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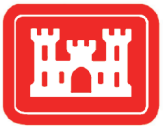

US Army Corps
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Development Center

Houston Ship Channel Expansion Improvement Project – Navigation Channel Improvement Study

Ship Simulation Results

S. Keith Martin, Larry L. Daggett, Morgan M. Johnston, Chris Hewlett, Kiara I. Pazan, Mario J. Sanchez, Dennis W. Webb, Mary C. Allison, and George Burkley

October 2021

Coastal and Hydraulics Laboratory

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Abstract

In 2020, the US Army Engineer Research and Development Center (ERDC), Coastal and Hydraulics Laboratory, provided technical oversight during a navigation study to assist the Galveston District evaluation of different channel widening alternatives for larger ships transiting the Houston Ship Channel (HSC), Texas. The widening proposals encompassed several areas of the HSC including the Bay Section, the Bayport Ship Channel, Barbours Cut Channel, and the Bayou Section. The study was performed at the San Jacinto College Maritime Technology and Training Center (SJCMTTC) Ship/Tug Simulator (STS) Facility in La Porte, TX.

The SJCMTTC STS is a real-time simulator; therefore, events on the simulator happen at the same time rate as real life. A variety of environmental forces act upon the ship during the simulation transit. These include currents, wind, waves, bathymetry, and ship-to-ship interaction.

Online simulations of the project were conducted at SJCMTTC over a 3-week period – May through June 2020. Several mariners including Houston Pilots and G&H tugboat Captains participated in the testing and validation exercises. ERDC oversight was performed remotely because of the COVID-19 pandemic.

Results in the form of engineering observations, track plots, and pilot interviews were reviewed to develop final conclusions and recommendations regarding the final design.

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Preface

This study was conducted for the US Army Corps of Engineers (USACE), Galveston District, and the Port of Houston Authority, under MIPR 1EKW0-CF71K3. The MIPR was funded as work-in-kind by Port of Houston Authority. The technical monitor was Ms. Nancy C. Young, USACE Galveston District, Engineering and Construction Division.

The work was performed by Waterway Simulation Technology, Inc., and LOCUS LLC, with technical oversight provided by personnel of the Navigation Branch of the Navigation Division, US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory (ERDC-CHL). At the time of publication of this report, Mr. Benjamin C. Burnham was Chief of the Navigation Branch; Ms. Ashley Frey was Chief of the Navigation Division; and Mr. Charles E. Wiggins was the Technical Director for Navigation Research and Development. The Deputy Director of ERDC-CHL was Mr. Keith Flowers, and Dr. Ty V. Wamsley was the Director.

The Commander of ERDC was COL Teresa A. Schlosser, and the Director was Dr. David W. Pittman.

1 Introduction

In the fall of 2018, feasibility-level ship simulations were completed in support of the Houston Ship Channel (HSC) Expansion Channel Improvement Project (ECIP) Feasibility Study (FS).[1] Since that time, the Feasibility Report (FR) and Environmental Impact Statement (EIS) have been completed, and a Chief's Report was signed on April 23, 2020 (DOA 2021). At the time the study was completed, the project was currently in the Preconstruction Engineering Design (PED) phase. The US Army Engineer Research and Development Center (ERDC), in collaboration with Waterway Simulation Technology, Inc. (WST), LOCUS LLC, the Houston Pilots, and G&H Towing, conducted ship simulations to more rigorously test the HSC ECIP FR EIS Recommended Plan channel dimensions.

Background

The HSC is a federally constructed deep-draft navigation channel, which serves the Port of Houston, and is located in the Chambers, Galveston, and Harris counties in Texas. The HSC is a high-use channel and one of the busiest waterways in the United States with over 9,000 deep draft and 200,000 barge transits per year (Port Houston: The International Port of Texas 2021). The HSC provides access to various private and public docks and berthing areas associated with Port Houston. Figure 1 shows the project location with the different segmented areas of the ECIP discussed in this report.

The HSC System is comprised of the HSC, Bayport Ship Channel (BSC), Barbours Cut Channel (BCC), and Greens Bayou. The HSC extends 52 mi[(2)] fromits juncture with Texas City Channel at the entrance to Galveston Bay and terminates at its turning basin in the city of Houston. From channel mile 0to channel mile 40 (Boggy Bayou), the authorized channel depth is 46.5 ft mean lower low water (MLLW), with a bottom width of 530 ft. The remaining channel depth from channel mile 40 (Boggy Bayou)

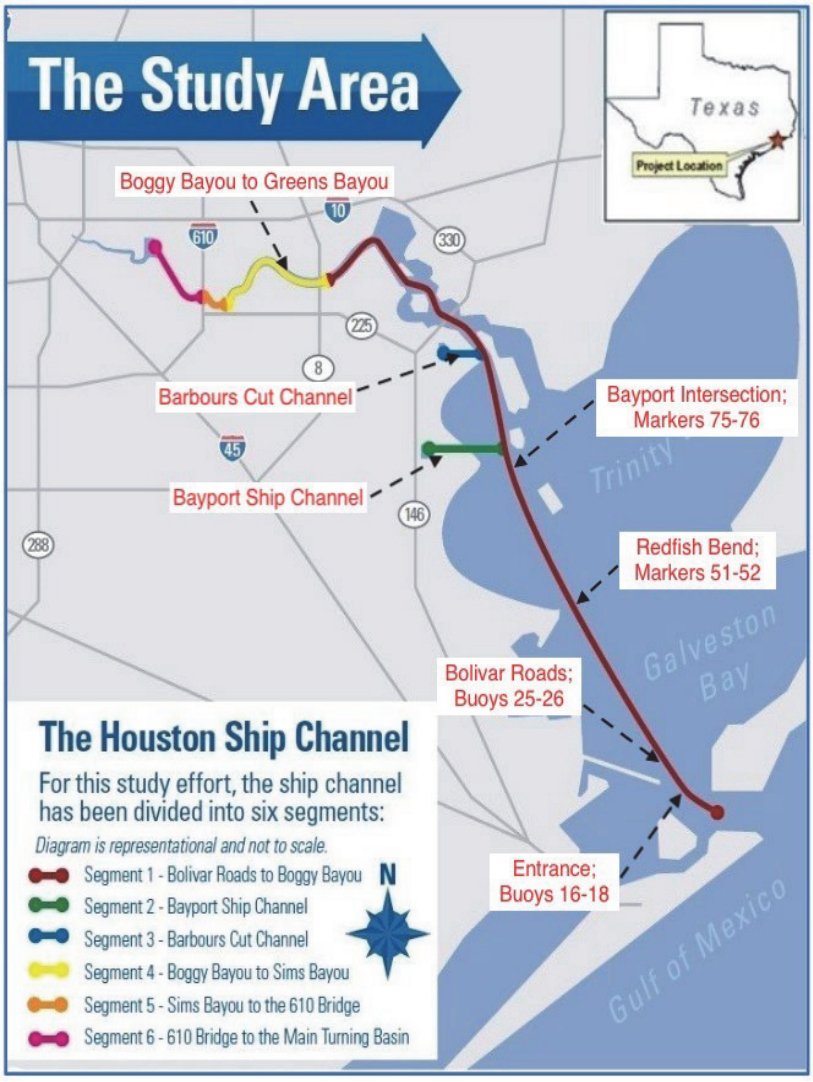
[1] Waterway Simulation Technology, Inc. and Maritime Pilots Institute, Ship Maneuvering Simulation Study of Proposed Channel Modifications; Houston Ship Channel Expansion Channel ImprovementProject Feasibility Study, Texas, Final Report, April 13, 2018, Revised June 25, 2019.

[2] For a full list of the spelled-out forms of the units of measure used in this document, please refer to US Government Publishing Office Style Manual, 31st ed. (Washington, DC: US Government Publishing Office 2016), 248-52, https://www.govinfo.gov/content/pkg/GPO-STYLEMANUAL-2016/pdf/GPO-STYLEMANUAL-2016.pdf.

to channel mile 52 (turning basin) varies from 37.5 ft to 41.5 ft MLLW, with a bottom width of 300 ft. The BSC extends 4.1 mi from its juncture with the HSC at mile 20.5 and terminates at its turning basin.

BCC extends 1.5 mi east from its juncture with the Houston Ship Channel at mile 26.3 and terminates at its turning basin. Both the BSC and BCC have been deepened to 46.5 ft MLLW by the Port of Houston Authority (PHA) under the authority of section 204, Water Resources Development Act of 1986, as amended. In May 2014, the Assistant Secretary of the Army (Civil Works) approved the assumption of federal operation and maintenance for the work that the port performed under section 204 on these channels.

Figure 1. HSC ECIP location map (source: Galveston District).



The Port of Houston is the Nation's number-one port in terms of foreign waterborne tonnage with an estimated tonnage of 191,000,000 and number two in total US tonnage with an estimated tonnage of 268,900,000 based on the 2018 Waterborne Commerce data. The major commodities include petroleum, chemicals, and bulk goods (https://porthouston.com/about-us/statistics/).

Development along the HSC has continued to increase, resulting in more vessel traffic and creating an increased risk of collisions and other incidents between vessels. The increased traffic also increases the benefits associated with channel deepening or widening, or other measures to improve efficiencies. Some vessels, especially those with lengths greater than 965 ft and beams greater than 106 ft (i.e., post-Panamax ships) calling at the Port of Houston, experience channel depth and width constraints.

The light loading of some of these vessels results in an increased number of vessel trips, which increases the total number of vessels on the HSC. One-way traffic is required for vessels with beams greater than 105 ft in some areas of the Boggy Bayou to Main Turning Basin, resulting in time delays. Current channel configurations require slowing with tug assistance for cargo vessels with a capacity over 150,000 dead weight tonnage.

In addition, the current HSC dimensions limit the admission of the largest ships in common use by the maritime industry and serviced by the expanded Panama Canal. This limitation also increases the number of ships required to service the volumes of commerce being handled by this port as well as expected increases of commodities shipped.

Objective

The purpose of this study was to assist the PHA and the US Army Corps of Engineers, Galveston District, in analyzing the navigation conditions for the proposed modifications to several sections of the HSC with an array of design vessels. The ship simulation study evaluated the effectiveness of the new design alternatives proposed for the Bay Section (Segment 1), BSC (Segment 2), BCC (Segment 3), and the Bayou Section of the HSC (Segment 4). The study also provided recommendations for the channel design to allow safe and efficient transits.

Approach

The HSC ECIP navigation study was conducted by WST and LOCUS LLC using a series of ship simulation exercises in cooperation with the Houston Pilots and G&H Towing performed at the San Jacinto Maritime Technology and Training Center (SJCMTTC), Ship-Tug Simulator (STS) Facility, in La Porte, TX. A detailed description of the process is presented in Chapter 3. Technical oversight for the project was conducted remotely by ERDC personnel in Vicksburg, MS. The test plan, including adjustments to the Recommend Plan (RP) and the proposed test matrix, was discussed by the study participants and the Port of Houston design team in two video teleconferences that were documented in Memorandums for Record presented in Appendix J. Results of the simulation tests performed by locally licensed pilots, and their thoughts and comments, were then analyzed to decide on the final recommendations.

Note that the oversight arrangement performed by ERDC for this study is non-standard. Typically, the oversight process is done on site to facilitate communication among all parties involved. Because of the COVID-19 pandemic and travel restrictions imposed on ERDC personnel during the quarantine period, special arrangements were made to allow remote participation of the ERDC personnel and to maintain the PHA schedule by using video teleconference technology. This allowed ERDC personnel to provide virtual technical oversight by observing the simulations, participate in debriefings following each simulation run, and attend summary briefings throughout the validation and 3-week simulation process.

The simulations were conducted in four specific segments of the HSC EICP projects. These segments and the specific sites of simulation reaches are shown in Figure 1. The simulation reaches are listed below. A detailed description of the design modifications tested appears in Chapter 2.

Segment 1 – Bay Section

The modifications to the Bay Section include widening to 700 ft with four bend easings. Testing included serial meetings between loaded Ultra Large Container Vessels (ULCVs) and Suezmax tankers in the following locations:

1. Bay entrance (Buoys 16–18)

2. Bolivar Roads (Buoys 25–26)
3. Redfish (Buoys 51–52)
4. Bayport Intersection (Buoys 75–76).

Segment 2 – Bayport Ship Channel (BSC)

The modifications to the BSC included widening the channel to 455 ft to the north, an adjustment to the turning basin, and a minor adjustment of the southern flare. These simulations involved ULCVs with support tugs.

Segment 3 – Barbours Cut Channel (BCC)

The BCC modifications included widening the channel to 455 ft to the north, adjusting the turning basin, and slightly modifying the southern flare. These simulations involved ULCVs with support tugs.

Segment 4 – Bayou Section

The modifications to the Bayou Section included widening to 530 ft and deepening to -46.5 ft MLLW to allow for meetings of Aframax and Suezmax with Panamax vessels.

2 Design Alternatives

The simulations were conducted in four specific segments of the navigation channel. The initially proposed channel dimensions and layout were provided in a drawing from the design team and referred to as the "Recommended Plan" or RP. Most of these designs were modified as the study proceeded based on recommendations by the study team participants and by experiences during the simulations. The RP was replaced with the designation of "Alternative 1." Although this new label does not strictly correspond to the initially proposed design as modifications to the RP made before the start of simulation testing are also included in Alternative 1. Barbours Cut falls into this category. As noted in Table 1, the modifications to Barbours Cut were added to Alternative 1, and the Alternative 5 label was removed. The numbering of other alternatives for the HSC from the Entrance to the BCC were made sequential from the first alternative until the last since all these channel layouts were in a commondatabase. The Bayou reach (Boggy Bayou to Greens Bayou) was a separate database, and the alternatives were numbered from first to last. The alternatives and their locations are shown in Table 1. Full detailed figures are provided in Appendix A.

Table 1. Alternative locations and designs.

Location	Name	Basis of Design	Figure
HSC from the Entrance tothe BCC	Alt 1	The RP based on the FS Design: a 700 ft width for the HSC and 455 ft width for Bayport and Barbours Cut. The FS tested a 650 ft channel width for the HSC and was found to be unsafe for the design two-way traffic. The 700 ft wide channel was tested and found to be feasible and was initially accepted by the Houston Pilots. A 750 ft wide channel was prepared for use in the PED study at the request of the Houston Pilots. However, since the PED testing of 700 ft channel was proven to be acceptable, the 750 ft width alternative testing was not performed. See Appendix I for the Houston Pilots acceptance agreement.	2, 5, 6
Entrance	Alt 2	900 ft modified angle bend widener with straightened channel lines on green side of channel – dropped from testing plan (see explanation below).	-
Entrance	Alt 3	1,215 ft cut-off bend widener on red side of channel.	3
Entrance	Alt 4	900 ft modified angle bend widener on red side of channel.	4
Barbours Cut Entrance	Alt 5 – Renamed Alt 1	A redesign of the RP by HDR commissioned by the Port of Houston.	11

Location	Name	Basis of Design	Figure
Barbours Cut Entrance	Alt 6	Moved the beginning of northern flare 740 ft west to southeast corner of Spilman Island, maintaining the Alt 1 1,800 ft turning circle and southern channel line.	12
Barbours Cut Entrance	Alt 7	Moved 1,800 ft turning circle 300 ft west and moving the northern flare 740 ft west to the southeast corner of Spilman Island, maintaining the Alt 1 1,800 ft turning circle and southern channel line; Not simulated.	-
Barbours Cut Entrance	Alt 8	Moved the beginning of northern flare 740 ft west to southeast corner of Spilman Island, breaking the angle from the channel from 14.43 deg to 70.31 deg, maintaining a tangent to the Alt 1 1,800 ft turning circle, maintaining the southern channel line.	13
BayportTurning Basin	Alt 1	Alt 1 modified the RP by stopped the 455 ft channel 2,400 ft from the western end creating a flare to the 400 ft channel to the end of the turning basin.	7,8
BayportTurning Basin	Alt 9A	Alt 1 with an extension of the Bayport Container Terminal Master Plan Berth 7 basin extending to the southeast flare to the turning basin.	9
BayportTurning Basin	Alt 9B	Alt 1 with the beginning of the southeast flare moved 270 ftto the east and the extension of Berth 7 basin.	10
Bayou	Alt 1	Modified the RP at the eastern end to provide setback for berths below the Texas Beltway 8 bridge.	14
Bayou	Alt 2	Modified the RP at the eastern end to provide additional setback for berths below the Texas Beltway 8 bridge.	15

Segment 1 – Bay section

In the Entrance area, there are two bends requiring widening beyond the 700 ft channel widening to allow for safe vessel maneuvering through the bends. One is between Buoy 16 and 18 (Entrance) and the other is at Buoys 25–26 (Bolivar Roads). The HSC ECIP FR EIS suggested a 1,093 ft cut-off bend at Station 128+683, the intersection of the HSC, the Entrance Channel, and a 1,032 ft wide cut-off bend at Station 128+731 in the Bolivar Roads bend. As part of the PED simulation evaluations, four alternatives were reviewed to determine if improvements could be made to gain efficiencies while maintaining appropriate engineering and navigation safety.

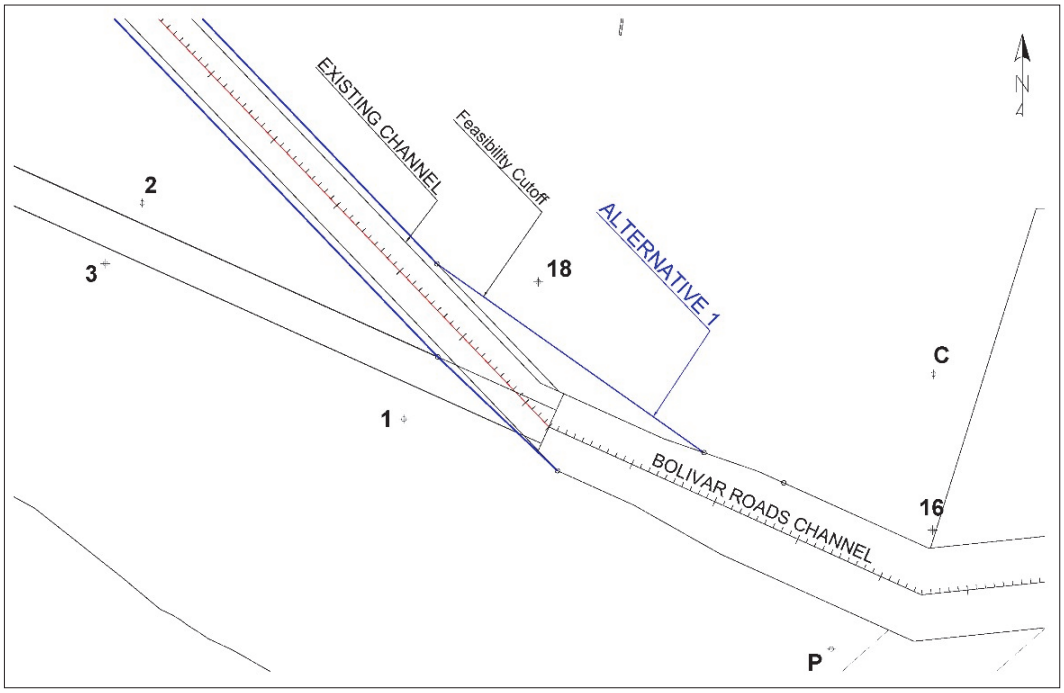
Bay Entrance (Buoys 16–18)

The Bay Entrance area includes an intersection of the Texas City Channel (TCC), HSC, Galveston Ship Channel, and the Entrance Channel with shared traffic though the widened bend near Buoy 18. Therefore, some simulated runs involved the normally practiced starboard to starboard meeting of an inbound Suezmax tanker entering the TCC and meeting an outbound ULCV from the HSC. These runs were in addition to the two-meeting scenario that was originally planned.

At the Bay Entrance, three alternatives were tested: Alternative 1, Alternative 3, and Alternative 4.

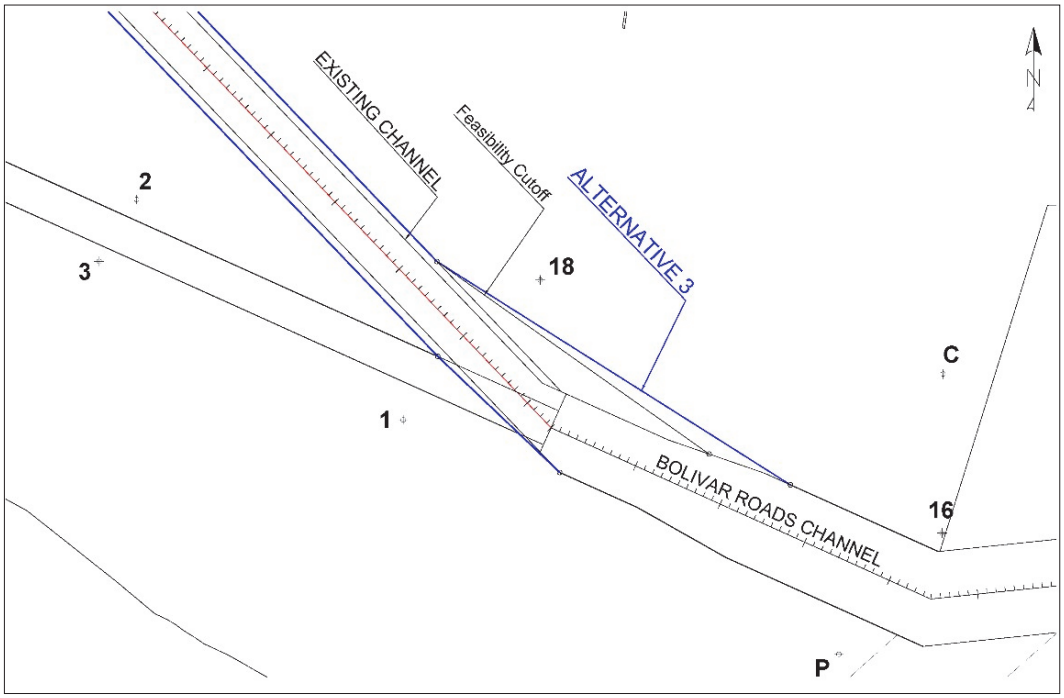
The initial widener (Alternative 1) tested at Buoy 18 was a cut-off bend shown in Figure 2 (Note: All figures of the Alternatives also include the Existing Channel and the HSC FR EIS Channel). The pilots initially expressed concern about the Alternative 1 channel layout due to multiple sequential turns, one within two ship lengths and the next within three ship lengths. In addition, this turn is difficult to mark for navigation. A similar situation previously occurred at the BSC Flare resulting in a project deficiency.

Figure 2. Bay Entrance bend Alternative 1.



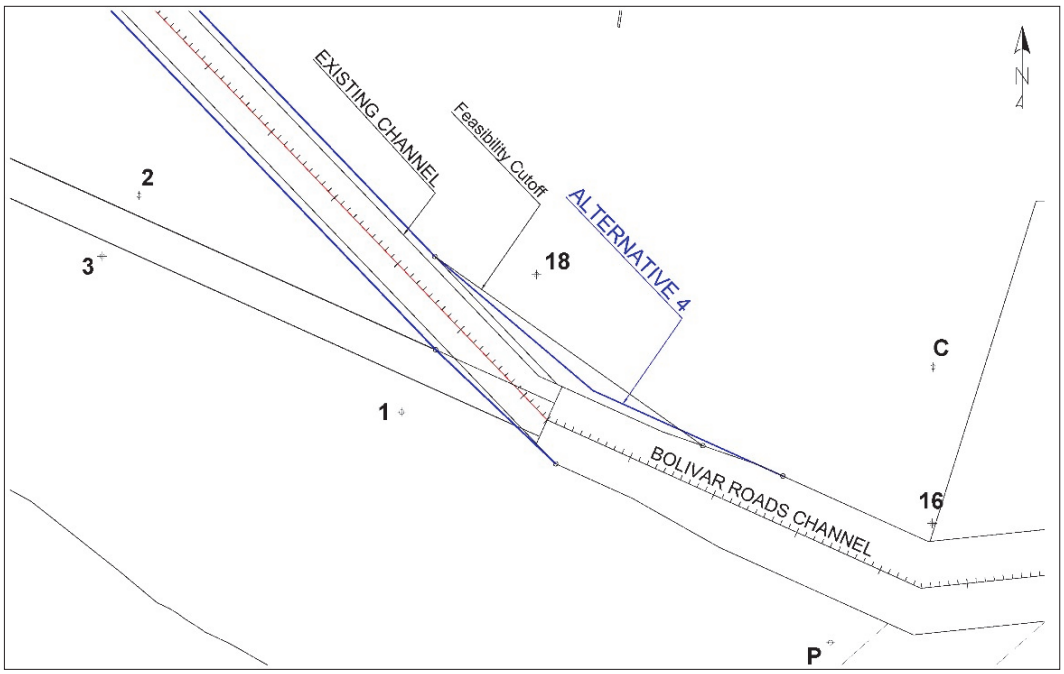
- Alt 3 – a 1,215 ft symmetrical cutoff bend starting at Station 136+222 and ending at Station 2+607, which would require a relatively small volume of dredging to bring the depth to - 46.0 ft MLLW. Alternative 3 is shown in Figure 3. This alternative was developed to reduce the number of course changes required while transiting the area and improve ease of channel marking.

Figure 3. Bay Entrance bend Alternative 3.



- Alt 4 – a 900 ft modified angle bend starting at Station 136+222 and ending at Station 2+607 resulting in little to no dredging to bring the depth to -46.0 ft MLLW. Alternative 4 is shown in Figure 4. Alternative 2 had the same bend widener as Alternative 4 but with an additional green side straightening. It was determined that Alternative 2 would not fit under the guidelines of this project, so it was dropped from the testing plan. As previously noted in Alternative 1, the pilots initially expressed concern over the number of rapid sequential unmarked turns, one within two ship lengths and the next within three ship lengths.

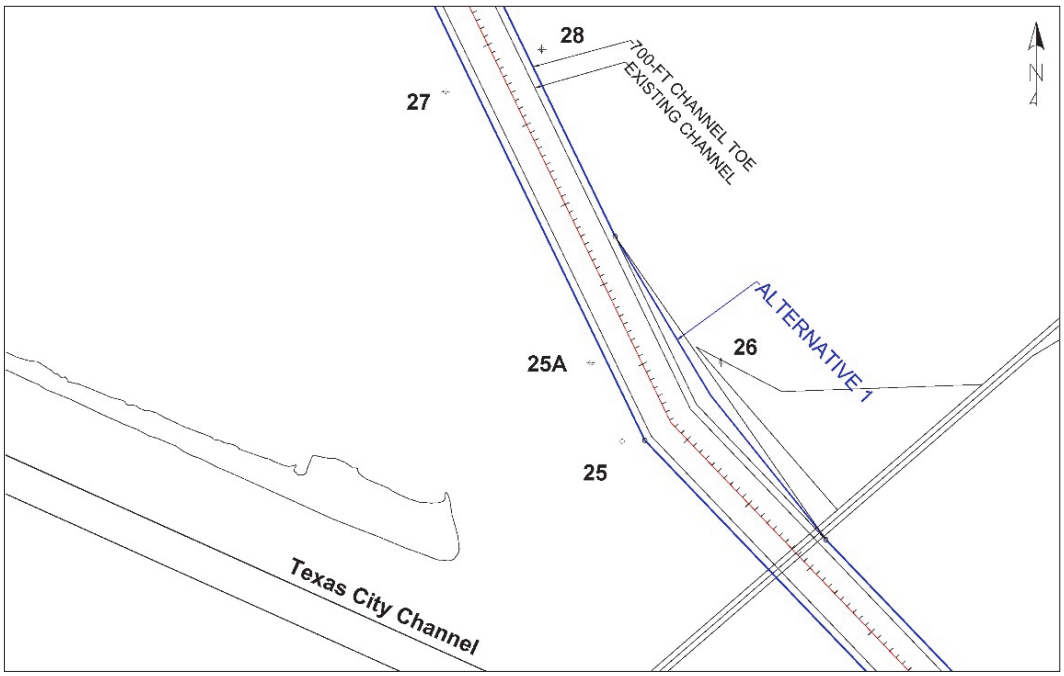
Figure 4. Bay Entrance bend Alternative 4.



Bolivar Roads (Buoys 25–26)

The HSC ECIP FR EIS determined that a 1,028 ft cut-off bend was feasible; however, the channel should be evaluated for potential reduction in PED. In addition, discussions with the Houston Pilots revealed that they preferred a gated bend like the existing bends in the HSC rather than the cut-off bend. Therefore, a modified 900 ft angle bend widener was tested for the bend at Buoys 25–26 extending from Station 126+568 to Station 130+893. This bend widener is shown in Figure 5 in comparison with the FR EIS and existing channels.

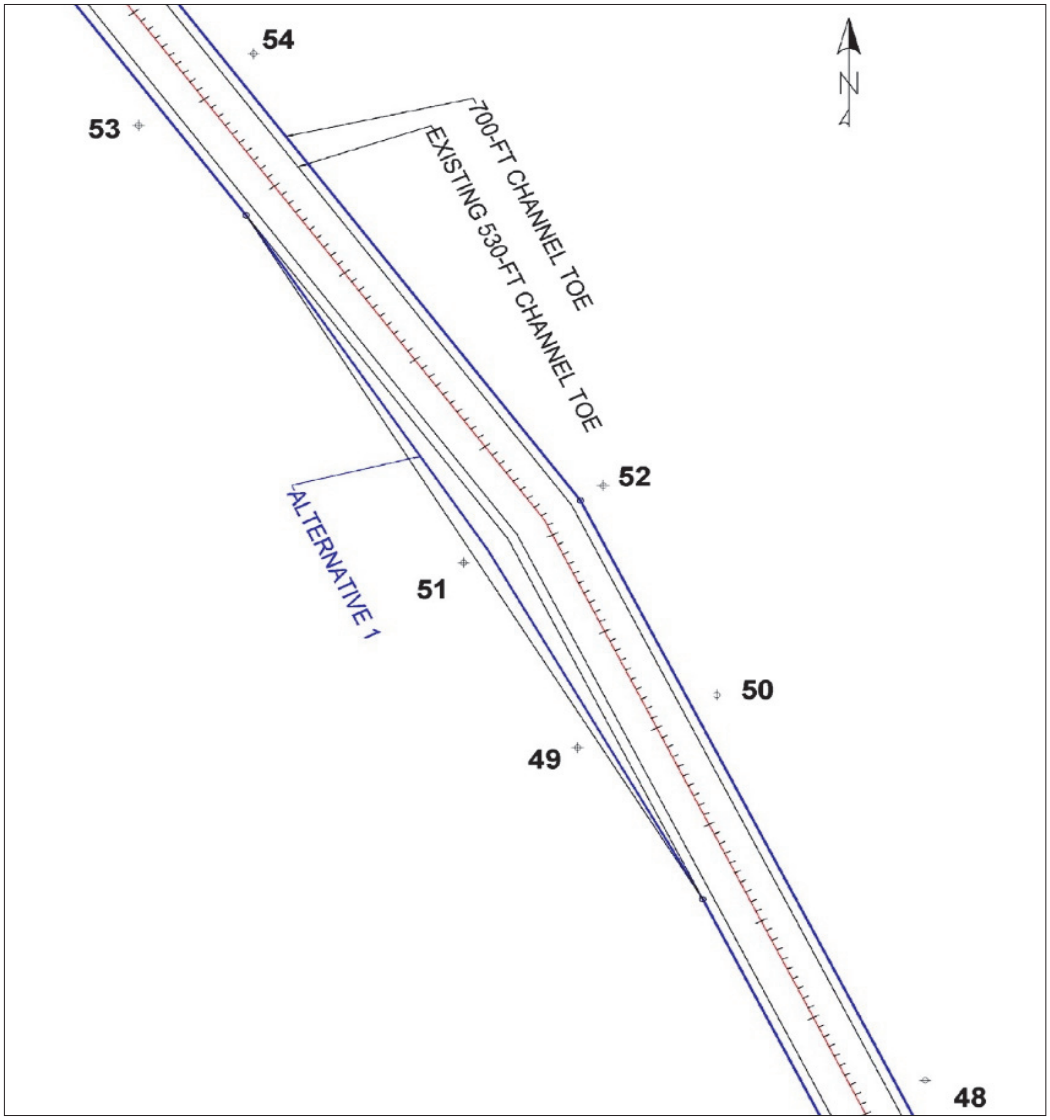
Figure 5. Bend at Buoys 25–26.



Redfish (RF) (Buoys 51–52)

As with Bolivar Roads Buoys 25–26, The HSC ECIP FR EIS determined that a 1,028 ft cutoff bend was feasible; however, the channel should be evaluated for potential reduction in PED. In addition, discussions with the Houston Pilots revealed that they preferred a gated bend like the existing bends in the HSC rather than the cutoff bend. Therefore, a 900 ft modified angle bend widener was tested for the bend at Buoys 51–52. This bend widener is shown in Figure 6 in comparison with the FR EIS and existing channels.

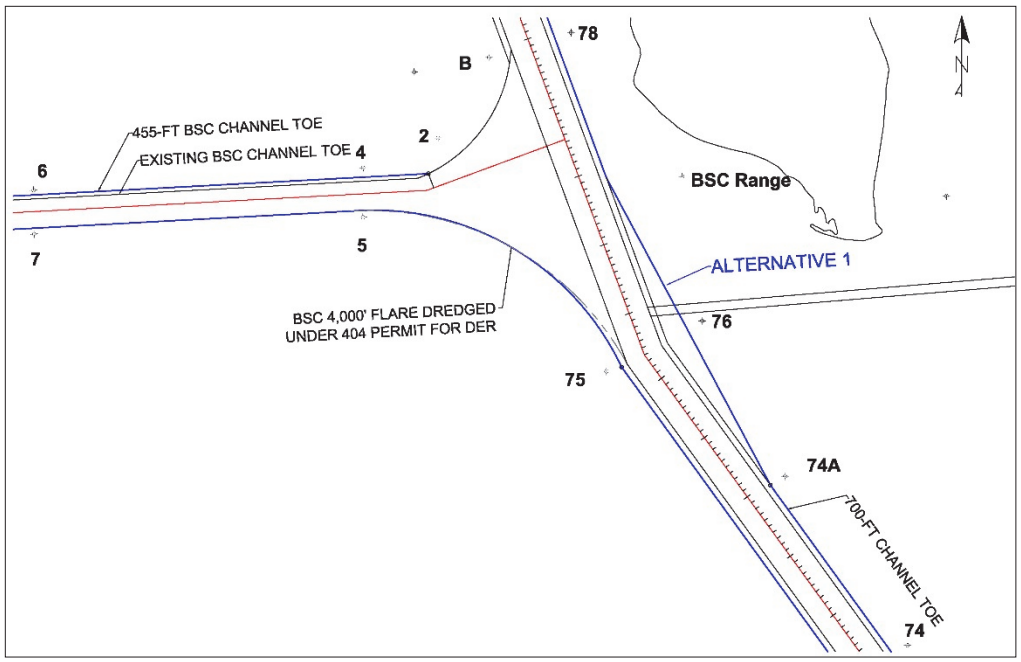
Figure 6. Redfish bend.



Bayport Intersection (Buoys 75–76)

The only modification to the Bend at Buoys 75–76 was the symmetric widening of the channel to 700 ft in combination with the already constructed 4,000 ft radius flare and widener on the east (red) side of the navigation channel. This included a minor adjustment to the southern flare as it intersects with the new 700 ft channel. Though it is only critical for turns into the BSC, the north side of the BSC was widened to 455 ft to complete the study parameters. This area, which is the intersection of the HSC and the BSC, is shown in Figure 7.

Figure 7. BSC intersection with HSC.



Segment 2 – BSC

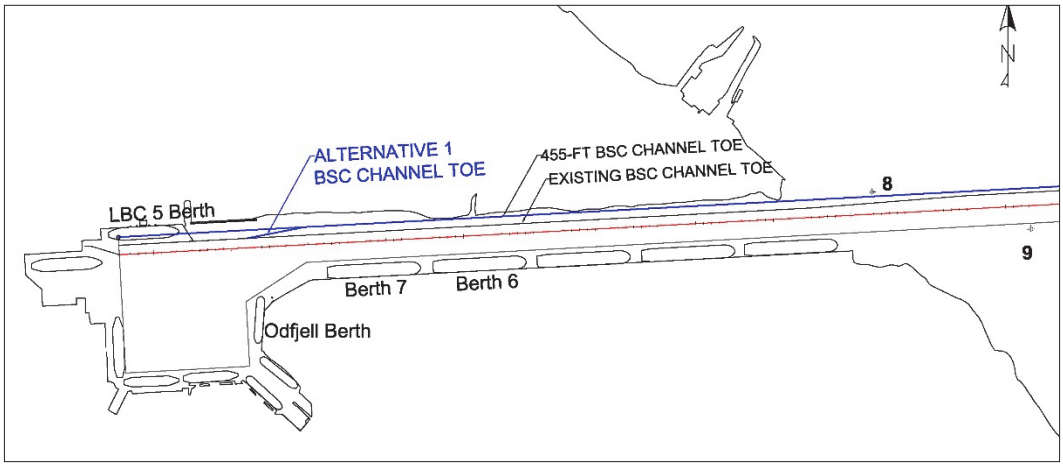
The design improvements for the BSC, shown in Figure 8, involve the widening of the channel on the north (red) side resulting in a total width of 455 ft. Inside the land cut of BSC, the channel will be widened 105 ft.

Initial slope stability evaluations in the FR EIS indicated that a robust sheet pile wall would need to be constructed along the north slope of the channel in the turning basin and adjacent to the San Jacinto College. The existing turning basin is large enough for vessels transiting the existing and future channel. Therefore, as part of the PED study, alternatives were simulated that would evaluate options to reduce or eliminate the sheet pile wall. These alternatives could also potentially provide a reduction in dredging. In addition, the construction of the LBC[1] 5 berth in the northwest corner of the turning basin for Bayport required a reduction in the widener in that area, which created a narrower entrance to the turning basin. This berth was permitted and constructed after the selection of the FR EIS RP in 2018. The plan included allowance for the Bayport Container Terminal Master Plan and the proposed Odfjell terminal on the east side of the turning basin that

[1] LBC Tank Terminals

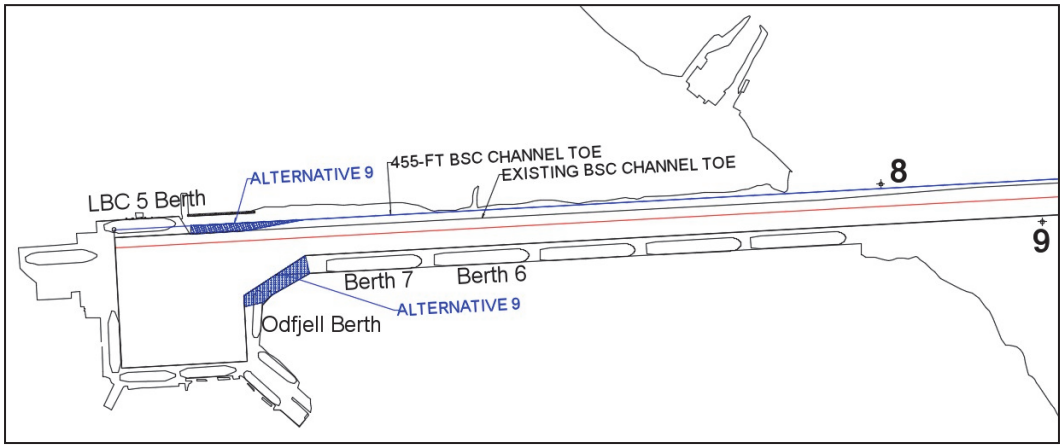
is projected to service Panamax-size vessels (limited to 600 ft length overall [LOA]). This design is called Alternative 1 for the BSC.

Figure 8. BSC and turning basin.



Simulations conducted with the Alternative 1 design demonstrated the benefit of relaxing the channel restrictions on the southeast side of the turning basin. As a result of these simulations, a proposed channel layout for the container terminal was developed to test the navigation improvements of widening the approach between the BSC and the turning basin. This tested condition is referred to as Alternative 9 and is shown in Figure 9.

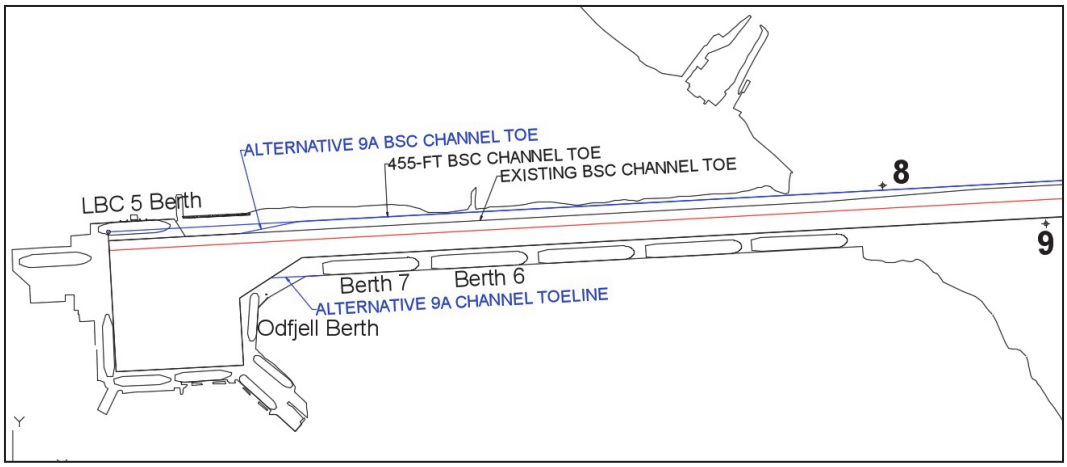
Figure 9. BSC with proposed Alternative 9 layout.



Following the successful testing of this alternative, a more practical layout for accomplishing the opening of this approach was developed as Alternative 9A, which calls for the dredging of the Berth 7 west end to

extend until it intersects the turning basin toeline in combination with Alternative 1. This is shown in Figure 10.

Figure 10. BSC with proposed Alternative 9A layout

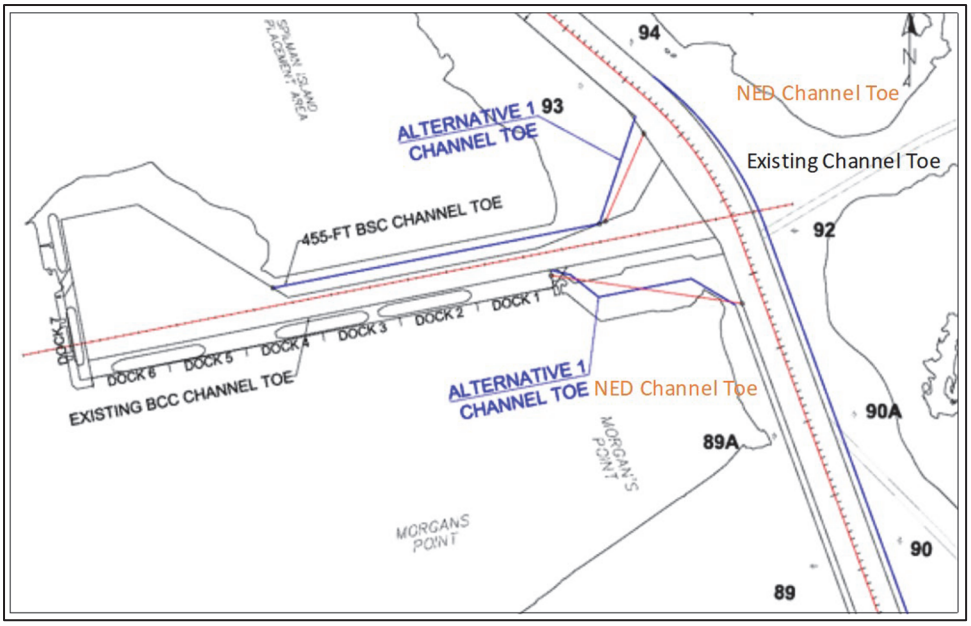


Segment 3 – BCC

As with the BSC, the BCC is proposed to be widened on the north side of the channel to 455 ft. In addition, the entrance to the channel from the HSC is being widened to create a turning area so ULCVs can turn out of the HSC on approach and back into the first two berths at the container terminal. The first tested alignment designed for this purpose is shown in Figure 11, which is referred to as Alternative 1. This alternative also removed the Lighter Aboard Ship (LASH) Dock (not shown) and opened the south side of the channel entrance. This channel entrance differed slightly from the National Economic Development (NED) plan shown in Figure 11, particularly on the south edge of the channel.

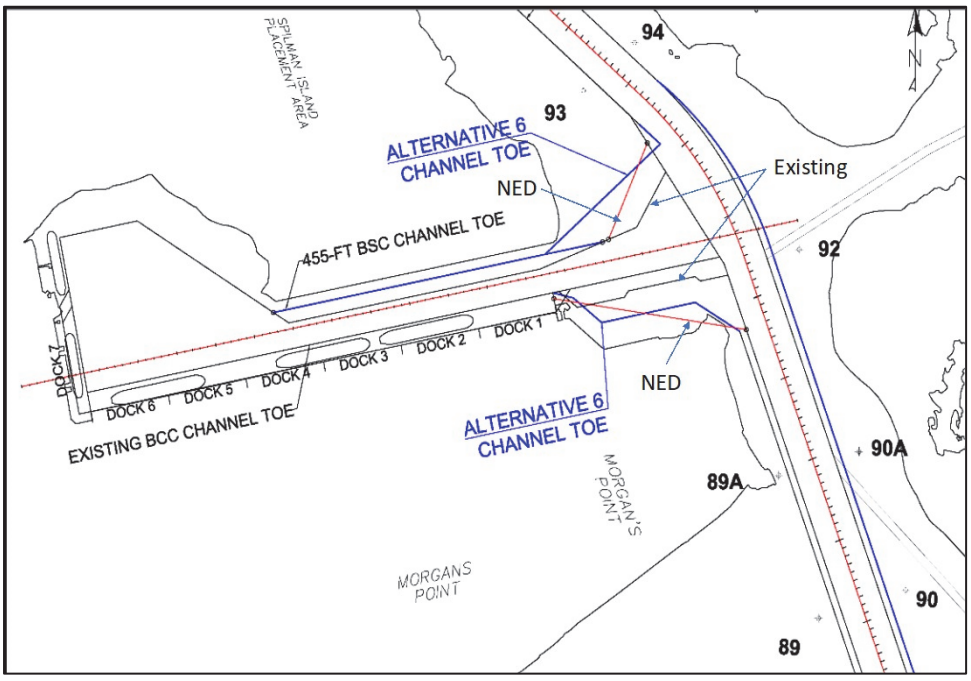
The north side of the NED channel is similar to Alternative 1 with a slightly smaller flare angle to the north.

Figure 11. BCC Alternative 1.



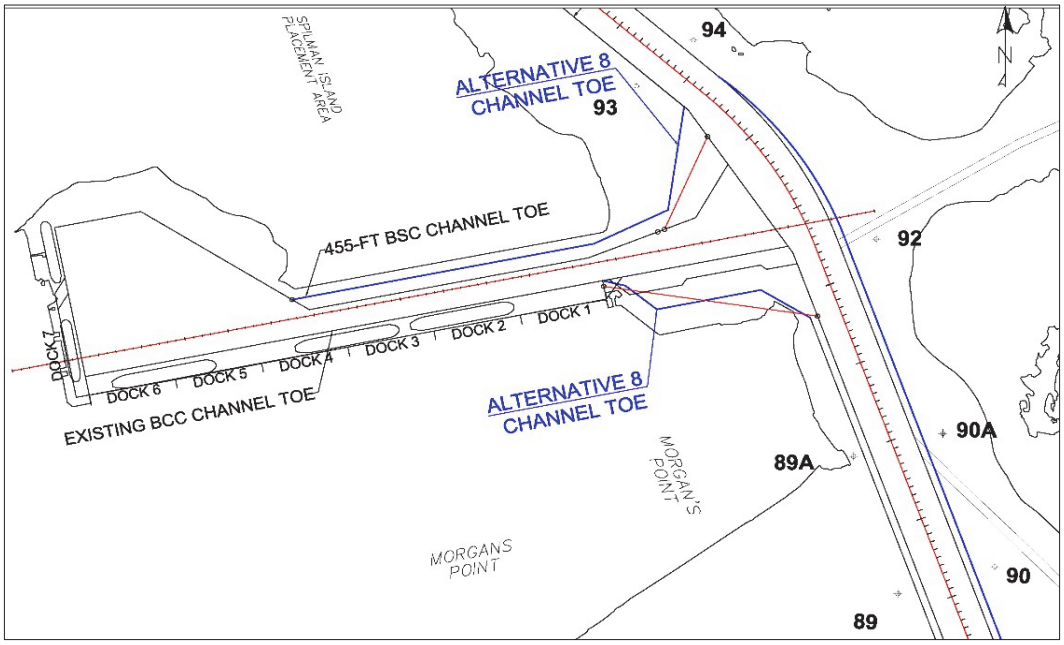
An alternative channel layout for the entry was developed and tested that allowed an earlier turn outbound with increased safety and efficiency. This alternative is shown in Figure 12 as Alternative 6. This alternative moved the beginning of the northern flare to the west near the point of land and corner of Spilman Island Placement Area.

Figure 12. BCC Alternative 6.



If either Alternative 1 or Alternative 6 is selected, there would be an increase in the dredging volume (approximately 435,550 cu yd) and require the removal of unknown objects in the area between the northern flare of Alternatives 1 and 6. To alleviate this, a mitigated flare for the north side of the entrance was laid out as shown in Figure 13 and referred to as Alternative 8.

Figure 13. BCC Alternative 8.



Segment 4 – Bayou Section

The reach of the HSC known as Segment 4 in the ECIP has two existing terminals (ITC[1] and MVP[2]) and two proposed terminals (TDWP[3] and GBT[4]). The proposed channel modifications would allow the terminals to accept Aframax and Suezmax tankers based on the proposed widening and deepening of the navigation channel to a width of 530 ft and depth of 46.5 ft below MLLW. These terminals are included in the economic evaluation of the ECIP. The channel layout with the proposed developed terminals is known as Alternative 1 and is shown in Figure 14.

[1] Intercontinental Terminals Company

[2] Magellan Valero Pasadena (aka Magellan Midstream Partners)

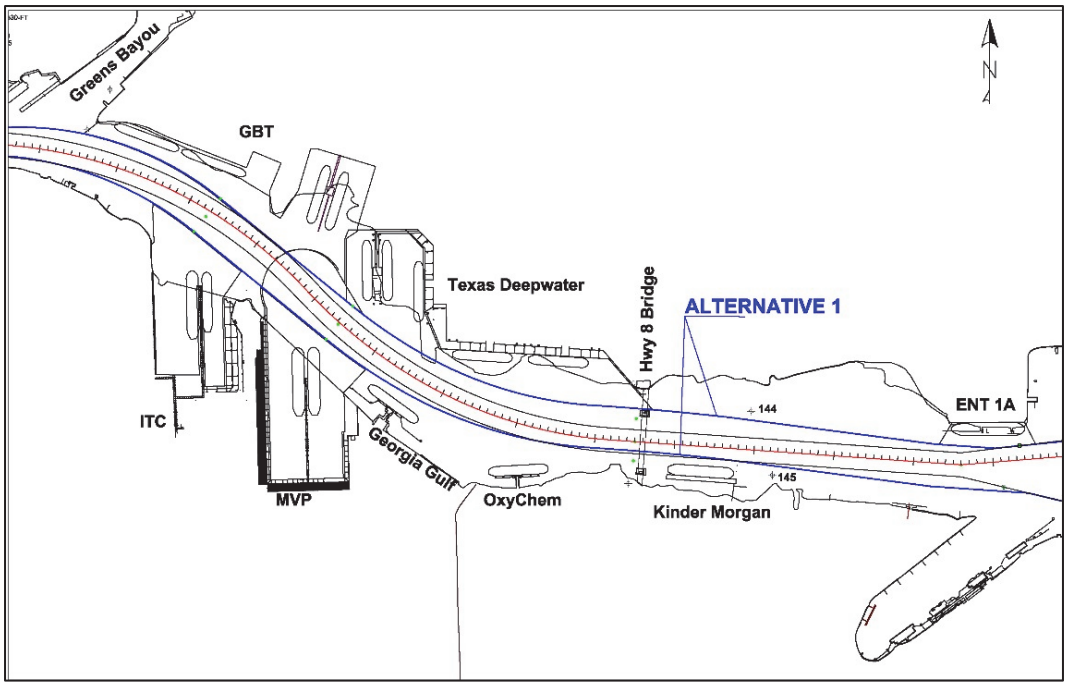
[3] Texas Deepwater Partners

[4] Greens Bayou Terminal

The present (feasibility) channel does not permit admission of these vessels. The pilot rules require a 119 ft setback between a moored vessel and the channel toe in this section.

As a result, a set of pretests was conducted by the PHA, Houston Pilots, G&H, and terminal owners/operators to examine the feasibility to successfully accommodate these large tankers for ingress and egress into the proposed terminals (see Appendix K). Identification of which of the terminals could accommodate the larger vessels was important for the design of the test program for this reach. These tests did identify a proposed change in the feasibility channel design.[1]

Figure 14. Bayou section (Boggy Bayou to Greens Bayou) Alternative 1.

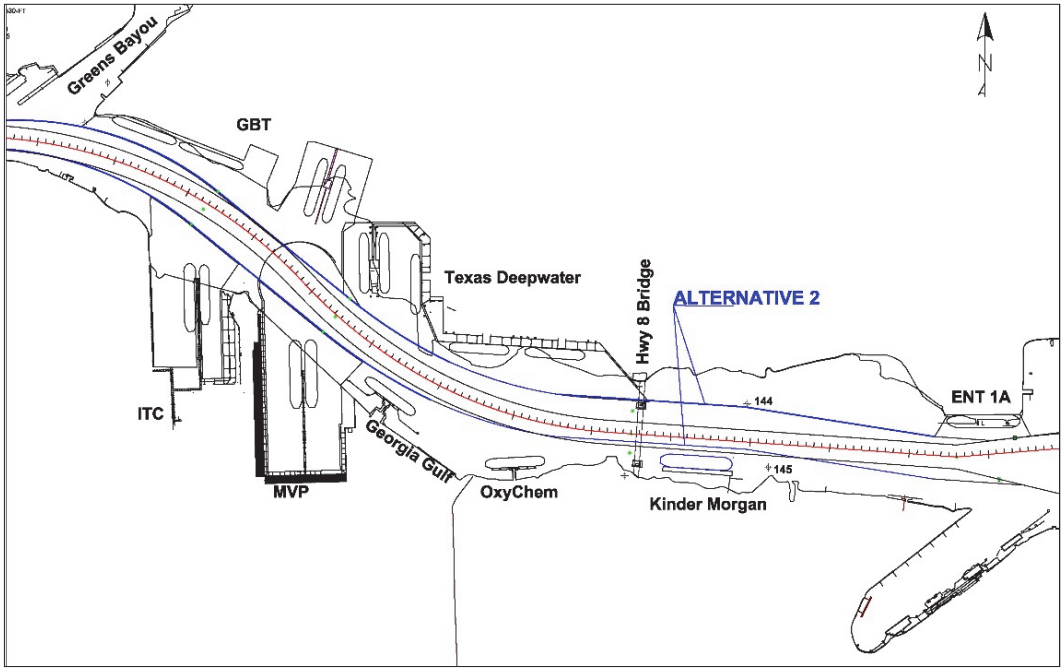


Additionally, the existing terminals were consulted and evaluated for their potential expansions. Kinder Morgan and Enterprise already have plans to utilize their existing facilities for Suezmax vessels. Therefore, all the facilities were evaluated to provide a 119 ft[1] vessel setback between the channel and the vessel. To provide this setback for these two terminals, the channel alignment was further shifted to accommodate all the facilities with the pilot-required setback as noted above, and a redesign of the

[1] Locus Report Simulation Evaluation of Suezmax Berthing in Area 4 of the Pending USACE 216-PED Simulations: A Focus on Future Designs for ITC/MVP/Texas Deepwater and GBT Berths, April 22–23, 2020, Version 1.

channel layout was proposed and tested as shown in Figure 15. This modified channel layout is called Alternative 2; this realignment yielded a setback from the channel edge to the Kinder Morgan terminal face of 283 ft, thus providing the 119 ft setback from the channel toeline to the channel side of a Suezmax tanker at the terminal.

Figure 15. Bayou section (Boggy Bayou to Greens Bayou) Alternative 2.



Construction of a replacement bridge for the existing Texas Beltway 8 Bridge over the HSC (Figure 14 and Figure 15) has been initiated with the existing bridge, including the piers in the waterway, to be removed when the new bridge is completed. The new bridge design places the two main piers outside the waterway, therefore eliminating any restriction from the bridge to navigation.

3 Database Development

Visual databases

The Houston Pilots use the SJCMTTC simulator extensively for training and research. Therefore, the visual databases were largely intact for this study. Changes were necessary to account for the relocation of the channel buoys and markers and any changes to the land caused by channel design modifications (e.g., Barbours Cut Entrance on the south side of the channel, the removal of the LASH terminal structures, and the replacement of the Texas Beltway 8 bridge). A typical visual scene is shown in Figure 16 and Figure 17. Visual databases are developed by inputting digital pictures taken on site as well as imagery and digital objects from other sources into a specialized piece of software that outputs flight files for the simulator.

Figure 16. Visual scene in the Bayou Section looking up-channel below the replacement Texas Beltway 8 bridge.

Figure 17. Visual scene of entering the Bayport container area.

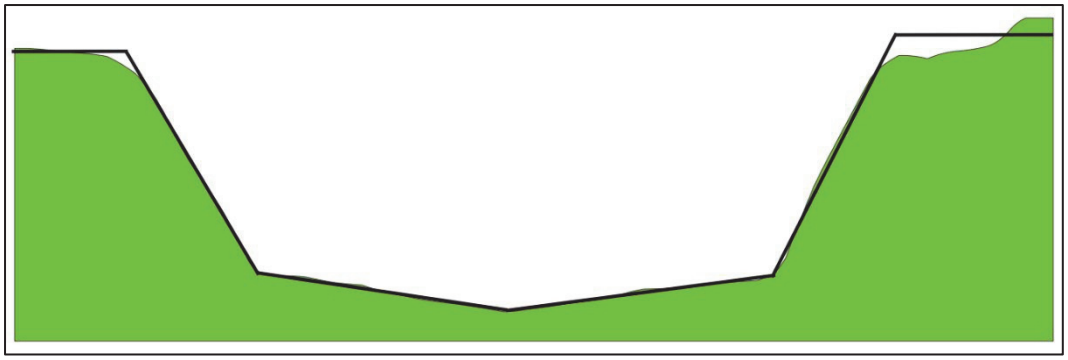
Channel databases

A basic model of the HSC navigation channels was available on the San Jacinto simulator. Widening is proposed for the HSC Bay Channels above Bolivar Roads to Morgan's Point to a width of 700 ft, which is greater than the existing 530 ft. Bend wideners for each of four bends were included for the Galveston Bay channel segment. No deepening is being considered in this area. Therefore, modifications of these model databases (visual, radar and ECDIS, channel bathymetry, and channel markers) were required to account for the channel improvements being tested. Since the adjustments in the bay channels was applied symmetrically, no changes were required for the channel centerline and leading ranges. WST assisted LOCUS LLC in this development.

