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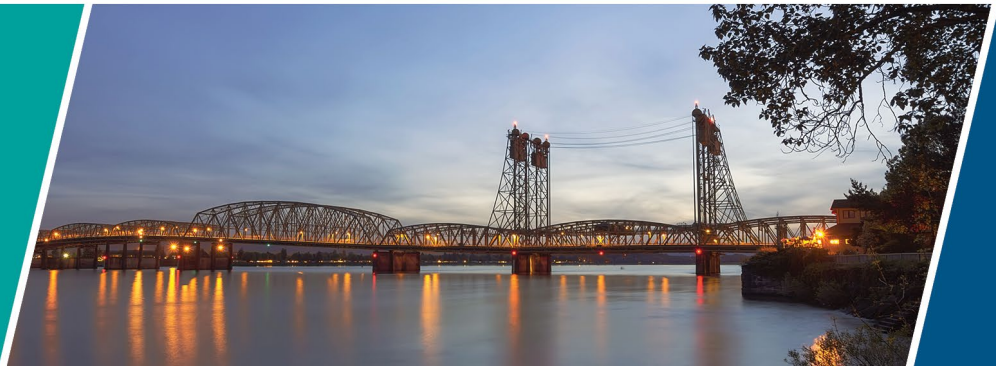

U.S. Army Corps of Engineers Section 408 Permission 1st Review Package – Part 2

Columbia River Bridges and Approaches

DRAFT Navigation Simulation Study Full-Mission Bridge Deep-Draft and Shallow-Draft Simulation Report

February 2024

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Columbia River Bridges and Approaches

Navigation Simulation Study

Full-Mission Bridge Deep-Draft and Shallow-Draft Simulation Report

EXECUTIVE SUMMARY

The Interstate Bridge Replacement (IBR) Program includes the replacement of the northbound and southbound Interstate 5 (I-5) bridges crossing the federal navigation channel of the Columbia River, known as the Interstate Bridge. This action proposes to modify existing federal navigation projects. As a result, these changes will be subject to review and authorization by the U.S. Army Corps of Engineers (USACE) established in Section 14 of the Rivers and Harbors Act of 1899, codified at 33 U.S. Code 408 (Section 408). Additionally, the construction of the proposed Interstate Bridge will require a bridge permit pursuant to Section 9 of the Rivers and Harbors Act of 1899 by the U.S. Coast Guard.

During the previous phase of the project (known as Columbia River Crossing), a series of deep-draft and shallow-draft ship maneuvering simulations were conducted for the project design vessels (CRC 2014a, 2014b). Since then, there have been changes to the project elements (including the bridge alignment, location of bridge foundations, etc.) and as a result, portions of the previous ship simulation studies needed to be repeated with these changes incorporated.

The IBR Program retained Moffatt & Nichol to develop and conduct a full-mission bridge navigation simulation study to evaluate the changes to project elements that affect the navigation, as governed by USACE Engineering Manual 1110-2-1613 and 1110-2-1611.

A real-time vessel simulation study was performed at the Maritime Institute of Technical and Graduate Studies West (MITAGS) in Seattle, Washington. The objective of this simulation effort was to evaluate the critical navigation characteristics of the modified channels and maneuvering areas during and following the construction of the replacement bridge for future deep-draft navigation (ocean-going vessels) and shallow draft navigation (river barges pushed by towboats).

Presently, there are three navigation channels that vessels utilize under the Interstate Bridge (Figure ES-1). These channels are authorized under the Vancouver to The Dalles project. The current primary channel is the most northern channel, also known as Tomahawk Bar. For the existing bridge, the most northern channel is approximately 263 feet wide (limited by the bridge piers) and maintained to a depth of -17 feet Colombia River Datum (CRD) by the USACE based on current navigation needs. There is a lift span over this most northern channel. When the lift span is down, the bottom chord of the span is at elevation +39 feet CRD, and when raised, the lowest part of the span is approximately +178 feet CRD.

In addition, there are currently two alternate barge channels, Alternate Barge Channel North and Alternate Barge Channel South, to the south of the Tomahawk Bar. The center channel is authorized to 300 feet wide, but the opening between the piers is approximately 511 feet with bridge low chord elevation varying from approximately +46 feet CRD at the north end of the span to +70 feet CRD at the south end of the span. The southernmost width is approximately feet wide, with a bottom chord at +72 feet CRD. The existing center and south channels are authorized to a depth of -15 feet CRD and -17 feet CRD, respectively.

The BNSF railroad bridge approximately 1 mile downstream of the Interstate has an influence on the navigation alignments. Vessels transiting either upriver or downstream must pass through the narrow BNSF swing bridge opening either immediately before or immediately after passing through the

Interstate Bridge span channels. The BNSF bridge will remain in place after the Interstate Bridge is replaced.

The interim construction navigation channels represent restricted navigation conditions during the construction of the new bridge while the existing bridge is still in service. During this period, the navigation channels will be limited based on the varying orientation of the proposed and existing bridge piers and due to construction equipment blocking the channels at various points. For this simulation effort, the most constrictive channel for the three navigation channels was evaluated, when construction of the proposed Interstate Bridge is nearing completion while the existing Interstate Bridge remains in place and used by vehicles (Figure ES-2). Two construction channels were evaluated, Construction North Channel and Construction South Channel. Due to the limited air draft clearances, the commercial vessel traffic will not be able to transit through the Construction Center Channel. The Construction North Channel has a minimum width of 200 feet and is limited to a vertical clearance of 100 feet to CRD. The Construction South Channel has a minimum width of 150 feet and vertical clearance of 72 feet to CRD.

The proposed navigation channels upon completion of the IBR Program are shown in Figure ES-3. At the time of the navigation simulations, there were three bridge design options under consideration: double-deck fixed-span bridge, single-level fixed-span bridge, and single-level movable-span bridge. Of these three options, the single-level movable-span bridge as designed will have the lowest air draft clearances for the north and south channels and will have the longest bridge piers (parallel to the channels). Longer bridge piers represent the most restrictive passage under the bridge; therefore, the single-level movable-span bridge was the bridge alternative evaluated during the simulation study.

Upon completion, all three proposed channels will be 300 feet wide with 50 feet of clearance to the bridge piers on each side of the channels for safety (400 feet from pier to pier). All three channels will have approximately 90 feet of vertical clearance to 0 CRD or more, even when the center lift span is completely down. When raised, the bottom chord of the lift span will be at +178 feet CRD. The Proposed North and South Channels will be maintained to a dredge depth of -17 feet CRD. The Proposed Center Channel will be maintained to a dredge depth of -17 feet CRD, but with the ability to be dredged to -27 feet CRD in the future for deep-draft, ocean-going vessels (with a lift span).

Figure ES-1: Existing Navigation Channels

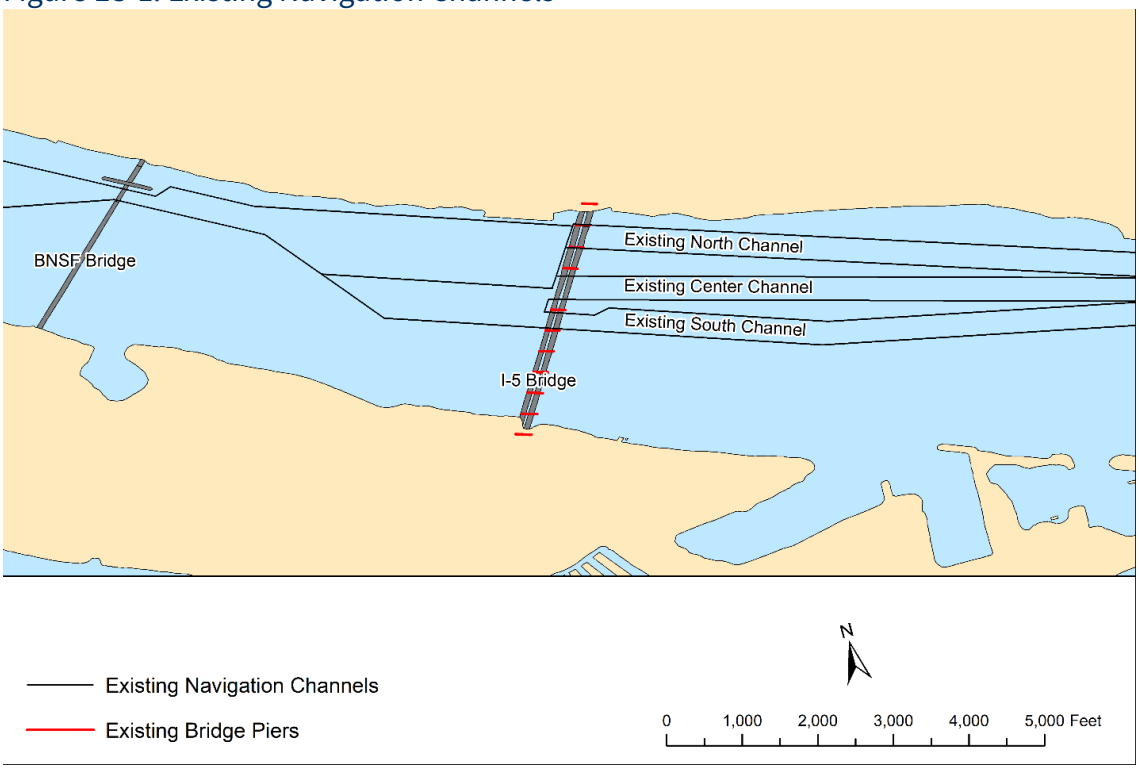


Figure ES-2: Interim Construction Navigation Channels

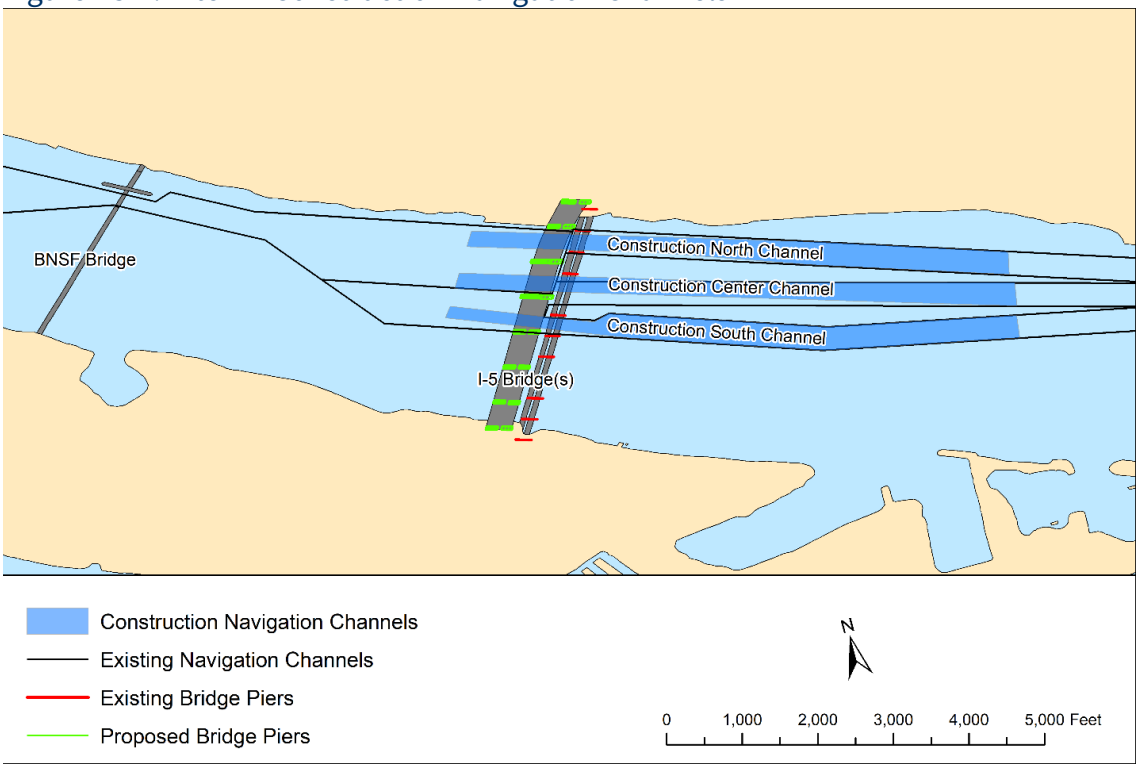
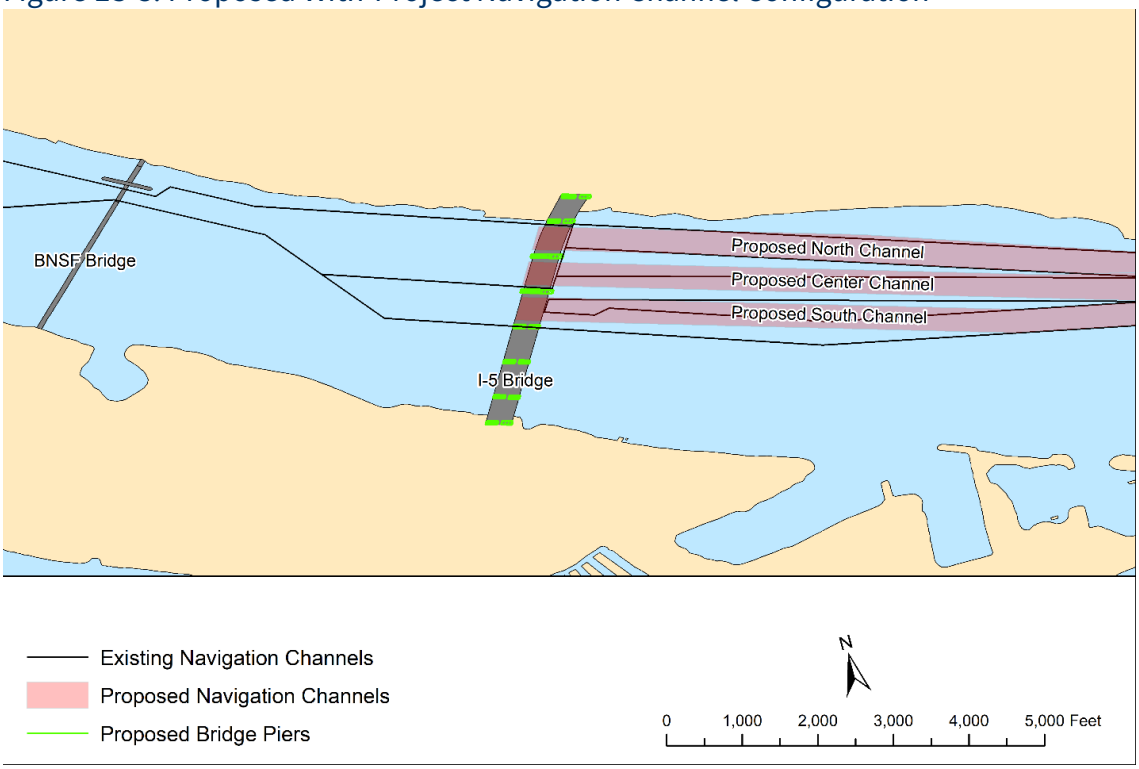


Figure ES-3: Proposed With-Project Navigation Channel Configuration



The Vancouver to The Dalles project has an authorized depth of -27 feet CRD and could accommodate handysize vessels. Currently, no deep-draft vessels use this project. To simulate the maneuvering characteristics of the design vessel with the simulation software used for this study (Wärtsilä Navi-Trainer Professional [NTPro] 5000), a representative model was obtained from MITAGS. The vessel particulars for the simulated vessel model are listed in Table ES-1.

Table ES-1: Deep-Draft Vessel Model Used in the Simulation

Vessel Model	Length Overall (meters / feet)	Beam (meters / feet)	Draft (meters / feet)	Maximum Air Draft (meters / feet)
Bulk Carrier	154.9 / 508.2	26.0 / 85.3	Ballast	
			5.9 / 19.4	31.6 / 103.7
			Loaded	
			7.6 / 25.0	29.9 / 98.2

The majority of the traffic under the existing Interstate Bridge is shallow-draft barges. There is a wide variety in the types, sizes, and configurations of barges and towboats, with the majority being made up

of four barges (two long and two abreast, i.e., 2x2) and two barges (one long and two abreast, i.e., 2x1). Based on this information and communication with local mariners, the design vessels used in this shallow-draft simulation testing were four configurations of tow barges in both light and loaded conditions and with the towboat position based on the operator's typical existing procedure. Specialty cargo on single, flat-decked barges also transit through the bridge. The particulars of these design barges are listed in Table ES-2.

Table ES-2: Shallow-Draft Design Vessels Used in the Simulation

Barge/Vessel Model and Propulsion	Length Overall (meters / feet)	Beam (meters / feet)	Controlling Draft (meters / feet)	Controlling Air Draft (meters / feet)
2x2 Barge + Twin Screw Pushboat (2 wide x 2 long)	224.7 / 737.0	26.0 / 85.3	4.3 / 14.0	16.4 / 53.8
2x1 Barge + Twin Screw Pushboat (2 wide x 1 long)	133.7 / 438.5	26.0 / 85.3	4.3 / 14.0	16.4 / 53.8
Specialty Barge + Z-drive Pushboat	154.2 / 505.8	30.5 / 100.0	3.2 / 10.5	32.0 / 105.0
Specialty Barge + Twin Screw Pushboat	145.9 / 478.5	30.5 / 100.0	3.2 / 10.5	32.0 / 105.0

The primary criterion for the success of each run was mariner feedback during the simulations and post-processed metrics from the runs. A key component of the evaluation was the mariner assessment of overall safety and opinion as to whether the specific maneuvers would be conducted in real life.

Additionally, the clearance of the transiting vessel to the bridge piers for the Interstate Bridge and the BNSF railroad bridge were recorded for each run. The minimum clearance to structures was evaluated based on the swept path of the vessels. For the Interstate Bridge pier, the desired clearance was at least 50 feet for both the existing and proposed bridges based on the clearance from the pier to the proposed navigation channel limit. For the BNSF railroad bridge pier, the desired clearance was at least 50 feet to the North Pier and at least 15 feet to the South Pier, based on the distance of the existing navigation channel to the BNSF bridge piers.

Shiphandling for the deep-draft vessel simulations was performed by licensed pilots from the Columbia River Pilots Association. For the shallow-draft vessel simulations, the ship handling was performed by local Columbia River tug masters from Shaver Transportation Company, Foss Maritime, Combined Forestry & Marine Services, or Tidewater. Both the deep-draft and shallow-draft simulations were observed by members of the USACE and U.S. Coast Guard.

In total, 109 production simulations were performed: 20 deep-draft simulations and 89 shallow-draft simulations. These simulations were performed over eight days, October 25–26, November 6–10, and

November 15, 2023. These simulations included maneuvers evaluating and comparing:

- The existing navigation channels (Figure ES-1)
- The construction navigation channels (Figure ES-2)
- The proposed navigation channels (Figure ES-3)

The existing navigation channel was simulated a total of 27 times to allow the mariners to verify the realism of the simulator and for comparison with the proposed and construction channels. A total of 54 simulations were completed to analyze the proposed navigation channels. The construction navigation channels were evaluated in a total of 28 simulations. The construction channels were not evaluated for deep-draft navigation because the ocean-going vessels do not transit upstream of the bridge under present day conditions.

The summary conclusions from this study regarding the proposed and construction channels are provided in the following subsections.

Proposed Channel Design

Review of the clearances to the BNSF railroad bridge indicated that the shallow-draft barges commonly come within the minimum safety clearances independent of whether the existing, proposed, or construction channels are being evaluated.

The average I-5 pier clearances for the existing and proposed simulations were compared. Comparatively the average clearances for the proposed Interstate Bridge increased from the existing Interstate Bridge, with the exception of the center channel downbound transits with the 2x2 barge.

The higher average clearances for the proposed bridge corroborate the feedback received from the mariners that the proposed navigation channels and corresponding proposed Interstate bridge is an improvement from a navigation perspective from the existing conditions. The mariners stated that the proposed channel positions allow for natural transitions to and from the Interstate Bridge to the BNSF railroad bridge. No concerns were raised regarding navigation with the proposed design from the mariners.

Interim Construction Channel Design

Two primary construction channels were evaluated, the North Construction Channel and the South Construction Channel. The North Construction Channel was successfully maneuvered, and the feedback from the mariners was that this channel resulted in a very similar transit to maneuvering the Existing North Channel today. The mariners did note that during construction there would be more obstacles to maneuver past, but overall this is the preferred construction channel.

The South Construction Channel was found to be tight and required a challenging maneuver to pass through the bridge pier opening. The mariners reported that the transit through the South Construction Channel was feasible but that there would initially be limitations to the transit until the mariners became more familiar with the maneuver.

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APPENDICES

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ACRONYMS AND ABBREVIATIONS

AIS	Automatic Identified System
CRC	Columbia River Crossing
CRD	Columbia River Datum
I-5	Interstate 5
IALA	International Lighthouse Authority
IBR	Interstate Bridge Replacement
MITAGS	Maritime Institute of Technology and Graduate Studies
MSC	Military Sealift Command
NTPro	Navi-Trainer Professional
RPM	Revolutions Per Minute
SOG	Speed Over Ground
SRH-2D	Sediment and River Hydraulics – Two-Dimensional
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard

1. INTRODUCTION

The Interstate Bridge Replacement (IBR) Program includes the replacement of the northbound and southbound Interstate 5 (I-5) bridges crossing the federal navigation channel of the Columbia River, known as the Interstate Bridge. This action proposes the modification of existing federal navigation projects. As a result, these changes will be subject to review and authorization by the U.S. Army Corps of Engineers (USACE) established in Section 14 of the Rivers and Harbors Act of 1899, codified at 33 U.S. Code 408 (Section 408). Additionally, the construction of the proposed bridge will require a bridge permit pursuant to Section 9 of the Rivers and Harbors Act of 1899 by the U.S. Coast Guard (USCG.

During the previous phase of the project (Columbia River Crossing [CRC]), a series of deep-draft and shallow-draft ship maneuvering simulations were conducted for the project design vessels (CRC 2014a, 2014b). Since then, there have been changes to the project elements (including the bridge alignment, location of bridge foundations, etc.), and as a result, portions of the previous ship simulation studies needed to be repeated with these changes incorporated. One portion of the previous simulations that did not need to be re-evaluated was the turning evolution of the deep-draft vessel in the Vancouver Upper Turning Basin. The CRC proposed I-5 bridge was closer in proximity to the BNSF bridge than the proposed Interstate Bridge. As a result, the findings of the previous simulations regarding the turning basin are still valid as the present design of the Vancouver Upper Turning Basin will be larger than the design that was tested in the CRC simulations.

The IBR Program retained Moffatt & Nichol to develop and conduct a full-mission bridge navigation simulation study to evaluate the changes to project elements that affect the navigation, as governed by USACE Engineering Manual 1110-2-1613 and 1110-2-1611.

This report provides the results of the full-mission bridge ship simulation study conducted on October 25–26, November 6–10, and November 15, 2023 at the Maritime Institute of Technology and Graduate Studies West (MITAGS) in Seattle, Washington.

1.1 Objectives

The objective of this simulation effort was to evaluate the critical navigation characteristics of the modified channels and maneuvering areas during and following the construction of the replacement bridge. In support of overall conclusions regarding the proposed channel, the following objectives were identified for this study:

- Evaluate the navigation safety and efficiency of the proposed federal navigation channels after completion of the replacement bridge relative to the existing navigation channels.
- Evaluate the navigation safety and efficiency of the proposed bridge relative to the existing bridge for deep-draft vessels, if the channels were maintained to the federally authorized dredge depth.
- Confirm that safe navigation can occur during the construction of the replacement bridge and demolition of the existing bridge, with the existing shallow-draft tow traffic.

- Identify any operational limiting conditions with respect to wind and currents and, if there are limiting conditions, determine strategies to manage these scenarios during construction and upon completion of the project.

1.2 Project Participants

The following stakeholders were present during all or part of the full-mission bridge simulations at MITAGS:

- Columbia River Tow Masters
- Columbia River Pilots
- USACE Portland District
- USACE dredge pilots
- USCG
- IBR Program

2. SIMULATION INPUTS

The primary inputs used in the vessel simulations are outlined in the following three categories:

- Navigation Channel Geometries (Section 2.1)
- Design Vessels and Vessel Models (Section 2.2)
- Environmental Conditions (Section 2.3)

2.1 Navigation Channels Geometries

This simulation effort evaluated three channel configurations for the navigation channels underneath the Interstate Bridge:

- Existing Navigation Channels
- Interim Construction Navigation Channels
- Proposed Navigation Channels

The details of these channel alignments are presented in the following subsections.

2.1.1 Existing Navigation Channels

Navigation through the existing BNSF railroad bridge and Interstate Bridge was simulated to accomplish two purposes: 1) to validate the simulation model against known real-world conditions and 2) to establish a baseline against which the interim and proposed navigation channels were evaluated.

The existing BNSF railroad bridge is approximately 1 mile downstream of the existing Interstate Bridge at river mile 105.6. The horizontal clearance pier to pier is approximately 200 feet wide, with the federal

navigation channel being approximately 150 feet wide between the BNSF bridge piers. When the BNSF bridge is open, there is unlimited vertical clearance through this channel. When closed, the bridge has a vertical clearance of 39 feet to Columbia River Datum (CRD). Commercial traffic requires the swing span to be opened for transit. There are currently few origins or destinations between the BNSF bridge and existing Interstate Bridge, and most commercial traffic has to navigate through both bridges in the same transit.

Presently, there are three navigation channels that vessels utilize under the Interstate Bridge. These channels are authorized under the Vancouver to The Dalles project, which was authorized under The Rivers and Harbors Acts of August 26, 1937, March 2, 1945, and July 24, 1946; Section 107 of the Rivers and Harbors Act of 1960; the Energy and Water Development Act of August 17, 1991; and the Water Resources Development Act of August 17, 1999 (USACE Portland District 2024). The current primary channel is the most northern channel, also known as Tomahawk Bar (Figure 2-1). For the existing bridge, the most northern channel is approximately 263 feet wide and maintained to a depth of -17 feet CRD by the USACE based on current navigation needs. This channel width is authorized to 300 feet wide. However, the existing bridge piers limit the channel to approximately 263 feet wide. Furthermore, this channel is authorized to a depth of -27 feet CRD but, as previously stated, currently maintained to -17 feet CRD. There is a lift span over this most northern channel. When the lift span is down, the bottom chord of the span is at elevation +39 feet CRD, and when raised, the lowest part of the span is approximately +178 feet CRD (Figure 2-2). In addition, there are currently two alternate barge channels, Alternate Barge Channel North and Alternate Barge Channel South, to the south of the Tomahawk Bar. Both the maintained and authorized depths were evaluated in the simulations.

The center channel is authorized to 300 feet wide, but the opening between the piers is approximately 511 feet wide with bridge low chord elevation varying from approximately +46 feet CRD at the north end of the span to +70 feet CRD at the south end of the span (Figure 2-2). The southernmost is approximately 260 feet wide, with a bottom chord at +72 feet CRD (Figure 2-2). The existing center and south channels are authorized to a depth of -15 feet CRD and -17 feet CRD, respectively.

While each channel has a defined width, the river bathymetry is generally as deep as or deeper than the maintained (north channel) and/or authorized depth (center and south channels), and therefore shallow-draft vessels may transit outside the channel limits without risk of grounding. The vertical air clearance available for navigation through each channel passage under the bridge depends on the river stage.

To avoid confusion and establish a common nomenclature with the proposed conditions, henceforth, the existing channels are referred to in this report as follows:

- Existing North Channel *(i.e., Tomahawk Bar Channel)*
- Existing Center Channel *(i.e., Alternate Barge Channel North*)
- Existing South Channel (*i.e., Alternate Barge Channel South*)

This nomenclature and the existing configuration are shown in Figure 2-1. Today, the typical operating procedure for these three navigation channels is as follows:

- The Existing North Channel is used when a greater vertical clearance is needed than the Existing Center and South Channels are able to provide. This includes high-water periods and when vessels with higher air drafts need to transit past the bridge. The lift span is only used when the other two channels do not provide safe navigation as the lift span greatly impacts the vehicular traffic flow.
- The Existing Center Channel is typically used for downbound transits because in this direction, vessels have less control, with the currents pushing them downstream and less speed through the water. As a result of these conditions, the downbound transits use the widest span, which is the Existing Center Channel, which limits the maneuvering required toward the Washington shore to align with the BNSF bridge.
- The Existing South Channel is typically used for upbound transits and any tow that requires higher clearance but not a clearance that requires the lift span. Upbound transits are typically more controllable than downbound.

Figure 2-1: Existing Navigation Channels

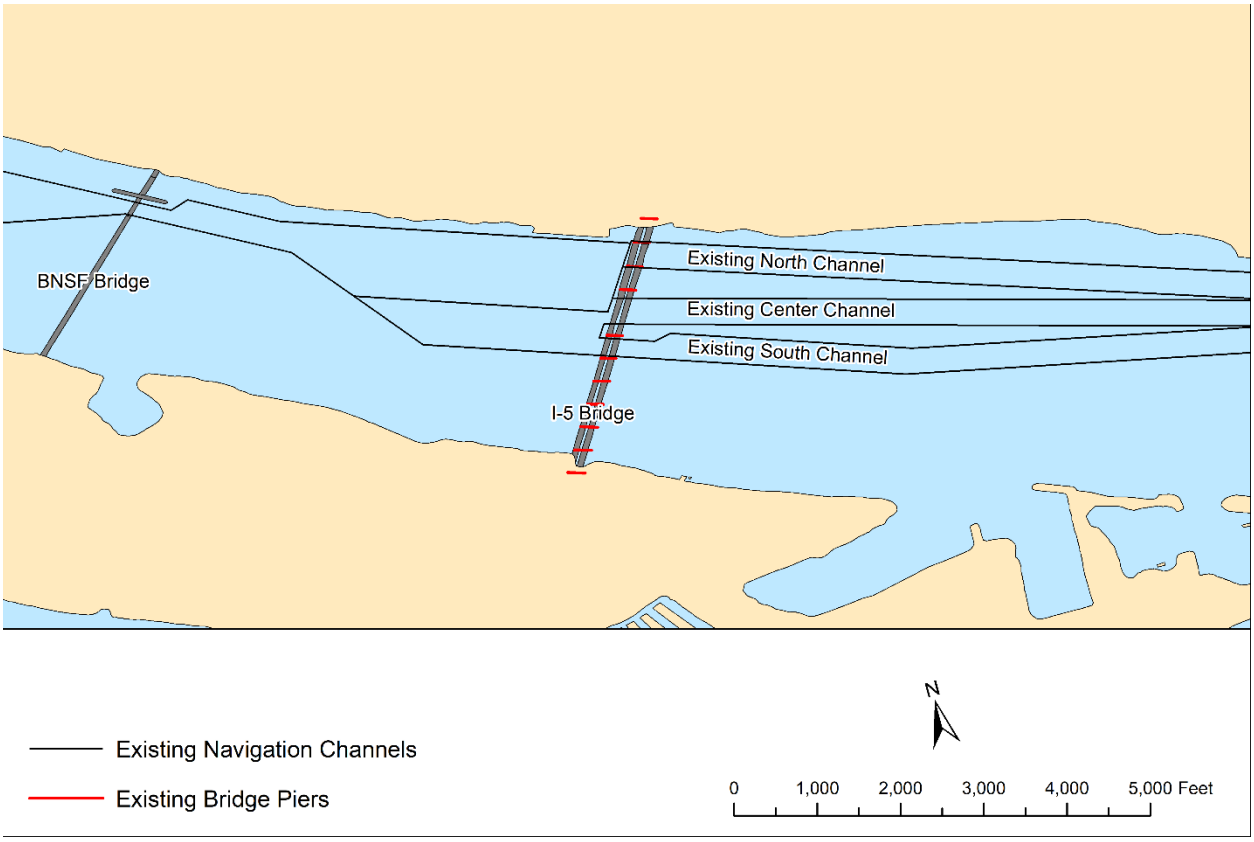
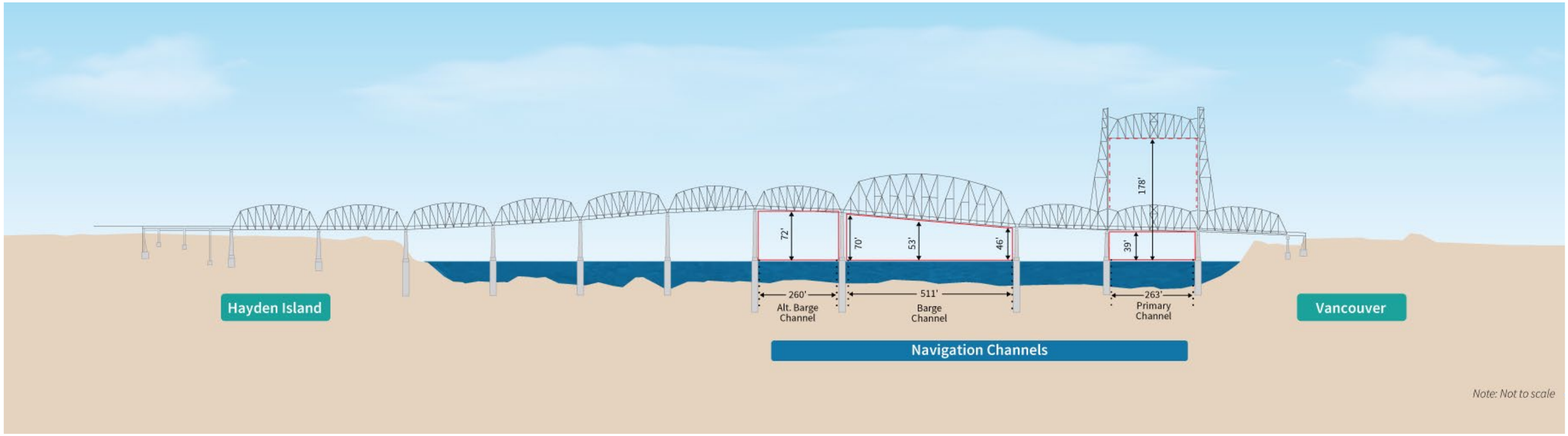


Figure 2-2: Existing Interstate Bridge Profile and Clearances



2.1.2 Interim Construction Navigation Channels

The interim construction navigation channels represent restricted navigation conditions during the construction of the new bridge while the existing bridge is still in service. The construction of the proposed bridge and demolition of the existing bridge are expected to take more than eight years. During this period, the navigation channels will be limited based on the varying orientation of the proposed and existing bridge piers and due to construction equipment blocking the channels at various points. For the simulation effort, the most constrictive channel for the three navigation channels was evaluated.

The interim most restrictive construction scenario will be when construction of the proposed Interstate Bridge is nearing completion while the existing Interstate Bridge continues to be in place and used. To represent the interim condition, both complete bridges were included, illustrating the point when the new bridge was completely constructed and demolition of the existing bridge had not yet started.

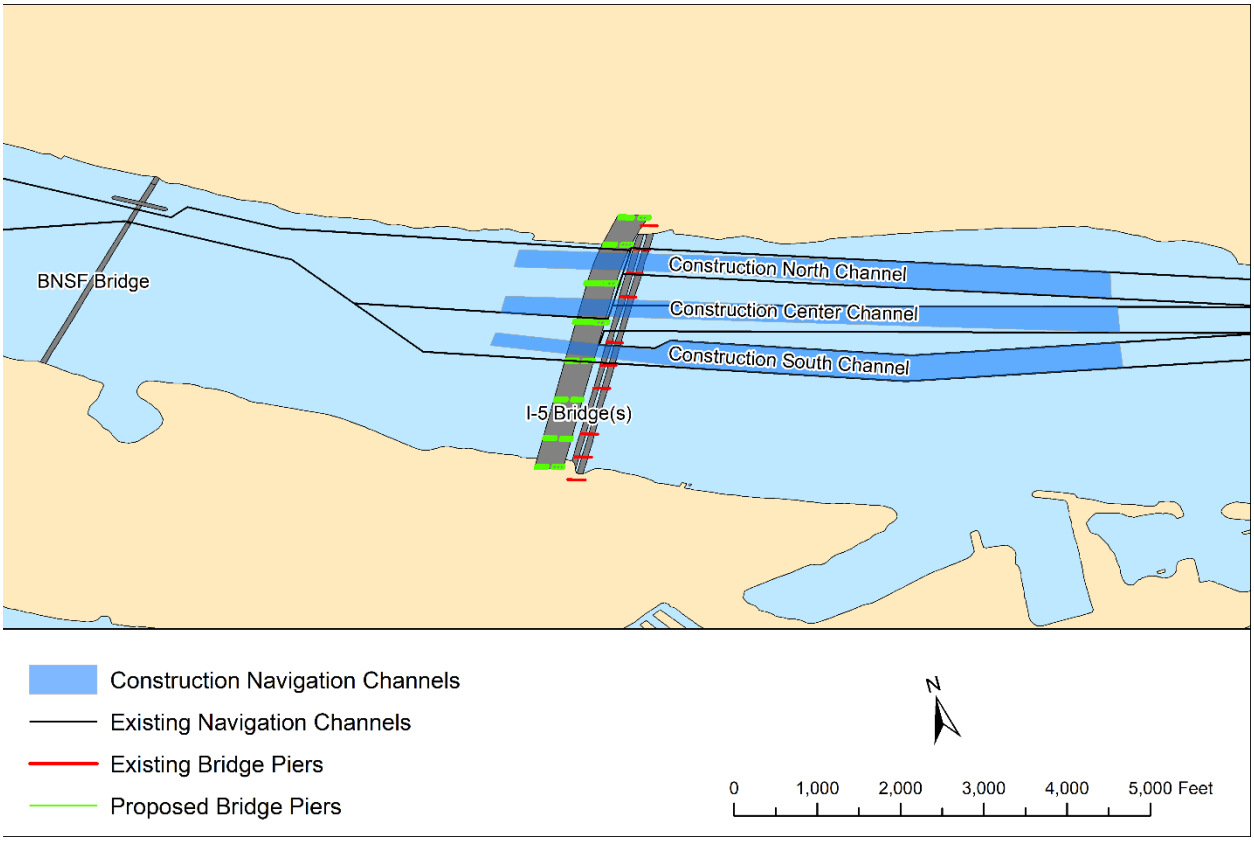
For these construction channels:

- The northernmost channel had a minimum width of 200 feet and was limited to a vertical clearance of 100 feet to CRD.
- The center channel had a minimum width of 200 feet and was limited to a vertical clearance of 43 feet to CRD. Due to the limited clearance for this study, it was assumed that this channel was closed due to none of the design vessels having sufficient clearance (even at the lowest river stage).
- The south channel had a minimum width of 150 feet and a vertical clearance of 72 feet to CRD.

The depth of the interim construction channels was maintained at -15 feet CRD or deeper, depending on the latest USACE bathymetric survey. The proposed temporary navigation conditions and channels are shown in Figure 2-3. The three construction navigation channels are referred to in this report as:

- Construction North Channel
- Construction Center Channel
- Construction South Channel

Figure 2-3: Interim Construction Navigation Channels



2.1.3 Proposed With-Project Navigation Channels

The proposed navigation channels upon completion of the IBR Program are shown in Figure 2-4. At the time of these navigation simulations, there were three bridge design options: double-deck fixed-span bridge, single-level fixed-span bridge, and single-level movable-span bridge (Figure 2-5). Of these three options, the single-level movable-span bridge as designed will have the lowest air draft clearances for the north and south channels and will have the longest bridge piers. Longer bridge piers result in greater navigation hazard for the mariners to avoid. Therefore, the single-level movable-span bridge was the bridge alternative evaluated during the simulation study. The findings of this study are applicable to the double-deck fixed-span bridge and the single-level fixed-span bridge as the footprint of the bridge piers under these two options will be less than that of the simulated bridge but in the same location/heading with respect to the proposed navigation channels and will have greater air draft clearances than the simulated bridge in the north and south channels and in the closed position for the center channel.

The proposed navigation channels are the same for the three bridge alternatives. All three proposed channels will be 300 feet wide with 50 feet of clearance to the bridge piers on each side of the channels for safety (400 feet from pier to pier). All three channels will have approximately 90 feet of vertical clearance to 0 CRD or more, even when the center lift span is completely down. When raised, the bottom chord of the lift span will be at +178 feet CRD. The three proposed with-project navigation channels are referred to in this report as:

- Proposed North Channel
- Proposed Center Channel
- Proposed South Channel

The Proposed North Channel will be maintained to a dredge depth of -17 feet CRD. The Proposed Center Channel will be maintained to a dredge depth of -17 feet CRD, but with ability to be dredged to -27 feet CRD for deep-draft, ocean-going vessels (with a lift span). Both the maintained and authorized dredge depths were evaluated as outlined in the simulation matrix. The Proposed South Channel will be maintained to a dredge depth of -17 feet CRD. With the increase in air draft clearances for the proposed bridge designs, any of the proposed channels would be able to accommodate the typical traffic today (air draft less than 80 feet) even during high-water conditions.

Figure 2-4: Proposed With-Project Navigation Channel Configuration

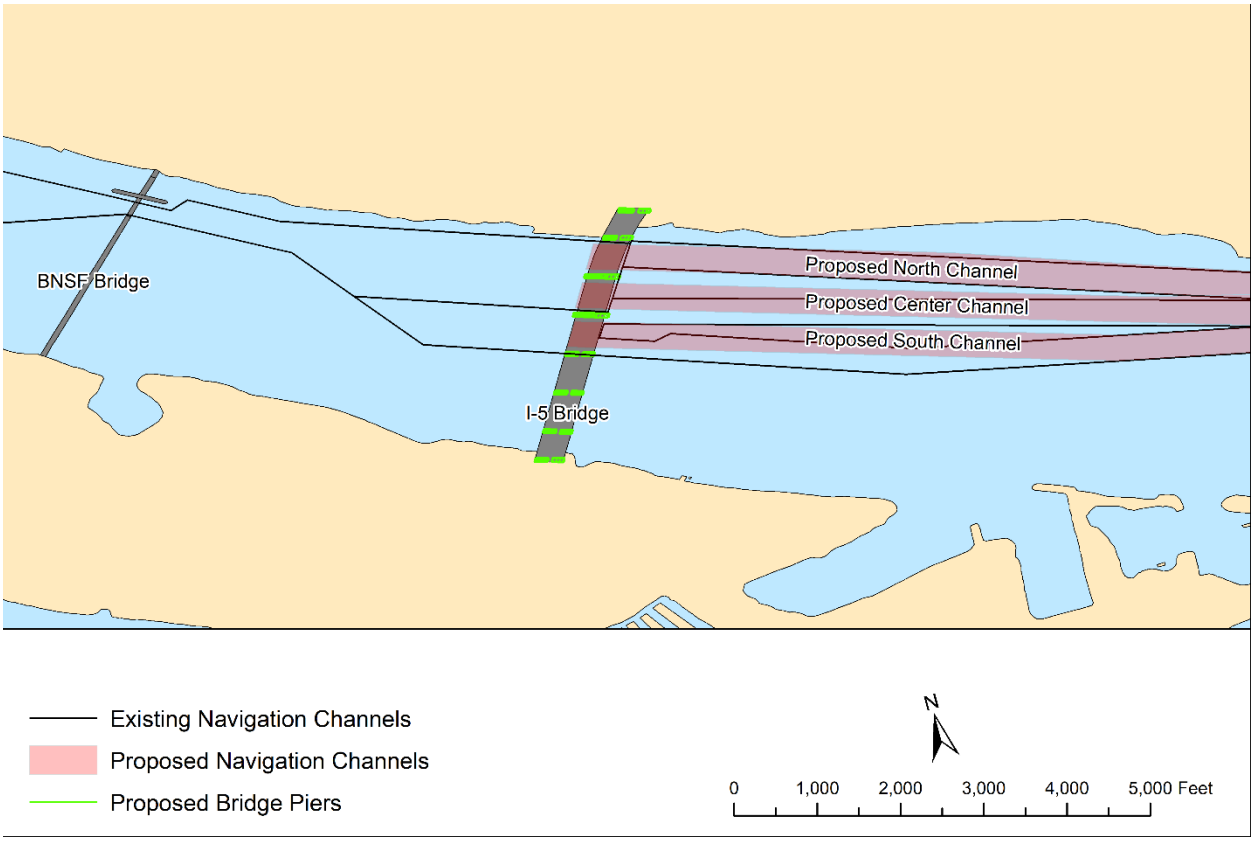
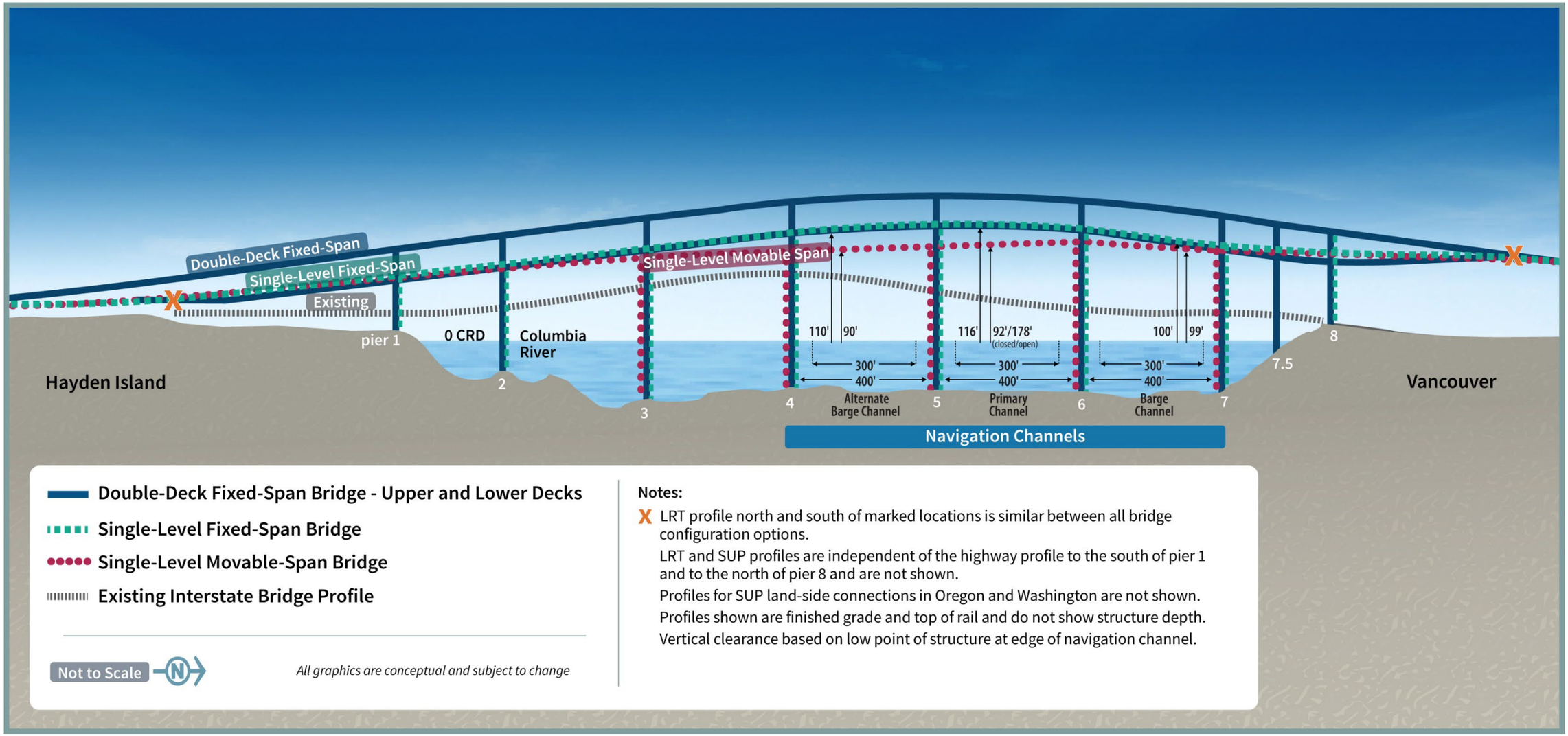


Figure 2-5: Interstate Bridge Replacement Bridge Designs



LRT = light-rail transit; SUP = shared-use path

2.2 Simulation Vessels

This section lists all vessels that were used in the navigation simulations. Pilot cards for each vessel are provided in Appendix A. Today, the commercial vessel traffic in the Columbia River near the Interstate Bridge is varied and subject to changes with the river, weather, and economic factors. However, the majority of the commercial traffic consists of shallow-draft barges being pushed by towboats or tugs (CRC 2014a). This study's goal was to evaluate present-day vessels, as well as potential future vessels.

2.2.1 Deep-Draft Vessels

The Vancouver to The Dalles project has an authorized depth of -27 feet CRD and could accommodate handysize vessels. Currently, no deep-draft vessels use this project. A single deep-draft design vessel was identified with the particulars listed in Table 2-1. The design vessel particulars were chosen based on Bonneville Lock dimensions and the limiting channel width (CRC 2014b).

To simulate the maneuvering characteristics of the design vessel with the simulation software used for this study (Wärtsilä Navi-Trainer Professional [NTPro] 5000, Section 3.3), a representative model was obtained from MITAGS. The vessel particulars for the simulated vessel model are listed in Table 2-2. This vessel is approximately 49 feet longer (11%) and 22 feet wider (35%) than the design vessel, which provides for a conservative navigation assessment.

If deep-draft vessels were to transit past the existing Interstate Bridge, their air drafts would require them to transit through the Existing North Channel with the lift span up. Similarly, if deep-draft vessels maneuvered under the proposed single-level movable-span bridge, they would need to transit through the Proposed Center Channel with the lift span up.

Table 2-1: Deep-Draft Design Vessel Particulars

Vessel	Length Overall (meters / feet)	Beam (meters / feet)	Draft (meters / feet)
Bulk Carrier	140 / 459	19 / 63	Ballast (trim) Aft 5.9 / 19.4 Forward 4.1 / 13.5
			Loaded (even keel) 7.6 / 25.0

Table 2-2: Deep-Draft Vessel Model Used in the Simulation

Vessel Model	Length Overall (meters / feet)	Beam (meters / feet)	Draft (meters / feet)	Maximum Air Draft (meters / feet)
Bulk Carrier 24	154.9 / 508.2	26.0 / 85.3	Ballast (trim) Aft 5.9 / 19.4 Forward 4.1 / 13.5	Ballast 31.6 / 103.7
			Loaded (even keel) 7.6 / 25.0	Loaded 29.9 / 98.2

2.2.2 Shallow-Draft Vessels and Push Towboat

The majority of the traffic under the existing Interstate Bridge is shallow-draft barges. There is a wide variety in the types, sizes, and configurations of barges and towboats, with the majority being made up of four barges (two long and two abreast) and two barges (both two long and one wide and one long and two abreast). The barge configurations and total width are typically dictated by the locks upstream of the Interstate Bridge. The towboats are not placed in the middle of the tow but rather on one side or the other, depending on the direction of travel, flow conditions, load conditions, and the decision of the tow master/operator. Most companies restrict the barge size to two barges when the flows are at or above 400,000 cubic feet per second (cfs) at The Dalles, Oregon. Additionally, there are construction and specialty barges that also vary in size, with the largest being approximately 100 feet wide and 400 feet long. The existing tug fleet that services the Columbia River for Shaver Transportation, Foss Maritime, Tidewater, and Combined Forestry & Marine Services are summarized in Table 2-3.

Based on this information and communication with the local mariners, the design vessels used in this shallow-draft simulation testing were three configurations of tow-barges in both light and loaded conditions and with the towboat position based on the operators typical existing procedure. The particulars of these design barges are listed in Table 2-4. The simulated configurations are shown in Figure 2-8.

Table 2-3: Tug Fleet Available on the Columbia River

Tug	Company	Horsepower	Bollard Pull	Length Overall (feet)	Beam (feet)	Draft (feet)	Air Draft (feet)	Drive Type
Carolyn Dorothy	Foss	3,600	53 metric tons (116,800 pounds)	78	34	15.5	45	Z-Drive
Peter J Brix	Foss	4,024	49 metric tons (108,000 pounds)	78	21	15.4	32	Z-Drive
PJ Brix	Foss	2,560	33 metric tons (72,800 pounds)	75	32	13	58	Z-Drive
Earl W. Redd	Foss	5,364	32 metric tons (70,500 pounds)	123	38	19	NA	Z-Drive
Daniel Foss	Foss	3,300	39 metric tons (86,000 pounds)	98	36	NA	NA	Z-Drive
Samantha S	Shaver	8,400	92 metric tons (202,000 pounds)	112	45	21	51	ASD
Shaver	Shaver	5000	63.5 metric tons (140,000 pounds)	80	38	16.5	44	ASD
Sommer S	Shaver	5360	57.2 metric tons (126,000 pounds)	80	38	16	44	ASD
Portland	Shaver	4,000	46.3 metric tons (102,000 pounds)	107	37	13	39	Z-Drive

Tug	Company	Horsepower	Bollard Pull	Length Overall (feet)	Beam (feet)	Draft (feet)	Air Draft (feet)	Drive Type
Deschutes	Shaver	3,540	40.8 metric tons (90,000 pounds)	93	36	13.5	58	ASD
Willamette	Shaver	3,540	39 metric tons (86,000 pounds)	93	36	13.5	58	ASD
Washington	Shaver	3,200	38.8 metric tons (85,500 pounds)	93	40	16	36	Z-Drive
Vancouver	Shaver	3,540	37.2 metric tons (82,000 pounds)	76	28	13	37.5	Z-Drive
Clearwater	Shaver	3,540	37.2 metric tons (82,000 pounds)	98	30	11	56	Conventional
Cascades	Shaver	3,540	32.2 metric tons (71,000 pounds)	102	30	9.5	56	Conventional
Columbia	Shaver	2,750	27.2 metric tons (60,000 pounds)	97	28	11	39	Conventional
Lincoln	Shaver	3,000	26.3 metric tons (58,000 pounds)	93	32	9.5	57	Conventional
Randy S	Shaver	2,400	23.1 metric tons (51,000 pounds)	87	26	10	56	Conventional
Lassen	Shaver	2,400	16.8 metric tons (37,000 pounds)	70	24	7.3	44	Conventional

Tug	Company	Horsepower	Bollard Pull	Length Overall (feet)	Beam (feet)	Draft (feet)	Air Draft (feet)	Drive Type
Captain Bob	Tidewater	3,000	NA	110	34	9.4	50.75	Conventional
The Chief	Tidewater	2,260	NA	122	40	7.5	49.75	Conventional
Clarkston	Tidewater	3,000	NA	80	25	10	48.17	Conventional
Crown Point	Tidewater	2,240	NA	102	38	NA	51	Conventional
Defiance	Tidewater	2,000	NA	95	31	10.5	48.5	Conventional
Granite Point	Tidewater	2,240	NA	102	38	NA	51	Conventional
Hurricane	Tidewater	3,000	NA	109	32	7	48.75	Conventional
Liberty	Tidewater	3,000	NA	108	34	7	44	Conventional
Maverick	Tidewater	2,350	NA	82	27	10.5	52	Conventional
Rebel	Tidewater	3,000	NA	87	30	10	48	Conventional
Ryan Point	Tidewater	2,240	NA	102	38	NA	51	Conventional
Sundial	Tidewater	4,000	NA	95	32	10.5	48	Conventional
Christie	Combined Forestry & Marine Services	1,320	NA	60	22	9.0	50	Conventional

Tug	Company	Horsepower	Bollard Pull	Length Overall (feet)	Beam (feet)	Draft (feet)	Air Draft (feet)	Drive Type
Ramona III	Combined Forestry & Marine Services	800	NA	43	14	5.0	42	Conventional

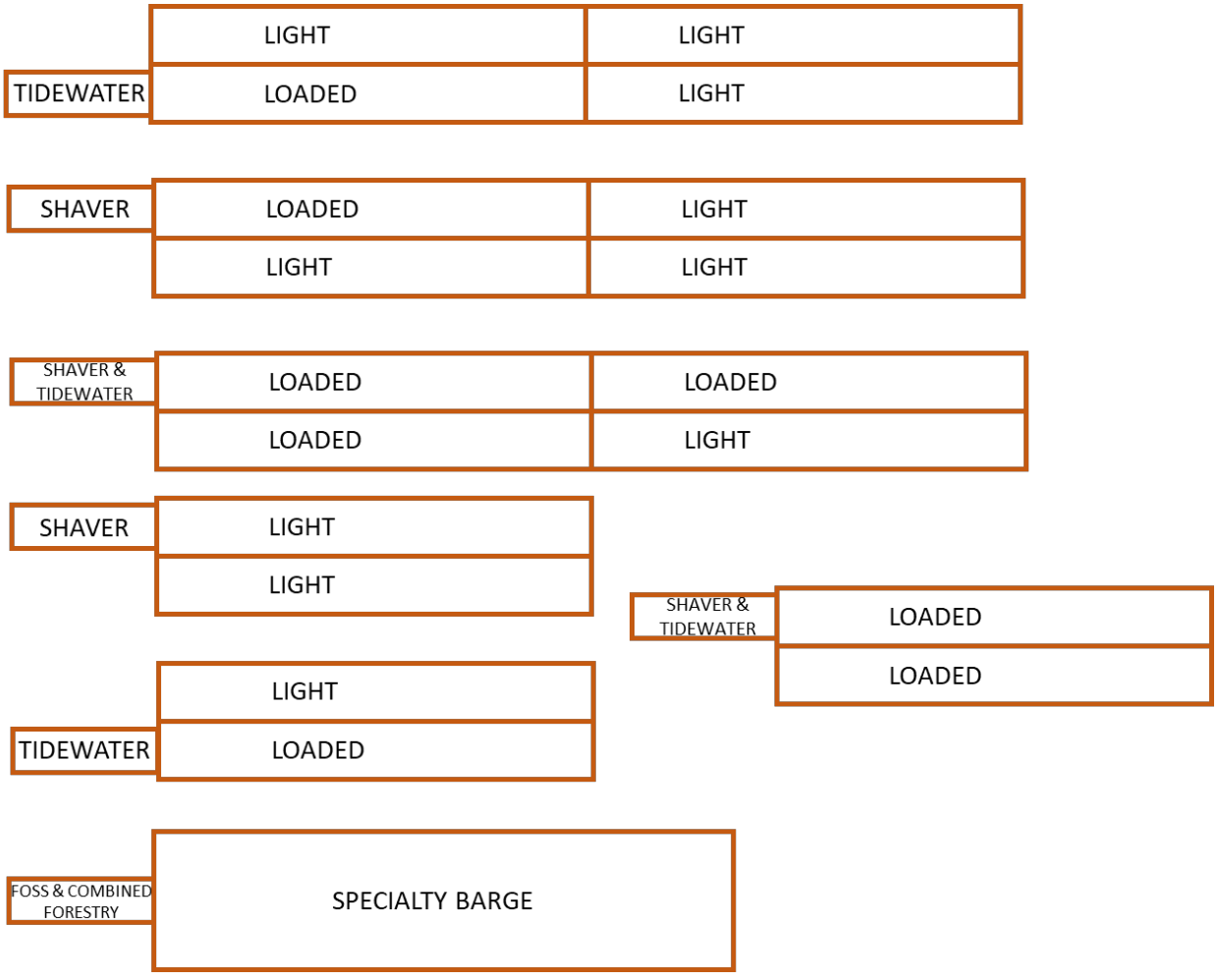
ASD = Azimuthing Stern Drive; NA = not applicable

Table 2-4: Shallow-Draft Design Vessels to Be Used in the Simulation

Vessel Model	Push Tug Location	Length Overall (meters / feet)	Beam (meters / feet)	Controlling Draft (meters / feet)	Controlling Air Draft (meters / feet)
Barge	Not Applicable	91.0 / 298.5	13.0 / 42.6	4.3 / 14.0	Not Available
Specialty Barge	Not Applicable	122.7 / 402.5	30.5 / 100.0	3.2 / 10.5	32.0 / 105.0
Twin Screw Pushboat 2	Not Applicable	42.7 / 140.1	12.8 / 42.0	3.1 / 10.2	16.4 / 53.8
Twin Screw Twin Screw Pushboat 3	Not Applicable	23.2 / 76.1	10.7 / 35.1	2.6 / 8.5	16.9 / 55.4
Z-Drive Pushboat	Not Applicable	31.5 / 103.3	10.5 / 34.4	2.5 / 8.2	15.3 / 50.3
2x2 Barge + Twin Screw Pushboat 2 (2 wide x 2 long)	Starboard Side	224.7 / 737.0	26.0 / 85.3	4.3 / 14.0	16.4 / 53.8
2x2 Barge + Twin Screw Pushboat 2 (2 wide x 2 long)	Port Side	224.7 / 737.0	26.0 / 85.3	4.3 / 14.0	16.4 / 53.8
2x1 Barge + Twin Screw Pushboat 2 (2 wide x 1 long)	Starboard Side	133.7 / 438.5	26.0 / 85.3	4.3 / 14.0	16.4 / 53.8
2x1 Barge + Twin Screw Pushboat 2 (2 wide x 1 long)	Port Side	133.7 / 438.5	26.0 / 85.3	4.3 / 14.0	16.4 / 53.8
Specialty Barge + Z-Drive Pushboat	Center	154.2 / 505.8	30.5 / 100.0	3.2 / 10.5	Full: 32.0 / 105.0 Limited: 15.3 / 50.3

Vessel Model	Push Tug Location	Length Overall (meters / feet)	Beam (meters / feet)	Controlling Draft (meters / feet)	Controlling Air Draft (meters / feet)
Specialty Barge + Twin Screw Pushboat 3	Center	145.9 / 478.5	30.5 / 100.0	3.2 / 10.5	Full: 32.0 / 105.0 Limited: 16.9 / 55.4

Figure 2-6: Simulated Tug Configurations



2.2.3 Assist Tugs

For the deep-draft simulations, an assist tug was not needed, as confirmed by the pilots. For the shallow-draft simulations, an assist tug was used for a handful of simulations as outlined in the

simulation matrix in Section 3.4. The assist tug used for these simulations was the Twin Screw Pushboat 2 (see Table 2-4). The assist tug was a live-manned tug.

2.3 Environmental Conditions

Environmental conditions considered in the simulations were tides, currents, waves, and winds. The majority of the simulations were performed during daylight with clear visibility. A number of nighttime and limited visibility simulations were performed during the deep-draft and shallow-draft vessels in the proposed channels, as outlined in the simulation matrix in Section 3.4.

2.3.1 Current Fields

In the IBR Program reach of the Columbia River, the currents are primarily generated by the flows released at the Bonneville Dam upstream of the Interstate Bridge. While there is tidal influence in the study area, there is no flow reversal. The primary tidal effect is on the water level.

The current fields for this study were obtained from a WSP and Parametrix calibrated U.S. Bureau of Reclamation's Sediment and River Hydraulics – Two-Dimensional (SRH-2D) depth-averaged model. The hydrodynamic model was run for three different spring freshet flow conditions (normal, transitional, and 10-year [Table 2-5]) and the three different navigation channels, as described in Section 2.1. In total, 15 flow scenarios were evaluated that considered the maintained and authorized dredge depths, Table 2-6.

The modeled spatially varying current fields (magnitude and direction) for each scenario were integrated into the ship simulator. Figure 2-9 shows an example current magnitude and directions extracted from hydraulic modeling for the existing channels at the maintained dredge depths for the transitional flow. Near the Existing North Channel at the existing Interstate Bridge, the current velocity is approximately 3 knots. Appendix B shows the current fields for each of the modeled scenarios.

During the shallow-draft validation runs, the input current field in the vicinity of the Interstate Bridge was showing an unrealistic visualization of the current in the simulator graphics due to the high resolution of input current points based on the original SRH-2D model grid. The SRH-2D model required high resolution around the Interstate Bridge to resolve the bridge piers correctly. However, with regards to the navigation simulations, the high resolution is not needed and caused unrealistic representations of water levels around the bridge piers in the simulator. As a result, prior to the shallow-draft production runs in the vicinity of the Interstate Bridge, the currents were represented on a uniform 5-meter grid, as discussed with MITAGS and the USACE during the simulations. The Columbia River pilots stated that the visualization of the water levels did not impact the deep-draft simulation outcomes as this effect was not visible from the deep-draft vessel bridge.

Table 2-5: Columbia River Flows for Navigation Simulations

Flow Condition	Discharge at The Dalles (cfs)	Water Level (meters / feet CRD)
Normal	140,000	0.90 / 2.94
Transitional	397,000	3.60 / 11.84
10-Year	539,000	5.01 / 16.44

cfs = cubic feet per second; CRD = Columbia River Datum

Table 2-6: Modeled Flow Scenarios

Scenario Number	Flow Scenario	Vessels Simulated
1	Proposed Channels, Authorized Dredge Depth, Normal Flow	Deep-Draft
2	Proposed Channels, Authorized Dredge Depth, Transitional Flow	Deep-Draft
3	Proposed Channels, Authorized Dredge Depth, 10-Year Flow	Deep-Draft
4	Existing Channels, Authorized Dredge Depth, Normal Flow	Deep-Draft
5	Existing Channels, Authorized Dredge Depth, Transitional Flow	Deep-Draft
6	Existing Channels, Authorized Dredge Depth, 10-Year Flow	Deep-Draft
7	Existing Channels, Maintained Dredge Depth, Normal Flow	Shallow-Draft
8	Existing Channels, Maintained Dredge Depth, Transitional Flow	Shallow-Draft
9	Existing Channels, Maintained Dredge Depth, 10-Year Flow	Shallow-Draft
10	Construction Channels, Maintained Dredge Depth, Normal Flow	Shallow-Draft
11	Construction Channels, Maintained Dredge Depth, Transitional Flow	Shallow-Draft
12	Construction Channels, Maintained Dredge Depth, 10-Year Flow	Shallow-Draft
13	Proposed Channels, Maintained Dredge Depth, Normal Flow	Shallow-Draft
14	Proposed Channels, Maintained Dredge Depth, Transitional Flow	Shallow-Draft
15	Proposed Channels, Maintained Dredge Depth, 10-Year Flow	Shallow-Draft

2.3.2 Water Levels

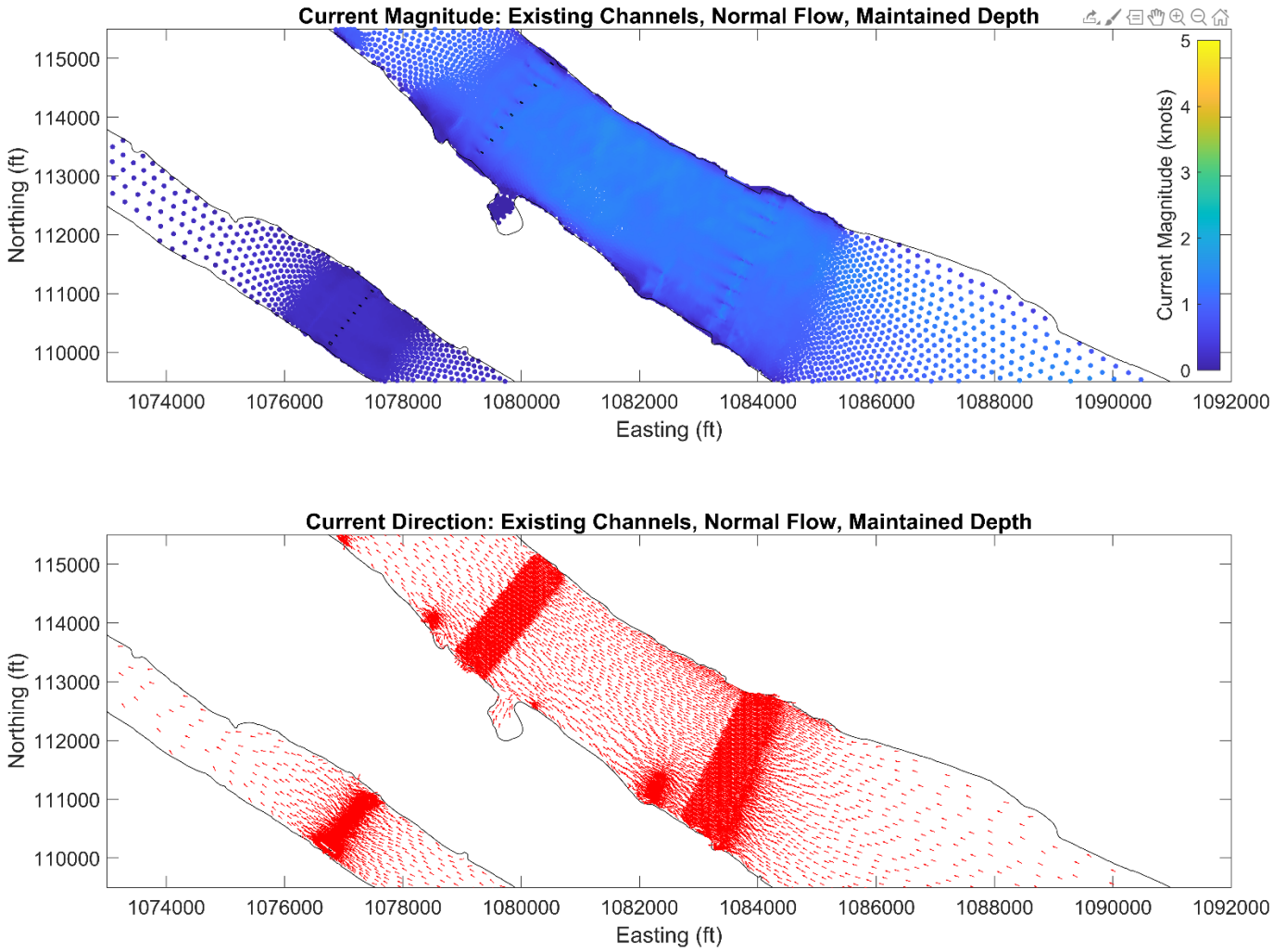
The water level for each of the modeled scenarios is listed in Table 2-5. The simulated water level was held constant at the modeled water level. The tidal datums used for this project referenced to the CRD are listed in Table 2-7. However, tidal effects were not included in the simulations; the water levels in Table 2-5 represent the typical elevation for each scenario.

Table 2-7: Interstate Bridge Replacement Program Tidal Datums

Description	Datum	Existing Interstate Bridge (feet, CRD)
North American Vertical Datum 1988	NAVD88	5.26
Mean Higher-High Water	MHHW	5.13
Mean High Water	MHW	4.60
Mean Sea Level	MSL	3.26
Mean Low Water	MLW	2.16
Mean Lower-Low Water	MLLW	1.94
Columbia River Datum USGS	CRD USGS	0.00

USGS = U.S. Geological Survey

Figure 2-7: Current Field for Existing Configuration with Two-Year Normal Flow Conditions

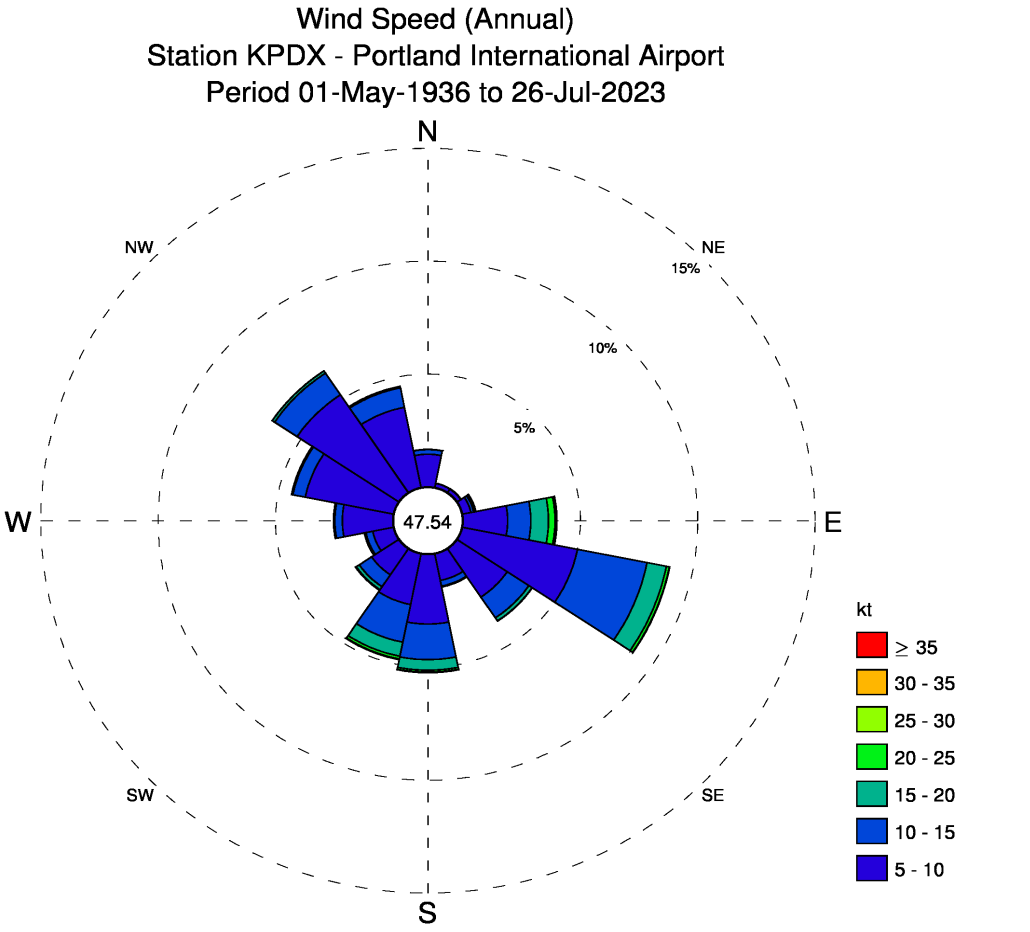


2.3.3 Wind Fields

To establish baseline wind conditions, a wind rose was prepared based on the anemometer at Portland International Airport, Oregon (Station KPDX) (Figure 2-10). Winds are distributed around the compass, but the most frequent and strongest winds tend to arrive from the east, southeast, and south.

The wind condition used in the simulations was identified with an understanding of the typical wind direction, but also with the goal of evaluating critical wind conditions that will control the design dimensions. Based on this criterion, a single wind condition was simulated as wind from the south at a sustained velocity of 20 knots. This wind condition was discussed with the local mariners, who agreed that this condition will be controlling and the most challenging. For reference, a sustained wind speed of 20 knots is exceeded approximately 1% of the time based on the annual data. Additional wind conditions were tested based on the input of the pilots as listed in simulation matrix in Section 3.4.

Figure 2-8: Annual Wind Rose at Portland International Airport



Percentage of Occurrence

Wind Speed, kt	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
Total	1.66	0.19	0.20	0.58	3.99	9.01	3.85	1.50	5.23	4.78	2.21	1.26	2.52	4.43	6.48	4.57	52.46
35																	
30																	
25																	0.14
20					0.28	0.13				0.12							0.70
15					0.75	0.84	0.16		0.47	0.64	0.16				0.11		3.47
10	0.20			0.12	0.99	3.02	1.11	0.26	1.58	1.70	0.64	0.30	0.32	0.54	1.15	0.88	12.82
5	1.44	0.18	0.18	0.37	1.90	5.00	2.57	1.20	3.08	2.29	1.38	0.90	2.15	3.83	5.21	3.62	35.30
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total

2.3.4 Wave Fields

Given the limited fetch at the site, waves are not anticipated to affect vessel transits and were only included only as a visual indicator of wind direction.

3. BASIS OF MANEUVERS

3.1 Vessel Speeds

The starting vessel transit speed for each simulation was chosen by the mariner as appropriate for the specified starting channel location, transit direction for the maneuver, and the mariner's approach to the maneuver.

3.2 Existing Vessel Traffic

Automatic Identification System (AIS) data from August to October 2022 was reviewed to assess the existing vessel traffic within the channel. AIS is an automated tracking system that displays vessel information (such as a vessel's position, type of ship, general dimension particulars of the vessel, course and speed of the vessel, etc.) for maritime use. An AIS transponder is required through the International Maritime Organization Convention for the Safety of Life at Sea Regulation V/19.2.4 for all vessels of 300 gross tonnage and above.

Approximately 700 transits occurred in one of the three existing channels under the existing Interstate Bridge during the three-month interval reviewed. For the upbound transit the vessel primarily travelled through the southern existing channel. The majority of the downbound transits used the center existing channel. In both transit directions the north existing channel was the least travelled. AIS data for the upbound and downbound transits are shown in Figure 3-1 and Figure 3-2.

Figure 3-1: Upbound Automatic Identified System Transit Data

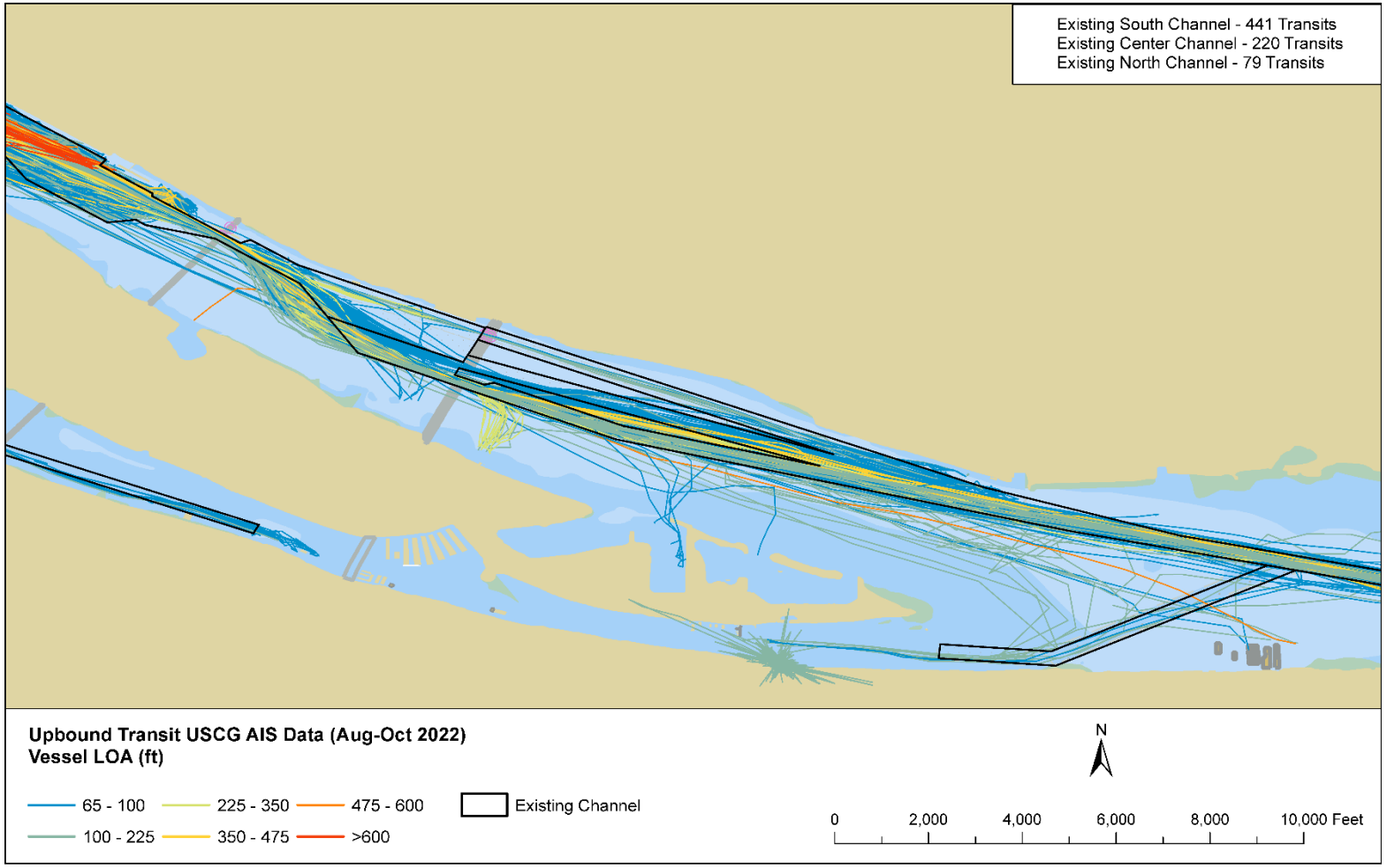
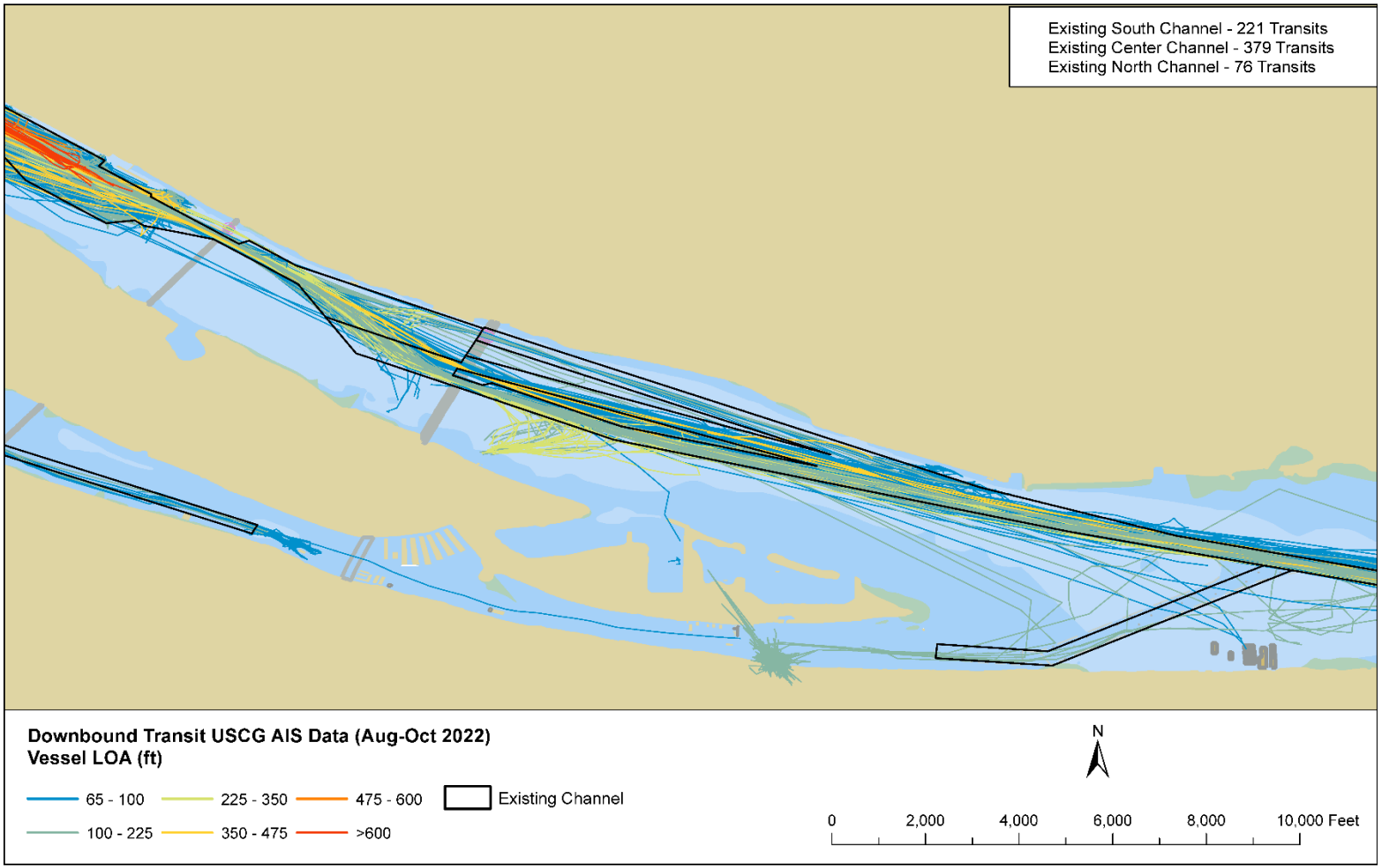


Figure 3-2: Downbound Automatic Identified System Transit Data



3.3 Simulator

The simulations were performed at the full-mission bridge ship simulation facility MITAGS West in Seattle, Washington. MITAGS is certified as a Maritime Training Provider by Det Norske Veritas. MITAGS is also compliant with criteria set forth by the USCG; the Seafarers' Training, Certification and Watchkeeping Code; the Military Sealift Command; the International Lighthouse Authority (IALA), the American Pilots' Association; the Maryland Higher Education Commission; and the Washington State Workforce Training, Education, and Coordinating Board.

MITAGS West offers three simulators: one Full-Mission Bridge Simulator, where the deep-draft simulations were performed; one Full-Mission Tug Simulator, where the shallow-draft simulations were conducted; and one Full-Mission Workboat Bridge Simulator, which is where the live tug for the shallow-draft simulations was operated. The MITAGS simulators are built on the Wärtsilä NTPro 5000 platform. For this simulation effort, Version 5.4 of NTPro was used. The MITAGS facility's full-mission bridges provide an effective simulation by providing pilots with a realistic experience.

3.3.1 Ship Handlers

The ship handling for the deep-draft vessel simulations was performed by a licensed pilot from the Columbia River Pilots Association. The ship handling for the shallow-draft vessel simulations was performed by a local tug master from either Shaver Transportation Company, Foss Maritime, Combined Forestry & Marine Services, or Tidewater. Table 3-1 lists the ship handlers and their associated company.

Table 3-1: Ship Handlers for Interstate Bridge Replacement Program Navigation Simulations

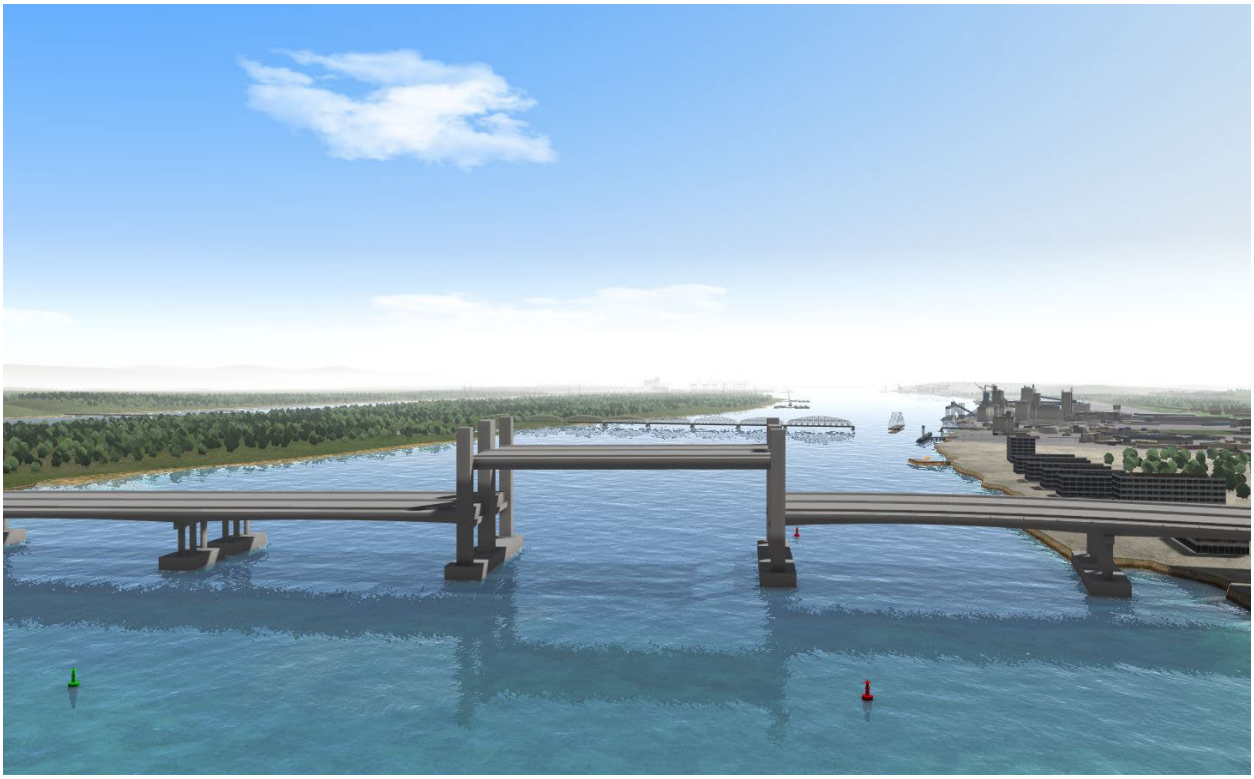
Ship Handler	Company
Dustin Johnson	Columbia River Pilots Association
Steve Dobbins	Columbia River Pilots Association
Chuck Dobbins	Columbia River Pilots Association
Andrew Bradley	Shaver Transportation Company
Jeremy Brock	Shaver Transportation Company
Luke Olson	Foss Maritime
Brian Fletcher	Tidewater
Jim Fletcher	Tidewater
Josh Nichols	Tidewater
Clark Caffall	Combined Forestry & Marine Services

3.3.2 Model Area

The scene for this study was based on the MITAGS modified Wärtsilä Portland scene. MITAGS has customized this scene to include a three-dimensional rendering of the proposed and existing bridges and the associated channels. In total, three scenes were evaluated: 1) Existing Database with the existing bridge and channels, 2) Interim Construction Database with the existing and proposed bridges and the interim construction channels, and 3) Proposed Database with the proposed bridge and channels. The base scene is shown in Figure 3-3. The rendering of the proposed bridge included in the navigation simulation scene is shown in Figure 3-4.

Figure 3-3: Existing Interstate Bridge Scene Rendering

Figure 3-4: Proposed Bridge Scene Rendering



3.3.3 Vessel Responses

The simulator provides the following dynamic modeling capabilities for the design vessels:

- **Vessel Control:** Real-time vessel response delays to rudder and speed commands. Each deep-draft vessel or primary tow boat was controlled by the ship handler.
- **Assist Tugs:** Ability to simulate and apply tug interaction visually and physically. This includes the ability to specify tug attachment point locations and real-time movement of tugs during repositioning. Tugs were seldom used for this simulation effort. But when they were, a live tug was used.
- **Vessel Response:** Real-time vessel response and horizontal and vertical location with respect to the navigation channel limits and bottom elevations (underkeel clearance).
- **Mooring:** Ability to specify mooring line locations; however, vessel mooring was not simulated.
- **Failures:** Ability to specify dead ship and rudder failure conditions; however, failure was not simulated.

3.4 Testing Matrix

Table 3-1 through Table 3-3 show the matrices of the completed simulations. The matrices were based on the test matrix included in the initial plan and modified based on mariners' input. All changes to matrices received concurrence from the simulation observers. In total, 22 deep-draft simulations and 89 shallow-draft simulations were conducted to evaluate the existing, proposed, and interim construction navigation channel configurations.

Table 3-2: Deep-Draft Simulation Matrix

Run	Transiting Vessel	Scenario	Transiting Channel	Transiting Direction	Dredge Depth	Lift Span Position	Load Condition	Time of Day	Visibility	Wind (knots)	Water Level (feet, CRD)	Available Art Draft (feet)	River Flow	Pilot
1	*Pilot Familiarization*													
2	*Pilot Familiarization*													
3	Bulk Carrier 24	Existing	North	Upbound	Authorized	Up	Light	Daytime	Clear	S 20	2.94	177.7	Normal	D. Johnson
4	Bulk Carrier 24	Existing	North	Downbound	Authorized	Up	Light	Daytime	Clear	S 20	2.94	177.7	Normal	S. Dobbins
5	Bulk Carrier 24	Proposed	Center	Upbound	Authorized	Up	Light	Daytime	Clear	S 20	2.94	182.22	Normal	D. Johnson
6	Bulk Carrier 24	Proposed	Center	Downbound	Authorized	Up	Light	Daytime	Clear	S 20	2.94	182.22	Normal	S. Dobbins
7	Bulk Carrier 24	Existing	North	Upbound	Authorized	Up	Loaded	Daytime	Clear	S 20	2.94	177.7	Normal	S. Dobbins
8	Bulk Carrier 24	Existing	North	Downbound	Authorized	Up	Loaded	Daytime	Clear	S 20	2.94	177.7	Normal	D. Johnson
9	Bulk Carrier 24	Proposed	Center	Upbound	Authorized	Up	Loaded	Daytime	Clear	S 20	2.94	182.22	Normal	D. Johnson
10	Bulk Carrier 24	Proposed	Center	Downbound	Authorized	Up	Loaded	Daytime	Clear	S 20	2.94	182.22	Normal	S. Dobbins
11	Bulk Carrier 24	Existing	North	Upbound	Authorized	Up	Light	Daytime	Clear	S 20	16.43	152.37	10-Year	S. Dobbins
12	Bulk Carrier 24	Existing	North	Downbound	Authorized	Up	Light	Daytime	Clear	S 20	16.43	152.37	10-Year	D. Johnson
13	Bulk Carrier 24	Proposed	Center	Upbound	Authorized	Up	Light	Daytime	Clear	S 20	16.43	156.89	10-Year	D. Johnson
14	Bulk Carrier 24	Proposed	Center	Downbound	Authorized	Up	Light	Daytime	Clear	S 20	16.43	156.89	10-Year	S. Dobbins
15	Bulk Carrier 24	Proposed	Center	Upbound	Authorized	Up	Loaded	Nighttime	Clear	S 20	11.84	173.32	Transitional	D. Johnson
16	Bulk Carrier 24	Existing	North	Upbound	Authorized	Up	Loaded	Daytime	Clear	S 20	16.43	152.37	10-Year	S. Dobbins
17	Bulk Carrier 24	Existing	North	Downbound	Authorized	Up	Loaded	Daytime	Clear	S 20	16.43	152.37	10-Year	D. Johnson
18	Bulk Carrier 24	Proposed	Center	Upbound	Authorized	Up	Loaded	Daytime	Clear	S 20	16.43	156.89	10-Year	S. Dobbins
19	Bulk Carrier 24	Proposed	Center	Downbound	Authorized	Up	Loaded	Daytime	Clear	S 20	16.43	156.89	10-Year	D. Johnson
20	Bulk Carrier 24	Proposed	Center	Downbound	Authorized	Up	Loaded	Daytime	Clear	S 20	16.43	156.89	10-Year	D. Johnson
21	Bulk Carrier 24	Existing	North	Upbound	Authorized	Up	Light	Daytime	Clear	S 25 and gusts	2.94	177.7	Normal	D. Johnson
22	Bulk Carrier 24	Proposed	North	Upbound	Authorized	Up	Light	Daytime	Clear	S 25 and gusts	2.94	177.7	Normal	S. Dobbins

Table 3-3: Shallow-Draft Simulation Matrix

Run	Scenario	Barge	Pushboat Model	Pushboat Position	Load Condition	Transiting Channel	Transiting Direction	Lift Span Position	Wind (knots)	River Flow	Time of Day	Visibility	Dredge Depth	Assist Tug	Pilot
1	Existing	2x2 Barge	Twin Screw Pushboat 2	Port	Light	North	Upbound	Up	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
2	Existing	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Downbound	Up	S 20	Normal	Daytime	Clear	Maintained	NA	Jim Fletcher
3	Existing	Specialty Barge	Z-Drive Pushboat	Center	Loaded	North	Upbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Luke Olson
4	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Light	Center	Upbound	Down	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
5	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Downbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Jim Fletcher
6	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Loaded	Center	Upbound	Up	S 20	Normal	Daytime	Clear	Maintained	NA	Luke Olson
7	Existing	2x2 Barge	Twin Screw Pushboat 2	Starboard	Light	North	Upbound	Up	S 20	Transitional	Daytime	Clear	Maintained	NA	Andy Bradley
8	Existing	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Downbound	Up	S 20	Transitional	Daytime	Clear	Maintained	NA	Jim Fletcher
9	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Downbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Jim Fletcher
10	Existing	Specialty Barge	Z-Drive Pushboat	Center	Light	North	Downbound	Up	S 20	Normal	Daytime	Clear	Maintained	NA	Luke Olson
11	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Light	North	Upbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Andy Bradley
12	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Light	Center	Downbound	Up	S 20	Normal	Daytime	Clear	Maintained	NA	Luke Olson
13	Existing	2x2 Barge	Twin Screw Pushboat 2	Port	Light	South	Upbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
14	Existing	Specialty Barge	Z-Drive Pushboat	Center	Loaded	North	Upbound	Up	S 20	Transitional	Daytime	Clear	Maintained	Twin Screw Pushboat 2	Luke Olson
15	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Light	South	Upbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
16	Existing	Specialty Barge	Z-Drive Pushboat	Center	Light	North	Downbound	Up	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
17	Existing	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	Center	Downbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
18	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Light	Center	Downbound	Up	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
19	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	Center	Downbound	Down	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
20	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Light	North	Downbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Luke Olson
21	Existing	2x2 Barge	Twin Screw Pushboat 2	Port	Light	South	Upbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Andy Bradley
22	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Loaded	Center	Upbound	Up	S 20	Transitional	Daytime	Clear	Maintained	Twin Screw Pushboat 2	Luke Olson

Run	Scenario	Barge	Pushboat Model	Pushboat Position	Load Condition	Transiting Channel	Transiting Direction	Lift Span Position	Wind (knots)	River Flow	Time of Day	Visibility	Dredge Depth	Assist Tug	Pilot
23	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Light	South	Upbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Andy Bradley
24	Existing	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	Center	Downbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
25	Existing	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Upbound	Up	S 20	10-Year	Daytime	Clear	Maintained	NA	Andy Bradley
26	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	Center	Downbound	Down	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
27	Proposed	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Upbound	NA	S 20	10-Year	Daytime	Clear	Maintained	NA	Andy Bradley
28	Existing	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Downbound	Up	S 20	10-Year	Daytime	Clear	Maintained	NA	Andy Bradley
29	Proposed	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Downbound	NA	S 20	10-Year	Daytime	Clear	Maintained	NA	Andy Bradley
30	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Loaded	North	Upbound	NA	S 20	Transitional	Daytime	Clear	Maintained	Twin Screw Pushboat 2	Luke Olson
31	Existing	2x1 Barge	Twin Screw Pushboat 2	Port	Light	North	Upbound	Up	S 20	10-Year	Daytime	Clear	Maintained	NA	Andy Bradley
32	Construction	Specialty Barge	Z-Drive Pushboat	Center	Loaded	North	Upbound	Up	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
33	Proposed	2x1 Barge	Twin Screw Pushboat 2	Port	Light	North	Upbound	NA	S 20	10-Year	Daytime	Clear	Maintained	NA	Andy Bradley
34	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Loaded	South	Upbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
35	Construction	Specialty Barge	Z-Drive Pushboat	Center	Loaded	South	Upbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
36	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Light	North	Upbound	Up	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
37	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Light	North	Downbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
38	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Light	North	Upbound	Up	S 20	Transitional	Daytime	Clear	Maintained	NA	Andy Bradley
39	Construction	Specialty Barge	Z-Drive Pushboat	Center	Light	North	Downbound	Up	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
40	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Downbound	Up	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
41	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Light	South	Downbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
42	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Downbound	Up	S 20	Transitional	Daytime	Clear	Maintained	NA	Andy Bradley
43	Construction	Specialty Barge	Z-Drive Pushboat	Center	Light	South	Downbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
44	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Light	South	Upbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
45	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Loaded	Center	Upbound	Up	S 20	Transitional	Nighttime	Clear	Maintained	NA	Luke Olson
46	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley

Run	Scenario	Barge	Pushboat Model	Pushboat Position	Load Condition	Transiting Channel	Transiting Direction	Lift Span Position	Wind (knots)	River Flow	Time of Day	Visibility	Dredge Depth	Assist Tug	Pilot
47	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Light	Center	Downbound	Up	S 20	Transitional	Nighttime	Clear	Maintained	NA	Luke Olson
48	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
49	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
50	Existing	Specialty Barge	Z-Drive Pushboat	Center	Light	North	Downbound	Up	S 20	10-Year	Daytime	Clear	Maintained	NA	Luke Olson
51	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Light	South	Upbound	NA	S 20	Normal	Daytime	Clear	Maintained	NA	Andy Bradley
52	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Light	Center	Downbound	Up	S 20	10-Year	Daytime	Clear	Maintained	NA	Luke Olson
53	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Light	South	Upbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Andy Bradley
54	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	Transitional	Nighttime	Clear	Maintained	NA	Andy Bradley
55	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Andy Bradley
56	Proposed	2x1 Barge	Twin Screw Pushboat 2	Port	Light	South	Upbound	NA	S 20	10-Year	Daytime	Clear	Maintained	NA	Andy Bradley
57	Proposed	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	10-Year	Daytime	Clear	Maintained	NA	Andy Bradley
58	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Light	South	Upbound	NA	S 20	Normal	Nighttime	Clear	Maintained	NA	Andy Bradley
59	Construction	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	Normal	Nighttime	Clear	Maintained	NA	Andy Bradley
60	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Light	Center	Upbound	Down	S 20	Transitional	Daytime	Fog 1-mile	Maintained	NA	Andy Bradley
61	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	Center	Downbound	Down	S 20	Transitional	Daytime	Fog 1-mile	Maintained	NA	Andy Bradley
62	Proposed	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	Center	Downbound	Down	S 20	10-Year	Nighttime	Clear	Maintained	NA	Luke Olson
63	Construction	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	North	Downbound	Up	S 20	10-Year	Daytime	Clear	Maintained	NA	Luke Olson
64	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Light	North	Downbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
65	Construction	Specialty Barge	Z-Drive Pushboat	Center	Light	South	Downbound	NA	S 20	Normal	Nighttime	Clear	Maintained	NA	Luke Olson
66	Construction	Specialty Barge	Z-Drive Pushboat	Center	Loaded	South	Upbound	NA	S 20	Normal	Nighttime	Clear	Maintained	NA	Luke Olson
67	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Loaded	Center	Upbound	Up	S 20	10-Year	Daytime	Clear	Maintained	NA	Luke Olson
68	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Loaded	Center	Downbound	Up	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
69	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Light	Center	Upbound	Down	S 20	Normal	Daytime	Clear	Maintained	NA	Luke Olson
70	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Light	Center	Upbound	Down	S 20	Transitional	Nighttime	Clear	Maintained	NA	Luke Olson

Run	Scenario	Barge	Pushboat Model	Pushboat Position	Load Condition	Transiting Channel	Transiting Direction	Lift Span Position	Wind (knots)	River Flow	Time of Day	Visibility	Dredge Depth	Assist Tug	Pilot
71	Proposed	2x1 Barge	Twin Screw Pushboat 2	Port	Light	Center	Upbound	Down	S 20	10-Year	Daytime	Clear	Maintained	NA	Luke Olson
72	Construction	2x1 Barge	Twin Screw Pushboat 2	Port	Light	North	Upbound	Up	S 20	10-Year	Daytime	Clear	Maintained	NA	Luke Olson
73	Construction	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Andy Bradley
74	Proposed	Specialty Barge	Z-Drive Pushboat	Center	Loaded	Center	Downbound	Up	S 20	Transitional	Daytime	Clear	Maintained	NA	Luke Olson
75	Construction	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	Transitional	Nighttime	Clear	Maintained	NA	Andy Bradley
76	Construction	2x1 Barge	Twin Screw Pushboat 2	Port	Light	South	Upbound	NA	S 20	10-Year	Nighttime	Clear	Maintained	NA	Andy Bradley
77	Construction	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	10-Year	Nighttime	Clear	Maintained	NA	Andy Bradley
78	Existing	Specialty Barge	Twin Screw Pushboat 3	Center	Loaded	North	Upbound	Up	S 10	Normal	Daytime	Clear	Maintained	NA	Clark Caffall
79	Proposed	2x2 Barge	Twin Screw Pushboat 2	Starboard	Light	Center	Upbound	Down	S 20	Transitional	Daytime	Clear	Maintained	NA	Josh Nichols
80	Existing	Specialty Barge	Twin Screw Pushboat 3	Center	Loaded	North	Downbound	Up	S 10	Transitional	Daytime	Clear	Maintained	NA	Clark Caffall
81	Proposed	2x2 Barge	Twin Screw Pushboat 2	Port	Loaded	Center	Downbound	Down	S 20	Transitional	Daytime	Clear	Maintained	NA	Brian Fletcher
82	Proposed	Specialty Barge	Twin Screw Pushboat 3	Center	Loaded	Center	Upbound	Up	S 10	Normal	Daytime	Clear	Maintained	NA	Clark Caffall
83	Proposed	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	10-Year	Daytime	Clear	Maintained	NA	Josh Nichols
84	Proposed	Specialty Barge	Twin Screw Pushboat 3	Center	Loaded	Center	Downbound	Up	S 10	Transitional	Daytime	Clear	Maintained	NA	Clark Caffall
85	Construction	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Josh Nichols
86	Proposed	Specialty Barge	Twin Screw Pushboat 3	Center	Loaded	South	Downbound	NA	S 10	Transitional	Daytime	Clear	Maintained	NA	Clark Caffall
87	Construction	2x1 Barge	Twin Screw Pushboat 2	Port	Loaded	South	Downbound	NA	S 20	Transitional	Daytime	Clear	Maintained	NA	Josh Nichols
88	Construction	Specialty Barge	Twin Screw Pushboat 3	Center	Loaded	South	Downbound	NA	S 10	Transitional	Daytime	Clear	Maintained	NA	Clark Caffall
89	Construction	2x1 Barge	Twin Screw Pushboat 2	Starboard	Light	South	Upbound	NA	S 20	Transitional	Daytime	Rain 1-Mile Visibility	Maintained	NA	Brian Fletcher

NA = Not Applicable

3.5 Evaluation Criteria

The primary criterion for the success of each run was mariner feedback during the simulations and post-processed metrics from the runs. A key component of the evaluation was the mariner assessment of overall safety and opinion as to whether the specific maneuvers would be conducted in real life. An example of the questionnaires prepared for these simulations is included in Appendix C.

Mariner feedback was recorded on the evaluation forms (Appendix D), along with notes and observations made by the engineer supervising the effort. Immediately following each simulation, the mariner was asked to rate the maneuver in three categories: Run Safety, Tug Adequacy (if applicable), and Run Difficulty. These ratings are discussed in greater detail in the subsections below.

- Run Safety: 1 to 5 with "5" highest safety and "3" average safety
- Tug Adequacy: 1 to 5 with "5" most adequate and "3" average
- Run Difficulty: 1 to 5 with "5" most difficult and "3" average

Additional variables that will be used to critique the performance of the runs include, but are not limited to:

- **Clearance to structures.** The minimum clearance to structures was evaluated based on the swept path of the vessels. For the Interstate Bridge pier, the desired clearance was at least 50 feet for both the existing and proposed bridges based on the USACE required safety clearance from the pier to the navigation channel limit. For the BNSF Bridge pier, the desired clearance was at least 50 feet to the North Pier and at least 15 feet to the South Pier, based on the distance of the existing navigation channel to the BNSF bridge piers (NOAA 2022). These stated clearances were the desired clearances. A run was still considered successful if the vessel came within these distances, as it is common practice today for shallow-draft transits to come within these stated clearances.
- **Clearance to navigation channel limits.** For the deep-draft transits, the vessel track was to remain within the federal navigation channel limits, as the water depth outside the channel will not provide sufficient water. For the shallow-draft transits, the vessel track would ideally remain within the channel limits. However, the common practice for shallow-draft vessels maneuvers in the study is to leave the channel limits and use areas that have more than sufficient water depths for the transiting vessels. As a result, departure from the navigation channel for the shallow-draft vessels was considered acceptable, assuming the vessel did not ground.
- **Reserve rudder.** Rudder use during the simulation was evaluated with the aim of maintaining sufficient reserve for unanticipated maneuvering. Simulations that required sustained hard-over rudder are not desired, as there is no reserve steering for unanticipated maneuvering.
- **Reserve engine power.** Engine power was tracked during the simulations to evaluate the reserve power.

4. RESULTS AND ANALYSIS

In total, 22 deep-draft simulations and 89 shallow-draft simulations were conducted to evaluate the existing, proposed, and interim construction navigation channel configurations. For each simulation, a swept path figure was created to illustrate the maneuver (see Appendix D). Additionally, a time series plot was created for each simulation to illustrate parameters such as use of the ship's engine, rate of turn, speed over ground (SOG) (see Appendix D). The parameters shown in simulation time series are listed below with a brief description and the unit used for each.

- SOG (knots) is the speed the vessel is transiting relative to the surface of the earth.
- Rudder angle (degrees) is the angle of the rudder, which is the device used for steering and maneuvering the vessel. The maximum rudder angles for the vessels simulated are listed below:
  - Bulk Carrier 24: 35 degrees
  - Twin Screw Push Boat 2: 45 degrees
  - Twin Screw Push Boat 3: 45 degrees
  - Z-Drive Pushboat: 180 degrees
- Engine speed (revolutions per minute [RPM]) is the number of revolutions per minute of the engine, which is an indicator of the engine order from the mariner.
- Rate of turn (degrees per minute) indicates the rate a vessel is turning.

For clarity, this result and analysis section is organized into the following subsections to allow comparison of similar simulations:

- Deep-draft upbound transits
- Deep-draft downbound transits
- Shallow-draft 2x2 barge upbound transits
- Shallow-draft 2x2 barge downbound transits
- Shallow-draft 2x1 barge upbound transits
- Shallow-draft 2x1 barge downbound transits
- Shallow-draft specialty barge upbound transits
- Shallow-draft specialty barge downbound transits

4.1 Deep-Draft Production Simulations

In total, 20 deep-draft production simulations were performed to compare the existing navigation channels to the proposed navigation channels. As previously stated, deep-draft vessels do not currently transit under the Interstate Bridge; therefore, this analysis is to evaluate a hypothetical future condition. The existing navigation channels were simulated to allow the pilots to gain familiarity with the existing bridge and what it would be like to maneuver the deep draft in present-day conditions to

give the pilots a baseline to compare the proposed bridge configuration. The construction channels were not evaluated for the deep-draft vessels as this vessel class does not currently transit this portion of the river and there are no future plans at the time of this report.

4.1.1 Upbound Transits

Of these 20 deep-draft simulations, 11 were upbound; five evaluated the existing navigation channels and six evaluated the proposed navigation channels. Three flow conditions were evaluated for these simulations, normal, transitional, and 10-year flows. Primarily, the simulated wind condition was a 20-knot wind from the south. Two simulations, one existing channel and one proposed channel run, evaluated a 25-knot gusting wind from the south.

Example swept paths and time series plots for existing and proposed navigation channels are shown in Figure 4-1, Figure 4-2, Figure 4-3, and Figure 4-4. Table 4-1 shows the minimum distances of the swept path from the Interstate Bridge piers, existing or proposed depending on the simulation scenario, and the distance from the BNSF bridge piers. All of these simulations met the minimum desired clearances, as stated in Section 3.5. On average for the Interstate Bridge, the minimum clearance to the piers were greater for the proposed bridge than the existing bridge.

Deep-draft **Simulation 3, 5, 9, 13, 15, 18, and 22** had slight departures from the channel boundaries upstream of the BNSF bridge on the red side of the channel. Figure 4-5 shows a merged envelope of these simulations' tracks and the recommended bend widener if a deep-draft vessel were to start transiting this portion of the river due to the numerous departures of the vessel from the navigation channel.

The pilot safety and run difficulty ratings for all the deep-draft upbound bulk carrier simulations are summarized in Table 4-2. Note that two different pilots performed these simulations and performance ratings are subjective to each individual pilot. On average, the upbound existing and proposed navigation channel transits were rated as having average safety and below-average difficulty. The was no noticeable difference in the ratings between the existing and proposed channels.

The pilots found the simulation and model to be a realistic representation. For all these simulations, the pilots would perform the transit in a real-world situation independent of the simulated channel/bridge. The pilots made the following observations comparing the existing and proposed navigation channels:

- The proposed navigation channels were a significant improvement in the transition between the BNSF bridge and Interstate Bridge a result of a steady heading through the BNSF bridge toward where the pilot wants to be positionally approaching the Interstate Bridge. With the proposed channel/bridge, there is a single turn point between 0the two bridges, whereas the current channel requires two corrections with the existing bridge.
- With the proposed Interstate Bridge piers, there is more maneuvering area than with the existing bridge piers. The existing bridge transit, is possible but the clearance is more restrictive.
- Passing through the existing bridge, the vessels come close to Vancouver and any vessels docked there and are constrained from maneuvering on one side. Pilots expressed that they

had to “dig out” from the existing bridge channel. These conditions were mitigated with the proposed bridge span and center channel alignment for the deep-draft vessels.

The pilots also commented on the aids to navigation as a result of the proposed project. The first comment was that the red and green buoys need to be switched to follow IALA maritime convention, as the primary navigation channel would no longer be the north channel but would become the center channel. The second comment was that the junction buoy needs to relocated south of the center channel, also to follow IALA convention.

Figure 4-1: Example Deep-Draft Upbound Existing Navigation Channel Swept Path Summary

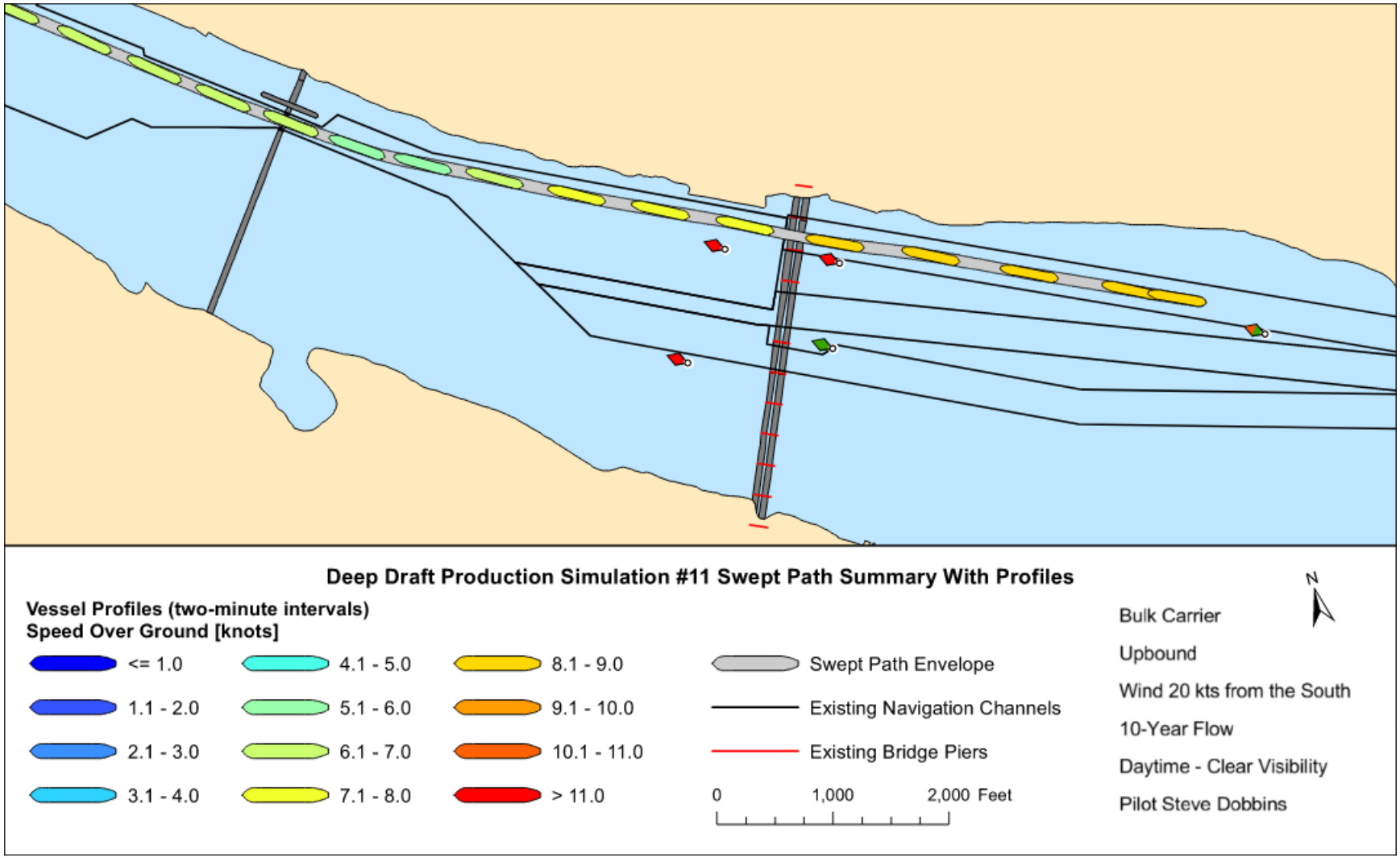


Figure 4-2: Example Deep-Draft Upbound Existing Navigation Channel Timeseries Plot

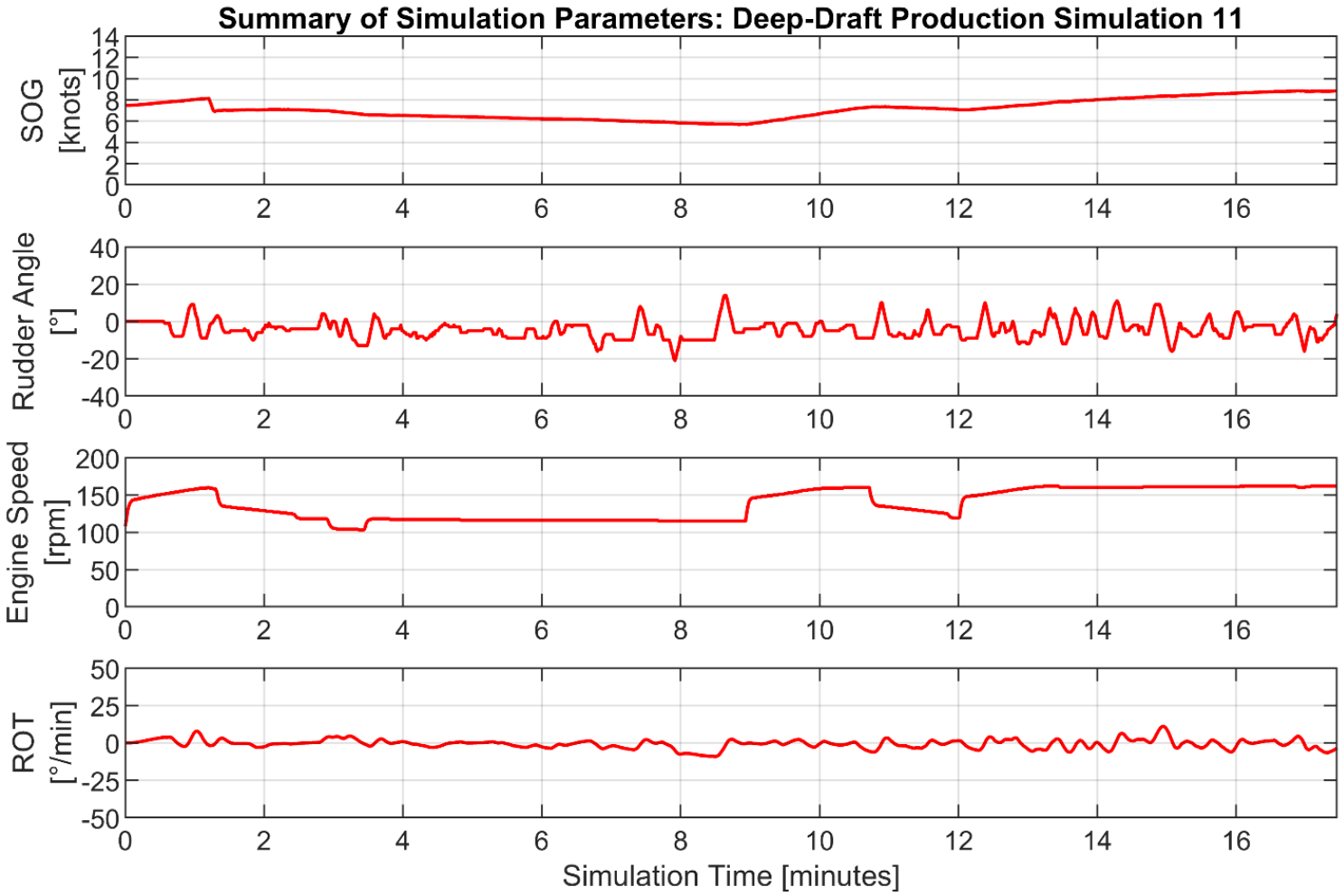


Figure 4-3: Example Deep-Draft Upbound Proposed Navigation Channel Swept Path Summary

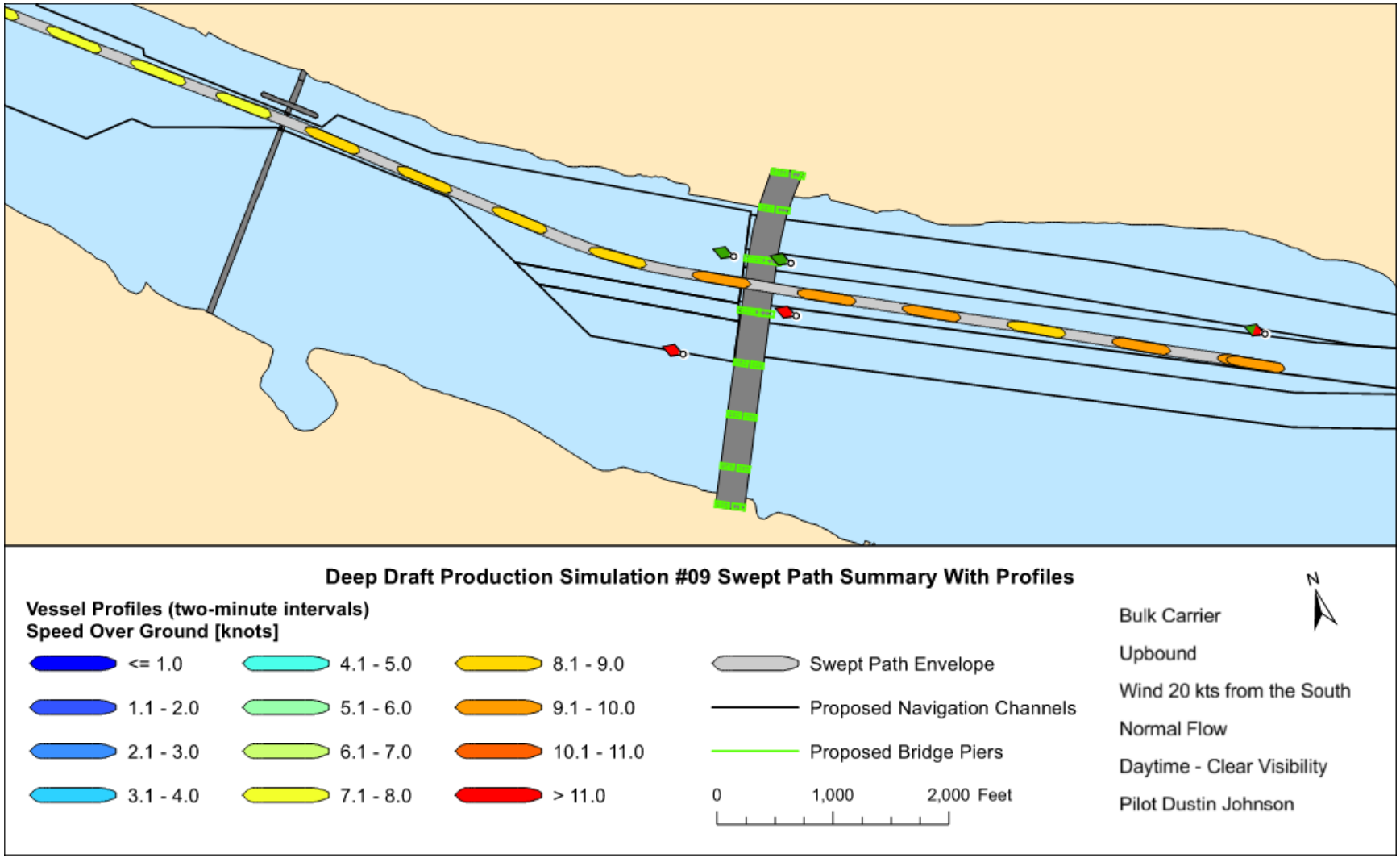


Figure 4-4: Example Deep-Draft Upbound Proposed Navigation Channel Timeseries Plot

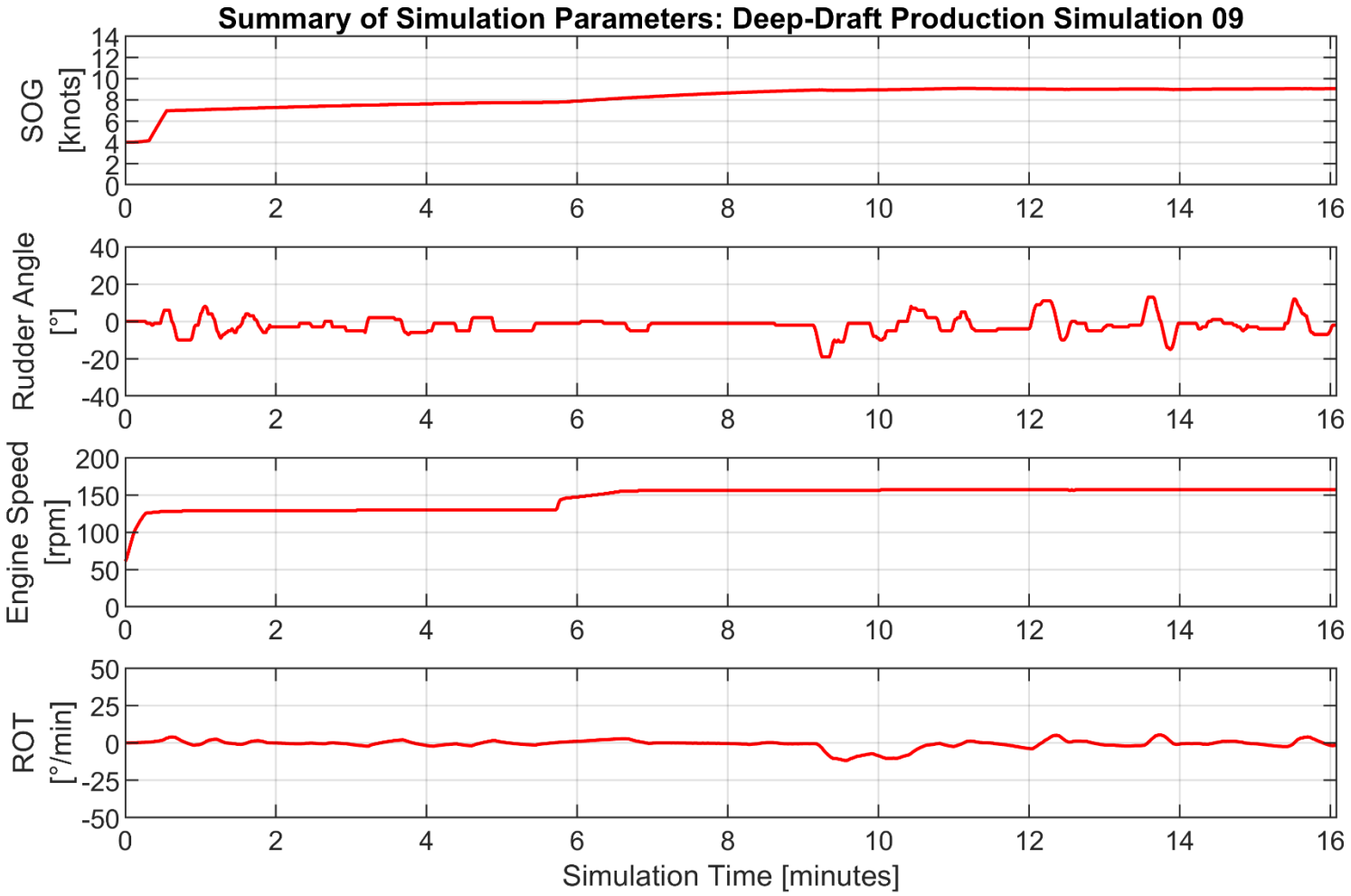


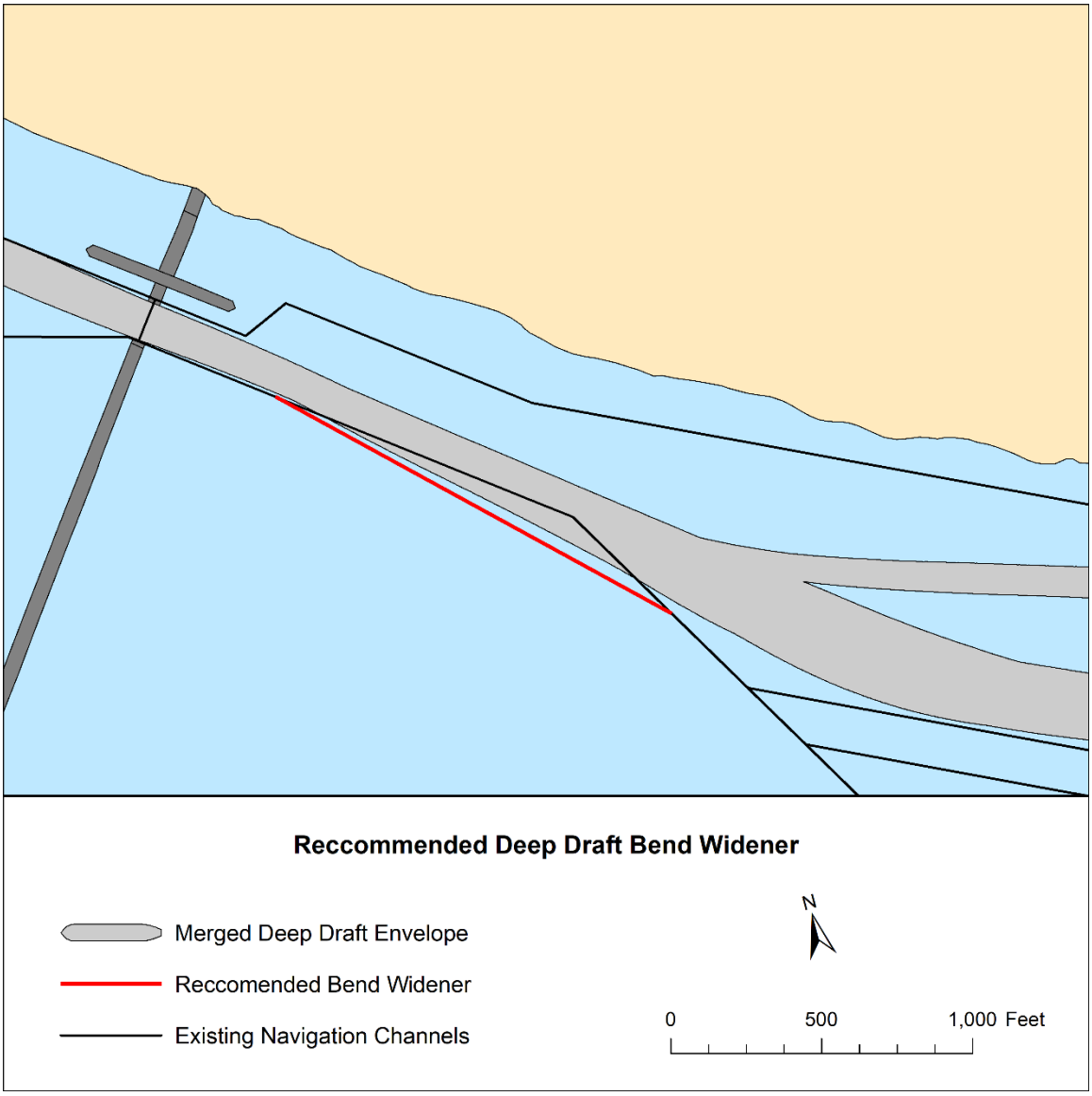
Table 4-1. Deep-Draft Upbound Simulations Minimum Distances to Interstate Bridge and BNSF Bridge Piers

Run	Distance to Bridge Pier (feet)					
	Existing Interstate Bridge		**Proposed Interstate Bridge**		**BNSF Bridge**	
	North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	*North Pier*	*South Pier*
3	90	94	--	--	80	39
5	--	--	108	186	59	53
7	100	92	--	--	86	39
8	93	97	--	--	54	59
9	--	--	145	156	75	49
11	115	77	--	--	73	39
13	--	--	161	136	65	54
15	--	--	186	114	73	49
16	110	84	--	--	66	55
18	--	--	104	185	76	43
21	98	84	--	--	71	50
22	--	--	168	125	92	18
Average Distance (feet)	***101***	***88***	***145***	***150***	***73***	***46***

Table 4-2. Deep-Draft Upbound Simulations Pilot Ratings for Safety and Difficulty

Existing Navigation Channels					Proposed Navigation Channels					Notes
Rows of table list runs of the same conditions with the exception of navigation channel and if noted in the "Notes" column of table.										
Run Number	Pilot	Run Safety	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Run Difficulty	Run Result	
3	D. Johnson	3	2	🟢	5	D. Johnson	3	3	🟢	**Run 3 & 5** departed channel on red side, bend widener recommended
7	S. Dobbins	5	1	🟢	9	D. Johnson	4	1	🟢	**Run 9** departed channel on red side, bend widener recommended
11	S. Dobbins	3	3	🟢	13	D. Johnson	2	3	🟢	**Run 13** departed channel on red side, bend widener recommended
--					15	D. Johnson	3	3	🟢	**Run 15** departed channel on red side, bend widener recommended
16	S. Dobbins	3	3	🟢	18	S. Dobbins	3	2	🟢	**Run 18** departed channel on red side, bend widener recommended
21	D. Johnson	2	4	🟢	22	S. Dobbins	3	1	🟢	**Run 22** departed channel on red side, bend widener recommended
Average Score	--	3.2	2.7	--	**Average Score**	--	3.0	2.2	--	--
🟢	Success. Run was well controlled with adequate clearance to channel edges and structures									
🔴	Unsuccessful. Run was failed due to allision with BNSF bridge									
🟣	Unsuccessful. Run was failed due to allision with Interstate Bridge									

Figure 4-5: Recommend Deep-Draft Bend Widener



4.1.2 Downbound Transits

Of the 20 deep-draft simulations, nine were downbound; four evaluated the existing navigation channels, and five evaluated the proposed navigation channels. Two flow conditions were evaluated for these simulations: normal and 10-year. For all of these simulations, the wind condition was a 20-knot wind from the south.

Example swept paths and time series plots for existing and proposed navigation channels are shown in Figure 4-6, Figure 4-7, Figure 4-8, and Figure 4-9. Table 4-3 shows the minimum distances of the swept

path from the Interstate Bridge piers, existing or proposed depending on the simulation scenario, and the distance from the BNSF bridge piers. Based on the evaluation criteria for desired minimum clearance to the bridge piers all of these simulations achieved those distances, excluding **Simulation 20** which came within 45 feet of the BNSF bridge North Pier. For the Interstate Bridge, the minimum clearance to the piers was higher, on average, for the proposed bridge than for the existing bridge.

Deep-draft **Simulations 8, 19, and 20** had slight departures from the channel boundaries. **Simulations 8 and 20** left the channel boundaries upstream of the BNSF bridge on the green side of the channel adjacent to the bridge pier. **Simulation 19** departed the channel limits upstream of the BNSF bridge on the red side of the channel. For this simulation, the pilot attempted a variation in his approach to the maneuver of not increasing the RPM. The subsequent run, **Simulation 20**, evaluated the same scenario as **Simulation 19,** but this time the pilot increased the RPM, resulting in a better approach from the pilot's perspective.

The pilot safety and run difficulty ratings for all the deep-draft downbound bulk carrier simulations are summarized in Table 4-4. Note that two different pilots performed these simulations, and performance ratings are subjective to each individual pilot. On average, the downbound existing and proposed navigation channel transits were rated as having average safety and below-average difficulty. The was no noticeable difference in the ratings between the existing and proposed channels.

The pilots found the simulation and model to be a realistic representation. For all of these simulations the pilot would perform the transit in a real-world situation independent of the simulated channel/ bridge. The pilots made the following observations comparing the existing and proposed navigation channels:

- The proposed navigation channels and bridge piers allowed for more natural transition from the proposed bridge to the BNSF bridge. The existing bridge requires a turn to the south and then another turn to the north, while the proposed bridge just required a single turn to the north to line up for the BNSF bridge.
- The transit in the existing channel with the existing bridge requires a lot of rudder commands to maintain the intended track.
- Increased clearance between bridge piers on the proposed bridge allowed more maneuvering room and allowed the pilots to start their turns earlier on the downbound passage (starting under the bridge) to set up for passage through the BNSF bridge.
- Passing through the existing bridge, the vessels come close to Vancouver and any vessels docked there and are constrained from maneuvering on one side. Pilots expressed that they had to "dig out" from the existing bridge. These conditions were mitigated with the proposed bridge span.
- Overall, the pilots commented that they felt more comfortable with the proposed bridge as they had more room to correct. An additional benefit of the proposed deep-draft channel switching from the north to the center channel is that more cruise ships are expected in the future to be moored at Vancouver adjacent to the north channel; therefore, the center channel will allow a greater passing distance between the cruise vessel and transiting vessel.

