

“NOT-LOW” OPINION PAPER FOR I-405 MP 24.4, SAMMAMISH RIVER CHANNEL MIGRATION ZONE

PURPOSE:

The purpose of this opinion paper is to assess the channel migration potential of the Sammamish River within the vicinity of I-405 near MP 24.4. The Washington State Department of Transportation (WSDOT) Hydraulics Manual section 7-2.5.4 states that all water crossing structures should assess past and potential future channel migration. If a channel is expected to migrate, further analyses will be the responsibility of the Design-Builder during final design.

BACKGROUND:

The I-405 Brickyard to SR 527 Improvement project proposes to alleviate traffic congestion by adding more capacity to the existing roadway between NE 160th St and SR 527 in Bothell. Expected work elements of the project include, but are not limited to, expanding I-405 by one lane in each direction, creating a dual express toll lanes (ETL) system from MP 21.80 to MP 27.06, and the construction of three new bridges over the Sammamish River for northbound I-405 and new access ramps and in-line transit stations. Because this project involves a river crossing, a channel migration assessment of the Sammamish River is necessary to evaluate potential hazards to the proposed structures.

APPROACH:

Our approach is based on guidance set forth in Rapp and Abbe (2003). It includes a review of historic watershed conditions based on public documents, followed by a review of historic and current conditions to determine the potential for channel migration. Plan sets and historic photos and a site visit were used to document the conditions.

Aerial photographs of the Sammamish River from 1936, 1998, and 2021 were compared against plan sheets for the last major channel realignment in 1964. The aerial photographs were obtained from King County. WSDOT provided plan sheets from the Army Corps of Engineers 1963 realignment plans, which were then georeferenced. For each year of record, the channel was traced and compared to evaluate for changes in alignment. No other plans, as-builts, or sets of aerial imagery were used in the analysis.

Site observations provided additional context in how the channel shape have changed at bridge column locations and along the recent King County repair sites.

FINDINGS:

Site History

The history of human modifications to the Sammamish River dates to the 1870s, when European settlers began logging in the upland forests of the river’s watershed and using the river the transport logs downstream for sale (King County 2002). There were multiple attempts since to straighten and deepen the river to alleviate flooding resulting from backwatered conditions at its confluence with Lake Washington. The first major modification occurred in 1911 with the construction of the Lake Washington Ship Canal to manage the lake level, that was lowered by 9 feet, and allowed for less seasonal fluctuation (King County 2002). This, in turn, caused an outflow from the Sammamish River and the subsequent draining of former wetlands adjacent to the river (King County 2002). Despite these alterations, the river continued to experience high water levels and seasonal flooding. The Army Corps of Engineers, asked to alleviate the flooding, deepened the river by 5 to 10 feet and straightened the

channel to its present alignment in 1964. Berms were constructed with material dredged from the river to further protect overbank areas from flooding. Armored rip-rap banks were also emplaced along 50% of the channel to protect bridges and some banks from erosion (King County 2002).

Channel Migration Analysis

The findings of the channel migration zone analysis are presented in **Figure 1**. The analysis shows that little to no movement of the channel has taken place since 1964. For location orientation, note that Figure 1 includes the I-405 mainline and ramp centerline alignments that were planned at the time of the drawings were made. Differences in the channel's alignment between the 1963 plans and 1998 and 2021 aerial imagery are more likely to be the result of georeferencing errors than channel movement. This is supported by how closely most of the 1936 channel aligns with the present-day channel. The most significant differences in channel alignment are directly under and east of the I-405 bridge crossings where the channel was straightened by the U. S. Army Corp of Engineers (USACE). The channel work also reduced the size of a bend half a mile east of I-405. These changes are explicitly shown in the 1963 plan sheets (**Figure 2**), suggesting that the river's course changed very little between 1936 and 1963. The channel traced from 1998 aerial imagery is barely visible in Aerial photographs from 2021 King County orthogonal imagery (Pictometry International, 2022). **Figure 1** due to how closely it aligns with the 1963 plans.

However, King County issued permits in 2017 to repair damaged banks in the vicinity of the Project's proposed bridge crossings and coincide with areas that had been modified by the USACE in 1964 (**Figure 1**) (WDFW 2017; King County 2018). While there has been little channel movement, the river appears to be slowly eroding the north banks in places where natural channel meanders were removed.

Site Observations

WSDOT completed a site recon of the site on January 1, 2023. During the site recon, they observed that the north bank near of the existing ramp appeared to consist of fine granular soils that are likely unstable at the current slope and that the bank was possibly sloughing into the river where it had previously been repaired. Figure 3 shows two locations where sloughing was observed just east of the Northbound I-405 to the eastbound SR 522 bridge crossing. No attempt was made to remove vegetation that limited the view of bank or river, but **Figures 4 and 5** show that the channel has changed from the original uniform trapezoidal shape and alignment of the USACE constructed channel. Long term scour is evident at the existing bridge columns along the north bank. An old corrugated metal pipe (**Figure 6**) projects beyond the south river bank just east of the northbound I-405 to eastbound SR 522 bridge crossing. Since this pipe outlet was likely constructed to match the channel bank, the current condition suggests that the south bank is also eroding or sloughing.