Channel cross sections were constructed to be representative of typical cross sections observed in the existing ship channels and to be representative of the typical conditions the ships would experience in the future after the channel has been used and shaped by the ship traffic. An example of the type of cross section that was used in the building of the widened channels is shown in Figure 18. Barge shelves were included to

represent the bank conditions with these present in any future project expansion. This construction design was applied to all the HSC, Bayport, and Barbours Cut Channels and were compared to the existing hydrographic survey data to generate a channel shaped by the deepest of the two channel bathymetries.

Figure 18. Typical cross section of a widened channel.



Similarly, the proposed navigation channels in the HSC above the Texas 8 bridge from Boggy Bayou to Greens Bayou were developed based on the existing hydrographic survey data modified to represent the proposed improvements to the channel with a nominal channel width of 530 ft and depth of 46.5 ft MLLW.

The BSC was widened on the north side of the ship channel from a width of 400 ft to 455 ft from the entrance near the bend at channel markers 75–76. The adjustment to the northern channel toeline to account for a new terminal being constructed for LBT 5, was described in the Alternatives section of this report. The BSC 4,000 ft flare was adjusted to connect with the apex of the bend near channel marker 75 for the HSC navigation channel model databases. No deepening was included.

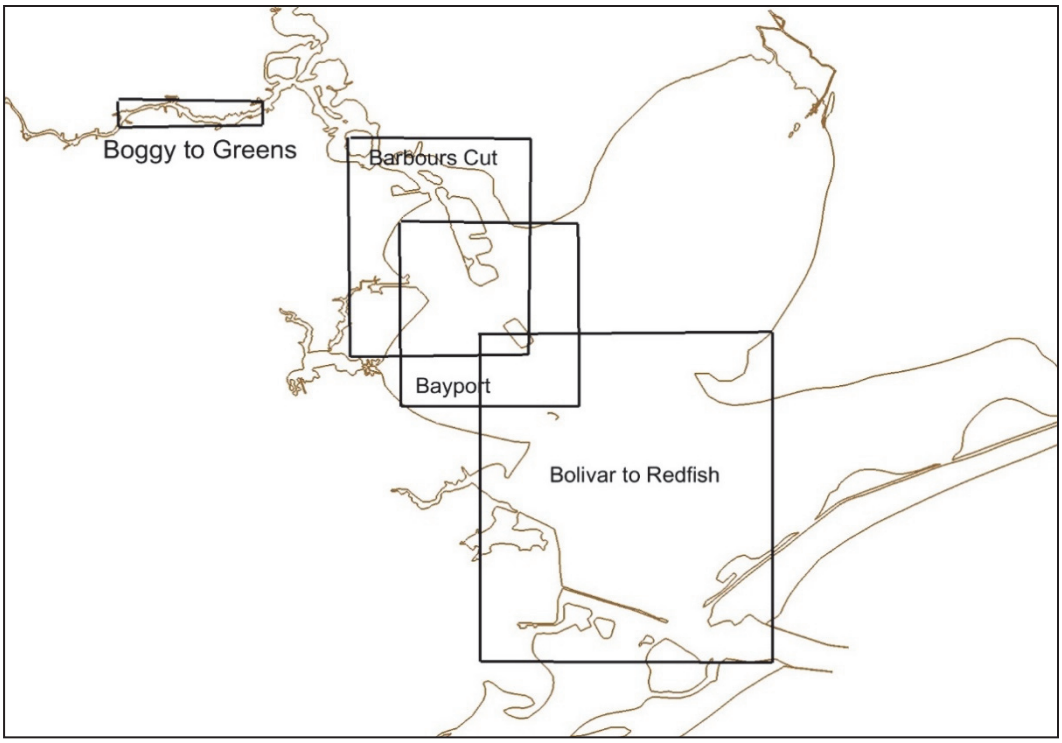
The BCC was modified to include a widening of the shipchannel from 300 ft to 455 ft with offsets from the container terminal to the north. No deepening was included. The entrance was modified as described in section 2 - Design Alternatives, Segment 3 Barbours Cut Channel on page 15 of this report.

Currents

The current databases for the HSC ECIP PED simulations were obtained from a three-dimensional hydrodynamic model of the HSC developed at the

ERDC.[1] The ERDC used the Adaptive Hydraulics modeling system for a sedimentation and salinity study of the Galveston Bay area. This model produced results for three proposed HSC bay channel widths – 650 ft, 700 ft and 750 ft. The three-dimensional current data results from the model were reduced by ERDC to depth- averaged values for use in the simulator database. These data included maximum ebb and flood currents for four specified blocked zones (Figure 19) of the navigation channel covering the several simulation test areas.

Figure 19. HSC current data extraction zones.



The current model times were chosen based on maximum magnitudes at critical locations in each of the blocks. Table 2 shows depth-averaged current (units measured in meters per second) at the chosen model times (modeled in 3 hr time steps for 2 yr) for three channel widths along with surface layer magnitudes for the 650 ft channel. The bolded values indicate the numerical model time chosen for the simulation test reaches. Values for the various model channel widths were included for comparison purposes only because the 700 ft width was the channel design tested

[1] McAlpin, Jennifer, Cassandra Ross, and Jared McKnight. In preparation. *Houston Ship Channel. Expansion Channel Improvement Project (ECIP) Numerical Modeling Report:Increased Channel Width Analysis*. ERDC/CHL Technical Report. Vicksburg, MS: US Army Engineer Research and Development Center.

during the simulation study. The model results indicate that increasing channel width does not significantly affect current magnitudes in the deep-draft navigation channel.

Table 2. Nominal current magnitudes for HSC ECIP ship simulation study.

HSC - Current Magnitude (mps)						
Model Time	Channel	HSC @ GIWW	Redfish	HSC @ Bayport Jnct	Barbours Cut	Hwy 8 Bridge
690	650ft - Surface Layer	1.32 (E)	0.57 (E)	0.23 (E)	0.53 (E)	0.26 (E)
	650ft - Depth Avg	1.13 (E)	**0.45 (E)**	**0.07 (E)**	**0.31 (E)**	0.06 (E)
	700ft - Depth Avg	0.94 (E)	**0.48 (E)**	**0.08 (E)**	**0.29 (E)**	0.06 (E)
	750ft - Depth Avg	0.95 (E)	**0.47 (E)**	**0.08 (E)**	**0.29 (E)**	0.07 (E)
948	650ft - Surface Layer	2.27 (E)	0.63 (E)	0.10 (F)	0.35 (E)	0.14 (E)
	650ft - Depth Avg	**1.94 (E)**	0.35 (E)	0.19 (F)	0.05 (F)	0.04 (E)
	700ft - Depth Avg	**1.94 (E)**	0.33 (E)	0.18 (F)	0.05 (F)	0.05 (E)
	750ft - Depth Avg	**1.95 (E)**	0.34 (E)	0.20 (F)	0.03 (F)	0.05 (E)
2397	650ft - Surface Layer	0.80 (F)	0.37 (F)	0.18 (F)	0.24 (F)	0.13 (F)
	650ft - Depth Avg	0.67 (F)	0.29 (F)	0.08 (F)	0.24 (F)	**0.05 (F)**
	700ft - Depth Avg	0.69 (F)	0.28 (F)	0.07 (F)	0.24 (F)	**0.05 (F)**
	750ft - Depth Avg	0.70 (F)	0.28 (F)	0.08 (F)	0.23 (F)	**0.05 (F)**
7335	650ft - Surface Layer	1.50 (E)	0.48 (E)	0.15 (E)	0.36 (E)	0.29 (E)
	650ft - Depth Avg	1.29 (E)	0.34 (E)	0.01 (E)	0.11 (E)	**0.02 (E)**
	700ft - Depth Avg	1.32 (E)	0.34 (E)	0.03 (E)	0.12 (E)	**0.05 (E)**
	750ft - Depth Avg	1.31 (E)	0.35 (E)	0.02 (E)	0.11 (E)	**0.03 (E)**
7389	650ft - Surface Layer	1.51 (F)	1.18 (F)	0.64 (F)	0.49 (F)	0.07 (E)
	650ft - Depth Avg	1.44 (F)	1.11 (F)	**0.62 (F)**	0.54 (F)	0.07 (F)
	700ft - Depth Avg	1.44 (F)	1.11 (F)	**0.63 (F)**	0.54 (F)	0.07 (F)
	750ft - Depth Avg	1.45 (F)	1.12 (F)	**0.66 (F)**	0.53 (F)	0.07 (F)
7926	650ft - Surface Layer	1.00 (F)	0.84 (F)	0.47 (F)	0.56 (F)	0.04 (E)
	650ft - Depth Avg	0.93 (F)	0.82 (F)	0.48 (F)	**0.52 (F)**	0.05 (F)
	700ft - Depth Avg	0.95 (F)	0.82 (F)	0.44 (F)	**0.51 (F)**	0.05 (F)
	750ft - Depth Avg	0.94 (F)	0.82 (F)	0.44 (F)	**0.49 (F)**	0.05 (F)
	Ebb		Flood			

Figures 20 through 31 show vector plots of the current cases used during the HSCECIP PED ship simulation study. Although channel current was included in the Boggy Bayou to Greens Bayou test area, a vector depiction was not included because of the minimal magnitudes in the area. For nominal reference, sample current magnitudes are noted on the figures for the test areas.

Figure 20. Barbours Cut – ebb tide – model time 690.

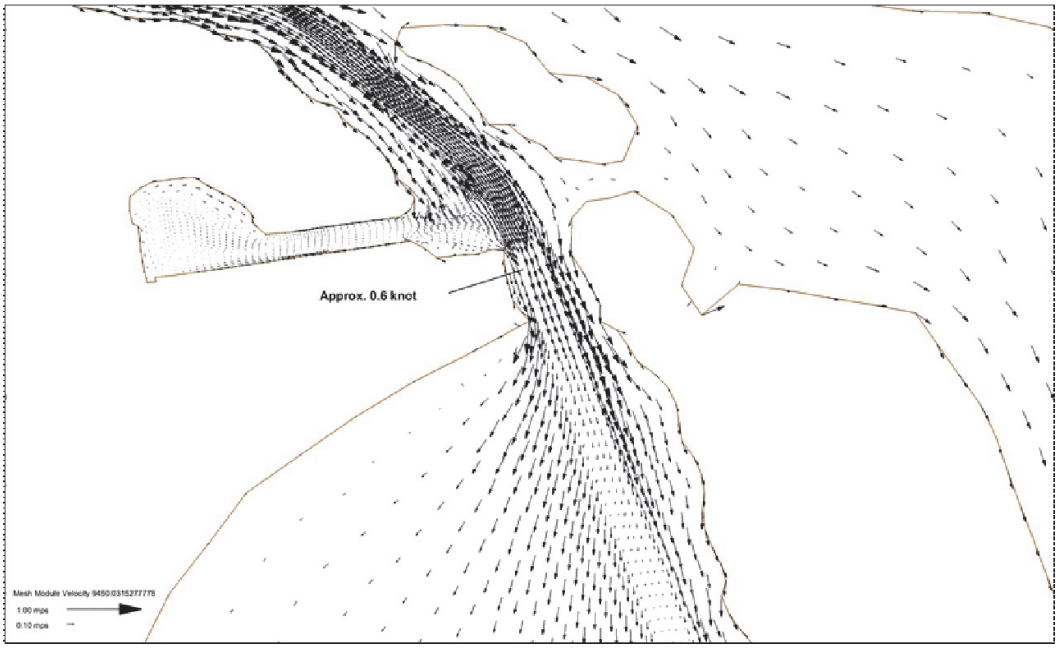


Figure 21. Barbours Cut – flood tide – model time 7926.

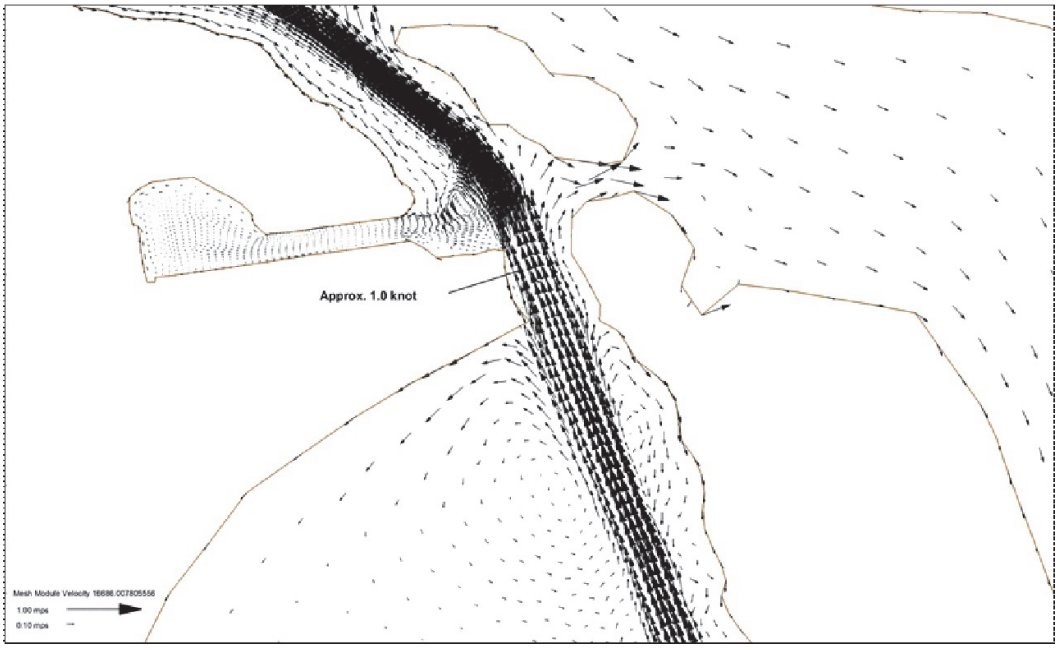


Figure 22. Bayport Junction – ebb tide – model time 690.

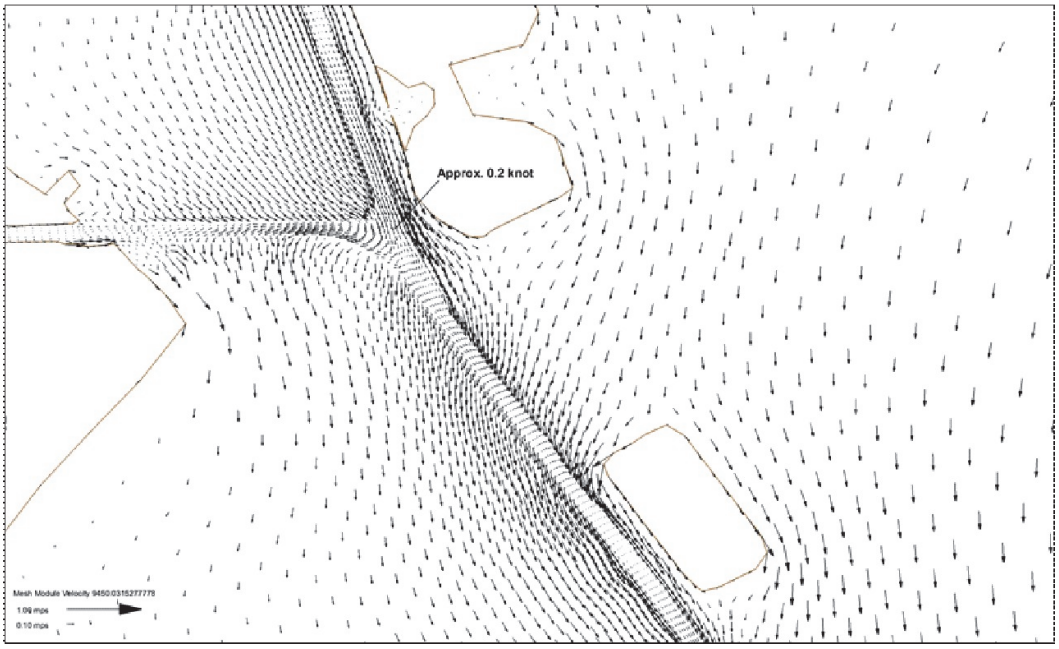


Figure 23. Bayport Junction – flood tide – model time 7926.

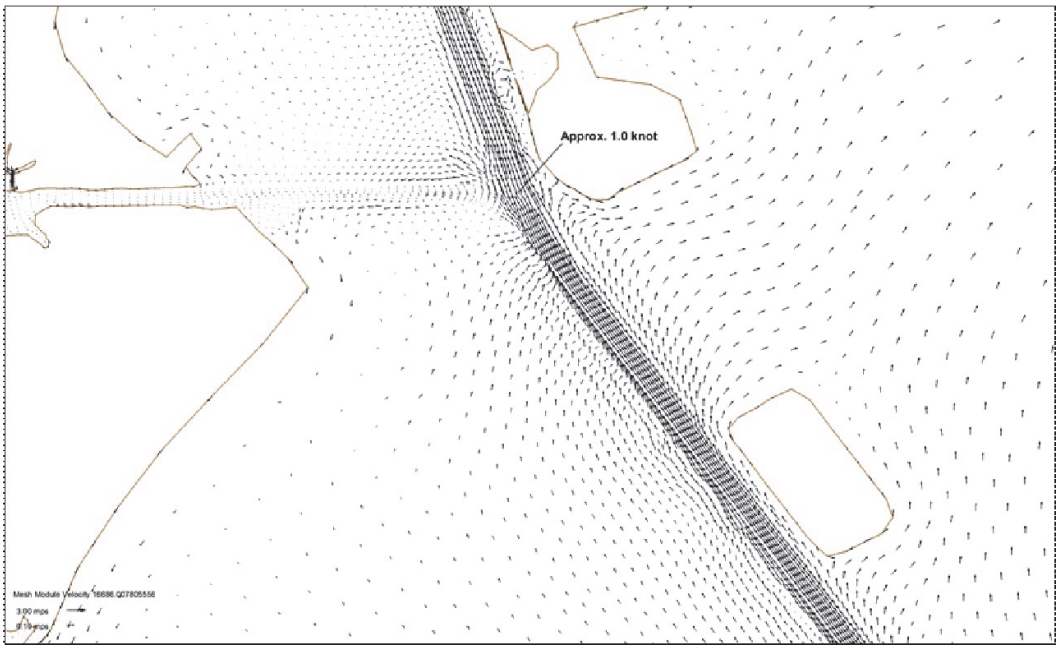


Figure 24. Bayport Channel – ebb tide – model time 690.

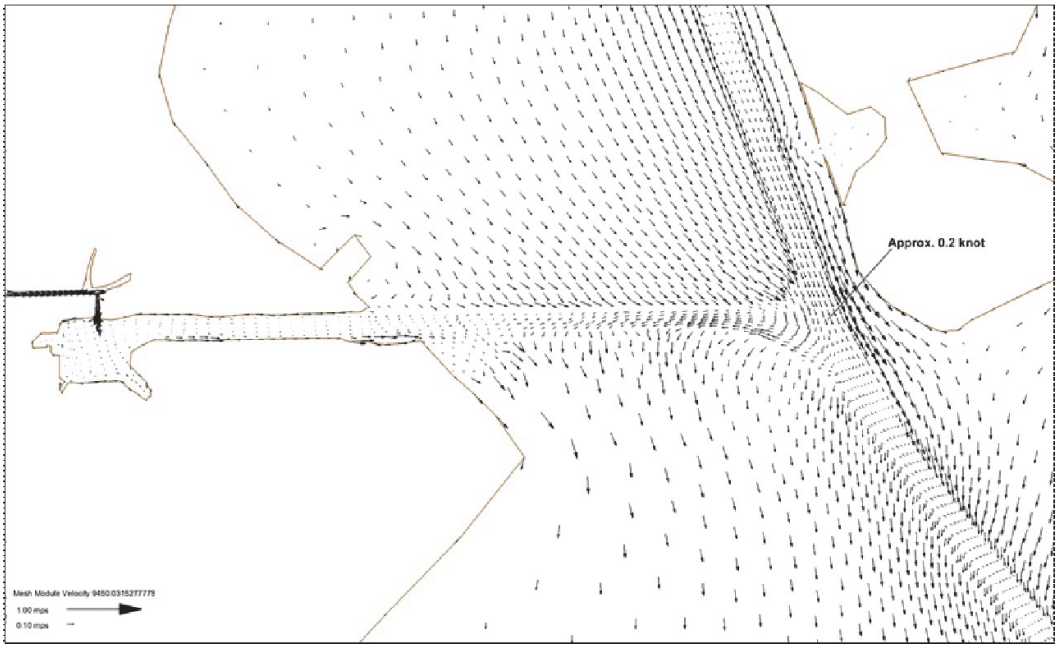


Figure 25. Bayport Channel – flood tide – model time 7926.

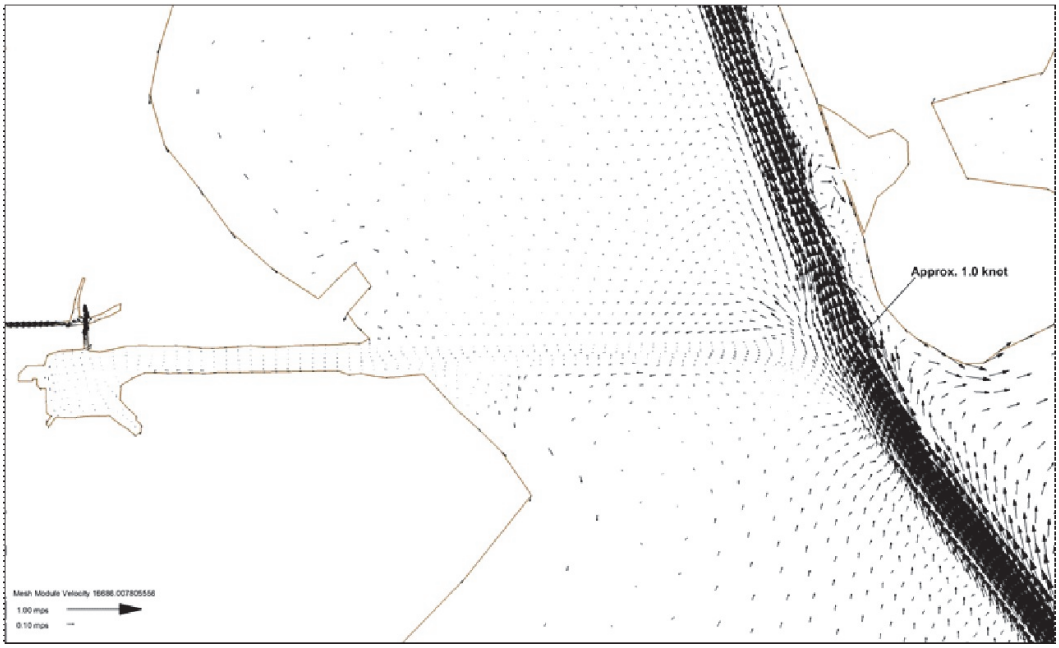


Figure 26. Redfish – ebb tide – model time 948.

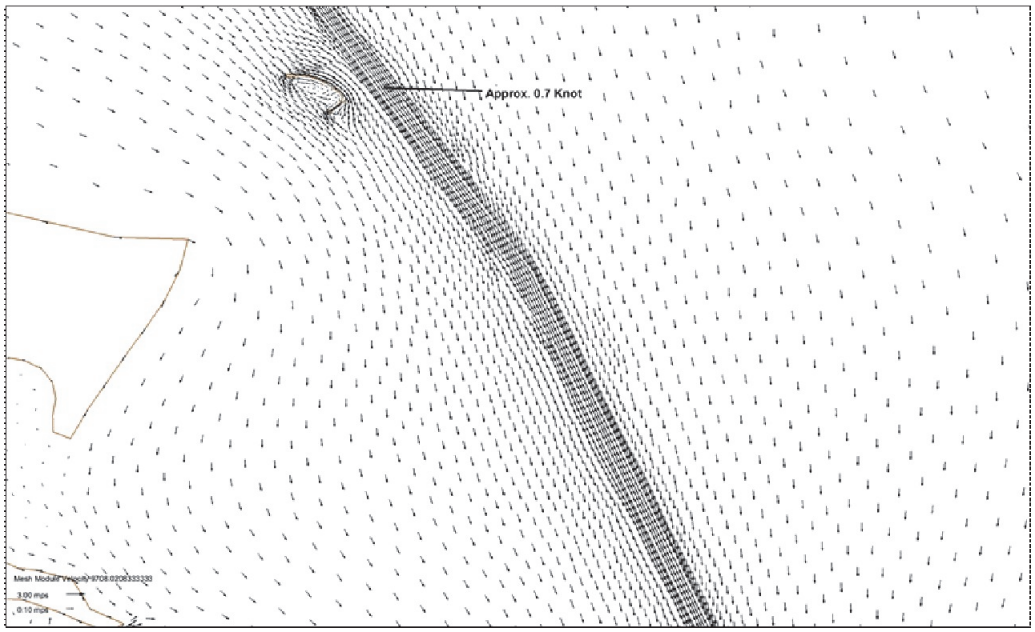


Figure 27. Redfish – flood tide – model time 7389.

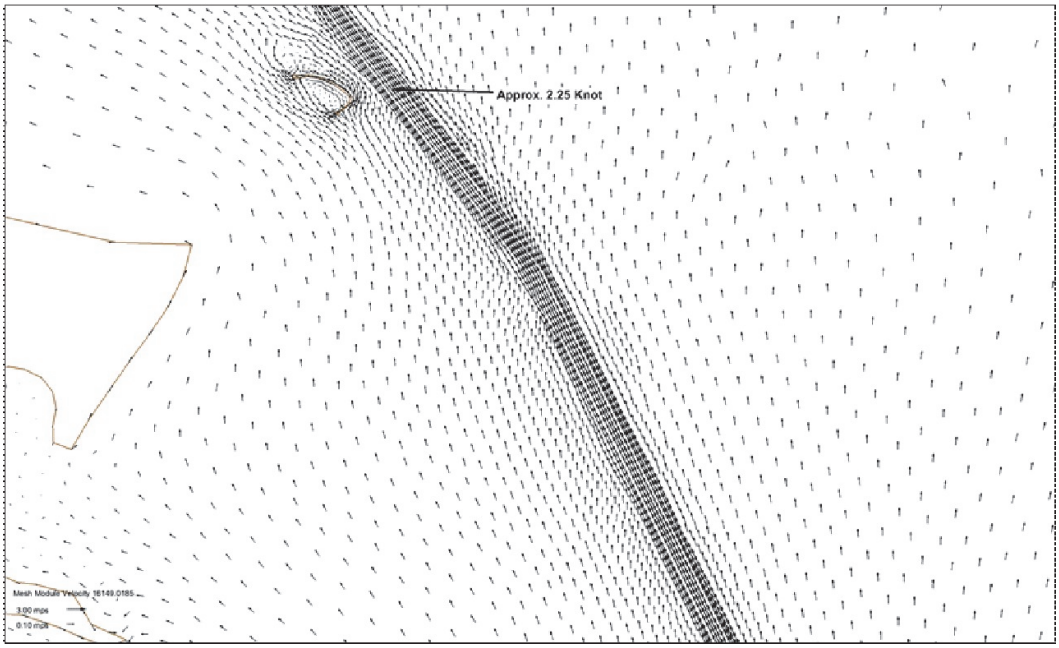


Figure 28. Bolivar Roads – ebb tide – model time 948.

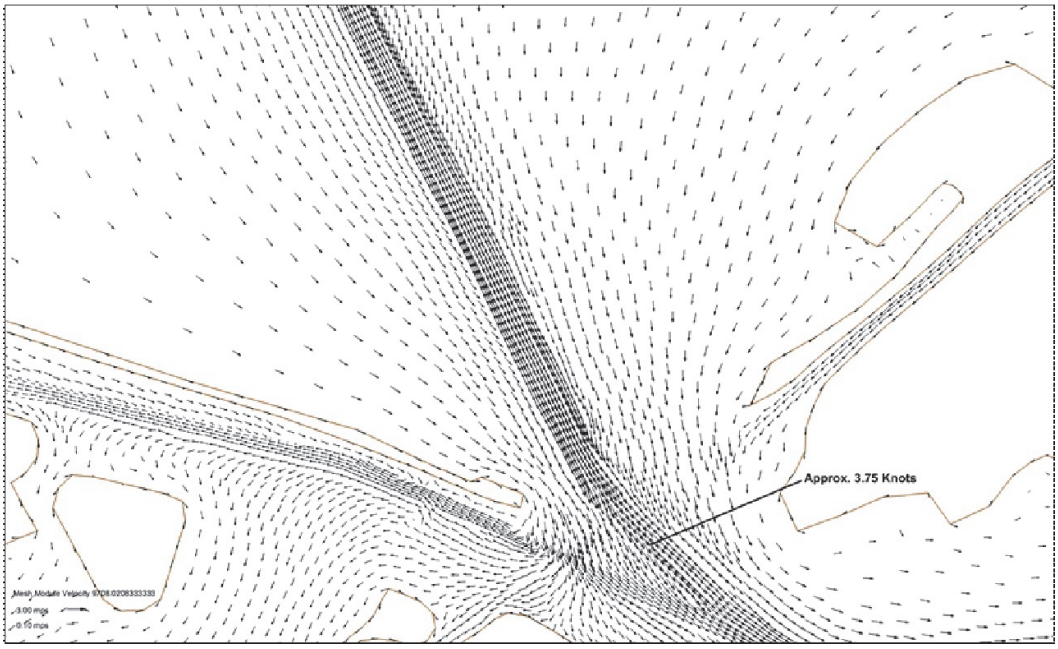
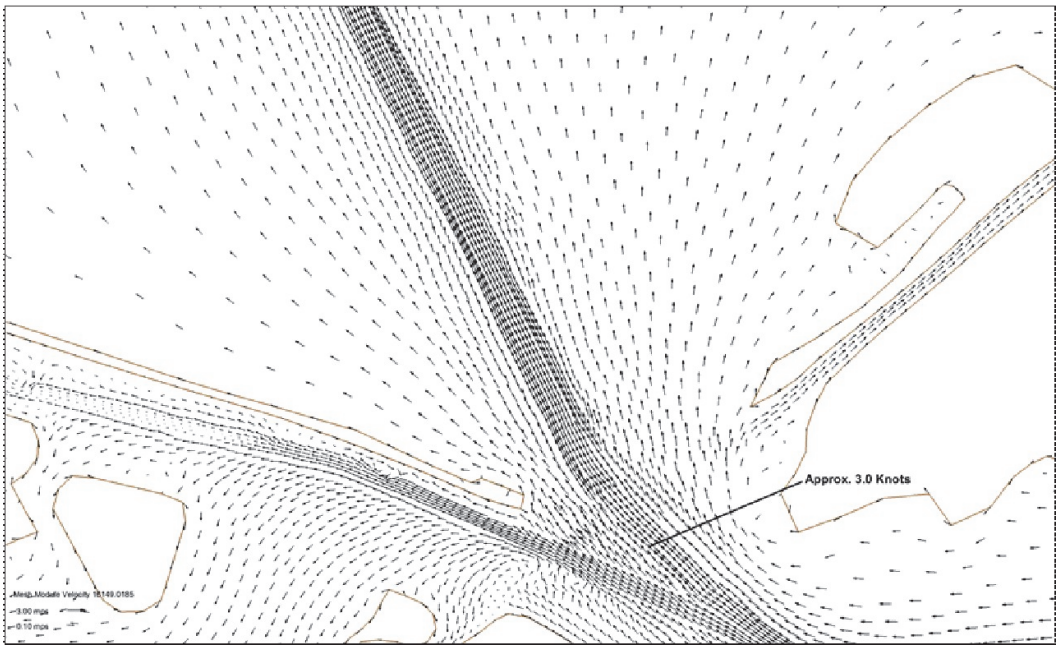


Figure 29. Bolivar Roads – flood tide – model time 7389.



Wind conditions

Wind data from National Oceanic and Atmospheric Administration (NOAA) meteorological gages at Morgan's Point and Eagle Point were analyzed for frequency distributions, direction, and magnitudes for the period of 2005 to 2011. The wind rose for these combined data is presented in Figure 30 and shows that the predominant wind direction is from the southeast (SE) and

south-southeast. During the winter, fronts from the north produce winds in the range of 15–20 kt from the north (N) to the northeast (NE). A look at the frequency of wind magnitudes shown in Figure 30 indicates that wind magnitudes above 20 kt are infrequent with less than 2% in that magnitude range. Winds in the range of 15–20 kt have a frequency of 7.5%. For the simulations, wind from the N and from the SE were used with the magnitude initially 20 kt; however, after tests with the ULCV entering the container terminals and consultation with the pilots, the wind was restricted to 15 kt for those maneuvers.

Figure 30. Wind rose for Morgans and Eagle Points for the years 2005 to 2011 (Eagle and Morgans Point NOAA PORTS 2005–2011).

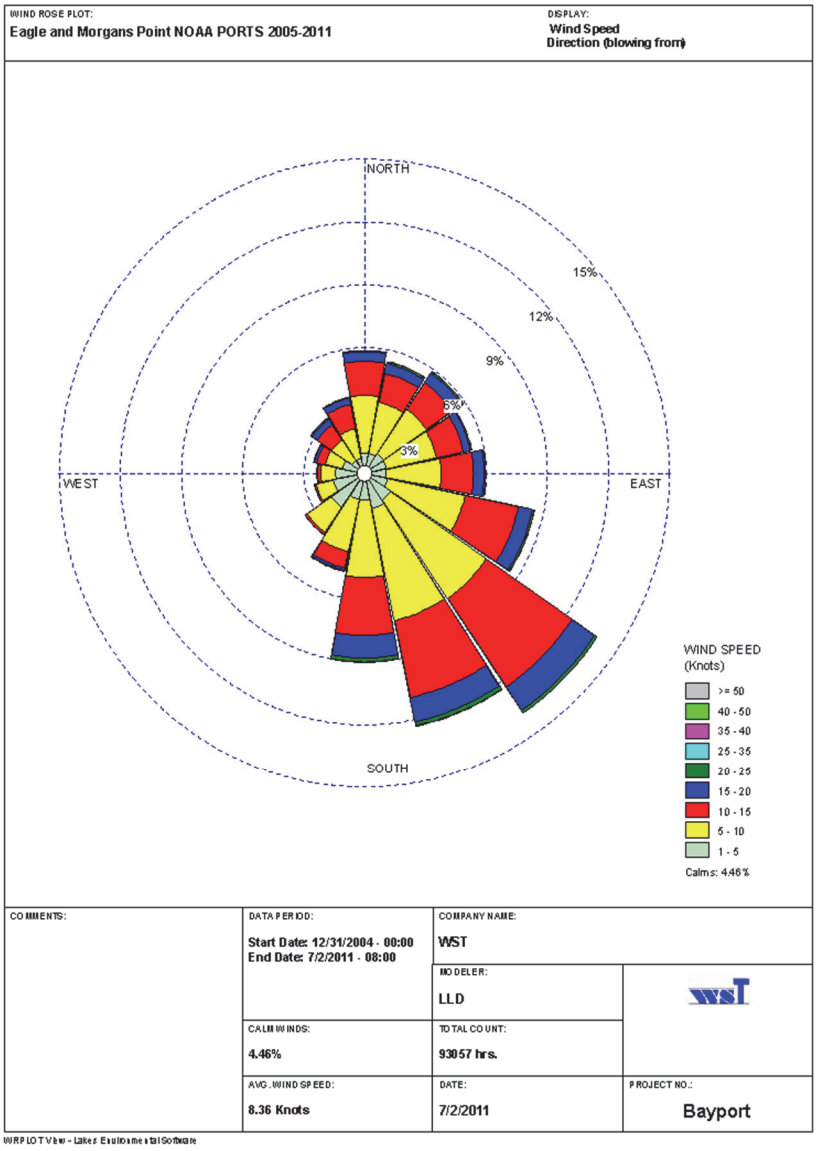
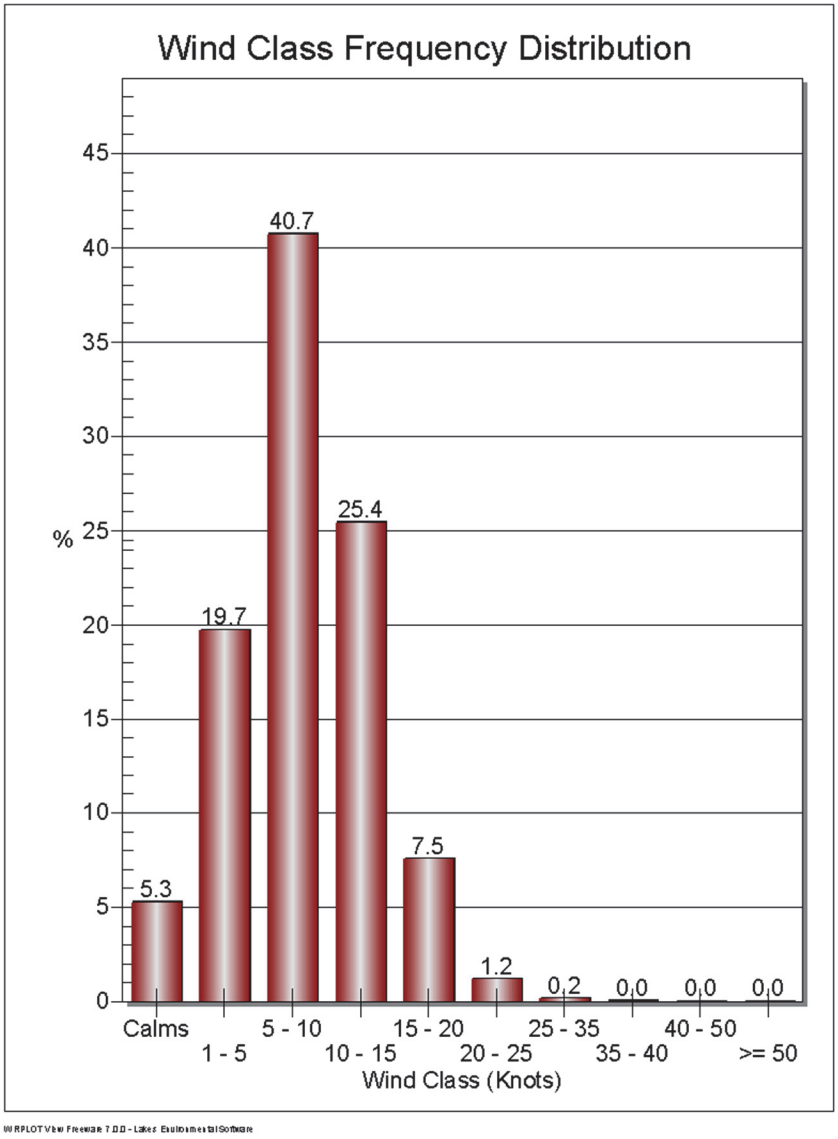


Figure 31. Wind frequency distribution from Morgans and Eagle Points for the years 2005 to 2011 (Eagle and Morgans Point NOAA PORTS 2005–2011).



While wind conditions were included in the modeling of the currents over the modeling period and special time periods were selected for inclusion in the navigation simulation modeling of each study segment, the wind conditions for each selected current period were not provided to the simulation team. Indeed, it is preferred that the most critical wind condition for the ship maneuvers should be used in the ship simulation modeling. Since the SE and SSE winds were so dominant, these wind conditions were selected as described above.

Design ships

The principal design ships used for Segments 1, 2, and 3 (Galveston Bay, Bayport, Barbours Cut) were ULCVs and Suezmax tankers. The principal design ships for Segment 4 (Bayou) were a Panamax bulk carrier, Aframax tanker, and Suezmax tanker. The ship models used for these vessels are listed in Table 3. The Pilot Cards for these model vessels are provided in Appendix G.

One ship model, the Very Large Crude Carrier (VLCC), was only used for one run, which was during atest of a ULCV outbound in the HSC meeting a VLCC inbound for Texas City in the Entrance reach. The use of a VLCC ship model in the simulations of the Bolivar Road Entrance Channel tests was a recognitionof the merging of Texas City and Houston ship traffic at the upper end of the Entrance Channel and the potential meeting situations that could occur with inbound ships to Texas City meeting outbound ships from Houston. Only one run was performed with a VLCC (which is the largest design vessel calling at Texas City and is expected to continue in the future); other testing of this situation involved meeting with an inbound Suezmax tanker.

The initial ULCV used in the validation and beginning simulations in the Galveston Bay channels was the MULCV14N model. This ULCV was adjusted according to observations and measurements of a prototype that began calling on the United States following the FS and to realistically replicate behavior expected by the Houston Pilots during meetings with the Suezmax tanker, SUEZ156R. When testing in the Bayport and BCCs, this model was found to be too responsive to the rudder and engine, and the visibility from the conning position was not restricted as fully loaded ULCV. This better-handling vessel would not represent the required type of ship handling that is needed to fully test the design of these channels. This led to the use of the ULCV model ULCV366M for the remainder of the test program (beginning with Run 34). Thus, the modeled design vessel for Bayport and Barbours Cut was a more realistic ULCV ship model than that used for the FS.

The tug model MZ7505 is a tug that has been specially developed and validated and is used extensively on this simulator. When two tugs are required for ship assistance at the container terminals, these tugs were operated interactively using the tug consoles with tug masters.

These are referred to as “live tugs.” When a third tug is required, the same tug model is used but is controlled by the simulator operator using an autopilot response to the commands input by the operator in response to the conning pilot.

Some of the ship models listed below had different versions used during the simulations because slight adjustments were required to dampen ship-to-ship and ship-to-bank interactions and to reduce observed excessive squat and trim. These adjustments were made soon after the model use was initially used, so only the dominant model version is listed.

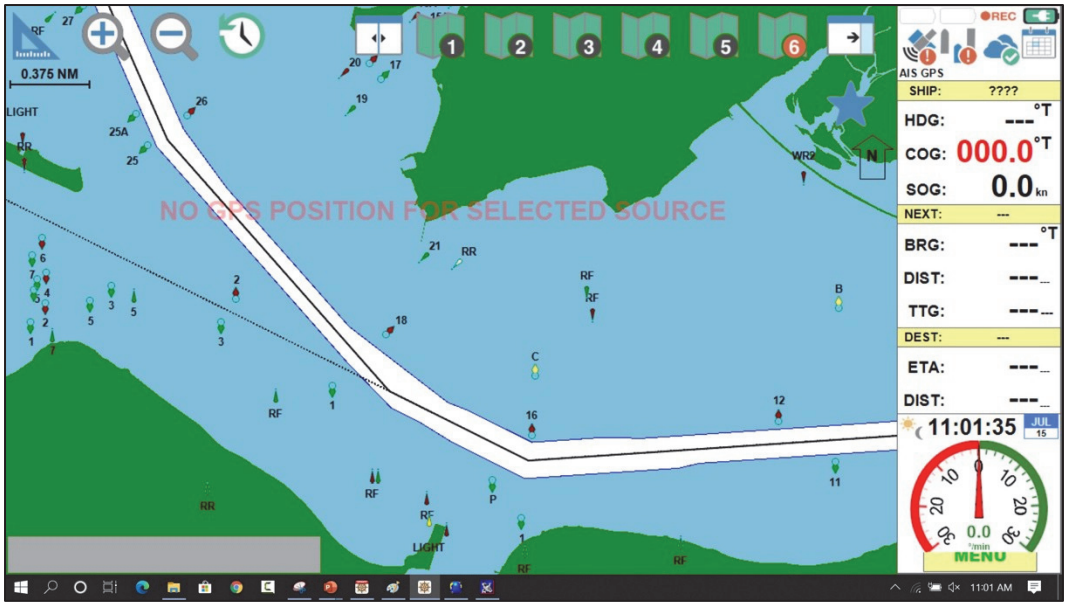
Table 3. Ship models used in simulations.

Ship Type	Model	LOA (m)	B (m)	Draft Aft (m)	Draft Fore (m)	Displacement (tonnes)
ULCV	MULCV14N	365.7	48.7	13.7	13.7	157,281
ULCV	ULCV366M	366.5	48.2	14.2	14.2	178,766
Suezmax	SUEZ156R	274	50	13.7	12.7	170,655
Aframax	MTKM107X	243.8	42	12.2	12.2	99,250
Panamax Bulker	MBULK32N	215	32	12.2	12.2	60,920
VLCC	MTK300H	332	60.96	10.97	10.97	177,669
Tug	MZ7505	30.02	11.99	5.99	5.85	733

Portable Pilot Units (PPUs)

The Houston Pilots commonly use a Portable Pilot Units (PPU) while onboard ships as they bring ships through the HSC to their destination or in their departure. The PPU displays a detailed layout of the channel and projects the own ship image as a scale image of the ship as well as all traffic vessels that are using the Automatic Identification System. The Houston Pilots provided three computers used as PPUs during these simulation tests. The pilots also arranged for *myppu.com* to work with WST and LOCUS to develop databases of the proposed project improvements with the PPUs during theship maneuvering simulation tests. A typical PPU chart for the Entrance reach with Alternative 1 is shown in Figure 32.

Figure 32. Typical PPU image showing Alternative 1 at the entrance.



Simulator description

At SJCMTTC, three Kongsberg Polaris full-mission bridge simulators can be operated with an interconnected Kongsberg Neptune Engine Room Simulation suite. These full-mission bridge simulators feature 65 hydro-dynamically accurate vessels that can be operated in 10 regions across the globe. With a selection of vessels, including patrol boats, tugboats, push boats, supply vessels, tankers, containers ships, cruise ships, and more, these bridges can be molded to fit most all needs. Kongsberg's state-of-art software allows for all three bridges to be run in the same exercise, or separately, depending on the study requirements. A typical bridge configuration is shown in Figure 33 and Figure 34.

Figure 33. Typical tug bridge configuration.

Figure 34. Typical ship bridge configuration.

4 Validation

During the period of May 11 to 14, 2020, WST and LOCUS met with the Houston Pilots and the staff of SJCMTTC to load the databases that had been prepared for these simulations, check for accuracy, correct errors identified, and build run templates. The databases validated were the Alternative 1 design. The primary effort was to

- identify missing or misplaced visual images in the databases
- locate and correct errors in defining the channel depths that would result in potential groundings during simulation runs
- ensure that the ship model behavior in the modeled navigation channels was realistic and correct the model as necessary
- confirm that the PPU routes were defined correctly.

The Houston Pilots maneuvered the ship models in each of the test reaches several times and conducted meetings to confirm that the models behaved as expected. Entry and exits from the BSC and BCC were performed and confirmed. Since the proposed Bayou reach channel alignment had been used previously for testing arrivals and departures of the design ships to and from the terminals, only a limited amount of checkout was required to ensure that the modified channel design was acceptable and had no high spots in the channel. Since the validation and run setups were completed a day earlier than scheduled, the simulation tests were initiated on May 15, 2020.

5 Results

This section presents results for the production run simulations. Results are presented in the form of track plots, and run information is in the form of plates with pilot comments after each run (Appendices C–F). Several pilot comments were summarized or paraphrased in each section, but the entirety of pilot comments can be found following each track plot. Track plots show the vessel paths in various colors to differentiate transit direction. Each plate features a label that identifies the channel, run number, tide condition, and wind condition used for that simulation.

Ship simulation results for channel design tend to be somewhat subjective. The evaluation of navigation simulation results typically consists of track plots, evaluation questionnaires or interviews, and observations that are recorded after each simulation exercise run. Simulator studies rely heavily on the experience of the mariners.

Therefore, the introduction of human judgement and execution into the study makes defining exact criteria for technical evaluation difficult (Martin and Webb 2019).

With respect to exact data collected during a simulation exercise, the ship's position and heading are post-processed into track plots that are input into computer-aided drawing software. This allows for the examination of individual and composite runs and querying of distances between ships and important impedances to free navigation such as the channel edge, other ships, and any other objects present in the environment. Compared to a full matrix of statistically reliable experimental design, ship simulation studies conduct a somewhat limited number of exercises. This is due to time and budget constraints as well as the availability of mariners to con the simulated vessels. That is why simulation conditions are typically limited to more severe conditions. These scenarios include combinations of wind and current under which the port would expect to be able to operate. This is the standard of practice for maximum conservative evaluation and how all the scenarios in this study were developed for the combinations of wind speed and direction, current, tug usage, and docked ships. When subject matter experts undertake the process of evaluating results, it is imperative to recognize that the data being evaluated are based on a limited number of exercises. These exercises are conducted under post-project conditions. This involves deeper-drafted ships than

presently call along the HSC and meeting ships larger than the present restriction for two-way traffic. Pilots are also operating with a visual scene that is a two-dimensional representation of the three-dimensional world, which can affect results. All of these variables come into play in navigation simulation studies and necessitate that simulation reports are provided in draft form for review by all the project stakeholders.

Segment 1 – Galveston Bay section

Bay Entrance (Buoys 16–18) and Bolivar Roads (Buoys 25–26)

The Bolivar Roads and Bay Entrance contain two main bend modifications: the entrance area bend (modifications near Buoys 16 and 18) and Bolivar Roads bend (modifications near Buoys 25–26). One alternative (Alternative 1) was originally suggested for this entire area; however, through testing, some additional alternatives were suggested on the bend at the entrance area. The only difference between Alternatives 1, 3, and 4 is the entrance bend (Figure 35). Track plots in Appendix C show the entire Bolivar Roads and entrance area in one plot.

Figure 35. Bolivar Roads/Entrance alternatives.

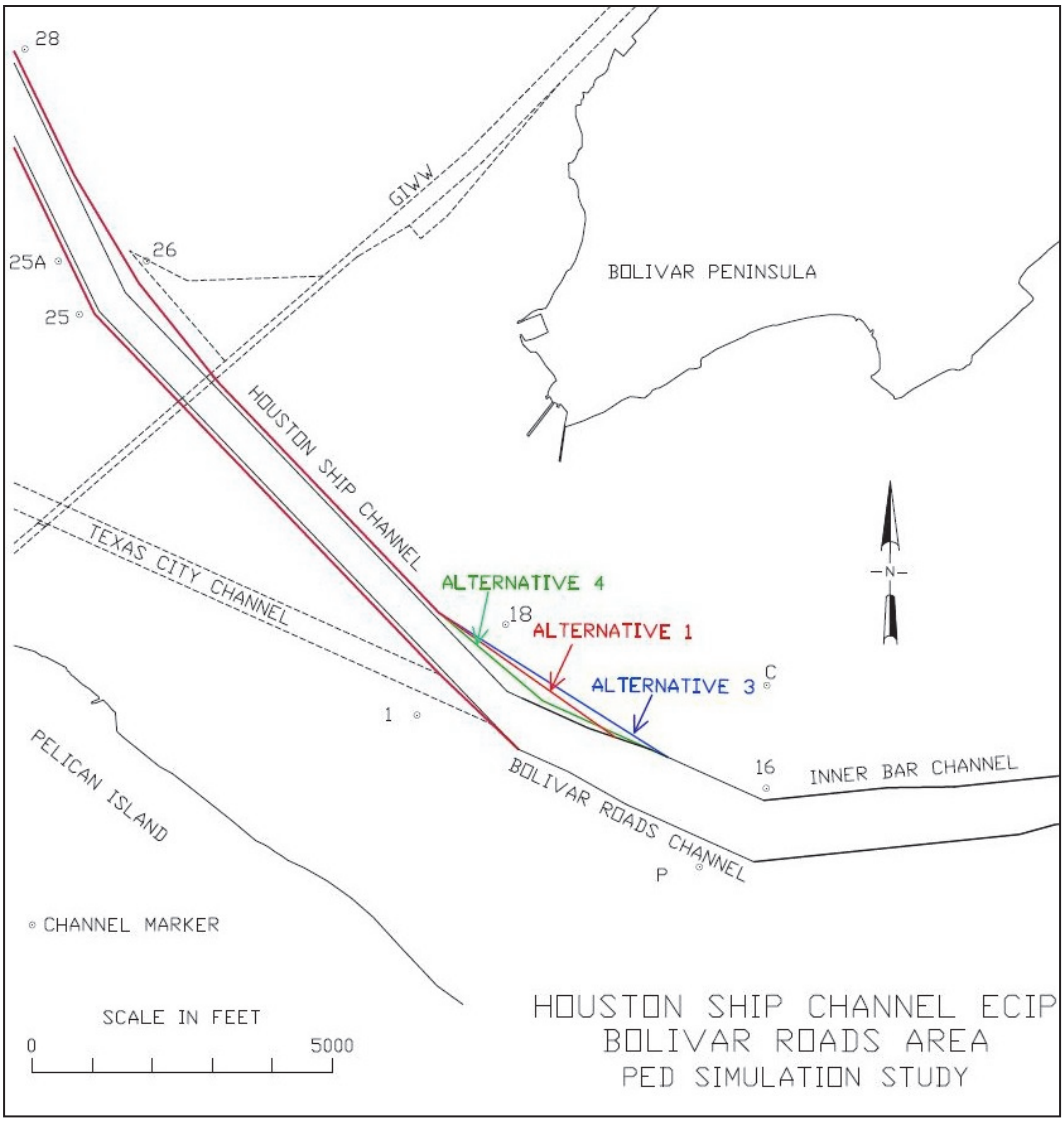


Table 4 lists the different simulations completed in the Bolivar Roads/Entrance area. The entrance area features an intersection of the HSC, the TCC, and the Entrance Channel. While the TCC was not part of this project, the modification to the entrance bend would affect traffic using the TCC. Some simulations were completed that included traffic that headed to the TCC after meeting an outbound vessel. The simulations that included TCC traffic are identified in Table 4 under the run notes heading. Plates 1–7 show Alternative 1 simulations, Plates 8–17 show Alternative 3 simulations, and Plates 18–27 show Alternative 4 simulations.

Four vessels were simulated in this area: ULCV366M, SUEZ156R/N, MULCV14N, and MTK300H.

Table 4. Test matrix scenarios for Bolivar Roads/Entrance.

Plate #	Channel	Tide	Wind	Main Vessel-Direction	First Vessel Meeting	Second Vessel Meeting	Run Notes	Run #
1	EB-Alt1	Flood	0	MULCV14N - Inbound	SUEZ156N	SUEZ156N		1
2	EB-Alt1	Flood	SE-20 kt	MULCV14N - Inbound	MULCV14N	SUEZ156R		2
3	EB-Alt1	Flood	SE-20 kt	ULCV366M-Inbound	ULCV366M	SUEZ156R		115
4	EB-Alt1	Flood	SE-20 kt	ULCV366M-Outbound	SUEZ156R		Inbound vessel to TCC	117
5	EB-Alt1	Ebb	N-20 kt	ULCV366M-Inbound	ULCV366M	SUEZ156R		116
6	EB-Alt1	Ebb	N-20 kt	MTK300H - Inbound	MULCV14N		Inbound vessel to TCC	55
7	EB-Alt1	Ebb	N-20 kt	ULCV366M-Outbound	SUEZ156N		Inbound vessel to TCC	118
8	EB-Alt3	Flood	SE-20 kt	ULCV366M-Inbound	MULCV14N	SUEZ156R		60
9	EB-Alt3	Flood	SE-20 kt	ULCV366M-Inbound	MULCV14N	SUEZ156R		61
10	EB-Alt3	Flood	SE-20 kt	ULCV366M-Inbound	ULCV366M			122
11	EB-Alt3	Flood	SE-20 kt	ULCV366M-Outbound	SUEZ156R		Inbound vessel to TCC	114
12	EB-Alt3	Ebb	N-20 kt	ULCV366M-Inbound	MULCV14N	SUEZ156R		62
13	EB-Alt3	Ebb	N-20 kt	ULCV366M-Inbound	MULCV14N	SUEZ156R		63
14	EB-Alt3	Ebb	N-20 kt	ULCV366M-Inbound	ULCV366M	SUEZ156R		64
15	EB-Alt3	Ebb	N-20 kt	ULCV366M-Inbound	ULCV366M			121
16	EB-Alt3	Ebb	N-20 kt	ULCV366M-Outbound	SUEZ156R		Inbound vessel to TCC	113
17	EB-Alt3	Ebb	N-20 kt	ULCV366M-Outbound	SUEZ156R		Inbound vessel to TCC	123
18	EB-Alt4	Flood	SE-20 kt	ULCV366M-Inbound	ULCV366M			108

Plate #	Channel	Tide	Wind	Main Vessel-Direction	First Vessel Meeting	Second Vessel Meeting	Run Notes	Run #
19	EB-Alt4	Flood	SE-20 kt	ULCV366M-Inbound	ULCV366M			119
20	EB-Alt4*	Ebb	N-20 kt	MULCV14N - Inbound	MULCV14N	SUEZ156N	Wrong channel used(Alt 2)	53
21	EB-Alt4†	Ebb	N-20 kt	SUEZ156R-Inbound	MULCV14N		Wrong channel used Inbound vessel to TCC	54
22	EB-Alt4	Ebb	N-20 kt	ULCV366M-Inbound	ULCV366M			109
23	EB-Alt4	Ebb	N-20 kt	ULCV366M-Inbound	ULCV366M			110
24	EB-Alt4	Ebb	N-20 kt	ULCV366M-Inbound	ULCV366M			120
25	EB-Alt4	Ebb	N-20 kt	ULCV366M-Outbound	SUEZ156R		Inbound vessel to TCC	111
26	EB-Alt4	Ebb	N-20 kt	ULCV366M-Outbound	SUEZ156R		Inbound vessel to TCC	112
27	EB-Alt4	Ebb	N-20 kt	ULCV366M-Outbound	SUEZ156R		Inbound vessel to TCC	124

* The wrong channel was used for this simulation, but it was a minor channel difference with the green side straightened between the Entrance Channel and the Texas City Channel. This simulation is grouped as Alternative 4.

† The wrong channel (Alt 2) was used for this simulation, but it was a minor channel difference with the green side straightened between the Entrance Channel and the Texas City Channel. This simulation is grouped as Alternative 4.

Entrance Area – Alternative 1

The pilots initially expressed concern about the Alternative 1 channel layout due to multiple sequential turns: one within two ship lengths and the next within three ship lengths. These multiple turns would be difficult to mark for navigation. A similar situation previously occurred at the BSC Flare that resulted in a project deficiency. Figure 36 shows a composite of all the tracks completed that used Alternative 1. The majority of simulations featured vessels that stayed within the channel confines; however, Plates 1, 4, and 5, contain vessels that exceeded the channel limits. Further discussions about all Alternative 1 plates can be found in the following section.

Figure 36. Composite track plots for Entrance Bend Alternative 1.