Figure 4-6: Example Deep-Draft Downbound Existing Navigation Channel Swept Path Summary

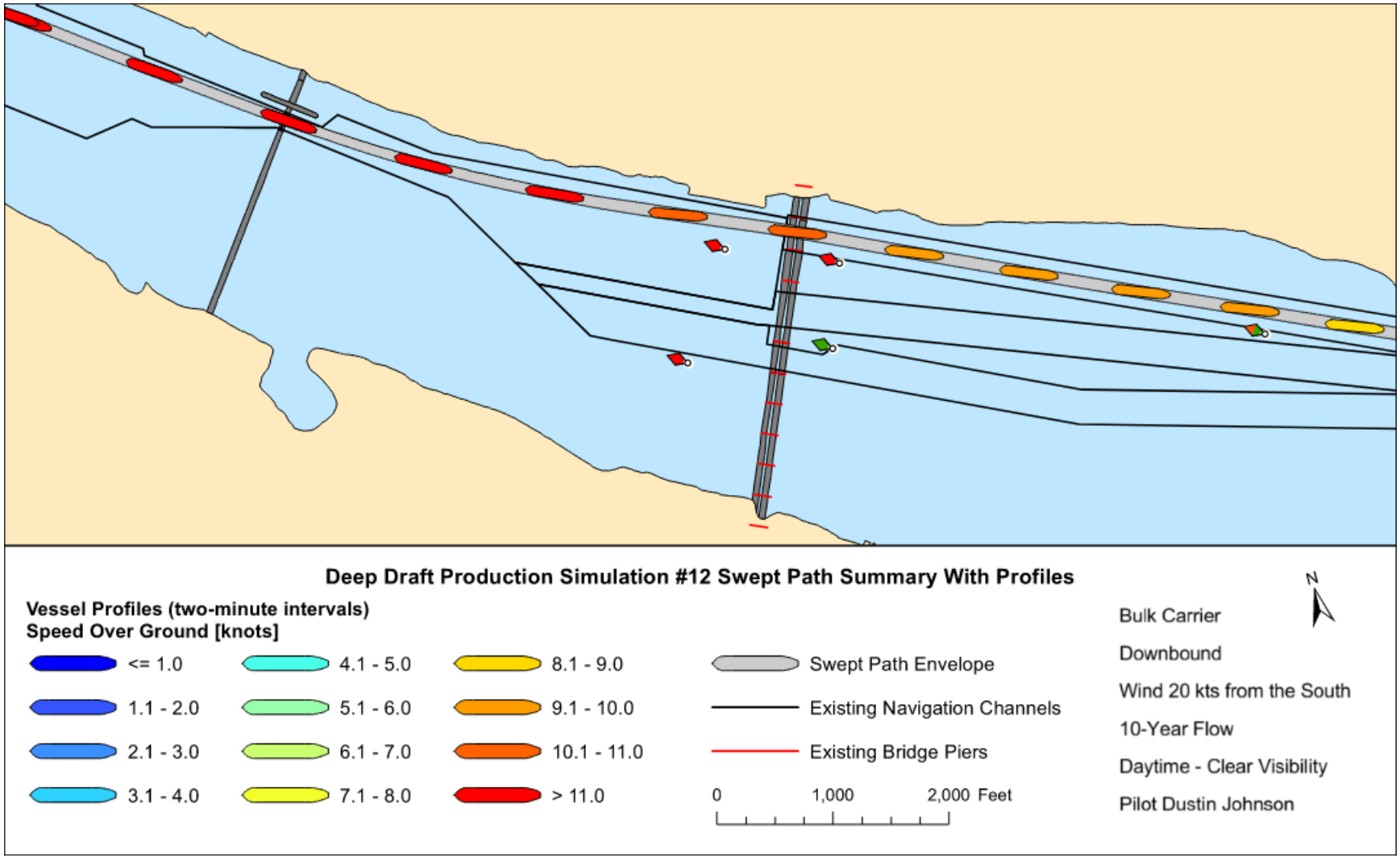


Figure 4-7: Example Deep-Draft Downbound Existing Navigation Channel Timeseries Plot

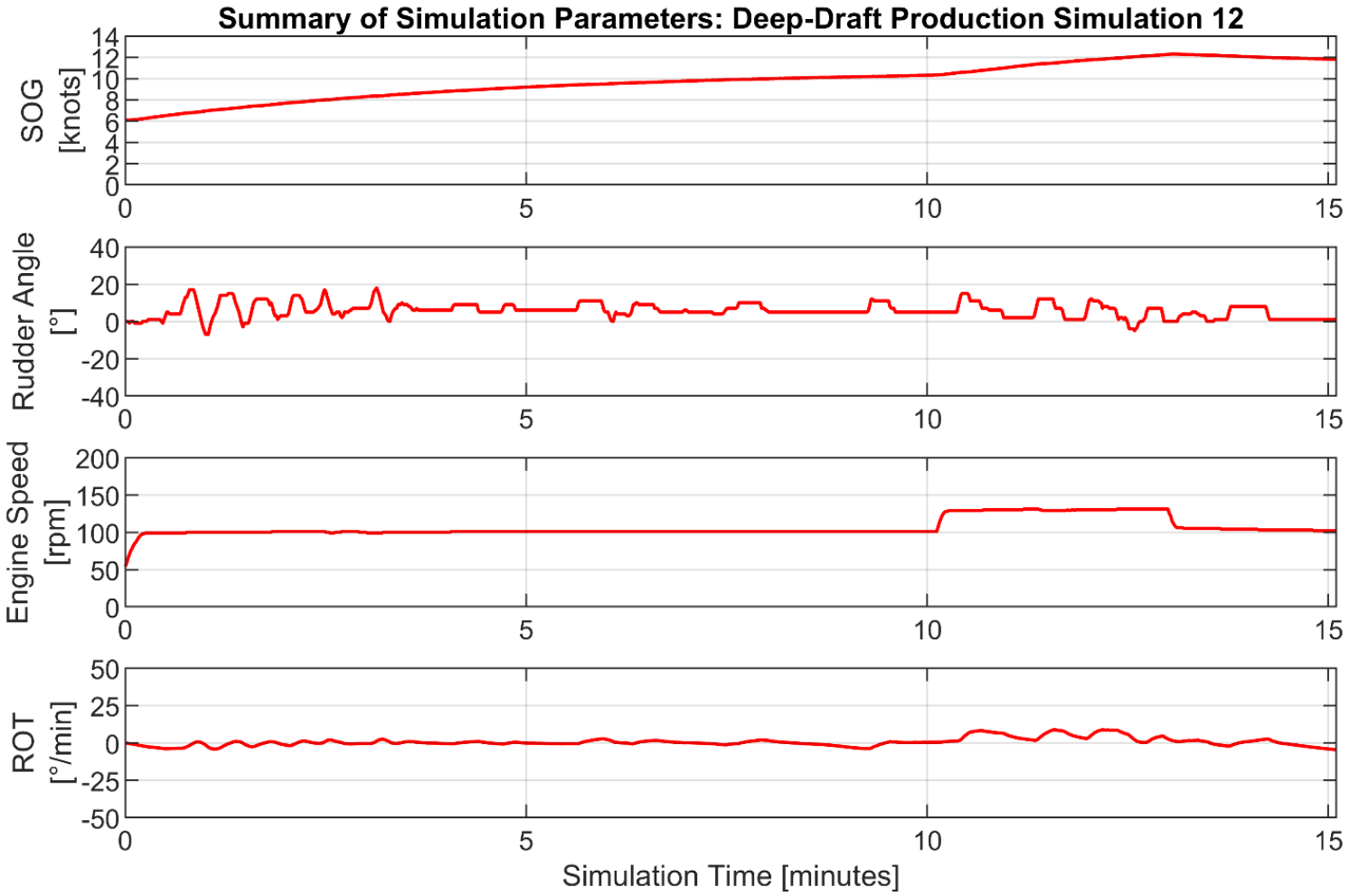


Figure 4-8: Example Deep-Draft Downbound Proposed Navigation Channel Swept Path Summary

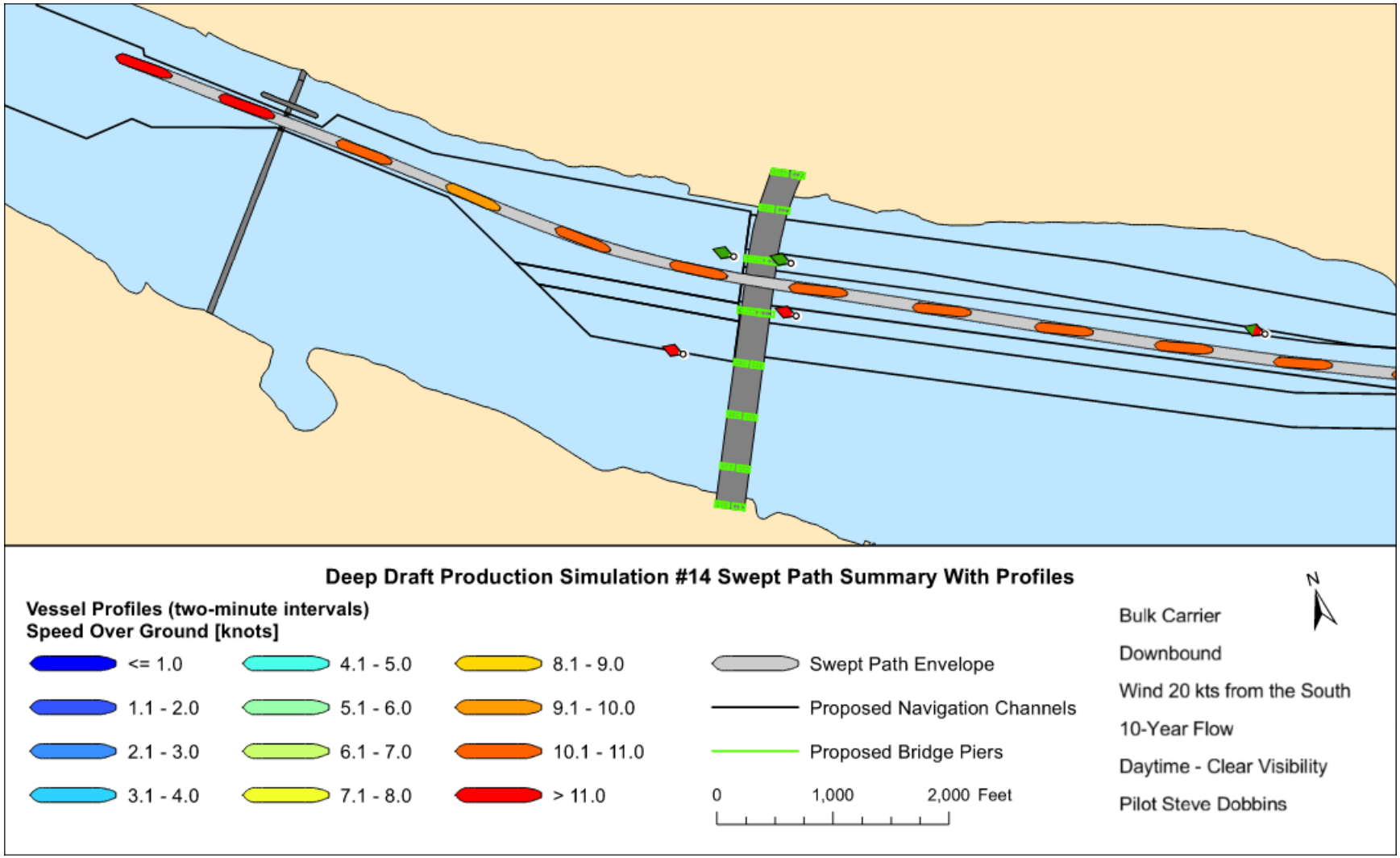


Figure 4-9: Example Deep-Draft Downbound Proposed Navigation Channel Timeseries Plot

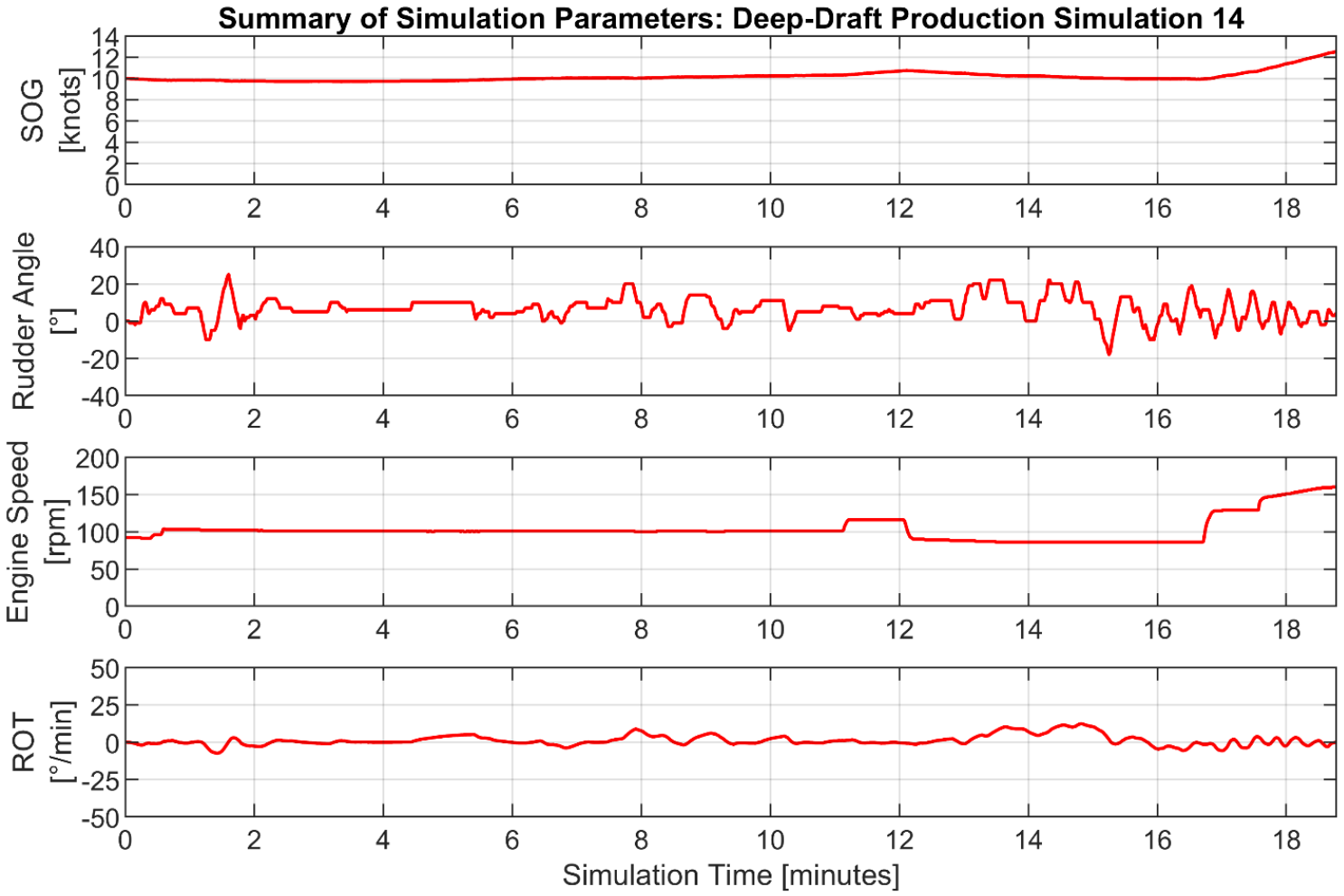


Table 4-3. Deep-Draft Downbound Simulations Minimum Distances to Interstate Bridge and BNSF Bridge Piers

Run	Distance to Bridge Pier (feet)					
	Existing Interstate Bridge		Proposed Interstate Bridge		BNSF Bridge	
	North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	*North Pier*	*South Pier*
4	124	52	--	--	67	57
6	--	--	135	160	94	32
8	93	97	--	--	54	59
10	--	--	123	176	70	49
12	74	100	--	--	64	53
14	--	--	111	188	81	40
17	65	117	--	--	64	51
19	--	--	170	132	61	59
20	--	--	101	205	45	72
Average Distance (feet)	89	92	128	172	67	52

Table 4-4. Deep-Draft Downbound Simulations Pilot Ratings for Safety and Difficulty

Existing Navigation Channels					Proposed Navigation Channels					Notes
Rows of table list runs of the same conditions with the exception of navigation channel and if noted in the "Notes" column of table.										
Run Number	Pilot	Run Safety	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Run Difficulty	Run Result	
4	S. Dobbins	3.5	3	🟢	6	S. Dobbins	2	2	🟢	--
8	D. Johnson	4	1	🟢	10	S. Dobbins	5	1	🟢	Run 8 departed channel on green side
12	D. Johnson	3	3.5	🟢	14	S. Dobbins	3	3	🟢	--
17	D. Johnson	2	3	🟢	19	D. Johnson	3	4	🟢	19 & 20 duplicate runs Run 19 departed channel on red side Run 20 departed channel on green side & within 50 feet of BNSF N Pier
					20	D. Johnson	3	4	🟢	
Average Score	--	3.1	2.6	--	**Average Score**	--	3.2	2.8	--	--
🟢	Success. Run was well controlled with adequate clearance to channel edges and structures									
🔴	Unsuccessful. Run was failed due to allision with BNSF bridge									
🟣	Unsuccessful. Run was failed due to allision with Interstate Bridge									

4.2 Shallow-Draft Production Simulations

In total, 89 shallow-draft productions simulations were performed to compare the existing navigation channels to the proposed navigation channels and interim construction navigation channels. The existing navigation channels were simulated to allow the tug masters to validate the simulator and give them a direct data point against which to compare the proposed and construction channels.

4.2.1 2x2 Barge Upbound Transits

Eighteen of the 89 shallow-draft simulations were upbound transits with the 2x2 barge. Four of these simulations evaluated the existing channels, eight runs simulated the proposed channels, and six simulations transited the construction channels. For the 2x2 barges, two flow conditions were evaluated: normal and transitional. These large barges typically are broken down into 2x1 barges when the flow exceeds the transitional flow. A single wind condition of 20 knots from the south was simulated based on mariner specification as the controlling condition for maneuvering past the bridge.

Example swept paths and time series plots for existing, proposed, and construction navigation channels are shown in Figure 4-10, Figure 4-11, Figure 4-12, Figure 4-13, Figure 4-14, and Figure 4-15.

During the shallow-draft simulations, the tug masters reported unrealistic shearing behavior in the vicinity of the BNSF bridge for the 2x2 barge. As a result, the current field in the vicinity of the BNSF bridge was interpolated onto the uniform 5-meter grid. **Simulations 1 to 13, 15, and 16** used the non-uniform grid at the BNSF bridge; the rest of the simulations used the uniform 5-meter grid currents at the BNSF bridge. After troubleshooting, it was determined that the currents were not causing the issue at the BNSF bridge but rather the configuration of the Shaver light loaded barge. To correct this issue, the rear port barge was changed from light load to a loaded barge. This correction made the transit feel realistic to the tug master. The tug masters stated that the simulations prior to this correction were still valid for the Interstate Bridge transit and approaching/departing the BNSF bridge as the unrealistic response was only happening directly adjacent to the BNSF bridge.

Table 4-5 shows the minimum distances of the swept path from the Interstate Bridge piers, existing, proposed, or both, for the construction channel, depending on the simulation scenario, and the distance from the BNSF bridge piers. Based on the evaluation criteria for minimum distances, the following simulations did not maintain the desired clearances for the stated bridge:

BNSF Bridge

Simulation 1, 4, 7, 11, 13, 15, 21, 23, 36, 38, 44, 51, 53, 58, 60, 70, and 79

Interstate Bridge

Simulation 1, 7, 11, 13, 21, 44, 51, and 53

Simulation 69 had clearances greater than the desired minimum for the bridge piers. Based on the clearance distances, **Simulation 11** had an allision with the BNSF bridge south pier, this allision did not crash the software and no issues with the performance of the vessel or the instrumentation occurred.

As a result, this simulation continued. This simulation was one of the last runs where mariners experienced the unrealistic shearing toward the north directly adjacent to the BNSF bridge. This issue was troubleshooted shortly after this simulation, but as a result of this software artifact, the mariners were accommodating this occurrence by favoring the south side of the channel, causing the limited to no clearances to the south bridge pier. The mariner did not state any concerns about performing this transit in a real-world situation or that it affected his opinion of the transit to and from the Interstate Bridge. The one comment given regarding this transit was that the north channel would not be the preferred channel under the strong wind from the south as the mariners would want the most maneuvering area to correct for the vessel drift due to the wind, which would be provided by south or center channels.

Similar to the deep-draft simulations, one area where the swept paths showed the barges commonly transiting outside the federal channel limits was upstream of the BNSF bridge on the red side of the channel. This area outside the dredge channel is naturally deep (>25 feet CRD), based on the latest USACE survey (December 2023), providing sufficient water for this maneuver. Additionally, the historical AIS data shown in Figure 3-1 indicates that this departure from the navigation channel limits is common practice today. This departure from the navigation channel happened in 10 of these 18 simulations: **Simulations 4, 21, 23, 44, 51, 53, 58, 69, 70, and 79.** These 10 simulations included runs in the existing, proposed, and construction channels to both the center and south channels.

The pilot safety and run difficulty ratings for all the 2x2 barge upbound simulations are summarized in Table 4-6. Note that three different pilots performed these simulations and performance ratings are subjective to each individual pilot. On average, the upbound existing and proposed navigation channel transits were rated as having above-average safety, above-average tug adequacy, and below-average difficulty. The construction navigation channel simulations were rated as having average safety, above-average tug adequacy, and average difficulty. There was no noticeable difference in the ratings between the existing and proposed channels, but there was increased difficulty and decreased safety with the construction channels.

The pilots found the simulation and model to be a realistic representation. For all these existing and proposed channel simulations, the pilot would perform the transit in a real-world situation independent of the simulated channel/bridge. The pilots made the following observations comparing the existing and proposed navigation channels:

- The approach to the north channel at the Interstate Bridge is easier and improved from the existing conditions due to the proposed Interstate Bridge piers shifting south, allowing the stern of the tug room to stay south rather than having to hold position on the north bank.
- The additional width of the proposed bridge piers is an improvement from existing conditions.
- For the south channel, it was noted that the proposed channel/bridge was preferred over the existing due to the enhanced visibility from the higher low-chord elevation of the bridge, a more gradual turn from the BNSF bridge to the Interstate Bridge, and wider channel between the bridge piers.

- The Proposed Center Channel was run with fog and nighttime conditions, independently, and no concerns were raised. This Proposed Center Channel felt like a typical transit performed today.

Six simulations evaluated the construction navigation channels. The Construction North Channel felt like a typical transit through the Existing North Channel, but with more obstacles. Overall, the mariners had limited concerns about transiting the Construction North Channel. For the Construction South Channel, the feedback was that the channel is tight. As a result, until mariners are familiar with transiting this channel, the 2x2 tows should be broken into a 2x1 tow. Additionally, the tug captains requested a temporary range for the Construction South Channel for the upbound transit. For this range, instead of marking the centerline of the channel, the mariners requested that the range be the center of the non-obstructed opening as shown in Figure 4-16. A secondary Construction South Channel was evaluated using the south end of the existing widespan to see if that opening would improve the maneuvering. The tug master who performed this simulation stated that he preferred the designed Construction South Channel. Upon reviewing the swept-path figures for this subsection of runs, it should be noted that **Simulation 58** shows the barge transiting outside the navigation channel after passing under the proposed and existing bridges through the temporary channel. Review of the latest USACE bathymetry survey found that there is sufficient water (> 15 feet CRD) to maneuver in this area but it is outside the federal channel limits.

Figure 4-10: Example Shallow-Draft 2x2 Barge Upbound Existing Navigation Channel Swept Path Summary

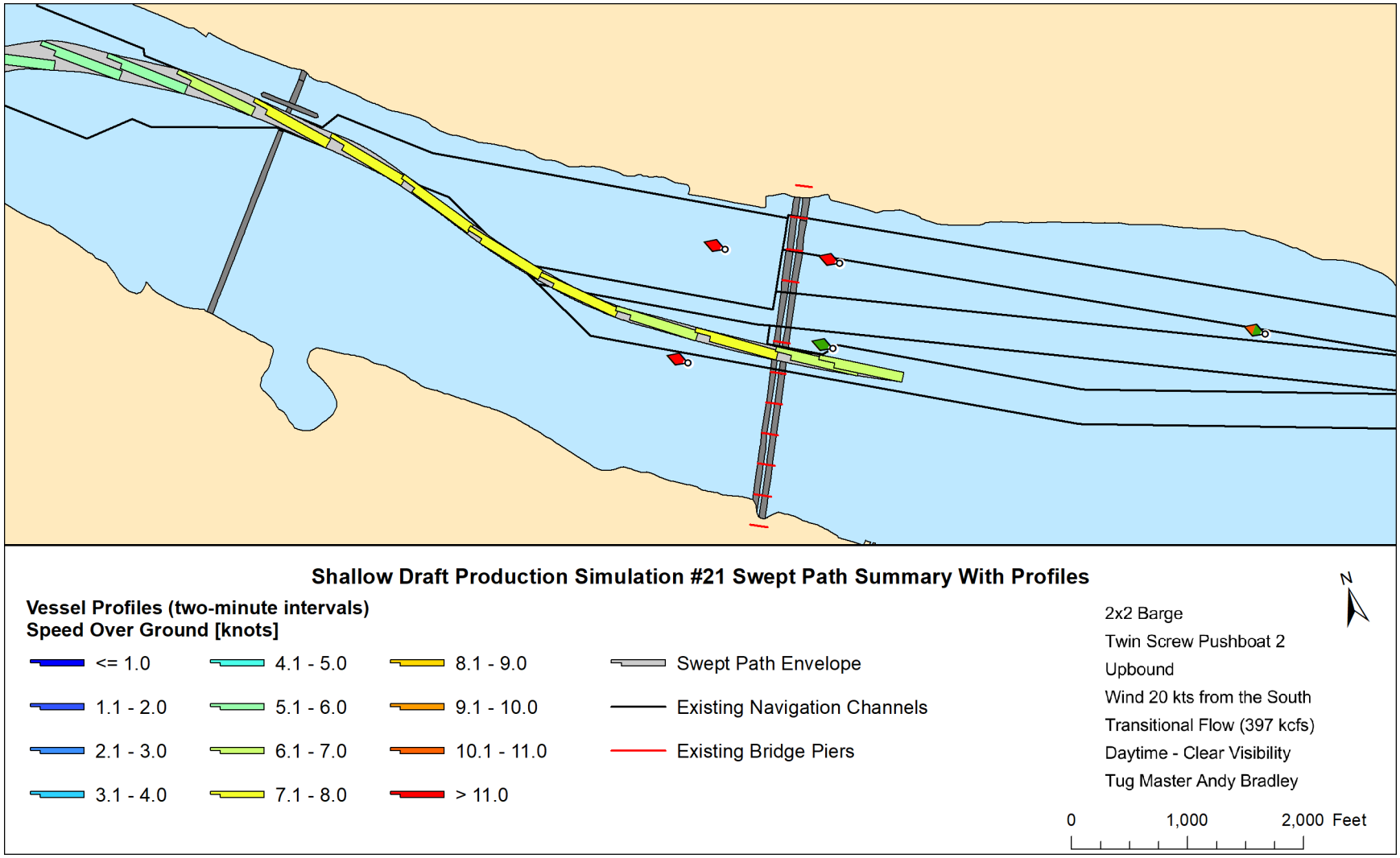


Figure 4-11: Example Shallow-Draft 2x2 Barge Upbound Existing Navigation Channel Time Series Plot

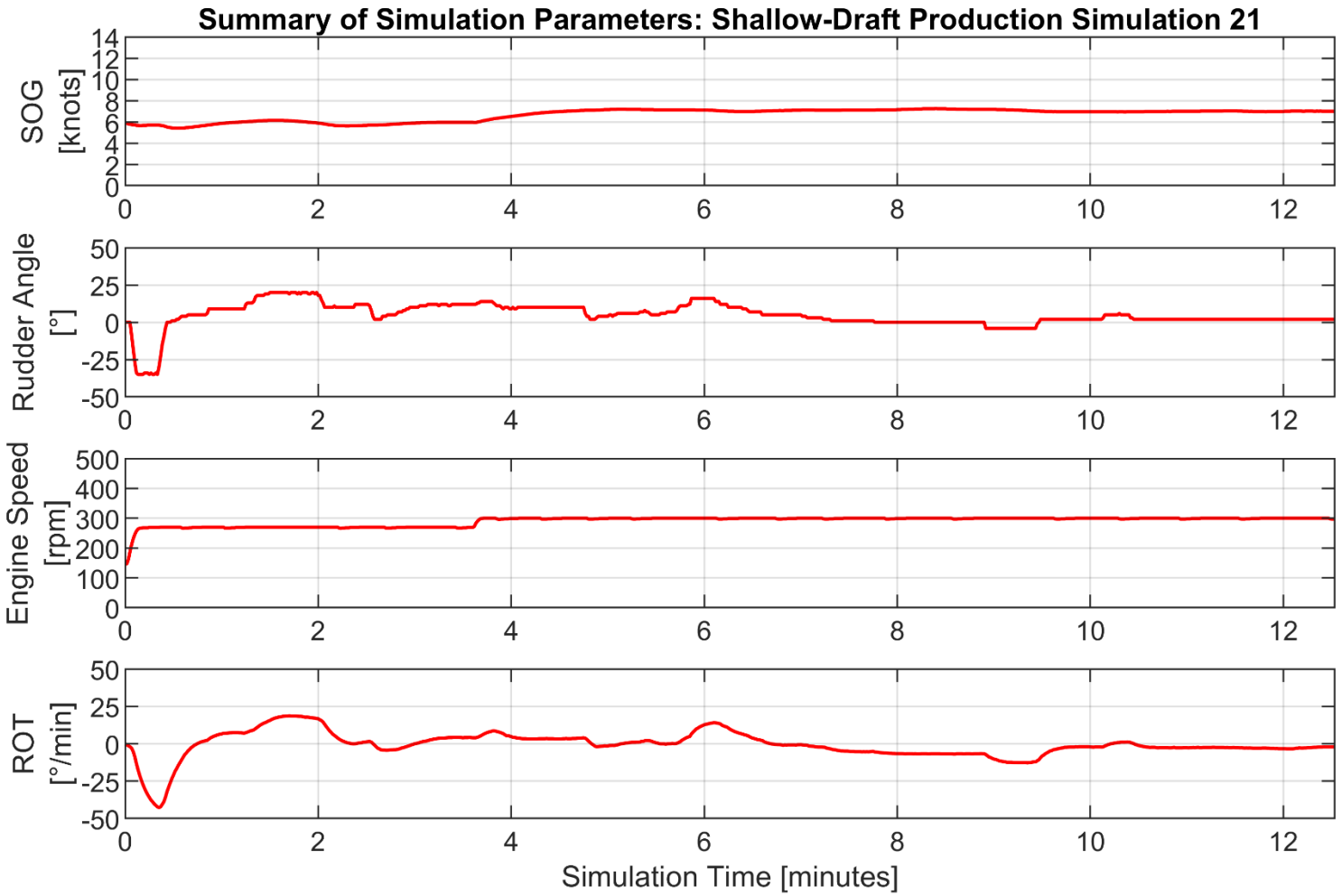


Figure 4-12: Example Shallow-Draft 2x2 Barge Upbound Proposed Navigation Channel Swept Path Summary

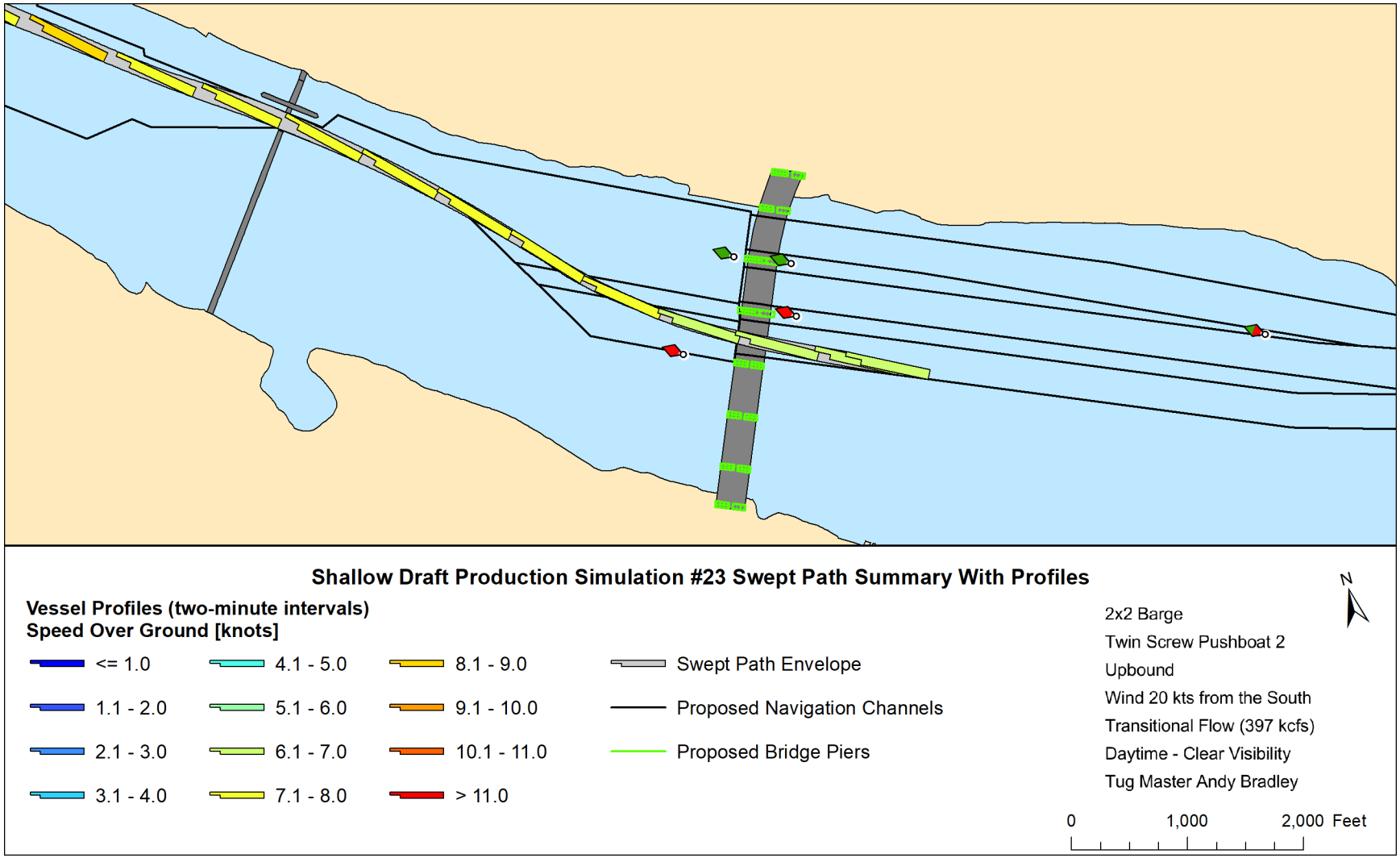


Figure 4-13: Example Shallow-Draft 2x2 Barge Upbound Proposed Navigation Channel Time Series Plot

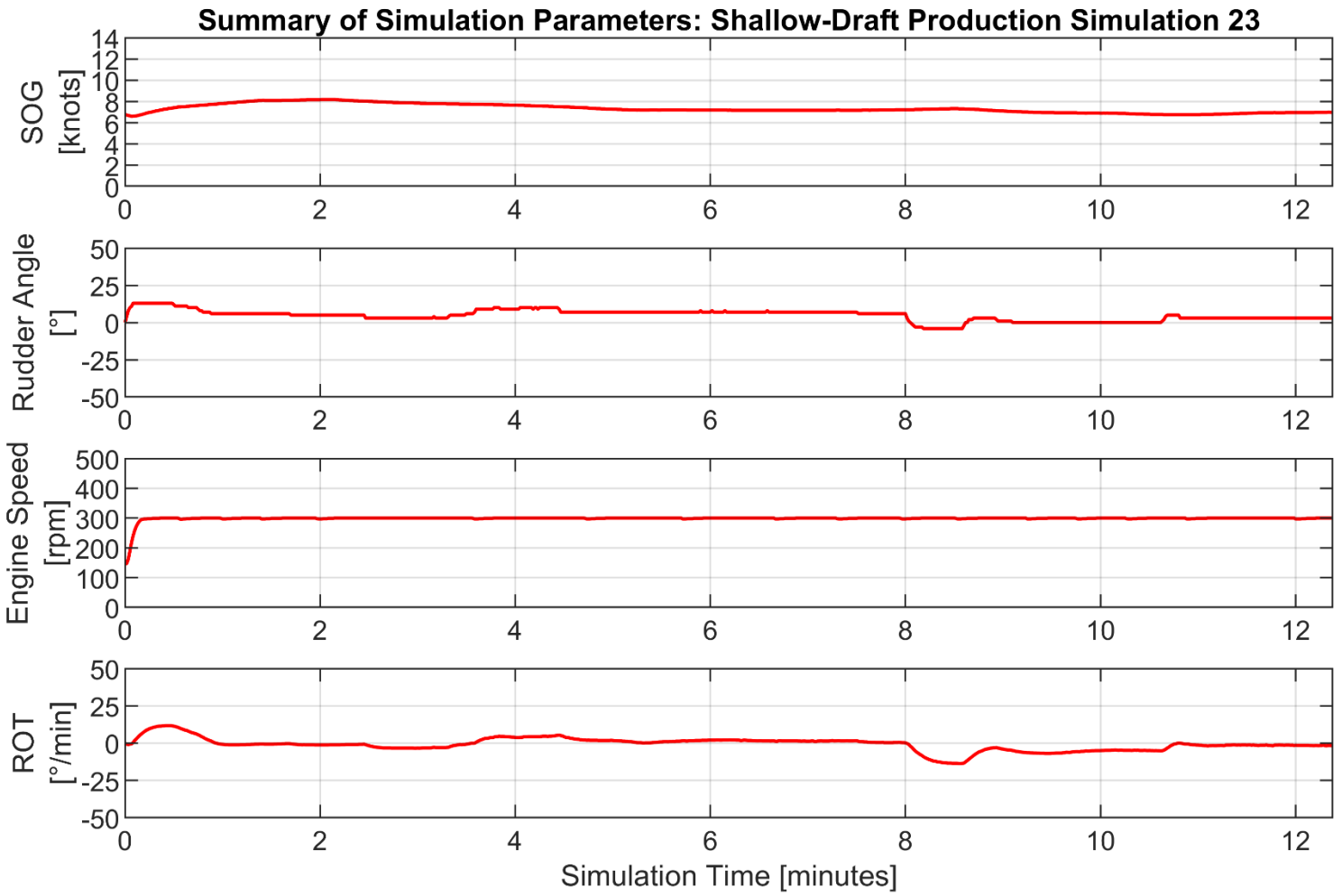


Figure 4-14: Example Shallow-Draft 2x2 Barge Upbound Construction Navigation Channel Swept Path Summary

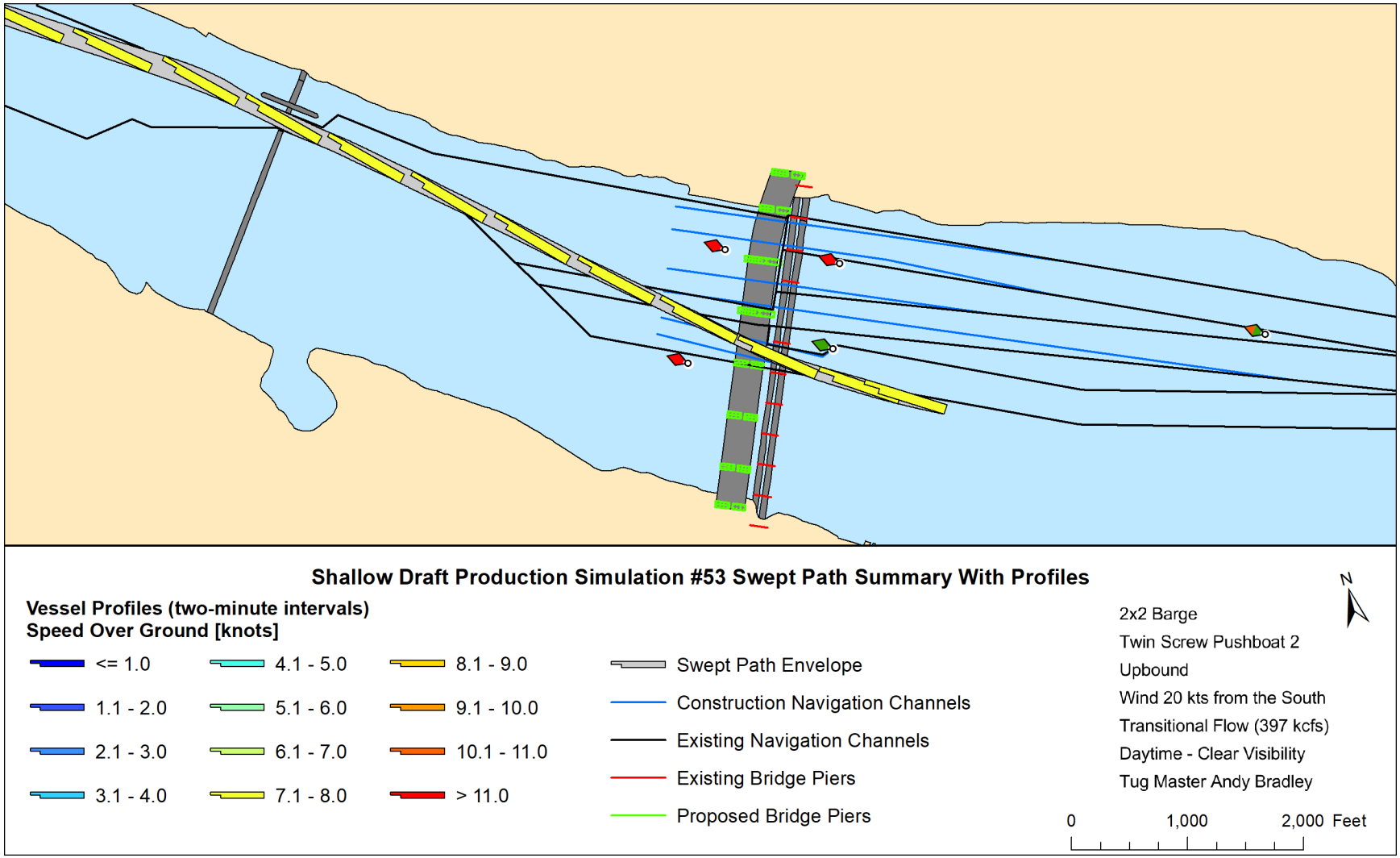


Figure 4-15: Example Shallow-Draft 2x2 Barge Upbound Proposed Construction Channel Time Series Plot

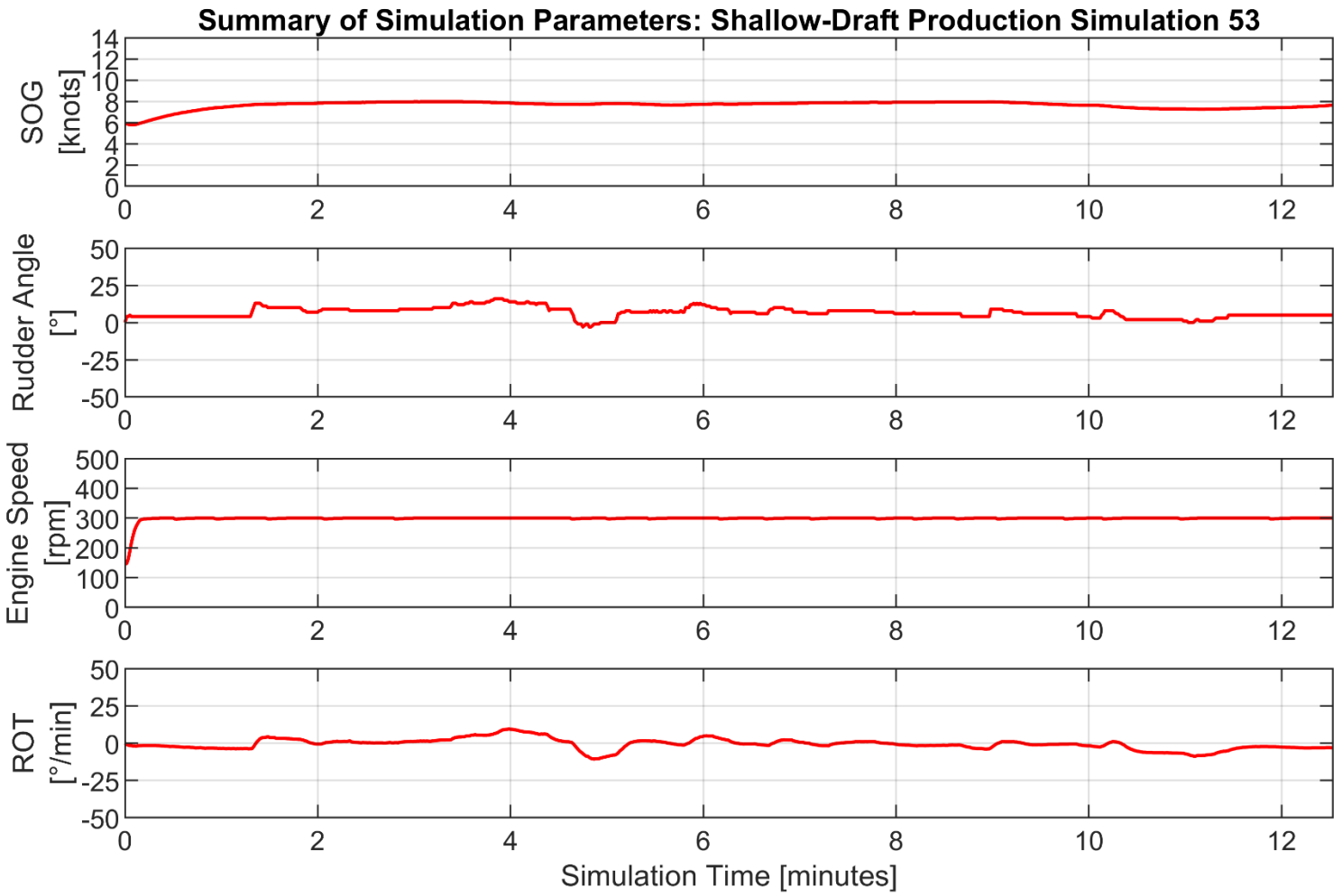


Table 4-5: Shallow-Draft 2x2 Barge Upbound Simulations Minimum Distances to Interstate Bridge and BNSF Bridge Piers

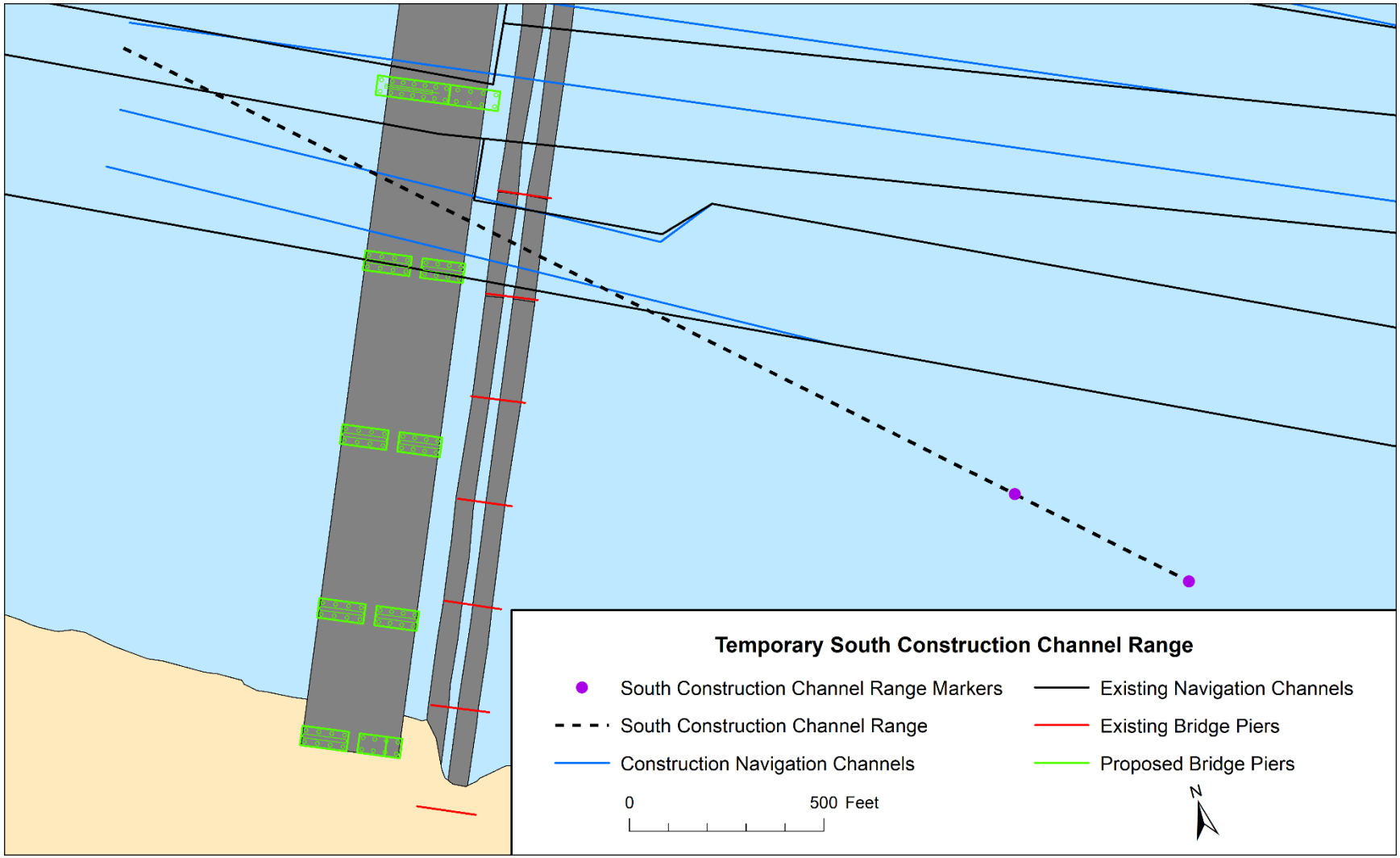
Run	Scenario	Distance to Bridge Pier (feet)													
		Existing Interstate Bridge						Proposed Interstate Bridge						BNSF Bridge	
		North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	*North Pier*	*South Pier*
1	Existing	39	94	--	--	--	--	--	--	--	--	--	--	26	6
4	Proposed	--	--	--	--	--	--	--	--	65	157	--	--	17	27
7	Existing	48	75	--	--	--	--	--	--	--	--	--	--	36	28
11	Proposed	--	--	--	--	--	--	211	46	--	--	--	--	15	0
13	Existing	--	--	--	--	74	39	--	--	--	--	--	--	10	7
15	Proposed	--	--	--	--	--	--	--	--	--	--	102	124	12	23
21	Existing	--	--	--	--	42	96	--	--	--	--	--	--	34	24
23	Proposed	--	--	--	--	--	--	--	--	--	--	149	109	48	12
36	Construction	80	55	--	--	--	--	75	165	--	--	--	--	26	46
38	Construction	72	62	--	--	--	--	66	170	--	--	--	--	30	27
44	Construction	--	--	--	--	46	88	--	--	--	--	194	50	32	24
51	Construction	--	--	--	--	24	287	--	--	--	--	45	227	26	36
53	Construction	--	--	--	--	73	49	--	--	--	--	157	37	39	19
58	Construction	--	--	--	--	54	52	--	--	--	--	119	51	38	15
60	Proposed	--	--	--	--	--	--	--	--	61	173	--	--	29	10
69	Proposed	--	--	--	--	--	--	--	--	104	112	--	--	54	16
70	Proposed	--	--	--	--	--	--	--	--	89	128	--	--	40	10
79	Proposed	--	--	--	--	--	--	--	--	76	152	--	--	40	17
Average Distance (feet)		Existing Interstate Bridge All Piers*						Proposed Interstate Bridge All Piers*						BNSF Bridge All Piers – Existing Scenario*	BNSF Bridge All Piers – Proposed Scenario*
		63						116						21	23

* Average excludes construction runs

Table 4-6: Shallow-Draft Upbound 2x2 Barge Pilot Ratings for Safety, Difficulty, and Tug Adequacy

Existing Navigation Channels						Proposed Navigation Channels						Construction Navigation Channels						Notes
Rows of table list runs of the same conditions with the exception of navigation channel and if noted in the "Notes" column of table.																		
Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	
1	A. Bradley	2	2	4	🟢	4	A. Bradley	4	5	3	🟢	36	A. Bradley	3	4	3	🟢	Run 1 within desired clearance to BNSF and Interstate Bridges Run 4 & 36 within desired clearance to BNSF bridge
7	A. Bradley	3	4	3	🟢	11	A. Bradley	2	2	3	🔴	38	A. Bradley	4	4	3	🟢	Run 7 within desired clearance to BNSF and Interstate Bridges Run 11 & 38 within desired clearance to BNSF bridge Run 11 allision explained in text.
13	A. Bradley	4	4	2	🟢	15	A. Bradley	4	4	2	🟢	44	A. Bradley	3	5	3	🟢	Run 58 at nighttime Run 13, 44, & 51 within desired clearance to BNSF and Interstate Bridges Run 15 & 58 within desired clearance to BNSF bridge
												51	A. Bradley	2	5	4	🟢	
												58	A. Bradley	3	4	3	🟢	
21	A. Bradley	5	5	2	🟢	23	A. Bradley	5	5	1	🟢	53	A. Bradley	3	4	3	🟢	Run 21 & 53 BNSF, I-5 Run 23 within desired clearance to BNSF bridge
--						60	A. Bradley	4	5	2	🟢	--						Run 60 with limited visibility (fog) Run 70 at nighttime Run 60 & 70 within desired clearance to BNSF bridge
						70	L. Olson	3	5	3	🟢							
--						69	L. Olson	5	5	2	🟢	--						Run 69 with normal flow conditions. Run 79 with transitional flow conditions. Run 79 within desired clearance to BNSF bridge
						79	J. Nichols	5	5	3	🟢							
Average Score	--	3.5	3.8	2.8	--	**Average Score**	--	4	4.5	2.4	--	**Average Score**	--	3	4.3	3.2	--	--
🟢	Success. Run was well controlled with adequate clearance to channel edges and structures																	
🔴	Unsuccessful. Run was failed due to allision with BNSF bridge																	
🟣	Unsuccessful. Run was failed due to allision with Interstate Bridge																	

Figure 4-16: Temporary Construction South Channel Range



4.2.2 2x2 Barge Downbound Transits

Eighteen of the 89 shallow-draft simulations were downbound transits with the 2x2 barge. Four of these simulations evaluated the existing channels, eight runs simulated the proposed channels, and six simulations transited the construction channels. For the 2x2 barges, two flow conditions were evaluated: normal and transitional. These large barges typically are broken down into 2x1 barges when the flow exceeds the transitional flow. A single wind condition of 20 knots from the south was simulated based on mariner specification as the controlling condition for maneuvering past the bridge.

Example swept paths and time series plots for existing, proposed, and construction navigation channels are shown in Figure 4-17, Figure 4-18, Figure 4-19, Figure 4-20, Figure 4-21, and Figure 4-22. **Simulation 5,** shown in Figure 4-19, shows a wide swing in the swept path at the junction buoy. This swing was a result of the tug master originally thinking that he was to transit through the center span rather than the north span. The tug master corrected his path, resulting in the wide swing.

Table 4-15 shows the minimum distances of the swept path from the Interstate Bridge piers, existing, proposed, or both, for the construction channel, depending on the simulation scenario, and the distance from the BNSF bridge piers. Based on the evaluation criteria for minimum distances, the following simulations did not maintain the desired clearances for the stated bridge:

BNSF Bridge

Simulation 55

Interstate Bridge

Simulation 24, 48, 49, 55, 59

Of the simulations that did not meet the desired clearances, one was an existing condition (**Simulation 24**) and the remainder evaluated a construction scenario.

In five simulations, **Simulation 46, 48, 49, 54, and 59**, a portion of the transiting barge maneuvered outside the federal navigation channel limits upstream of the BNSF bridge on the red side of the channel. This area outside the dredge channel is naturally deep (>25 feet CRD), based on the latest USACE survey (December 2023), providing sufficient water for this maneuver. Additionally, the historical AIS data shown in Figure 3-2 indicates that this departure from the navigation channel limits is common practice today. These five simulations included runs in the proposed and construction channels through the south channel.

The pilot safety and run difficulty ratings for all the 2x2 barge downbound simulations are summarized in Table 4-8. Note that four different mariners performed these simulations and performance ratings are subjective to each individual mariner. On average, the upbound existing and proposed navigation channel transits were rated as having above-average safety, the highest tug adequacy, and below-average difficulty. The construction navigation channel simulations were rated as having above-average safety, above-average tug adequacy, and average difficulty. There was no noticeable difference in the ratings between the existing and proposed channels, but there was increased difficulty with the construction channels.

The pilots found the simulation and model to be a realistic representation of this portion of the river. For all these existing and proposed channel simulations the pilot would perform the transit in a real-world situation independent of the simulated channel/bridge. The pilots made the following observations comparing the existing and proposed navigation channels:

- The approach downbound from the junction buoy to the Interstate Bridge was different than the existing condition, but with familiarity, adjustments will be made and no concerns with the proposed design were noted.
- The north channel transit at the Interstate Bridge felt easier than existing conditions due to the proposed bridge piers shifting south, making the transition to the BNSF bridge more natural. Additionally, with the proposed bridge there will no longer be a need to wait for the lift span to lift, which is a concern of the mariners as the proposed elevation is sufficient for all 2x2 tows.
- For the south channel, it was noted that the proposed channel/bridge was easier than under existing conditions due to an easier transition from the Interstate Bridge to the BNSF bridge improving the overall safety of the transit.
- The center proposed channel and bridge are a substantial improvement from the existing conditions, both visually and spatially. The Proposed Center Channel limits the course correction needed between the Interstate Bridge and the BNSF bridge. The mariners stated that this channel would be the preferred channel to transit for both upbound and downbound transits.

Seven simulations evaluated the construction navigation channels. The Construction North Channel felt like a typical transit through the Existing North Channel, but with more obstacles. The mariners did note that all construction barges should be required to have an active AIS signal and that the construction channel lines should be updated on the published navigation charts. Overall, the mariners had no concerns about transiting the Construction North Channel. For the Construction South Channel, the feedback was that the channel is tight. As a result, until mariners are familiar with transiting the Construction South Channel, the 2x2 tows should be broken into 2x1 tows. Similar to the upbound transits, a secondary Construction South Channel was evaluated using the south end of the existing widespan to see if that opening would improve the maneuvering. The tug master who performed this simulation preferred the designed Construction South Channel as the turn toward the BNSF bridge is able to happen sooner with the designed Construction South Channel.

Figure 4-17: Example Shallow-Draft 2x2 Barge Downbound Existing Navigation Channel Swept Path Summary

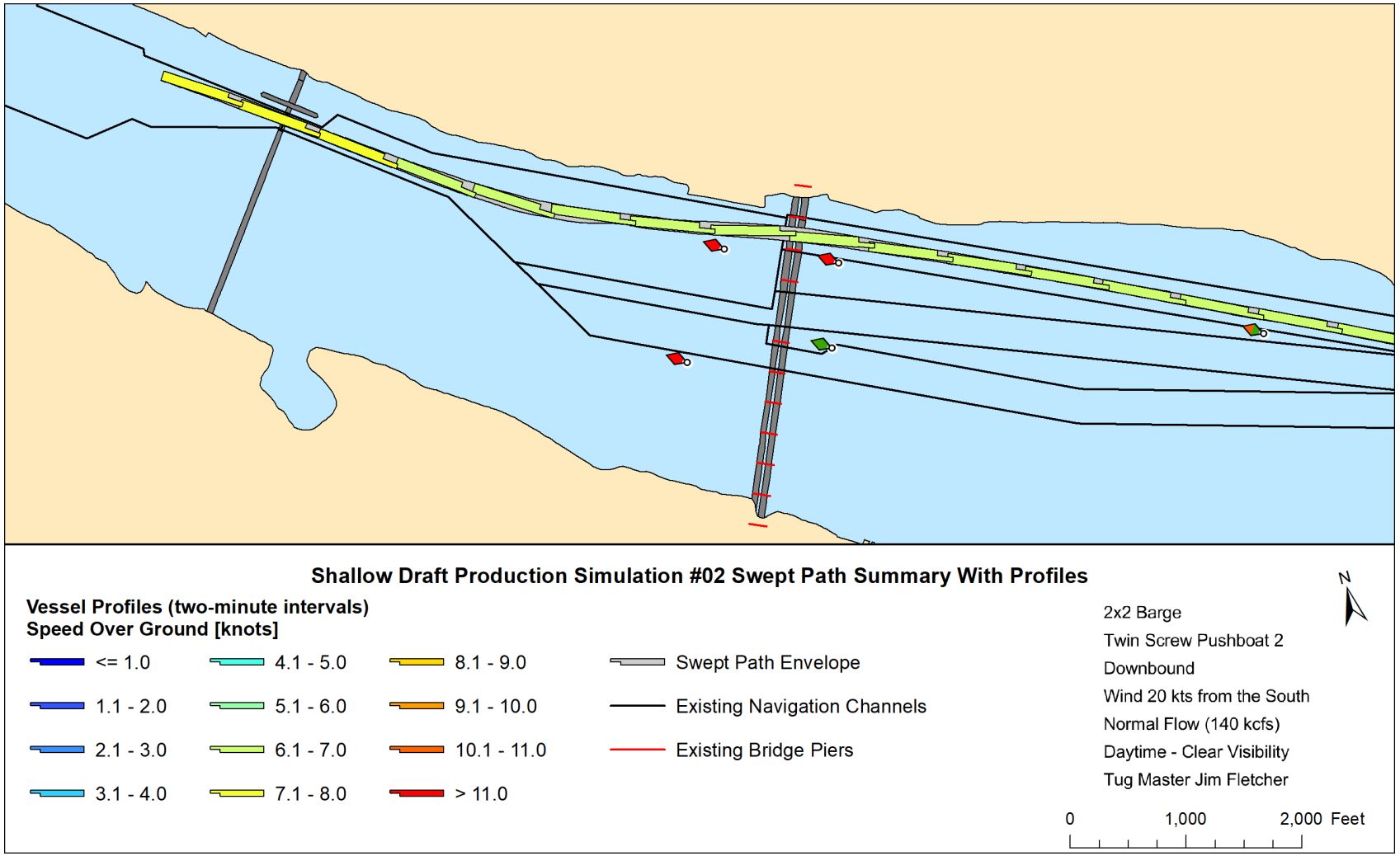


Figure 4-18: Example Shallow-Draft 2x2 Barge Downbound Existing Channel Time Series Plot

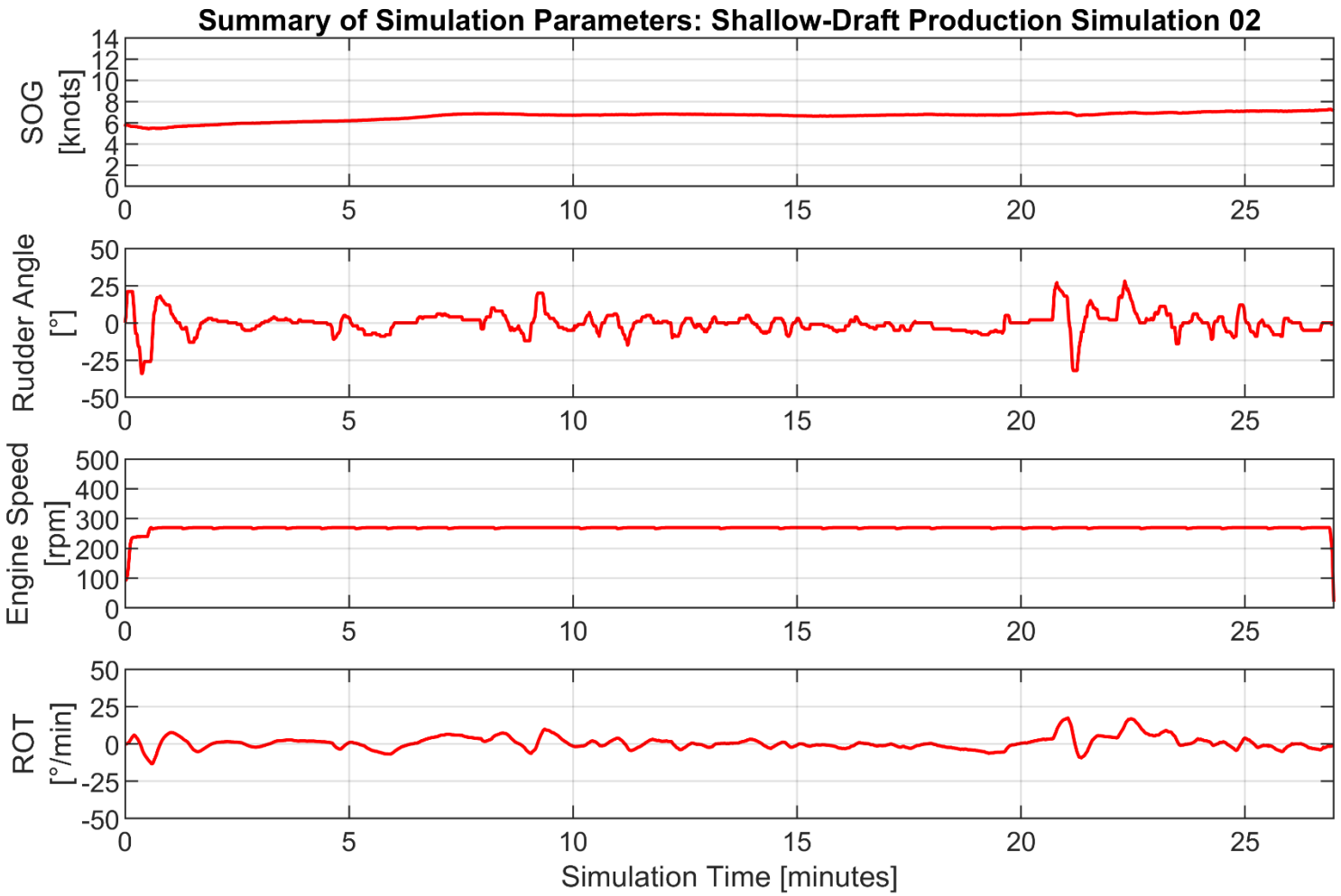


Figure 4-19: Example Shallow-Draft 2x2 Barge Downbound Proposed Navigation Channel Swept Path Summary

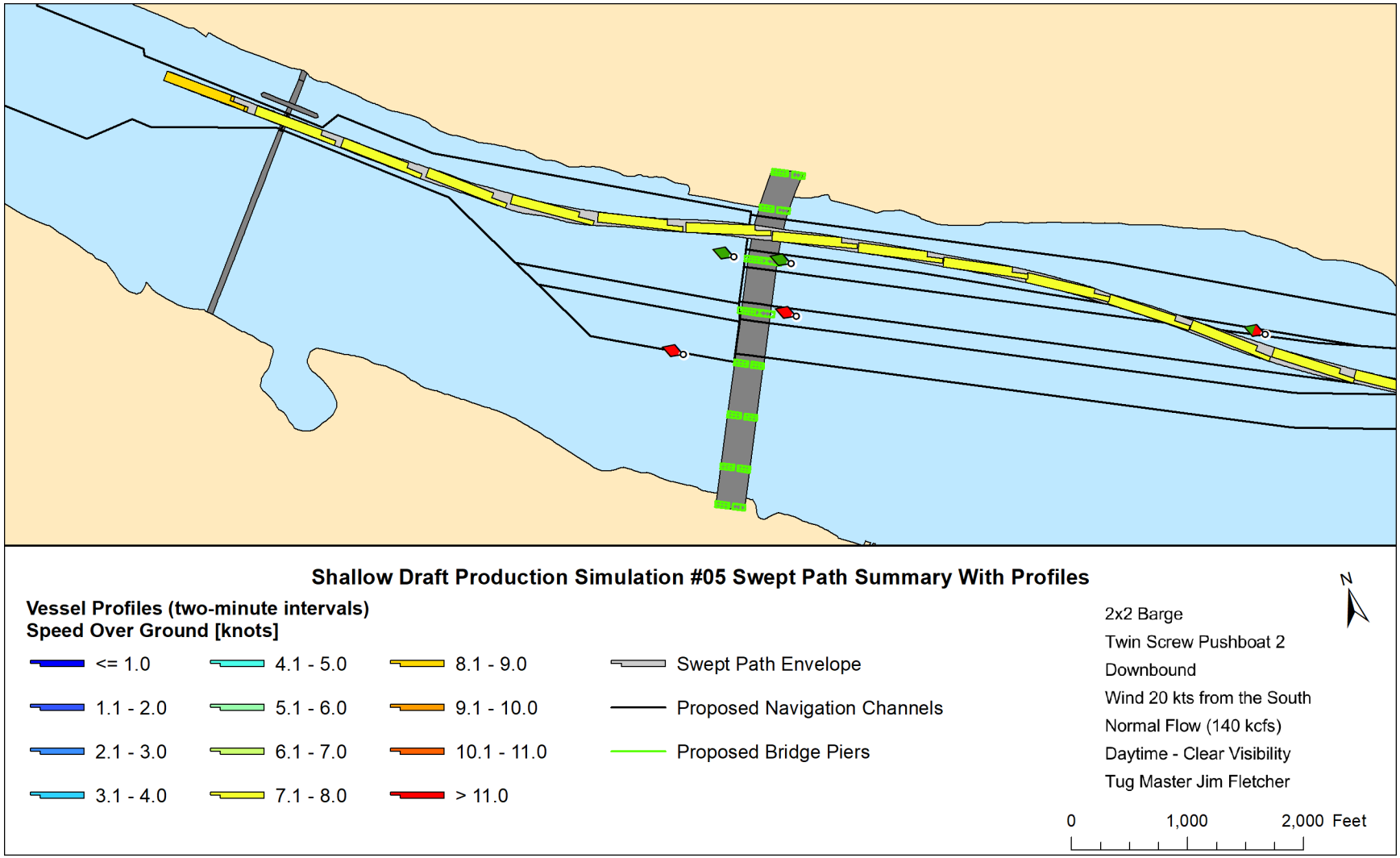


Figure 4-20: Example Shallow-Draft 2x2 Barge Downbound Proposed Navigation Channel Time Series Plot

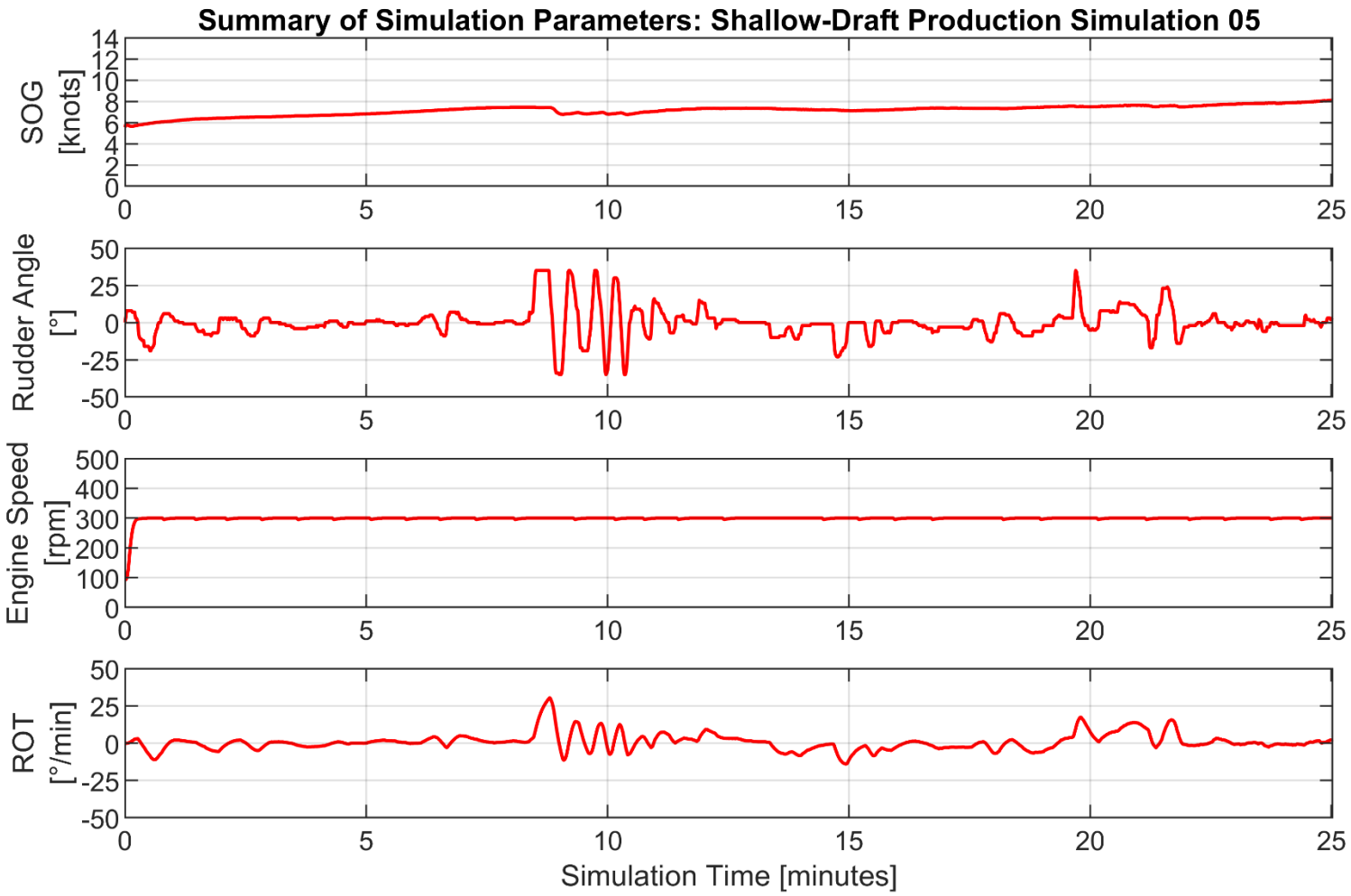


Figure 4-21: Example Shallow-Draft 2x2 Barge Downbound Construction Channel Swept Path Summary

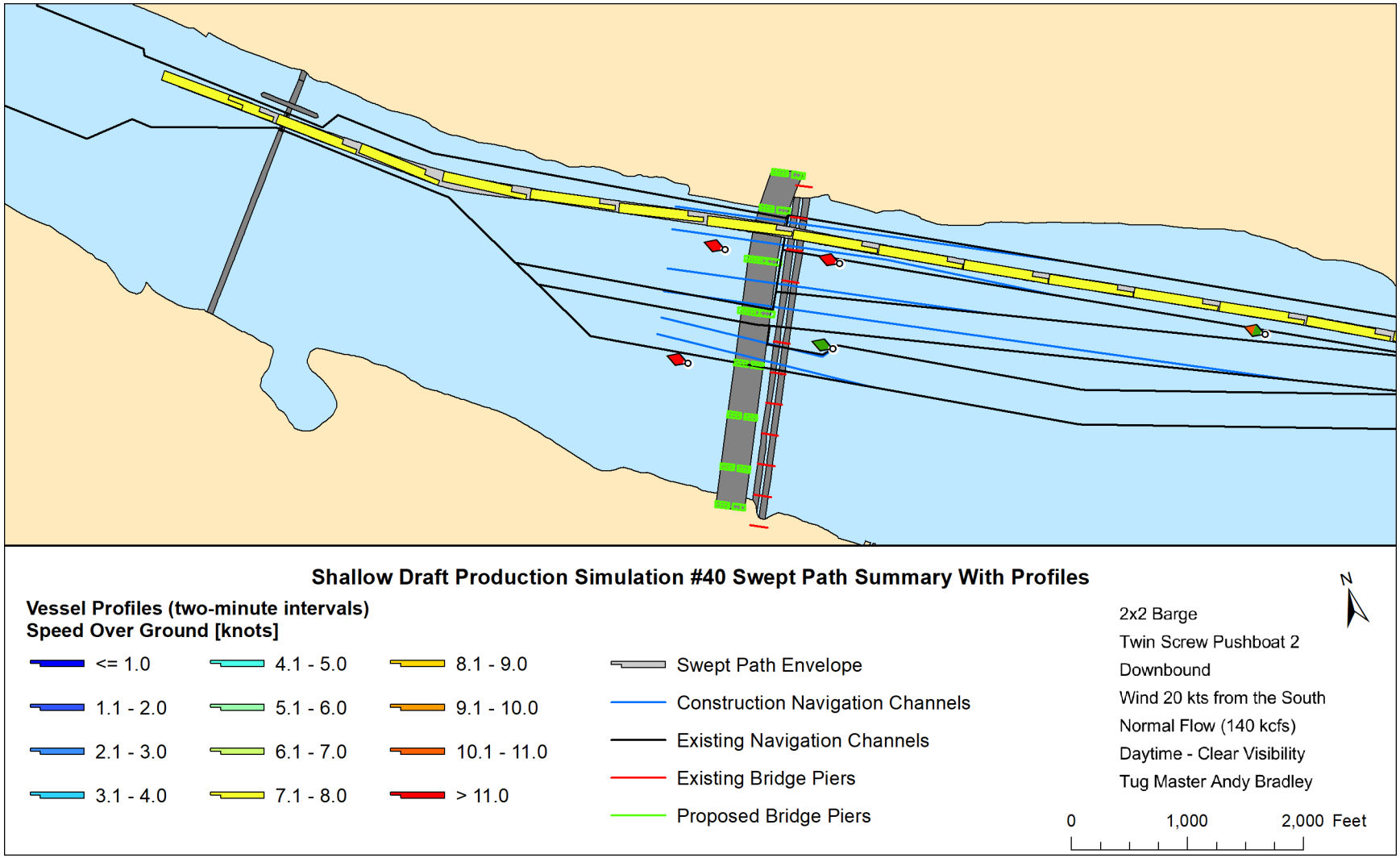


Figure 4-22: Example Shallow-Draft 2x2 Barge Downbound Construction Navigation Channel Time Series Plot

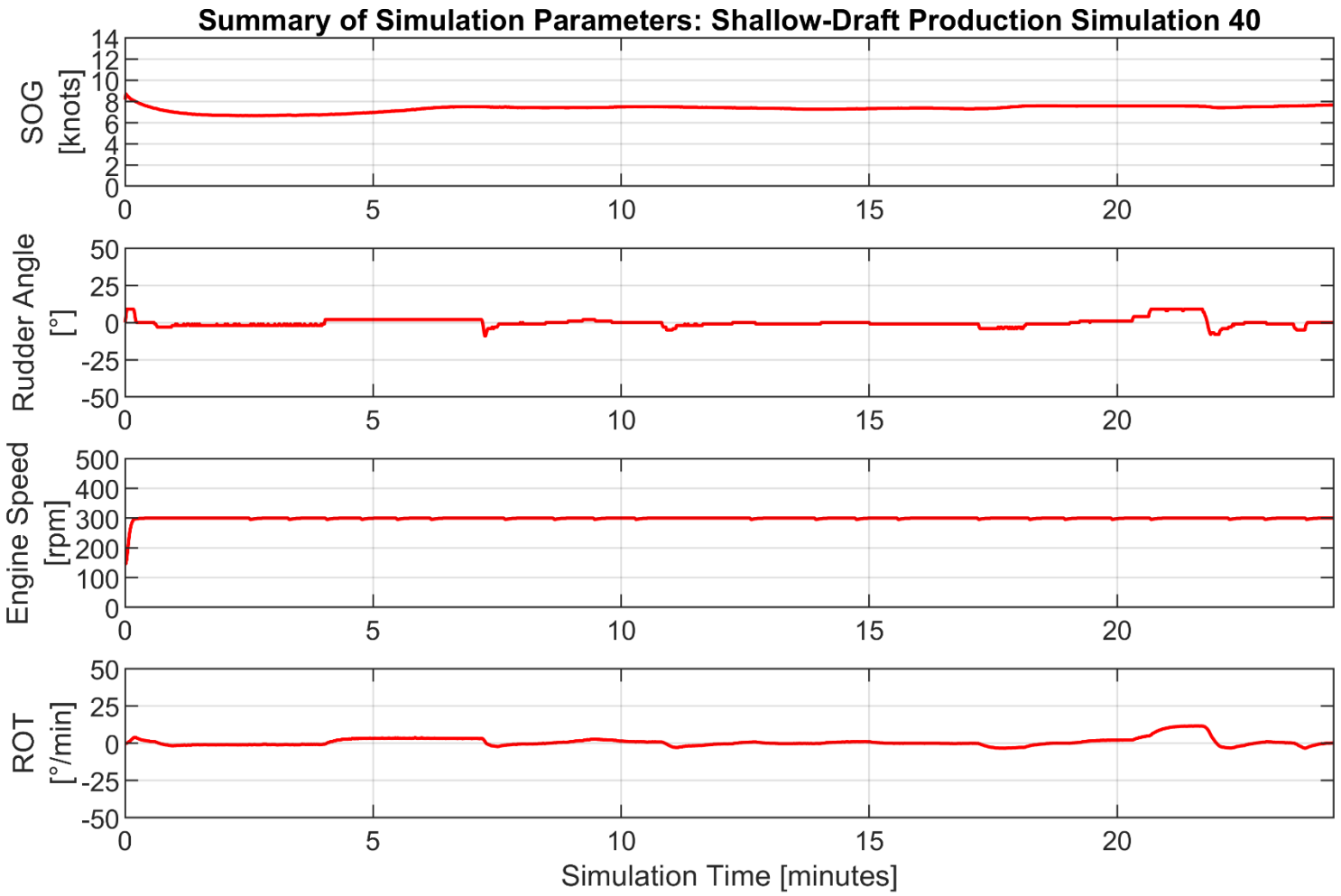


Table 4-7. Shallow-Draft 2x2 Barge Downbound Simulations Minimum Distances to Interstate and BNSF Bridge Piers

Run	Scenario	Distance to Bridge Pier (feet)													
		Existing Interstate Bridge						Proposed Interstate Bridge						BNSF Bridge	
		North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	*North Pier*	*South Pier*
2	Existing	86	67	--	--	--	--	--	--	--	--	--	--	68	55
5	Proposed			--	--	--	--	133	147	--	--	--	--	76	95
8	Existing	108	59	--	--	--	--	--	--	--	--	--	--	80	59
9	Proposed	--	--	--	--	--	--	155	122	--	--	--	--	86	34
17	Existing	--	--	275	129	--	--	--	--	--	--	--	--	79	37
19	Proposed	--	--	--	--	--	--	--	--	74	189	--	--	66	54
24	Existing	--	--	297	44	--	--	--	--	--	--	--	--	68	53
26	Proposed	--	--	--	--	--	--	--	--	81	157	--	--	73	92
40	Construction	89	88	--	--	--	--	91	193	--	--	--	--	79	110
42	Construction	74	102	--	--	--	--	84	205	--	--	--	--	81	29
46	Proposed	--	--	--	--	--	--	--	--	--	--	83	143	94	92
48	Construction	--	--	--	--	57	323	--	--	--	--	37	222	99	22
49	Construction	--	--	--	--	22	95	--	--	--	--	170	41	86	30
54	Proposed	--	--	--	--			--	--	--	--	88	131	74	44
55	Construction	--	--	--	--	32	89	--	--	--	--	201	20	47	49
59	Construction	--	--	--	--	33	103	--	--	--	--	226	33	77	33
61	Proposed	--	--	--	--	--	--	--	--	127	114	--	--	92	34
81	Proposed	--	--	--	--	--	--	--	--	71	175	--	--	82	45
Average Distance (feet)		Existing Interstate Bridge All Piers*						Proposed Interstate Bridge All Piers*						BNSF Bridge All Piers – Existing Scenario*	BNSF Bridge All Piers – Proposed Scenario*
		133						124						62	71

* Average excludes construction runs

Table 4-8: Downbound 2x2 Barge Pilot Ratings for Safety, Difficulty, and Tug Adequacy

Existing Navigation Channels						Proposed Navigation Channels						Construction Navigation Channels						Notes
Rows of table list runs of the same conditions with the exception of navigation channel and if noted in the "Notes" column of table.																		
Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	
2	J. Fletcher	5	5	3	🟢	5	J. Fletcher	5	5	2	🟢	40	A. Bradley	4	4	2	🟢	
8	J. Fletcher	5	5	2	🟢	9	J. Fletcher	5	5	2	🟢	42	A. Bradley	3	3	3	🟢	
17	A. Bradley	5	5	1	🟢	19	A. Bradley	5	5	1	🟢	--						
24	L. Olson	5	5	1	🟢	26	L. Olson	5	5	2	🟢	--						Run 61 with limited visibility (fog) Run 24 within desired clearance to Interstate Bridge
						61	A. Bradley	5	5	1	🟢							
						81	B. Fletcher	5	5	1	🟢							
--						46	A. Bradley	4	5	2	🟢	48	A. Bradley	3	4	3	🟢	Run 59 at nighttime Run 48, 49 & 59 within desired clearance to Interstate Bridge
												49	A. Bradley	4	4	2	🟢	
												59	A. Bradley	3	3	3	🟢	
--						54	A. Bradley	4	5	1	🟢	55	A. Bradley	3	4	5	🟢	Run 54 at nighttime Run 55 within desired clearance to BNSF & Interstate Bridges
Average Score	--	5	5	1.8	--	**Average Score**	--	4.7	5	1.6	--	**Average Score**	--	3.6	3.9	2.7	--	
🟢	Success. Run was well controlled with adequate clearance to channel edges and structures																	
🔴	Unsuccessful. Run was failed due to allision with **BNSF bridge**																	
🟣	Unsuccessful. Run was failed due to allision with **Interstate Bridge**																	

4.2.3 2x1 Barge Upbound Transits

Nine of the 89 shallow-draft simulations were upbound transits with the 2x1 barge. Two of these simulations evaluated the existing channels, four runs simulated the proposed channels, and three simulations transited the construction channels. For the 2x1 barges, two flow conditions were evaluated: transitional and 10-year. The transitional flow was evaluated for the construction condition where the mariners would want to reduce the tow size due to the restricted channels. A single wind condition of 20 knots from the south was simulated based on mariner specifications as the controlling condition for maneuvering through the bridge.

Example swept paths and time series plots for existing, proposed, and construction navigation channels are shown in Figure 4-23, Figure 4-24, Figure 4-25, Figure 4-26, Figure 4-27, and Figure 4-28. Table 4-10 shows the minimum distances of the swept path from the Interstate Bridge piers, existing, proposed, or both, for the construction channel, depending on the simulation scenario, and the distance from the BNSF bridge piers. Based on the evaluation criteria for minimum distances the following simulations did not maintain the desired clearances for the stated bridge:

BNSF Bridge

Simulation 72

Interstate Bridge

Simulation 25 and 89

For the simulations that did not meet the desired minimum clearances, one was an existing condition (**Simulation 25**) and the remainder evaluated a construction scenario.

In seven simulations, **Simulation 25, 27, 56, 71, 72, 76, and 89,** a portion of the transiting barge maneuvered outside the federal navigation channel limits upstream of the BNSF bridge on the red side of the channel. This area outside the dredge channel is naturally deep (>25 feet CRD), based on the latest USACE survey (December 2023), providing sufficient water for this maneuver. Additionally, the historical AIS data shown in Figure 3-1 indicates that this departure from the navigation channel limits is common practice today. These seven simulations included runs in the existing, proposed and construction channels through the all three channels.

The pilot safety and run difficulty ratings for all the 2x1 barge upbound simulations are summarized in Table 4-9. Note that three different pilots performed these simulations and performance ratings are subjective to each individual pilot. On average the upbound existing and proposed navigation channel transits were rated as having above-average safety, above-average tug adequacy, and below-average difficulty. The construction navigation channel simulations were rated as having above-average safety, above-average tug adequacy, and below-average difficulty. There was no noticeable difference in the ratings between the existing and proposed channels, but there was slightly increased difficulty and decreased safety with the construction channels.

The tug captains found the simulation and model to be a realistic representation of this portion of the river. For all these existing and proposed channel simulations the pilot would perform the transit in a real-world situation independent of the simulated channel/bridge. The pilots made the following observations comparing the existing and proposed navigation channels:

- Overall, the proposed channels are preferred over the existing channels because of their increased visibility and increased channel width, which results in a better safety margin and maneuvering area.
- All of these runs had high water, which, under existing conditions, limits the air draft clearance of the barges. Due to the increased air draft of the proposed bridge, this limitation would be reduced.

Three simulations evaluated the construction navigation channels. The Construction North Channel felt like a typical transit through the Existing North Channel, but with more obstacles. Overall, the mariners had limited concerns about transiting the Construction North Channel. For the Construction South Channel, the feedback is this it was doable with the high current flow and smaller tow. **Simulation 72 and 76** swept-path figures show the barge transiting outside the navigation channel after passing under the proposed and existing bridge through the temporary north and south channels, respectively. Review of the latest USACE bathymetry survey (March 2023) indicates that, north of the north channel, the mariners need to use caution transiting outside this channel as the water depth drops to 12 feet CRD. During **Simulation 72,** the visuals on the simulator malfunctioned, causing the pilot to become disoriented when passing under the Interstate Bridges and resulting in the departure of the barge from the channel limits. Review of this same survey for the south channel indicated that there is sufficient water (> 15 feet CRD) to maneuver in this area but it is outside the federal channel and temporary channel limits.

Figure 4-23: Example Shallow-Draft 2x1 Barge Upbound Existing Channel Swept Path Summary

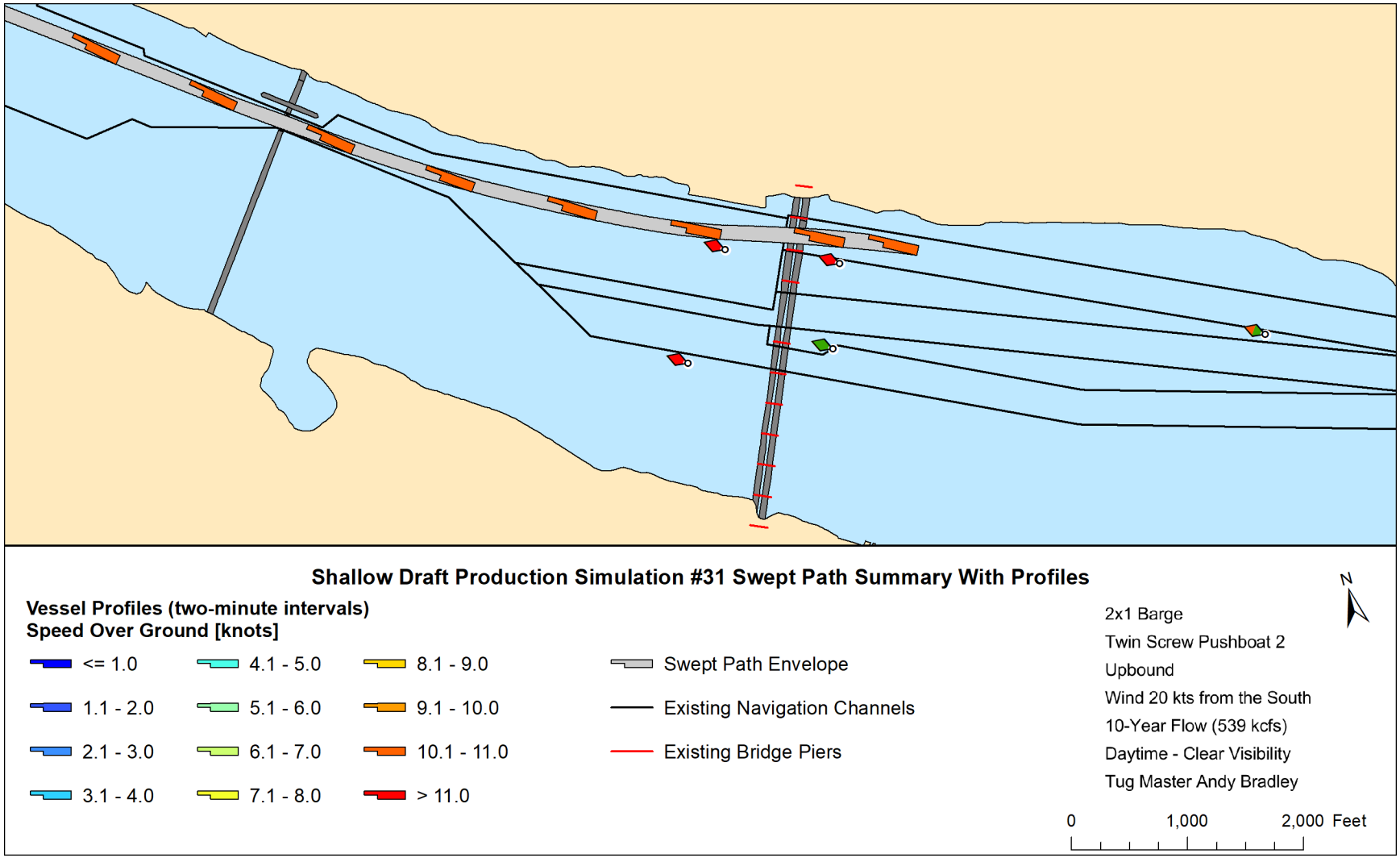


Figure 4-24: Example Shallow-Draft 2x1 Barge Upbound Existing Channel Time Series Plot

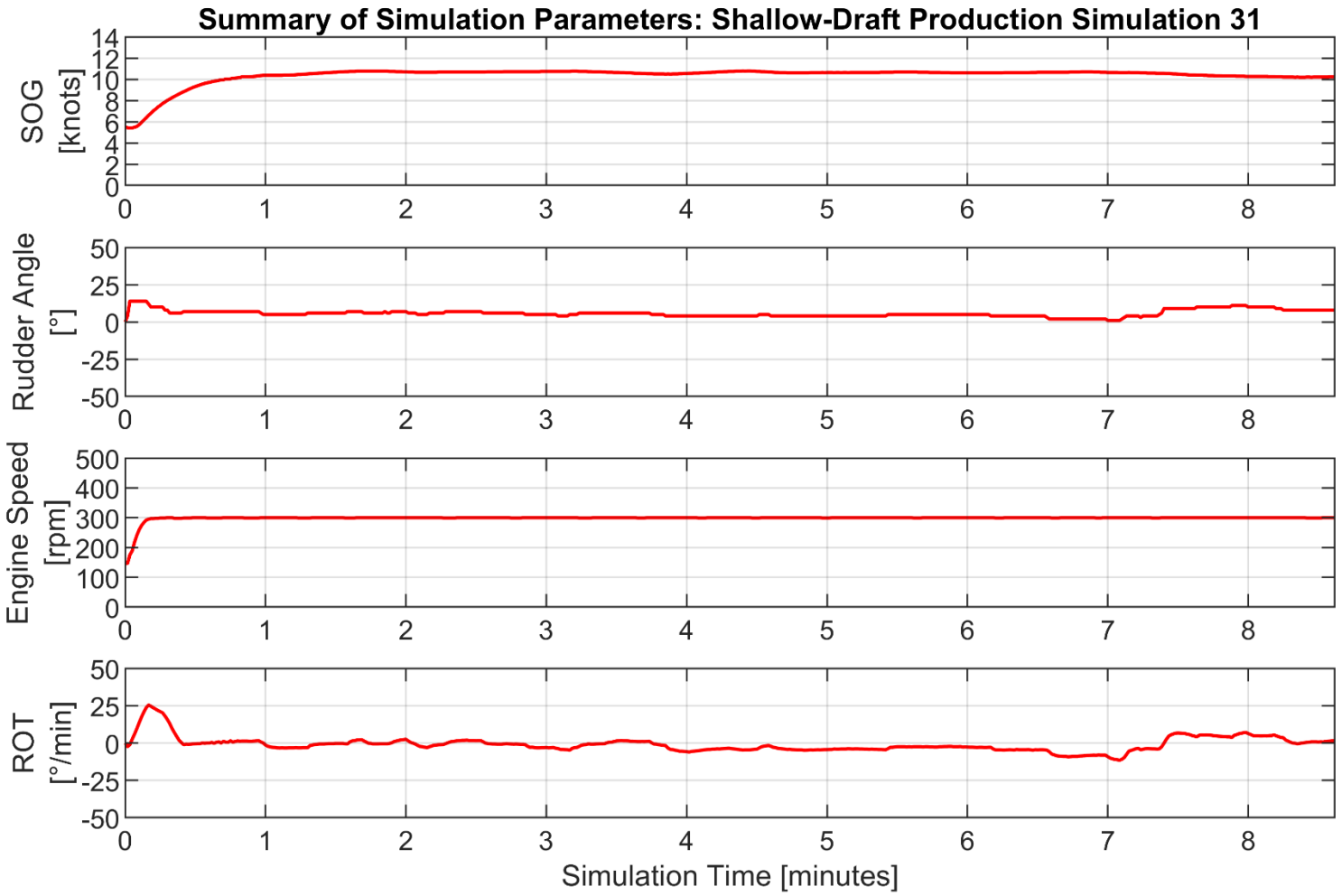


Figure 4-25: Example Shallow-Draft 2x1 Barge Upbound Proposed Channel Swept Path Summary

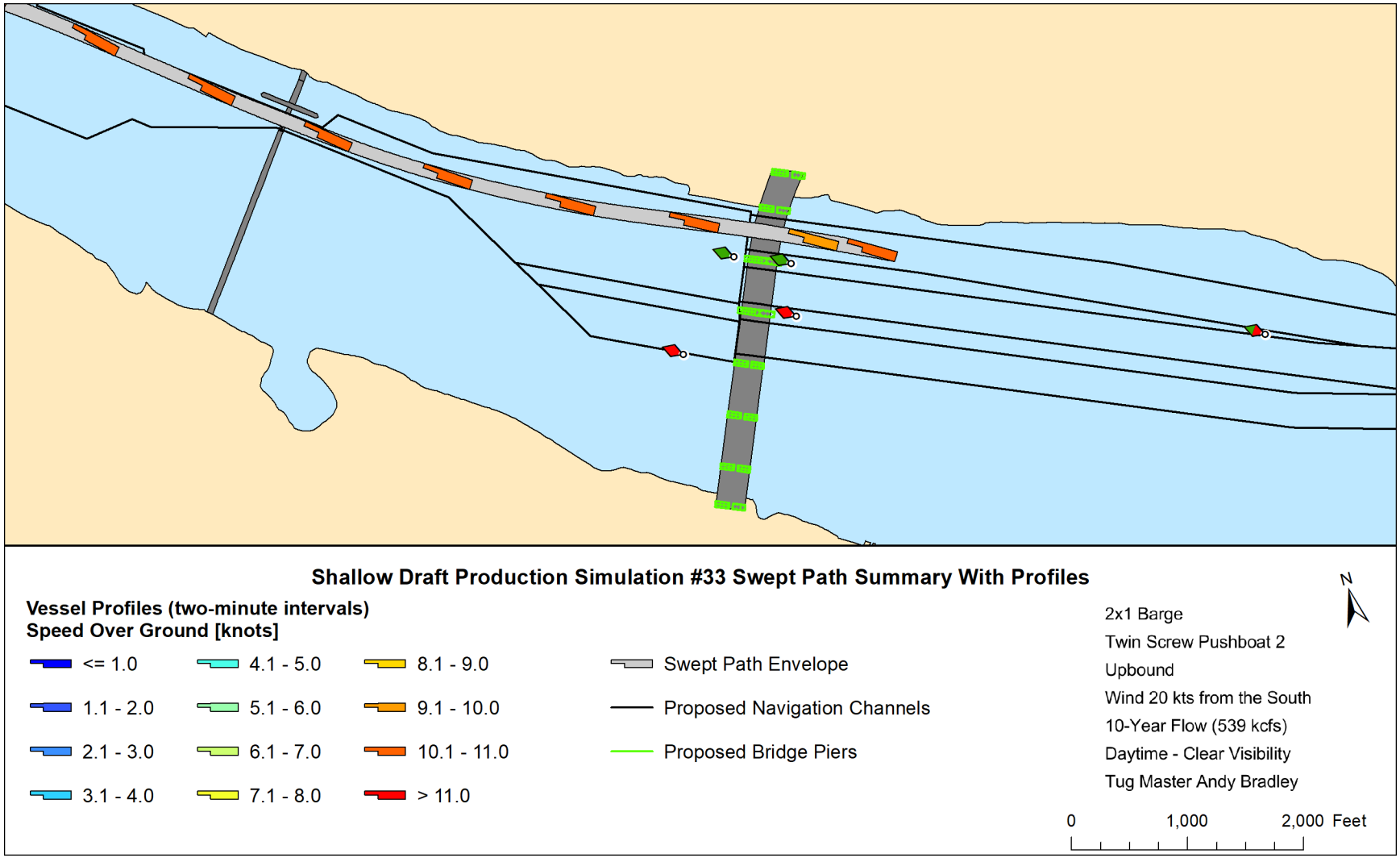


Figure 4-26: Example Shallow-Draft 2x1 Barge Upbound Proposed North Channel Time Series Plot

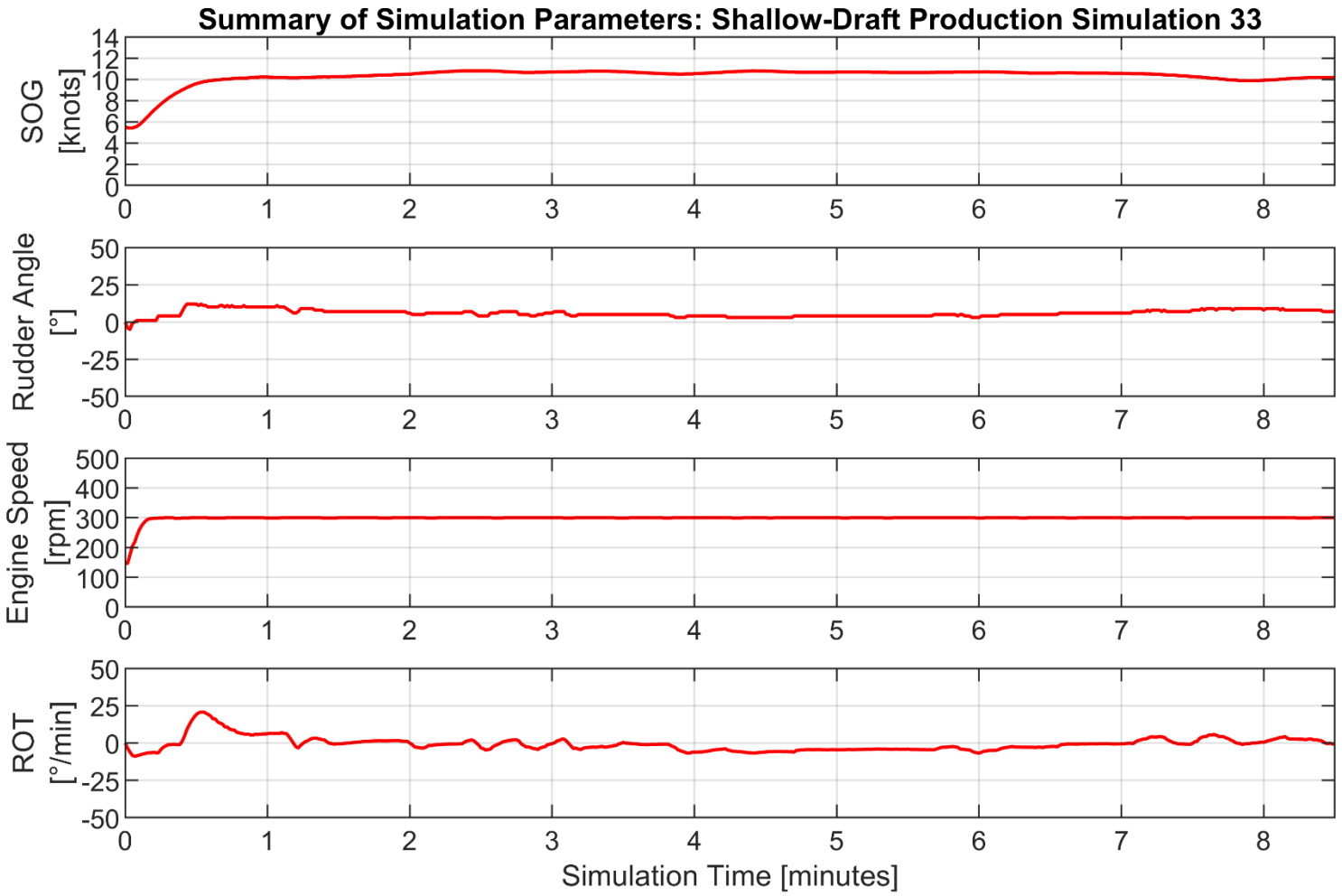


Figure 4-27: Example Shallow-Draft 2x1 Barge Upbound Construction Channel Swept Path Summary

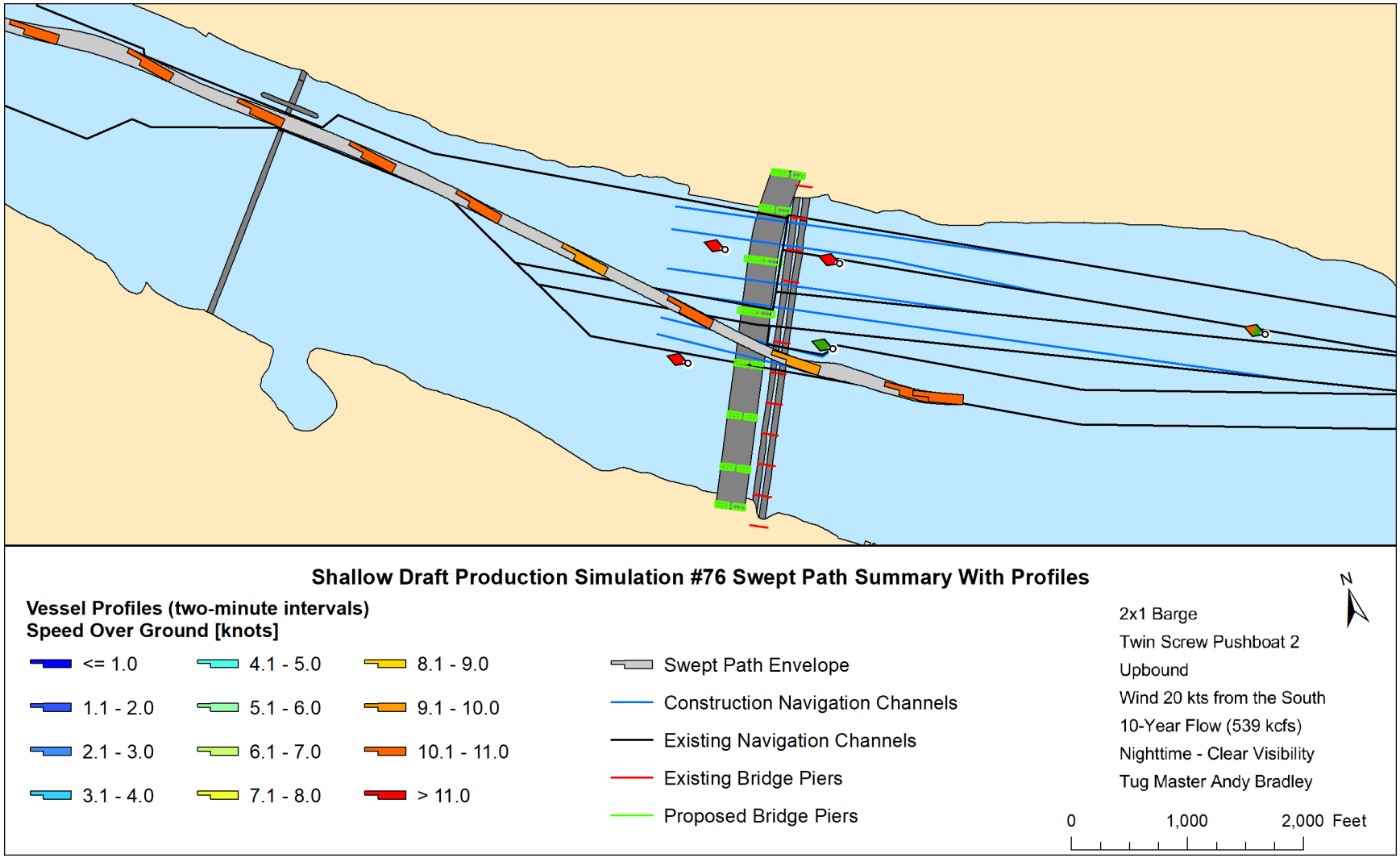


Figure 4-28: Example Shallow-Draft 2x1 Barge Upbound Construction Navigation Channel Time Series Plot

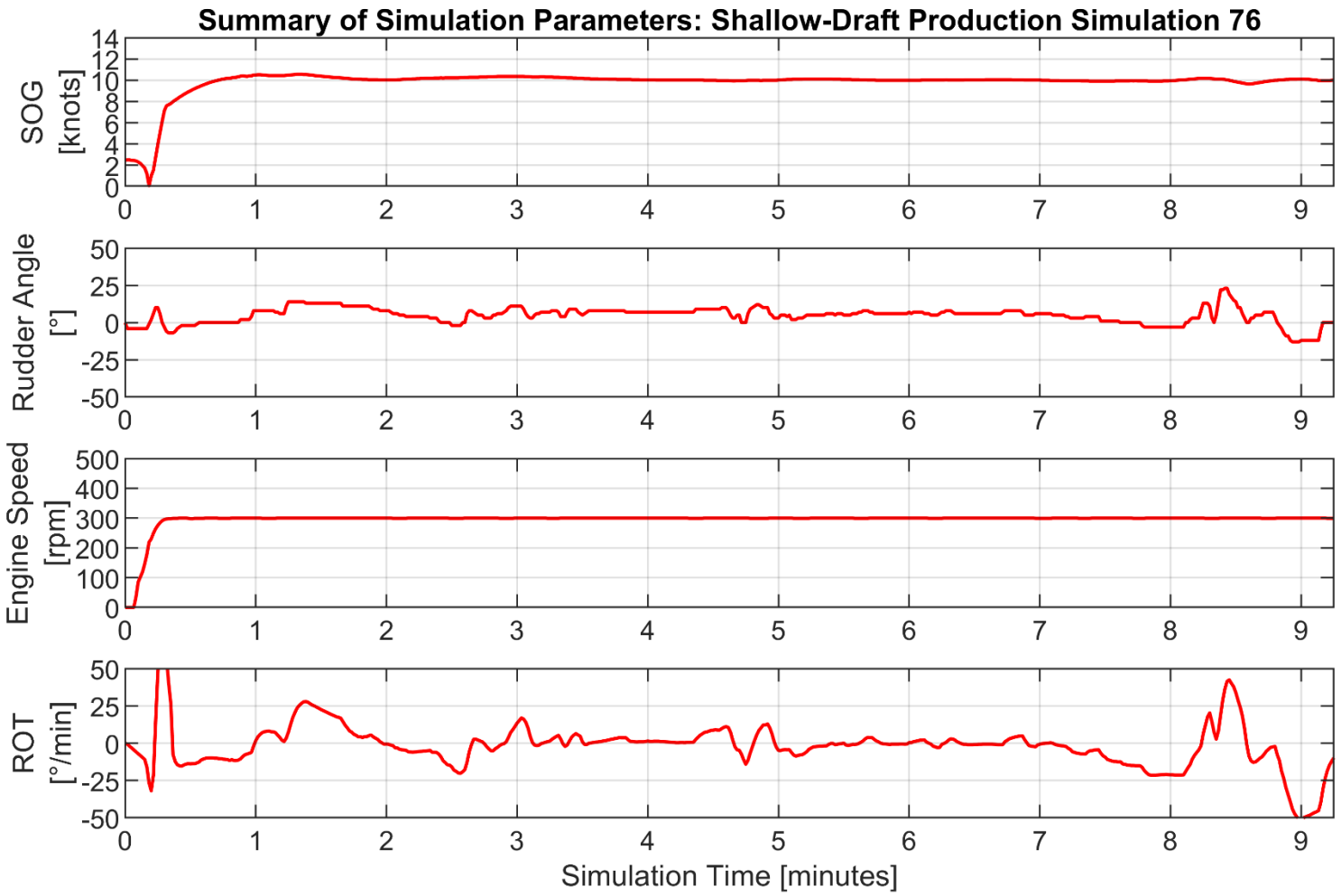


Table 4-9. Shallow-Draft 2x1 Barge Upbound Simulations Minimum Distances to Interstate Bridge and BNSF Bridge Piers

Run	Scenario	Distance to Bridge Pier [feet]													
		Existing Interstate Bridge						Proposed Interstate Bridge						BNSF Bridge	
		North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	*North Pier*	*South Pier*
25	Existing	147	29	--	--	--	--	--	--	--	--	--	--	98	18
27	Proposed	--	--	--	--	--	--	211	77	--	--	--	--	82	29
31	Existing	82	52	--	--	--	--	--	--	--	--	--	--	73	19
33	Proposed	--	--	--	--	--	--	113	156	--	--	--	--	57	41
56	Proposed	--	--	--	--	--	--	--	--	--	--	52	217	50	35
71	Proposed	--	--	--	--	--	--	--	--	71	169	--	--	71	19
72	Construction	69	81	--	--	--	--	80	164	--	--	--	--	82	11
76	Construction	--	--	--	--	60	72	--	--	--	--	142	57	65	25
89	Construction	--	--	--	--	74	83	--	--	--	--	258	30	94	16
Average Distance (feet)		Existing Interstate Bridge All Piers*						Proposed Interstate Bridge All Piers*						BNSF Bridge All Piers – Existing Scenario*	BNSF Bridge All Piers – Proposed Scenario*
		78						133						52	48

* Average excludes construction runs

Table 4-10: Shallow-Draft Upbound 2x1 Barge Pilot Ratings for Safety, Difficulty, and Tug Adequacy

Existing Navigation Channels						Proposed Navigation Channels						Construction Navigation Channels						Notes
Rows of table list runs of the same conditions with the exception of navigation channel and if noted in the "Notes" column of table.																		
Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	
25	A. Bradley	4	4	2	🟢	27	A. Bradley	4	4	2	🟢	--						Run 25 within desired clearance to Interstate Bridge
31	A. Bradley	4	5	1	🟢	33	A. Bradley	4	5	1	🟢	72	L. Olson	3	5	3	🟢	Run 72 within desired clearance to BNSF bridge
						56	A. Bradley	4	5	2	🟢	76	A. Bradley	4	5	2	🟢	Run 76 at nighttime Run 89 within desired clearance to Interstate Bridge
												89	B. Fletcher	5	5	2	🟢	
--						71	L. Olson	5	5	1	🟢	--						--
Average Score	--	4	4.5	1.5	--	**Average Score**	--	4.3	4.8	1.5	--	**Average Score**	--	4	5	2.3	--	--
🟢	Success. Run was well controlled with adequate clearance to channel edges and structures																	
🔴	Unsuccessful. Run was failed due to allision with **BNSF bridge**																	
🟣	Unsuccessful. Run was failed due to allision with **Interstate Bridge**																	

4.2.4 2x1 Barge Downbound Transits

Eleven of the 89 shallow-draft simulations were downbound transits with the 2x1 barge. One of these simulations evaluated the existing channels, four runs simulated the proposed channels, and six simulations transited the construction channels. For the 2x1 barges, two flow conditions were evaluated: transitional and 10-year. The transitional flow was evaluated for the construction condition where the mariners would want to reduce the tow size due to the restricted channels. A single wind condition of 20 knots from the south was simulated based on mariner specification as the controlling condition for maneuvering through the bridge.

Example swept paths and time series plots for existing, proposed, and construction navigation channels are shown in Figure 4-29, Figure 4-30, Figure 4-31, Figure 4-32, Figure 4-33, and Figure 4-34. Table 4-13 shows the minimum distances of the swept path from the Interstate Bridge piers, existing, proposed, or both, for the construction channel, depending on the simulation scenario, and the distance from the BNSF bridge piers. Based on the evaluation criteria for minimum distances the following simulations did not maintain the desired clearances for the stated bridge:

BNSF Bridge

Simulation 83 and 85

Interstate Bridge

Simulation 73, 75, 77, 85, 87

For the simulations that did not meet the desired clearances, one was a proposed condition (**Simulation 83**) and the remainder evaluated a construction scenario.

In four simulations, **Simulation 57, 73, 75, and 77**, a portion of the transiting barge maneuvered outside the federal navigation channel limits upstream of the BNSF bridge on the red side of the channel. This area outside the dredge channel is naturally deep (>25 feet CRD), based on the latest USACE survey (December 2023), providing sufficient water for this maneuver. Additionally, the historical AIS data shown in Figure 3-2 indicates that this departure from the navigation channel limits is common practice today. These four simulations included runs in the proposed and construction channels through the south channel.

The pilot safety and run difficulty ratings for all the 2x1 barge downbound simulations are summarized in Table 4-11. Note that three different pilots performed these simulations and performance ratings are subjective to each individual pilot. On average, the downbound existing and proposed navigation channel transits were rated as having above-average safety, above-average tug adequacy, and below-average difficulty. The construction navigation channel simulations were rated as having average safety, above-average tug adequacy, and below-average difficulty. There was no noticeable difference in the ratings between the existing and proposed channels, but there was slightly increased difficulty and decreased safety with the construction channels.

The tug captains found the simulation and model to be a realistic representation of this portion of the river. For all these existing and proposed channel simulations, the mariner would perform the transit in

a real-world situation independent of the simulated channel/bridge. The pilots made the following observations comparing the existing and proposed navigation channels:

- Overall, the proposed channels are preferred over the existing channels because of their increased visibility and increased channel width, which results in an overall easier transit.
- All of these runs had high water, which, under existing conditions limits the air draft clearance of the barges. Due to the increased air draft of the proposed bridge, this limitation would be reduced.

Six simulations evaluated the construction navigation channels. The Construction North Channel felt like a typical transit through the Existing North Channel. Overall, the mariners had limited concerns about transiting the Construction North Channel. For the Construction South Channel, it was stated that the required maneuver between the Interstate Bridge and the BNSF bridge was challenging. However, with familiarity and repetition in the simulator, the mariner stated the maneuver became easier, making the mariner more comfortable. A second mariner evaluated the two possible construction channels for the south channel and, unlike the first mariner, preferred the south portion of the existing center channel but stated that sufficient air draft for this area would need to be confirmed.

Figure 4-29: Example Shallow-Draft 2x1 Barge Downbound Existing Channel Time Series Plot

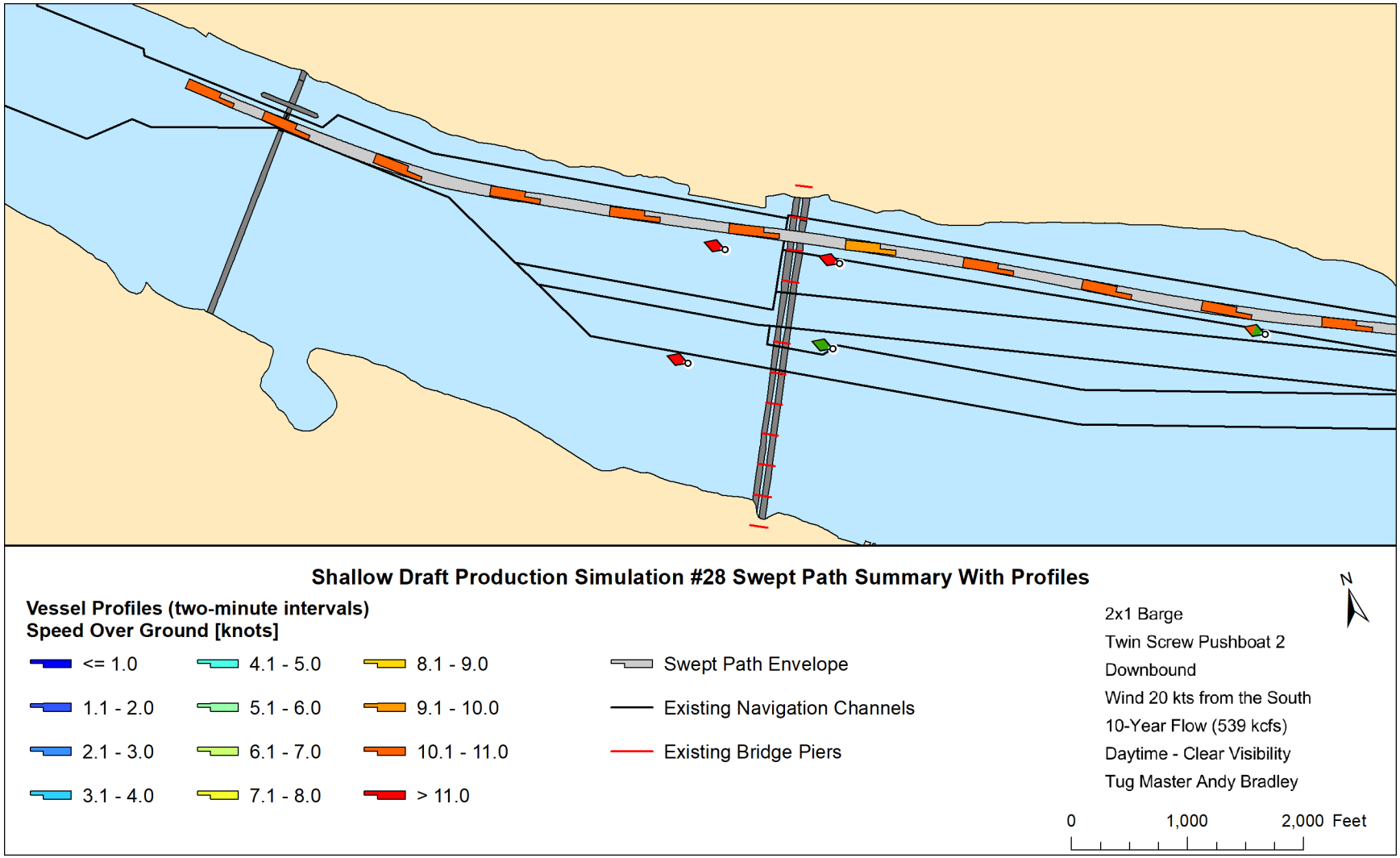


Figure 4-30: Example Shallow-Draft 2x1 Barge Downbound Existing Channel Time Series Plot

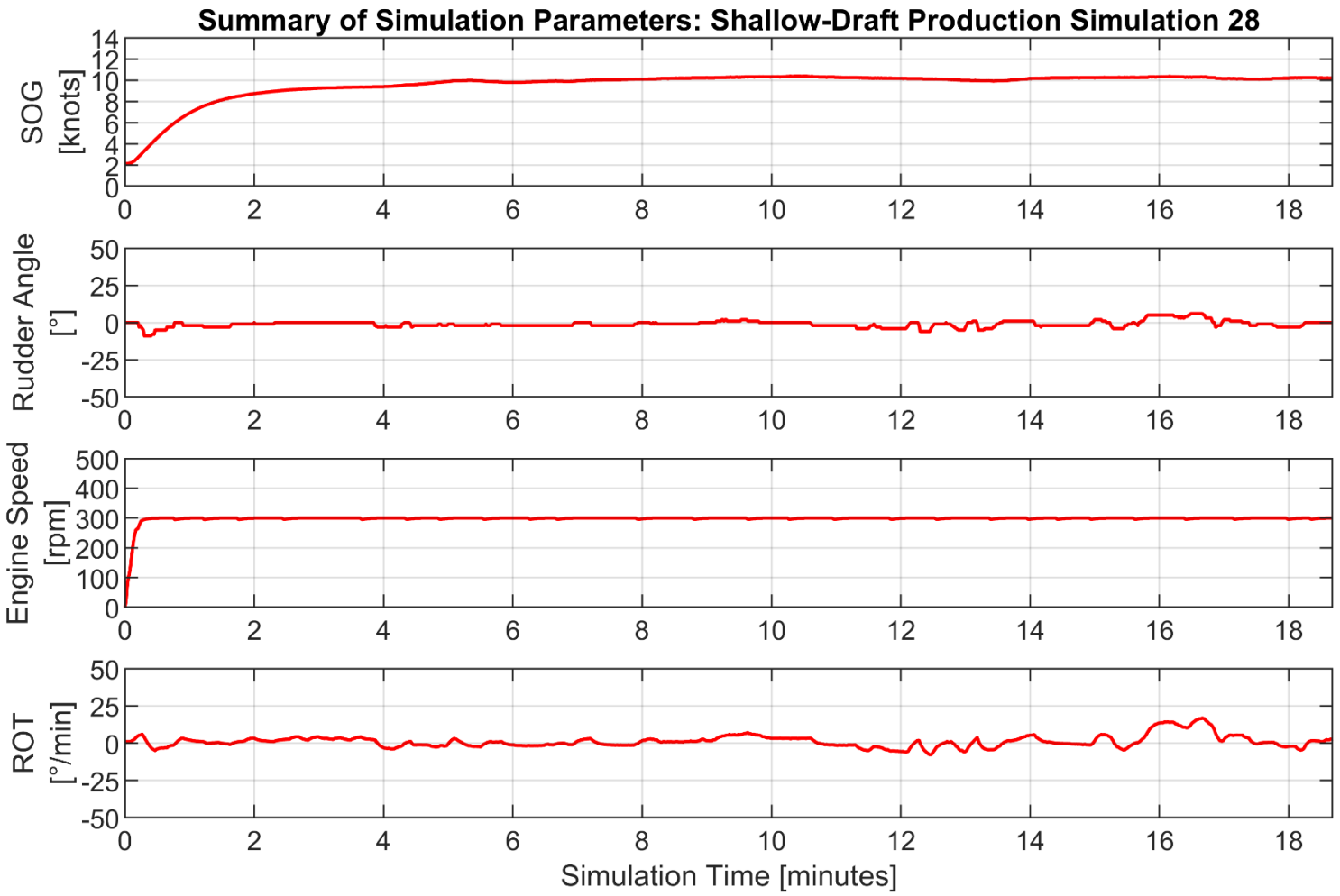


Figure 4-31: Example Shallow-Draft 2x1 Barge Downbound Proposed Channel Swept Path Summary

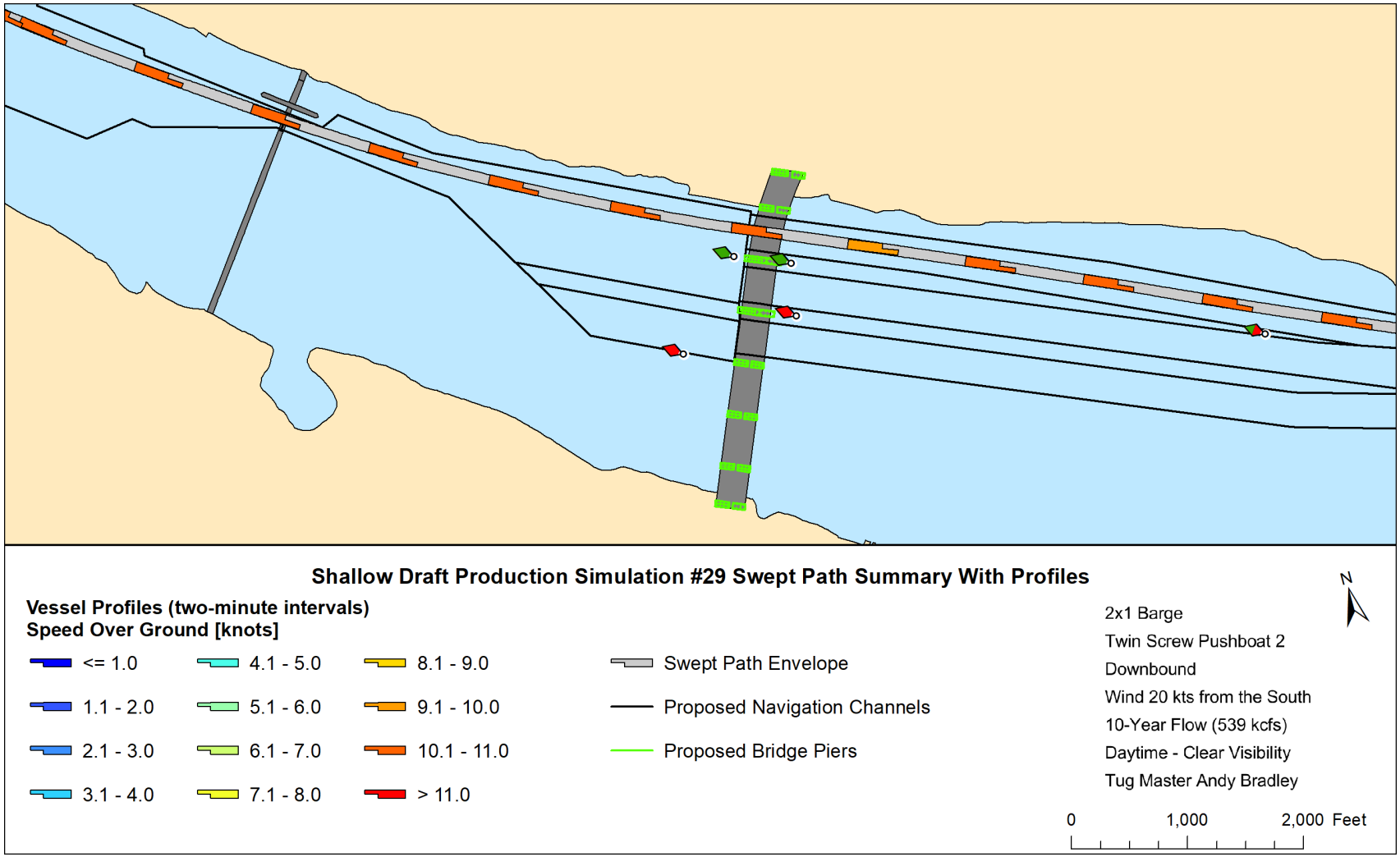


Figure 4-32: Example Shallow-Draft 2x1 Barge Downbound Proposed Channel Time Series Plot

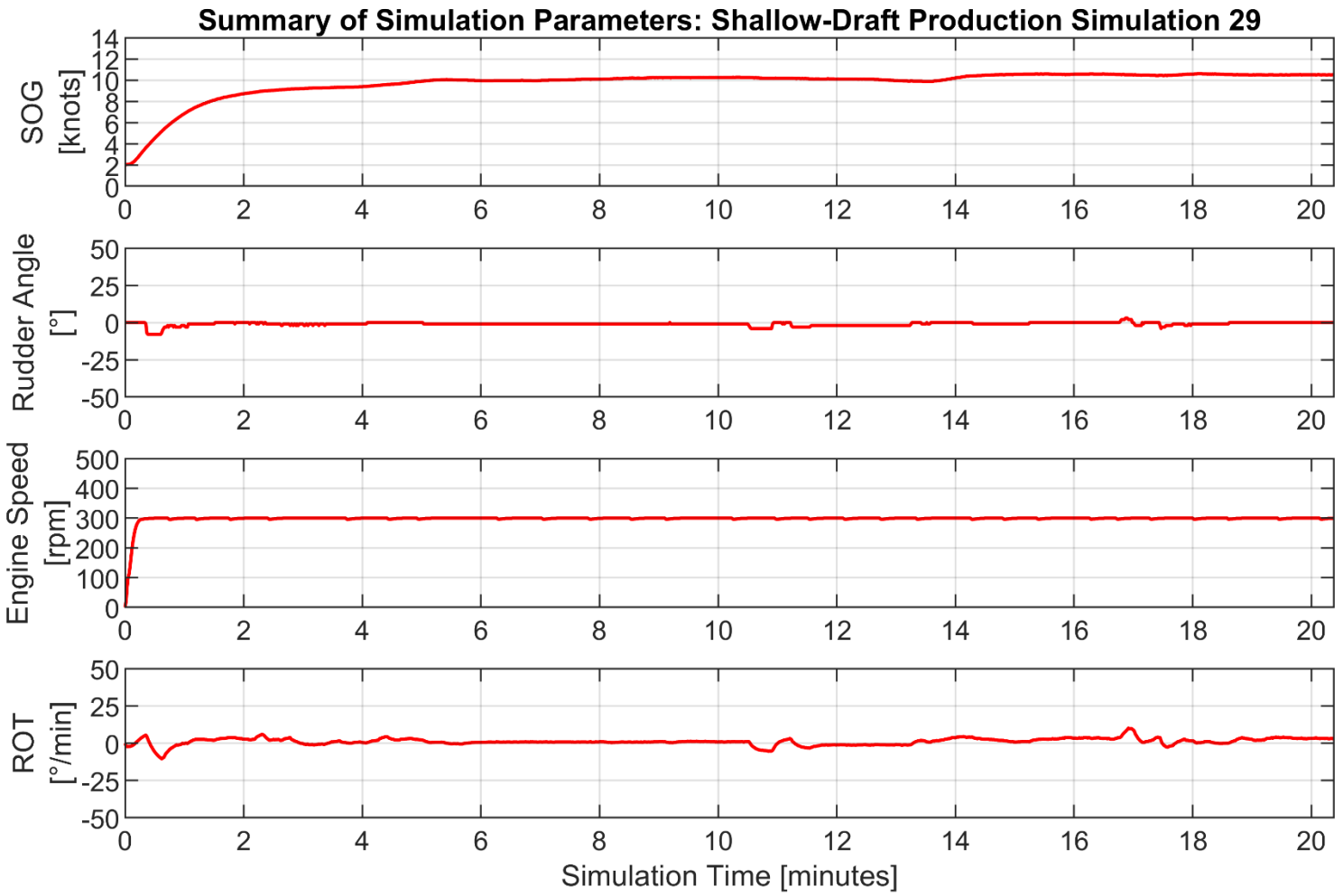


Figure 4-33: Example Shallow-Draft 2x1 Barge Downbound Construction Channel Swept Path Summary

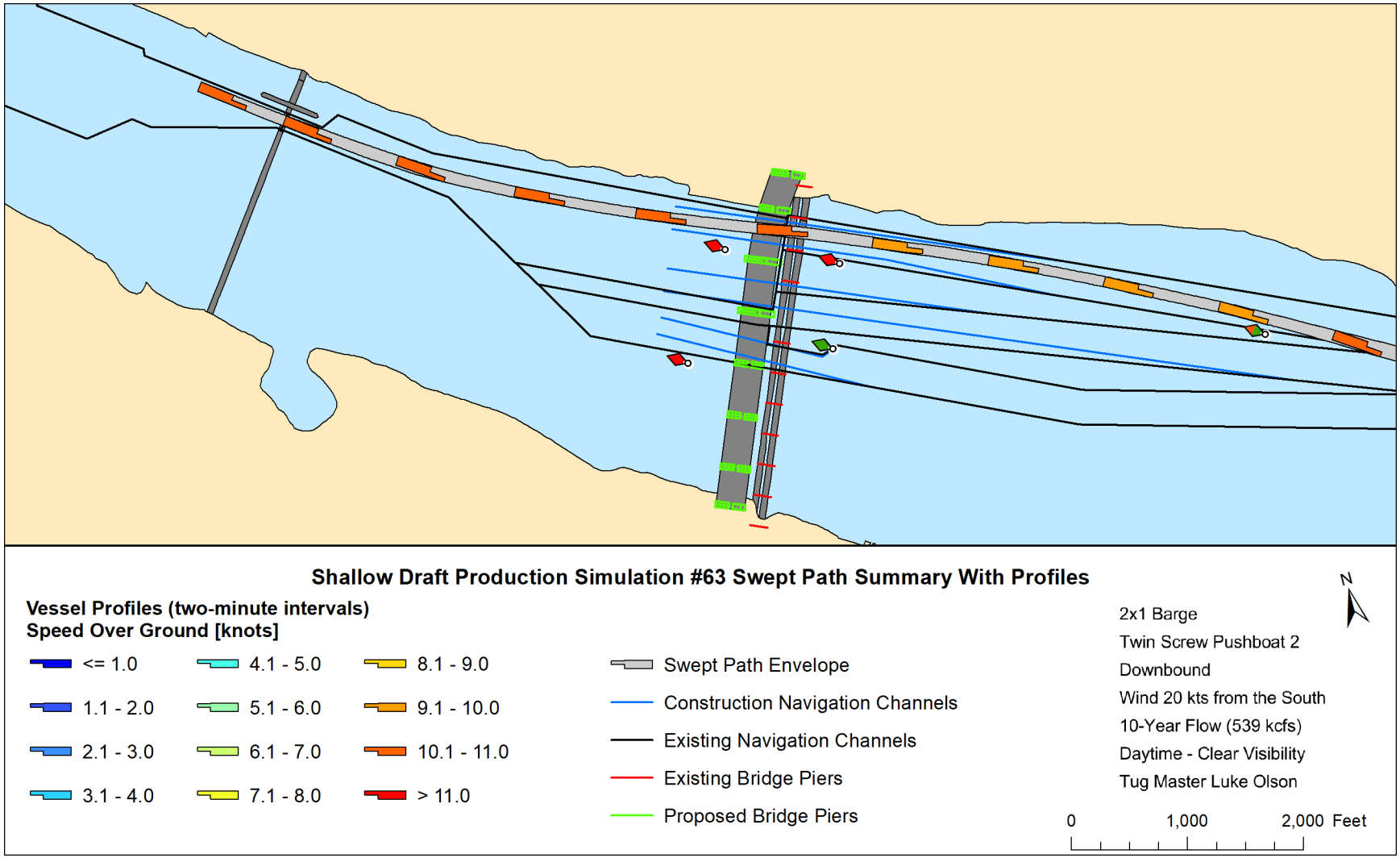


Figure 4-34: Example Shallow-Draft 2x1 Barge Downbound Construction Channel Time Series Plot

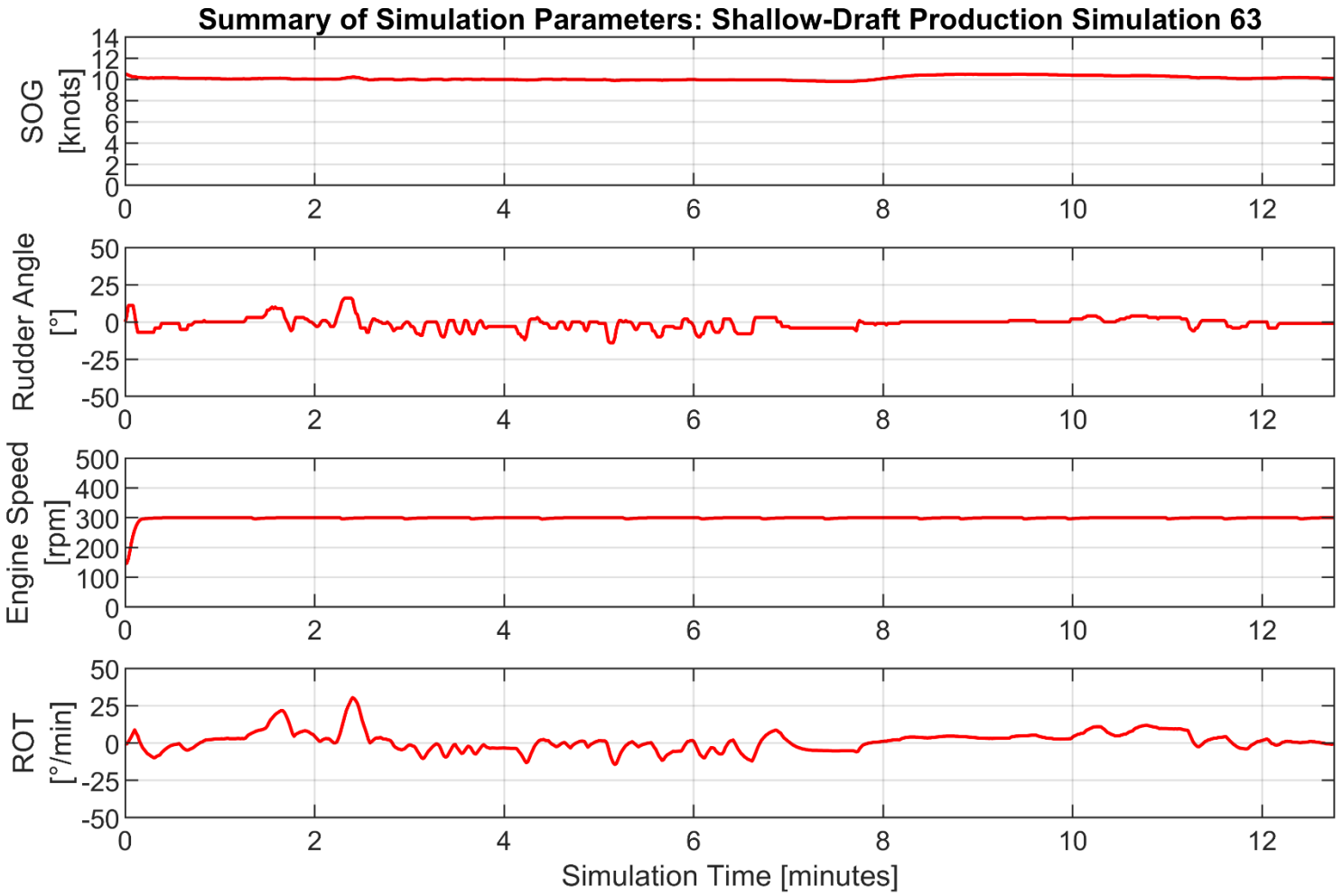


Table 4-11. Shallow-Draft 2x1 Barge Downbound Simulations Minimum Distances to Interstate Bridge and BNSF Bridge Piers

Run	Scenario	Distance to Bridge Pier (feet)													
		Existing Interstate Bridge						Proposed Interstate Bridge						BNSF Bridge	
		North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	*North Pier*	*South Pier*
28	Existing	117	67	--	--	--	--	--	--	--	--	--	--	102	22
29	Proposed	--	--	--	--	--	--	138	171	--	--	--	--	58	57
57	Proposed	--	--	--	--	--	--	--	--	--	--	61	212	56	59
62	Proposed	--	--	--	--	--	--	--	--	115	156	--	--	77	54
63	Construction	77	103	--	--	--	--	99	195	--	--	--	--	70	49
73	Construction	--	--	--	--	27	126	--	--	--	--	192	70	59	63
75	Construction	--	--	--	--	30	117	--	--	--	--	201	46	74	36
77	Construction	--	--	--	--	20	127	--	--	--	--	205	47	86	37
83	Proposed	--	--	--	--	--	--	--	--	--	--	52	172	49	63
85	Construction	--	--	--	--	24	127	--	--	--	--	195	66	43	68
87	Construction	--	--	--	--	71	328	--	--	--	--	32	185	56	54
Average Distance (feet)		Existing Interstate Bridge All Piers*						Proposed Interstate Bridge All Piers*						BNSF Bridge All Piers – Existing Scenario*	BNSF Bridge All Piers – Proposed Scenario*
		92						135						62	59

* Average excludes construction runs

Table 4-12: Shallow-Draft Downbound 2x1 Barge Pilot Ratings for Safety, Difficulty, and Tug Adequacy

Existing Navigation Channels						Proposed Navigation Channels						Construction Navigation Channels						Notes
Rows of table list runs of the same conditions with the exception of navigation channel and if noted in the "Notes" column of table.																		
Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	
28	A. Bradley	4	5	2	🟢	29	A. Bradley	4	5	2	🟢	63	L. Olson	4	5	3	🟢	--
--						57	A. Bradley	4	4	2	🟢	73	A. Bradley	3	5	3	🟢	Runs 73, 75, 85 & 87 with transitional flow conditions Run 77 at nighttime Run 83 within desired clearance to BNSF bridge Run 73, 77 & 87 within desired clearance to Interstate Bridge Run 75 & 85 within desired clearance to BNSF & Interstate Bridges
												75	A. Bradley	4	4	2	🟢	
												77	A. Bradley	3	4	2	🟢	
						83	J. Nichols	4	5	2	🟢	85	J. Nichols	3	5	3	🟢	
												87	J. Nichols	3	5	2	🟢	
--						62	L. Olson	4	5	3	🟢	--						--
Average Score	--	4	5	2	--	**Average Score**	--	4	4.8	2.2	--	**Average Score**	--	3.4	4.7	2.5	--	--
🟢	Success. Run was well controlled with adequate clearance to channel edges and structures																	
🔴	Unsuccessful. Run was failed due to allision with **BNSF bridge**																	
🟣	Unsuccessful. Run was failed due to allision with **Interstate Bridge**																	

4.2.5 Specialty Barge Upbound Transits

Thirteen of the 89 shallow-draft simulations were upbound transits with the specialty barge. Three of these simulations evaluated the existing channels, seven runs simulated the proposed channels, and three simulations transited the construction channels. For the specialty barge, three flow conditions were evaluated: normal, transitional and 10-year. Two wind conditions of 20 knots and 10 knots from the south were evaluated. The difference in evaluated windspeeds was a result of different operators comfort threshold for maneuvering the specialty barge under elevated winds.

Example swept paths and time series plots for existing, proposed, and construction navigation channels are shown in Figure 4-35, Figure 4-36, Figure 4-37, Figure 4-38, Figure 4-39, Figure 4-40. Table 4-14 shows the minimum distances of the swept path from the Interstate Bridge piers, existing, proposed, or both, for the construction channel, depending on the simulation scenario, and the distance from the BNSF bridge piers. Based on the evaluation criteria for minimum distances, the following simulations did not maintain the desired clearances for the stated bridge:

BNSF Bridge

Simulation 3, 6, 14, 22, 30, 32, 34, 35, 45, 66, 78, and 82

Interstate Bridge

Simulation 3, 14, 32, 35, and 66

In 11 simulations, **Simulation 3, 6, 14, 22, 30, 32, 34, 35, 45, 66, and 67,** a portion of the transiting barge maneuvered outside the federal navigation channel limits upstream of the BNSF bridge on the red side of the channel. This area outside the dredge channel is naturally deep (>25 feet CRD), based on the latest USACE survey (December 2023), providing sufficient water for this maneuver. Additionally, the historical AIS data shown in Figure 3-1 indicates that this departure from the navigation channel limits is common practice today. These 11 simulations included runs in the existing, proposed and construction channels through the all three channels.

The pilot safety and run difficulty ratings for all the specialty barge upbound simulations are summarized in Table 4-13. Note that two different pilots performed these simulations and performance ratings are subjective to each individual pilot. On average the upbound existing navigation channel transits were rated as having average safety, above-average tug adequacy, and above-average difficulty. The proposed navigation channel simulations were rated as having average safety, above-average tug adequacy, and average difficulty. The construction navigation channel simulations were rated as below-average safety, above-average tug adequacy, and above-average difficulty. The existing channel transits were rated with a higher difficulty than the proposed channel simulations. The construction channels were rated similar to the existing channel transits with the exception of the safety being slightly less than existing.

The tug captains found the simulation and model to be a realistic representation of this portion of the river. For all these existing and proposed channel simulations, the mariner would perform the transit in a real-world situation independent of the simulated channel/bridge. The Foss Maritime captain did note that whenever the load on the barge impedes the captain's vision, the requirement is to have an assist tug. Three simulations in this study evaluated the specialty barge with a live assist tug. Overall, the

mariner said that in real life and in the simulator he believes that the assist tug is more of a hindrance than a help in the transit and recommended simulating with the primary towboat only. The pilots made the following observations comparing the existing and proposed navigation channels:

- Initially, the feedback was that transits in the existing and proposed channels were indifferent. However, as more scenarios were evaluated, it was stated that the proposed channels improved the transit because of the wider channels. It was stated that the Proposed Center Channel requires the fewest course corrections compared to the south and north proposed channels.
- One initial concern of the Foss Maritime captain was the reduced distance between the proposed bridge and the BNSF bridge. However, after numerous simulations, he determined that the reduced distance was countered by the wider channels between the proposed bridge piers.
- No comments were made regarding the air draft clearance when the specialty barge transited the two proposed channels without the lift span (north and south channels). The captain did state that currently they do not bid on contracts that require an air draft of 69 feet or more. As a result, the low chord elevation of the simulated proposed bridge for all three channels would be sufficient for their tows.

For the proposed bridge, one comment was received regarding the lighting on the bridge. For the Proposed Center Channel, there should be three white lights in a vertical line with a fourth green light underneath the white lights in the center of the span to follow typical maritime bridge lighting. For the other proposed spans, a single green light in the center of the span is sufficient.

Three simulations evaluated the construction navigation channels. The Construction North Channel felt like a typical transit through the Existing North Channel, but with more obstacles due to the need to pass under two bridges. Overall, the mariner had limited concerns about transiting the Construction North Channel. For the Construction South Channel, the feedback was the channel is tight and that all of these maneuvers should happen during daylight due to the difficulty. Additionally, the deckhand would need to be on the barge constantly giving the tug captain distances throughout this transit.