CONCLUSIONS:

A visual review of historical aerial imagery and comparison to the 1963 realignment plans for the Sammamish River show little to no moment of the channel's alignment since the project was completed in 1964. Looking closer at the channel banks, the site observations and history of bank repairs demonstrate that the channel is eroding the existing stream bank.

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.

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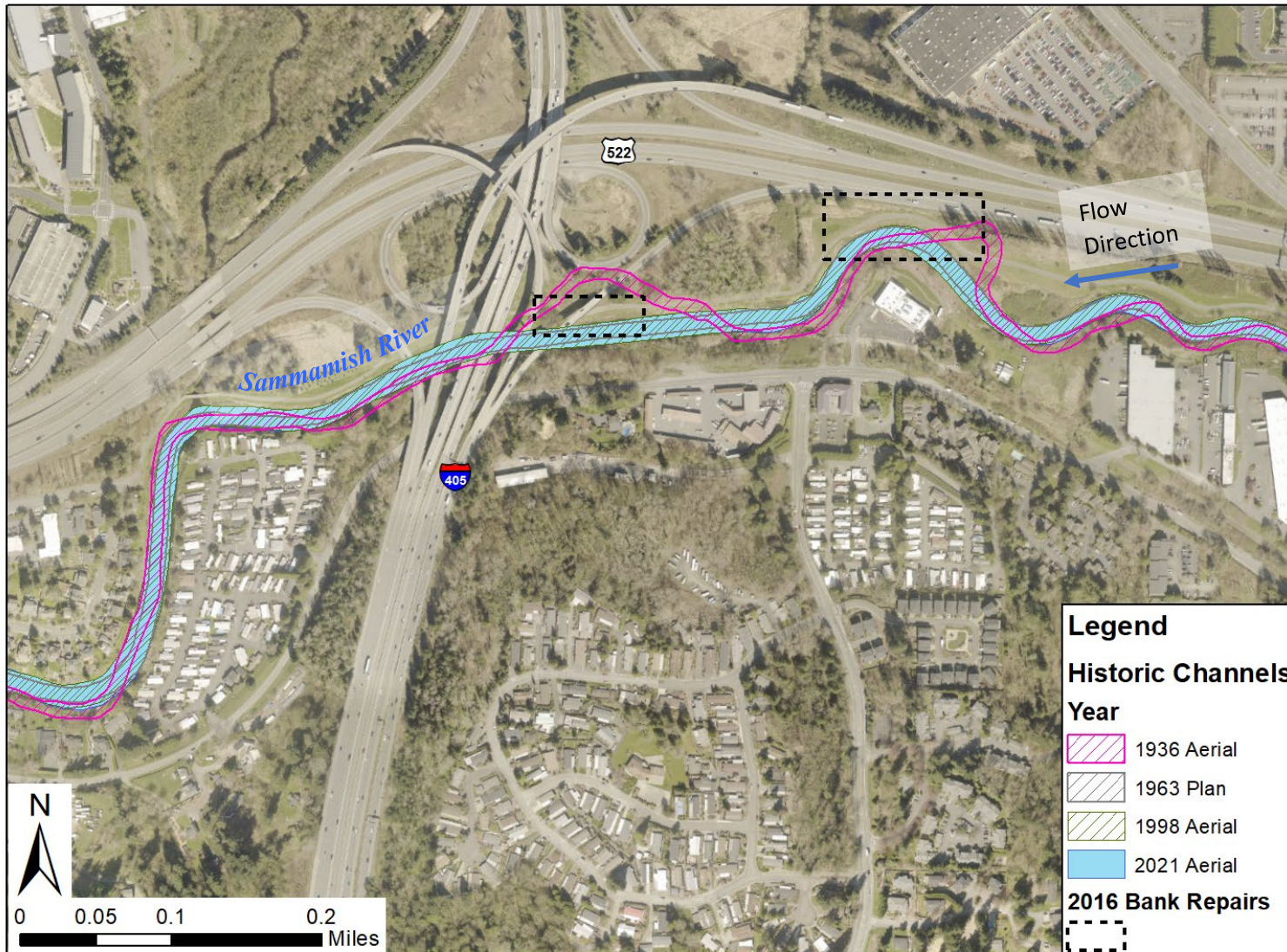
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FIGURES



Aerial photographs from 2021 King County orthogonal imagery (Pictometry International, 2022).