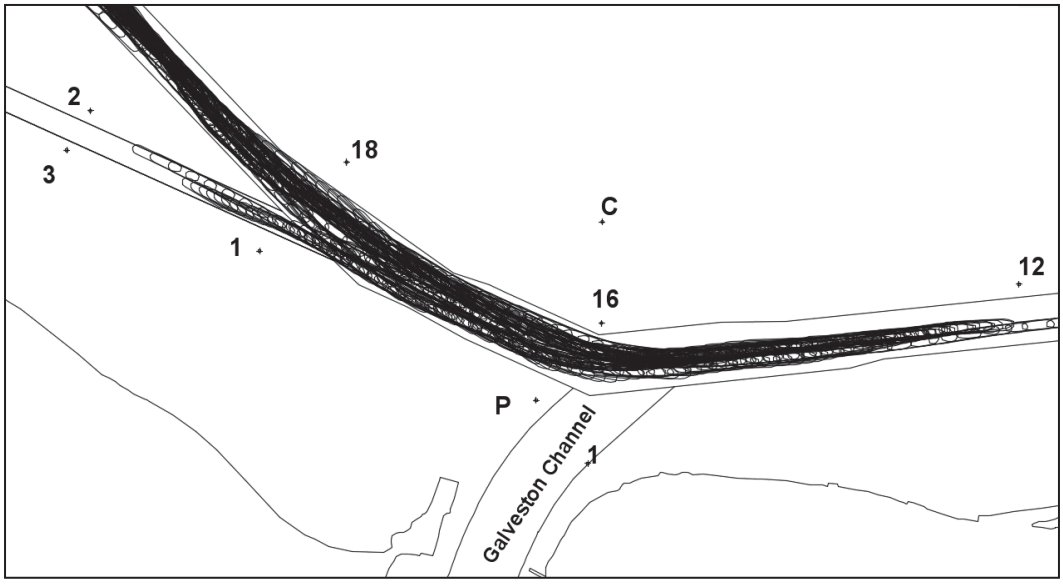


Plate 1 – Plate 7 show all the transits that were completed using Alternative 1. All simulations completed using this alternative were rated as "easy" (approximately 67% of the time) or "normal"(approximately 33% of the time) by the pilots. Also, each recovery and meeting were confirmed as controllable, and all runs were rated as safe to do in real life by the pilots for all Alternative 1 simulations.

Plate 1 shows a MULCV14N meeting two outbound SUEZ156Ns. A flood tide was simulated without wind to allow pilots to get accustomed to the simulator as it was the first simulation completed during testing. In Plate 1, the inbound vessel skimmed against the side of the channel near Buoy 18 (where the first meeting occurred) and slightly exceeded the channel past Buoy 26. During the first meeting, the vessels were approximately 190 ft apart. The second meeting occurred at Buoy 25A with the vessels maintaining 290 ft apart.

A flood tide with 20 kt wind from the southeast was simulated in the tracks shown in Plate 2 – Plate 4. In Plate 2, an inbound MULCV14N met a MULCV14N and SUEZ156N. The first meeting occurred in the entrance bend across from the TCC while the second meeting occurred close to the Gulf Intracoastal Waterway (GIWW) and HSC intersection. The vessels maintained a distance of greater than 220 ft apart during both meetings. One of the pilots commented on the desire to redesign the bend due to the multiple turns.

In Plate 3, an inbound ULCV366M met an ULCV366M just above the entrance bend near Buoy 18 while maintaining a distance of approximately 210 ft between vessels. The inbound vessel then met a SUEZ156R near Buoy 25A. During the second meeting, the outbound ULCV366M got within 68 ft of the channel but maintained a distance of approximately 300 ft from the inbound vessel. The inbound pilot commented that the flood current was more adverse for him as it required more rudder, but he still felt there was adequate room in the channel for a meet.

A SUEZ156R was simulated going into the TCC after meeting an outbound ULCV366M in the tracks shown in Plate 4. The meeting occurred as the SUEZ156R entered the TCC with approximately 450 ft between the vessels. The SUEZ156R exceeded the TCC after the meeting but stayed within the Alternative 1 channel limits.

Plate 5 – Plate 7 show tracks of simulations that were completed with an ebb tide and 20 kt wind from the north. In Plate 5, an inbound ULCV366M met a ULCV366M and SUEZ156R. The first meeting occurred midway between Buoys 16 and 18 while the second meeting occurred just northwest of the GIWW and HSC intersection. During the first meeting, the outbound ULCV366M got within 35 ft of the channel but maintained a distance of approximately 390 ft from the inbound vessel. The vessels maintained a distance of approximately 230 ft apart during the second meeting; however, the outbound SUEZ156R exceeded the Alternative 1 channel limits during the meeting. The pilot operating the SUEZ156R commented that he went outside of the Alternative 1 channel limits due to the inbound vessel being farther over than ideal, but he acknowledged that there was enough deep water that he did not feel forced out of the channel.

The tracks in Plate 6 show a MTK300H going into the TCC aftermeeting an outbound MULCV14N. The MTK300H vessel used three instructor tugs during its transit. The meeting occurred near Buoy 16 with approximately 310 ft between the starboard tug and outbound vessel. The pilot controlling the outbound vessel commented that although he did not like the shape of the channel, he felt there was plenty of room to meet a vessel in this area.

A SUEZ156N was simulated going into the TCC after meeting an outbound ULCV366M in the tracks shown in Plate 7. The meeting occurred midway between Buoy 16 and Buoy 18. During the meeting, the inbound vessel got

within 73 ft of the channel but maintained a distance of approximately 390 ft from the outbound vessel.

Entrance Area – Alternative 3

Figure 37 shows a composite of all the tracks completed using Alternative 3. The majority of simulations featured vessels that stayed within the channel confines; however, Plates 11 and 14 contain vessels that exceeded the channel limits. Further discussions about all Alternative 3 plates can be found in the following section.

Figure 37. Composite track plots for Entrance Bend Alternative 3.

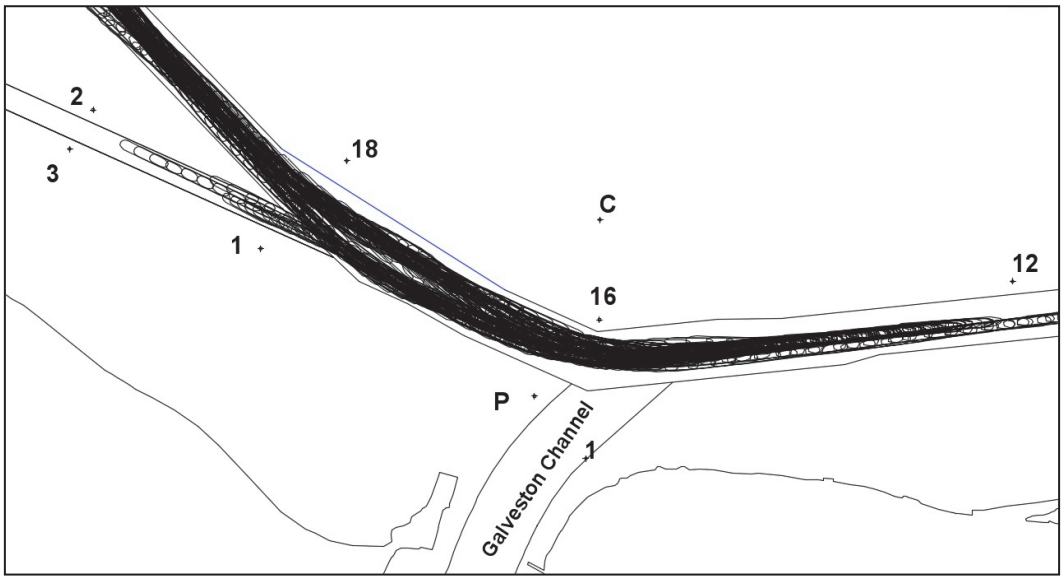


Plate 8 – Plate 17 show all the transits that were completed using Alternative 3. All but one Alternative 3 simulation (shown in Plate 8) were rated as either "easy" (approximately 8% of the time) or "normal" (approximately 88% of the time) by the pilots.Each recovery and meeting were confirmed as controllable, and all runs were rated as safe to do in real life by the pilots for all Alternative 3 simulations. One additional simulation was completed that is not shown in these results or in Appendix C. This additional simulation resulted in a grounding due to excessive squat. This grounding occurred near the beginning of the simulation, so data were not saved.

The environmental conditions simulated in the tracks shown in Plate 8 – Plate 11 was a flood tide with 20 kt wind from the southeast. In Plate 8 and Plate 9, an inbound ULCV366M met aMULCV14N and SUEZ156R. In

Plate 8, the first meeting occurred just south of the TCC with the vessels getting within 110 ft of each other. During the second meeting, which occurred near Buoy 25, the vessels maintained approximately 190 ft apart. In Plate 9, the first meeting occurred just south of the TCC while the second meeting occurred near Buoy 26. The vessels maintained a distance of greater than 250 ft apart during both meetings.

The tracks in Plate 10 show a ULCV366M meeting an ULCV366M near the TCC. During the meeting, the outbound vessel got within 110 ft of the channel but maintained a distance of approximately 430 ft from the inbound vessel. Both pilots commented about preferring this alternative over others tested.

The tracks in Plate 11 show a SUEZ156R going into the TCC after meeting an outbound ULCV366M. The meeting occurred near the TCC entrance with approximately 410 ft between the vessels.The SUEZ156R exceeded the TCC after the meeting but stayed within the Alternative 3 channel limits. Both pilots commented about preferring this alternative over Alternative 4.

Plate 12 – Plate 17 show tracks of simulations that were completed with an ebb tide and 20 kt wind from the north. In Plate 12 and Plate 13, an inbound ULCV366M met a MULCV14Nand SUEZ156R. In Plate 12, the first meeting occurred near Buoy16 with the vessels maintaining a distance of 270 ft. During the second meeting, which occurred just northwest of the entrance bend, the inbound vessel got within 78 ft of the channel but maintained a distance of approximately 230 ft from the outbound vessel. In Plate 13, the first meeting occurred just southof the TCC while the second meeting occurred near Buoy 25. The vessels maintained a distance of more than 250 ft during both meetings.

In Plate 14, an inbound ULCV366M met a ULCV366M and SUEZ156R. The first meeting occurred southeast of the entrance to TCC while the second meeting occurred midway between Buoys 18 and 26. Following the second meeting, the inbound vessel slightly exceeded the Alternative 3 channel limits. The vessels maintained a distance of more than 300 ft during both meetings. The inbound pilot commented that the run was manageable.

The tracks in Plate 15 show a ULCV366M meeting an ULCV366M near the TCC entrance. During this meeting, the inbound vessel utilized the added area from Alternative 3, and vessels were approximately 540 ft apart during the meeting. The outbound pilot commented on preferring this alternative to the other alternatives tested due to the added space on the red side ofthe channel.

In Plate 16 and Plate 17, tracks show a SUEZ156R going into the TCC after meeting an outbound ULCV366M. The meeting in both plates occurred midway between Buoys 16 and 18 and both recorded a distance of approximately 300 ft or more between vessels. Both pilot comments following the simulation shown in Plate 16 expressed preference for this alternative compared to others tested.

Entrance Area – Alternative 4

Figure 38 shows a composite of all the tracks completed using Alternative 4. The majority of simulations featured vessels that stayed within the channel confines; however, Plate 20 contains avessel that exceeded the channel limits. While the runs were mostly successful, the pilots expressed concerns with the ability to navigate it in real time and without a PPU. By marking the channel with multiple markers, the line of sight would be disrupted, and navigation could be difficult. Further discussions about all Alternative 4 plates can be found in the following section.

Figure 38. Composite track plots for Entrance Bend Alternative 4.

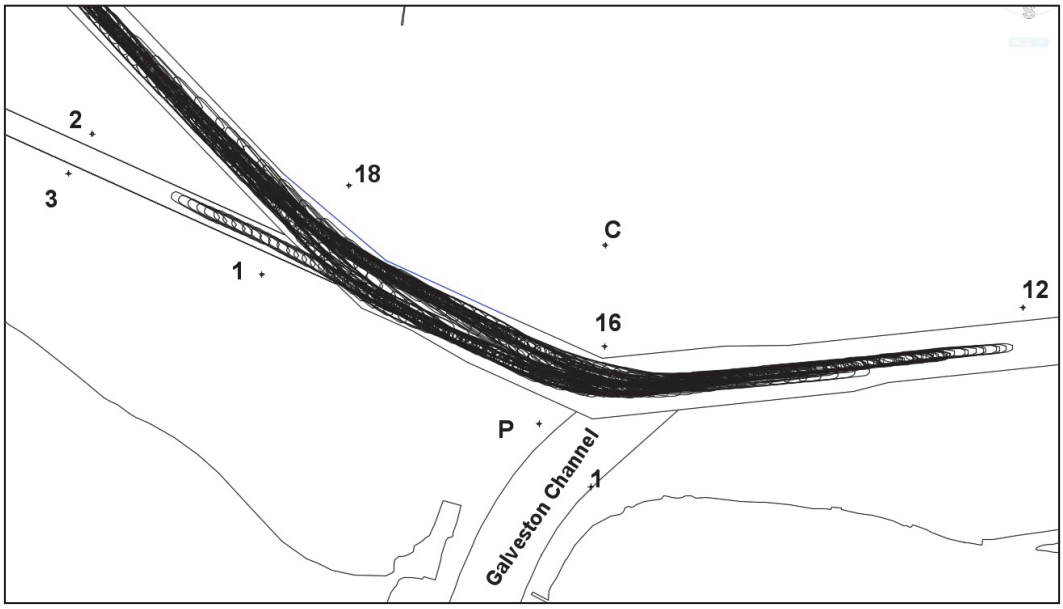


Plate 18 – Plate 27 show all the transits that were completed using Alternative 4. All simulations completed using this alternative were rated as "normal" by the pilots expect for one simulation (shown in Plate 27) that was rated as "easy." Each recovery and meeting were confirmed as controllable, and all runs were rated as safe to do in real life by the pilots for all Alternative 4 simulations.

The environmental conditions simulated in the tracks shown in Plate 18 and Plate 19 are a flood tide with 20 kt wind from the southeast. Both plates show tracks of an ULCV366M meeting a ULCV366M. The meeting in Plate 18 occurred near the entrance of the TCC with vessels 250 ft apart. The meeting in Plate 19 occurred southeast of the entrance of the TCC and the vessels maintained a distance of approximately 280 ft apart. In pilot comments about Plate 19, both pilots expressed an Alternative 1 preference over this alternative because this layout required more rudder use and has less space to maneuver.

Plate 20 – Plate 27 show tracks of simulations that were completed with an ebb tide and 20 kt wind from the N. The only difference between Alternative 2 and Alternative 4 is a small modification on the green side of the channel near the TCC. After discussions, it was determined that Alternative 2 would not fit under the guidelines of this project, so it was dropped, and Alternative 4 was developed instead. Alternative 2 was accidentally loaded in both simulations shown in Plate 20 and Plate 21. Since Alternative 2 was removed from testing, both of these simulations are shown with the Alternative 4 channel and grouped with these results. In Plate 20, an inbound MULCV14N met a MULCV14N and SUEZ156N. The first meeting occurred midway between Buoy 16 and Buoy 18 while the second meeting occurred near the HSC and GIWW intersection. During the first and second meetings, vessels maintained a distance of approximately 390 ft and 280 ft apart, respectively. The outbound SUEZ156N slightly exceeded the channel during the meeting and its recovery. The pilot on the SUEZ156N commented that although he went outside of the channel, it was due to the pilot getting accustomed to the vessel and not because the scenario required it. The tracks in Plate 21 show a SUEZ156R going into the TCC after meeting an outbound MULCV14N. The meeting occurred southeast of the TCC entrance with approximately 250 ft between the vessels.

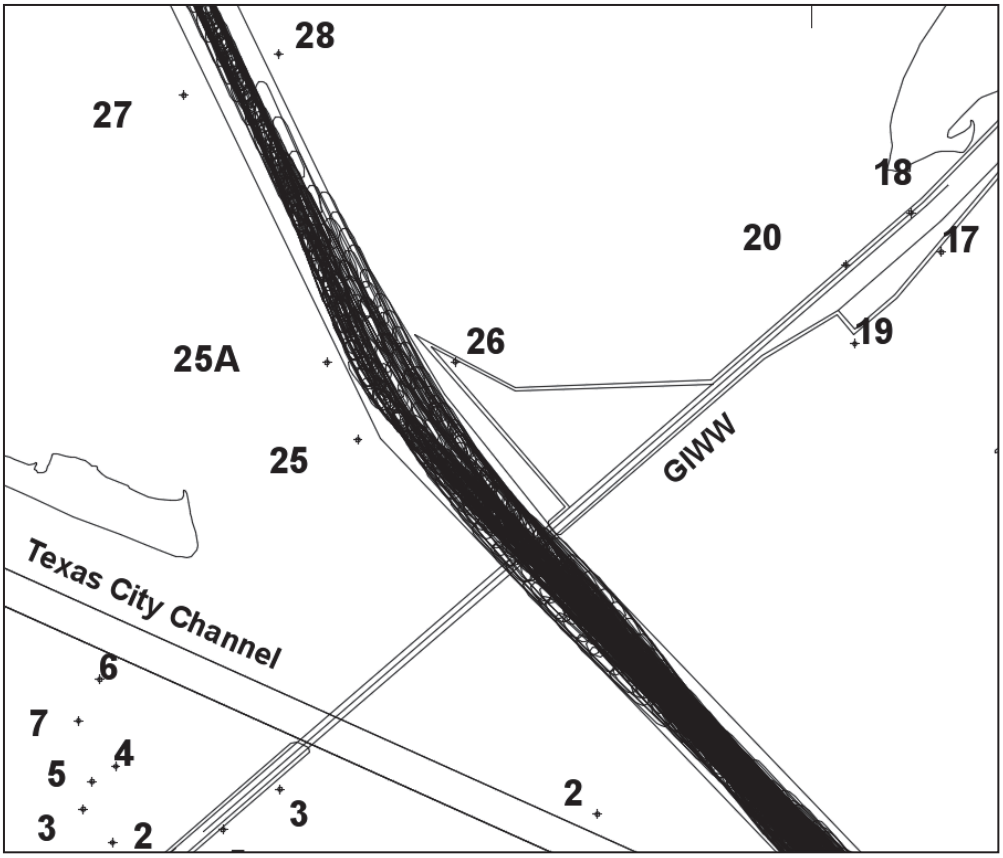
In Plate 22 – Plate 24 an inbound ULCV366M met an ULCV366M. The meeting in Plate 22 occurred near Buoy 16 with vessels approximately 260 ft apart. The meeting in Plate 23 occurred southeast of the entrance of the TCC. During the meeting, the inbound vessel got within 84 ft of the channel but maintained a distance of approximately 330 ft from the outbound vessel. The meeting in Plate 24 occurred southeast of the entrance of the TCC. During the meeting, the outbound vessel got within 50 ft of the channel, and the inbound vessel got within 107 ft of the channel, but the distance between vessels was more than 400 ft. Both pilots expressed a preference of Alternative 1 over this alternative due to increased rudder requirements and less space.

The tracks in Plate 25 – Plate 27 show a SUEZ156R headed into the TCC after meeting an outbound ULCV366M. The meeting location was approximately midway between Buoys 16 and 18 in all of these plates. In Plate 25 and Plate 26, the distance between vessels was approximately 300 ft during meetings. In Plate 27, the distance between vessels was approximately 250 ft. One of the pilots commented about preferring Alternative 3 due to more space to maneuver and less rudder requirements over Alternative 4 following the simulation shown in Plate 27.

Bolivar Roads – Alternative 1

All simulations in this area tested the entrance bend, but some simulations did not include testing of the turn at Bolivar Roads (Buoys 25–26). The meetings that occurred here were the second meeting of the inbound vessel with a Suezmax tanker. The meetings typically took place in two general locations, the first in or near the bend and the second was below the GIWW in the 700 ft channel. Track plots in Appendix C show the entirety of the vessel runs, so if the turn at Bolivar Roads was tested, it can be viewed in Plates 1–27. Figure 39 shows a composite of all the tracks completed that traversed the Bolivar Roads area. The majority of simulations featured vessels that stayed within the channel confines; however, Plate 1, Plate 5, Plate 14, and Plate 20 contain vessels that slightly exceeded the channel limits. Further discussion about those specific simulations can be found in the previous sections. In general, the vessels that exceeded the channel limits near the Bolivar Roads bend did not leave the federal channel due to a channel deficiency.

Figure 39. Composite track plots for Bolivar Roads Alternative 1.



RF (Buoys 51–52)

Moving up geographically from the Bolivar Roads testing area, the next area to be tested was the bend near Redfish Island. The extent of this test area begins at Buoys 41/42 and ends at Buoys 55/56. The RF reach contains one bend modification: a widened, gated turn at the bend at Buoys 51/52. Like the rest of the main bay channel, the channel on either side of the bend has a proposed width of 700 ft. The bend design is an angle turn with a modified cutoff that comes to an apex. This results in a 900 ft widened turn at the apex. Gated markers will be placed at the beginning (Buoys 47/48 and 53/54) and ending (Buoys 51/52) of the flare on both sides of the bend.

The different simulations performed in RF are listed in Table 5. Test matrix for RF. All the simulations focused on a single, outbound container ship meeting an inbound container ship and an inbound Suezmax tanker, SUEZ156R. The container ships used in the transits began with the MULCV14N and transitioned to the ULCV366M in the later runs. The

starting location for the outbound ship was Buoys 55/56. The first inbound ship to pass started at Buoys 45/46, and the second started at Buoys 41/42.

With the exception of Plate 34, the first inbound ship was always the container ship. In Plate 34, the Suezmax ship was the first inbound ship. Plates 28–38 show the results of the individual simulated transits in RF.

Table 5. Test matrix for Redfish.

Plate #	Channel	Tide	Wind	Outbound Vessel	First Vessel Meeting	Second Vessel Meeting	Run Notes	Run#
28	RF-Alt1	Ebb	N-20 kt	MULCV14N	MULCV14N	SUEZ156R		3
29	RF-Alt1	Ebb	N-20 kt	MULCV14N	MULCV14N	SUEZ156R	Pilot - "space allows maneuver to happen"	4
30	RF-Alt1	Ebb	N-20 kt	MULCV14N	MULCV14N	SUEZ156R		5
31	RF-Alt1	Ebb	N-20 kt	ULCV366M	ULCV366M	SUEZ156R		65
32	RF-Alt1	Ebb	N-20 kt	ULCV366M	ULCV366M	SUEZ156R		66
33	RF-Alt1	Ebb	N-20 kt	ULCV366M	ULCV366M	SUEZ156R		125
34	RF-Alt1	Flood	SE-20 kt	MULCV14N	SUEZ156R	MULCV14N		6
35	RF-Alt1	Flood	SE-20 kt	MULCV14N	MULCV14N	SUEZ156R	After meeting. pilots experimented	12
36	RF-Alt1	Flood	SE-20 kt	ULCV366M	ULCV366M	SUEZ156R	Soft grounding occurred	67
37	RF-Alt1	Flood	SE-20 kt	ULCV366M	ULCV366M	SUEZ156R		68
38	RF-Alt1	Flood	SE-20 kt	ULCV366M	ULCV366M	SUEZ156R		126

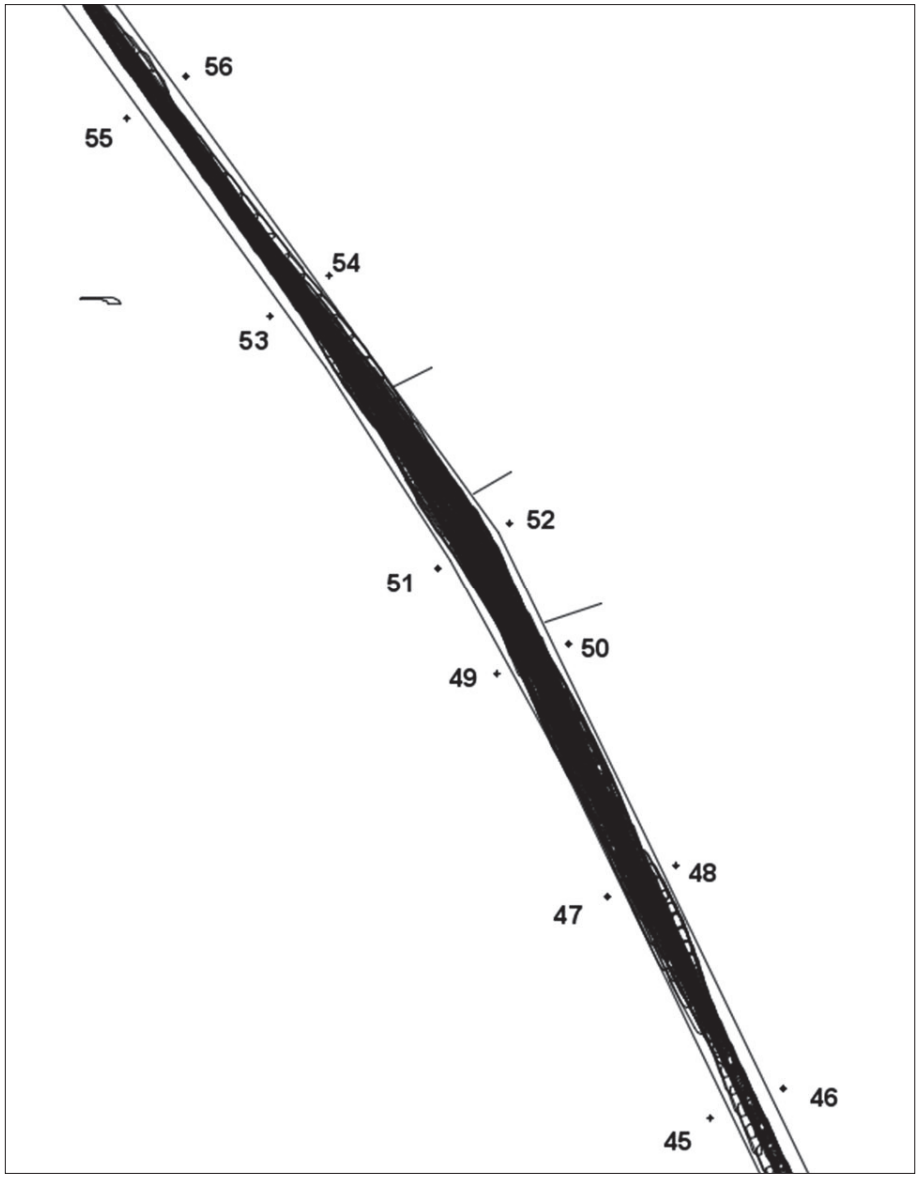
Redfish (RF) – Alternative 1

The simulations in the RF area focused on determining if the proposed 700 ft channel coupled with the bend dimensions provided sufficient room for the multiple meetings and recoveries of the design ships, MULCV14N, ULCV366M, and SUEZ156R, in the vicinity of the bend.

The solitary, outbound ship is the key ship in these transits as it has to meet and pass the first inbound ship, recover sufficiently to meet and successfully pass the second ship, and successfully recover from the second passing.

Figure 40 shows the composite plot of all simulated transits of the RF area. Examination of Figure 39 indicates that several of the runs did approach or touch the channel extent. Examination of the individual track plots indicates that four of the transits met this criterion. Those transits touching the channel extent above the bend would be those of the first inbound ship at some time during the execution of its passing maneuver or recovery. The transits touching the channel extent below the bend would be those of the outbound ship during its meeting with the second inbound or its recovery after the meeting. However, 100% of the transits were considered successful.

Figure 40. Composite track plots for RF Alternative 1.



Simulated transits were performed in fair and opposing tide conditions for the solitary ship, which are tidal currents propagating in the same and opposite direction, respectively, as the ship's transit direction. Fair tide runs represent the most adverse, navigable conditions for the primary ship as the ship must travel faster than the current to maintain steerage.

The primary ship for all transits was outbound as the first meeting occurs just before the bend, and a ship facing a right turn after a meeting is considered a significantly difficult maneuver.

Coupling the right turn with a meeting followed by another meeting after the turn represents the maximum adverse, navigable condition for this channel reach.

Using the beam width of the Suezmax ship, 164.1 ft, all the individual skin-to-skin distances when the passing ships are abeam of one another are approximately one beam width apart with the exception of the second meeting on Plate 32, which was only slight less than a beam width at 161 ft. For all simulation runs, the skin-to-skin distance for the second passing was smaller than the first, averaging approximately 8 ft less than the first passing. The smaller distance for the second meetings can be attributed to the effect recovery from the first passing had on the position of the outbound ship as it met the second inbound ship. In addition, the first meeting occurred either above or in the bend, which allowed for more lateral space for recovery than that of the second meeting.

The average distance to the bank for each ship at the time the ships were abeam of one another was 153 ft (outbound) and 106 ft (inbound) for the first meeting and 64 ft (outbound) and 103 ft (inbound) for the second meeting. The significantly lower average distance of the outbound ship to the channel extent for the second meeting is attributed to two factors: pilot choice and pilot familiarity with simulator controls. The second factor is noted as the runs where the smallest spacing to the channel extent occurred during four runs very early in the testing programs, Plates 28, 29, 30, and 34. In addition, these smaller spaces do not indicate lack of room in the channel, as these same early runs had larger skin-to-skin spacing, over 200 ft, during the meetings. Summarily, the channel appears to provide sufficient room with regard to skin-to-skin and ship-to-bank spacing. A discussion of individual runs based on tidal conditions follows.

Plates 28–33 show the individual runs for the ebb condition. These runs were considered successful. Plates 28, 31, 32, and 33 illustrated no significant issues. The pilots had specific comments regarding runs shown in Plate 29 and 30.

Plate 28 shows Run 3, the first RF simulated transit, an outbound MULCV14N meeting an inbound MULCV14N followed by a meeting with an inbound SUEZ156R. The first meeting occurred just above the bend with both pilots swinging wide of the centerline while still being able to maintain space between the ships and their respective bank lines. For the second meeting, both pilots executed a similar maneuver, but the outbound pilot skimmed the bank line. This situation is attributed to the outbound pilot's recovery as he was not able to return to the centerline before executing the second passing maneuver. Also, the outbound pilot noted the visual screens did not seem accurate, which may simply be related to unfamiliarity with the design channel. The inbound pilots noted no issues with the meetings.

A similar situation occurred during Run 4 (Plate 29) with outbound pilot skimming the channel extent during the second meeting. The outbound pilot said he felt squeezed by the first inbound ship and therefore was not able to recover all the way to the center of the channel, resulting in being on the channel edge during the meeting with the second inbound ship. He also indicated the wind and tide affected his recovery from the first meeting. The pilot of the second ship noted the meeting was more difficult than usual due to the meet occurring in the bend. The pilot of outbound ship noted that he had gotten too far over during the first meeting and attributed it to possibly not having enough familiarization time on the simulator. He also felt the second inbound vessel could have been farther over.

Plate 30 shows the results of Run 5. As in Runs 3 and 4, the outbound ship got very near the channel extent during and after the second meeting. The outbound pilot noted he made mistakes in the first meeting, which made the second meeting more difficult. However, he indicated that the added channel space made it possible to recover from the mistake.

Run 65 is shown in Plate 31. Both meetings and recoveries occurred without incident. The outbound pilot stated the width of the channel and corresponding bank cushion allowed the maneuvers to occur safely. He did

comment that he had to use extra throttle ("kick") to get the vessel behavior and speed he expected.

The meetings in Run 66 (Plate 32) were executed without any issues with sufficient ship-to-ship and ship-to-bank space. The first meeting occurred in the bend, and the second meeting occurred at buoys 47/48. All three pilots felt the wind and current. The outbound pilot stated he needed to adjust his speed to compensate for the current.

Plate 33 shows the final RF transit, Run 125, performed under ebb tidal conditions. As in Run 66, the first meeting occurred in the bend. The second meeting with the SUEZ156R occurred just below buoys 47/48. Both meetings had sufficient room, and the pilots noted no issues with space or forces.

The runs executed under flood tide conditions are shown inPlates 34–38. These runs were considered successful.

Run 6 is shown in Plate 34. The first meeting occurred just above the bend with the inbound SUEZ156R skimming the channel extent, which produced a ship-to-ship spacing of over 275 ft. The second meeting occurred just below the bend at buoys 49/50 with sufficient spacing. While the first inbound pilot indicated he was slow to recover, all three pilots noted the channel design provided the required room for the maneuvers.

Plate 35 shows the transit for Run 12. Both the outbound pilot and second inbound pilot noted that the outbound ship was squeezed by the inbound, but the room in the channel allowed for this, and the outbound pilot was able to avoid a collision.

Run 67 is depicted in Plate 36. The outbound pilot noted the run was somewhat more difficult due to his vessel not being in the middle of the channel as a result of the turn at the bend.

However, he indicated the meet was still a safe maneuver. The second inbound pilot commented the outbound pilot's speed should have been slower during meeting with the first ship to increase the distance between the two ships, but that even with this perceived "mistake," the meeting was executed safely.

The meetings in Run 68 (Plate 37) were executed without incident. All three pilots stated there was plenty of space in the channel.

Run 126 (Plate 38) was the final RF transit simulated with flood conditions. Even with the first meeting occurring in the bend of the channel, both meetings were executed with no issues. The pilot on the first inbound vessel, ULCV366M, did note the maneuver was slightly difficult due the handling of thevessel.

In summary, all RF transits were considered successful.

Bayport Intersection (Buoys 75–76)

The Bayport Intersection area contains one main modification to the Bend at Buoys 75–76, which was the widening of the channel to 700 ft in combination with the already constructed 4000 ft radius flare and widener on the east side of the navigation channel. This included a minor adjustment to the southern flare as it intersects with the new 700 ft channel.

Though only critical for turns into the BSC, widening of the BSC to 455 ft was included to complete the study parameters. This area, which is the intersection of the HSC and the BSC, is shown in Figure 7. Track plots in Appendix C show the entire Bayport Intersection area in one plot.

Table 6 lists the different simulations completed in the Bayport Intersection area. All the simulations focused on a single, inbound container ship (ULCV) meeting an outbound ULCV and an outbound Suezmax tanker. Three vessels were simulated in this area: MULCV14N, ULCV366M, and SUEZ156R.

Table 6. Test matrix scenarios for Bayport Intersection.

Plate #	Channel	Tide	Wind	Inbound Vessel	First Vessel Meeting	Second Vessel Meeting	Run Notes	Run#
39	BI-A1	Flood	SE-20 kt	MULCV14N	MULCV14N	SUEZ156R		7
40	BI-A1	Flood	SE-20 kt	MULCV14N	MULCV14N	SUEZ156R		8
41	BI-A1	Flood	SE-20 kt	MULCV14N	MULCV14N	SUEZ156R		9
42	BI-A1	Flood	SE-20 kt	ULCV366M	ULCV366M	SUEZ156R		69
43	BI-A1	Flood	SE-20 kt	ULCV366M	ULCV366M	SUEZ156R	Inbound vessel had a soft grounding due to having a larger draft compared to the vessels that normally come into this area.	70
44	BI-A1	Flood	SE-20 kt	ULCV366M	ULCV366M	SUEZ156R		128
45	BI-A1	Ebb	N-20 kt	MULCV14N	MULCV14N	SUEZ156R	Suez grounded during the meeting	10
46	BI-A1	Ebb	N-20 kt	MULCV14N	MULCV14N	SUEZ156R		11
47	BI-A1	Ebb	N-20 kt	ULCV366M	ULCV366M	SUEZ156R		71
48	BI-A1	Ebb	N-20 kt	ULCV366M	ULCV366M	SUEZ156R		127

Bayport Intersection – Alternative 1

Figure 41 shows a composite of all the tracks completed that used Alternative 1. The majority of simulations featured vessels that stayed within the channel confines, with the exception of Plate 45, which contains a vessel that exceeded the channel limits and ran aground. Further discussions about all Alternative 1 plates can be found in the following section.

Figure 41. Composite track plots for Bayport Intersection Alternative 1.

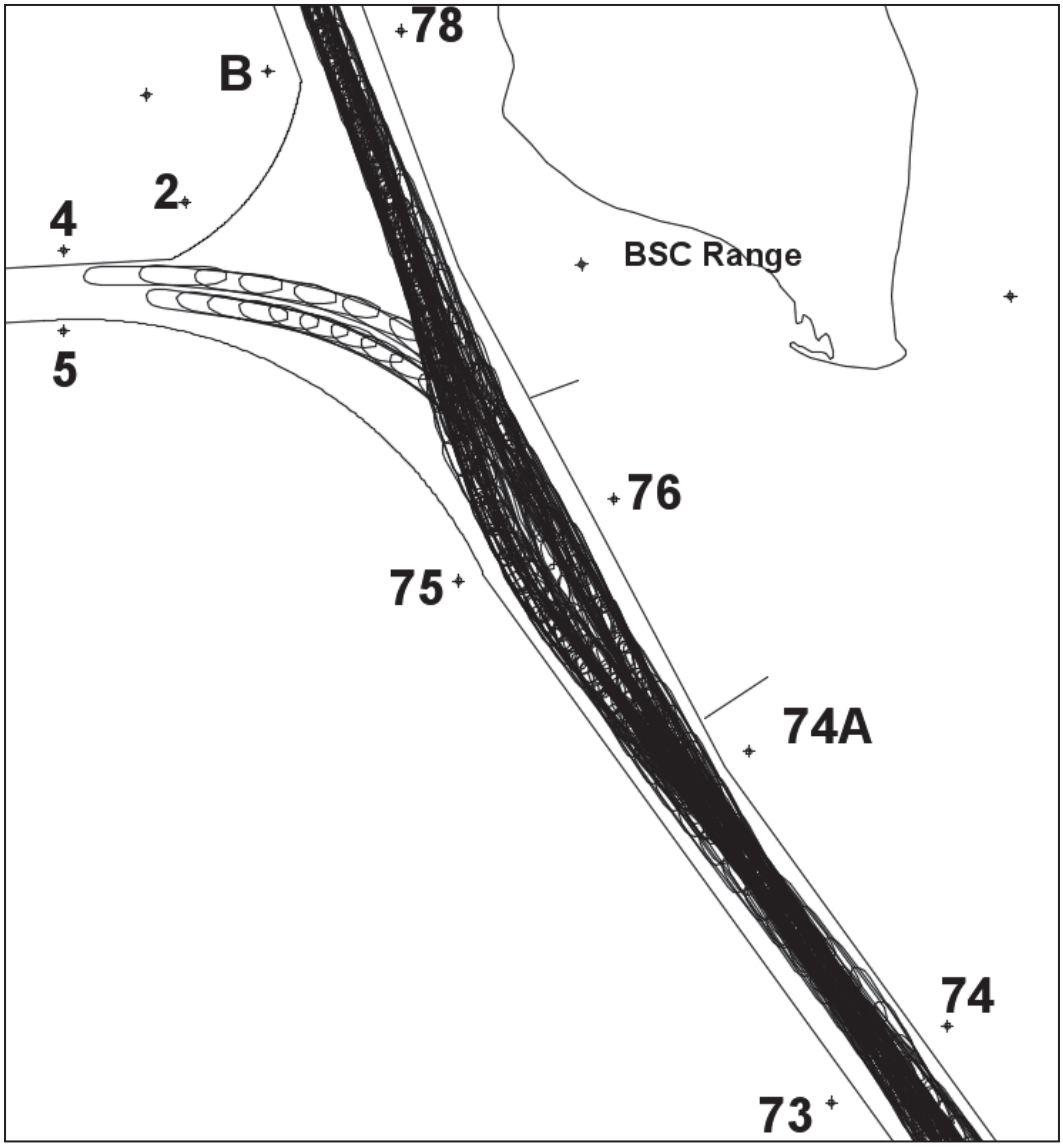


Plate 39–Plate 48 show all the transits that were completed using Alternative 1. Simulations completed using this alternativewere rated as "easy" (approximately 13% of the time) or "normal"(approximately 80% of the time) by the pilots. Only twice (approximately 7% of the time) did pilots rate a run as difficult.

Also, each recovery and meeting were confirmed as controllable, and all runs were rated as safe to do in real life by the pilots for all Alternative 1 simulations.

A flood tide with 20 kt wind from the southeast was simulated in the tracks shown in Plate 39–Plate 44. Plate 39–Plate 41 show an inbound

MULCV14N meeting a MULCV14N and a SUEZ156R. Plate 42–Plate 44 show an inbound ULCV366M meeting a ULCV366M and a SUEZ156R. In Plate 39, the first meeting occurred at Buoy 71-72 while maintaining a distance of 193 ft; the second meeting occurred close to Buoy 74A while maintaining a distance of 302 ft. The pilots agreed that the meeting locations were perfect for maneuvering due to the channel width.

In Plate 40, the inbound MULCV14N ended the run with a turn into the BSC. During the first meeting with a MULCV14N near Buoy 71/72, the vessels maintained a distance of 175 ft between vessels. The inbound pilot indicated that he did not completely recover from the meeting, but he was easily able to perform the second maneuver. During the second meeting, the vessels maintained a distance of 187 ft. After the second meeting with a SUEZ156R, the inbound pilot noted he was in a position that would allow for an easy turn into the BSC.

The pilots were in accordance again that the channel width is optimal for performing meetings and safely recover.

An inbound MULCV14N was simulated along the HSC while first meeting an outbound MULCV14N followed by an outbound SUEZ156R in the tracks shown in Plate 41. During the meeting, the pilots maintained a distance of 215 ft between vessels. The inbound pilot had to adjust the speed at the beginning of the run and ended up altering the meeting location. The meeting, however, was performed in a controlled manner. The second meeting occurred north of Buoy 76 with distance of 244 ft between the vessels. The pilots had no issues with the channel.

In Plate 42, the first meeting occurred below Buoy 69/70 (west of the Blue Water Atoll) while maintaining a distance of 172 ft; the second meeting occurred at Buoy 75/76 while maintaining a distance of 374 ft. The pilots agreed that the meeting locations were perfect for maneuvering with this design alternative.

Environmental conditions were working in favor of the outboundships; there were no differences for the inbound ship.

In Plate 43, the vessels maintained a distance of 188 ft during thefirst meeting below Buoy 69/70. While preparing for the second meeting in Buoy 75/76, the inbound pilot experienced a soft grounding that

drastically decreased the speed of the vessel. The meeting with the SUEZ156R was still manageable, maintaining a distance of 352 ft between the vessels. The pilots agreed that the channel width increases the margin of safety for meetings in this area.

In Plate 44, as part of the run, the inbound ULCV366M ended the transit with a turn into the BSC. During the first meeting with a ULCV366M between Buoys 70 and 72, the vessels maintained a distance of 167 ft. The second meeting occurred at Buoy 75/76, with the vessels maintaining a distance of 308 ft.

After the second meeting with a SUEZ156R, the inbound pilot decided at the last minute to make the turn into the BSC. Even while making that decision late in the maneuver, the turn was successful due to the channel geometry.

Environmental conditions were not a factor in performing the maneuvers for any of the pilots.

Plate 45–Plate 48 show tracks of simulations that were completed with an ebb tide and 20 kt wind from the N. In Plate 45, an inbound MULCV14N met a MULCV14N and a SUEZ156R. The first meeting occurred midway between Buoys 72and 74 while the second meeting occurred just south of Buoy 75. During the first meeting, the inbound MULCV14N got within 62 ft of the channel but maintained a distance of approximately 215 ft from the outbound vessel. The pilots noted that the change in current did not affect the maneuver, but the outbound pilot indicated that he had to adjust at the beginning of the run to account for wind effect on the vessel. The vessels maintained a distance of approximately 344 ft apart during the second meeting; however, the outbound SUEZ156R exceeded the Alternative 1 channel limits during the meeting, causing him to run aground. The pilot operating the SUEZ156R commented that he broke too much prior to the meeting causing him to turn too late. Although describing it as a difficult run, this was noted as pilot error and not a problem with the channel.

The tracks in Plate 46 show a repetition of the run presented in Plate 43. The first meeting occurred between Buoys 72 and 74. There was pilot error on the inbound ship, but the maneuver was successfully completed due to the amount of space in the channel.The outbound ship experienced a

system error causing the pilot to describe the maneuver as difficult. The ships maintained a distance of 175 ft between them, with the current being a factor in controlling the outbound ship. The second meeting occurred at the flare just north of Buoy 75. The vessels maintained a distance of 187 ft between them and the environmental conditions were not a factor for completing the maneuver.

In Plate 47 and Plate 48, an inbound ULCV366M met a ULCV366M and SUEZ156R. In Plate 47, the first meeting occurred between Buoys 70 and 72, with the vessels maintaining adistance of 207 ft. The inbound indicated that the current allowed for better control of the vessel. The second meeting occurred between Buoys 74A and 76, with the vessels maintaining a distance of 205 ft. All the pilots agreed that the width of the channel allows for safe operations with these vessel types.

In Plate 48, the first meeting occurred between Buoys 70 and 72. While the distance between ships was 233 ft, the inbound pilot indicated that due to pilot error, the vessel went too wide during the maneuver, getting close to less than 20 ft from the channel limits during recovery. The second meeting occurred just south ofBuoy 75/76. During the meeting, the outbound vessel got within 97 ft of the channel but maintained a distance of approximately 325 ft from the inbound vessel. Environmental factors did not affect the maneuverability of the ships.

Segment 2 – BSC

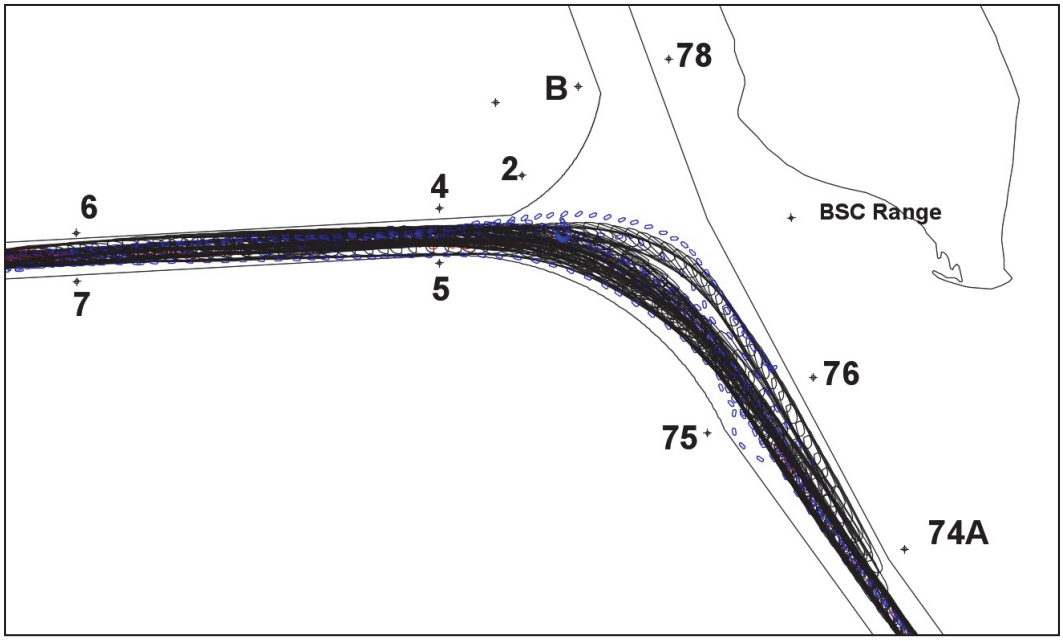
The entrance to the BSC from the HSC remained the same as the existing channels except for the symmetric widening to 700 ft of the HSC in combination with the already constructed 4000 ft radius flare and widener on the east (red) side of the navigation channel and to 455 ft widening of the BSC for these simulations, as shown in Figure 7. This included a minor adjustment to the southern flare as it intersects with the new 700 ft channel. Six inbound (Plates 49–54) and four outbound (Plates 55–58) runs (Table 7) were made through the entrance of the BSC with one meeting situation. The turn into the BSC following the meeting (Plate 49) was unsuccessful for the inbound ULCV as the maneuver was initiated by chance by the pilot and took place too close to the BSC entrance and too far north to make the turn successfully. All the other runs were successful with one going slightly outside the channel toeline (Plate 52) for a success rate of 90%. Figure 42 shows that the runs stayed in the channel limits, except for the runs on Plates 49 and 52, which are

not included in the composite plot. The two runs were excluded because they were unsuccessful due to factors not related to channel design.

Table 7. Simulation runs for BSC Entrance.

Plate #	Channel	Tide	Wind	Main Vessel-Direction	Vessel Meeting	Run Notes	Run #
49	BS-A1	Flood	SE-15 kt	ULCV366M - Inbound	ULCV366M	Inbound vessel became unstable after the meet and was not able to make the turn intoBayport.	58
50	BS-A1	Flood	SE-20 kt	ULCV366M - Inbound		Decreased wind to 15 kt once in the terminal. Starboard quarter instructor-controlled tugbailed out during the run due tolack of space. Track plot shows the tug although it was notvisible.	72
51	BS-A1	Flood	SE-15 kt	ULCV366M - Inbound			76
52	BS-A1	Flood	SE-15 kt	ULCV366M - Inbound		Vessel left federal channel while making the turn into the terminal [BSC].	78
53	BS-A1	Flood	SE-15 kt	ULCV366M - Inbound			134
54	BS-A1	Ebb	N-15 kt	ULCV366M - Inbound			135
55	BS-A1	Ebb	N-15 kt	ULCV366M - Outbound			77
56	BS-A1	Flood	SE-20 kt	ULCV366M - Outbound			79
57	BS-A1	Flood	SE-15 kt	ULCV366M - Outbound			136
58	BS-A1	Ebb	N-15 kt	ULCV366M - Outbound			137

Figure 42. BSC Entrance at HSC.



The design improvements for the BSC, shown in Figure 43 and described in the introduction, involve the widening of the channel on the north (red) side resulting in a total width of 455 ft. Inside the land cut of BSC, the channel will be widened 105 ft. Initial slope stability evaluations in the FR EIS indicated that a robust sheet pile wall would need to be constructed along the north slope of the channel in the turning basin and adjacent to San Jacinto College. The existing turning basin is large enough for the existing and future channel. Therefore, as part of the PED process, alternatives were simulated that would evaluate options to reduce or eliminate the sheet pile wall. These alternatives could also potentially provide a reduction in dredging. In addition, the construction of the LBC 5 berth in the northwest corner of the turning basin for Bayport required a reduction in the widener in that area, which created a narrower entrance to the turning basin. This berth was permitted and constructed after the selection of the FR EIS Recommended Plan in 2018. The plan included allowance for the Bayport Container Terminal Master Plan and the proposed Odfjell terminal on the east side of the turning basin that is projected to service Panamax size vessels (limited to 600 ft Length Overall). This design is called Alternative 1 for the BSC.

Figure 43. BSC and turning basin.

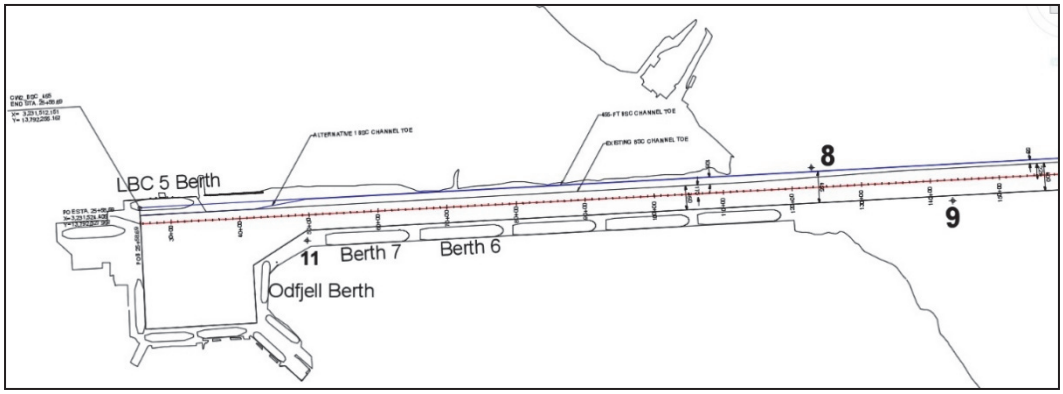


Table 8 shows the 21 runs (Plates 59–78) conducted during the PED Simulation Study for the inner portion of the BSC. Current is insignificant for this part of the channel; therefore, wind was the critical environmental factor for these tests. The navigation of the ULCVs through the 455 ft BSC was uneventful until entering the land cut. Entering the restricted water of that channel and the berthing of vessels at the container terminal required the slowing of the ULCVs to approximately 4 kt. This made the ship vulnerable to wind and required setting of a drift angle to maintain course. Entering the turn into the turning basin required careful maneuvering to avoid the ships at Berth 7 of the Bayport Container Terminal and the Odfjell terminal. This is especially important to provide clearance for the tugs that are not allowed to venture beyond the 25 ft depth contour.

Table 8. Simulation runs for BSC Alternative 1.

Plate #	Channel	Tide	Wind	Main Vessel-Direction	Run Notes	Run #
59	BS-A1	Flood	SE-20 kt	ULCV366M - Inbound	Vessel wrecked during turn. Pilot noted that the vessel was not slowing down speed, even with all factors working to slow it down. Instructor moved ship back outside of turning basin and started at 3.5 kt to try to make the turn again.	47
60	BS-A1	Flood	SE-20 kt	ULCV366M - Inbound		48
61	BS-A1	Flood	N-20 kt	ULCV366M - Inbound		49
62	BS-A1	Flood	N-20 kt	ULCV366M - Inbound	Line kept breaking for the bow tug due to simulation error causing the pilot to be unable to use the tug while entering into the turning basin.	50

Plate #	Channel	Tide	Wind	Main Vessel-Direction	Run Notes	Run #
63	BS-A1	Flood	N-15 kt	ULCV366M - Inbound	Decreased wind to 15 kt after deciding 20 kt is too difficult.	51
64	BS-A1	Flood	N-15 kt	ULCV366M - Inbound	Wind accidentally started at 20 kt. Pilot noticed, and the change was made. Starboard tug was made invisible while entering the flare because the pilot released him due to space. Track plot makes it look like the tug went through the berthed vessel. Tug returned after entering turning basin.	52
65	BS-A1	0	N-15 kt	ULCV366M - Inbound	Using a different approach for these runs - going farther into the turning basin to perform the turn. Sticking to a 15 kt wind limit for this area.	56
66	BS-A1	0	N-15 kt	ULCV366M - Inbound		57
67	BS-A1	Ebb	N-15 kt	ULCV366M - Inbound	Instructor tugs released while the vessel was in the flare exiting the turning basin due to not being needed.	74
68	BS-A1	Ebb	N-15 kt	ULCV366M - Inbound		75
69	BS-A1	Ebb	N-15 kt	ULCV366M - Inbound		92
70	BS-A1	Ebb	N-15 kt	ULCV366M - Inbound		131
71	BS-A1	Ebb	N-15 kt	ULCV366M - Inbound		132
72	BS-A1	0	N-15 kt	ULCV366M - Outbound	Special docking maneuver to Berth 7.	145
73	BS-A1	0	N-15 kt	ULCV366M - Outbound	Special docking maneuver to Berth 6.	146
74	BS-A1	Flood	SE-20 kt	ULCV366M - Inbound	Decreased wind to 15 kt once in the terminal. Starboard quarter instructor-controlled tug bailed out during the run due to lack of space. Track plot shows the tug although it was not visible. Vessel's stern went outside of the federal channel prior to entering the turning basin. Simulation paused and repositioned vessel to center of channel to make the turn in the basin.	72

Plate #	Channel	Tide	Wind	Main Vessel-Direction	Run Notes	Run #
75	BS-A1	Flood	SE-15 kt	ULCV366M - Inbound	Vessel hit LBC 2 while in the turning basin. Continued run to finish the turn and exit basin. Vessel exited the federal channel in the north side of the basin. Instructor tugs were not used by the pilot during run.	73
76	BS-A1	Flood	SE-15 kt	ULCV366M - Inbound		93
77	BS-A1	Flood	SE-15 kt	ULCV366M - Inbound		129
78	BS-A1	Flood	SE-15 kt	ULCV366M - Inbound		130
79	BS-A1	Flood	SE-15 kt	ULCV366M - Inbound		133

The first simulation runs for this portion of the BSC (Plates 59–62) involved wind speeds of 20 kt. These runs proved to be too difficult as shown in Figure 44, and considering limits set at other major container terminals, it was agreed that a 15 kt wind speed limit should be placed on operations of the ULCVs for the Houston area. Wind data for Morgan's and Eagle Points were analyzed, and wind speeds over 15 kt occurred approximately 3% of the time (Section 3.3). This wind upper limit was also applied to BCC operations.

Figure 44. BSC Alternative 1 land cut/turning basin (20 kt wind).

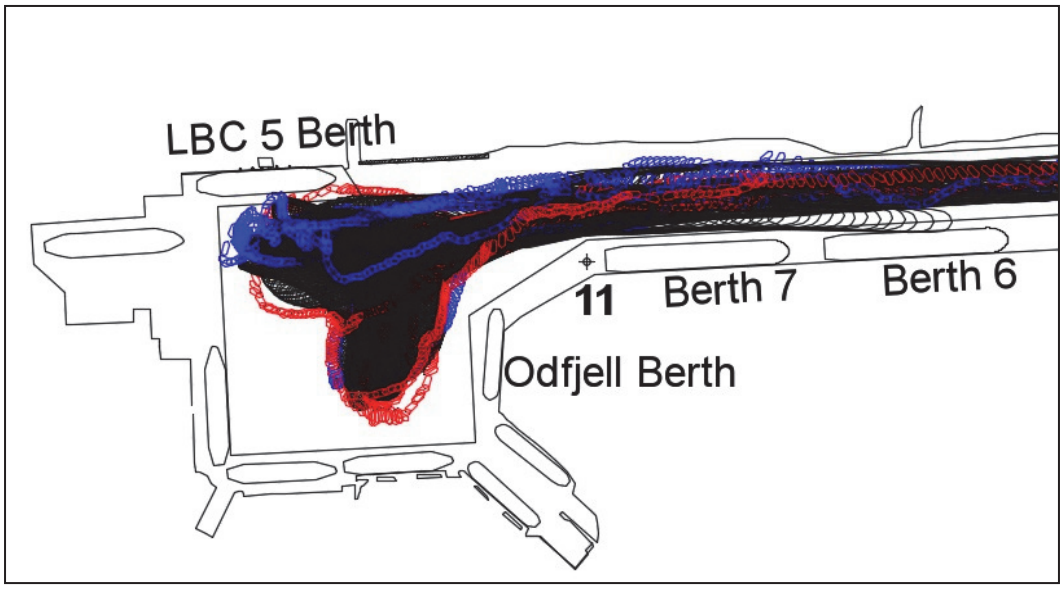
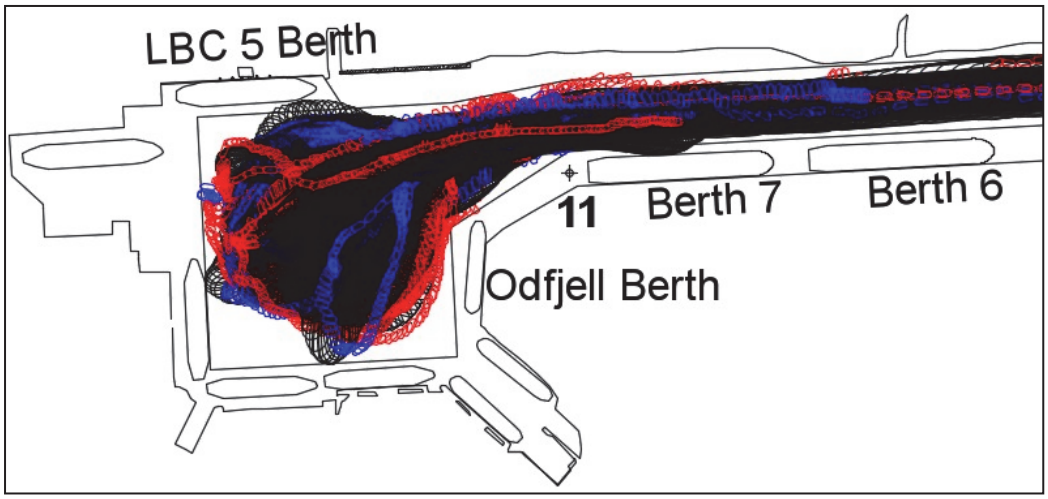


Figure 45 shows the composite track plot for the turning basin runs conducted with wind of 15 kt (Plates 63–79). The pilot in one run (Plate75) attempted the turning maneuver in the north portion of the turning basin, which resulted in drifting past the channel edge near berth LBC 5.

