral migration risk for the Sammamish River at the I-405/ SR 522 interchange has been conducted by performing Level 1, Level 2, and Level 3 analysis procedures as described in Section 7.1.

    Level 1 and Level 2 assessments both indicate the potential for lateral migration at the project reach is "low", and the Level 3 analysis shows little-to-no movement of the river channel since the 1964 USACE flood improvement project, while BSTEM indicates that minimal bank erosion occurs during the 500-year flood, and that the resulting banks are stable with no impact to existing grade at the proposed pier locations."

    Therefore, the current draft FHD followed the Hydraulics Manual and the Bridge Design Manual – the scour was designed based on a uniform offset from the channel.

<u>WSDOT's Engineering Determination:</u>

RFP *Section 2.30.5.2.1 Certain Structure and Channel Design Characteristics* states: "The Sammamish River "not low" lateral migration determination discussed in the Sammamish River Migration Risk Assessment (Appendix H) shall apply to the new structures within the river flow limits defined by the 500-year flood elevation".

RFP *Section 2.30.5.6 Scour Analysis* provides specific requirements for scour analysis and informs the risk analysis of lateral migration (structural). In this case it should be based on the lateral migration determination of "not low" (as stated in RFP section 2.30.5.2.1).

The issue of lateral migration of the Sammamish River has been discussed in comment resolution meetings, over the shoulder reviews, and development of the FHD. The contract is clear in RFP Section 2.30, *Water* Crossings that the risk of lateral migration for piers in the 500-year floodplain of the Sammamish River shall be considered "**not-low**". Because the contract requires the design to analyze the river crossing with this risk level, the hydraulic design is required to assume lateral migration has the potential to occur to any piers within the 500-year floodplain. The design must therefore apply the long-term degradation scour, contraction scour, and local scour in accordance with Figure 7-6 of the Hydraulics Manual – starting at the thalweg elevation straight across then adding the total scour. The current draft final FHD does not comply with this requirement and must be revised to include it.

"Not Low" determination is a contractual requirement, therefore, any change to the "Not Low" lateral migration risk as defined by the contract would require a Design-Builder initiated change order, and shall follow RFP Chapter 1, General Previsions *Section 1-04 Changes*. The draft FHD submitted by Skanska AECOM unilaterally and incorrectly alters the lateral migration risk requirement and therefore applies several key scour elements incorrectly.