Figure 4-35: Example Shallow-Draft Specialty Barge Upbound Existing Channel Swept Path Summary

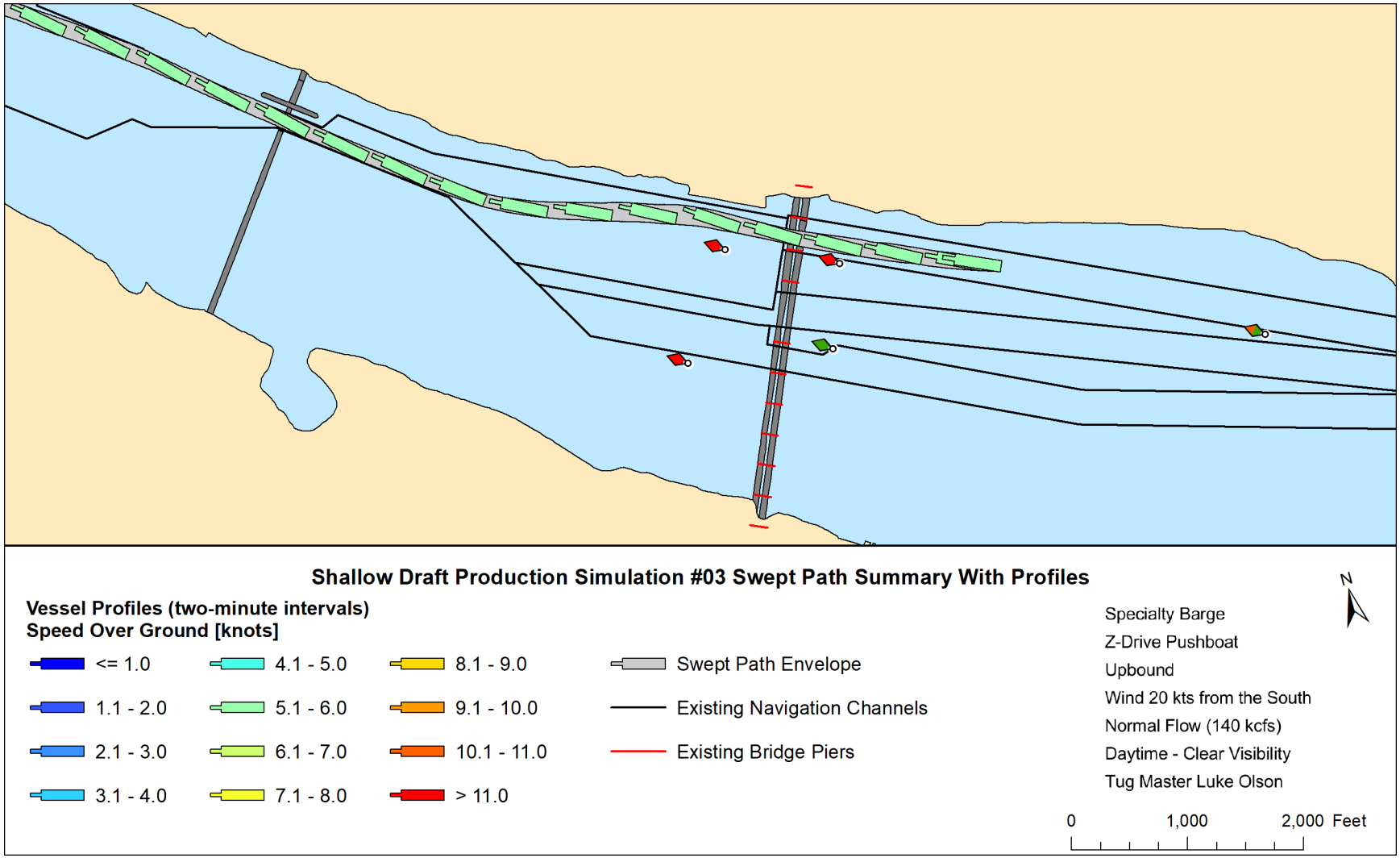


Figure 4-36: Example Shallow-Draft Specialty Barge Upbound Existing Channel Time Series Plot

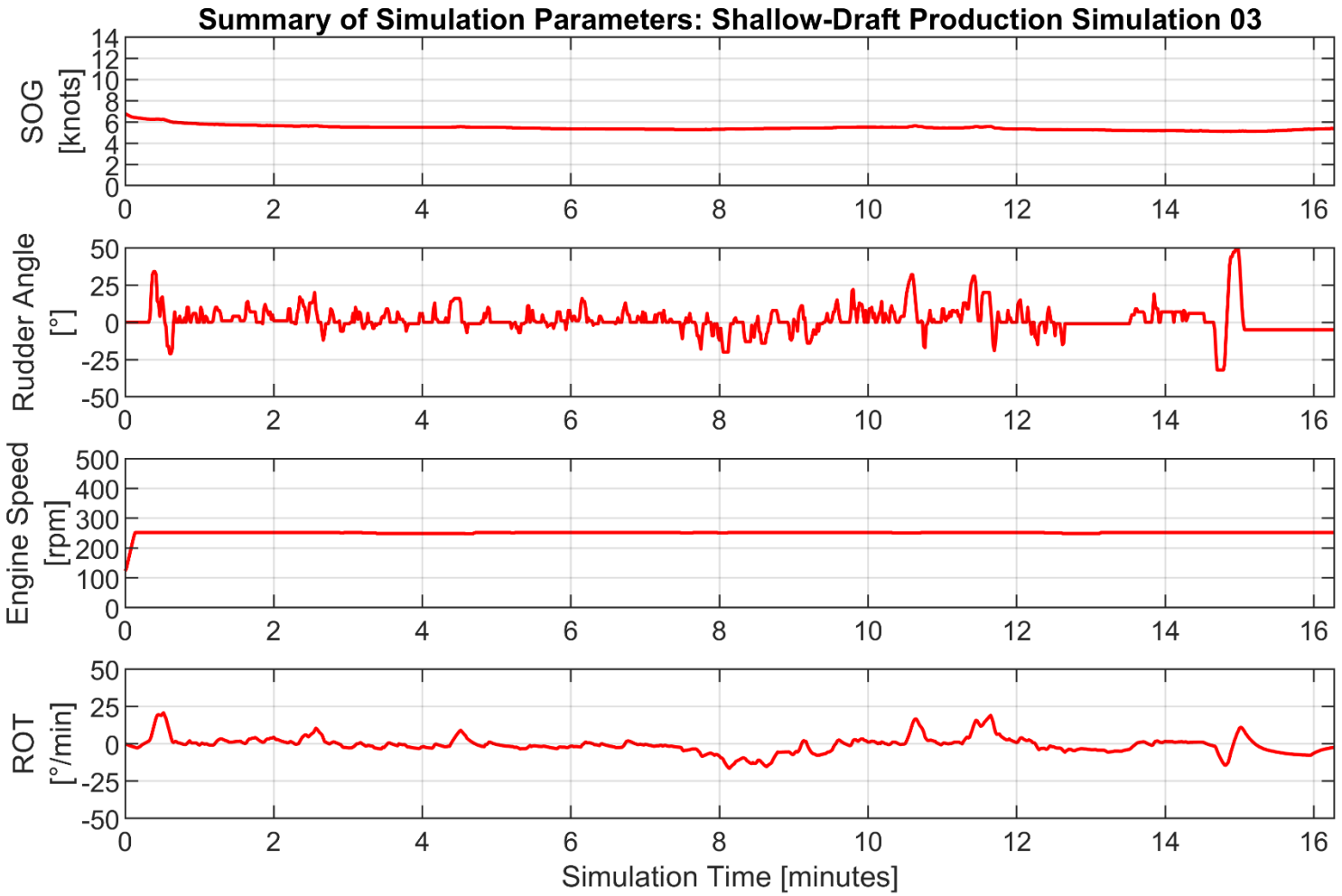


Figure 4-37: Example Shallow-Draft Specialty Barge Upbound Proposed Channel Swept Path Summary

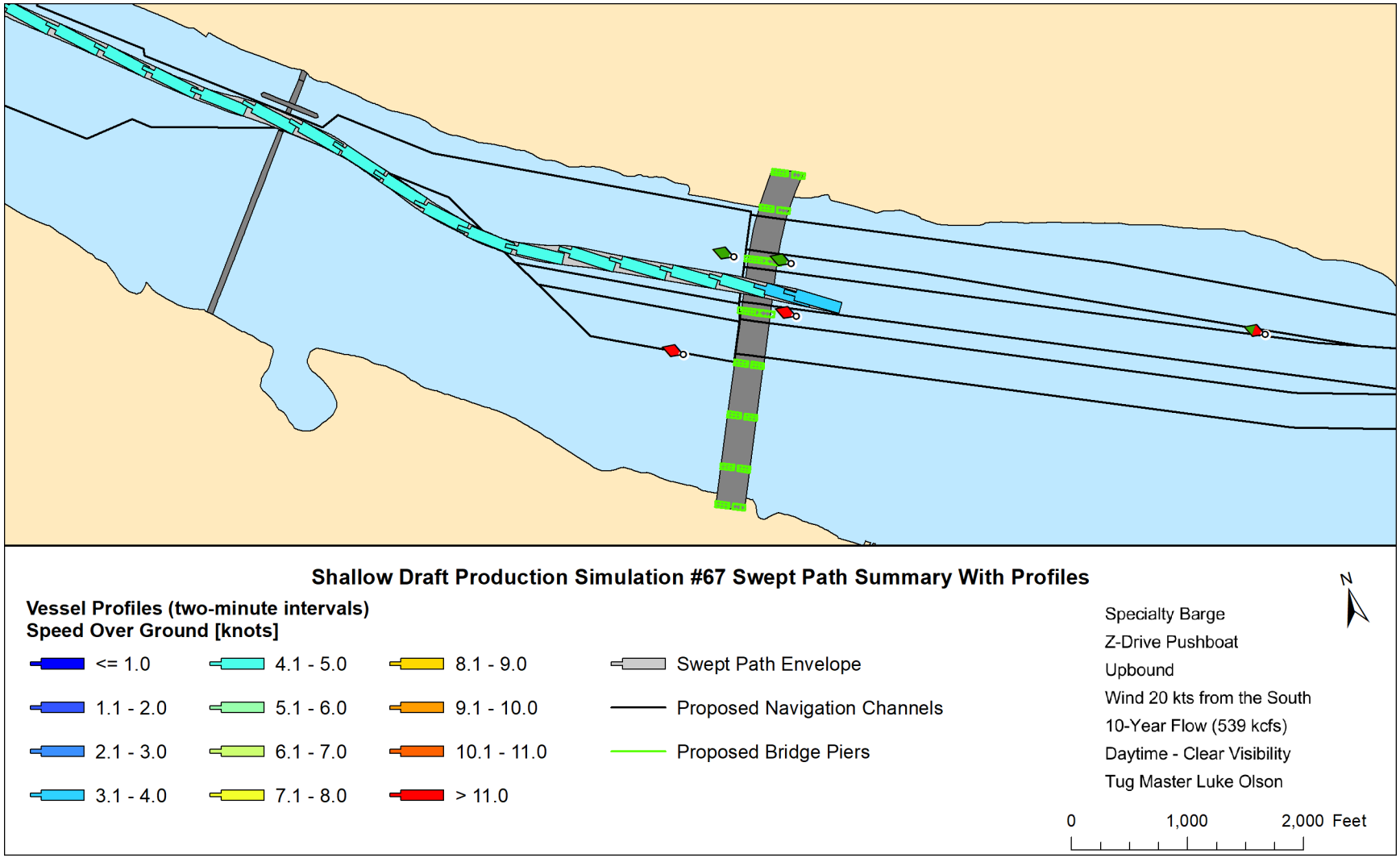


Figure 4-38: Example Shallow-Draft Specialty Barge Upbound Proposed Channel Time Series Plot

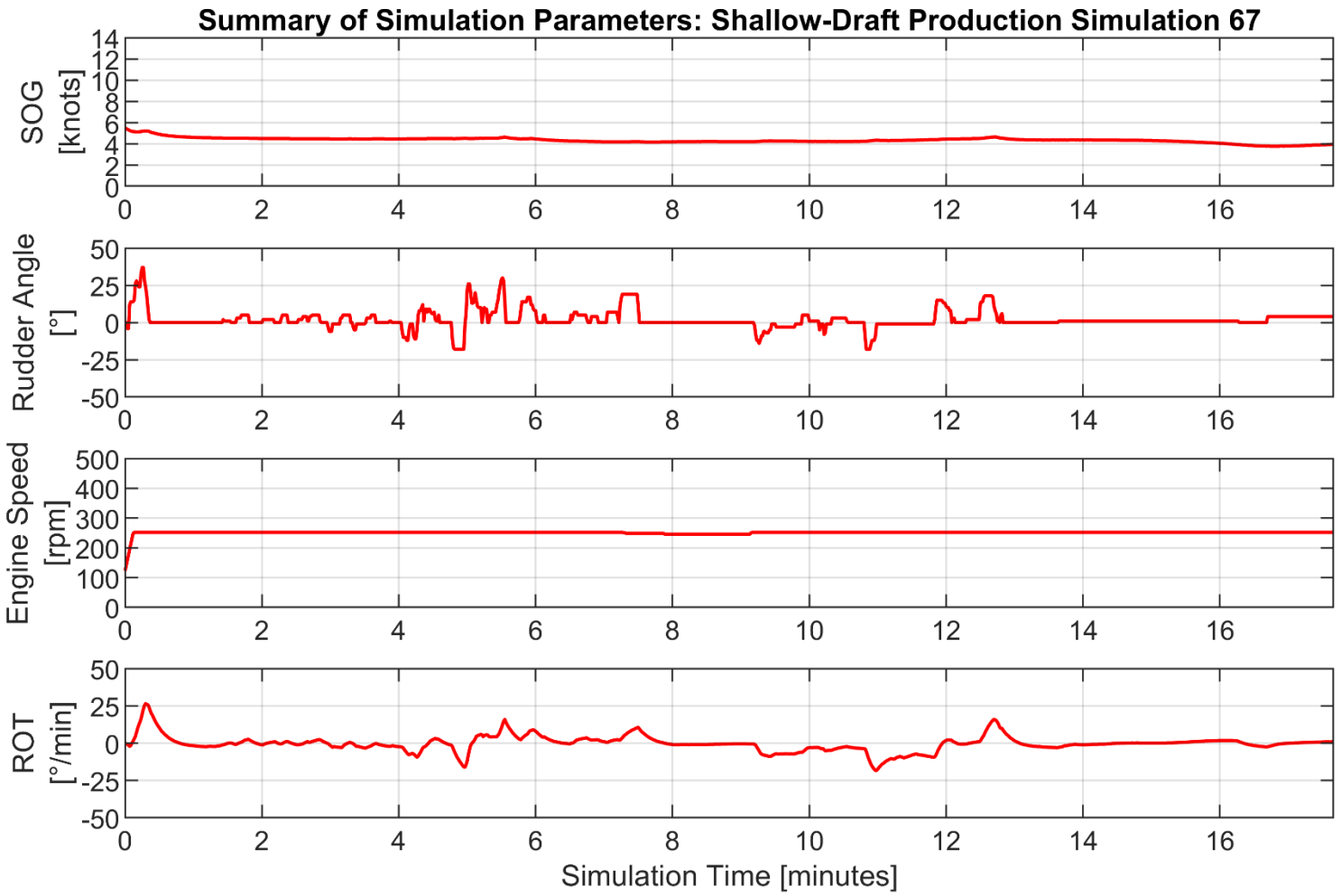


Figure 4-39: Example Shallow-Draft Specialty Barge Upbound Construction Channel Swept Path Summary

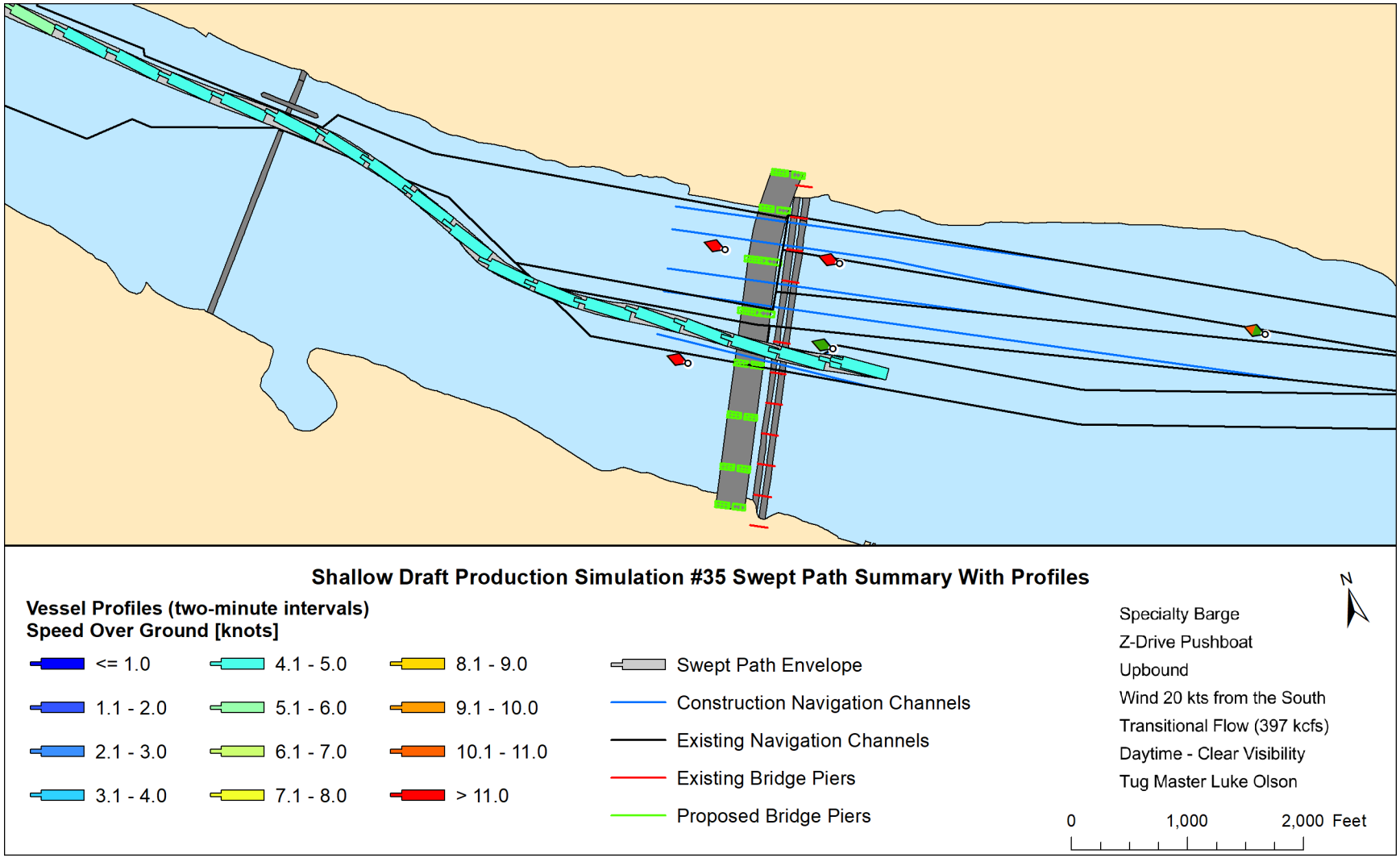


Figure 4-40: Example Shallow-Draft Specialty Barge Upbound Construction Channel Time Series Plot

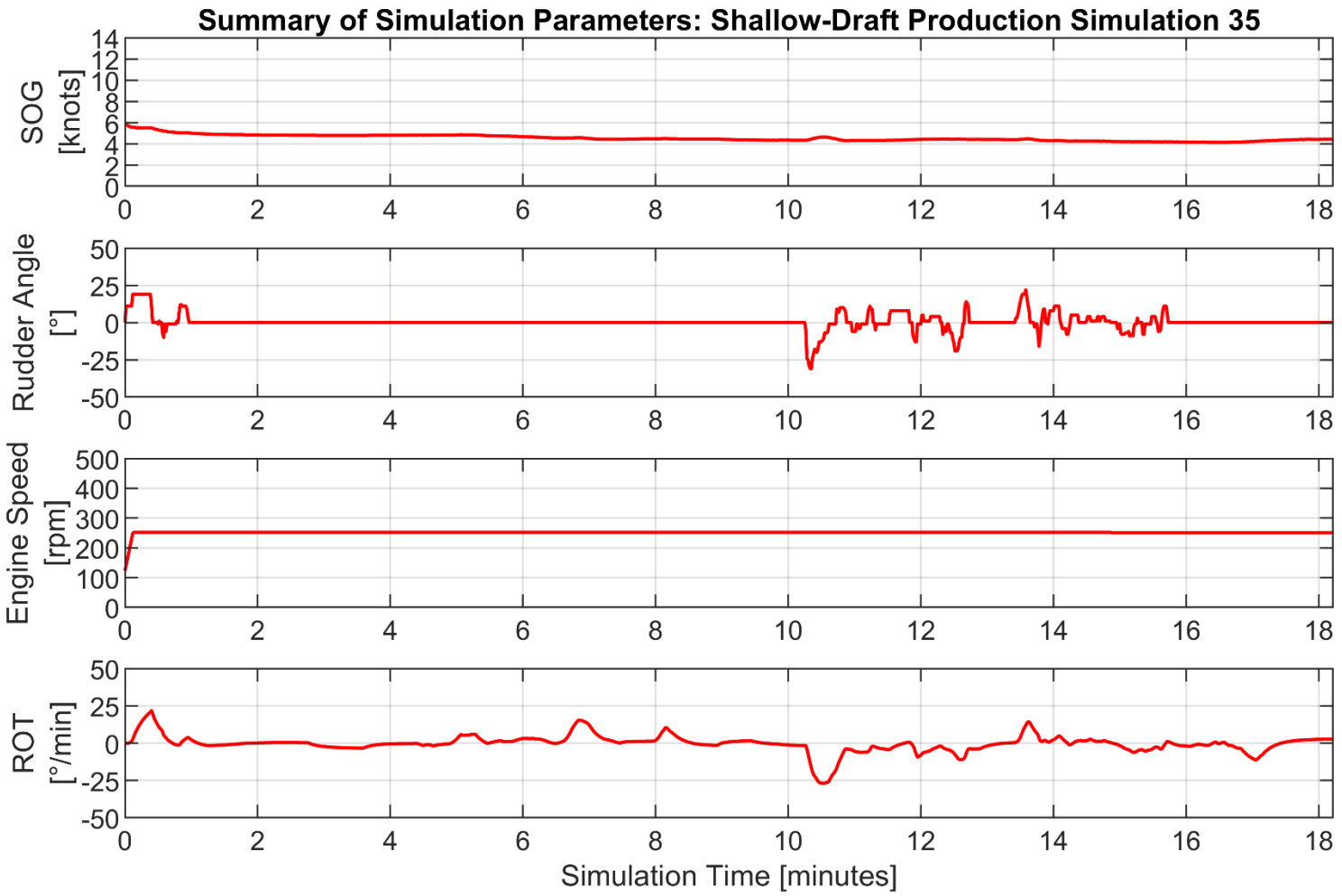


Table 4-13. Shallow-Draft Specialty Barge Upbound Simulations Minimum Distances to Interstate Bridge and BNSF Bridge Piers

Run	Scenario	Distance to Bridge Pier [feet]													
		Existing Interstate Bridge						Proposed Interstate Bridge						BNSF Bridge	
		North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	*North Pier*	*South Pier*
3	Existing	108	38	--	--	--	--	--	--	--	--	--	--	47	26
6	Proposed	--	--	--	--	--	--	--	--	63	141	--	--	19	3
14	Existing	100	23	--	--	--	--	--	--	--	--	--	--	59	7
22	Proposed	--	--	--	--	--	--	--	--	184	54	--	--	35	14
30	Proposed	--	--	--	--	--	--	229	50	--	--	--	--	85	4
32	Construction	105	28	--	--	--	--	129	130	--	--	--	--	68	7
34	Proposed	--	--	--	--	--	--	--	--	--	--	132	93	48	22
35	Construction	--	--	--	--	25	97	--	--	--	--	184	53	57	13
45	Proposed	--	--	--	--	--	--	--	--	126	112	--	--	51	8
66	Construction	--	--	--	--	25	83	--	--	--	--	120	61	59	3
67	Proposed	--	--	--	--	--	--	--	--	141	98	--	--	57	10
78	Existing	90	60	--	--	--	--	--	--	--	--	--	--	22	66
82	Proposed	--	--	--	--	--	--	--	--	65	192	--	--	2	80
Average Distance (feet)		Existing Interstate Bridge All Piers*						Proposed Interstate Bridge All Piers*						BNSF Bridge All Piers – Existing Scenario*	BNSF Bridge All Piers – Proposed Scenario*
		70						120						38	31

* Average excludes construction runs

Table 4-14: Shallow-Draft Upbound Specialty Barge Pilot Ratings for Safety, Difficulty, and Tug Adequacy

Existing Navigation Channels						Proposed Navigation Channels						Construction Navigation Channels						Notes
Rows of table list runs of the same conditions with the exception of navigation channel and if noted in the "Notes" column of table.																		
Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	
3	L. Olson	5	5	3	🟢	6	L. Olson	5	4	3	🟢	--						Run 67 with 10-year flow conditions Run 6 within desired clearance to BNSF bridge Run 3 within desired clearance to BNSF & Interstate Bridge
						67	L. Olson	4	5	3	🟢							
14	L. Olson	2	5	5	🟢	22	L. Olson	2	5	4	🟢	32	L. Olson	2	5	4	🟢	Run 30 transited North Channel. Run 32 did not use an assist push boat Run 45 at nighttime Run 22, 30 & 45 within desired clearance to BNSF bridge Run 14 & 32 within desired clearance to BNSF & Interstate Bridge
						30	L. Olson	3	5	3	🟢							
						45	L. Olson	3	5	4	🟢							
--						34	L. Olson	3	5	3	🟢	35	L. Olson	3	5	4	🟢	Run 66 at nighttime Run 34 within desired clearance to BNSF bridge Run 35 & 66 within desired clearance to BNSF & Interstate Bridge
												66	L. Olson	1	5	5	🟢	
78	C. Caffall	2	1	4	🟢	82	C. Caffall	4	4	2	🟢	--						Run 78 & 82 within desired clearance to BNSF bridge
Average Score	--	3	3.7	4	--	**Average Score**	--	3.4	4.7	3.1	--	**Average Score**	--	2.5	5	4	--	--

🟢	Success. Run was well controlled with adequate clearance to channel edges and structures
🔴	Unsuccessful. Run was failed due to allision with **BNSF bridge**
🟣	Unsuccessful. Run was failed due to allision with **Interstate Bridge**

4.2.6 Specialty Barge Downbound Transits

Twenty of the 89 shallow-draft simulations were downbound transits with the specialty barge. Four of these simulations evaluated the existing channels, 12 runs simulated the proposed channels, and four simulations transited the construction channels. For the specialty barge, three flow conditions were evaluated: normal, transitional, and 10-year. Two wind conditions of 20 knots and 10 knots from the south were evaluated. The difference in evaluated windspeeds was a result of different operators' comfort thresholds for maneuvering the specialty barge under elevated winds.

Example swept paths and time series plots for existing, proposed, and construction navigation channels are shown in Figure 4-41, Figure 4-42, Figure 4-43, Figure 4-44, Figure 4-45, and Figure 4-46. Table 4-16 shows the minimum distances of the swept path from the Interstate Bridge piers, existing, proposed, or both, for the construction channel, depending on the simulation scenario, and the distance from the BNSF bridge piers. Based on the evaluation criteria for minimum distances, the following simulations did not maintain the desired clearances for the stated bridge:

BNSF Bridge

Simulation 10, 12, 18, 20, 37, 41, 64, 65, 68, and 88

Interstate Bridge

Simulation 39, 43, 50, 65, 80, 84, 86, and 88

In **Simulation 37**, there was an allision with the BNSF bridge North Pier. The mariner stated that he turned too early toward the BNSF bridge. This simulation was repeated in **Simulation 64**, where the mariner changed the timing of his turn toward the BNSF bridge, which resulted in a successful transit with no allisions. **Simulation 86** ended with an allision with the proposed bridge pier for the south channel. During **Simulation 88**, which evaluated the Construction South Channel, an allision occurred with the transiting barge and the North Pier of the proposed bridge for the south channel. For both **Simulations 86 and 88**, the simulator operator accidently put in the transitional flow conditions instead of the desired normal flow. Captain Caffall from Combined Marine Forestry Services was the ship handler for both of these simulations that ended with allisions and stated that he does not typically transit in flows above 350,000 cfs, irrespective of the bridge and channel design, based on his tug power. Additionally, after **Simulation 88**, Captain Caffall stated that for him to successfully transit the Construction South Channel, he would need to start the simulation further upstream to allow himself to correctly approach the bridge transit.

Upon reviewing this subsection of simulations, the swept paths of **Simulations 12, 39, 43, 65, 68, and 88** showed the barge transiting outside the federal navigation channel limits upstream of the BNSF bridge on the red side of the channel. This area outside the dredge channel is naturally deep (>25 feet CRD), based on the latest USACE survey (December 2023), providing sufficient water for this maneuver. Additionally, the historical AIS data shown in Figure 3-2 indicates that this departure from the navigation channel limits is common practice today. These six simulations included runs in the proposed and construction channels through the all three channels.

The pilot safety and run difficulty ratings for all the specialty barge downbound simulations are summarized in Table 4-15. Note that two different pilots performed these simulations and performance

ratings are subjective to each individual pilot. On average, the downbound existing navigation channel transits were rated as having average safety, above-average tug adequacy, and above-average difficulty. The proposed navigation channel simulations were rated as having average safety, above-average tug adequacy, and average difficulty. The construction navigation channel simulations were rated as below-average safety, above-average tug adequacy, and above-average difficulty. The existing channel transits were rated with a higher difficulty than the proposed channel simulations. The construction channels were rated similar to the existing channel transits, with the exception of the safety being slightly less than existing.

The tug captains found the simulation and model to be a realistic representation of this portion of the river. For all these existing and proposed channel simulations, the pilot would perform the transit in a real-world situation independent of the simulated channel/bridge, with the exception of the runs completed by Captain Caffall from Combined Marine Forestry Services during the transitional flow condition. Captain Caffall stated that he does not typically transit in flows above 350,000 cfs irrespective of the bridge and channel design. Comparatively between the existing and proposed navigation channels the tug master thought the maneuvers were comparable with a slight preference to the proposed channel/bridge due to the increased channel width.

Four simulations evaluated the construction navigation channels. The mariner expressed that the Construction North Channel felt like a typical transit through the Existing North Channel, with additional obstacles with the piers from both bridges. Overall, the mariner had limited concerns about transiting the Construction North Channel. For the Construction South Channel, it was stated that the channel was tight, especially with a 100-foot-wide barge. Foss Maritime's typical barge is 76 feet wide, and the tug captain would feel better with a barge of that width transiting the Construction South Channel. The Construction North Channel is preferred. The Construction South Channel is feasible but will have more limits. Initially, for the specialty barge downbound transits would be limited to daytime, an assist tug would be required, and environmental conditions will need to be evaluated case by case.

Figure 4-41: Example Shallow-Draft Specialty Barge Downbound Existing Channel Swept Path Summary

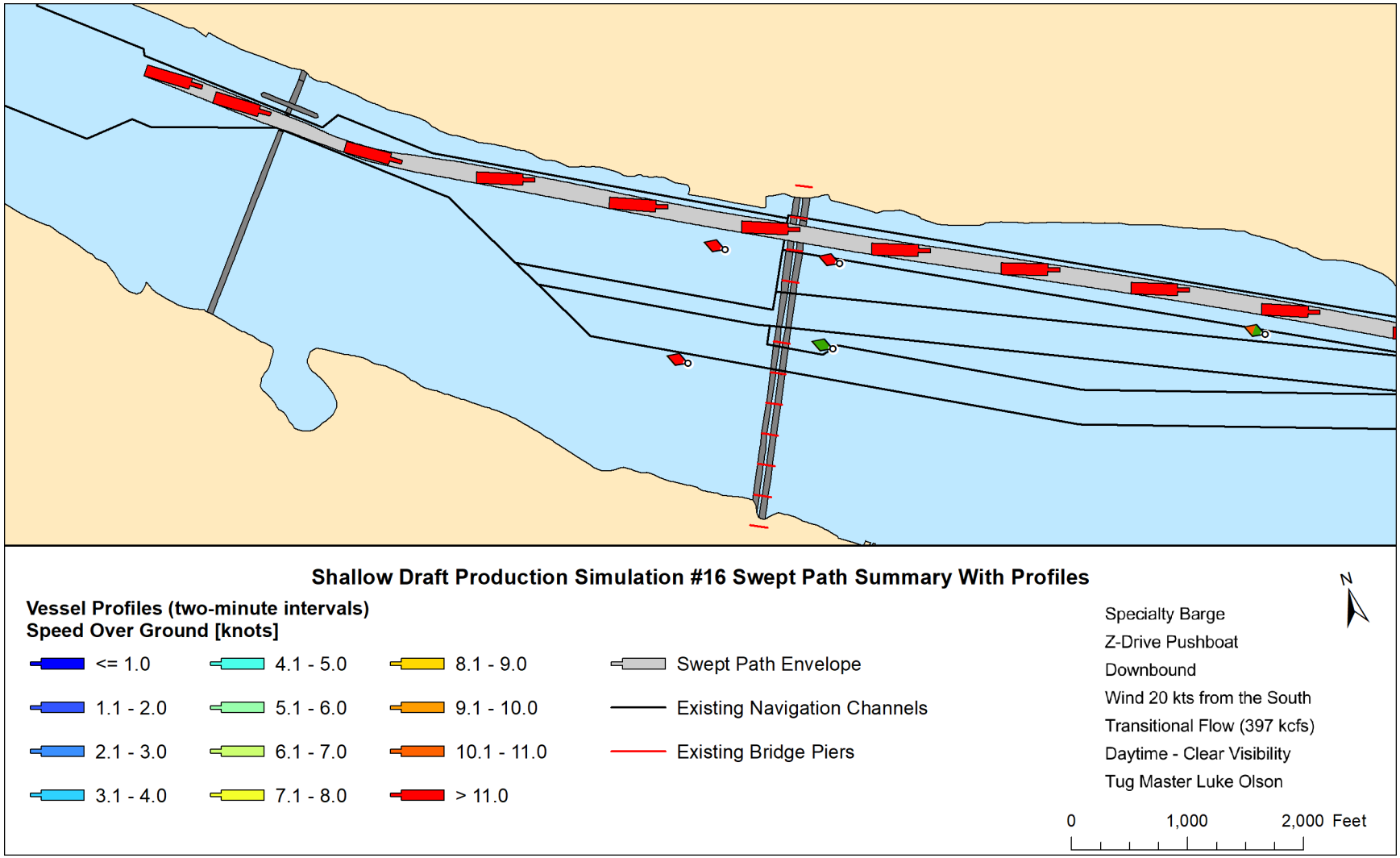


Figure 4-42: Example Shallow-Draft Specialty Barge Downbound Existing Navigation Channel Time Series Plot

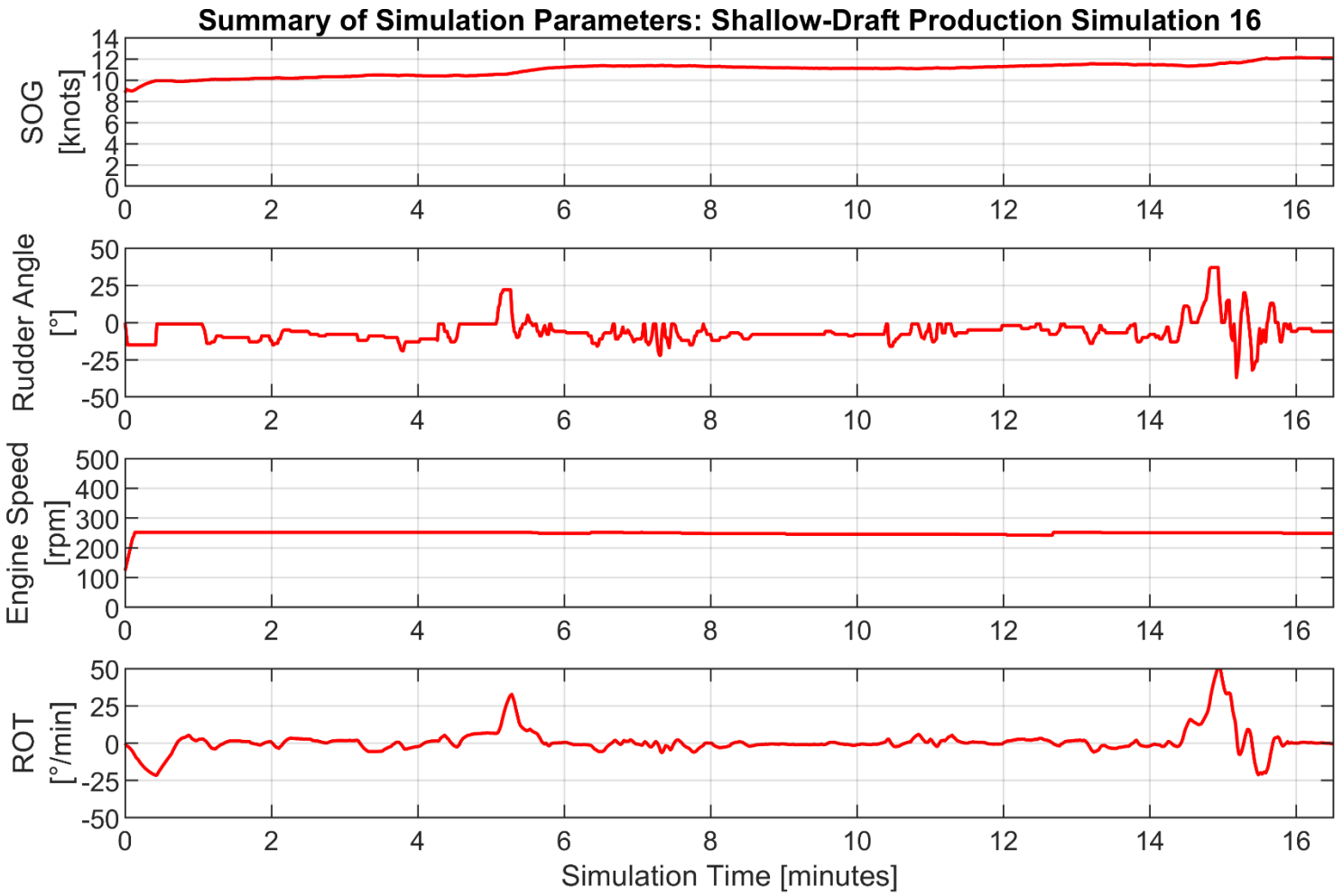


Figure 4-43: Example Shallow-Draft Specialty Barge Downbound Proposed Channel Swept Path Summary

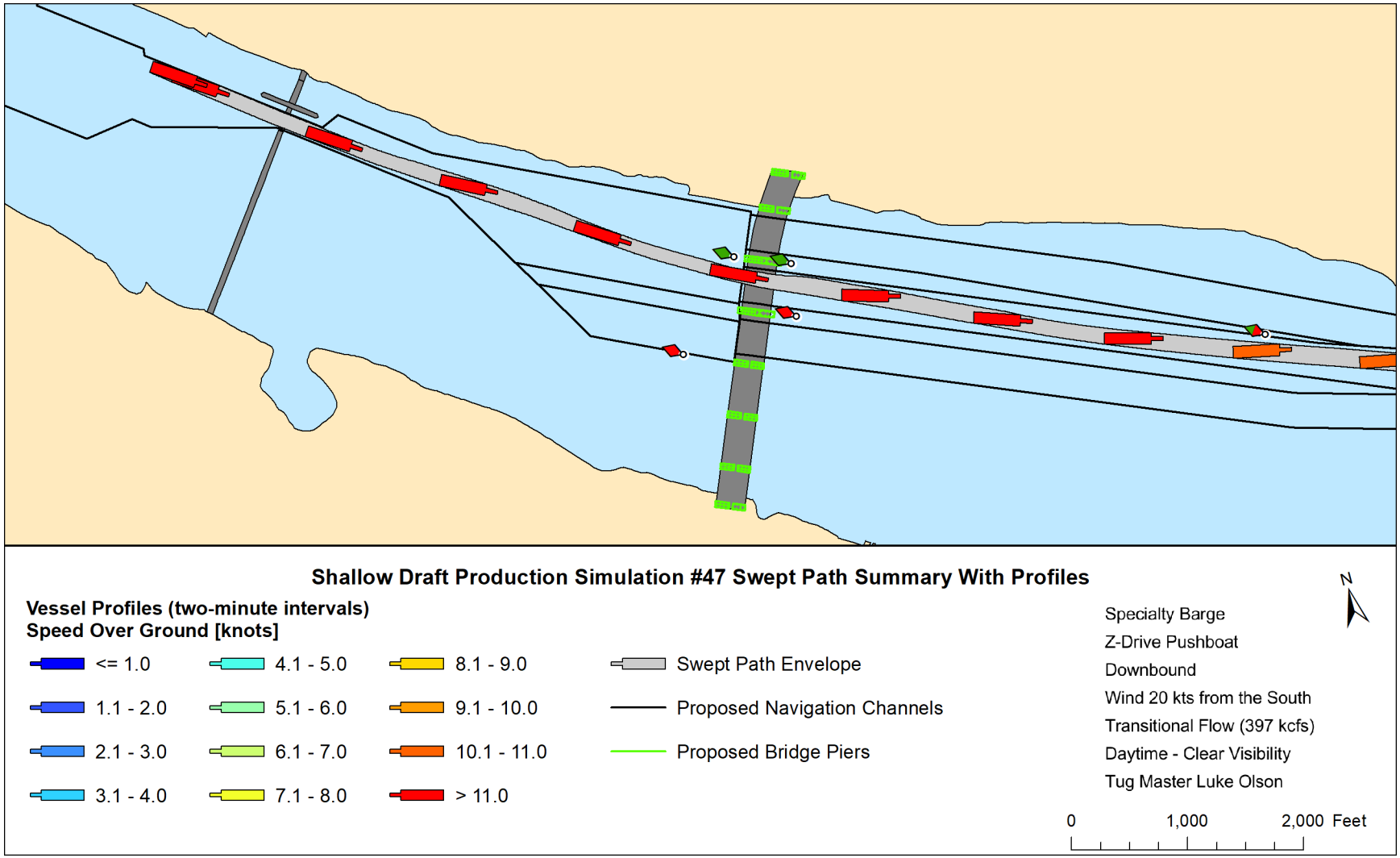


Figure 4-44: Example Shallow-Draft Specialty Barge Downbound Proposed Channel Time Series Plot

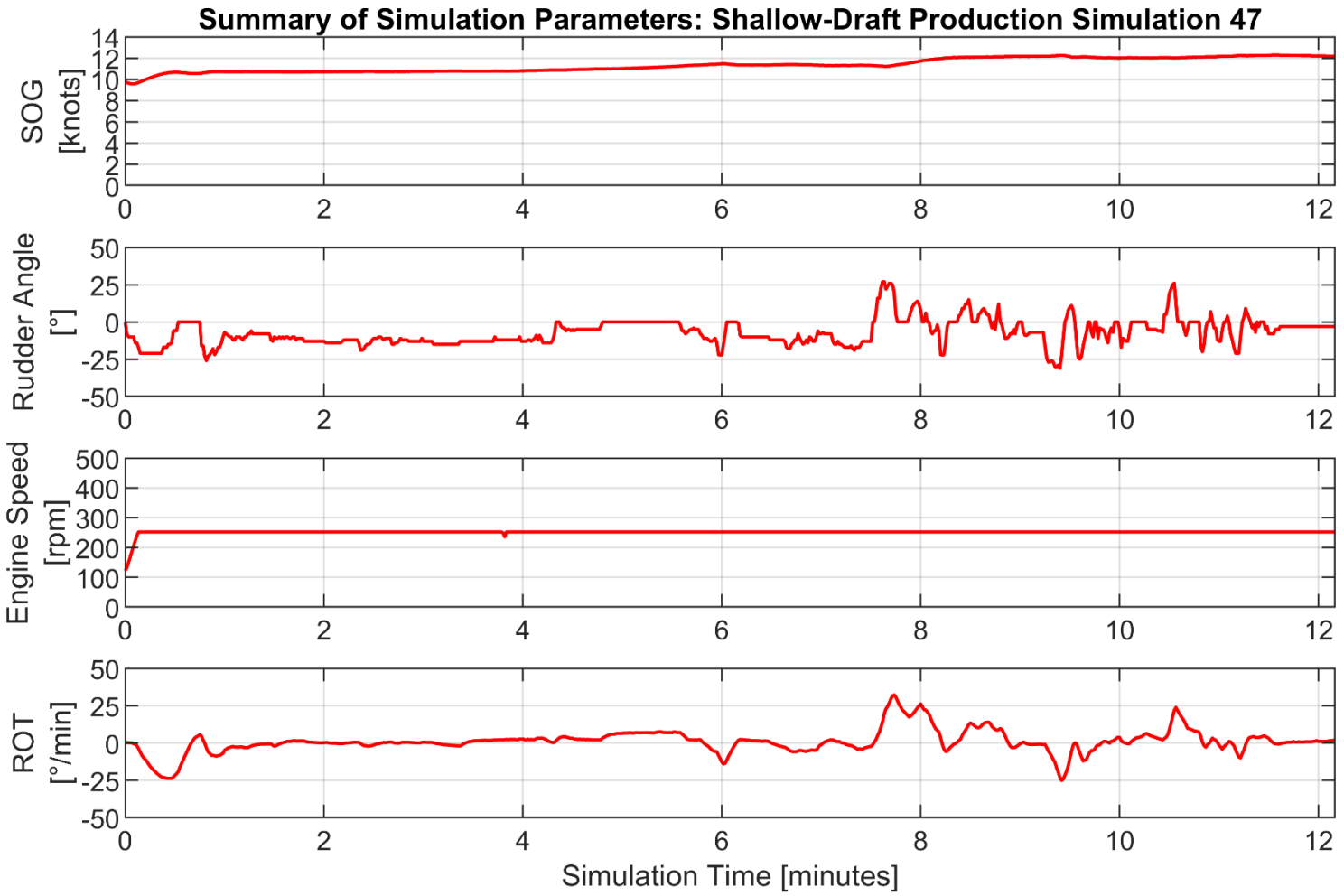


Figure 4-45: Example Shallow-Draft Specialty Barge Downbound Construction Channel Swept Path Summary

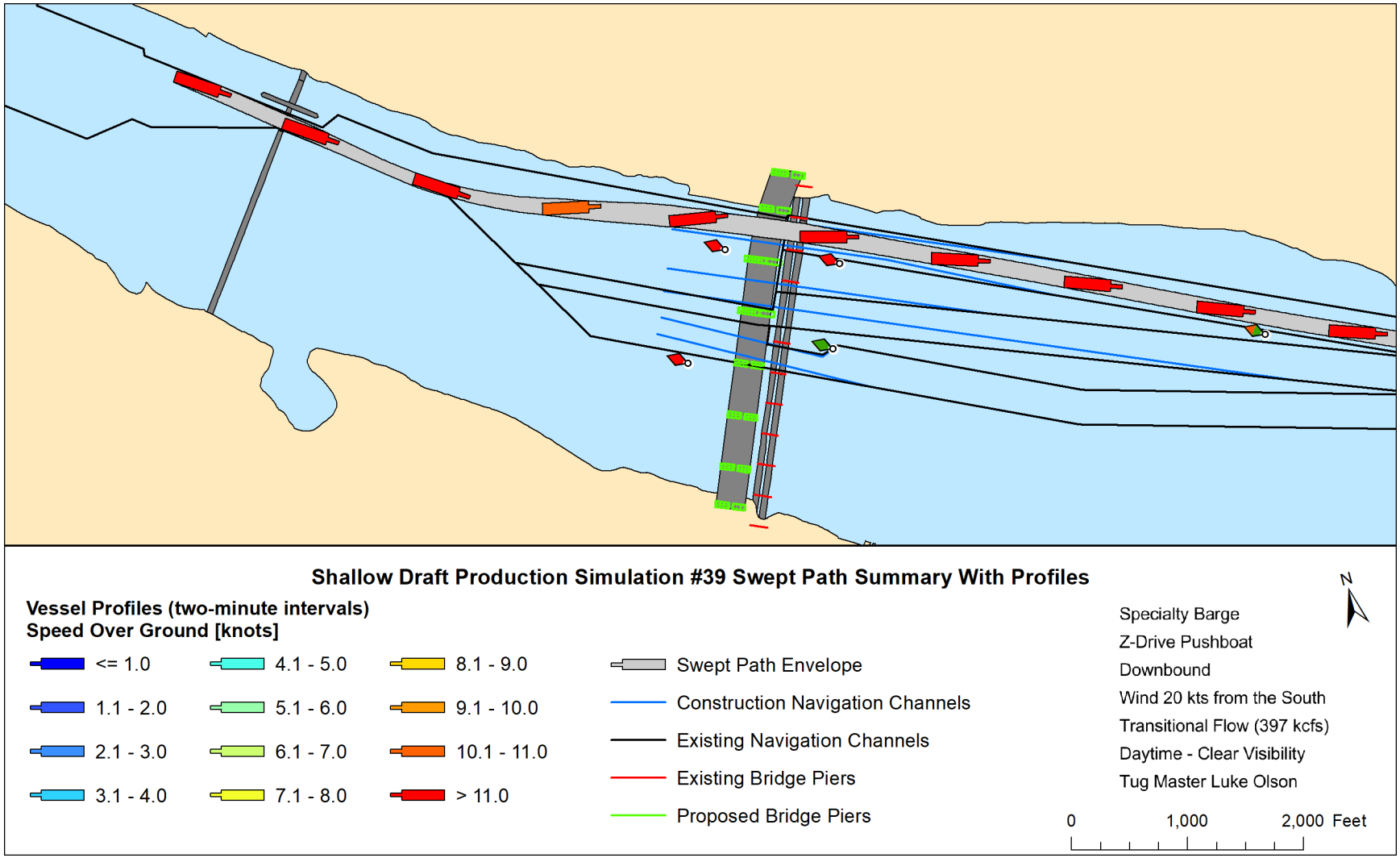


Figure 4-46: Example Shallow-Draft Specialty Barge Downbound Construction Channel Time Series Plot

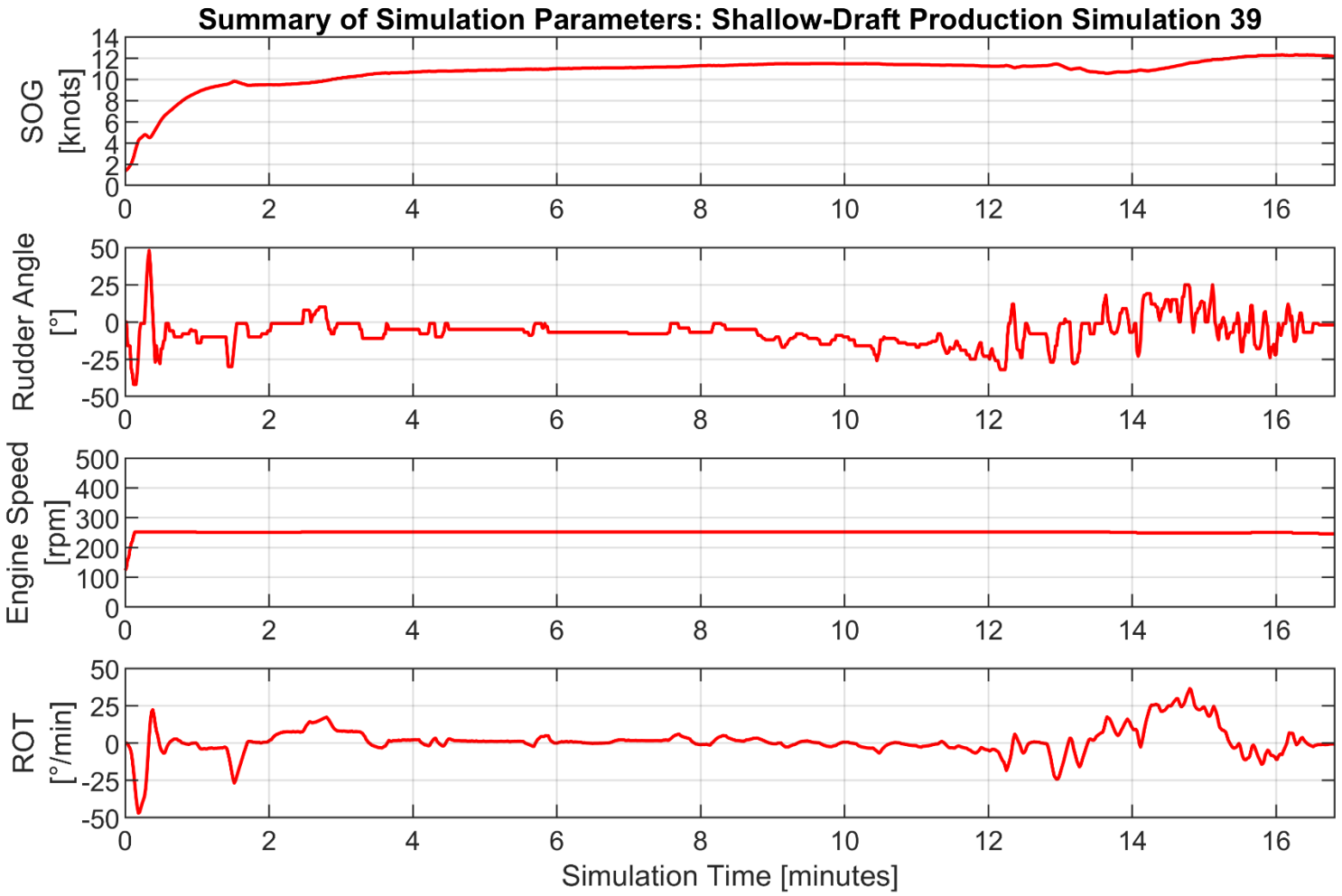


Table 4-15. Shallow-Draft Specialty Barge Downbound Simulations Minimum Distances to Interstate Bridge and BNSF Bridge Piers

Run	Scenario	Distance to Bridge Pier (feet)													
		Existing Interstate Bridge						Proposed Interstate Bridge						BNSF Bridge	
		North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	North Channel *North Pier*	North Channel *South Pier*	Center Channel *North Pier*	Center Channel *South Pier*	South Channel *North Pier*	South Channel *South Pier*	*North Pier*	*South Pier*
10	Existing	59	59	--	--	--	--	--	--	--	--	--	--	16	70
12	Proposed			--	--	--	--	--	--	59	195	--	--	35	43
16	Existing	60	69	--	--	--	--	--	--	--	--	--	--	72	16
18	Proposed	--	--	--	--	--	--	--	--	114	136	--	--	20	52
20	Proposed	--	--	--	--	--	--	160	76	--	--	--	--	32	53
37	Proposed	--	--	--	--	--	--	144	86	--	--	--	--	0	78
39	Construction	42	71	--	--	--	--	59	169	--	--	--	--	59	17
41	Proposed	--	--	--	--	--	--	--	--	--	--	67	176	23	53
43	Construction	--	--	--	--	66	60	--	--	--	--	194	23	51	23
47	Proposed	--	--	--	--	--	--	--	--	74	185	--	--	55	31
50	Existing	112	16	--	--	--	--	--	--	--	--	--	--	57	25
52	Proposed	--	--	--	--	--	--	--	--	78	182	--	--	62	17
64	Proposed	--	--	--	--	--	--	166	77	--	--	--	--	47	27
65	Construction	--	--	--	--	41	80	--	--	--	--	161	43	67	7
68	Proposed	--	--	--	--	--	--	--	--	56	190	--	--	82	3
74	Proposed	--	--	--	--	--	--	--	--	61	205	--	--	68	24
80	Existing	11	122	--	--	--	--	--	--	--	--	--	--	65	37
84	Proposed	--	--	--	--	--	--	--	--	27	250	--	--	52	41
86	Proposed	--	--	--	--	--	--	--	--	--	--	0	287	--	--
88	Construction	--	--	--	--	91	329	--	--	--	--	0	127	18	86
Average Distance (feet)		Existing Interstate Bridge All Piers*						Proposed Interstate Bridge All Piers*						BNSF Bridge All Piers – Existing Scenario*	BNSF Bridge All Piers – Proposed Scenario*
		64						127						45	41

* Average excludes construction runs

Table 4-16: Shallow-Draft Downbound Specialty Barge Pilot Ratings for Safety, Difficulty, and Tug Adequacy

Existing Navigation Channels						Proposed Navigation Channels						Construction Navigation Channels						Notes
Rows of table list runs of the same conditions with the exception of navigation channel and if noted in the "Notes" column of table.																		
Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	Run Number	Pilot	Run Safety	Tug Adequacy	Run Difficulty	Run Result	
10	L. Olson	3	5	3	🟢	12	L. Olson	3	5	3	🟢	--						Run 20 transited North Channel. Run 10, 12 & 20 within the desired clearance to BNSF bridge
						20	L. Olson	5	5	3	🟢							
16	L. Olson	4	5	4	🟢	18	L. Olson	4	5	2	🟢	--						Run 47 at nighttime. Runs 68 & 74 had loaded condition. Run 18 & 68 within the desired clearance to BNSF bridge
						47	L. Olson	4	5	3	🟢							
						68	L. Olson	3	5	3	🟢							
						74	L. Olson	3	5	3	🟢							
--						37	L. Olson	5	5	3	🔴	39	L. Olson	5	5	3	🟢	Run 37 & 64 within the desired clearance to BNSF bridge Run 39 within the desired clearance to Interstate Bridge Run 37 allision explained in text.
						64	L. Olson	5	5	3	🟢							
--						41	L. Olson	3	5	4	🟢	43	L. Olson	1	5	5	🟢	Run 65 at nighttime Run 41 within the desired clearance to BNSF bridge Run 43 within the desired clearance to Interstate Bridge Run 65 within the desired clearance to BNSF & Interstate Bridges
												65	L. Olson	2	5	4	🟢	
50	L. Olson	4	5	4	🟢	52	L. Olson	3	5	3	🟢	--						Run 50 within the desired clearance to Interstate Bridge
80	C. Caffall	1	2	5	🟢	84	C. Caffall	4	4	4	🟢	--						Run 80 & 84 within the desired clearance to Interstate Bridge
--						86	C. Caffall	1	3	5	🟣	88	C. Caffall	2	3	5	🟣	Run 86 & 88 within the desired clearance to Interstate Bridge Run 86 & 88 allisions explained in text.
Average Score	--	3	3.7	4	--	**Average Score**	--	3.4	4.7	3.1	--	**Average Score**	--	2.5	5	4	--	--

🟢	Success. Run was well controlled with adequate clearance to channel edges and structures
🔴	Unsuccessful. Run was failed due to allision with **BNSF bridge**
🟣	Unsuccessful. Run was failed due to allision with **Interstate Bridge**

5. SUMMARY AND CONCLUSIONS

A real-time vessel simulation study was performed at the Maritime Institute of Technical and Graduate Studies West (MITAGS) in Seattle, Washington. These simulations were performed to evaluate the navigability and safety of the proposed Interstate bridge and proposed changes to the navigation channels. Ship handling for the deep-draft vessel simulations was performed by a licensed pilot from the Columbia River Pilots Association. For the shallow-draft vessel simulations, the ship handling was performed by a local Columbia River tug master from Shaver Transportation Company, Foss Maritime, Combined Forestry & Marine Services, or Tidewater.

In total, 109 production simulations were performed: 20 deep-draft and 89 shallow-draft. These simulations were performed over eight simulation days, October 25–26, November 6–10, and November 15, 2023. These simulations included maneuvers evaluating and comparing:

- The existing navigation channels
- The proposed navigation channels
- The construction navigation channels

The existing navigation channel was simulated a total of 27 times to allow the mariners to verify the realism of the simulator and for comparison with the proposed and construction channels. A total of 54 simulations were completed to analyze the proposed navigation channels. The construction navigation channels were evaluated in a total of 28 simulations. The construction channels were not evaluated with the deep-draft bulk carrier, as this vessel does not transit this channel today and there are no definitive plans for this transit in the future to the best of our knowledge.

The primary conclusions and recommendations from this study are provided in the following subsections.

Proposed Channel Design

Review of clearances to the BNSF bridge found that the shallow-draft barges commonly come within the minimum safety clearances independent of whether the existing, proposed, or construction channels are being evaluated.

The average I-5 pier clearance for the existing and proposed simulations are compared in Table 5-1. The average clearances for the proposed Interstate bridge are greater than for the existing Interstate Bridge, with the exception of the center channel downbound transits with the 2x2 barge. In this scenario the existing average clearance is 186 feet, while the proposed average clearance is 124 feet. The average clearances are greater for the existing bridge because existing piers for this span are over 500 feet apart, compared to 400 feet in the proposed design. Even though the existing center span is over 500 feet wide, the whole span cannot be transited due to the low chord elevation of the bridge varying from approximately +46 feet CRD at the north end of the span to +70 feet CRD. The average air draft of the tugs listed in Table 2-3 is 47 feet.

Table 5-1: Average Interstate Bridge Pier Clearances

Scenario	Average Interstate Bridge Pier Clearance (feet)							
	2x2 Barge Upbound Transits		**2x2 Barge Downbound Transits**		**2x1 Barge Upbound Transits**		**2x1 Barge Downbound Transits**	
	North Existing Channel vs North Proposed Channel	South Existing Channel vs South Proposed Channel	North Existing Channel vs North Proposed Channel	Center Existing Channel vs Center Proposed Channel	North Existing Channel vs North Proposed Channel	North Existing Channel vs Center Proposed Channel	North Existing Channel vs North Proposed Channel	North Existing Channel vs Center Proposed Channel
Existing	64	63	80	186	78		92	
Proposed	129	121	139	124	139	120	155	136

Scenario	**Specialty Barge Upbound Transits**	**Specialty Barge Downbound Transits**	**Deep-Draft Bulk Carrier Upbound Transits**	**Deep-Draft Bulk Carrier Downbound Transits**
	North Existing Channel vs Center Proposed Channel	North Existing Channel vs Center Proposed Channel	North Existing Channel vs Center Proposed Channel	North Existing Channel vs Center Proposed Channel
Existing	70	64	95	90
Proposed	118	129	148	150

The higher average clearances for the proposed bridge corroborate the feedback received from the mariners that the proposed navigation channels and corresponding Interstate Bridge are an improvement over the existing conditions, from a navigation perspective. The wider channels and higher bridge elevation in the proposed channel and bridge design allow a greater margin of safety and better visibility. Furthermore, with the proposed bridge, the 2x2 and 2x1 barges will be able to transit all three of the navigation channels during high-water conditions as a result of the proposed bridge having approximately 90 feet of vertical clearance to 0 CRD or more. Currently, during high water conditions (when the air draft clearance is less than 60 feet), the lift span is the only channel that can be transited.

The mariners stated that the proposed channel positions allow for natural transitions between the Interstate Bridge and the BNSF bridge. The mariners did not raise any concerns regarding navigation with the proposed design.

Commonly for both shallow- and deep-draft simulations, the transiting vessel departed the limits of the federal navigation channel upstream of the BNSF bridge on the red side of the channel. Presently, according to historical AIS data, this departure from the navigation limits is common practice today for the shallow-draft vessels due to sufficient water depth (> 15 feet CRD). However, if deep-draft vessels were to start transiting this portion of the river, a bend widener would be recommended in this area where the vessel repeatedly left the channel boundaries.

Construction Channel Design

Two primary construction channels were evaluated: the Construction North Channel and the Construction South Channel. The Construction Center Channel will have air draft limitations that restrict the shallow-draft pushtugs from transiting that channel. The Construction North Channel was successfully maneuvered, and the feedback from the mariners was that this channel resulted in a very similar transit to maneuvering the Existing North Channel today. The mariners did note that during construction there would be more obstacles to maneuver past, but overall this is the preferred construction channel.

The Construction South Channel was found to be tight, and a challenging transit. The mariners thought that the transit through the Construction South Channel was feasible but that there would initially be limitations to the transit until the mariners were more familiar with it. The limitations initially could include the following:

- 2x2 barges should be broken into 2x1 barge, independent of flow conditions.
- The specialty barges' transits should be limited to daylight, an assist tug should be available, and the deckhand would need to be on the barge giving the tug master constant distances.
- Breaking up the barge may require fleeting areas (i.e., areas used to provide barge mooring) upstream of the project area and downstream of the BNSF bridge.

Upon reviewing the swept paths of the simulations that evaluated the Construction South Channel, it was noted that the barges typically departed the federal navigation channel limits after passing through the two set of bridge piers east of the existing Interstate Bridge. According to the latest USACE bathymetry survey, there is sufficient water depth in this area for the barges to transit. This departure from the channel limits is most likely a result of the construction channel alignment and will be common practice while construction is ongoing under the simulated conditions.

A secondary Construction South Channel was evaluated that transited the southern portion of the existing center span. The mariners' channel preferences varied. However, if this secondary Construction South Channel is to be used, the available air draft will need to be confirmed.

Aids to Navigation

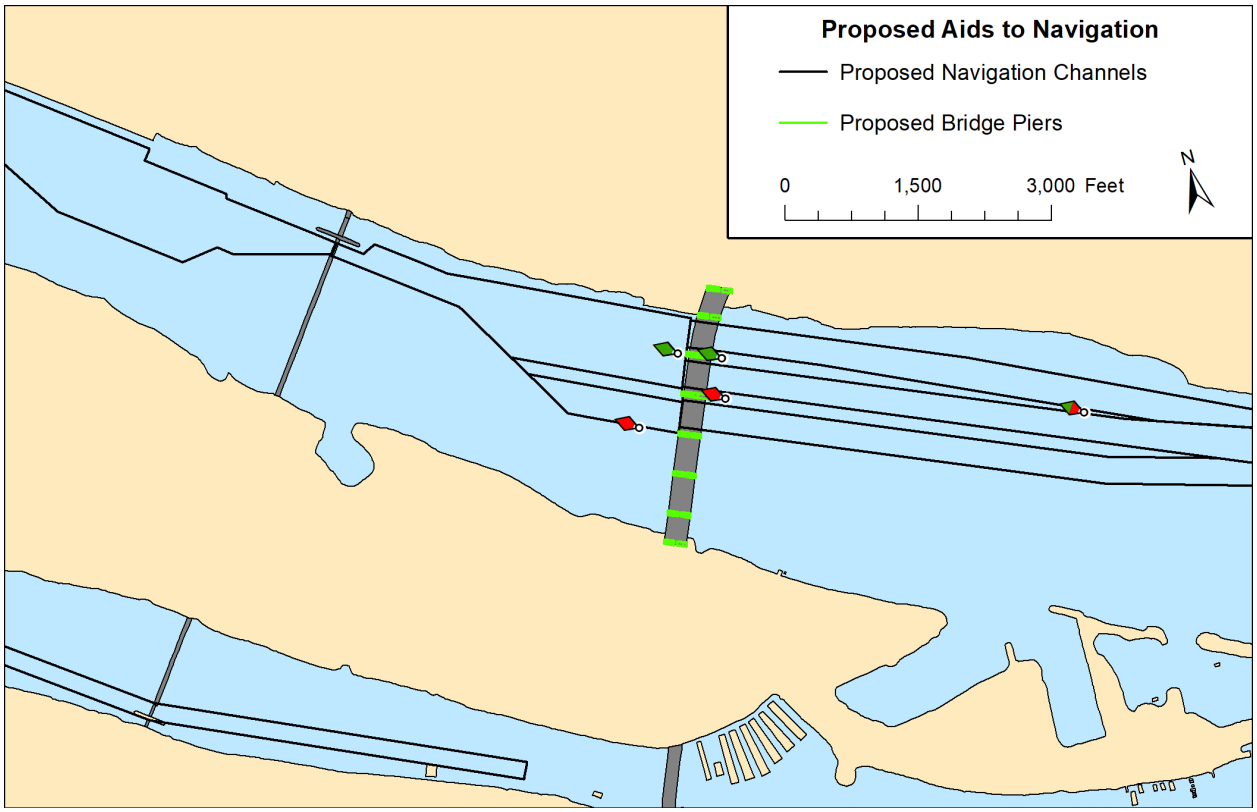
Three comments were received on the aids to navigation from the mariners, as listed below:

- During the deep-draft simulations, the pilots stated that with the proposed project, the red and green buoys should be swapped to indicate the primary navigation channel as the center

channel. Additionally, the junction buoy would need to be relocated south of the center channel to follow maritime convention. The buoys were updated for the shallow-draft simulations (Figure 5-1), with the exception of the junction buoy.

- The lighting on the proposed bridge needs to follow maritime convention. For the Proposed Center Channel there needs to be three white lights in a vertical line, with a fourth green light underneath the white lights in the center of the span. For the other proposed spans, there needs to be a single green light in the center of the span.
- Lastly, the tug captains requested a temporary range for the Construction South Channel for the upbound transit. For this range, instead of marking the centerline of the channel, the mariners requested that the range be the center of the non-obstructed opening, as shown in Figure 4-16.

Figure 5-1: Simulated Proposed Aids to Navigation in the Vicinity of the IBR Program



6. REFERENCES

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CRC (Columbia River Crossing). 2014b. Ship Navigation Study of Changes to Federal Deep-Draft Navigation Channels Due to the Interstate 5 Columbia River Crossing Replacement Bridge. March 2014.

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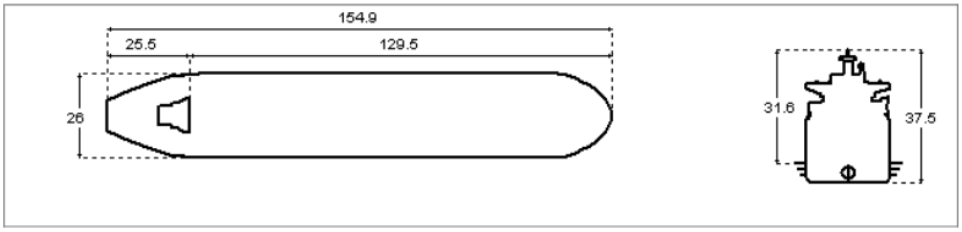
USACE (U.S. Army Corps of Engineers) Portland District. 2024. Building Strong from Vancouver to The Dalles. USACE. Available at <https://www.nwp.usace.army.mil/Missions/Navigation/Channels/Vancouver-to-The-Dalles/> Accessed January 24, 2024.

APPENDIX A: PILOT CARDS

Pilot Card : MN Bulk_carrier_24 v2 (VSY: 2.94.4043.0, SMM_RD: 2.223.1810.1, Date: ... Page 1 of 1

PILOT CARD					
Ship name	MN Bulk_carrier_24 v2 3.0.9.0 *			Date	18.10.2023
IMO Number	9256444	Call Sign	H9NM	Year built	2001
Load Condition	Ballast				
Displacement	12633.5 tons		Draft forward	4.1 m / 13 ft 5 in	
Deadweight	10311.08 tons		Draft forward extreme	4.1 m / 13 ft 5 in	
Capacity			Draft after	5.9 m / 19 ft 4 in	
Air draft	31.62 m / 104 ft 0 in		Draft after extreme	5.9 m / 19 ft 4 in	

Ship's Particulars			
Length overall	154.94 m	Type of bow	Bulbous
Breadth	26 m	Type of stern	Stern with thickened deadwood
Anchor(s) (No./types)	2 (PortBow / StbdBow)		
No. of shackles	24 / 24		(1 shackle =25 m / 13.7 fathoms)
Max. rate of heaving, m/min	18 / 18		



Steering characteristics			
Steering device(s) (type/No.)	Normal balance rudder / 1	Number of bow thrusters	1
Maximum angle	35	Power	1350 kW
Rudder angle for neutral effect	0.19 degrees	Number of stern thrusters	N/A
Hard over to over(2 pumps)	25 seconds	Power	N/A
Flanking Rudder(s)	0	Auxiliary Steering Device(s)	N/A

Stopping			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	309.6 s	5.11 cbls	Advance	2.7 cbls
HAH to HAS	382.6 s	4.68 cbls	Transfer	1.28 cbls
SAH to SAS	522.6 s	4.47 cbls	Tactical diameter	2.93 cbls

Main Engine(s)			
Type of Main Engine	Low speed diesel	Number of propellers	1
Number of Main Engine(s)	1	Propeller rotation	Right
Maximum power per shaft	1 x 4200 kW	Propeller type	FPP
Astern power	60 % ahead	Min. RPM	50
Time limit astern	N/A	Emergency FAH to FAS	33.2 seconds

Engine Telegraph Table				
Engine Order	Speed, knots	Engine power, kW	RPM	Pitch ratio
"FSAH"	14.6	3310	165.9	0.66
"FAH"	11.3	1611	129	0.66
"HAH"	8.7	789	99.1	0.66
"SAH"	6.4	363	73.4	0.66
"DSAH"	5.3	216	59.8	0.66
"DSAS"	-3.4	260	-60	0.66
"SAS"	-3.9	420	-70.8	0.66
"HAS"	-5.6	1014	-100.4	0.66
"FAS"	-7.3	2070	-130.3	0.66

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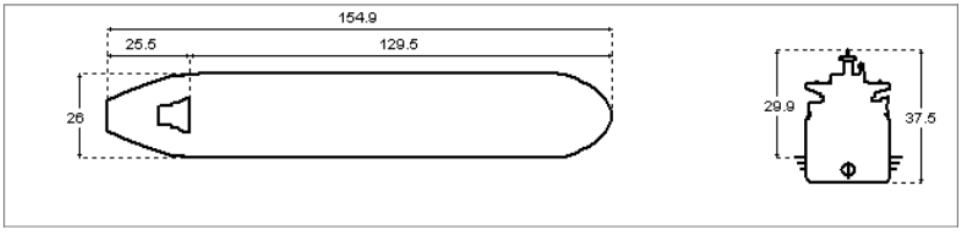
PILOT CARD					
Ship name	MN Bulk_carrier_24 v2 3.0.9.0 *			Date	18.10.2023
IMO Number	9256444	Call Sign	H9NM	Year built	2001
Load Condition	Full load				
Displacement	21112.94 tons		Draft forward	7.6 m / 25 ft 0 in	
Deadweight	18790.52 tons		Draft forward extreme	7.6 m / 25 ft 0 in	
Capacity			Draft after	7.6 m / 25 ft 0 in	
Air draft	29.92 m / 98 ft 5 in		Draft after extreme	7.6 m / 25 ft 0 in	

Ship's Particulars			
Length overall	154.94 m	Type of bow	Bulbous
Breadth	26 m	Type of stern	Stern with thickened deadwood
Anchor(s) (No./types)	2 (PortBow / StbdBow)		
No. of shackles	24 / 24		(1 shackle =25 m / 13.7 fathoms)
Max. rate of heaving, m/min	18 / 18		



Steering characteristics			
Steering device(s) (type/No.)	Normal balance rudder / 1	Number of bow thrusters	1
Maximum angle	35	Power	1350 kW
Rudder angle for neutral effect	0.25 degrees	Number of stern thrusters	N/A
Hard over to over(2 pumps)	25 seconds	Power	N/A
Flanking Rudder(s)	0	Auxiliary Steering Device(s)	N/A

Stopping			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	453.6 s	6.41 cbls	Advance	2.88 cbls
HAH to HAS	578.6 s	6.24 cbls	Transfer	1.44 cbls
SAH to SAS	796.6 s	5.96 cbls	Tactical diameter	3.13 cbls

Main Engine(s)			
Type of Main Engine	Low speed diesel	Number of propellers	1
Number of Main Engine(s)	1	Propeller rotation	Right
Maximum power per shaft	1 x 4200 kW	Propeller type	FPP
Astern power	60 % ahead	Min. RPM	50
Time limit astern	N/A	Emergency FAH to FAS	16.2 seconds

Engine Telegraph Table				
Engine Order	Speed, knots	Engine power, kW	RPM	Pitch ratio
"FSAH"	14	3518	162	0.66
"FAH"	11.2	1945	130.6	0.66
"HAH"	8.6	956	100.6	0.66
"SAH"	6	379	70.4	0.66
"DSAH"	5.2	254	60.2	0.66
"DSAS"	-3	292	-59.9	0.66
"SAS"	-3.4	429	-69.8	0.66
"HAS"	-4.9	1107	-99.4	0.66
"FAS"	-6.4	2332	-129.4	0.66

MN I 5 box_barge V2 (Dis.5062t)

Last Build Tool	2.223.1810.1/2.94.4043.0/3.0.13.0
Model Name	Big box barge
Model State	able to run
Model Vendor	Wärtsilä Voyage Ltd.
Motion Model	Smm v.2.223.1810.1
Test result	Not tested.
Work Tool	Ship Yard v.2.94.4043.0
Ship Particulars	
a. Default Load Condition	Loaded
b. Load Conditions	Conditions Count: 2
Empty	Empty
Displacement	713 t
Speed	NaN knots
Ta	0.6 m
Tf	0.6 m
Tm	0.6 m
Loaded	Loaded
Displacement	5110 t
Speed	NaN knots
Ta	4.3 m
Tf	4.3 m
Tm	4.3 m
c. Displacement	5109.79 t
d. Engine power	N/A
e. Service speed	
f. Length o.a.	91 m
g. Breadth m.	13 m
h. Draft forward	4.3 m
i. Draft after	4.3 m

PILOT CARD					
Ship name	MN Z-Drive_Pushboat(BP 47t) 3.0.42.0 *			Date	18.10.2023
IMO Number	N/A	Call Sign	N/A	Year built	N/A
Load Condition	Full load				
Displacement	500 tons		Draft forward	2.5 m / 8 ft 2 in	
Deadweight	N/A tons		Draft forward extreme	2.5 m / 8 ft 2 in	
Capacity			Draft after	2.5 m / 8 ft 2 in	
Air draft	15.28 m / 50 ft 3 in		Draft after extreme	2.5 m / 8 ft 2 in	

Ship's Particulars			
Length overall	31.5 m	Type of bow	-
Breadth	10.5 m	Type of stern	Transom
Anchor(s) (No./types)	2 (PortBow / StbdBow)		
No. of shackles	11 / 11		(1 shackle =25 m / 13.7 fathoms)
Max. rate of heaving, m/min	9 / 9		

Steering characteristics			
Steering device(s) (type/No.)	Azimuth thruster / 2	Number of bow thrusters	N/A
Maximum angle	180	Power	N/A
Rudder angle for neutral effect	0 degrees	Number of stern thrusters	N/A
Hard over to over(2 pumps)	2 seconds	Power	N/A
Flanking Rudder(s)	0	Auxiliary Steering Device(s)	N/A

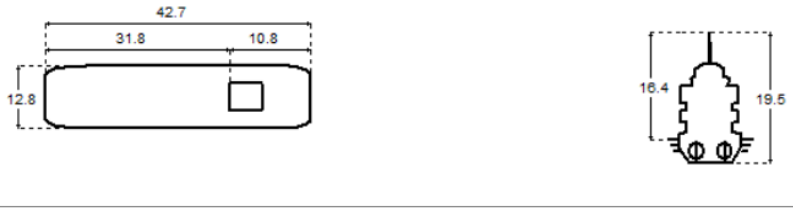
Stopping			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	10.7 s	0.18 cbls	Advance	0.28 cbls
HAH to HAS	11.8 s	0.17 cbls	Transfer	0.06 cbls
SAH to SAS	12.9 s	0.15 cbls	Tactical diameter	0.18 cbls

Main Engine(s)			
Type of Main Engine	High speed diesel	Number of propellers	2
Number of Main Engine(s)	2	Propeller rotation	Left/Right
Maximum power per shaft	2 x 2500 kW	Propeller type	Azimuth FPP
Astern power	0 % ahead	Min. RPM	100
Time limit astern	N/A	Emergency FAH to FAS	10.7 seconds

Engine Telegraph Table				
Engine Order	Speed, knots	Engine power, kW	RPM	Pitch ratio
"10"	11.2	4850	252	1.35
"9"	10.5	4070	237.7	1.35
"8"	9.9	3378	223.4	1.35
"7"	9.3	2770	209.1	1.35
"6"	8.6	2239	194.8	1.35
"5"	8	1780	180.4	1.35
"4"	7.4	1390	166.1	1.35
"3"	6.7	1061	151.8	1.35
"2"	6.1	788	137.5	1.35
"1"	5.5	567	123.2	1.35

PILOT CARD					
Ship name	Twin screw push boat 2 (bp 77t) 3.0.1.0 *			Date	29.03.2016
IMO Number	N/A	Call Sign	N/A	Year built	N/A
Load Condition	Full Load				
Displacement	950 tons		Draft forward	3.1 m / 10 ft 2 in	
Deadweight	N/A tons		Draft forward extreme	3.1 m / 10 ft 2 in	
Capacity			Draft after	3.1 m / 10 ft 2 in	
Air draft	16.4 m / 53 ft 11 in		Draft after extreme	3.1 m / 10 ft 2 in	

Ship's Particulars			
Length overall	42.7 m	Type of bow	Spoon
Breadth	12.8 m	Type of stern	U-shaped
Anchor(s) (No./types)	2 (PortBow / StbdBow)		
No. of shackles	11 / 11		(1 shackle =25 m / 13.7 fathoms)
Max. rate of heaving, m/min	18 / 18		



Steering characteristics			
Steering device(s) (type/No.)	Normal balance rudder / 2	Number of bow thrusters	N/A
Maximum angle	45	Power	N/A
Rudder angle for neutral effect	0 degrees	Number of stern thrusters	N/A
Hard over to over(2 pumps)	8 seconds	Power	N/A
Flanking Rudder(s)	2 (Max.Angle = 45)	Auxiliary Steering Device(s)	N/A

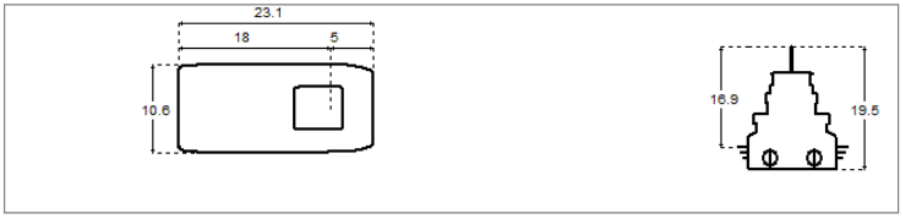
Stopping			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	30.2 s	0.63 cbls	Advance	0.45 cbls
HAH to HAS	29.2 s	0.49 cbls	Transfer	0.18 cbls
SAH to SAS	31.2 s	0.35 cbls	Tactical diameter	0.45 cbls

Main Engine(s)			
Type of Main Engine	High speed diesel	Number of propellers	2
Number of Main Engine(s)	2	Propeller rotation	Left/Right
Maximum power per shaft	2 x 2100 kW	Propeller type	FPP
Astern power	68 % ahead	Min. RPM	500
Time limit astern	N/A	Emergency FAH to FAS	2.1 seconds

Engine Telegraph Table				
Engine Order	Speed, knots	Engine power, kW	RPM	Pitch ratio
"100%"	14.3	3359	300	1.1
"80%"	12.5	1662	240	1.1
"60%"	9.9	707	180	1.1
"40%"	7.2	285	130	1.1
"20%"	5.7	152	102.9	1.1
"-20%"	-4.1	171	-104.3	1.1
"-40%"	-6	500	-154.3	1.1
"-60%"	-7.8	1043	-200	1.1
"-80%"	-9.5	1861	-244.3	1.1
"-100%"	-10.8	2856	-282.1	1.1

PILOT CARD					
Ship name	Twin screw push boat 3 (bp 17t) 3.0.1.0 *			Date	29.03.2016
IMO Number	N/A	Call Sign	N/A	Year built	N/A
Load Condition	Full Load				
Displacement	412 tons		Draft forward	2.59 m / 8 ft 6 in	
Deadweight	N/A tons		Draft forward extreme	2.59 m / 8 ft 6 in	
Capacity			Draft after	2.59 m / 8 ft 6 in	
Air draft	16.91 m / 55 ft 7 in		Draft after extreme	2.59 m / 8 ft 6 in	

Ship's Particulars			
Length overall	23.17 m	Type of bow	Spoon
Breadth	10.67 m	Type of stern	U-shaped
Anchor(s) (No./types)	2 (PortBow / StbdBow)		
No. of shackles	10 / 10		(1 shackle =25 m / 13.7 fathoms)
Max. rate of heaving, m/min	18 / 18		



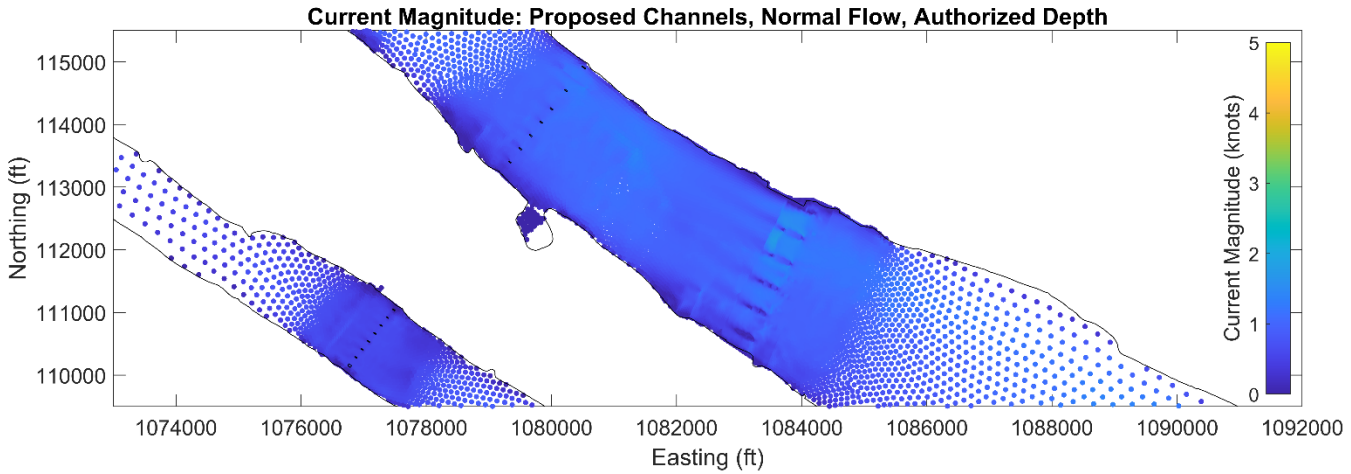
Steering characteristics			
Steering device(s) (type/No.)	Normal balance rudder / 2	Number of bow thrusters	N/A
Maximum angle	45	Power	N/A
Rudder angle for neutral effect	0 degrees	Number of stern thrusters	N/A
Hard over to over(2 pumps)	8 seconds	Power	N/A
Flanking Rudder(s)	2 (Max.Angle = 45)	Auxiliary Steering Device(s)	N/A

Stopping			Turning circle	
Description	Full Time	Head reach	Ordered Engine: 100%, Ordered rudder: 35 degrees	
FAH to FAS	31.2 s	0.53 cbls	Advance	0.3 cbls
HAH to HAS	34.2 s	0.42 cbls	Transfer	0.11 cbls
SAH to SAS	41.2 s	0.36 cbls	Tactical diameter	0.29 cbls

Main Engine(s)			
Type of Main Engine	High speed diesel	Number of propellers	2
Number of Main Engine(s)	2	Propeller rotation	Left/Right
Maximum power per shaft	2 x 672 kW	Propeller type	FPP
Astern power	56 % ahead	Min. RPM	200
Time limit astern	N/A	Emergency FAH to FAS	2.1 seconds

Engine Telegraph Table				
Engine Order	Speed, knots	Engine power, kW	RPM	Pitch ratio
"80%"	10	757	232.1	0.8
"60%"	7.9	293	174.4	0.8
"40%"	6	127	130.7	0.8
"20%"	4	41	86.8	0.8
"-20%"	-3.2	44	-86.6	0.8
"-40%"	-4.9	139	-130.3	0.8
"-60%"	-6.5	311	-174.1	0.8
"-80%"	-8.5	734	-232.1	0.8

APPENDIX B: CURRENT FIELDS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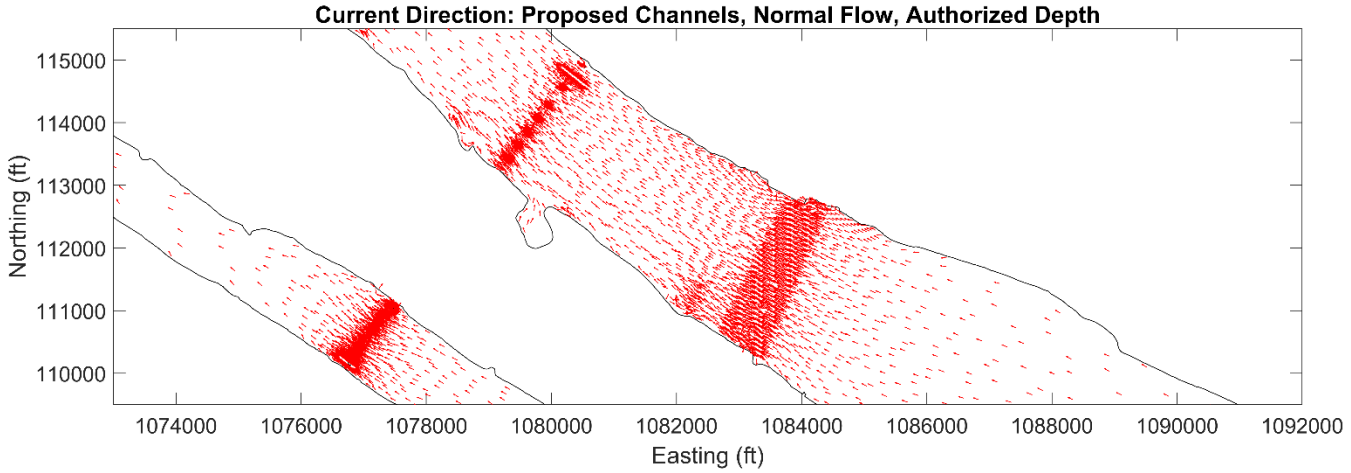
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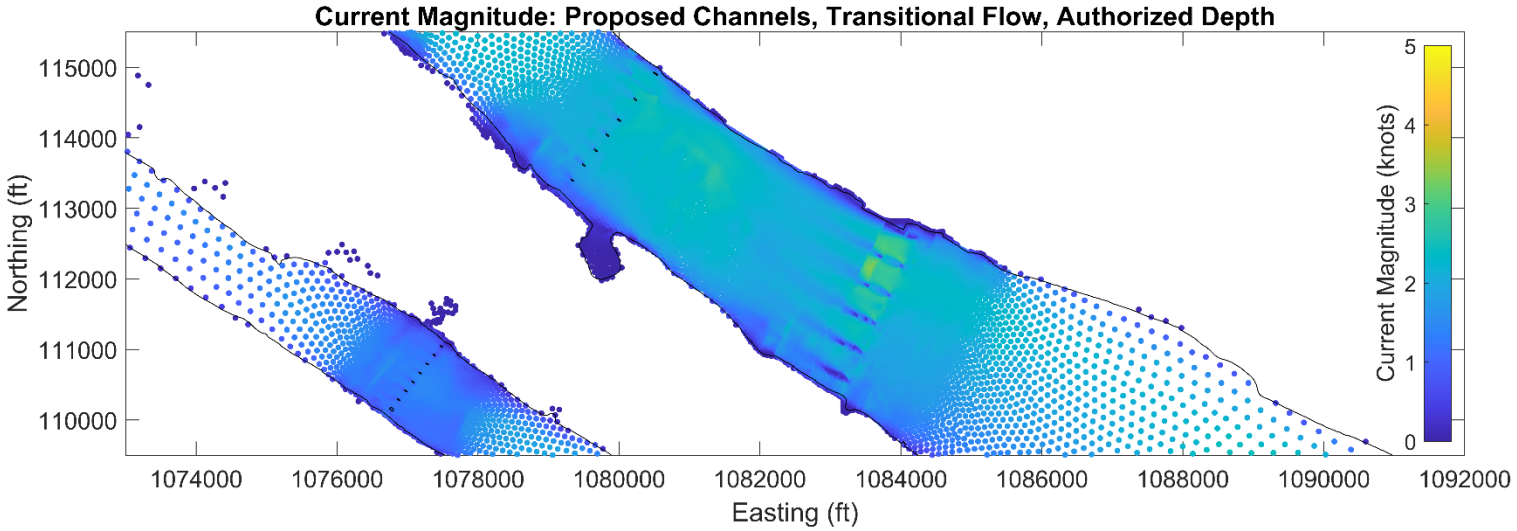
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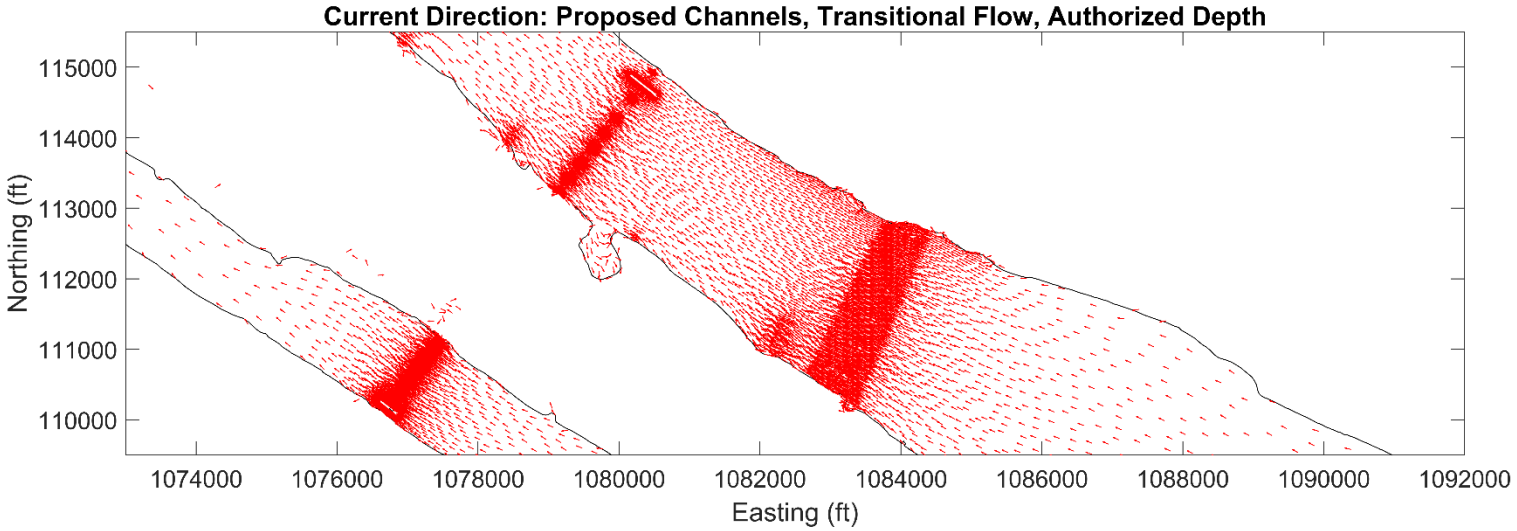
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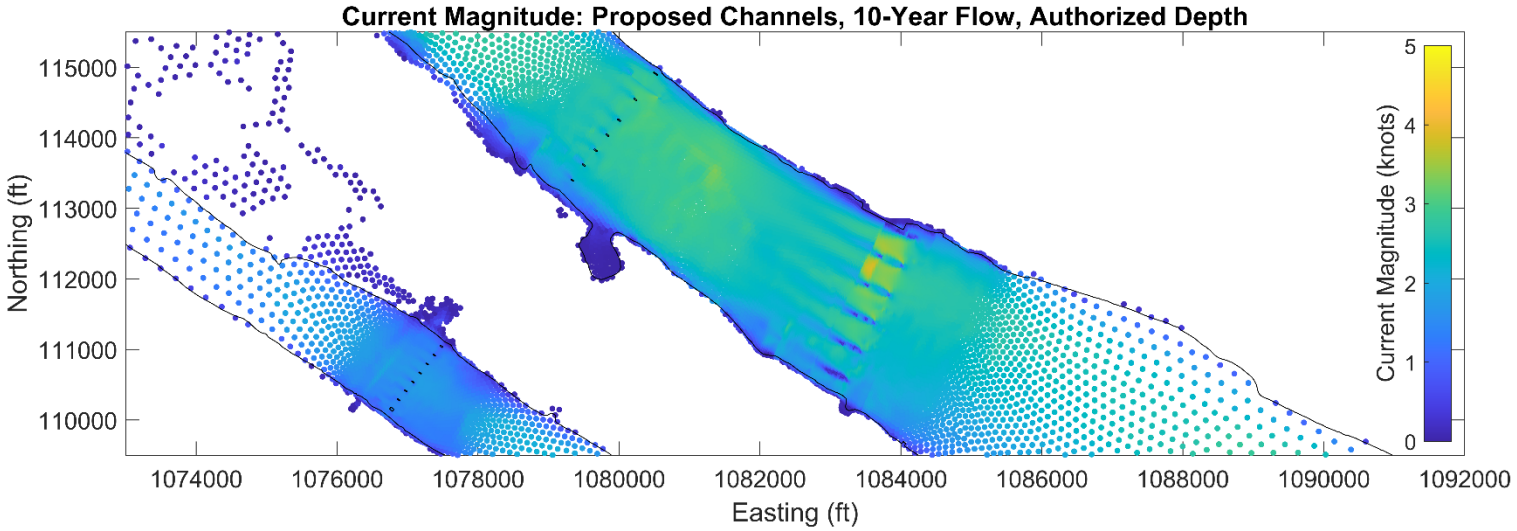
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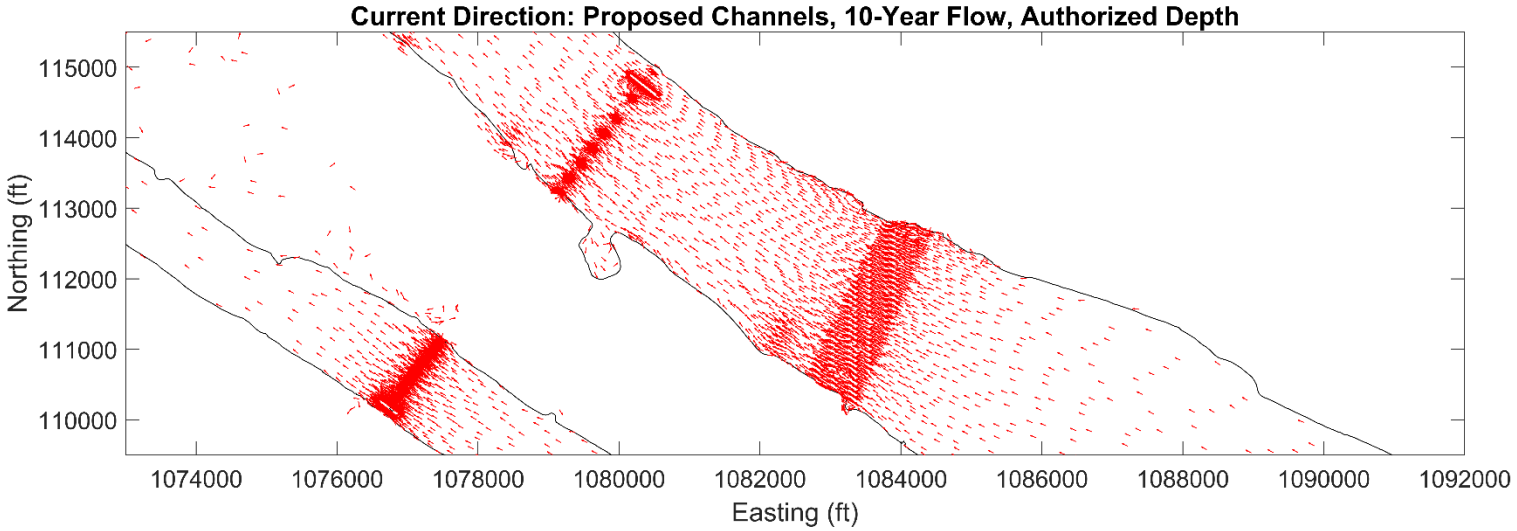
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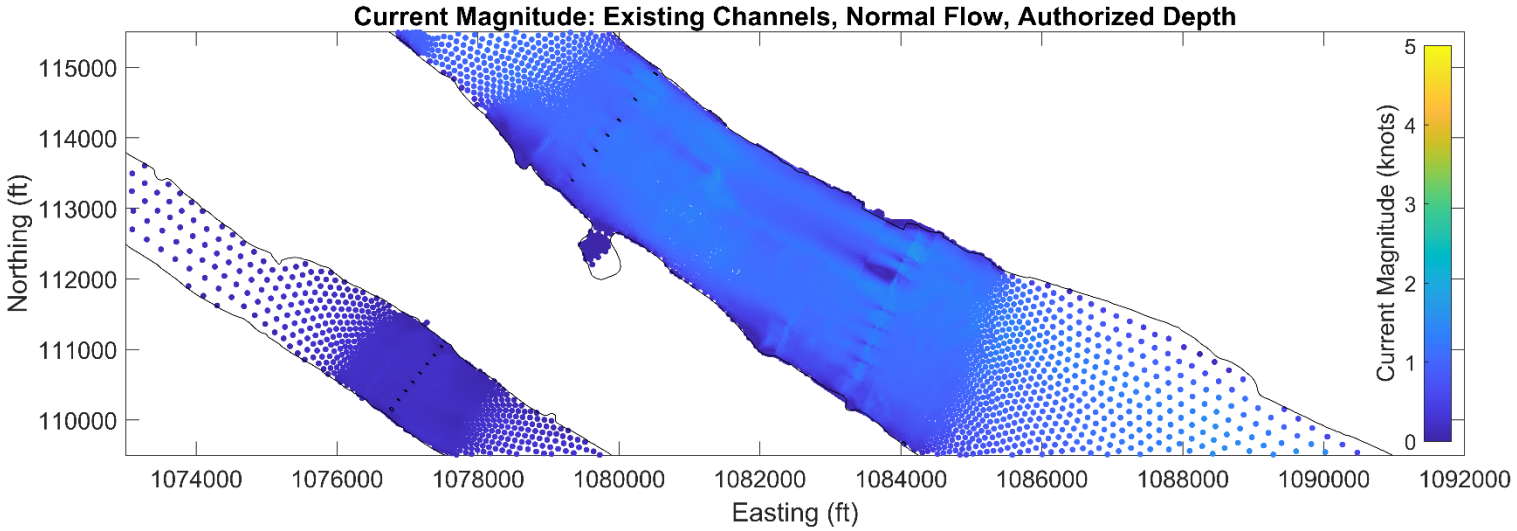
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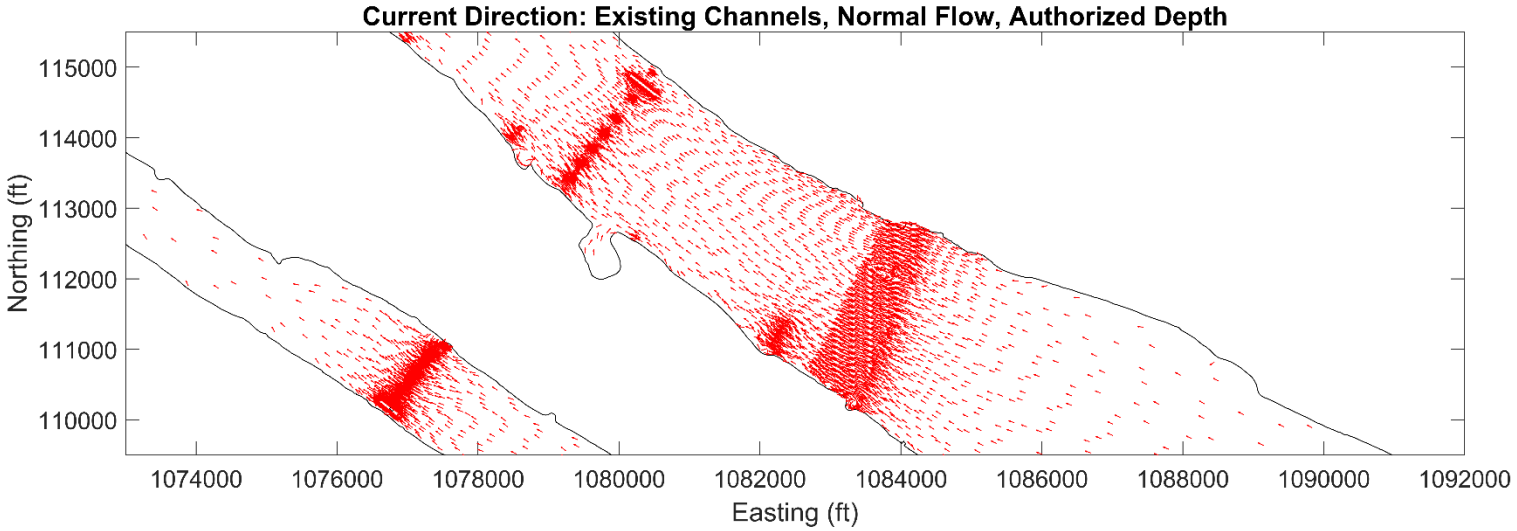
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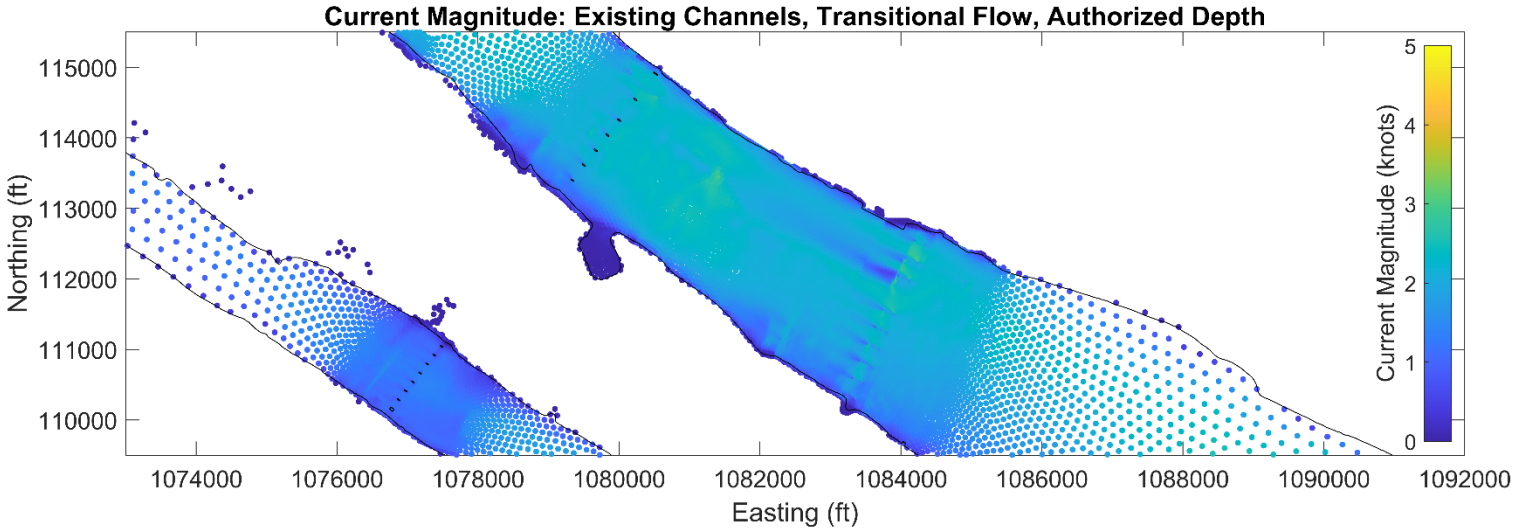
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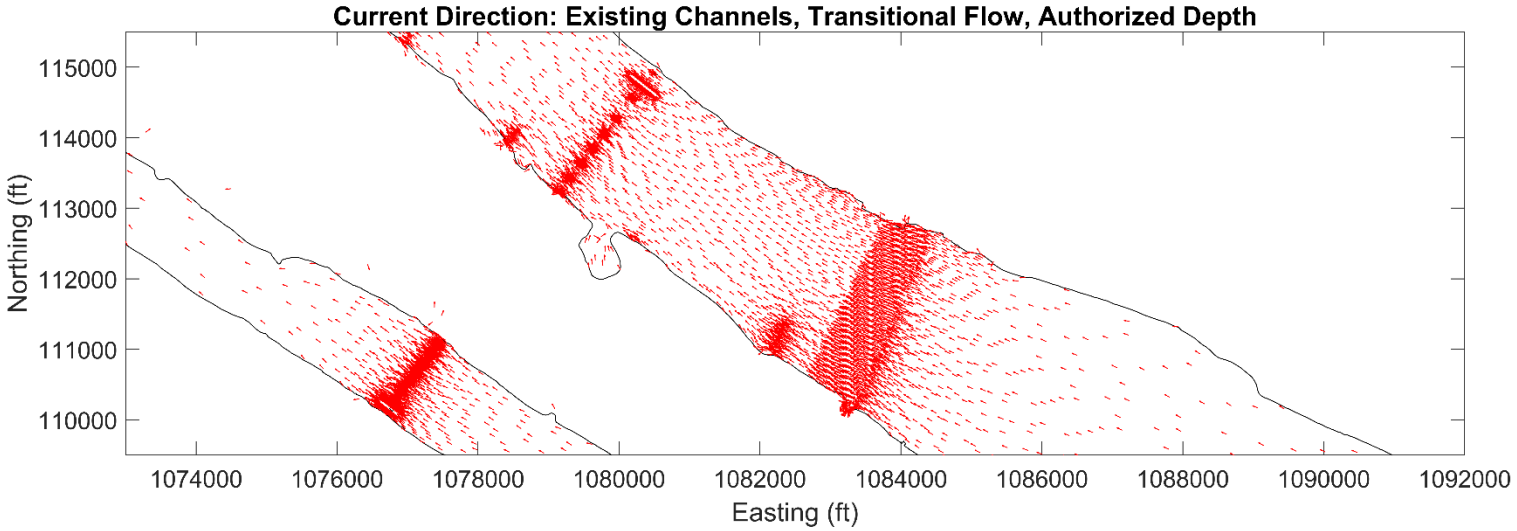
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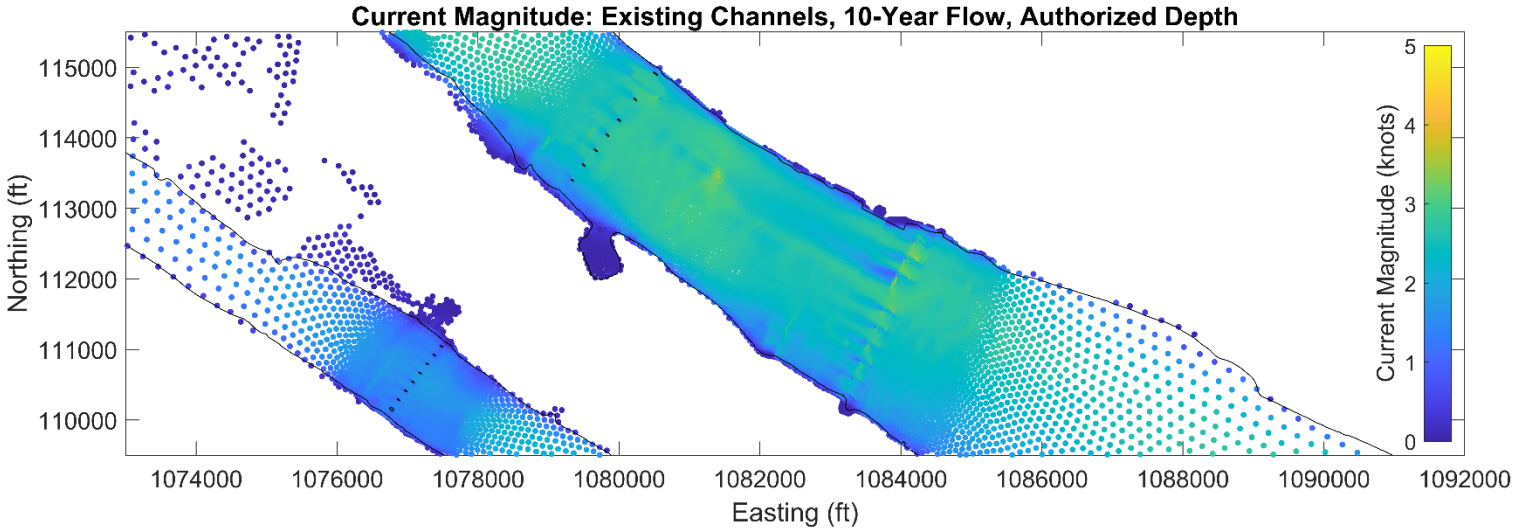
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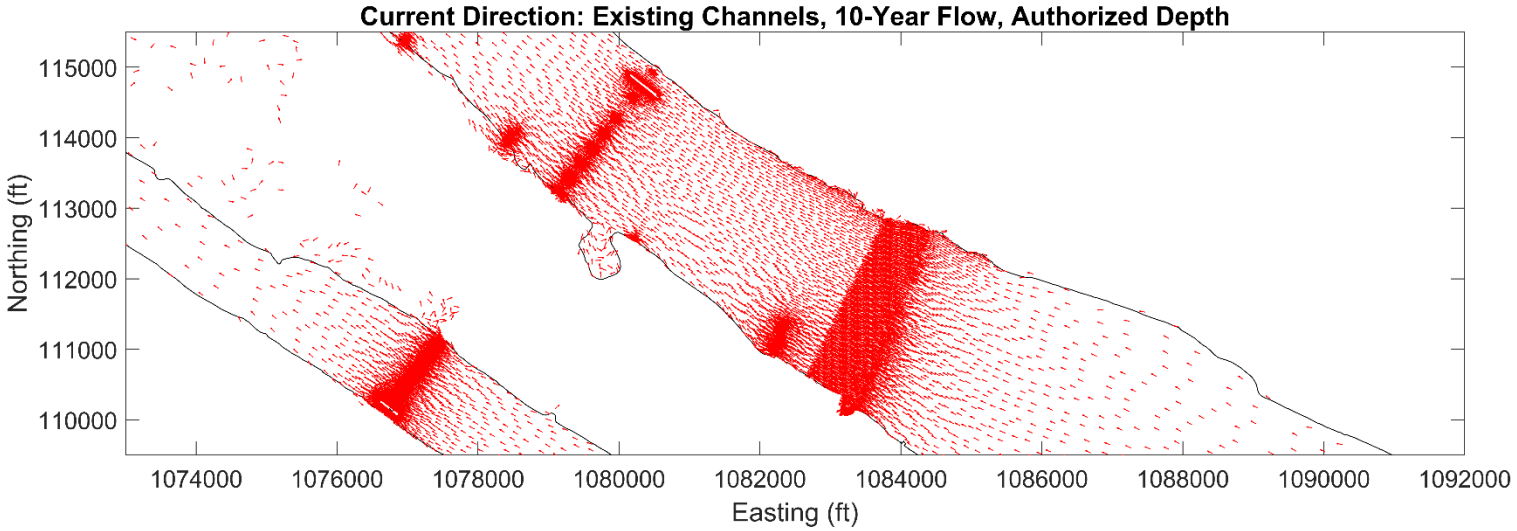
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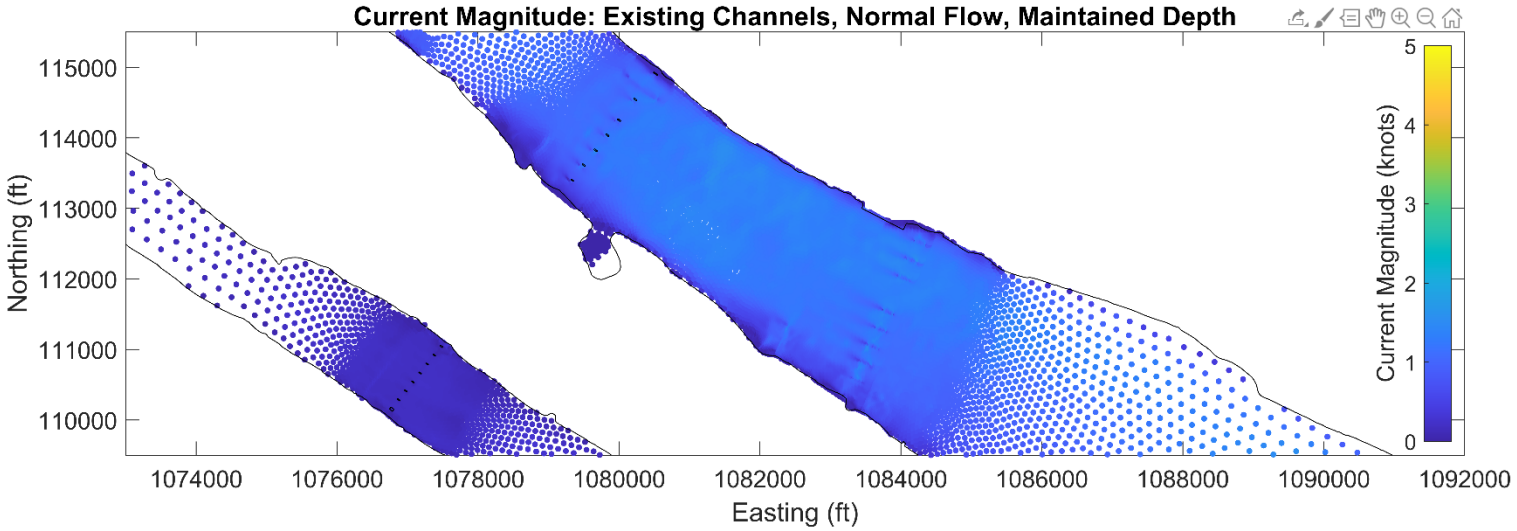
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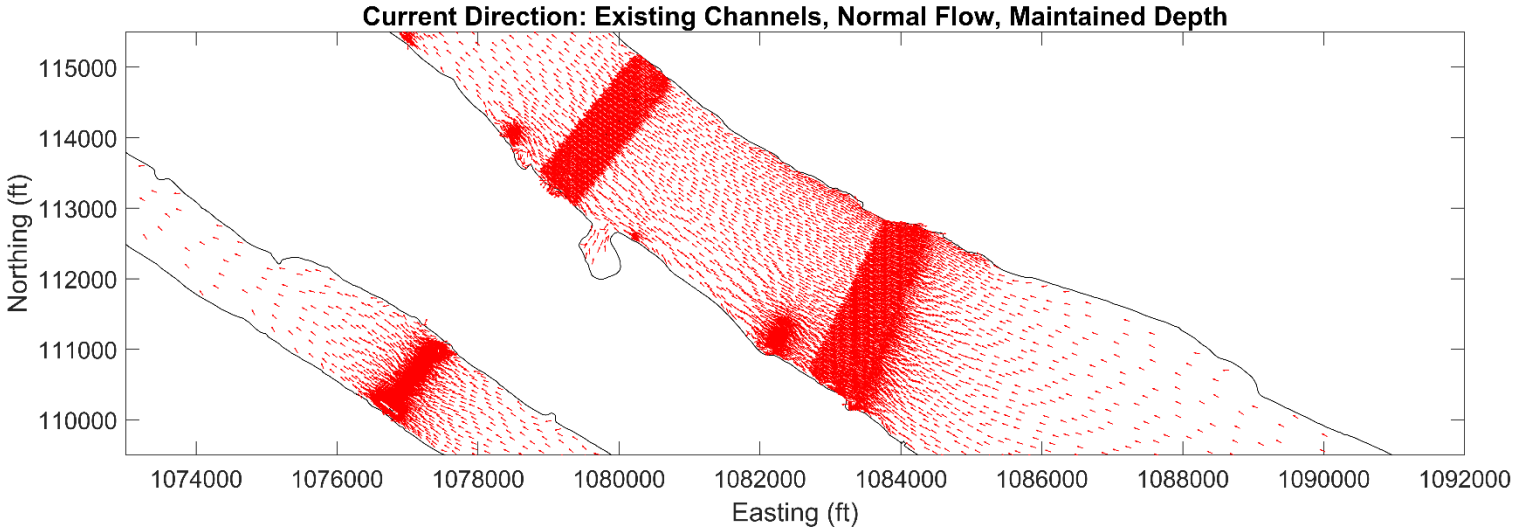
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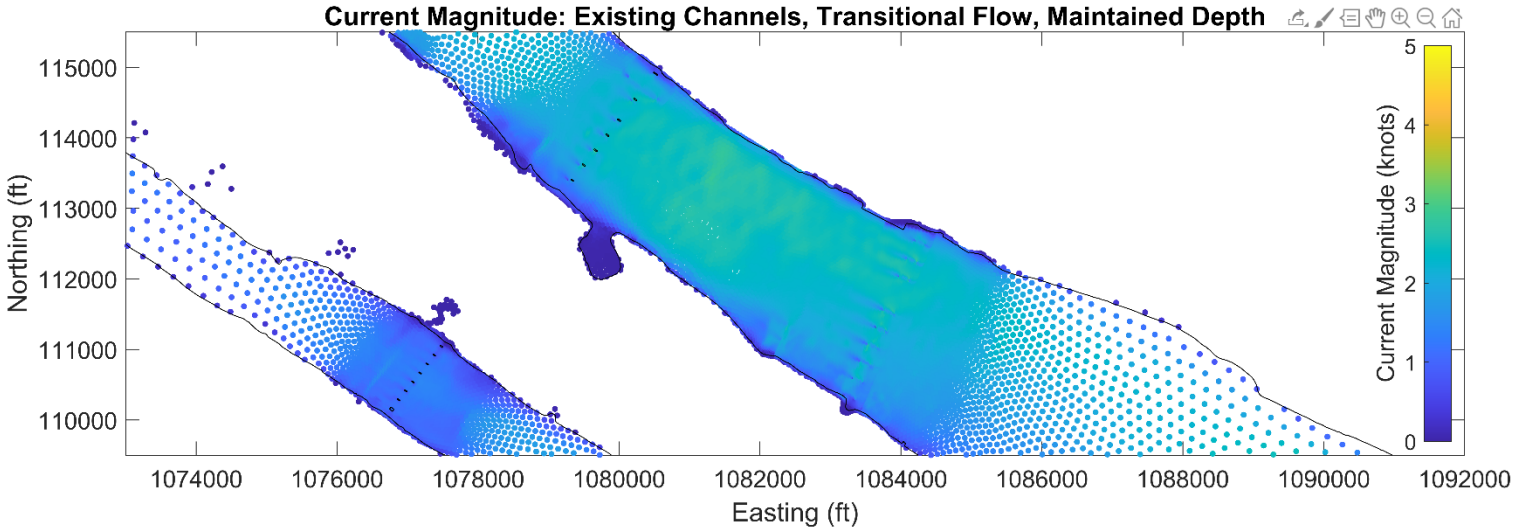
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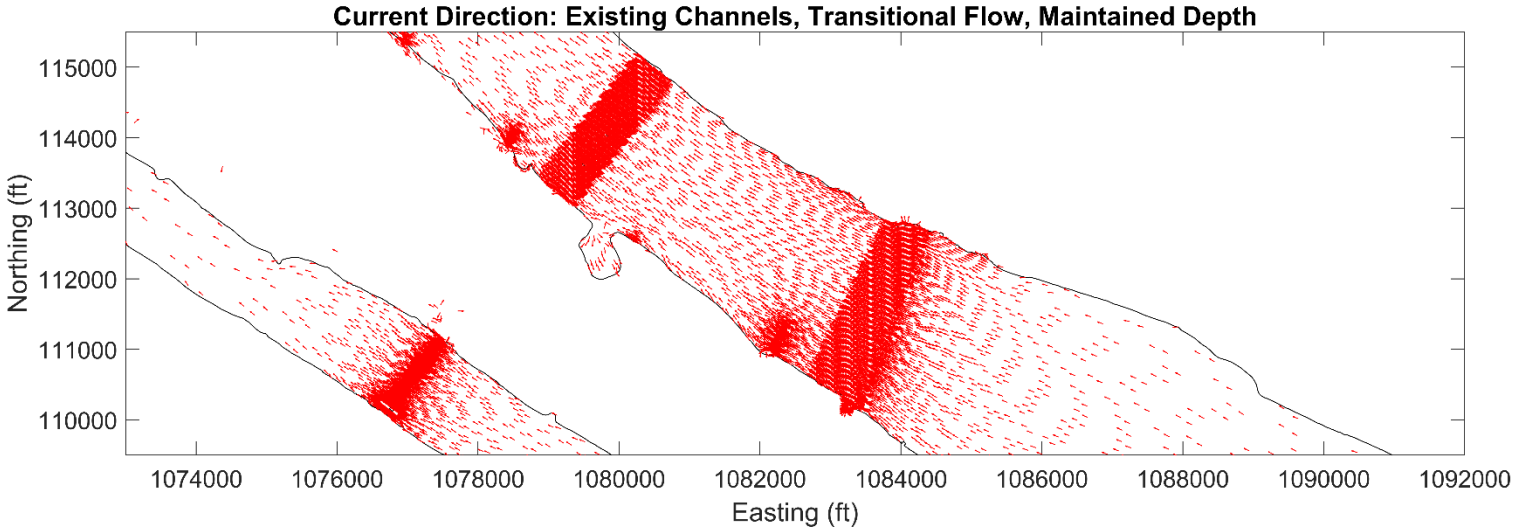
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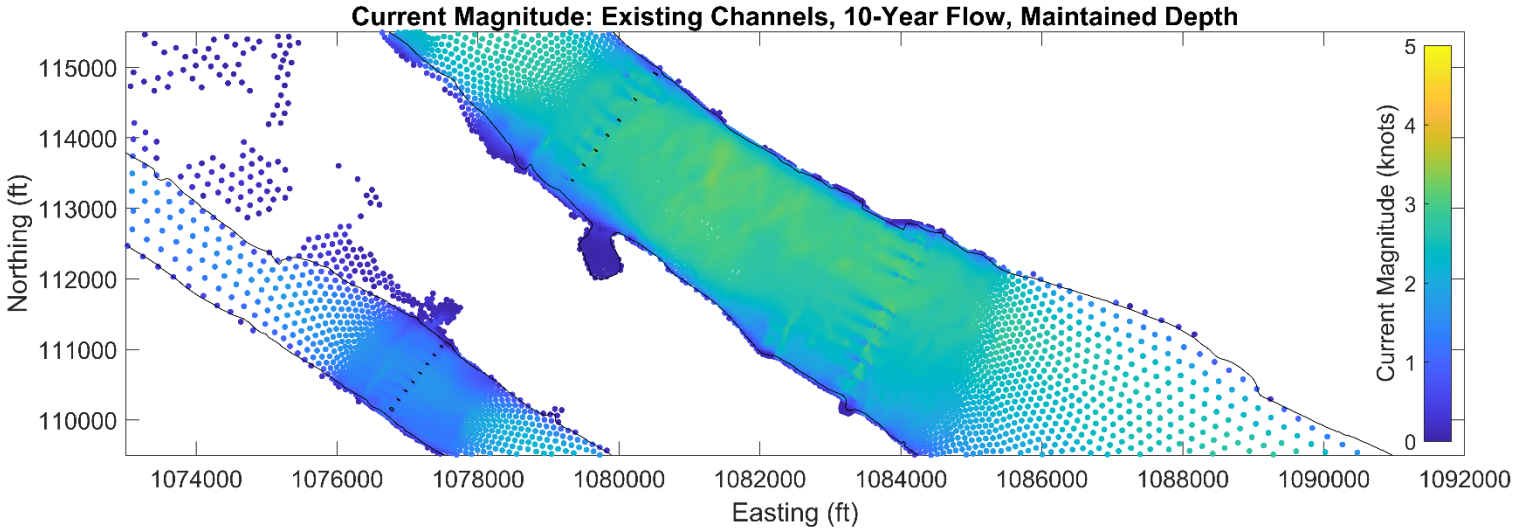
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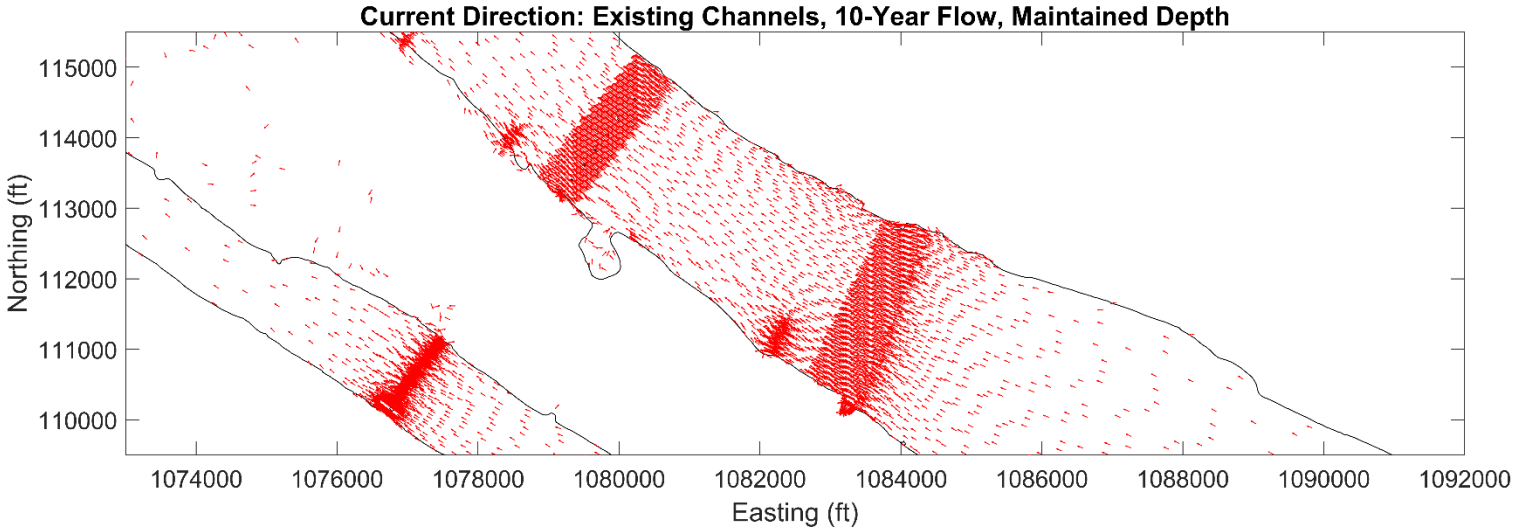
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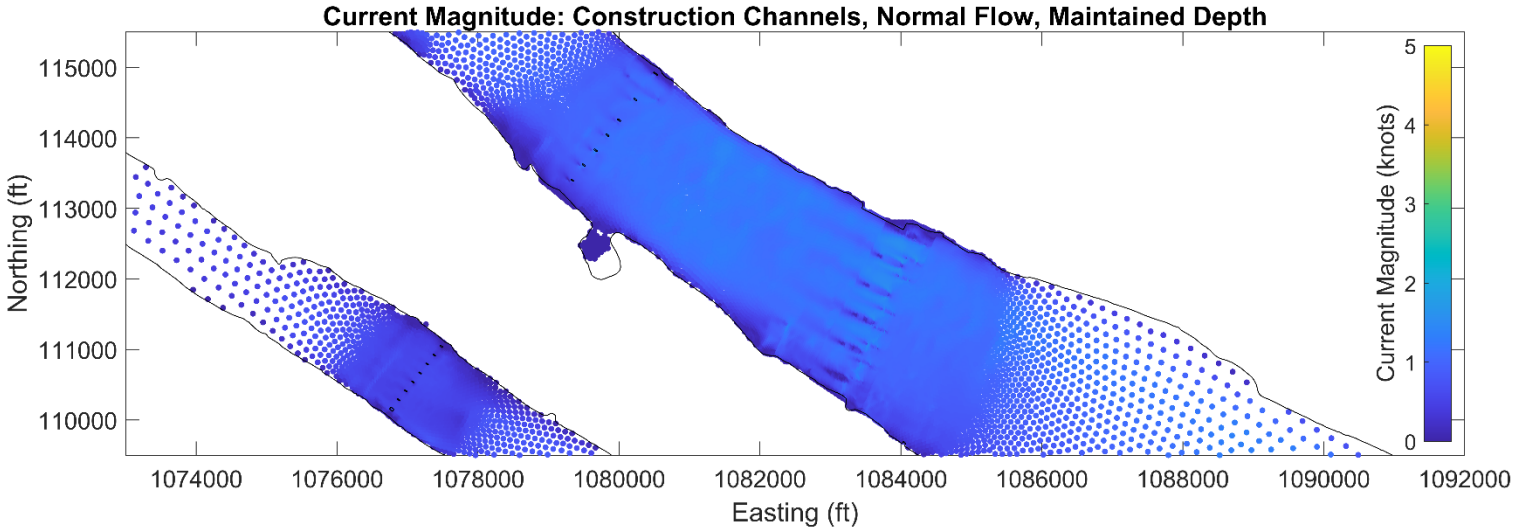
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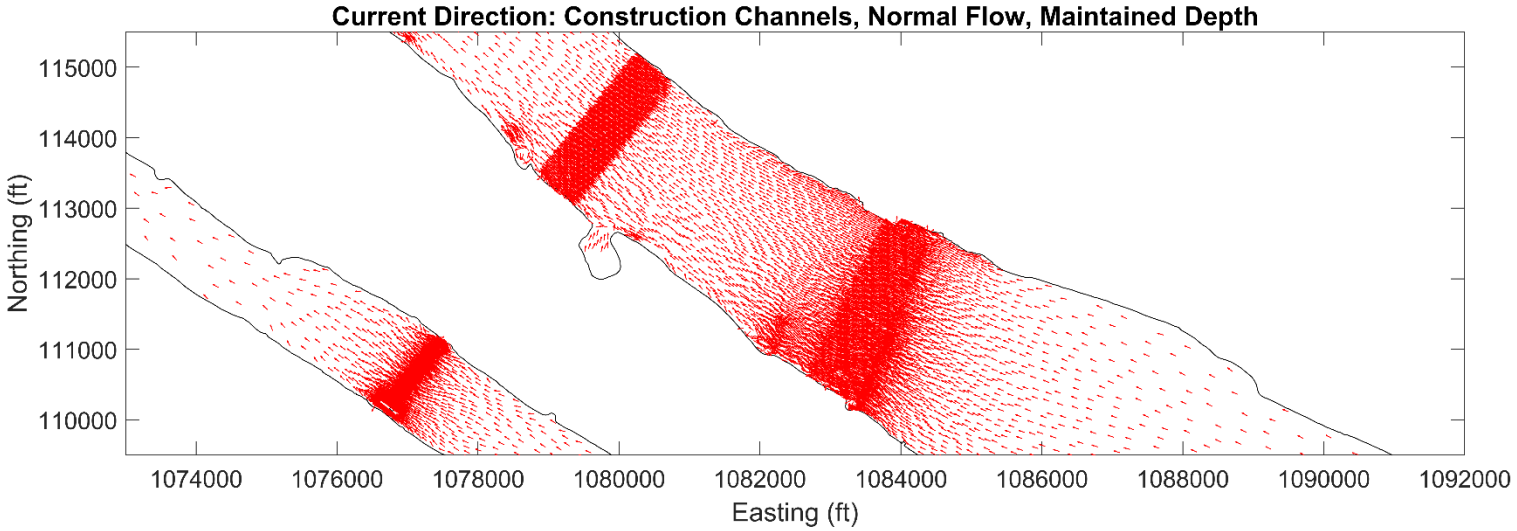
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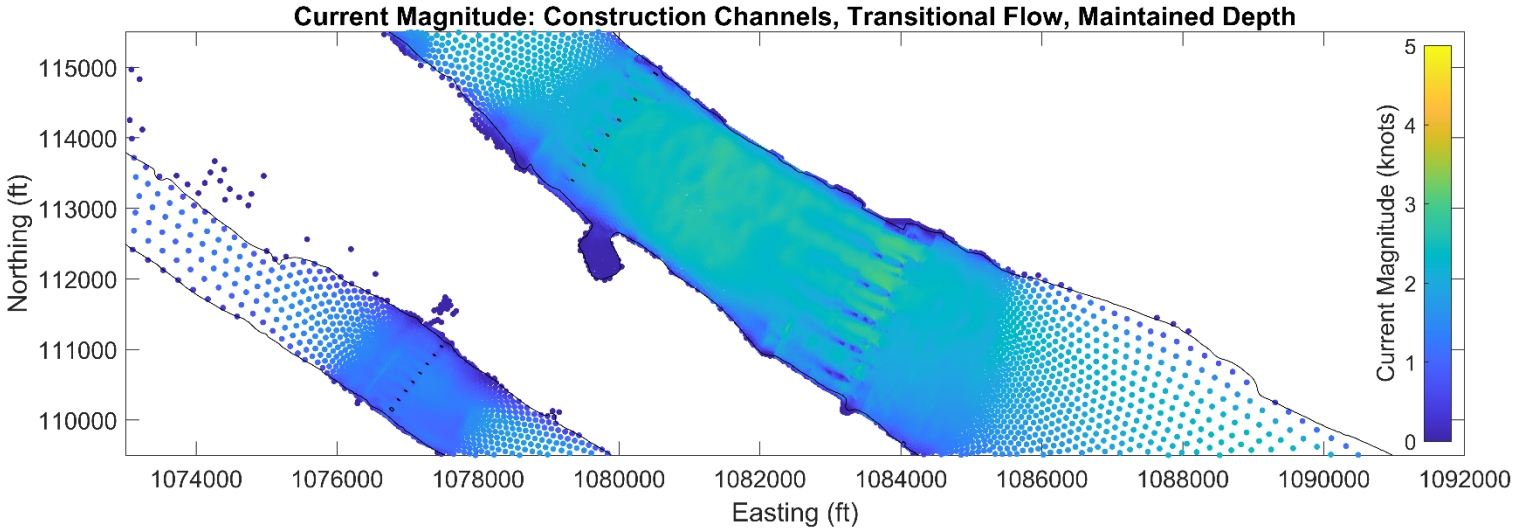
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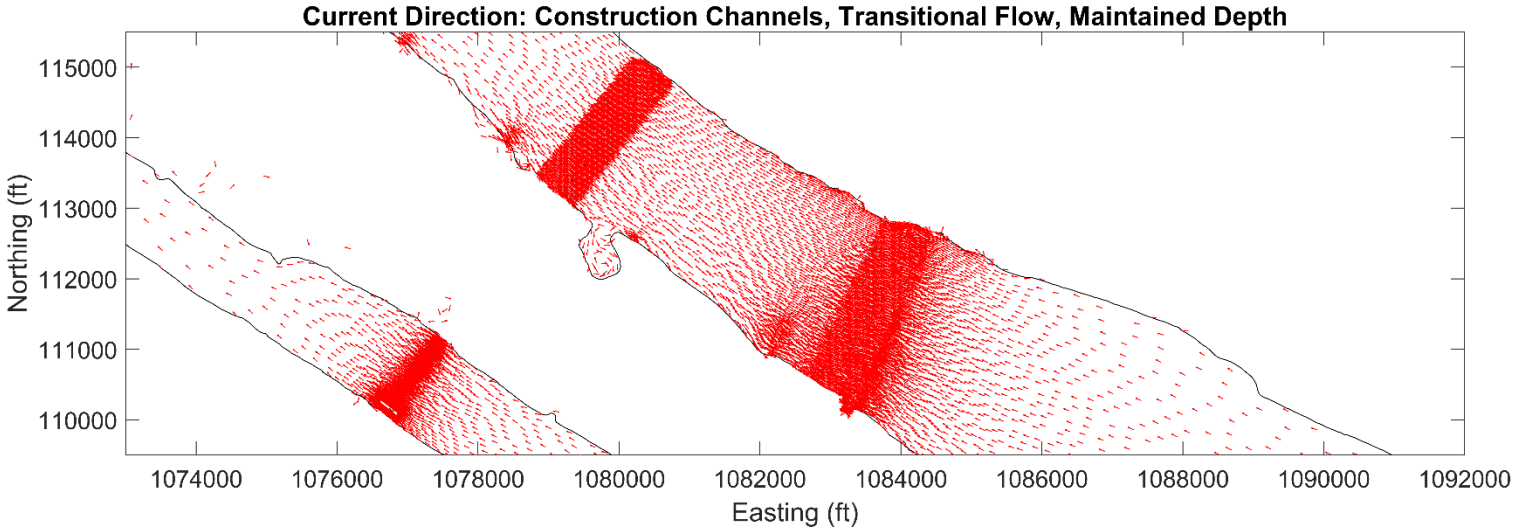
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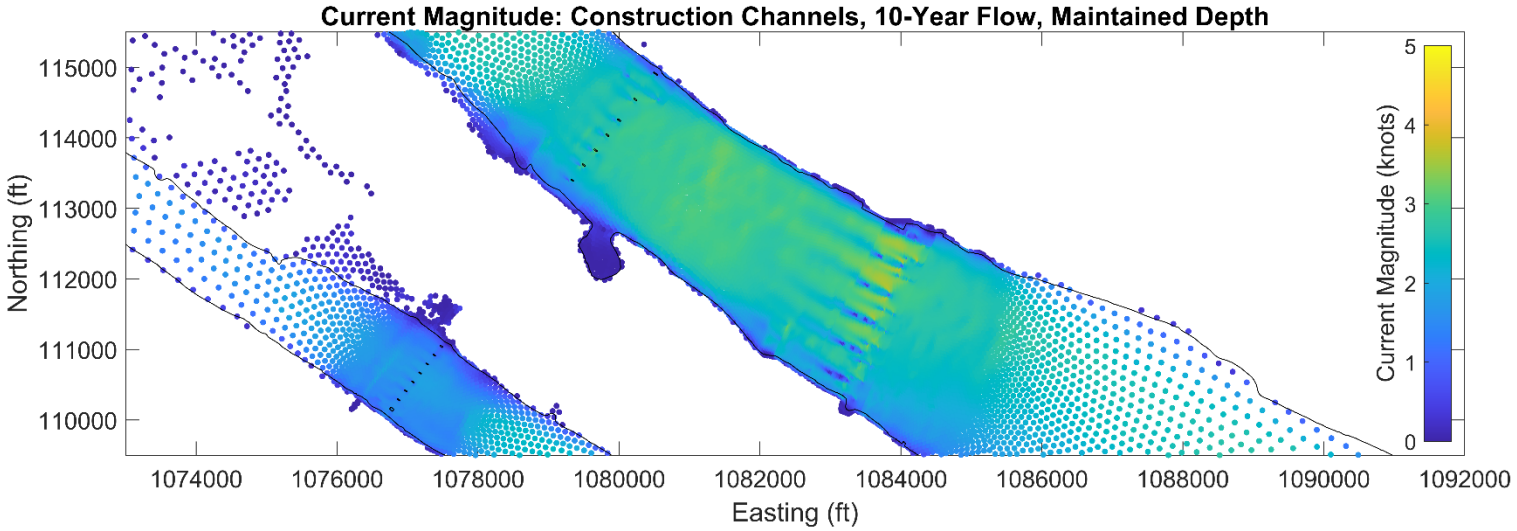
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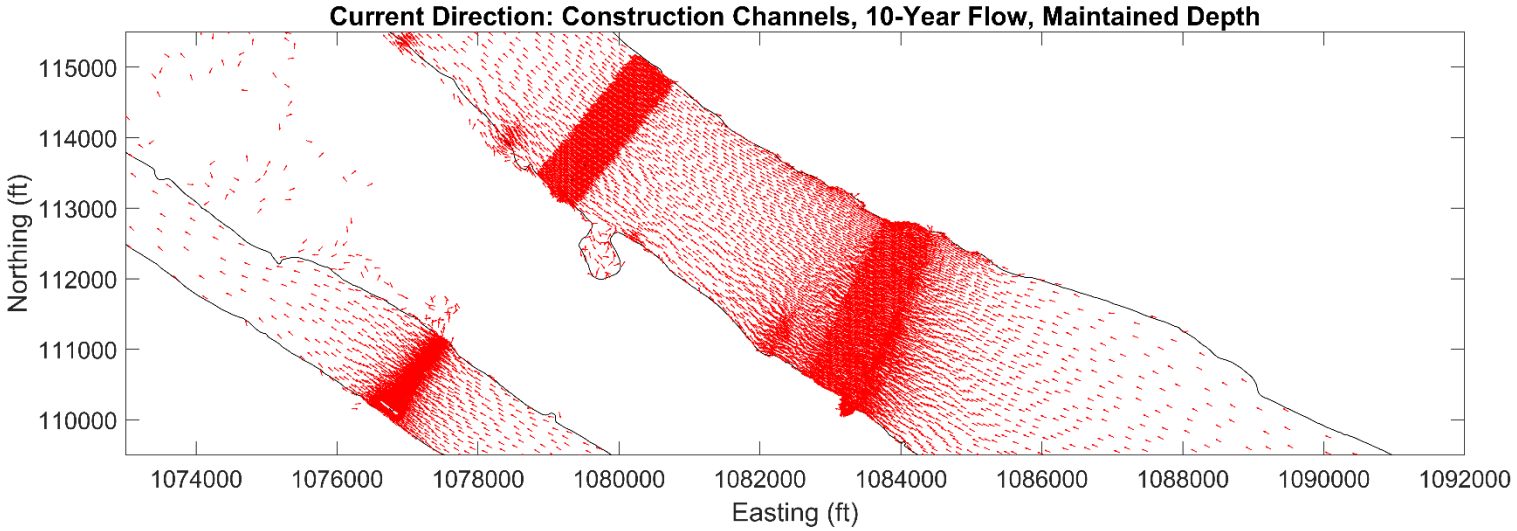
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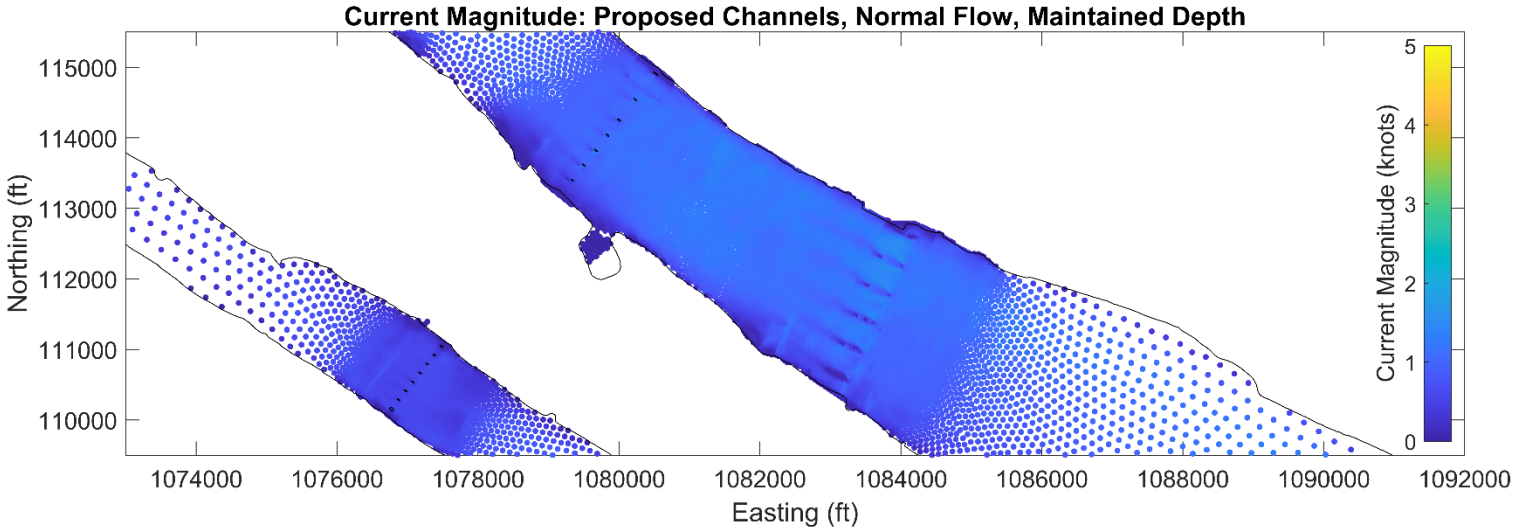
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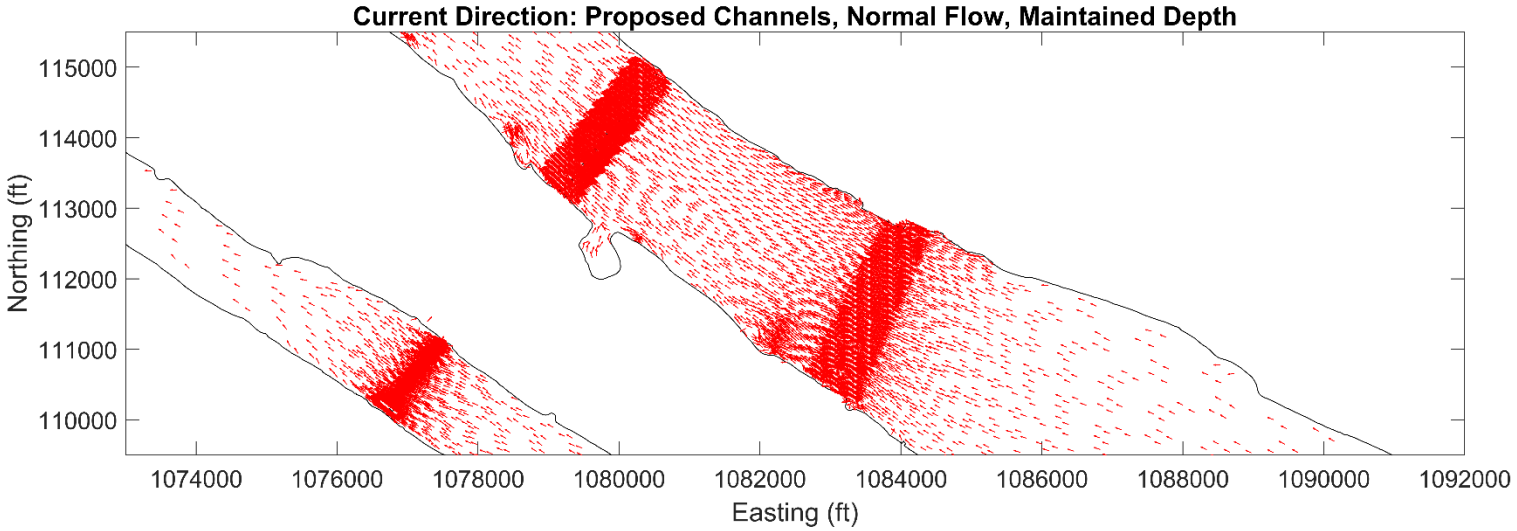
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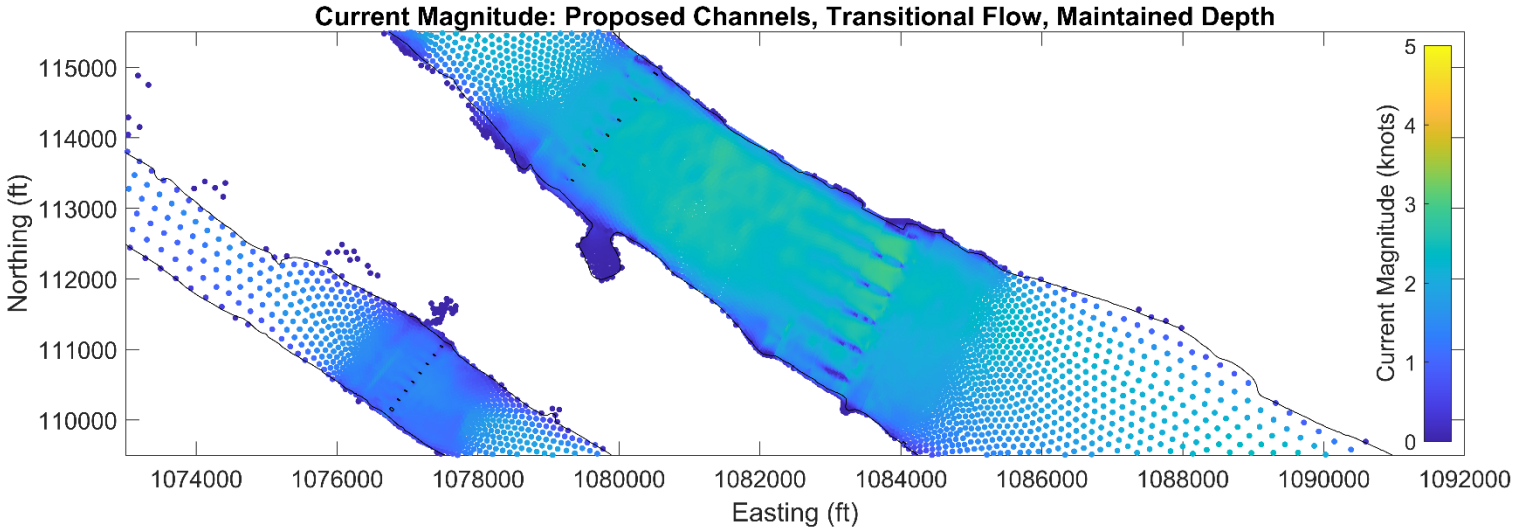
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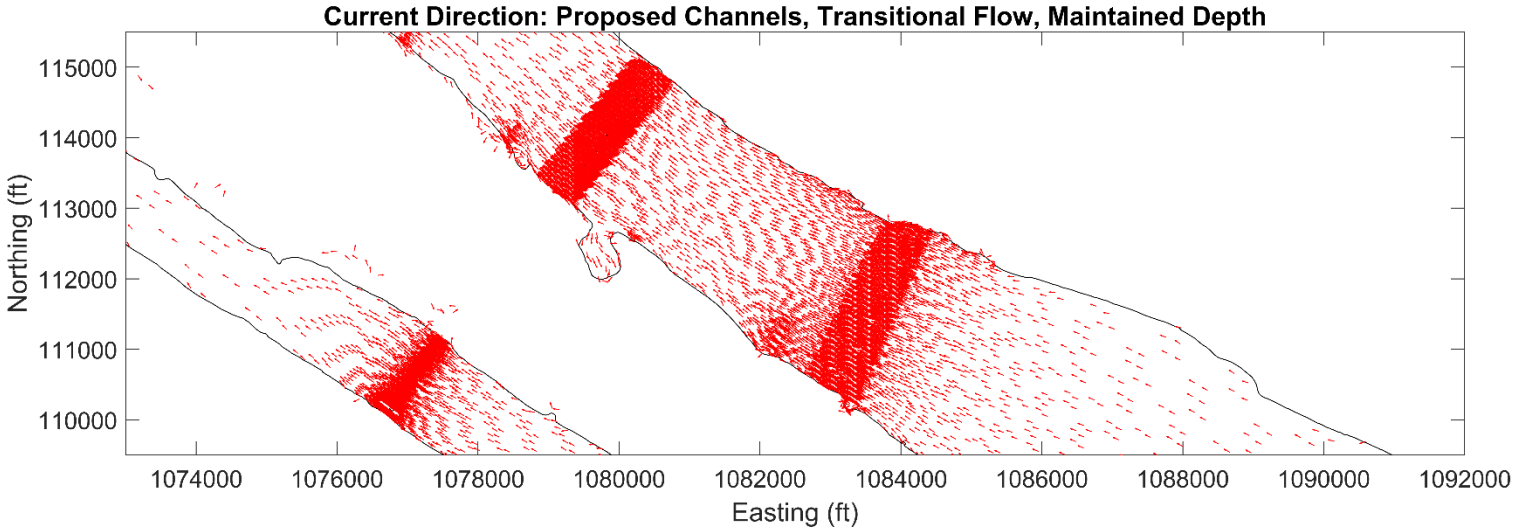
113000
112000
111000
110000
1074000
1076000
1078000
1080000
1082000
1084000
1086000
1088000
1090000
1092000
Easting (ft)
Current Magnitude (knots)
5
4
3
2
1
0


Current Direction: Proposed Channels, Transitional Flow, Maintained Depth
Northing (ft)
115000
114000
113000
112000
111000
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1076000
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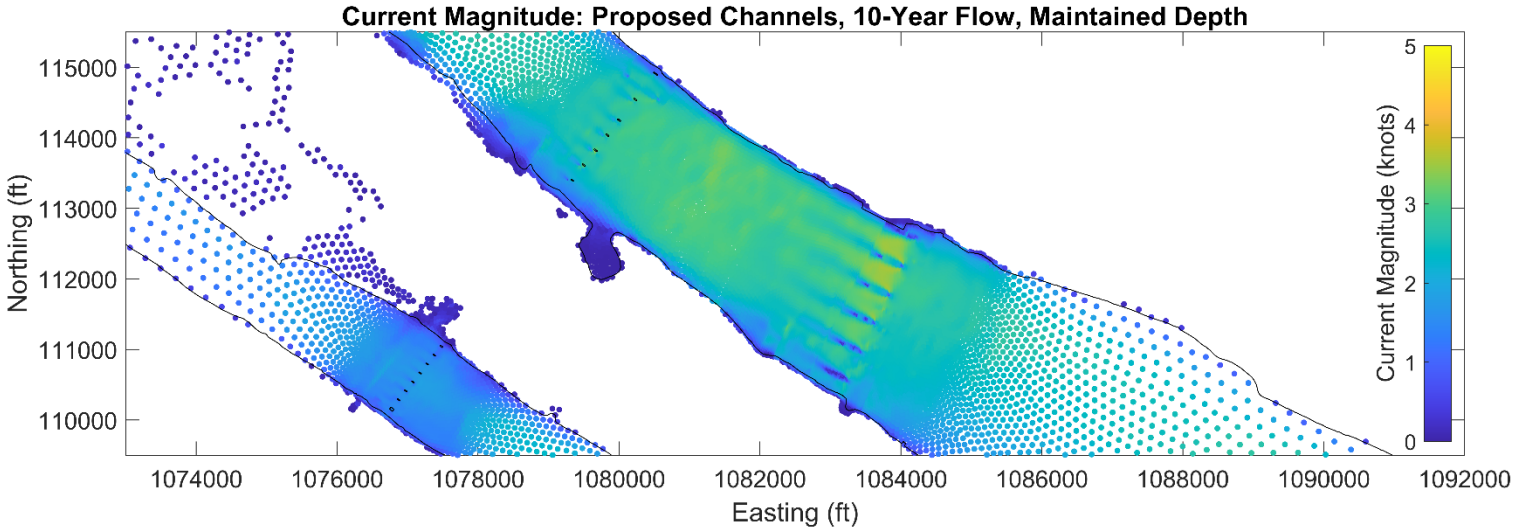
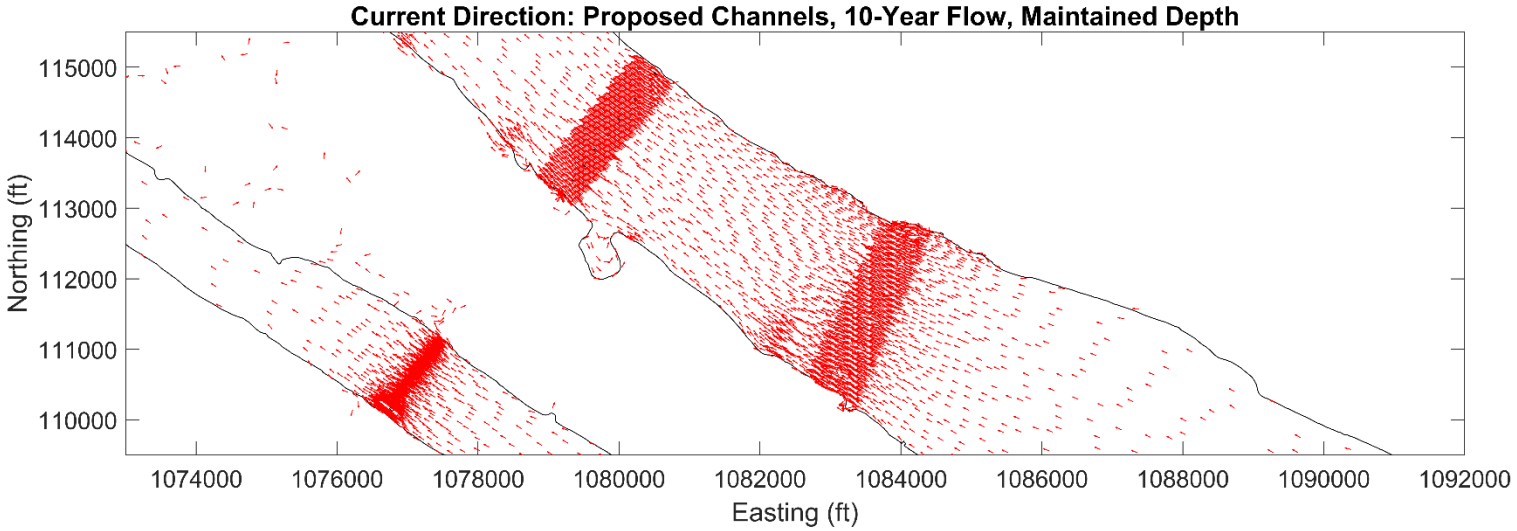
1080000
1082000
1084000
1086000
1088000
1090000
1092000
Easting (ft)


Current Magnitude: Proposed Channels, 10-Year Flow, Maintained Depth
Northing (ft)
115000
114000
113000
112000
111000
110000
1074000
1076000
1078000
1080000
1082000
1084000
1086000
1088000
1090000
1092000
Easting (ft)
Current Magnitude (knots)
5
4
3
2
1
0


Current Direction: Proposed Channels, 10-Year Flow, Maintained Depth
Northing (ft)
115000
114000
113000
112000
111000
110000
1074000
1076000
1078000
1080000
1082000
1084000
1086000
1088000
1090000
1092000
Easting (ft)

APPENDIX C: MARINER EVALUATION FORMS

213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/2023
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 1
Vancouver, WA Tug Master / Pilot: Steve

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario:** (Existing) / Construction / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized) **Transiting Channel:** North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition:** (Loaded) / Ballast

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 5 kts, South River Flow (*Discharge*): Normal

Water Level: _____ Available Air Draft: _____

Notes During Simulation: Pilot Familiarization

Time	Observations/Notes
8:24	Half ahead approaching br. 6 knots speed
	rudder commands 10-20 degs.
9:25	Full ahead
12:11	Sea speed passing through br. up to 7 kts

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Most unfamiliar w/ highway bridge

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   yes.