Also, the tugs drifted beyond the channel edge during the run shown on Plate 77. Turning deep into the center of the turning basin proved to be more successful, particularly when moving the vessel back into the ship channel. As shown in Figure 45, the large vessel was difficult to handle in these maneuvers with such tight quarters, and there was little room for misjudgments. Note that visual references indicating channel edge or moored ship clearances were not available because of the containers onboard, making the turning maneuver essentially an electronic piloting job. Additional docking simulations at Berths 6 and 7 were conducted after pilots expressed concern about coming out of the turning basin with the ship's speed reduced to allow berthing (Plates 72 and 73). These maneuvers were found to be even more difficult to control with the wind conditions.

Figure 45. BSC Alternative 1 land cut/turning basin (15 kt wind).



As a result of this concern, a series of simulated test runs were performed eliminating the restrictions on the north and the area between the container terminal Berth 7 and the Odfjell Berth. Also, based on the previous tests, there was agreement that the flare at the west end of Berth 7 should be eliminated and the terminal approach should be a straight in-line cut between the berthing face and the intersection of the turning basin toeline. The adopted simulator alignment designed to test this is shown in Figure 46 and is referred to as Alternative 9. Table 9 shows the seven runs conducted for Alternative 9 during the simulation study. Simulated transits from

within the land cut were made to the turning basin and out to Berth 6 (Plates 80, 81, 83) with the results shown in Figure 47. The ship in the run shown on Plate 84 stopped too early and was unable to turn resulting in early termination of the simulation. Likewise, runs were made to take advantage of the direct opening to approach Berth 7 (Plates 82 and 86) as seen in Figure 48. The run shown in Plate 85 ended unsuccessfully due to the ship not going deep enough into the turning basin.

Table 9. Simulation runs for Bayport ship channel Alternative 9.

Plate #	Channel	Tide	Wind	Main Vessel-Direction	Run Notes	Run #
80	BS-A9	0	SE-15 kt	ULCV366M - Inbound		154
81	BS-A9	0	SE-15 kt	ULCV366M - Inbound		156
82	BS-A9	0	SE-15 kt	ULCV366M - Inbound		163
83	BS-A9	Ebb	N-15 kt	ULCV366M - Inbound		153
84	BS-A9	0	N-15 kt	ULCV366M - Inbound	Pilot misjudged the entry into the turning basin and ended up in a position where the turn could not be completed. The run was stopped early.	155
85	BS-A9	0	N-15 kt	ULCV366M - Inbound	Vessel went outside of the federal channel in the north side of the turning basin. Run wasstopped. Pilot does believe that he would have been able to recover and successfullycomplete the turn to exit the basin.	157
86	BS-A9	0	N-15 kt	ULCV366M - Inbound		158

Figure 46. Bayport ship channel Alternative 9 land cut and turning basin.

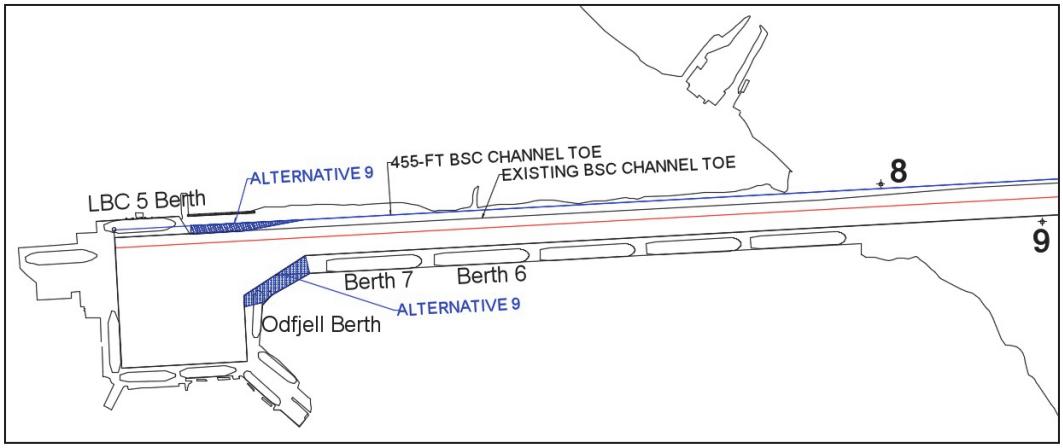


Figure 47. Bayport ship channel Alternative 9 to Berth 6 (15 kt wind).

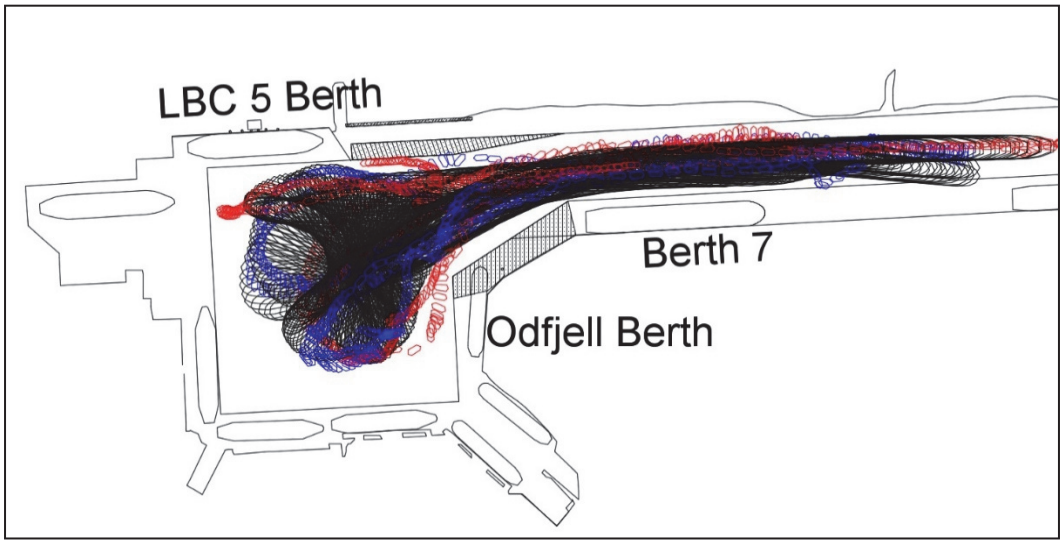
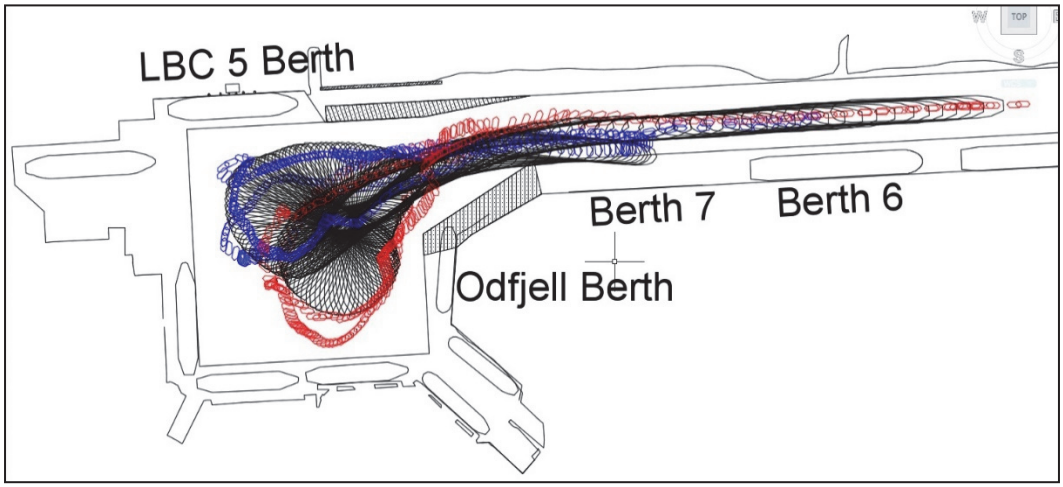


Figure 48. Bayport ship channel Alternative 9 to Berth 7 (15 kt wind).



These simulations demonstrated the benefit of relaxing the channel restrictions on the southeast side of the turning basin. As a result of these simulations, a proposed channel layout for the container terminal was developed. Note that this layout, Alternative 9A, was not explicitly tested. Alternative 9A calls for the dredging of the Berth 7 west end to extend until it intersects the turning basin toeline in combination with Alternative 1 on the north as shown in Figure 49. Replotting the runs shown in Figure 47 and Figure 48 with the proposed layout for Alternative 9 shows that this design is safe and efficient (Figure 50).

Figure 49. BSC with proposed Alternative 9A layout.

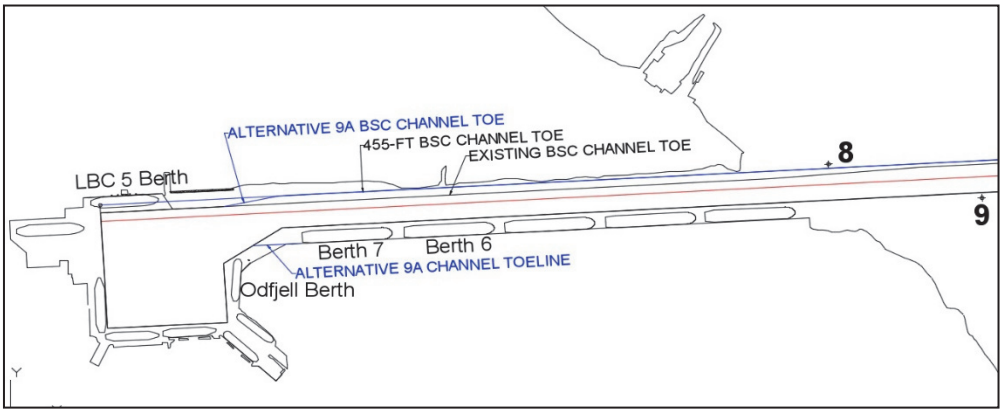
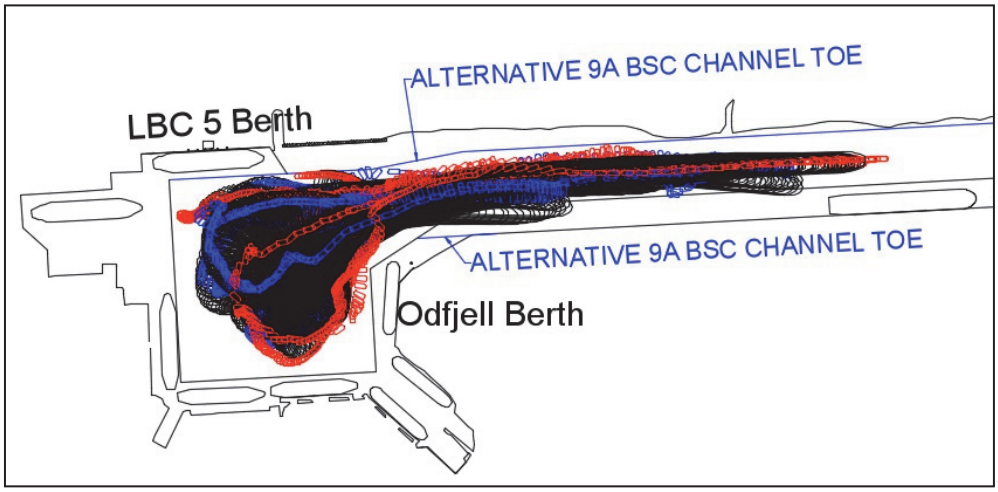


Figure 50. BSC with proposed Alternative 9A layout and simulation runs for Alternative 9.



Segment 3 – BCC

As with the BSC, BCC proposals call for the ship channel to be widened to 455 ft from the existing 300 ft width. The 155 ft widening was designed to be dredged on the north side of the channel away from the containership berths at the terminal. Also, channel design proposals for the entrance to

the BCC from the HSC call for the creation of a turning area so ULCVs can turn on approach and back into the first two berths at the container terminal. The LASH dock (not shown) was removed, and the south side of the channel entrance was opened. The opening up of the entrance area also proved to benefit the outbound transits. Over the entirety of the PED simulation study, three channel alignment alternatives were tested – Alternatives 1, 6, and 8. These alternatives are described in Section 2 of this report.

For the present PED simulation study, 44 simulation runs were conducted in the BCC to test entry and departure of ULCVs for the three channel alignment alternatives. These are listed in Table 10. Several different entry maneuvering scenarios were tested due to having two turning areas: one interior and one at the entrance. In the following sections, composite track plots of the runs in the three alternative alignments are shown. The track plots are comprised of the tracks of the ULCV tested as well as tracks for up to two "live tugs" controlled by G&H tug masters. Positions of the vector tugs are not recorded in the SJCMCTT simulator; therefore, their tracks do not appear in the track plots.

Table 10. Simulation runs for Barbours Cut (BC).

Plate #	Channel	Tide	Wind	Ship Direction	Run Notes/#TUGS	Run #
87	BC-A1	Flood	SE-20 kt	MULCV14Z- Inbound	Turn and Back in/2	32
88	BC-A1	Flood	SE-20 kt	MULCV14Z- Inbound	Turn and Back in/3	33
89	BC-A1	Flood	SE-20 kt	ULCV366M- Inbound	Turn and Back in/3	34
90	BC-A1	Flood	SE-15 kt	ULCV366M- Inbound	Turn and Back in/4	80
91	BC-A1	Ebb	N-20 kt	ULCV366M- Inbound	Turn and Back in/3	36
92	BC-A1	Ebb	N-20 kt	ULCV366M- Inbound	Turn and Back in/3	37
93	BC-A1	Ebb	N-15 kt	ULCV366M- Inbound	Turn and Back in/4	81
94	BC-A1	Flood	SE-20 kt	MULCV14Z- Inbound	Head in/3	39
95	BC-A1	Ebb	N-20 kt	ULCV366M- Inbound	Head in/3	35
96	BC-A1	Ebb	N-20 kt	ULCV366M- Inbound	Head in/3	38
97	BC-A1	Flood	SE-20 kt	ULCV366M- Inbound	Head in and Turn/2	45
98	BC-A1	Ebb	N-20 kt	ULCV366M- Inbound	Head in and Turn/2	46
99	BC-A1	Flood	SE-15 kt	ULCV366M- Inbound	Head in, Turn, Head out/3	90
100	BC-A1	Flood	SE-20 kt	ULCV366M- Outbound	Head out/2	40
101	BC-A1	Flood	SE-20 kt	ULCV366M- Outbound	Head out/2	41

Plate #	Channel	Tide	Wind	Ship Direction	Run Notes/#TUGS	Run #
102	BC-A1	Flood	SE-20 kt	ULCV366M-Outbound	Head out/2	42
103	BC-A1	Flood	SE-15 kt	ULCV366M-Outbound	Head out/3	82
104	BC-A1	Flood	SE-15 kt	ULCV366M-Outbound	Head out/3	143
105	BC-A1	Flood	SE-15 kt	ULCV366M-Outbound	Head out/3	144
106	BC-A1	Ebb	N-20 kt	ULCV366M-Outbound	Head out/2	43
107	BC-A1	Ebb	N-20 kt	ULCV366M-Outbound	Head out/4	44
108	BC-A1	Ebb	N-15 kt	ULCV366M-Outbound	Head out/3	83
109	BC-A1	Ebb	N-15 kt	ULCV366M-Outbound	Head out/3	91
110	BC-A6	Flood	SE-15 kt	ULCV366M- Inbound	Turn and Back in/2	84
111	BC-A6	Flood	SE-15 kt	ULCV366M- Inbound	Turn and Back in/4	138
112	BC-A6	Ebb	N-15 kt	ULCV366M- Inbound	Turn and Back in/4	139
113	BC-A6	Ebb	N-15 kt	ULCV366M- Inbound	Turn and Back in/4	85
114	BC-A6	Ebb	N-15 kt	ULCV366M- Inbound	Head in, Turn, Head out/4	88
115	BC-A6	Flood	SE-15 kt	ULCV366M-Outbound	Head out/2	86
116	BC-A6	Flood	SE-15 kt	ULCV366M-Outbound	Head out/3	140
117	BC-A6	Flood	SE-15 kt	ULCV366M-Outbound	Head out/3	141
118	BC-A6	Ebb	N-15 kt	ULCV366M-Outbound	Head out/2	87
119	BC-A6	Ebb	N-15 kt	ULCV366M-Outbound	Head out/2	89
120	BC-A6	Ebb	N-15 kt	ULCV366M-Outbound	Head out/3	142
121	BC-A8	Flood	SE-15 kt	ULCV366M- Inbound	Turn and Back in/3	151
122	BC-A8	Flood	SE-15 kt	ULCV366M- Inbound	Turn and Back in/3	162
123	BC-A8	Ebb	N-15 kt	ULCV366M- Inbound	Turn and Back in/3	152
124	BC-A8	Ebb	N-15 kt	ULCV366M- Inbound	Turn and Back in/3	161
125	BC-A8	Flood	SE-15 kt	ULCV366M- Inbound	Head in/3	159
126	BC-A8	Ebb	N-15 kt	ULCV366M- Inbound	Head in/3	160
127	BC-A8	Flood	SE-15 kt	ULCV366M-Outbound	Head out/3	149

Plate #	Channel	Tide	Wind	Ship Direction	Run Notes/#TUGS	Run #
128	BC-A8	Flood	N-15 kt	ULCV366M-Outbound	Head out/3	147
129	BC-A8	Ebb	SE-15 kt	ULCV366M-Outbound	Head out/3	148
130	BC-A8	Ebb	N-15 kt	ULCV366M-Outbound	Head out/3	150

Barbours Cut – Alternative 1

Figure 51 shows 10 outbound runs (Plates 100–109) conducted in the Alternative 1 alignment. Outbound runs with the UCLV in this alignment resulted in excursions beyond the channel edge along the eastern side of the HSC (Plates 101, 102, 106). These failures were a result of the inability of the pilots to start the right turn out of the BCC early enough because of the eastern extension of the northern channel edge beyond the Spilman Island Placement Area. Generally, two live tugs were used during these maneuvers with an additional vector tug attached on several runs. These runs were characterized by higher speeds as the pilots tried to "drive out" from the terminal. This exit strategy was abandoned in later simulations as the pilots experienced the increased inertia of the proposed ULCV when compared to that of contemporary containerships they are accustomed to handling. The runs that did not ground on the eastern side of the HSC were characterized by a slow approach to the HSC and a forceful turn while progressing slowly into the HSC with high tug use, a rather brute force approach that was time consuming.

On some of the runs (Plates 101 and 104), the tugs themselves crossed the channel toe-line on the northern side of the channel along Spilman Island while attempting to assist the ship to start the rightward turn into the HSC. There is a rule that the tugs must not cross the 25 ft contour, which generally equals half the length of the tug beyond the channel toe.

Figure 52 shows the composite track plot for 13 inbound runs (Plates 87–99) conducted in the Alternative 1 alignment. The track plot on Plate 96 was not included in the composite because the ship's interaction with a docked ship was unrealistic and the ship ran out of the channel adjacent to the terminal. Following this run, a ship model adjustment occurred that eliminated the issue for subsequent simulations. The maneuvers focused on two primary piloting objectives: drive straight into the BCC from the HSC and turn in the inner turning basin or turn in the entrance turning

area to setup for backing the ship to a dock. Three runs (Plates 97–99) tested the first objective completely with the ship entering the BCC head-in, transiting the entire channel to the inner turning basin and then turning around. These tests indicated the inner turning basin was adequate for a tug-assisted turn of the ULCV. The remainder of the runs in Figure 52 tested the entrance portion of the channel for both objectives. The composite track plot for these runs indicates adequate channel dimensions for the ULCV to enter the BCC either head-in or backing.

However, because of the location of the entrance turning area (east of Spilman Island) the turning operation for the ships took place largely within the HSC.

Figure 51. BCC Alternative 1 outbound simulations.

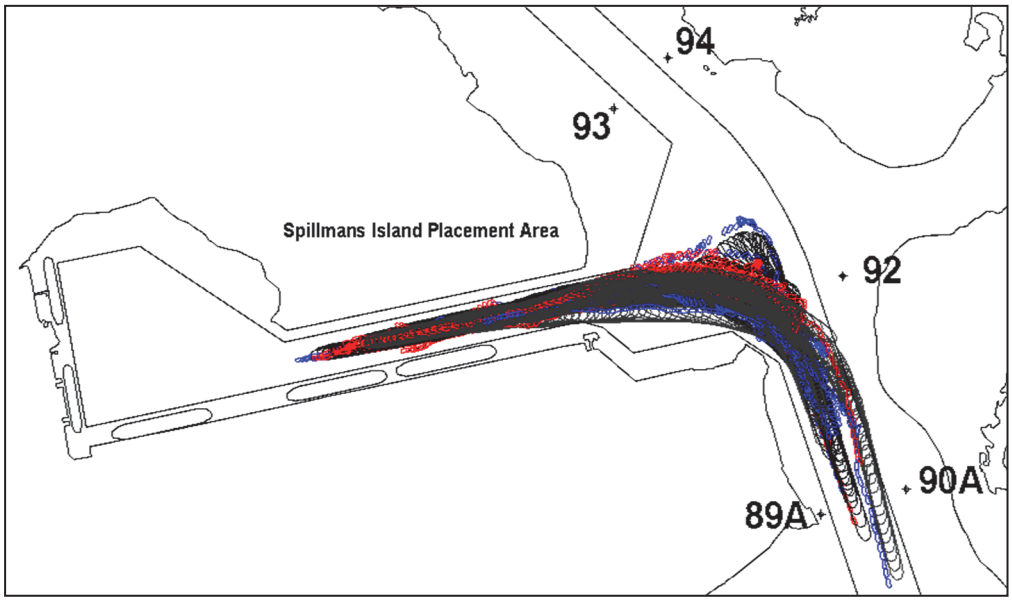
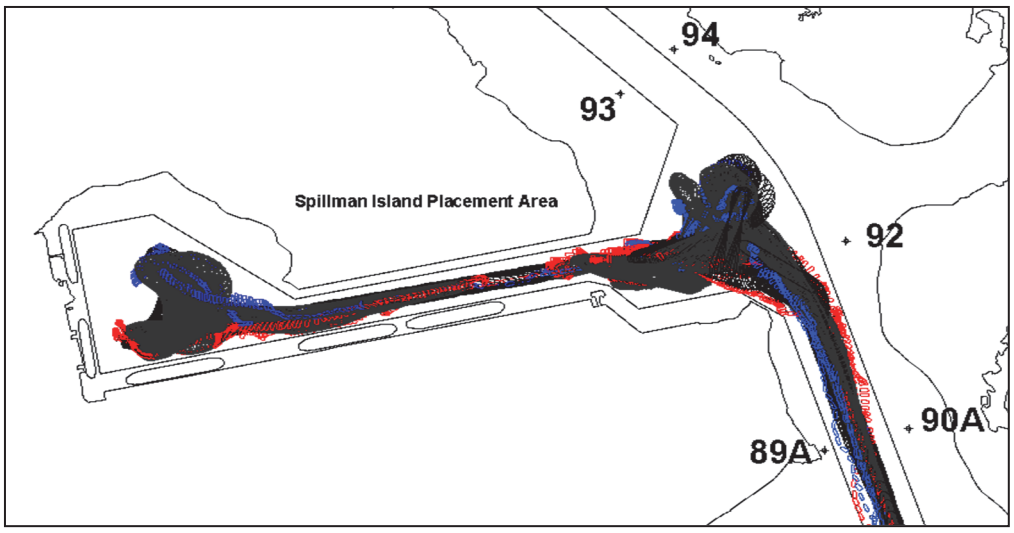


Figure 52. BCC Alternative 1 inbound simulations.



Barbours Cut – Alternative 6

Alternative 6 was developed to allow the vessel to make an earlier turn outbound with increased safety and efficiency. In this alternative design, the beginning of the northern flare was moved to the west near the eastern corner of Spilman Island and opposite the beginning of the widening on the south side of the channel. A composite track plot for the outbound runs (Plates 115–120) for this alternative is shown in Figure 53. Generally, two live tugs were used during these maneuvers combined with one or two vector tugs. The pilots developed a strategy in which they approached the right turn into the HSC at a low speed of 3 to 4 kt so that tug assist was most effective. The modified alignment provided additional room for the pilot to move the ship's stern northward to start the turn and for the support tugs to move safely into a position to assist the turn. The track plots indicate a successful maneuver, and the pilots were satisfied with the new location of the northern channel edge in this alignment alternative.

Figure 53. BCC Alternative 6 outbound simulations.

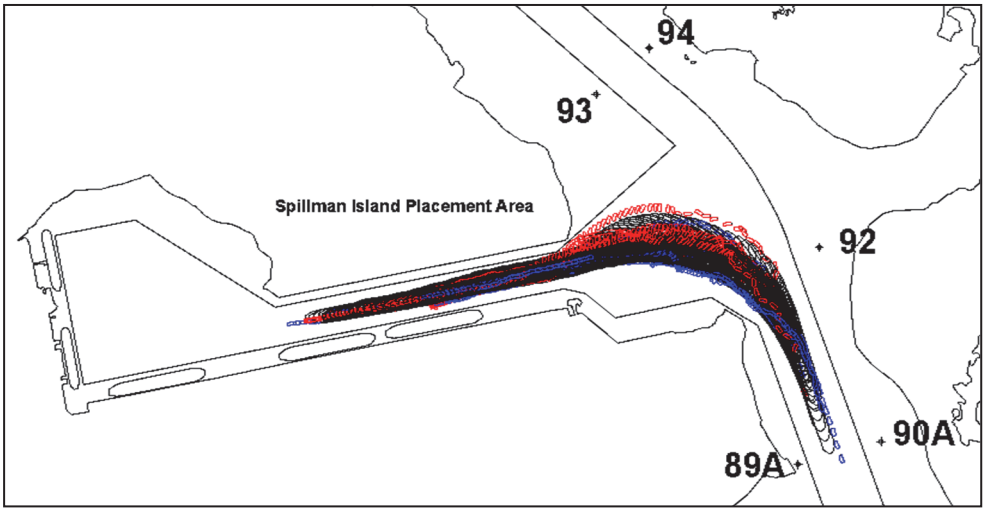
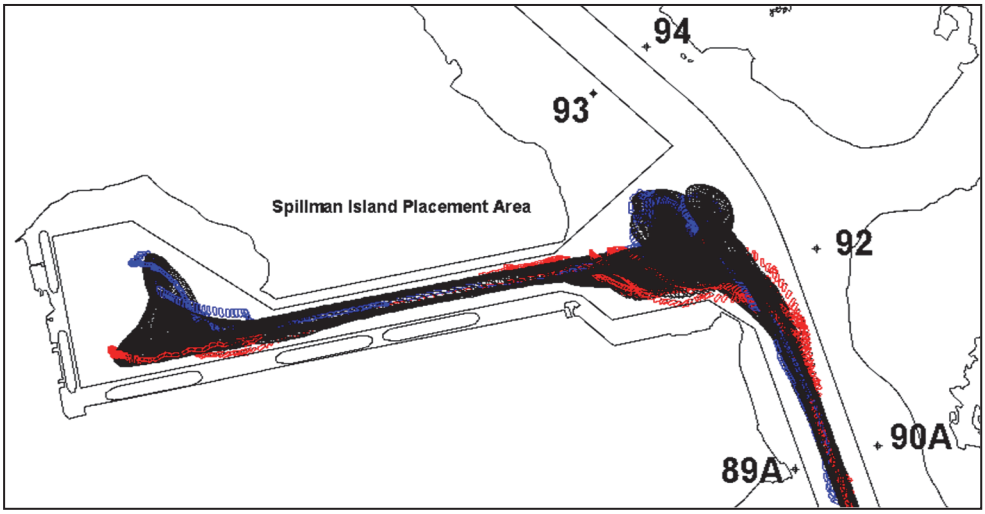


Figure 54 shows a composite track plot of the inbound runs for Alternative 6 (Plates 110–114). One of these runs (Plate 114) entered the BCC head-in from the HSC, transited the entire terminal channel, and turned around in the inner turning basin. For the remainder of the runs, the ship was either turned and backed into the 455 ft wide terminal channel in preparation for docking at the eastern berths or driven head-in in preparation for transiting to the inner turning basin. In either case, the modified alignment provided adequate ship maneuvering room as well as for tug operation. Up to four tugs were used for these maneuvers with two live 85 TBP tugs and one or two vector tugs of the same power. All the simulation runs for Alternative 6 were considered successful by the pilots who preferred this design option. This alternative was a significant improvement over Alternative 1. A comparison of pilot's ratings of the outbound transits showed that 0% rated the transit difficult and unsafe while 50% rated transits outbound in Alternative 1 as difficult and 30% rated them unsafe.

Figure 54. BCC Alternative 6 inbound simulations.



Barbours Cut – Alternative 8

Comparing the dredging required for Alternative 6 with that required for Alternative 1, there would be an increase in the dredging volume of approximately 435,550 cu yd. Alternative 6 construction also would require the removal of unknown objects in the vicinity of the northern flare east of Spilman Island. To alleviate this, a mitigated flare for the north side of the entrance was laid out as shown in Figure 13 and referred to as Alternative 8. Alternative 8 would only increase the dredging volume over that required for Alternative 1 by 120,300 cu yd. The results of the outbound runs (Plates 127–130) performed with Alternative 8 are shown in Figure 55. The results of the inbound runs (Plates 121–126) for Alternative 8 are shown in Figure 56. Both figures indicate adequate room for the ship and tug maneuvers tested. In all of these runs, two live tugs and one vector tug were used by the pilots. This steady use of three tugs for maneuvers in the Alternative 8 channel generally indicates improved conditions when compared to the other alternatives as several of those runs (see Plates 90, 93, 107, 111–114) were conducted with four tugs. This alternative was considered safe and acceptable to the pilots; however, it was not preferred over Alternative 6. In the Alternative 8 channel, more efficient use of the tugs was required to make slower speed turns with the ULCV. Alternative 8 was found to be a significant improvement over Alternative 1 with over 50% of the pilot response stating that the outbound transit in Alternative 1 was difficult and 30% stating that it was unsafe and 0% stating that the transit outbound in Alternative 8 was difficult and unsafe. However, the Pilots were concerned that the ULCV could not begin the turn as soon as and at the same rate of turn as with Alternative 6 and

tended to venture to the red side of the HSC headed outbound more than Alternative 6.

Figure 55. BCC Alternative 8 outbound simulations.

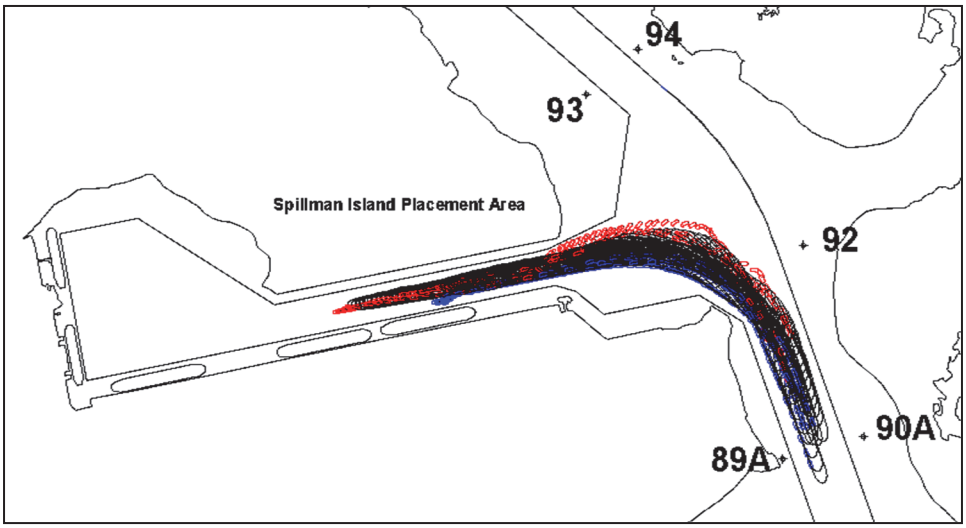
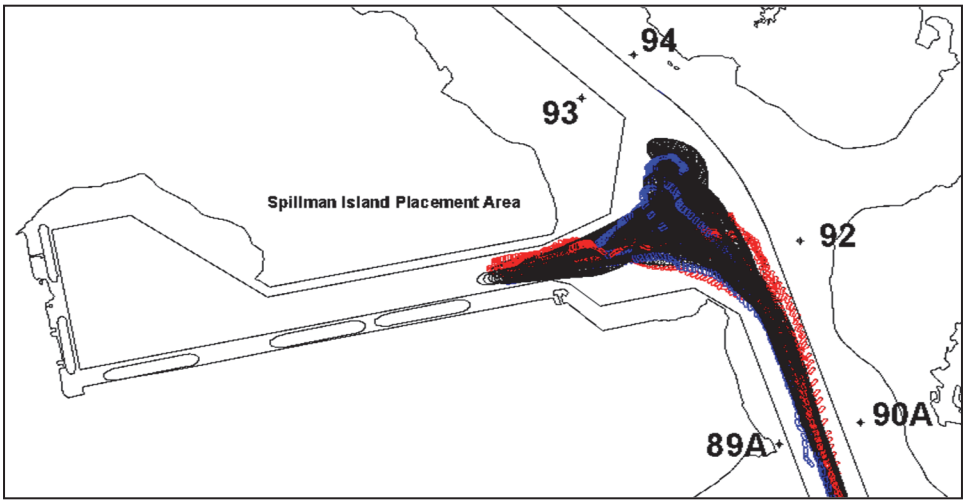


Figure 56. BCC Alternative 8 inbound simulations.



Since Alternative 1 and the NED plan provide similar maneuvering areas in the entrance (especially on the north side which is critical to the outbound turn into the HSC), two example runs conducted in the Alternative 1 design have been plotted in the NED plan channel. As shown in Figure 57, the ULCV tracks and tugs fit inside the channel; however, the early simulations with the Alternative 1 channel could not begin the turn early enough to avoid grounding on the east side of the HSC as shown by Run 42. As shown with Run 143, the pilots adjusted and began to approach the turn at a slow speed (2–3 kt) so that the tugs

were more effective and to keep the ULCV from outrunning the turn. With this maneuver, the ULCV was kept from grounding, but this maneuver made the ULCV more vulnerable to the effects of wind and also tied up HSC traffic. However, Figure 58, presenting the results of Runs 86 and 140, shows that the piloting approach allowed by the Alternative 6 channel could not be executed in the NED plan as there is not enough room on the north side of the NED channel to safely execute the turns and keep the tugs safe.

Figure 57. Example of outbound runs from Alternative 1 plotted with the NED plan.

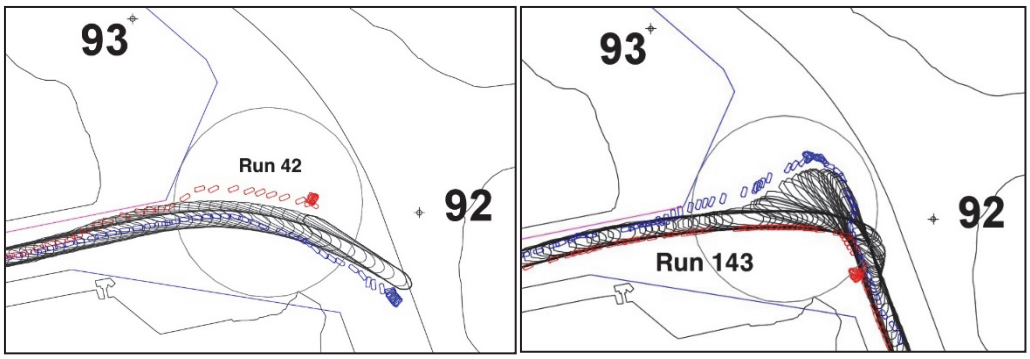
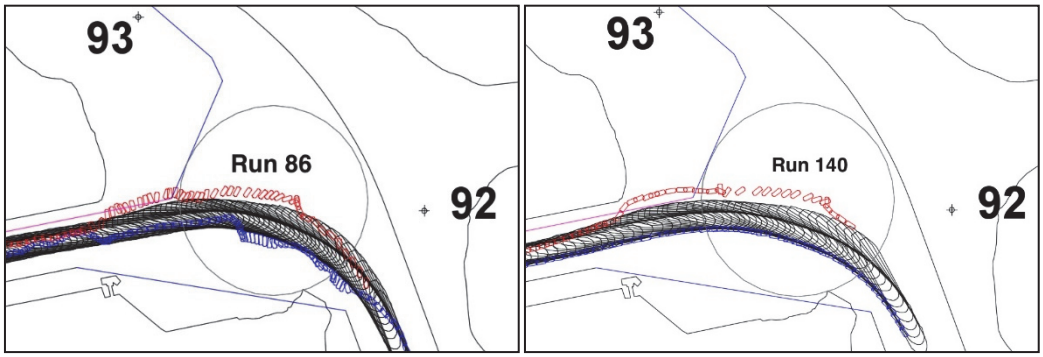


Figure 58. Example of outbound runs from Alternative 6 plotted with the NED plan.



Segment 4 – Bayou section

The bayou section contains the widening to 530 ft and deepening to 46.5 ft between Boggy Bayou and Greens Bayou. This widening and deepening will allow application of the Houston Pilot's combined beam rule from Lights 41/42 to Shell of 272 ft. One alternative (Alternative 1) was originally suggested for this area; however, an additional alternative was suggested to provide adequate room for vessels berthed at the Kinder Morgan terminal and maintain the setback for Enterprise. Both alternatives are shown in Figure 59. See Table 11 for simulation runs for Bayou section. Track plots of the entire bayou are shown in Appendix F.

Figure 59. Bayou section alternatives.

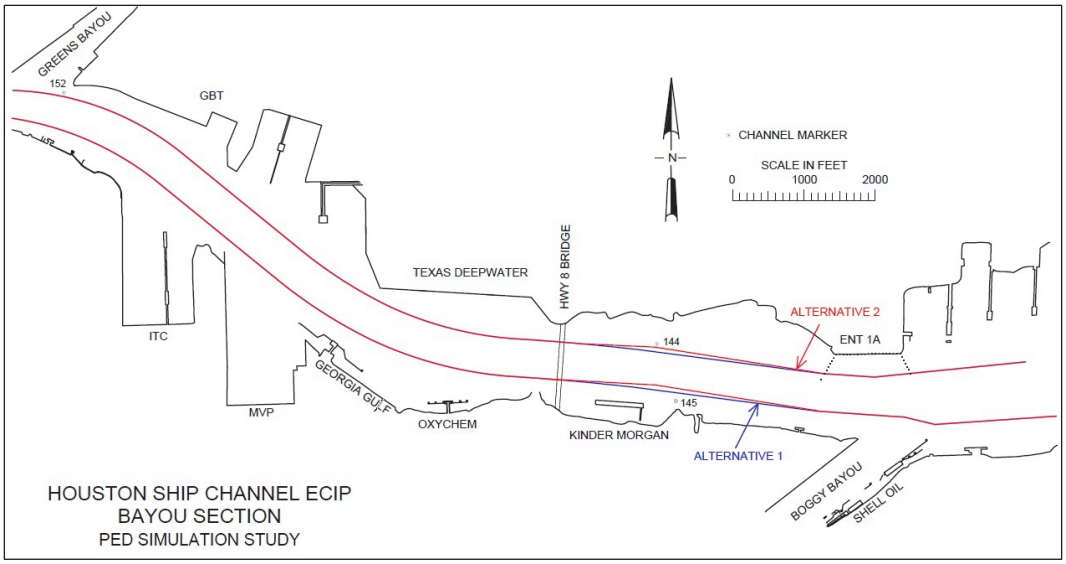


Table 11. Simulation runs for Bayou section.

Plate #	Channel	Tide	Wind	Main Vessel-Direction	First Vessel Meeting	Second Vessel Meeting	Run Notes	Run #
131	BG-A1	Flood	SE-20 kt	MTKM107X -Inbound	MBULK32N		Run performed with intentions that the inbound vessel would be preparing to dock at ITC or GBT.	13
132	BG-A1	Flood	SE-20 kt	MTKM107X -Inbound	MBULK32N		Run performed with intentions that the inbound vessel would be preparing to dock at ITC or GBT.	14
133	BG-A1	Flood	SE-20 kt	MTKM107X -Inbound	MBULK32N			15
134	BG-A1	Flood	SE-20 kt	MTKM107X -Inbound	MBULK32N			16
135	BG-A1	Flood	SE-20 kt	MTKM107X -Inbound	MBULK32N			17
136	BG-A1	Flood	SE-20 kt	MTKM107X -Inbound	MBULK32N			18
137	BG-A1	Flood	SE-20 kt	MTKM107X -Inbound	MBULK32N			19
138	BG-A1	Flood	SE-20 kt	MTKM107X -Inbound	MBULK32N			20
139	BG-A1	Flood	SE-20 kt	MTKM107X - Outbound	MBULK32X		MBULK32N and MTCM107N models	21

Plate #	Channel	Tide	Wind	Main Vessel-Direction	First Vessel Meeting	Second Vessel Meeting	Run Notes	Run #
							updated to strength the passing interaction forces (bothare Model X now).	
140	BG-A1	Flood	SE-20 kt	MTKM107X - Outbound	MBULK32X			22
141	BG-A1	Ebb	N-20 kt	MTKM107X - Outbound	MBULK32X			23
142	BG-A1	Flood	SE-20 kt	SUEZ156R-Inbound	MBULK32X			94
143	BG-A1	Flood	SE-20 kt	SUEZ156R-Inbound	MBULK32X			98
144	BG-A1	Flood	SE-20 kt	SUEZ156R-Outbound	MBULK32X	MBULK32X		96
145	BG-A1	Flood	SE-20 kt	SUEZ156R-Outbound	MBULK32X			101
146	BG-A1	Ebb	N-20 kt	SUEZ156R-Inbound	MBULK32X			24
147	BG-A1	Ebb	N-20 kt	SUEZ156R-Inbound	MBULK32X			25
148	BG-A1	Ebb	N-20 kt	SUEZ156R-Inbound	MBULK32X			95
149	BG-A1	Ebb	N-20 kt	SUEZ156R-Inbound	MBULK32X			99
150	BG-A1	Ebb	N-20 kt	SUEZ156R-Inbound	MBULK32X			26
151	BG-A1	Ebb	N-20 kt	SUEZ156R-Inbound	MBULK32X			27
152	BG-A1	Ebb	N-20 kt	SUEZ156R-Outbound	MBULK32X-Inbound			30
153	BG-A1	Ebb	N-20 kt	SUEZ156R-Outbound	MBULK32X-Inbound			31
154	BG-A1	Ebb	N-20 kt	SUEZ156R-Outbound	MBULK32X	MBULK32X	Over 50% of outbound vessel was outside of the federal channel during the first meet. There is deep water in that area, so the vessel did not ground.	97
155	BG-A1	Ebb	N-20 kt	SUEZ156R-	MBULK32X			100

Plate #	Channel	Tide	Wind	Main Vessel-Direction	First Vessel Meeting	Second Vessel Meeting	Run Notes	Run #
				Outbound				
156	BG-A1	Ebb	N-20 kt	SUEZ156R-Outbound	MBULK32X-Inbound			28
157	BG-A1	Ebb	N-20 kt	SUEZ156R-Outbound	MBULK32X-Inbound			29
158	BG-A2	Flood	SE-15 kt	SUEZ156R-Inbound	MBULK32X	MBULK32X		164
159	BG-A2	Flood	SE-20 kt	SUEZ156R-Outbound	MBULK32X	MBULK32X	Outbound vessel left the federal channel by Georgia Gulf and was approximately 106 ft away from the berthed vessel.	104
160	BG-A2	Ebb	N-20 kt	SUEZ156R-Inbound	MBULK32X	MBULK32X		103
161	BG-A2	Ebb	N-20 kt	SUEZ156R-Inbound	MBULK32X	MBULK32X		107
162	BG-A2	Ebb	N-20 kt	SUEZ156R-Outbound	MBULK32X	MBULK32X		105
163	BG-A2	Ebb	N-20 kt	SUEZ156R-Outbound	MBULK32X	MBULK32X		106

* Note: the variations in model number reflect modifications that have been made in the ship model to make aspects of the model more realistic (e.g., ship/ship interactions, ship/bank interactions, ship squat, or ship response to the rudder, etc.).

Bayou Section – Alternative 1

Figure 60 shows a composite of all the tracks completed that were run in Alternative 1. All simulations featured vessels that stayed within the channel confines, with the exception of Plate 138 and Plate 155, which contained a vessel that exceeded the channel limits. Further discussions about all Alternative 1 plates can be found in the following section.

Figure 60. Composite track plots for Bayou Alternative 1, excluding Run 97.

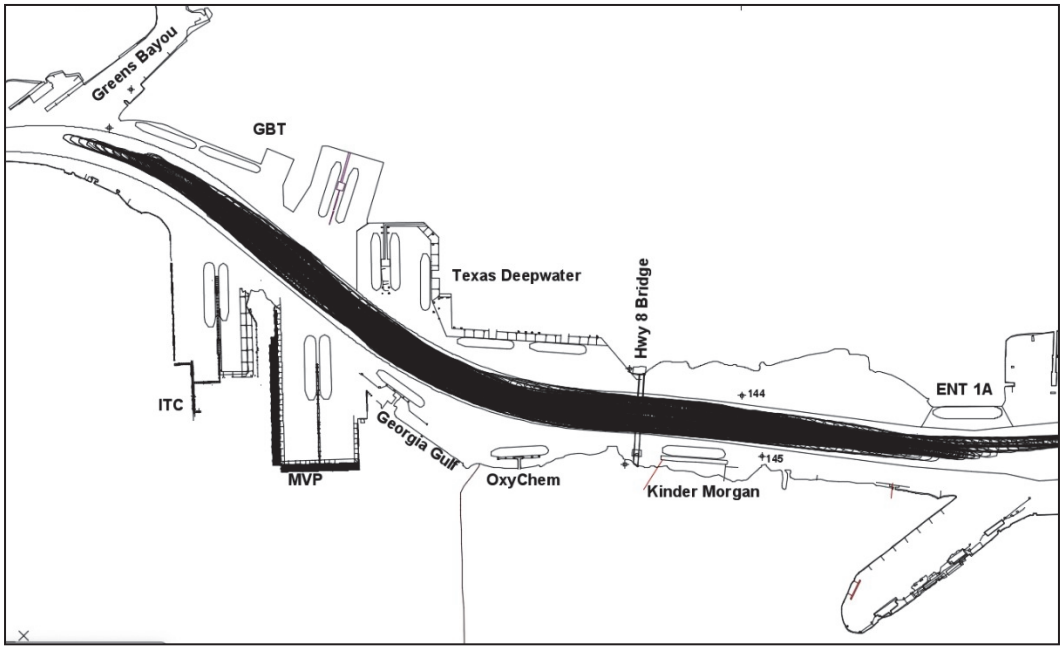


Plate 131–Plate 157 show all the transits that were completed using Alternative 1. All simulations completed using this alternative were rated as "normal" (approximately 93% of the time) or "difficult" (approximately 7% of the time) by the pilots. Also, each recovery and meeting were confirmed as controllable, and all runs were rated as safe to do in real life by the pilots for all Alternative 1 simulations.

Plate 131–Plate 140 show tracks of simulations that were completed with a flood tide and 20 kt wind from the southeast.

In Plate 131–Plate 134, an inbound MTKM107X met an outbound MBULK32N at or near the Texas Highway 8 bridge. In Plate 131, the vessels maintained a distance of 191 ft during the meeting, but the inbound vessel approached the channel limits after the meeting. The inbound pilot rated this run as "difficult" but manageable in real life. The pilots commented the simulator visual issues encountered at the beginning of the run may have affected meeting recovery. In Plate 132, the vessels maintained a separation distance of 164 ft during the meeting while the inbound MTKM107X was within 56 ft of the channel limit. The inbound pilot commented the meeting location right at the bridge was manageable, but it would be different in a real life scenario. The outbound pilot commented on the lack of bank and passing ship effects on the MBULK32N. In Plate 133, the vessels maintained a separation distance of

131 ft during the meeting while the inbound MTKM107X was within 62 ft of the channel limit. The inbound pilot commented that two tugs would be typical for this scenario, but the one tug was sufficient. The outbound pilot commented the meeting location, just downstream of the bridge, is not ideal but was manageable. In Plate 134, the vessels maintained a separation distance of 132 ft during the meeting while the inbound MTKM107X was within 84 ft of the channel limit.

In Plate 135–Plate 138, an inbound MTKM107X met an outbound MBULK32N at or near the bend between the Texas Deepwater and ITC. In Plate 135, the meeting at the bend occurred with vessels maintaining a separation distance of 121 ft. The outbound vessel was within 59 ft of the channel limit. The outbound pilot commented he felt close to the channel edge during the passing but was in control and was able to stay within the channel. In Plate 136, the vessels maintained a separation distance of 129 ft, while the outbound MBULK32N was within 40 ft of the channel limit. Both pilots commented the run was not challenging and had adequate room. In Plate 137, the meeting occurred just upstream of the bend with 178 ft between vessels. The inbound vessel was within 75 ft of the channel limit. The outbound pilot commented he could have moved farther out of the way for the inbound vessel, but the meeting was still comfortable. In Plate 138, the stern of the MTKM107X exceeded the channel limits after the meeting upstream of the bend. The inbound pilot rated this maneuver as “difficult” due to the starting location at the bend and a slow initial speed of 3.5 kt. This required him to apply maximum rudder as soon as the run started to get into position for the meeting.

In Plate 139–Plate 140, an outbound MTKM107X met an inbound MBULK32N at bend near the Texas Deepwater. In Plate 139, the meeting occurred with a 160 ft distance between vessels. The outbound MTKM107X was within 47 ft of the channel limit. The outbound pilot commented that the slow vessel speed (initially 1 kt) caused reduced steerage. This made it difficult for him to get into position to allow enough room for the passing vessel. Both pilots agreed there was plenty of room for the meeting. In Plate 140, the same run and initial starting conditions from Plate 139 were repeated with different pilots. During the meeting, the vessels maintained a distance of 162 ft apart, with the outbound vessel within 64 ft of the channel limit. During recovery, the outbound vessel came close to the channel edge, but the pilot overall felt comfortable with the run.

Plate 141 shows a meeting of an outbound MTKM107X with an inbound MBULK32N at the Highway (Hwy) 8 Bridge. The environmental condition simulatedwas an ebb tide with 20 kt wind from the north. The vessels maintained a distance of 184 ft apart, but the outbound vessel was within 23 ft of the channel limit. The outbound pilot noted in reality he would have reduced speed and not be concerned with trying to meet the inbound vessel in a specific location.

Plate 142–Plate 145 show tracks of meetings between the SUEZ156R and MBULK32N, with a flood tide and 20 kt wind from the southeast.

Plate 142 shows the inbound SUEZ156R meeting an outbound MBULK32N at the Hwy 8 Bridge. The vessels were approximately 151 ft apart during the meeting. The inbound pilot noted the meeting location at the bridge is not ideal but manageable with a reduced speed. Plate 143 shows the inbound SUEZ156R meeting the MBULK32N at the bend.

Vessels maintained a distance of 113 ft apart while the outbound vessel was within 28 ft of the channel. Both pilots commented that plenty of channel width was available for this maneuver.

Plate 144 shows the outbound SUEZ156R meeting two inbound MBULK32Ns. The first meeting occurred at the bend with the outbound vessel maintaining a distance of 136 ft from the passing ship and 30 ft from the channel limit. The second meeting occurred at the bridge with vessels maintaining a distance of 183 ft apart and 45 ft to the channel limit. Realistically, the inbound vessels would be spaced farther apart, approximately 1 mi, to allow enough time and room for the outbound vessel to recover. Plate 145 shows the outbound SUEZ156R meeting an inbound MBULK32N at the bend, with a distance of 140 ft between vessels. Both pilots agreed there was enough room for this maneuver.

Plate 146–Plate 148 show meetings at the bridge between an inbound SUEZ156R and outbound MBULK32N, with an ebb tide and 20 kt wind from the N. In Plate 146, the meeting occurs with a distance of 153 ft between vessels. The outbound MBULK32N came within 24 ft of the channel limit. Similar to previous comments regarding meetings at the bridge, the pilot commented the location is not ideal but manageable. In Plate 147, the meeting occurs with a distance of 92 ft between vessels. The inbound pilot also commented on the difficulty of the meeting location due

to needing to turn to starboard right after the recovery. Both pilots agreed the maneuver was manageable. In Plate 148, the meeting occurs with a distance of 166 ft between vessels. The SUEZ156R came within 44 ft to the channel limit. During the meet, the pilot felt bank suction effects, but since a low speed was maintained, he was able to recovery successfully.

Plate 149 –Plate 151 show meetings at or upstream of the bend, with an inbound SUEZ156R and outbound MBULK32N. The environmental condition simulated is an ebb tide and 20 kt wind from the north. In Plate 149, the meeting occurs at the bend with 111 ft between vessels. The outbound MBULK32N had less than 25 ft of clearance to channel limit. Both pilots commented they had enough space in the channel for this maneuver. In Plate 150, the meeting occurred upstream of the bend with 132 ft between vessels. Both pilots preferred this meeting location over meeting at the bridge. In Plate 151, the meeting also occurs upstream of the bend with 110 ft between vessels while the inbound vessel had a 51 ft distance to the channel limit.

Plate 152–Plate 153 show meetings downstream of the Hwy 8 Bridge with an outbound SUEZ156R and inbound MBULK32N. The environmental condition simulated was an ebb tide and 20 kt wind from the north. In Plate 152, the meeting occurred with a 120 ft distance between vessels.

The outbound pilot noted the meeting location is not ideal due to the proximity of the Kinder Morgan terminal, but it was still manageable. In Plate 153, the vessels were approximately 143 ft apart. The pilots commented again on the meeting area, stating they would avoid meeting there if possible. Both pilots felt they had sufficient channel width.

Plate 154 shows the outbound SUEZ156R meeting two inbound MBULK32Ns, with ebb tide and 20 kt wind from the north. The first meeting occurred at the bend in which over 50% of the outbound SUEZ156R exceeded the channel. This was caused by vessel tracks from a previous run still appearing on the pilot's PPU. This led to confusion in what the PPU predicted track was. The second meeting occurred at the bridge, where the outbound vessel was still outside the channel as it was still recovering from the previous meeting. This run was not included in the composite track plot shown in Figure 60.

Plate 155–Plate 157 show meetings at or upstream of the bend with an outbound SUEZ156R and inbound MBULK32N. The environmental condition simulated was an ebb tide and 20 kt wind from the north. In Plate 155, the meeting occurred at the bend with a 121 ft distance between vessels. The outbound pilot noted the meeting location was not ideal due to the docked vessel at Georgia Gulf. In Plate 156, the meeting occurred upstream of the bend with a distance of 92 ft between vessels. The slow starting speed of 1 kt on the outbound vessel made it harder to position the ship properly, but both pilots agreed there was still plenty of space for passing. In Plate 157, the meeting also occurs upstream of the bend with a distance of 152 ft between vessels. The pilots commented they had adequate room to maneuver.

Bayou Section – Alternative 2

Six runs, all with a Suezmax meeting two Panamax bulkers in sequence, were performed with Alternative 2, for a total of 14 meetings. Figure 61 shows a composite of all the tracks completed using this alternative.

Further discussions about all Alternative 2 plates can be found in the following section.

Figure 61. Composite track plots for Bayou Alternative 2.

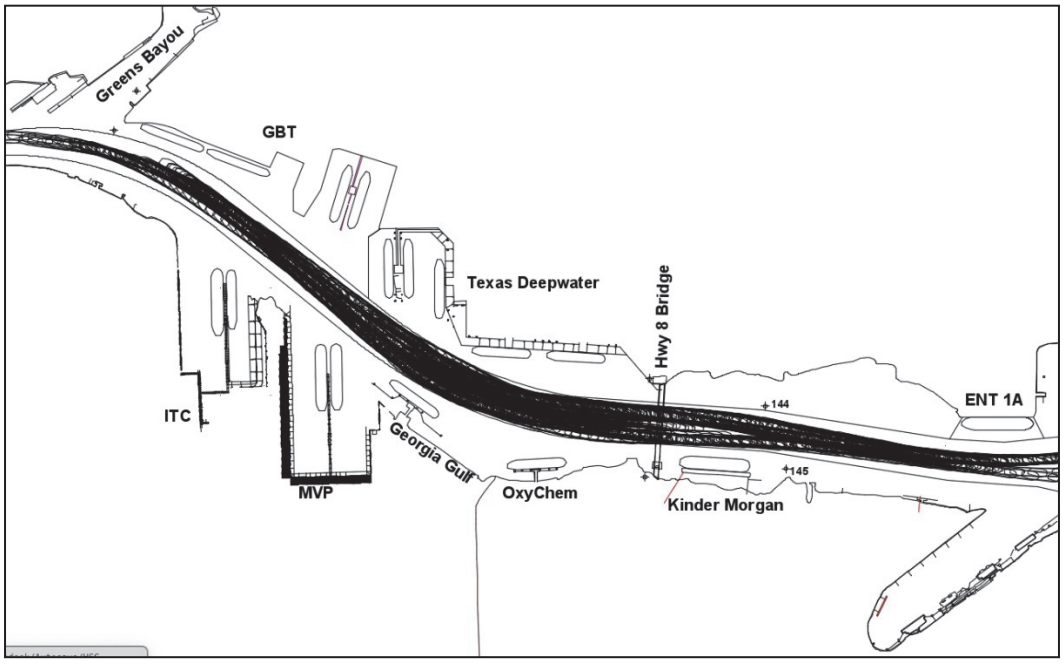


Plate 158–Plate 163 show all the transits that were completed using Alternative 2. One of the Alternative 2 simulations was rated as “difficult” while the remaining five simulations were rated as “normal” or “easy.”

Each recovery and meeting were confirmed as controllable, and all runs were rated as safe to do in real life by the pilots for all Alternative 2 simulations. All Alternative 2 simulations included two vessel meetings, compared to Alternative 1 in which the majority of runs had only one meeting.

Plate 158 shows an inbound SUEZ156R meeting two outbound MBULK32Xs with flood tide and 15 kt wind from the southeast. The first meeting occurred at the bridge with 170 ft distance between vessels. The inbound vessel came within 31 ft of the channel limit. The second meeting occurred at the bend with 178 ft between vessels. The inbound vessel had less than 20 ft of clearance to the channel limit. The inbound pilot felt the vessel was controllable. The outbound pilots commented they had plenty of room to pass safely.