Figure 1. Historical Channel Alignments of the Sammamish River

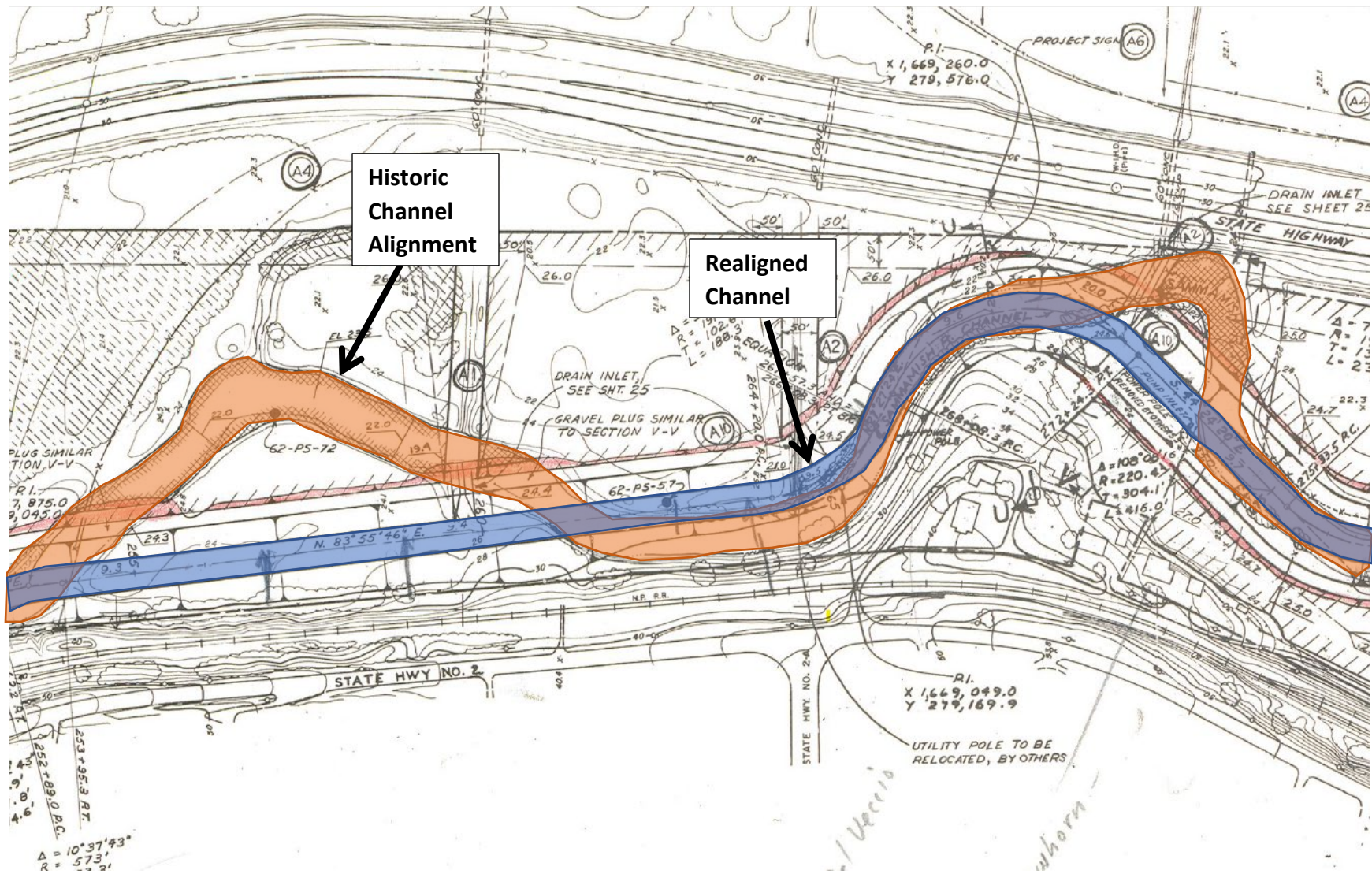


Figure 2. Plan 7 from the Army Corp of Engineers 1963 Sammamish River, Washington Channel Improvement plan sheets. Orange highlighted areas show where existing meanders were straightened or reshaped as part of the project (Army Corps of Engineers, 1963).



Figure 3. Photo of north bank sloughing at 20 feet and 60 feet north of the existing NB I-405 to WB SR 522 bridge crossing (western end of the King County repairs) taken during January 1, 2023 site visit. The red lines highlight the top of impacted bank slope.



Figure 4. Photo of the Sammamish River looking west through the crossings. Note the right bank scour around the existing NB I-405 to WB SR 522 bridge column in the foreground (January 1, 2023 site visit).



Figure 5. Photo of the Sammamish River looking west through the crossings. Note the right bank scour around the existing NB I-405 mainline bridge columns (January 1, 2023 site visit).



Figure 6. Photo of the Sammamish River looking west through along the south bank. Note the projecting pipe and bank scour around the existing NB I-405 ramp column (January 1, 2023 site visit).