3. Were the maneuvering areas sufficient for the intended track?

   Yes.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   set on the RR bridge. Yes.
   Could feel loaded condition and set. Visibility made better

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes.

6. Please provide any comments on aids to navigation.

   None.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   Tugs would escorting but no made it. ->
   only use tugs under restricted visibility.

8. Additional Commentary:

   Loaded condition -> slow reaction to bells. 9 knots
   initial speed is wrong.

213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/2023
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 2
Vancouver, WA Tug Master / Pilot: Dustin

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario:** (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: Maintained / (Authorized) **Transiting Channel:** (North) / Center / South

Lift Span position: (Up) / Down **Vessel Load Condition:** (Loaded) / Ballast

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 5 kts S River Flow (*Discharge*): 140,000

Water Level: 3 Available Air Draft: 175

Notes During Simulation:

Time	Observations/Notes
4:25	Approaching BS. @ 8.4 kts, Full ahead
7:30	reduce to half ahead spd. 8.9 kts
	Water level too high → 16.4'
13:00	9.7 kts approaching BNSF BS. heading 305°

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5	
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5	N/A
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5	

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: higher water

   Tug Adequacy:

   Difficulty: 4th time through the span - developing feel for the ship.

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   yes.

3. Were the maneuvering areas sufficient for the intended track?

   yes.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   yes. felt realistic → starboard bow needed 20.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes.

6. Please provide any comments on aids to navigation.

   yes. Green light down below light #51

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Water level stage was set to 16'
   Pilot felt difference in 4KC.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Pilot/Tug Master Evaluation
Vancouver, WA

Date: 10/25/2023
Simulation #: 3
Tug Master / Pilot: [illegible]

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized)

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: Loaded / (Ballast)

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts S. River Flow (*Discharge*): 140,000

Water Level: 3' Available Air Draft: 175'

Notes During Simulation:

Time	Observations/Notes

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: still safe with wind - more effect at slow speed starting.

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes. Wind was imparting lots of rudder - hard to hold heading - reverted to rudder commands.

3. Were the maneuvering areas sufficient for the intended track?

   Yes.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   reacted as expected - some response to wind.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes.

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Stone: don't see why south channel will be necessary with new bridge. The only reason barges use it now is for the high span.

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/2023
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 4
Vancouver, WA Tug Master / Pilot: Steve

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario**: (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location**: _____ **Direction of Transit**: Upbound / (Downbound)

Dredge Depth: Maintained / (Authorized) **Transiting Channel**: (North) / Center / South

Lift Span position: (Up) / Down **Vessel Load Condition**: Loaded / (Ballast)

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts S River Flow (*Discharge*): 140,000

Water Level: 3' Available Air Draft: 175'

Notes During Simulation:

Time	Observations/Notes
_____	_____
	_____
_____	_____
	_____
_____	_____
	_____

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3) 3.5	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Because of wind, reaction of vessel.

   Tug Adequacy:

   Difficulty: favored left side approaching highway br. judging turning point. cautious approach.

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   yes. lots of rudder to maintain the track

3. Were the maneuvering areas sufficient for the intended track?

   ~~lots of rudder to~~ tight quarters - lots of rudder commands.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   effects of wind are realistic

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes.

6. Please provide any comments on aids to navigation.

   fine - looking at buoys.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   holding to left side of channel due to wind.

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 5
Vancouver, WA Tug Master / Pilot: DUSTIN

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario:** (Existing) / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized) **Transiting Channel:** North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition:** Loaded / (Ballast)

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kt S River Flow (*Discharge*): 140,000

Water Level: 3 Available Air Draft: 175

Notes During Simulation:

Time Observations/Notes (Run 17 from Matrix)

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: due to wind effects - risk in close quarters

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)
   significant improvement in transition from one bridge to the next.

3. Were the maneuvering areas sufficient for the intended track?
   lots of room through the bridge.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?
   ship handle very well. - handle as it typical.
   start runs @ 7 knots.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?
   yes.

6. Please provide any comments on aids to navigation.
   Buoy placement seemed reasonable.
   Junction buoy → relocate.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 6
Vancouver, WA Tug Master / Pilot: Steve

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: Maintained / (Authorized) **Transiting Channel:** North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition:** Loaded / (Ballast)

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S River Flow (*Discharge*): 140,000

Water Level: 3 Available Air Draft: 175

Notes During Simulation: Run #20 from Matrix

Time	Observations/Notes
_____	Some confusion on correct channel for center span
11:40	needs lots of rudder in wind ~10° ± ship wants to crab into the wind
_____	

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: with wind helped maneuver got more to

   Tug Adequacy:

   Difficulty: don't have turn points . . but not hard

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)
   could maintain track line didn't know where line.

3. Were the maneuvering areas sufficient for the intended track?
   yes.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?
   yes. a lot rudder needed to counter the wind.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?
   yes.

6. Please provide any comments on aids to navigation.
   buoy seemed appropriate.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:
   Started full upstream. situational awareness
   Not used to this route. Did not ~~feel~~ feel comfortable
   Better transition from proposed bridge to
   BNSF -> more turn to right than expected.

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 7
Vancouver, WA Tug Master / Pilot: ~~DOS~~ STEVE

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario:** (Existing) Construction / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized) **Transiting Channel:** (North) / Center / South

Lift Span position: (Up) / Down **Vessel Load Condition:** (Loaded) / Ballast

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S. River Flow (*Discharge*): 140,000

Water Level: 3 Available Air Draft: 175

Notes During Simulation:

Time	Observations/Notes
_____	_____
	_____
_____	_____
	_____
_____	_____
	_____

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   yes.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   lowdrum to engine. long time to come up to speed.
   slow down relatively quickly - ~~not~~ realistic response to helm.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   good rudder.

   yes.

6. Please provide any comments on aids to navigation.

   ~~Red buoy~~.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   Wind had a lot of set -> no effect

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 8
Vancouver, WA Tug Master / Pilot: DUSTIN

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario:** (Existing) / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized) **Transiting Channel:** North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition:** (Loaded) / Ballast

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S River Flow (*Discharge*): 140,000

Water Level: 3' Available Air Draft: 175

Notes During Simulation:

Time	Observations/Notes
_____	_____
	_____
_____	_____
	_____
_____	_____
	_____

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes.

3. Were the maneuvering areas sufficient for the intended track?

   Yes. Could be more room under bridge

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes.

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Pilot/Tug Master Evaluation
Vancouver, WA

Date: 10/25/23
Simulation #: 9
Tug Master / Pilot: DUSTIN

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location**: _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized)

Transiting Channel: North / (Center) / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Ballast

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S

River Flow (*Discharge*): 140,000

Water Level: 3

Available Air Draft: 175

Notes During Simulation:

Time	Observations/Notes

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   yes.

3. Were the maneuvering areas sufficient for the intended track?

   yes.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   yes.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes.

6. Please provide any comments on aids to navigation.

   Switch red and green buoys

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   better approach
   steady bearing through RR bridge toward where
   you want to be. single turn point
   versus two corrections w/ existing bridge.

p. 2 of 2

213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 10
Vancouver, WA Tug Master / Pilot: STEVE

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario**: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: Upbound / (Downbound)

Dredge Depth: Maintained / (Authorized) **Transiting Channel**: North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition**: (Loaded) / Ballast

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 9 kts S River Flow (*Discharge*): 149,000

Water Level: 3 Available Air Draft: 175

Notes During Simulation:

Time	Observations/Notes

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: looked on very stable compared to ballast

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   yes.

3. Were the maneuvering areas sufficient for the intended track?

   yes. started turn in middle of highway bridge.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   yes.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes.

6. Please provide any comments on aids to navigation.

   buoy position looked correct.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   New bridge better line up - better transition naturally flows in that direction.

   ex. you have to turn S from north w/ ex. bridge.

   New bridge is a better transition.

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 17
Vancouver, WA Tug Master / Pilot: STEVE

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario**: (Existing) / Construction / Proposed

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized) **Transiting Channel**: (North) / Center / South

Lift Span position: (Up) / Down **Vessel Load Condition**: Loaded / (Ballast)

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts S River Flow (*Discharge*): ~~540~~,200

Water Level: 16.4' Available Air Draft: 161.6

Notes During Simulation:

Time	Observations/Notes
_____	_____
	_____
_____	_____
	_____
_____	_____
	_____

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: hard more on your toes
   hard on helmsman

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)
   lots of small adjustments
   paying attention.

3. Were the maneuvering areas sufficient for the intended track?
   RR tight-
   poorer job on highway bridge should've wanted to Nat

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?
   bit unstable in wind.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?
   yes.

6. Please provide any comments on aids to navigation.

   —

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:
   Noticeable effects on

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 12
Vancouver, WA Tug Master / Pilot: DUSTIN

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario:** (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: Maintained / (Authorized) **Transiting Channel:** North / Center / South

Lift Span position: (Up) / Down **Vessel Load Condition:** Loaded / (Ballast)

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts S River Flow (*Discharge*): 340,000

Water Level: 16.4' Available Air Draft: 161.6'

Notes During Simulation:

Time	Observations/Notes
7:00	Approaching BR. @ 9.8 knots
8:45	@ Bridge @ 10.1 knots
10:00	↑ to PAH, SB rudder 15° to ~~initiate~~ initiate turn @ 11 kts, ROT 6°/min.
12:00	Approaching BNSF @ 12 knots
13:00	Max 12.3 knots, Through BNSF Br, Course 305°

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	(3) 3.5	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: extreme conditions built up ahead. not as bad on run.

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   yes. lot of work for helmsmen

3. Were the maneuvering areas sufficient for the intended track?

   Tight – esp. at higher speed.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   yes - wind was dominant - make sense.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes, but look at environments - if there were other vessels at dock.

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   USCG = would you request escort tug?
   Dustin - maybe a tug center lead aft for safety stern arrest

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/25/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 13
Vancouver, WA Tug Master / Pilot: DUSTIN

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized) **Transiting Channel:** North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition:** Loaded / (Ballast)

Time of Day: (Daytime) Nighttime

Piloted Vessel:

Bulk Carrier 24 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts River Flow (*Discharge*): 540,000

Water Level: 16.4' Available Air Draft: 161.6'

Notes During Simulation: (RUN 19 FROM MATRIX)

Time	Observations/Notes
_____	_____
	_____
_____	_____
	_____
_____	_____
	_____

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: empty w/ wind a concern.

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes. Lot of help.

3. Were the maneuvering areas sufficient for the intended track?

   Maneuvering areas improved - increase span width and location -> steady heading to turn point.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes. Need more awareness -> more focused. difficult but not a no go.

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Tugs not required on this.

   New bridge makes maneuver simpler - hold steady heading through RR bridge.

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/26/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 14
Vancouver, WA Tug Master / Pilot: STEVE

Simulation Summary:

Vessel Type: Deep-Draft / Shallow-Draft **Scenario:** Existing / Construction / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / Downbound

Dredge Depth: Maintained / Authorized **Transiting Channel:** North / Center / South

Lift Span position: Up / Down **Vessel Load Condition:** Loaded / Ballast

Time of Day: Daytime Nighttime

Piloted Vessel:

Bulk Carrier 24 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kt S River Flow (*Discharge*): 340,000

Water Level: 16.6' Available Air Draft: 162.4'

Notes During Simulation:

Time	Observations/Notes
_____	Approach junction buoy @ 9kts, half ahead leaving 3rd engine in reserve
12:00	Approaching bridge @ 10.6 kts
	Start turn w/ bow under bridge ROT 6°/min - 10°/min
_____	

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	3	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Wind + current set - different the lower water - tried to hold to solution

   Tug Adequacy:

   Difficulty: Oriented -> learned myself out there

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   hard to steer – lots of adjustments to steering.

3. Were the maneuvering areas sufficient for the intended track?

   yes. 10 degrees rudder didn't get her turning, had to go to 20 degrees.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   yes for the conditions

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   ~~not~~ yes.

6. Please provide any comments on aids to navigation.

   green buoys blended w/ water

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Pilot/Tug Master Evaluation
Vancouver, WA

Date: 10/26/23
Simulation #: 15
Tug Master / Pilot: DUSTIN

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) Downbound

Dredge Depth: Maintained / (Authorized)

Transiting Channel: North / (Center) / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Ballast

Time of Day: Daytime (Nighttime)

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts S

River Flow (*Discharge*): 400,000

Water Level: 11.8'

Available Air Draft: 166.2'

Notes During Simulation:

Time	Observations/Notes
_____	Buoys up/down of bridge flashing - no lights in ventilg.
10:30	Turning point 6-7°/min ROT @ 6.7 kts.
_____	

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):			(3)		
Tug Adequacy (*5 is most adequate*):					
Run Difficulty (*5 is most difficult*):			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: First run at night

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   yes.

3. Were the maneuvering areas sufficient for the intended track?

   yes, lots of room

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Ship handled well

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes.

6. Please provide any comments on aids to navigation.

   Flashing buoys are nice, but sun buoys in real life
   Good placement of lights on bridge - center span lights good.
   Need to be able to see / over bridge lights south of RR bridge.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Flashing red lights near airport? Small boat harbor
   Bridge lights in model need to be that bright.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Pilot/Tug Master Evaluation
Vancouver, WA

Date: 10/26/23
Simulation #: 16
Tug Master / Pilot: STEVE

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized)

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Ballast

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kt S. River Flow (*Discharge*): 540,000

Water Level: _____ Available Air Draft: _____

Notes During Simulation:

Time	Observations/Notes
10:00	Steve notes a set to vessel approaching ex. bridge.
12:00	Pass bridge @ 8.3 knots

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):			(3)		
Tug Adequacy (*5 is most adequate*):					
Run Difficulty (*5 is most difficult*):			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: unfamiliar w/ sets during high flow
   halfway to br. come left and getting more than expected.

   Tug Adequacy:

   Difficulty: gradual steer toward bridge to avoid over steer toward bank.

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   yes, but struggled at twice due to sets.

3. Were the maneuvering areas sufficient for the intended track?

   yes.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   yes. very nice rudder.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes.

6. Please provide any comments on aids to navigation.

   /

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   /
   Current doesn't increase markedly w/ water level on the Columbia River ch.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Pilot/Tug Master Evaluation
Vancouver, WA

Date: ~~12~~ 10/26/23
Simulation #: 17
Tug Master / Pilot: DUSTIN

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft

Scenario (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: Maintained / (Authorized)

Transiting Channel: North / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Ballast

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S

River Flow (*Discharge*): 340,000

Water Level: ~~16.6~~ 16.4'

Available Air Draft: ~~17~~ 161.6'

Notes During Simulation:

Time	Observations/Notes
_____	_____
_____	_____
_____	_____

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: strong currents. approach not ideal

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   yes.

3. Were the maneuvering areas sufficient for the intended track?

   yes. but not ideal.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   yes.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes.

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   picked up speed -> went from HAA to EAA between bridges to maintain rudder through RR Bridge.

   Casey: Tugs? would not have tugs unless vessels declared before.

   Steve: in real world would have tug on line as insurance.

   Tug for arrest if bridge doesn't open in time would be a good policy.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Pilot/Tug Master Evaluation
Vancouver, WA

Date: 10/26/23
Simulation #: 18
Tug Master / Pilot: STEVE

Simulation Summary:

Vessel Type: Deep-Draft / Shallow-Draft

Scenario: Existing / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: Upbound / Downbound

Dredge Depth: Maintained / Authorized

Transiting Channel: North / Center / South

Lift Span position: Up / Down

Vessel Load Condition: Loaded / Ballast

Time of Day: Daytime / Nighttime

Piloted Vessel:

Bulk Carrier 24 | 2x2 Barge* | 2x1 Barge* | 1x2 Barge*

Specialty Barge (Max Air Draft) | Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts

River Flow (*Discharge*): 340,000

Water Level: 16.4

Available Air Draft: 161.6'

Notes During Simulation:

Time	Observations/Notes
6:30	Heading 129°, Speed

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: The ## deflection is 12-13° on the turn, the new bridge turn point is midway between the two

   Tug Adequacy:

   Difficulty: not difficult able, to choose where I wanted to be

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)
   Difference to New Bridge?
   New bridge more natural line up from existing did not notice a change in set approaching the bridge.
3. Were the maneuvering areas sufficient for the intended track?

   yes.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   yes.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes.

6. Please provide any comments on aids to navigation.
   hard to judge perspective on buoys.
   Placement of buoys is good.
7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:
   Chose to cut the angle rather than one large turn

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/26/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 19
Vancouver, WA Tug Master / Pilot: DUSTIN

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: Maintained / (Authorized) **Transiting Channel:** North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition:** (Loaded) / Ballast

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S River Flow (*Discharge*): 340,000

Water Level: 16.4' Available Air Draft: 161.6

Notes During Simulation:

Time	Observations/Notes

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: experiment w/ model, did not increase RPMs
   would be good to have a boat

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)
   Initial turn after the bridge. not enough time to make line up for RR Bridge

3. Were the maneuvering areas sufficient for the intended track?
   More comfortable. room - but needed more rudder or steerage.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?
   yes.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?
   would do for conditions. more speed.

6. Please provide any comments on aids to navigation.
   don't need additional buoy for RR Bridge.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?
   Keep RPMs steady

8. Additional Commentary:
   difference w/ ex run - did not ↑ RPMs
   agree that tug is needed for this scenario would be a good idea.

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213196 Interstate Bridge Replacement Navigation Simulations Date: 10/26/23
Simulation Summary, Notes, & Pilot/Tug Master Evaluation Simulation #: 20
Vancouver, WA Tug Master / Pilot: _____

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: Maintained / (Authorized) **Transiting Channel:** North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition:** (Loaded) / Ballast

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S River Flow (*Discharge*): 340,000

Water Level: 16.4 Available Air Draft: 161.6

Notes During Simulation:

Time	Observations/Notes

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)
   expected turn earlier, big bite to initiate turn.
   getting familiar

3. Were the maneuvering areas sufficient for the intended track?
   yes.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?
   yes.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?
   yes.

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:
   Comfort better w/ new bridge - more room to correct
   if load approaches.
   Steve D. Kind of trapped in the existing bridge.
   Dustin more constant and can see the background
   Have to "dig out" of the ex. bridge.
   Steve More "stuff" on Vancouver side - Grant Street pier
   and you have to keep away
   Dustin : may have cruise ships in future.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Pilot/Tug Master Evaluation
Vancouver, WA

Date: 10/26/23
Simulation #: 21
Tug Master / Pilot: DUSTIN

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized)

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: Loaded / (Ballast)

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): South 25kt +gust River Flow (*Discharge*): 140,000

Water Level: 3 Available Air Draft: 175

Notes During Simulation:

Time	Observations/Notes
_____	_____
_____	_____
_____	_____

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Wind noticeable

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   yes.

3. Were the maneuvering areas sufficient for the intended track?

   tight on clearance
   used ~~brought~~ broadside wind to help steady

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   yes. we were at the safe limit of wind.

6. Please provide any comments on aids to navigation.

   —

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   No steadying up on that run.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Pilot/Tug Master Evaluation
Vancouver, WA

Date: 10/26/23
Simulation #: 22
Tug Master / Pilot: _____

Simulation Summary:

Vessel Type: (Deep-Draft) / Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: Maintained / (Authorized)

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: Loaded / (Ballast)

Time of Day: (Daytime) Nighttime

Piloted Vessel:

(Bulk Carrier 24) 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 25 kt + gust

River Flow (*Discharge*): 140,000

Water Level: 3

Available Air Draft: 175

Notes During Simulation:

Time	Observations/Notes
_____	_____
_____	_____
_____	_____

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	(2)	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: high wind

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)
   Need perspective on when to turn – need a visual reference. Maintain track.

3. Were the maneuvering areas sufficient for the intended track?
   yes.

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?
   yes.

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?
   yes. Same with new or old bridge.

6. Please provide any comments on aids to navigation.
   Need a reference point on when to make turn not necessarily

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:
   Stayed on SB bridge wing → this is how would go thru RR bridge in real world.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/6/2023
Simulation #: 1
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): ShaverUp 22 Pushboat 2

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S 180

River Flow (*Discharge*): Normal

Water Level: 2.94 ft

Available Air Draft: 177.70 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	1	(2)	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Wind made him have to hold ✱

   Tug Adequacy:

   Difficulty: Most challenging side b/c run out of room to hold against wind.

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Mostly

3. Were the maneuvering areas sufficient for the intended track?

   No, no maneuvering space for error. Would prefer south span

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   At maximum operation conditions

6. Please provide any comments on aids to navigation.

   Red Buoy Prior to I-5 navigation hazard. Wanted to transit area of buoy

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   Unrealistic to todays operation but ran such that we can compare proposed

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/6/2023
Simulation #: 2
Tug Master: Jim Fletcher

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDawn 22 Pushboat 2

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: S

Wind (*Speed / Direction From*): 20 kts 180

River Flow (*Discharge*): Normal

Water Level: 2.94 ft

Available Air Draft: 177.70 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Loaded, limited ability correct if get off course

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Typical operation if high water

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/6/2023
Simulation #: 3
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Light 14.1ft

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLoad

Pushboat Position: Starboard / Port (Center)

Barge: 2 Drive Push Boat

2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: S

Wind (*Speed / Direction From*): 20 kts 180

River Flow (*Discharge*): Normal

Water Level: 2.94

Available Air Draft: 177.70ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED / LIGHT)	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy: Higher Horsepower than fleet, on subsequent runs will not full power

   Difficulty: Average

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/6/2023
Simulation #: 4
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario**: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized **Transiting Channel**: (North) / Center / South

Lift Span position: Up / Down **Vessel Load Condition**: Loaded / (Light)

Time of Day: (Daytime) / Nighttime **Visibility**: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): Shaver Up 22 **Pushboat Position**: Starboard / (Port)

Barge: Pushboat 2 (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts 180 S River Flow (*Discharge*): Normal

Water Level: 2.94 ft Available Air Draft: 177.70 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				(4)	
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Approach easier and improved from existing bridge, since I-5 North Bridge Piers to the south allows the stern of the tug room to stay south rather than having to hold position on north bank like they do in existing

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/6/2023
Simulation #: 5
Tug Master: Jim Fletcher

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: Up / (Down)

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): ST Down 22 Pushboat 2

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180 5

River Flow (*Discharge*): Normal

Water Level: 2.94ft

Available Air Draft: 177.70 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Originally tonght was going through center span. Corrected to go through north span.

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   Had sufficient room to course correct.

8. Additional Commentary:

   Felt easier than existing due to shift to the south and removing the need to wait for the lift which in reality is a concern for the mariners

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/6/2023
Simulation #: 6
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / (Center) / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Light → 9.8ft

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat *(Model/Power/Name)*: SBLoad 2 Drive Push Boat

Pushboat Position: Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug *(if applicable – Model/Power/Name)*: _____

Environmental Conditions:

Wind *(Speed / Direction From)*: 20 kts S 180

River Flow *(Discharge)*: Normal

Water Level: 2.94 ft

Available Air Draft: 177.70 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety *(5 is safest)*:					(5)
Tug Adequacy *(5 is most adequate)*:				(4)	
Run Difficulty *(5 is most difficult)*:			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   During this simulation tug master stated draft of 14.1ft unrealistic changed to 9.8ft, Captain stated comprision still representative

8. Additional Commentary:

   Going upstream proposed is better than existing as the current is pushing the stern south and therefore lift span in the center makes a more natural transit. Overall more maneuvering space

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/6/2023
Simulation #: 7
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: (Existing) / Construction / Proposed
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized
Transiting Channel: (North) / Center / South
Lift Span position: (Up) / Down
Vessel Load Condition: Loaded / (Light)
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): Tidewater Up 22
Pushboat Position: (Starboard) / Port
Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S 180
River Flow (*Discharge*): Transitional
Water Level: 11.84 ft
Available Air Draft: 168.8 ft

Barge Configuration:
Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / (LIGHT)
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	(1)	2	3	4	5	3
Tug Adequacy (*5 is most adequate*):	1	2	(3)	4	5	4
Run Difficulty (*5 is most difficult*):	1	2	3	4	(5)	3

Ratings excluding BNSF transit

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Low Rating due to unrealistic transit through BNSF

   Tug Adequacy: Thought due to loaded barge

   Difficulty: Current should have more effect than wind. In this scenario wind high effect at BNSF

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Realistic approach to I-5 Bridge

Ratings excluding BNSF section

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/6/2023
Simulation #: 8
Tug Master: Jim Fletcher

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDawn22

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 168.8 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   In real-life with these conditions would transit lift span

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/6/2023
Simulation #: 9
Tug Master: Jim Fletcher

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location**: _____ **Direction of Transit**: Upbound / (Downbound)
Dredge Depth: (Maintained) / Authorized
Transiting Channel: (North) / Center / South
Lift Span position: Up / Down
Vessel Load Condition: (Loaded) / Light
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): STDawn22
Pushboat Position: Starboard / (Port)
Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts 180
River Flow (*Discharge*): Transitional
Water Level: 11.84 ft
Available Air Draft: 168.8 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):					(5)
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):		(2)			

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Easier than existing with wider

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 10
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat *(Model/Power/Name)*: SBLight

Pushboat Position: Starboard / Port / Center

1M 3.3 ft

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug *(if applicable – Model/Power/Name)*: _____

Environmental Conditions: 180

Wind *(Speed / Direction From)*: S 20 kts

River Flow *(Discharge)*: Normal

Water Level: 2.94 ft

Available Air Draft: 177.70 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / ~~LIGHT~~
~~LOADED~~ / LIGHT	~~LOADED~~ / ~~LIGHT~~

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	(3)	4	5
Tug Adequacy *(5 is most adequate)*:	1	2	3	4	(5)
Run Difficulty *(5 is most difficult)*:	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Wind having greater affect than expected.

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 11
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____
Direction of Transit: (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized
Transiting Channel: (North) / Center / South
Lift Span position: Up / Down
Vessel Load Condition: Loaded / (Light)
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): Shaver Up 22
Pushboat Position: Starboard / (Port)
Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kt 180 S
River Flow (*Discharge*): Transitional
Water Level: 11.84
Available Air Draft: 86.66

Barge Configuration:
Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

At BNSF Bridge push towards North (wash)

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	1	(2)	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: North Span not perferred due to string wind

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Want the Red Buoy after I-5 bridge relocated ~100 ft from Bridge Pier to allow maneuvering

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   (N deep water outside channel limits

8. Additional Commentary:

   Proposed better than existing b/c wider and due to being slightly to the south

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 12
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)
Dredge Depth: (Maintained) / Authorized
Transiting Channel: North / (Center) / South
Lift Span position: (Up) / Down
Vessel Load Condition: Loaded / (Light)
Time of Day: ~~Daytime~~ / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): SB Light
Pushboat Position: Starboard / Port (Center)
Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*
(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180 S
River Flow (*Discharge*): Normal
Water Level: 2.94 ft
Available Air Draft: 175.06

Barge Configuration:
Add Pushboat location & circle load of barge

LOADED / (LIGHT)	~~LOADED~~ / LIGHT
~~LOADED~~ / LIGHT	~~LOADED~~ / ~~LIGHT~~

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):			(3)		
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Wind effect greater than expected.

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise? When transiting North Channel can continue to drive into the wind. Both maneuvers doable one just slightly more challenging if wind direction changed opinion would vary.

8. Additional Commentary:
   Comparing existing to proposed conditions thought existing was easier than proposed due to direction of wind. With the wind from the South the center channel transit makes it so you have to maneuver/turn in the direction of the wind making it more challenging to counter the total force to line up for BNSF Bridge

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 13
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location:_____ **Ending Location**:_____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat *(Model/Power/Name)*: Shaver Up 22

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug *(if applicable – Model/Power/Name)*: _____

Environmental Conditions: S

Wind *(Speed / Direction From)*: 180 20 kts

River Flow *(Discharge)*: Normal

Water Level: 2.94

Available Air Draft: 69.06

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

At BNSF Bridge push towards North (wash)

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety *(5 is safest)*:				(4)	
Tug Adequacy *(5 is most adequate)*:				(4)	
Run Difficulty *(5 is most difficult)*:		(2)			

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Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy: Typical transit and realistic conditions

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   —

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 14
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: (Existing) / Construction / Proposed
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized
Transiting Channel: (North) / Center / South
Lift Span position: (Up) / Down
Vessel Load Condition: (Loaded) / Light — 9.8 ft
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): SB Loaded
Pushboat Position: Starboard / Port (Center)
Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*
(Specialty Barge) (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): ATPushboat 2 (Live Tug Bridge)

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts S 180
River Flow (*Discharge*): Transitional
Water Level: 11.84 ft
Available Air Draft: 168.80 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	~~LOADED~~ / LIGHT
~~LOADED~~ / LIGHT	~~LOADED~~ / LIGHT

Notes During Simulation:

used grid current at BNSF Bridge

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	3	4	(5)

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Overall this transit is a low safety and higher difficulty due to low visibility independent of Bridge

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   overall couldn't see due to no visibility

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   This transit will always require assist tug due to low visibility

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 15
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____
Direction of Transit: (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized
Transiting Channel: North / Center / (South)
Lift Span position: Up / Down
Vessel Load Condition: Loaded / (Light)
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat *(Model/Power/Name):* ShaverUp22
Pushboat Position: Starboard / (Port)
Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug *(if applicable – Model/Power/Name):* _____

Environmental Conditions:

Wind *(Speed / Direction From):* 20kts S 180
River Flow *(Discharge):* Normal
Water Level: 2.94 ft
Available Air Draft: 86.86 ft

Barge Configuration:
Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

non-grid currents at BNSF Bridge

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety *(5 is safest)*:				(4)	
Tug Adequacy *(5 is most adequate)*:				(4)	
Run Difficulty *(5 is most difficult)*:		(2)			

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Proposed preffered over existing due to inhanced visibility wider channel

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 16
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** (Existing) / Construction / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** (North) / Center / South

Lift Span position: (Up) / Down **Vessel Load Condition:** Loaded / (Light) — 1m

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLight **Pushboat Position:** Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts S 180 River Flow (*Discharge*): transitional

Water Level: 11.84 ft Available Air Draft: 168.80 ft

Barge Configuration:

Add Pushboat location & circle load of barge

~~LOADED~~ / (LIGHT)	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

non-grid currents at BNSF Bridge

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy: Higher wind effect than expected

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   —

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 17
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / (Center) / South

Lift Span position: Up / Down **Vessel Load Condition:** Loaded / Light

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): ST Down22 **Pushboat Position:** Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 KTS River Flow (*Discharge*): Normal

Water Level: 2.94 ft Available Air Draft: 67.06

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

GRid currents used at BNSF

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy: Realistic Run w. typical conditions

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   —

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 18
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)
Dredge Depth: (Maintained) / Authorized
Transiting Channel: North / (Center) / South
Lift Span position: (Up) / Down
Vessel Load Condition: Loaded / (Light)
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): SBLight
Pushboat Position: Starboard / Port / (Center)
Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*
(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180 S
River Flow (*Discharge*): Transitional
Water Level: 11.84
Available Air Draft: 166.16

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED / LIGHT)	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

BNSF currents original (non-grid)

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				(4)	
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):		(2)			

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Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Good as proposed.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Indifferent when comparing existing to proposed scenarios.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 19
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / (Center) / South

Lift Span position: Up / (Down)

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDown 22

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts 180 S

River Flow (*Discharge*): Normal

Water Level: 2.94 ft

Available Air Draft: 88.66 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Grid currents used at BNSF Bridge

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Junction Buoy -

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Comparing Existing to Proposed
   Proposed a substantially improvement
   visually
   +
   Spatially

   No longer need to maneuver to
   to the white light.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 20
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light) – 1m

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat *(Model/Power/Name):* SB Light

Pushboat Position: Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug *(if applicable – Model/Power/Name):* _____

Environmental Conditions:

Wind *(Speed / Direction From):* 20kts S 180

River Flow *(Discharge):* Normal

Water Level: 2.94 ft

Available Air Draft: 95.56 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	3	4	(5)
Tug Adequacy *(5 is most adequate)*:	1	2	3	4	(5)
Run Difficulty *(5 is most difficult)*:	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: First time transiting north channel - in proposed channel

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Red AtoNs in line with Pier Bridge towards oregon (south) Check Junction Buoy

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   overall channel felt good, no concerns denoted.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/7/2023
Simulation #: 21
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** (Existing) / Construction / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / Center / (South)

Lift Span position: Up / Down **Vessel Load Condition:** Loaded / (Light)

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): Shaver Up 22 **Pushboat Position:** Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20KTS River Flow (*Discharge*): Transitional

Water Level: 11.84 ft Available Air Draft: 100.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Felt like normal realistic transit.

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   —

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 22
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition:** (Loaded) / Light 9.8 ft

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLoaded **Pushboat Position:** Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): ATPushboat 2 (Live Tug Bridge)

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20kts River Flow (*Discharge*): Transitional

Water Level: 11.84 ft Available Air Draft: 1616.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

	(LOADED) / LIGHT	LOADED / LIGHT
	LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Low Safety and High Difficulty due to limited visibility rather than result of channel design

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Unable to see due to low visibility

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Indifferent btw existing and proposed transits

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 23
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location**:_____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): Shaver Up 22

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20kt

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 77.96 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Typical transit

   Tug Adequacy: with increased visibility

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Existing - tighter turn, low visibility

   Proposed - more gradual, better visibility

   more forgiving due to more room

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 24
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** (Existing) / Construction / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / (Center) / South

Lift Span position: Up / Down **Vessel Load Condition:** (Loaded) / Light

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDawn 22 **Pushboat Position:** Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20kts River Flow (*Discharge*): Transitional

Water Level: 11.84 ft Available Air Draft: 58.16 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy: Typical + Realistic Transit.

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 25
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location:_____ **Ending Location**:_____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STUp21

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): S 20kts 180

River Flow (*Discharge*): 10-year

Water Level: 16.43 ft

Available Air Draft: 152.36 ft

Barge Configuration:

Add Pushboat location & circle load of barge

	(LOADED) / LIGHT	LOADED / LIGHT
	(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Shaver - 2x1 upbound Light
Tidewater - 2x1 upbound Loaded fuel + Light

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				(4)	
Tug Adequacy (*5 is most adequate*):				(4)	
Run Difficulty (*5 is most difficult*):		(2)			

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: overall higher impact from current and needing to steer more.

   Tug Adequacy:

   Difficulty: overall going slower due to currents

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   —

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 26
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / (Center) / South

Lift Span position: Up / (Down) **Vessel Load Condition:** (Loaded) / Light

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat *(Model/Power/Name):* STDawn 22 **Pushboat Position:** Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug *(if applicable – Model/Power/Name)*: _____

Environmental Conditions: 180

Wind *(Speed / Direction From)*: S 20kts River Flow *(Discharge)*: Transitional

Water Level: 11.84 ft Available Air Draft: 79.76 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	3	4	(5)
Tug Adequacy *(5 is most adequate)*:	1	2	3	4	(5)
Run Difficulty *(5 is most difficult)*:	1	(2)	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good as placed.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Comparing Existing to Proposed.
   Proposed easier than existing
   But neither challenging

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 27
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized
Transiting Channel: (North) / Center / South
Lift Span position: Up / Down
Vessel Load Condition: (Loaded) / Light
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): STUp 21
Pushboat Position: Starboard / (Port)
Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:
Wind (*Speed / Direction From*): S 20kts 180
River Flow (*Discharge*): 10-year
Water Level: 16.43 ft
Available Air Draft: 70.22 ft

Barge Configuration:
Add Pushboat location & circle load of barge

⊏	(LOADED) / LIGHT	LOADED / LIGHT
	(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				(4)	
Tug Adequacy (*5 is most adequate*):				(4)	
Run Difficulty (*5 is most difficult*):		(2)			

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Straight clear path.

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Proposed. channel better due to better visibility and wider channel

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 28
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** (Existing) Construction / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** (North) / Center / South

Lift Span position: (Up) / Down **Vessel Load Condition:** (Loaded) / Light

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDawn21 **Pushboat Position:** Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts 180 (S) River Flow (*Discharge*): 10-year

Water Level: 16.43 ft Available Air Draft: 152.36 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				(4)	
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):		(2)			

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy: overall happened faster as a result of higher current

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 29
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location**:_____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STUp21

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 kts

River Flow (*Discharge*): 10-year

Water Level: 16.43 ft

Available Air Draft: 70.22 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				(4)	
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):		(2)			

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Straight alignment

   Tug Adequacy: Min. Course corrections

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Easier & Favorable compared to existing.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 30
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized
Transiting Channel: (North) / Center / South
Lift Span position: Up / Down
Vessel Load Condition: (Loaded) / Light 9.8ft
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): SBLoad
Pushboat Position: Starboard / Port / (Center)
Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*
(Specialty Barge) (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): ATPushboat 2 (Live Tug Bridge)

Environmental Conditions:
Wind (*Speed / Direction From*): 5 20kts 180
River Flow (*Discharge*): Transitional
Water Level: 11.84 ft
Available Air Draft: 86.66 ft

Barge Configuration:
Add Pushboat location & circle load of barge

LOADED / LIGHT	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):			(3)		
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Move green buoy out of South channel

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Foss requires assist tug with limited visibility. Cpt. Olson stated an assist tug makes simulation more difficult in simulator & real-life.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 31
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STLight 21

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge)* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20kts

River Flow (*Discharge*): 10 year

Water Level: 16.43 ft

Available Air Draft: 152.36 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / LIGHT
LOADED / (LIGHT)	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   No concerns, typical transit.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 32
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLoad

Pushboat Position: Starboard / Port (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 180 S 20kts

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 88.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED / LIGHT)	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Going Through multiple bridges at once, Creating an obstacle for longer

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes Model acted as expected did notice change in currents as result of the 2 Bridges

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   No additional Aids would help

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 33
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): ST Light 21

Pushboat Position: Starboard / Port

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180 S

River Flow (*Discharge*): 10-year

Water Level: 16.43 ft

Available Air Draft: 70.22 ft

Barge Configuration:
Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / LIGHT
LOADED / (LIGHT)	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   —

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Proposed preffered
   more room for error | better safety margin
   better visibility

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 34
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / Center / (South)
Lift Span position: Up / Down **Vessel Load Condition:** (Loaded) / Light
Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime
Pushboat (*Model/Power/Name*): SB Load **Pushboat Position:** Starboard / Port (Center)
Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*
(Specialty Barge) (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): No Assist Tug

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180 S **River Flow** (*Discharge*): Transitional
Water Level: 11.84 ft **Available Air Draft:** 77.96 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED / LIGHT)	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):			(3)		
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Comparing the three channels
   Center channel requires least course corrections compared to N + S channels

   Overall Proposed bridge better than existing bridge.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 35
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: Maintained / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLoad

Pushboat Position: Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 KTS

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 60.16 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

No Construction Barges

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):			(3)		
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):				(4)	

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Green Light marking center of construction channel & temp Range

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Even knowing came within ~10 ft from Existing Bridge Pier felt okay since deck hand could be constantly giving distances

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/8/2023
Simulation #: 36
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat *(Model/Power/Name):* Shaver Up 22

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug *(if applicable – Model/Power/Name):* _____

Environmental Conditions: 180

Wind *(Speed / Direction From):* S 20kts

River Flow *(Discharge):* Normal

Water Level: 2.94 ft

Available Air Draft: 97.06

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED / LIGHT)	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety *(5 is safest)*:			(3)		
Tug Adequacy *(5 is most adequate)*:				(4)	
Run Difficulty *(5 is most difficult)*:			(3)		

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: More obstacles

   Tug Adequacy: Want to see it at night

   Difficulty: Need to pay attention more. Tighter maneuver

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Would want temporary range denoting centerline of temp channel b/c

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise? Critical to keep a course

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 37
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** (North) / Center / South

Lift Span position: Up / Down **Vessel Load Condition:** Loaded / (Light)

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLight **Pushboat Position:** Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20kts River Flow (*Discharge*): Transitional

Water Level: 11.84 ft Available Air Draft: 86.66 ft

Barge Configuration:
Add Pushboat location & circle load of barge

LOADED / LIGHT	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Unsuccessful through railroad bridge

Felt unrealistic at railroad bridge

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Ratings excluding unrealistic feeling at BNSF railroad

   Tug Adequacy:

   Difficulty: Overall Safetransit, average difficultly

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Unsuccessful at BNSF Railroad due to Master error and weird environmental effects at BNSF

   Yes until BNSF Bridge

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes, but not BNSF

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Junction Buoy - feels much closer to wash.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   Checked scenes Junction buoy in same location for Existing + Proposed.

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 38
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / (Construction) / Proposed
Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized
Transiting Channel: (North) / Center / South
Lift Span position: Up / Down
Vessel Load Condition: Loaded / (Light)
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): Shaver Up 22 **Pushboat Position**: Starboard / (Port)
Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*):_____

Environmental Conditions: 180
Wind (*Speed / Direction From*): S 20 kts River Flow (*Discharge*): Transitional
Water Level: 11.84 ft Available Air Draft: 88.16 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	(4)	5
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Temp Range for centerline

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   No concern with construction
   North Channel.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 39
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: Upbound / (Downbound)

Dredge Depth: Maintained / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLight

Pushboat Position: Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge (~~Max Air Draft~~)) ~~Specialty Barge (Limited Air Draft)~~

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20kts

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 88.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / LIGHT
~~LOADED / LIGHT~~	~~LOADED / LIGHT~~

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Transit feels very similar to a typical transit in North Channel

   Tug Adequacy:

   Difficulty: Proposed bridge more an obstacle when going upbound

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   No temp ranges needed downbound since there are many existing objects to use

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   Also if had upbound range could use it going downband to assist.

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 40
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: Maintained / Authorized **Transiting Channel:** (North) / Center / South

Lift Span position: Up / Down **Vessel Load Condition:** (Loaded) / Light

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) Nighttime

Pushboat (*Model/Power/Name*)**:** STDown 22 **Pushboat Position:** Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*)**:** _____

Environmental Conditions:

Wind (*Speed / Direction From*)**:** 180 S 20 kts River Flow (*Discharge*)**:** Normal

Water Level: 2.94 ft Available Air Draft: 97.06 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				(4)	
Tug Adequacy (*5 is most adequate*):				(4)	
Run Difficulty (*5 is most difficult*):		(2)			

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Realistic + Similar to existing downbound North Channel transit.

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   No concerns with 2x2 Barge in North Channel.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 41
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location**:_____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLight

Pushboat Position: Starboard / Port / Center

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) ~~(Max Air Draft)~~ ~~Specialty Barge (Limited Air Draft)~~

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*):_____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S 180

River Flow (*Discharge*): Transitional

Water Level: 11.84

Available Air Draft: 77.96 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED / LIGHT)	~~LOADED / LIGHT~~
~~LOADED~~ / LIGHT	~~LOADED / LIGHT~~

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):			(3)		
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):				(4)	

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Need to start earlier, before bridge started turn.

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes - getting tight

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Challenging maneuver will not be a typical transit.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 42
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDown22

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge)* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180 S

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 88.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	(3)	4	5
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy: Timing of everything faster due to increased currents

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   would want Chart lines of Construction Channel on ECDIS

   Construction All Barges transmit AIS signal

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Normal Transit

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 43
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / Proposed

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: Upbound / Downbound

Dredge Depth: Maintained / Authorized

Transiting Channel: North / Center / South

Lift Span position: Up / Down

Vessel Load Condition: Loaded / Light

Time of Day: Daytime / Nighttime

Visibility: Clear / Nighttime

Pushboat (*Model/Power/Name*): SBLight

Pushboat Position: Starboard / Port / Center

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge ~~(Max Air Draft)~~ Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180 S

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 60.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / LIGHT	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Felt tighter than upbound
   Got close to new propose pier than desired. Should have started turn earlier

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)
   Yes

3. Were the maneuvering areas sufficient for the intended track?
   Felt tight with 104ft wide barge
   ↳ would feel better with 76 ft wide barge

4. Did the ship model react as expected with the given environmental conditions? If not, what was different? which Master is use to.
   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?
   With 104 ft beam barge - NO
   with 76ft beam barge - Yes

6. Please provide any comments on aids to navigation.
   —

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:
   Tug Master thinks normal vs transitional doesn't make significant difference to transit, same feedback would be given

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 44
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): Shaver Up 22

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 KTS

River Flow (*Discharge*): Normal

Water Level: 2.94 ft

Available Air Draft: 69.06 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Angle that need to steer different than today

   Tug Adequacy:

   Difficulty: Aiming more SE than E

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes - limited room for error. Very tight

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

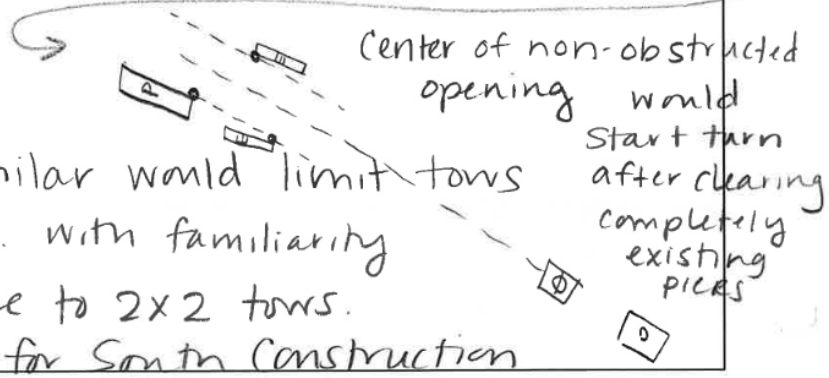
5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   temp Range Critical but doesn't want the range in centerline of channel instead wants!

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?



8. Additional Commentary:

   Until familar would limit tows to 2x1. with familiarity increase to 2x2 tows.
   Only for South Construction
   no concern with North Construction

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 45
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location**:_____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / (Center) / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: Daytime / (Nighttime)

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLoad

Pushboat Position: Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) ~~(Max Air Draft)~~ ~~Specialty Barge (Limited Air Draft)~~

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*):_____

Environmental Conditions:

Wind (*Speed / Direction From*): 180 S 20kts

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 166.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED / LIGHT)	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Night Run

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Typical Nightime transit.

   Tug Adequacy: Nightime typically harder than daytime

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   OW
   OW
   OW
   OG Three white lights for center span and a green light other spans single green light

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Thought this transit is slightly easier than existing transit

   With the I-5 Bridge closer to BNSF bridge that higher difficulty is completely counted by wider Spans

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 46
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: Maintained / Authorized **Transiting Channel:** North / Center / (South)

Lift Span position: Up / Down **Vessel Load Condition:** (Loaded) / Light

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): ST Down 22 **Pushboat Position:** Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 kts River Flow (*Discharge*): Normal

Water Level: 2.94 ft Available Air Draft: 86.86 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Simple transit, transition to railroad bridge easy

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Easier than existing conditions

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 47
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / Construction / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / Downbound

Dredge Depth: Maintained / Authorized **Transiting Channel:** North / Center / South

Lift Span position: Up / Down **Vessel Load Condition:** Loaded / Light

Time of Day: Daytime / Nighttime **Visibility:** Clear / Nighttime

Pushboat (*Model/Power/Name*): SBLight **Pushboat Position:** Starboard / Port

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge ~~(Max Air Draft)~~ ~~Specialty Barge (Limited Air Draft)~~

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20 kts S 180 River Flow (*Discharge*): Transitional

Water Level: 11.84 ft Available Air Draft: 166.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / LIGHT	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				4	
Tug Adequacy (*5 is most adequate*):					5
Run Difficulty (*5 is most difficult*):			3		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: No concerns, typical nighttime transit

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Bridge lighting follow lighting as described Run 45

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 48
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDawn 22

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: S

Wind (*Speed / Direction From*): 180 20kts

River Flow (*Discharge*): Normal

Water Level: 2.94 ft

Available Air Draft: 69.06 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

(*) Went through existing midspan for construction channel.

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):			(3)		
Tug Adequacy (*5 is most adequate*):				(4)	
Run Difficulty (*5 is most difficult*):			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes - That angle is challenging

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Range would be helpful.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 49
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario**: Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: Upbound / Downbound

Dredge Depth: (Maintained) / Authorized **Transiting Channel**: North / Center / (South)

Lift Span position: Up / Down **Vessel Load Condition**: (Loaded) / Light

Time of Day: (Daytime) / Nighttime **Visibility**: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDawn 22 **Pushboat Position**: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 180 S 20kts River Flow (*Discharge*): Normal

Water Level: 2.94 ft Available Air Draft: 69.010 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Repeat Run 48

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	(4)	5
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: This approach is better than run 48 for BNSF able to turn towards the bridge BNSF sooner.

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Range on centerline of drawn construction channel.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Better gauge the stern of the tow compared to wide span "construction" channel.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 50
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: (Existing) / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: (Up) / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SB Light

Pushboat Position: Starboard / Port / center

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) ~~(Max Air Draft)~~ Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 kts

River Flow (*Discharge*): 10 year

Water Level: 16.43 ft

Available Air Draft: 152.36 ft

Barge Configuration:
Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				(4)	
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):				(4)	

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Due to high flow

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Behaved as accepted

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 51
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / (Construction) / Proposed
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized
Transiting Channel: North / Center / (South)
Lift Span position: Up / Down
Vessel Load Condition: Loaded / (Light)
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): ShaverUp 22
Pushboat Position: Starboard / (Port)
Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:
Wind (*Speed / Direction From*): 5 20kts 180
River Flow (*Discharge*): Normal
Water Level: 2.94 ft
Available Air Draft: 69.06 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:
(*) Went through existing widespan for construction channel.

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: tight and limited room

   Tug Adequacy:

   Difficulty: If needed to do transit consider tug configuration – move push to starboard side

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   No

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   No

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Preference to stay in designed Smtn channel compared to wide span

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 52
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition:** Loaded / (Light)

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SB Light **Pushboat Position:** Starboard / Port (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) ~~(Max Air Draft)~~ Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180 S River Flow (*Discharge*): 10 year

Water Level: 16.43 ft Available Air Draft: 161.57 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	~~LOADED~~ / LIGHT
~~LOADED~~ / LIGHT	~~LOADED~~ / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good placement.
   Junction buoy update with primary channel change.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Felt easier than existing North Channel transit.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/9/2023
Simulation #: 53
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): ShaverUp22

Pushboat Position: Starboard / Port

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180 S

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 60.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	(4)	5
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Current set causing more course changes than normal flow

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes - tight space

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes but would rather break into 2x1 or add assist boat.

6. Please provide any comments on aids to navigation.

   Temp Range as previously requested wanted

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary: Would Either want to break into 2x1 OR require assist tug

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 54
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: Daytime / (Nighttime)

Visibility: Clear / (Nighttime)

Pushboat (*Model/Power/Name*): STDown22

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 kts

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 77.96 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Easy transit. Turn to South Channel more gradual than today improving overall safety of transit.

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   no need for permanent range.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 55
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location:**_____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDawn 22

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 180 S 20kts

River Flow (*Discharge*): Trasitional

Water Level: 11.84 ft

Available Air Draft: 60.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	(4)	5
Run Difficulty (*5 is most difficult*):	1	2	3	4	(5)

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Turn to BNSF Bridge is a higher challenge

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes for the most part

3. Were the maneuvering areas sufficient for the intended track?

   No

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   NO recommend breaking into 2x1, and need assist boat once through I-5 bridge

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   This is a hard transit today that mariners avoid due to difficulty

   Rerunning with 2x1 Barge - Run 73

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 56
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location**:_____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STUp 21

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable -- Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): 20 kts S

River Flow (*Discharge*): 10-year

Water Level: 16.43 ft

Available Air Draft: 61.52 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / LIGHT
LOADED / (LIGHT)	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				(4)	
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):		(2)			

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Good visibility and good maneuvering room to adjust to strong currents

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Unable to do this transit today due to limited Air draft clearance

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 57
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): ST Down 21

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 20kts 180 S

River Flow (*Discharge*): 10 year

Water Level: 16.43

Available Air Draft: 61.52

Barge Configuration:

Add Pushboat location & circle load of barge

	(LOADED) / LIGHT	LOADED / LIGHT
	(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	(4)	5
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Easy overall

   Tug Adequacy: no Concerns

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Unable to do this transit today due to air draft limitations

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 58
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / Center / (South)

Lift Span position: Up / Down **Vessel Load Condition:** Loaded / (Light)

Time of Day: Daytime / (Nighttime) **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): Shaver Vp22 **Pushboat Position:** Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 River Flow (*Discharge*): Normal

Water Level: 2.94 ft Available Air Draft: 69.06 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):			(3)		
Tug Adequacy (*5 is most adequate*):				(4)	
Run Difficulty (*5 is most difficult*):			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: no need to course correct after BNSF bridge and until through I-5 bridge

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes but tight

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Would need experience and famailarity to do this transit.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 59
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / Center / (South)

Lift Span position: Up / Down **Vessel Load Condition:** (Loaded) / Light

Time of Day: Daytime / (Nighttime) **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): ST Dawn 22 **Pushboat Position:** Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): S 180 20kts River Flow (*Discharge*): Normal

Water Level: 2.94 ft Available Air Draft: 69.06 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	(3)	4	5
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Aggressive turn needed after I-5 bridge to line up BNSF transit

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes but limited and requires waiting to turn due to stern of tow Clearing Proposed Bridge Piers

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes but reccomend 2X1 tow until familar.

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 60
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized
Transiting Channel: North / (Center) / South
Lift Span position: Up / (Down)
Vessel Load Condition: Loaded / (Light)
Time of Day: (Daytime) / Nighttime
Visibility: Clear / ~~Nighttime~~ Fog 1 mile
Pushboat (*Model/Power/Name*): ShaverUp22
Pushboat Position: Starboard / (Port)
Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180
Wind (*Speed / Direction From*): S 20kts
River Flow (*Discharge*): Transitional
Water Level: 11.84 ft
Available Air Draft: 79.76 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: With fog could still see bridge so no issue transiting

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 61
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / (Center) / South

Lift Span position: Up / (Down)

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: Clear / ~~Nighttime~~ Fog 1mile

Pushboat (*Model/Power/Name*): STDown22

Pushboat Position: Starboard / Port

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): S 180 20kts

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 79.76 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Approach to I-5 proposed to BNSF straight / no course correction, ideal even with the fog

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Downbound + Upbound

   Center Channel Preffered. Ideal. Improvement from existing

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 62
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____

Direction of Transit: Upbound / (Downbound)

Dredge Depth: Maintained / Authorized

Transiting Channel: North / (Center) / South

Lift Span position: Up / (Down)

Vessel Load Condition: (Loaded) / Light

Time of Day: Daytime / (Nighttime)

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name):* _____

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind *(Speed / Direction From)*: S 20kts

River Flow *(Discharge)*: 10 yr

Water Level: 16.43 ft

Available Air Draft: 63.32 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	3	(4)	5
Tug Adequacy *(5 is most adequate)*:	1	2	3	4	(5)
Run Difficulty *(5 is most difficult)*:	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Higher flow + nighttime

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   —

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 63
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDown 21

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): S 180 20kts

River Flow (*Discharge*): 10 yr

Water Level: 16.43 ft

Available Air Draft: 71.72 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Felt really realistic.

   Tug Adequacy: Reduce Safety + Difficulty due to high water

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 104
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** (North) Center / South

Lift Span position: Up / Down **Vessel Load Condition:** Loaded / (Light)

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLight **Pushboat Position:** Starboard / Port / Center

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) ~~(Max Air Draft)~~ ~~Specialty Barge (Limited Air Draft)~~

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20kts River Flow (*Discharge*): Transitional

Water Level: 11.84 ft Available Air Draft: 86.66

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / ~~LIGHT~~
~~LOADED~~ / LIGHT	~~LOADED~~ / ~~LIGHT~~

Notes During Simulation:

Repeat Run 37

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Last time turned too soon
   no concerns

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 65
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: Daytime / (Nighttime)

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLight

Pushboat Position: Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 kts

River Flow (*Discharge*): Normal

Water Level: 2.94 ft

Available Air Draft: 69.06 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / ~~LIGHT~~
~~LOADED~~ / LIGHT	~~LOADED~~ / ~~LIGHT~~

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: In Simulator missing search lights

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   With an assist tug at night
   Yes and with increased famailarity

6. Please provide any comments on aids to navigation.

   Temp Range would be helpful to orientent

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   North Construction Channel easier and preferred.

   South construction channel feasible, will most likely have limits initially of daytime only, assist tug, limited environmental

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 606
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario**: Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location**:_____ **Direction of Transit**: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized **Transiting Channel**: North / Center / (South)

Lift Span position: Up / Down **Vessel Load Condition**: (Loaded) / Light

Time of Day: Daytime / (Nighttime) **Visibility**: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLoad **Pushboat Position**: Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) (Max Air Draft)___ ~~Specialty Barge (Limited Air Draft)~~

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*):_____

Environmental Conditions:

Wind (*Speed / Direction From*): 5 20kts 180 River Flow (*Discharge*): Normal

Water Level: 2.94 ft Available Air Draft: 69.06 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
~~LOADED~~ / LIGHT	~~LOADED~~ / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	(1)	2	3	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	3	4	(5)

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Low Safety & High Difficulty due to Nighttime

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes tight

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   NO – would require this be a daytime transit.

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Independent of flow
   would require all Loaded
   SB transits be at daytime
   an Assist tug would not help.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 67
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / (Center) / South

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLoad

Pushboat Position: Starboard / Port

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) ~~(Max Air Draft)~~ Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 5 20kts 180

River Flow (*Discharge*): 10 year

Water Level: 16.43 ft

Available Air Draft: 161.57 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				(4)	
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Flow made the run more difficult

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Overall felt good doing that maneuver in high flow

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 108
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____
Direction of Transit: Upbound / (Downbound)
Dredge Depth: (Maintained) / Authorized
Transiting Channel: North / (Center) / South
Lift Span position: Up / Down
Vessel Load Condition: (Loaded) / Light
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime / (Center)
Pushboat (*Model/Power/Name*): SBLoad
Pushboat Position: Starboard / Port
Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*
(Specialty Barge) ~~(Max Air Draft)~~ ~~Specialty Barge (Limited Air Draft)~~
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180
Wind (*Speed / Direction From*): S 20kts
River Flow (*Discharge*): Transitional
Water Level: 11.84 ft
Available Air Draft: 166.16 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:
Hit railroad bridge on Port Side due to tug master

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Easier going upstream w. BNSF bridge independent of tow due to being able to stem current.

   Didn't turn soon enough for BNSF Bridge - Pilot error.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: _____
Simulation #: 109
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / (Center) / South

Lift Span position: Up / (Down) **Vessel Load Condition:** Loaded / (Light)

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): ShaverUp22 **Pushboat Position:** Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 kts River Flow (*Discharge*): Normal

Water Level: 2.94 ft Available Air Draft: 89.66 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Typical Run

   Tug Adequacy: no concerns

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   good.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 70
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / (Center) / South

Lift Span position: Up / (Down)

Vessel Load Condition: Loaded / (Light)

Time of Day: Daytime / (Nighttime)

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*)**:** _____

Pushboat Position: Starboard / (Port)

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 5 20 kts 180

River Flow (*Discharge*): Transitional

Water Level: 11.84 ft

Available Air Draft: 79.76 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
LOADED / (LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Average night run.

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 71
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / (Center) / South

Lift Span position: Up / (Down)

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name):* STUp21

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind *(Speed / Direction From)*: 20kts S 180

River Flow *(Discharge)*: 10 year

Water Level: 16.43

Available Air Draft: 63.32

Barge Configuration:
Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / LIGHT
LOADED / (LIGHT)	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	3	4	(5)
Tug Adequacy *(5 is most adequate)*:	1	2	3	4	(5)
Run Difficulty *(5 is most difficult)*:	(1)	2	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Standard typical run

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 72
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: (North) / Center / South

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STUp21

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): S 20kts

River Flow (*Discharge*): 10yR

Water Level: 16.43 ft

Available Air Draft: 71.22 ft

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / LIGHT
LOADED / (LIGHT)	LOADED / LIGHT

Notes During Simulation:

Visuals of simulator malfunctioned making pilot get disoriented and noticable in track btw proposed + existing bridge

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

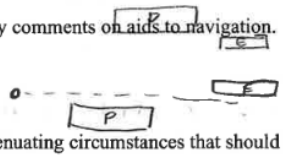
4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.



Put red buoy btw south piers of E + P bridge piers

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 73
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / (Construction) / Proposed
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)
Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / Center / (South)
Lift Span position: Up / Down **Vessel Load Condition:** (Loaded) / Light
Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime
Pushboat (*Model/Power/Name*): STDown21 **Pushboat Position:** Starboard / (Port)
Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180
Wind (*Speed / Direction From*): S 20kts River Flow (*Discharge*): Transitional
Water Level: 11.84 ft Available Air Draft: 60.116 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / (LIGHT)
(LOADED) / LIGHT	LOADED / (LIGHT)

Notes During Simulation:
Repeat 55 but with 2x1 Barge

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):			(3)		
Tug Adequacy (*5 is most adequate*):					(5)
Run Difficulty (*5 is most difficult*):			(3)		

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: Easier than 2x2 but still a challenging maneuver

   Tug Adequacy:

   Difficulty: Hard after I-5 bridge to cut back to BNSF Bridge

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Range needed

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Need to break into 2x1 downbound in South Construction channel also have deckhand on barge

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 74
Tug Master: Luke Olson

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / (Center) / South

Lift Span position: (Up) / Down **Vessel Load Condition:** (Loaded) / Light

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SBLoad **Pushboat Position:** Starboard / Port / (Center)

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) ~~(Max Air Draft)~~ Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): S 180 20kts River Flow (*Discharge*): Transitional

Water Level: 11.84 ft Available Air Draft: 106.16 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / ~~LIGHT~~
~~LOADED~~ / LIGHT	LOADED / LIGHT

Notes During Simulation:

Repeat Run 68

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Felt as good as expected with blind tug.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 75
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: Daytime / (Nighttime)

Visibility: (Clear) / Nighttime

Pushboat *(Model/Power/Name):* ST Up21

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug *(if applicable – Model/Power/Name):* _____

Environmental Conditions:

Wind *(Speed / Direction From):* 180 S 20 kts

River Flow *(Discharge):* Transitional

Water Level: 11.84 ft

Available Air Draft: 60.16 ft

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Repeat Run 73 but at night

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	3	(4)	5
Tug Adequacy *(5 is most adequate)*:	1	2	3	(4)	5
Run Difficulty *(5 is most difficult)*:	1	(2)	3	4	5

213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   With familarity transit has become easier

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 76
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound

Dredge Depth: (Maintained) / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: Loaded / (Light)

Time of Day: Daytime / (Nighttime)

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): SLight21

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 5 20kts 180 River Flow (*Discharge*): 10-year

Water Level: 16.43 ft Available Air Draft: 43.72

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / ~~LIGHT~~
LOADED / (LIGHT)	LOADED / ~~LIGHT~~

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Felt okay with high water/flow in construction channel.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/10/2023
Simulation #: 77
Tug Master: Andy Bradley

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North / Center / (South)

Lift Span position: Up / Down **Vessel Load Condition:** (Loaded) / Light

Time of Day: Daytime / (Nighttime) **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name*): STDawn21 **Pushboat Position:** Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions: 180

Wind (*Speed / Direction From*): S 20 kts River Flow (*Discharge*): 10 year

Water Level: 16.43 ft Available Air Draft: 43.72 ft

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	(3)	4	5
Tug Adequacy (*5 is most adequate*):	1	2	3	(4)	5
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: At night harder to see tug position/movement/set to reduce concern of mariner

   Tug Adequacy:

   Difficulty: More focused on instrumentation

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Repition of this run has helped with comfort of this transit.

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15/23
Simulation #: 1-T
Tug Master: Josh

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** (Upbound) / Downbound
Dredge Depth: (Maintained) / Authorized
Transiting Channel: North / (Center) / South
Lift Span position: (Up) / Down
Vessel Load Condition: Loaded / (Light)
Time of Day: ~~Daytime~~ / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): _____
Pushboat Position: (Starboard) / Port
Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): S 20 knots
River Flow (*Discharge*): Transit
Water Level: _____
Available Air Draft: _____

Barge Configuration:
Add Pushboat location & circle load of barge

(LOADED / LIGHT)	LOADED / (LIGHT)
(LOADED / LIGHT)	LOADED / (LIGHT)

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	4	(5)
Tug Adequacy (*5 is most adequate*):	1	2	3	4	(5)
Run Difficulty (*5 is most difficult*):	1	2	(3)	4	5

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Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: high wind w/ the given load

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   No comment

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Start seems off, feels like starting from a stop

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15
Simulation #: 2-T
Tug Master: Brian

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: (Maintained) / Authorized **Transiting Channel:** North (Center) / South

Lift Span position: Up / Down **Vessel Load Condition:** (Loaded) / Light

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name):* _____ **Pushboat Position:** Starboard / Port

Barge: (2x2 Barge*) 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind *(Speed / Direction From)*: 5 20 kts River Flow *(Discharge)*: transitional

Water Level: _____ Available Air Draft: _____

Barge Configuration:

Add Pushboat location & circle load of barge

	(LOADED) / LIGHT	(LOADED) / LIGHT
	(LOADED) / LIGHT	(LOADED) / LIGHT

bow Starboard barge should have been light

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	3	4	(5)
Tug Adequacy *(5 is most adequate)*:	1	2	3	4	(5)
Run Difficulty *(5 is most difficult)*:	(1)	2	3	4	5

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Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes, very

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   should the red upstream be a junction buoy

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   abutments disappear under that much flow

8. Additional Commentary:

   approach from junction buoy down was quite a bit different than the existing. will adjust w/ time

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15
Simulation #: 3-T
Tug Master: Josh N.

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / ~~Proposed~~
Starting Location: _____ **Ending Location:** _____
Direction of Transit: Upbound / Downbound
Dredge Depth: Maintained / Authorized
Transiting Channel: North / Center / South
Lift Span position: Up / Down
Vessel Load Condition: ~~Loaded~~ / Light
Time of Day: ~~Daytime~~ / Nighttime
Visibility: ~~Clear~~ / Nighttime
Pushboat (*Model/Power/Name*): Push #2
Pushboat Position: Starboard / Port
Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): S 20kts
River Flow (*Discharge*): 10-45
Water Level: _____
Available Air Draft: _____

Barge Configuration:

Add Pushboat location & circle load of barge

~~LOADED~~ / LIGHT	LOADED / LIGHT
~~LOADED~~ / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

	1	2	3	4	5
Run Safety (*5 is safest*):				4	
Tug Adequacy (*5 is most adequate*):					5
Run Difficulty (*5 is most difficult*):		2			

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Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: high flow + load stop this from being a 5

   Tug Adequacy:

   Difficulty: felt familiar, similar track line to going through old widespan could feel the current

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   No

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   No

8. Additional Commentary:

   No

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15
Simulation #: 4-7
Tug Master: Josh

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / Proposed

Starting Location: _____ **Ending Location:** _____

Direction of Transit: Upbound / Downbound

Dredge Depth: Maintained / Authorized

Transiting Channel: North / Center / South

Lift Span position: Up / Down

Vessel Load Condition: Loaded / Light

Time of Day: Daytime / Nighttime

Visibility: Clear / Nighttime

Pushboat (*Model/Power/Name):* _____

Pushboat Position: Starboard / Port

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind *(Speed / Direction From)*: S 20kt

River Flow *(Discharge)*: transitional

Water Level: _____

Available Air Draft: _____

Barge Configuration:

Add Pushboat location & circle load of barge

LOADED / LIGHT	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	(3)	4	5
Tug Adequacy *(5 is most adequate)*:	1	2	3	4	(5)
Run Difficulty *(5 is most difficult)*:	1	2	(3)	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: narrow shoot through the bridge

   Tug Adequacy:

   Difficulty: narrow passage forces different track

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes but it seemed very tight

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes, seemed easier than it should have been to maneuver after the bridge

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes, assume it will be easier w/ I-5 real life depth perception

6. Please provide any comments on aids to navigation.

   no,

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   no

8. Additional Commentary:

   no

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15
Simulation #: 5-T
Tug Master: Josh N.

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: Maintained / Authorized

Transiting Channel: North / Center / (South)

Lift Span position: Up / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: (Daytime) / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name):*_____

Pushboat Position: Starboard / (Port)

Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*):_____

Environmental Conditions:

Wind *(Speed / Direction From)*: S 20th

River Flow *(Discharge)*: Transitional

Water Level:_____

Available Air Draft:_____

Barge Configuration:

Add Pushboat location & circle load of barge

(LOADED) / LIGHT	LOADED / LIGHT
(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Preferred this transit over the "as-designed" south construction span (most south)

Concerned about having enough air draft

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	(3)	4	5
Tug Adequacy *(5 is most adequate)*:	1	2	3	4	(5)
Run Difficulty *(5 is most difficult)*:	1	(2)	3	4	5

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Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: little more comfortable compared to other south construction channel

   Tug Adequacy:

   Difficulty: more room to start turn to BNSF earlier

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes, still very tight

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   No. At night a temp range would be useful.

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   No

8. Additional Commentary:

   No

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15
Simulation #: 6-T
Tug Master: Brian

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / (Construction) / Proposed
Starting Location: _____ **Ending Location:** _____
Direction of Transit: (Upbound) / Downbound
Dredge Depth: Maintained / Authorized
Transiting Channel: North / Center / (South)
Lift Span position: Up / Down
Vessel Load Condition: Loaded / Light
Time of Day: Daytime / Nighttime
Visibility: Clear / Nighttime
Pushboat (*Model/Power/Name*): _____
Pushboat Position: Starboard / Port
Barge: 2x2 Barge* (2x1 Barge*) 1x2 Barge*
Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind *(Speed / Direction From)*: S 20kts
River Flow *(Discharge)*: transitional flow
Water Level: _____
Available Air Draft: _____

Barge Configuration:
Add Pushboat location & circle load of barge

LOADED / (LIGHT)	LOADED / LIGHT
(LOADED) / LIGHT	LOADED / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	3	4	(5)
Tug Adequacy *(5 is most adequate)*:	1	2	3	4	(5)
Run Difficulty *(5 is most difficult)*:	1	(2)	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: Very comparable to transiting existing wide span

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes

6. Please provide any comments on aids to navigation.

   Was the existing red buoy in the existing location

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   Could be double w/ loaded 2x1 and maybe even a loaded 2x2

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15/23
Simulation #: 1 - C
Tug Master: Clark C.

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: (Existing) / Construction / Proposed
Starting Location: _____ **Ending Location:** _____
Direction of Transit: (Upbound) / Downbound
Dredge Depth: ~~Maintained~~ / Authorized
Transiting Channel: (North) / Center / South
Lift Span position: (Up) / Down
Vessel Load Condition: (Loaded) / Light
Time of Day: ~~Daytime~~ / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): # 3
Pushboat Position: Starboard / Port
Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*
(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): S 10 kts
River Flow (*Discharge*): Normal
Water Level: _____
Available Air Draft: _____

Barge Configuration:
Add Pushboat location & circle load of barge

Specialty

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	(LOADED) / LIGHT

Notes During Simulation:

pilot noted that they are going very slow for how much throttle is being used through the BNSF Bridge

radar not working, Chart not tracking

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	(2)	3	4	5
Tug Adequacy (*5 is most adequate*):	(1)	2	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	3	(4)	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: not enough power for a 1x4

   Tug Adequacy: underpowered for barge

   Difficulty: w/ this equipment it is difficult

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes,

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   No, equipment would be insufficient generally a little bit

6. Please provide any comments on aids to navigation.

   N/A

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 1115
Simulation #: 2-C*
Tug Master: Clark C.

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** ~~Existing~~ / Construction / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / Downbound

Dredge Depth: ~~Maintained~~ / Authorized **Transiting Channel:** North / Center / South

Lift Span position: Up / Down **Vessel Load Condition:** Loaded / Light

Time of Day: ~~Daytime~~ / Nighttime **Visibility:** Clear / Nighttime

Pushboat (*Model/Power/Name*): Twin Screw P-boat #3 **Pushboat Position:** Starboard / Port

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

Specialty Barge (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 5 - 10 knots River Flow (*Discharge*): transitional

Water Level: _____ Available Air Draft: 9.8 ft

Barge Configuration:
Add Pushboat location & circle load of barge

Special

LOADED / LIGHT	LOADED / LIGHT
LOADED / LIGHT	LOADED / LIGHT

Notes During Simulation:

*Hit north abutment on I-5 bridge

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	(1)	2	3	4	5
Tug Adequacy (*5 is most adequate*):	1	(2)	3	4	5
Run Difficulty (*5 is most difficult*):	1	2	3	4	(5)

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: low horse power, higher flow than what he would operate under

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes, experienced big shift upriver of I-5 bridge leading to collision

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes, not out of the ordinary

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   No, too high flows, typ. won't transit w/ flow over 250,000 cfs (200,000 w/ this load) + no wind

6. Please provide any comments on aids to navigation.

   No

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

   No

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15
Simulation #: 3-C
Tug Master: Clark C.

Simulation Summary:

Vessel Type: Shallow-Draft

Scenario: Existing / Construction / (Proposed)

Starting Location: _____ **Ending Location:** _____

Direction of Transit: (Upbound) / Downbound

Dredge Depth: Maintained / Authorized

Transiting Channel: North / (Center) / South

Lift Span position: (Up) / Down

Vessel Load Condition: (Loaded) / Light

Time of Day: ~~Daytime~~ / Nighttime

Visibility: (Clear) / Nighttime

Pushboat (*Model/Power/Name*): Push #3

Pushboat Position: Starboard / Port

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge) (Max Air Draft) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind (*Speed / Direction From*): 5 10kts

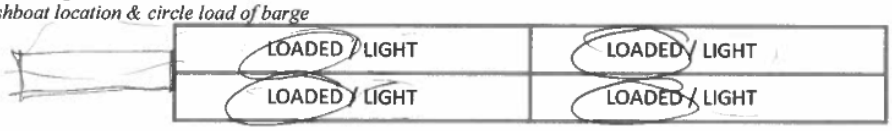
River Flow (*Discharge*): Normal

Water Level: _____

Available Air Draft: _____

Barge Configuration:

Add Pushboat location & circle load of barge



Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety (*5 is safest*):	1	2	3	(4)	5
Tug Adequacy (*5 is most adequate*):	1	2	3	(4)	5
Run Difficulty (*5 is most difficult*):	1	(2)	3	4	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety:

   Tug Adequacy:

   Difficulty: wider span helps, more leeway

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes, seemed like it was realistic for flow + horsepower

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   Yes, depending on the wind

6. Please provide any comments on aids to navigation.

   On the radar, the green can was hard to pick out against the bridge abutment

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   NO

8. Additional Commentary:

   No

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15
Simulation #: 4-c
Tug Master: Clark C.

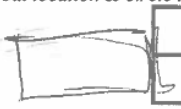
Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)
Dredge Depth: Maintained / Authorized
Transiting Channel: North / (Center) / South
Lift Span position: (Up) / Down
Vessel Load Condition: (Loaded) / Light
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): Push #3
Pushboat Position: Starboard / Port
Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*
(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind *(Speed / Direction From)*: S 10kts
River Flow *(Discharge)*: Transitional
Water Level: _____
Available Air Draft: _____

Barge Configuration:
Add Pushboat location & circle load of barge



(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	(LOADED) / LIGHT

Notes During Simulation:

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	2	3	(4)	5
Tug Adequacy *(5 is most adequate)*:	1	2	3	(4)	5
Run Difficulty *(5 is most difficult)*:	1	2	3	(4)	5

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: high flow w/ toe w/ limited visibility
   5 w/ more visibility

   Tug Adequacy:

   Difficulty: limited visibility, would go down to 3 w/ better vis.

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   Yes

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   No, would at 150k cfs but too much flow. Not a result of prop. bridge config.

6. Please provide any comments on aids to navigation.

   No

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   No

8. Additional Commentary:

   No

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15
Simulation #: 5-C*
Tug Master: Clark C.

Simulation Summary:

Vessel Type: Shallow-Draft
Scenario: Existing / Construction / (Proposed)
Starting Location: _____ **Ending Location:** _____ **Direction of Transit:** Upbound / (Downbound)
Dredge Depth: Maintained / Authorized
Transiting Channel: North / Center / (South)
Lift Span position: (Up) / Down
Vessel Load Condition: (Loaded) / Light
Time of Day: (Daytime) / Nighttime
Visibility: (Clear) / Nighttime
Pushboat (*Model/Power/Name*): _____
Pushboat Position: Starboard / Port
Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*
(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)
*Barge wide x long
Assist Tug (*if applicable – Model/Power/Name*): _____

Environmental Conditions:

Wind *(Speed / Direction From)*: S 10kts
River Flow *(Discharge)*: transitional
Water Level: _____
Available Air Draft: _____

Barge Configuration:
Add Pushboat location & circle load of barge

Special

(LOADED) / LIGHT	(LOADED) / LIGHT
(LOADED) / LIGHT	(LOADED) / LIGHT

Notes During Simulation:

*hit I-5 bridge

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	(1)	2	3	4	5
Tug Adequacy *(5 is most adequate)*:	1	2	(3)	4	5
Run Difficulty *(5 is most difficult)*:	1	2	3	4	(5)

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: given tow w/ bad visibility w/ high flow

   Tug Adequacy:

   Difficulty:

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   No, load, visibility, & flow conditions

3. Were the maneuvering areas sufficient for the intended track?

   Yes

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   No, not a 400,000 cfs w/ the given tow. Even w/ typical tow it would be dependent on a careful review of env. conditions

6. Please provide any comments on aids to navigation.

   No, okay

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

   No

8. Additional Commentary:

   No

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213196 Interstate Bridge Replacement Navigation Simulations
Simulation Summary, Notes, & Tug Master Evaluation
Vancouver, WA

Date: 11/15
Simulation #: 6-C*
Tug Master: ClarkC.

Simulation Summary:

Vessel Type: Shallow-Draft **Scenario:** Existing / (Construction) / Proposed

Starting Location:_____ **Ending Location:**_____ **Direction of Transit:** Upbound / (Downbound)

Dredge Depth: Maintained / Authorized **Transiting Channel:** North / Center / (South)

Lift Span position: Up / Down **Vessel Load Condition:** (Loaded) / Light

Time of Day: (Daytime) / Nighttime **Visibility:** (Clear) / Nighttime

Pushboat (*Model/Power/Name):*_____ **Pushboat Position:** Starboard / Port

Barge: 2x2 Barge* 2x1 Barge* 1x2 Barge*

(Specialty Barge (Max Air Draft)) Specialty Barge (Limited Air Draft)

*Barge wide x long

Assist Tug (*if applicable – Model/Power/Name*):_____

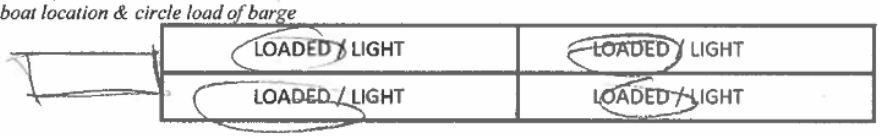
Environmental Conditions:

Wind *(Speed / Direction From)*: S 10 Kts River Flow *(Discharge)*: transitional

Water Level:_____ Available Air Draft:_____

Barge Configuration:

Add Pushboat location & circle load of barge



Notes During Simulation:

*hit I-5 (new)

Run would be doable in the real world if he could line up as far up river as he would like

Summary Ratings for Safety, Tug Adequacy, and Difficulty:

Run Safety *(5 is safest)*:	1	(2)	3	4	5
Tug Adequacy *(5 is most adequate)*:	1	2	(3)	4	5
Run Difficulty *(5 is most difficult)*:	1	2	3	4	(5)

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213196 Interstate Bridge Replacement Program Navigation Simulations
Simulation Summary, Notes, & Pilot Evaluation
Vancouver, WA

Post Simulation Review/Debrief:

1. Any qualification regarding the simulation summary ratings?

   Safety: high flow + low horse power

   Tug Adequacy:

   Difficulty: high flow + start point + low horse power

2. Were you able to maintain the intended track line and voyage plan on this exercise? (If not, why?)

   No, due to high flow + starting point

3. Were the maneuvering areas sufficient for the intended track?

   very tight

4. Did the ship model react as expected with the given environmental conditions? If not, what was different?

   Yes

5. Would you perform a similar transit / maneuver in a real-world situation? If not, why?

   No, flow + horse power

6. Please provide any comments on aids to navigation.

   no
   a temp range would be useful

7. Are there any extenuating circumstances that should be taken into account when examining the results of this simulation exercise?

8. Additional Commentary:

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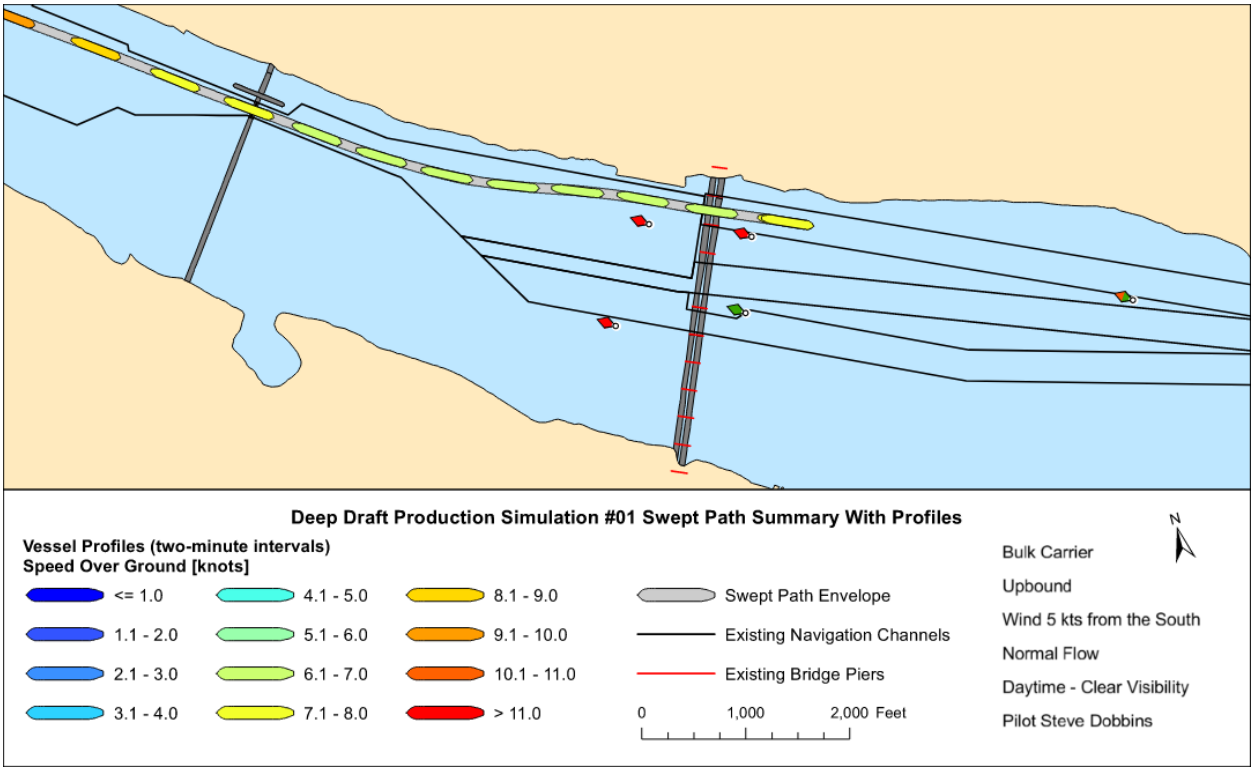
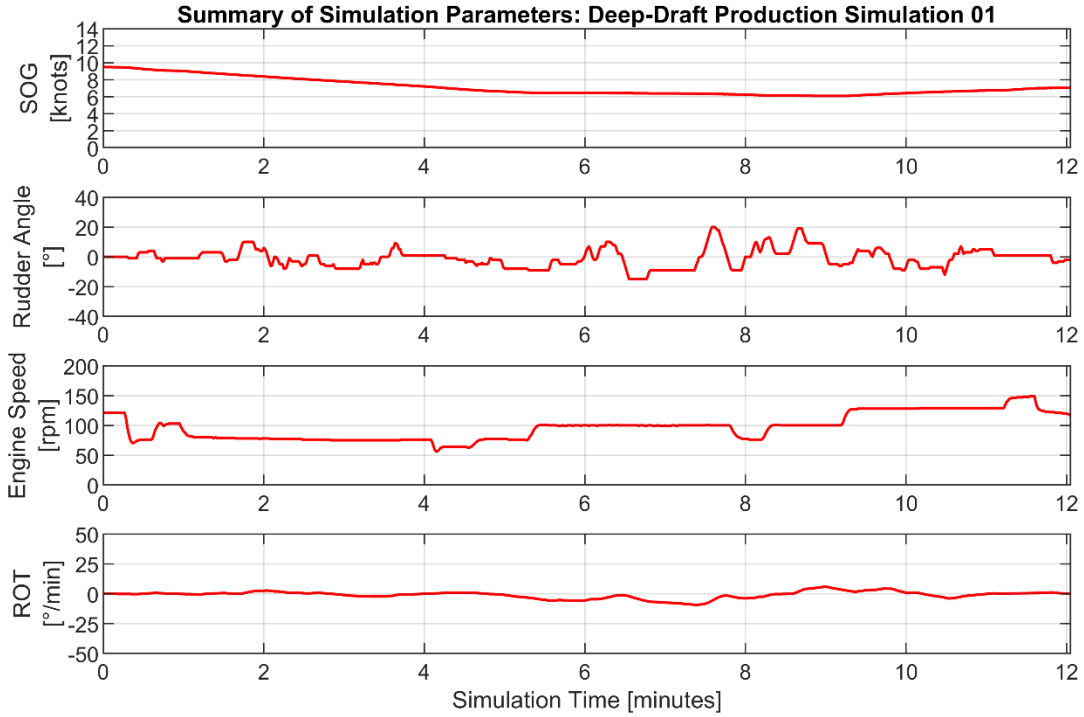
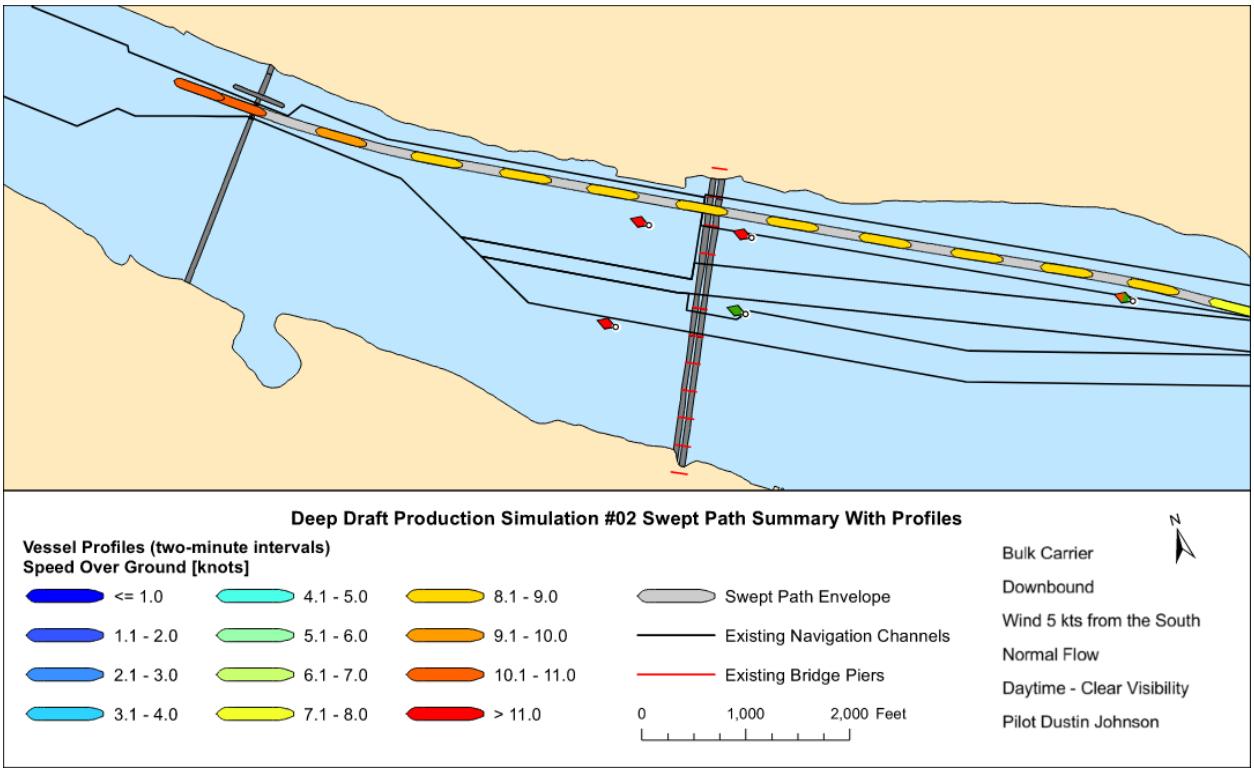
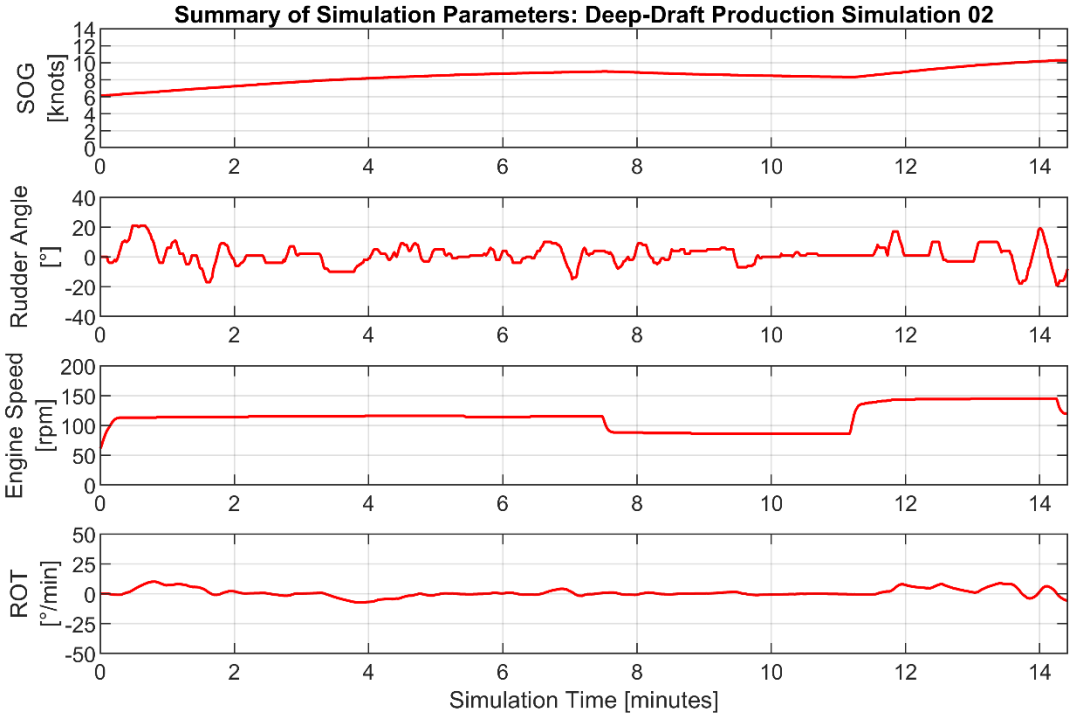
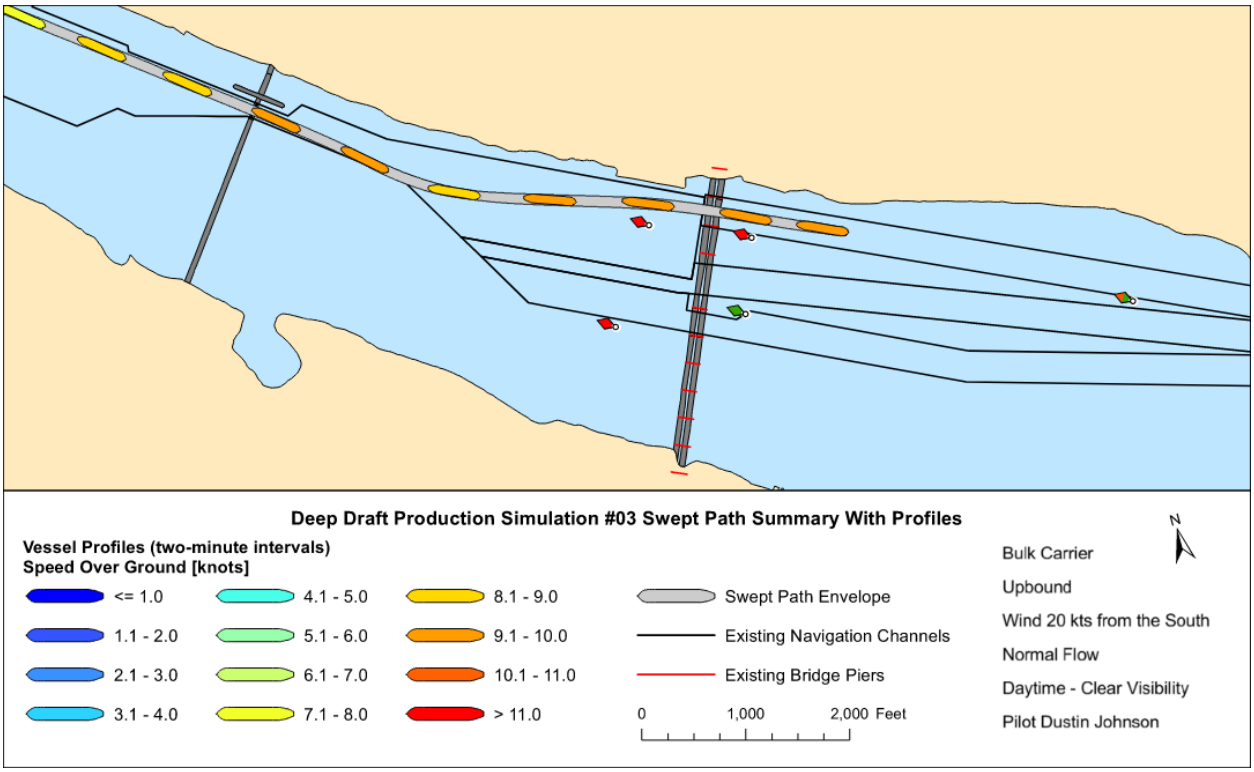
APPENDIX D: SWEPT PATH FIGURES AND TIME SERIES PLOTS

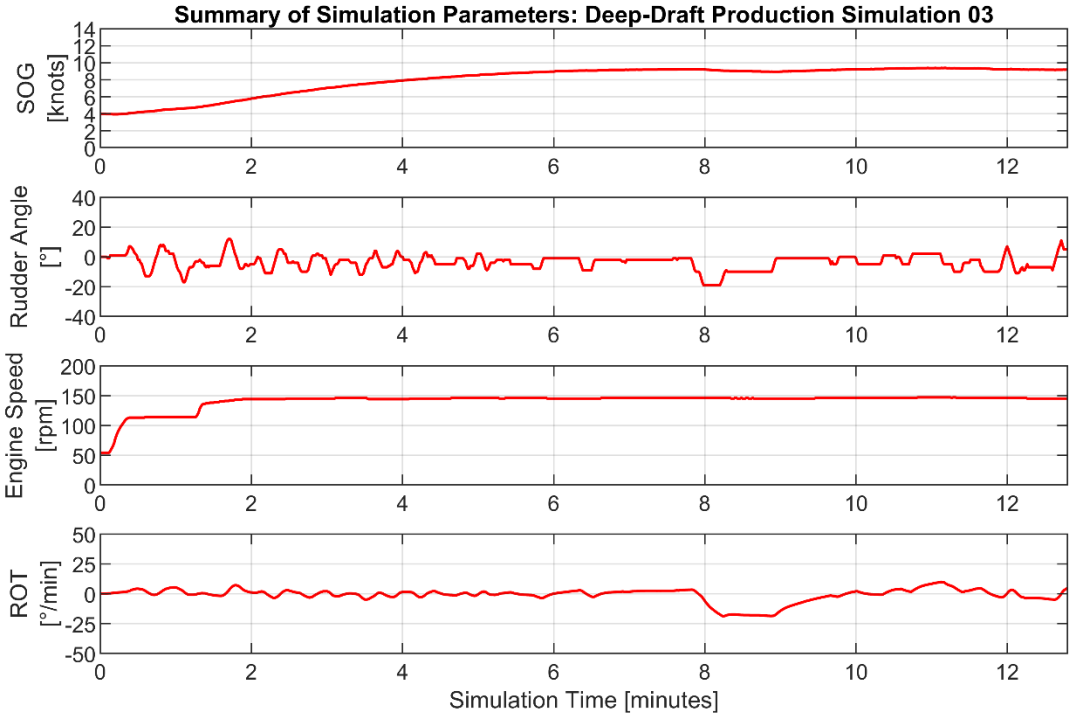

Deep Draft Production Simulation #01 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 5 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Steve Dobbins

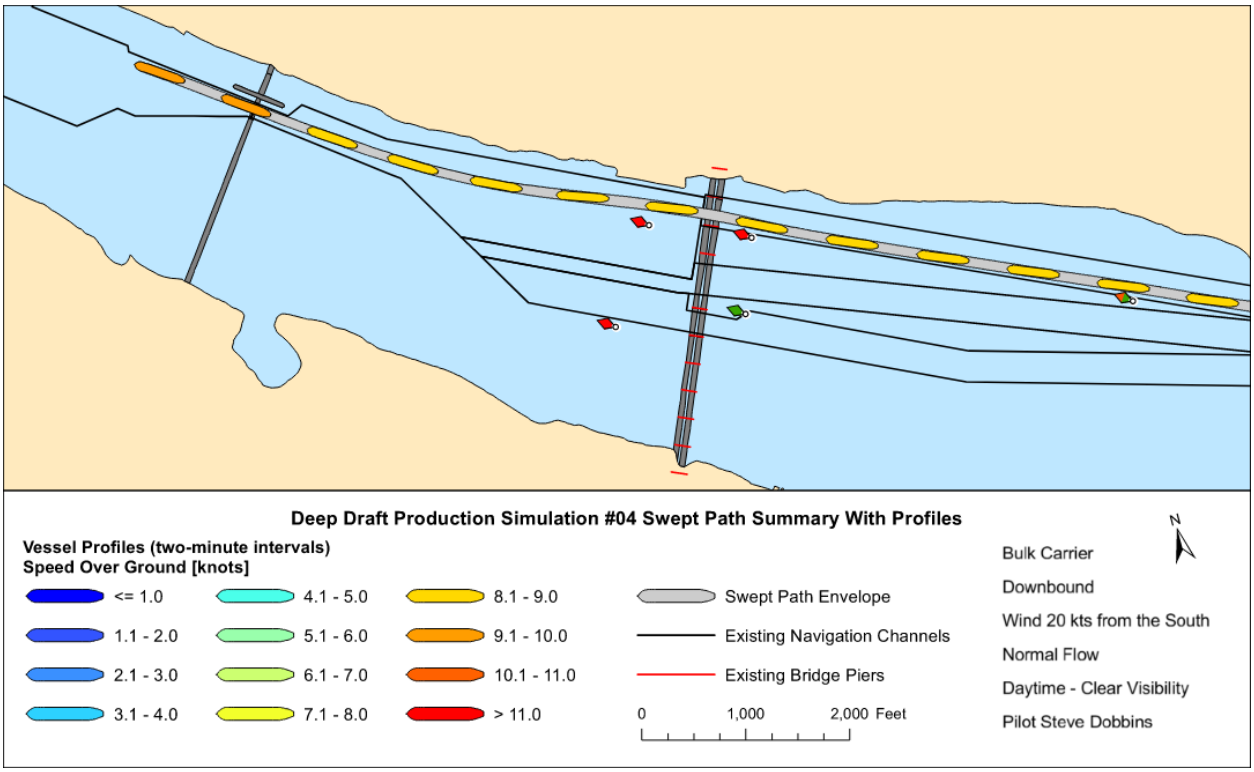

Summary of Simulation Parameters: Deep-Draft Production Simulation 01
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

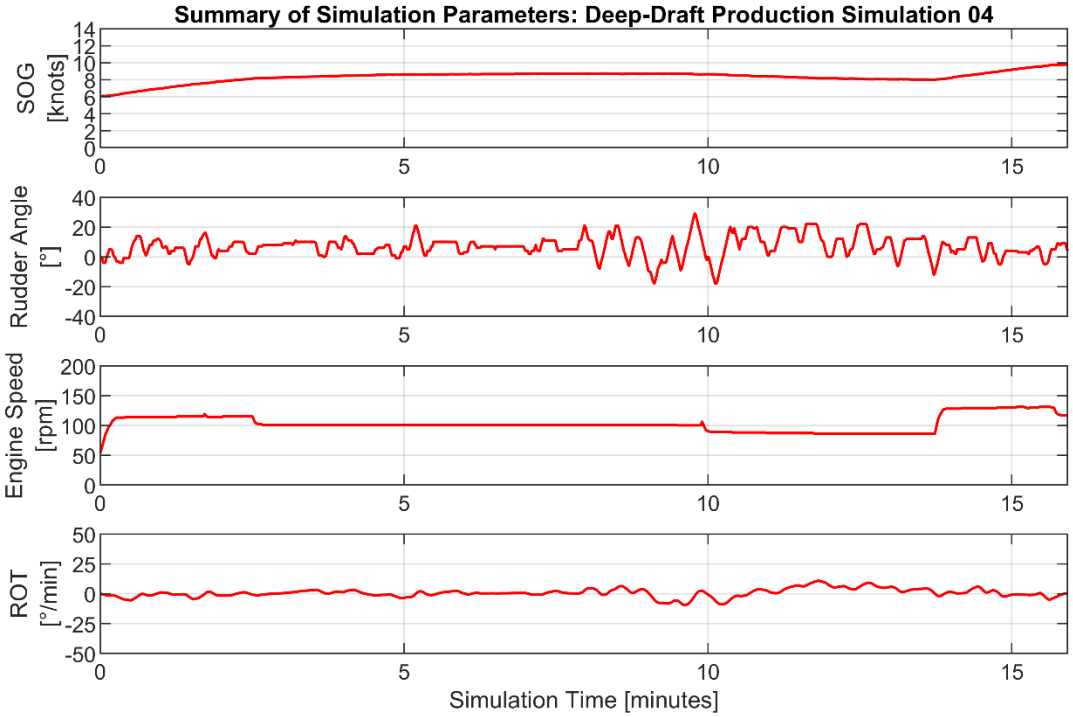

Deep Draft Production Simulation #02 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Downbound
Wind 5 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

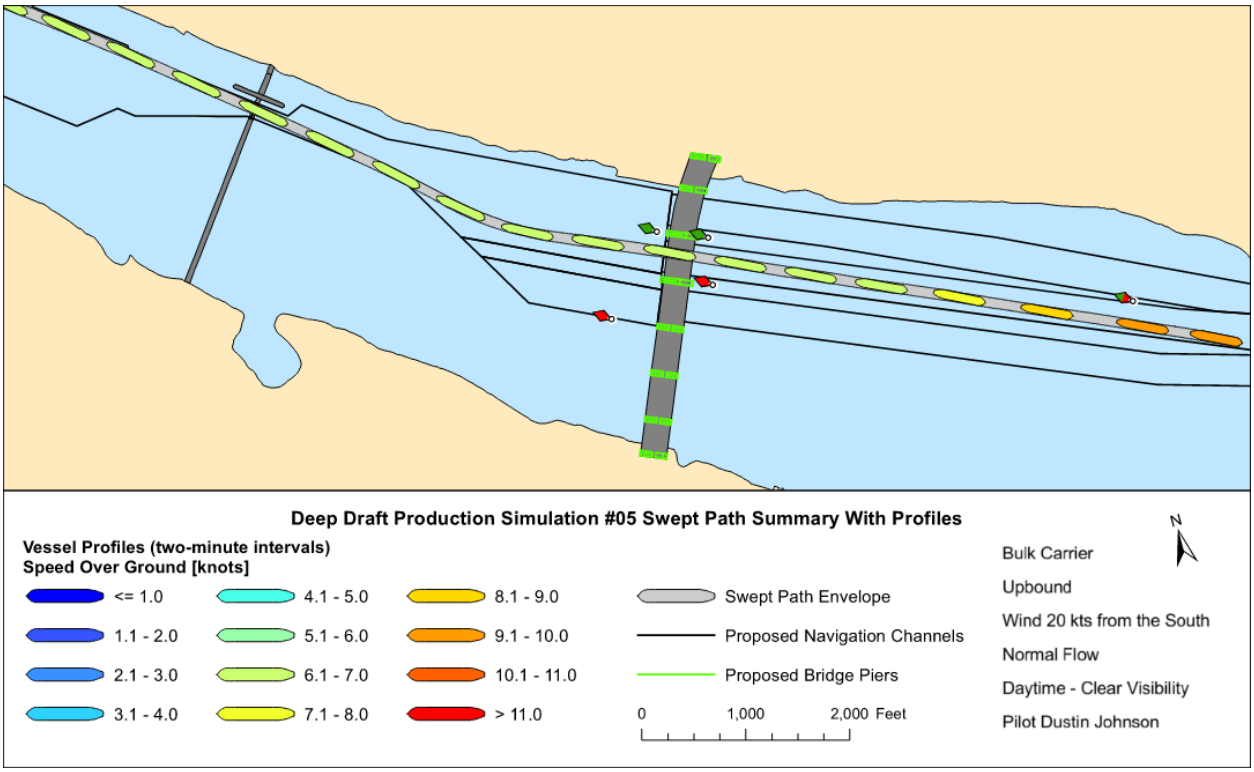

Summary of Simulation Parameters: Deep-Draft Production Simulation 02
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

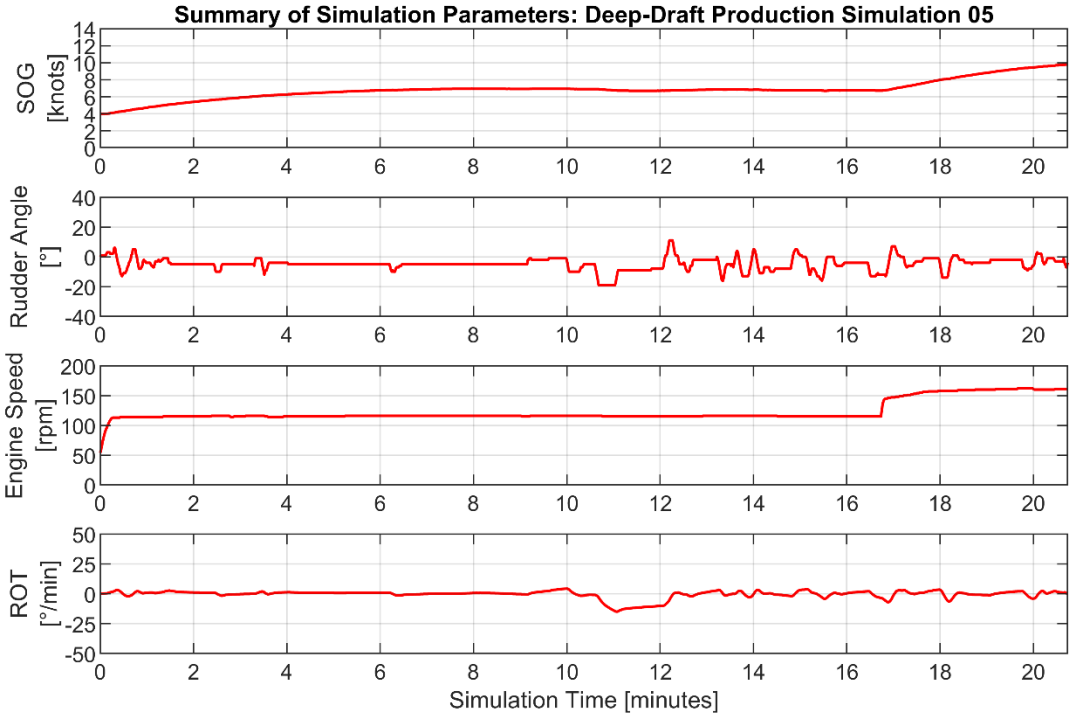

Deep Draft Production Simulation #03 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 20 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

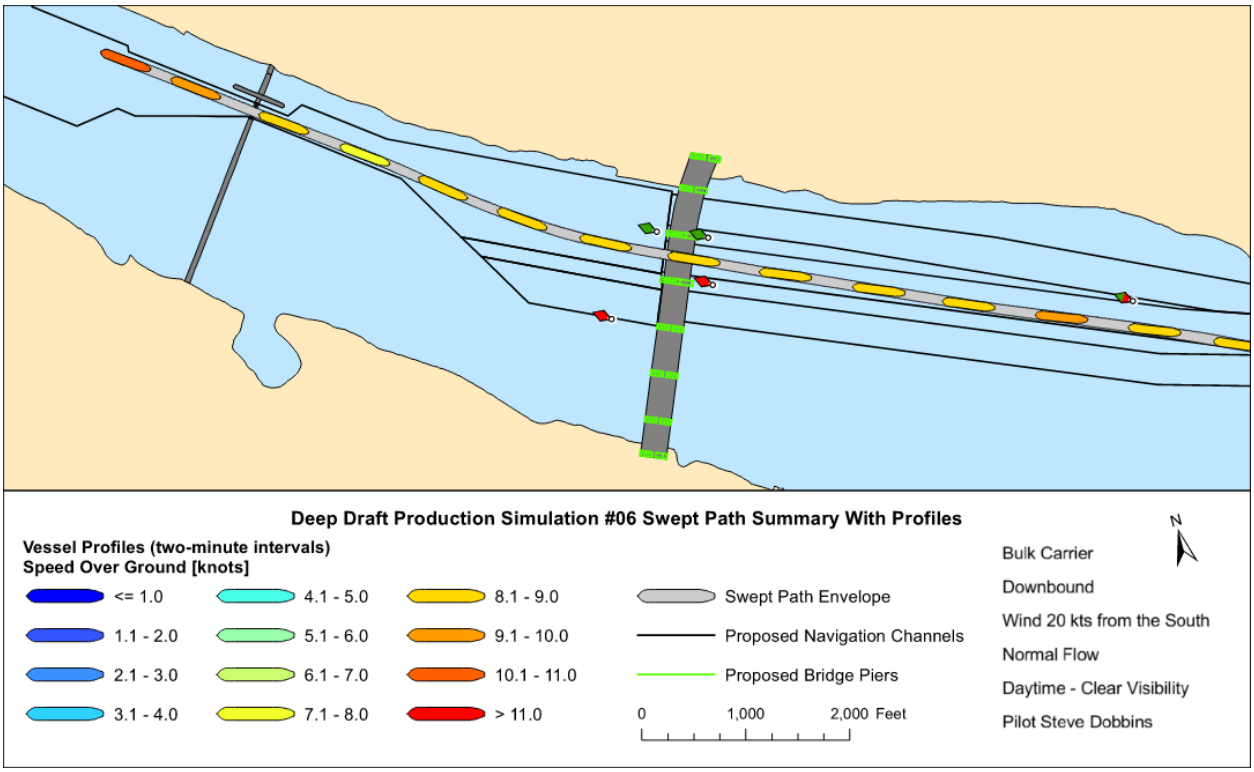

Summary of Simulation Parameters: Deep-Draft Production Simulation 03
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

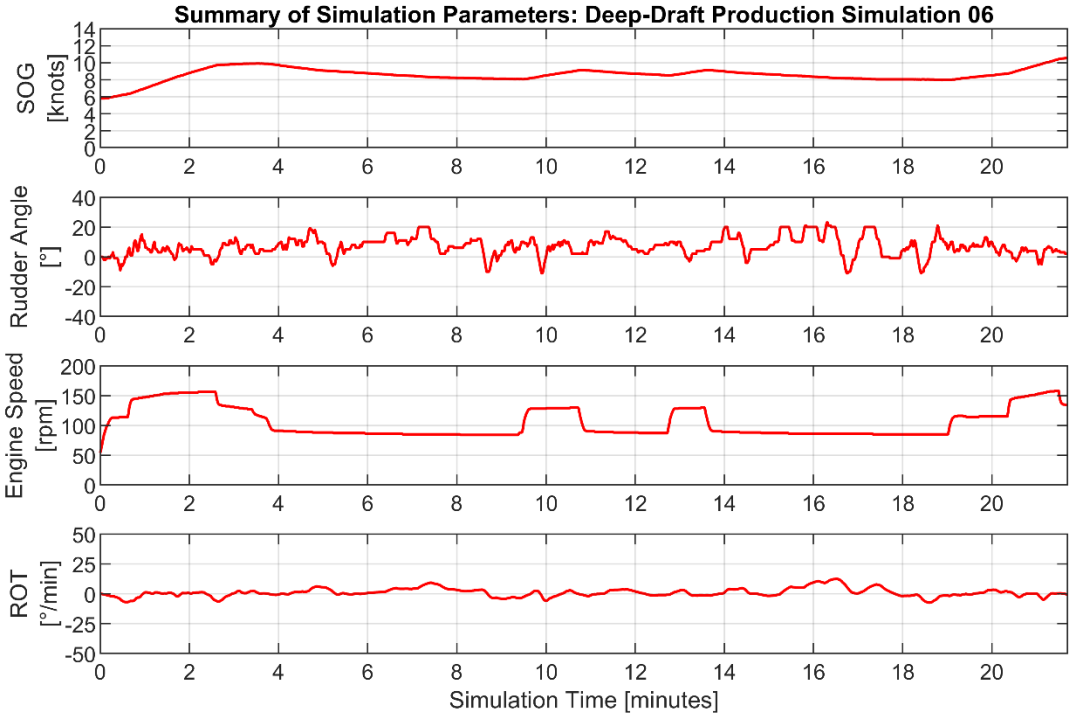

Deep Draft Production Simulation #04 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Downbound
Wind 20 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Steve Dobbins

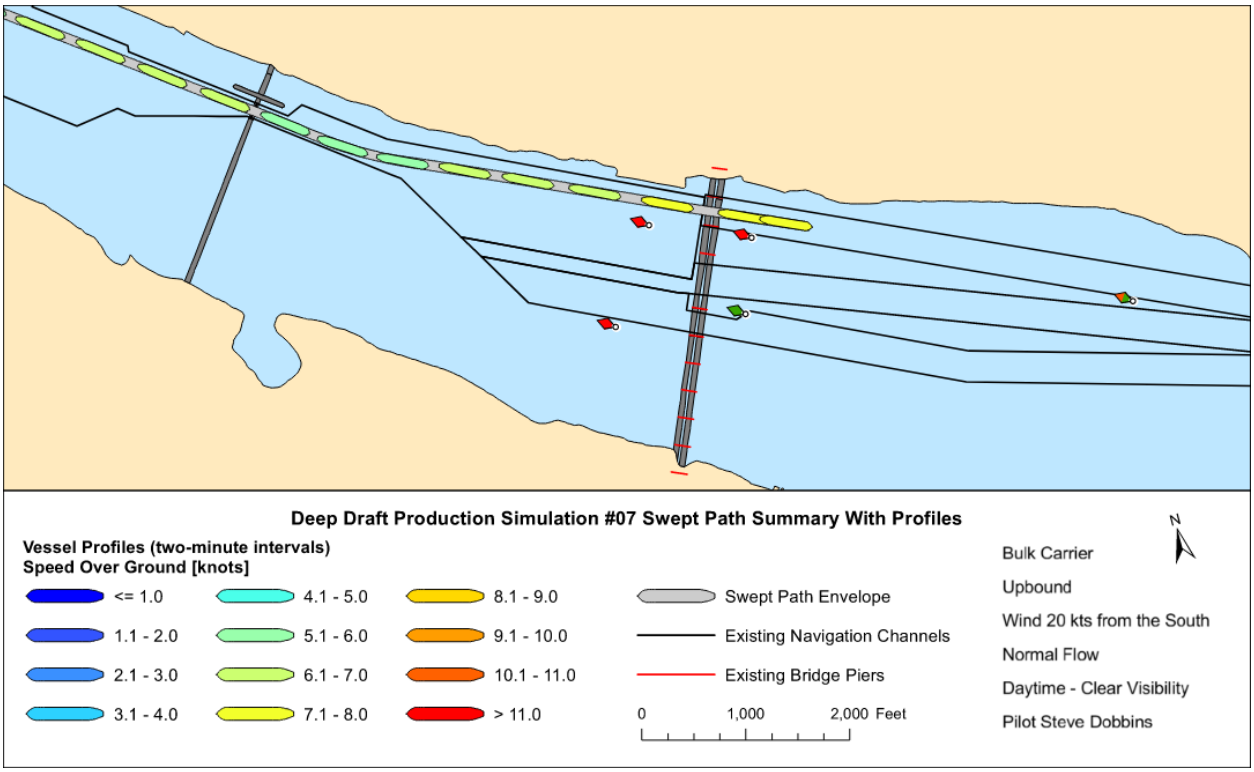

Summary of Simulation Parameters: Deep-Draft Production Simulation 04
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

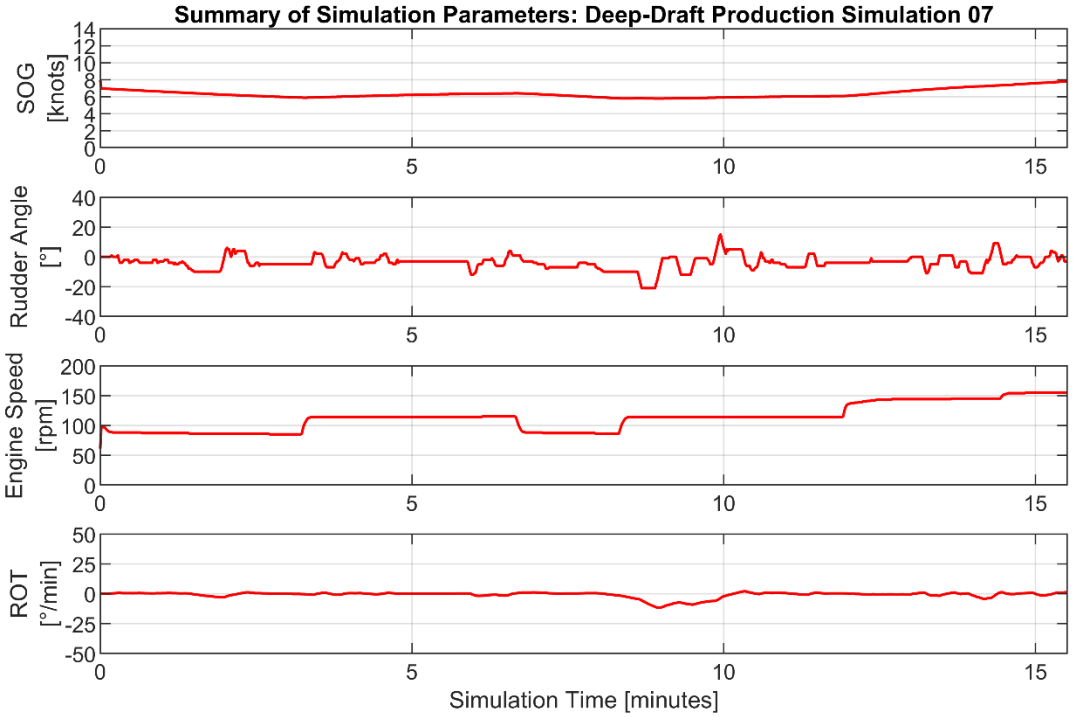

Deep Draft Production Simulation #05 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 20 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

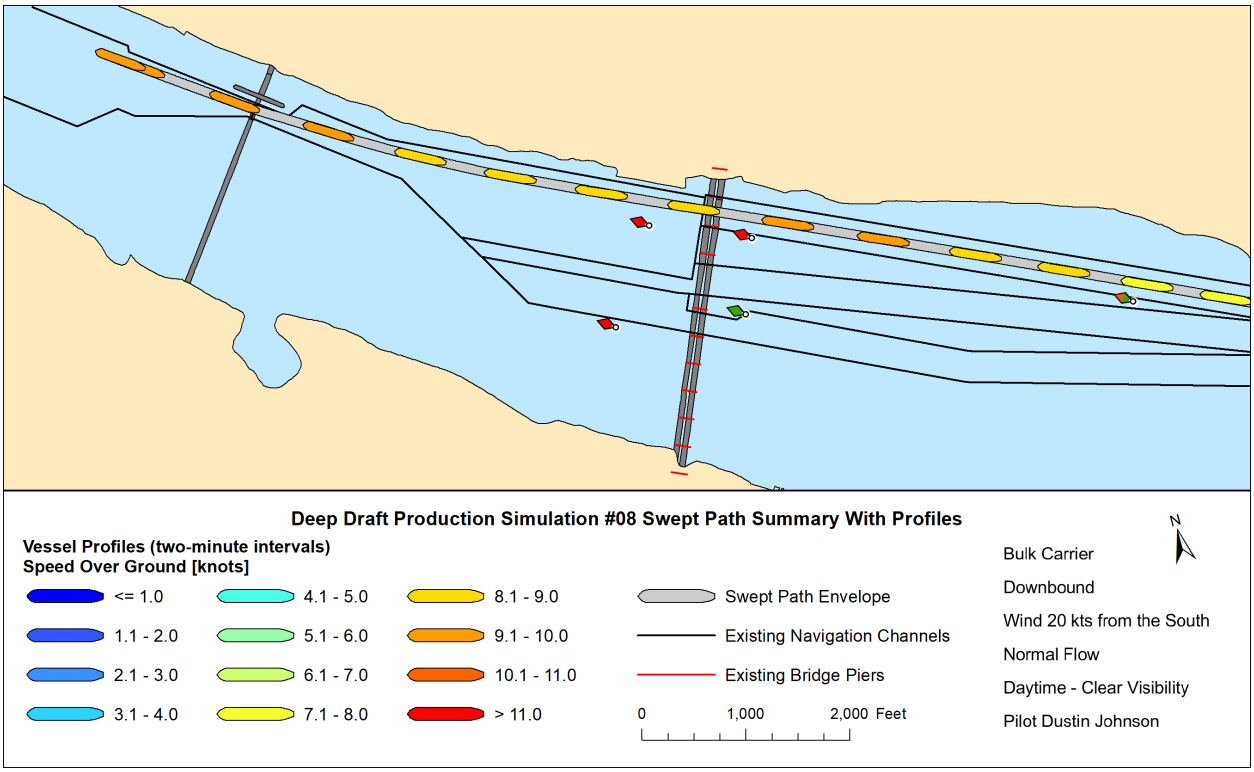

Summary of Simulation Parameters: Deep-Draft Production Simulation 05
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

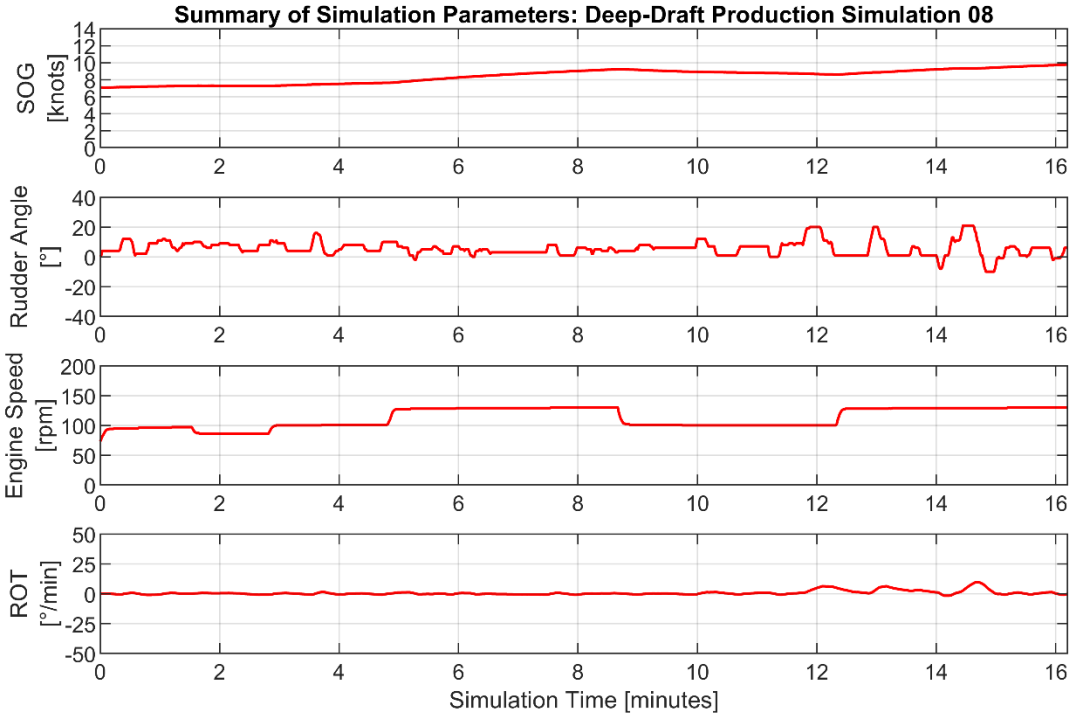

Deep Draft Production Simulation #06 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Downbound
Wind 20 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Steve Dobbins

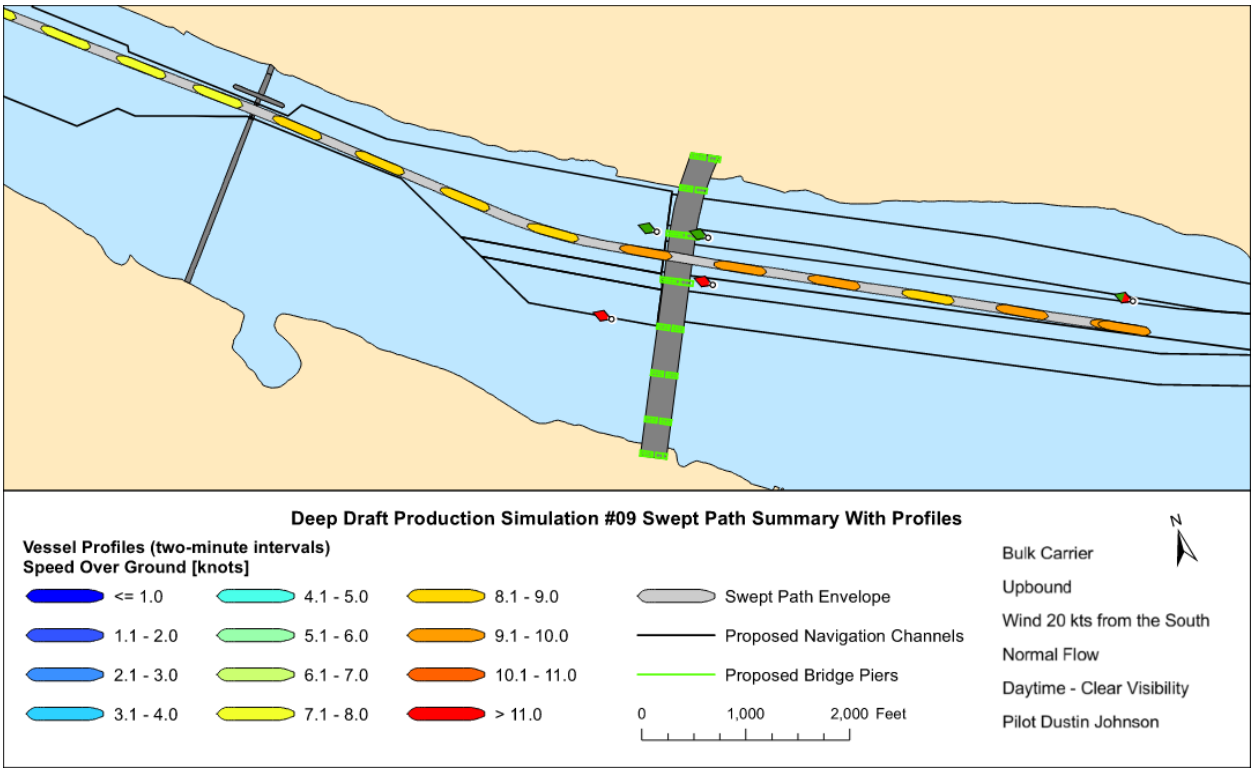

Summary of Simulation Parameters: Deep-Draft Production Simulation 06
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

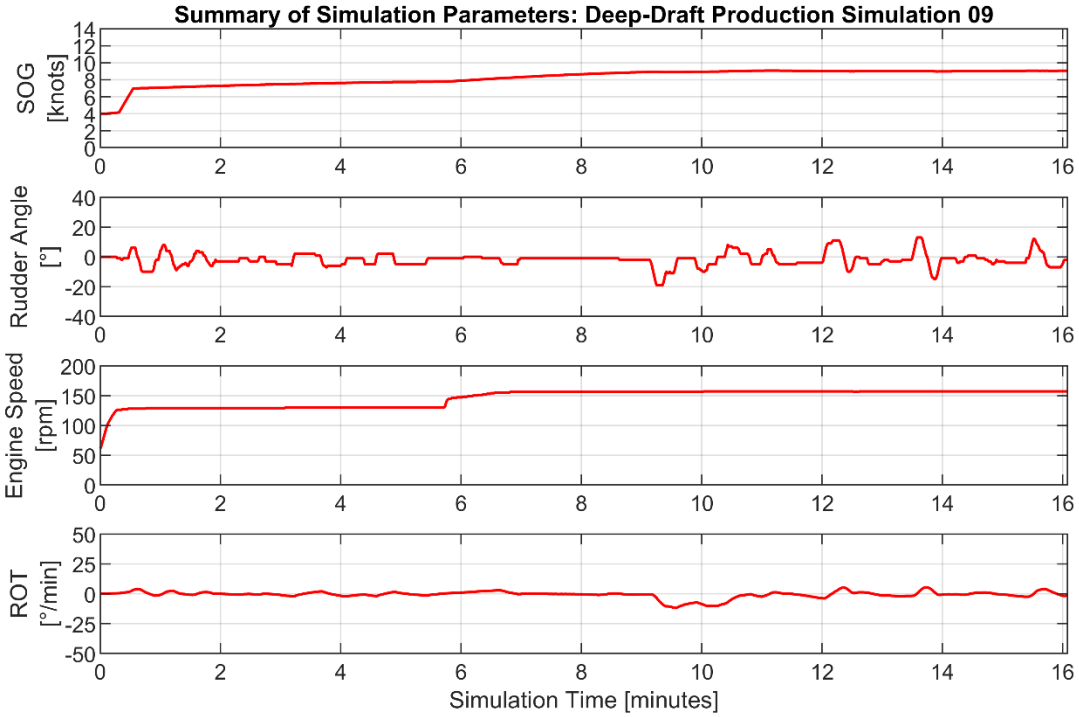

Deep Draft Production Simulation #07 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 20 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Steve Dobbins