Plate 159 shows an outbound SUEZ156R meeting two inbound MBULK32Xs with flood tide and 20 kt wind from the southeast. The first meeting occurred at the bend, with 129 ft between vessels. During recovery, the stern of the SUEZ156R exceeded channel limits. The vessel was approximately 106 ft from the docked vessel at Georgia Gulf. The simulation began with the first inbound vessel’s engine disengaged due to a computer error. The pilot deemed this run as “difficult” due to the initial loss of engines and controllability. The second meeting occurred at the bridge with 140 ft between vessels and was controllable.

Plate 160–Plate 161 shows an inbound SUEZ156R meeting two outbound MBULK32Xs with ebb tide and 20 kt wind from the N. In Plate 160,the first meeting occurred at the bridge with 171 ft between vessels, and the inbound vessel came within 35 ft of the channel limit. The second meeting at the bend had a 146 ft distance between vessels and the outbound vessel came within 25 ft of the channel limit. In Plate 161, the first meeting occurred at the bridge with 158 ft between vessels, and the outbound MBULK32X came within 33 ft of the channel limit. The second meeting at the bend had a 145 ft distance between vessels, and the outbound MBULK32X had less than 20 ft to the channel limit. The inbound pilot acknowledged that the outbound vessels provided plenty of maneuvering

room for the larger SUEZ156R to pass. It was also recommended to space out meetings to allow enough time and room for recovery.

Plate 162–Plate 163 shows an outbound SUEZ156R meeting two inbound MBULK32Xs with ebb tide and 20 kt wind from the N. In Plate 162,the first meeting near the bend had 140 ft between vessels. The inbound pilot commented that meeting N of Georgia Gulf was a better location to meet than exactly at the bend because it provided more room for the SUEZ156R. The second meeting occurred west of the bridge with 155 ft between vessels. The inbound vessel at this meeting was less than 20 ft from the channel edge. Considering the *small* size of the MBULK32X, this amount of clearance is acceptable since there is enough water outside of the channel. The pilot wanted to give as much room as possible to the SUEZ156R. The main outbound pilot commented that the additional channel width allows for vessels to safely meet in locations they would typically not choose to meet. In Plate 163, the first meeting occurred north of the bend with a 149 ft distance between vessels and no issues. The second meeting occurred west of the Hwy 8 Bridge with 206 ft between vessels. The outbound SUEZ156R began the turn at the bend later to allow enough space during the first meeting; however, this caused the vessel to exceed the channel in the second meeting. The meeting was controllable, but the vessel could not recover due to being out of position.

Bayou Segment 4 – Alternative 1 with economic design bulkcarrier design dimensions

According to Appendix B – Economic Appendix (6 Dec 2019) Section 2.8.2 Segment 4, the design vessel dimensions for the bulk carrier are LOA of 810 ft and a beam of 106 ft. A bulk carrier model, *Fraiser River*, was available with an LOA of 869 ft and beam of 105.9 ft; however, this model did not have realistic behavior when tested. A realistically behaving bulk carrier model with an LOA of 705 ft by 105 ft was available, was the closest to the design vessel, and was used for the simulation tests of the Bayou Segment 4. Since these vessels represent the Panamax class of vessels (maximum beam of 106 ft), a comparison of the actual and the *potential* track plots of the two vessels during meetings was made by plotting the design bulker in place of the simulated bulker. Such a comparison is reasonable because both ships are moving at a very low speed (under 5 kt) due to the presence of moored ships on both sides of the channel, essentially no currents to affect ship handling as well as no effects of banks on either side of the channel due to deepen berth areas. In addition, most

of the simulation runs with these ships did not have an escort tug on the stern of the loaded Suezmax or Aframax tanker. The pilot guidelines (Section 5.4.3) require an escort tug be assigned to a deep-loaded vessel above Morgans Point (WB-8), which will increase the controllability of the larger vessel and make the meetings even more controlled than most of the simulated meetings.

In making a comparison of the simulated and *potential* track plots, as proposed above, the track plots of Alternative 1 for the Bayou (Segment 4) will be used as it was selected for recommendation (Section 6.4).

However, because both alternative channel design layouts resulted in acceptable test results and acceptance by the pilots, either of these test results could be used for this analysis. The same will be true for the next report section (5.4.2).

Figure 62 shows the simulated track plot and the modified track plot with the economic bulk carrier image, respectively, meeting the Suezmax tanker for a sample run, Run 100. This shows that the larger bulk carrier (LOA = 810 ft) could still meet the Suezmax tanker with sufficient clearances considering that it could follow the same path as the smaller bulk carrier. Figure 63 shows that all Alternative 1 track plots shown in Figure 60 with the simulated bulk carrier replace with the 810 ft LOA bulkcarrier icon meeting the Suezmax tanker result in acceptable clearances.

All ships stayed within the channel limits and did not come close to one another.

The Houston Pilots have a combined beam rule of 272 ft for the navigation channels from Buoy 75/76 to Boggy Bayou (WB-7).[1] The maximum ship size for this reach is 950 ft LOA and 166 ft beam. The pilots stated that they would apply these rules when the channel between Boggy Bayou to Greens Bayou is widened to 530 ft and deepened to 46.5 ft. The design vessels meet both the length and combined beam criteria.

[1] Houston Pilots, Navigation Safety Guidelines for the Houston Ship Channel, Updated December 2,2020.

Figure 62. Suezmax meeting a 705.4 ft by 105 ft and an 810 ft by 106 ft bulk carrier – Run 100.

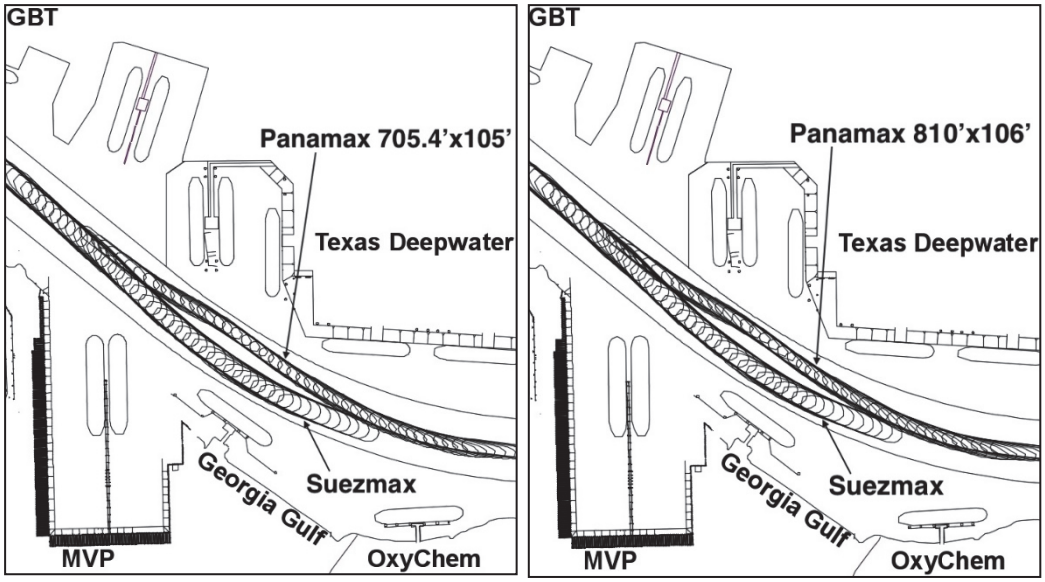
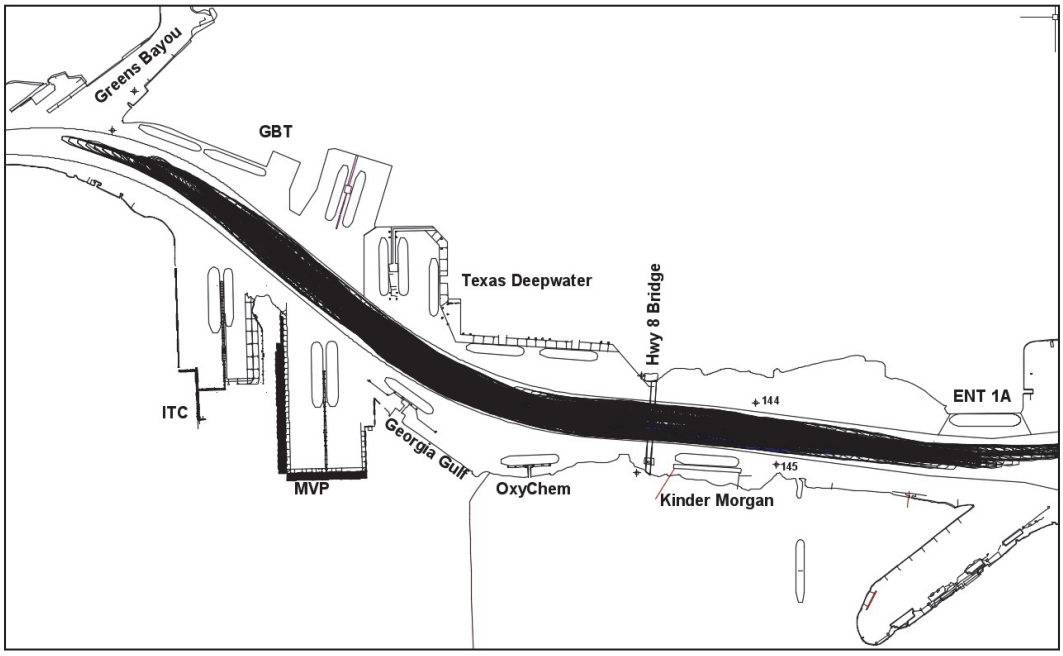


Figure 63. All potential run Track plots with Suezmax tanker meeting an 810 ft by 106 ft bulk carrier – all runs except Run 97.

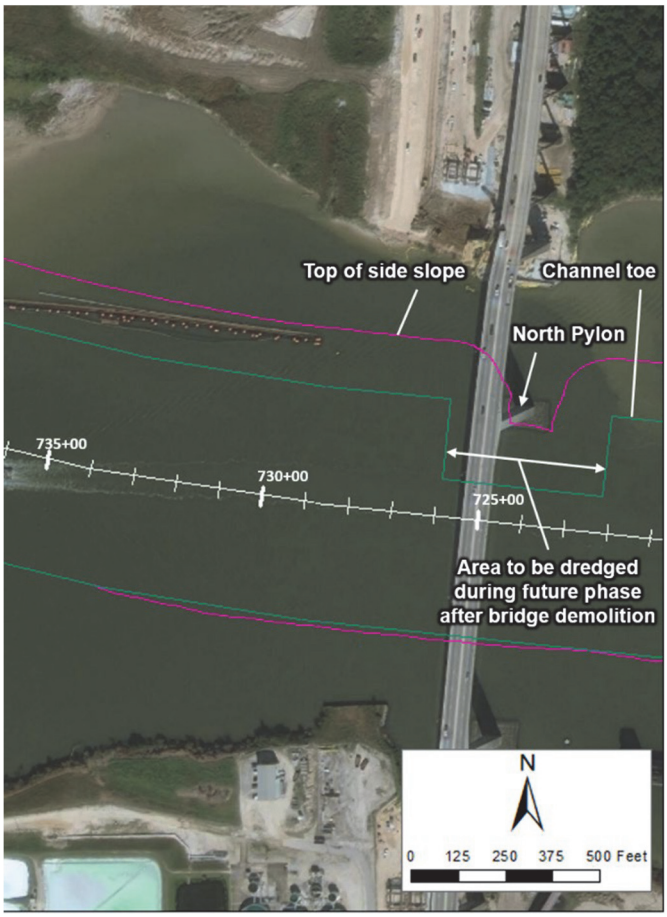


Bayou Segment 4 – Alternative 1 with Texas Beltway 8 Bridge northern pier not removed

As shown in Figure 64, the Alternative 1 navigation channel will overlap the north pylon of the existing Beltway 8 Bridge. This bridge is scheduled to be demolished and replaced within the next 2 to 5 yr by the Harris County Toll Road Authority. Dredging around the N pylon will therefore

be completed in phases as needed for coordination with the planned bridge replacement project. The pylons for the new bridge will be located on dryland and will not present a dredging or navigation obstruction.

Figure 64. Dredging plan allowance if the Texas Beltway 8 Bridge north pylon is not removed prior to dredging of the HSC.



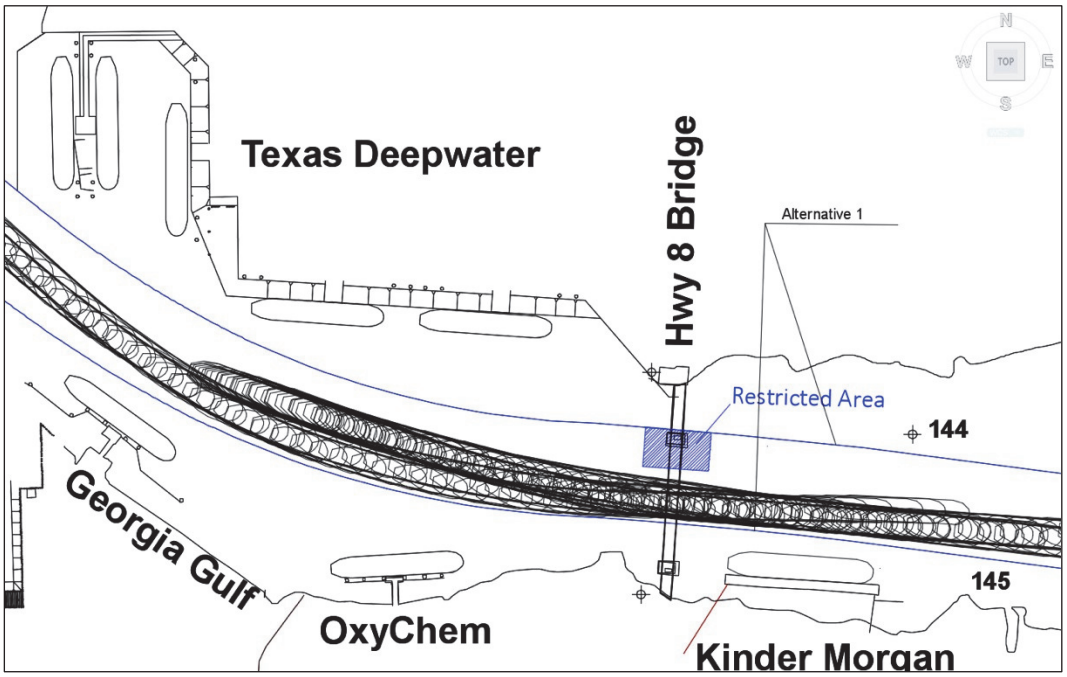
If the replacement of the Texas Beltway 8 Bridge is not completed and the old pier on the north side of the navigation channel is not removed at the time the proposed navigation widening and deepening is completed, a restriction to the navigation channel on the north side of the widened and deepened channel will be left until that pier is removed. This restriction is shown in Figure 65. The available channel width within the restricted area is between 311 ft and 315 ft. Lighted channel markers or buoys should be placed at the inside corners of the restriction to indicate the restricted area limits as long as this restriction remains in effect.

Many of the simulated runs made during the testing of the Segment 4 channel designs involved movements above or below the Texas Beltway 8

Bridge or the larger ships, Aframax and Suezmax tankers, moving inbound or meeting in the vicinity of the bridge, which caused the vessels to use the northern portion of the bridge. Therefore, only five outbound simulated runs could be used to show the potential tracks of the newly admitted vessels into the Segment 4 channel.

It is evident that the channel is narrow at this location, and meeting above Boggy Bayou (Shell) will have to be limited during the time this portion of the channel cannot be completely dredged. This would be consistent with the Houston Pilots Navigation Safety Guidelines for the Houston Ship Channel – Wide-body (WB) Rule WB-7 (Section 5.4.3). Of course, these plotted transits did not experience the bank effects from the narrowed northern channel toe line; however, these transits were experiencing ship/ship interaction forces and moments since meeting a Panamax bulk carrier was the reason for these simulated transits. The only way to fully determine the safety of navigating these newly admitted tankers (inbound and outbound) in this segment with the restriction would be to conduct simulations specifically for this situation. The necessity of this will depend on the anticipated length of time this situation will exist.

Figure 65. Proposed restricted area due to presence of Texas Beltway 8 Bridge pier with Suezmax Runs 30, 31, and 96 and Aframax Runs 22 and 23 track plots.



Bayou Segment 4 – Possible Houston Pilots navigation safety guidelines for the HSC

Under the present guidelines for navigation safety published by the Houston Pilots,[1] the limitations below are applied to Segment 4:

VI. Channel Restrictions

6.03 Upper Ship Channel

A. Vessels with a beam of over 105 ft shall not meet any ship traffic (of any beam) above Boggy Bayou

XII. Criteria for Routine Vessel Transits and Maximum Vessel Sizes

ABOVE BOGGY BAYOU (SHELL) TO MAGELLAN/TARGA #5

- Routine transit vessel size: Less than 750 ft LOA and 106 ft beam.
- Maximum vessel size: 811 ft LOA and 125 ft beam [See DK-10, KMD exception] 05.20.20.
- Daylight above Beltway 8 Bridge for vessels over 750 ft LOA or over 39 ft draft. 11.18.09, 04.29.15.

Draft Restrictions

Maximum permitted draft for vessels transiting the Houston Ship Channel above Boggy Bayou and below North Texas Slip shall not exceed 40 ft (fresh water).

With the proposed channel dimension changes in the HSC Segment 4 of a beam of 530 ft width and 46.5 ft depth and the removal of the existing Texas Beltway 8 bridge piers, the pilots indicated that the guidelines could be modified for the reaches immediately below Boggy Bayou (Shell) which are as follows:

X. Wide-body (WB) Rules

[1] Houston Pilots, Navigation Safety Guidelines for the Houston Ship Channel, Updated December 2,2020.

WB-4 The maximum beam of any vessel allowed to come to Houston without prior approval from the Houston Pilots and the respective terminalis 166 ft.

WB-5 The maximum LOA above Morgan's Point High Lines without prior approval from the Houston Pilots and the respective terminal is 950 ft.

WB-7 Two wide-body vessels meeting in the Houston Ship Channel between beacons 75/76 and Boggy Bayou shall be restricted to a combined beam of 272 ft and shall be limited to a combined draft of 77 ft.

WB-8 Deep loaded vessels transiting above Morgan's Point will be assigned an escort tug from Morgan's Point to their dock, or from their dock to Morgan's Point in accordance with the tug matrix.

XII. Criteria for Routine Vessel Transits and Maximum Vessel Sizes

ABOVE BARBOUR'S CUT HIGHLINES TO BOGGY BAYOU (SHELL) 04.29.15

- Routine transit vessel size – Less than 825 ft LOA and 120 ft beam.
- Maximum vessel size: 950 ft LOA and 166 ft beam [as per WB rule #6].
- Daylight above Baytown for vessels with over 40 ft draft. [See WB-9]. 12.07.2005

Draft Restrictions

Maximum permitted draft for vessels transiting the HSC below Boggy Bayou (including Bayport and Barbours Cut) shall not exceed 45 ft (fresh water).

The participating pilots noted during the simulation testing that they routinely meet vessels of the design size in the reach between beacons 75/76 and Boggy Bayou with the rule WB-7. Because of this, they stated that this rule could be applied to the Segment 4 reach as soon as the construction is complete.

Until the existing Texas Beltway 8 Bridge pier on the north side of the channel is removed, an interim rule should be applied that would allow vessels of a maximum LOA of 950 ft and beam of 166 ft and a maximum draft of 40 ft. A restriction of no meetings of any vessel with a beam greater than 105 ft should be allowed above Boggy Bayou.

6 Conclusions and Recommendations

Conclusions and recommendations are based upon the vessel track plots (Appendices C–F), pilot comments on the run sheets (Appendices C–F), and observations during simulations.

A total of 164 simulated vessel transits were conducted for the present navigation study. Widening alternatives for four different areas of the HSC were evaluated for larger ships transiting the Houston Ship Channel (HSC), Texas. The areas of the HSC evaluated include the Bay Section (Segment 1), the Bayport Ship Channel (BSC) (Segment 2), Barbours Cut Channel (BCC) (Segment 3), and the Bayou Section (Segment 4).

Segment 1 – Bay Section

A total of 48 simulated transits were completed for the Bay Section. The section was divided into four different areas: Entrance, Bolivar Roads, Redfish, and the BSC Intersection. The track plots and pilot comments are located in Appendix C.

The straight reaches of Segment 1 are recommended to have a bottom width of 700 ft.

Three design alternatives were evaluated for the Entrance: Alternatives 1, 3, and 4. The composite track plots for Alternatives 1, 3, and 4 are shown in Figures 36, 37, and 38, respectively. Individual track plots are located in Appendix C, Plates 1–27. Evaluation of the track plots and pilot feedback showed Alternative 3 to provide the safest transit. The alternative consisted of a 1,215 ft symmetrical cutoff bend starting at Station 136+222 and ending at Station 2+607 (Appendix A, Figure 2). This design alternative should be relatively simple to mark for navigation. All runs elicited a description of “normal” or “easy” from the pilots and a “yes” to controlled meetings and recovery.

Only one alternative was tested for the Bolivar Roads area, a modified 900 ft angle bend widener for the bend at Buoys 25/26 extending from Station 126+568 to Station 130+893 (Appendix A, Figure 4). Simulator transits of this alternative confirmed the alternative as the recommended design.

The Redfish (RF) area had only one alternative designed, Alternative 1 (Appendix A, Figure 5). This design consisted of a modified 900 ft bend widener for the bend at Buoys 25/26 extending from Station 75+048 to Station 82+605. This alternative is recommended based on pilot elicitation and track plots (Plates 28–38).

Alternative 1 for the BSC Intersection was comprised of the proposed Feasibility Report, Environmental Impact Statement design with a minor extension of the southern 4,000 ft flare to meet the new 700 ft channel represents the only alternative (Appendix A, Figure 6). This alternative was the only alternative proposed/tested and is recommended based on the track plots (Plates 39–48) and pilot elicitation.

Segment 2 – BSC

Simulated transits were conducted for the entrance into the BSC channel, the channel portion of the BSC, and for the turning basin at the western end of the BSC. Ten transits conducted for entrance to the BSC from the HSC. Twenty-one transits were conducted for the channel and turning basin combined. Seven transits were conducted for the turning basin only.

Only one design alternative, Alternative 1, was considered for the entrance into the BSC from the HSC. This alternative maintained the 700 ft width of HSC combined with the previously constructed 4,000 ft radius flare and a widening of the BSC channel to 455 ft. Alternative 1 is recommended based upon successful ULCV transits (Appendix A, Figure 6) and pilot comments. Note that safe transits of the entrance to the BSC were limited to those conducted at or below wind speeds of 15 kt.

Alternative 1 for the channel section of the BSC is simply a widening of the channel to 455 ft. This is the recommended alternative as all transits of the channel west of the BSC entrance (Plates 49–58) were conducted successfully and resulted in positive comments from the pilots participating in the simulated transits.

Alternative 1 was the initial design alternative for the BSC turning basin (Appendix A, Figure 7) for this simulation study. The tapering of the northern edge of the turning basin combined with the length of the design ship made the turning maneuvers difficult due to the amount of space in turning basin and the confined space of the entrance into the turning basin. Since tugs are required components of the turning maneuvers in the

turning basin, the difficulty associated with the reduced spacing in the transition between the channel and the turning basin is further exacerbated. These difficulties resulted in the development of Alternative 9. Variations of this alternative, Alternatives 9A and 9B (Appendix A, Figure 8-9) were developed to widen the entrance into the turning basin. Alternative 9A and 9B were both considered to increase the safety of the turning and exit maneuver and to be acceptable based on the simulations of Alternative 9, the deepening of the point between Berth 7, and the Odfjell berth. Note that Alternative 9A and 9B were not explicitly tested. A final selection between 9A and 9B will have to be made between the federal and non-federal project sponsors.

Segment 3 – BCC

Three alternatives were tested for the BCC: Alternative 1, Alternative 6, and Alternative 8. A combined total of 44 transits (Plates 87–130 in Appendix E) were conducted for the BCC alternatives. Twenty-three transits were conducted for Alternative 1, eleven for Alternative 6, and ten for Alternative 8. All three alternatives included a widening of the channel to the northern side from approximately Station 23+88 to Station 67+20. Alternative 1 was the originally proposed design alternative (Appendix A, Figure 10). Alternatives 6 and 8 (Appendix A, Figure 11-12) were developed to address two specific needs in the entrance to the BCC from the HSC discovered during Alternative 1 testing:

1. Allowing earlier turns for ships exiting the BCC and entering theHSC.
2. Allowing extra room on inbound transits from the HSC to reduce the amount of the HSC blocked while ships are turning and backing to the first two berths at the container terminal.

Alternatives 6 and 8 represent two different approaches to providing additional maneuvering space on the northern side of the entrance to the BCC. Both alternatives involve removing material from the eastern-most point of the northern channel edge near the southeastern corner of Spilman Island.

Alternatives 6 and 8 both allowed for safe transits of the BCC. Note that safe transits of the entrance to the BCC were limited to those conducted at or below wind speeds of 15 kt. While less dredging was required for Alternative 8 over Alternative 6 – when compared to Alternative 1 – significantly more control of the ULCV was required in Alternative 8. This

fact made transits of Alternative 8 more difficult than those of Alternative 6. Therefore, Alternative 6 is the recommended design alternative for the entrance into BCC.

In addition to the channel widening of the BCC, Alternative 6 includes the removal of the LASH dock and the point near HSC Station 0+00 and with modifications at the entrance on the north (N) and south (S).

When comparing the Alternative 6 design layout to the NED design layout, it is recommended that the northern layout of the entrance to the BCC be adopted for the NED design. In addition, the southern portion of the BCC entrance recommendation is a combination of the western portion of the NED southern toeline and the eastern portion of the Alternative 6 southern toeline, thus reducing the dredging and bulkhead required. This recommended design is shown in Figure 66, and this design with all of the Alternative 6 run track plots is shown in Figure 67.

Figure 66. Recommended BCC Entrance design.

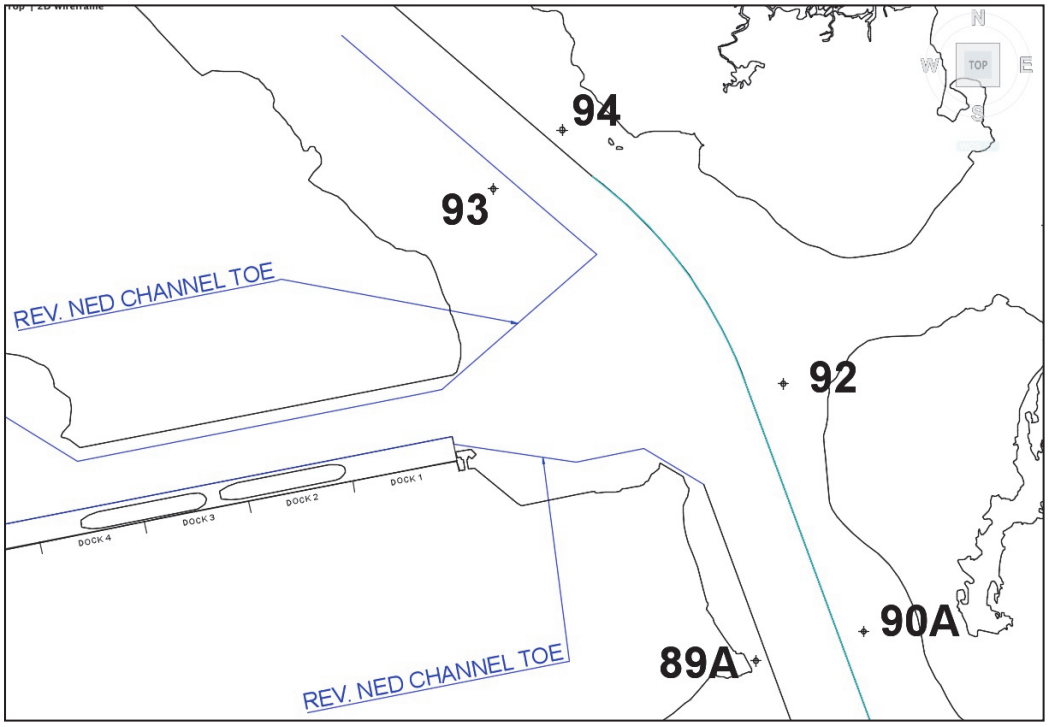
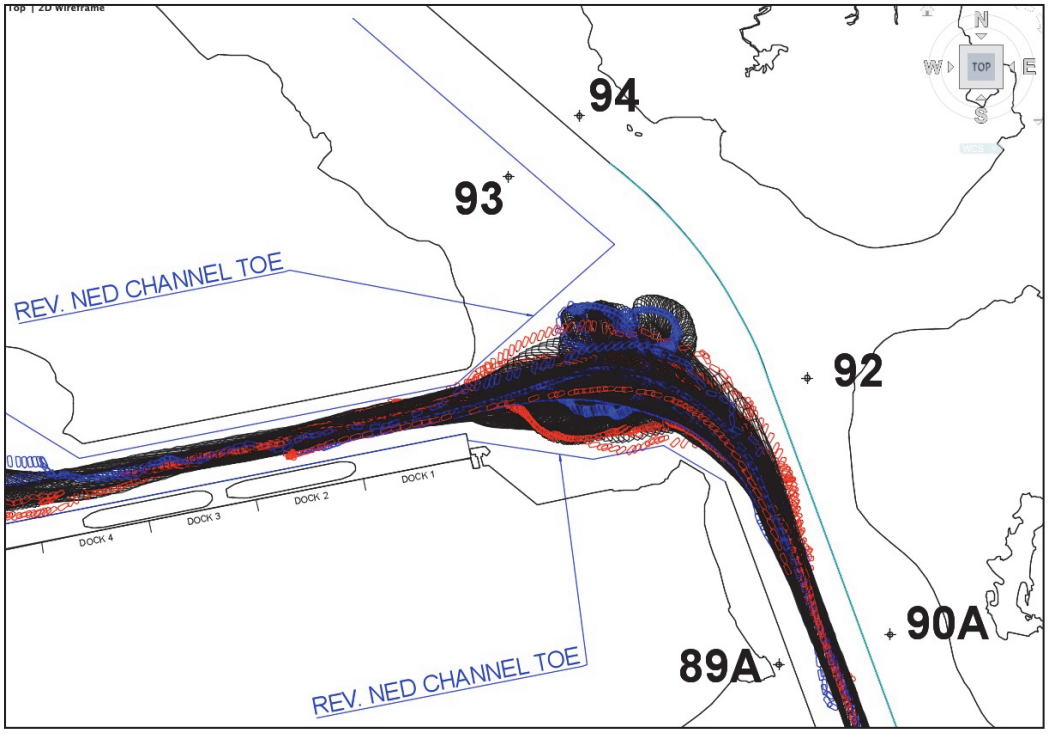


Figure 67. Recommended BCC Entrance with Alternative 6 simulated run track plots.



Segment 4 – Bayou Section

A total of 34 simulated transits was conducted for the Bayou Section with 27 transits (Plates 131–157) being simulated for Alternative 1 and six transits simulated for Alternative 2 (Plates 158–163). The design of each alternative is shown in Appendix A, Figures 13 and 14, for Alternatives 1 and 2, respectively.

Alternative 1 is recommended as it is the least costly alternative that provides the function and value described in the feasibility study. Alternative 1 requires approximately 80,000 cu yd less dredging than Alternative 2 and reduces adjacent impacts by approximately 2 acres. The alternative provides existing clearances for moored vessels as recommended by the Houston Pilots for berths adjacent to this reach including Enterprise and Kinder Morgan.

Alternative 1 includes widening the channel from 300 ft to 530 ft and deepening it to 46.5 ft MLLW from approximately Station 676+53 to Station 823+35 as the recommended channel dimensions described in the 23 April 2020 Chief's Report.

If the Texas Beltway 8 Bridge north pier is not removed, then the dredging to -46.5 ft will not be performed beyond the north (red) side of the existing HSC channel toe line, and a channel restriction with a width of approximately 300 ft will be available for navigation between approximately existing HSC Station 719+20 to 728+70. During the period that this condition exists, the Houston Pilot Navigation Safety Guideline WB-7 should be observed, and meetings with Aframax and Suezmax vessels should be restricted.

A draft copy of this report was furnished to the participating maritime organizations and the Port of Houston Authority for review and comment.

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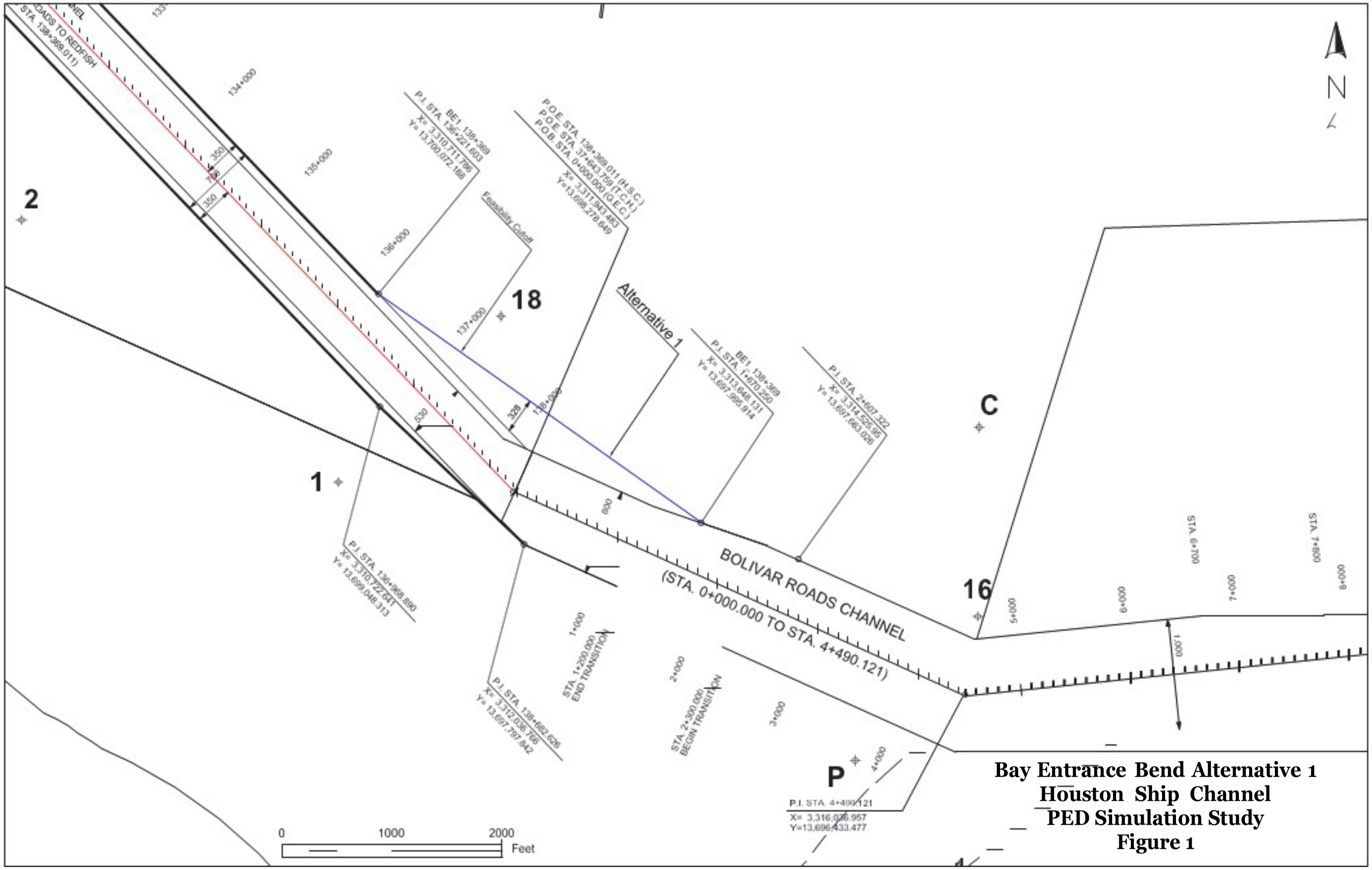
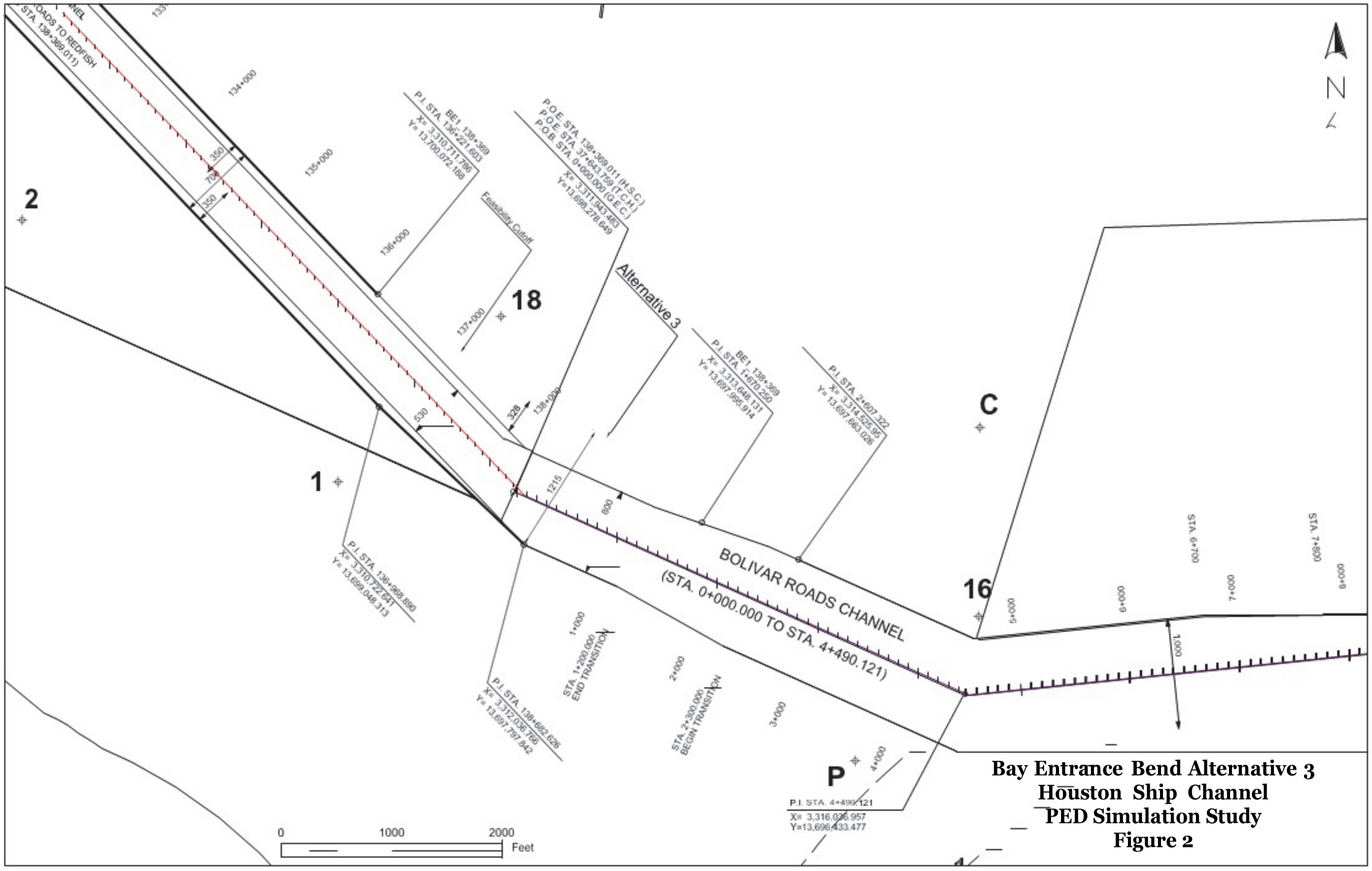
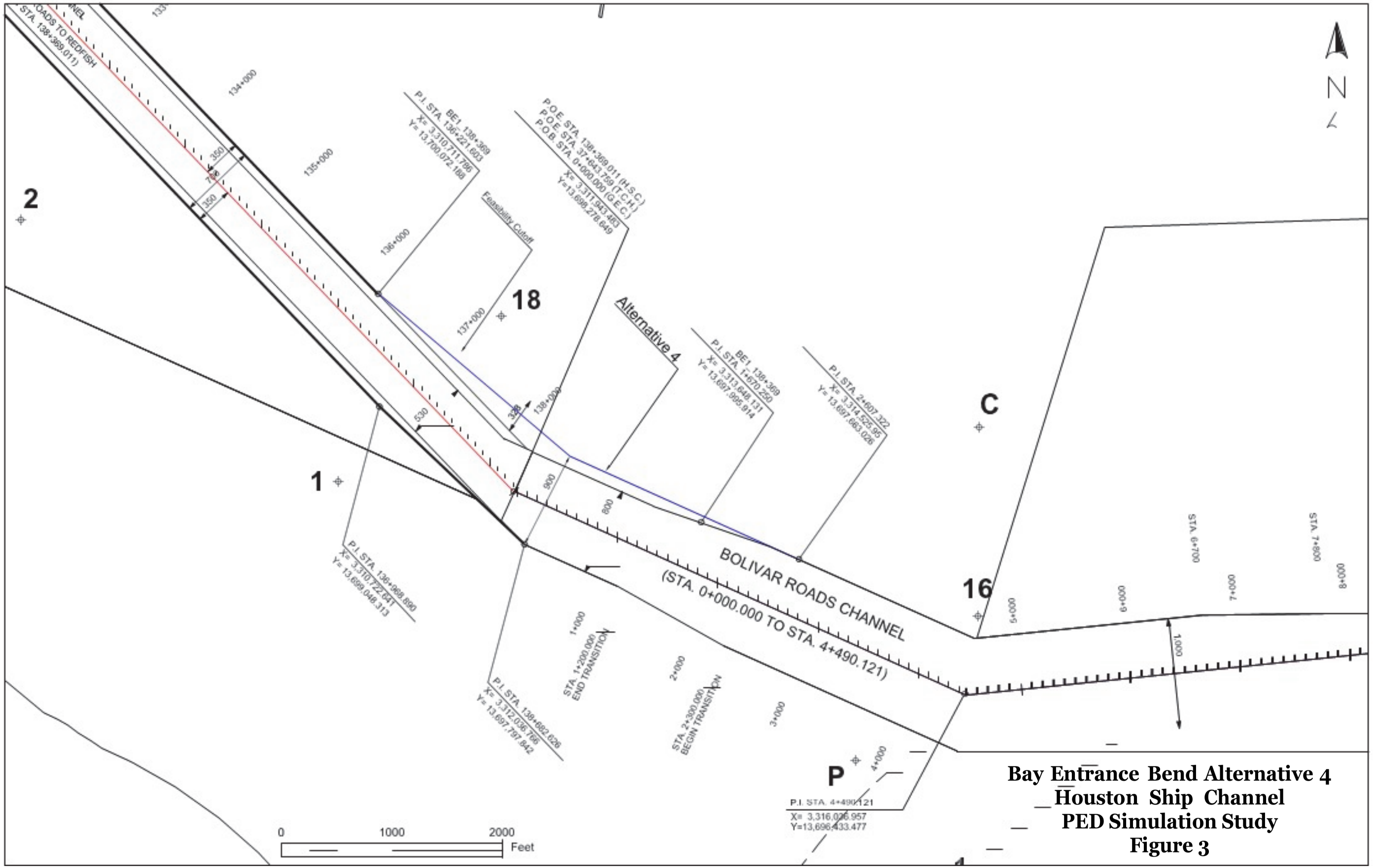
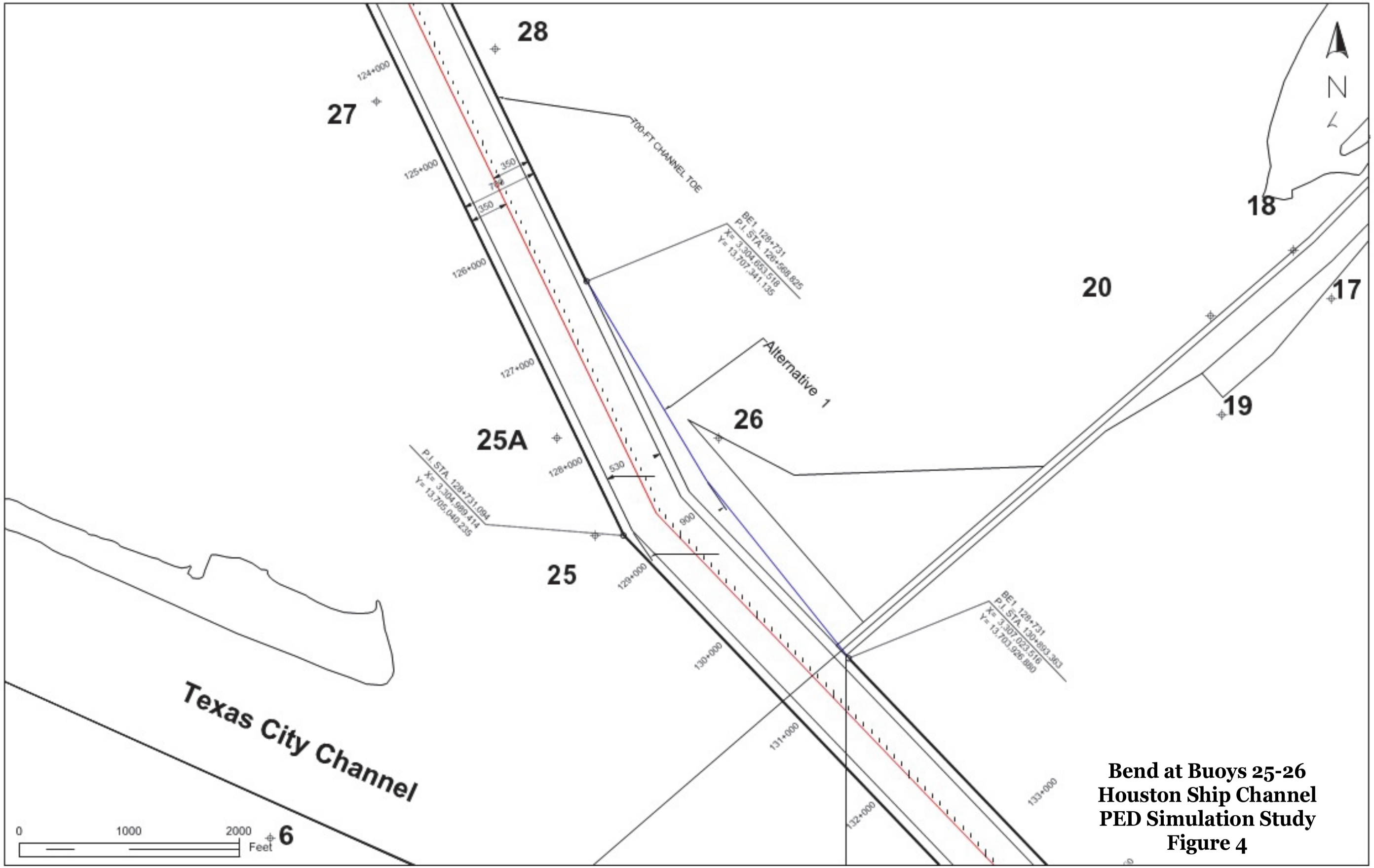
Appendix A: Design Alternatives



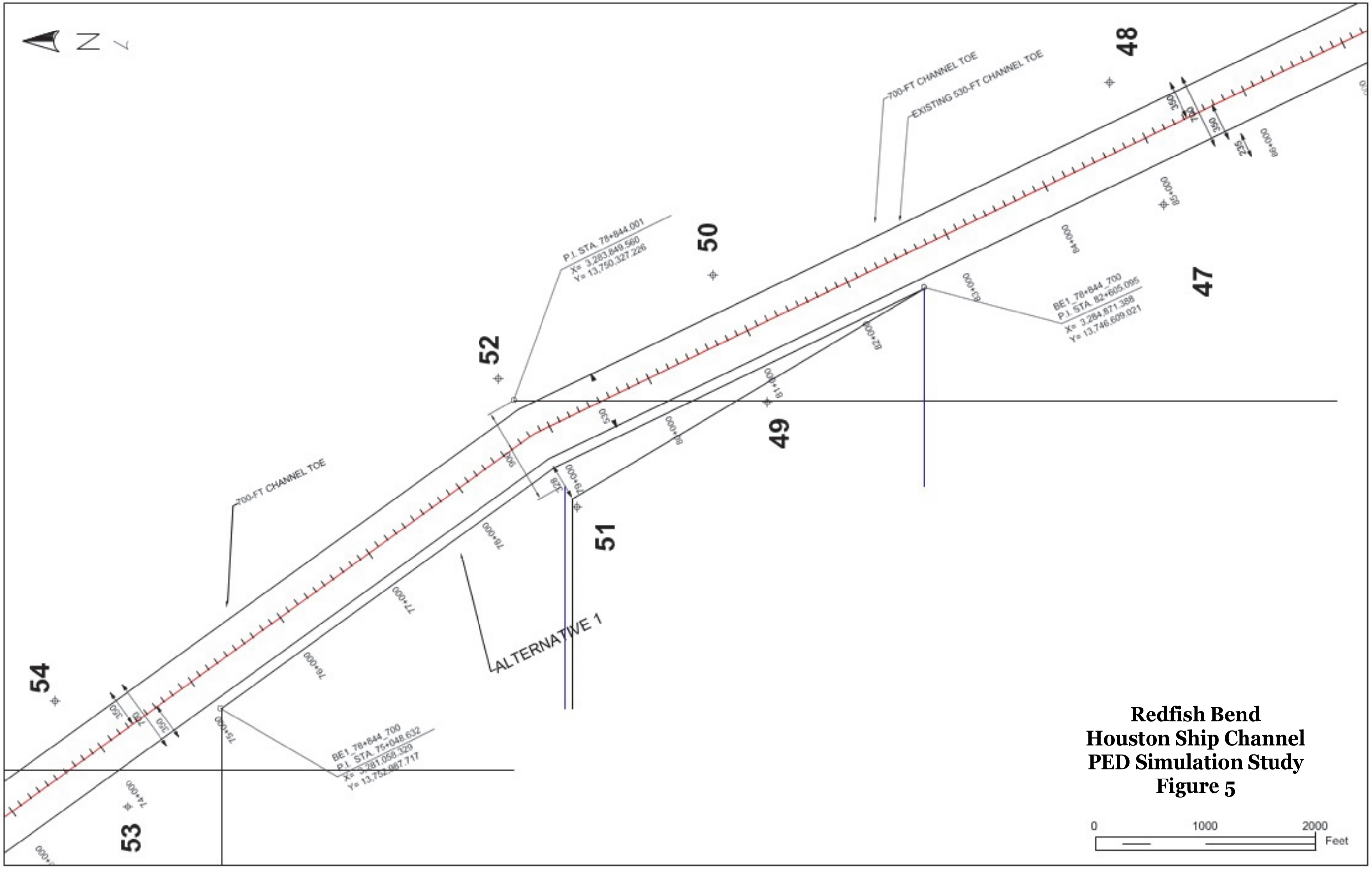
Bay Entrance Bend Alternative 1
Houston Ship Channel
PED Simulation Study
Figure 1

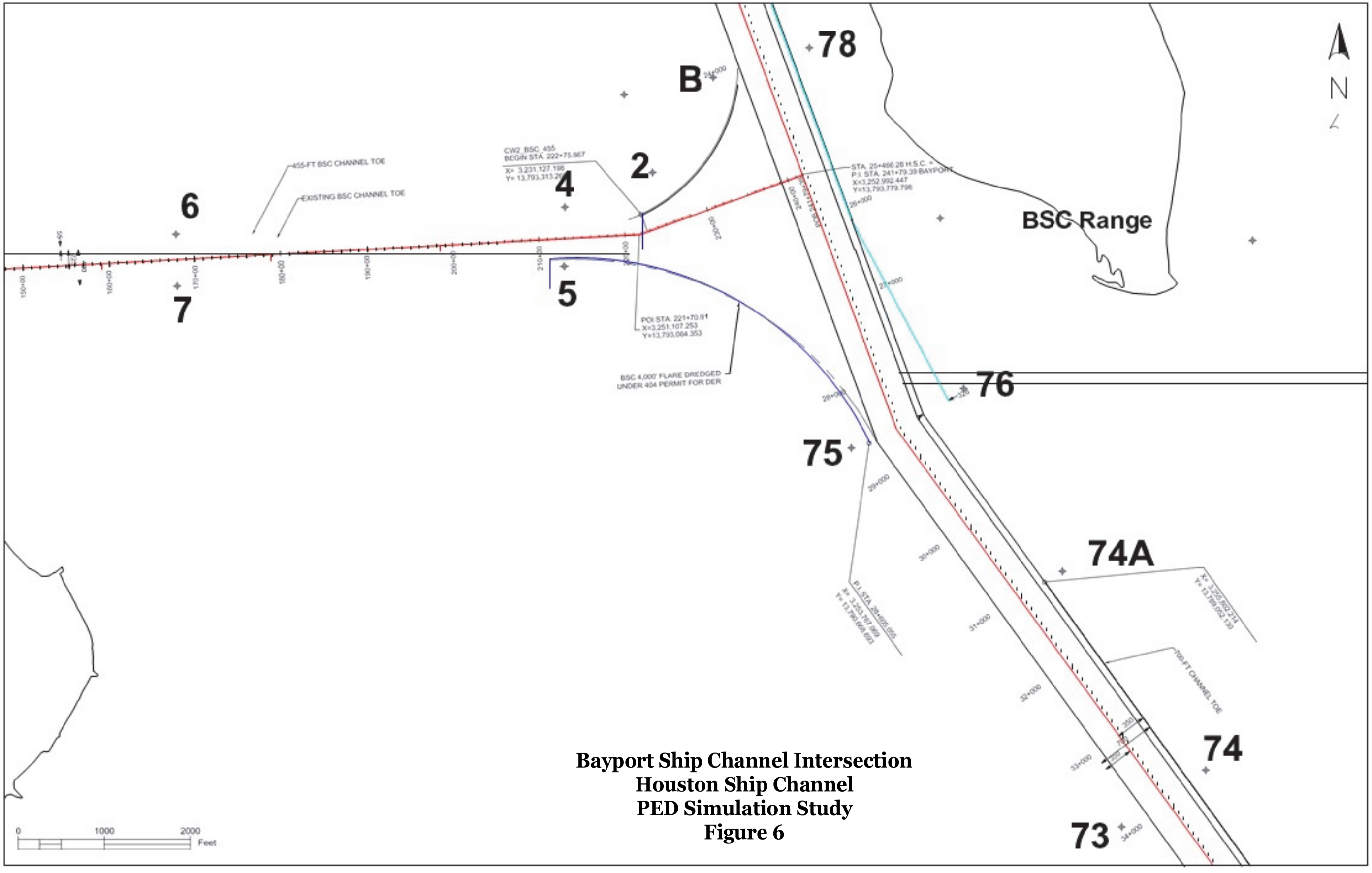

N
2
18
1
16
C
P
Alternative 3
Feasibility Cutoff
BOLIVAR ROADS CHANNEL
(STA. 0+000.000 TO STA. 4+490.121)
P.I. STA 136+221.603
X= 3,310,711.796
Y= 13,700,072.188
P.O.E. STA 138+369.011 (H.S.C.)
P.O.E. STA 37+643.769 (T.C.H.)
P.O.B. STA 0+000.000 (G.E.C.)
X= 3,311,943.483
Y=13,696,278.649
P.I. STA 1+670.250
X= 3,313,646.131
Y= 13,697,995.914
P.I. STA. 2+607.322
X= 3,314,526.95
Y= 13,697,663.026
P.I. STA. 136+968.690
X= 3,310,722.641
Y= 13,699,046.313
P.I. STA. 139+662.626
X= 3,312,036.766
Y= 13,697,797.842
P.I. STA. 4+490.121
X= 3,316,026.957
Y=13,696,433.477
STA. 1+200.000
END TRANSITION
STA. 2+300.000
BEGIN TRANSITION
STA. 6+700
STA. 7+800
0
1000
2000
Feet
Bay Entrance Bend Alternative 3
Houston Ship Channel
PED Simulation Study
Figure 2


N
2
18
1
16
C
P
Alternative 4
Feasibility Cutoff
BOLIVAR ROADS CHANNEL
(STA. 0+000.000 TO STA. 4+490.121)
BE1 138+369
P.I. STA. 136+221.603
X= 3,310,711.796
Y= 13,700,072.188
POE STA. 138+369.011 (H.S.C.)
POE STA. 37+641.759 (T.C.H.)
P.O.B. STA. 0+000.000 (G.E.C.)
X= 3,311,943.483
Y= 13,698,278.649
BE1 138+369
P.I. STA. 1+670.200
X= 3,313,648.131
Y= 13,697,995.914
P.I. STA. 2+607.322
X= 3,314,525.95
Y= 13,697,663.026
P.I. STA. 136+968.890
X= 3,310,722.041
Y= 13,699,048.313
P.I. STA. 139+662.626
X= 3,312,036.768
Y= 13,697,797.842
STA. 1+200.000
END TRANSITION
STA. 2+300.000
BEGIN TRANSITION
P.I. STA. 4+490.121
X= 3,316,026.957
Y=13,696,433.477
0
1000
2000
Feet
Bay Entrance Bend Alternative 4
Houston Ship Channel
PED Simulation Study
Figure 3

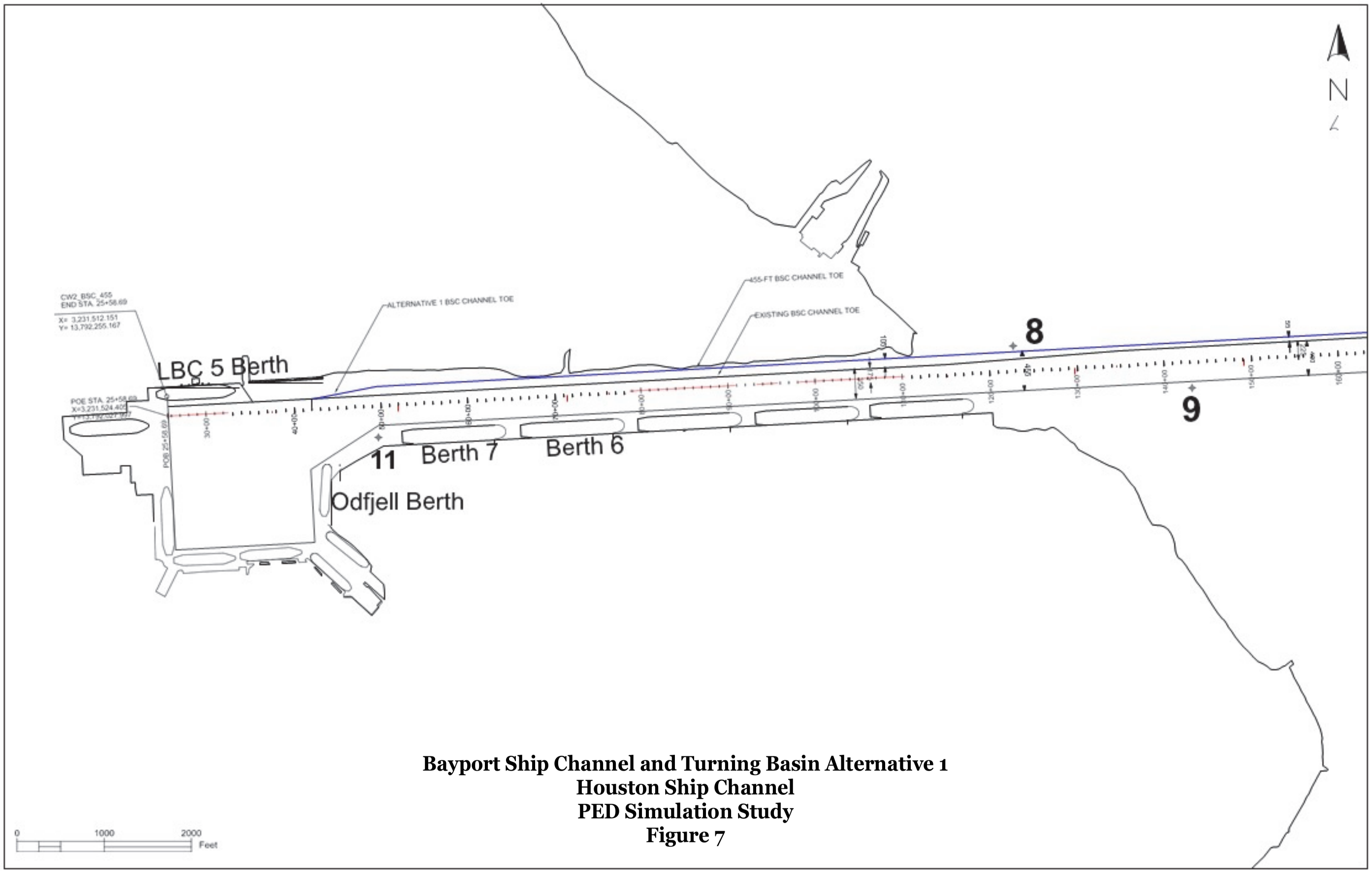


Bend at Buoys 25-26
Houston Ship Channel
PED Simulation Study
Figure 4

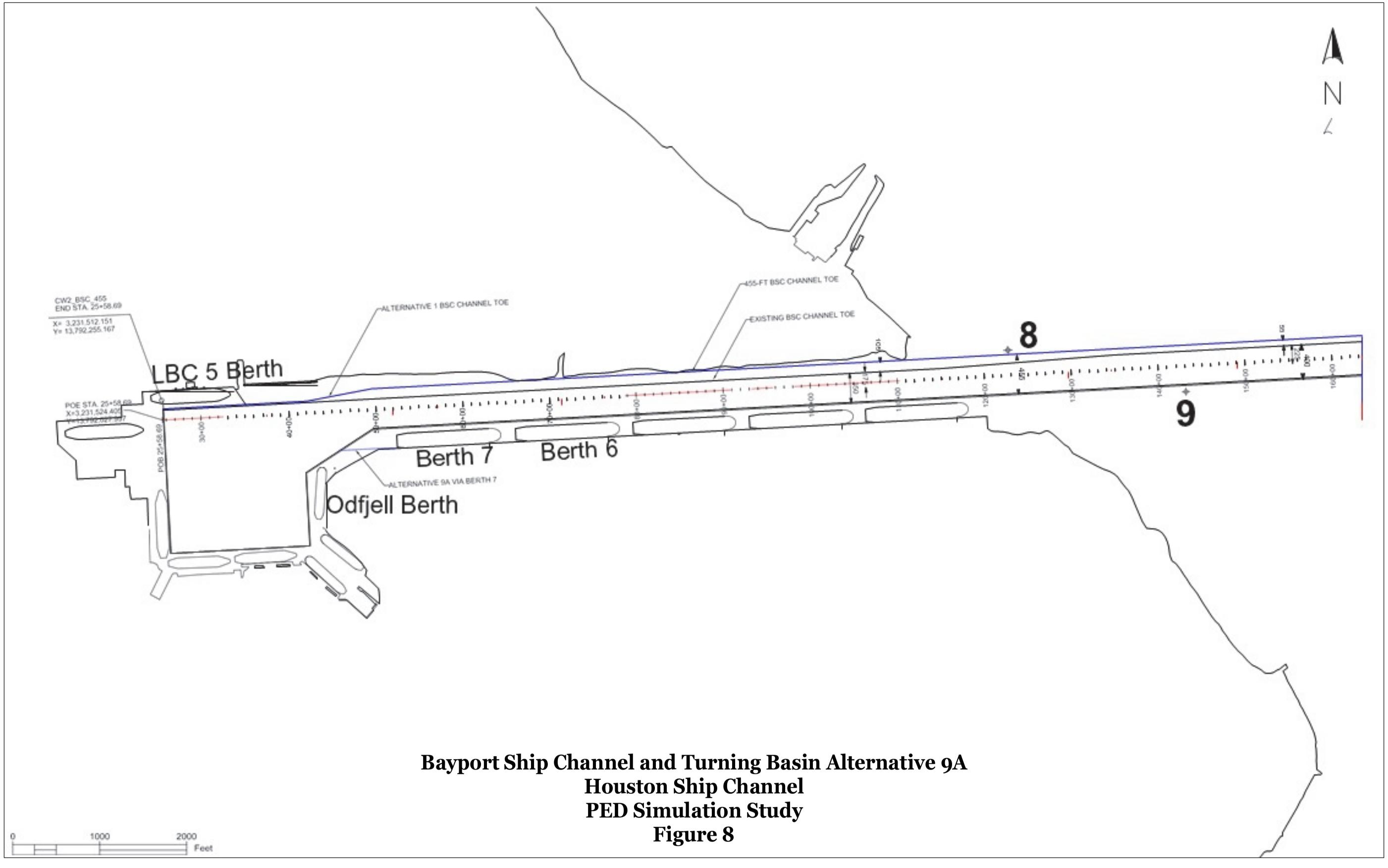

N
700-FT CHANNEL TOE
EXISTING 530-FT CHANNEL TOE
48
47
50
52
49
51
53
54
P.I. STA. 78+844.001
X= 3,283,849.560
Y= 13,750,327.226
BE1_78+844_700
P.I. STA. 82+605.095
X= 3,284,871.388
Y= 13,746,609.021
BE1_78+844_700
P.I. STA. 75+048.632
X= 3,281,058.329
Y= 13,752,997.717
ALTERNATIVE 1
700-FT CHANNEL TOE
530
528
300
Redfish Bend
Houston Ship Channel
PED Simulation Study
Figure 5
0
1000
2000
Feet



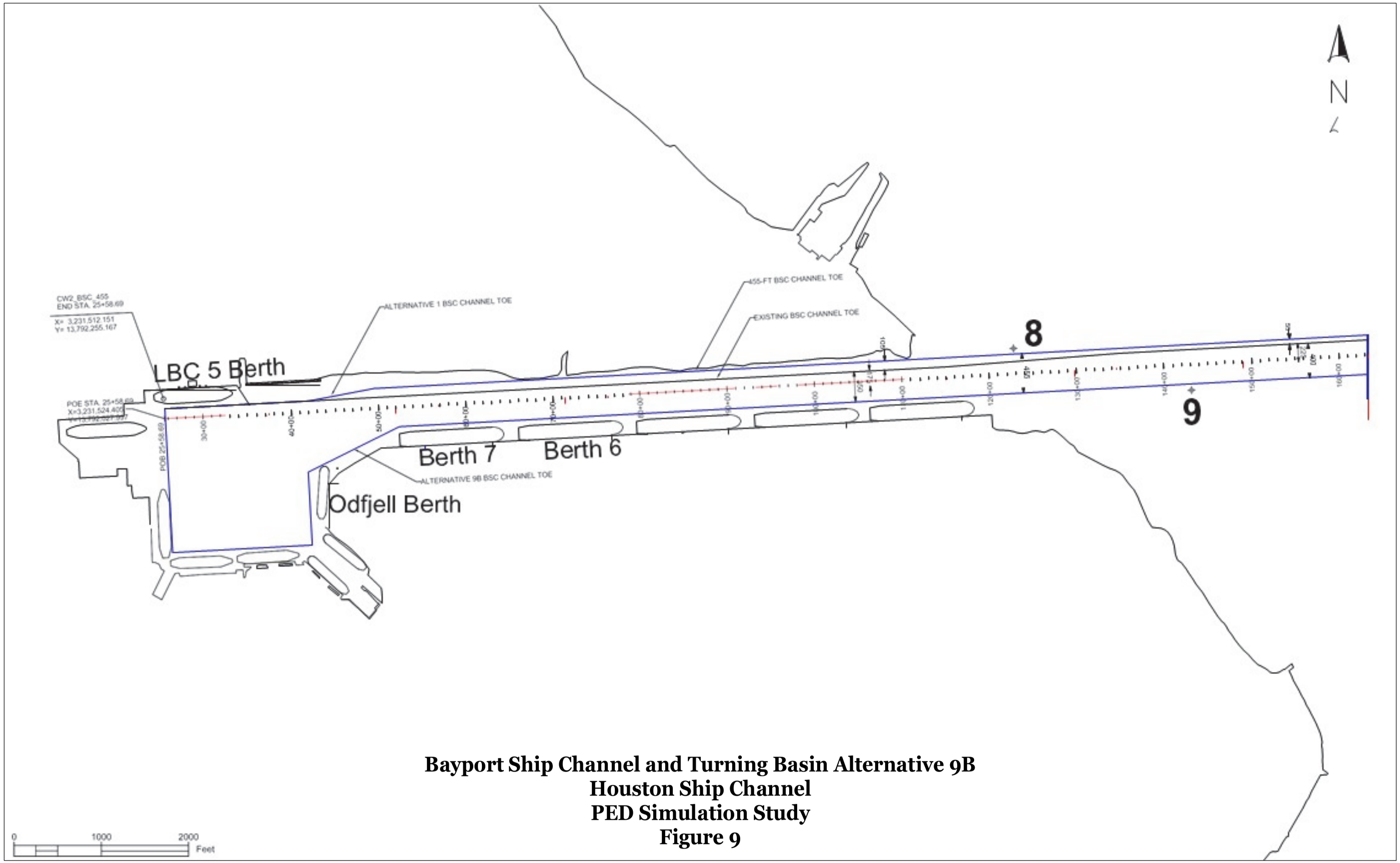
Bayport Ship Channel Intersection
Houston Ship Channel
PED Simulation Study
Figure 6



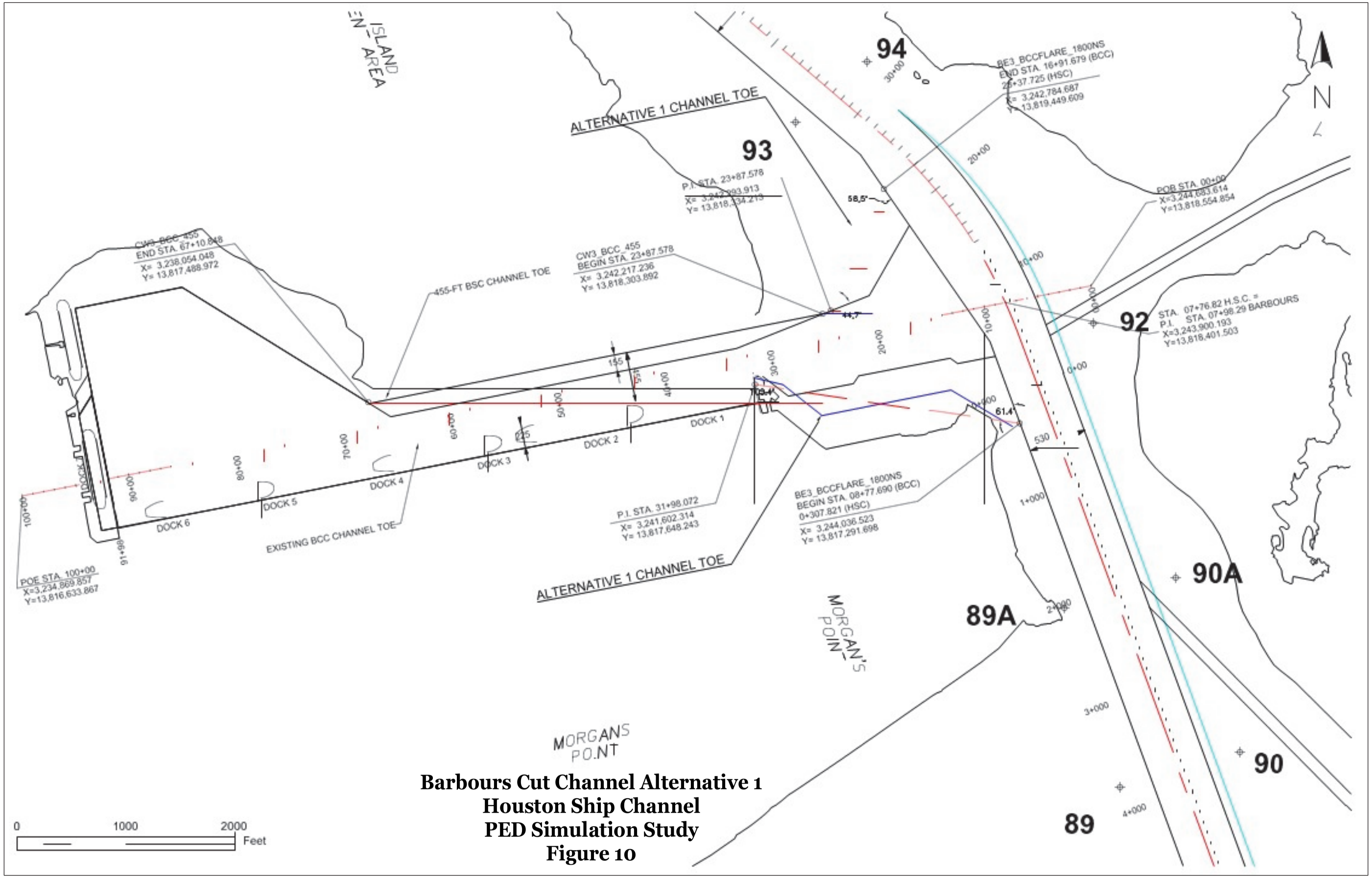
Bayport Ship Channel and Turning Basin Alternative 1
Houston Ship Channel
PED Simulation Study
Figure 7



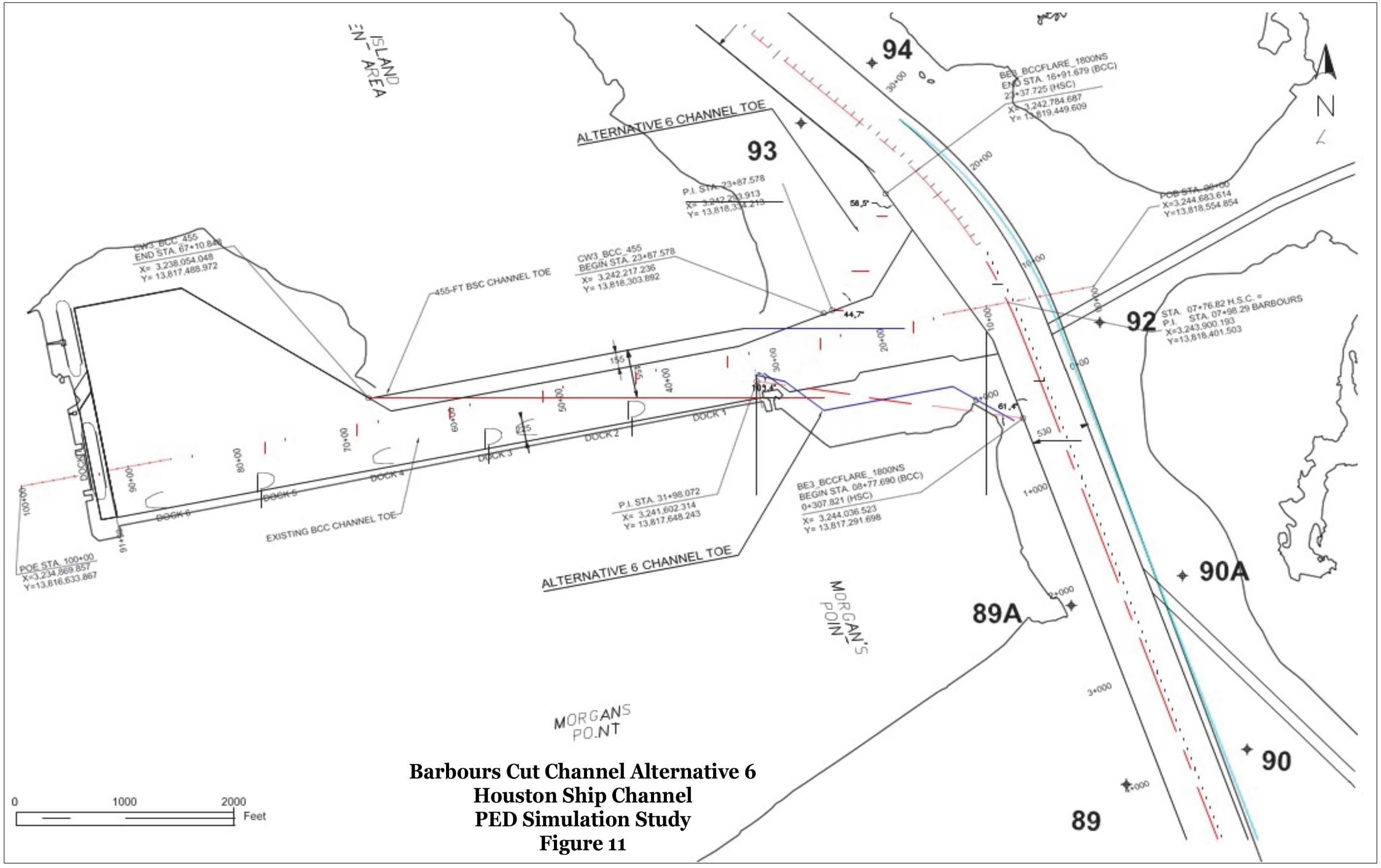
Bayport Ship Channel and Turning Basin Alternative 9A
Houston Ship Channel
PED Simulation Study
Figure 8



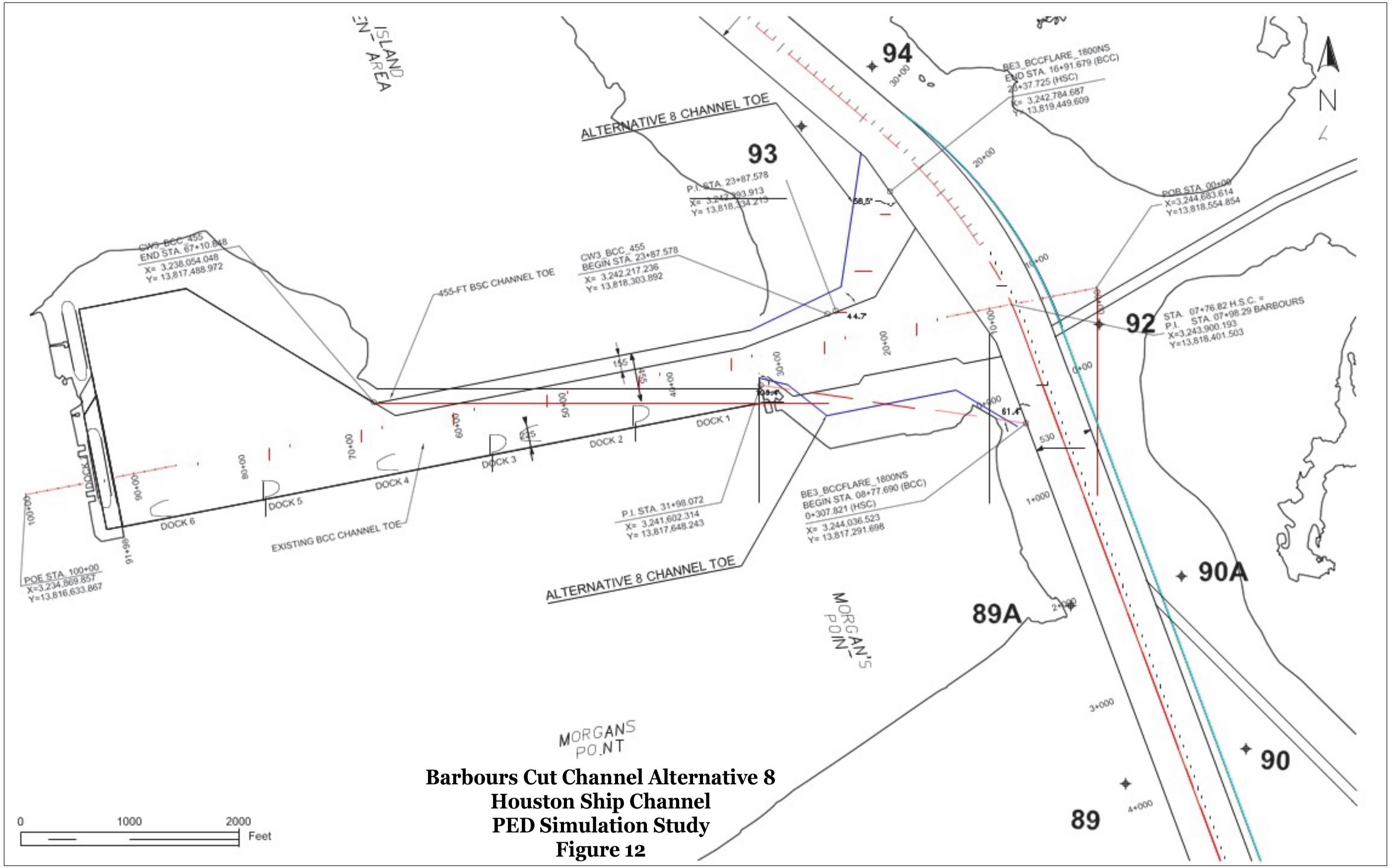
Bayport Ship Channel and Turning Basin Alternative 9B
Houston Ship Channel
PED Simulation Study
Figure 9



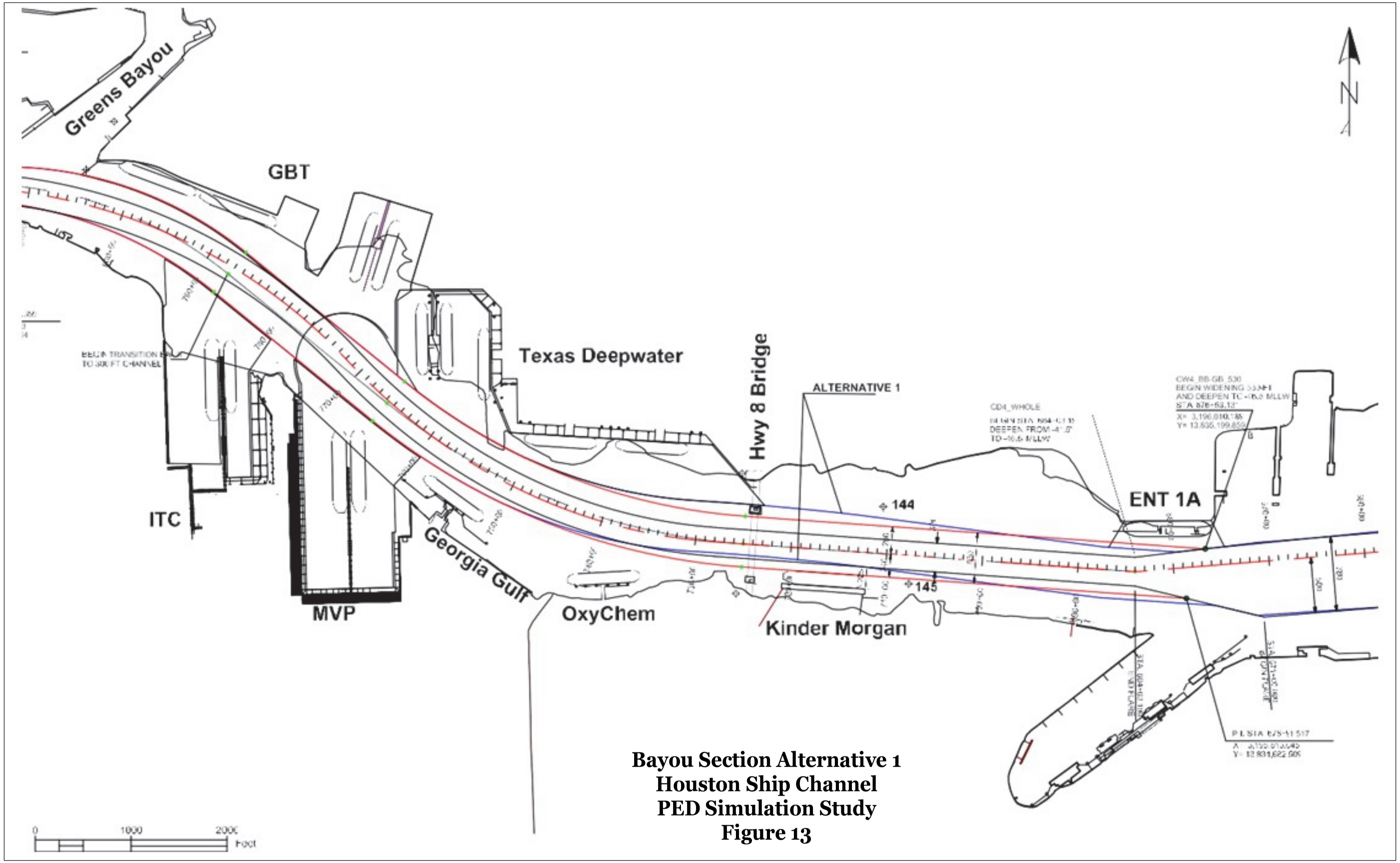
Barbours Cut Channel Alternative 1
Houston Ship Channel
PED Simulation Study
Figure 10



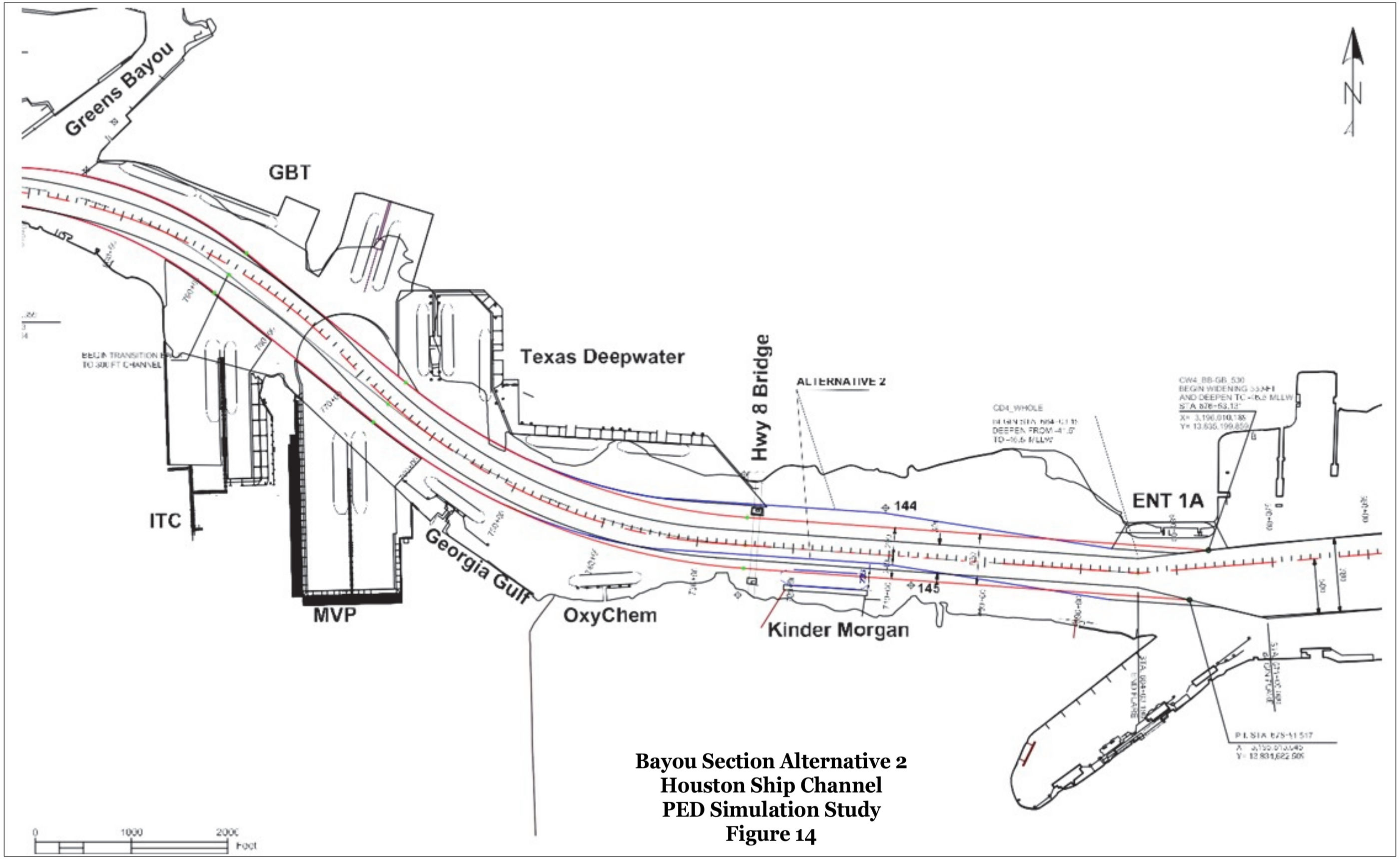
Barbours Cut Channel Alternative 6
Houston Ship Channel
PED Simulation Study
Figure 11



Barbours Cut Channel Alternative 8
Houston Ship Channel
PED Simulation Study
Figure 12



Bayou Section Alternative 1
Houston Ship Channel
PED Simulation Study
Figure 13



Bayou Section Alternative 2
Houston Ship Channel
PED Simulation Study
Figure 14

Appendix B: Test Matrix

The following executed test matrix is arranged by plate number, reach, alternative, and environmental conditions.

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skinto Skin Dist.(ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head.(deg)/ InitialSpeed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head.(deg)/ InitialSpeed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
1	1	EB-A1	*MULCV14N	266.4/10	12	A	N/A	192	SUEZ156N	138.2/10	18	F	N/A	Flood	0	0	Testing at Bolivar Roads - meet one ship in each bend
							N/A	290	SUEZ156N	156.4/10	31-32	E	N/A				
2	2	EB-A1	*MULCV14N	266.4/10	12	A	N/A	276	MULCV14N	138.2/10	18	B	N/A	Flood	SE/20	0	Testing at Bolivar Roads - meet one ship in each bend
							N/A	225	SUEZ156R	156.4/10	31-32	E	N/A				
3	115	EB-A1	*ULCV366M	266/10	31	N	225	211	ULCV366M	139/10	25-26	D	68	Flood	SE/20	0	Testing at Bolivar Roads - meet one vessel in each bend
							133	304	SUEZ156R	155/10	29-30	J	78				
4	117	EB-A1	SUEZ156R	267/10	12	N	135	451	*ULCV366M	139/13	28	J	233	Flood	SE/20	0	Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City
5	116	EB-A1	*ULCV366M	266/10	31	D	115	390	ULCV366M	139/10	25-26	J	35	Ebb	N/20	0	Testing at Bolivar Roads - meet one vessel in each bend
							146	226	SUEZ156R	155/10	29-30	N	0				
6	55	EB-A1	*MTK300H	266.4/12.5	12	I	131	313	MULCV14N	136.8/9	18	A	116	Ebb	N/20	3 (MZ7505) - Inbound vessel	Testing at Bolivar Roads in RP. Inbound vessel to Texas City Channel.Three instructor controlled tugs used for inbound vessel.
7	118	EB-A1	SUEZ156R	267/10	12	D	73	385	*ULCV366M	139/13	28	N	157	Ebb	N/20	0	Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City
8	60	EB-A3	*ULCV366M	267.2/10	12	H	429	105	MULCV14N	138/12	18	G	278	Flood	SE/20	0	Testing at Bolivar Roads - meet one ship in each bend
							171	193	SUEZ156R	156/13	30	J	157				
9	61	EB-A3	*ULCV366M	267.2/8	12	G	319	329	MULCV14N	138/8	18	J	216	Flood	SE/20	0	Testing at Bolivar Roads - meet one ship in each bend
							400	265	SUEZ156R	156/8	30	H	185				
10	122	EB-A3	*ULCV366M	266/10	12	J	300	434	ULCV366M	139/10	28	D	110	Flood	SE/20	0	Testing at Bolivar Roads - meet in the bend
11	114	EB-A3	SUEZ156R	267/11	12	A	106	406	*ULCV366M	136/10	28	C	284	Flood	SE/20	0	Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City
12	62	EB-A3	*ULCV366M	267.2/8	12	J	159	270	MULCV14N	138/8	18	H	212	Ebb	N/20	0	Testing at Bolivar Roads - meet one ship in each bend
							78	229	SUEZ156R	156/8	30	G	156				
13	63	EB-A3	*ULCV366M	266/8	16	H	300	260	MULCV14N	139/8	25-26	G	320	Ebb	N/20	0	Testing at Bolivar Roads - meet one ship in each bend
							434	268	SUEZ156R	156/8	34	J	179				
14	64	EB-A3	*ULCV366M	266/8	16	G	226	324	ULCV366M	139/8	25-26	J	192	Ebb	N/20	0	Testing at Bolivar Roads - meet one ship in each bend
							233	342	SUEZ156R	156/8	34	H	120				
15	121	EB-A3	*ULCV366M	266/10	12	B	183	535	ULCV366M	139/10	28	J	119	Ebb	N/20	0	Testing at Bolivar Roads - meet in the bend
16	113	EB-A3	SUEZ156R	267/11	12	D	218	299	*ULCV366M	136/10	28	A	279	Ebb	N/20	0	Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City
17	123	EB-A3	SUEZ156R	267/15	12	B	195	320	*ULCV366M	139/10	28	D	306	Ebb	N/20	0	Testing at Bolivar Roads - meet in the bend

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skinto Skin Dist.(ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head.(deg)/ InitialSpeed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head.(deg)/ InitialSpeed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
18	108	EB-A4	*ULCV366M	266/10	12	D	156	250	ULCV366M	137/10	28	A	100	Flood	SE/20	0	Testing at Bolivar Roads - meet in the bend
19	119	EB-A4	*ULCV366M	266/10	12	J	118	283	ULCV366M	139/13.5	28	D	204	Flood	SE/20	0	Testing at Bolivar Roads - meet in the bend
20	53	EB-A3	*MULCV14N	266.4/15	12	A	147	388	MULCV14N	136.8/6	18	H	182	Ebb	N/20	0	Testing at Bolivar Roads in RP - meet one ship in each bend.
							357	276	SUEZ156N	156.4/7	31-32	G	176				
21	54	EB-A3	*SUEZ156R	266.4/12.5	12	I	195	248	MULCV14N	136.8/9	18	G	194	Ebb	N/20	0	Testing at Bolivar Roads in RP. Inbound vessel to go to the Texas City Channel.
22	109	EB-A4	*ULCV366M	266/10	12	C	175	258	ULCV366M	137/10	28	D	225	Ebb	N/20	0	Testing at Bolivar Roads - meet in the bend
23	110	EB-A4	*ULCV366M	266/13.1	12	C	84	326	ULCV366M	137/10	28	A	180	Ebb	N/20	0	Testing at Bolivar Roads - meet in the bend
24	120	EB-A4	*ULCV366M	266/10	12	D	107	405	ULCV366M	139/13.5	28	J	50	Ebb	N/20	0	Testing at Bolivar Roads - meet in the bend
25	111	EB-A4	SUEZ156R	267/11	12	A	165	308	*ULCV366M	136/10	28	D	161	Ebb	N/20	0	Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City
26	112	EB-A4	SUEZ156R	267/11	12	C	192	296	*ULCV366M	136/10	28	A	164	Ebb	N/20	0	Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City
27	124	EB-A4	SUEZ156R	267/15	12	D	180	245	*ULCV366M	139/10	28	J	198	Ebb	N/20	0	Testing at Bolivar Roads - meet in the bend
28	3	RF-A1	MULCV14N	337/10	45-46	B	162	282	*MULCV14N	146/10	55-56	A	70	Ebb	N/20	0	Testing at Redfish - Meet in the bend and after the bend
			SUEZ156R	336/10	41-42	E	144	260					0				
29	4	RF-A1	MULCV14N	337/10	45-46	E	185	190	*MULCV14N	146/10	55-56	A	129	Ebb	N/20	0	Testing at Redfish - Meet in the bend and after the bend
			SUEZ156R	336/10	41-42	B	89	241					0				
30	5	RF-A1	MULCV14N	337/10	45-46	A	163	237	*MULCV14N	146/10	55-56	E	162	Ebb	N/20	0	Testing at Redfish - Meet in the bend and after the bend
			SUEZ156R	336/10	41-42	B	42	267					0				
31	65	RF-A1	ULCV366M	336/10	50	H	163	174	*ULCV366M	146/10	55	J	230	Ebb	N/20	0	Testing at Redfish - Meet in the bend and after the bend
			SUEZ156R	336/10	47	G	61	241					94				
32	66	RF-A1	ULCV366M	336/10	50	G	80	173	*ULCV366M	146/10	55	H	190	Ebb	N/20	0	Testing at Redfish - Meet in the bend and after the bend
			SUEZ156R	336/10	47	J	145	161					74				
33	125	RF-A1	ULCV366M	336/10	50	J	68	259	*ULCV366M	146/10	55	D	136	Ebb	N/20	0	Testing at Redfish - Meet in the bend and after the bend
			SUEZ156R	336/10	47	B	40	164					96				
34	6	RF-A1	SUEZ156R	337/10	45-46	A	0	276	*MULCV14N	146/10	55-56	B	117	Flood	SE/20	0	Testing at Redfish - Meet in the bend and after the bend
			MULCV14N	336/10	41-42	E	127	220					72				
35	12	RF-A1	MULCV14N	337/10	45-46	B	50	235	*MULCV14N	146/10	55-56	A	82	Flood	SE/20	0	Testing at Redfish - Meet in the bend and after the bend
			SUEZ156R	336/10	41-42	E	169	188					134				

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skinto Skin Dist.(ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head.(deg)/ InitialSpeed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head.(deg)/ InitialSpeed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
36	67	RF-A1	ULCV366M	336/10	50	J	114	228	*ULCV366M	146/10	55	G	196	Flood	SE/20	0	Testing at Redfish - Meet in the bend and after the bend
			SUEZ156R	336/10	47	H	110	191					66				
37	68	RF-A1	ULCV366M	336/10	50	H	99	207	*ULCV366M	146/10	55	J	214	Flood	SE/20	0	Testing at Redfish - Meet in the bend and after the bend
			SUEZ156R	336/10	47	G	85	186					99				
38	126	RF-A1	ULCV366M	336/10	50	B	82	256	*ULCV366M	146/10	55	J	153	Flood	SE/20	0	Testing at Redfish - Meet in the bend and after the bend
			SUEZ156R	336/10	47	D	121	185					74				
39	7	BI-A1	*MULCV14N	326/10	67	E	144	193	MULCV14N	146.2/10	73-74	B	46	Flood	SE/20	0	Testing around Bend @ 75-76 - Meet below and above the bend with turn between
							197	302	SUEZ156R	162/10	81-82	A	132				
40	8	BI-A1	*MULCV14N	326/10	67	B	58	175	MULCV14N	146.2/10	73-74	A	80	Flood	SE/20	0	Testing around Bend @ 75-76 - Meet below and above the bend with turn between
							82	187	SUEZ156R	162/10	81-82	E	102				
41	9	BI-A1	*MULCV14N	326/10	67	A	50	215	MULCV14N	146.2/10	73-74	B	96	Flood	SE/20	0	Testing around Bend @ 75-76 - Meet below and above the bend with turn between
							123	244	SUEZ156R	162/10	81-82	E	205				
42	69	BI-A1	*ULCV366M	326/10	65-66	G	108	172	ULCV366M	146/10	73-74	H	98	Flood	SE/20	0	Testing around Bend @ 75-76 - First meet below bend and second at bend 75-76.
							154	374	SUEZ156R	162/10	85-86	J	132				
43	70	BI-A1	*ULCV366M	326/10	65-66	H	104	188	ULCV366M	146/10	73-74	J	65	Flood	SE/20	0	Testing around Bend @ 75-76 - First meet below bend and second at bend 75-76.
							155	352	SUEZ156R	162/10	83-84	G	120				
44	128	BI-A1	*ULCV366M	326/10	65-66	D	124	167	ULCV366M	146/10	73-74	J	121	Flood	SE/20	0	Testing around Bend @ 75-76 - First meet below bend and second at bend 75-76.
							216	308	SUEZ156R	162/10	83-84	B	148				
45	10	BI-A1	*MULCV14N	326/10	67	B	62	224	MULCV14N	146.2/10	73-74	E	91	Ebb	N/20	0	Testing around Bend @ 75-76 - Meet below and above the bend with turn between
							200	344	SUEZ156R	162/10	81-82	A	0				
46	11	BI-A1	*MULCV14N	326/10	67	E	100	175	MULCV14N	146.2/10	73-74	A	150	Ebb	N/20	0	Testing around Bend @ 75-76 - Meet below and above the bend with turn between
							215	187	SUEZ156R	162/10	81-82	B	430				
47	71	BI-A1	*ULCV366M	326/10	65-66	J	121	207	ULCV366M	146/10	73-74	G	121	Ebb	N/20	0	Testing around Bend @ 75-76 - First meet below bend and second at bend 75-76.
							253	205	SUEZ156R	162/10	83-84	H	189				
48	127	BI-A1	*ULCV366M	326/10	65-66	B	<20	233	ULCV366M	146/10	73-74	D	125	Ebb	N/20	0	Testing around Bend @ 75-76 - First meet below bend and second at bend 75-76.
							201	325	SUEZ156R	162/10	83-84	J	97				
49	58	BS-A1	ULCV366M	324/6	71-72	B	650	125	*ULCV366M	090/6	Cruise Terminal		473	Flood	SE/15	2	Outbound vessel from Bayportmeeting below the flare.
																	One instructor controlled tug on inbound vessel.

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skin to Skin Dist. (ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
50, 74	72	BS-A1	*ULCV366M	325/8	73-74	L								Flood	SE/20	4	Enter Bayport and turn in updated Turning Basin. Pilot put the tug on the port bow rather than at the stem like previous runs. Two instructor controlled tugs.
51	76	BS-A1	*ULCV366M	326/8	73-74	K								Flood	SE/15	1	Enter Bayport terminal.
52	78	BS-A1	*ULCV366M	326/8	73-74	L								Flood	SE/15	1	Enter Bayport terminal.
53	134	BS-A1	*ULCV366M	326/10	73-74	J								Flood	SE/15	1	Enter Bayport Terminal.
54	135	BS-A1	*ULCV366M	326/10	73-74	O								Ebb	N/15	1	Enter Bayport Terminal.
55	77	BS-A1							*ULCV366M	088/8	Cruise Terminal	M		Ebb	N/15	1	Exiting Bayport terminal.
56	79	BS-A1							*ULCV366M	088/8	Cruise Terminal	K		Flood	SE/15	1	Exiting Bayport terminal.
57	136	BS-A1							*ULCV366M	088/8	Cruise Terminal	D		Flood	SE/15	1	Exiting Bayport Terminal.
58	137	BS-A1							*ULCV366M	086/8	Cruise Terminal	J		Ebb	N/15	1	Exiting Bayport Terminal.
59	47	BS-A1	*ULCV366M	269/6	Cruise Terminal	H								Flood	SE/20	4	Enter Bayport and Turn in Updated Turning Basin. Added two instructor controlled tugs during the run for the turn in the basin.
60	48	BS-A1	*ULCV366M	269/6	Cruise Terminal	G								Flood	SE/20	4	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
61	49	BS-A1	*ULCV366M	269/6	Cruise Terminal	H								Flood	N/20	4	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
62	50	BS-A1	*ULCV366M	269/6	Cruise Terminal	G								Flood	N/20	4	Enter Bayport and Turn in Updated Turning Basin. Changed the tug models to 80 tontugs instead of 75 tons. Two instructor controlled tugs.
63	51	BS-A1	*ULCV366M	269/6	Cruise Terminal	H								Flood	N/15	4	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
64	52	BS-A1	*ULCV366M	269/6	Cruise Terminal	G								Flood	N/15	4	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
65	56	BS-A1	*ULCV366M	268.5/3	Cruise Terminal	G								0	N/15	3	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skin to Skin Dist. (ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
66	57	BS-A1	*ULCV366M	271/3	Cruise Terminal	A								0	N/15	3	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
67	74	BS-A1	*ULCV366M	270/3.5	Cruise Terminal	M								Ebb	N/15	4	Turn in updated Turning Basin. Two instructor controlled tugs invisible on the starboard side until the vessel entered the basin to simulate real life situation. Track plots shown during the entire run.
68	75	BS-A1	*ULCV366M	270/3.5	Cruise Terminal	L								Ebb	N/15	4	Turn in updated Turning Basin. Two instructor controlled tugs invisible on the starboard side until the vessel entered the basin to simulate real life situation. Track plots shown during the entire run.
69	92	BS-A1	*ULCV366M	271/5	Cruise Terminal	A								Ebb	N/15	3	Turn in Bayport Turning Basin. One instructor controlled tug.
70	131	BS-A1	*ULCV366M	269/4	Cruise Terminal	A								Ebb	N/15	4	Turn in Bayport Turning Basin. Two instructor controlled tugs.
71	132	BS-A1	*ULCV366M	269/4	Cruise Terminal	J								Ebb	N/15	4	Turn in Bayport Turning Basin. Two instructor controlled tugs.
72	145	BS-A1							*ULCV366M	062/1	Turning Basin	C		0	N/15	3	Exiting the turning basin and berthing at dock 7. One instructor controlled tugs.
73	146	BS-A1							*ULCV366M	060/1	Turning Basin	D		0	N/15	4	Exiting the turning basin and berthing at dock 6. Two instructor controlled tugs.
75	73	BS-A1	*ULCV366M	268/3.5	Cruise Terminal	K								Flood	SE/15	4	Turn in updated Turning Basin. Two instructor controlled tugs invisible on the starboard side until the vessel entered the basin to simulate real life situation. Track plots shown during the entire run.
76	93	BS-A1	*ULCV366M	267/5	Cruise Terminal	D								Flood	SE/15	3	Turn in Bayport Turning Basin. One instructor controlled tug.
77	129	BS-A1	*ULCV366M	269/4	Cruise Terminal	D								Flood	SE/15	4	Turn in Bayport Turning Basin. Two instructor controlled tugs.
78	130	BS-A1	*ULCV366M	269/4	Cruise Terminal	J								Flood	SE/15	4	Turn in Bayport Turning Basin. Two instructor controlled tugs.
79	133	BS-A1	*ULCV366M	269/4	Cruise Terminal	O								Flood	SE/15	4	Turn in Bayport Turning Basin. Two instructor controlled tugs.
80	154	BS-A9	*ULCV366M	270/4	Berth 6	A								0	SE/15	4	Turn in Bayport Turning Basin. Two instructor controlled tugs.

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skin to Skin Dist. (ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
81	156	BS-A9	*ULCV366M	270/4	Berth 6	C								0	SE/15	4	Turn in Bayport Turning Basin and dock at Berth 6. Two instructor controlled tugs.
82	163	BS-A9	*ULCV366M	268/4	Berth 6	A								0	SE/15	4	Turn in Bayport Turning Basin and dock at Berth 7. Two instructor controlled tugs.
83	153	BS-A9	*ULCV366M	270/4	Berth 6	O								Ebb	N/15	4	Turn in Bayport Turning Basin. Two instructor controlled tugs.
84	155	BS-A9	*ULCV366M	270/4	Berth 6	C								0	N/15	4	Turn in Bayport Turning Basin. Two instructor controlled tugs.
85	157	BS-A9	*ULCV366M	270/4	Berth 6	M								0	N/15	4	Turn in Bayport Turning Basin. Two instructor controlled tugs.
86	158	BS-A9	*ULCV366M	270/4	Berth 6	M								0	N/15	4	Turn in Bayport Turning Basin and dock at Berth 7. Two instructor controlled tugs.
87	32	BC-A1	*MULCV14Z	340/8	87-88	D								Flood	SE/20	2	Entrance to Barbours Cut - Turn at Entrance TB.
88	33	BC-A1	*MULCV14Z	340/5	87-88	C								Flood	SE/20	3	Entrance to Barbours Cut - Turn at Entrance TB. Added a third instructor controlled tug to eliminate the bow thruster use on main vessel.
89	34	BC-A1	*ULCV366M	341/5	87-88	D								Flood	SE/20	3	Entrance to Barbours Cut - Turn at Entrance TB.
90	80	BC-A1	*ULCV366M	342/4	89-90	J								Flood	SE/15	4	Entrance to Barbours Cut - Turn at Entrance TB. Two instructor controlled tugs.
91	36	BC-A1	*ULCV366M	341/5	87-88	C								Ebb	N/20	3	Entrance to Barbours Cut - Turn at Entrance TB.
92	37	BC-A1	*ULCV366M	341/5	87-88	D								Ebb	N/20	3	Entrance to Barbours Cut - Turn at Entrance TB.
93	81	BC-A1	*ULCV366M	342/4	89-90	D								Ebb	N/15	4	Entrance to Barbours Cut - Turn at Entrance TB. Two instructor controlled tugs.
94	39	BC-A1	*MULCV14Z	341/5	87-88	D								Flood	SE/20	3	Inbound turn into Barbours Cut.
95	35	BC-A1	*ULCV366M	341/5	87-88	C								Ebb	N/20	3	Entrance to Barbours Cut - Turn at Entrance TB.
96	38	BC-A1	*ULCV366M	341/5	87-88	C								Ebb	N/20	3	Inbound turn into Barbours Cut.
97	45	BC-A1	*ULCV366M	260/3	Cruise Terminal	C								Flood	SE/20	2	Turn in basin at Barbours Cut.
98	46	BC-A1	*ULCV366M	260/3	Cruise Terminal	D								Ebb	N/20	2	Turn in basin at Barbours Cut.

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skin to Skin Dist. (ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
99	90	BC-A1	*ULCV366M	261/4	Midway	D								Ebb	N/15	3	Enter Barbours Cut and turn in Turning Basin. One instructor controlled tug.
100	40	BC-A1							*ULCV366M	081/3	Cruise Terminal	G		Flood	SE/20	2	Outbound turn from Barbours Cut.
101	41	BC-A1							*ULCV366M	081/3	Cruise Terminal	C		Flood	SE/20	2	Outbound turn from Barbours Cut.
102	42	BC-A1							*ULCV366M	081/3	Cruise Terminal	D		Flood	SE/20	2	Outbound turn from Barbours Cut.
103	82	BC-A1							*ULCV366M	081/2.5	Midway	A		Flood	SE/15	3	Depart Barbour's Cut from Mid-channel. One instructor controlled tug was included just in case pilot needed it but invisible during the run. Track plot will show but tug was not used.
104	143	BC-A1							*ULCV366M	081/3.5	Midway	C		Flood	N/15	3	Depart Barbour's Cut from Mid-channel. One instructor controlled tug.
105	144	BC-A1							*ULCV366M	081/3.5	Midway	D		Flood	N/15	3	Depart Barbour's Cut from Mid-channel. One instructor controlled tug.
106	43	BC-A1							*ULCV366M	081/3	Cruise Terminal	H		Ebb	N/20	2	Outbound turn from Barbours Cut.
107	44	BC-A1							*ULCV366M	081/3	Cruise Terminal	G		Ebb	N/20	4	Outbound turn from Barbours Cut. Adding two instructor controlled tugs for this run.
108	83	BC-A1							*ULCV366M	081/2.5	Midway	J		Ebb	N/15	3	Depart Barbour's Cut from Mid-channel. One instructor controlled tug was included just in case pilot needed it but invisible during the run. Track plot will show but tug was not used.
109	91	BC-A1							*ULCV366M	078/2.5	Midway	C		Ebb	N/15	3	Depart Barbours Cut from Mid-channel.
110	84	BC-A6	*ULCV366M	342/4	89-90	D								Flood	SE/15	2	Entrance to Barbour's Cut - Turn at Entrance TB
111	138	BC-A6	*ULCV366M	342/4	87-88	D								Flood	SE/15	4	Entrance to Barbours Cut - Turn at Entrance TB. Two instructor controlled tugs.
112	139	BC-A6	*ULCV366M	342/4	87-88	C								Ebb	N/15	4	Entrance to Barbours Cut - Turn at Entrance TB. Two instructor controlled tugs.
113	85	BC-A6	*ULCV366M	342/4	89-90	J								Ebb	N/15	4	Entrance to Barbours Cut - Turn at Entrance TB. Two instructor controlled tugs.

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skin to Skin Dist. (ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
114	88	BC-A6	*ULCV366M	342/4	89-90	A								Ebb	N/15	4	Enter Barbours Cut and turn in Turning Basin. Two instructor controlled tugs.
115	86	BC-A6							*ULCV366M	081/2.5	Midway	D		Flood	SE/15	2	Depart Barbours Cut from Mid-channel.
116	140	BC-A6							*ULCV366M	081/2.5	Midway	D		Flood	SE/15	3	Depart Barbours Cut from Mid-channel. One instructor controlled tug.
117	141	BC-A6							*ULCV366M	081/2.5	Midway	C		Flood	SE/15	3	Depart Barbours Cut from Mid-channel. One instructor controlled tug.
118	87	BC-A6							*ULCV366M	081/2.5	Midway	J		Ebb	N/15	2	Depart Barbours Cut from Mid-channel.
119	89	BC-A6							*ULCV366M	081/2.5	Midway	D		Ebb	N/15	2	Depart Barbours Cut from Mid-channel.
120	142	BC-A6							*ULCV366M	081/3.5	Midway	D		Ebb	N/15	3	Depart Barbours Cut from Mid-channel. One instructor controlled tug.
121	151	BC-A8	*ULCV366M	342/5	87-88	C								Flood	SE/15	3	Entrance to Barbours Cut - Turn at Entrance TB. One instructor controlled tug.
122	162	BC-A8	*ULCV366M	340/5	87-88	C								Flood	SE/15	3	Enter Barbours Cut. One instructor controlled tug.
123	152	BC-A8	*ULCV366M	342/5	87-88	M								Ebb	N/15	3	Entrance to Barbours Cut - Turn at Entrance TB. One instructor controlled tug.
124	161	BC-A8	*ULCV366M	340/5	87-88	M								Ebb	N/15	3	Enter Barbours Cut. One instructor controlled tug.
125	159	BC-A8	*ULCV366M	340/5	87-88	A								Flood	SE/15	3	Enter Barbours Cut. One instructor controlled tug.
126	160	BC-A8	*ULCV366M	340/5	87-88	C								Ebb	N/15	3	Enter Barbours Cut. One instructor controlled tug.
127	149	BC-A8							*ULCV366M	082/2.5	Midway	O		Flood	SE/15	3	Depart Barbours Cut from Mid-channel. One instructor controlled tug.
128	147	BC-A8							*ULCV366M	082/2.5	Midway	C		Flood	N/15	3	Depart Barbours Cut from Mid-channel. One instructor controlled tug.
129	148	BC-A8							*ULCV366M	082/2.5	Midway	M		Ebb	SE/15	3	Depart Barbours Cut from Mid-channel. One instructor controlled tug.
130	150	BC-A8							*ULCV366M	082/2.5	Midway	A		Ebb	N/15	3	Depart Barbours Cut from Mid-channel. One instructor controlled tug.
131	13	BG-A1	*MTKM107X	278.6/5.5	Enterprise	D	0	191	MBULK32N	133/5.5	Texas Deepwater	C	23	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Aframax/Panamax by the Bridge. Instructor controlled tug used.

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skinto Skin Dist.(ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head.(deg)/ InitialSpeed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head.(deg)/ InitialSpeed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
132	14	BG-A1	*MTKM107X	278.6/5.5	Enterprise	C	56	164	MBULK32N	133/5.5	Texas Deepwater	D	63	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Aframax/Panamax bythe Bridge. Instructor controlled tug used.
133	15	BG-A1	*MTKM107X	278.6/3.5	Enterprise	D	62	131	MBULK32N	133/5.5	Texas Deepwater	C	86	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Aframax/Panamax bythe Bridge. Instructor controlled tug used.
134	16	BG-A1	*MTKM107X	278.6/3.5	Enterprise	C	84	132	MBULK32N	133/5.5	Texas Deepwater	D	62	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Aframax/Panamax bythe Bridge. Instructor controlled tug used.
135	17	BG-A1	*MTKM107X	277.6/4.5	Bridge	D	108	121	MBULK32N	130.8/5.5	ITC	C	59	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Aframax/Panamax atthe bend between the bridge and ITC. Instructor controlled tug used.
136	18	BG-A1	*MTKM107X	277.6/4.5	Bridge	C	133	129	MBULK32N	130.8/5.5	ITC	D	40	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Aframax/Panamax atthe bend between the bridge and ITC. Instructor controlled tug used.
137	19	BG-A1	*MTKM107X	298/3.5	Texas Deepwater	D	75	178	MBULK32N	112/5	ITC	C	107	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Aframax/Panamax atthe bend between the bridge and ITC. Instructor controlled tug used.
138	20	BG-A1	*MTKM107X	298/3.5	Texas Deepwater	C	0	108	MBULK32N	112/5	ITC	D	70	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Aframax/Panamax atthe bend between the bridge and ITC. Instructor controlled tug used.
139	21	BG-A1	MBULK32X	279/5	Enterprise	C	70	160	*MTKM107X	130/1	ITC	D	47	Flood	SE/20	1 (MZ7505) - Outbound Vessel	Meet loaded Aframax/Panamax atthe bend between the bridge and ITC. Instructor controlled tug used.
140	22	BG-A1	MBULK32X	279/5	Enterprise	D	65	162	*MTKM107X	130/1	ITC	C	64	Flood	SE/20	1 (MZ7505) - Outbound Vessel	Meet loaded Aframax/Panamax atthe bend between the bridge and ITC. Instructor controlled tug used.
141	23	BG-A1	MBULK32X	265.7/5.5	Enterprise	C	69	184	*MTKM107X	110/1	Texas Deepwater	D	23	Ebb	N/20	1 (MZ7505) - Outbound Vessel	Meet loaded Aframax/Panamax bythe bridge. Instructor controlled tug used.
142	94	BG-A1	*SUEZ156R	279/5	Enterprise	C	91	151	MBULK32X	125/5	Texas Deepwater	A	44	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/Panamax bythe Bridge. Instructor controlled tug used.
143	98	BG-A1	*SUEZ156R	277/4	Bridge	C	120	113	MBULK32X	131/4	Texas Deepwater	D	28	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax by Georgia Gulf. Instructor controlled tug used.
144	96	BG-A1	MBULK32X	277/4	Bridge	C	65	136	*SUEZ156R	130/5	Texas Deepwater	D	30	Flood	SE/20	1 (MZ7505) - Outbound Vessel	Meet loaded Suezmax/ Panamax by Texas Deepwater and Bridge. Instructor controlled tug used.
			MBULK32X	279/4	Enterprise	A	46	183					45				
145	101	BG-A1	MBULK32X	276/4	Bridge	C	37	140	*SUEZ156R	132/4	Texas Deepwater	D	91	Flood	SE/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax by Georgia Gulf. Instructor controlled tug used.