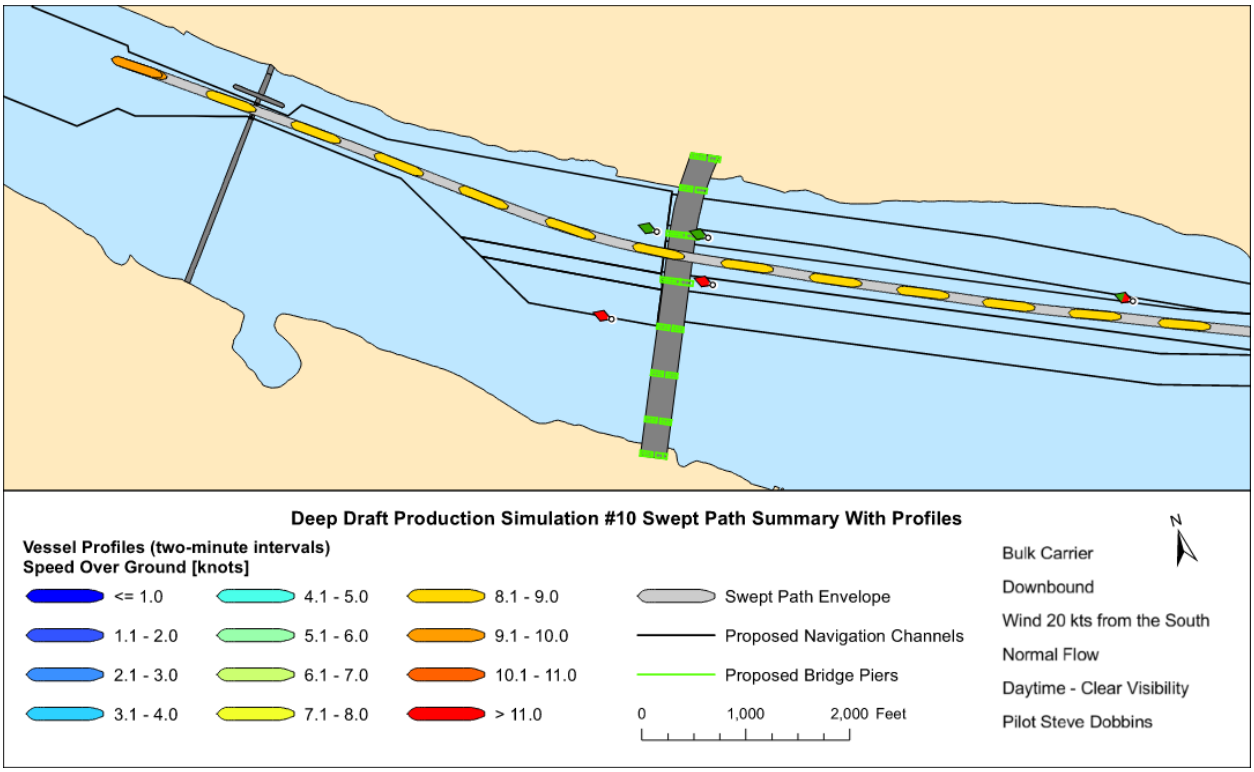

Summary of Simulation Parameters: Deep-Draft Production Simulation 07
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

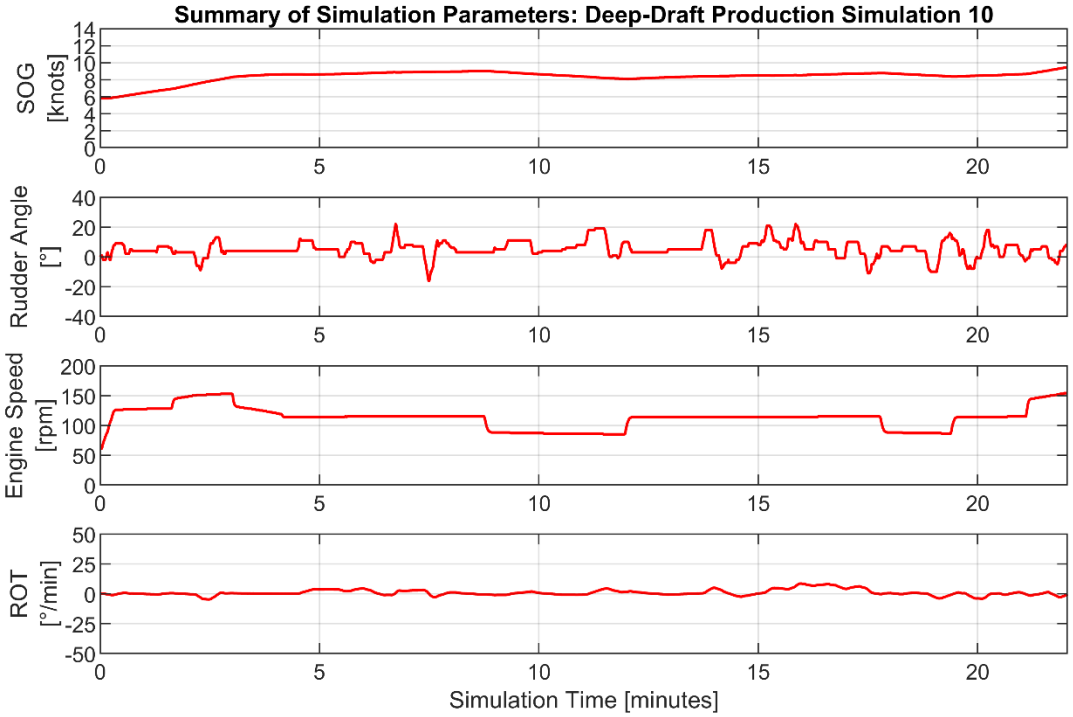

Deep Draft Production Simulation #08 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Downbound
Wind 20 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

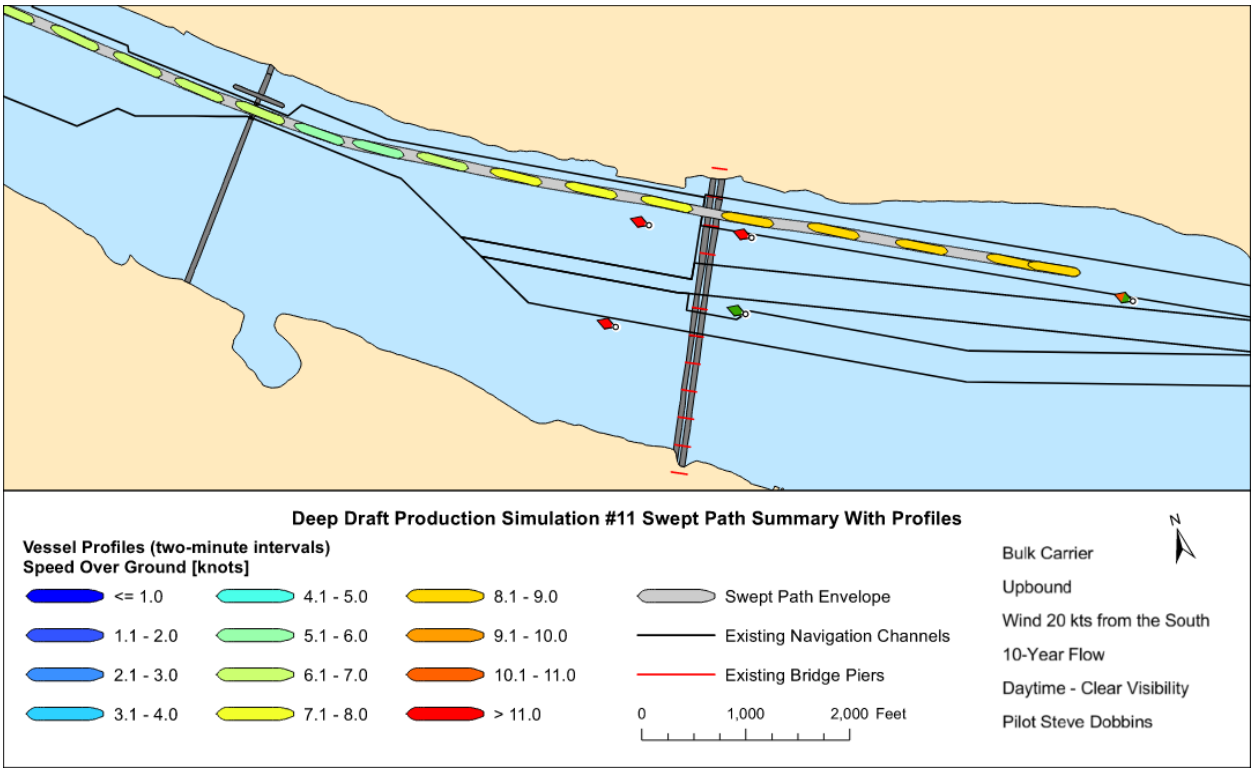

Summary of Simulation Parameters: Deep-Draft Production Simulation 08
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

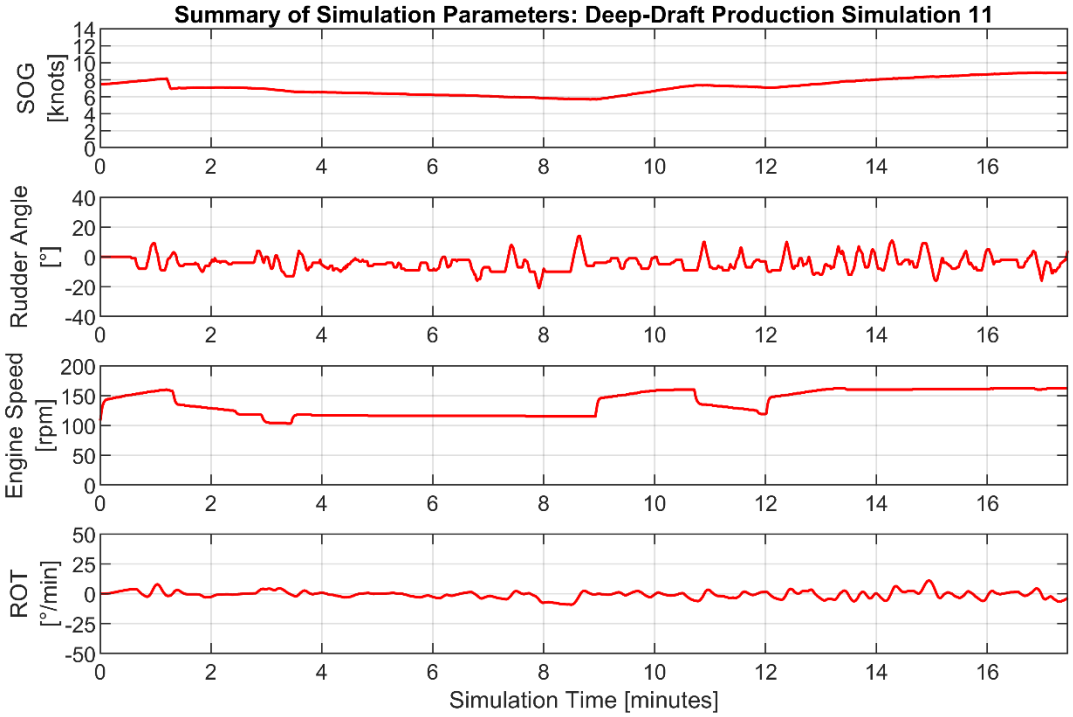

Deep Draft Production Simulation #09 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 20 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

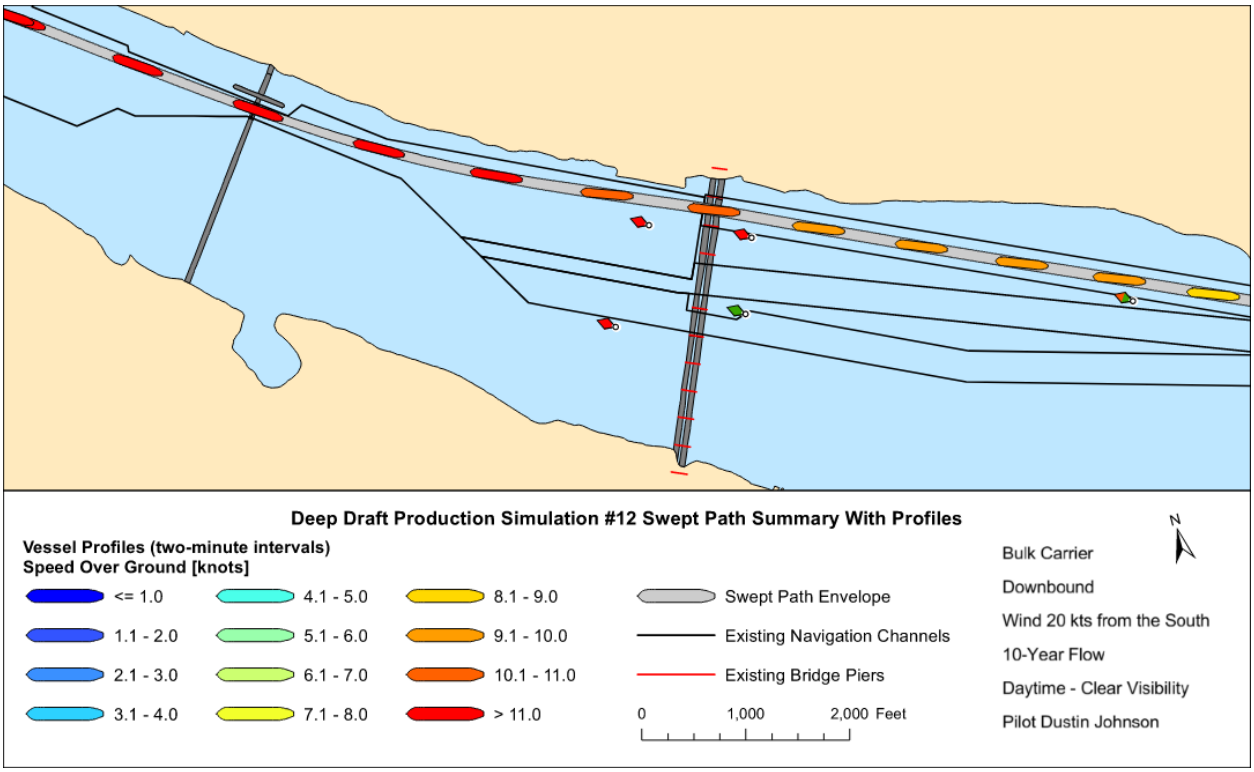

Summary of Simulation Parameters: Deep-Draft Production Simulation 09
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

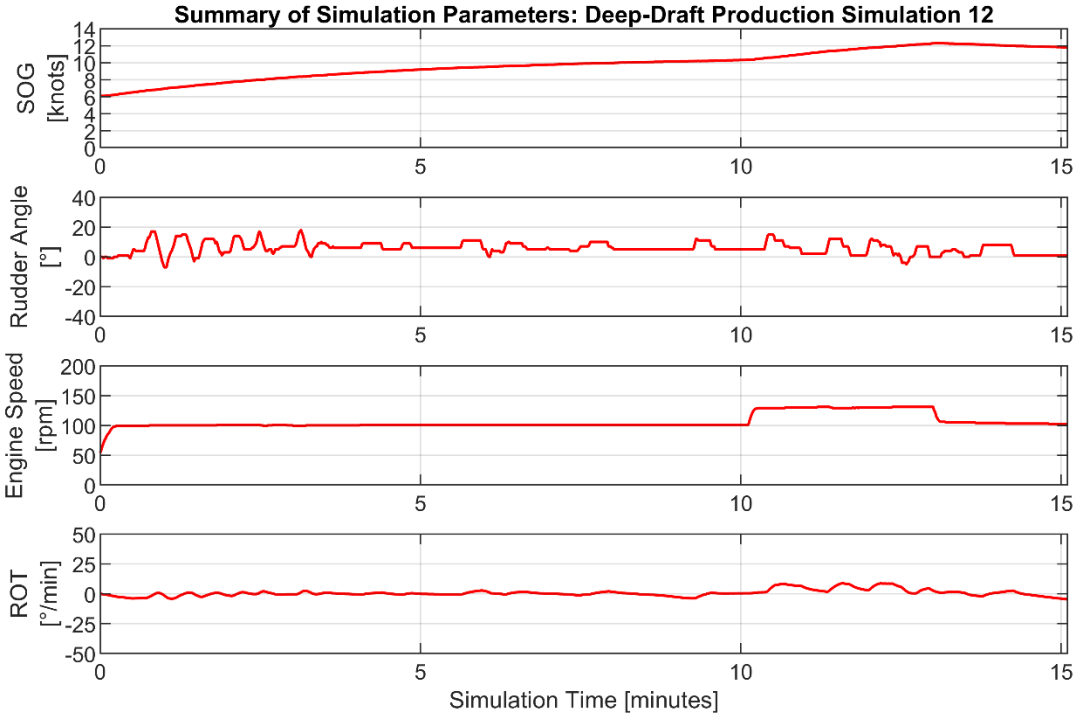

Deep Draft Production Simulation #10 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Downbound
Wind 20 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Steve Dobbins

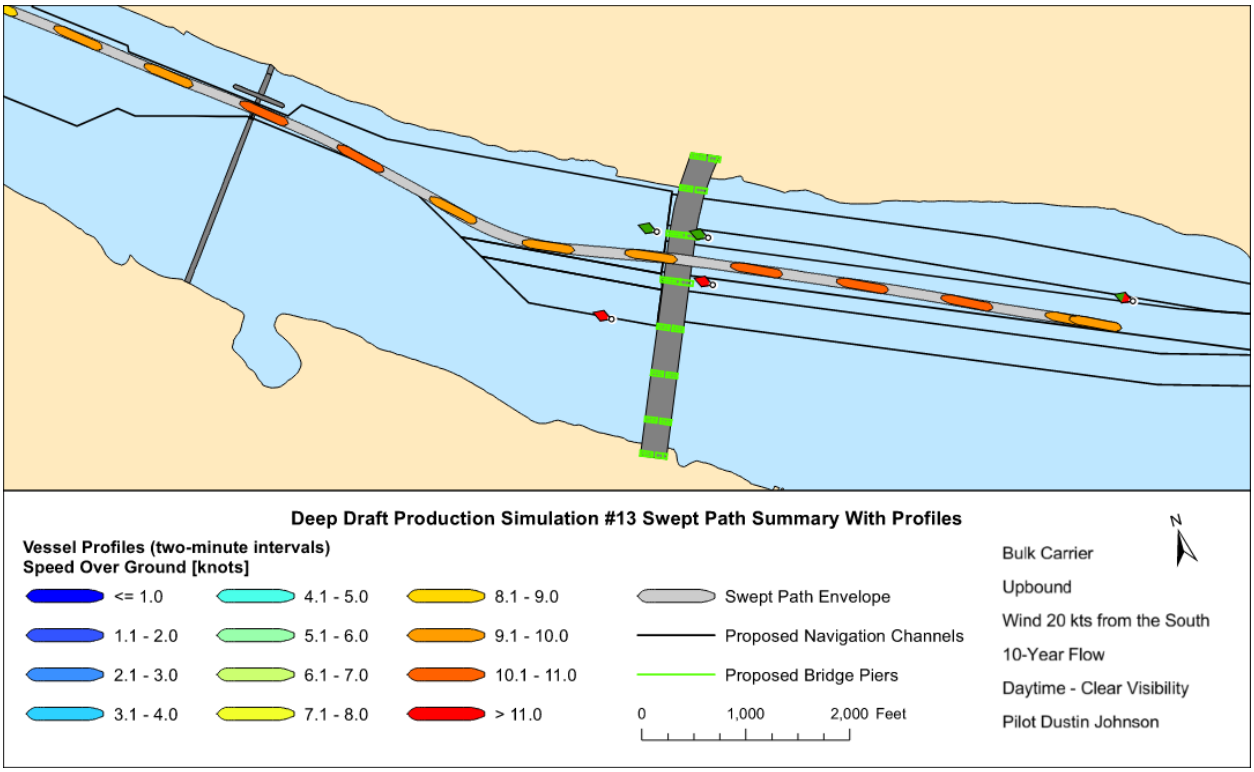

Summary of Simulation Parameters: Deep-Draft Production Simulation 10
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

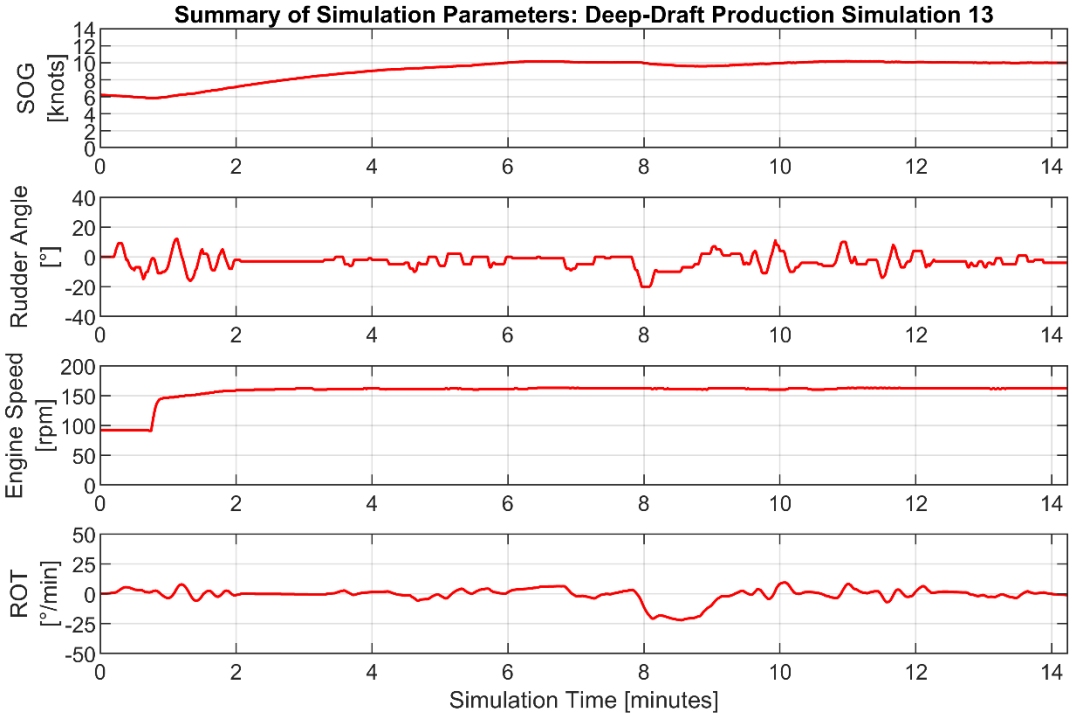

Deep Draft Production Simulation #11 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 20 kts from the South
10-Year Flow
Daytime - Clear Visibility
Pilot Steve Dobbins

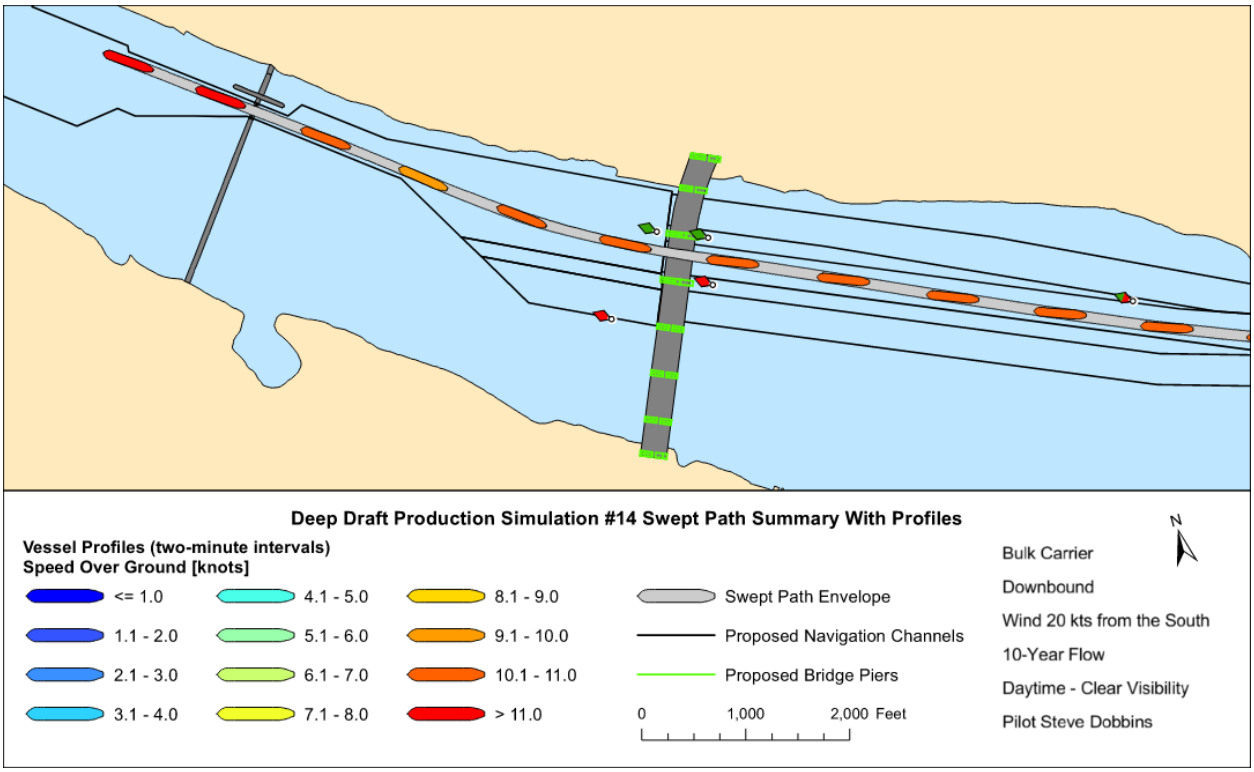

Summary of Simulation Parameters: Deep-Draft Production Simulation 11
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

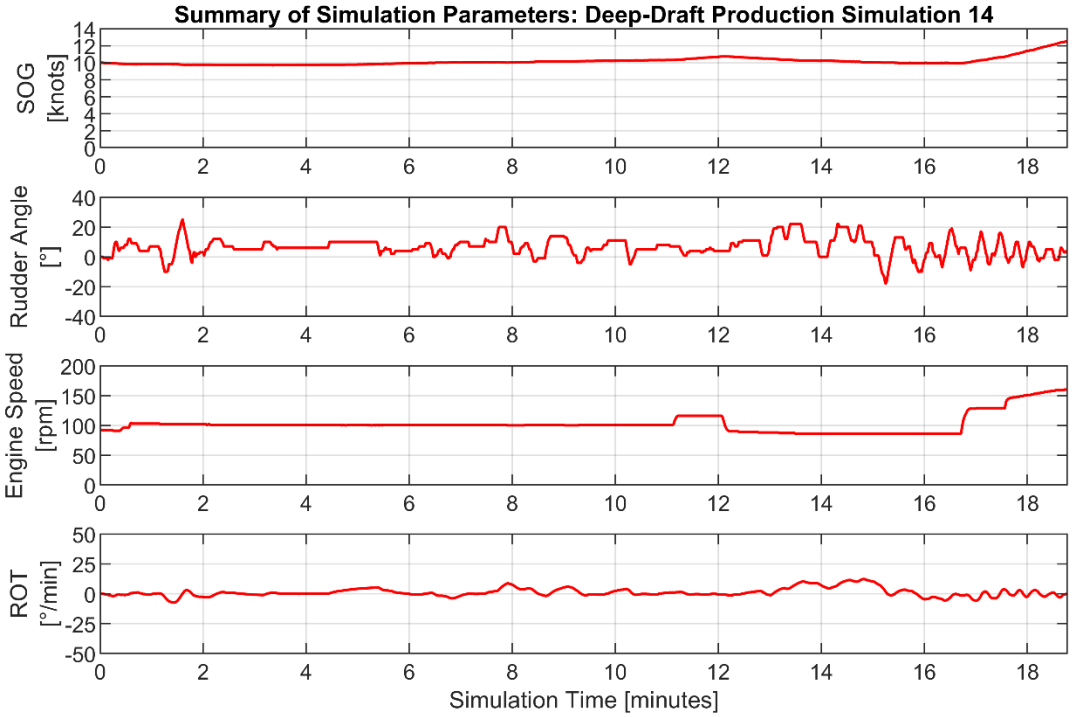

Deep Draft Production Simulation #12 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Downbound
Wind 20 kts from the South
10-Year Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

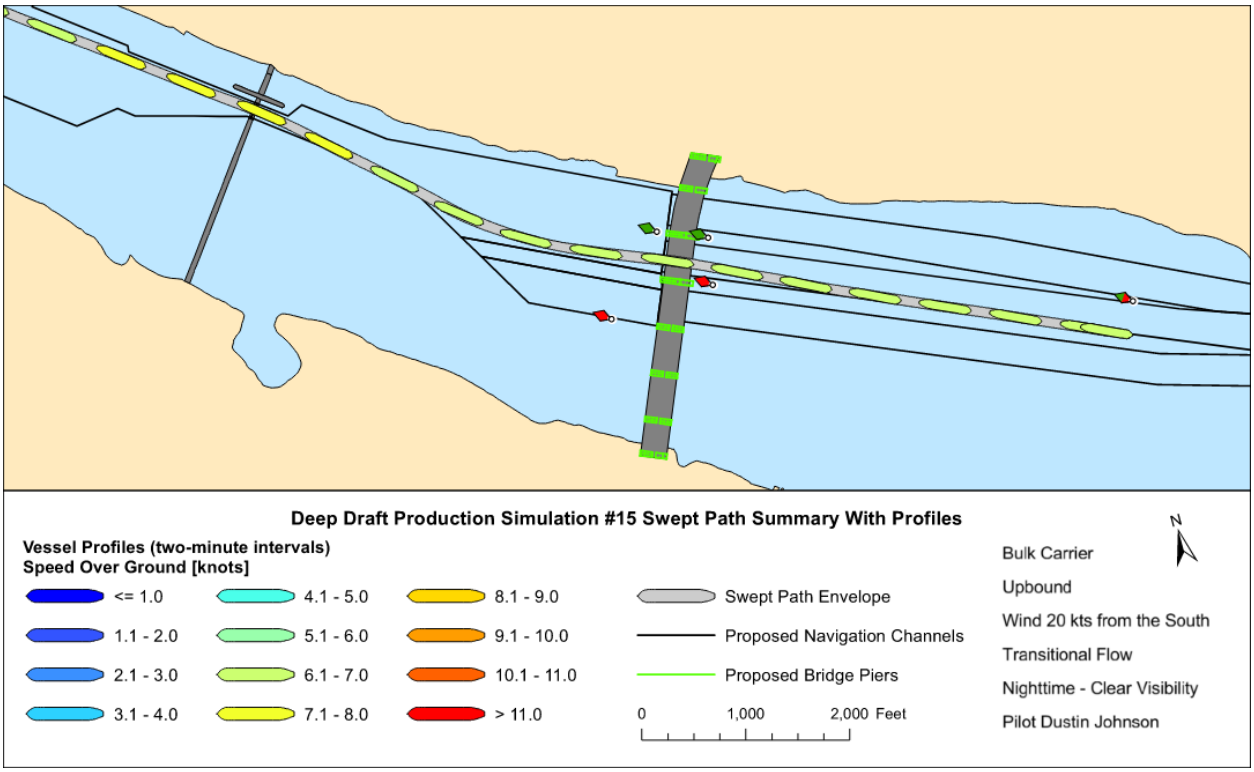

Summary of Simulation Parameters: Deep-Draft Production Simulation 12
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

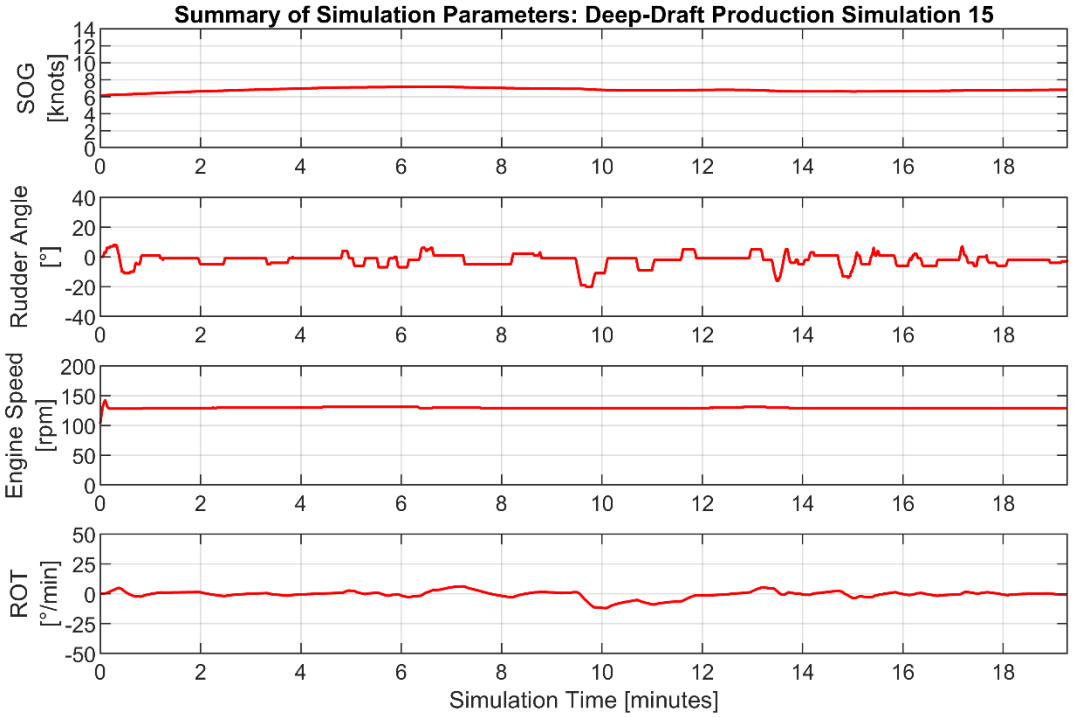

Deep Draft Production Simulation #13 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 20 kts from the South
10-Year Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

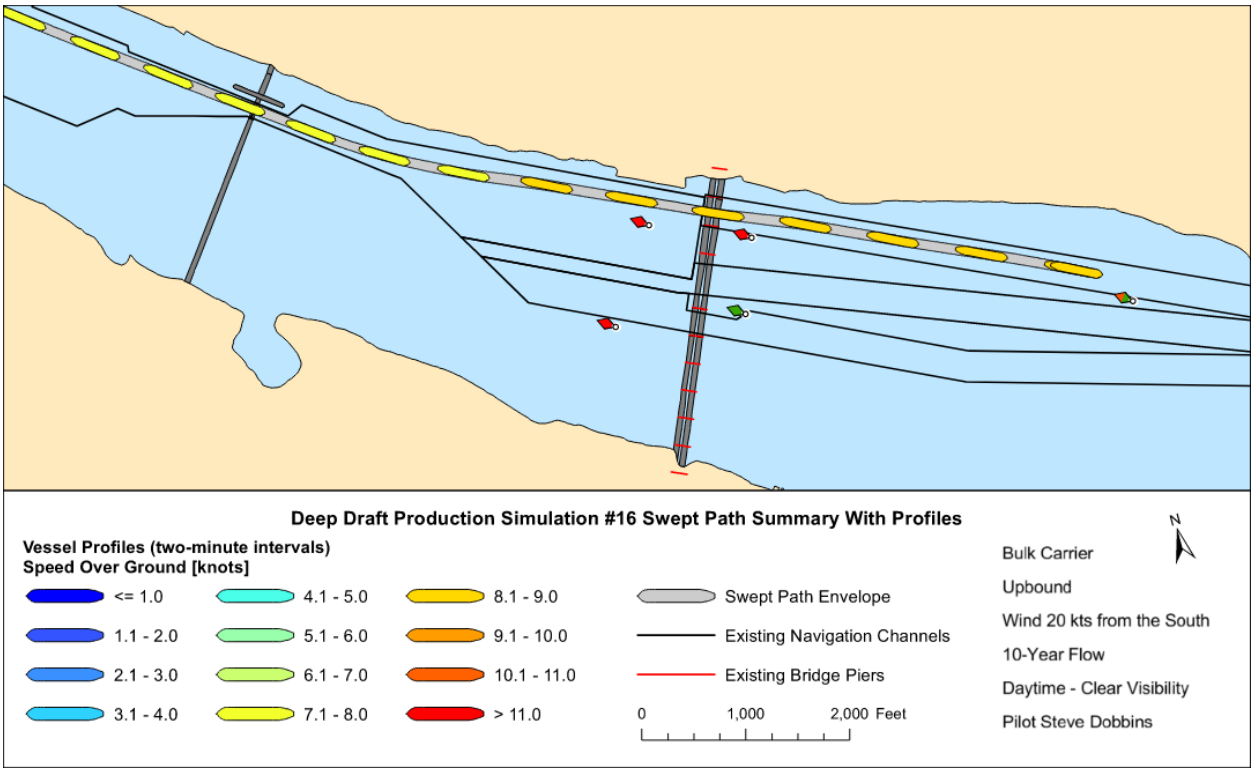

Summary of Simulation Parameters: Deep-Draft Production Simulation 13
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

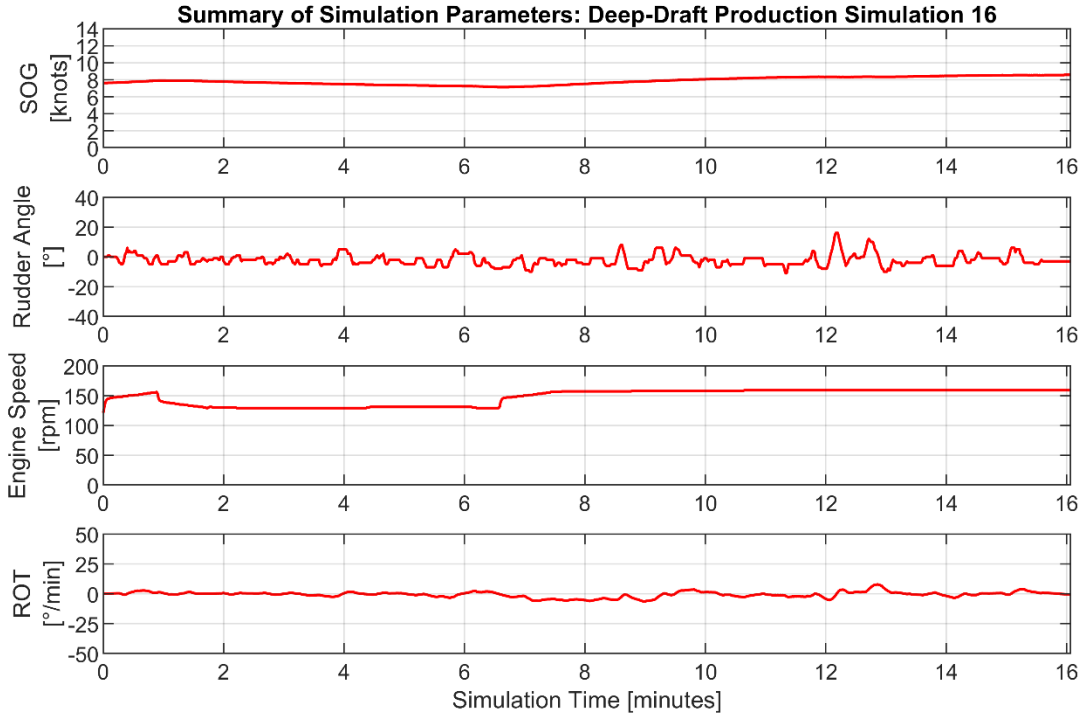

Deep Draft Production Simulation #14 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Downbound
Wind 20 kts from the South
10-Year Flow
Daytime - Clear Visibility
Pilot Steve Dobbins

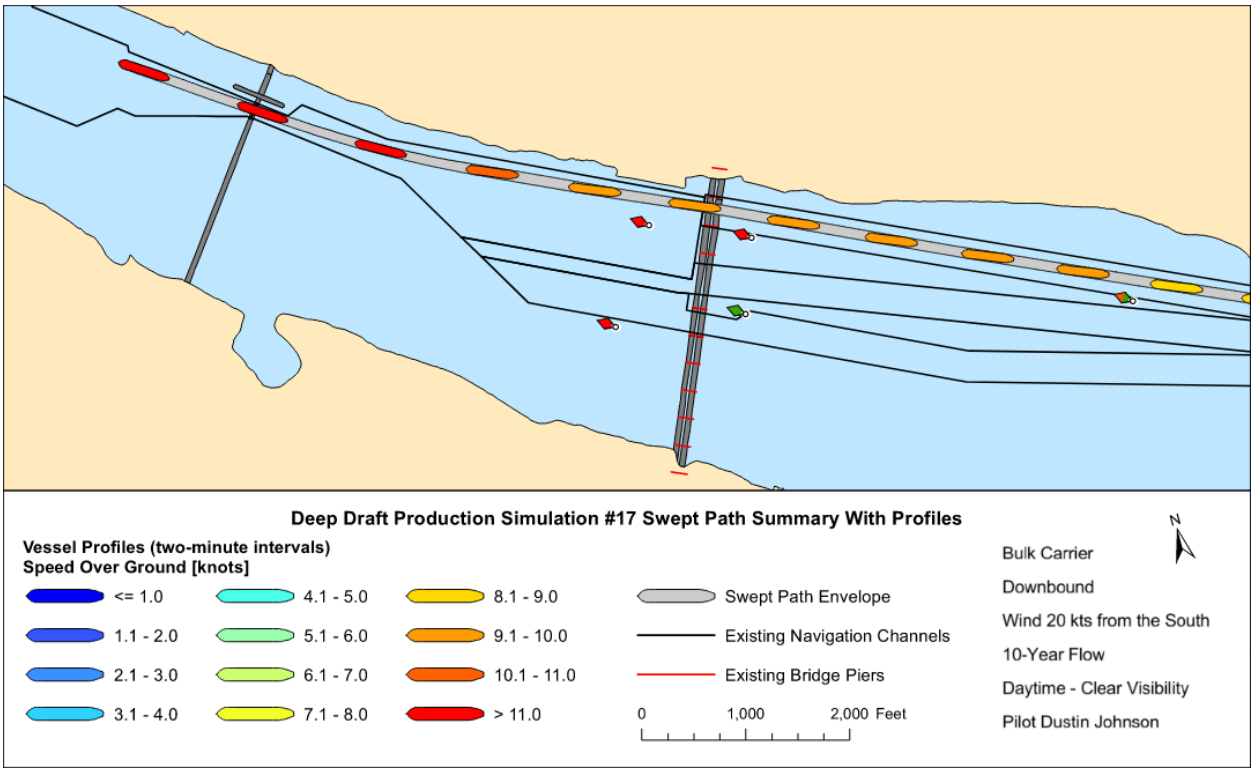

Summary of Simulation Parameters: Deep-Draft Production Simulation 14
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

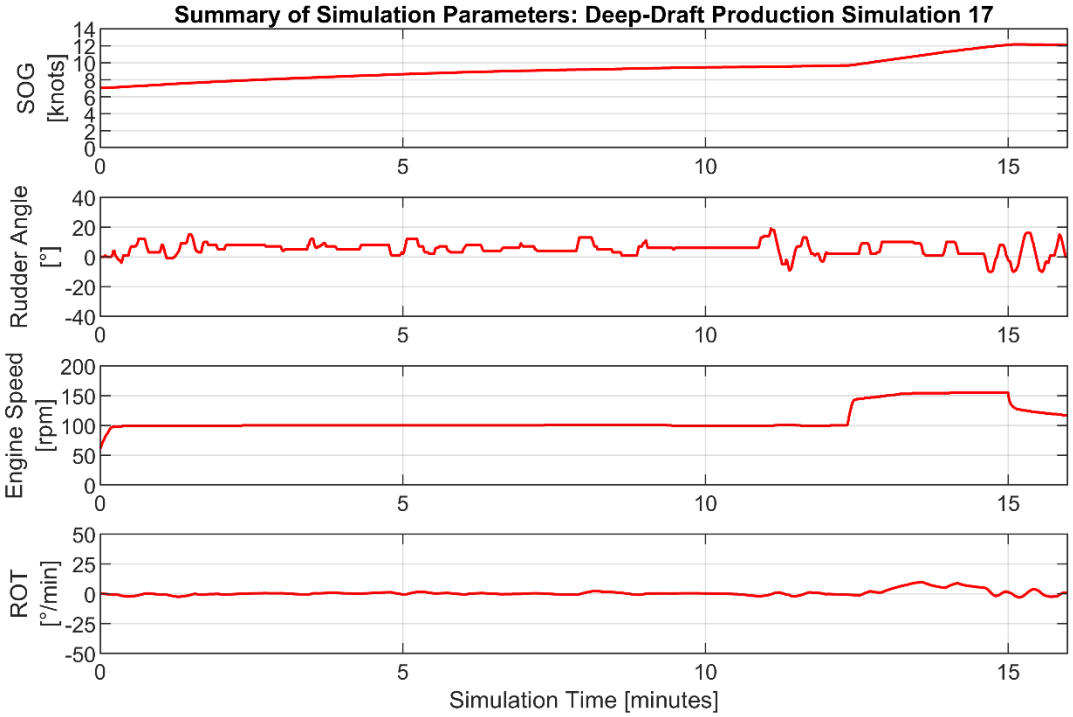

Deep Draft Production Simulation #15 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 20 kts from the South
Transitional Flow
Nighttime - Clear Visibility
Pilot Dustin Johnson

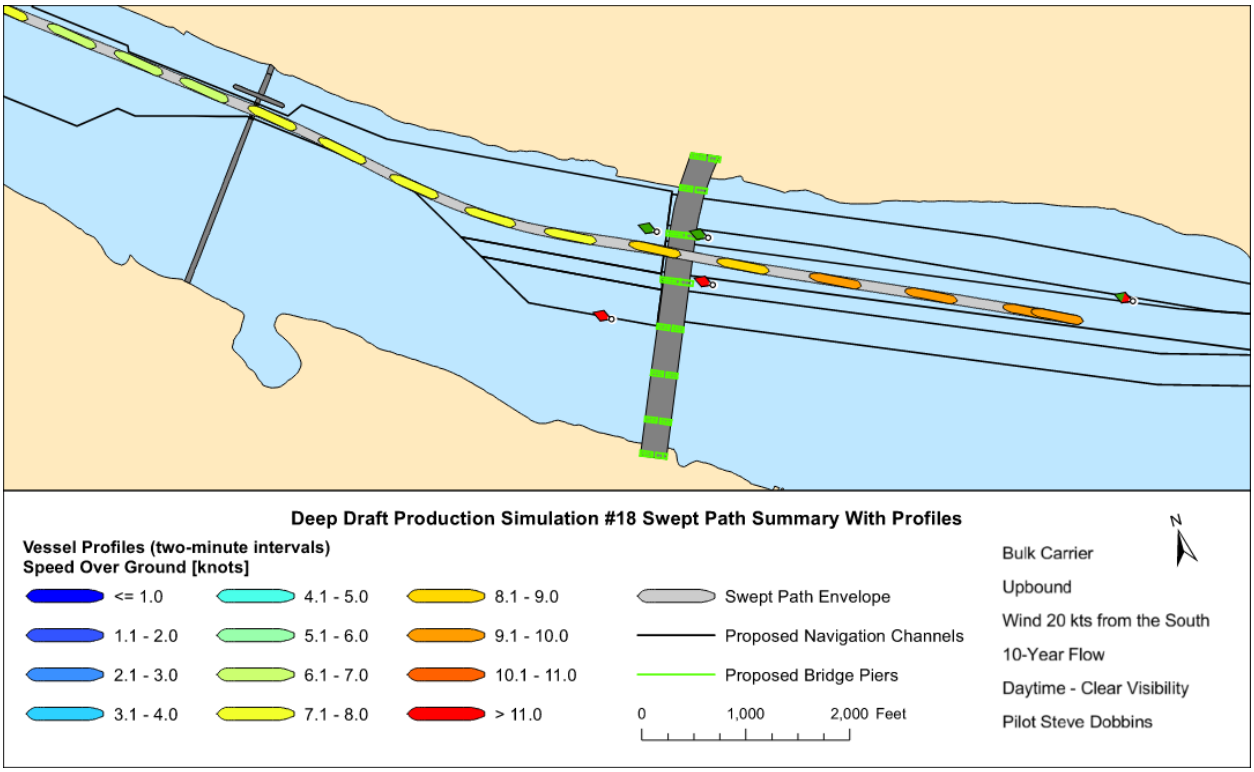

Summary of Simulation Parameters: Deep-Draft Production Simulation 15
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

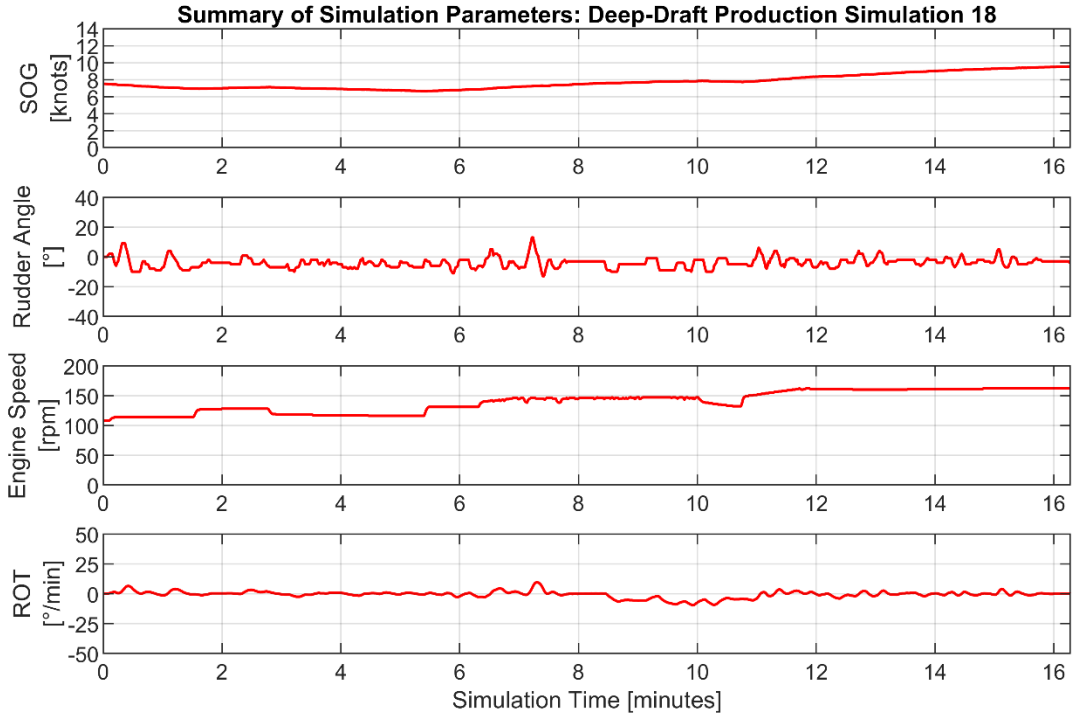

Deep Draft Production Simulation #16 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 20 kts from the South
10-Year Flow
Daytime - Clear Visibility
Pilot Steve Dobbins

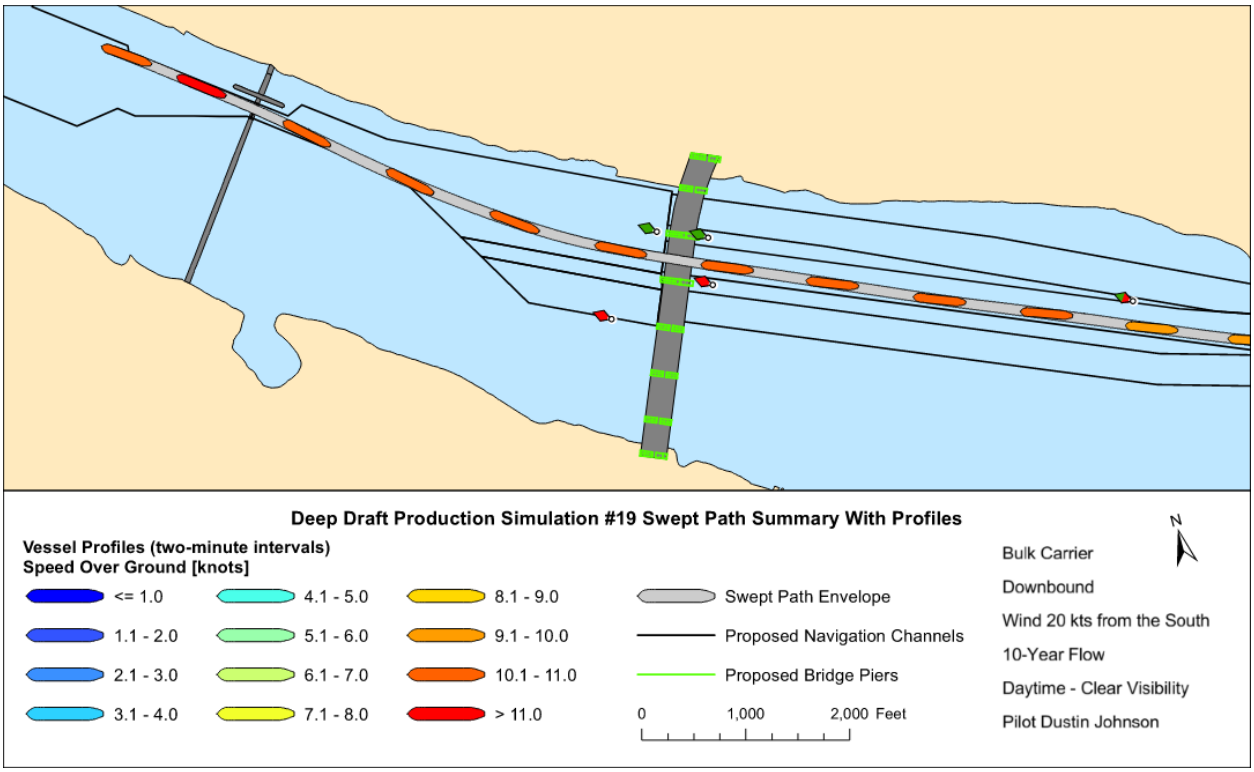

Summary of Simulation Parameters: Deep-Draft Production Simulation 16
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

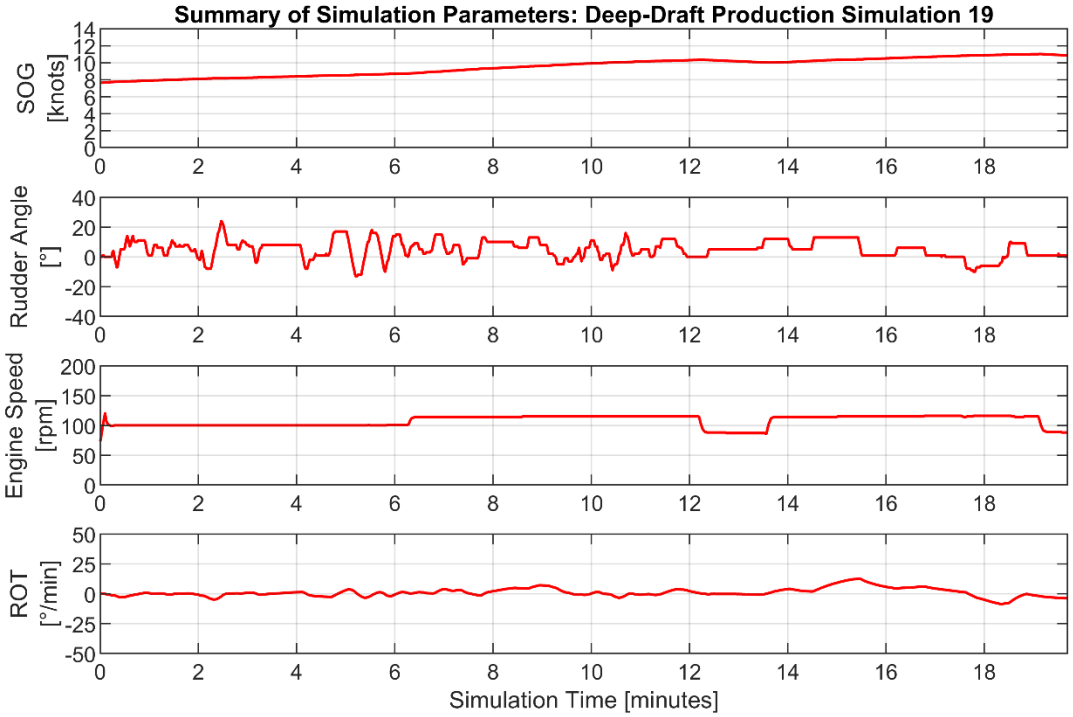

Deep Draft Production Simulation #17 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Downbound
Wind 20 kts from the South
10-Year Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

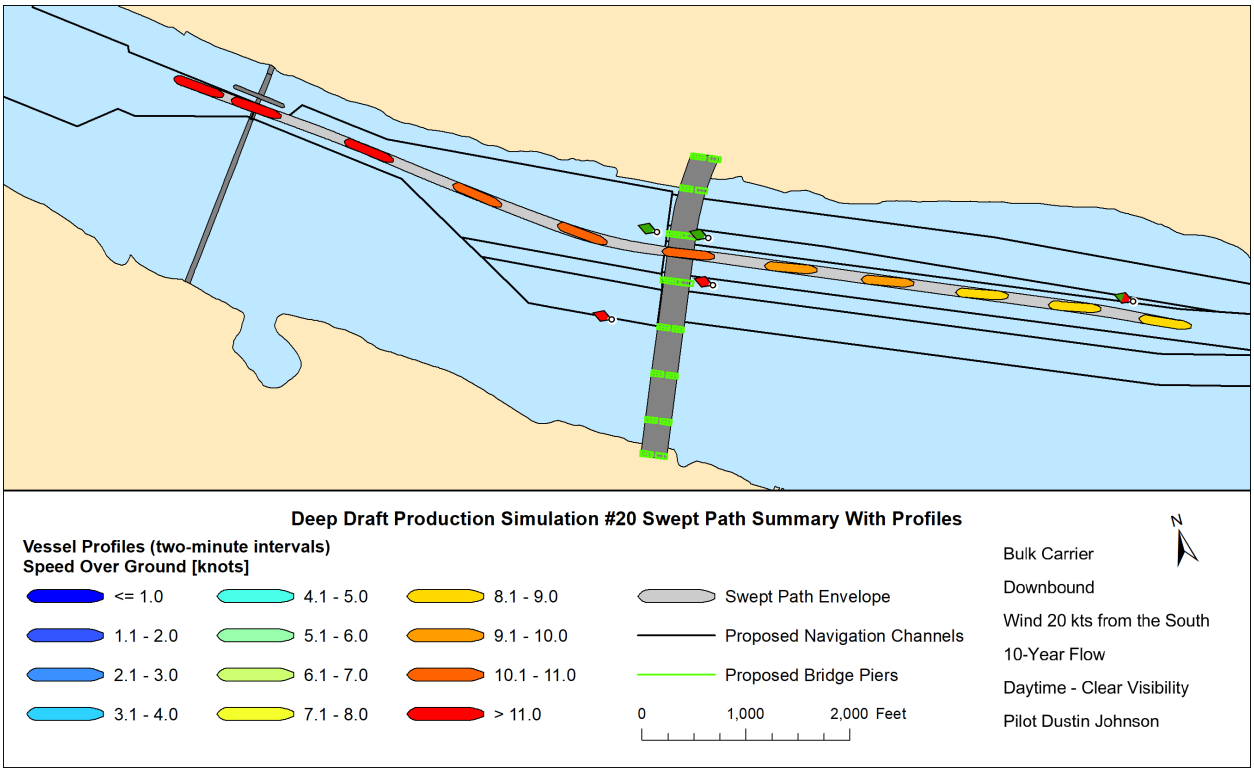

Summary of Simulation Parameters: Deep-Draft Production Simulation 17
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

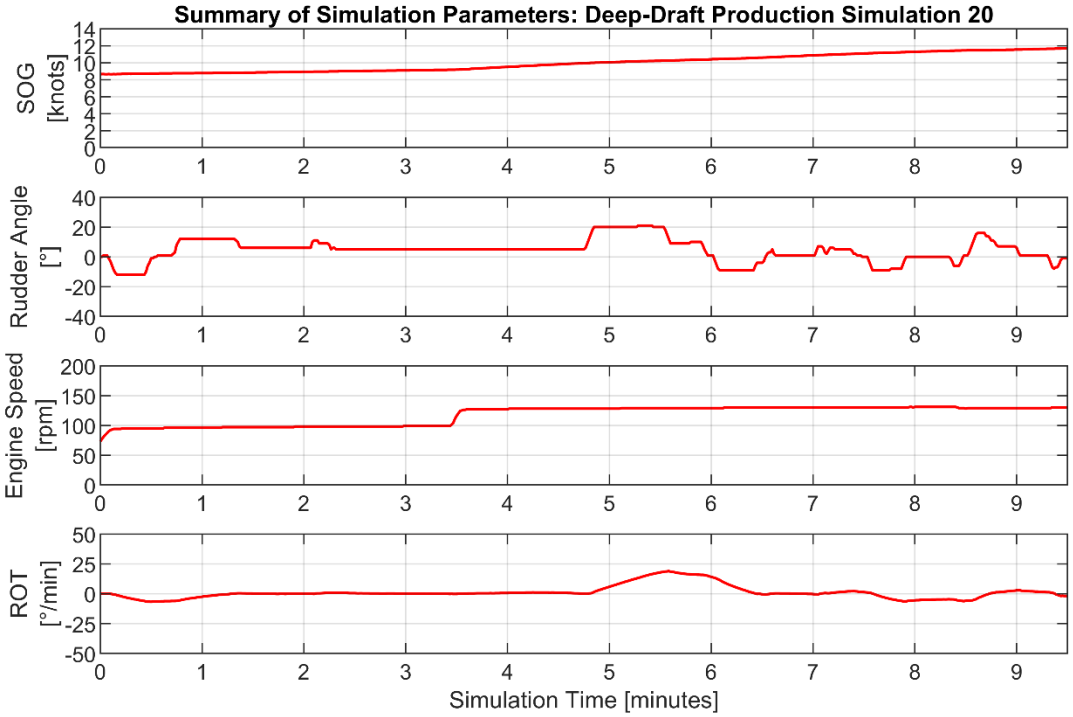

Deep Draft Production Simulation #18 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 20 kts from the South
10-Year Flow
Daytime - Clear Visibility
Pilot Steve Dobbins

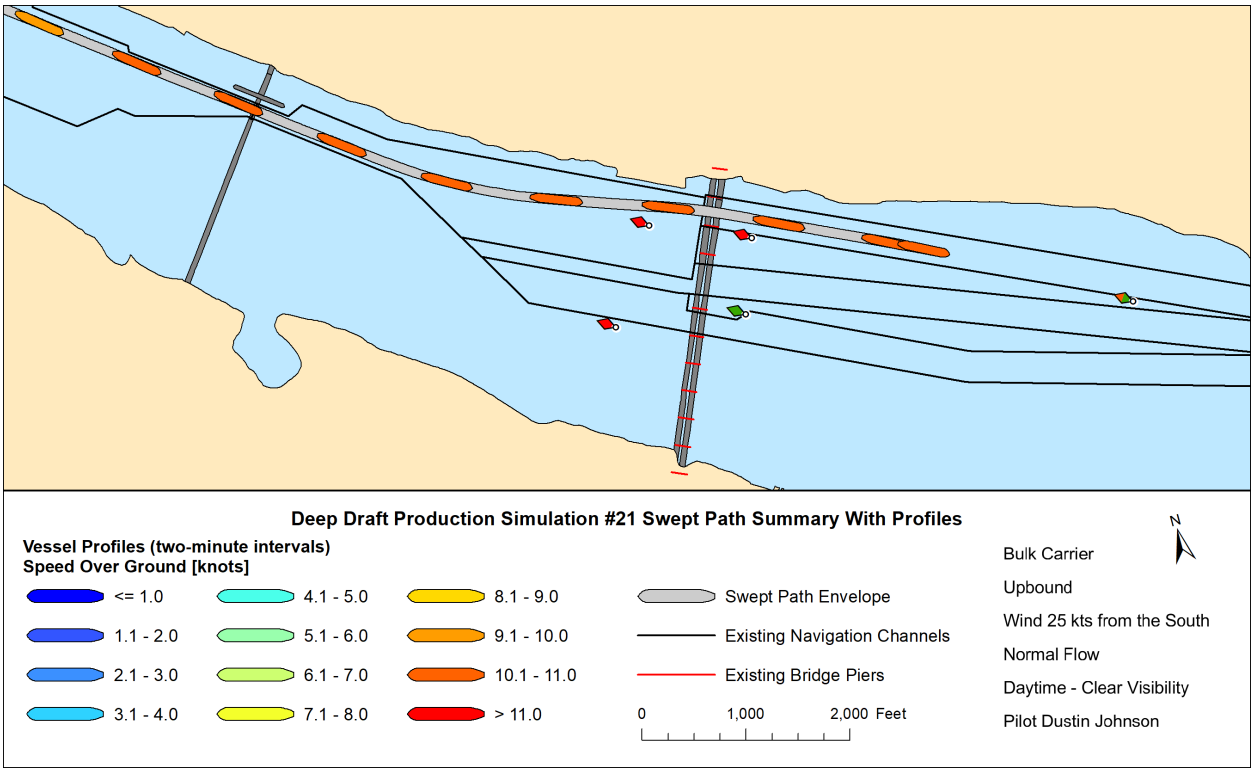

Summary of Simulation Parameters: Deep-Draft Production Simulation 18
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

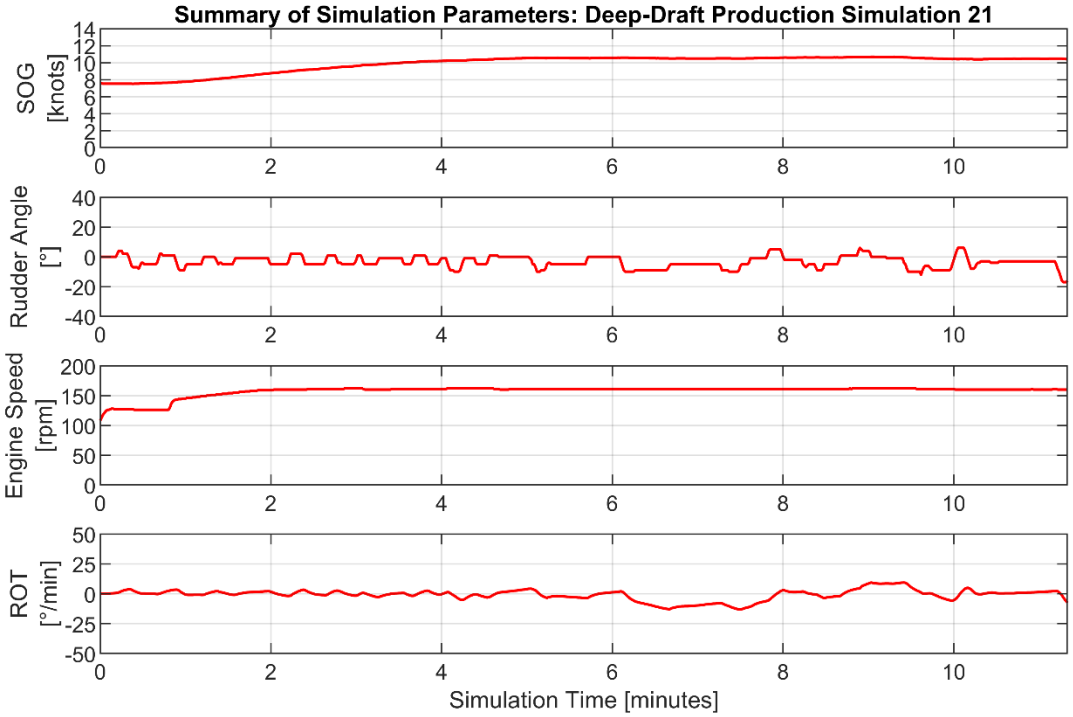

Deep Draft Production Simulation #19 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Downbound
Wind 20 kts from the South
10-Year Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

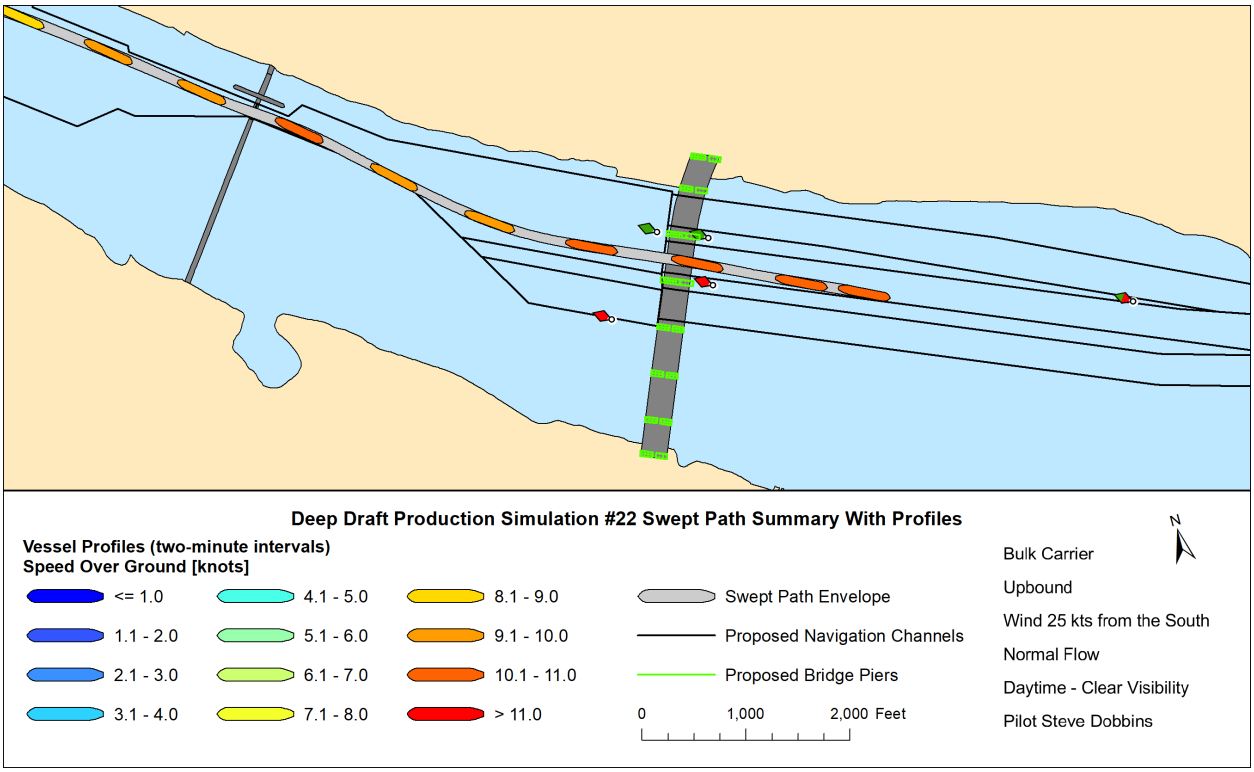

Summary of Simulation Parameters: Deep-Draft Production Simulation 19
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

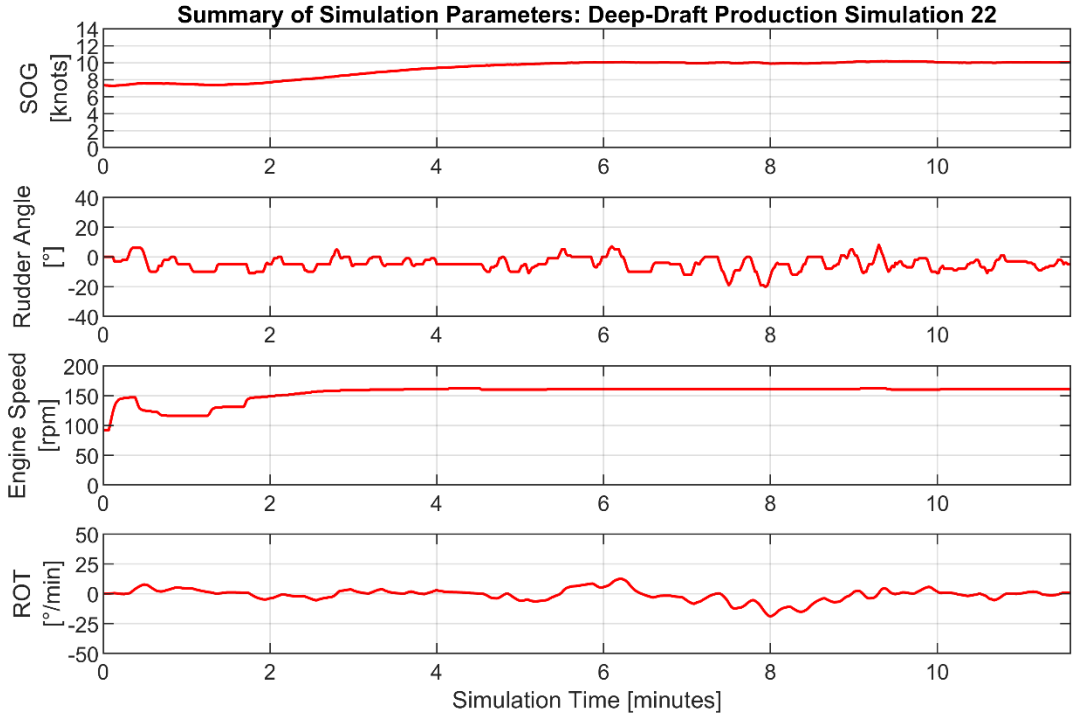

Deep Draft Production Simulation #20 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Downbound
Wind 20 kts from the South
10-Year Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

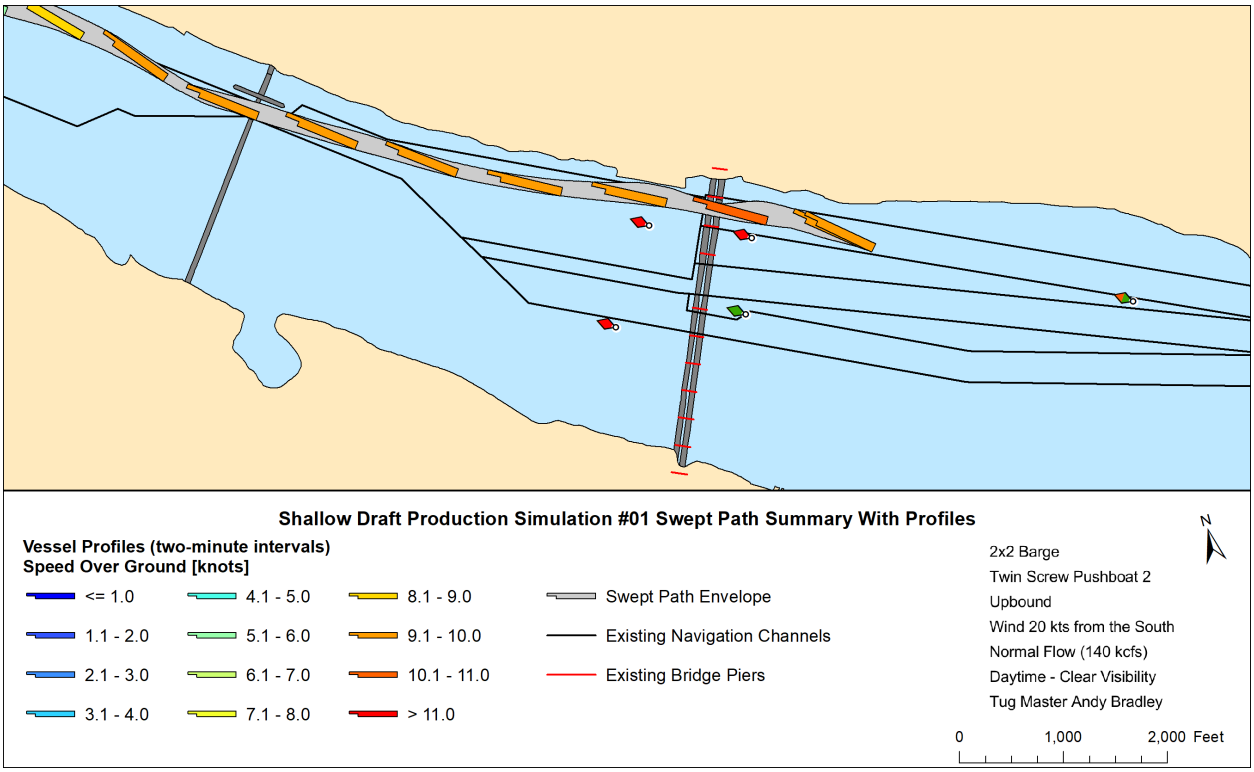

Summary of Simulation Parameters: Deep-Draft Production Simulation 20
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

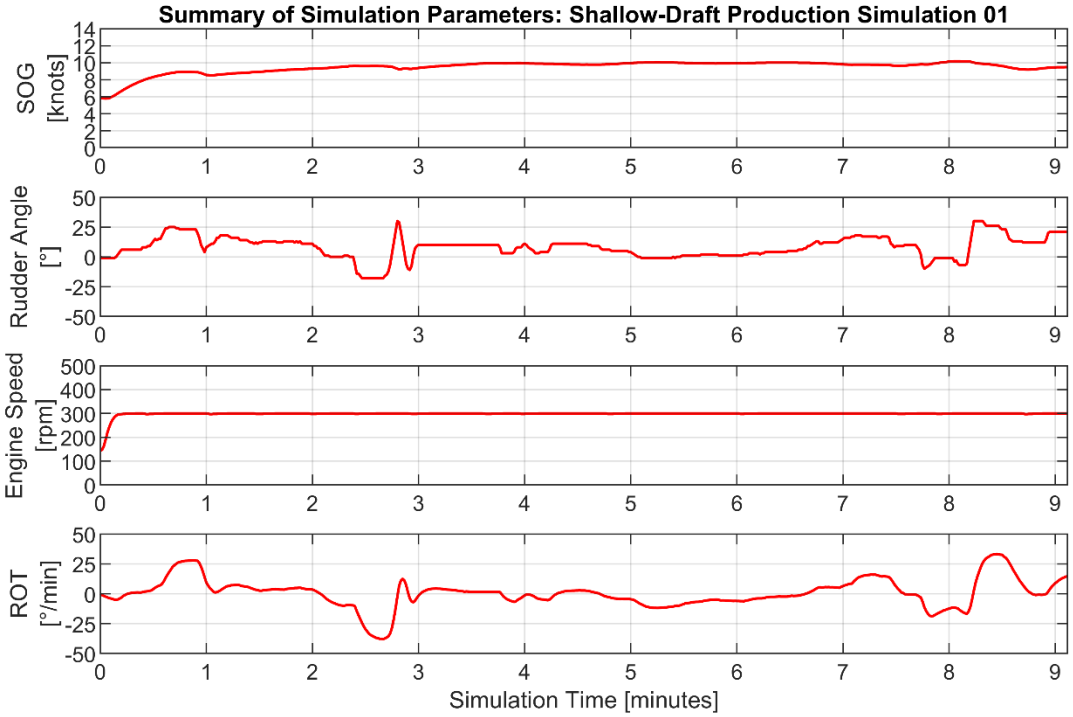

Deep Draft Production Simulation #21 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 25 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Dustin Johnson

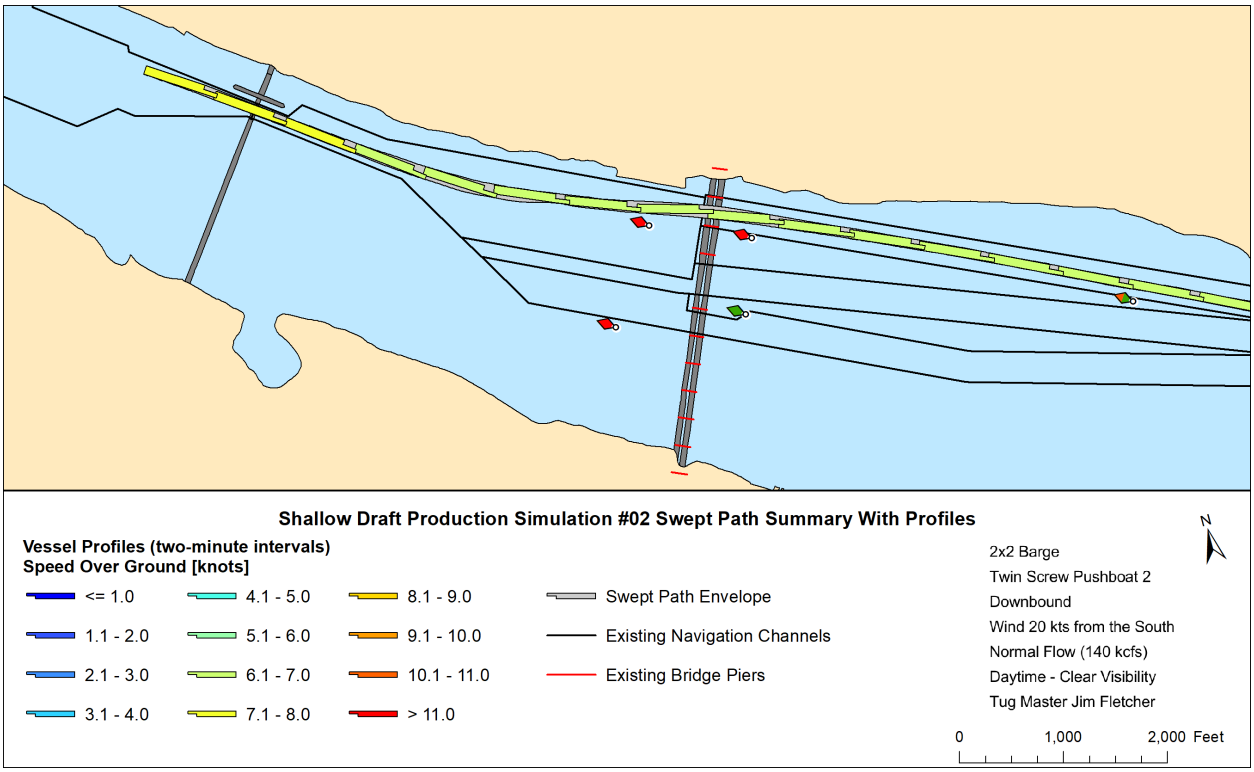

Summary of Simulation Parameters: Deep-Draft Production Simulation 21
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

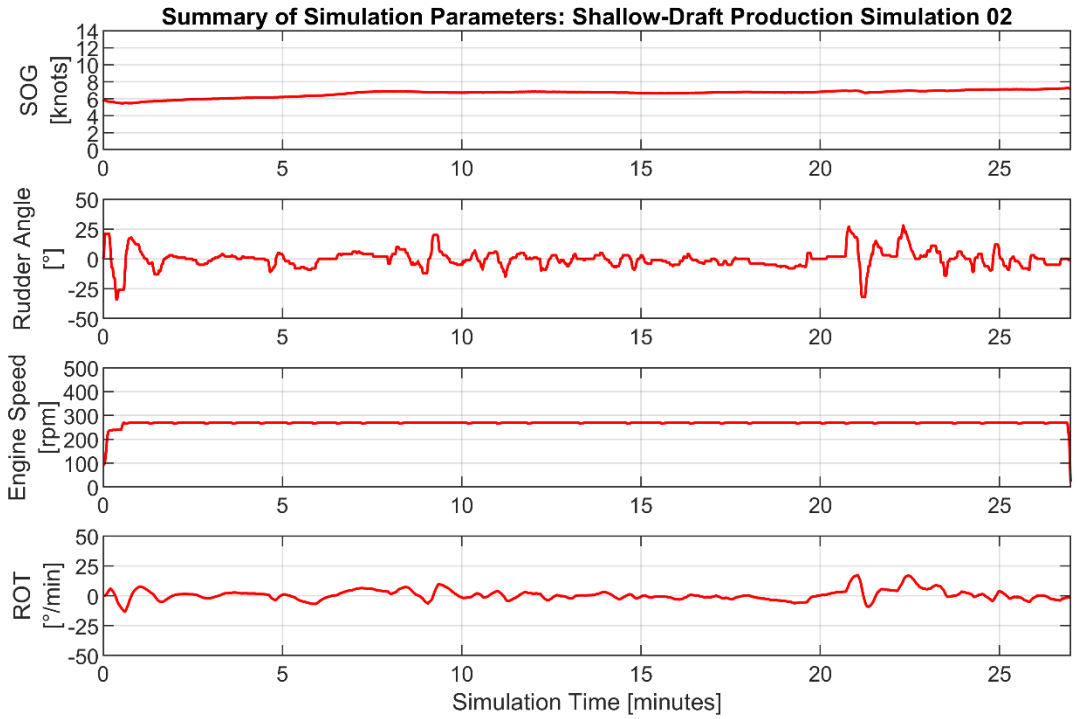

Deep Draft Production Simulation #22 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
0
1,000
2,000 Feet
N
Bulk Carrier
Upbound
Wind 25 kts from the South
Normal Flow
Daytime - Clear Visibility
Pilot Steve Dobbins

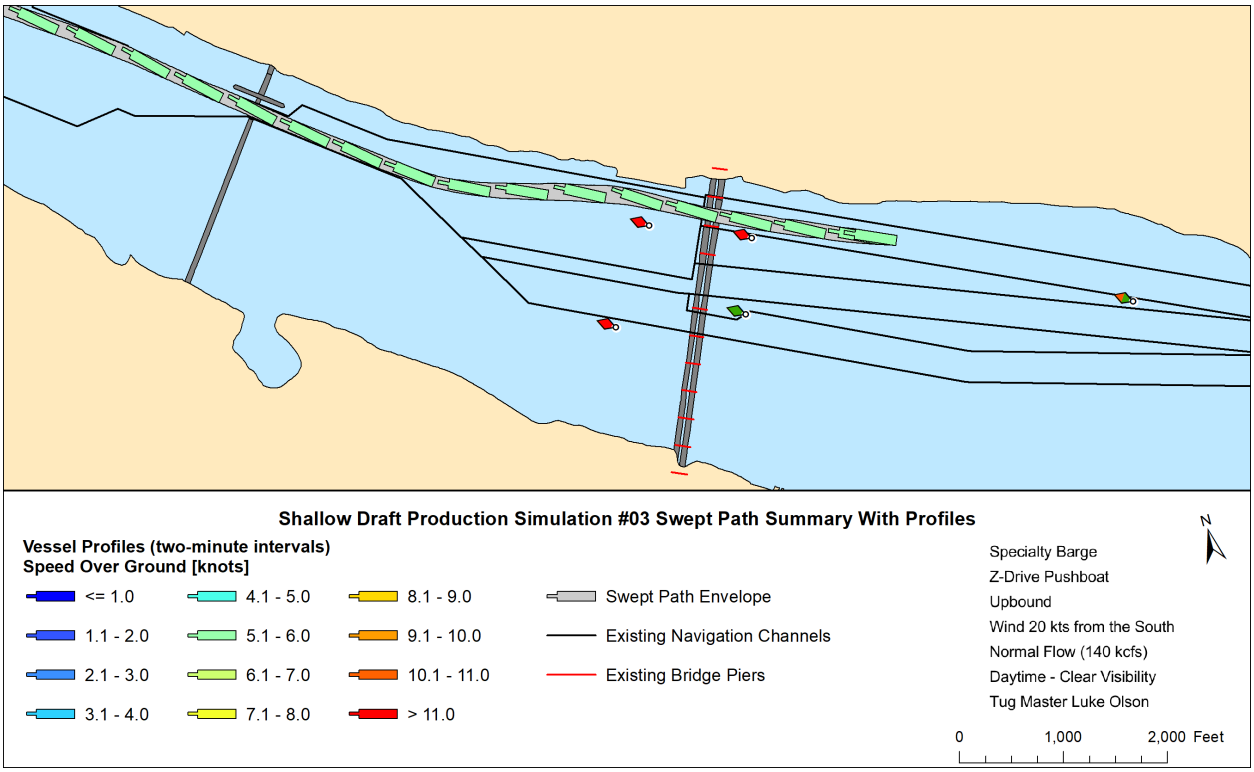

Summary of Simulation Parameters: Deep-Draft Production Simulation 22
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

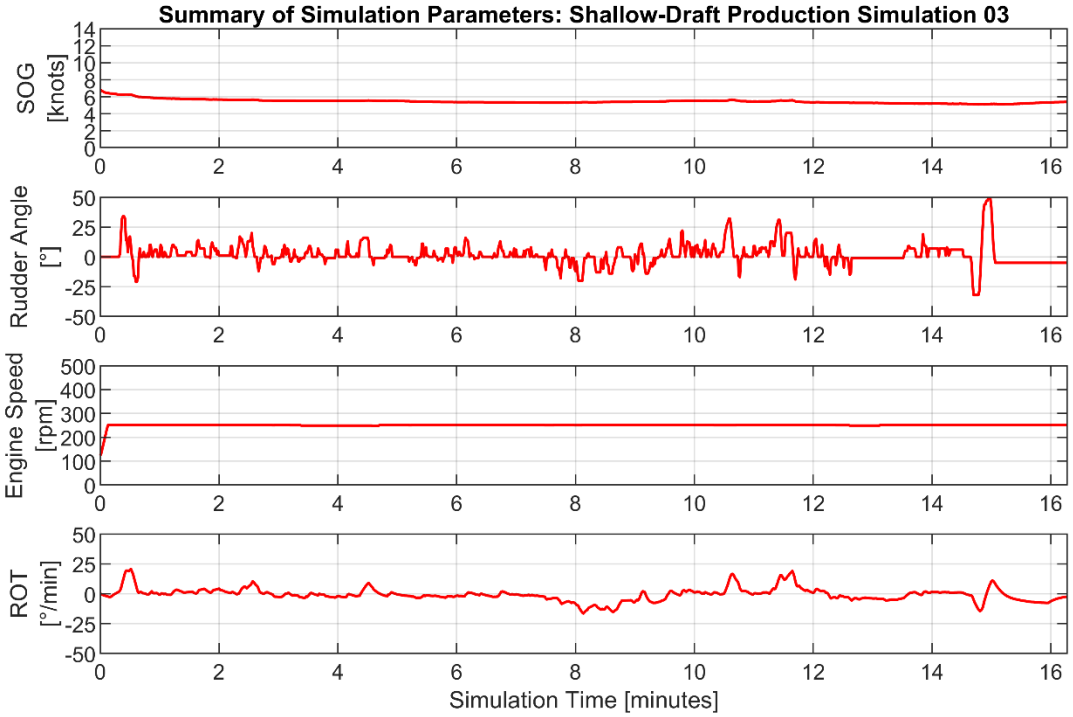

Shallow Draft Production Simulation #01 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

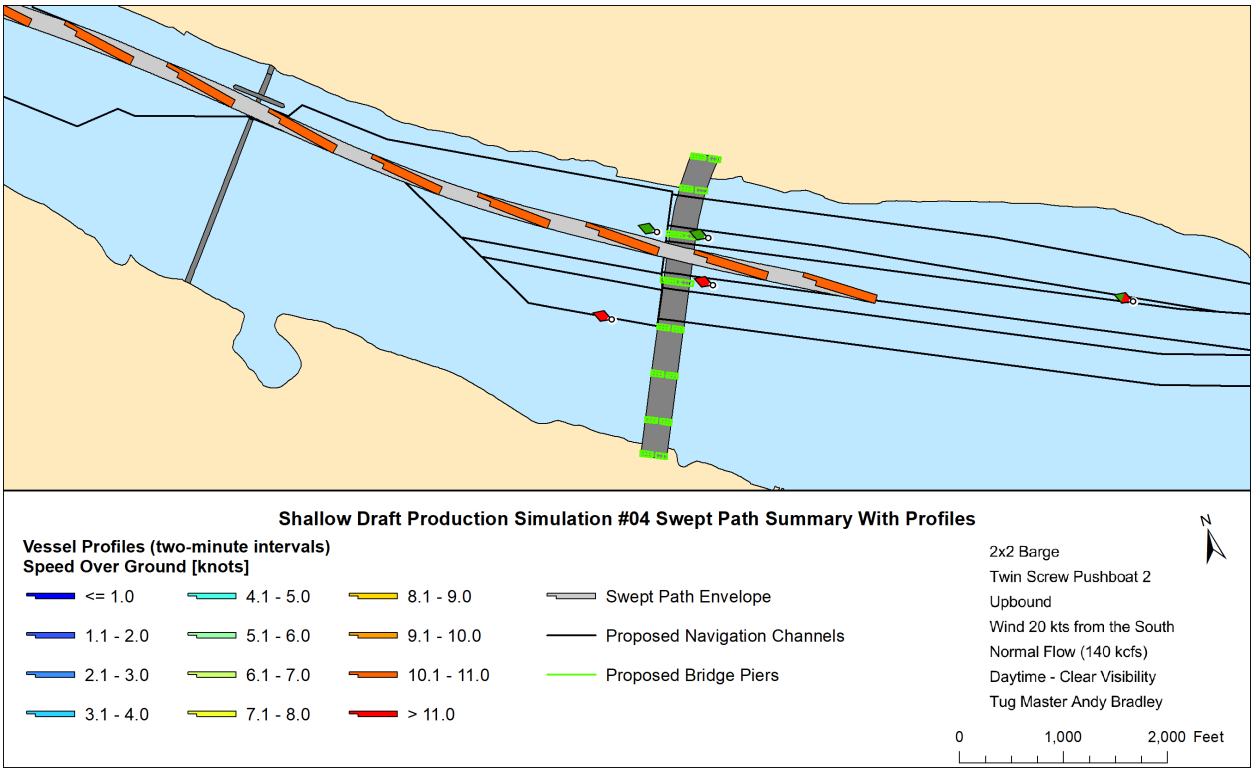

Summary of Simulation Parameters: Shallow-Draft Production Simulation 01
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

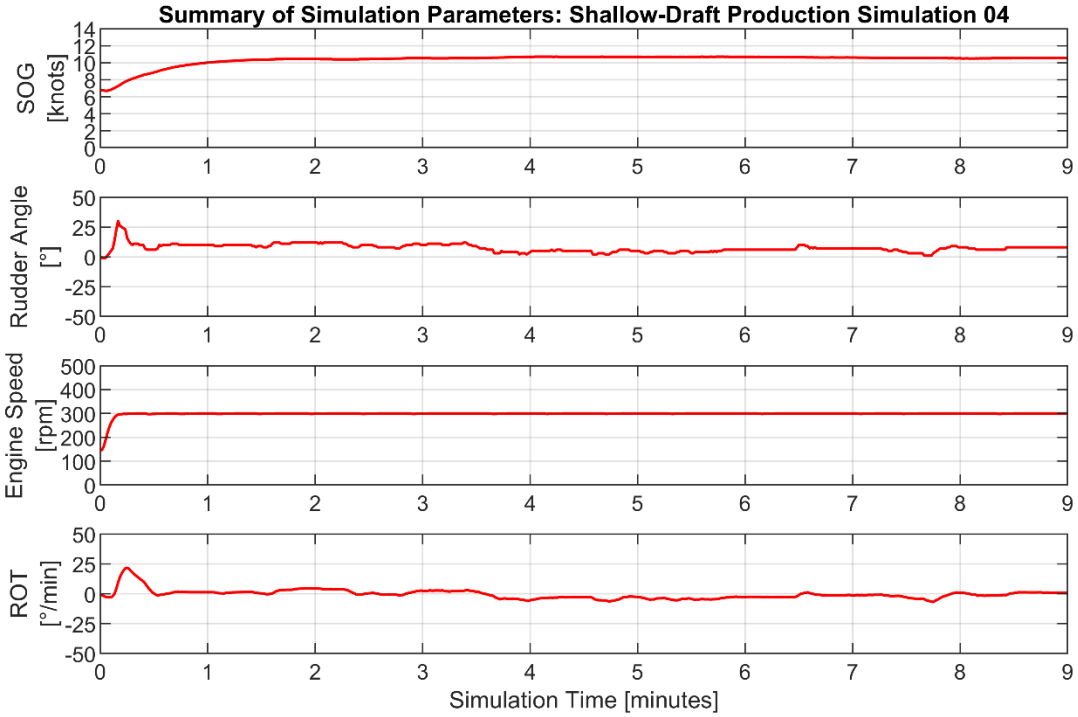

Shallow Draft Production Simulation #02 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Jim Fletcher
N
0
1,000
2,000 Feet

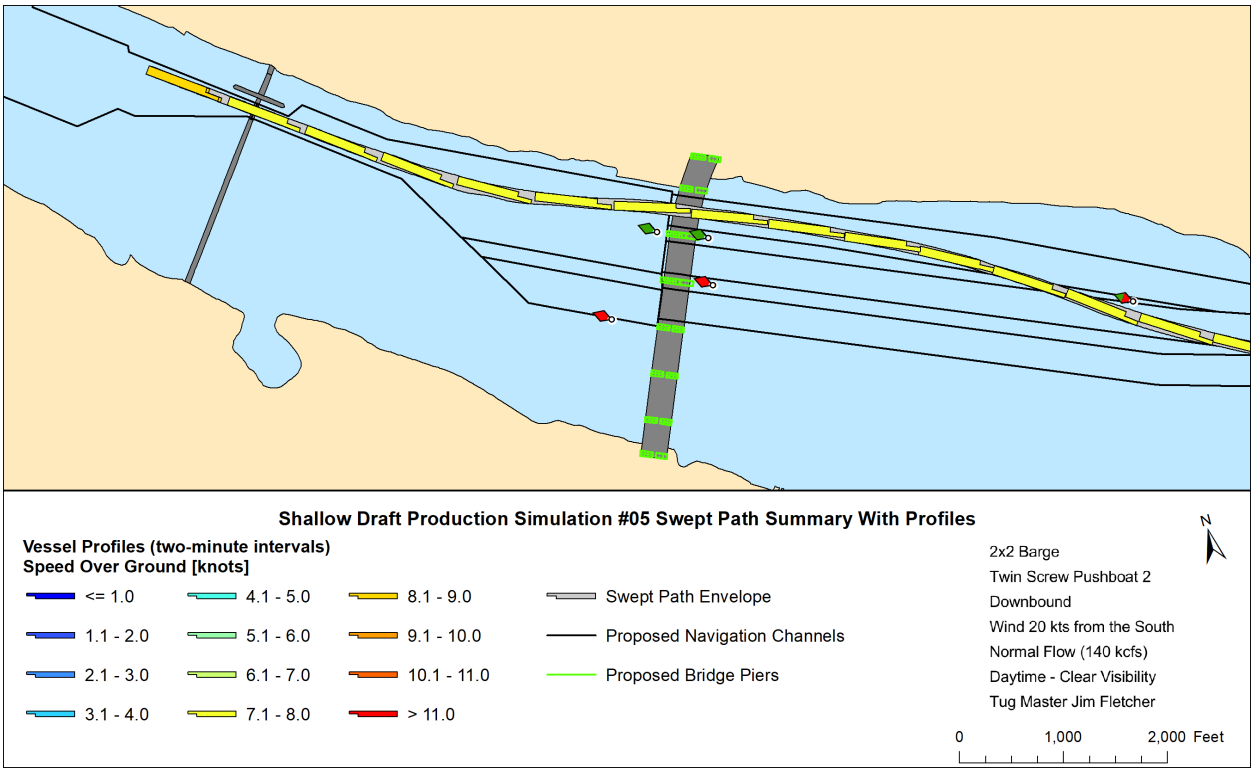

Summary of Simulation Parameters: Shallow-Draft Production Simulation 02
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

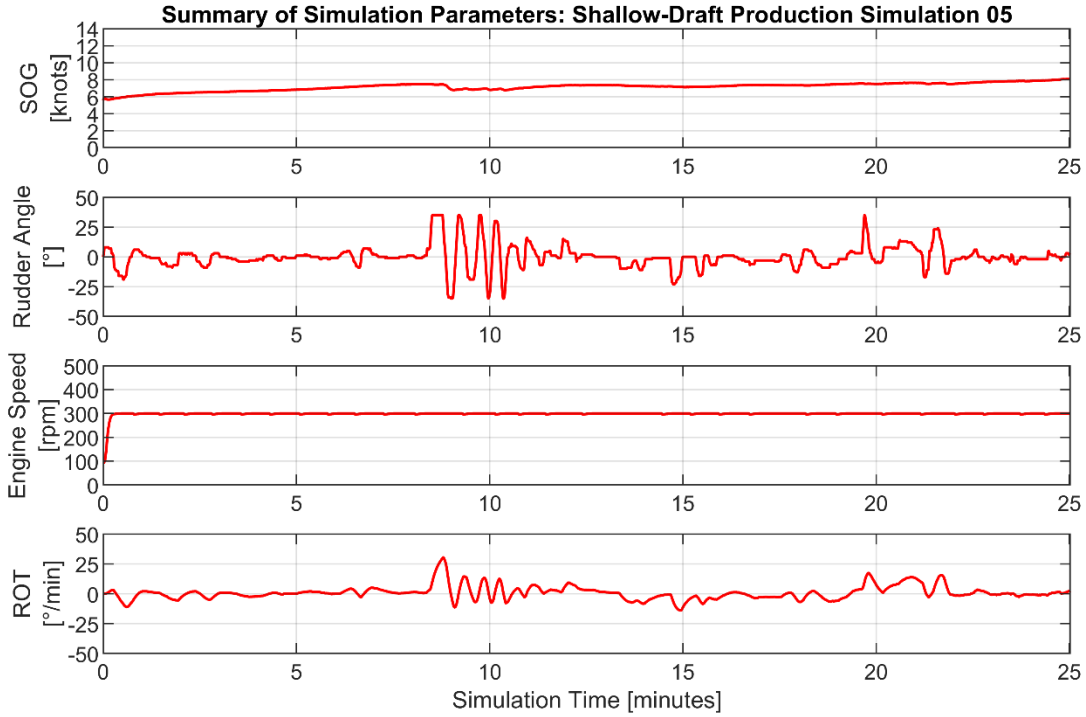

Shallow Draft Production Simulation #03 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

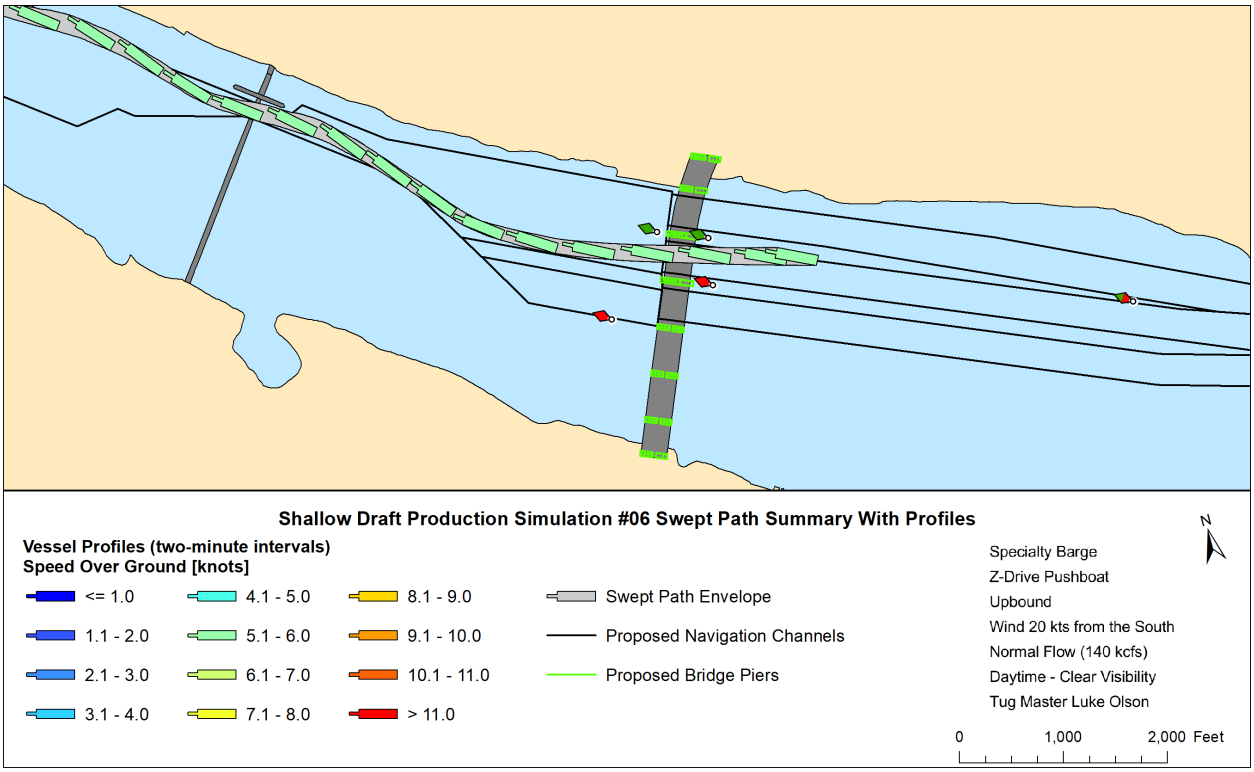

Summary of Simulation Parameters: Shallow-Draft Production Simulation 03
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

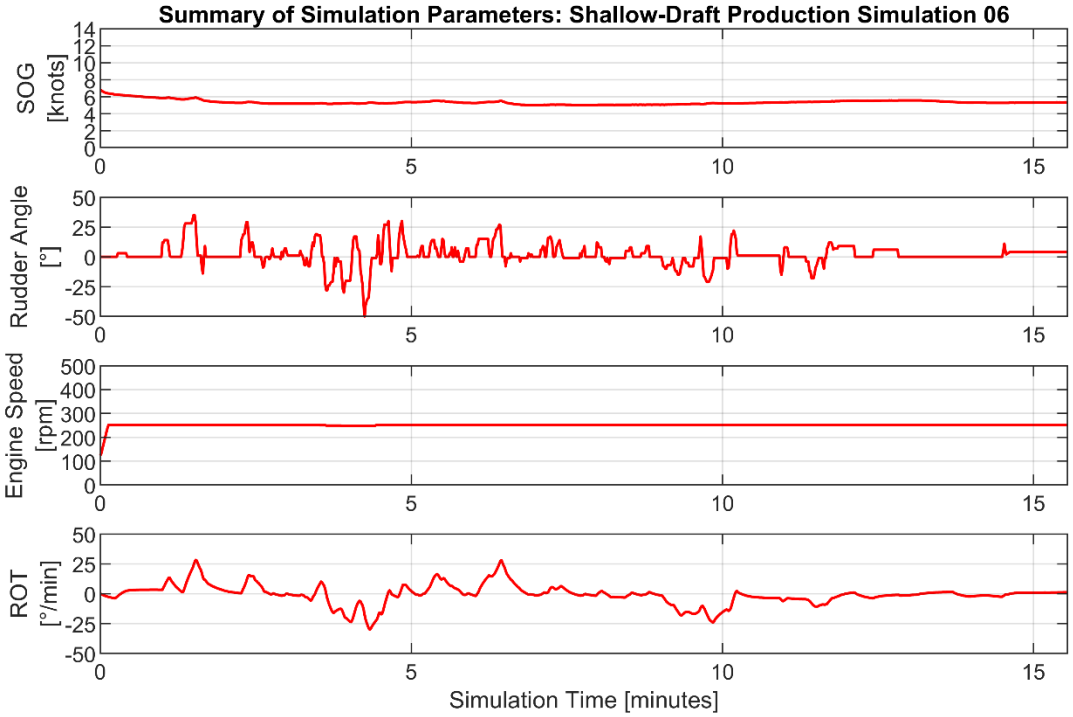

Shallow Draft Production Simulation #04 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

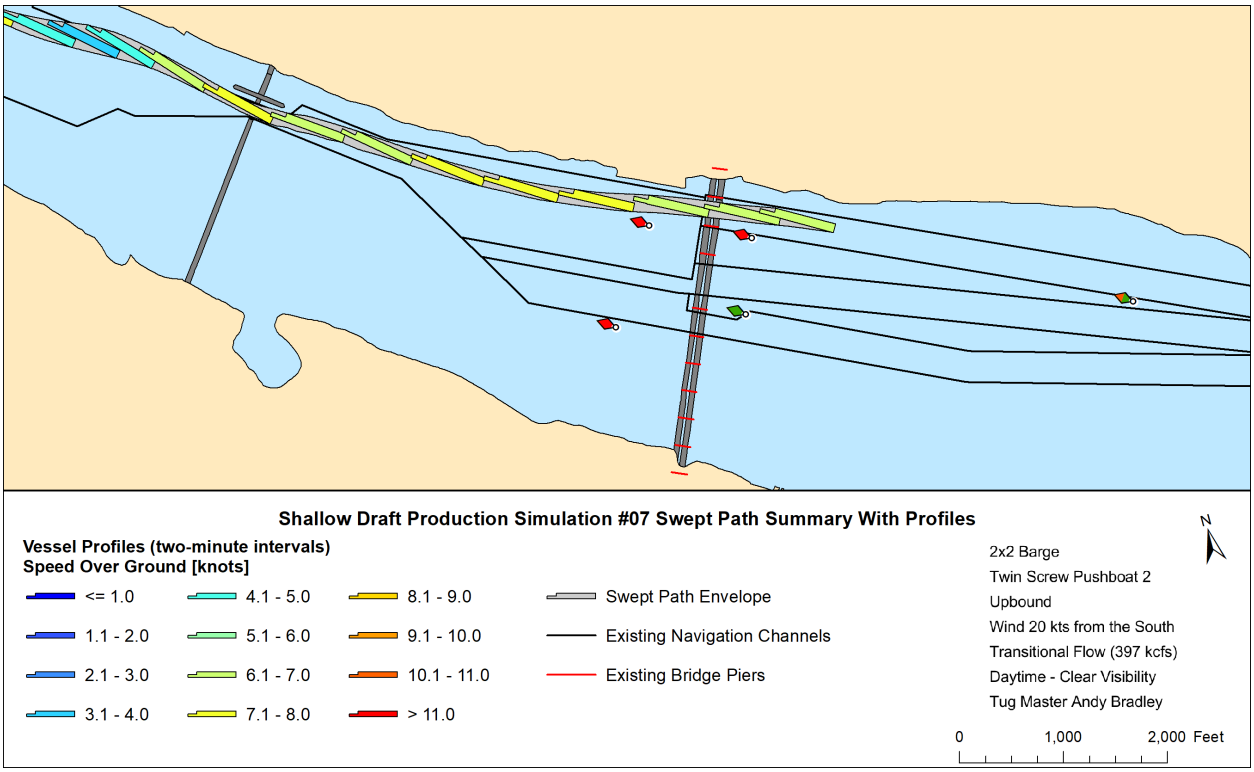

Summary of Simulation Parameters: Shallow-Draft Production Simulation 04
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

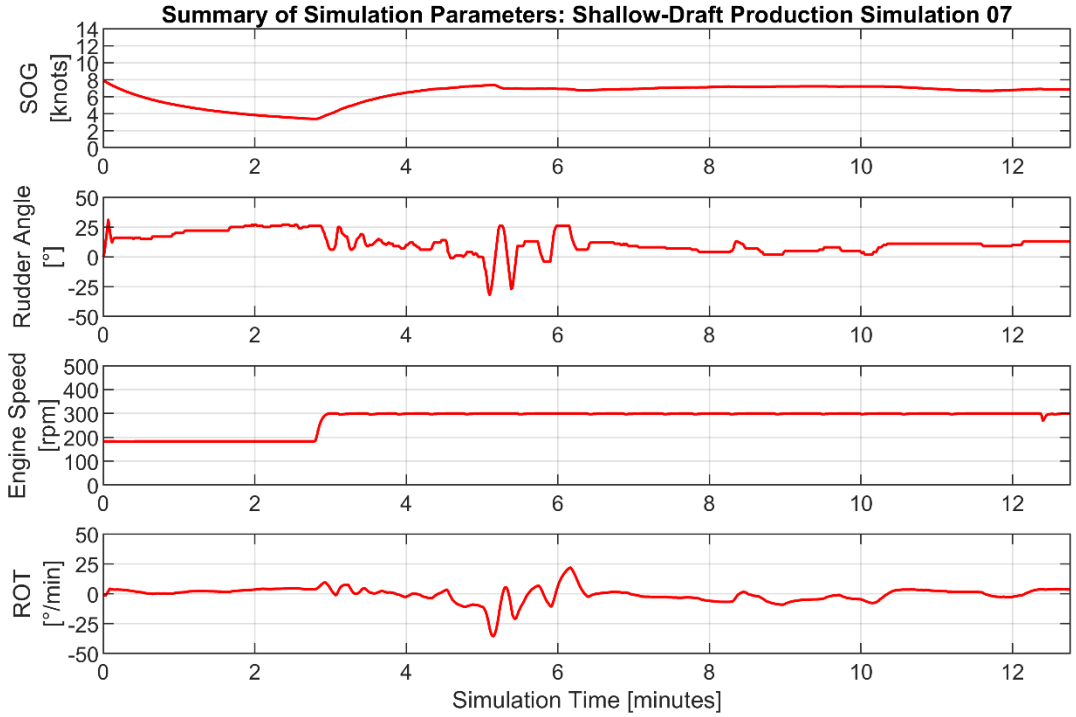

Shallow Draft Production Simulation #05 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Jim Fletcher
N
0
1,000
2,000 Feet

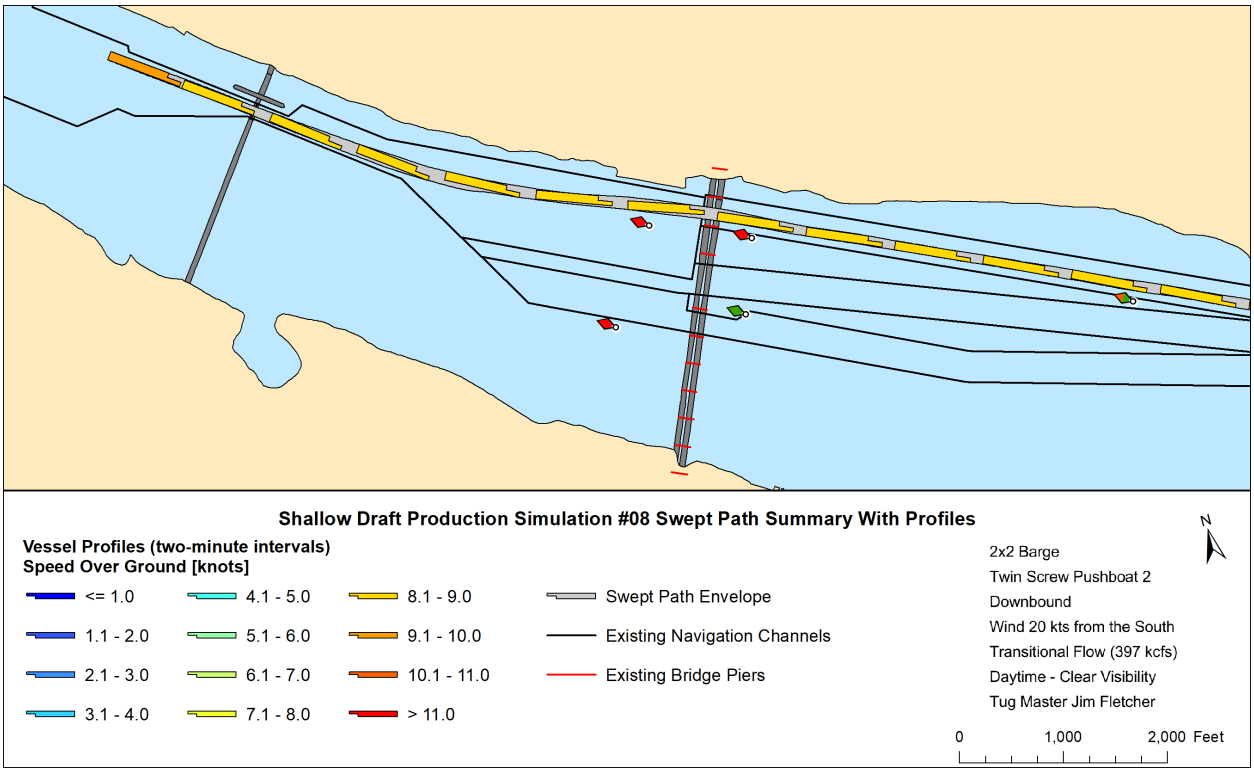

Summary of Simulation Parameters: Shallow-Draft Production Simulation 05
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

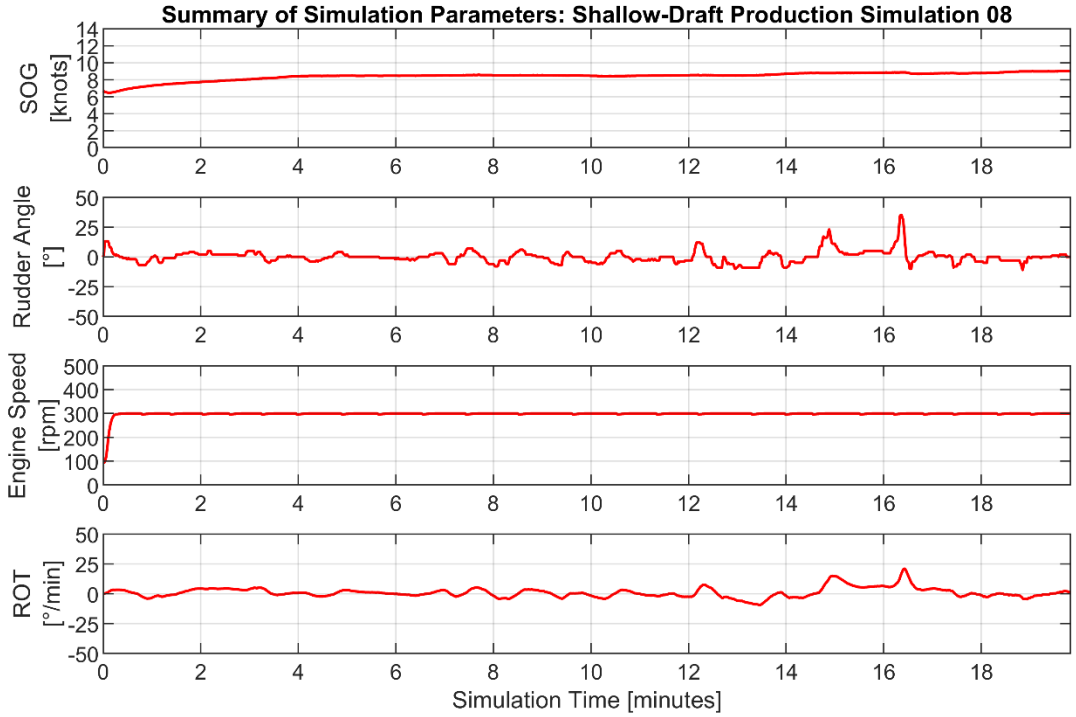

Shallow Draft Production Simulation #06 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

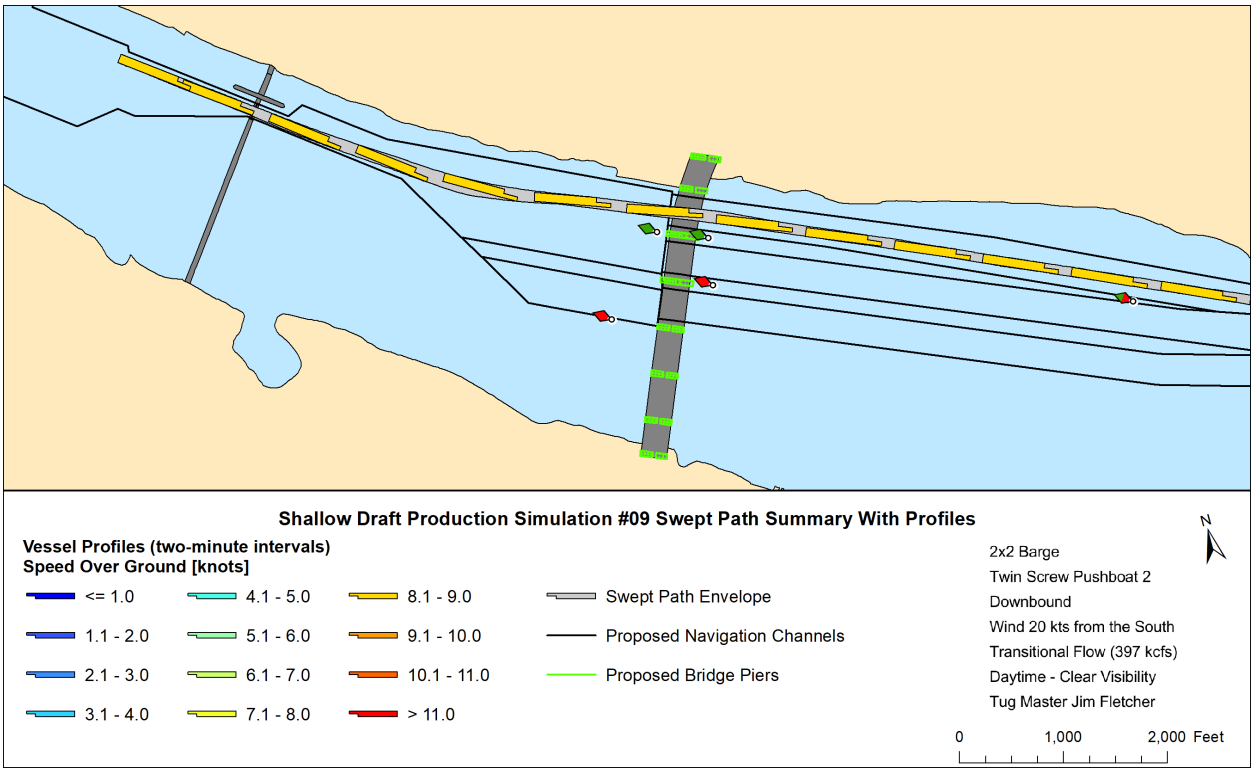

Summary of Simulation Parameters: Shallow-Draft Production Simulation 06
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

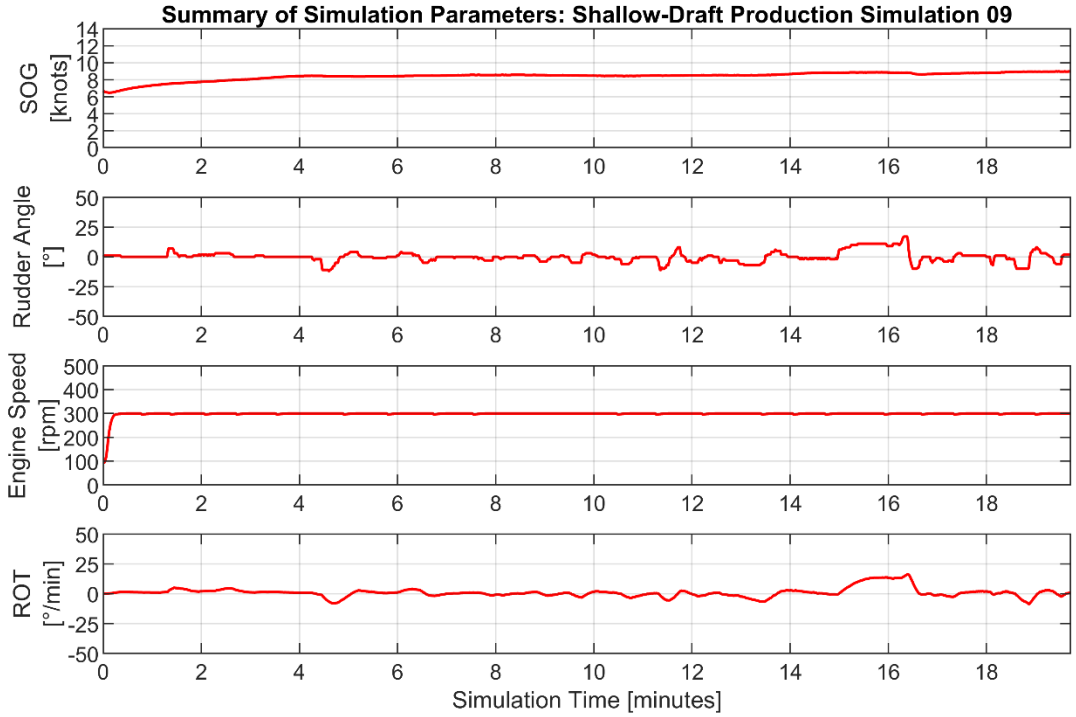

Shallow Draft Production Simulation #07 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

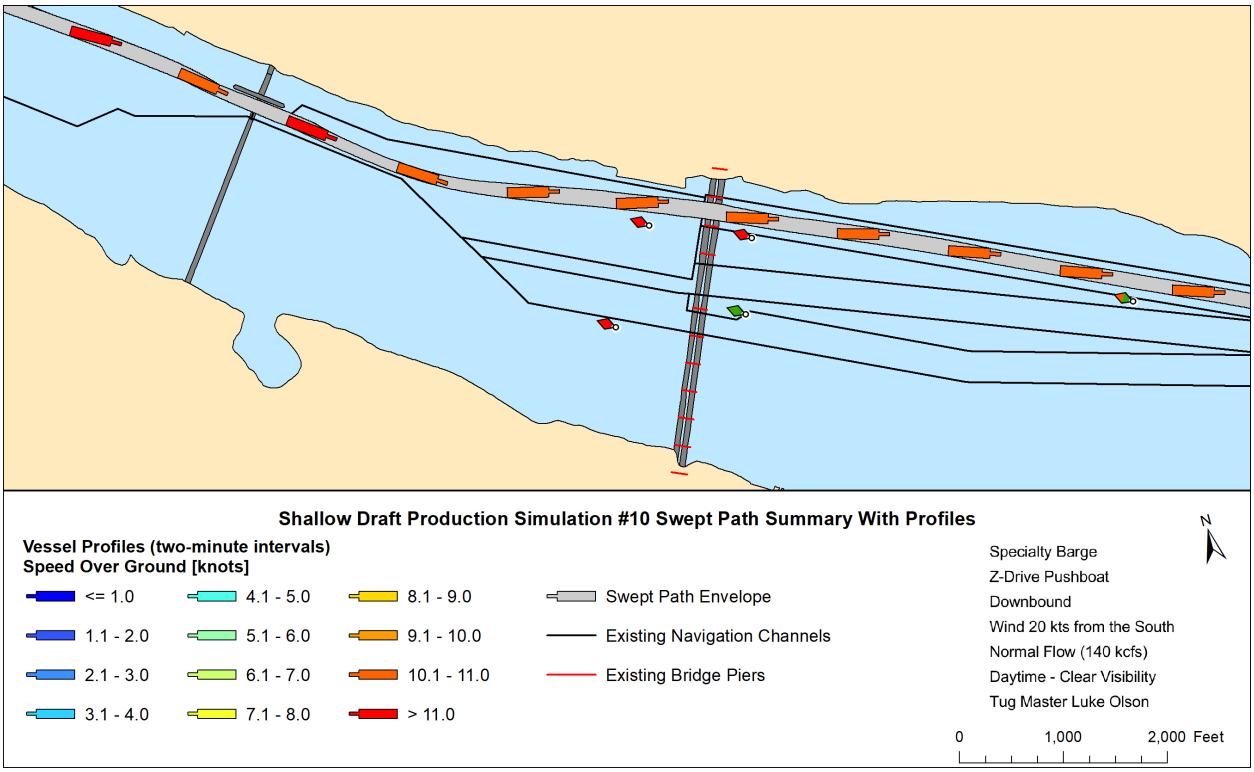

Summary of Simulation Parameters: Shallow-Draft Production Simulation 07
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

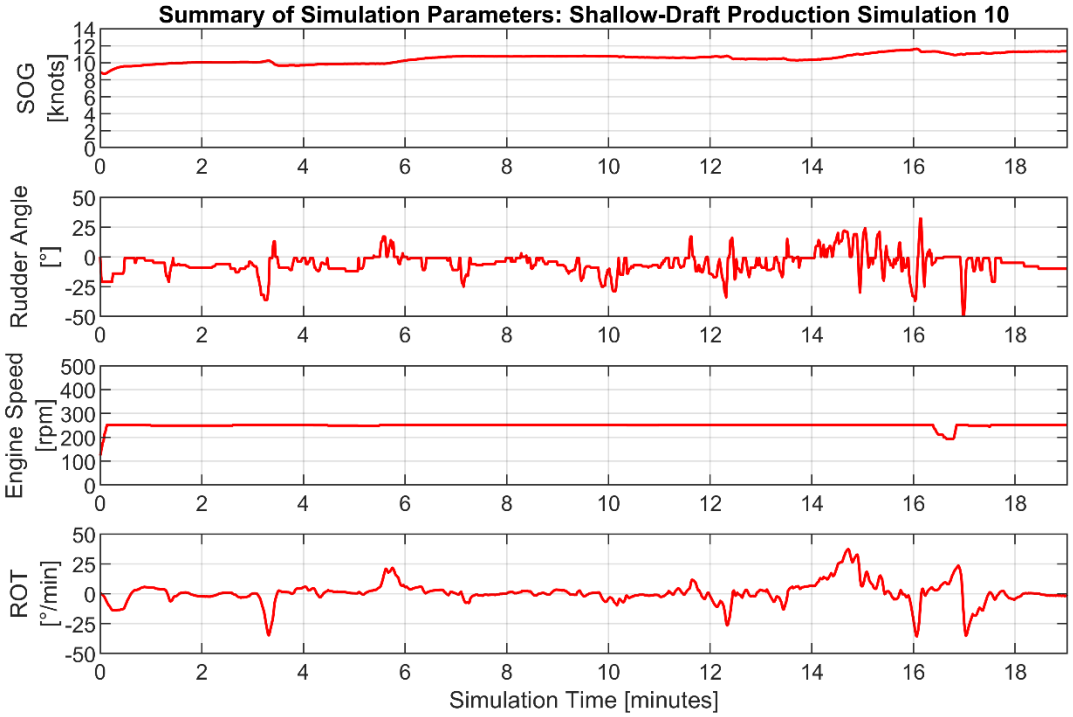

Shallow Draft Production Simulation #08 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Jim Fletcher
N
0
1,000
2,000 Feet

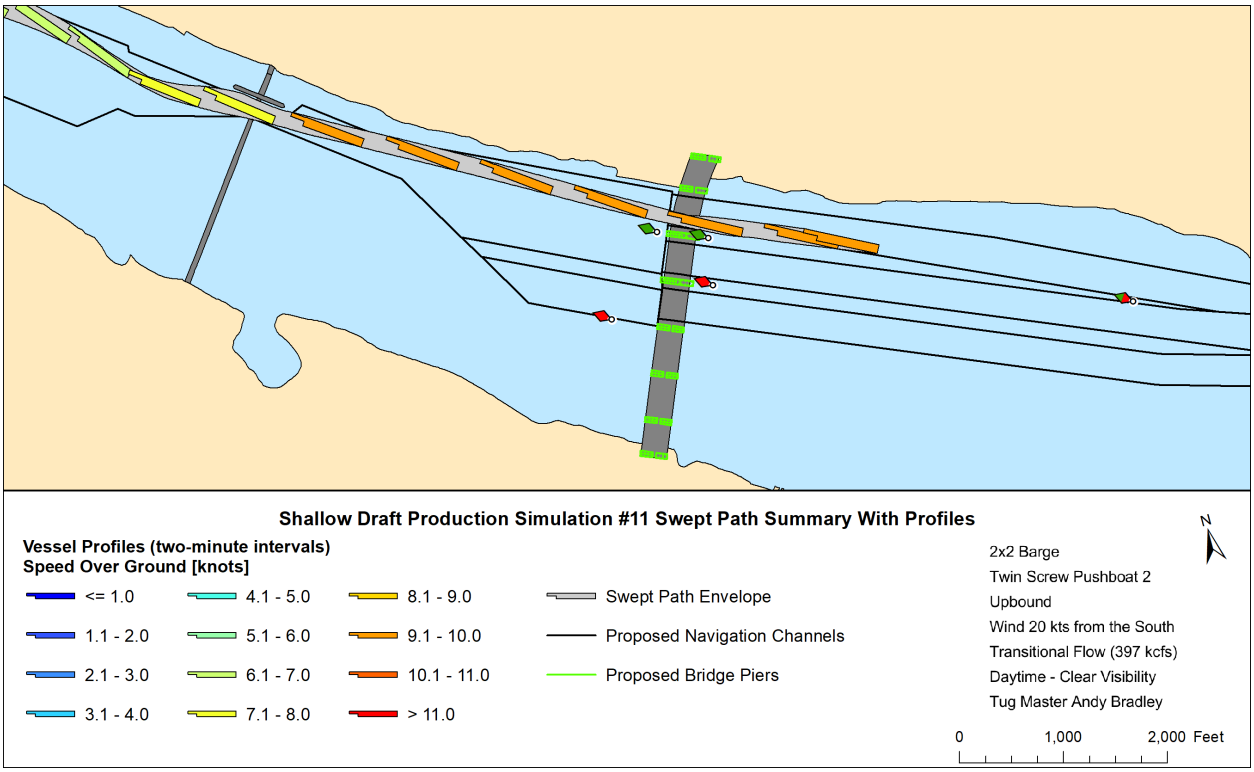

Summary of Simulation Parameters: Shallow-Draft Production Simulation 08
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

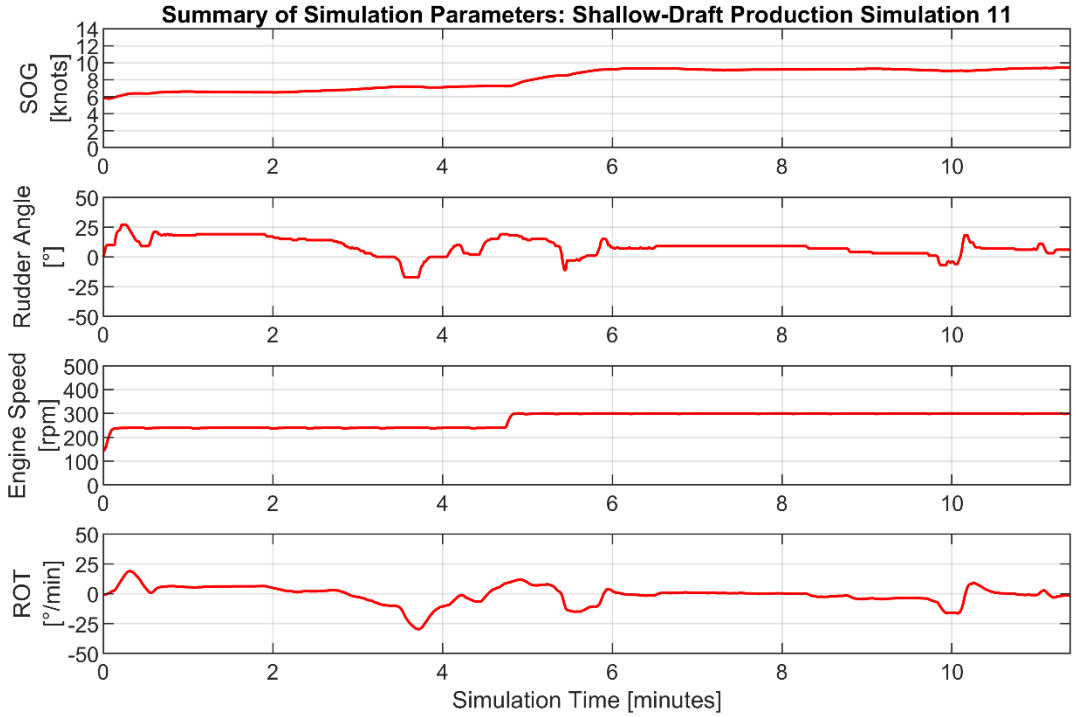

Shallow Draft Production Simulation #09 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Jim Fletcher
N
0
1,000
2,000 Feet

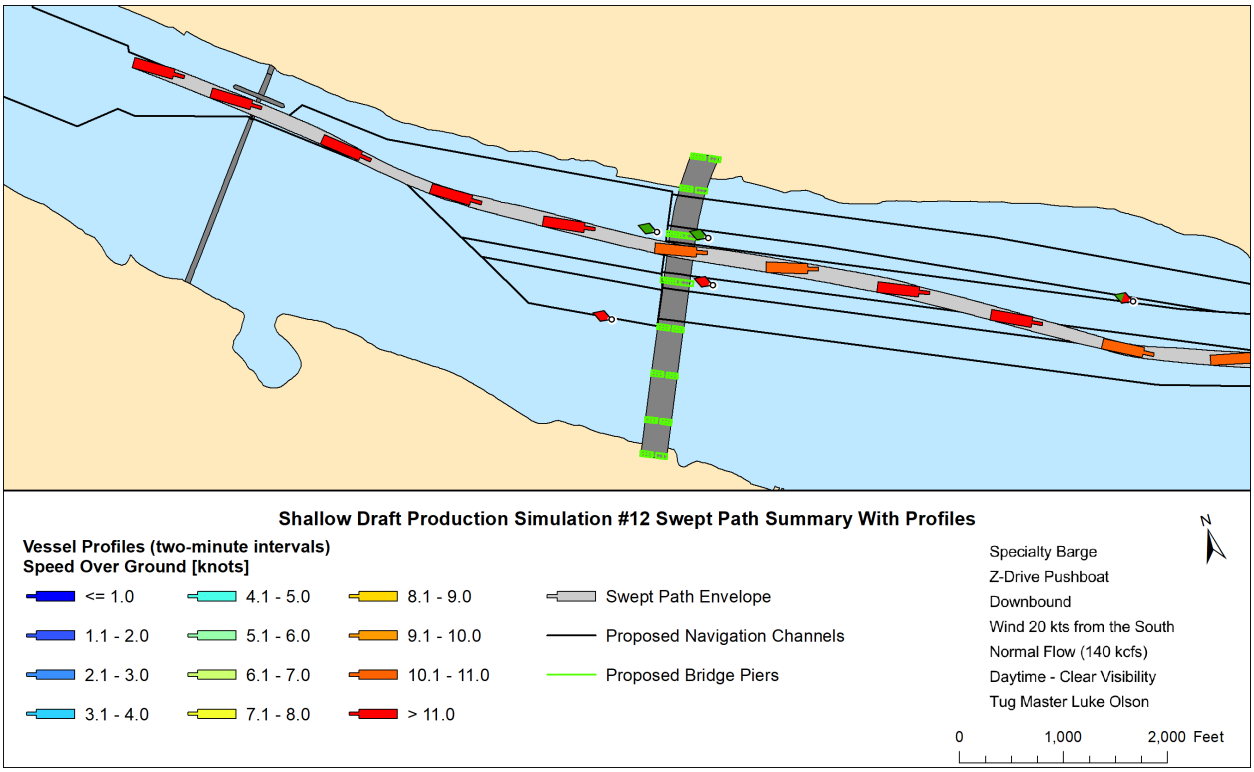

Summary of Simulation Parameters: Shallow-Draft Production Simulation 09
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

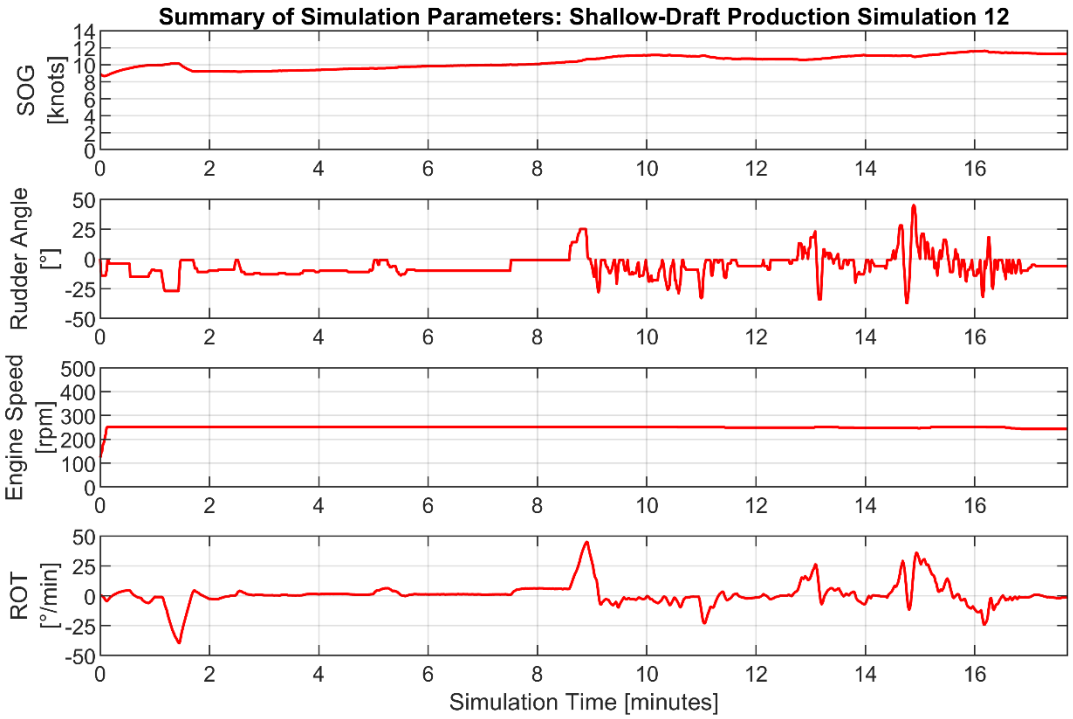

Shallow Draft Production Simulation #10 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
N
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
0
1,000
2,000 Feet

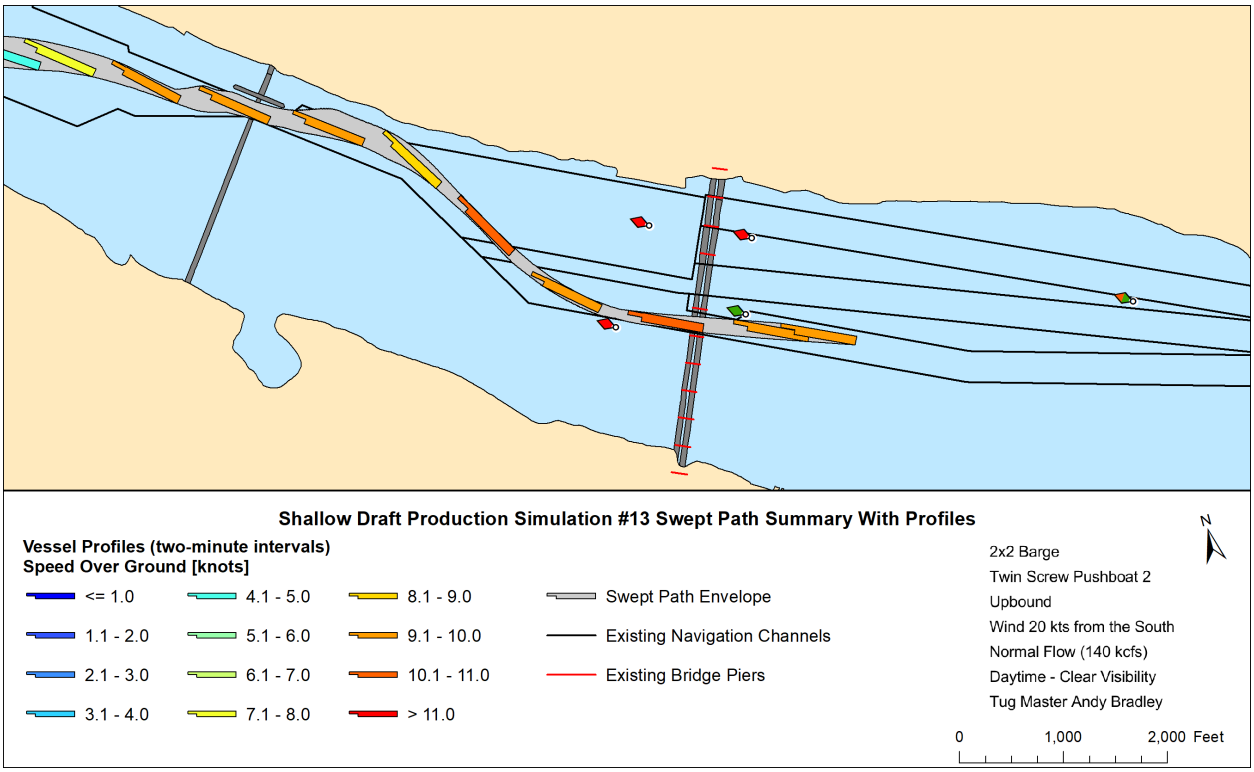

Summary of Simulation Parameters: Shallow-Draft Production Simulation 10
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

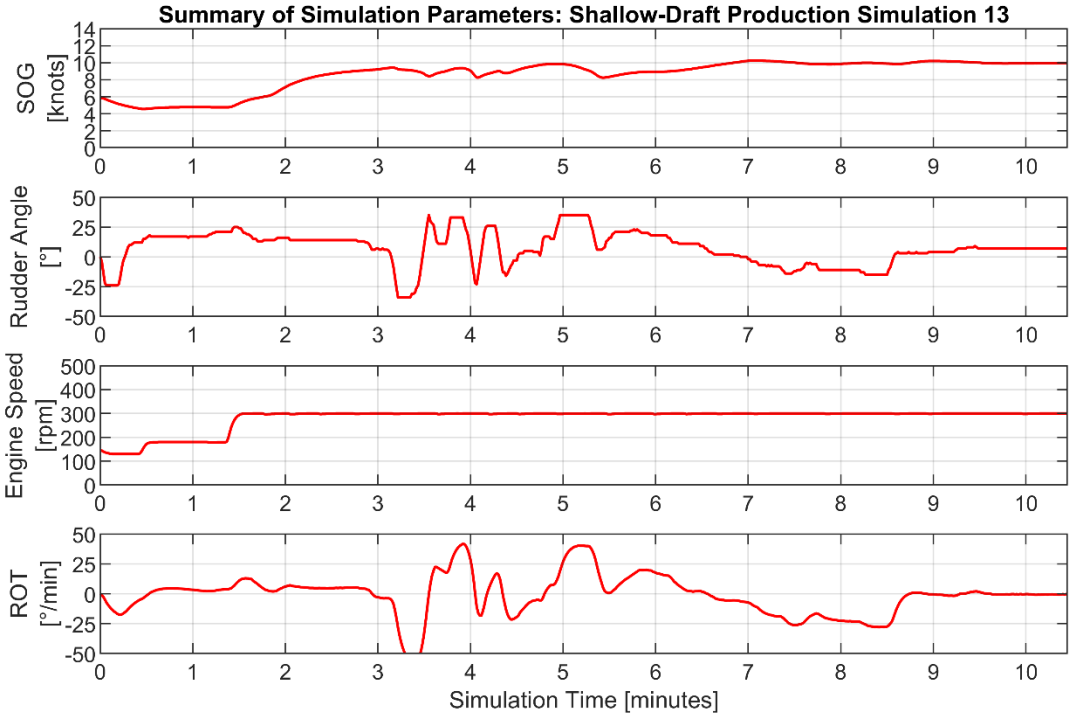

Shallow Draft Production Simulation #11 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

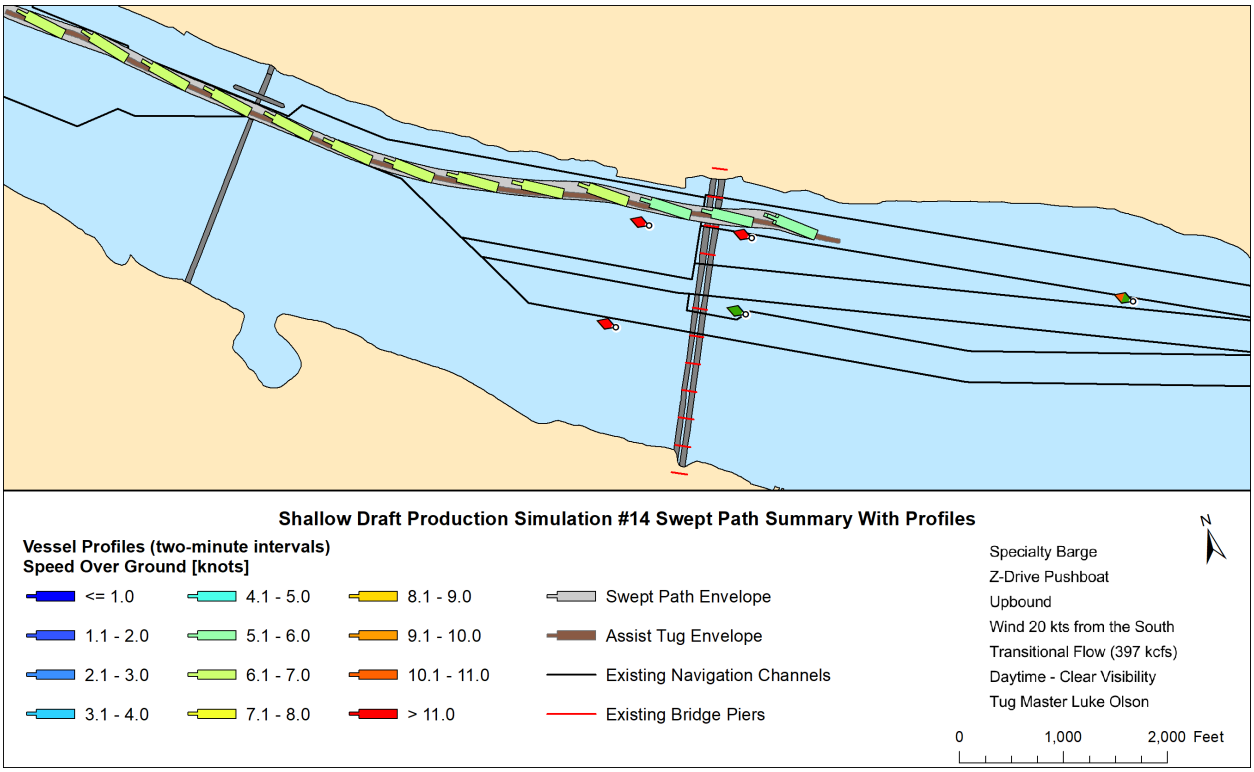

Summary of Simulation Parameters: Shallow-Draft Production Simulation 11
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

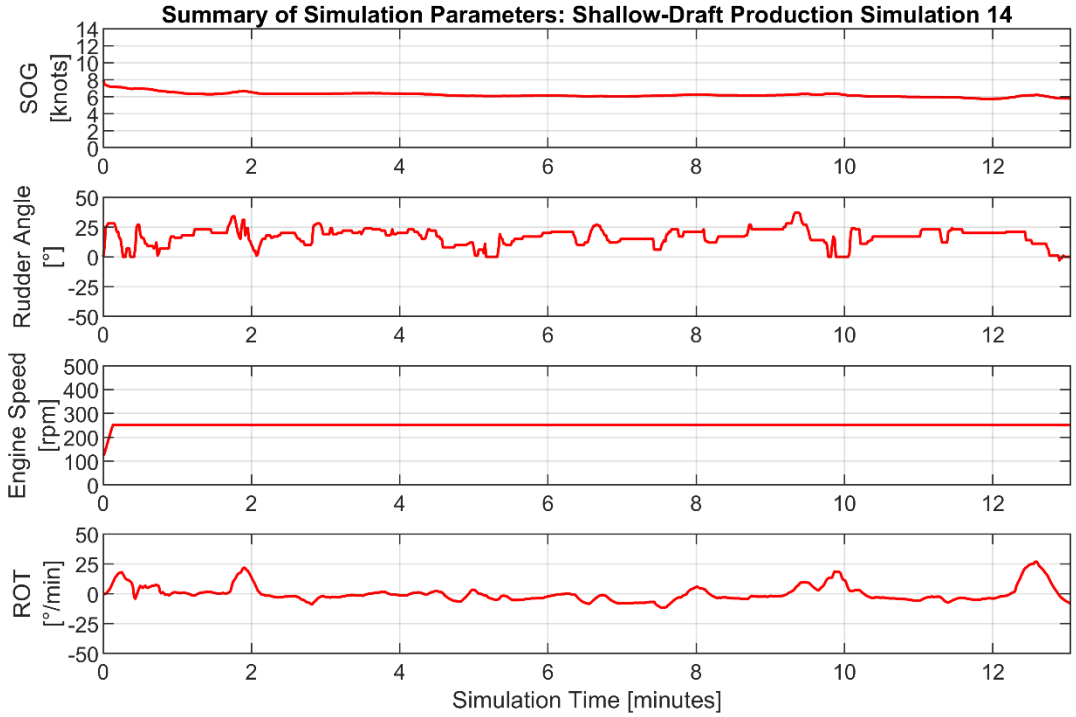

Shallow Draft Production Simulation #12 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

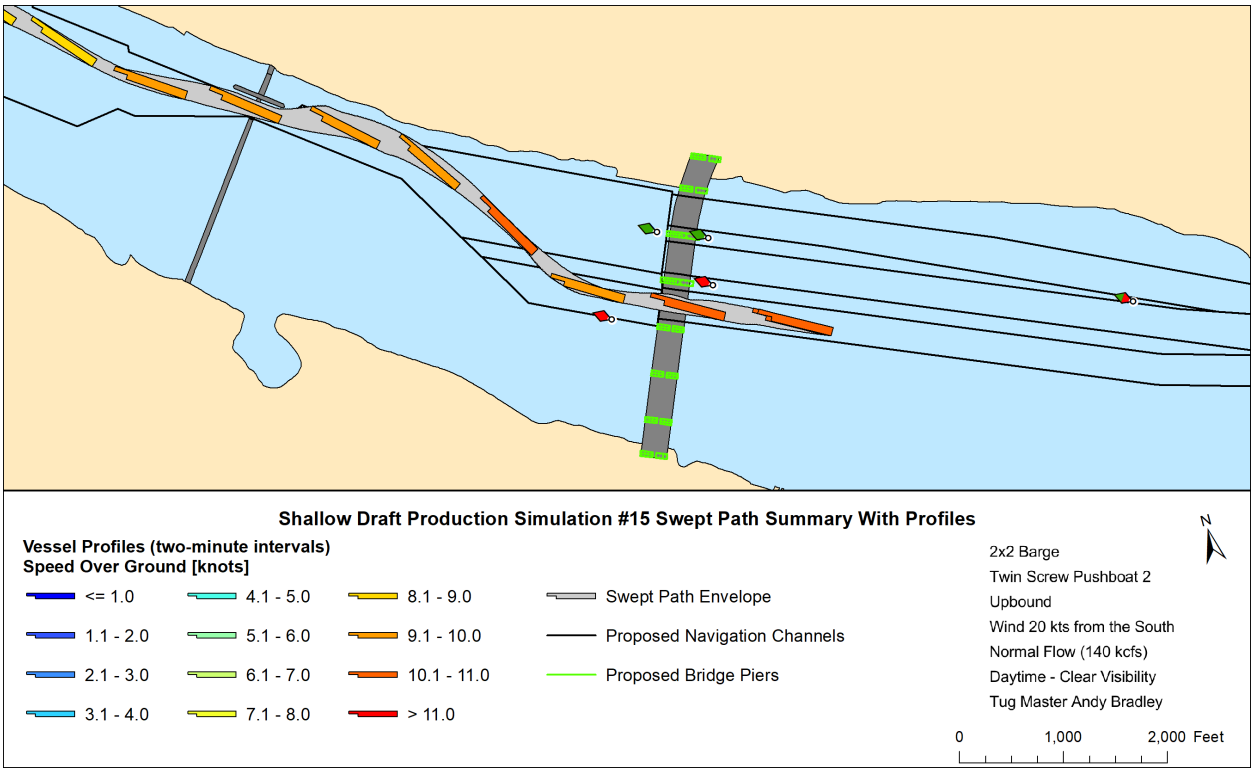

Summary of Simulation Parameters: Shallow-Draft Production Simulation 12
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

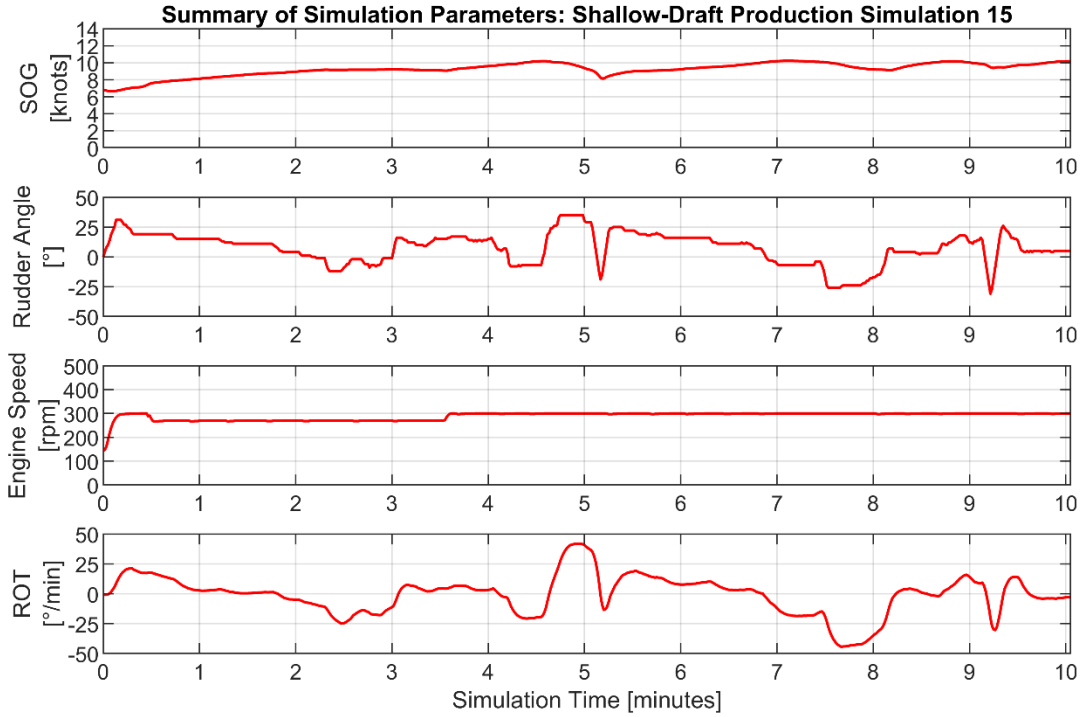

Shallow Draft Production Simulation #13 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

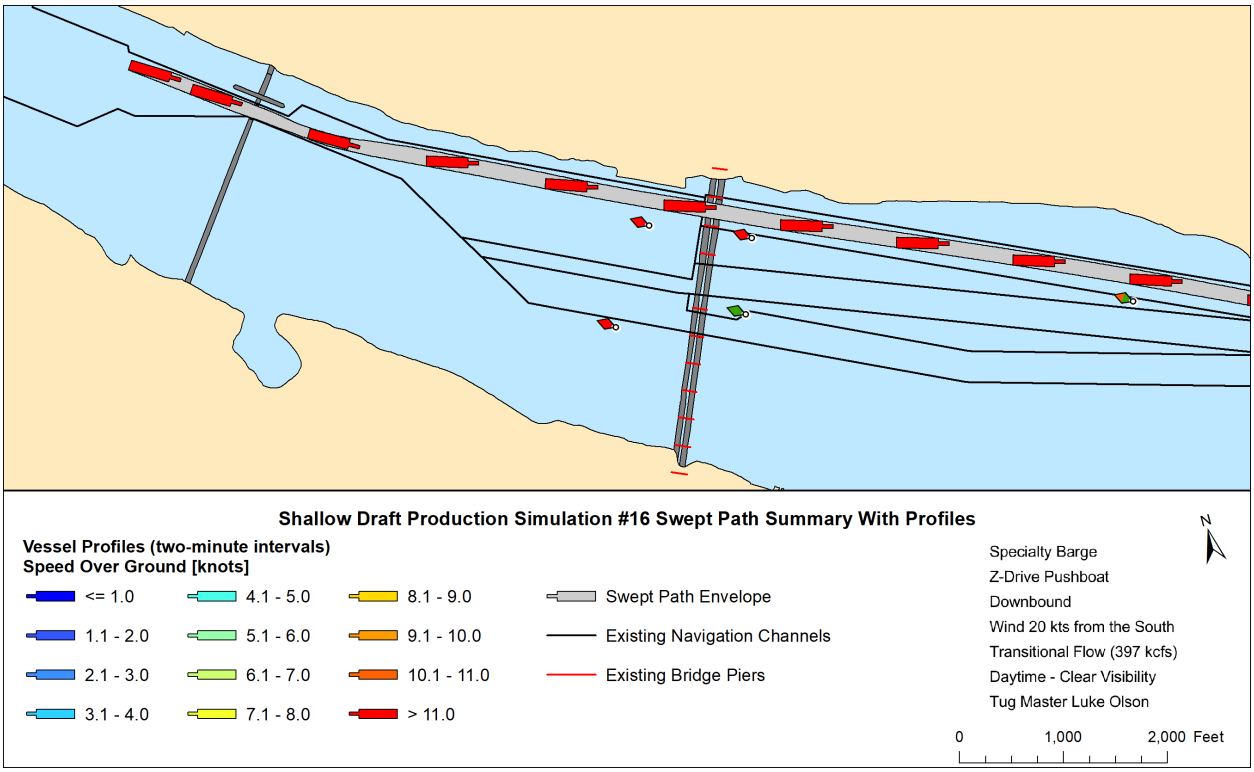

Summary of Simulation Parameters: Shallow-Draft Production Simulation 13
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

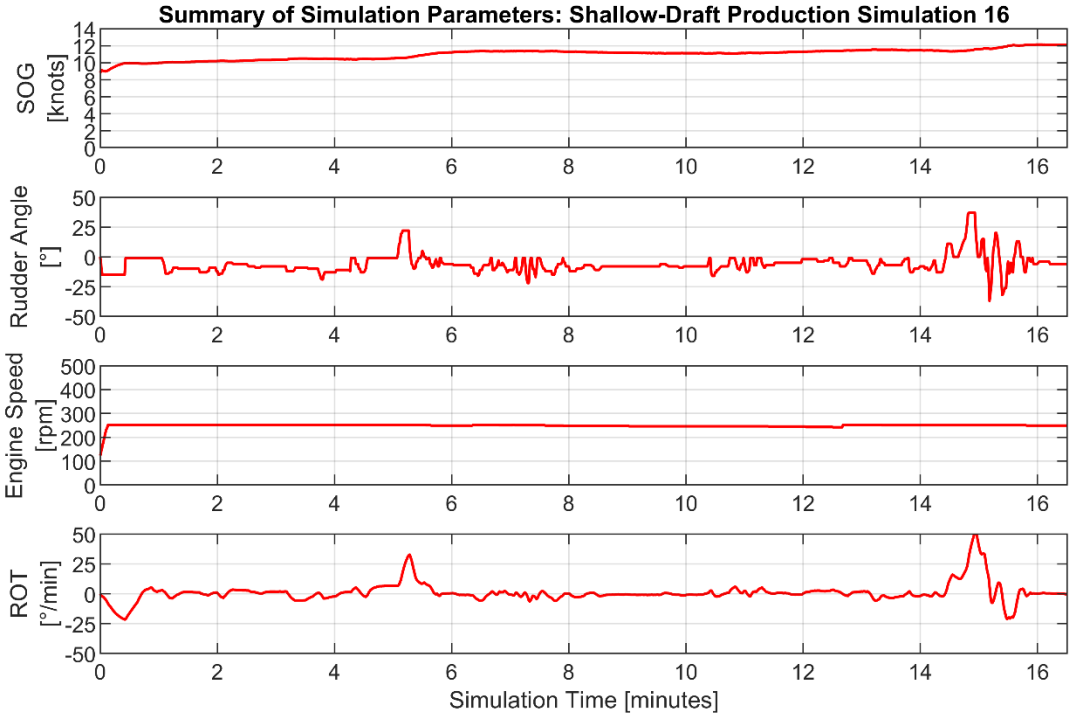

Shallow Draft Production Simulation #14 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Assist Tug Envelope
Existing Navigation Channels
Existing Bridge Piers
N
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
0
1,000
2,000 Feet

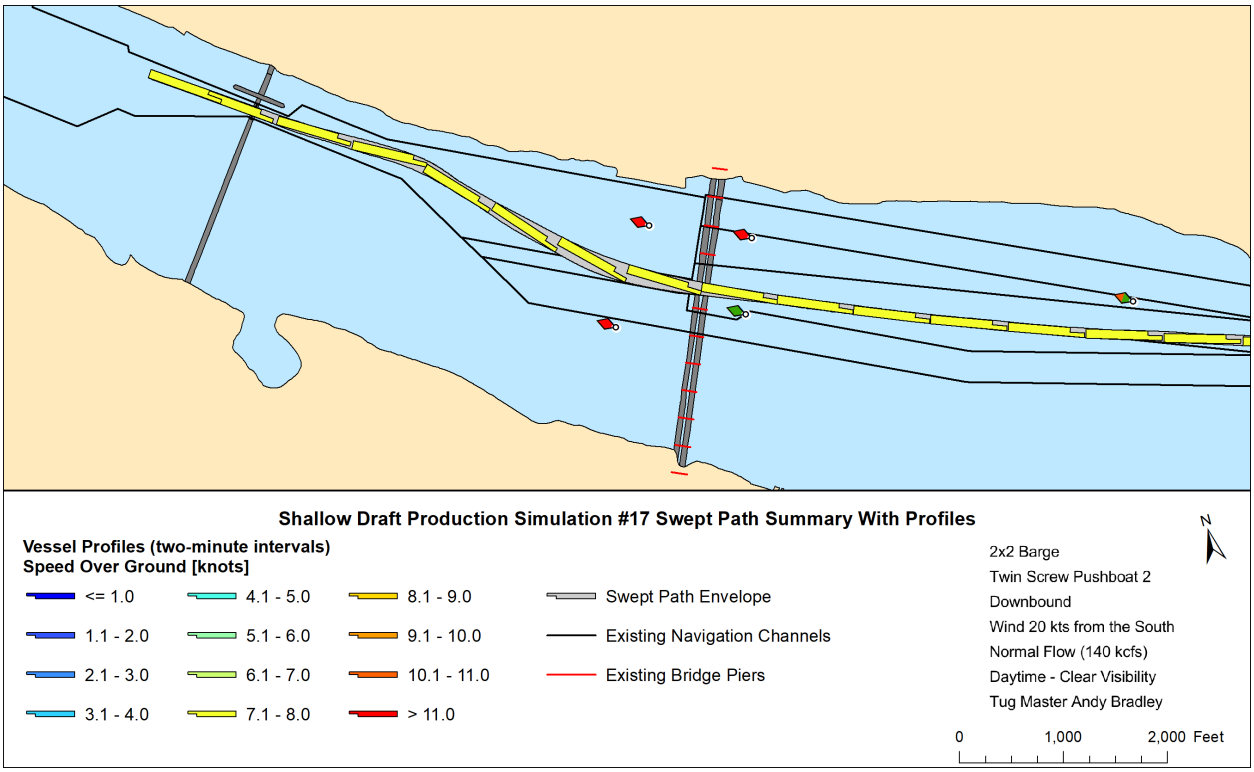

Summary of Simulation Parameters: Shallow-Draft Production Simulation 14
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

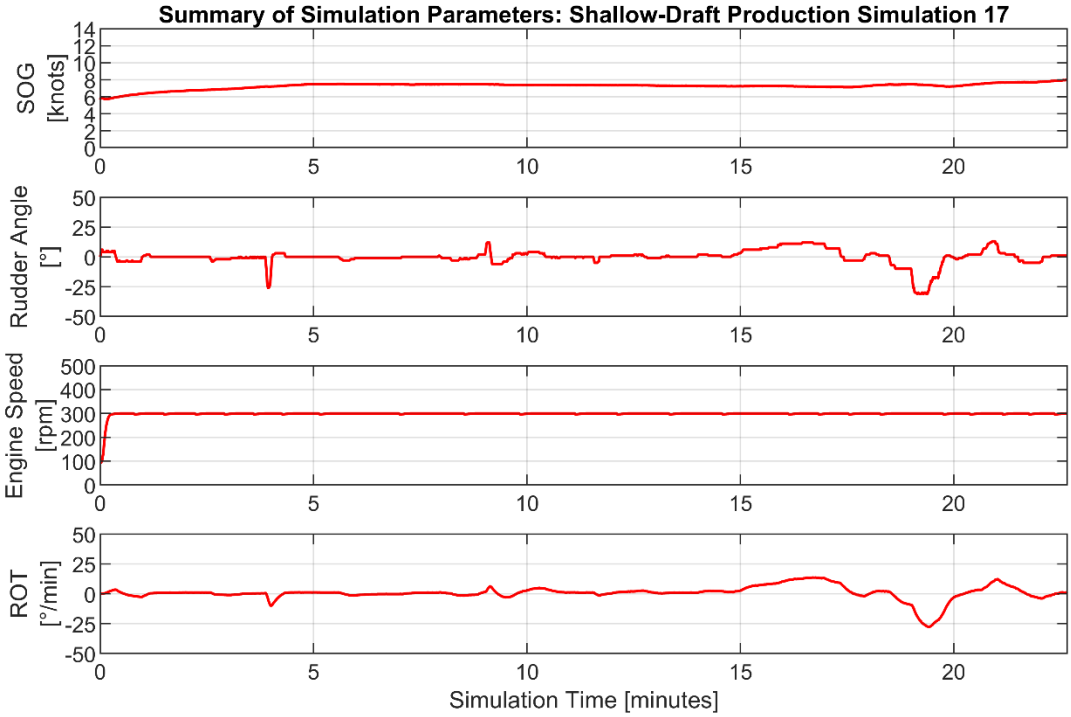

Shallow Draft Production Simulation #15 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

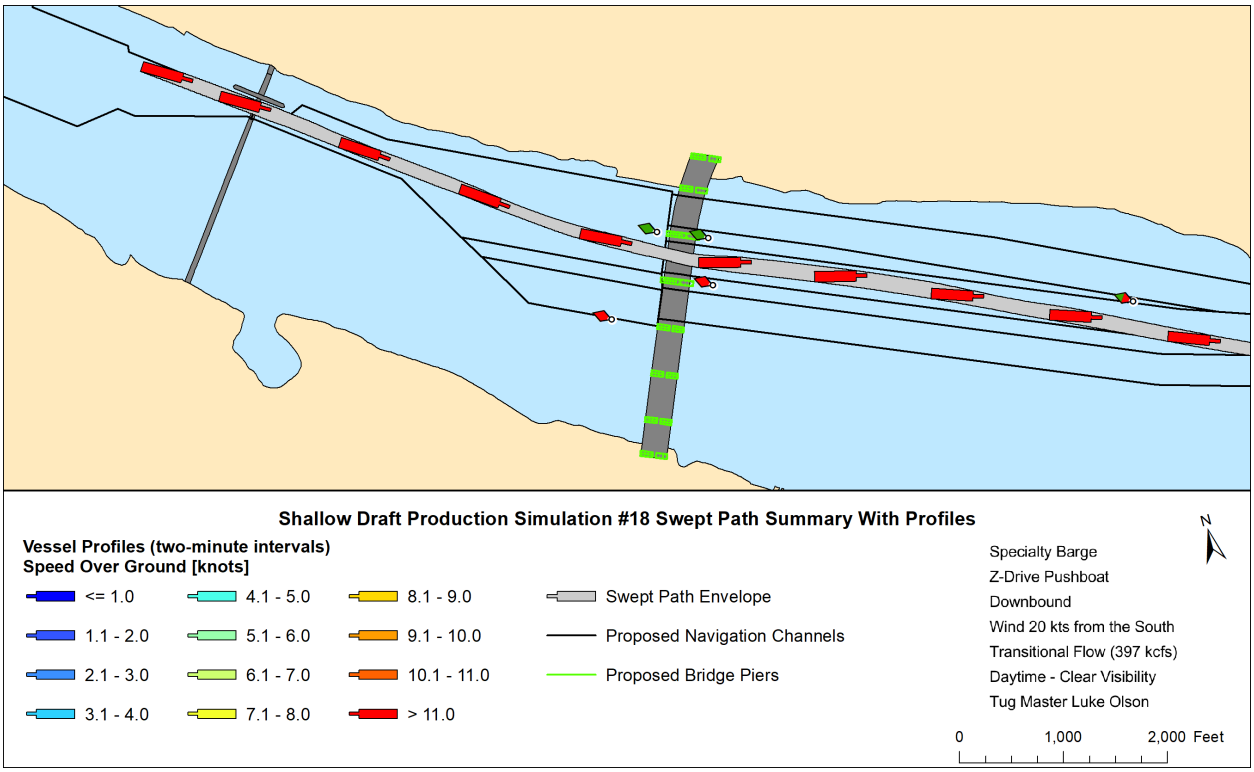

Summary of Simulation Parameters: Shallow-Draft Production Simulation 15
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

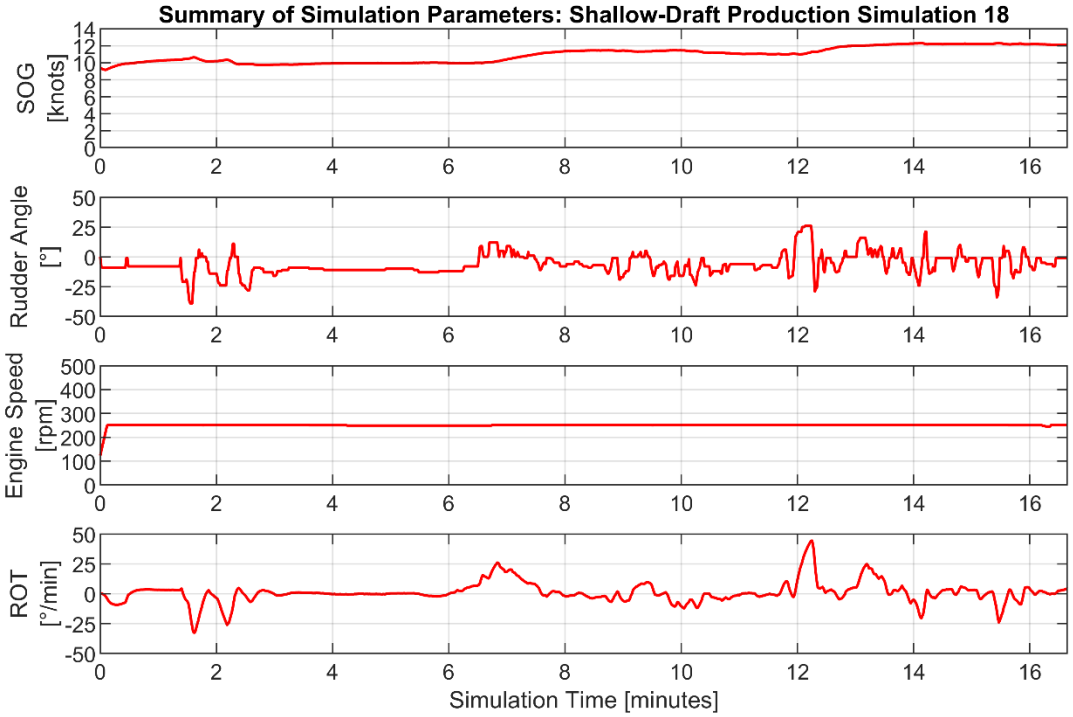

Shallow Draft Production Simulation #16 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

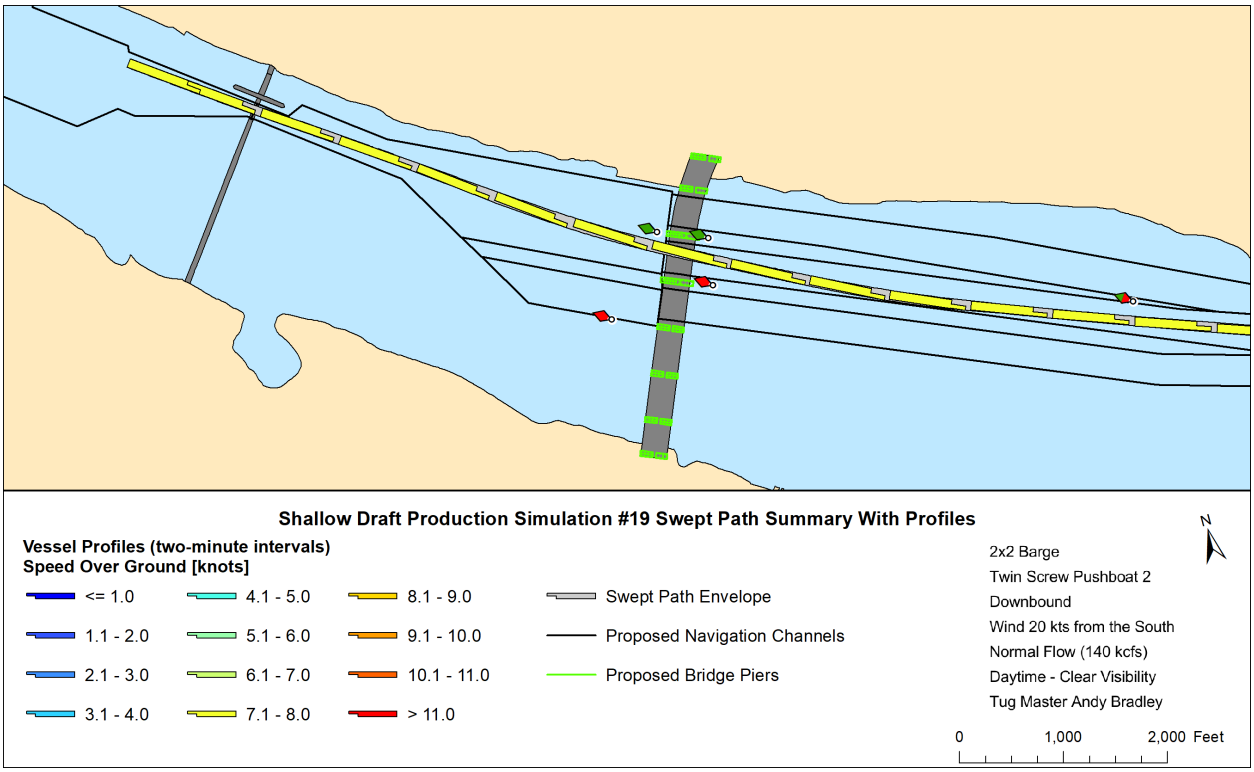

Summary of Simulation Parameters: Shallow-Draft Production Simulation 16
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

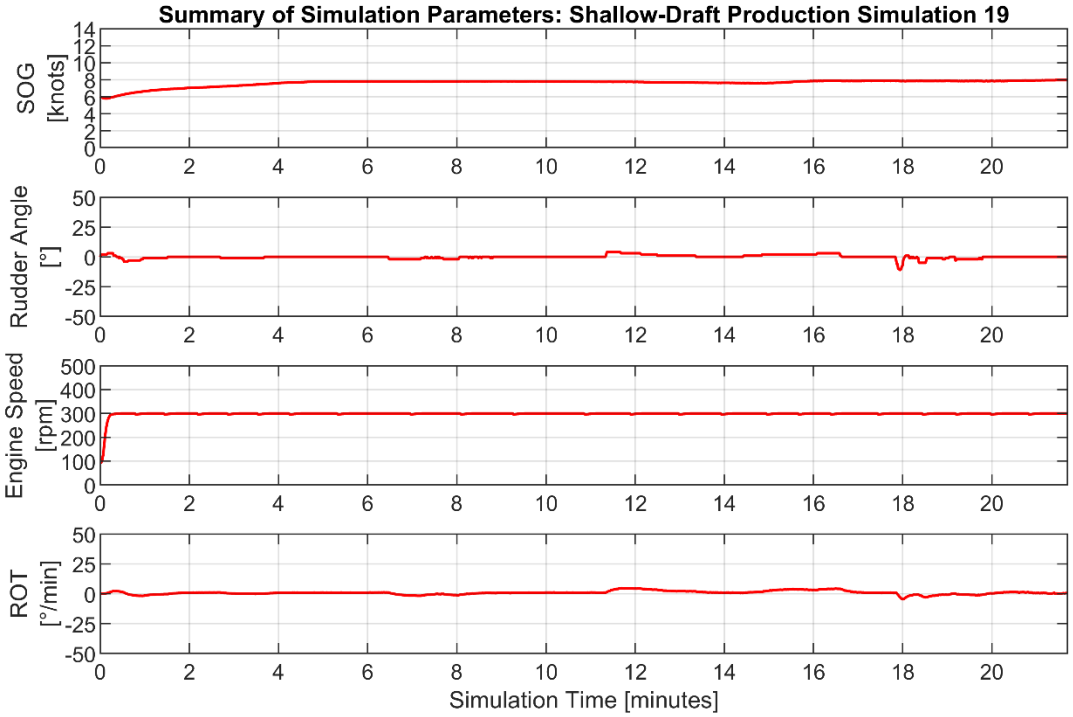

Shallow Draft Production Simulation #17 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

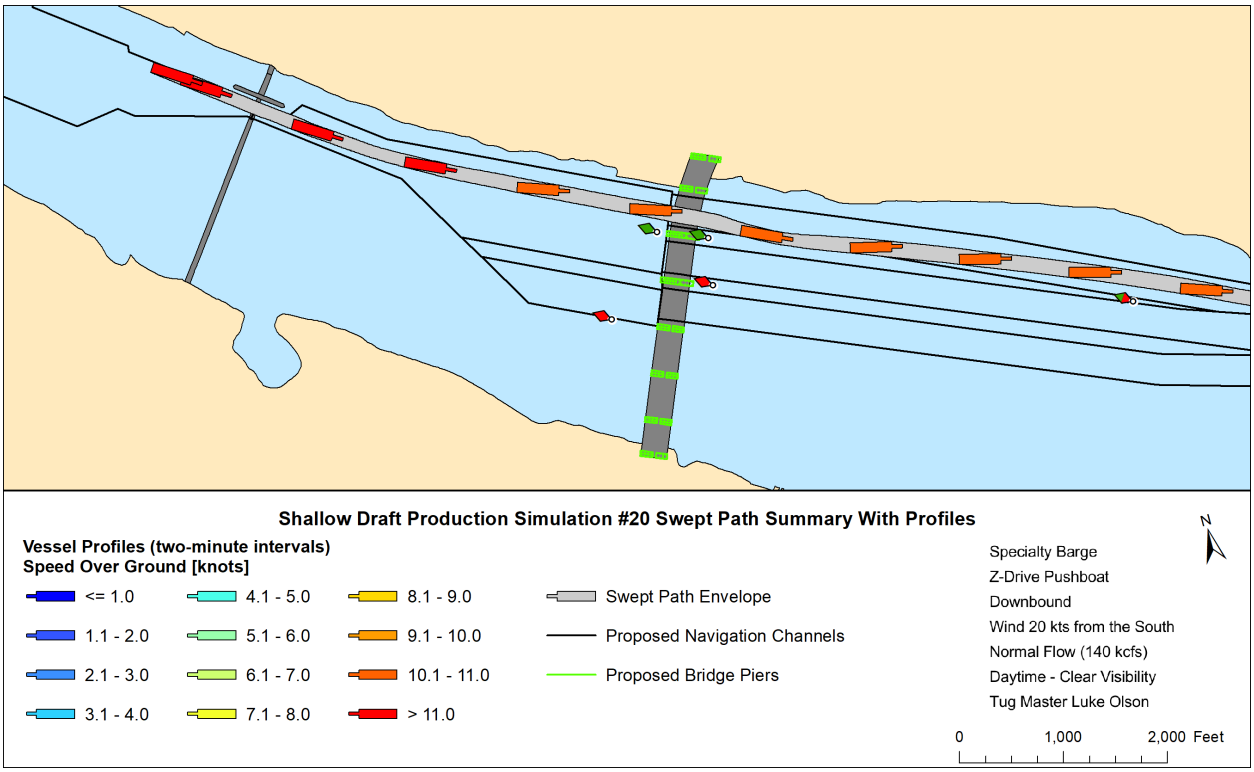

Summary of Simulation Parameters: Shallow-Draft Production Simulation 17
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

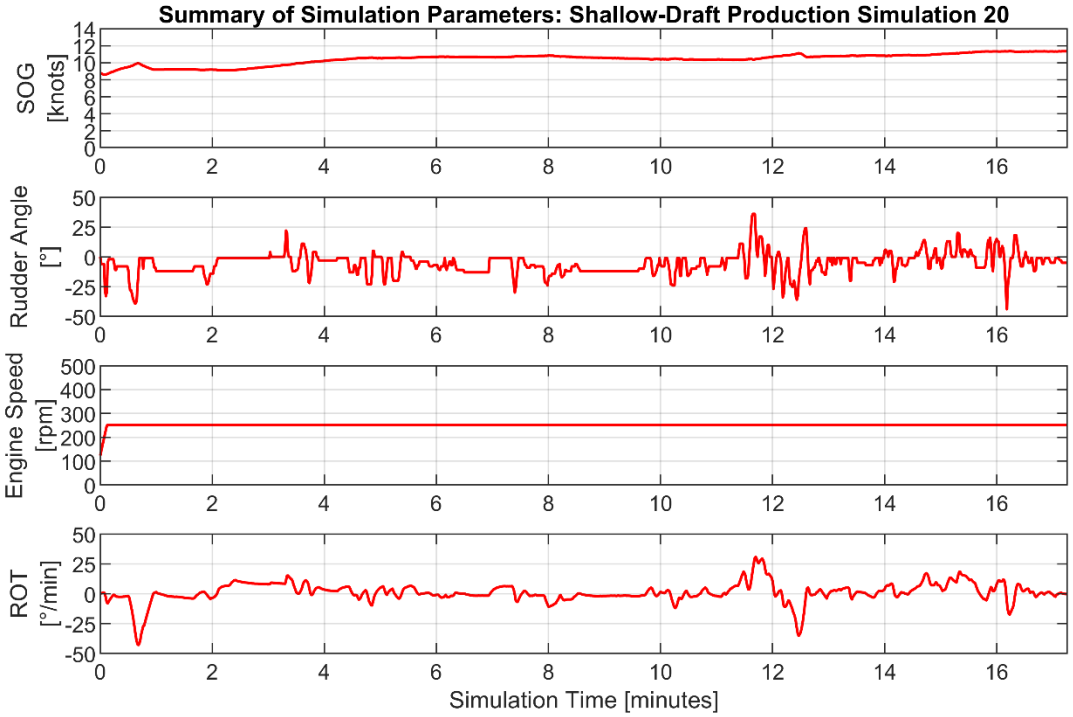

Shallow Draft Production Simulation #18 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

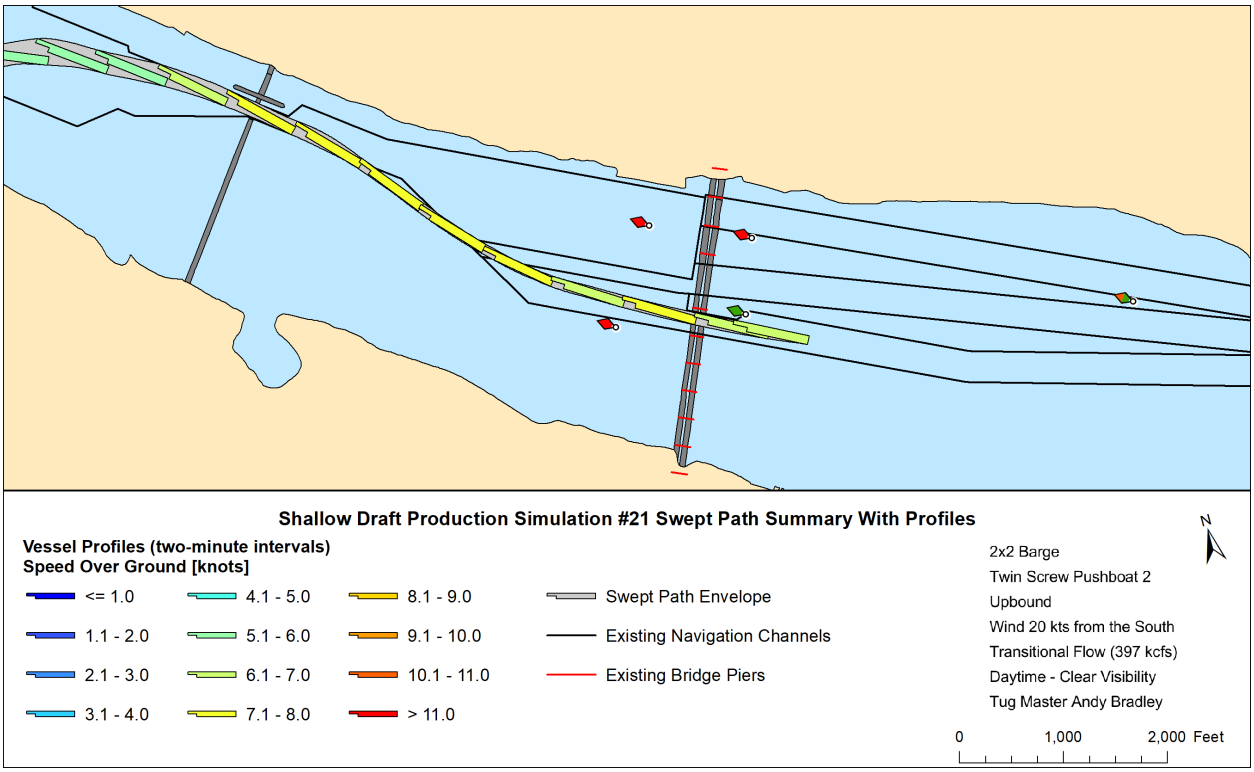

Summary of Simulation Parameters: Shallow-Draft Production Simulation 18
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

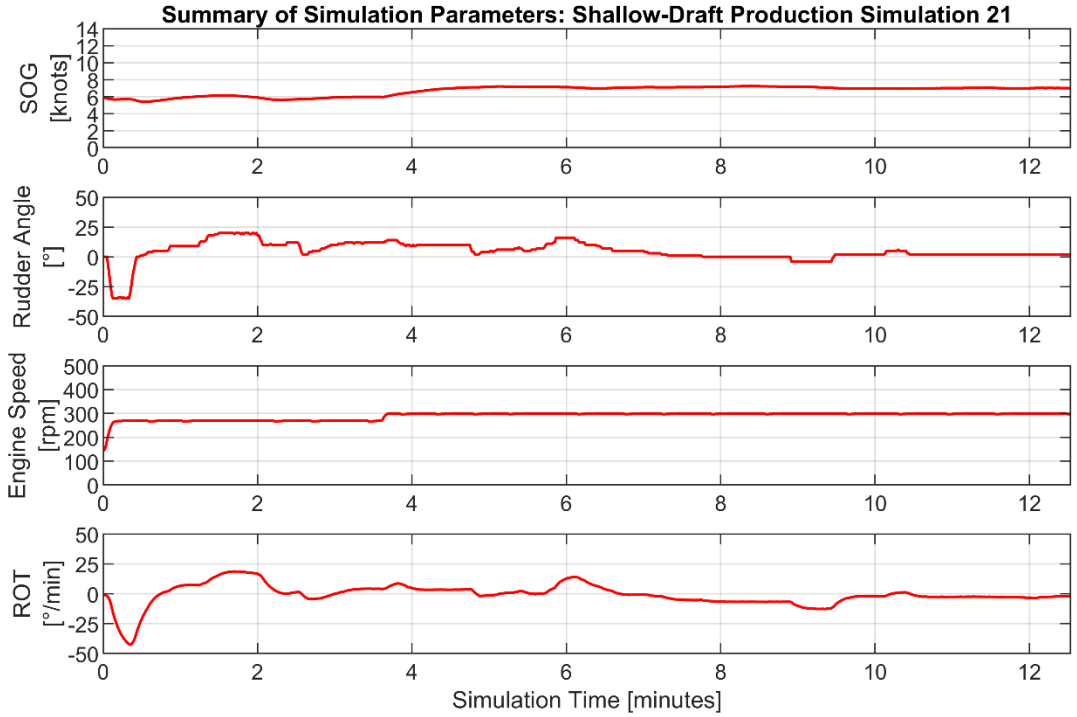

Shallow Draft Production Simulation #19 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

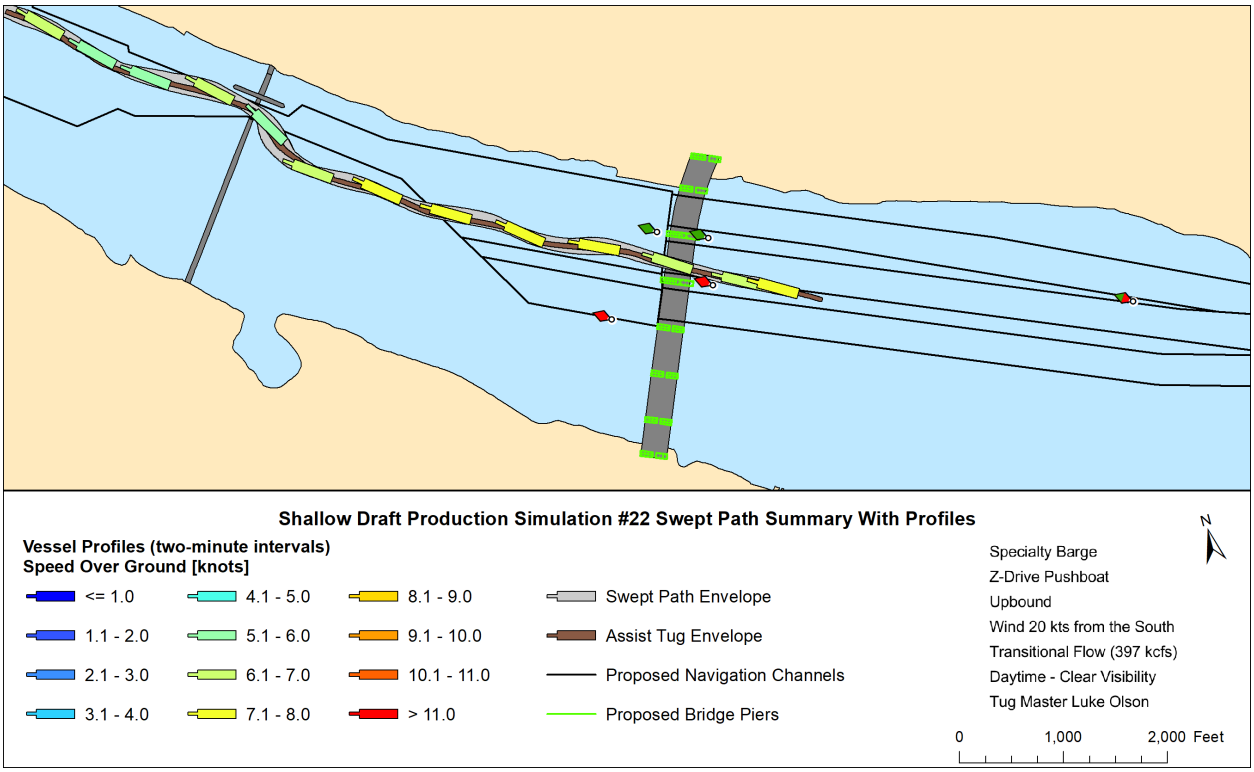

Summary of Simulation Parameters: Shallow-Draft Production Simulation 19
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

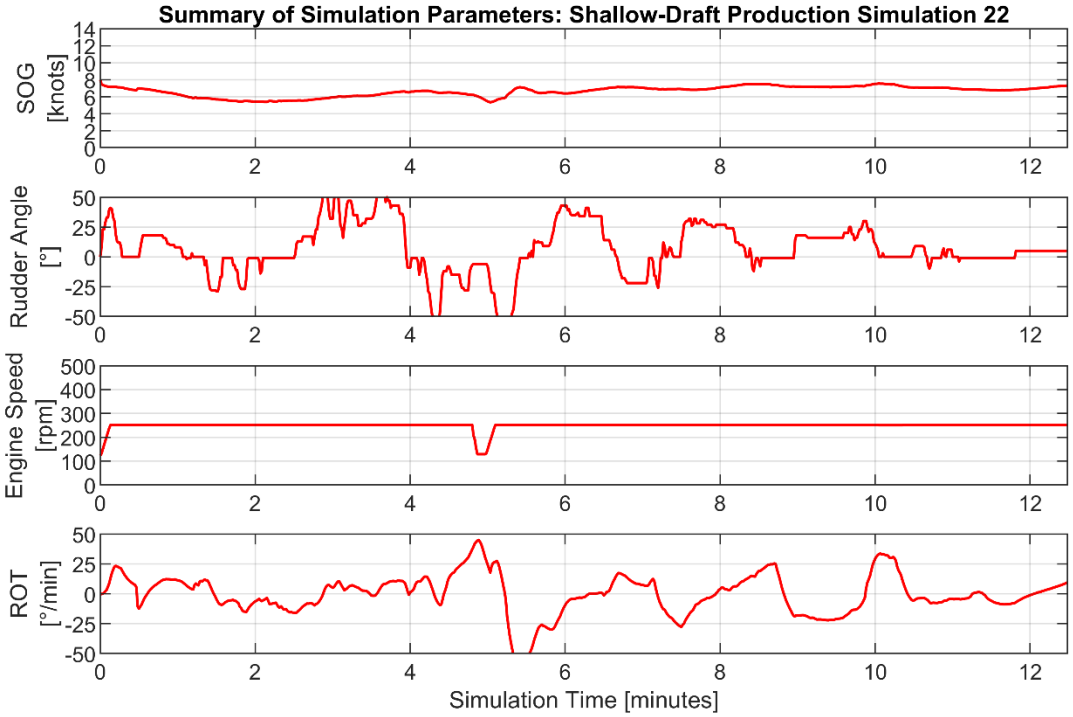

Shallow Draft Production Simulation #20 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

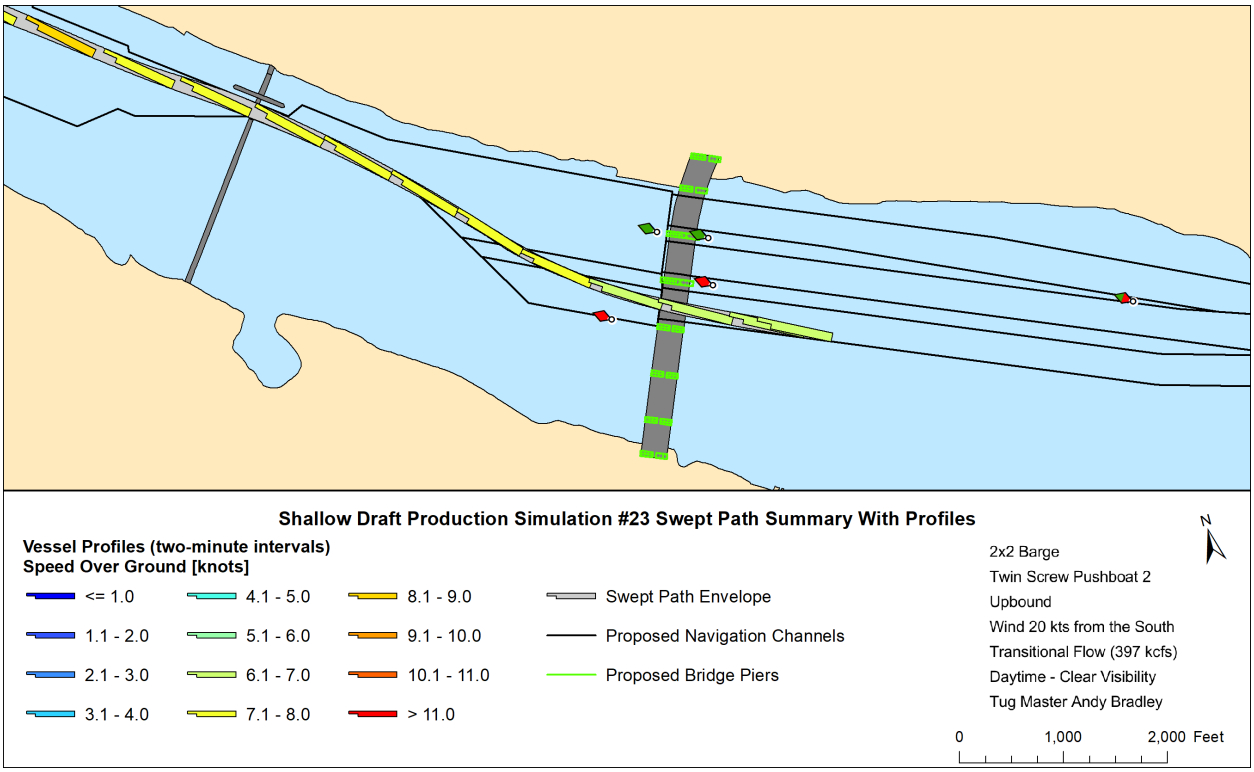

Summary of Simulation Parameters: Shallow-Draft Production Simulation 20
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

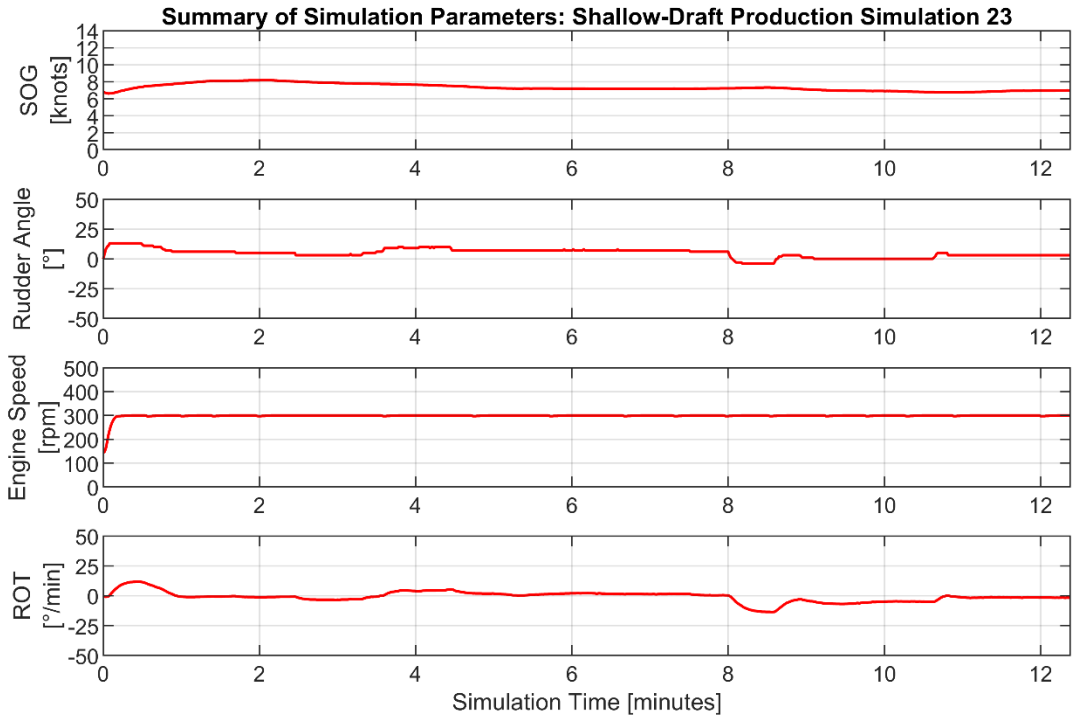

Shallow Draft Production Simulation #21 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

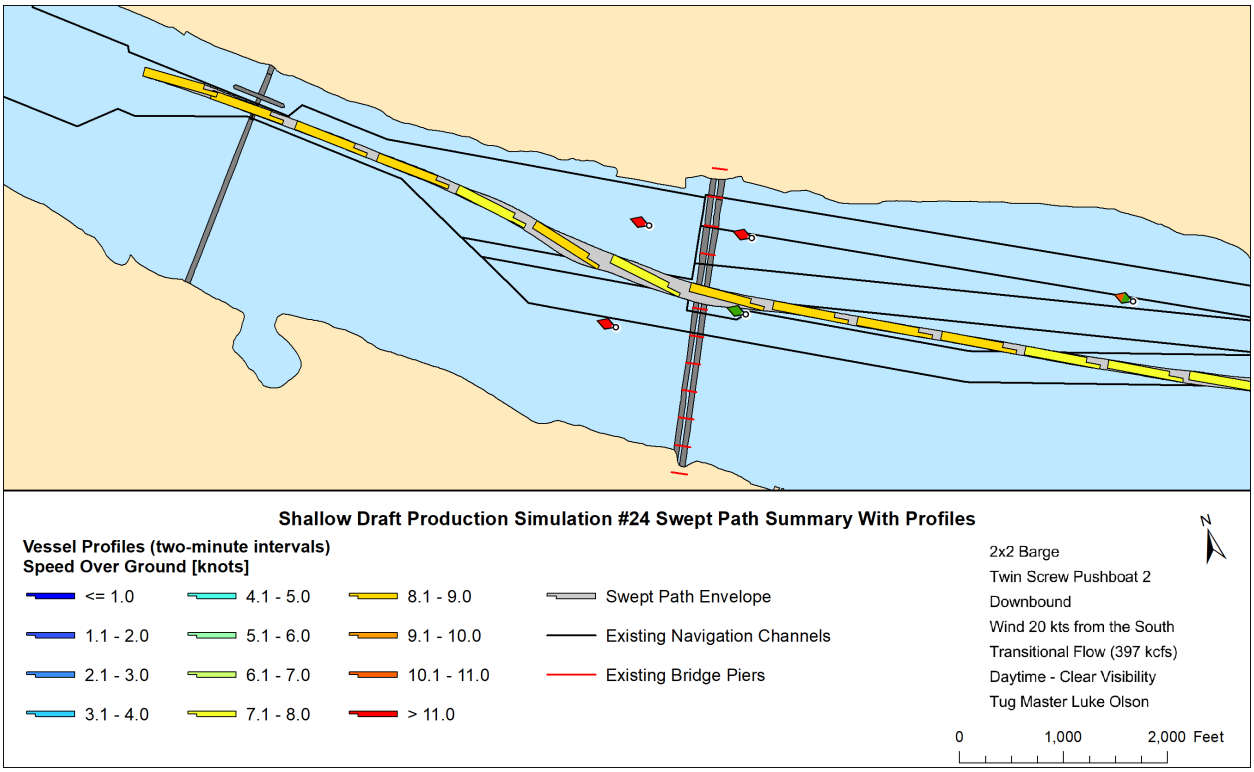

Summary of Simulation Parameters: Shallow-Draft Production Simulation 21
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

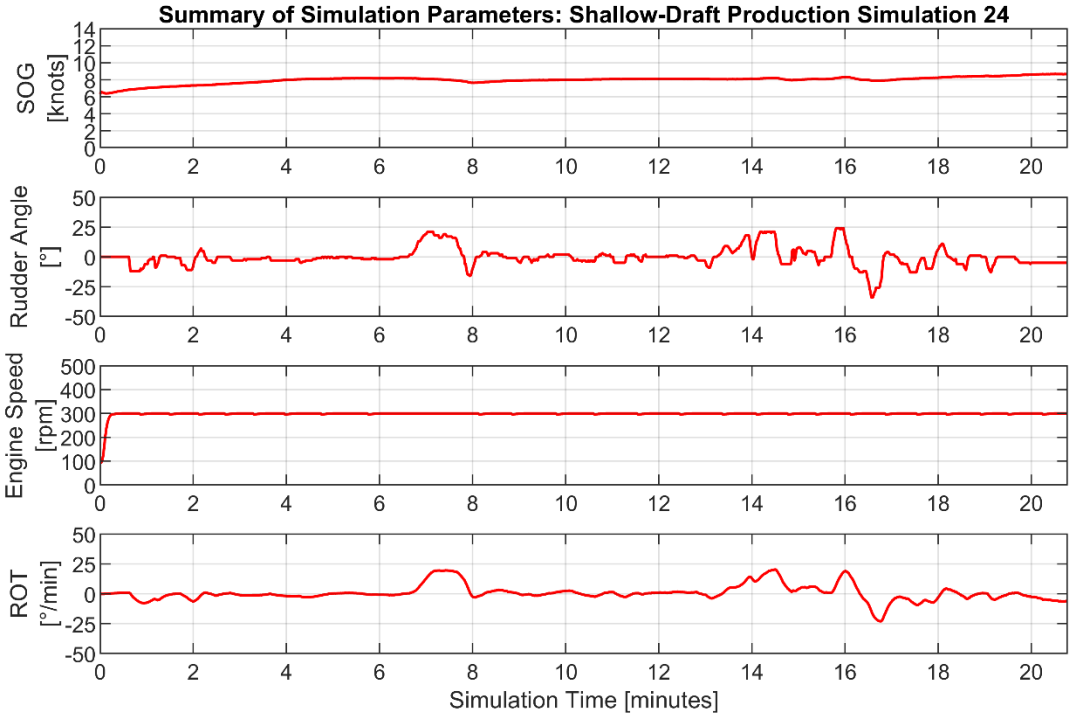

Shallow Draft Production Simulation #22 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Assist Tug Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

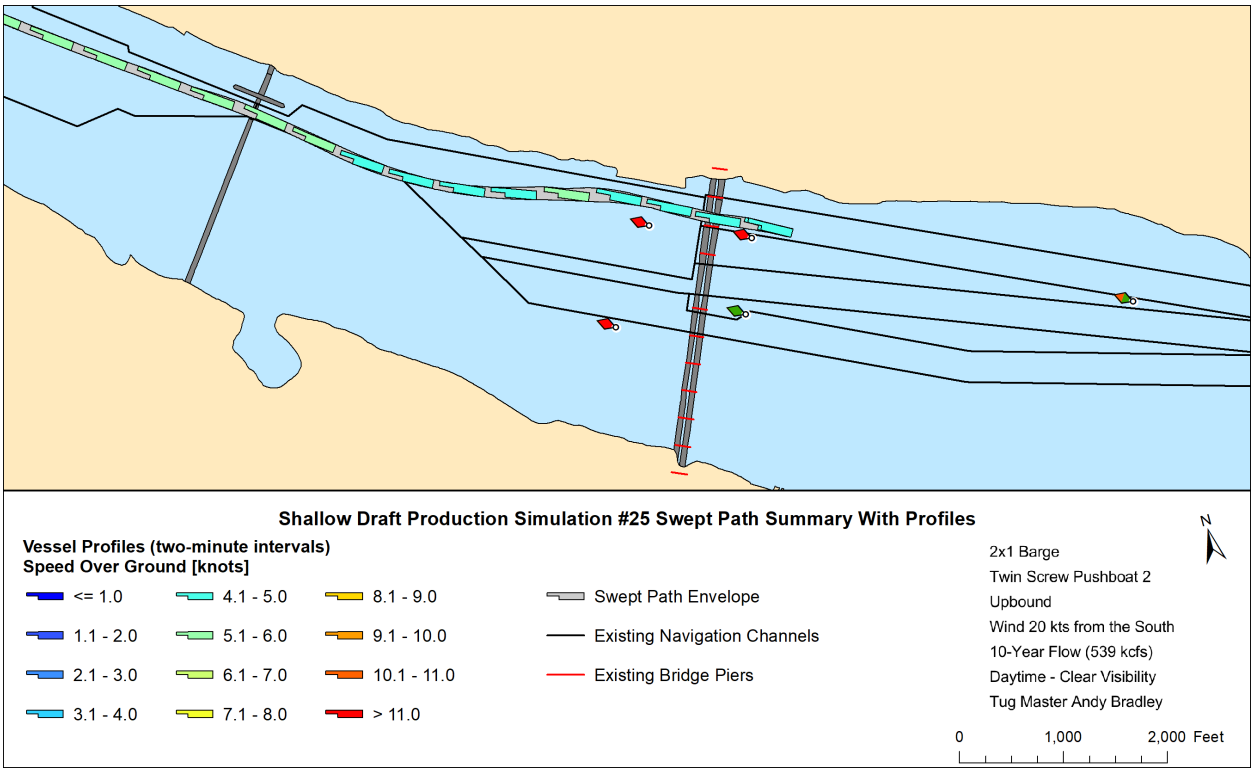

Summary of Simulation Parameters: Shallow-Draft Production Simulation 22
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

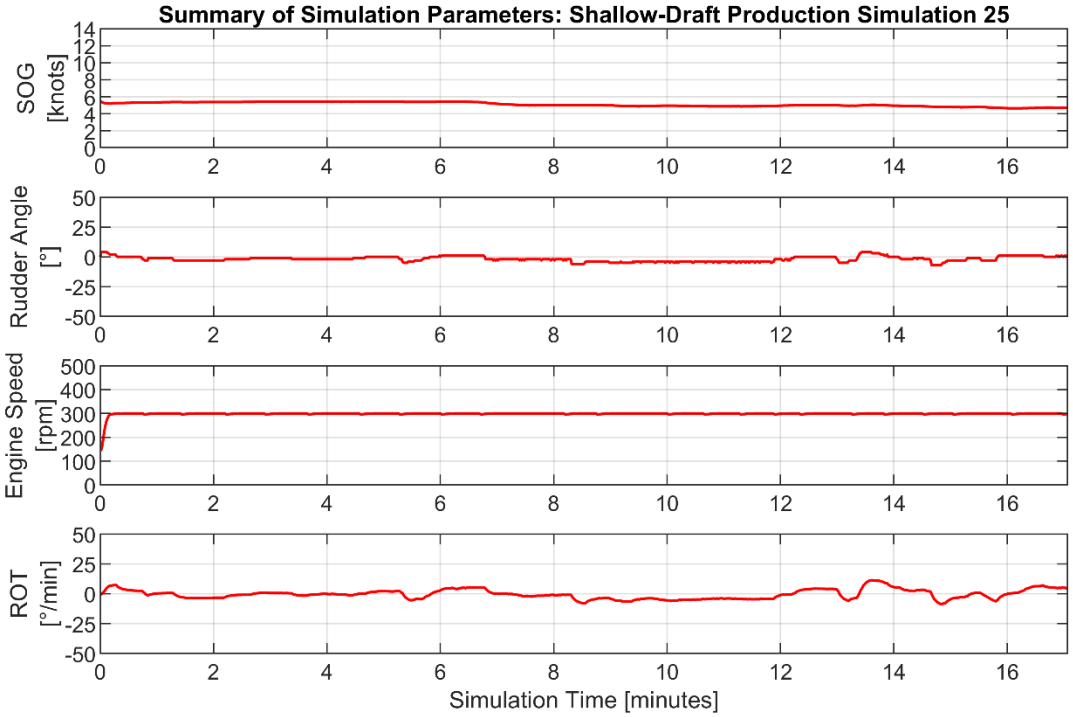

Shallow Draft Production Simulation #23 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

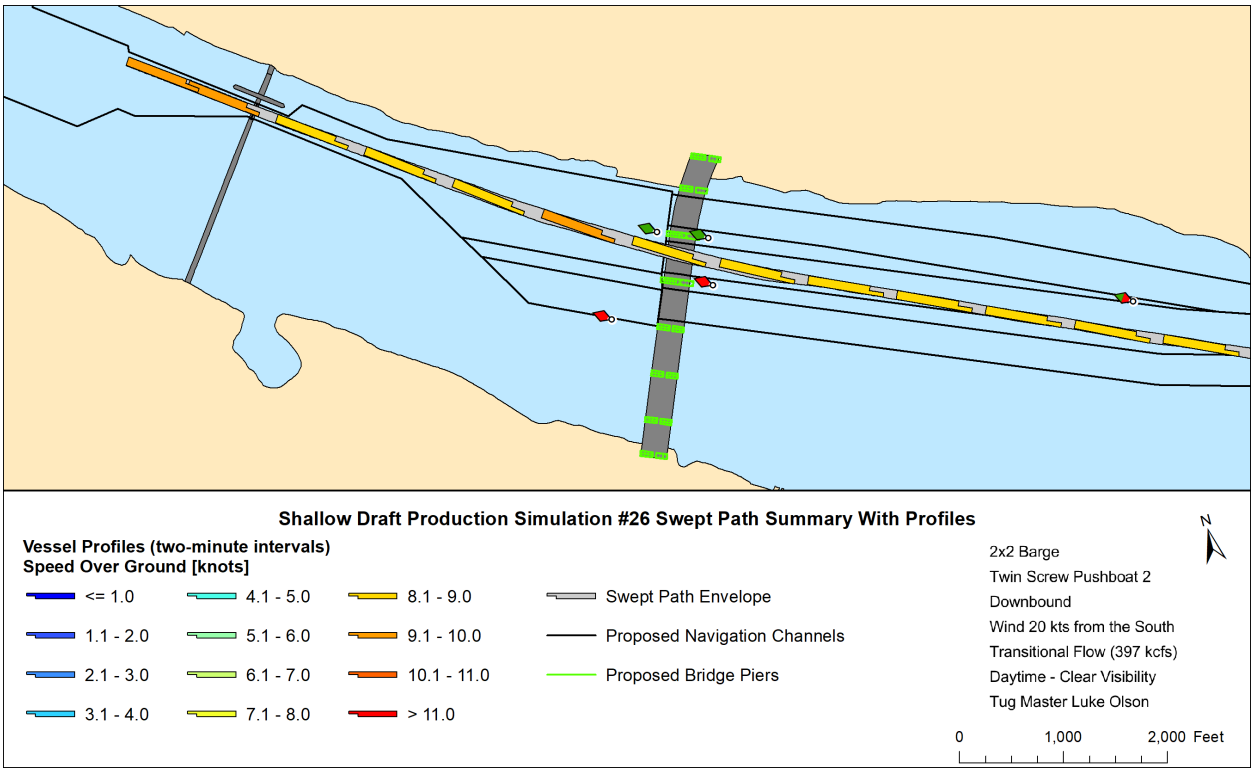

Summary of Simulation Parameters: Shallow-Draft Production Simulation 23
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

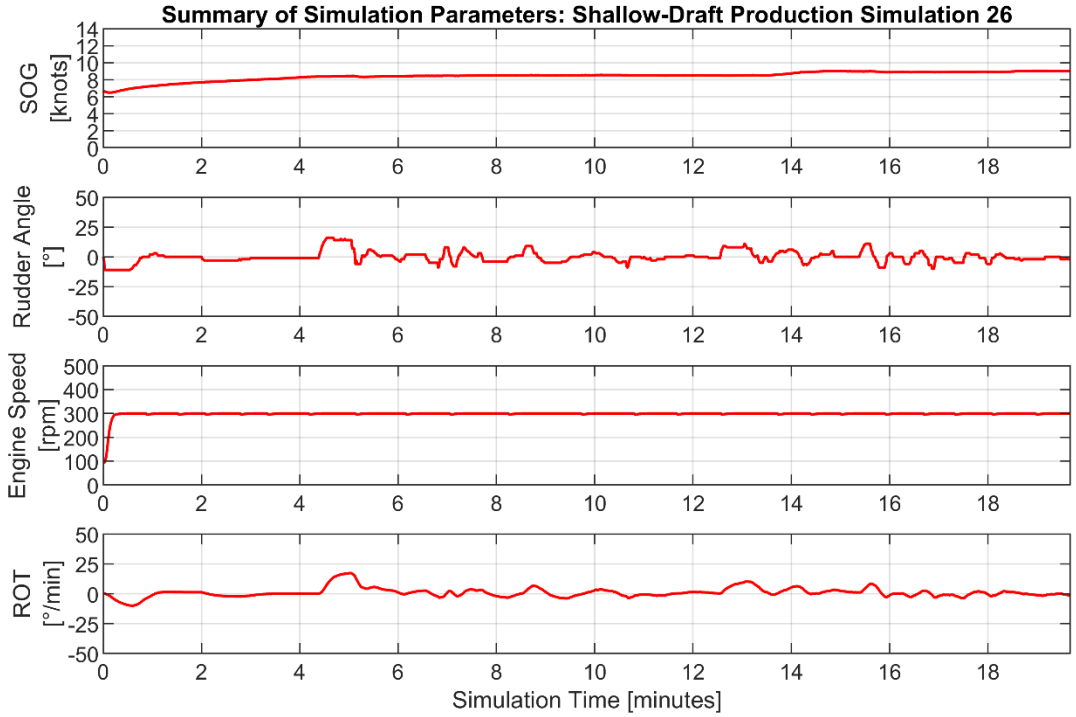

Shallow Draft Production Simulation #24 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

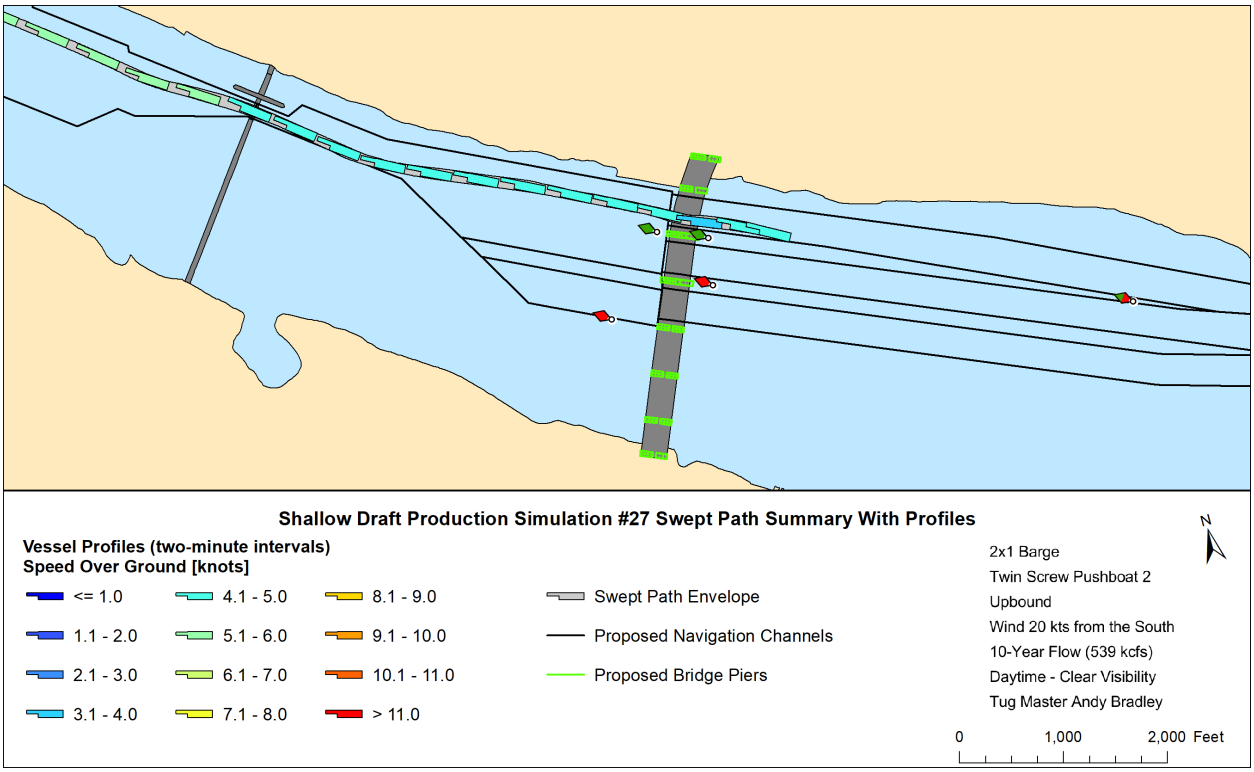

Summary of Simulation Parameters: Shallow-Draft Production Simulation 24
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

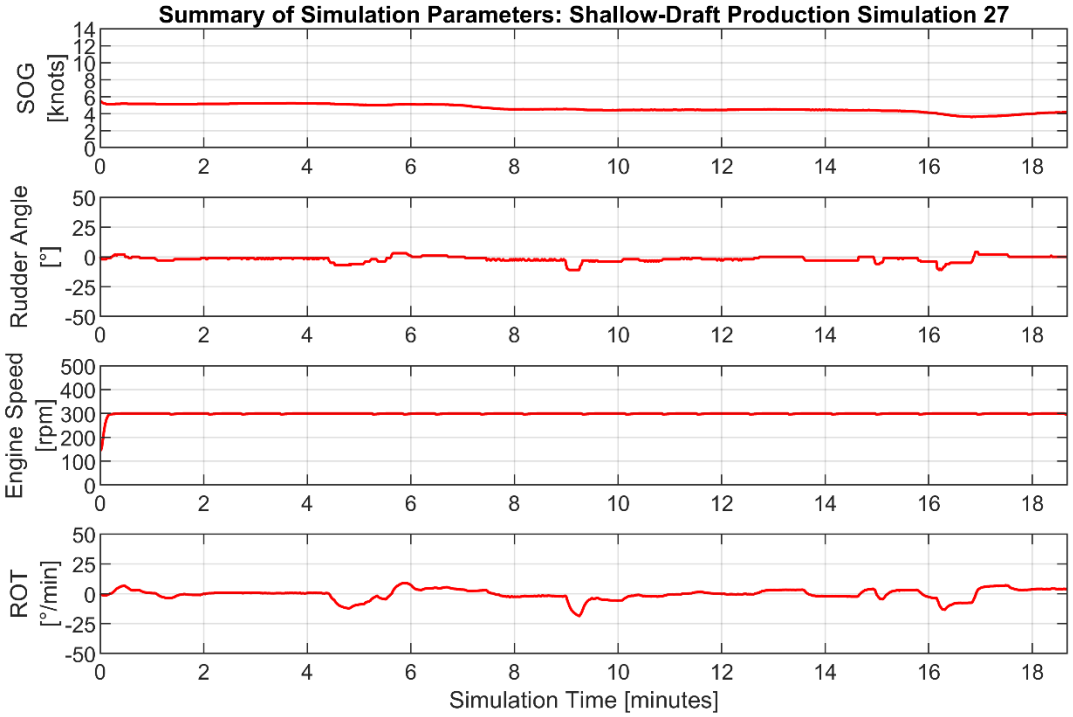

Shallow Draft Production Simulation #25 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

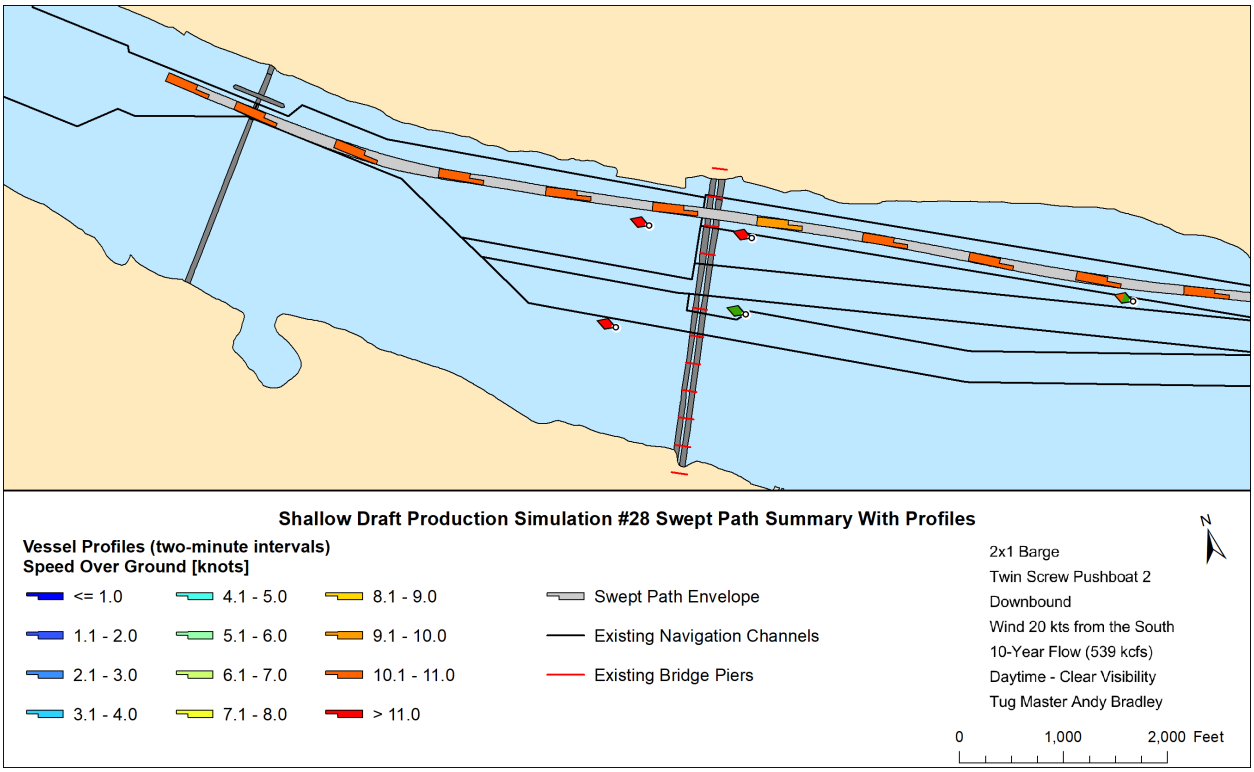

Summary of Simulation Parameters: Shallow-Draft Production Simulation 25
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

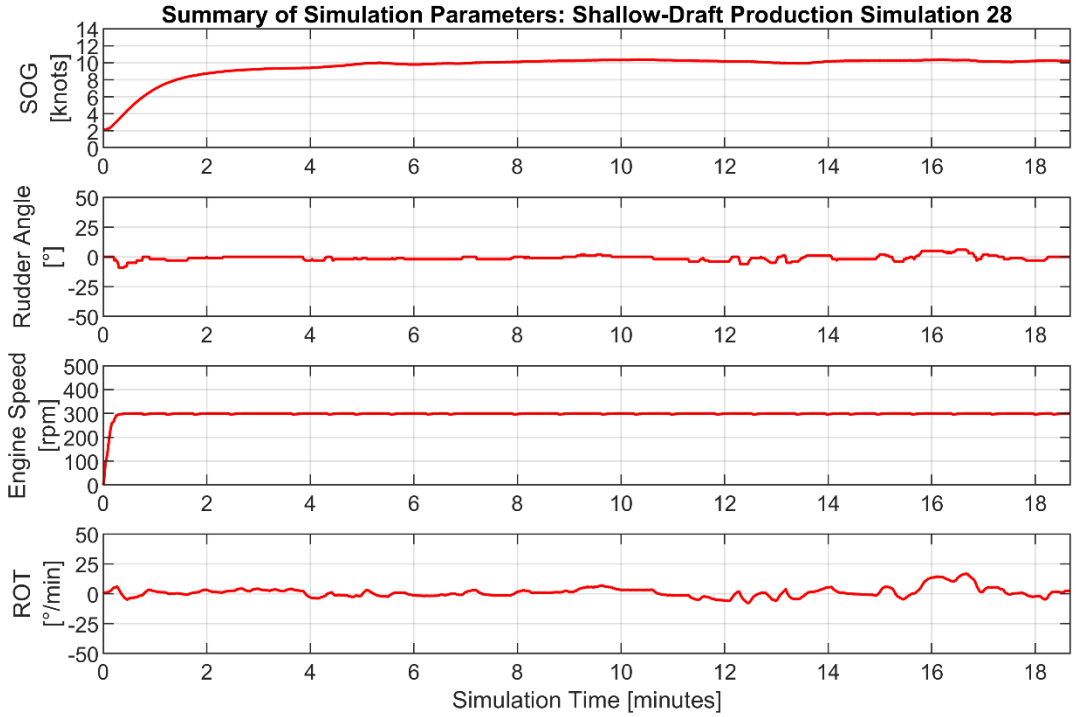

Shallow Draft Production Simulation #26 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

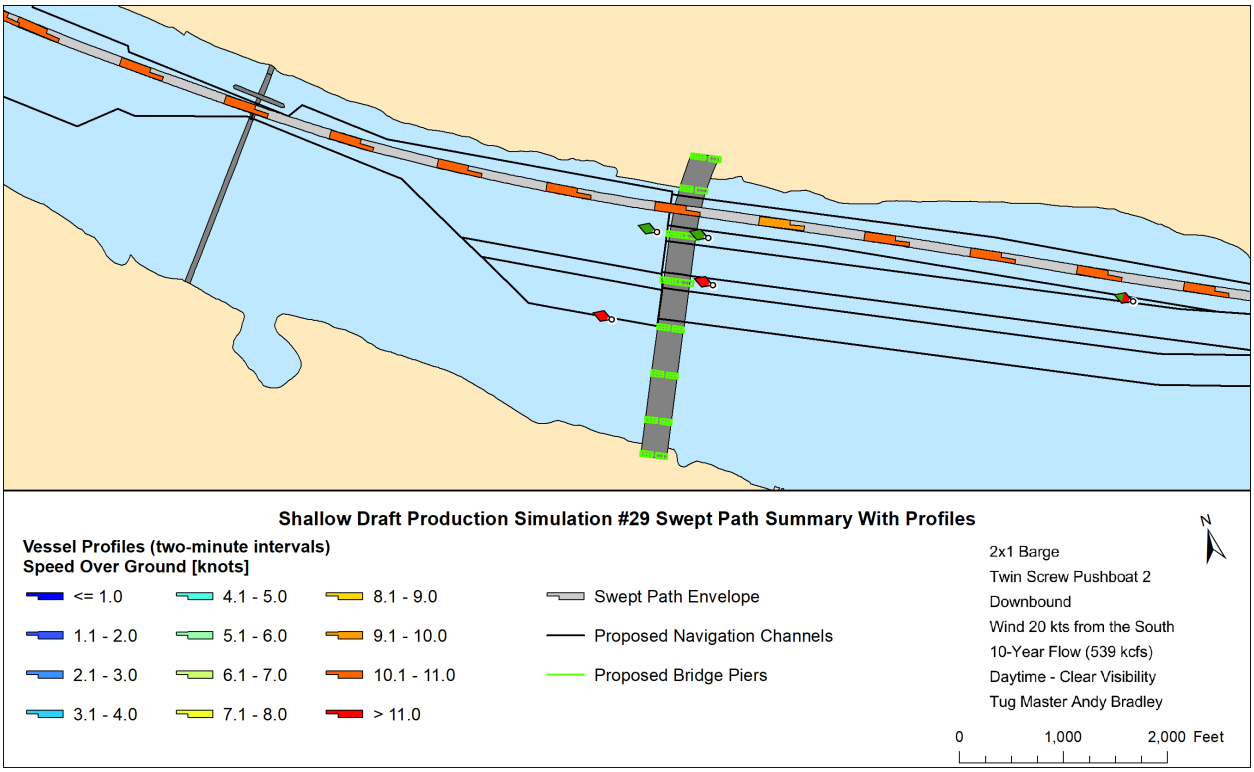

Summary of Simulation Parameters: Shallow-Draft Production Simulation 26
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

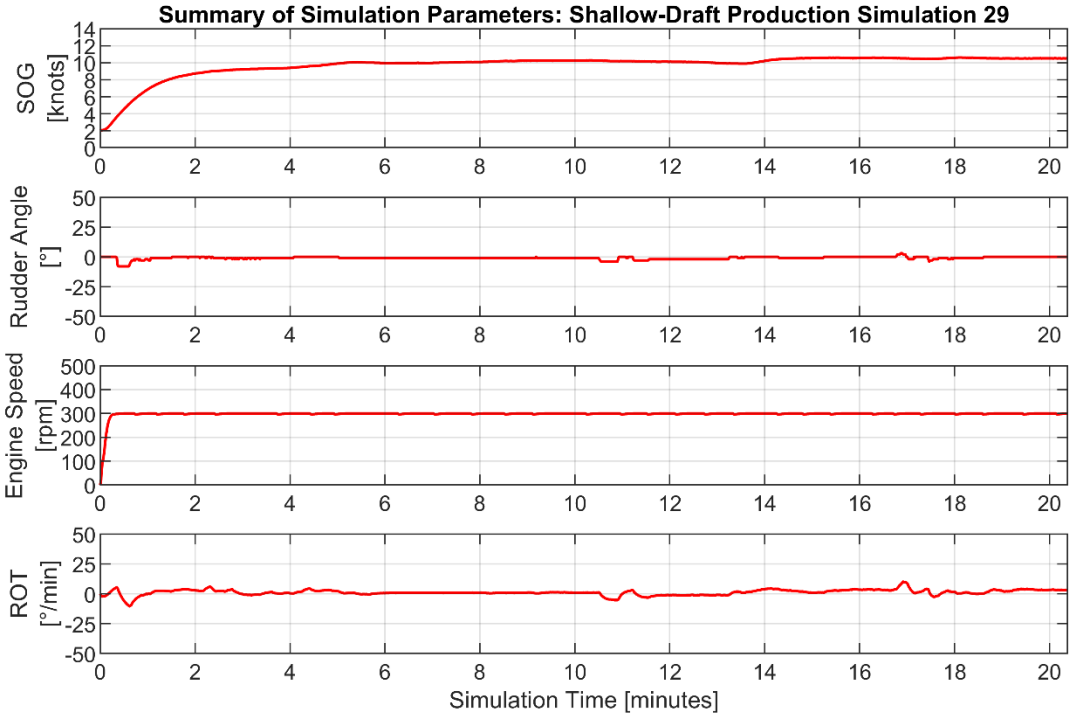

Shallow Draft Production Simulation #27 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet
N

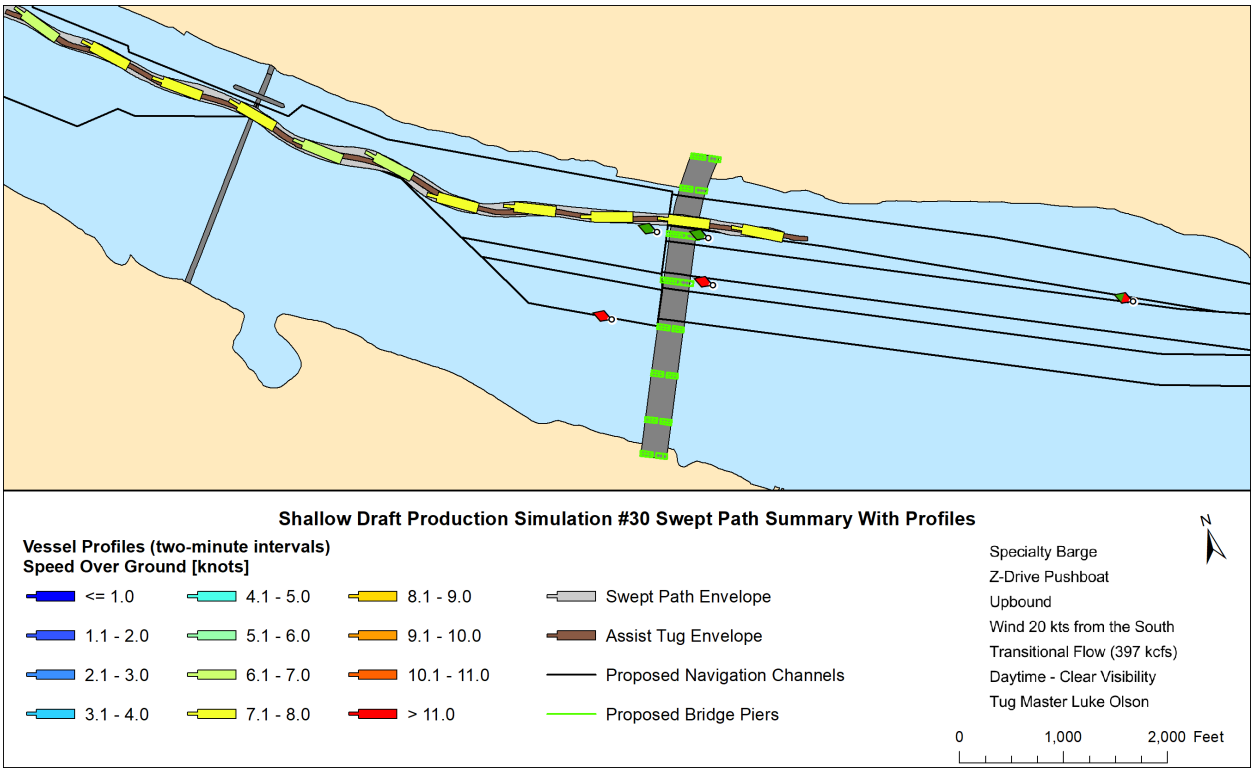

Summary of Simulation Parameters: Shallow-Draft Production Simulation 27
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

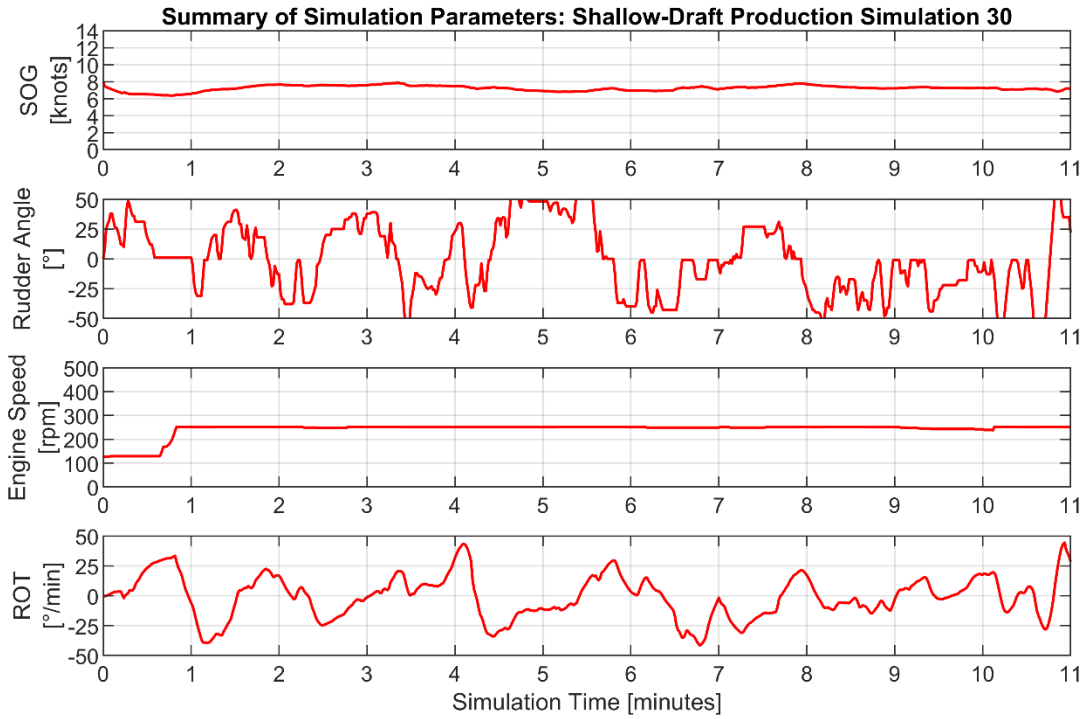

Shallow Draft Production Simulation #28 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

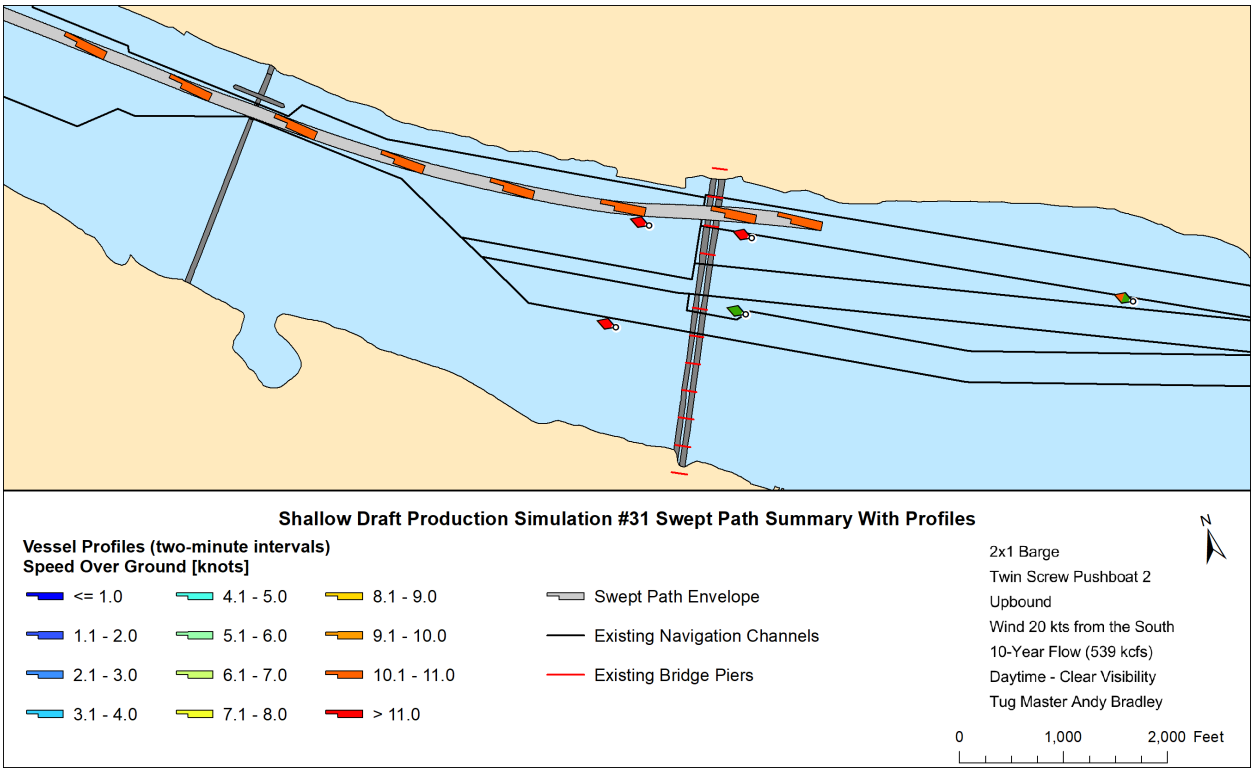

Summary of Simulation Parameters: Shallow-Draft Production Simulation 28
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

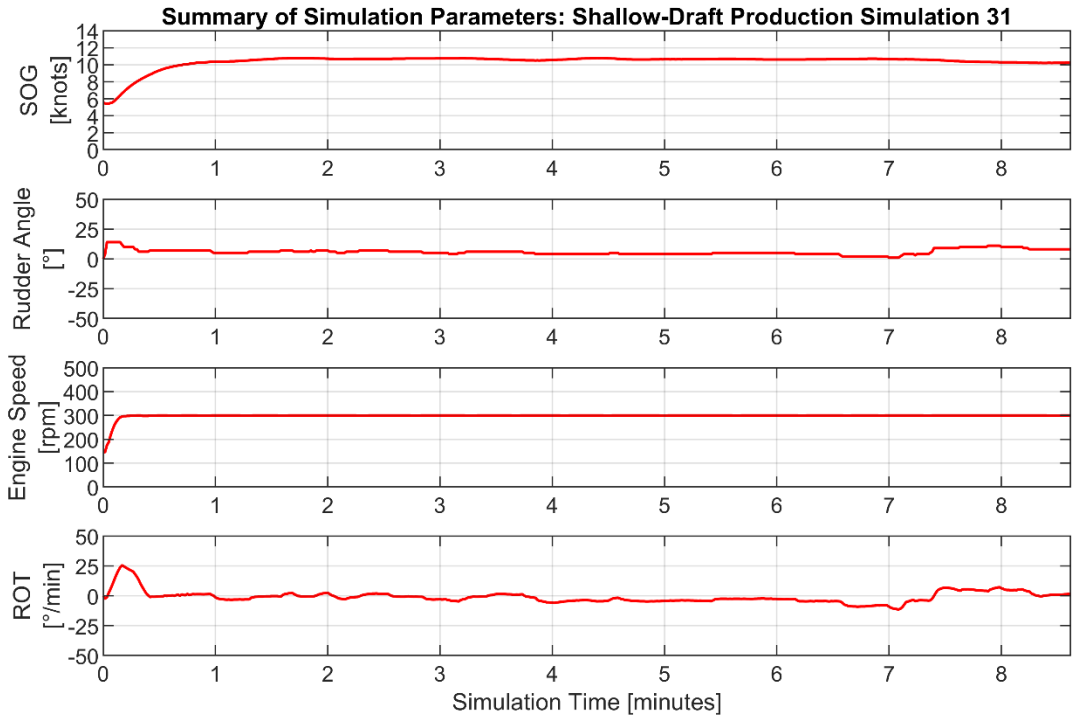

Shallow Draft Production Simulation #29 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

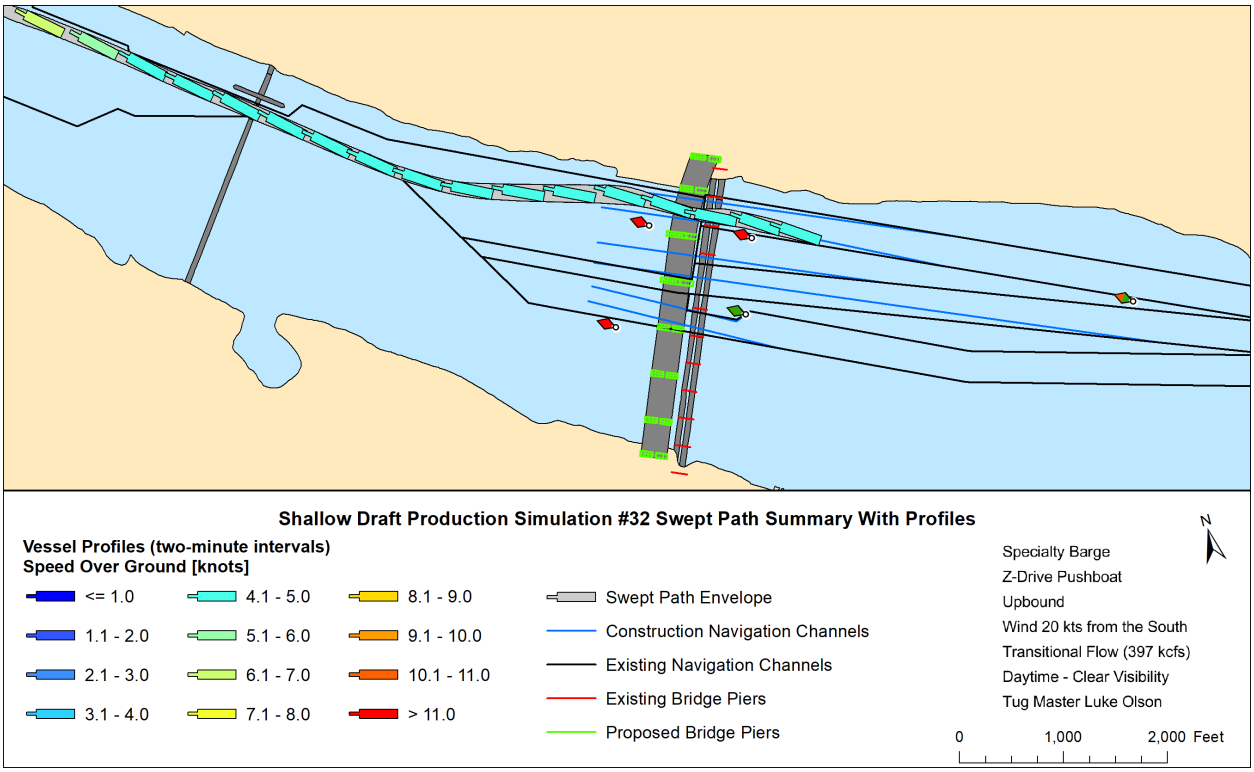

Summary of Simulation Parameters: Shallow-Draft Production Simulation 29
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

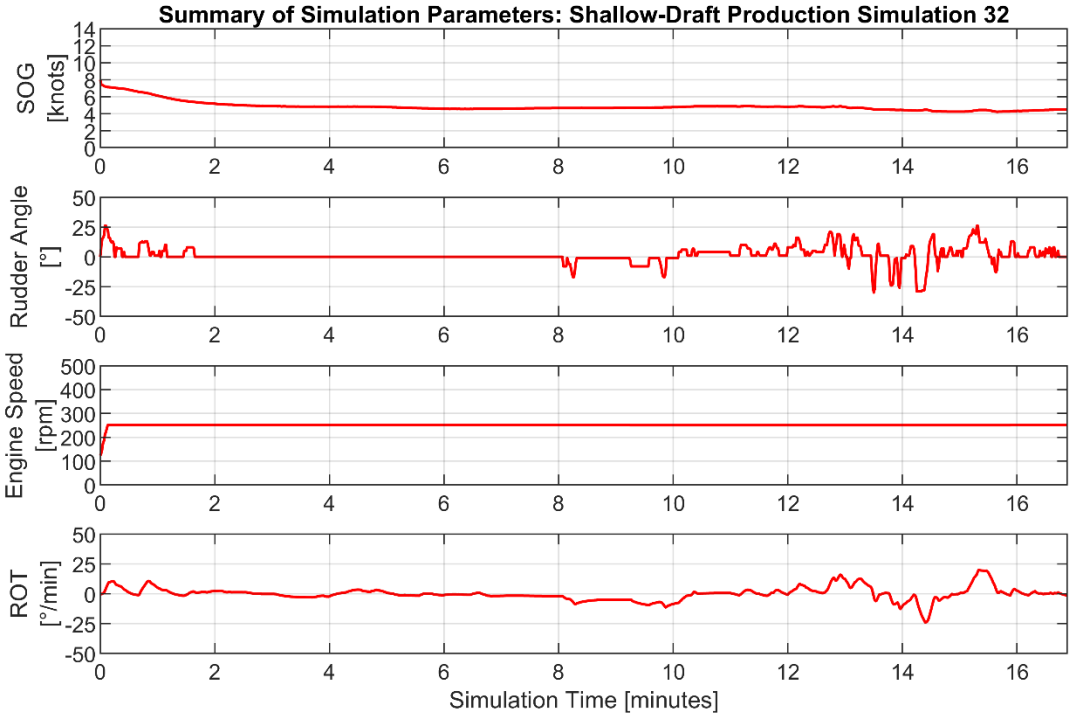

Shallow Draft Production Simulation #30 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Assist Tug Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

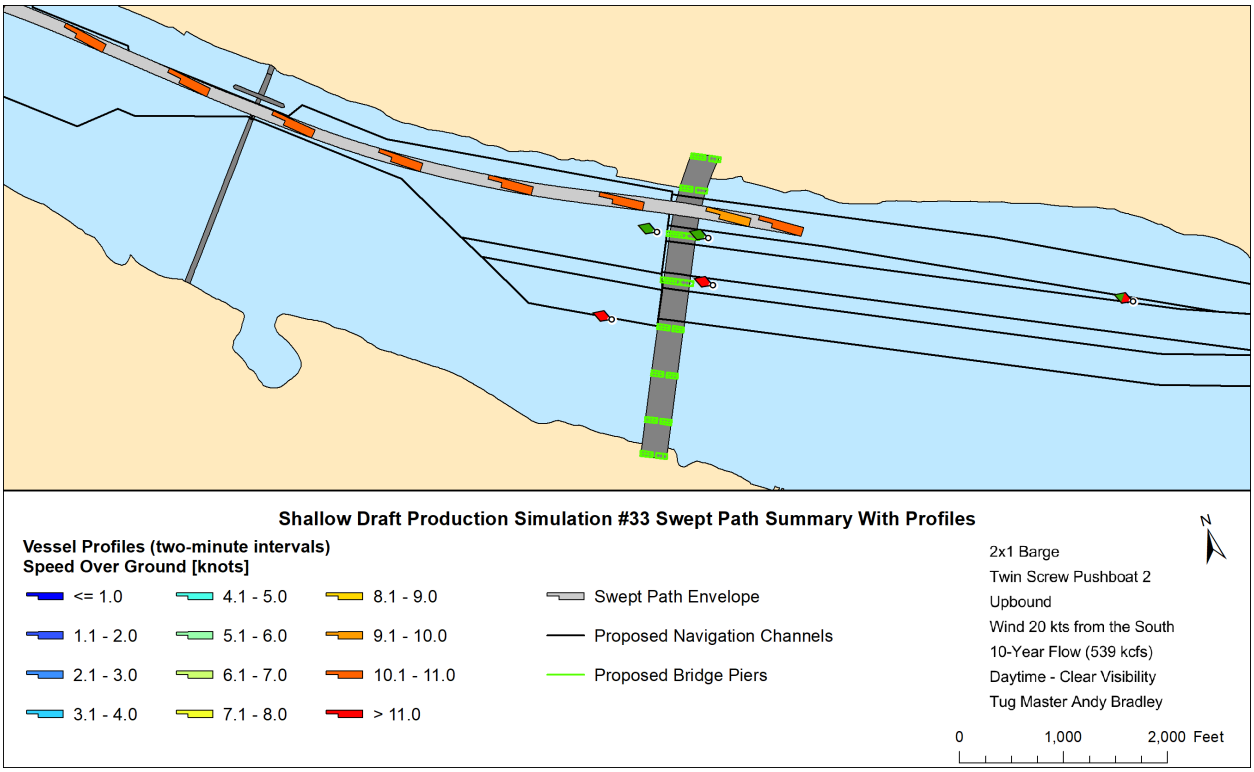

Summary of Simulation Parameters: Shallow-Draft Production Simulation 30
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

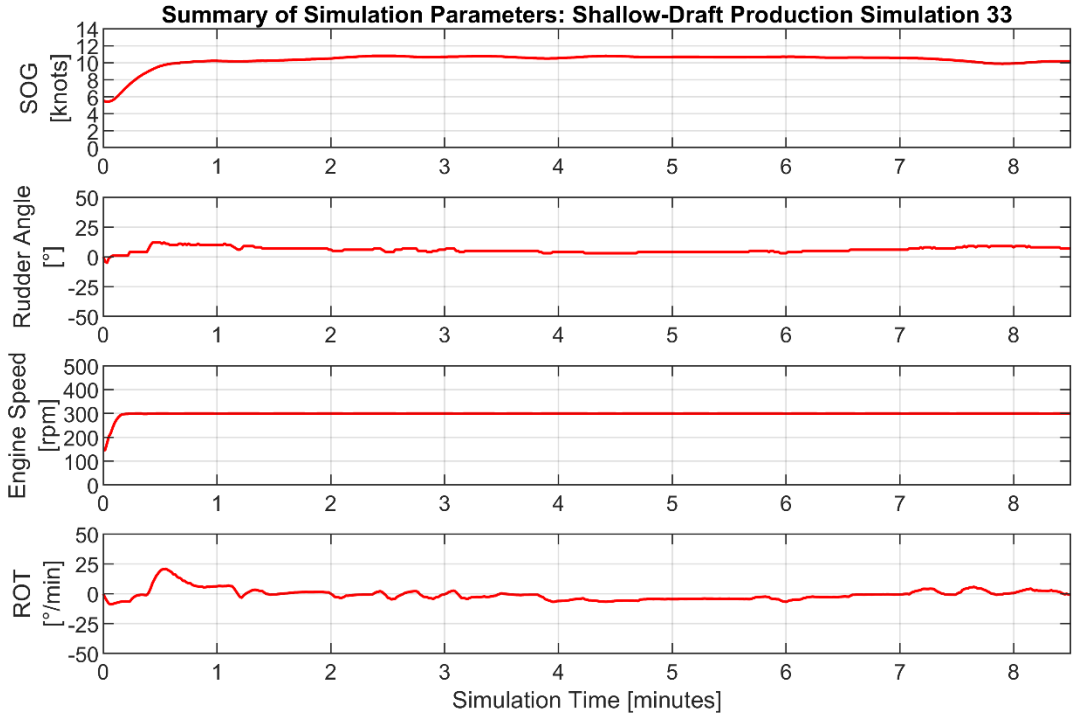

Shallow Draft Production Simulation #31 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

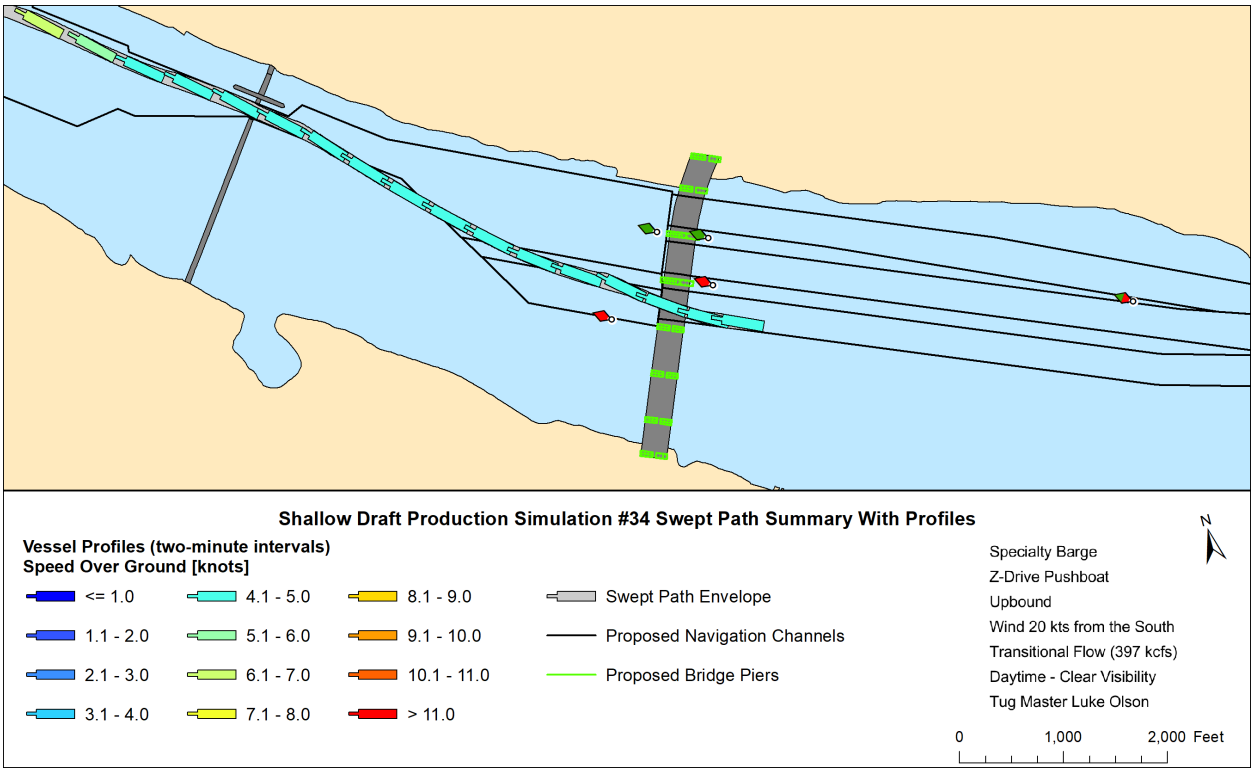

Summary of Simulation Parameters: Shallow-Draft Production Simulation 31
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

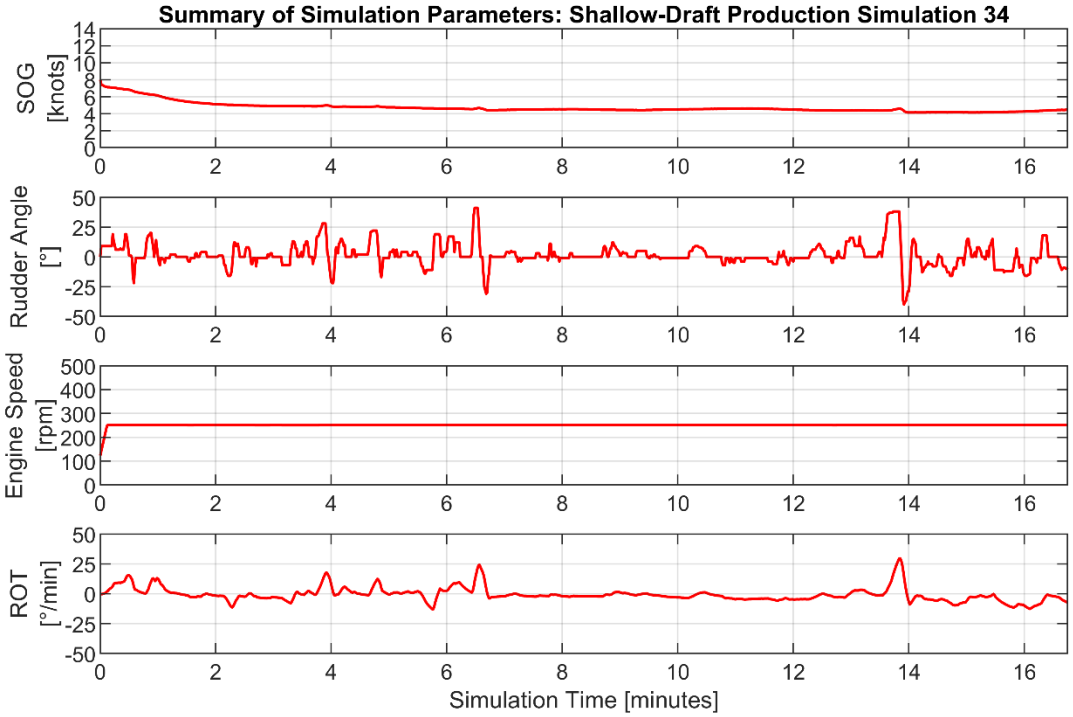

Shallow Draft Production Simulation #32 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
0
1,000
2,000 Feet

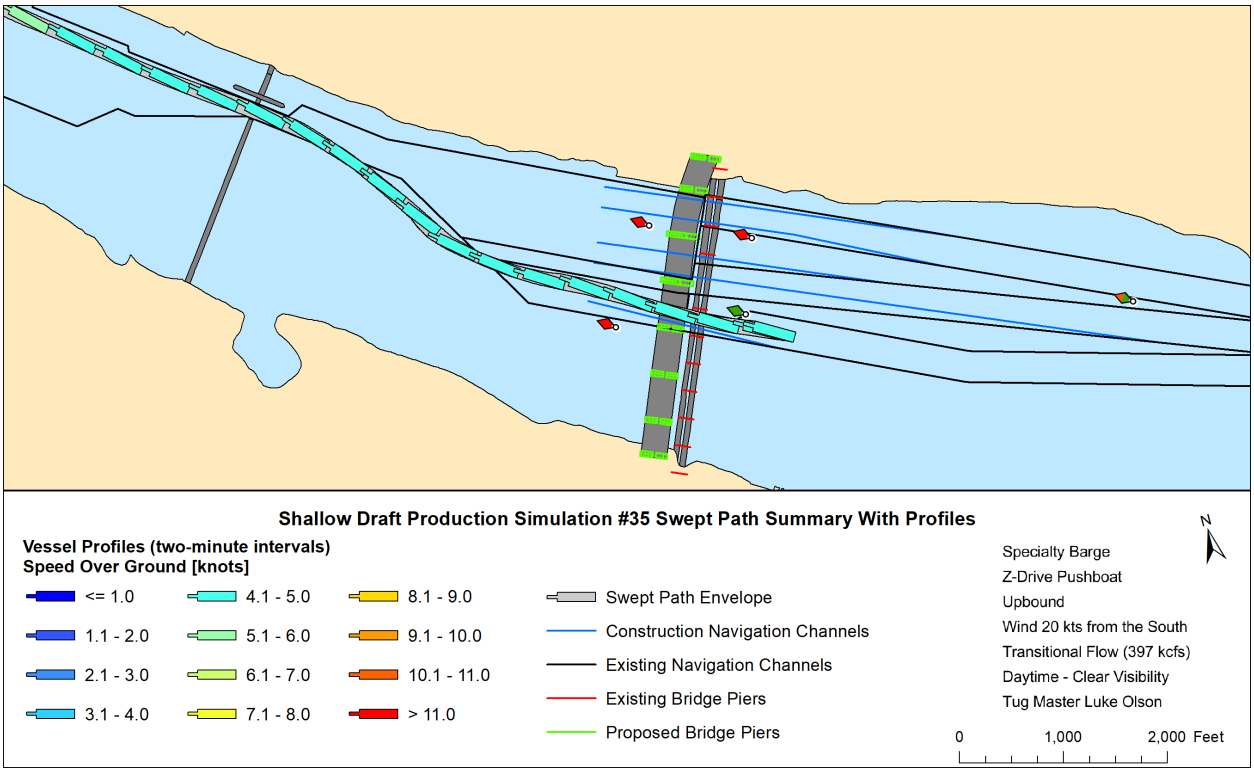

Summary of Simulation Parameters: Shallow-Draft Production Simulation 32
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

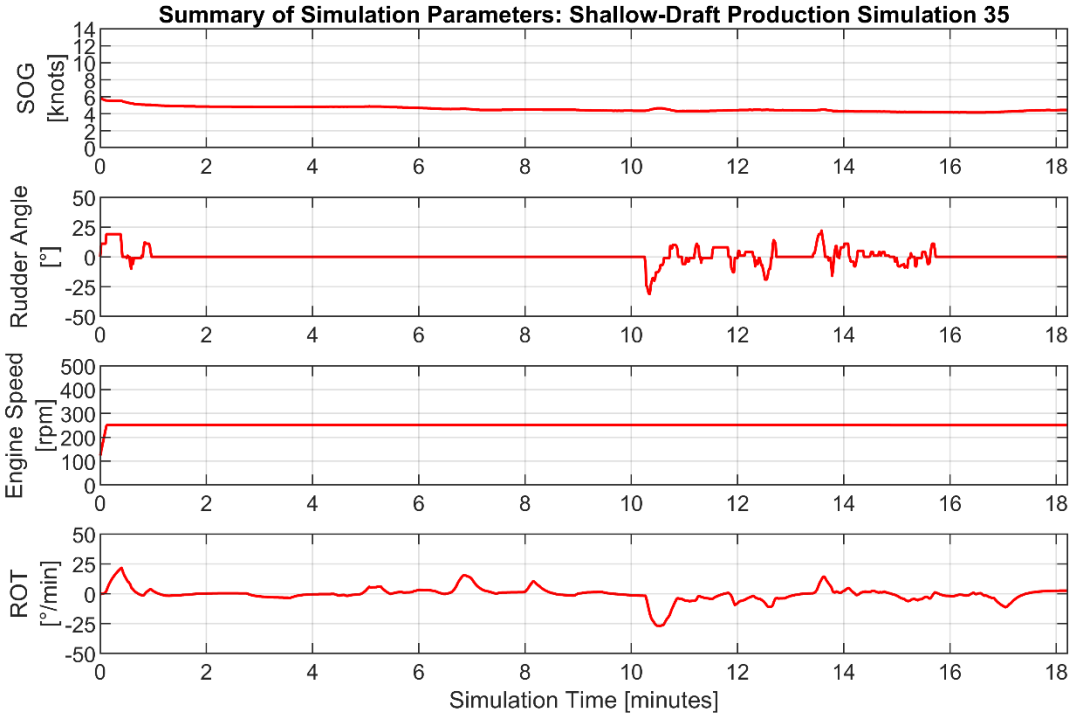

Shallow Draft Production Simulation #33 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

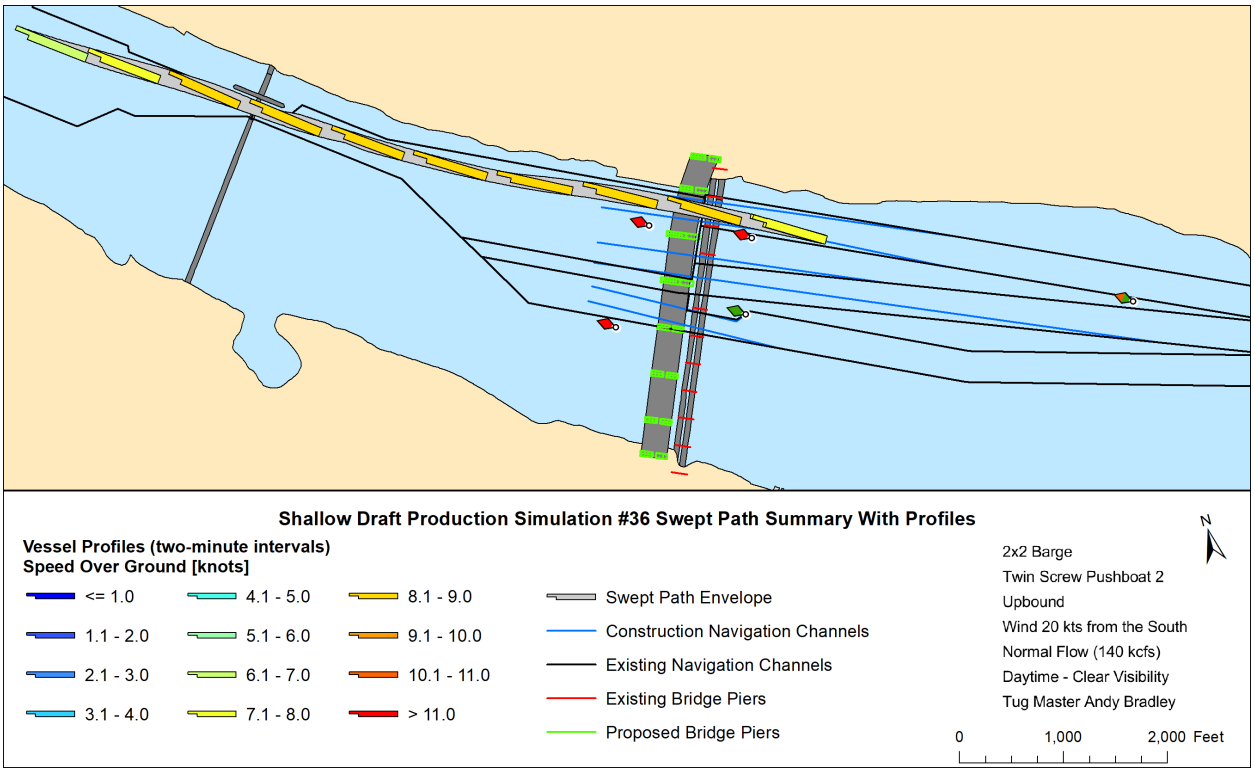

Summary of Simulation Parameters: Shallow-Draft Production Simulation 33
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

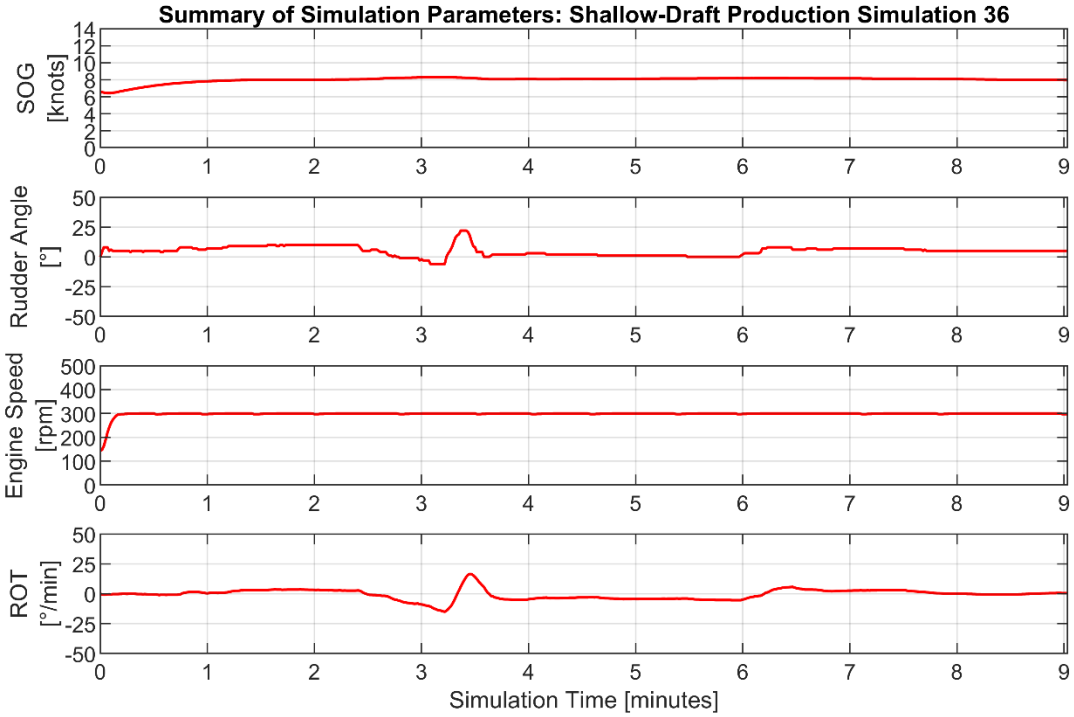

Shallow Draft Production Simulation #34 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

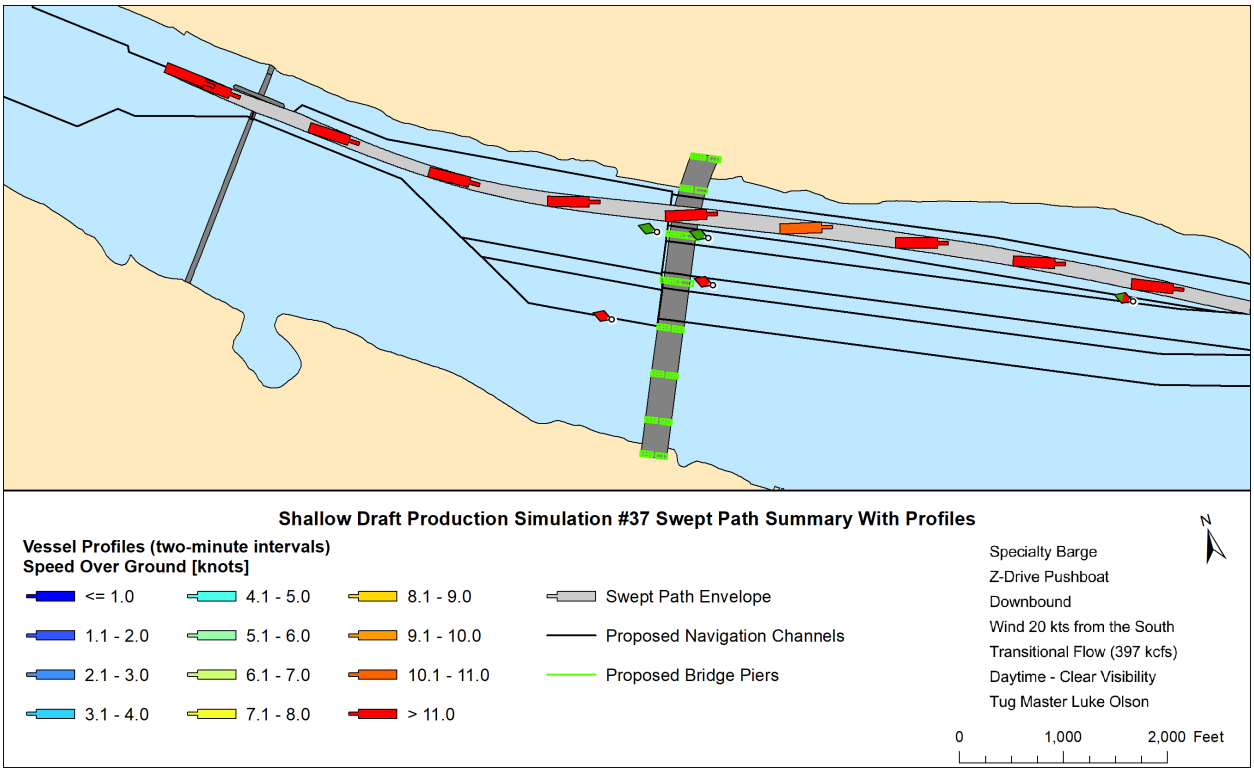

Summary of Simulation Parameters: Shallow-Draft Production Simulation 34
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

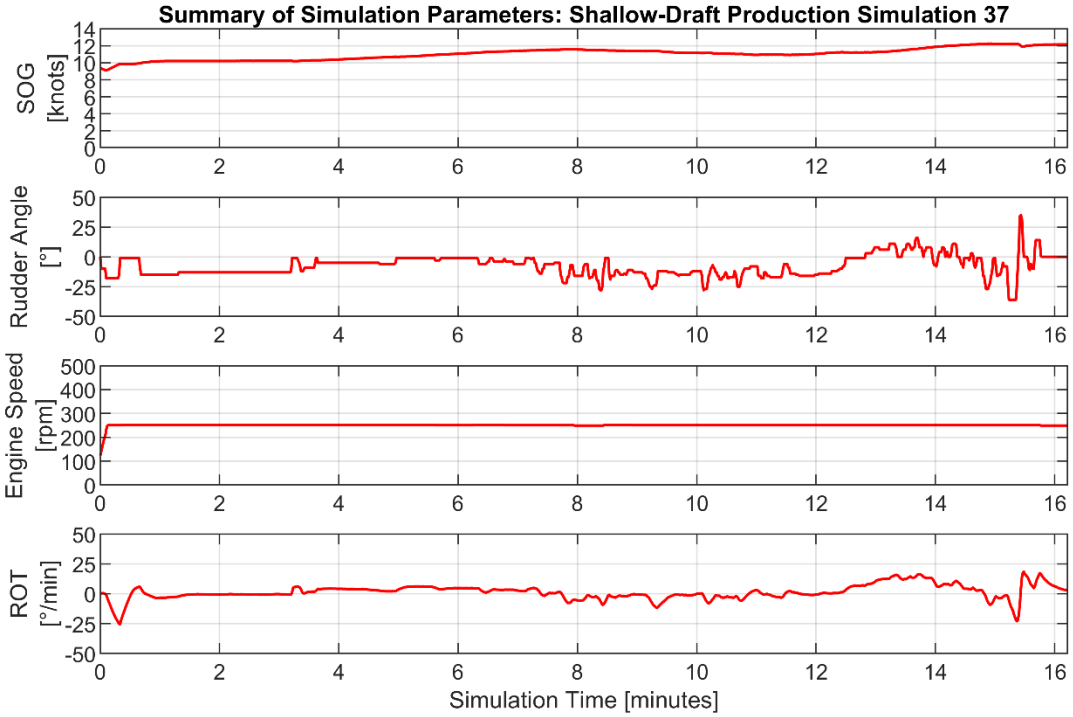

Shallow Draft Production Simulation #35 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
0
1,000
2,000 Feet

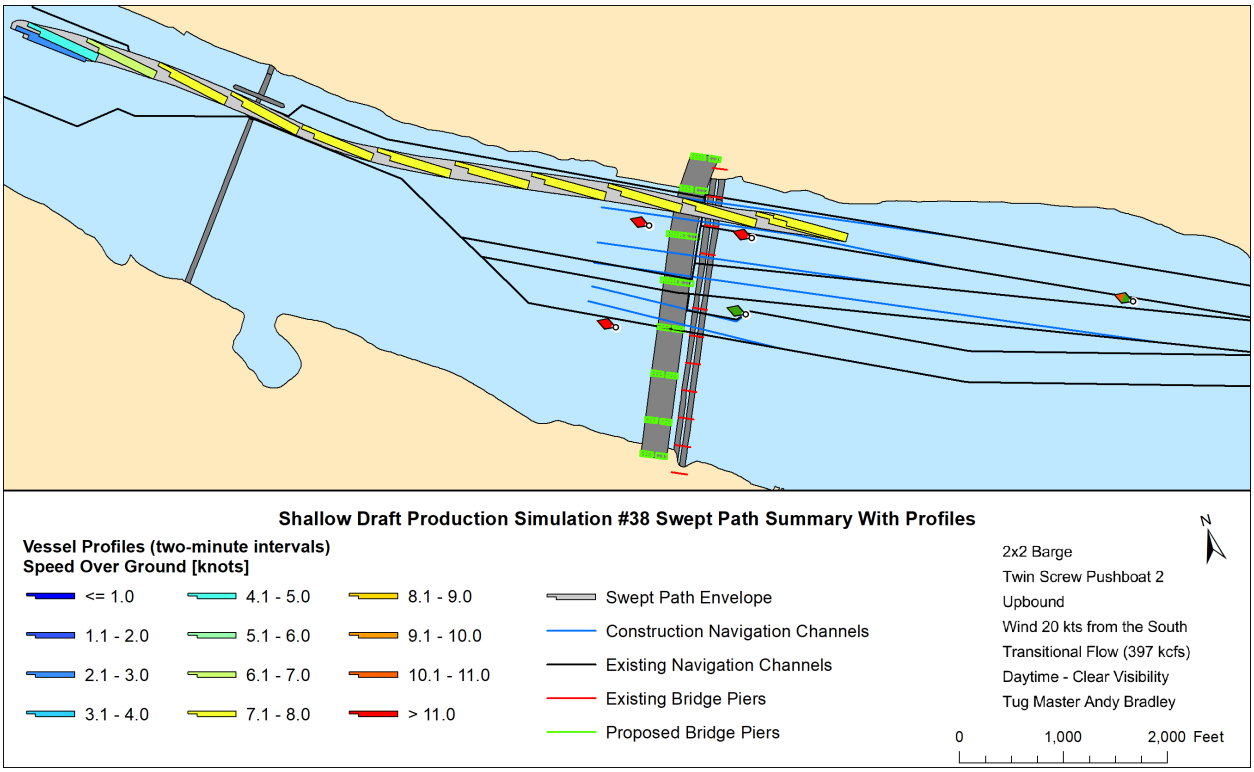

Summary of Simulation Parameters: Shallow-Draft Production Simulation 35
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

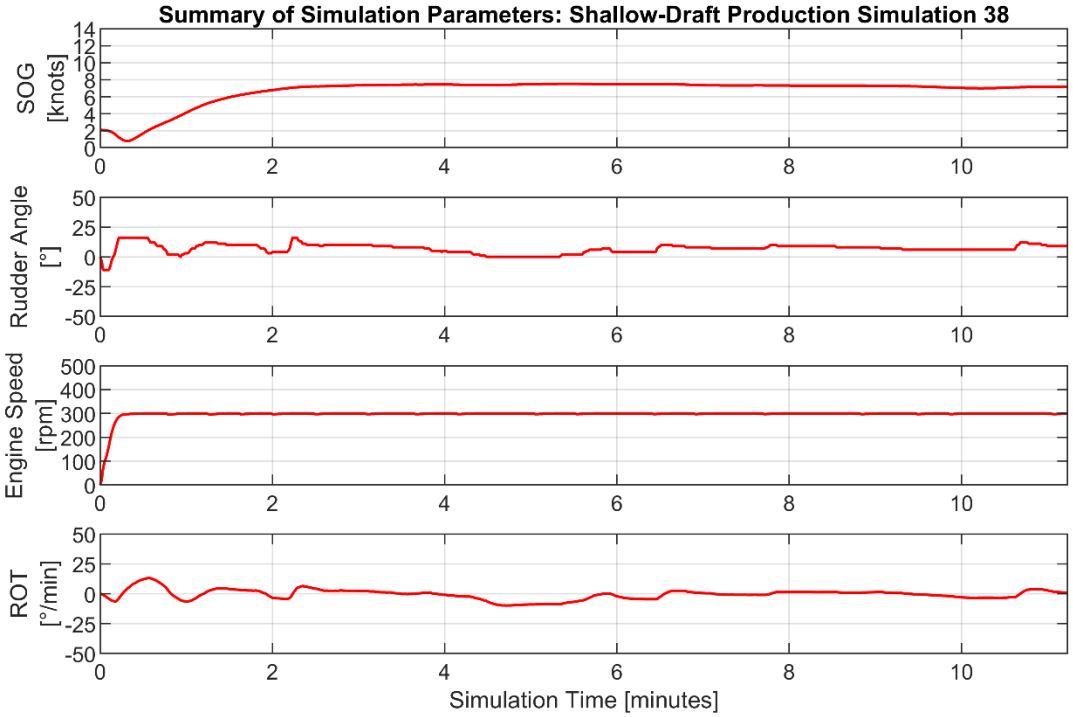

Shallow Draft Production Simulation #36 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