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skinto Skin Dist.(ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head.(deg)/ InitialSpeed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head.(deg)/ InitialSpeed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
146	24	BG-A1	*SUEZ156R	278/5.5	Enterprise	C	76	153	MBULK32X	119.7/5.5	Texas Deepwater	D	24	Ebb	N/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax bythe bridge. Instructor controlled tug used.
147	25	BG-A1	*SUEZ156R	278/5.5	Enterprise	D	76	92	MBULK32X	119.7/5.5	Texas Deepwater	C	40	Ebb	N/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax bythe bridge. Instructor controlled tug used.
148	95	BG-A1	*SUEZ156R	279/5	Enterprise	A	44	166	MBULK32X	125/5	Texas Deepwater	D	40	Ebb	N/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax bythe bridge. Instructor controlled tug used.
149	99	BG-A1	*SUEZ156R	277/4	Bridge	A	101	111	MBULK32X	131/4	Texas Deepwater	D	<25	Ebb	N/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax by Georgia Gulf. Instructor controlled tug used.
150	26	BG-A1	*SUEZ156R	294/5.5	Texas Deepwater	C	86	132	MBULK32X	109/5.5	ITC	D	54	Ebb	N/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax between the bridge and ITC. Instructor controlled tug used.
151	27	BG-A1	*SUEZ156R	294/5.5	Texas Deepwater	D	51	110	MBULK32X	109/5.5	ITC	C	116	Ebb	N/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax between the bridge and ITC. Instructor controlled tug used.
152	30	BG-A1	MBULK32X	265.7/5.5	Enterprise	D	62	120	*SUEZ156R	110/5.5	Texas Deepwater	C	46	Ebb	N/20	1 (MZ7505) - Outbound Vessel	Meet loaded Suezmax/ Panamax bythe bridge. Man tug used for this run instead of computer.
153	31	BG-A1	MBULK32X	265.7/5.5	Enterprise	C	82	143	*SUEZ156R	110/5.5	Texas Deepwater	D	48	Ebb	N/20	1 (MZ7505) - Outbound Vessel	Meet loaded Suezmax/ Panamax bythe bridge. Man tug used for this run instead of computer.
154	97	BG-A1	MBULK32X	277/4	Bridge	A	92	272	*SUEZ156R	130/5	Texas Deepwater	C	0	Ebb	N/20	1 (MZ7505) - Outbound Vessel	Meet loaded Suezmax/ Panamax by Texas Deepwater and the bridge. Instructor controlled tug used.
			MBULK32X	279/4	Enterprise	D	94	147					0				
155	100	BG-A1	MBULK32X	276/4	Bridge	A	59	121	*SUEZ156R	132/4	Texas Deepwater	C	98	Ebb	N/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax by Georgia Gulf. Instructor controlled tug used.
156	28	BG-A1	MBULK32X	281/5	Texas Deepwater	D	48	92	*SUEZ156R	117/1	ITC	C	116	Ebb	N/20	1 (MZ7505) - Outbound Vessel	Meet loaded Suezmax/ Panamax between the bridge and ITC. Instructor controlled tug used.
157	29	BG-A1	MBULK32X	281/5	Texas Deepwater	C	60	152	*SUEZ156R	117/1	ITC	D	71	Ebb	N/20	1 (MZ7505) - Outbound Vessel	Meet loaded Suezmax/ Panamax between the bridge and ITC. Instructor controlled tug used.
158	164	BG-A2	*SUEZ156R	279/5	Enterprise	M	31	170	MBULK32X	131/5	Texas Deepwater	A	45	Flood	SE/15	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax bythe bridge and Texas Deepwater. Instructor controlled tug used.
							<20	178	MBULK32X	123/2	ITC	C	65				

Plate No.	Run No.	Channel Cond.	Inbound Ship					Skin to Skin Dist. (ft)	Outbound Ship					Current	Wind Direction/ Speed (kt)	Tugs	Notes
			Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)		Type	Head. (deg)/ Initial Speed (kt)	Init. Pos.	Pilot	Min. Dist. to Channel Line (ft)				
159	104	BG-A2	MBULK32X	277/5	Bridge	D	46	129	*SUEZ156R	128/5	ITC	C	127	Flood	SE/20	1 (MZ7505) - Outbound Vessel	Meet loaded Suezmax/ Panamax by Texas Deepwater and the bridge. Instructor controlled tug used.
			MBULK32X	266/5	Enterprise	A	59	140					40				
160	103	BG-A2	*SUEZ156R	279/5	Enterprise	A	35	171	MBULK32X	122/5	Texas Deepwater	C	63	Ebb	N/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax bythe bridge and Texas Deepwater. Instructor controlled tug used.
							75	146	MBULK32X	098/5	ITC	D	25				
161	107	BG-A2	*SUEZ156R	279/5	Enterprise	C	62	158	MBULK32X	122/5	Texas Deepwater	D	33	Ebb	N/20	1 (MZ7505) - Inbound Vessel	Meet loaded Suezmax/ Panamax bythe bridge and Texas Deepwater. Instructor controlled tug used.
							87	145	MBULK32X	098/5	ITC	A	<20				
162	105	BG-A2	MBULK32X	277/5	Bridge	A	55	140	*SUEZ156R	128/5	ITC	D	68	Ebb	N/20	1 (MZ7505) - Outbound Vessel	Meet loaded Suezmax/Panamax by Texas Deepwater and the bridge. Instructor controlled tug used.
			MBULK32X	266/5	Enterprise	C	<20	155					92				
163	106	BG-A2	MBULK32X	277/5	Bridge	D	39	149	*SUEZ156R	128/5	ITC	A	73	Ebb	N/20	1 (MZ7505) - Outbound Vessel	Meet loaded Suezmax/Panamax by Texas Deepwater and the bridge. Instructor controlled tug used.
			MBULK32X	266/5	Enterprise	C	55	206					0				

Appendix C: Track Plots and Run Sheets – Bay Section

Bay Entrance (Buoys 16–18) and Bolivar Roads (Buoys 25–26)

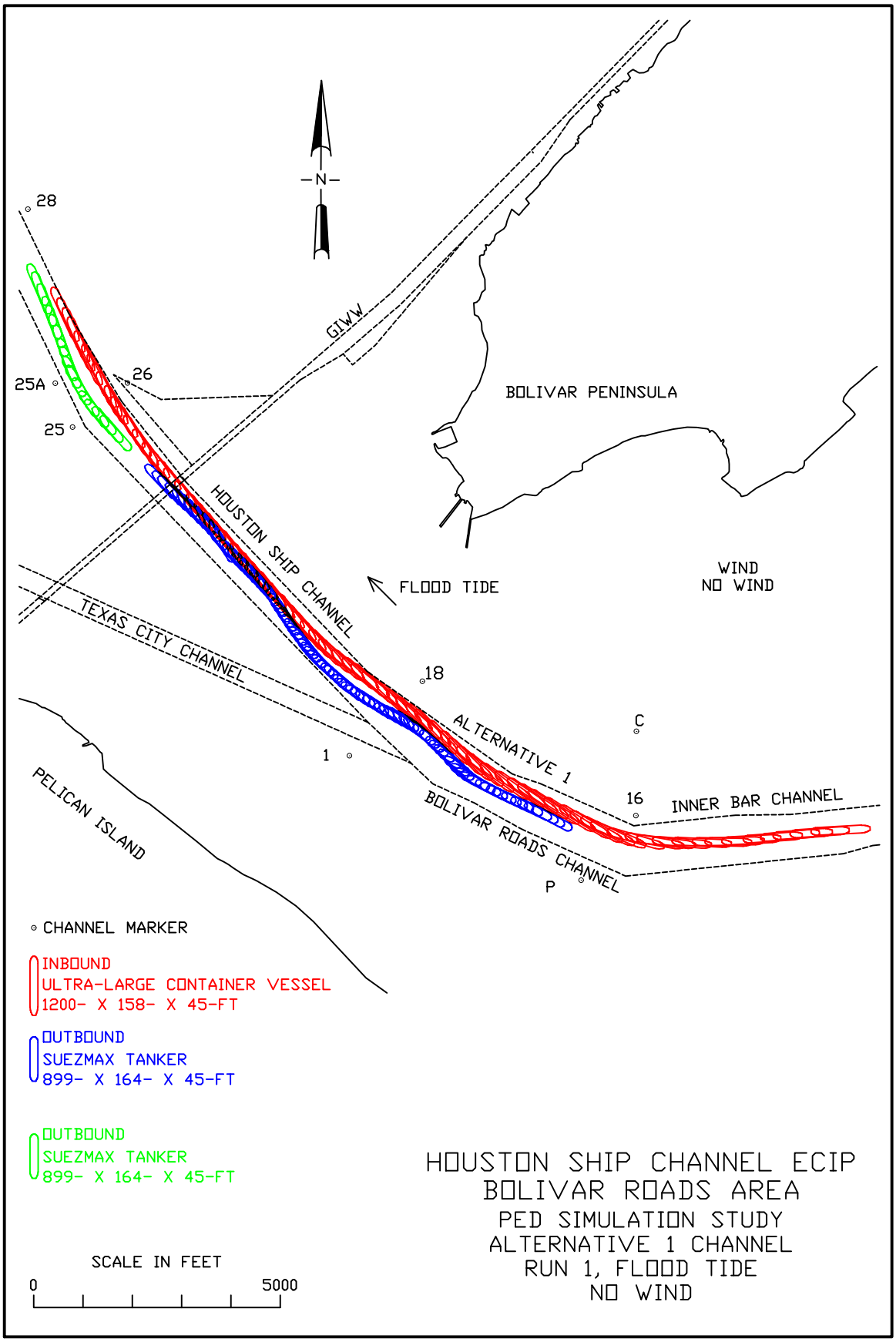

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
FLOOD TIDE
WIND
NO WIND
TEXAS CITY CHANNEL
18
C
ALTERNATIVE 1
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 1, FLOOD TIDE
NO WIND

PLATE 1

Run **1**

Purpose Testing at Bolivar Roads - meet one ship in each bend

Date 5/15/2020
Start Time 0900
End Time 0925
Plan EB-A1
Current Fld
Tide (m) 1
Wind Direction
/Speed Knots 0
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14N	45.0/13.7	266.4/10	12
Outbound	SUEZ156N	44.1/13.7	138.2/10	18
Outbound	SUEZ156N	44.1/13.7	156.4/10	31-32

Run Comments
Had a failure to start due to bridge control causing the scenario to be two suezs meeting a container. Also had a change in pilot to an unlicensed pilot (Pilot F). Realized the channel was incorrect. Channel was wider and had extra bends on north and south side that should not be there in the RP channel. Channel fixed and correct version used starting at Run 55.

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MULCV14N	A	N/A	192	N/A	290
Outbound	SUEZ156N	F	N/A			
Outbound	SUEZ156N	E			N/A	

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Inbound	Normal	Yes	Meetings are the same in regards to space compared between the scenario and real life.	Yes	Yes	Yes	Yes	Run was easy. Pilot had to lower speed to ensure the meeting occured in the correct location.
F	Outbound	Normal	Yes	Safe to perform the maneuver, however would be better if the meet occurred where it was supposed to.	Yes	Yes			Slow entering the turn so the time was off for the meet, did not meet in bend but in the entrance to it.
E	Outbound	Easy	Yes	Plenty of space to perform the maneuver. Location of meet compared with the vessel made it safer.			Yes	Yes	Run felt good.

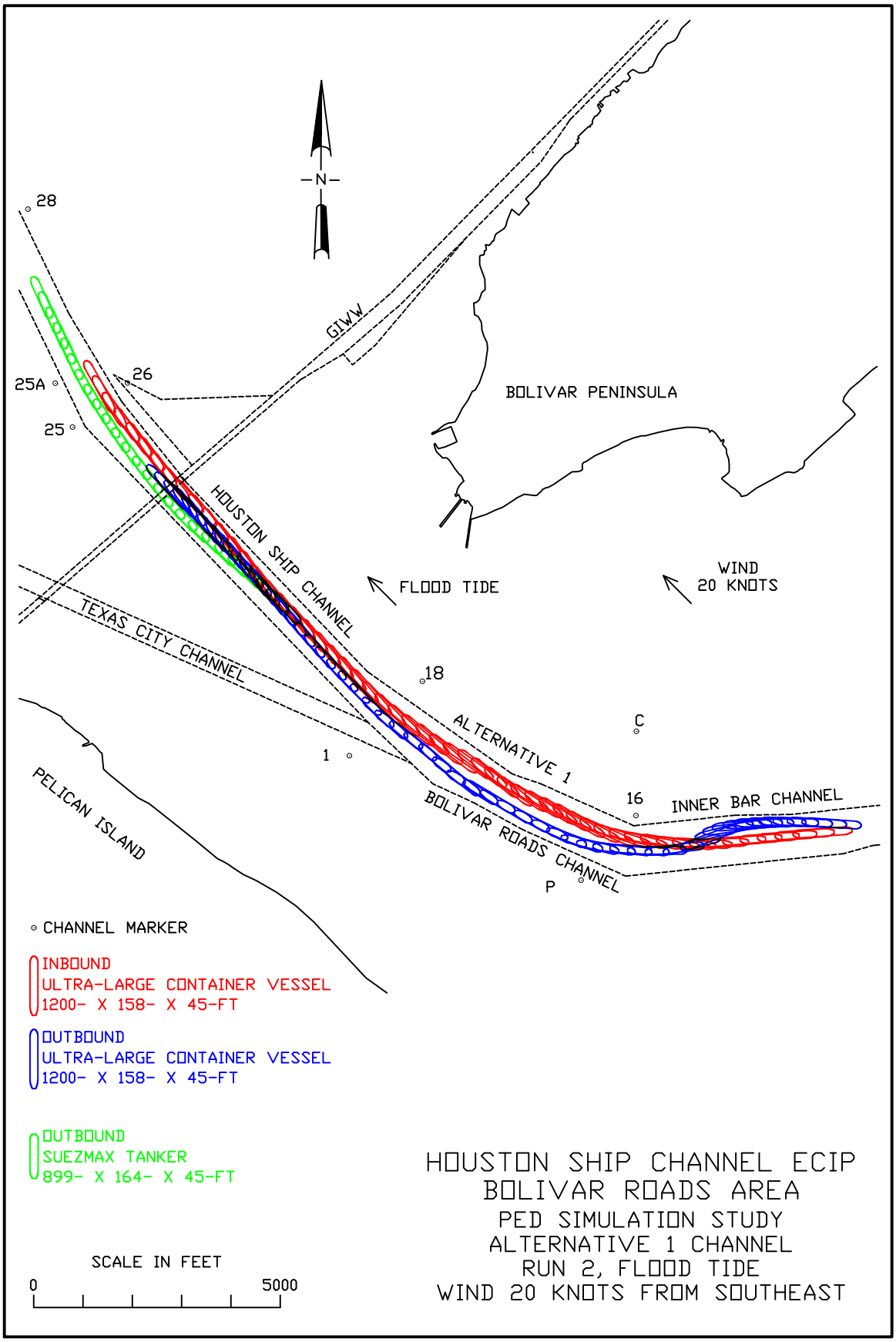

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
FLOOD TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
ALTERNATIVE 1
C
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 2, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 2

Run **2**

Purpose Testing at Bolivar Roads - meet one ship in each bend

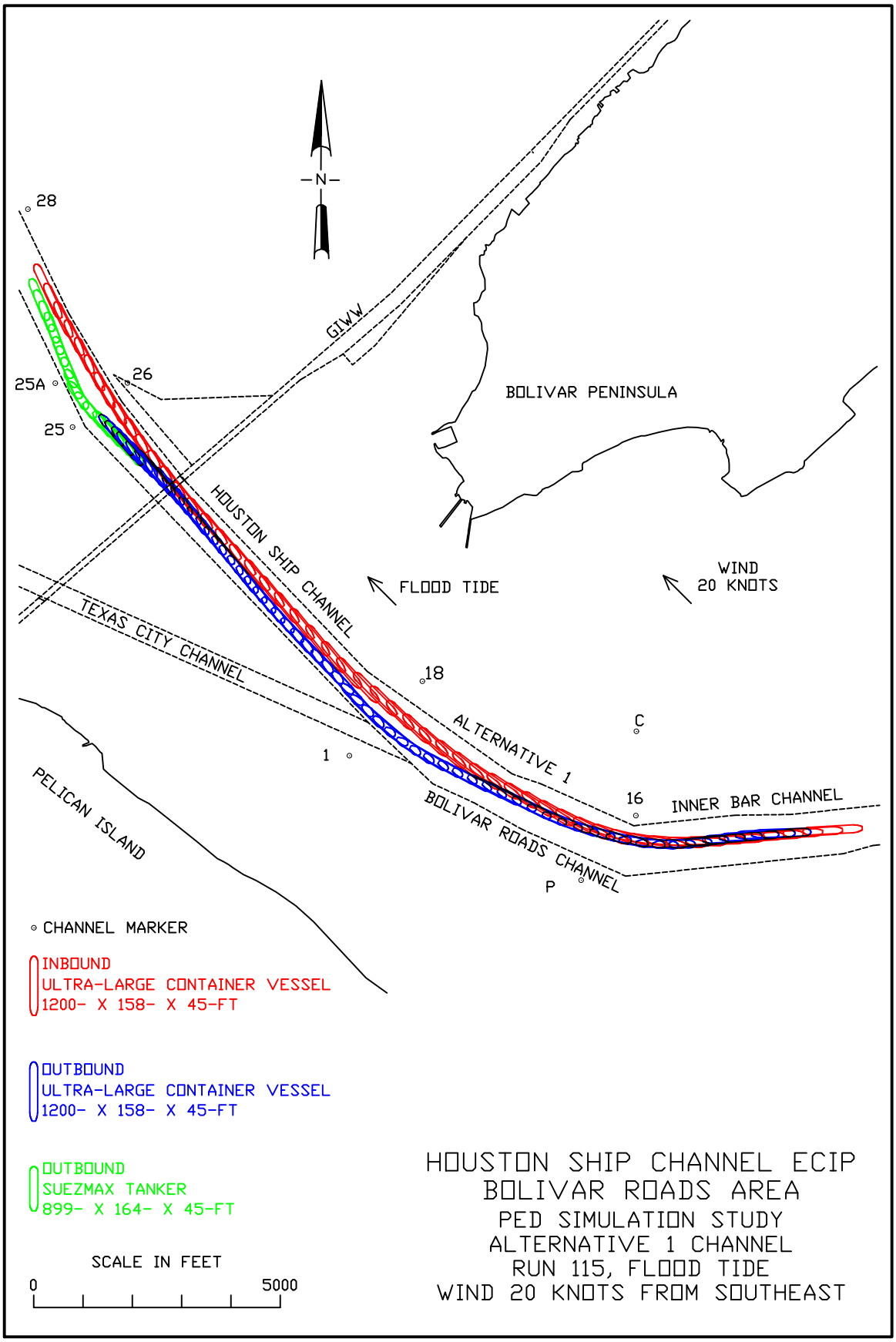
Date 5/15/2020
Start Time 0940
End Time 1000
Plan EB-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14N	45.0/13.7	266.4/10	12
Outbound	MULCV14N	45.0/13.7	138.2/10	18
Outbound	SUEZ156R	44.1/13.7	156.4/10	31-32

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MULCV14N	A	N/A	276	N/A	225
Outbound	MULCV14N	B	N/A			
Outbound	SUEZ156R	E			N/A	

Run Comments
Comments from pilots regarding the layout of the first bend in Bolivar Roads results in multiple turns and needs to be redesigned. Moving to another area to continue testing while the design for Bolivar Roads is updated. Realized the channel was incorrect. Channel was wider and had extra bends on north and south side that should not be there in the RP channel. Channel fixed and correct version used starting at Run 55.

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Inbound	Normal	Yes	A lot of space in the channel to perform the maneuver.	Yes	Yes	Yes	Yes	Channel design needs to be evaulated.
B	Outbound	Normal	Yes	Safe because it is a normal situation.	Yes	Yes			The channel is good with plenty of space.
E	Outbound	Easy	Yes	Width of the channel allows the maneuver to occur.			Yes	Yes	



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 115, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 3

Run **115**

Purpose Testing at Bolivar Roads - meet one vessel in each bend

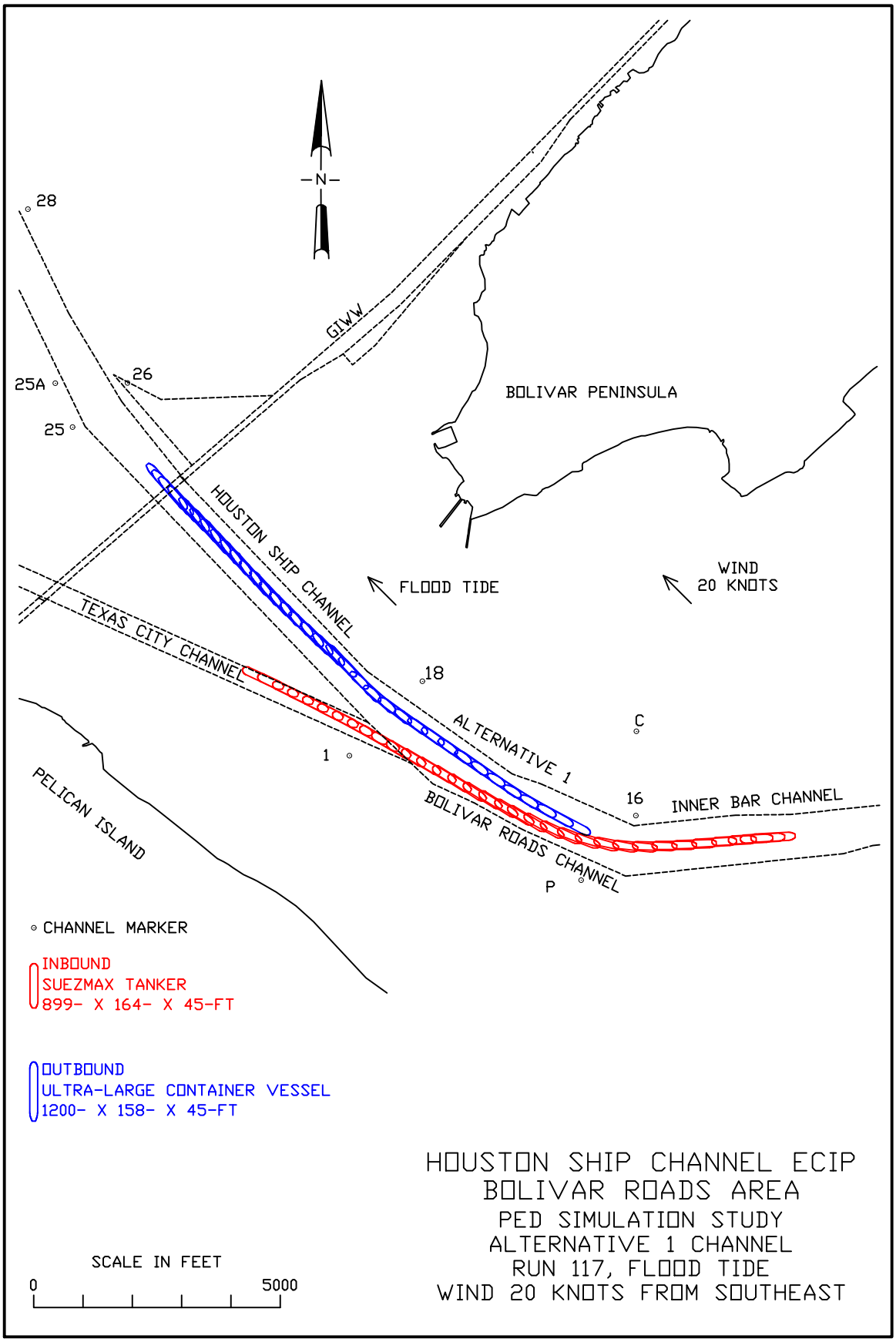
Date 6/8/2020
Start Time 0850
End Time 0905
Plan EB-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/10	31
Outbound	ULCV366M	46.7/14.2	139/10	25-26
Outbound	SUEZ156R	44.1/13.7	155/10	29-30

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	N	225	211	133	304
Outbound	ULCV366M	D	68			
Outbound	SUEZ156R	J			78	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
N	Inbound	Normal	Yes	Plenty of room in the channel.	Yes	Yes	Yes	Yes	Pretty normal. Current direction did require more rudder but it was manageable.
D	Outbound	Normal	Yes	Plenty of room.	Yes	Yes			Wind and current did not make a difference.
J	Outbound	Normal	Yes	Wider channel allows for more space between the vessels and extra protection while meeting other ships.			Yes	Yes	Current direction allowed for better control for the outbound vessels.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 117, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 4

Run **117**

Purpose Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City

Date 6/8/2020
Start Time 0950
End Time 1000
Plan EB-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	SUEZ156R	44.1/13.7	267/10	12
Outbound	*ULCV366M	46.7/14.2	139/13	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	SUEZ156R	N	135	451		
Outbound	*ULCV366M	J	233			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Inbound	Easy	Yes	Stemming the tide gave the pilot more control. The cutout at 16-18 allows for more distance between the vessels while passing.	Yes	Yes			Good turn with not a lot of rudder used due to the amount of space.
N	Outbound	Easy	Yes	Did not have to really make any turns or notice the outbound ship because of the meeting location. Going towards Texas City and meeting on two whistles allowed the pilot to turn once and then just drive straight pass the outbound vessel.	Yes	Yes			Two whistle is preferred for the pilot in this area even if going towards Houston. Did not feel the wind but felt the current and needed to use more rudder to control the ship but it was manageable.

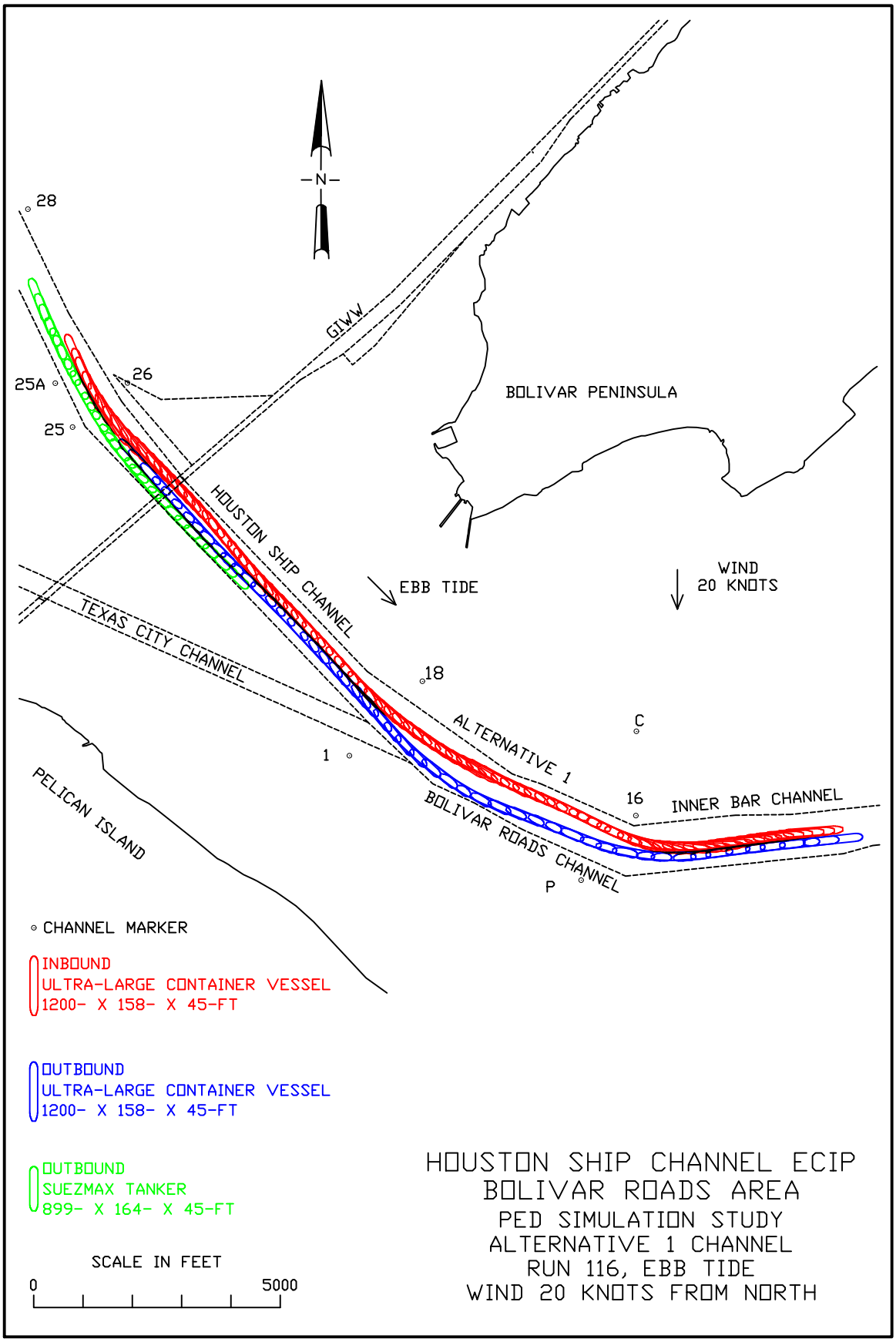

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
EBB TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
C
ALTERNATIVE 1
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 116, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 5

Run **116**

Purpose Testing at Bolivar Roads - meet one vessel in each bend

Date 6/8/2020
Start Time 0915
End Time 0935
Plan EB-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/10	31
Outbound	ULCV366M	46.7/14.2	139/10	25-26
Outbound	SUEZ156R	44.1/13.7	155/10	29-30

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	D	115	390	146	226
Outbound	ULCV366M	J	35			
Outbound	SUEZ156R	N			0	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Plenty of room.	Yes	Yes	Yes	Yes	Squeezed the second vessel during the meet due to not getting over far enough. Wind and current slowed the vessel down but did not cause problems.
J	Outbound	Normal	Yes	Plenty of space.	Yes	Yes			Due to the current, the pilot had to make sure to turn earlier but the extra space in the channel made the meet easier.
N	Outbound	Easy	Yes	Plenty of room. Lots of margin.			Yes	Yes	Pilot did go outside of the federal channel after the meet but that was due to giving the inbound vessel more space and knowing that there is deep water on the far side. Did not feel squeezed or forced out of the channel, pilot did what was normal for him.

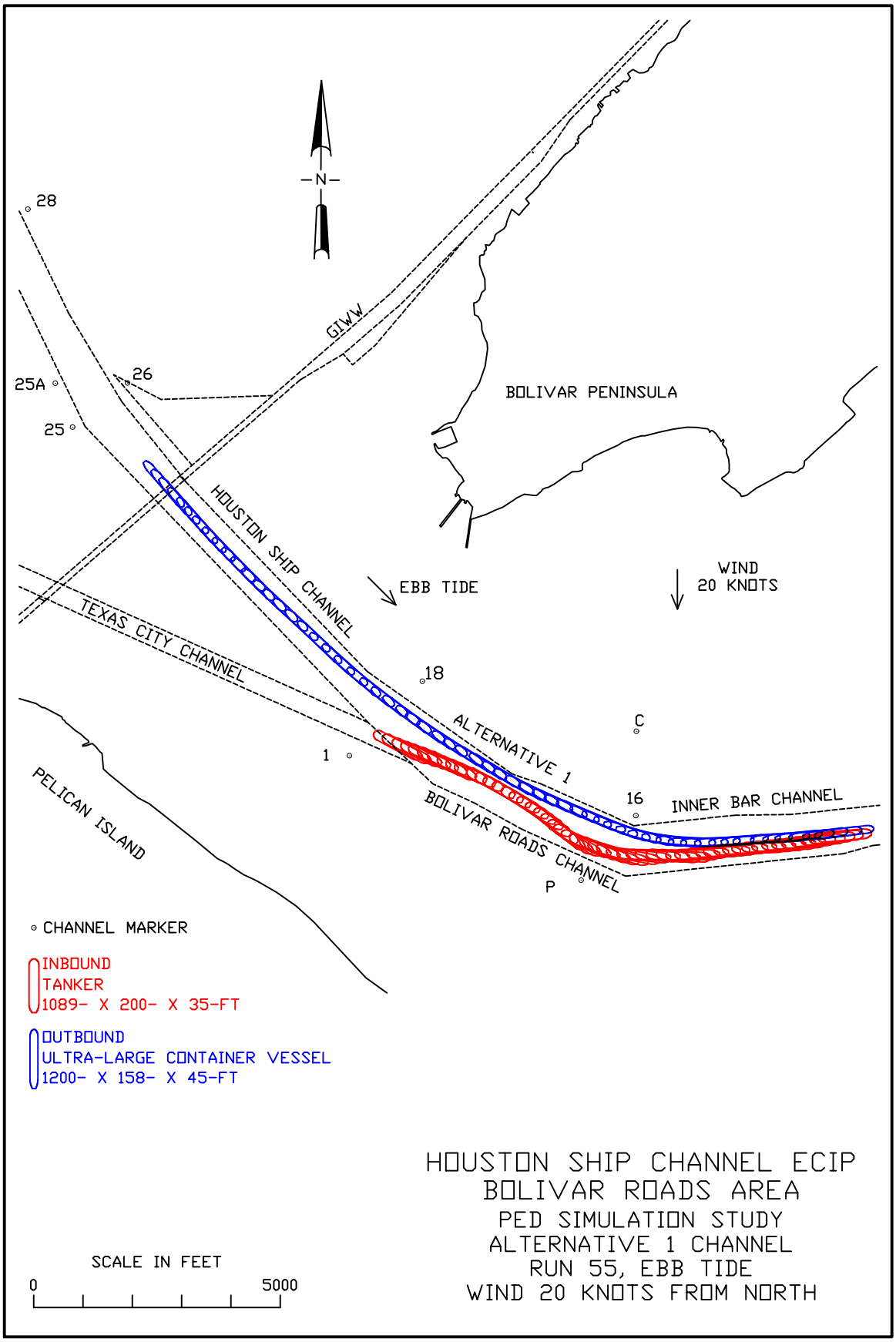

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
EBB TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
ALTERNATIVE 1
C
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
TANKER
1089- X 200- X 35-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 55, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 6

Run **55**

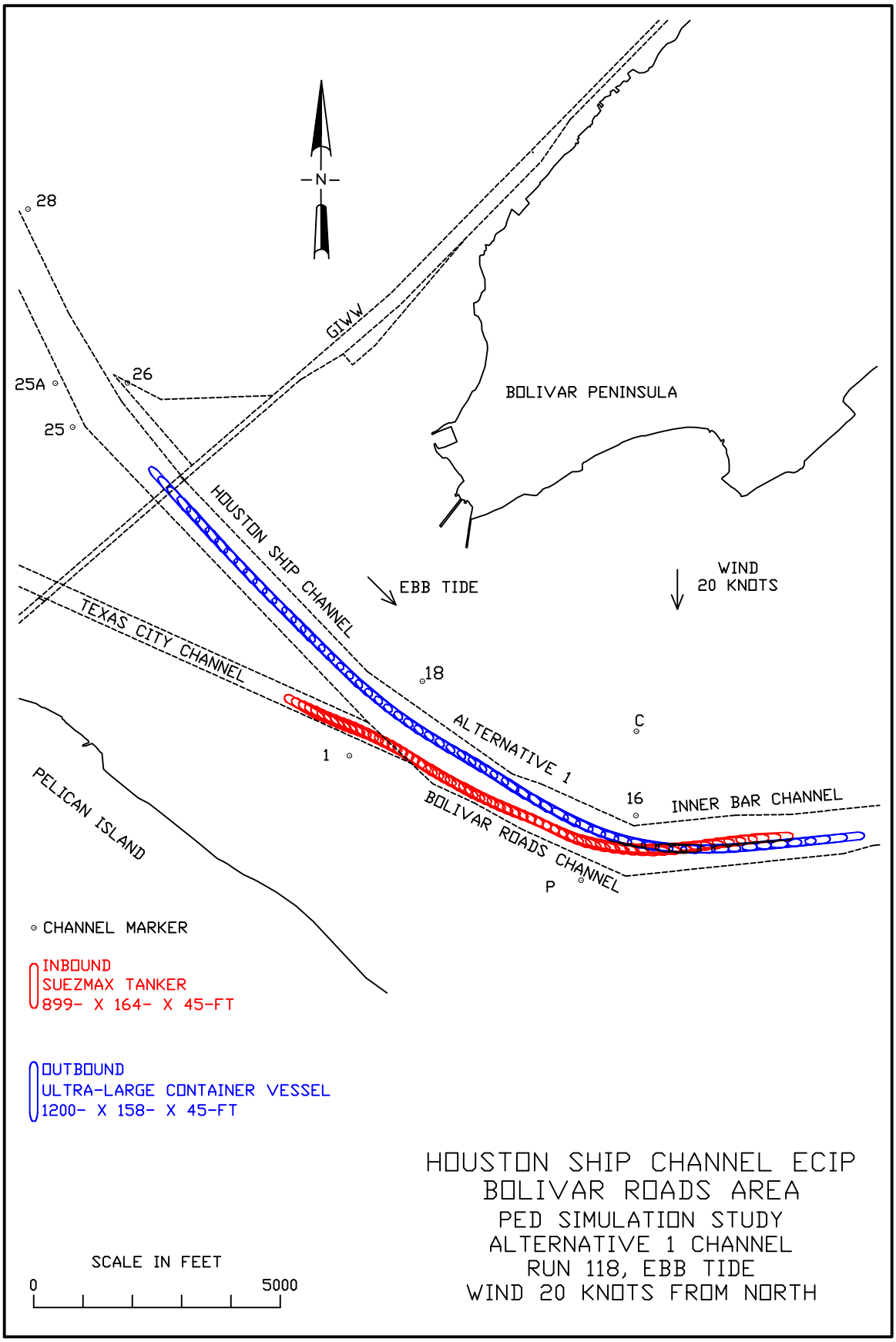
Purpose	Testing at Bolivar Roads in RP. Inbound vessel to go to the Texas City Channel. Three instructor controlled tugs used for inbound vessel.
Date	5/22/2020
Start Time	1125
End Time	1140
Plan	EB-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	3 (MZ7505) - Inbound vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MTK300H	35.1/10.97	266.4/12.5	12
Outbound	MULCV14N	45.0/13.7	136.8/9	18

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MTK300H	I	131	313		
Outbound	MULCV14N	A	116			

Run Comments
Skin to skin distance recorded from the starboard tug to the outbound vessel. Distance to channel for inbound vessel recorded from Port tug to channel line.

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
I	Inbound	Normal	Yes	Depending on the conditions this could be safe to do in real life. With the strong wind and current with this specific vessel, it was harder and not as safe to do.	Yes	Yes			Pilot noted that he believes the new model does react quicker in a turn then he would expected it to in real life.
A	Outbound	Normal	Yes	The new design allows for more space on the red side.	Yes	Yes			Pilot still does not like the shape of the channel but there is plenty of room to meet and continue in a line.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 118, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 7

Run **118**

Purpose Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City

Date 6/8/2020
Start Time 1010
End Time 1020
Plan EB-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	SUEZ156R	44.1/13.7	267/10	12
Outbound	*ULCV366M	46.7/14.2	139/13	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	SUEZ156R	D	73	385		
Outbound	*ULCV366M	N	157			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
N	Inbound	Easy	Yes	Inbound vessel was out of the way so no interaction between ships.	Yes	Yes			Current did require additional rudder to check the vessel but did not cause problems.
D	Outbound	Normal	Yes	Plenty of space in the channel.	Yes	Yes			Wind and current did not affect the vessel.

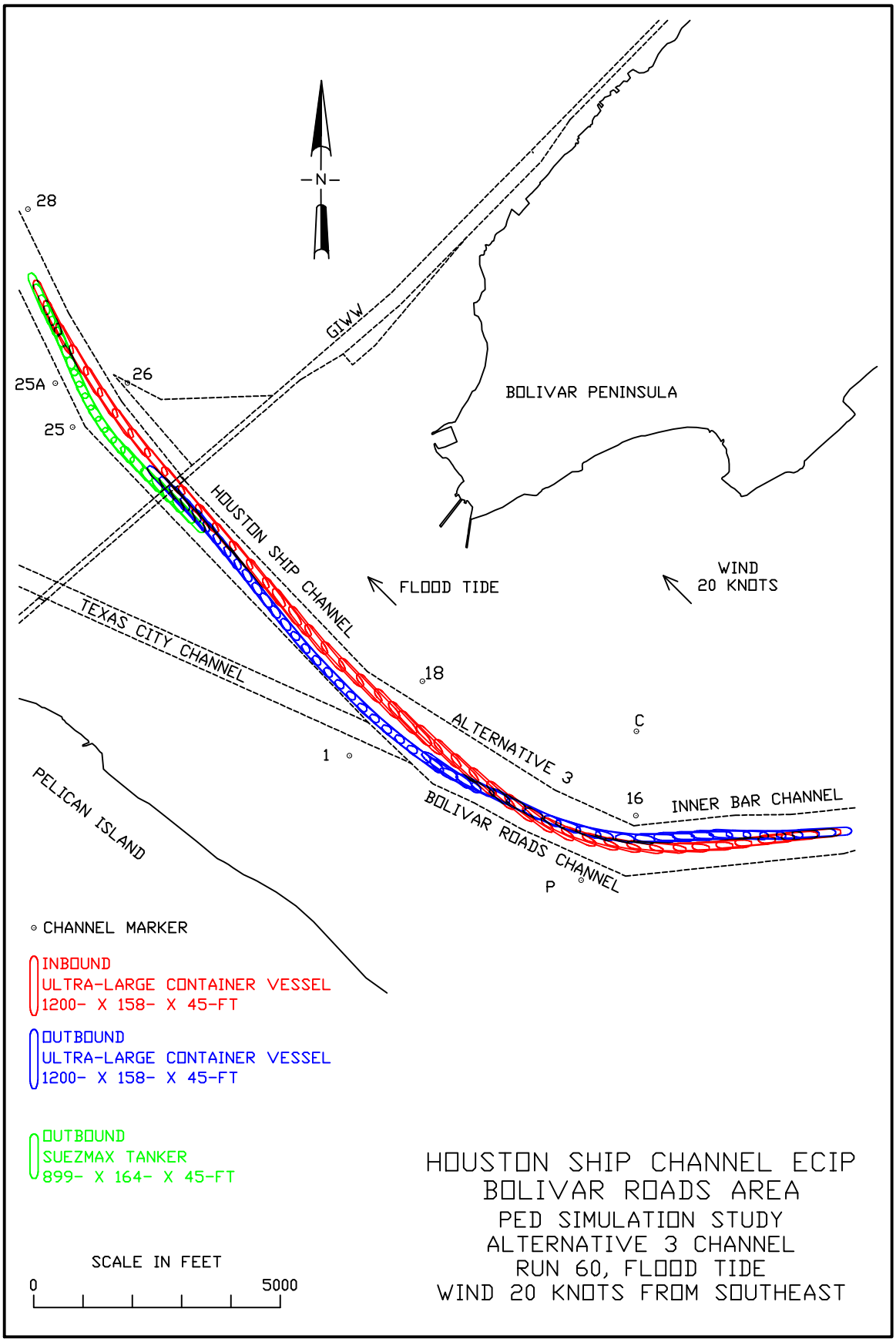

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
FLOOD TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
C
ALTERNATIVE 3
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 3 CHANNEL
RUN 60, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 8

Run **60**

Purpose Testing at Bolivar Roads - meet one ship in each bend

Date 6/1/2020
Start Time 1025
End Time 1040
Plan EB-A3
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	267.2/10	12
Outbound	MULCV14N	45.0/13.7	138/12	18
Outbound	SUEZ156R	44.1/13.7	156/13	30

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	H	429	105	171	193
Outbound	MULCV14N	G	278			
Outbound	SUEZ156R	J			157	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
H	Inbound	Difficult	Yes	The conditions with the current, wind, and speed requires more piloting.	Yes	Yes	Yes	Yes	Look at using different speeds and meeting locations.
G	Outbound	Normal	Yes	Wider channel allows for increased safety with vessel size.	Yes	Yes			Recovery got up to 30 degrees so it was harder but it was manageable.
J	Outbound	Normal	Yes	Vessel handled well and went pretty normal.			Yes	Yes	Change the meeeting time to in the turn to see how that situation would be. Pilot thinks the speed should be decreased.

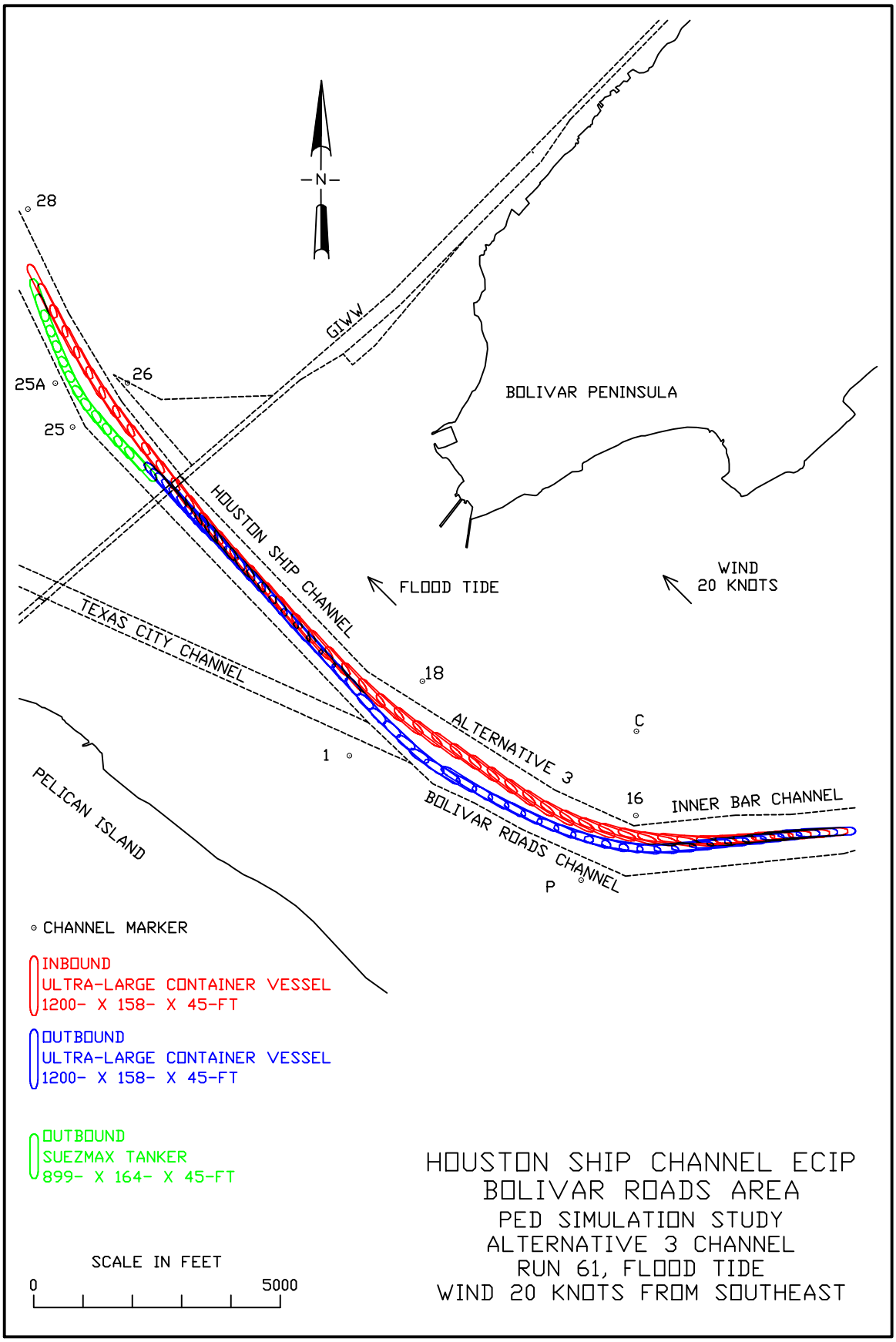

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
FLOOD TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
ALTERNATIVE 3
C
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 3 CHANNEL
RUN 61, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 9

Run **61**

Purpose Testing at Bolivar Roads - meet one ship in each bend

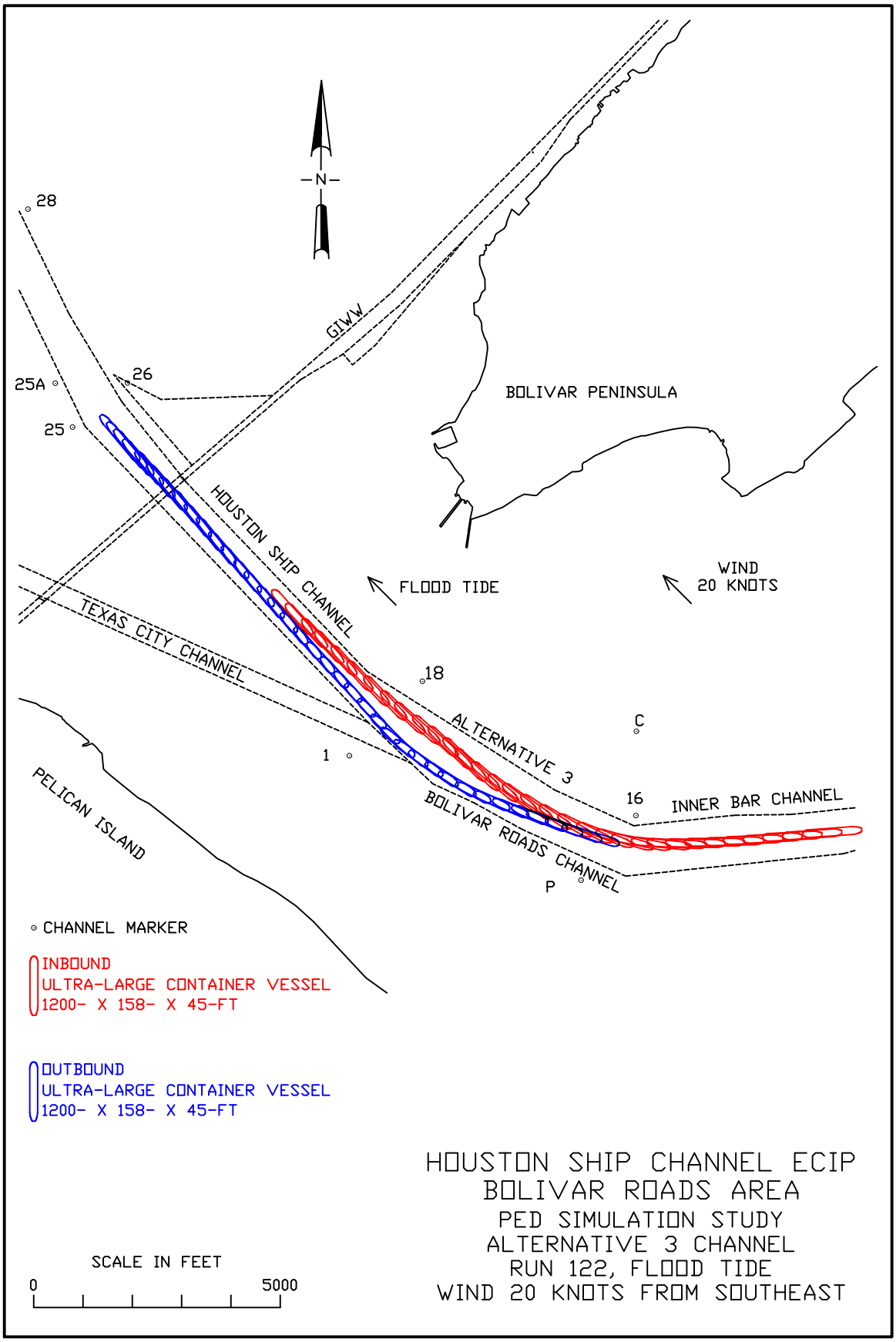
Date 6/1/2020
Start Time 1050
End Time 1105
Plan EB-A3
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	267.2/8	12
Outbound	MULCV14N	45.0/13.7	138/8	18
Outbound	SUEZ156R	44.1/13.7	156/8	30

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	G	319	329	400	265
Outbound	MULCV14N	J	216			
Outbound	SUEZ156R	H			185	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
G	Inbound	Normal	Yes	The additional width in the channel allows for adequate distances between vessel and to the channel line.	Yes	Yes	Yes	Yes	The meeting locations were not ideal but it was manageable. Pilot also would have liked to be slower.
J	Outbound	Normal	Yes	Wider channel allows for more distances for skin to skin.	Yes	Yes			Pilot believed he turned a little early so he could have given the inbound vessel more space. Meeting location is not ideal.
H	Outbound	Normal	Yes	No issues.			Yes	Yes	Meeting in the turn is not the best place but with the larger channel it makes it more doable.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 3 CHANNEL
RUN 122, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 10

Run **122**

Purpose Testing at Bolivar Roads - meet in the bend

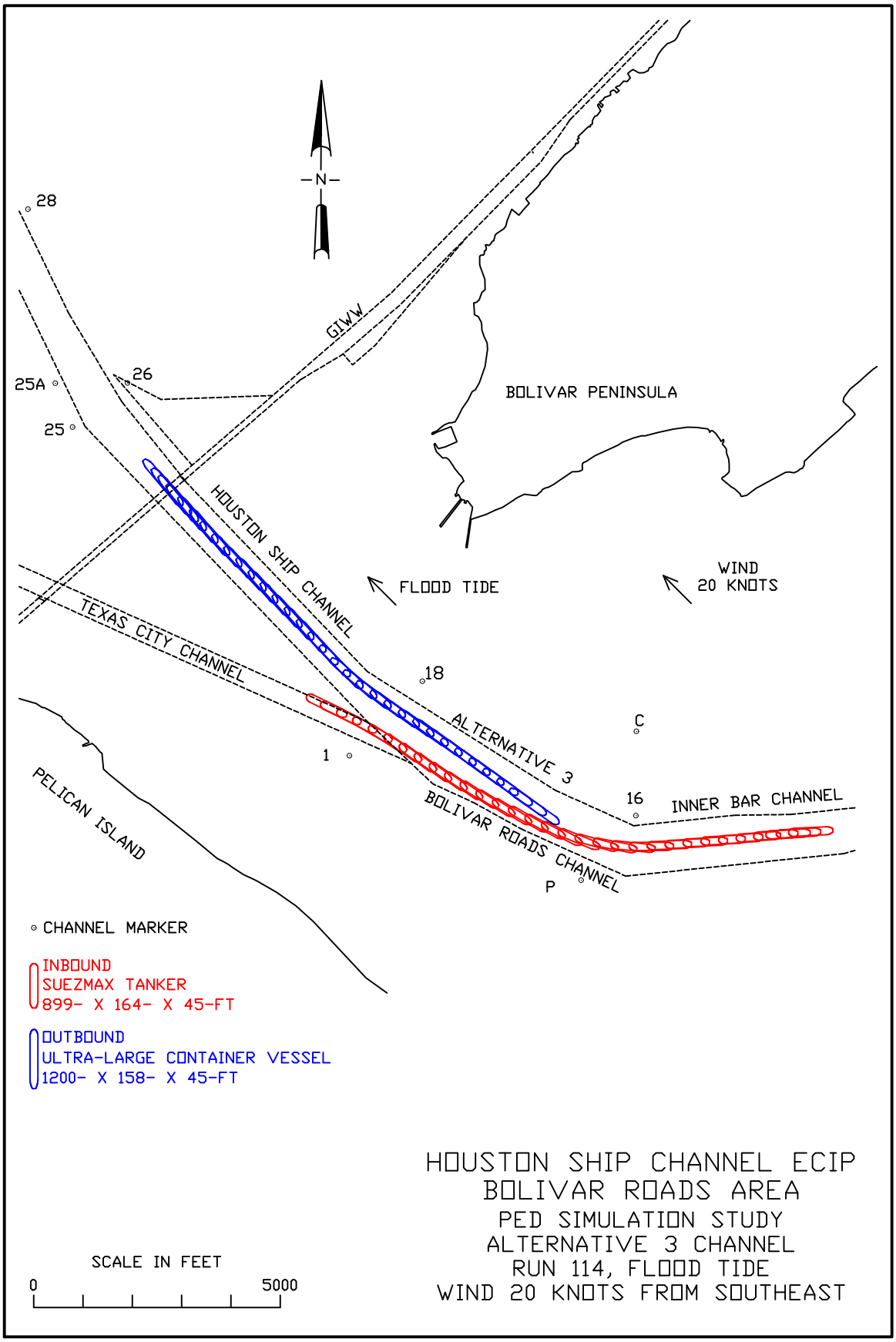
Date 6/8/2020
Start Time 1240
End Time 1250
Plan EB-A3
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/10	12
Outbound	ULCV366M	46.7/14.2	139/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	J	300	434		
Outbound	ULCV366M	D	110			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Inbound	Normal	Yes	The cutout on the red side allows for a lot of space to pass.	Yes	Yes			This layout is still preferred for this pilot. Had to make the turn earlier due to the current.
D	Outbound	Normal	Yes	A lot more space in this layout to safely maneuver due to the cutout being longer.	Yes	Yes			Cutout being longer helps the inbound vessel to use a smaller angle during the turn and this allows the outbound vessel to have extra space while passing. The outbound vessel does not have to watch the stern of the inbound ship and can make their turn whenever they feel fit to. Current was felt but due to the extra space the pilot had more room to set up and did not cause problems. Pilot prefers Alt 3 layout.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 3 CHANNEL
RUN 114, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 11