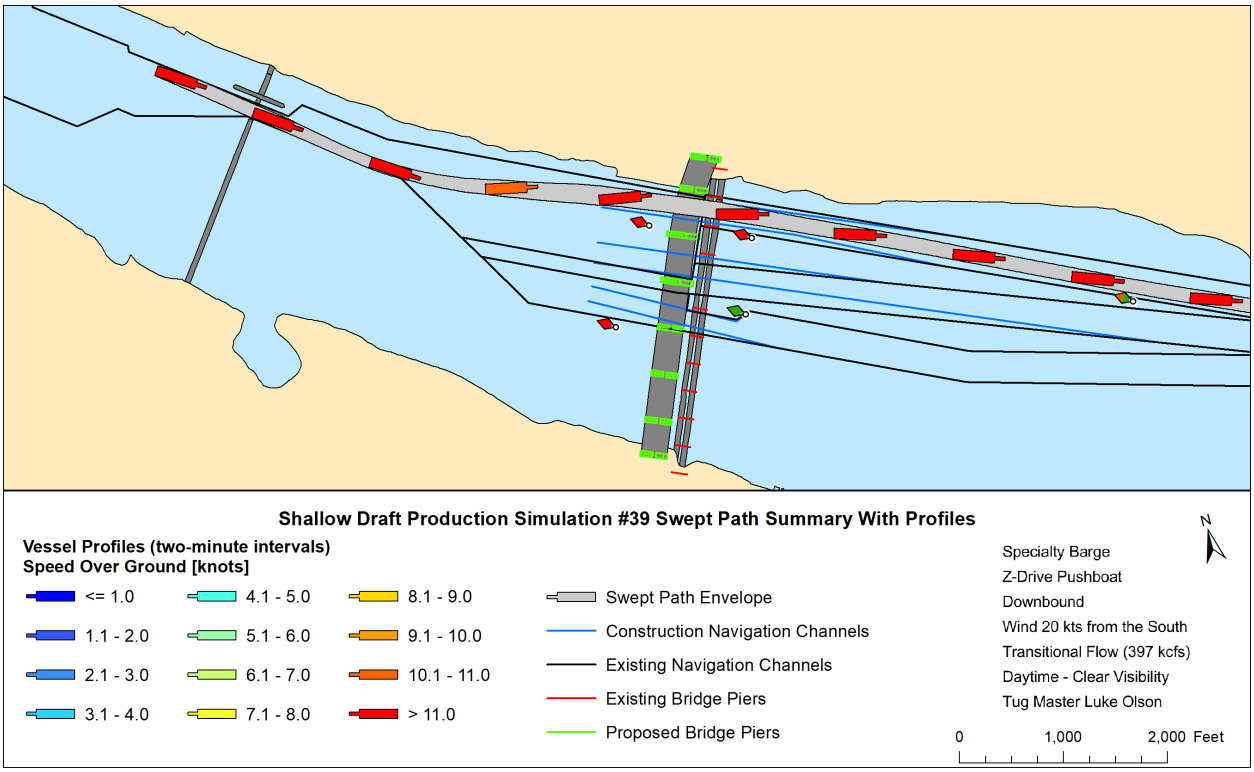

Summary of Simulation Parameters: Shallow-Draft Production Simulation 36
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

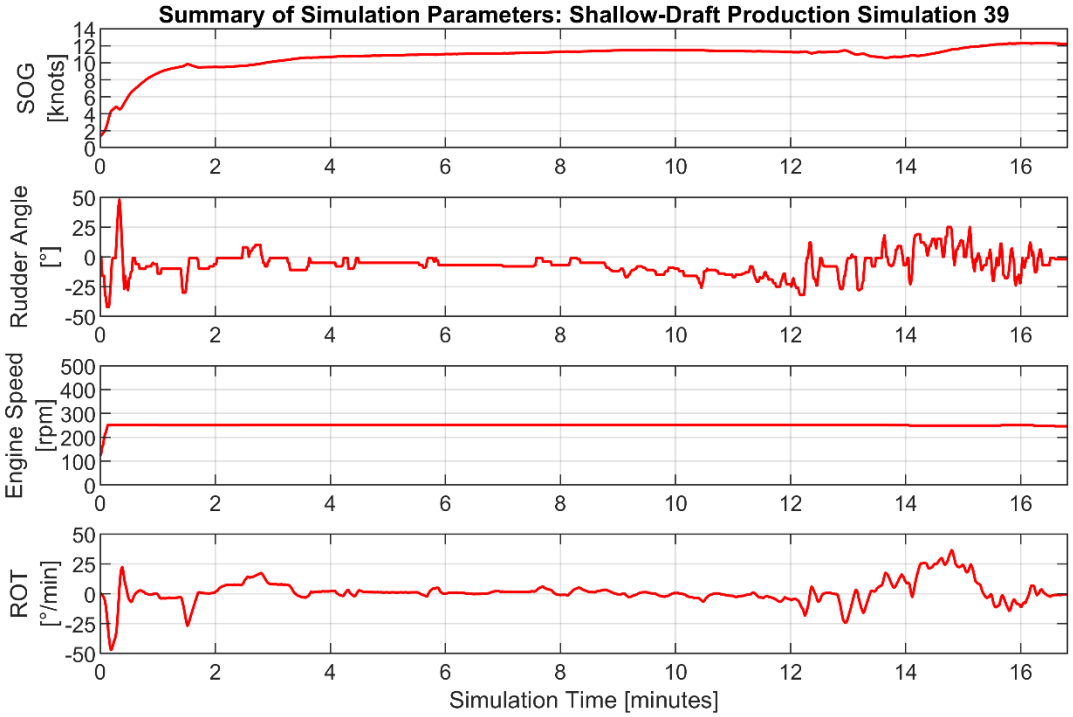

Shallow Draft Production Simulation #37 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

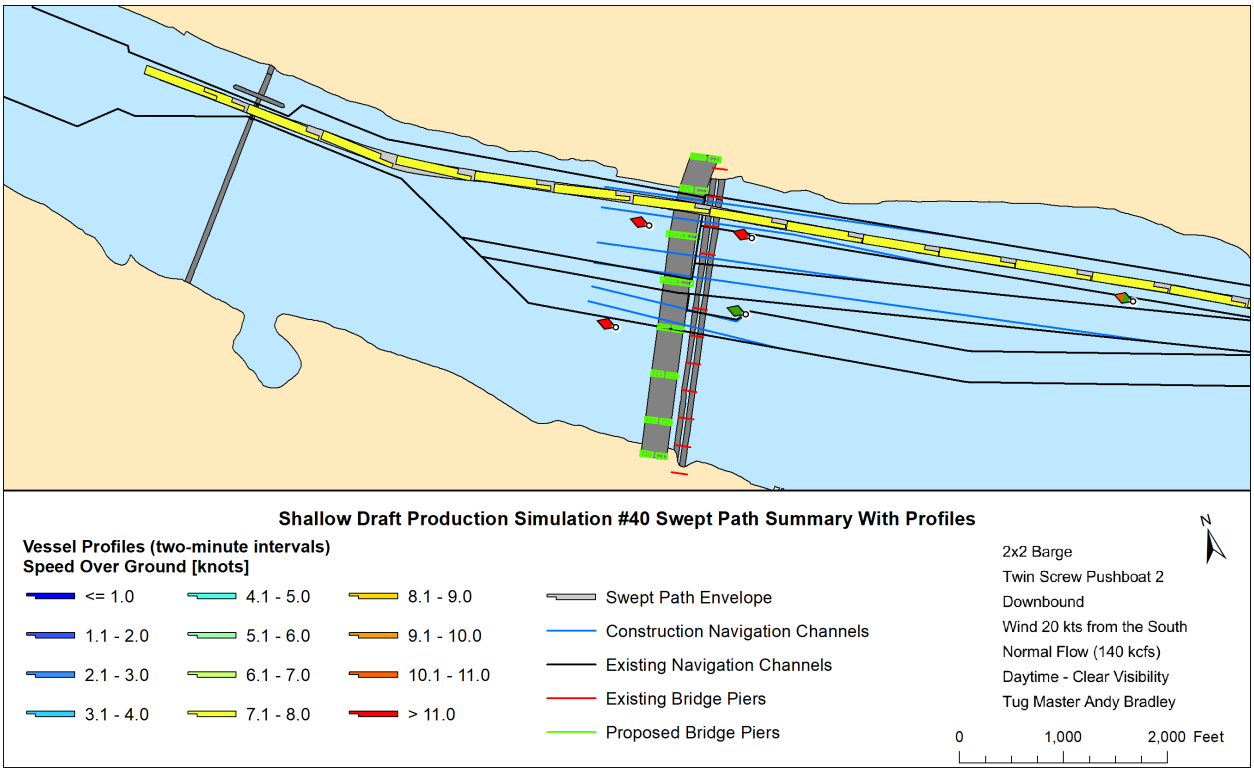

Summary of Simulation Parameters: Shallow-Draft Production Simulation 37
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

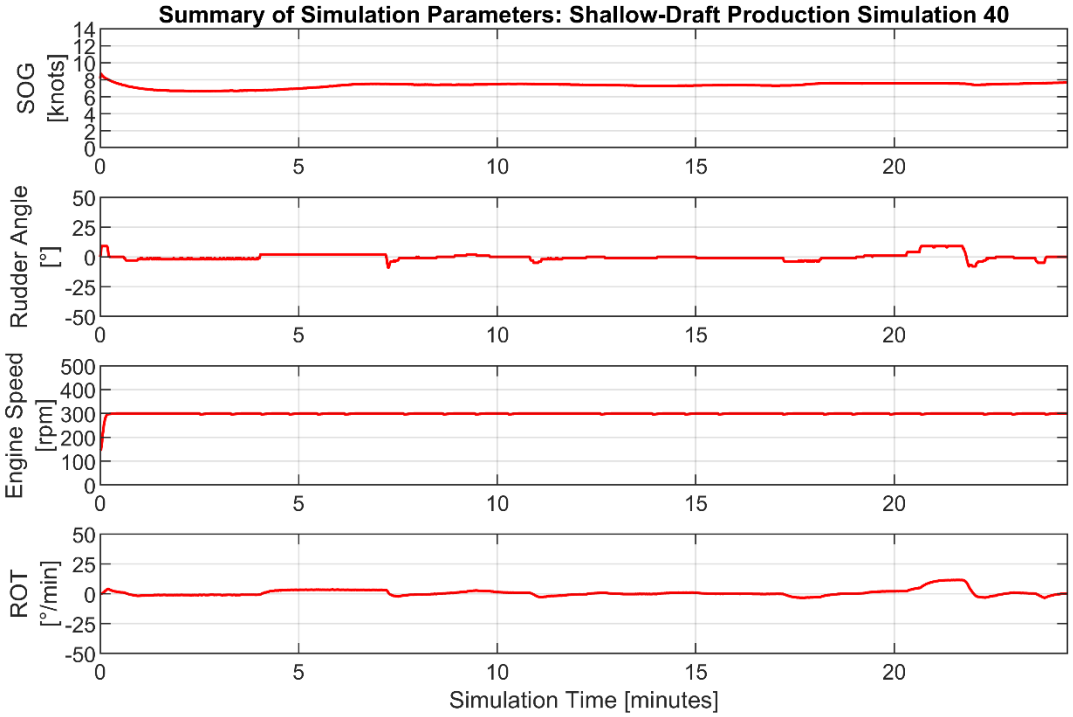

Shallow Draft Production Simulation #38 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

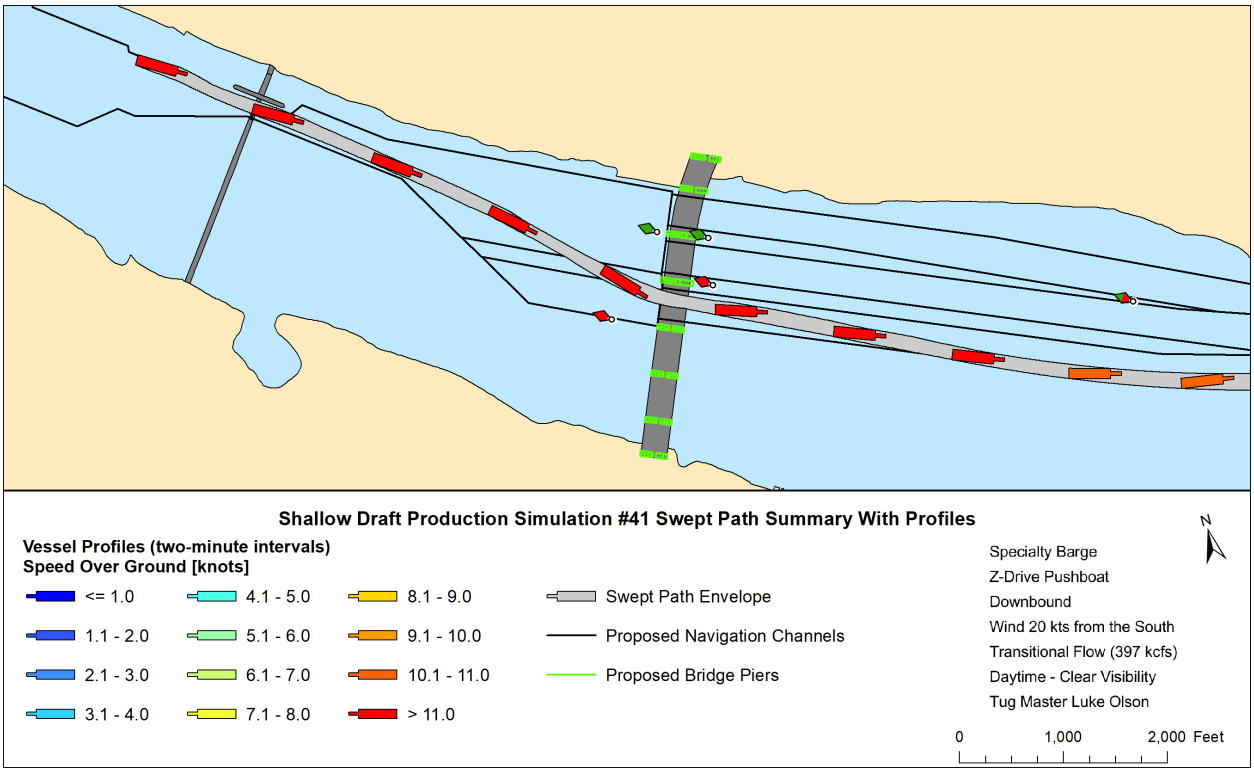

Summary of Simulation Parameters: Shallow-Draft Production Simulation 38
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

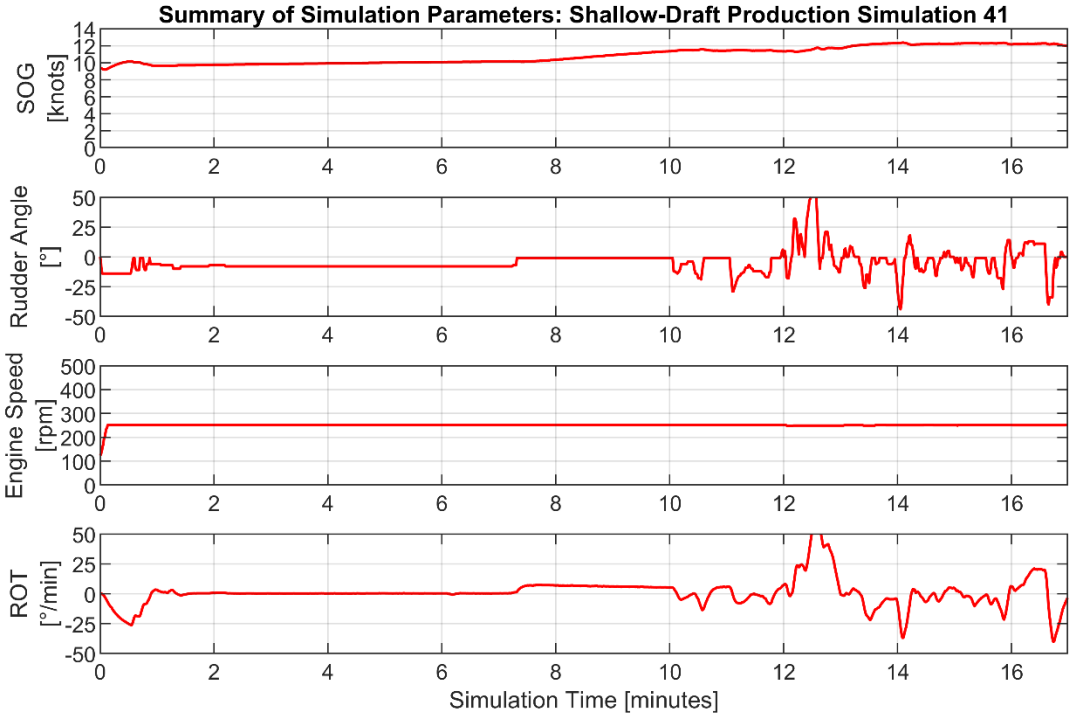

Shallow Draft Production Simulation #39 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
0
1,000
2,000 Feet

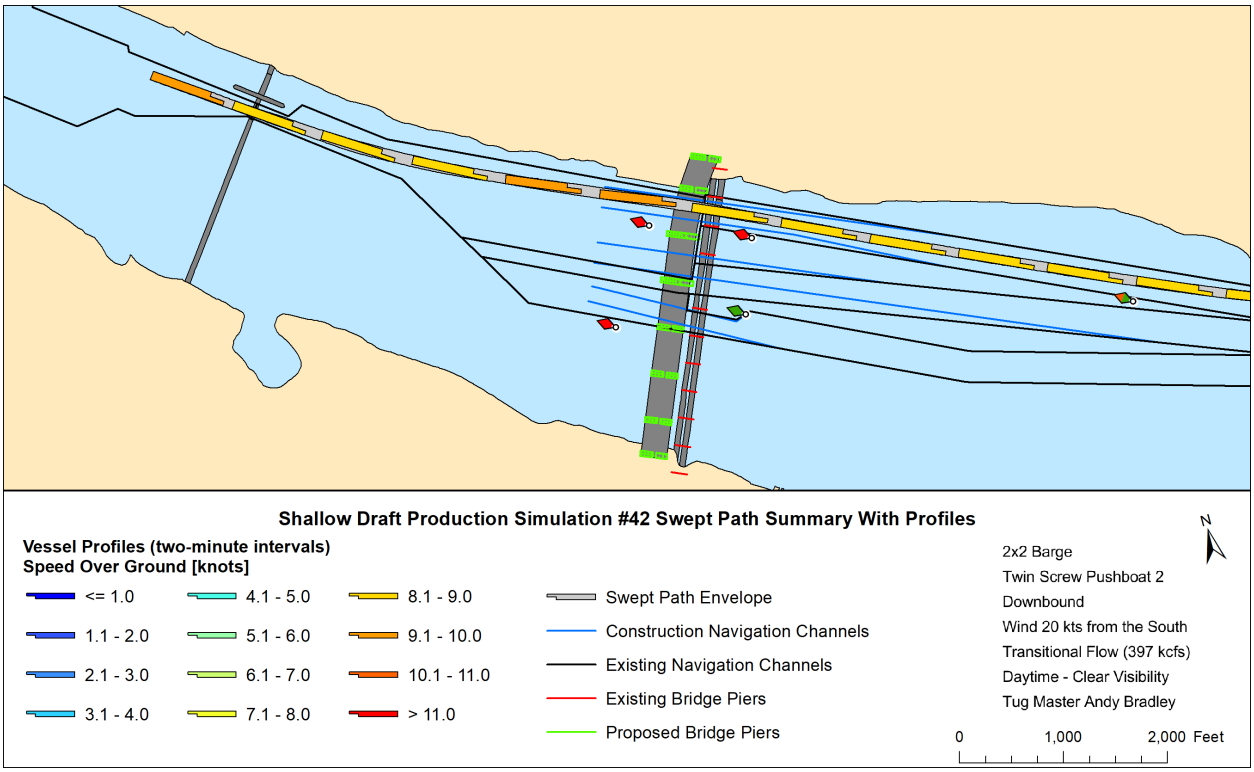

Summary of Simulation Parameters: Shallow-Draft Production Simulation 39
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

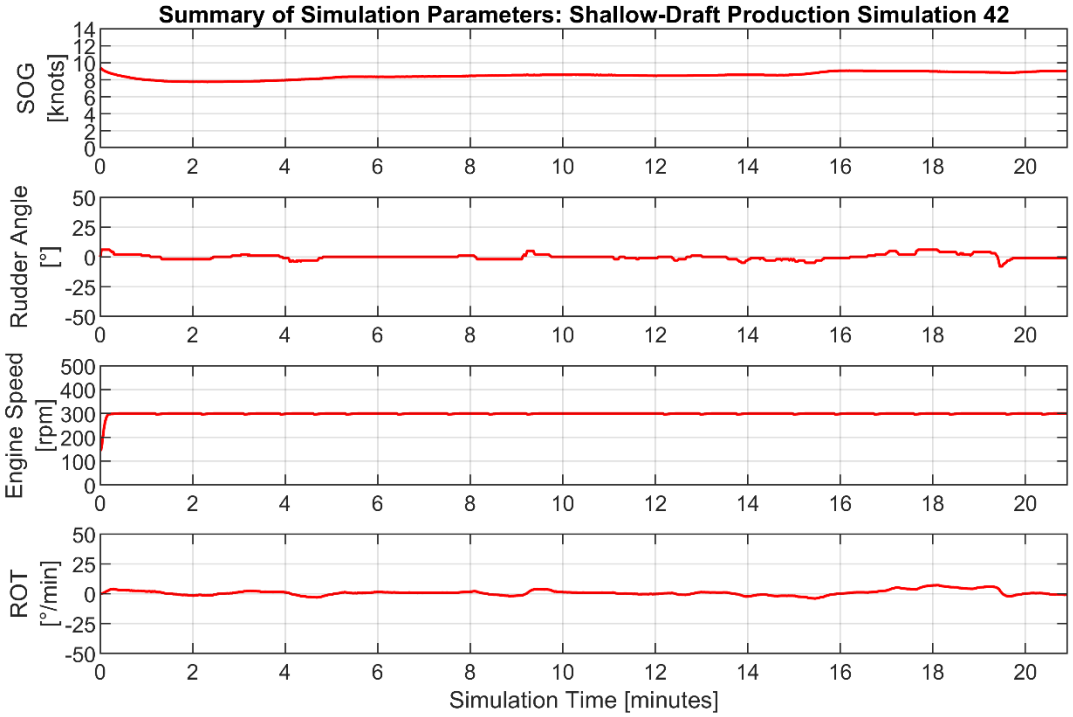

Shallow Draft Production Simulation #40 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

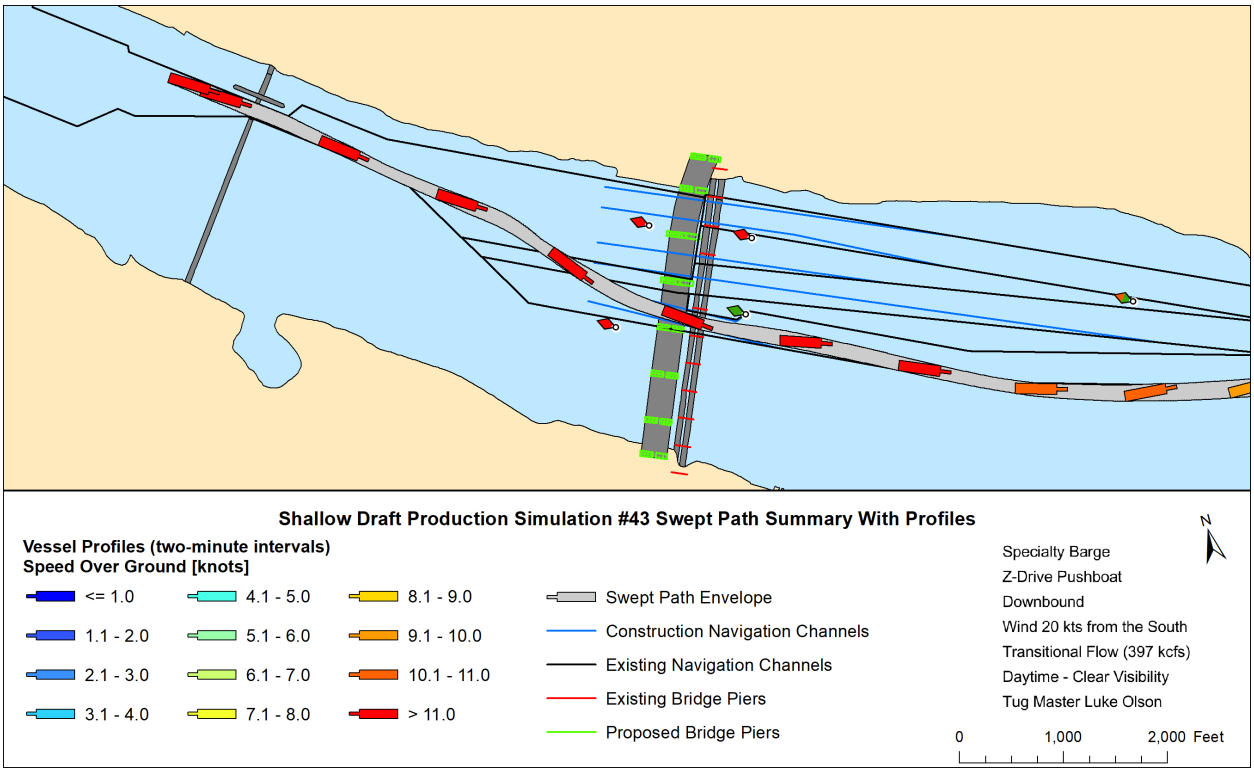

Summary of Simulation Parameters: Shallow-Draft Production Simulation 40
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

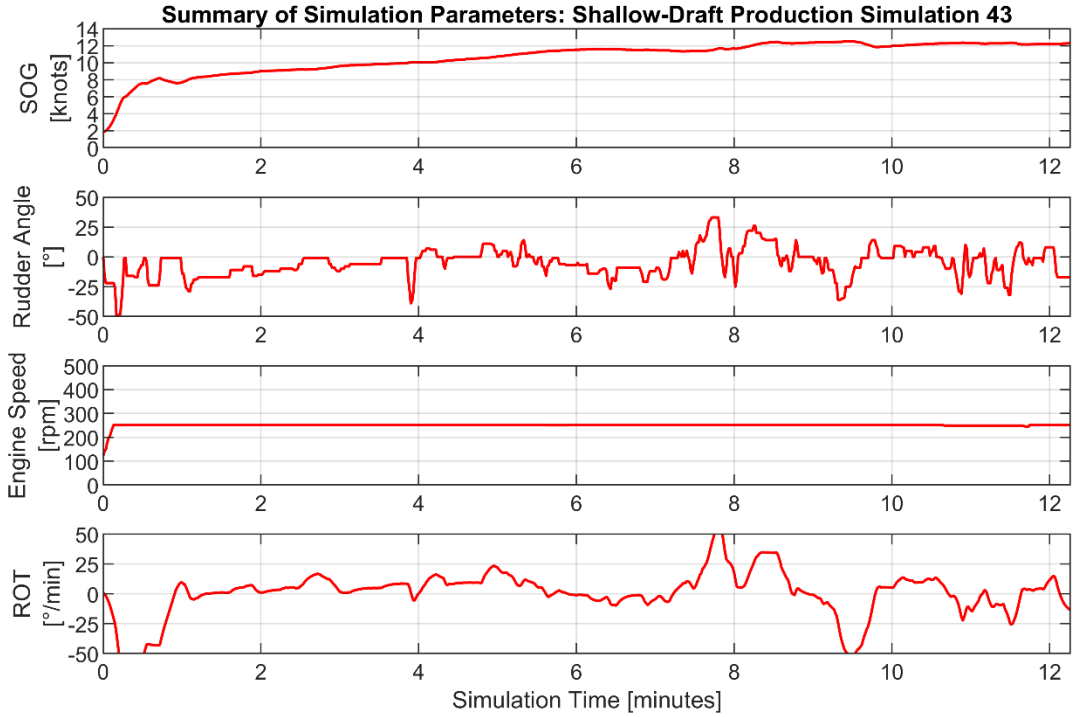

Shallow Draft Production Simulation #41 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

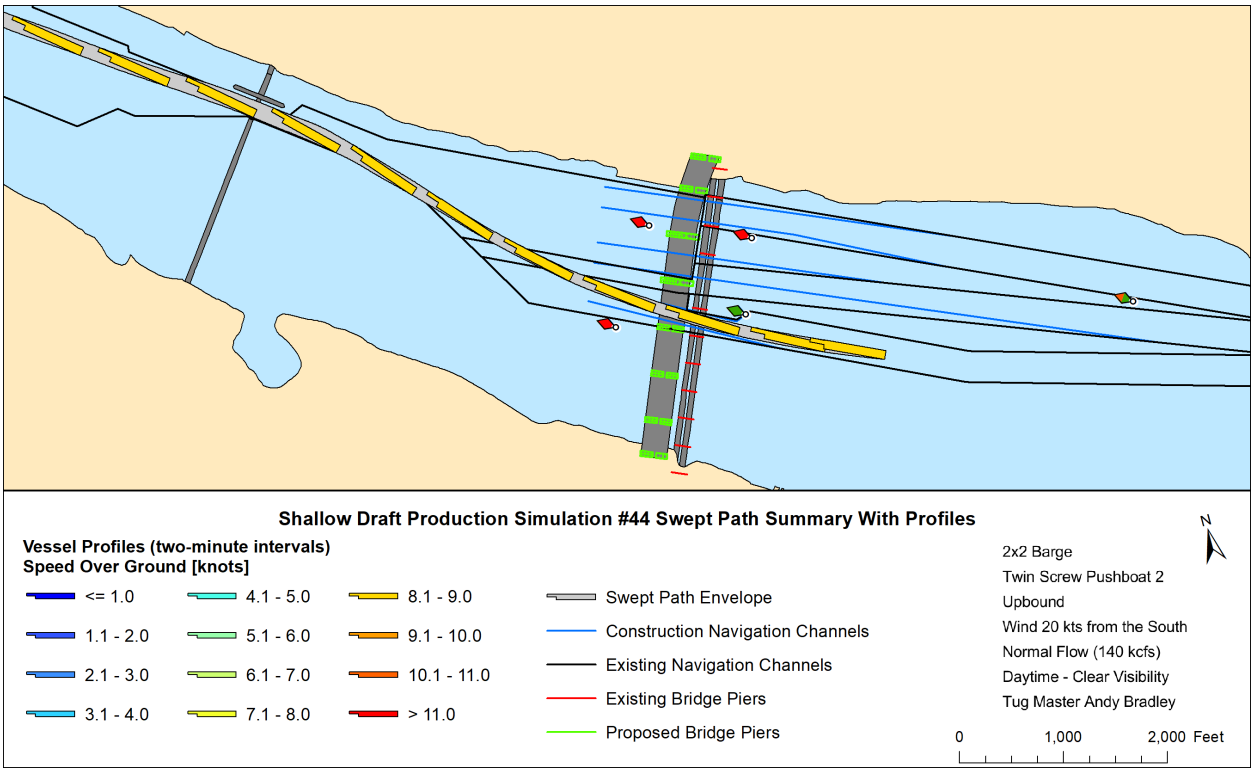

Summary of Simulation Parameters: Shallow-Draft Production Simulation 41
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

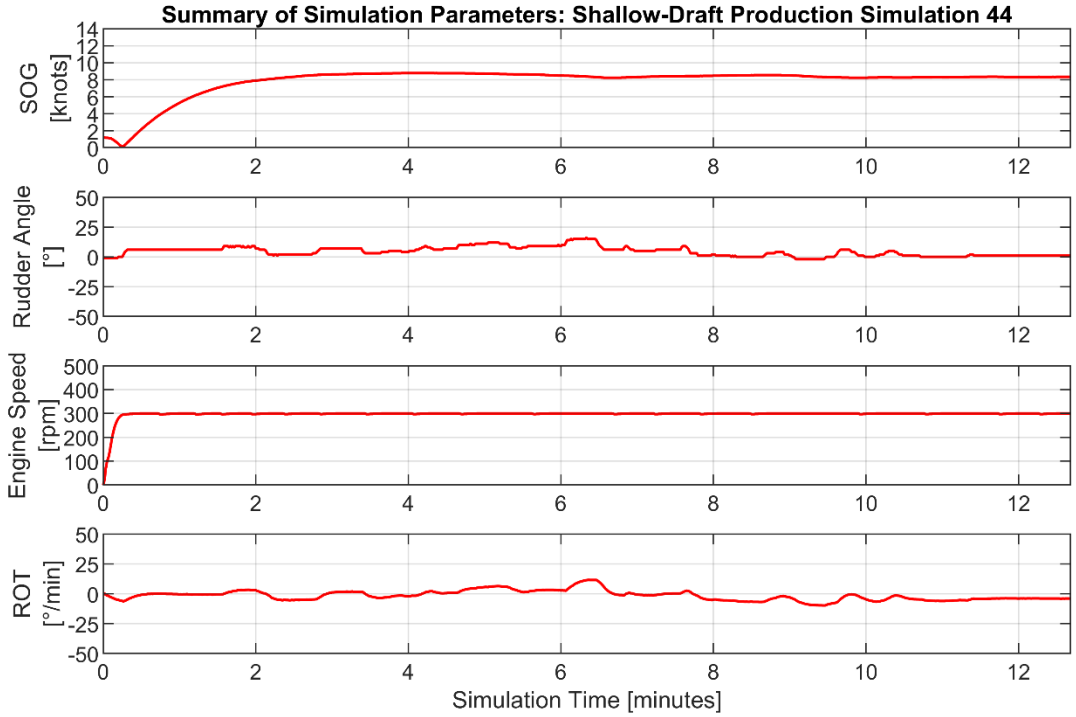

Shallow Draft Production Simulation #42 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

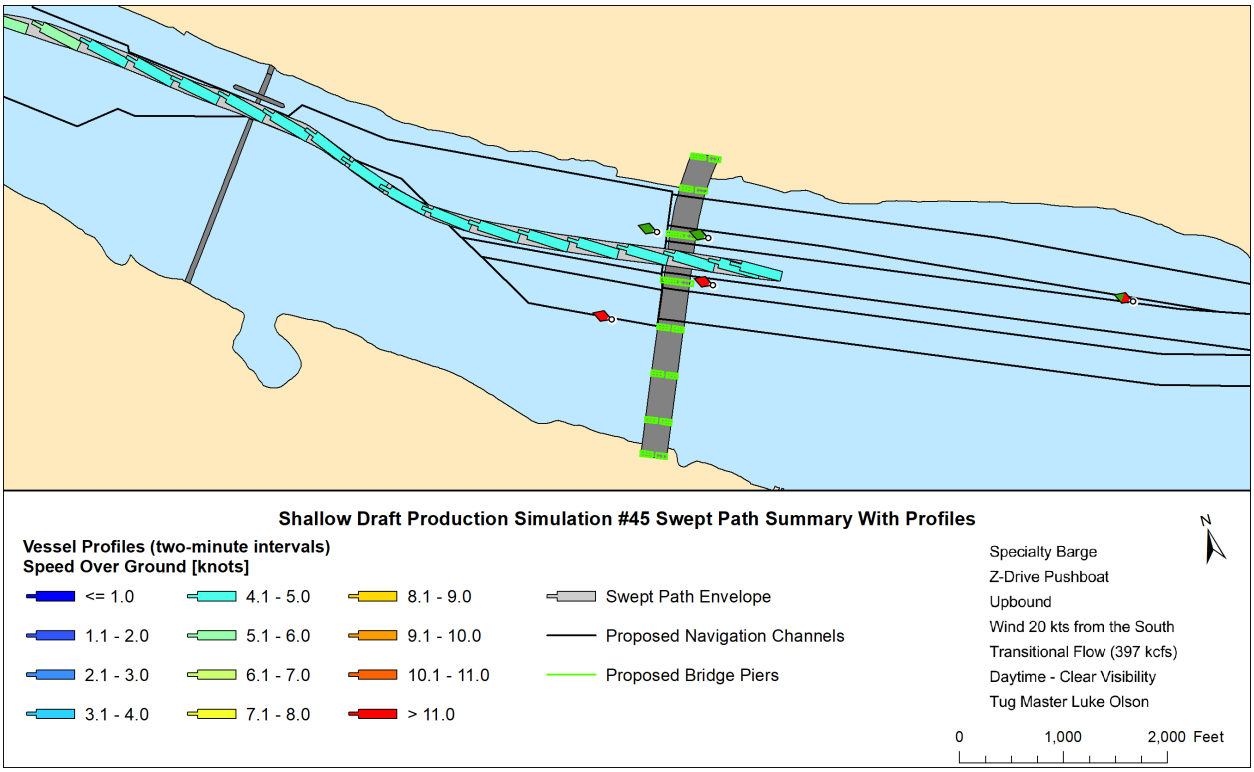

Summary of Simulation Parameters: Shallow-Draft Production Simulation 42
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

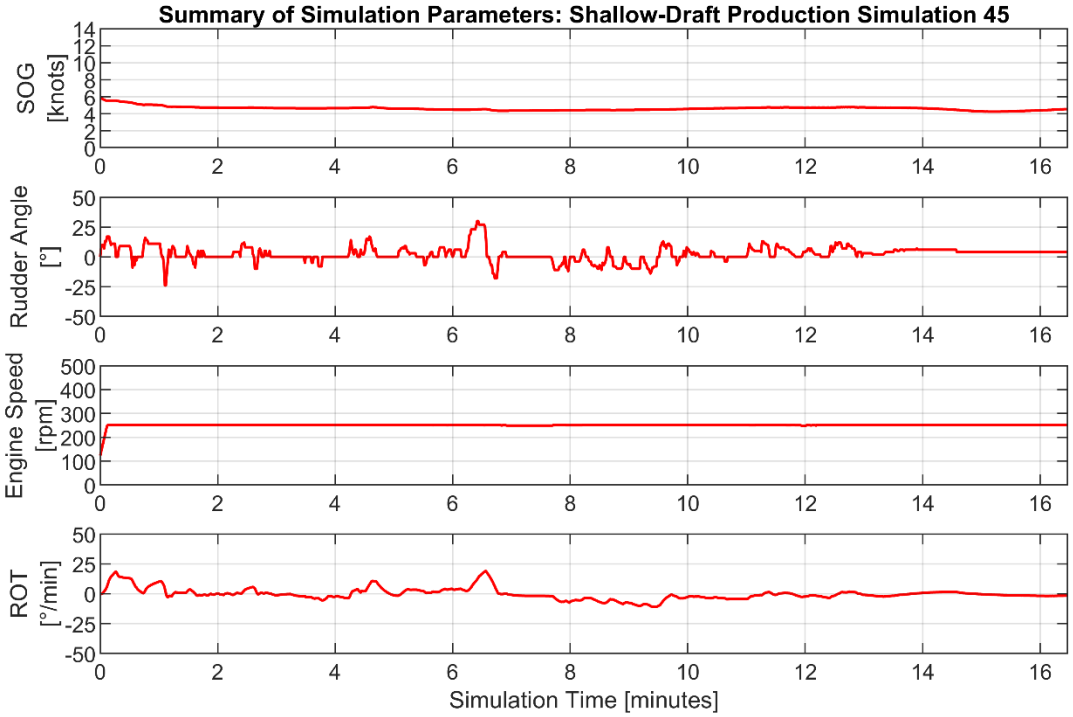

Shallow Draft Production Simulation #43 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
0
1,000
2,000 Feet

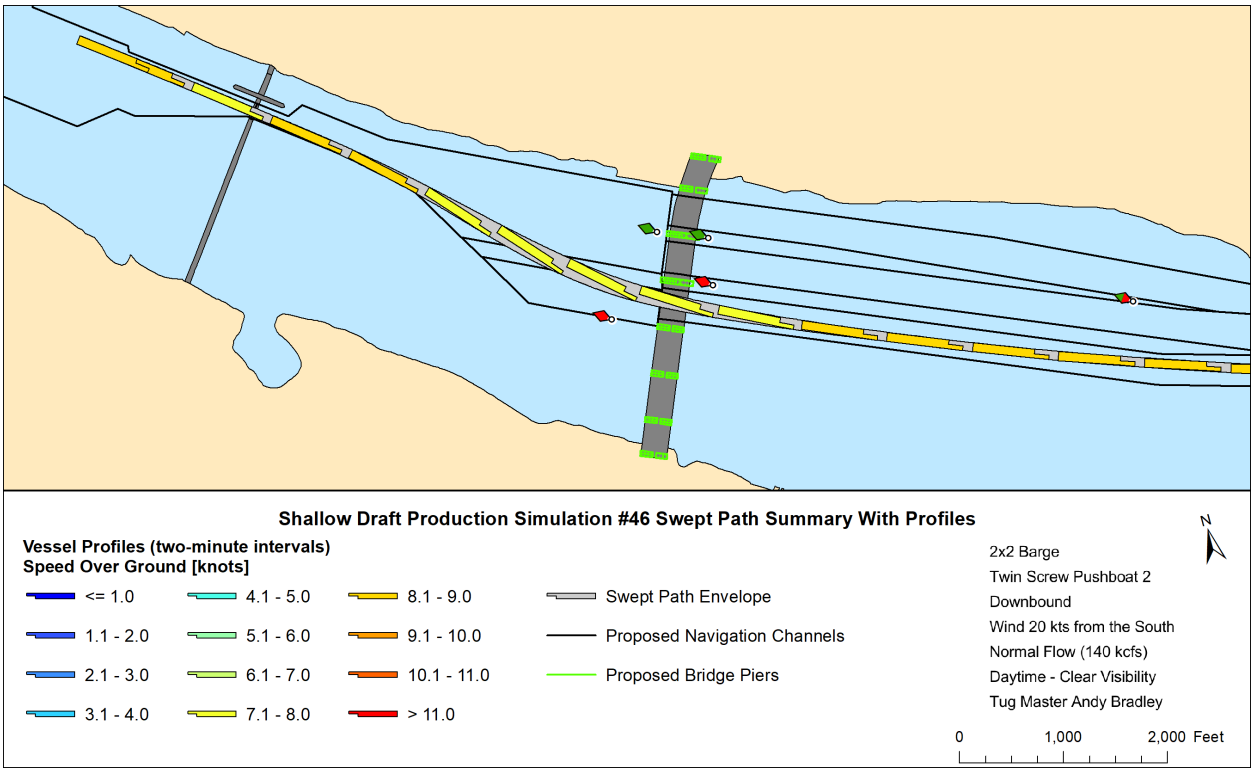

Summary of Simulation Parameters: Shallow-Draft Production Simulation 43
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

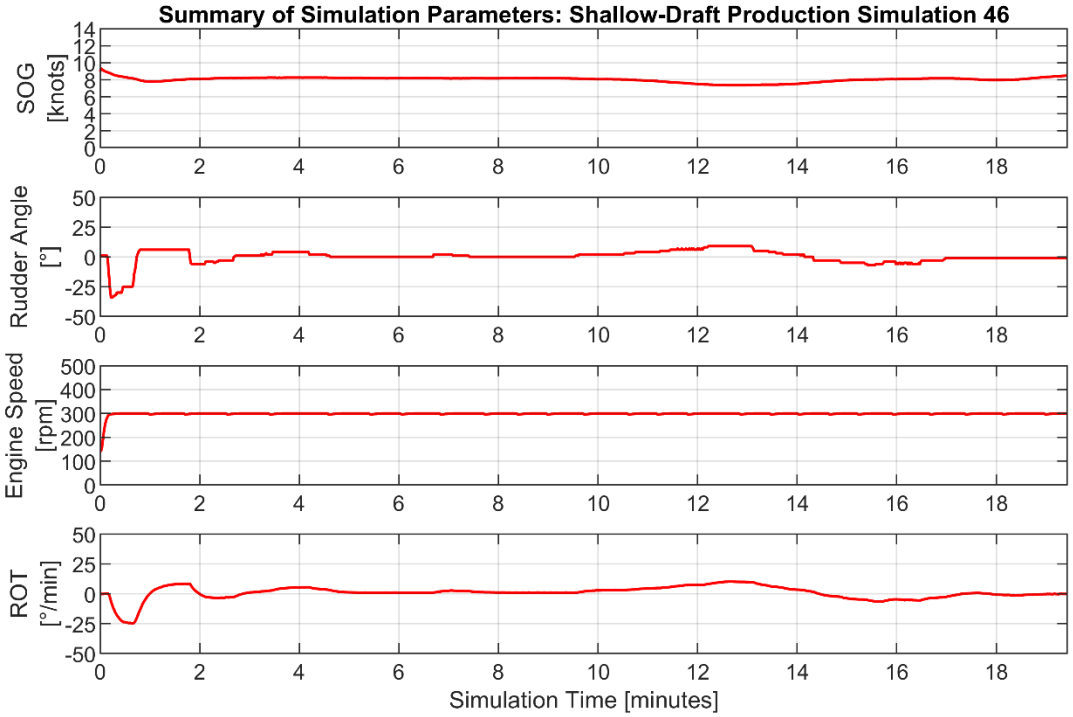

Shallow Draft Production Simulation #44 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

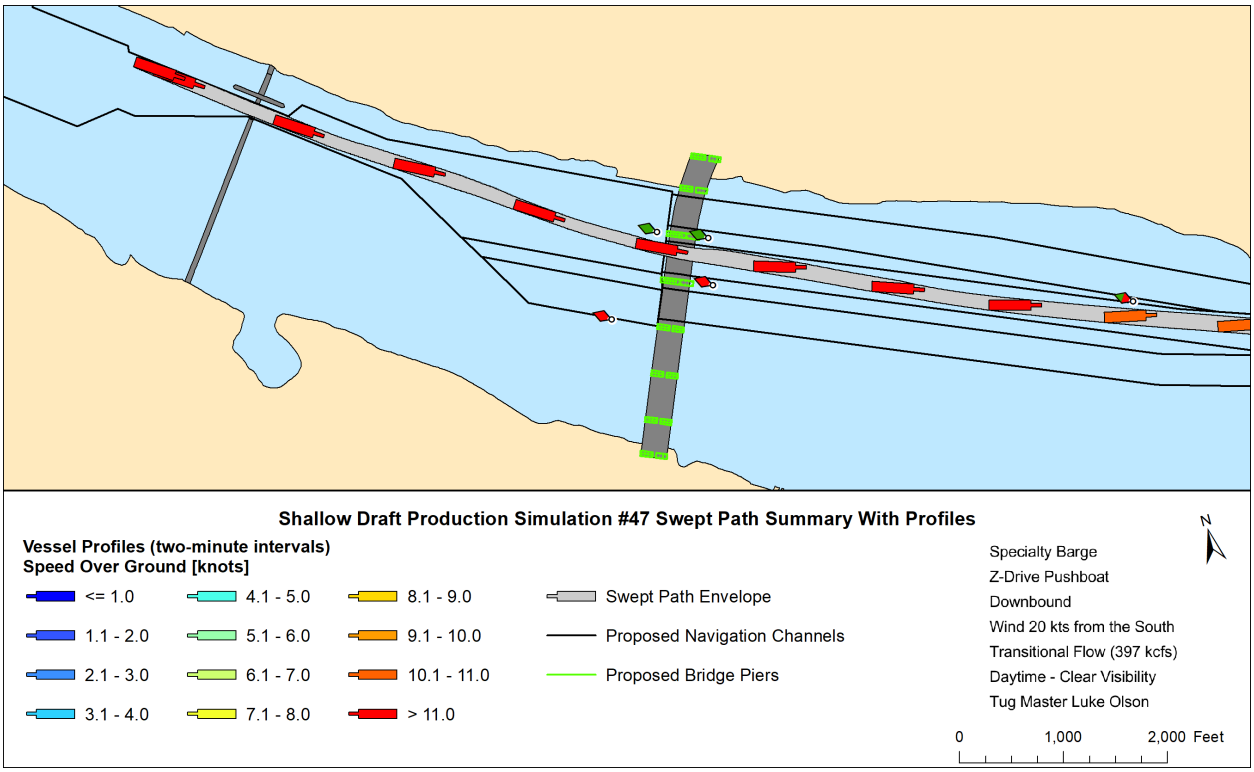

Summary of Simulation Parameters: Shallow-Draft Production Simulation 44
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

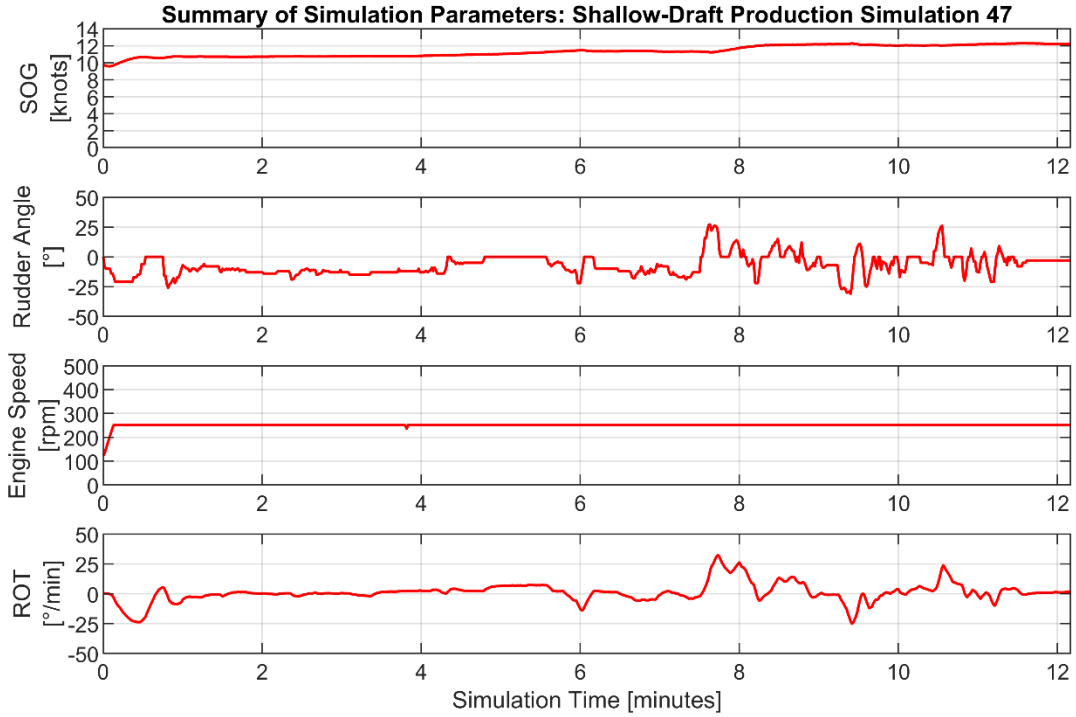

Shallow Draft Production Simulation #45 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

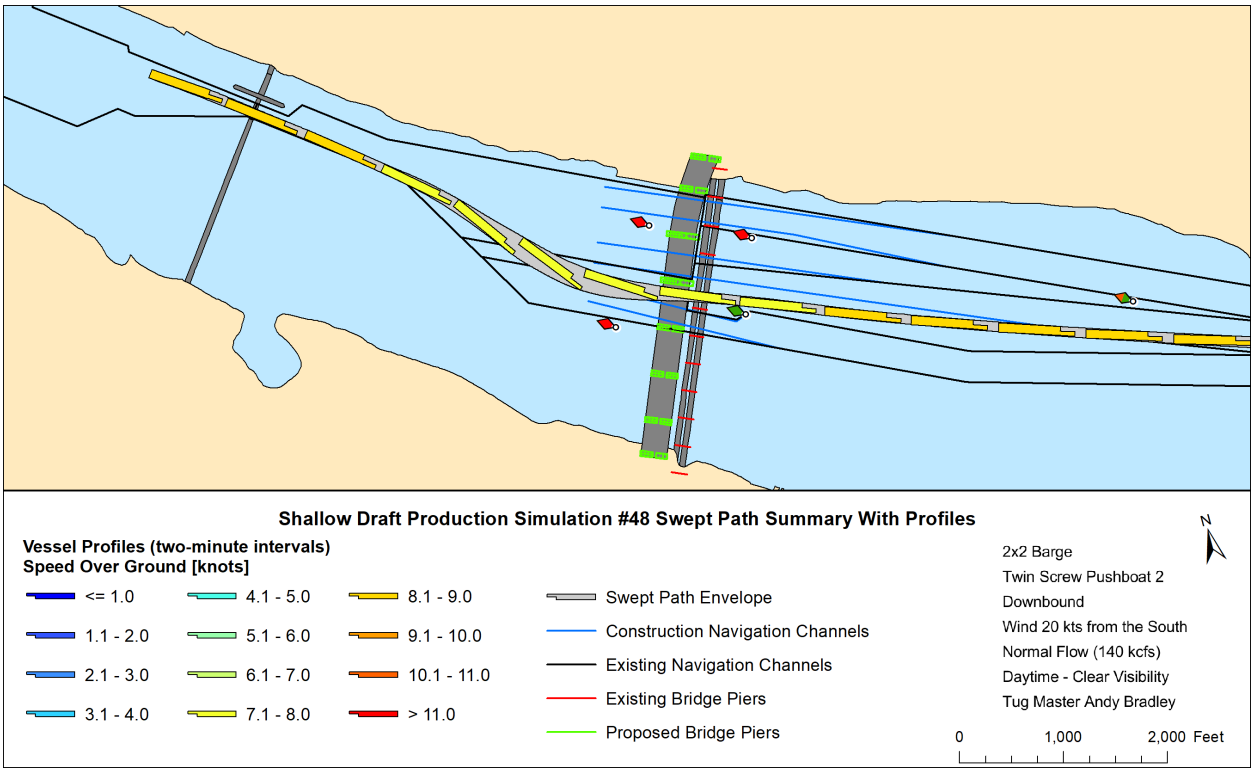

Summary of Simulation Parameters: Shallow-Draft Production Simulation 45
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

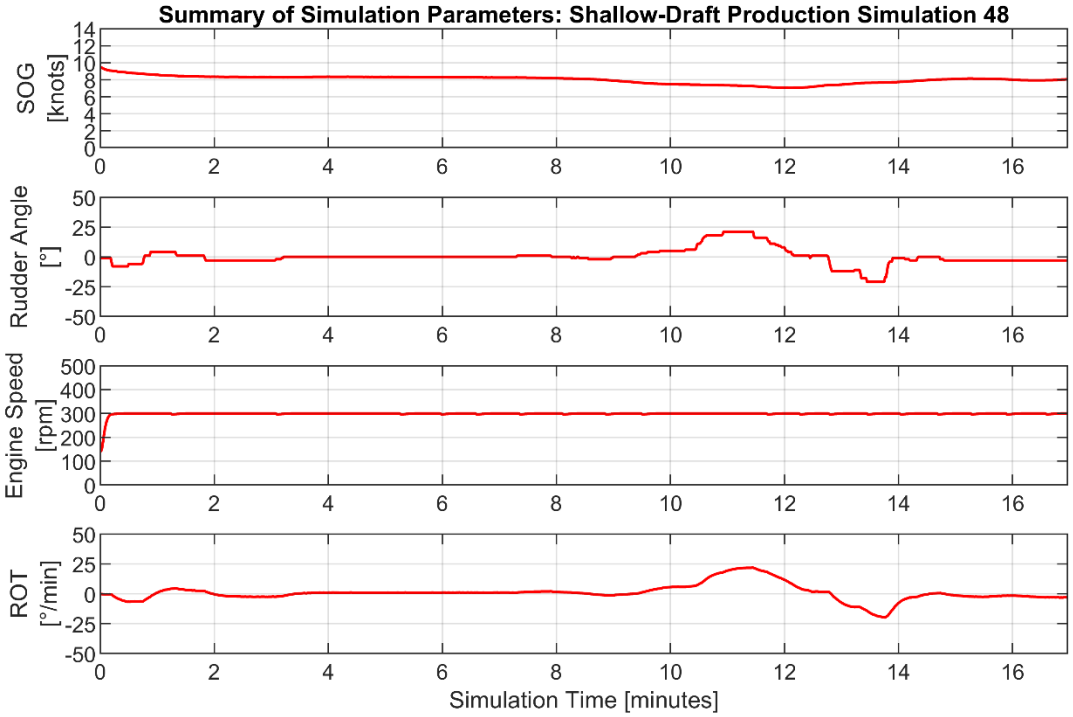

Shallow Draft Production Simulation #46 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

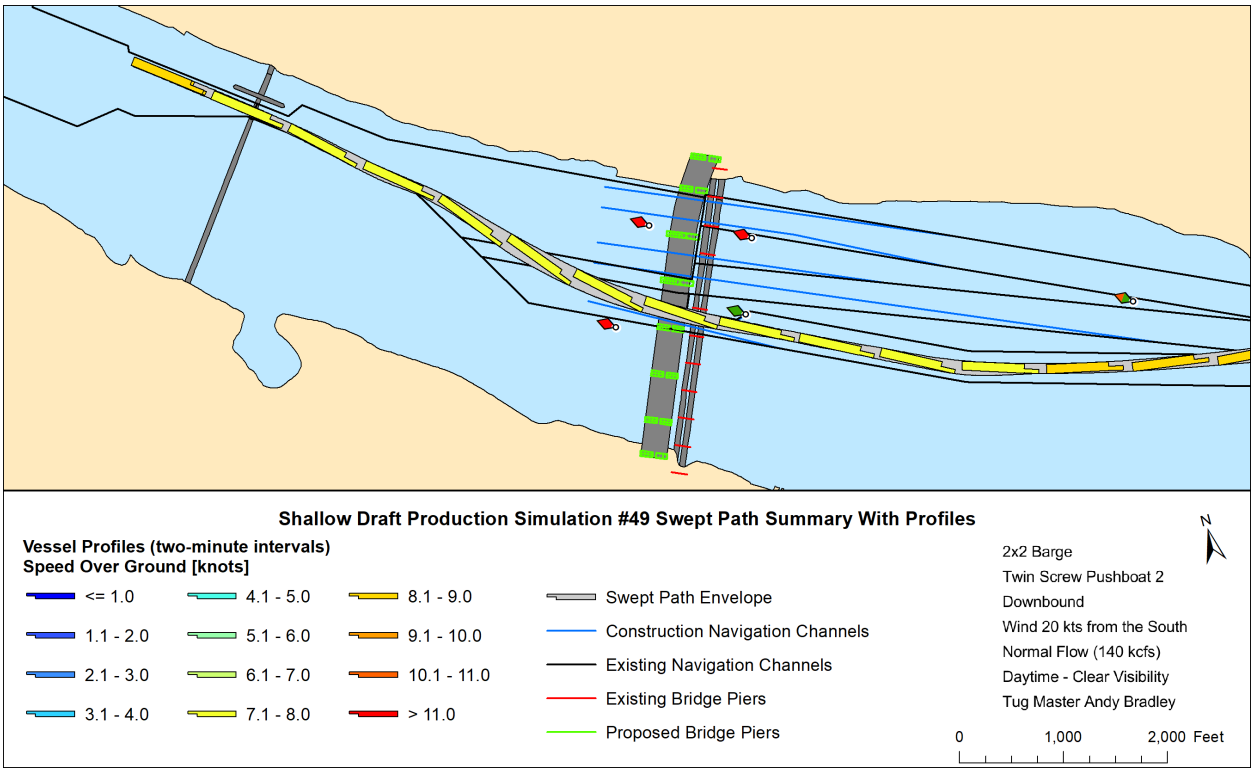

Summary of Simulation Parameters: Shallow-Draft Production Simulation 46
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

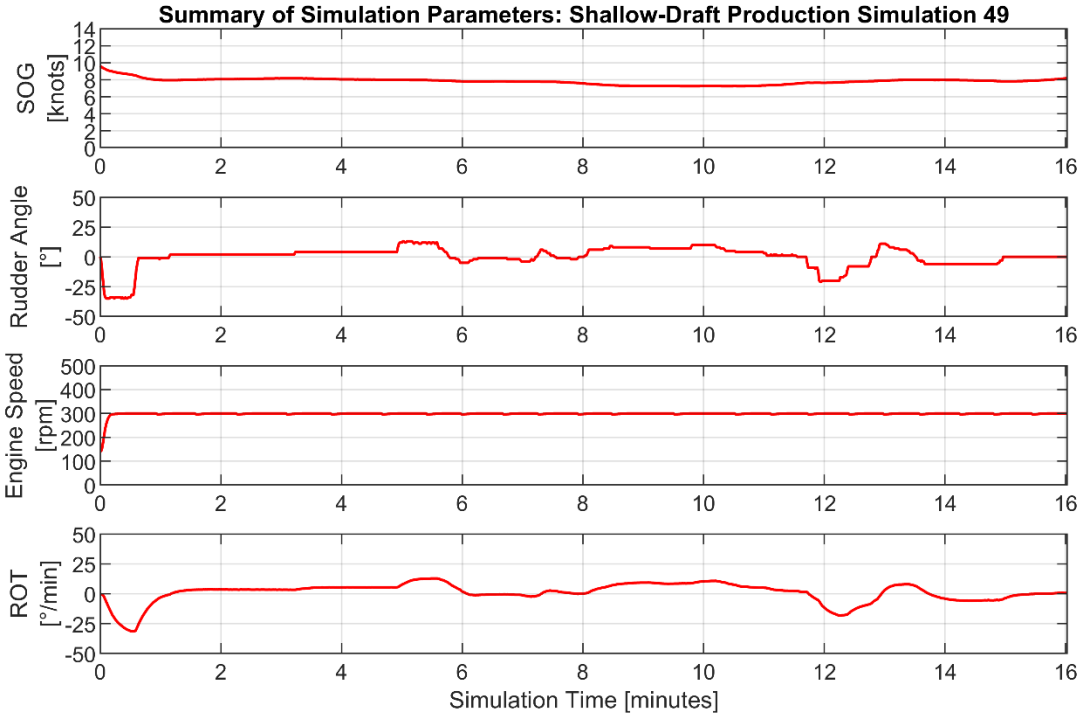

Shallow Draft Production Simulation #47 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

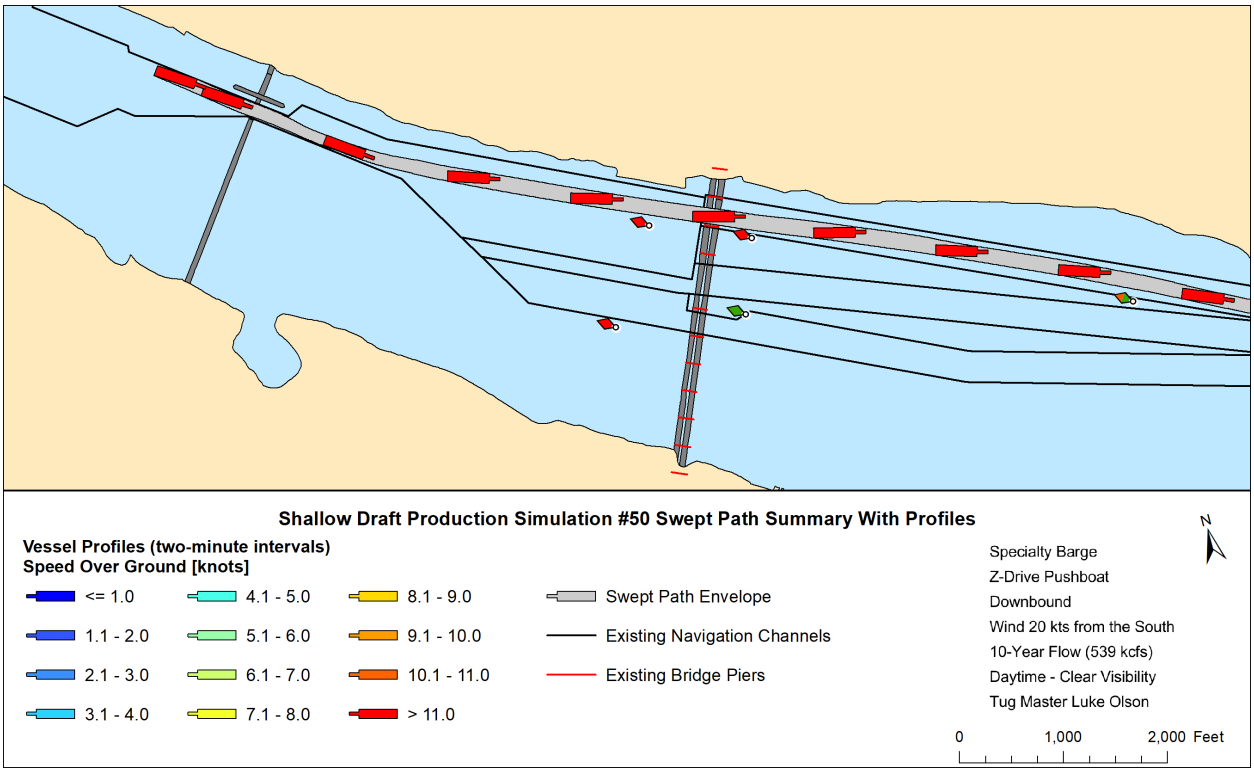

Summary of Simulation Parameters: Shallow-Draft Production Simulation 47
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

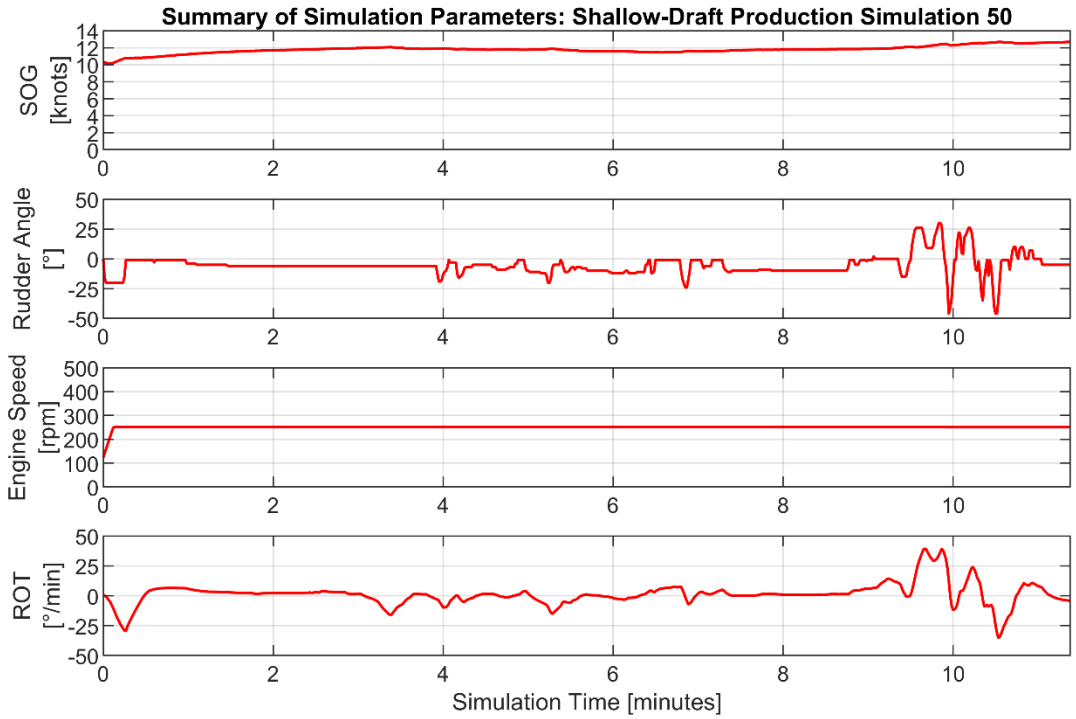

Shallow Draft Production Simulation #48 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

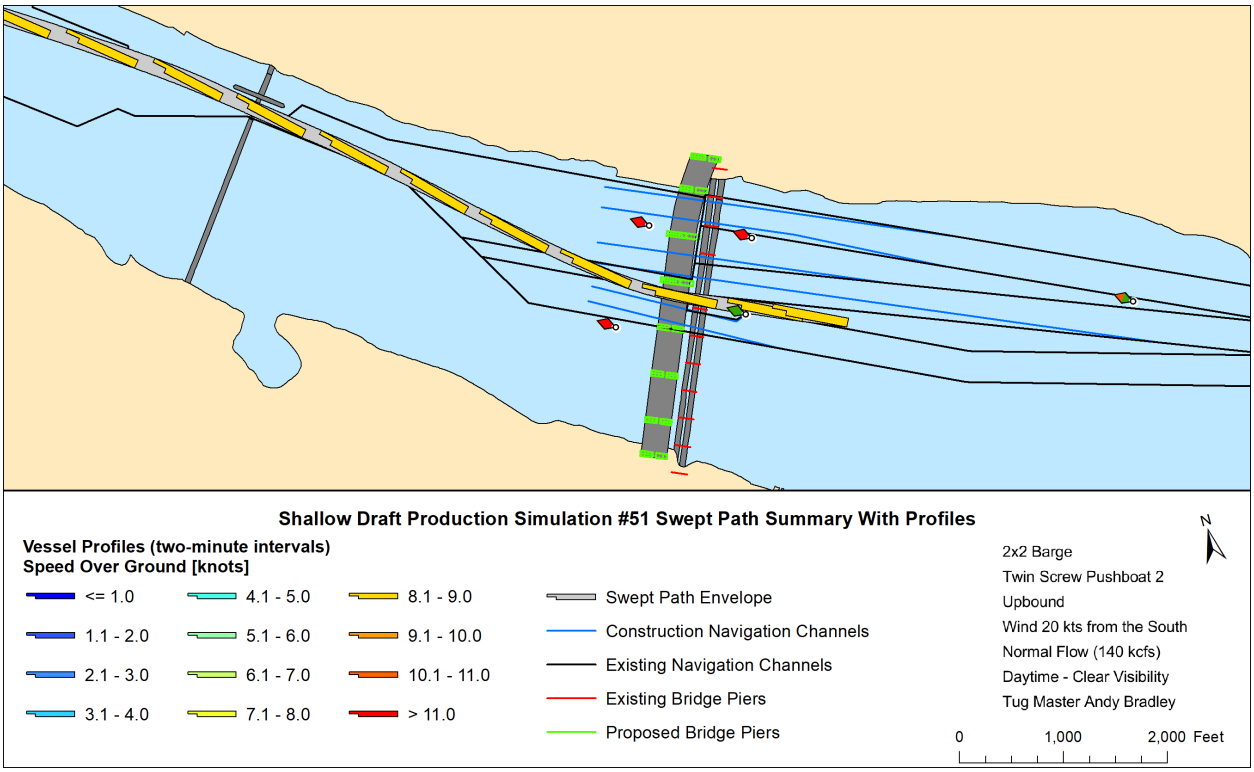

Summary of Simulation Parameters: Shallow-Draft Production Simulation 48
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

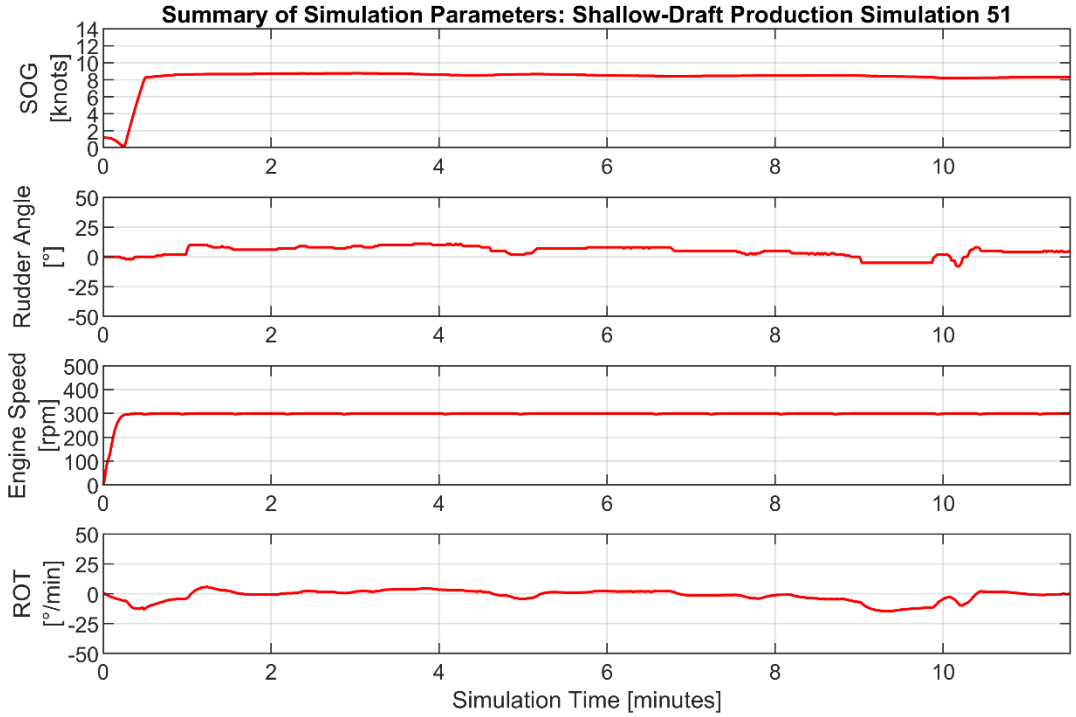

Shallow Draft Production Simulation #49 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

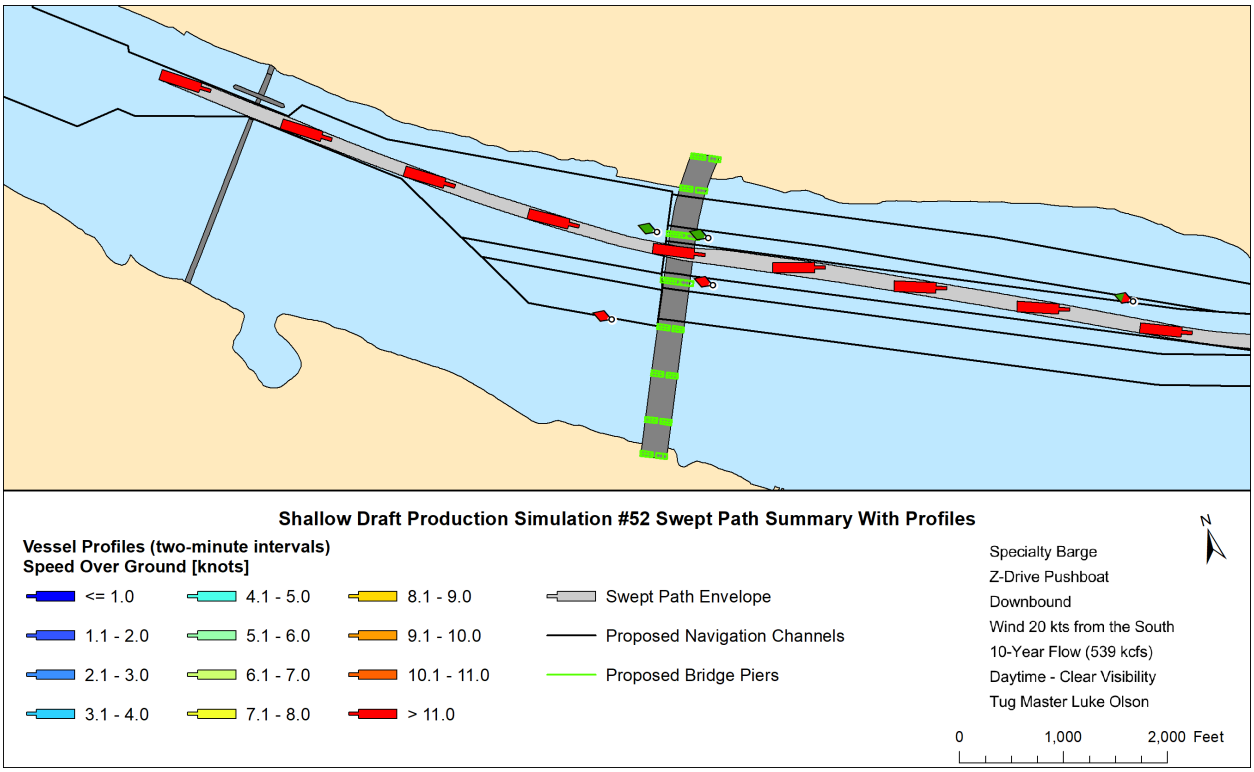

Summary of Simulation Parameters: Shallow-Draft Production Simulation 49
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

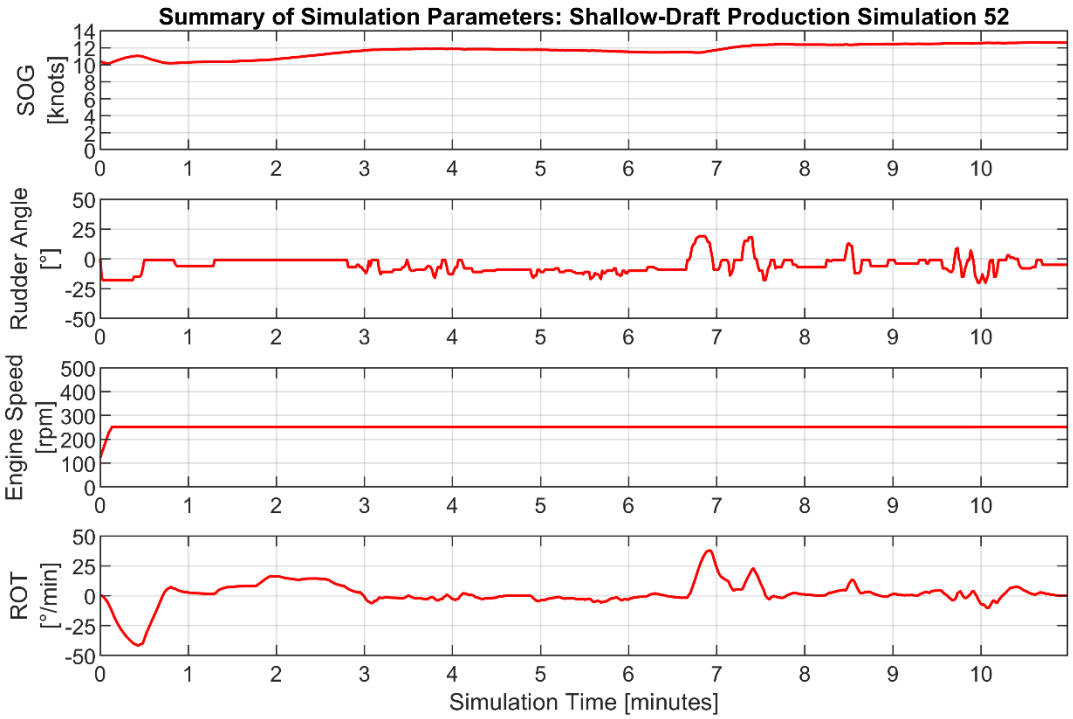

Shallow Draft Production Simulation #50 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

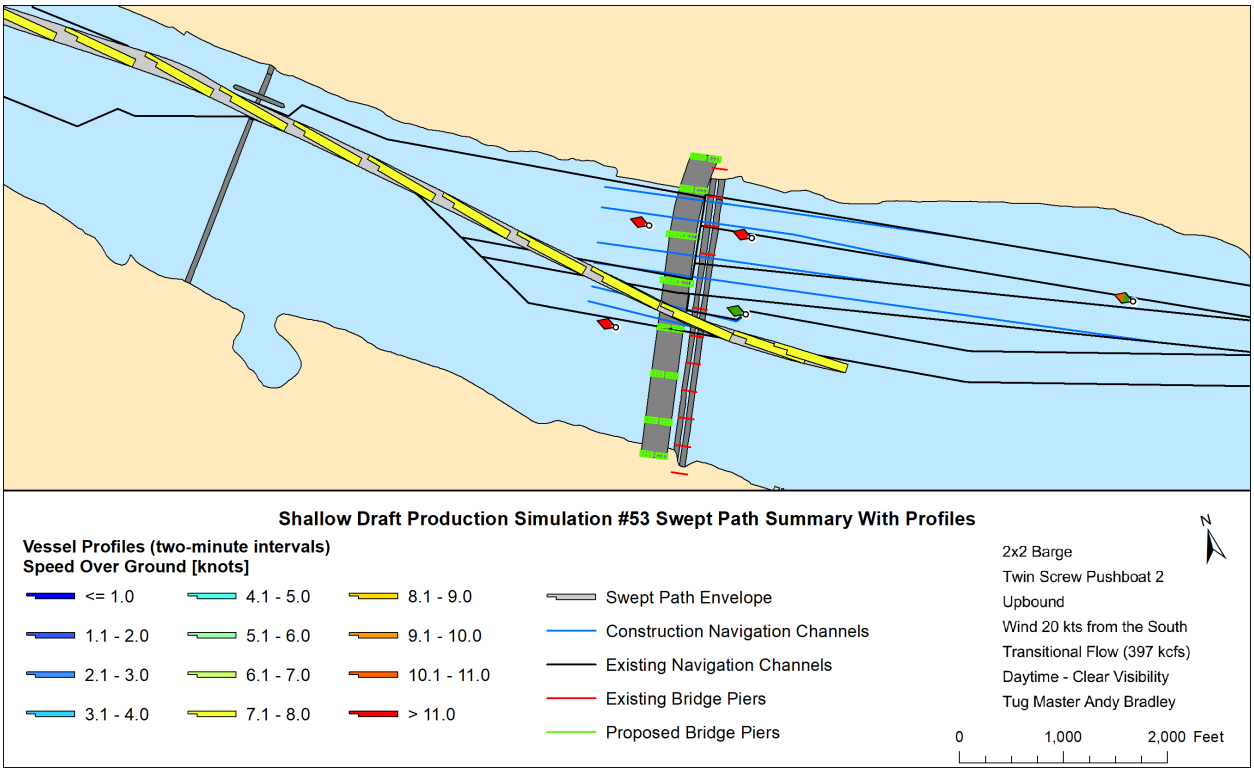

Summary of Simulation Parameters: Shallow-Draft Production Simulation 50
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

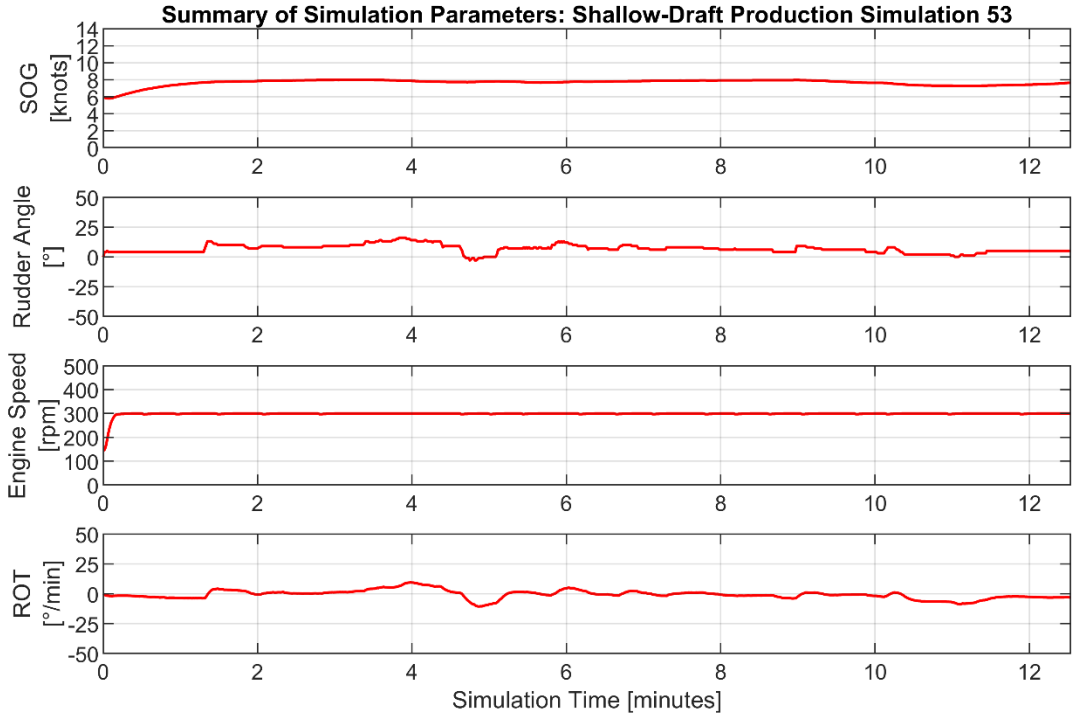

Shallow Draft Production Simulation #51 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

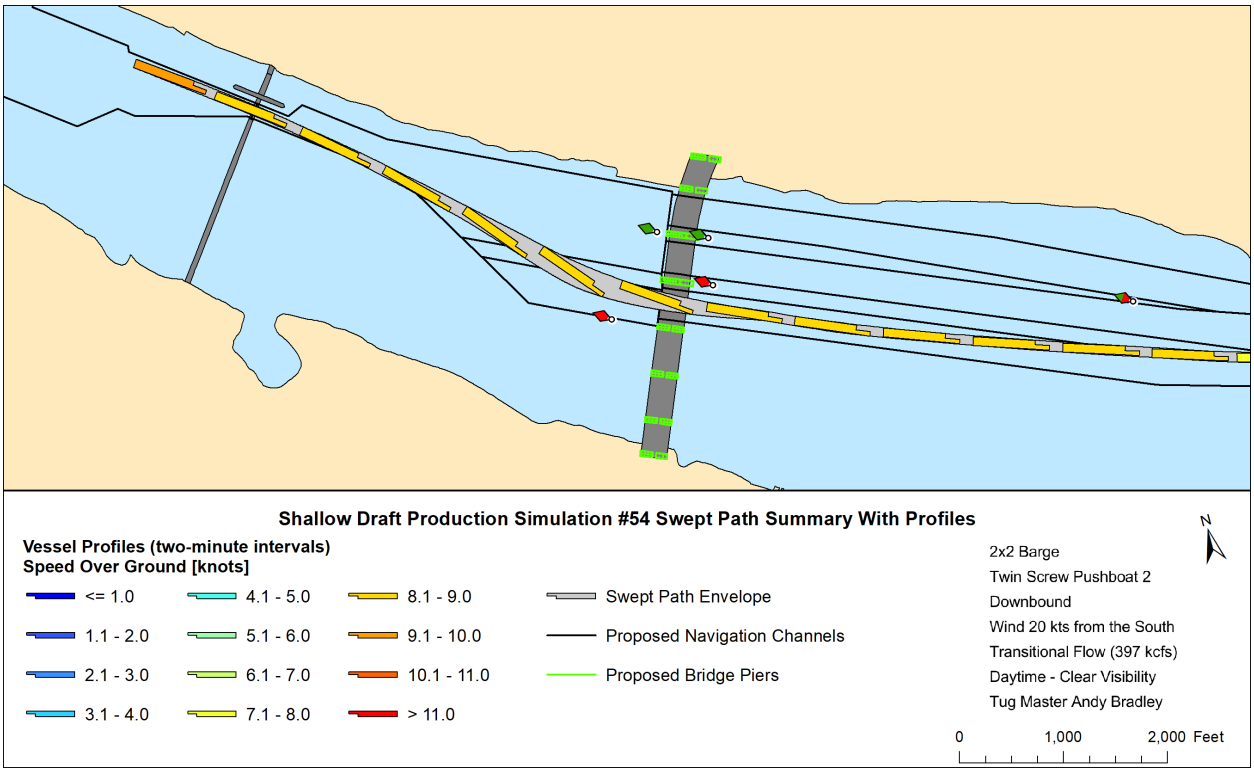

Summary of Simulation Parameters: Shallow-Draft Production Simulation 51
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

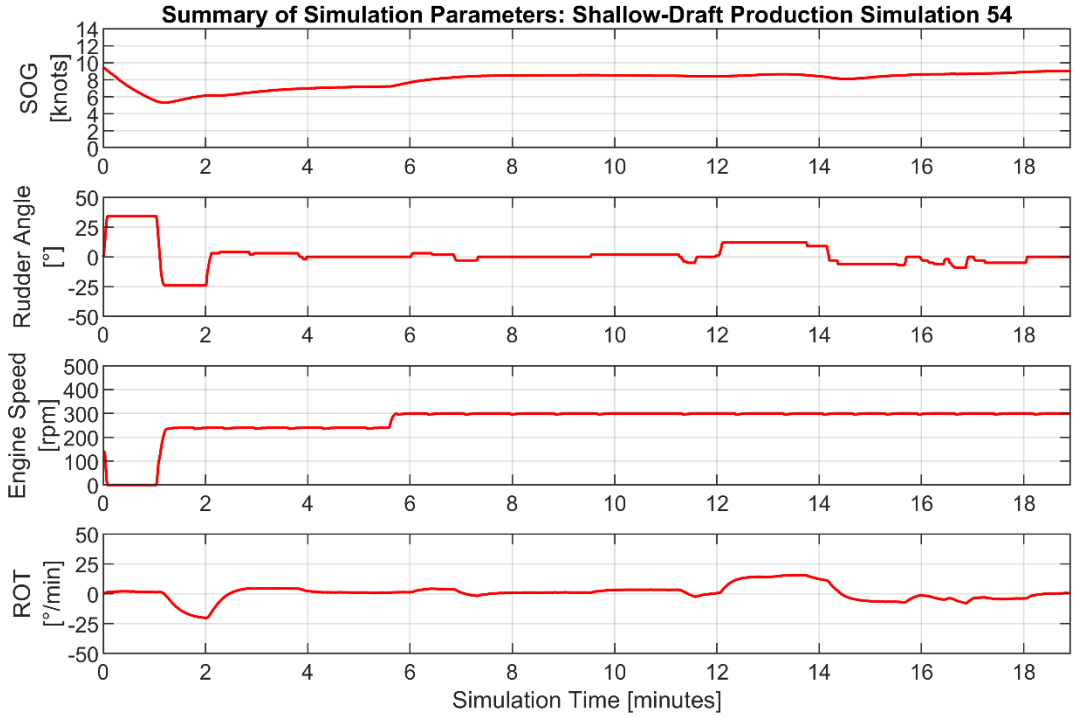

Shallow Draft Production Simulation #52 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

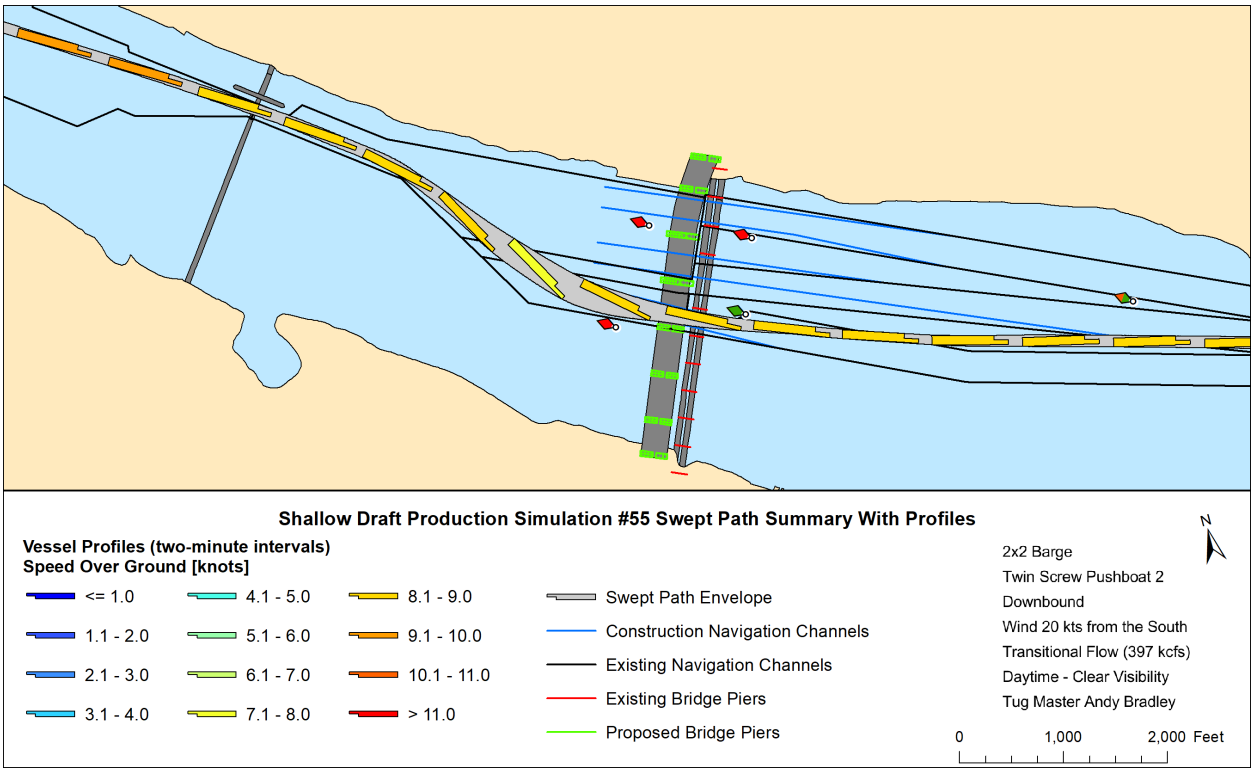

Summary of Simulation Parameters: Shallow-Draft Production Simulation 52
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

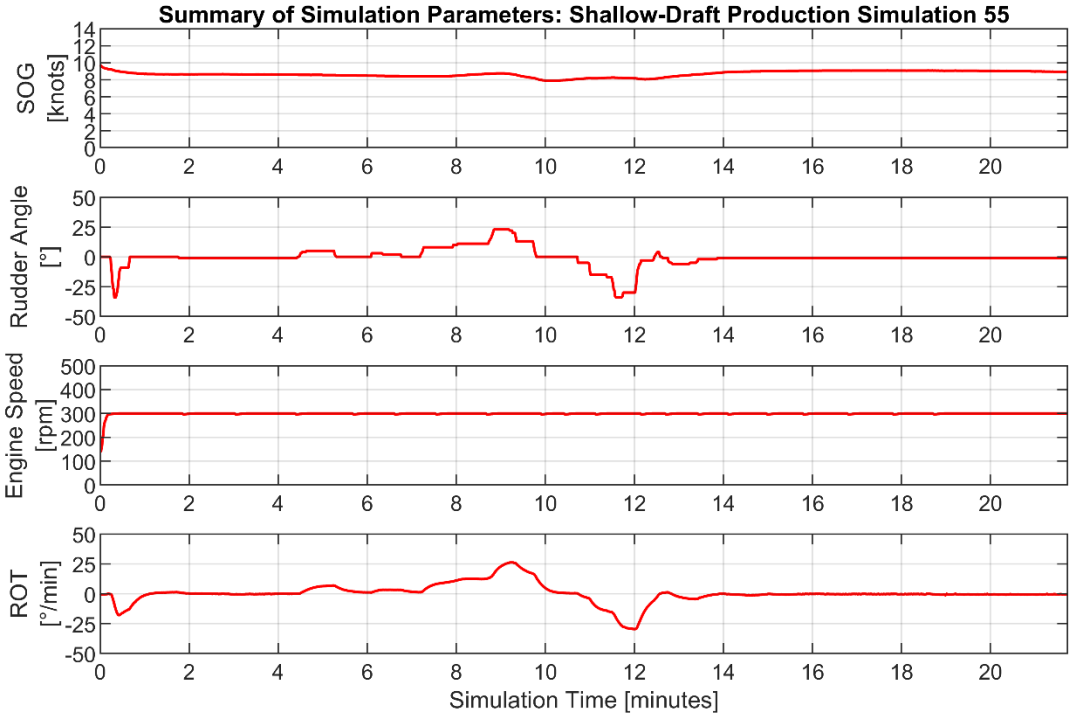

Shallow Draft Production Simulation #53 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

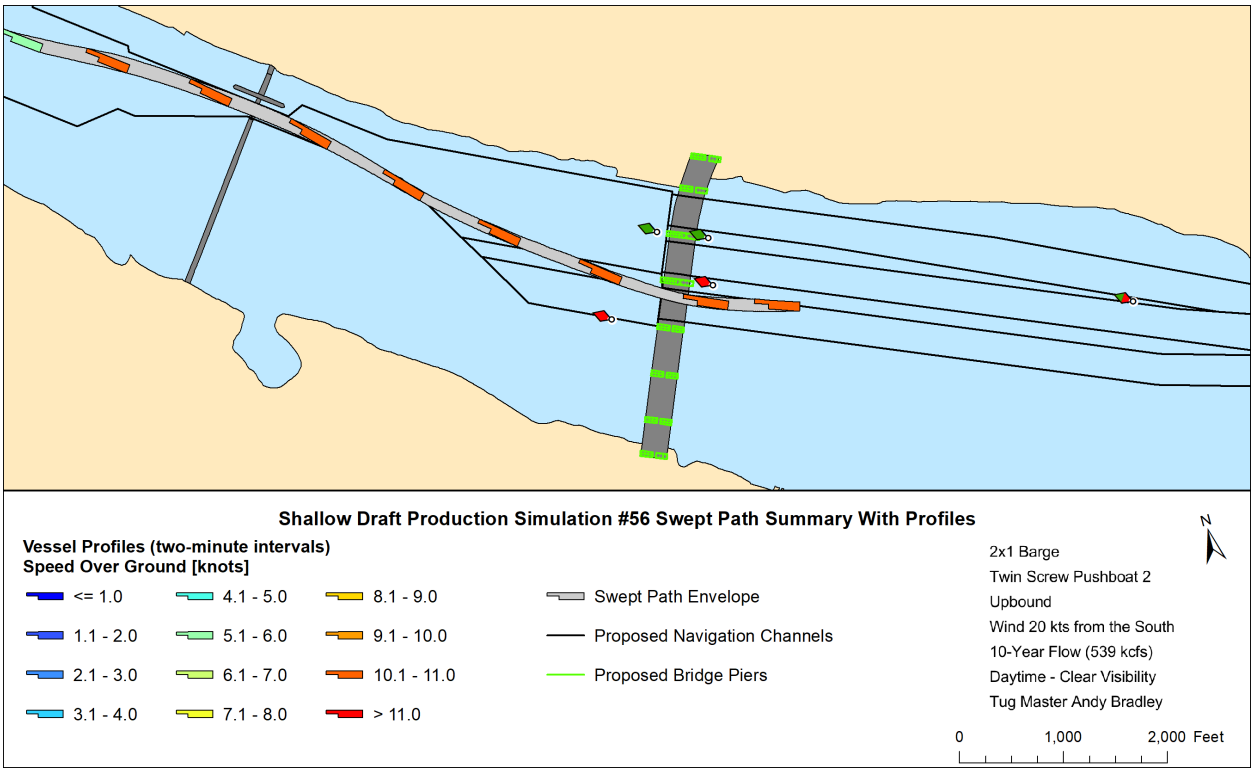

Summary of Simulation Parameters: Shallow-Draft Production Simulation 53
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

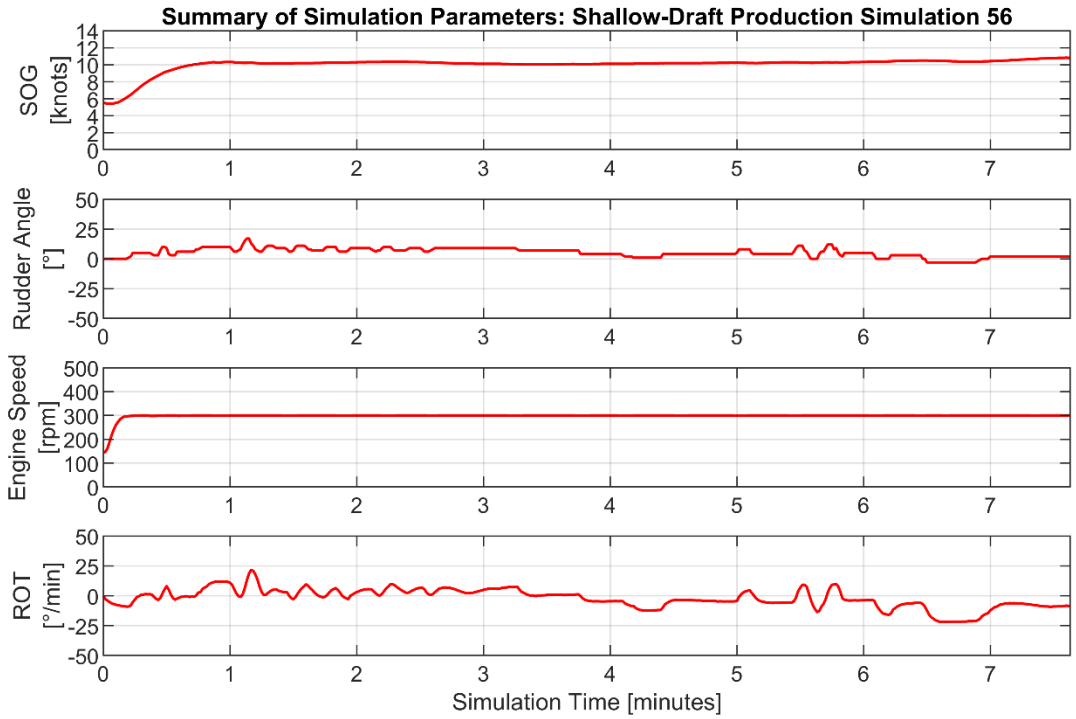

Shallow Draft Production Simulation #54 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

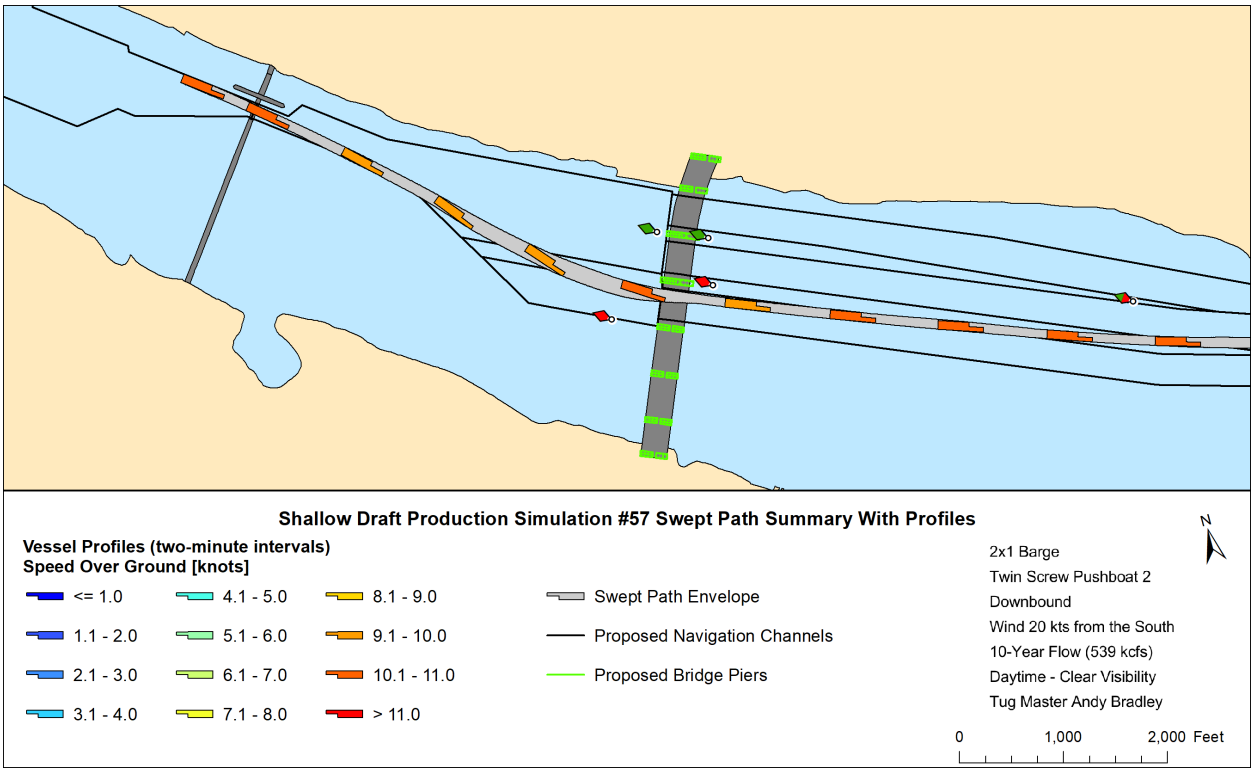

Summary of Simulation Parameters: Shallow-Draft Production Simulation 54
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

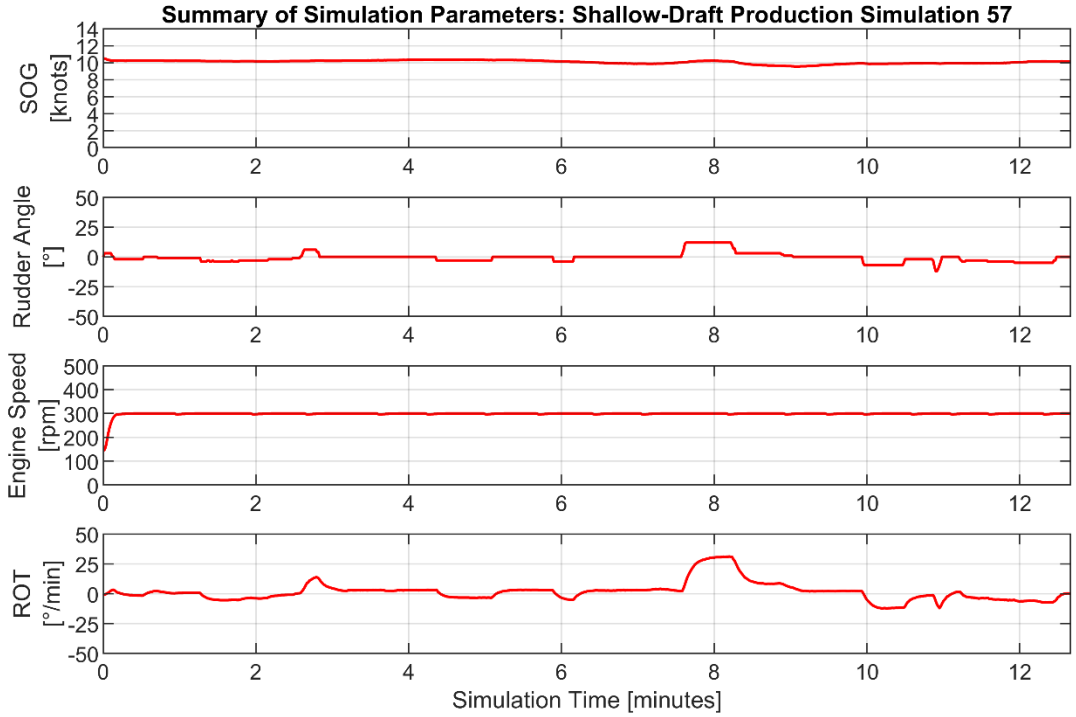

Shallow Draft Production Simulation #55 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

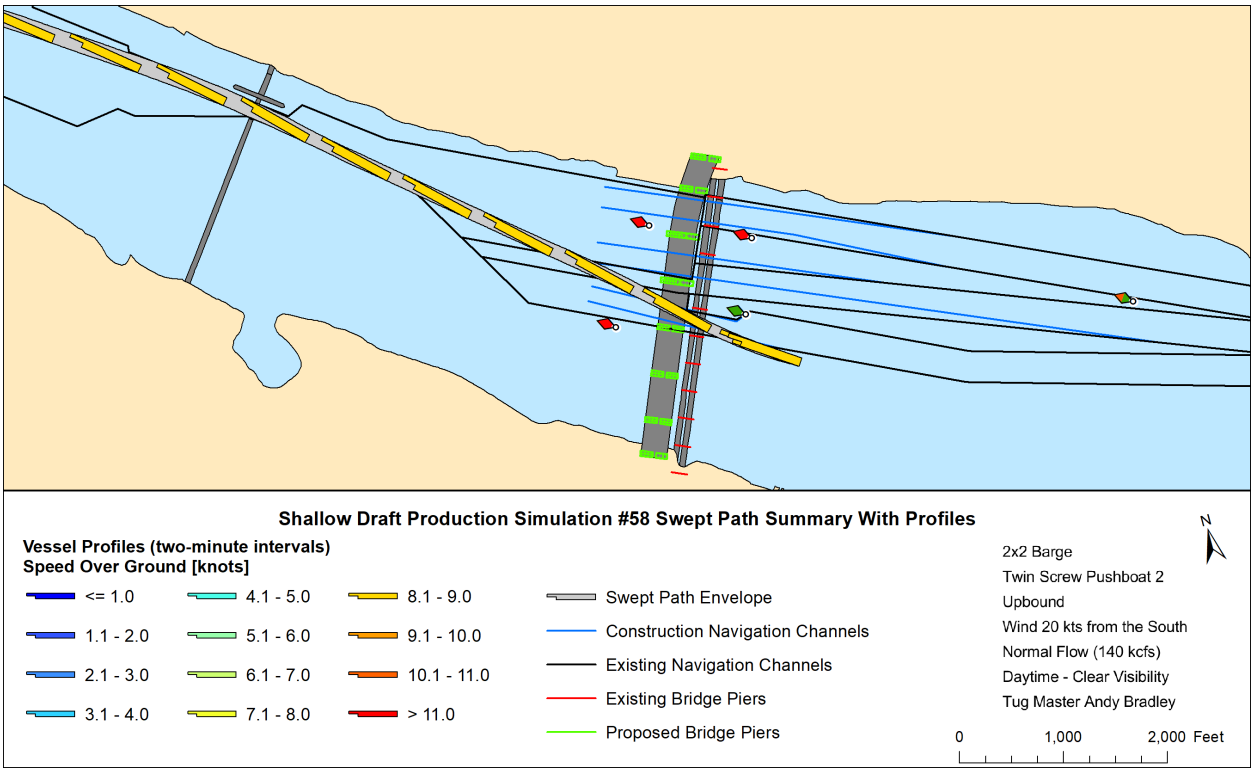

Summary of Simulation Parameters: Shallow-Draft Production Simulation 55
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

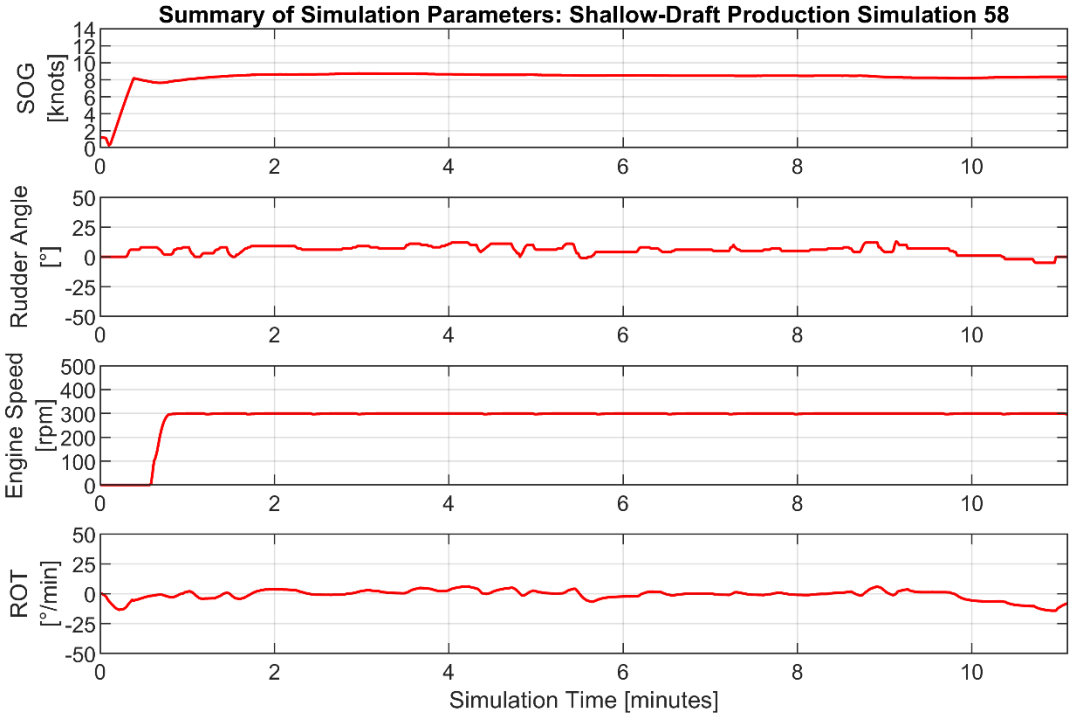

Shallow Draft Production Simulation #56 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

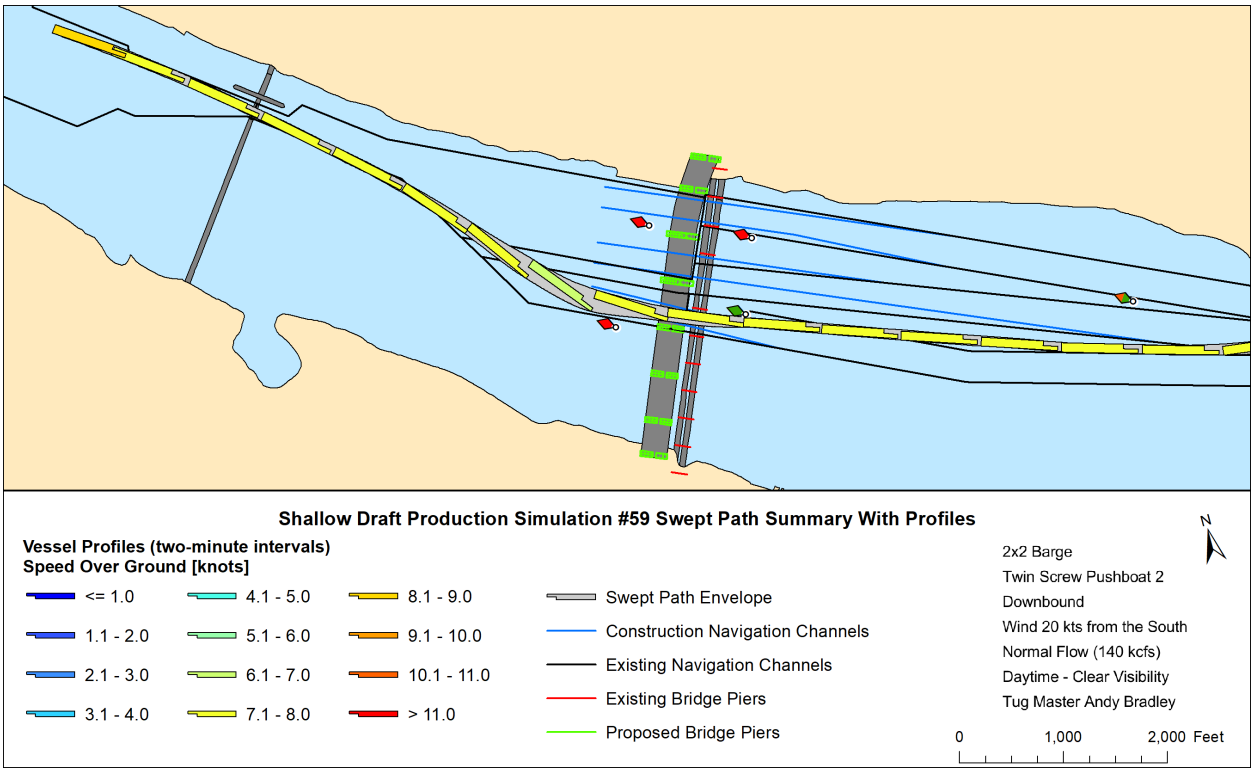

Summary of Simulation Parameters: Shallow-Draft Production Simulation 56
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

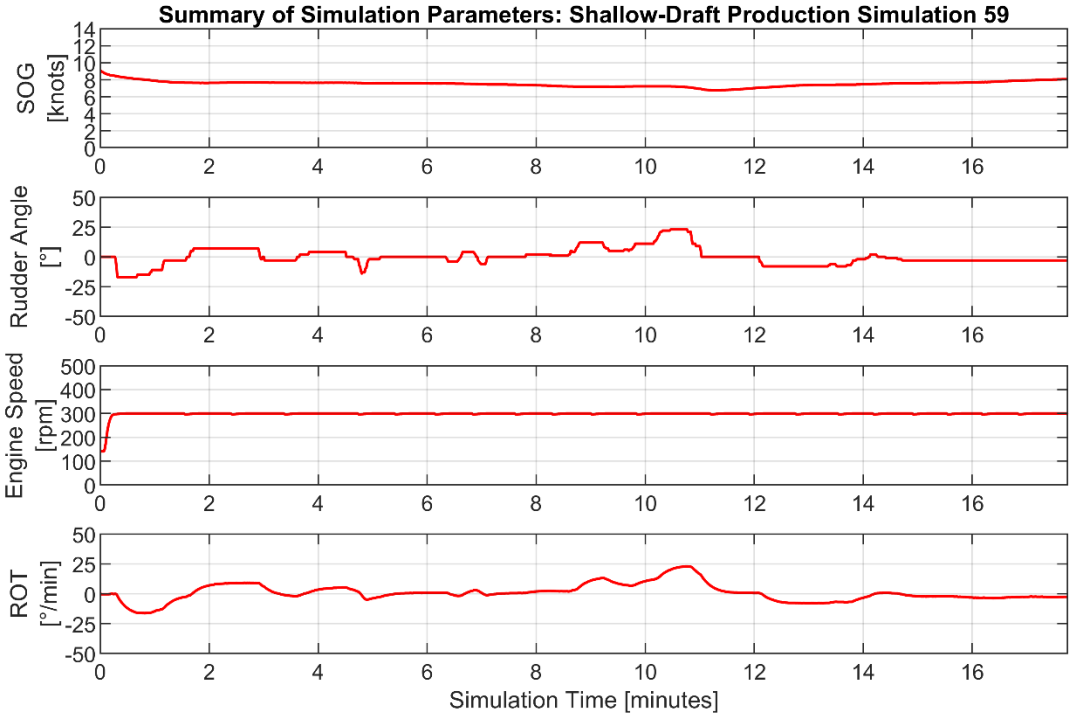

Shallow Draft Production Simulation #57 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

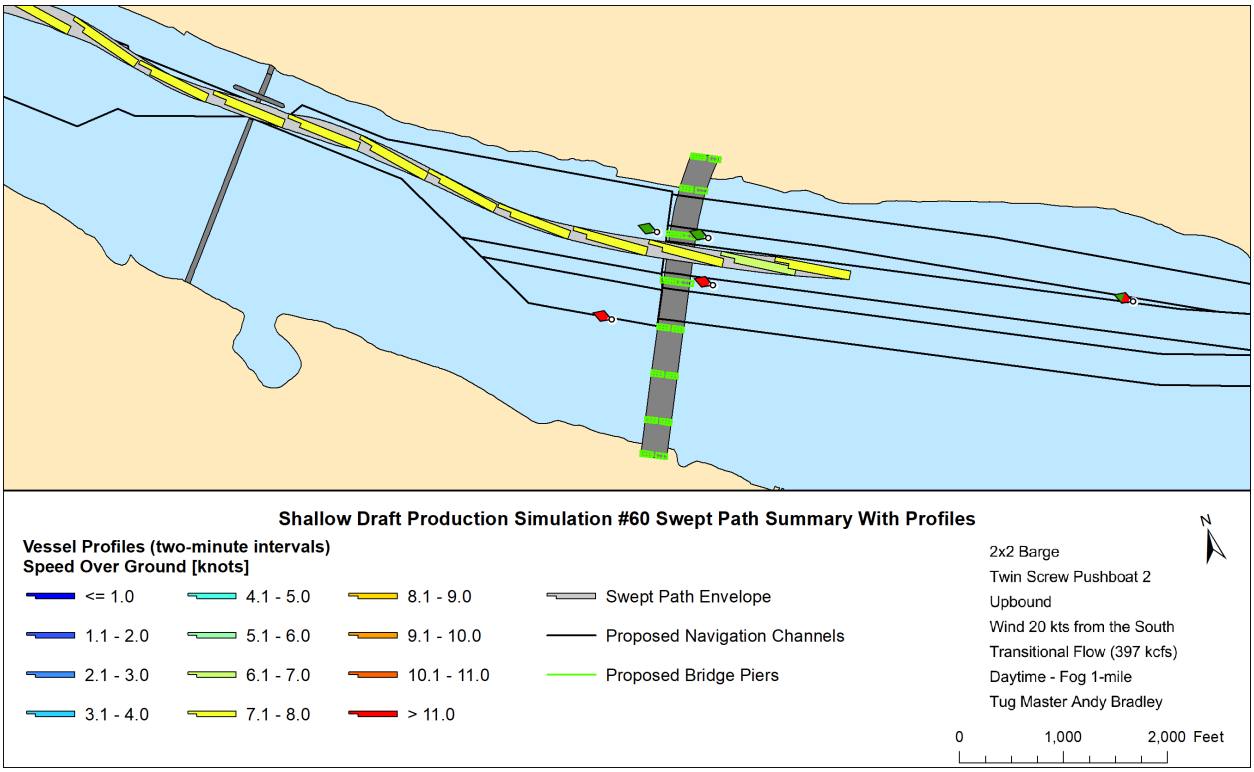

Summary of Simulation Parameters: Shallow-Draft Production Simulation 57
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

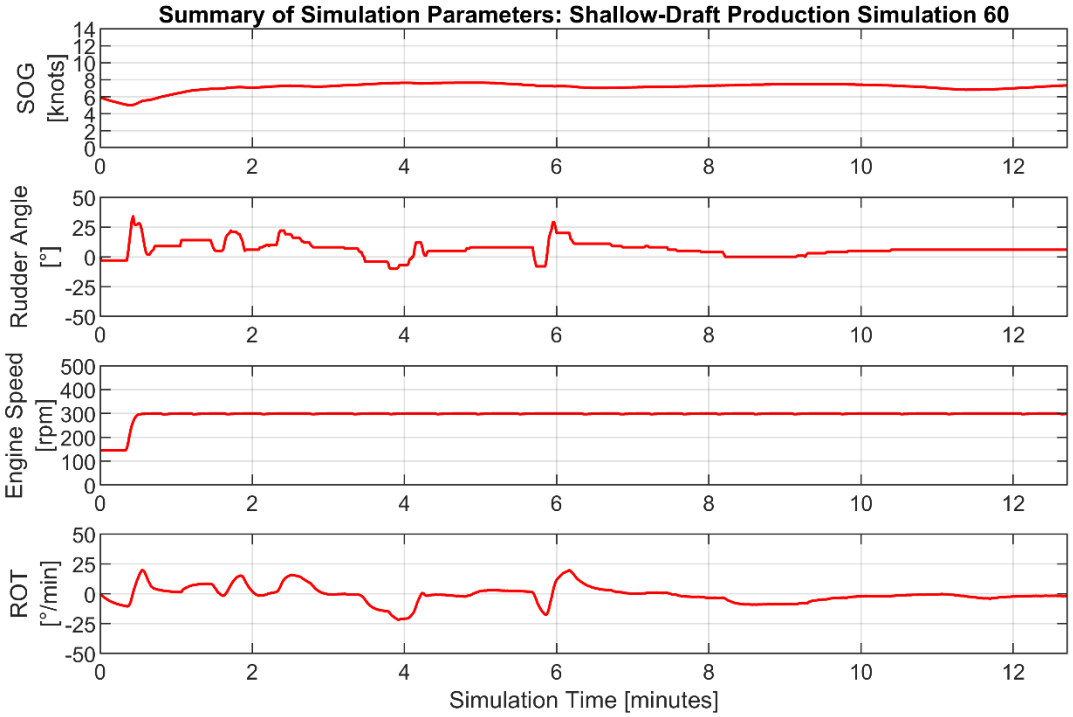

Shallow Draft Production Simulation #58 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

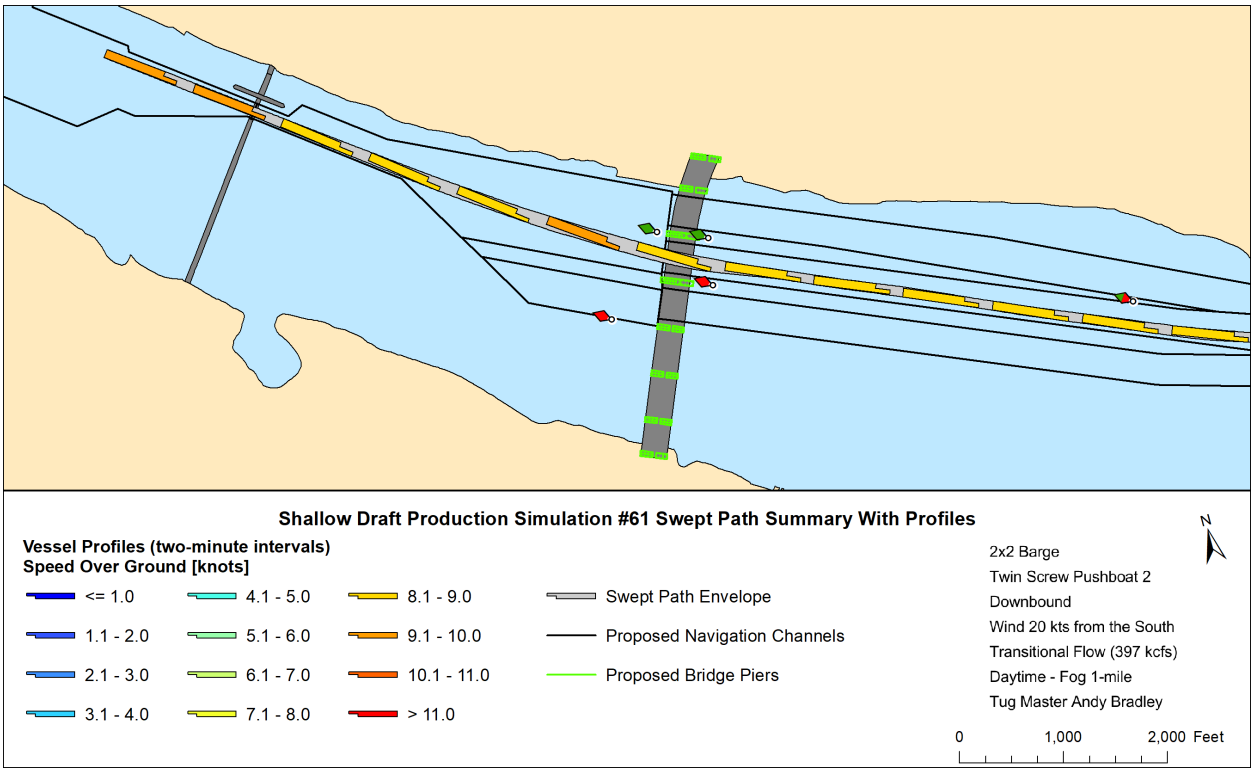

Summary of Simulation Parameters: Shallow-Draft Production Simulation 58
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

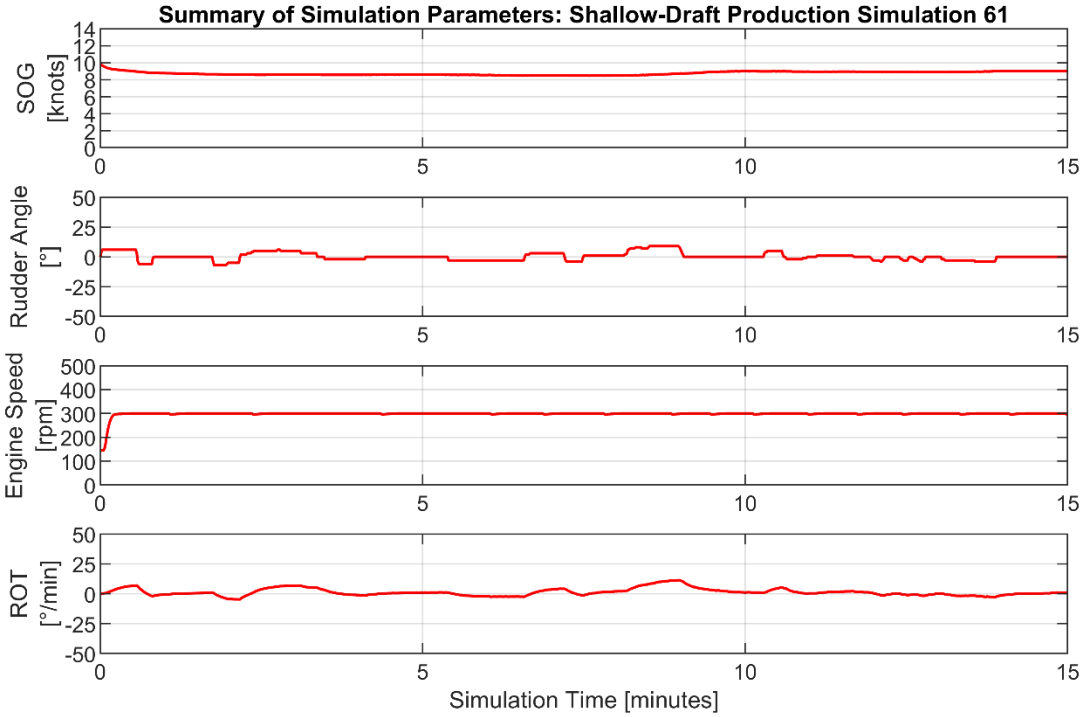

Shallow Draft Production Simulation #59 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

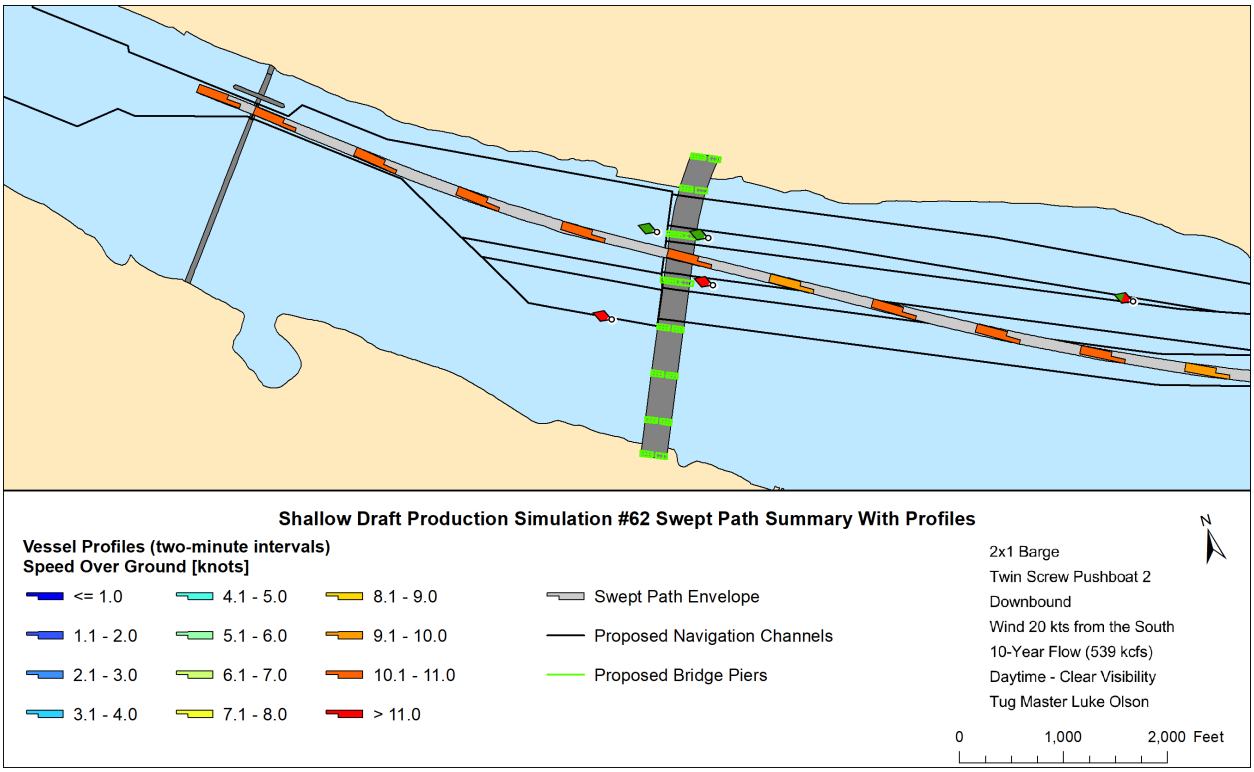

Summary of Simulation Parameters: Shallow-Draft Production Simulation 59
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

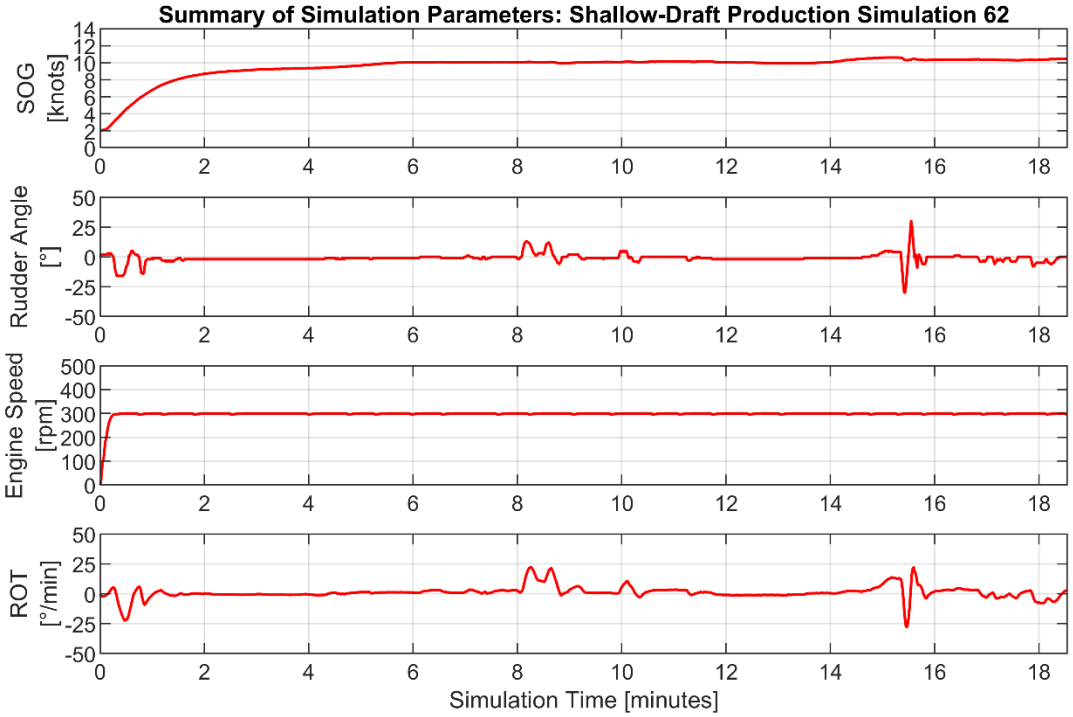

Shallow Draft Production Simulation #60 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Fog 1-mile
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

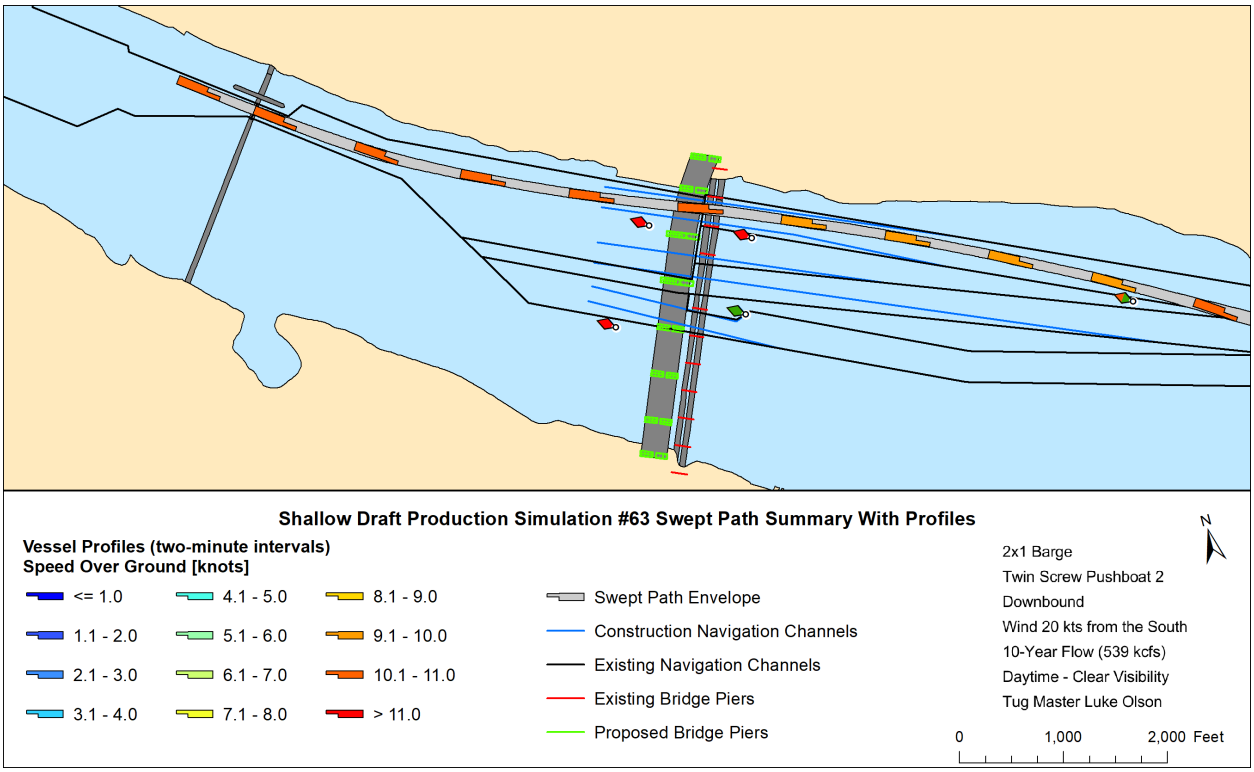

Summary of Simulation Parameters: Shallow-Draft Production Simulation 60
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

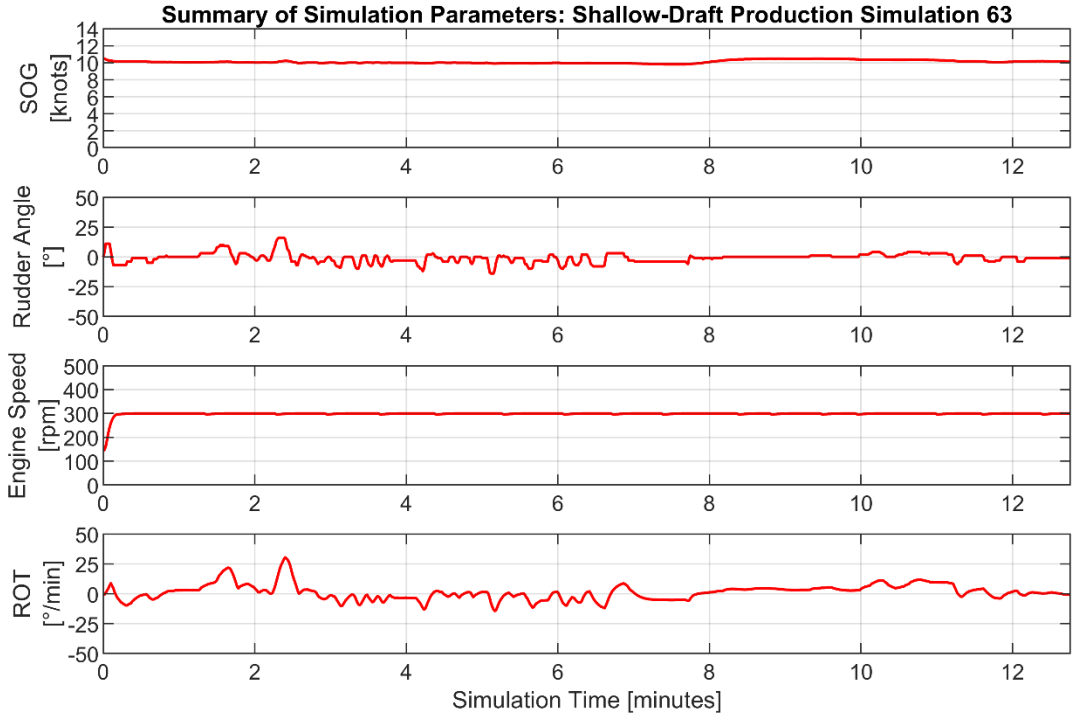

Shallow Draft Production Simulation #61 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Fog 1-mile
Tug Master Andy Bradley
N
0
1,000
2,000 Feet

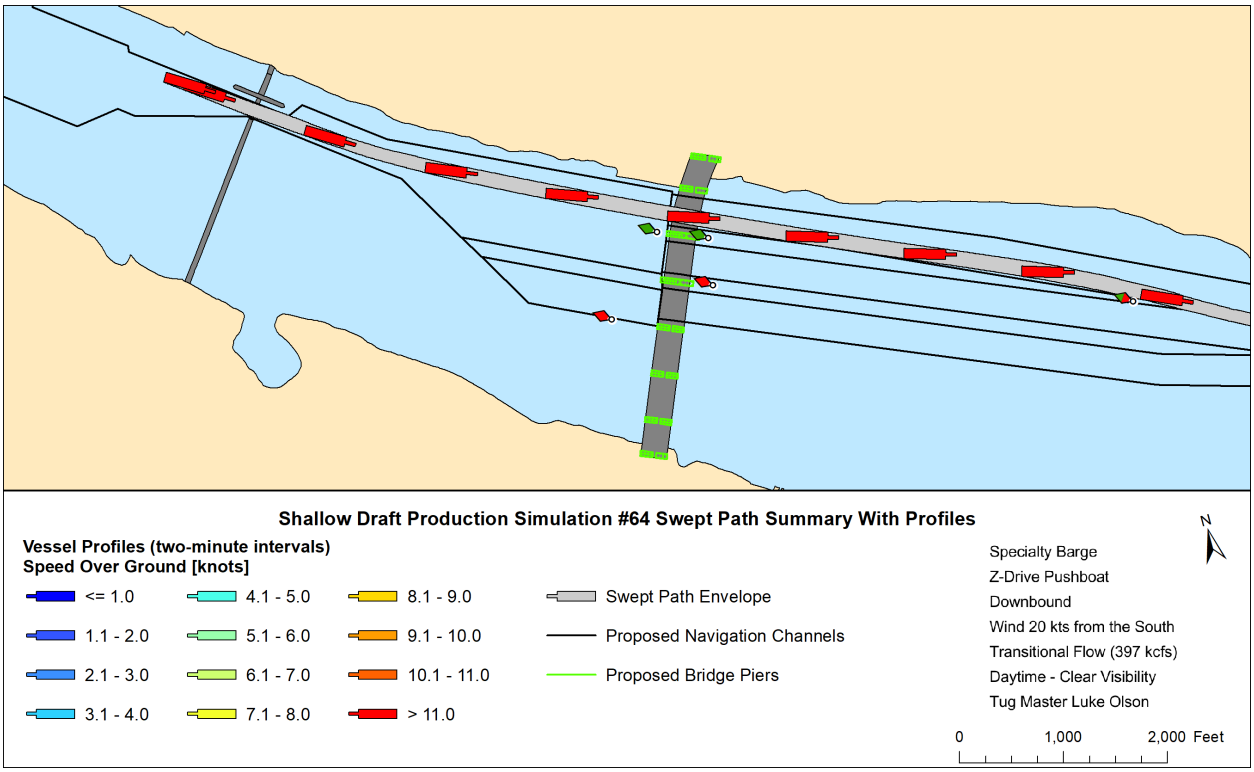

Summary of Simulation Parameters: Shallow-Draft Production Simulation 61
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

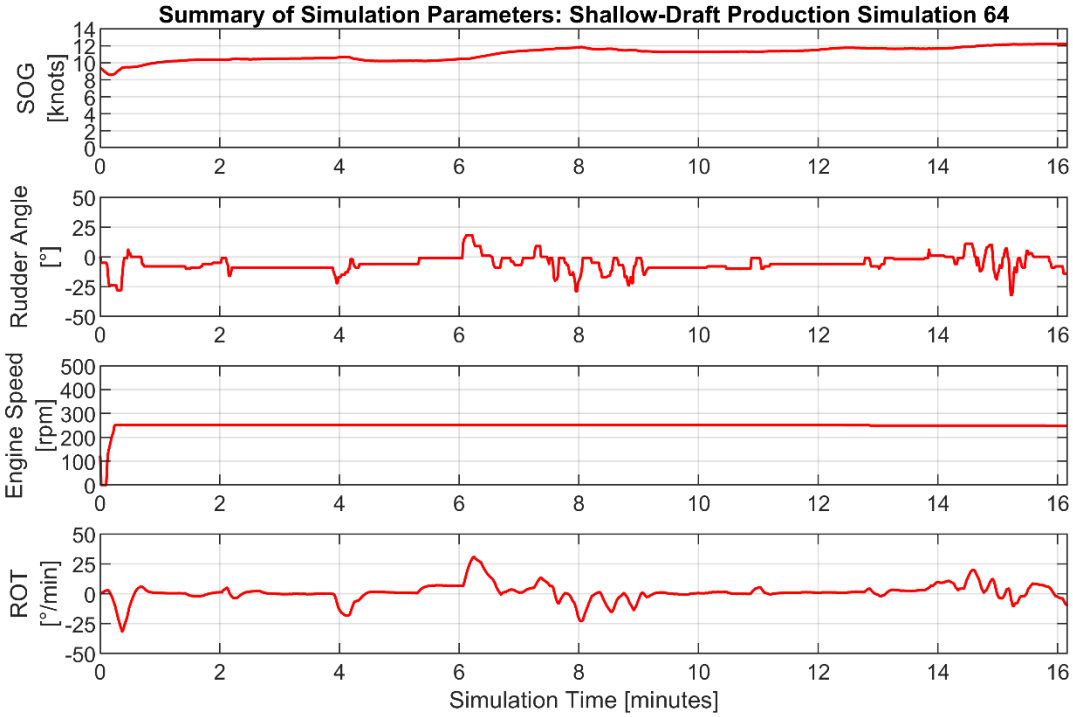

Shallow Draft Production Simulation #62 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

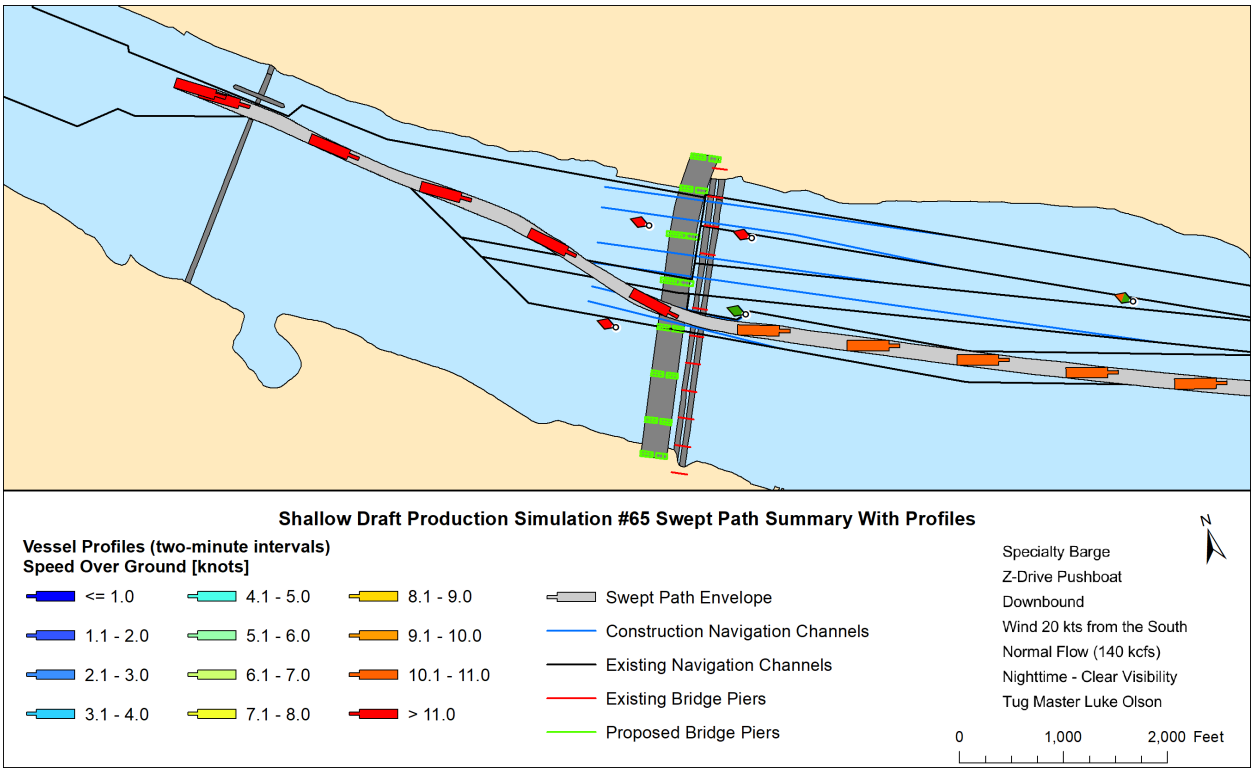

Summary of Simulation Parameters: Shallow-Draft Production Simulation 62
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

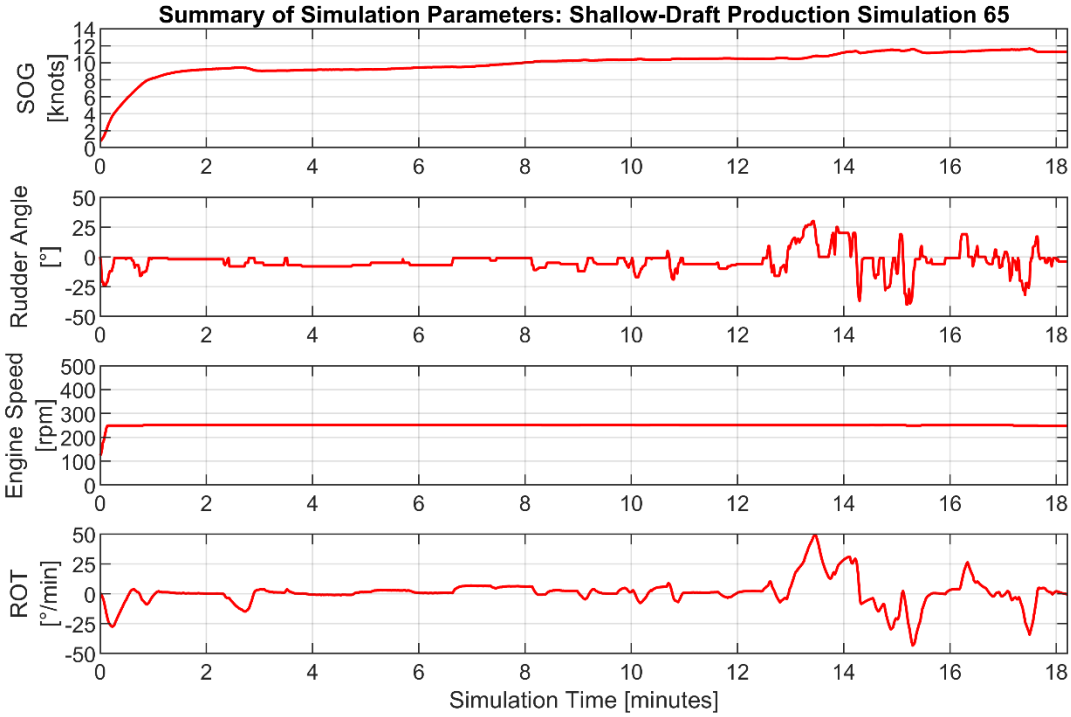

Shallow Draft Production Simulation #63 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

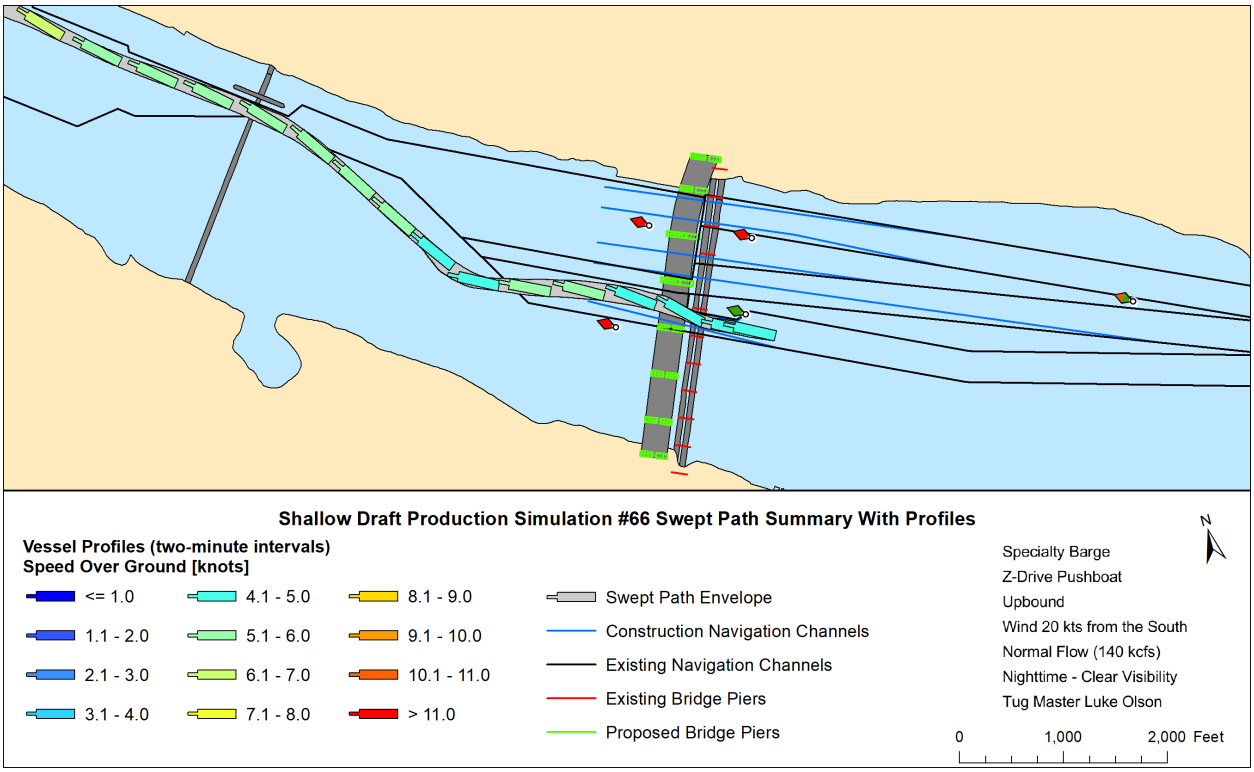

Summary of Simulation Parameters: Shallow-Draft Production Simulation 63
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

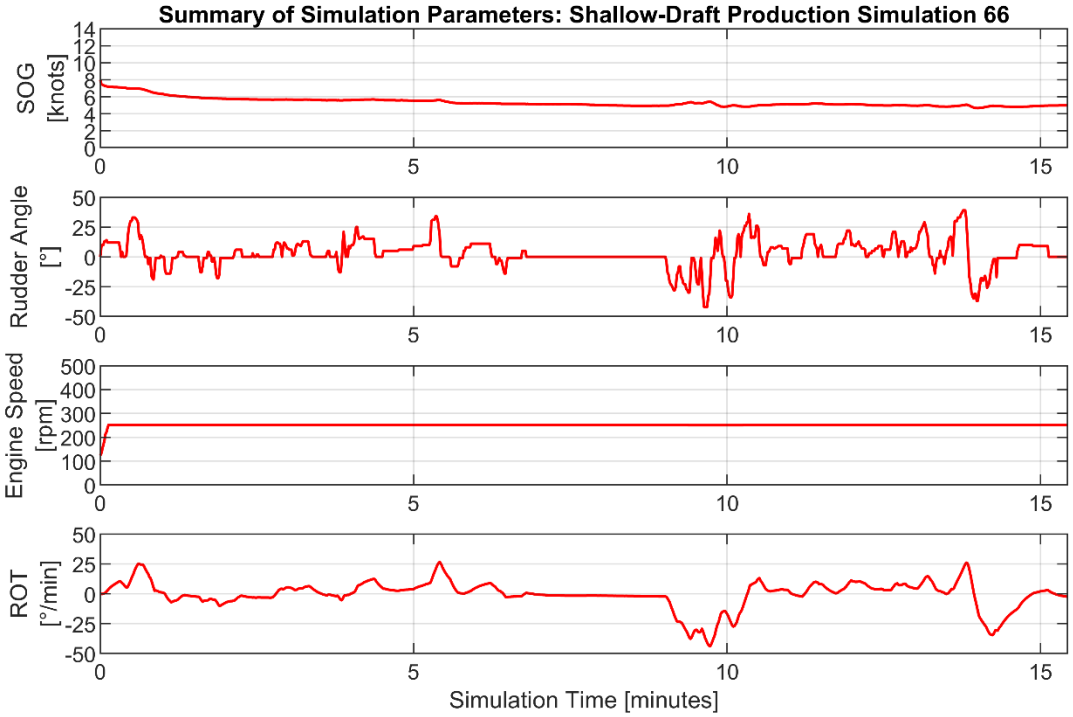

Shallow Draft Production Simulation #64 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

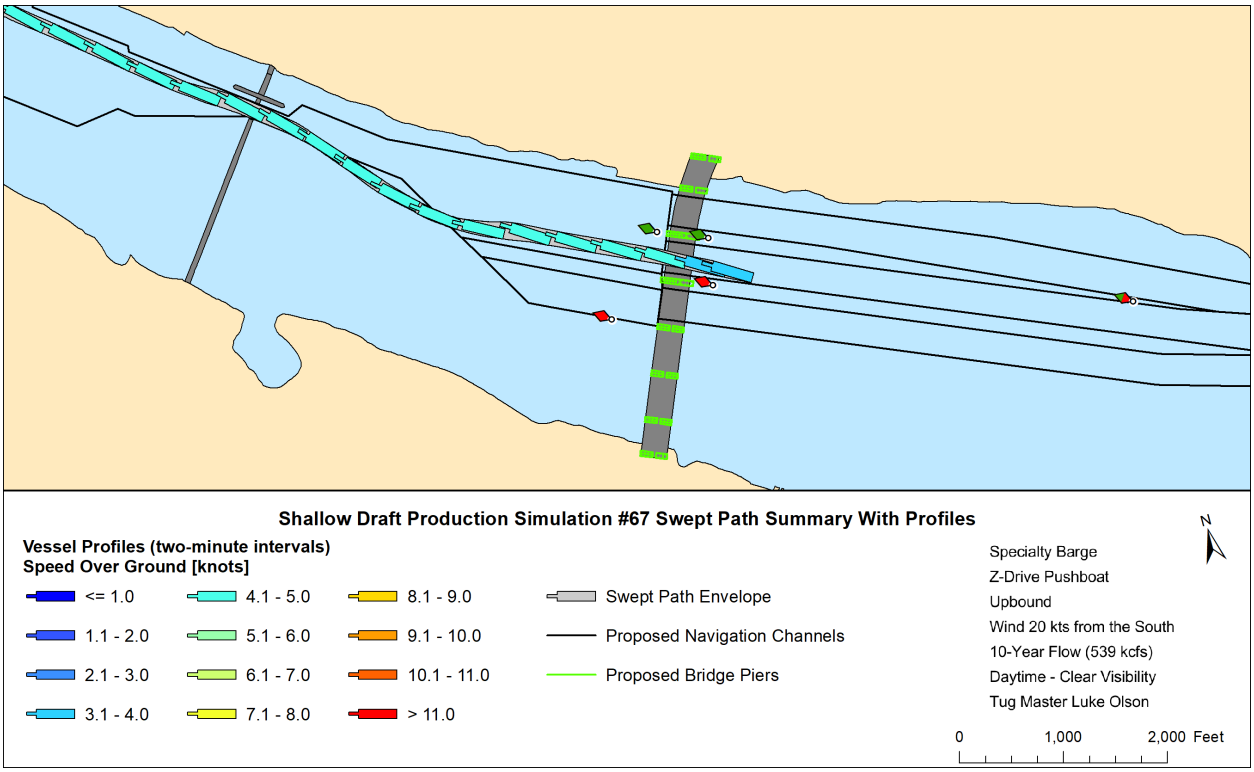

Summary of Simulation Parameters: Shallow-Draft Production Simulation 64
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

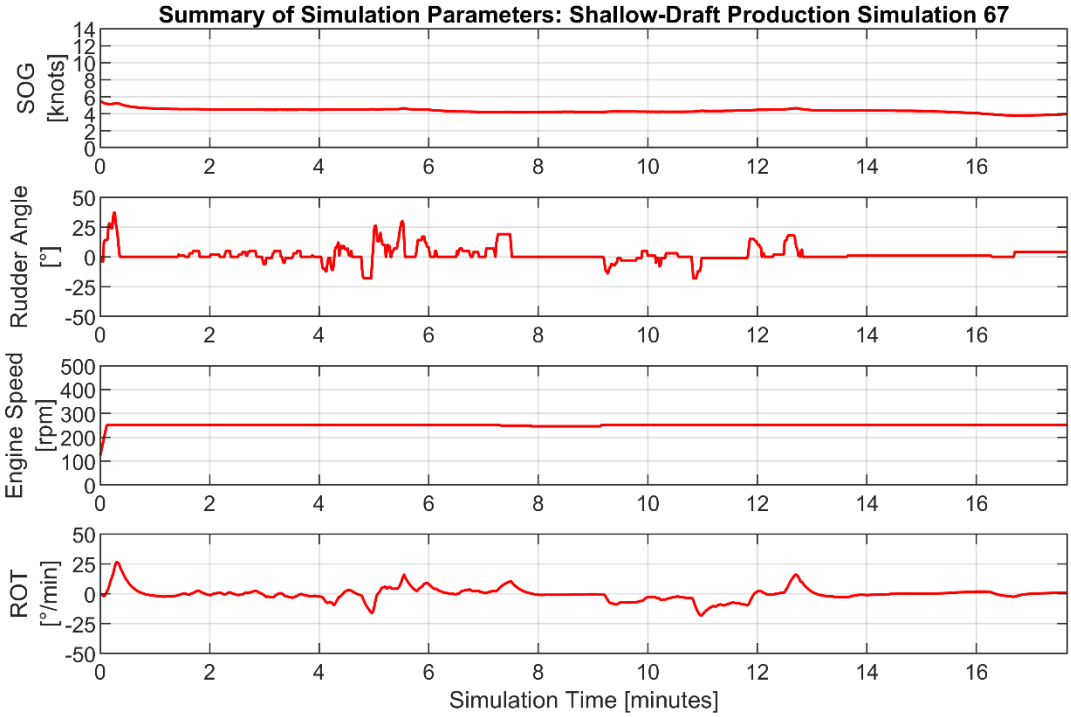

Shallow Draft Production Simulation #65 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Nighttime - Clear Visibility
Tug Master Luke Olson
0
1,000
2,000 Feet

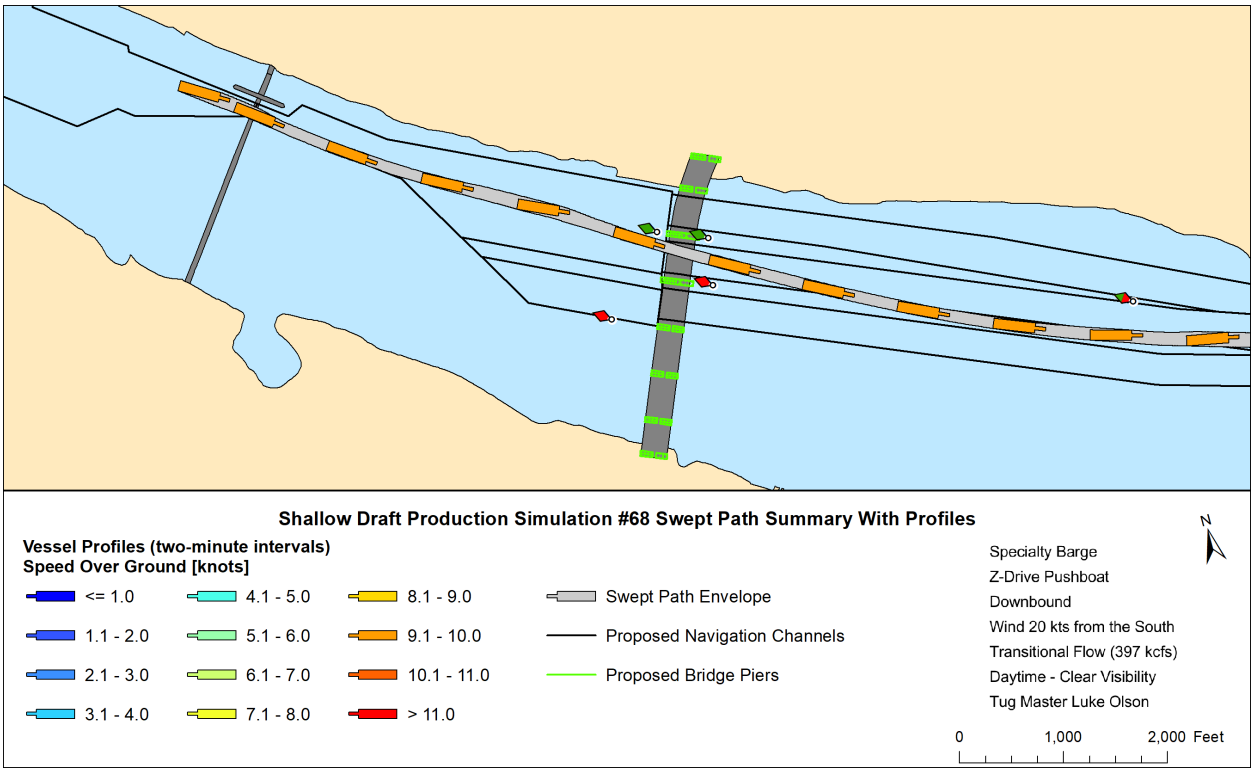

Summary of Simulation Parameters: Shallow-Draft Production Simulation 65
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

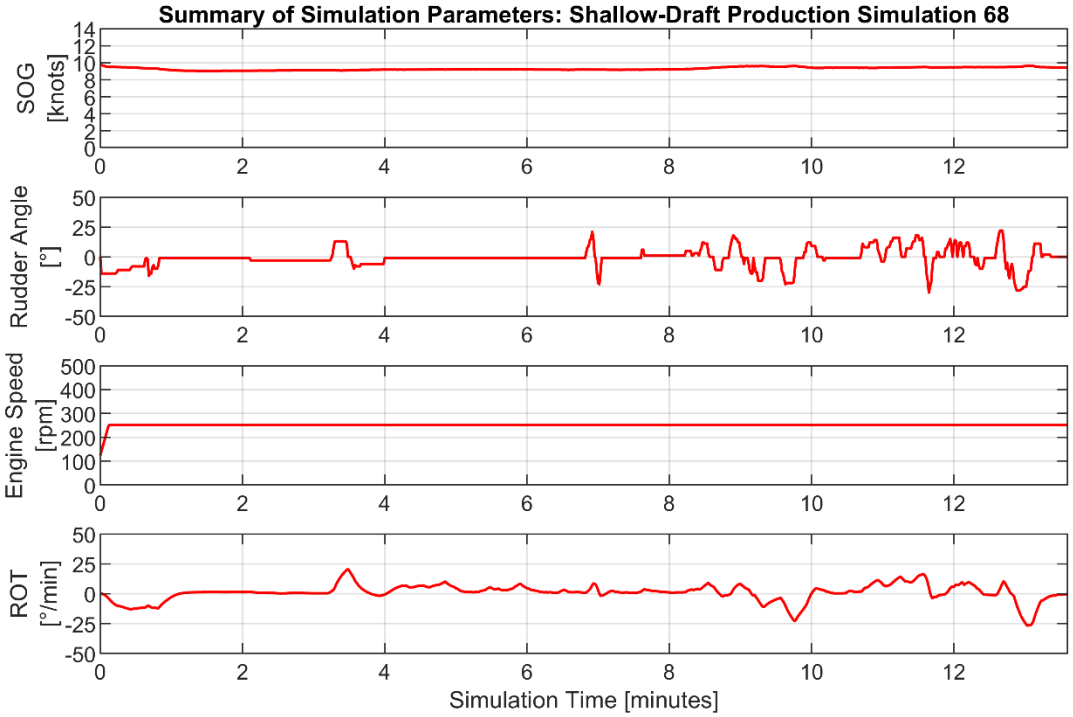

Shallow Draft Production Simulation #66 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Nighttime - Clear Visibility
Tug Master Luke Olson
0
1,000
2,000 Feet

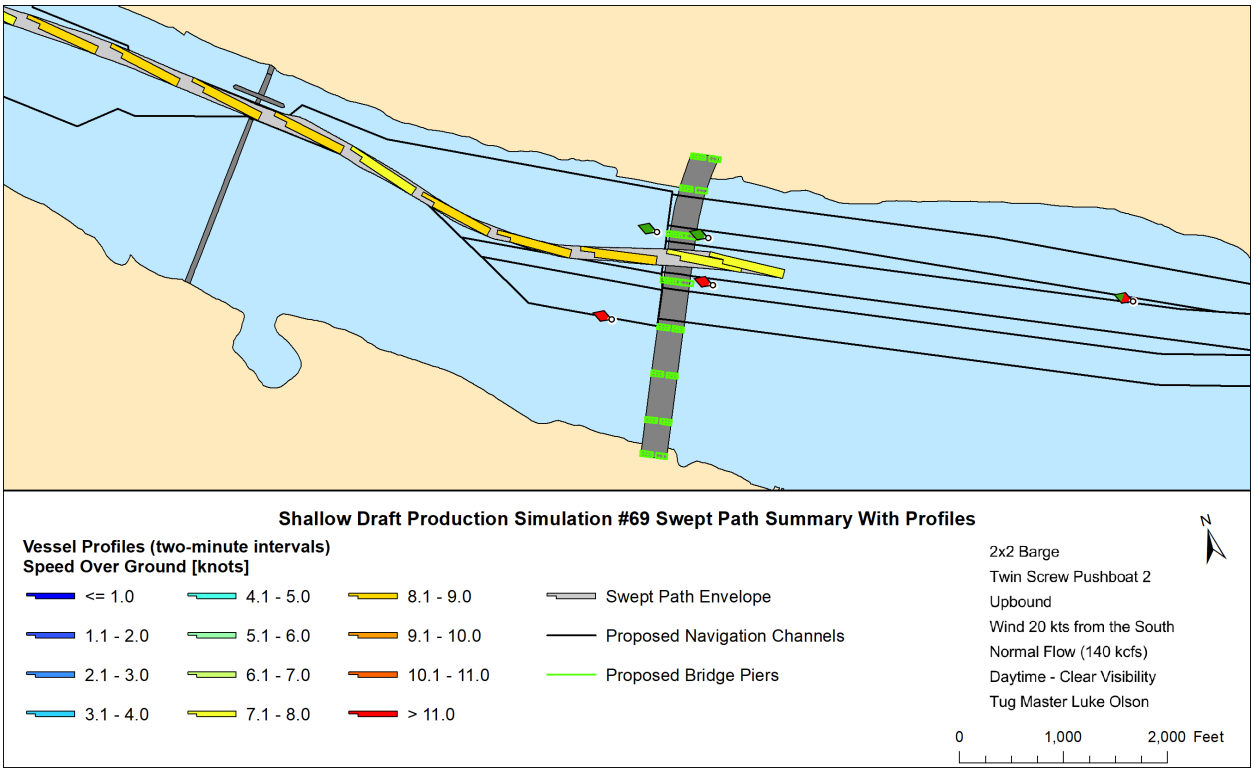

Summary of Simulation Parameters: Shallow-Draft Production Simulation 66
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

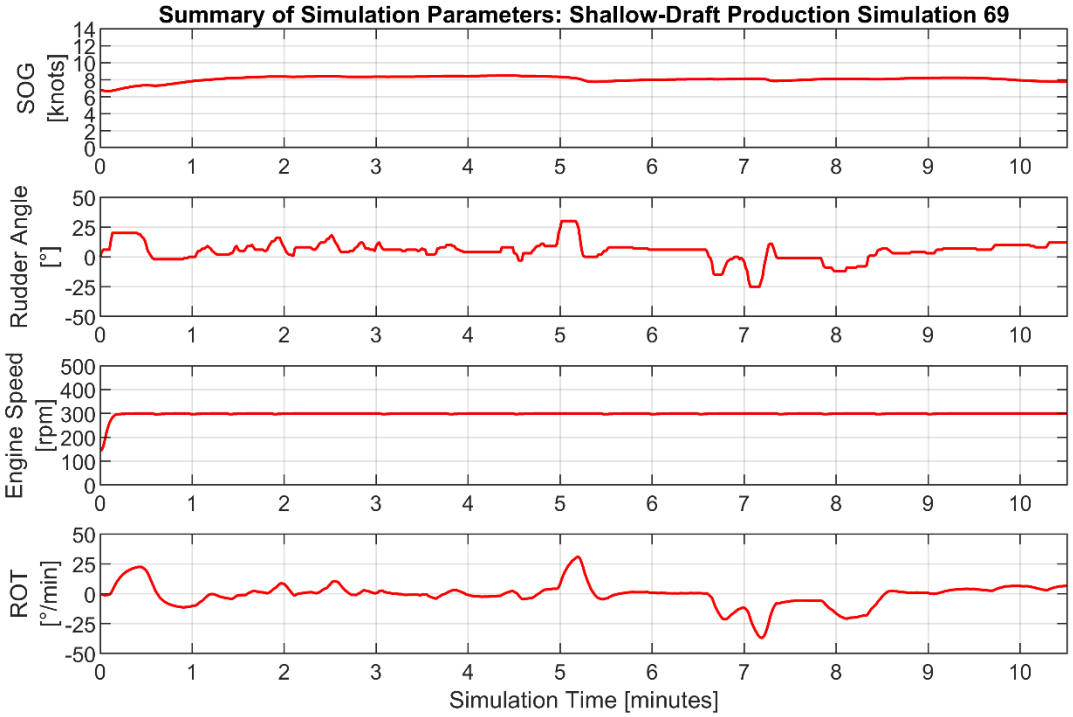

Shallow Draft Production Simulation #67 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Upbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

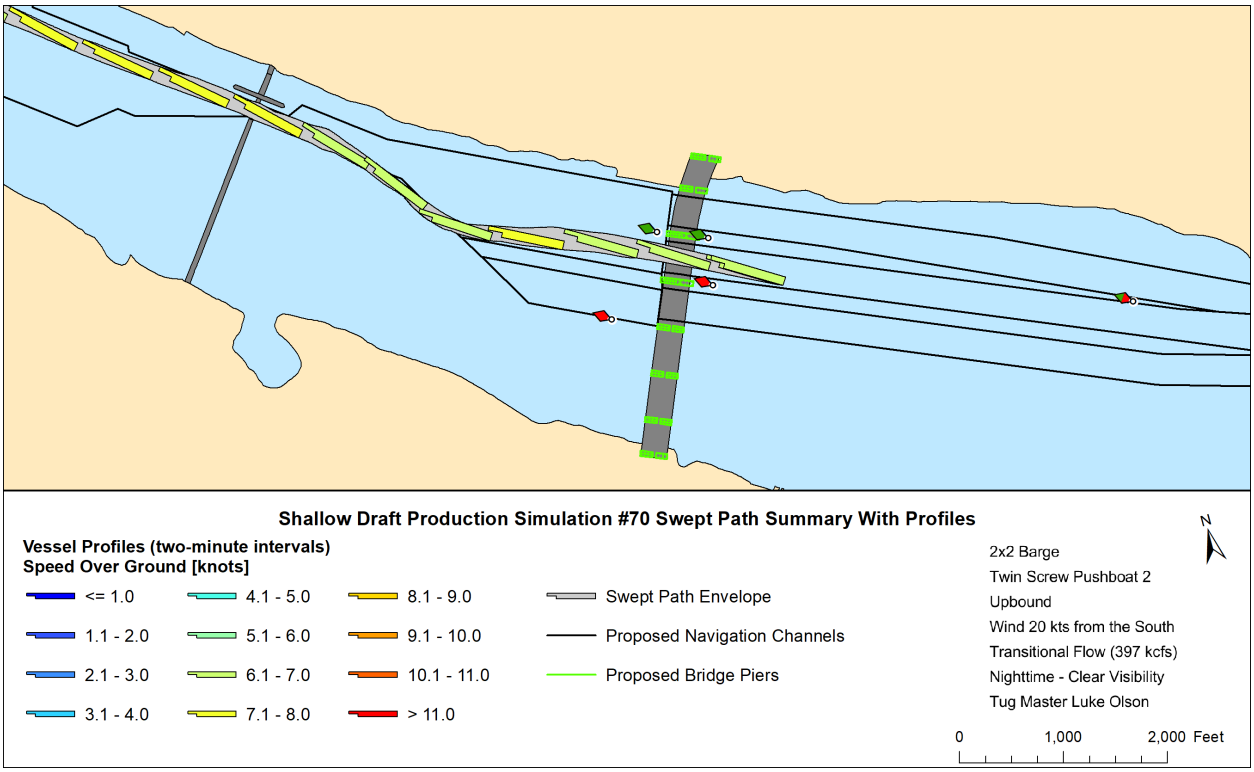

Summary of Simulation Parameters: Shallow-Draft Production Simulation 67
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

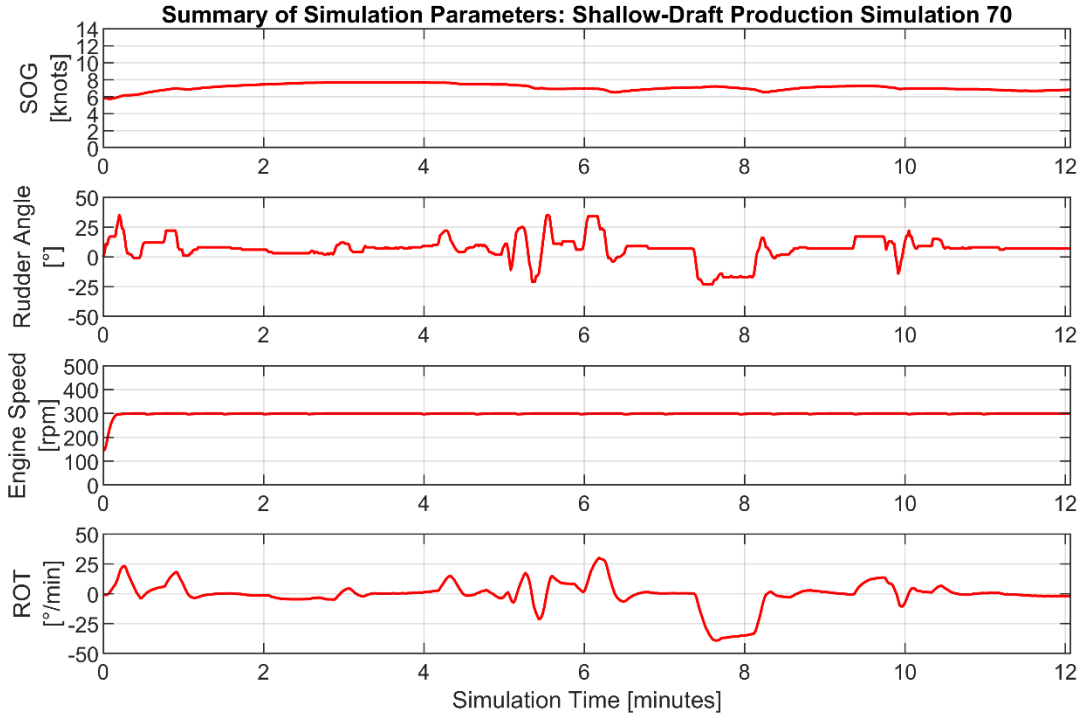

Shallow Draft Production Simulation #68 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

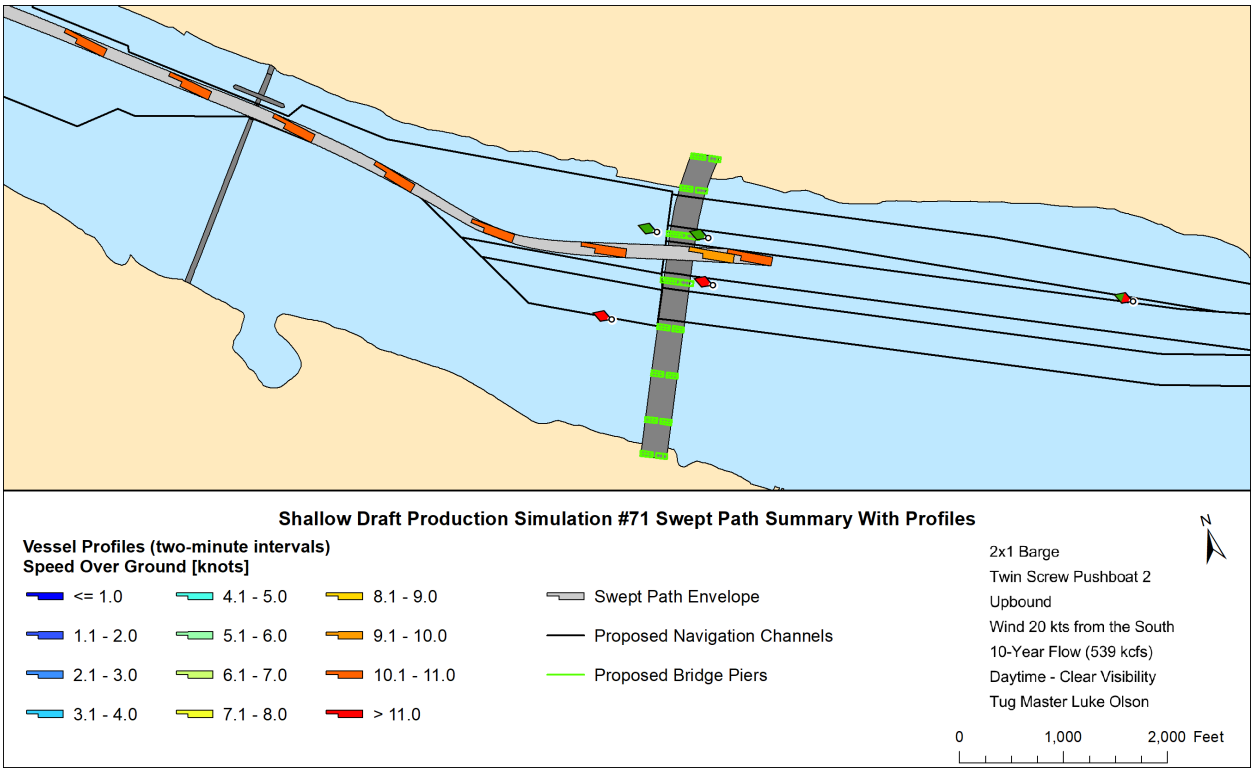

Summary of Simulation Parameters: Shallow-Draft Production Simulation 68
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

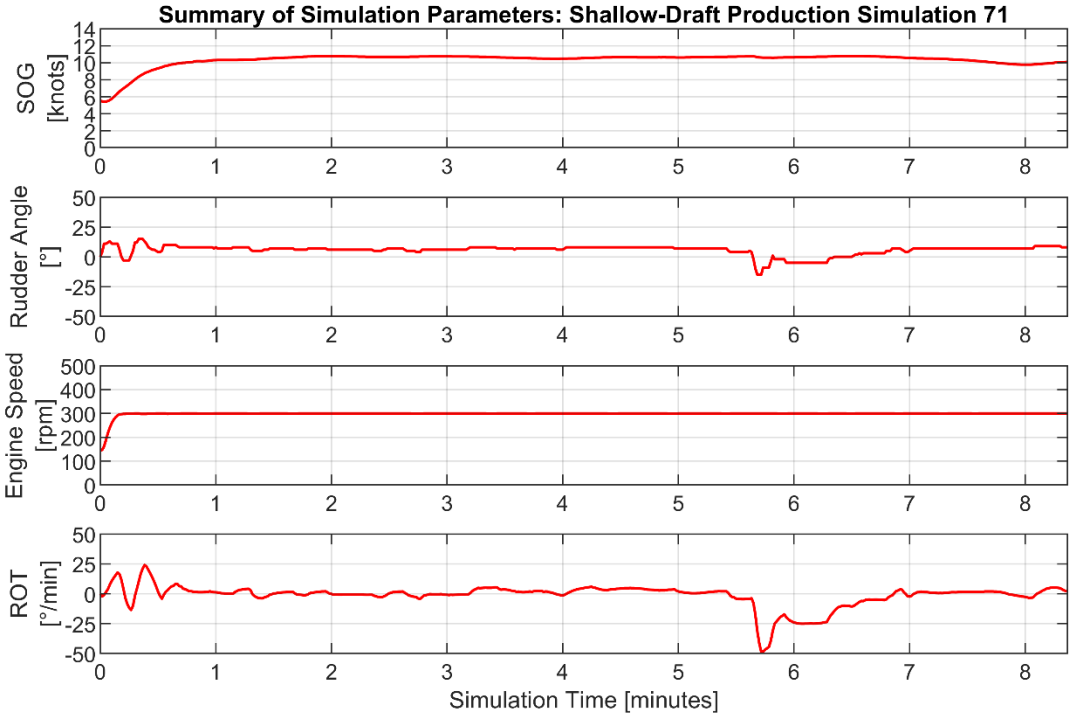

Shallow Draft Production Simulation #69 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

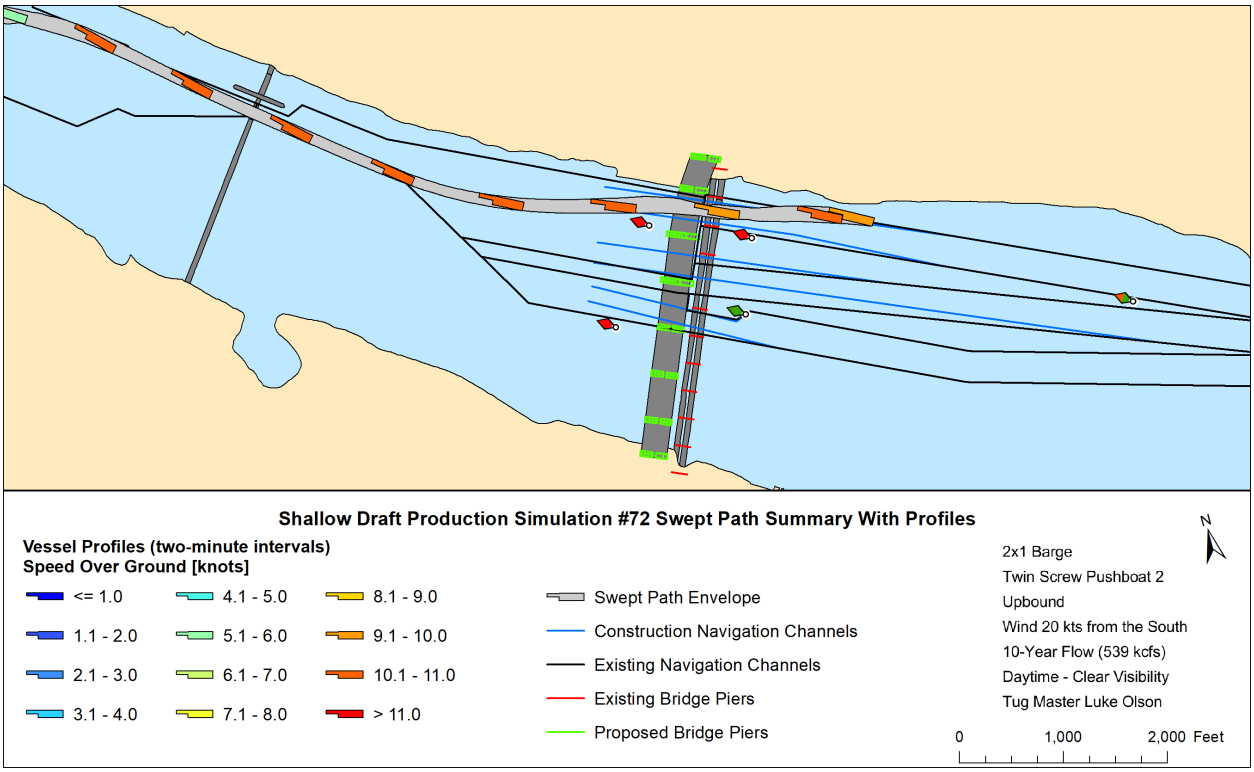

Summary of Simulation Parameters: Shallow-Draft Production Simulation 69
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

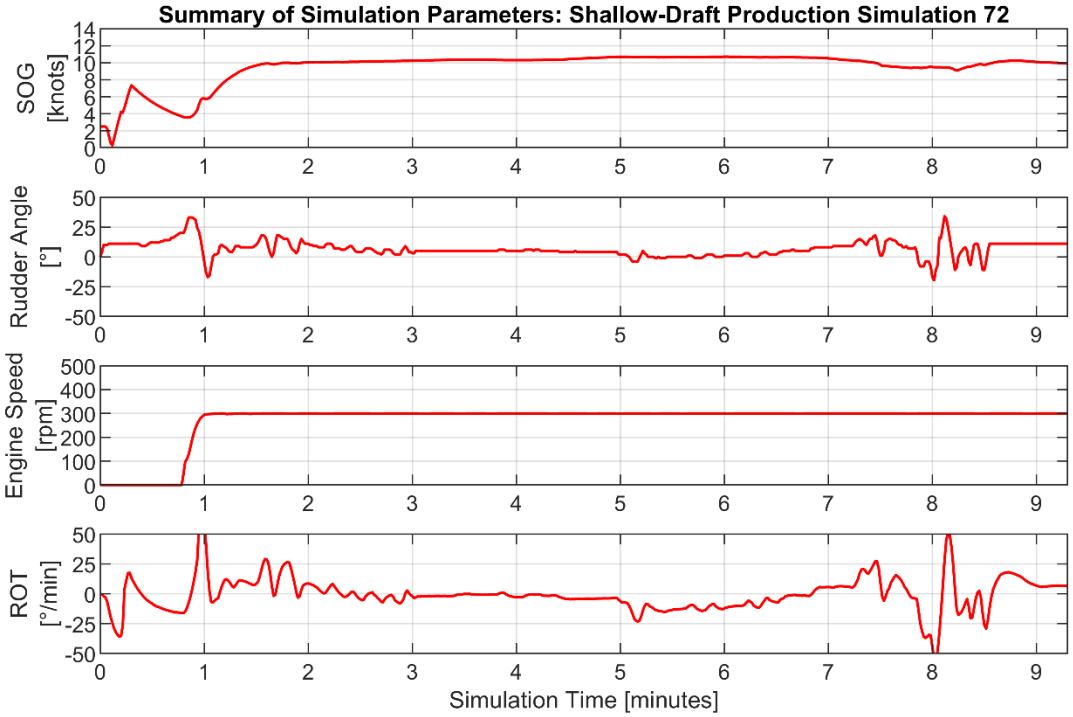

Shallow Draft Production Simulation #70 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Nighttime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

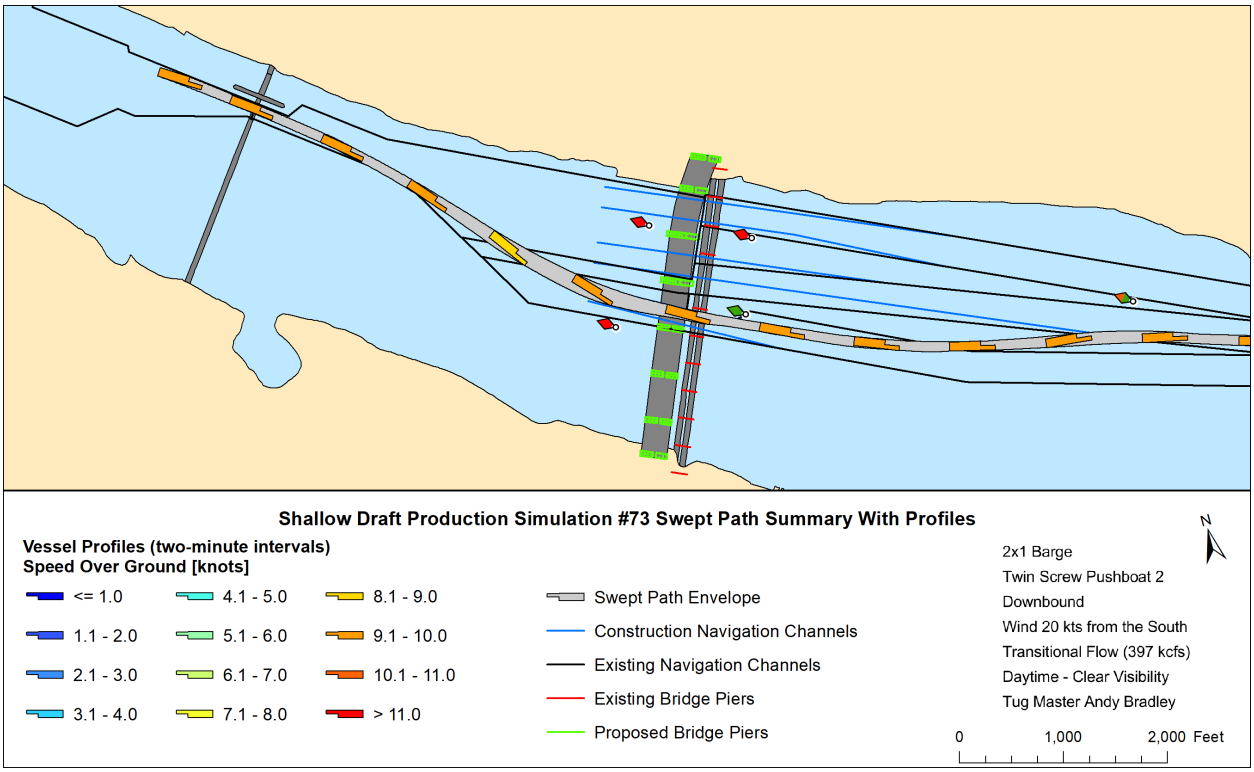

Summary of Simulation Parameters: Shallow-Draft Production Simulation 70
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

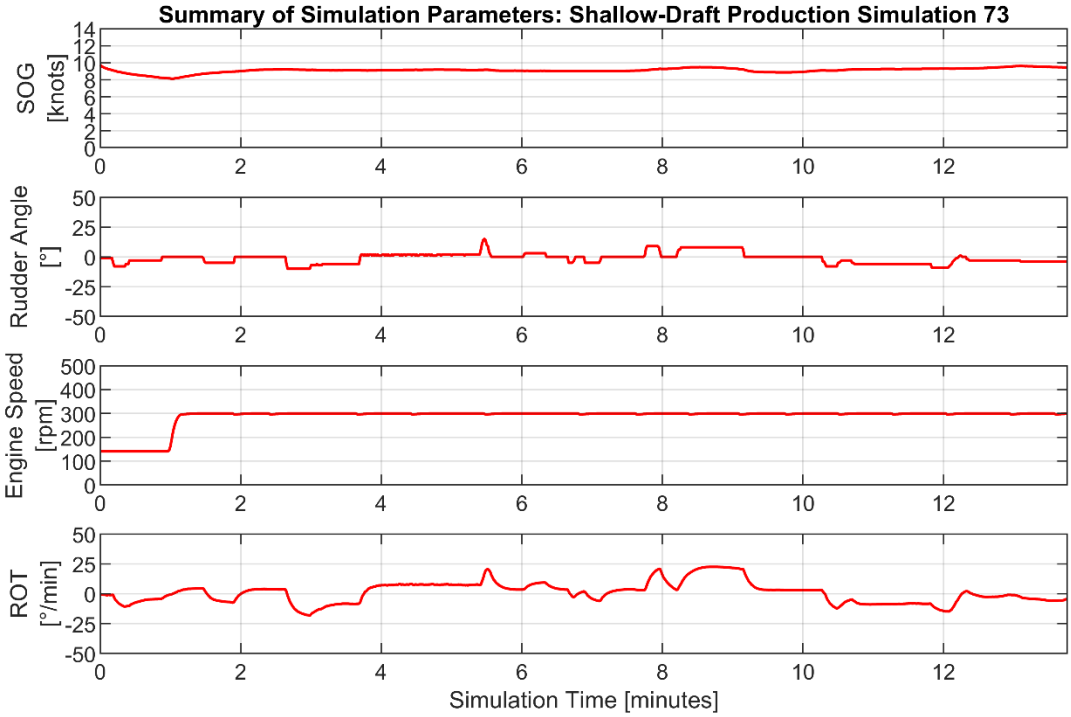

Shallow Draft Production Simulation #71 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

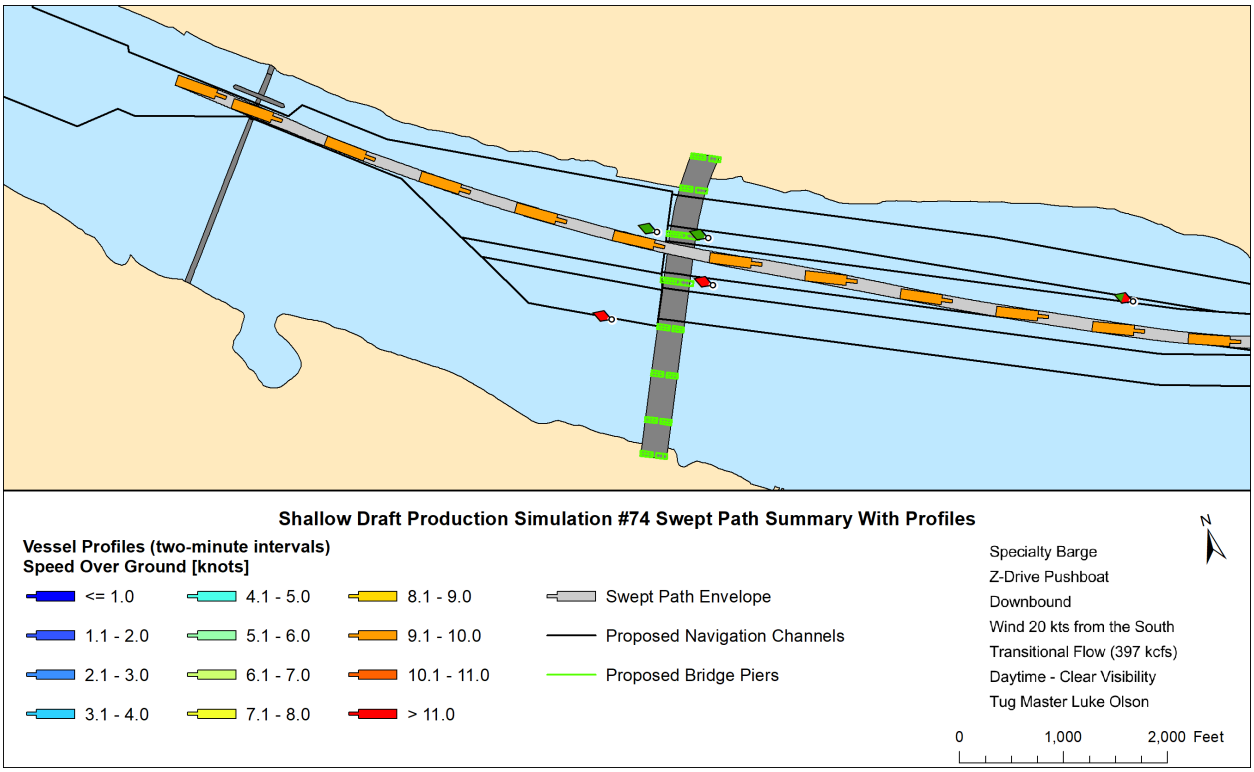

Summary of Simulation Parameters: Shallow-Draft Production Simulation 71
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

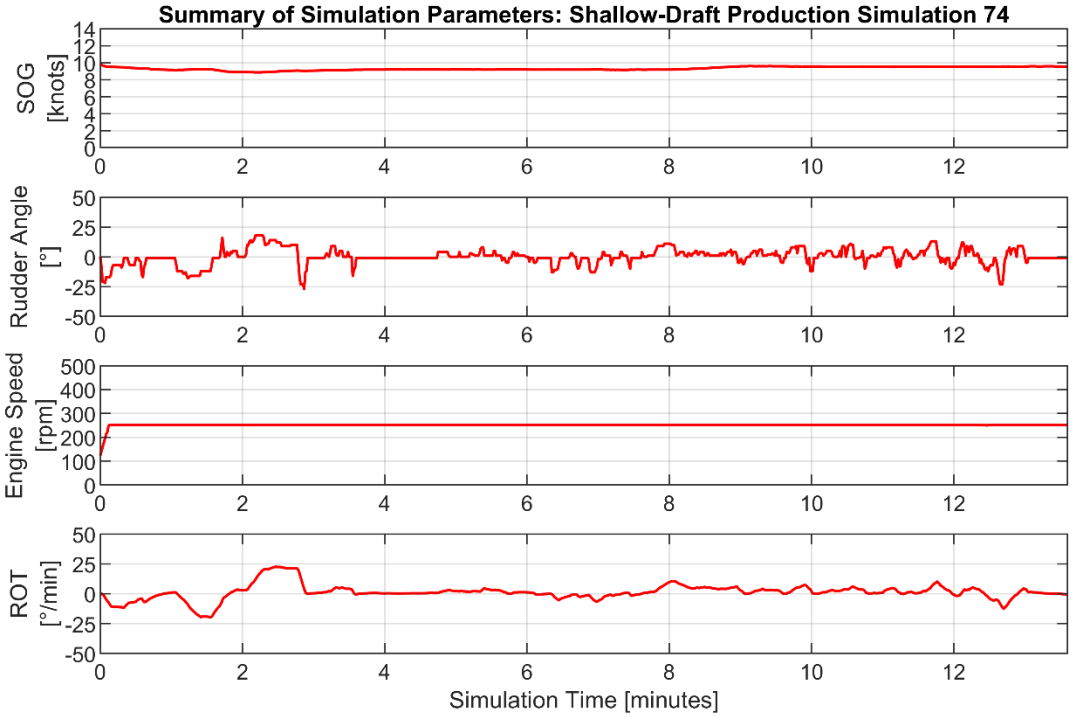

Shallow Draft Production Simulation #72 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x1 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
0
1,000
2,000 Feet

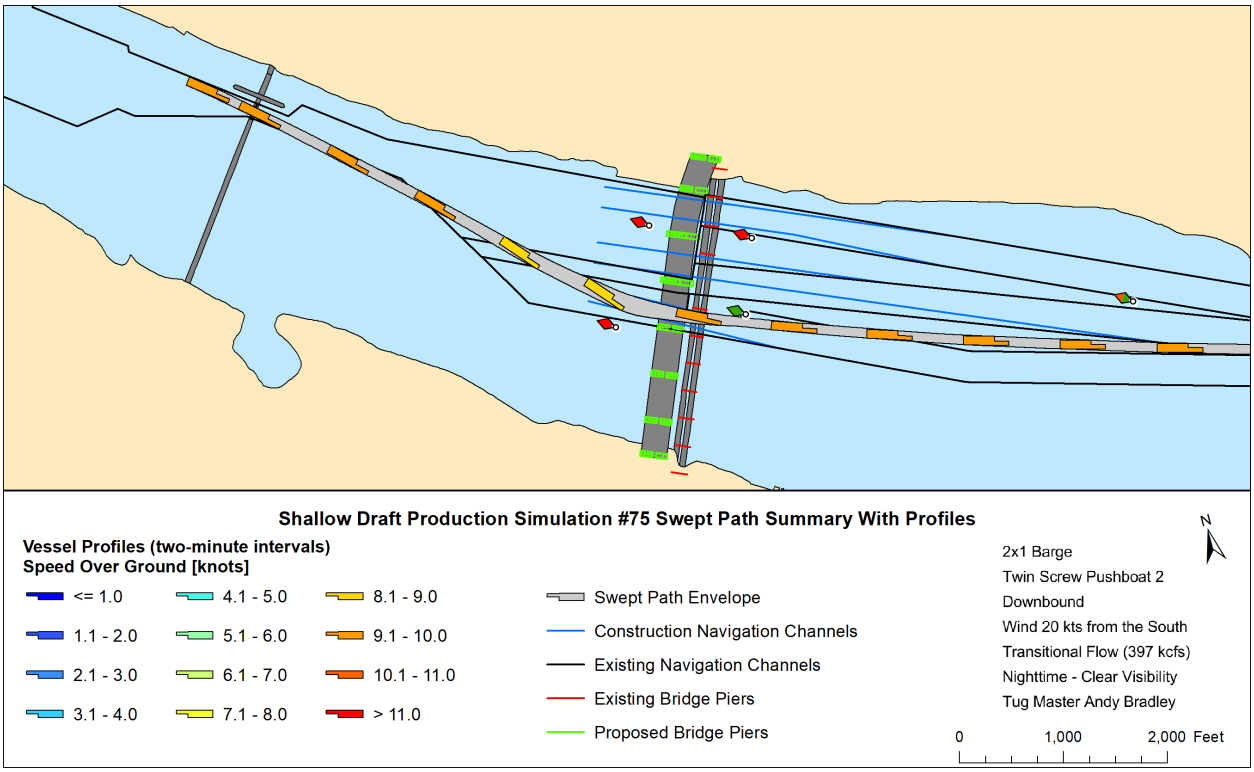

Summary of Simulation Parameters: Shallow-Draft Production Simulation 72
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

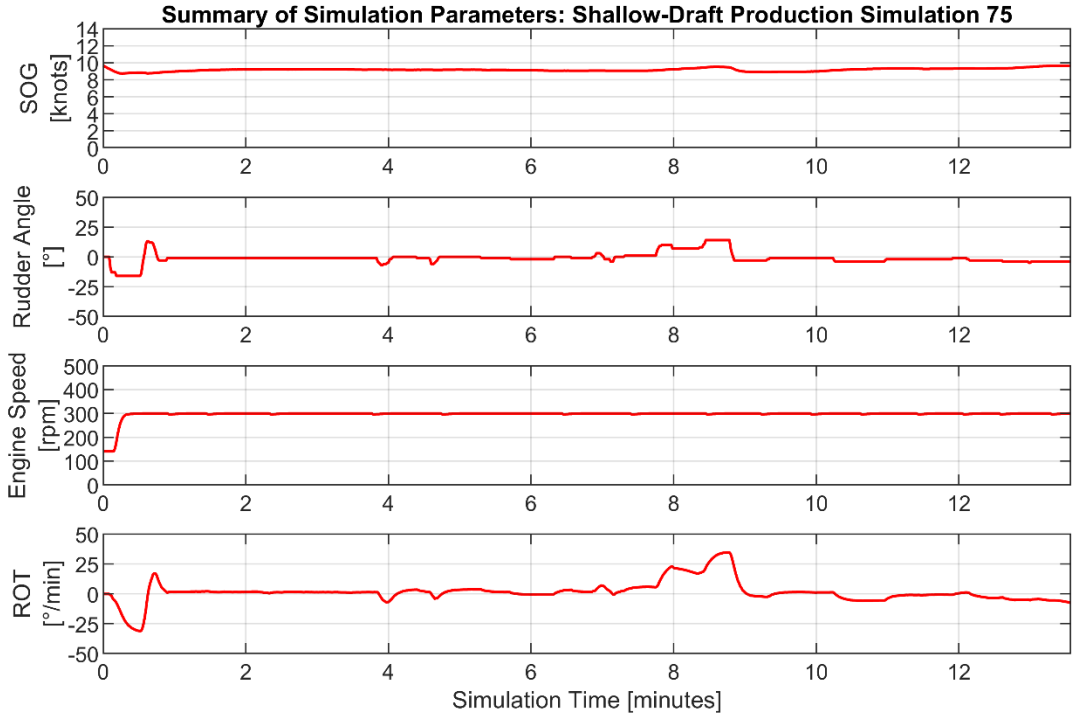

Shallow Draft Production Simulation #73 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

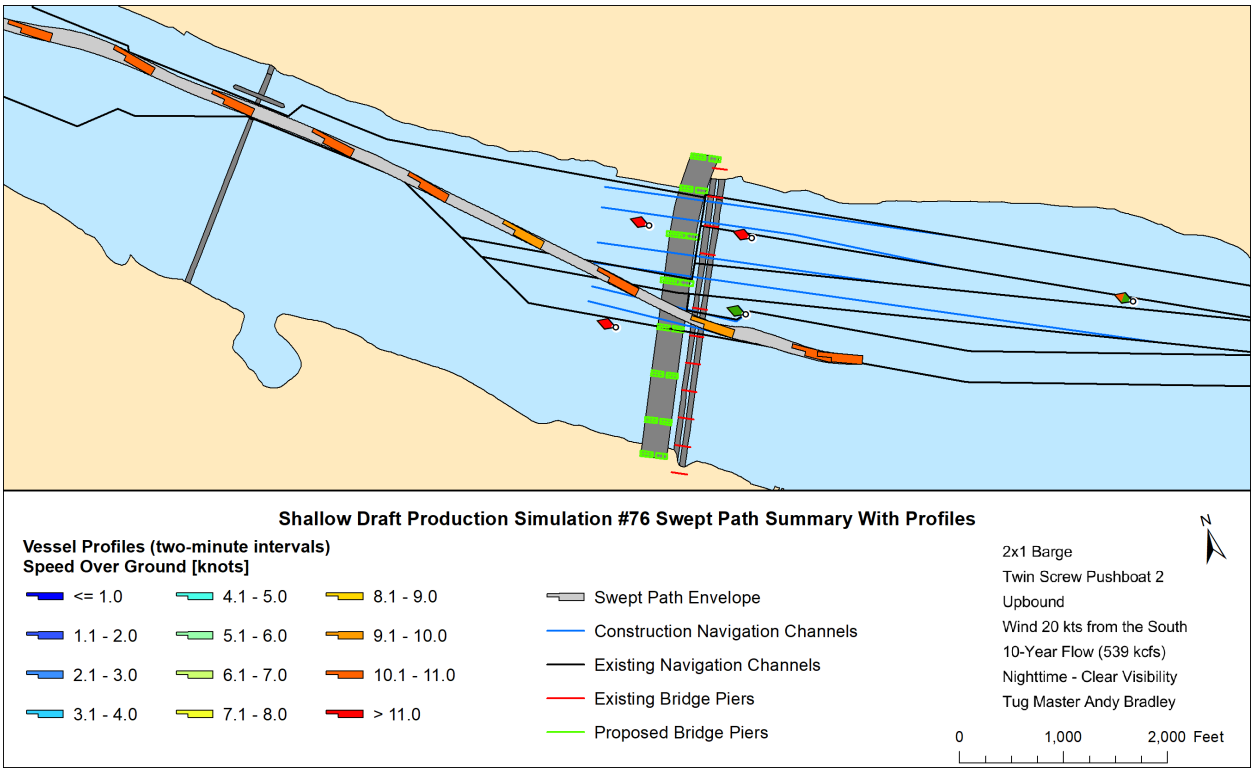

Summary of Simulation Parameters: Shallow-Draft Production Simulation 73
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

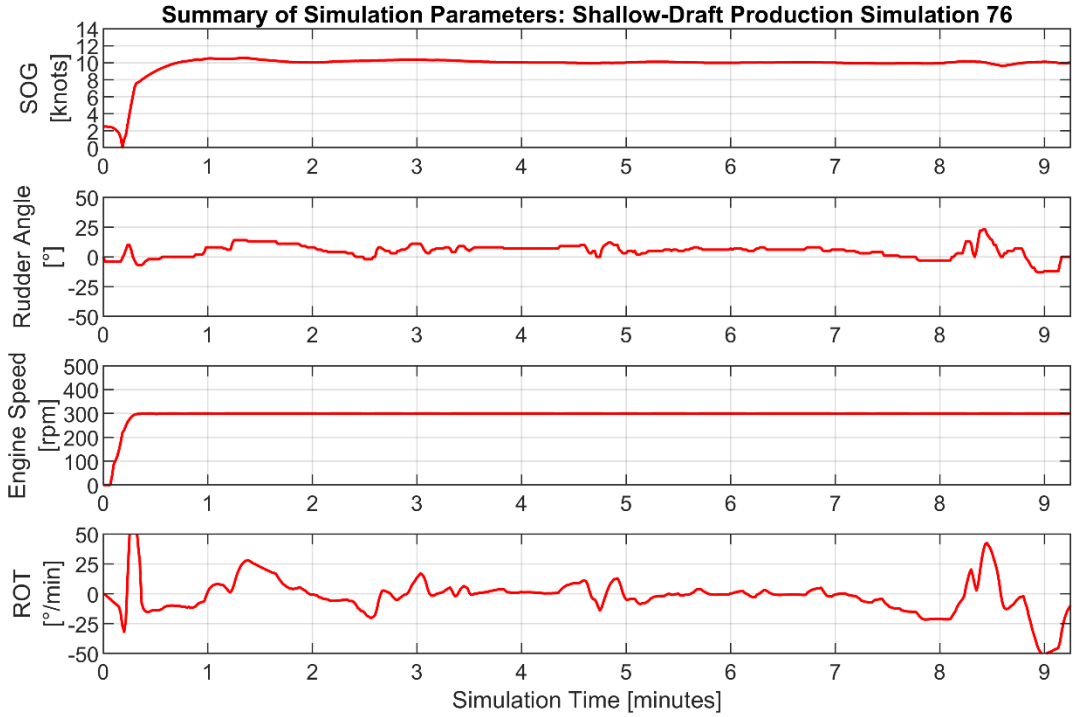

Shallow Draft Production Simulation #74 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Z-Drive Pushboat
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Luke Olson
N
0
1,000
2,000 Feet

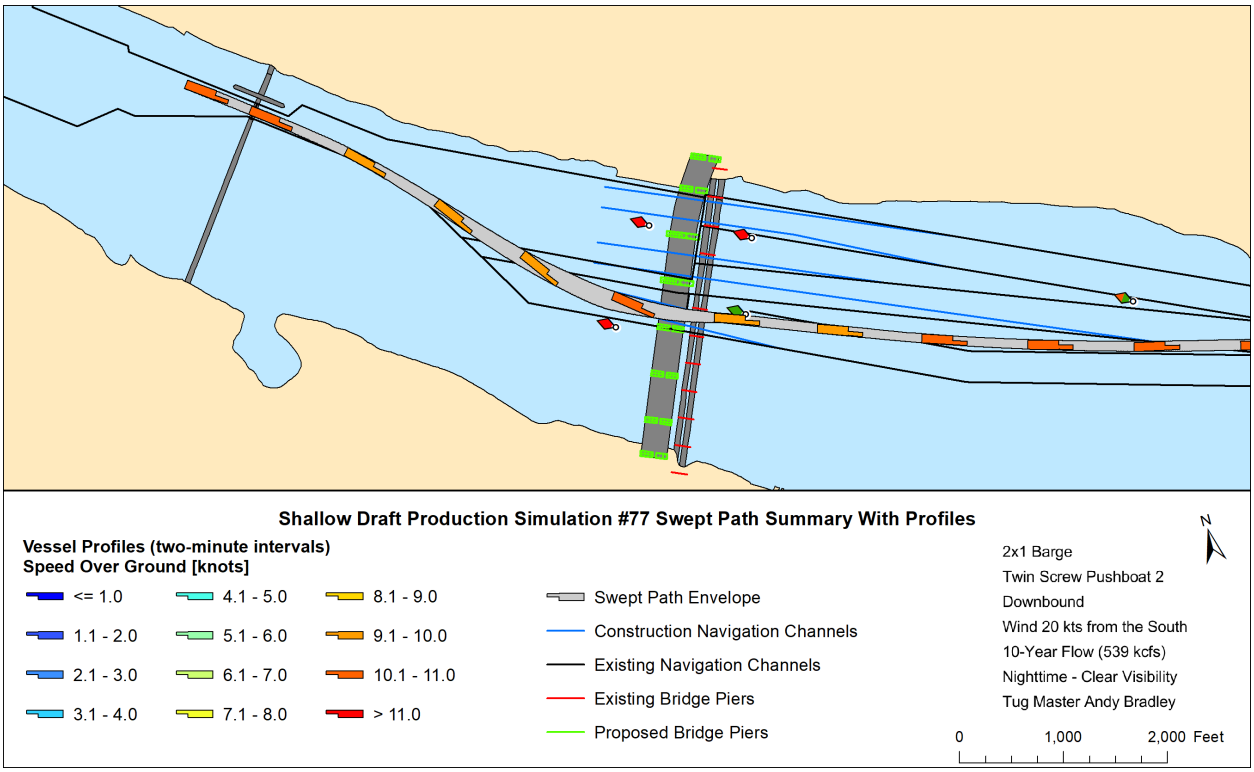

Summary of Simulation Parameters: Shallow-Draft Production Simulation 74
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

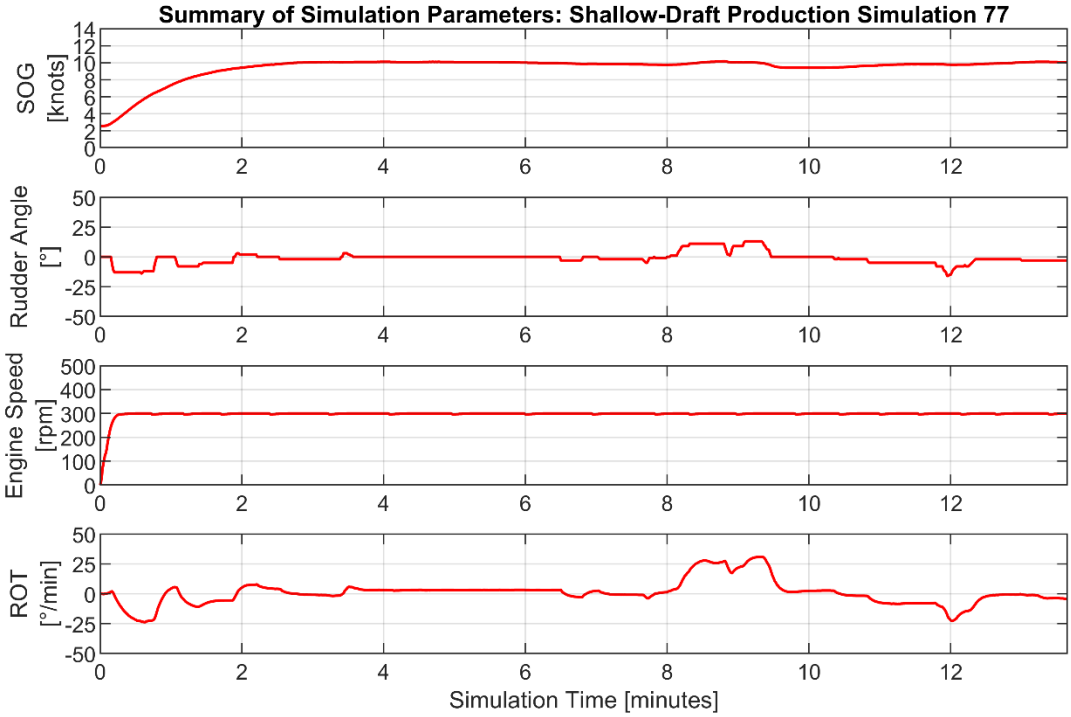

Shallow Draft Production Simulation #75 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Nighttime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

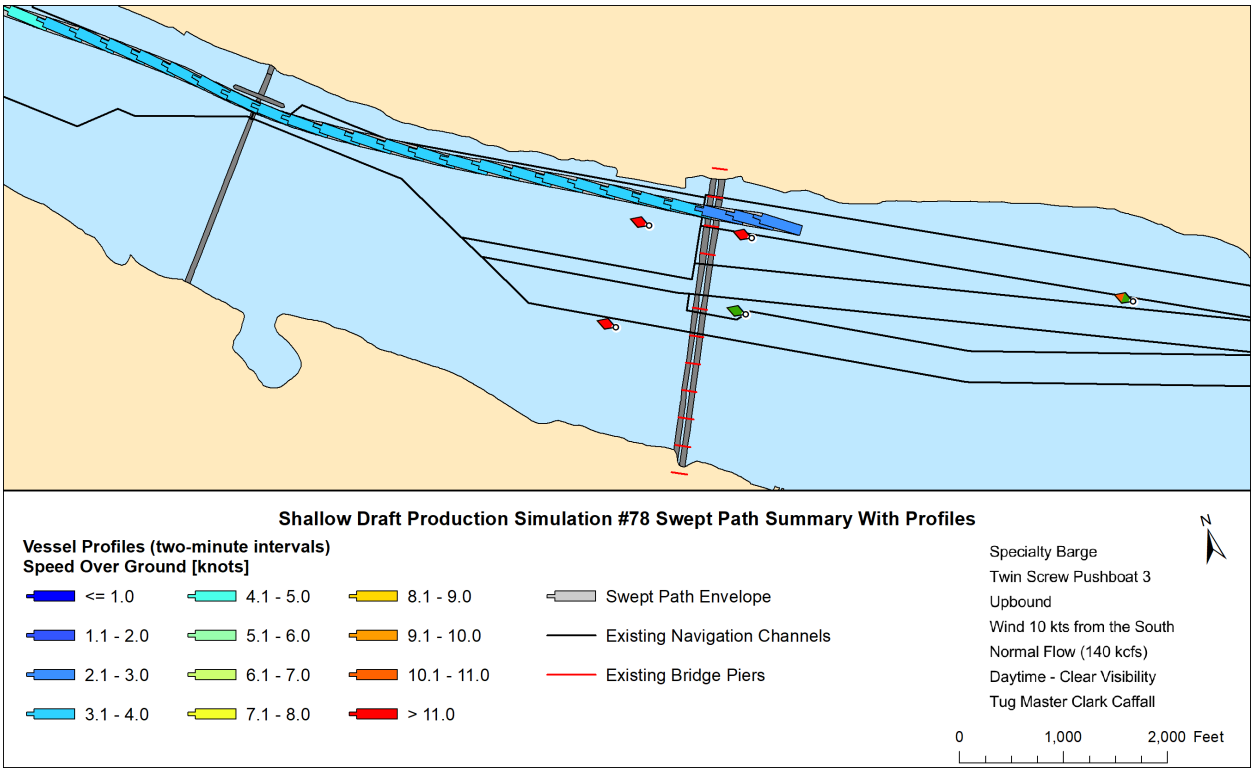

Summary of Simulation Parameters: Shallow-Draft Production Simulation 75
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

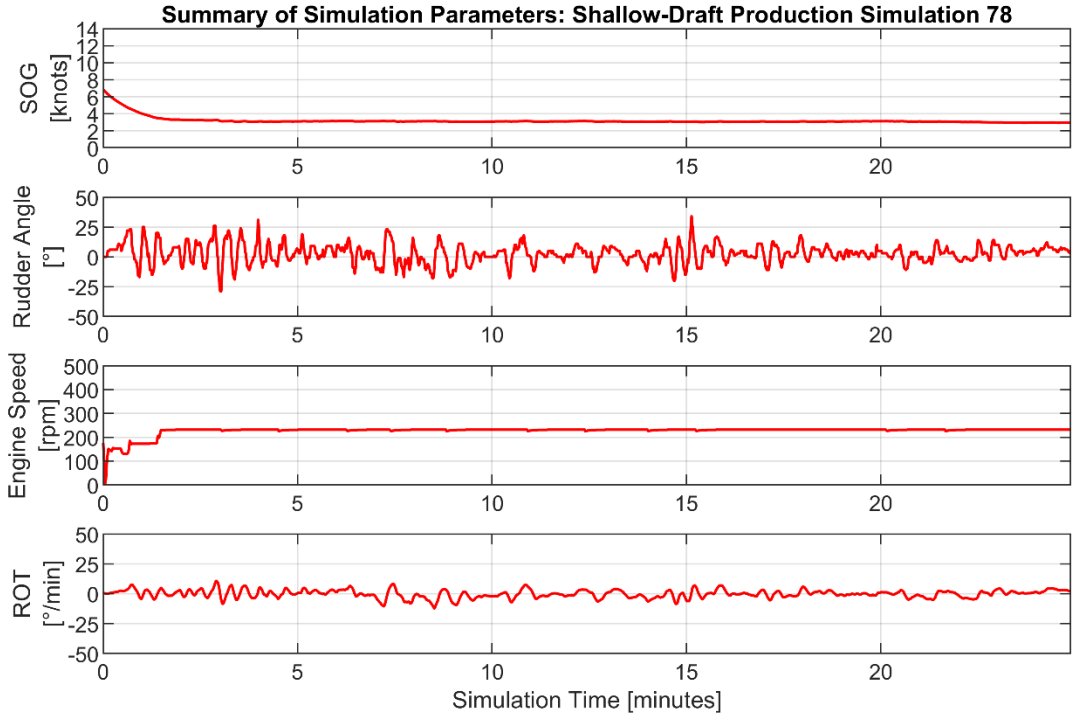

Shallow Draft Production Simulation #76 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x1 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Nighttime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

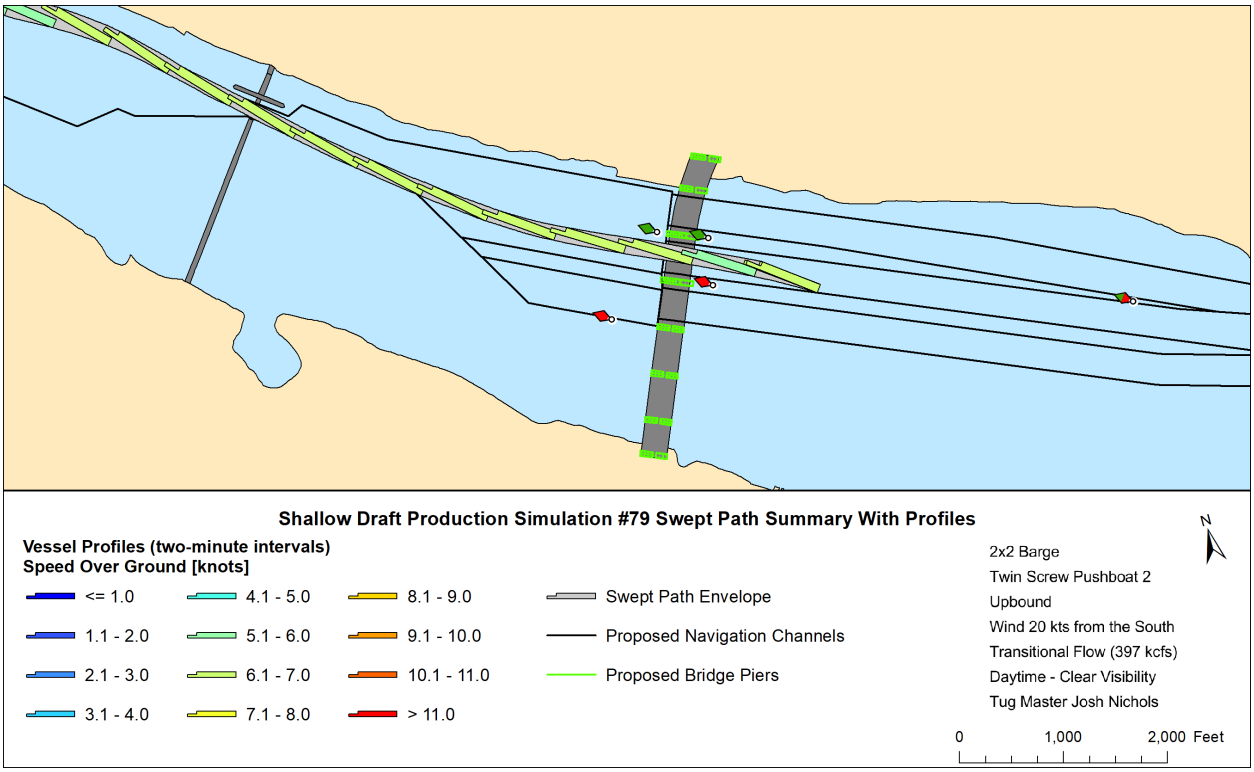

Summary of Simulation Parameters: Shallow-Draft Production Simulation 76
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

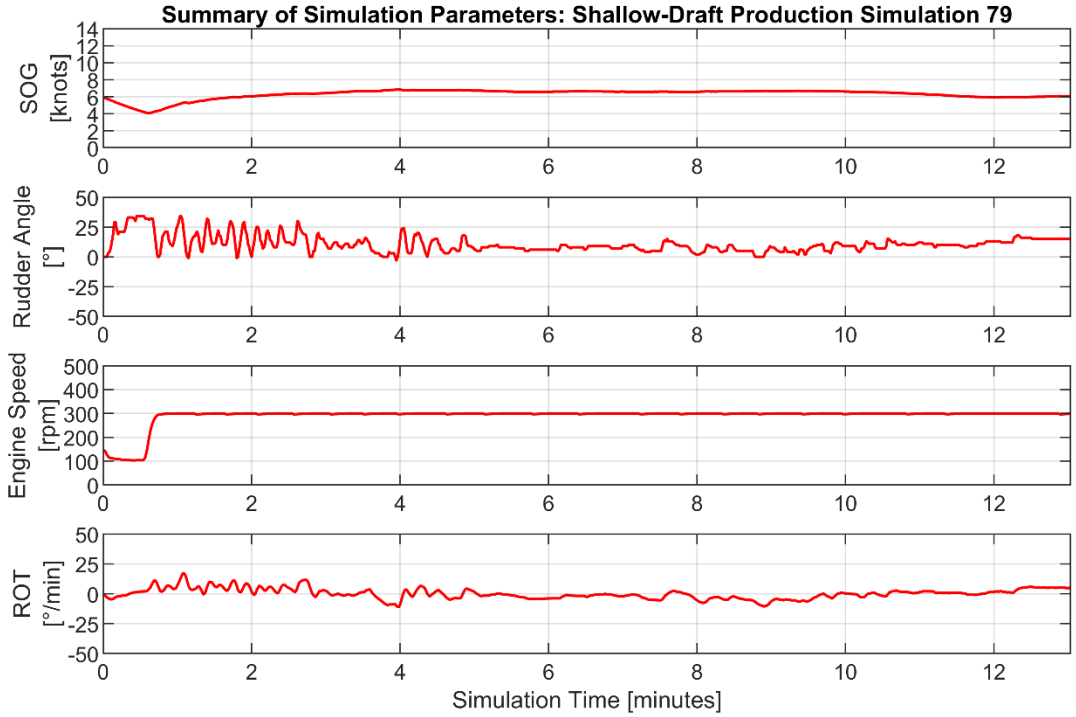

Shallow Draft Production Simulation #77 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Nighttime - Clear Visibility
Tug Master Andy Bradley
0
1,000
2,000 Feet

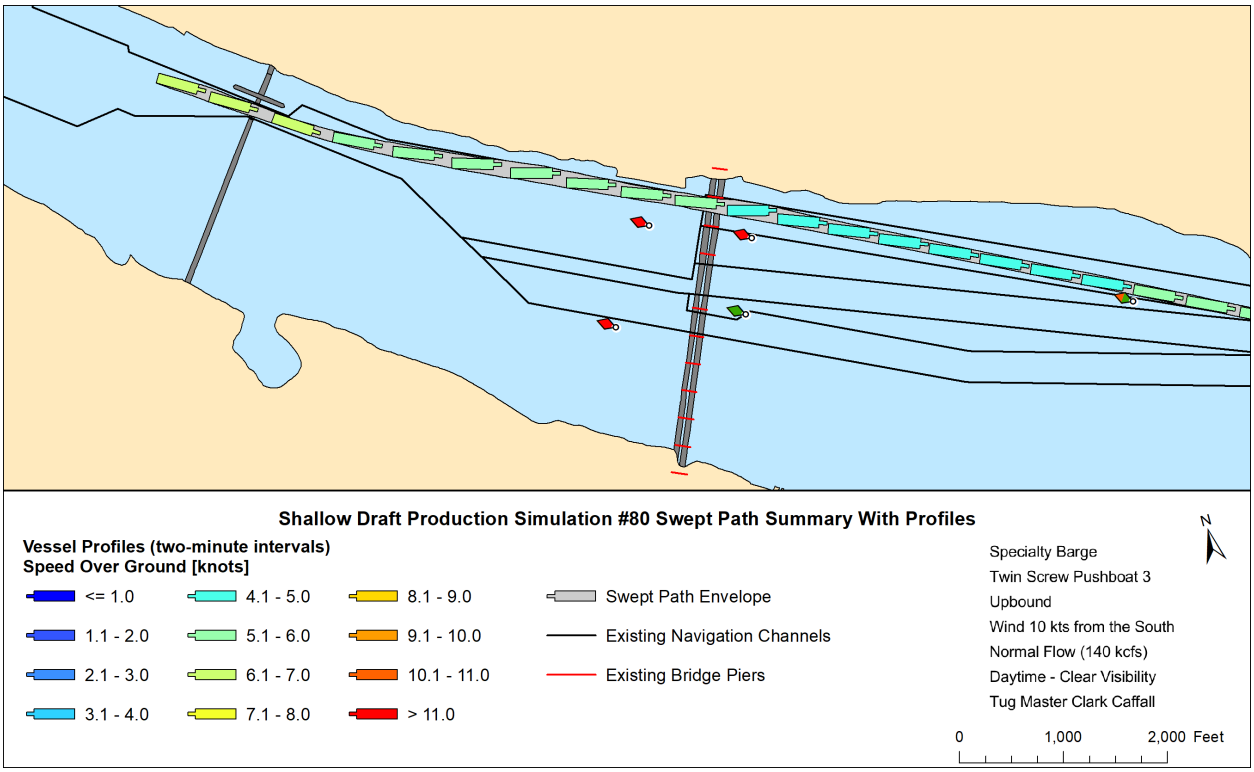

Summary of Simulation Parameters: Shallow-Draft Production Simulation 77
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

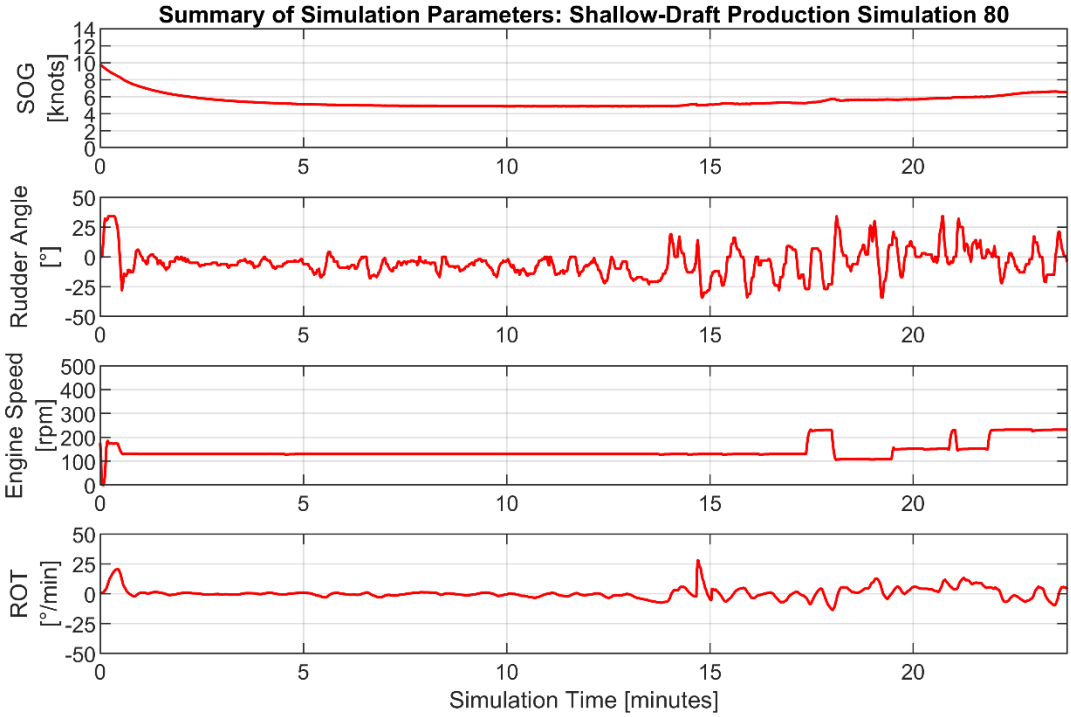

Shallow Draft Production Simulation #78 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
Specialty Barge
Twin Screw Pushboat 3
Upbound
Wind 10 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Clark Caffall
N
0
1,000
2,000 Feet

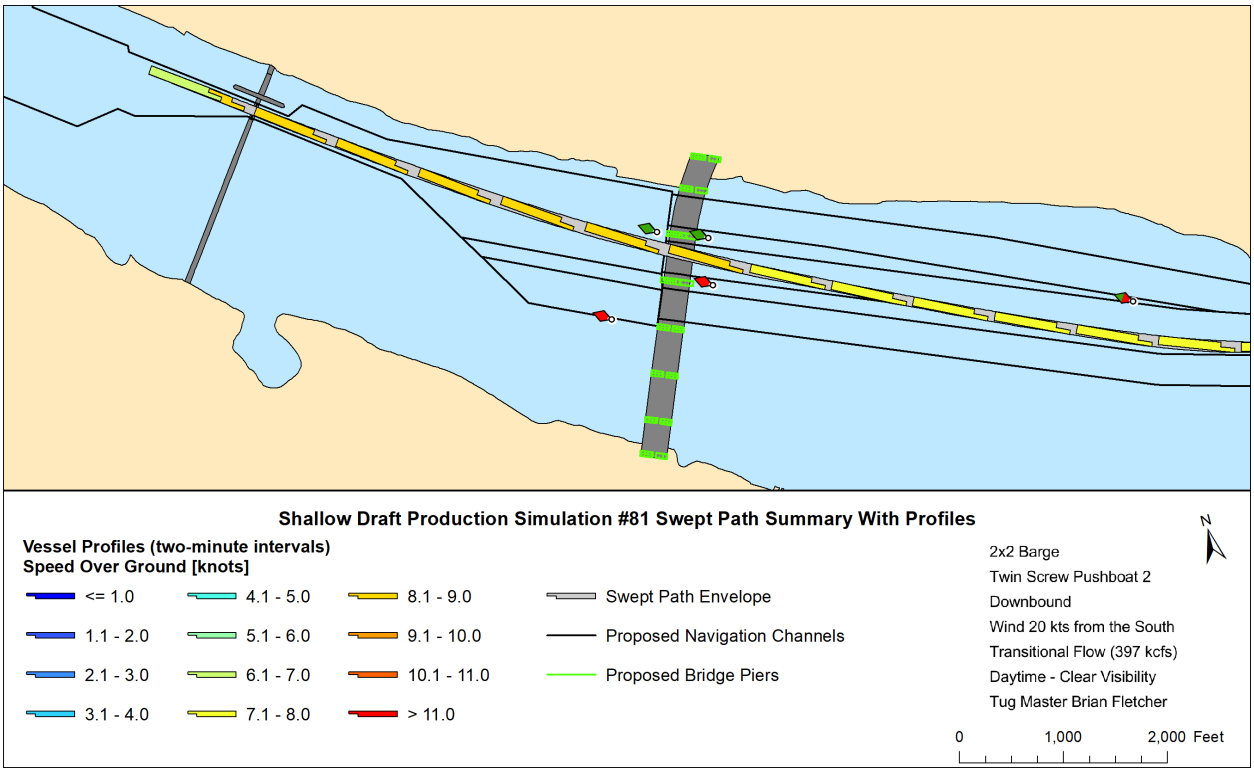

Summary of Simulation Parameters: Shallow-Draft Production Simulation 78
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

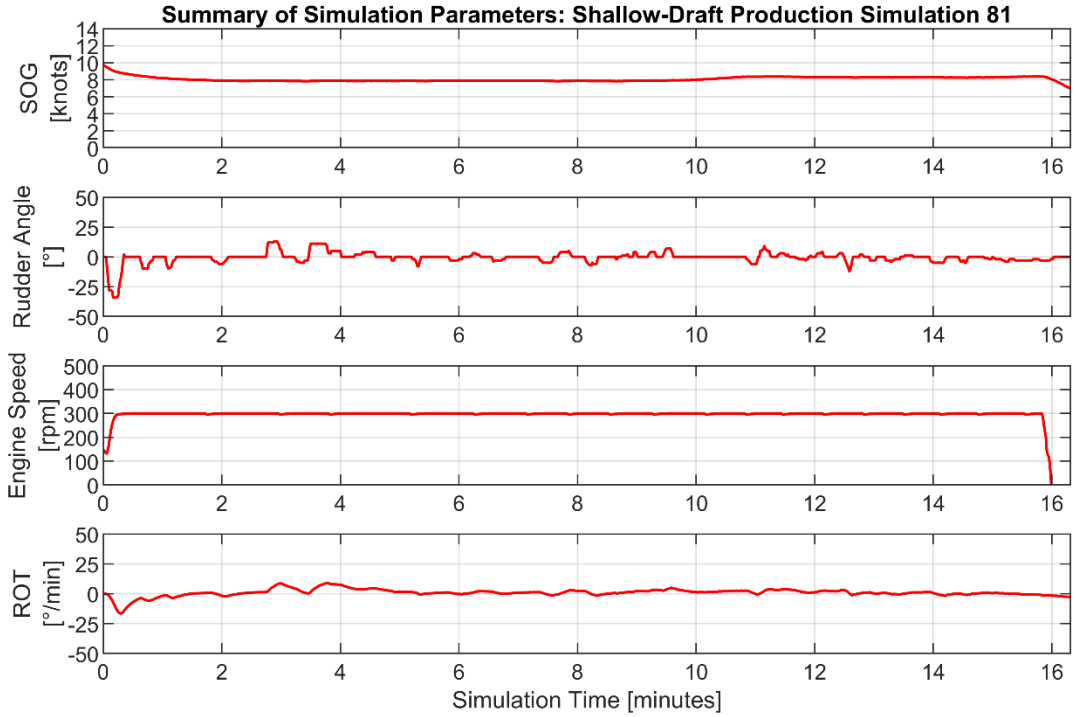

Shallow Draft Production Simulation #79 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Josh Nichols
N
0
1,000
2,000 Feet

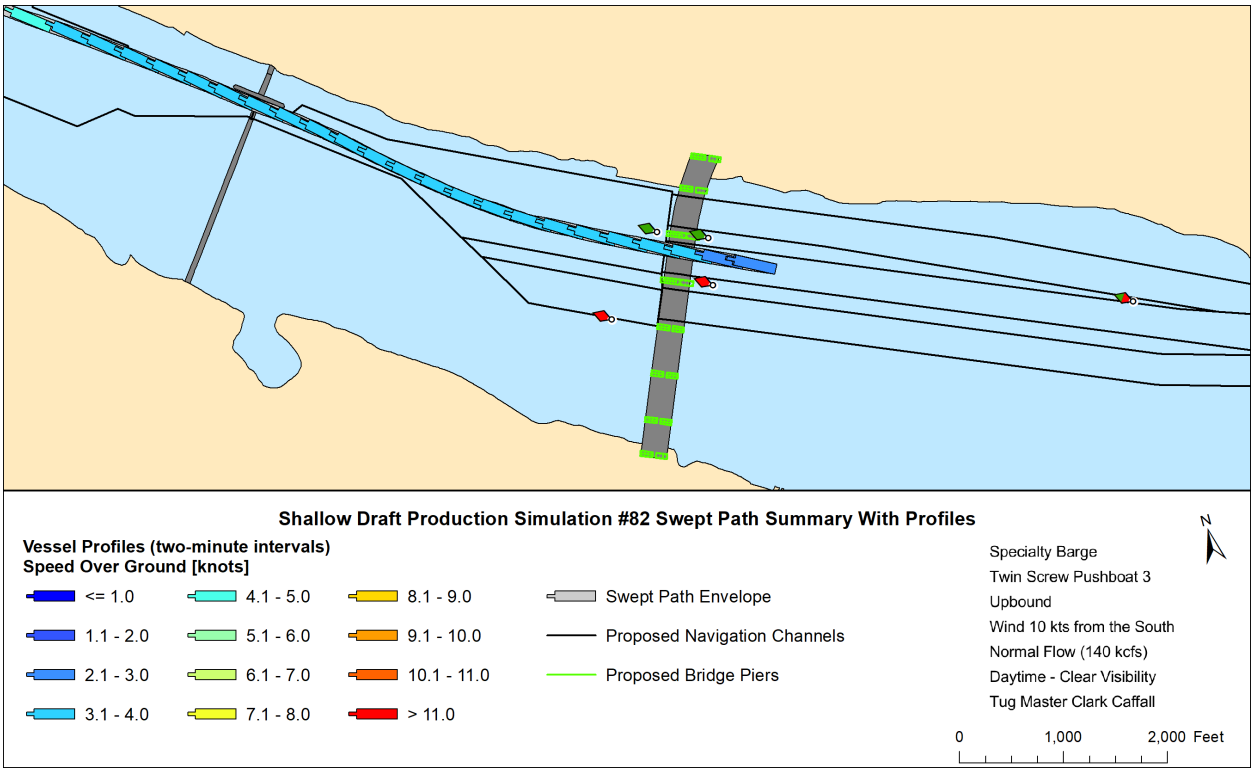

Summary of Simulation Parameters: Shallow-Draft Production Simulation 79
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

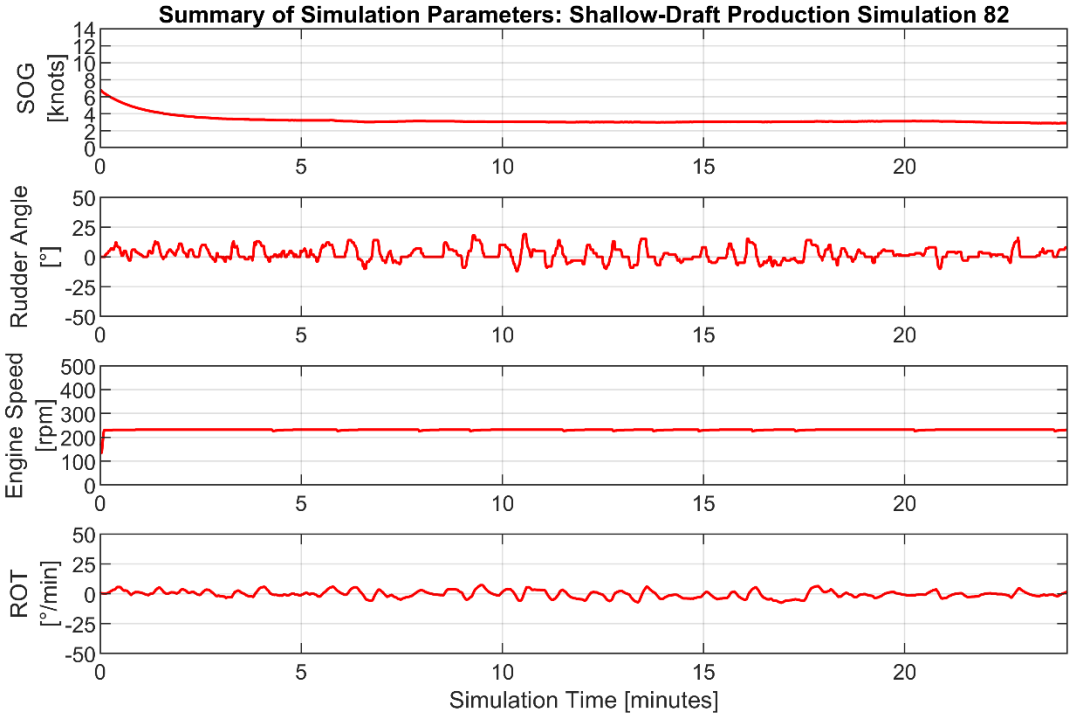

Shallow Draft Production Simulation #80 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Existing Navigation Channels
Existing Bridge Piers
N
Specialty Barge
Twin Screw Pushboat 3
Upbound
Wind 10 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Clark Caffall
0
1,000
2,000 Feet

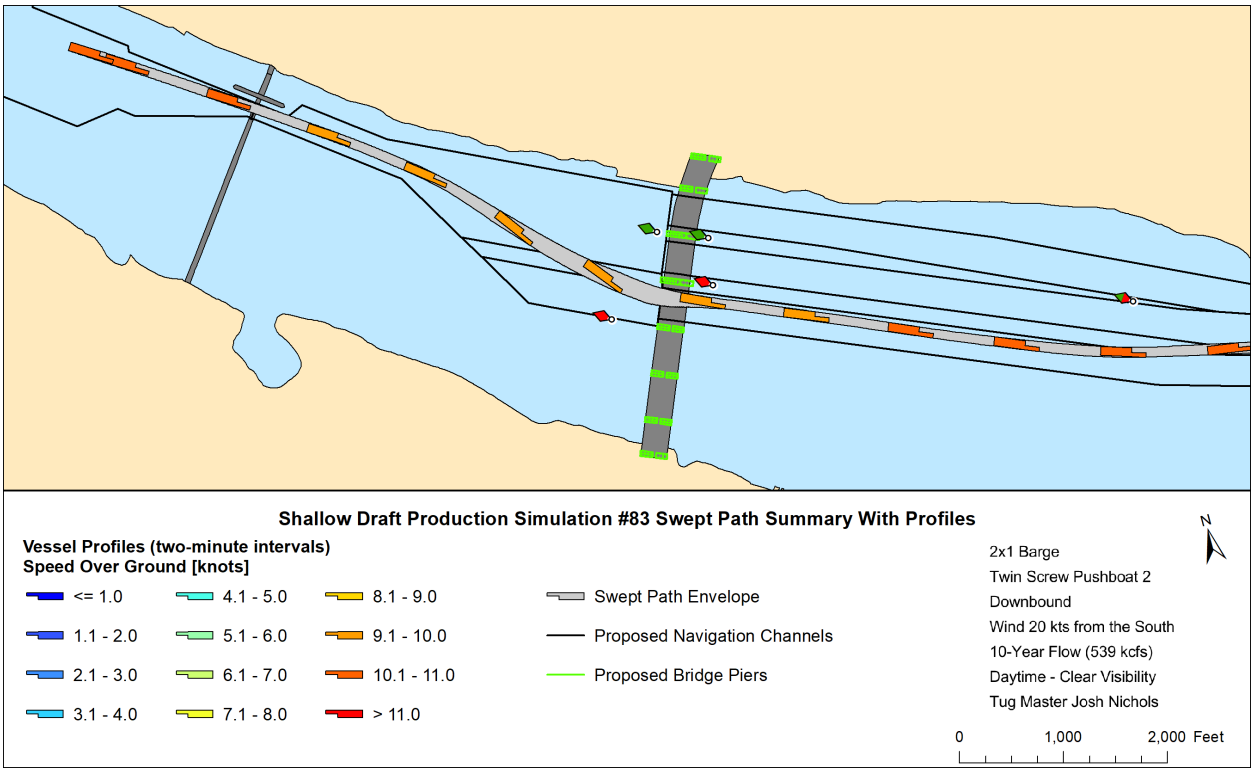

Summary of Simulation Parameters: Shallow-Draft Production Simulation 80
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

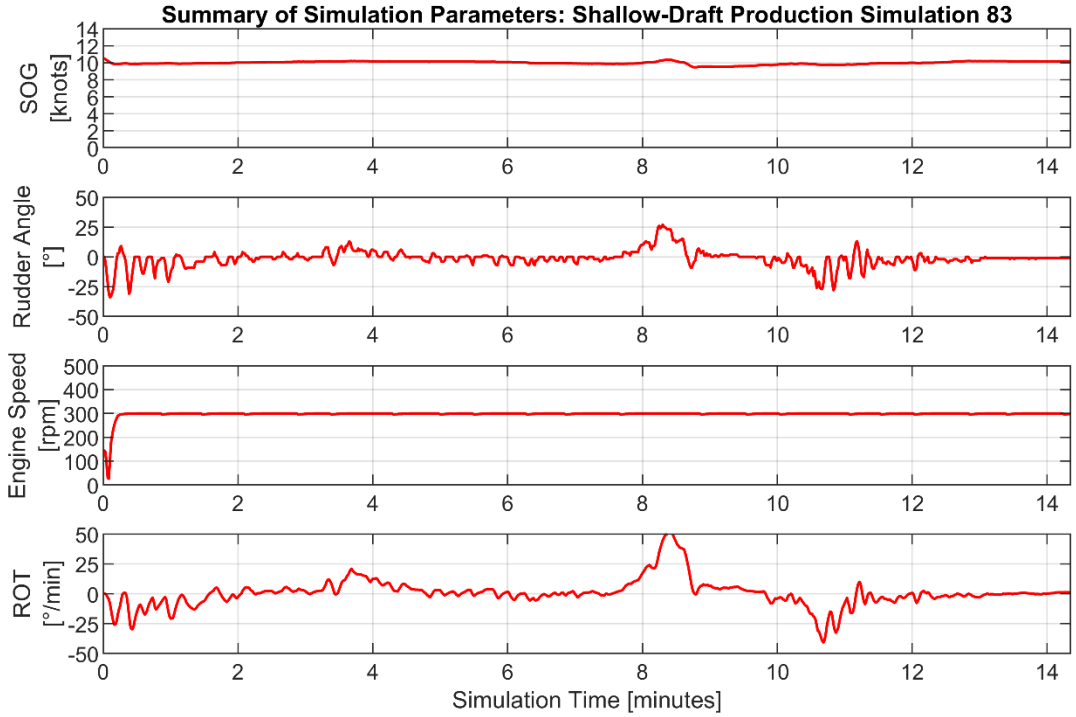

Shallow Draft Production Simulation #81 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x2 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Brian Fletcher
N
0
1,000
2,000 Feet

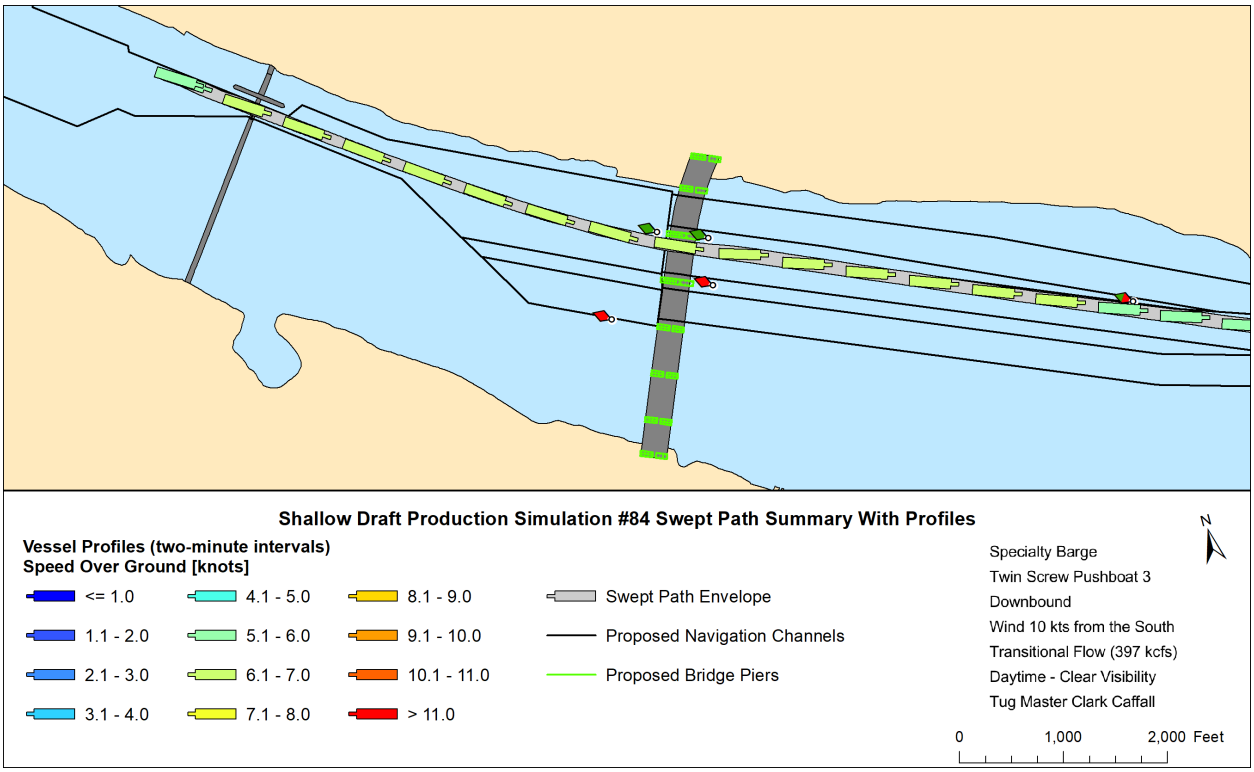

Summary of Simulation Parameters: Shallow-Draft Production Simulation 81
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

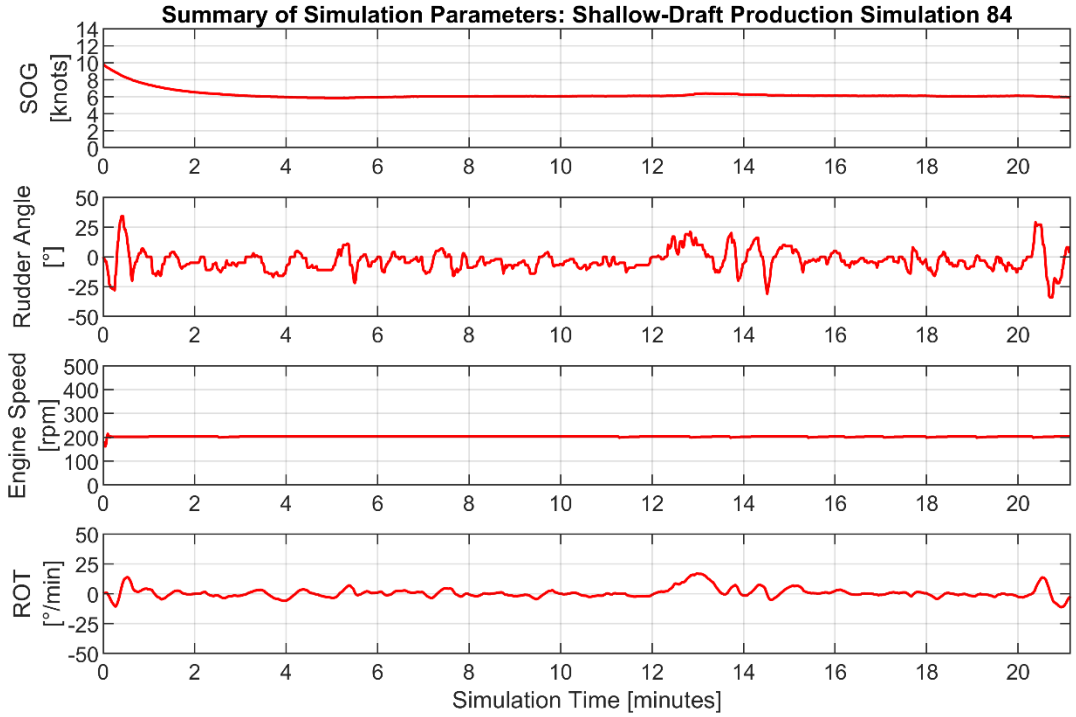

Shallow Draft Production Simulation #82 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Twin Screw Pushboat 3
Upbound
Wind 10 kts from the South
Normal Flow (140 kcfs)
Daytime - Clear Visibility
Tug Master Clark Caffall
N
0
1,000
2,000 Feet

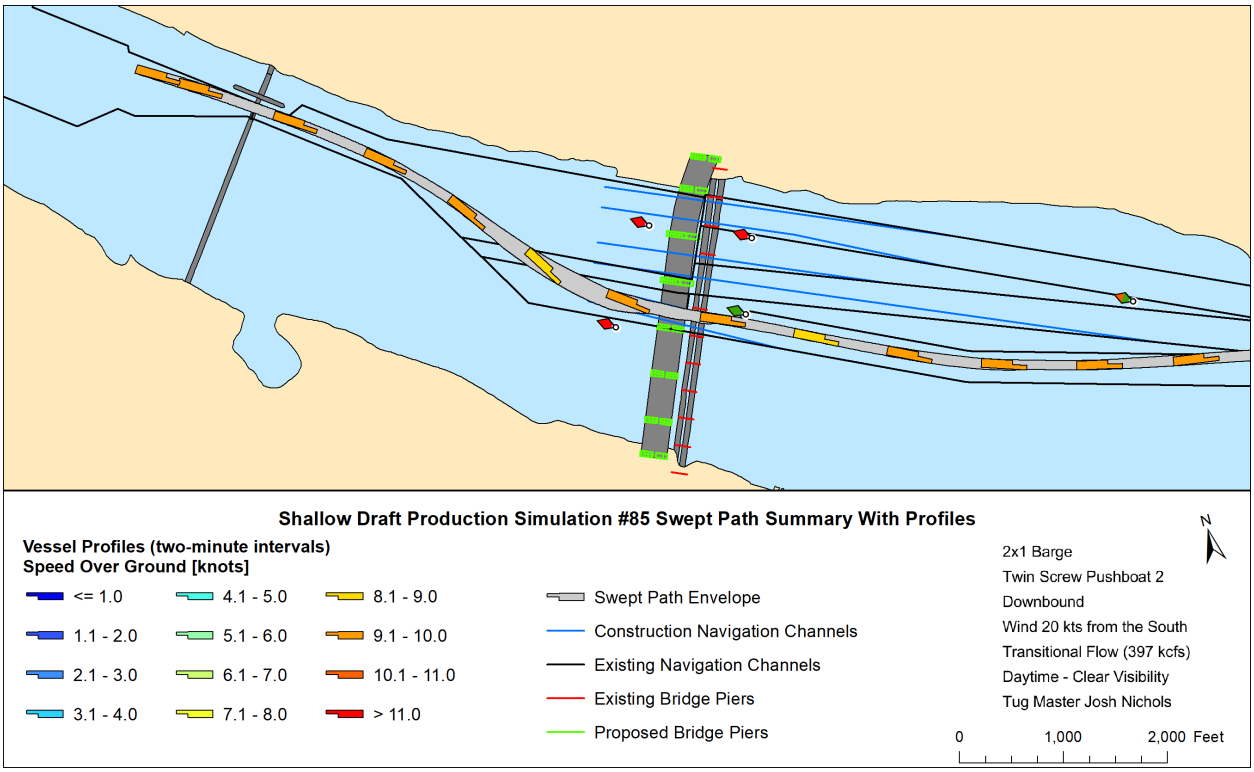

Summary of Simulation Parameters: Shallow-Draft Production Simulation 82
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

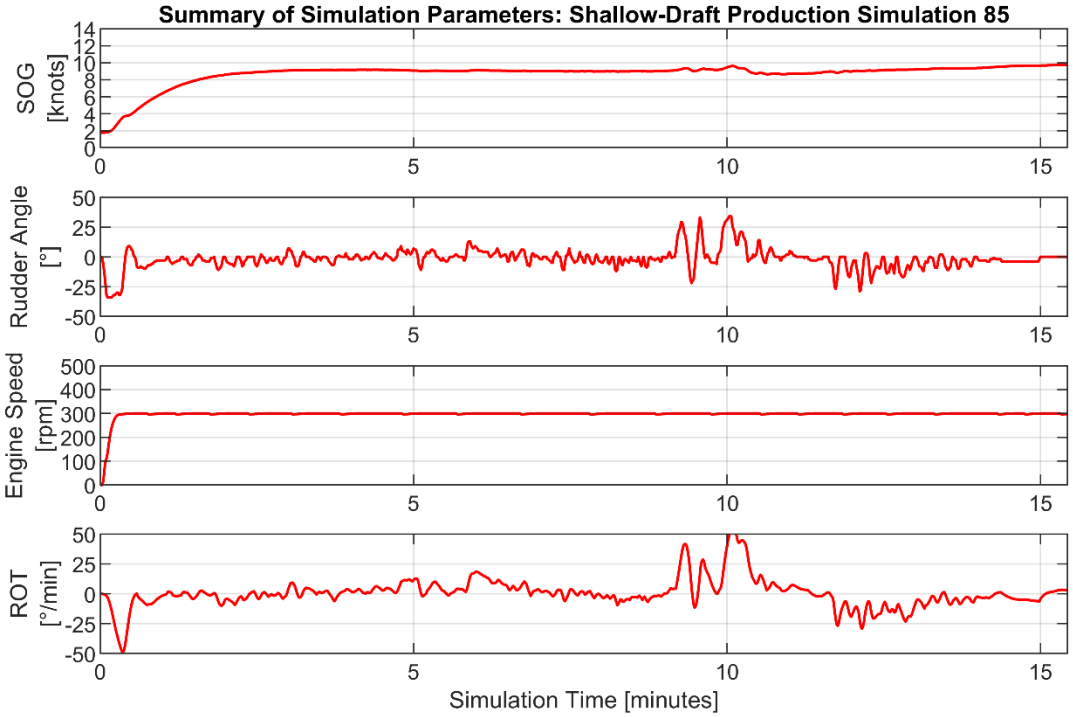

Shallow Draft Production Simulation #83 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
10-Year Flow (539 kcfs)
Daytime - Clear Visibility
Tug Master Josh Nichols
N
0
1,000
2,000 Feet

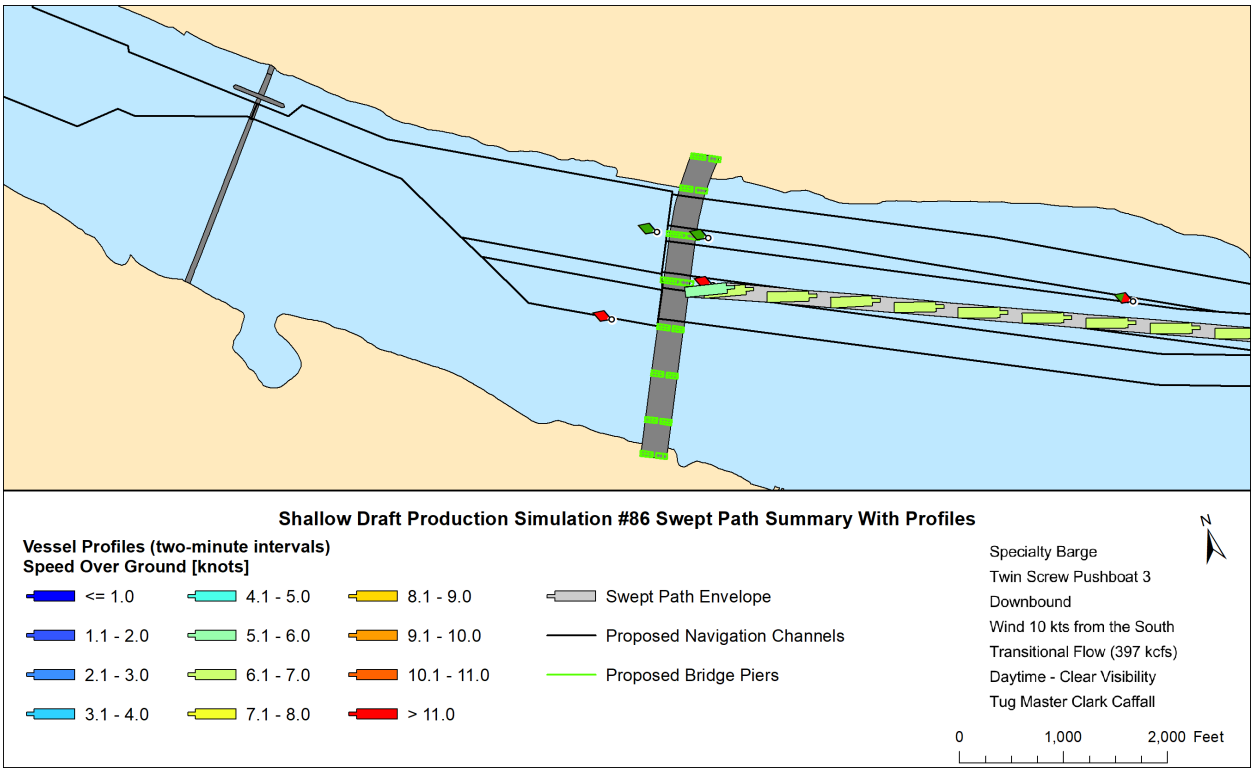

Summary of Simulation Parameters: Shallow-Draft Production Simulation 83
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

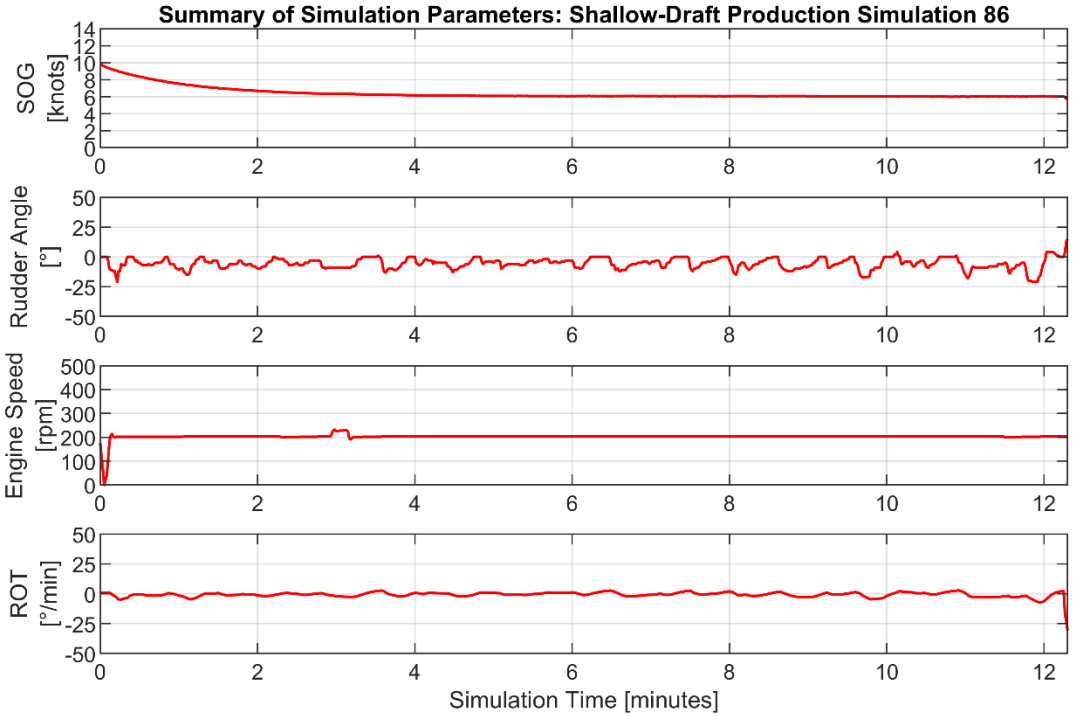

Shallow Draft Production Simulation #84 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Twin Screw Pushboat 3
Downbound
Wind 10 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Clark Caffall
N
0
1,000
2,000 Feet

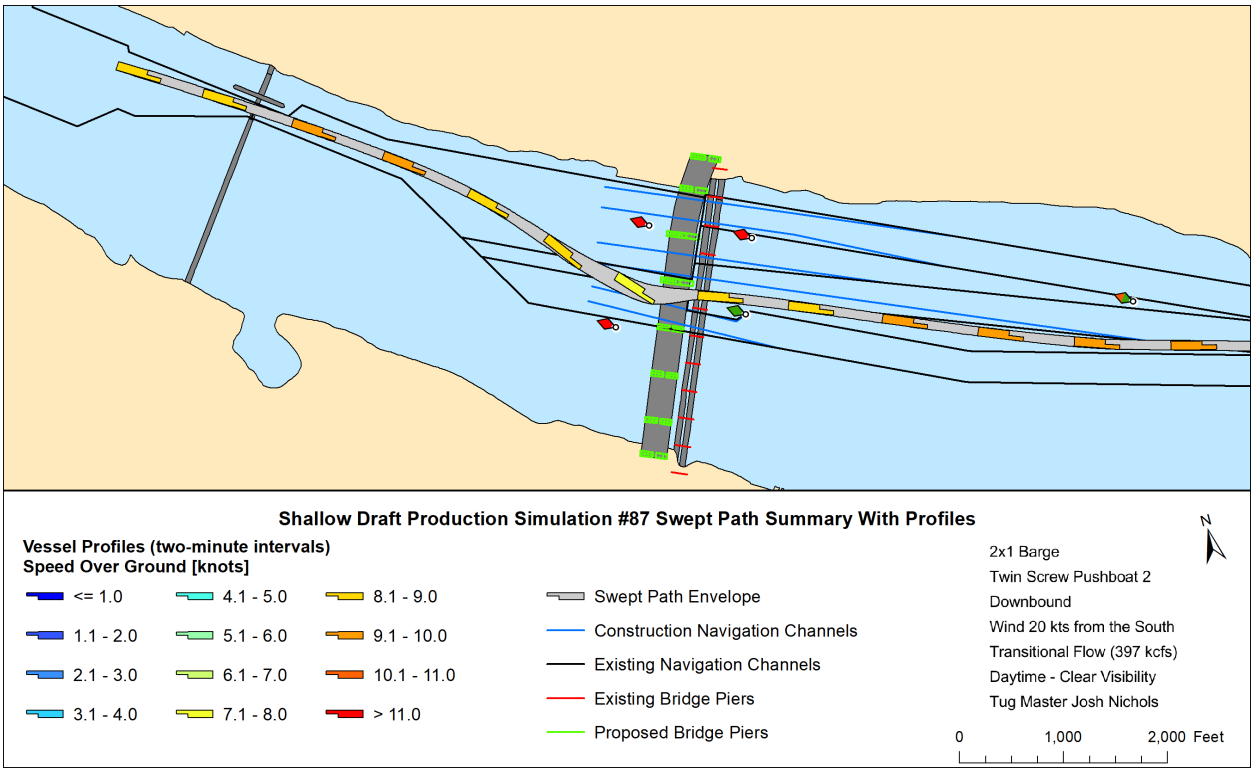

Summary of Simulation Parameters: Shallow-Draft Production Simulation 84
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

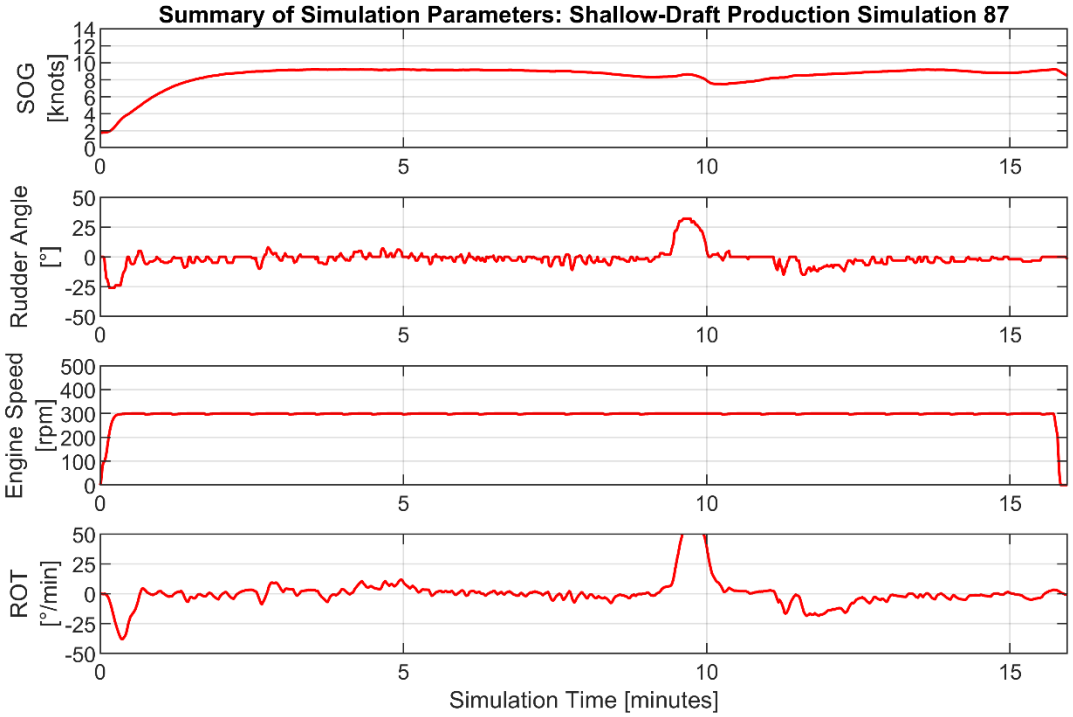

Shallow Draft Production Simulation #85 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Josh Nichols
N
0
1,000
2,000 Feet

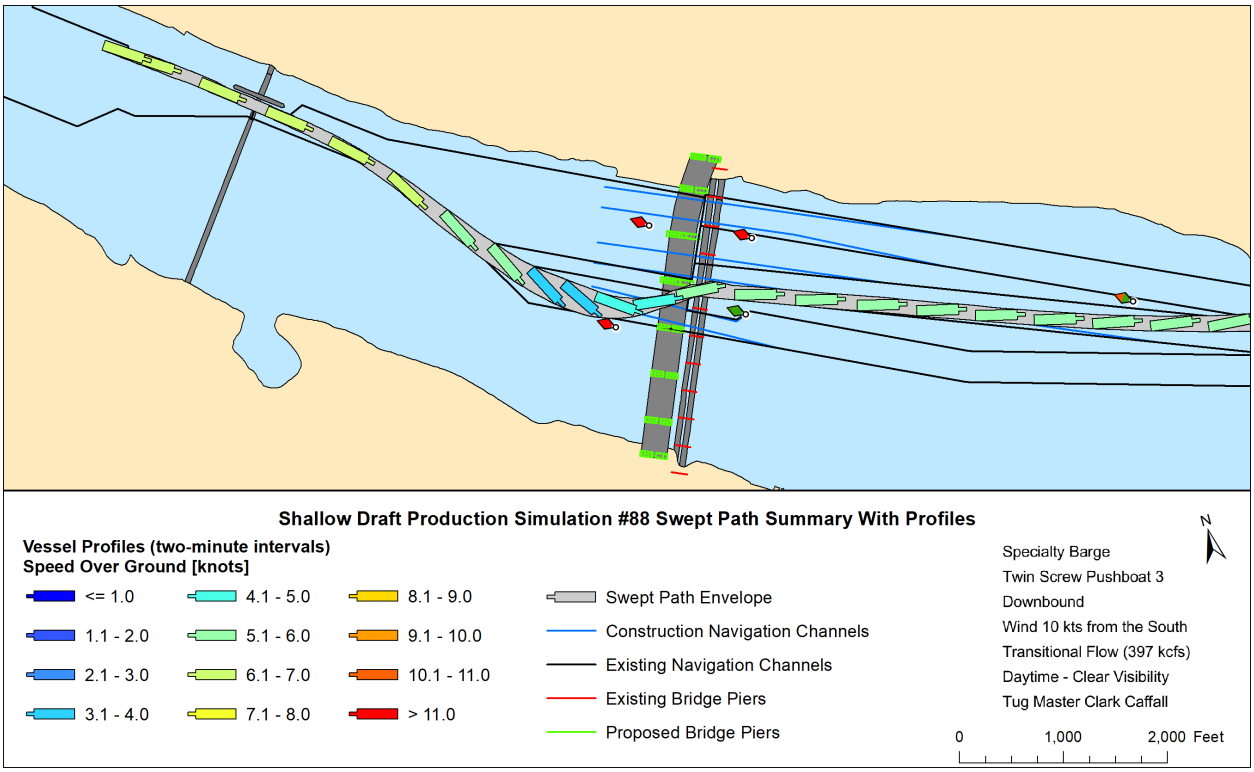

Summary of Simulation Parameters: Shallow-Draft Production Simulation 85
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

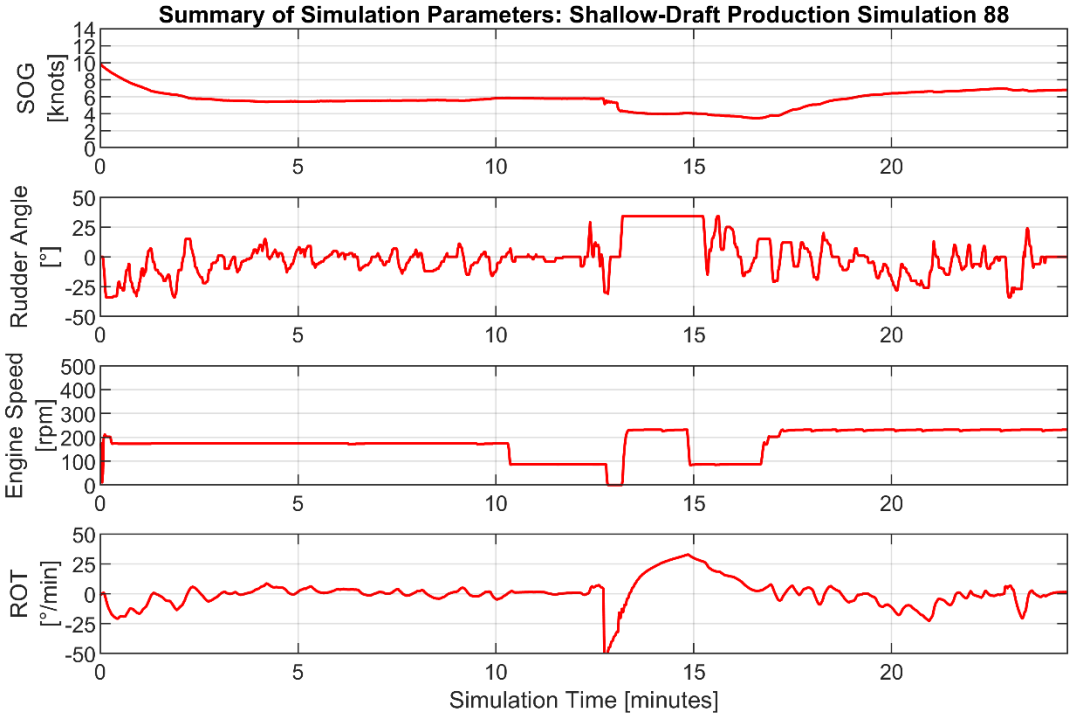

Shallow Draft Production Simulation #86 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Proposed Navigation Channels
Proposed Bridge Piers
Specialty Barge
Twin Screw Pushboat 3
Downbound
Wind 10 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Clark Caffall
N
0
1,000
2,000 Feet

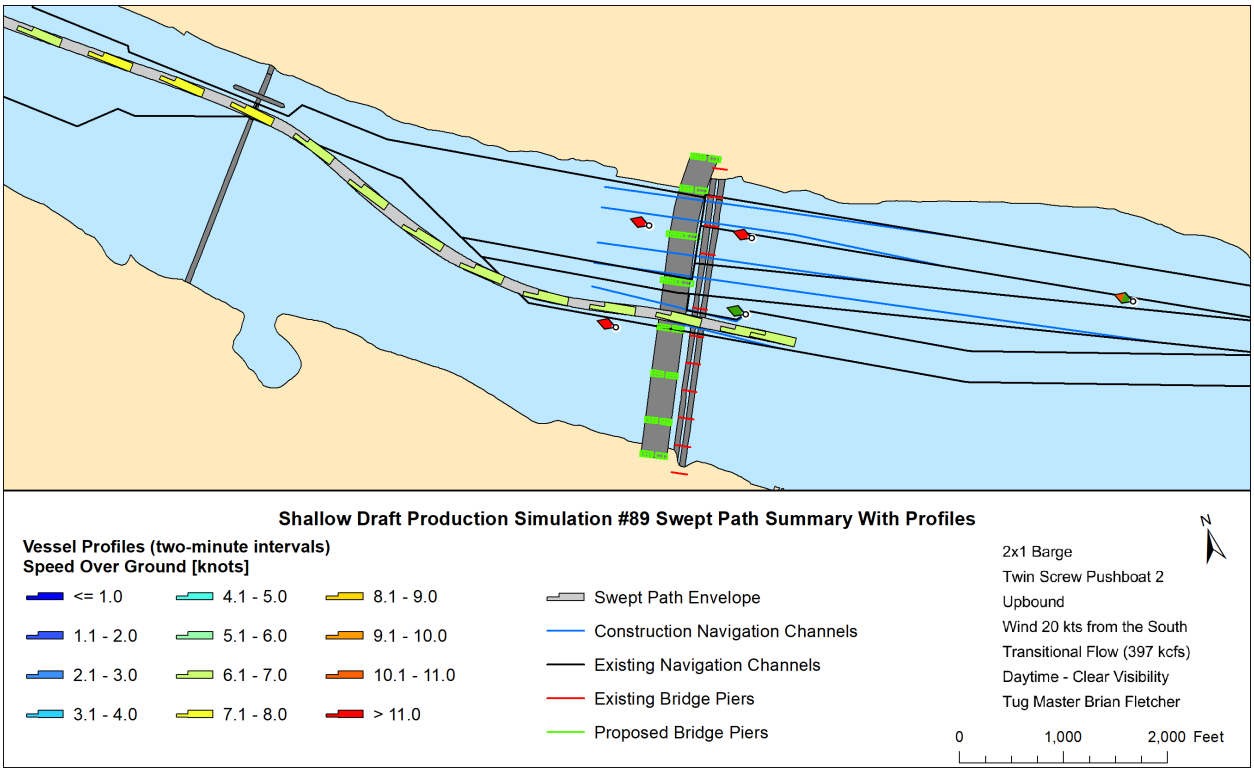

Summary of Simulation Parameters: Shallow-Draft Production Simulation 86
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]

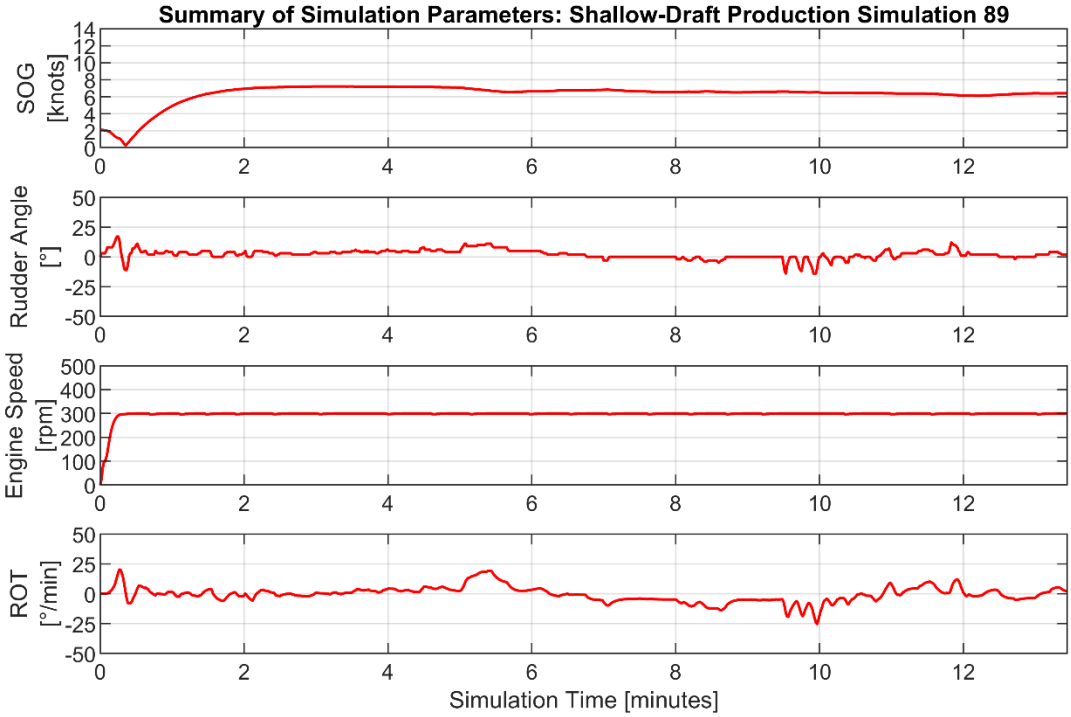

Shallow Draft Production Simulation #87 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x1 Barge
Twin Screw Pushboat 2
Downbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Josh Nichols
0
1,000
2,000 Feet


Summary of Simulation Parameters: Shallow-Draft Production Simulation 87
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]


Shallow Draft Production Simulation #88 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
Specialty Barge
Twin Screw Pushboat 3
Downbound
Wind 10 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Clark Caffall
0
1,000
2,000 Feet


Summary of Simulation Parameters: Shallow-Draft Production Simulation 88
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]


Shallow Draft Production Simulation #89 Swept Path Summary With Profiles
Vessel Profiles (two-minute intervals)
Speed Over Ground [knots]
<= 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
> 11.0
Swept Path Envelope
Construction Navigation Channels
Existing Navigation Channels
Existing Bridge Piers
Proposed Bridge Piers
N
2x1 Barge
Twin Screw Pushboat 2
Upbound
Wind 20 kts from the South
Transitional Flow (397 kcfs)
Daytime - Clear Visibility
Tug Master Brian Fletcher
0
1,000
2,000 Feet


Summary of Simulation Parameters: Shallow-Draft Production Simulation 89
SOG [knots]
Rudder Angle [°]
Engine Speed [rpm]
ROT [°/min]
Simulation Time [minutes]