Run **114**

Purpose Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City

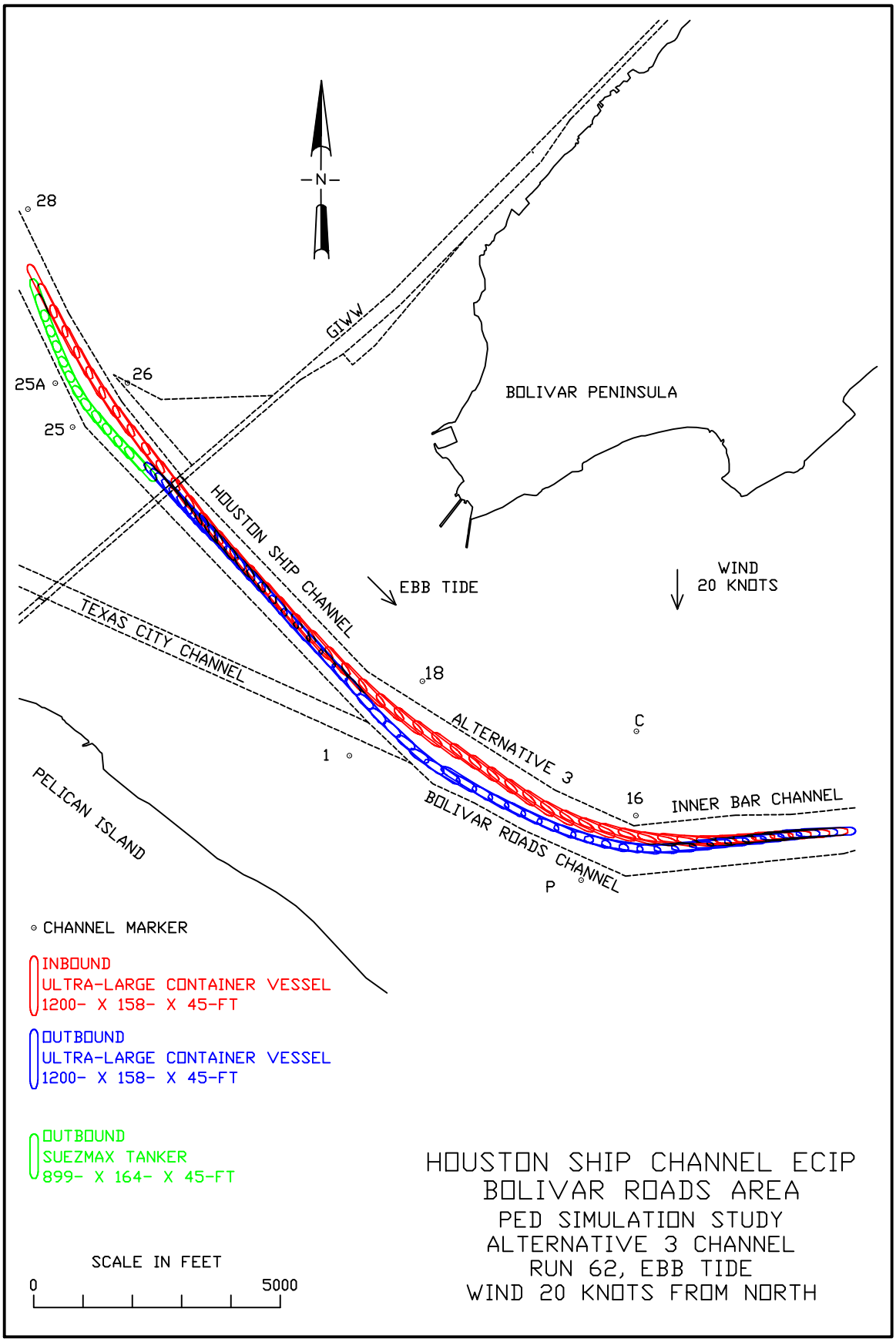
Date 6/5/2020
Start Time 1425
End Time 1435
Plan EB-A3
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	SUEZ156R	44.1/13.7	267/11	12
Outbound	*ULCV366M	46.7/14.2	136/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	SUEZ156R	A	106	406		
Outbound	*ULCV366M	C	284			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Adequate sea room. Making the turn with the widener allows you to make the turn earlier so that the other vessel can have more space during passing.	Yes	Yes			Not much recovery because of the space, you can line up and just go straight till the next bend. Pilot prefers this over Alt 4.
A	Outbound	Normal	Yes	Plenty of room.	Yes	Yes			Wind and current did not make a difference. Plot prefers this layout over Alt 4.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 3 CHANNEL
RUN 62, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 12

Run **62**

Purpose Testing at Bolivar Roads - meet one ship in each bend

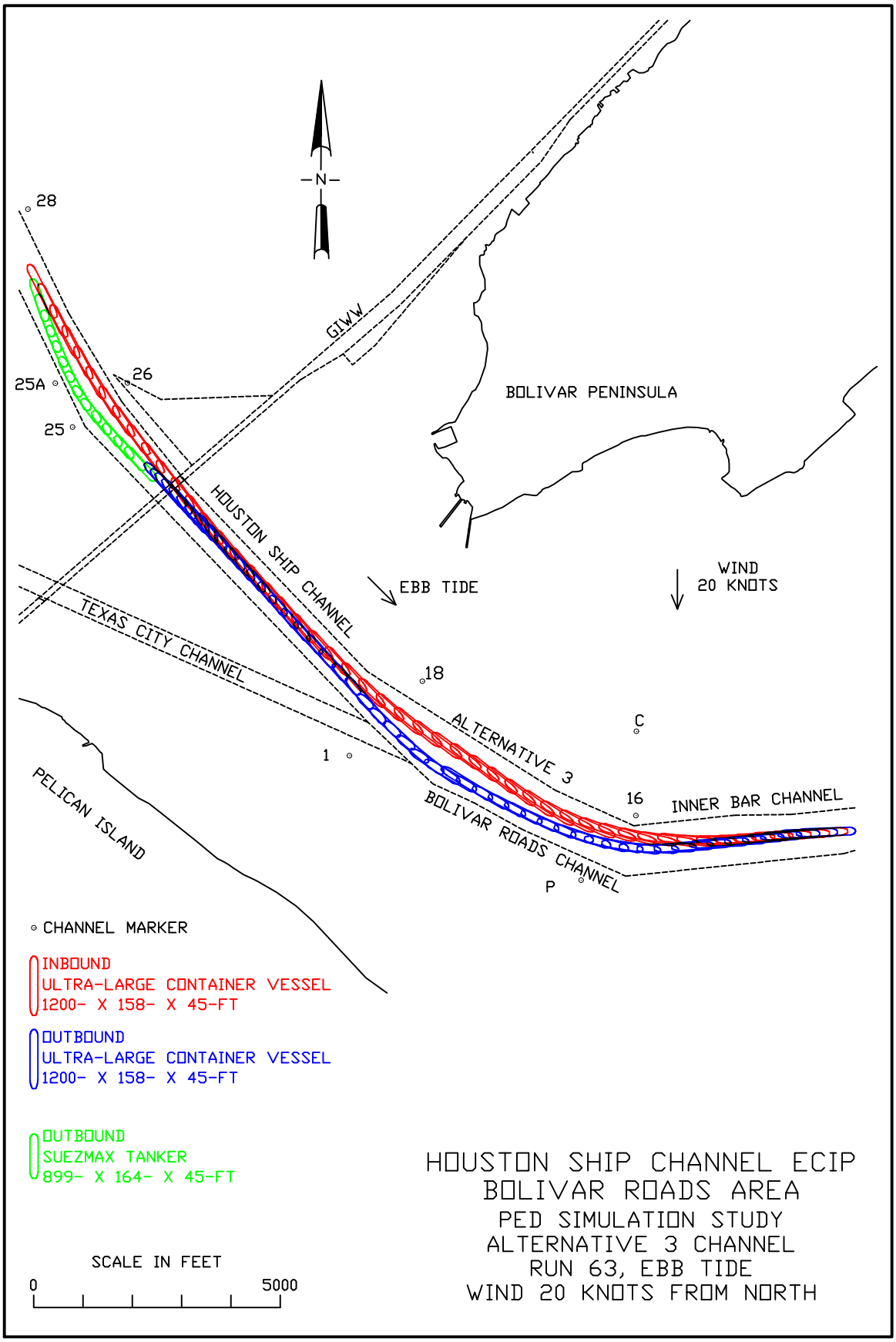
Date 6/1/2020
Start Time 1115
End Time 1135
Plan EB-A3
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	267.2/8	12
Outbound	MULCV14N	45.0/13.7	138/8	18
Outbound	SUEZ156R	44.1/13.7	156/8	30

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	J	159	270	78	229
Outbound	MULCV14N	H	212			
Outbound	SUEZ156R	G			156	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Inbound	Normal	Yes	Wider channel makes it easier to control. Met the ship in the straightway so it was easier.	Yes	Yes	Yes	Yes	Used full because the ship started drifting to starboard but it was manageable.
H	Outbound	Normal	Yes	Felt the channel width makes it safe. Meeting location not ideal but works.	Yes	Yes			Change in the wind and current did not affect the pilot.
G	Outbound	Normal	Yes	The width in the channel and wideners allow for adequate space.			Yes	Yes	Everything felt fine.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 3 CHANNEL
RUN 63, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 13

Run **63**

Purpose Testing at Bolivar Roads - meet one ship in each bend

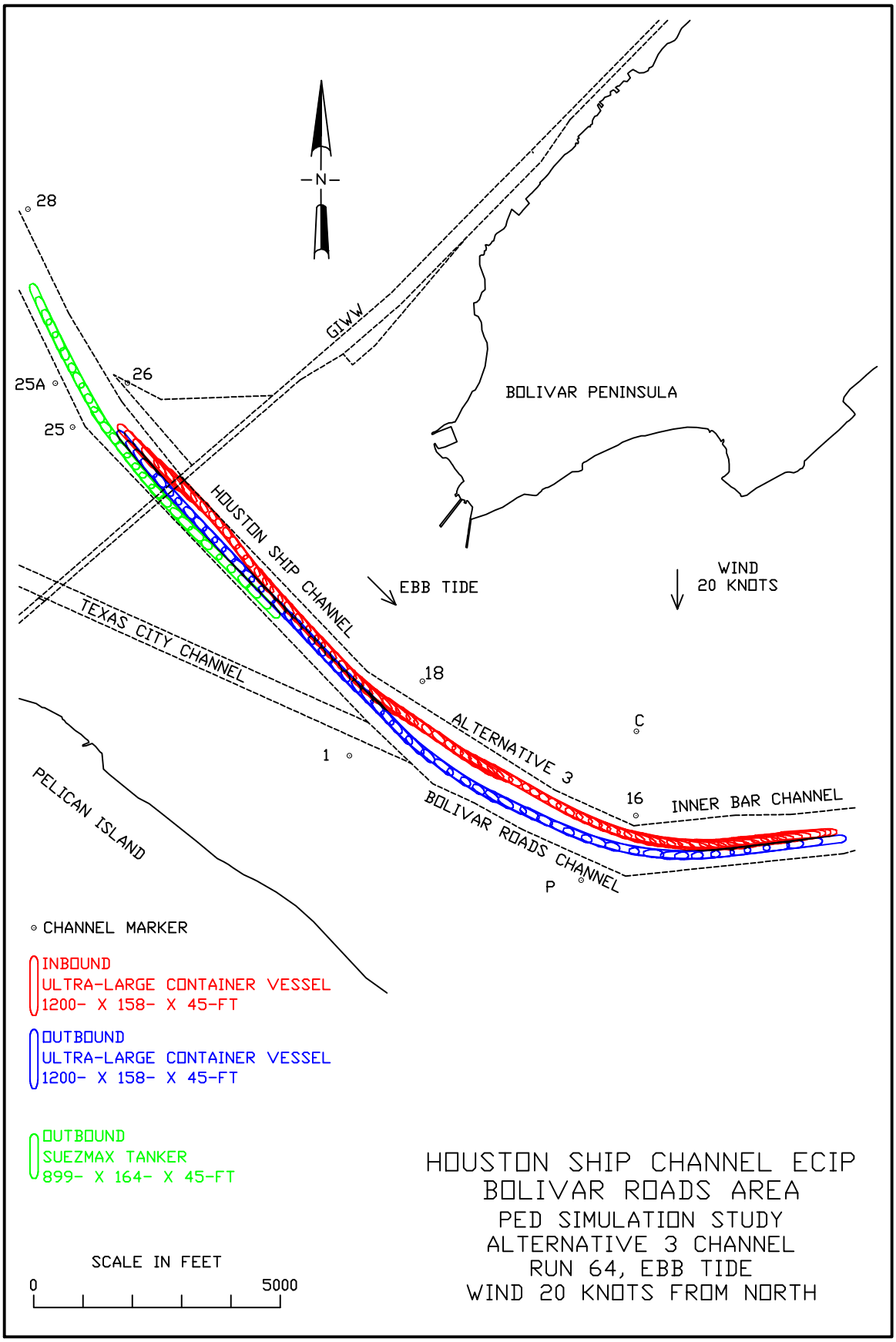
Date 6/1/2020
Start Time 1145
End Time 1205
Plan EB-A3
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/8	16
Outbound	MULCV14N	45.0/13.7	139/8	25-26
Outbound	SUEZ156R	44.1/13.7	156/8	34

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	H	300	260	434	268
Outbound	MULCV14N	G	320			
Outbound	SUEZ156R	J			179	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
H	Inbound	Normal	Yes	Nothing out of the ordinary.	Yes	Yes	Yes	Yes	Cut outs are good spots to meet.
G	Outbound	Normal	Yes	Width of the channel and space between ships and channel increase the safety.	Yes	Yes			Meeting around buoy 18 was a good spot to meet for the vessels.
J	Outbound	Normal	Yes	Wider channel allows for more margin of error. Can get over further to make the turn easier.			Yes	Yes	Better to meet in a straightway with two large vessels but meeting in the bend is manageable.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 3 CHANNEL
RUN 64, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 14

Run **64**

Purpose Testing at Bolivar Roads - meet one ship in each bend

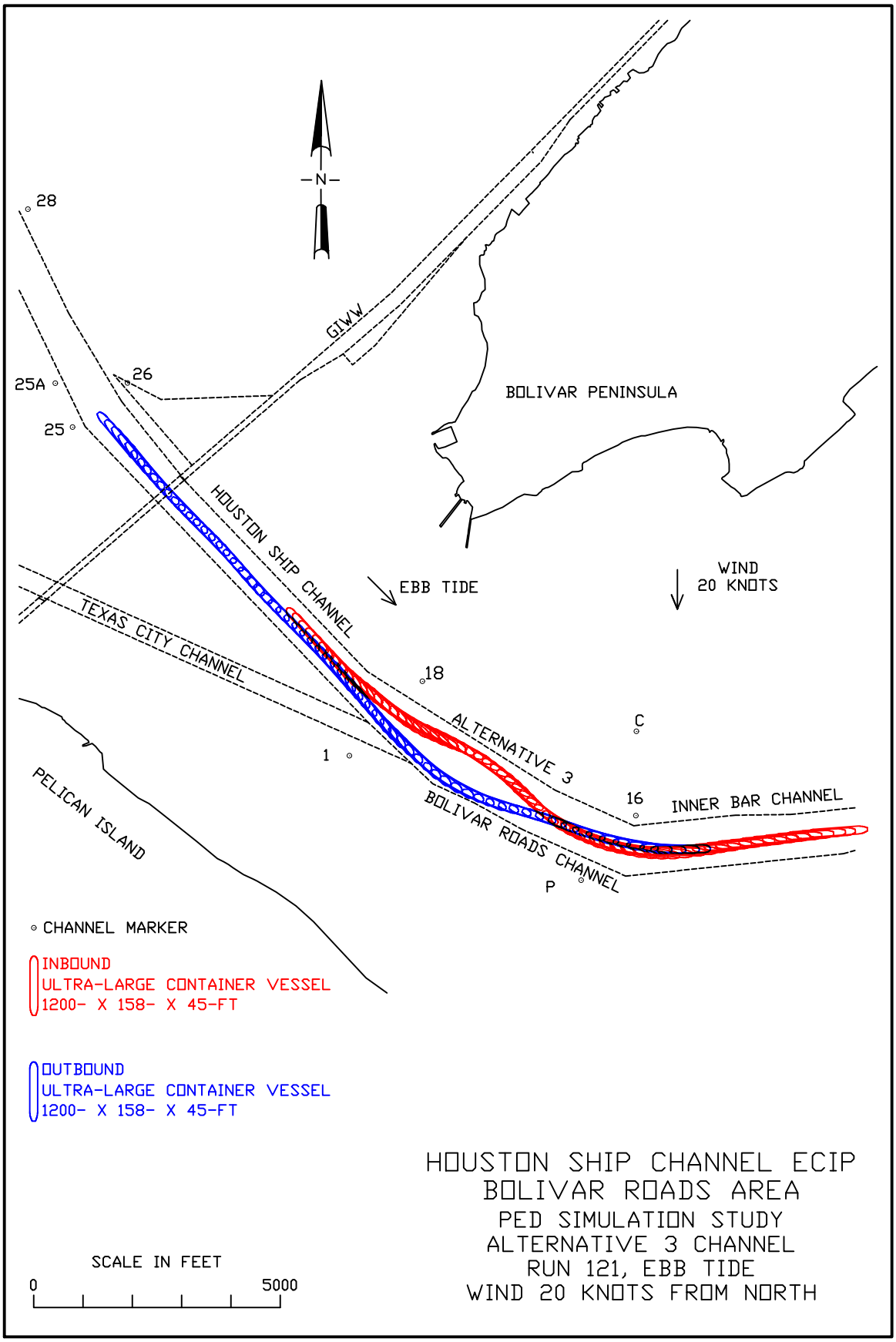
Date 6/1/2020
Start Time 1250
End Time 1310
Plan EB-A3
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/8	16
Outbound	ULCV366M	46.7/14.2	139/8	25-26
Outbound	SUEZ156R	44.1/13.7	156/8	34

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	G	226	324	233	342
Outbound	ULCV366M	J	192			
Outbound	SUEZ156R	H			120	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
G	Inbound	Normal	Yes	Extra space in the channel and the redesign at buoy 18 to remove the curve made the situation safer.	Yes	Yes	Yes	Yes	Everything was manageable.
J	Outbound	Normal	Yes	Wider channel allowed for a bigger swept path. Cutout design is nice.	Yes	Yes			Not ideal meeting location but it was controllable.
H	Outbound	Easy	Yes	Nothing out of the ordinary. Standard operation.			Yes	Yes	



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 3 CHANNEL
RUN 121, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 15

Run **121**

Purpose Testing at Bolivar Roads - meet in the bend

Date 6/8/2020
Start Time 1220
End Time 1230
Plan EB-A3
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/10	12
Outbound	ULCV366M	46.7/14.2	139/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	B	183	535		
Outbound	ULCV366M	J	119			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
B	Inbound	Normal	Yes	Slightly difficult due to the handling of the ship, not due to the channel size. There is plenty of room in the channel to maneuver.	Yes	Yes			Wind and current did not affect the pilot. Plenty of space in the channel to safely pass another large vessel.
J	Outbound	Normal	Yes	More space in the cutout for vessels to meet. Safe even with the environmental factors being used.	Yes	Yes			This layout allows for more space on the red side of the channel. Pilot prefers Alt 3 over the other two layouts used today (Alt 1 and Alt 4).

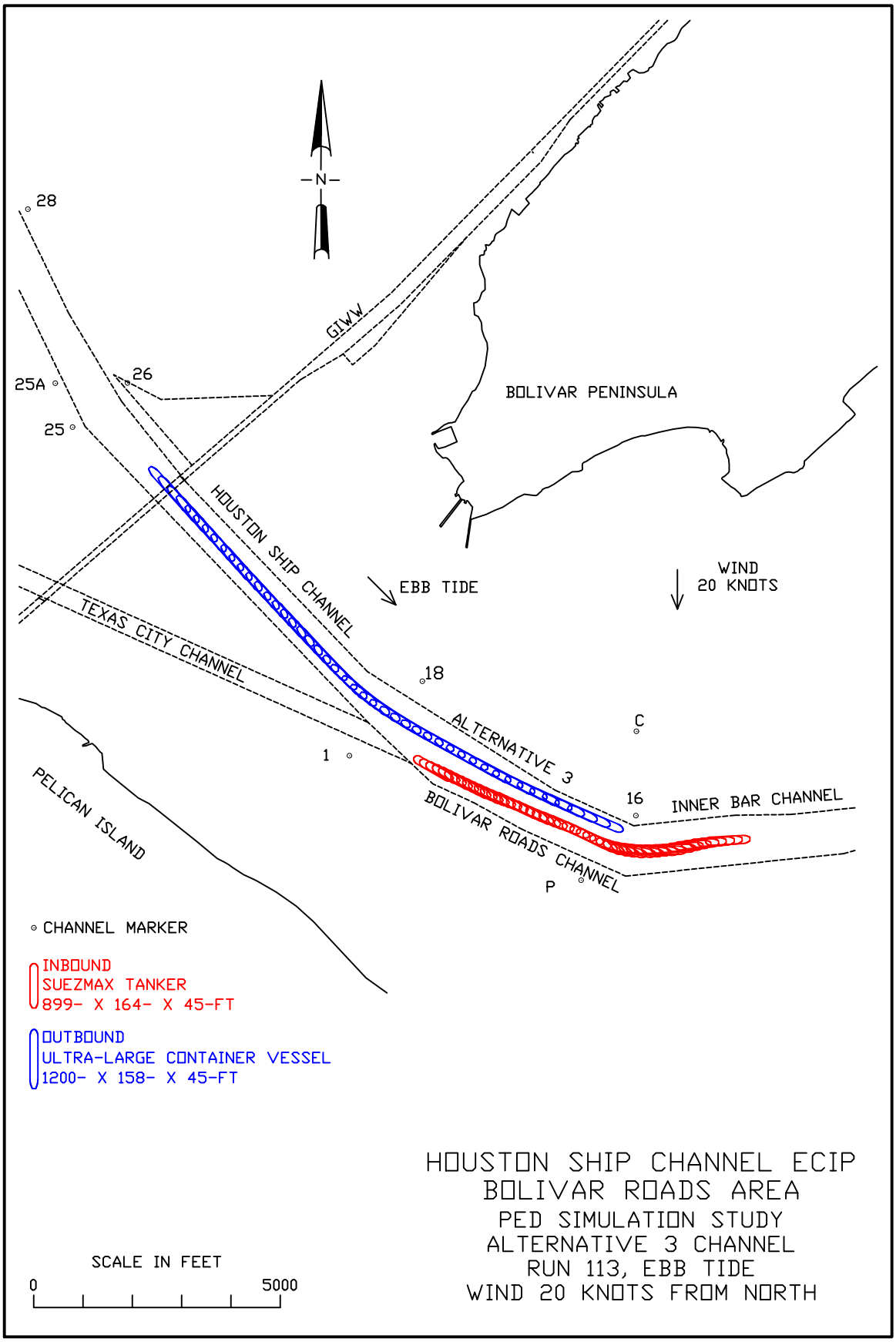

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
EBB TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
ALTERNATIVE 3
C
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 3 CHANNEL
RUN 113, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 16

Run **113**

Purpose Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City

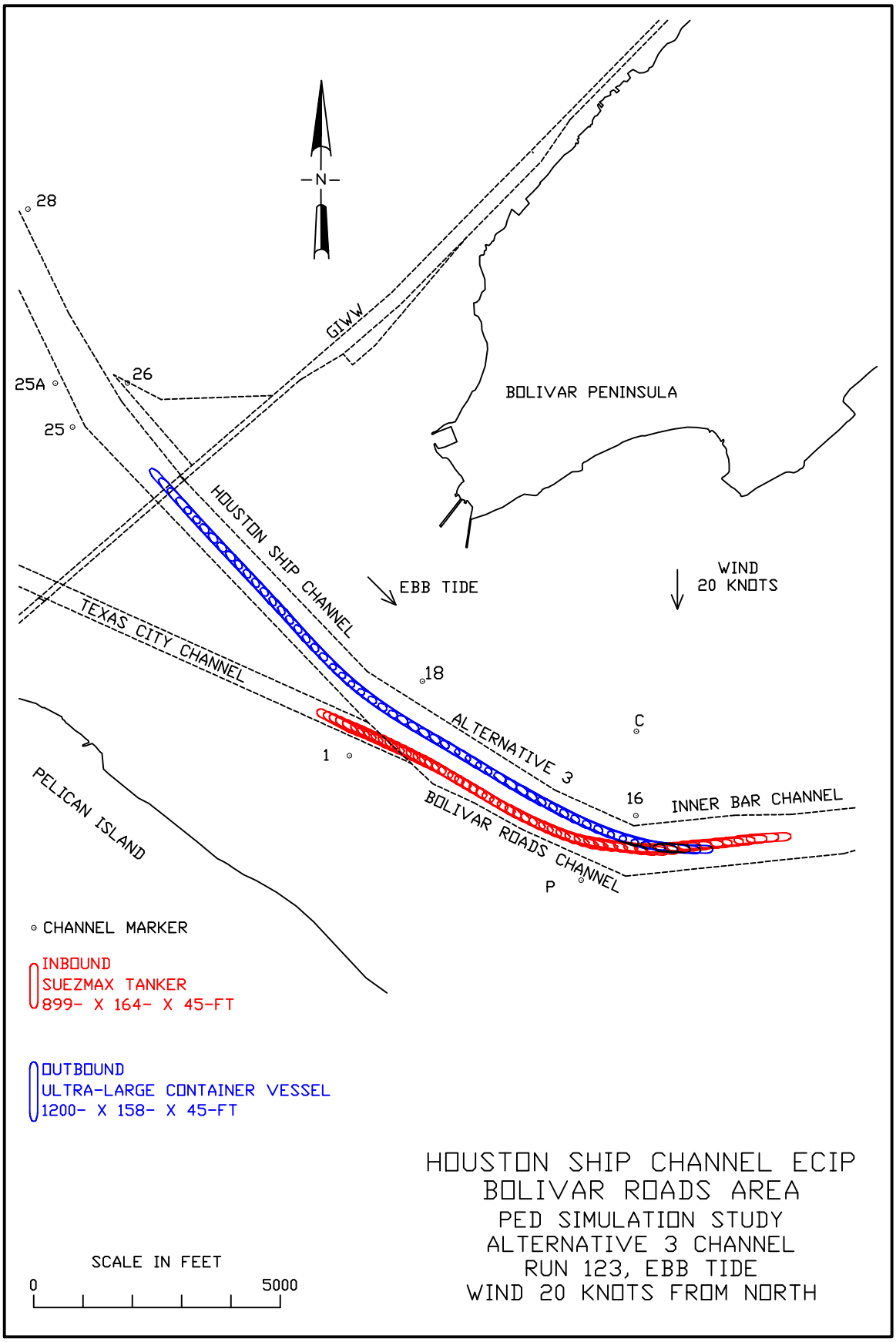
Date 6/5/2020
Start Time 1410
End Time 1420
Plan EB-A3
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	SUEZ156R	44.1/13.7	267/11	12
Outbound	*ULCV366M	46.7/14.2	136/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	SUEZ156R	D	218	299	[redacted]	
Outbound	*ULCV366M	A	279	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Inbound	Normal	Yes	More room than previous version	Yes	Yes	[redacted]		This cutout is better for meeting on two whistles compared to Alt 4. Prefers this layout.
D	Outbound	Normal	Yes	There is plenty of room.	Yes	Yes			Alt 3 cutout on the east side is much more ideal for meeting a vessel starboard to starboard. This layout would also create a safe space for a vessel to overtake another vessel while going outbound.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 3 CHANNEL
RUN 123, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 17

Run **123**

Purpose Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City

Date 6/8/2020
Start Time 1300
End Time 1310
Plan EB-A3
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	SUEZ156R	44.1/13.7	267/15	12
Outbound	*ULCV366M	46.7/14.2	139/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	SUEZ156R	B	195	320		
Outbound	*ULCV366M	D	306			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	The cutout at 18 allows for more room while making the maneuver.	Yes	Yes			Meeting starboard to starboard with a little bit longer of a cutout could make the maneuver a little bit safer. But even with the cutout as it is, the maneuver is safe and successful.
B	Outbound	Easy	Yes	Plenty of room and the vessel handled well.	Yes	Yes			The cutout works great for the maneuver.

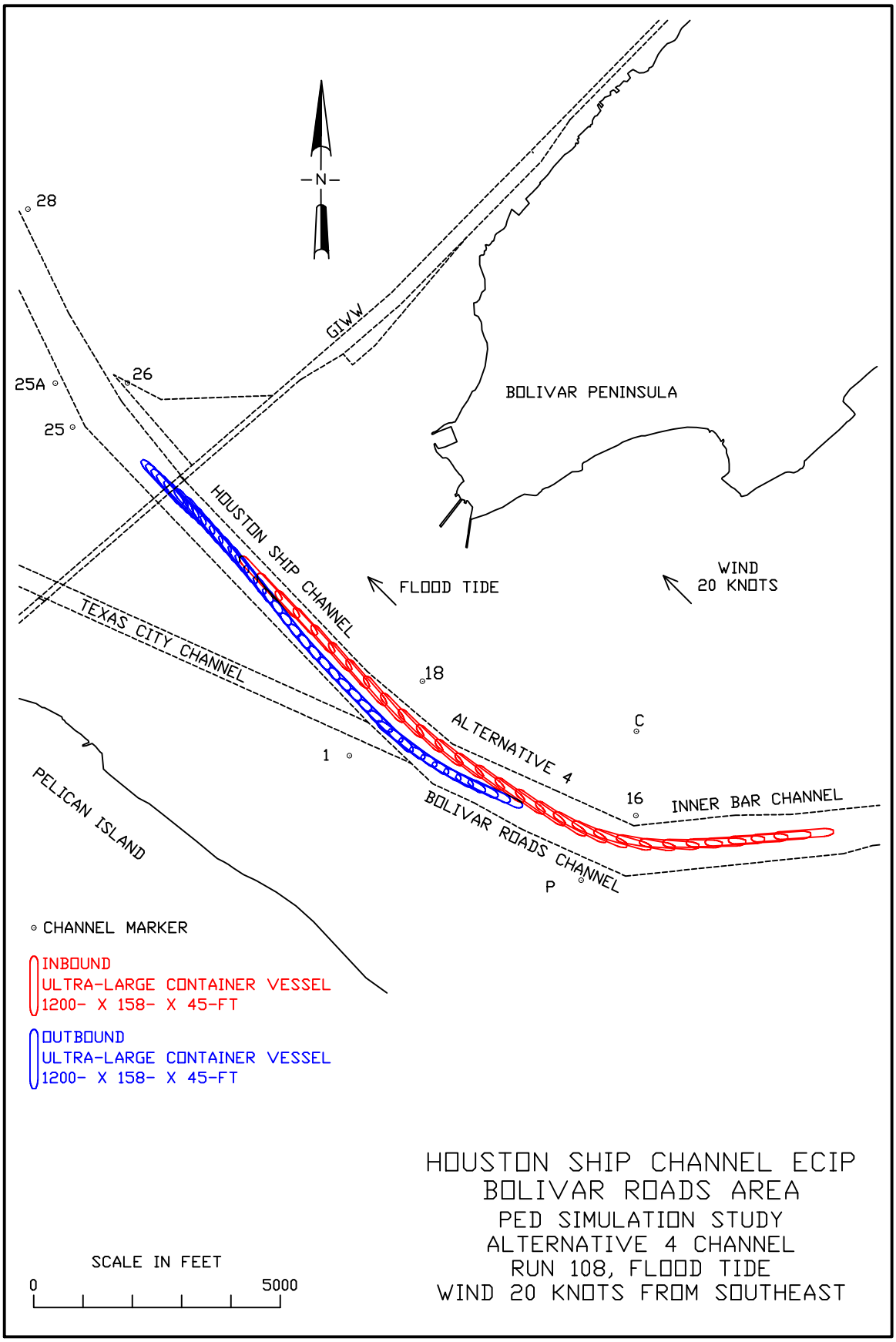

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
FLOOD TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
C
ALTERNATIVE 4
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 4 CHANNEL
RUN 108, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 18

Run **108**

Purpose Testing at Bolivar Roads - meet in the bend

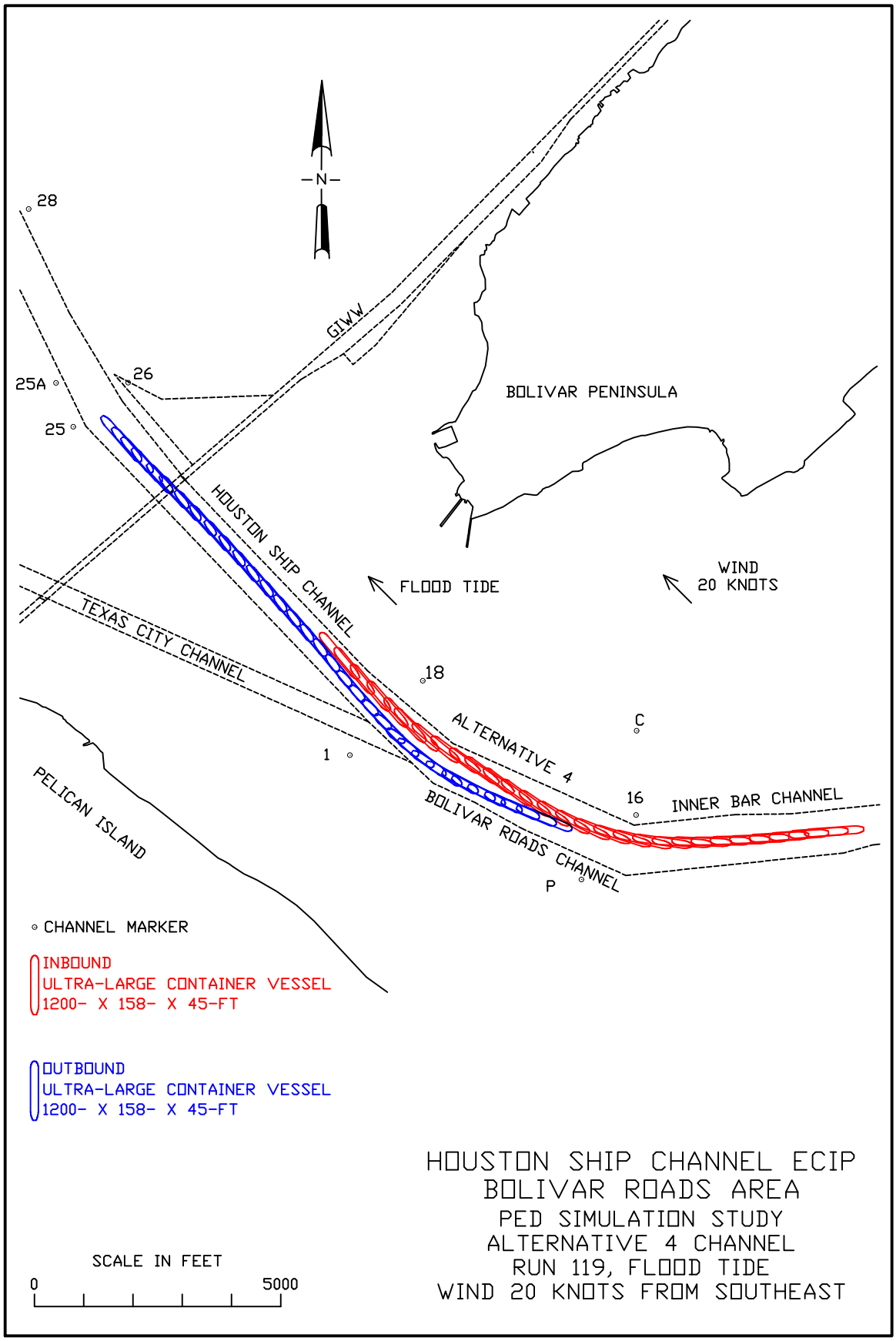
Date 6/5/2020
Start Time 1230
End Time 1240
Plan EB-A4
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/10	12
Outbound	ULCV366M	46.7/14.2	137/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	D	156	250	[redacted]	
Outbound	ULCV366M	A	100	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Plenty of room.	Yes	Yes	[redacted]		It was good. Current did affect the turning due to being pushed to the left side of the channel and having to go against the current to make the meet.
A	Outbound	Normal	Yes	Plenty of room.	Yes	Yes			Slower due to the tide being against the vessel but everything was good while meeting in the bend. All factors were in his favor.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 4 CHANNEL
RUN 119, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 19

Run **119**

Purpose Testing at Bolivar Roads - meet in the bend

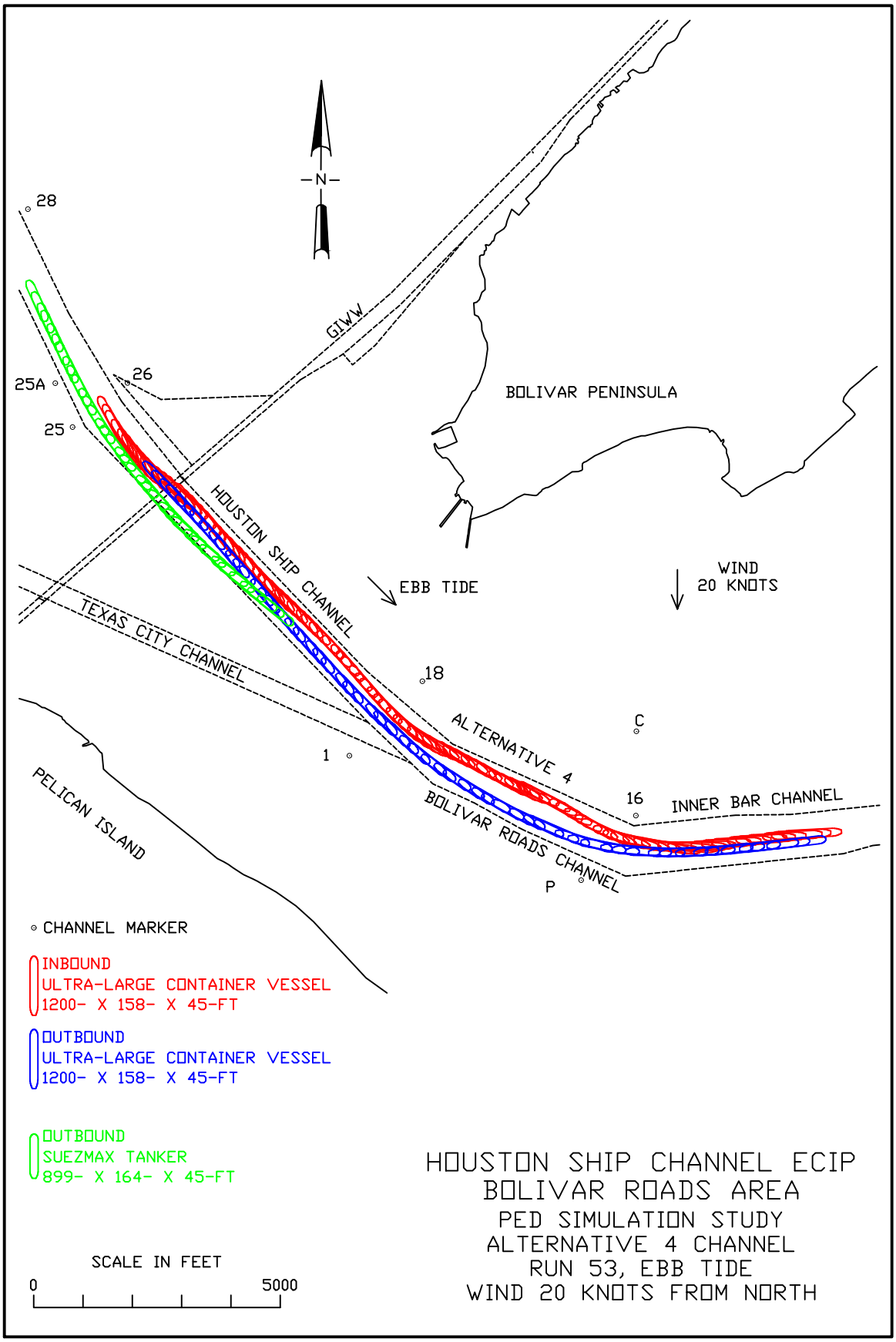
Date 6/8/2020
Start Time 1100
End Time 1110
Plan EB-A4
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/10	12
Outbound	ULCV366M	46.7/14.2	139/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	J	118	283		
Outbound	ULCV366M	D	204			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Inbound	Normal	Yes	Wider channel and more space between the vessels.	Yes	Yes			The pilot commented that there is a lot of space to maneuver in this layout but not as much space as there is in RP. This layout with the decrease of space required more turns to be made and more rudder. The turn required about 18-20 degree turn with hard over rudder. Pilot prefers Alt 1 over Alt 4.
D	Outbound	Normal	Yes	There is enough room in the channel to safely maneuver.	Yes	Yes			With vessels this size, channel width, and environmental conditions you are required to make the turn earlier than normal with anticipation of the slide from the current. Redid this run due to the pilot dropping his speed during the maneuver which allowed the current to set the vessel lower than expected and outside of the federal channel line. Redid the run and he kept a higher speed so he could remain in the channel. Piloting error, not a problem with the channel design. Pilot prefers Alt 1 over Alt 4.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 4 CHANNEL
RUN 53, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 20

Run **53**

Purpose Testing at Bolivar Roads in RP - meet one ship in each bend.

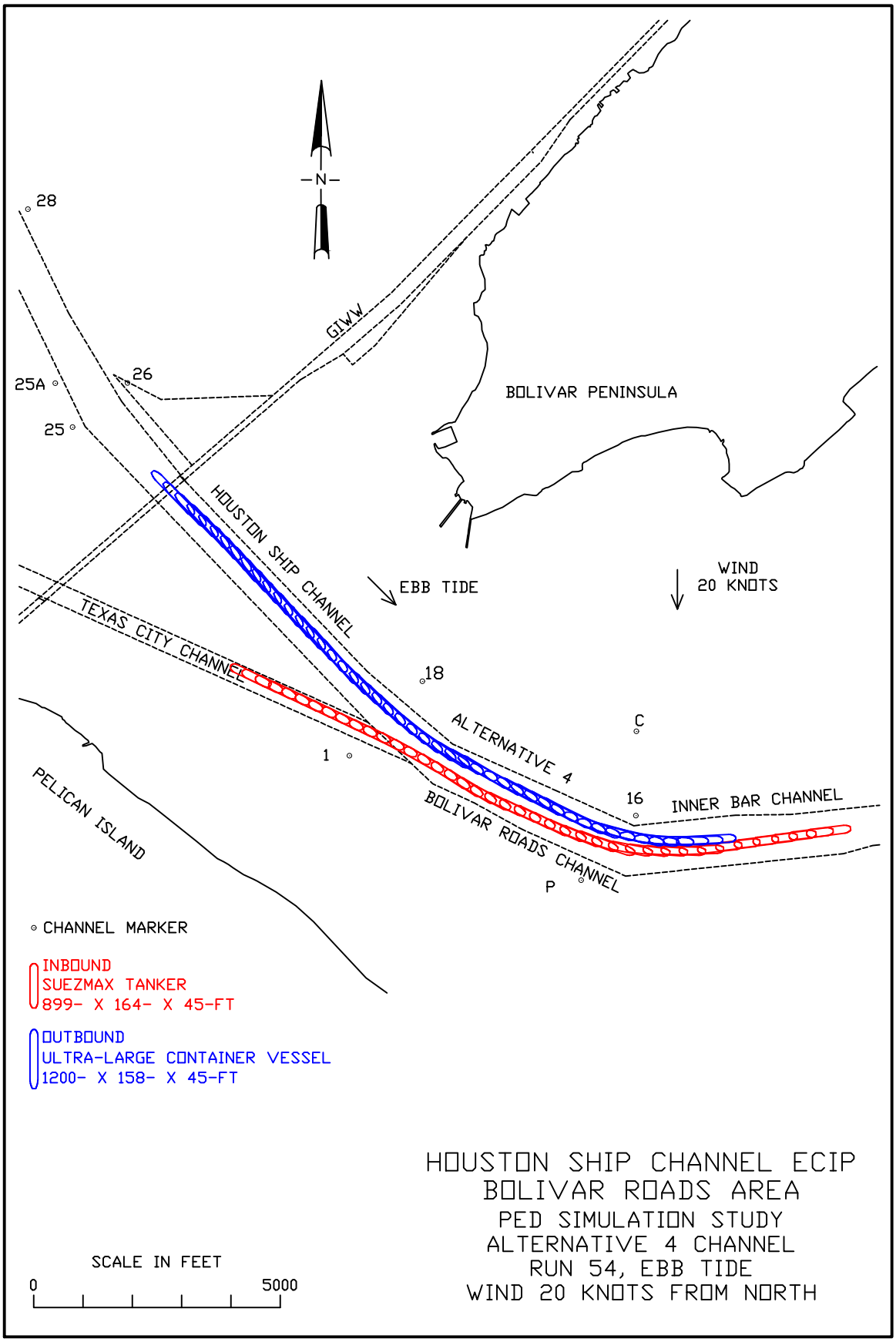
Date 5/22/2020
Start Time 0940
End Time 1005
Plan EB-A4*
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14N	45.0/13.7	266.4/15	12
Outbound	MULCV14N	45.0/13.7	136.8/6	18
Outbound	SUEZ156N	44.1/13.7	156.4/7	31-32

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MULCV14N	A		388		276
Outbound	MULCV14N	H				
Outbound	SUEZ156N	G				

Run Comments
Realized the channel was incorrect. Channel was wider and had extra bends on north and south side that should not be there in the RP channel. Channel fixed and correct version used starting at Run 55.

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Inbound	Normal	Yes	Plenty of space.	Yes	Yes	Yes	Yes	Learning how to work with the new turn.
H	Outbound	Normal	Yes	Spacing allowed the meet with plenty of room to the vessel and the channel line.	Yes	Yes			Very routine.
G	Outbound	Normal	Yes	Extra width on the channel made it a safe operation.			Yes	Yes	Everything felt normal. Went outside of the federal channel a little but it was the pilot getting use to the vessel and the area not because he had to.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 4 CHANNEL
RUN 54, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 21

Run **54**

Purpose Testing at Bolivar Roads in RP. Inbound vessel to go to the Texas City Channel.

Date 5/22/2020
Start Time 1020
End Time 1035
Plan EB-A4*
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	266.4/12.5	12
Outbound	MULCV14N	45.0/13.7	136.8/9	18

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	I	195	248	[redacted]	
Outbound	MULCV14N	G	194	[redacted]		

Run Comments
Realized the channel was incorrect. Channel was wider and had extra bends on north and south side that should not be there in the RP channel. Channel fixed and correct version used starting at Run 55.

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
I	Inbound	Normal	Yes	Nothing abnormal during the scenario to indicate a problem in real life.	Yes	Yes	[redacted]		
G	Outbound	Normal	Yes	Width of the channel allowed for the meet.	Yes	Yes			Pilot had a different chart to look at then the main bridge but even with the differences the maneuver went smooth and successfully.

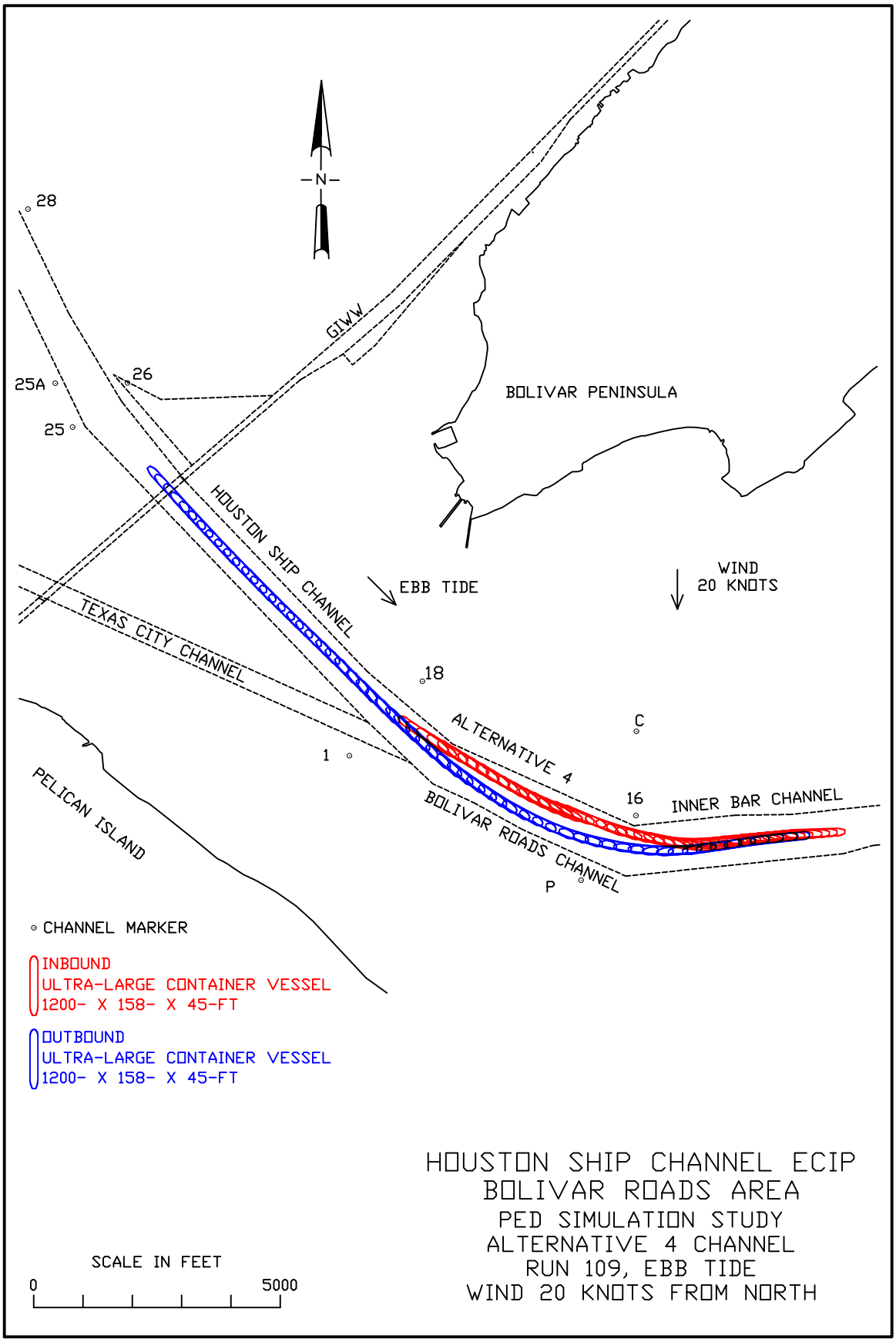

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
EBB TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
ALTERNATIVE 4
C
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 4 CHANNEL
RUN 109, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 22

Run **109**

Purpose Testing at Bolivar Roads - meet in the bend

Date 6/5/2020
Start Time 1245
End Time 1300
Plan EB-A4
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/10	12
Outbound	ULCV366M	46.7/14.2	137/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	C	175	258	[redacted]	
Outbound	ULCV366M	D	225	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Plenty of room in the channel.	Yes	Yes	[redacted]		Current played an affect on the turn as the pilot had to start turning a little bit later. Meeting location was good due to being in a wide part of the channel.
D	Outbound	Normal	Yes	Plenty of room.	Yes	Yes			

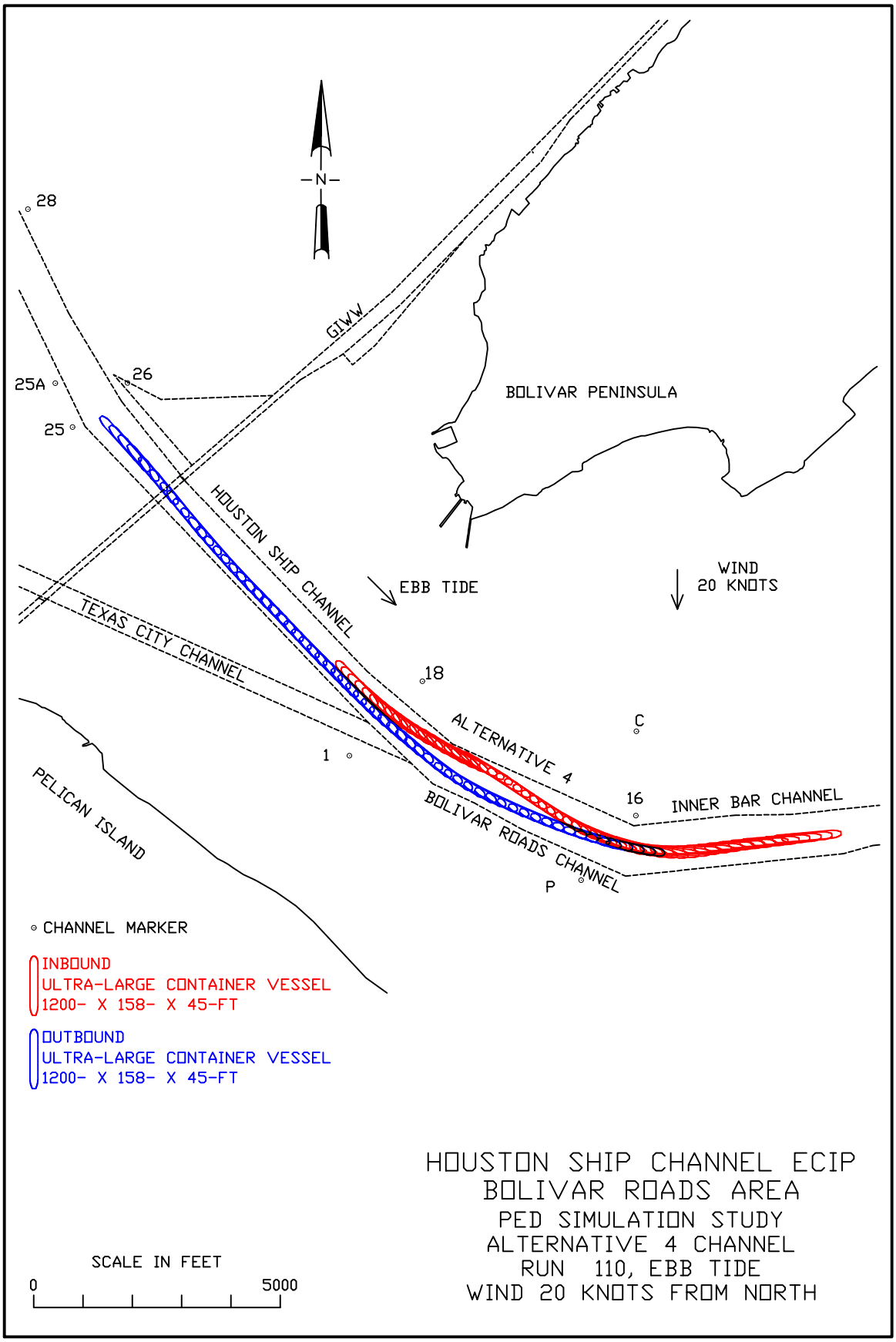

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
EBB TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
ALTERNATIVE 4
C
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 4 CHANNEL
RUN 110, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 23

Run **110**

Purpose Testing at Bolivar Roads - meet in the bend

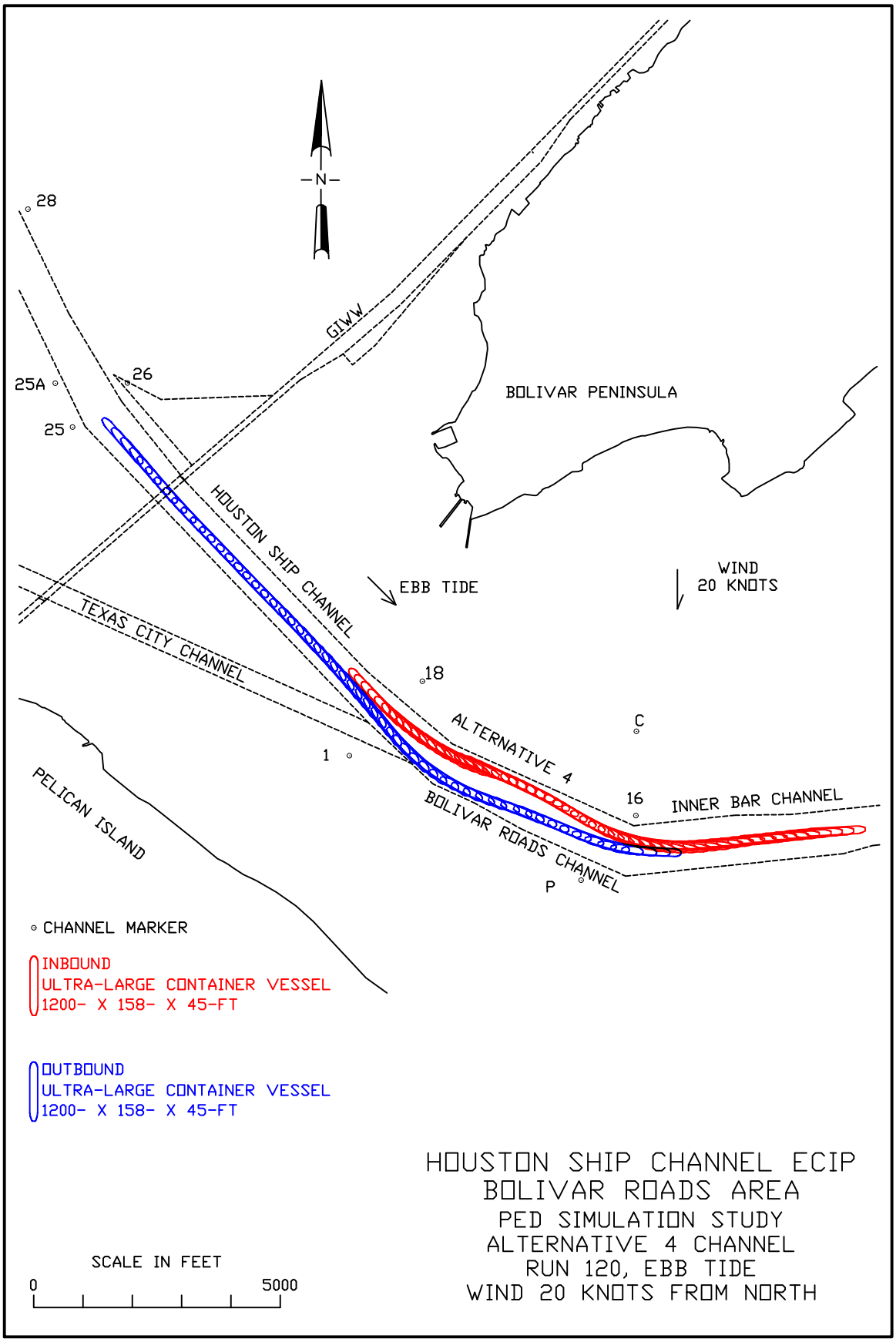
Date 6/5/2020
Start Time 1305
End Time 1315
Plan EB-A4
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/13.1	12
Outbound	ULCV366M	46.7/14.2	137/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	C	84	326	[redacted]	
Outbound	ULCV366M	A	180	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	There is adequate room to maneuver with vessels this size.	Yes	Yes	[redacted]		Pilot noted that the simulation design does not seem to look exactly as it does in real life so it made it a little more difficult to position himself where he wanted in the channel.
A	Outbound	Normal	Yes	Channel has plenty of space.	Yes	Yes			Fighting the current to slow down so the meet could occur where it was planned to.



HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 4 CHANNEL
RUN 120, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 24

Run **120**

Purpose Testing at Bolivar Roads - meet in the bend

Date 6/8/2020
Start Time 1125
End Time 1135
Plan EB-A4
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	266/10	12
Outbound	ULCV366M	46.7/14.2	139/13.5	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	D	107	405	[redacted]	
Outbound	ULCV366M	J	50	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	There is enough room to pass vessels this size but more room would be ideal.	Yes	Yes	[redacted]		Prefers Alt 1 over Alt 4. The current was felt but did not have a strong impact on the inbound vessel. The pilot had to wait for the other vessel's stern to clear the area before he could make his turn and due to this, he had to use a lot more rudder to make the turn. Additional room would remove this problem.
J	Outbound	Normal	Yes	Wider channel allows for more space between the vessels.	Yes	Yes			Alt 1 requires less rudder compared to this layout due to having less space in Alt 4 to make the turn. This layout required hard over rudder multiple times to make it safely. Pilot commented that for Alt 4 more room on the red side of the channel.

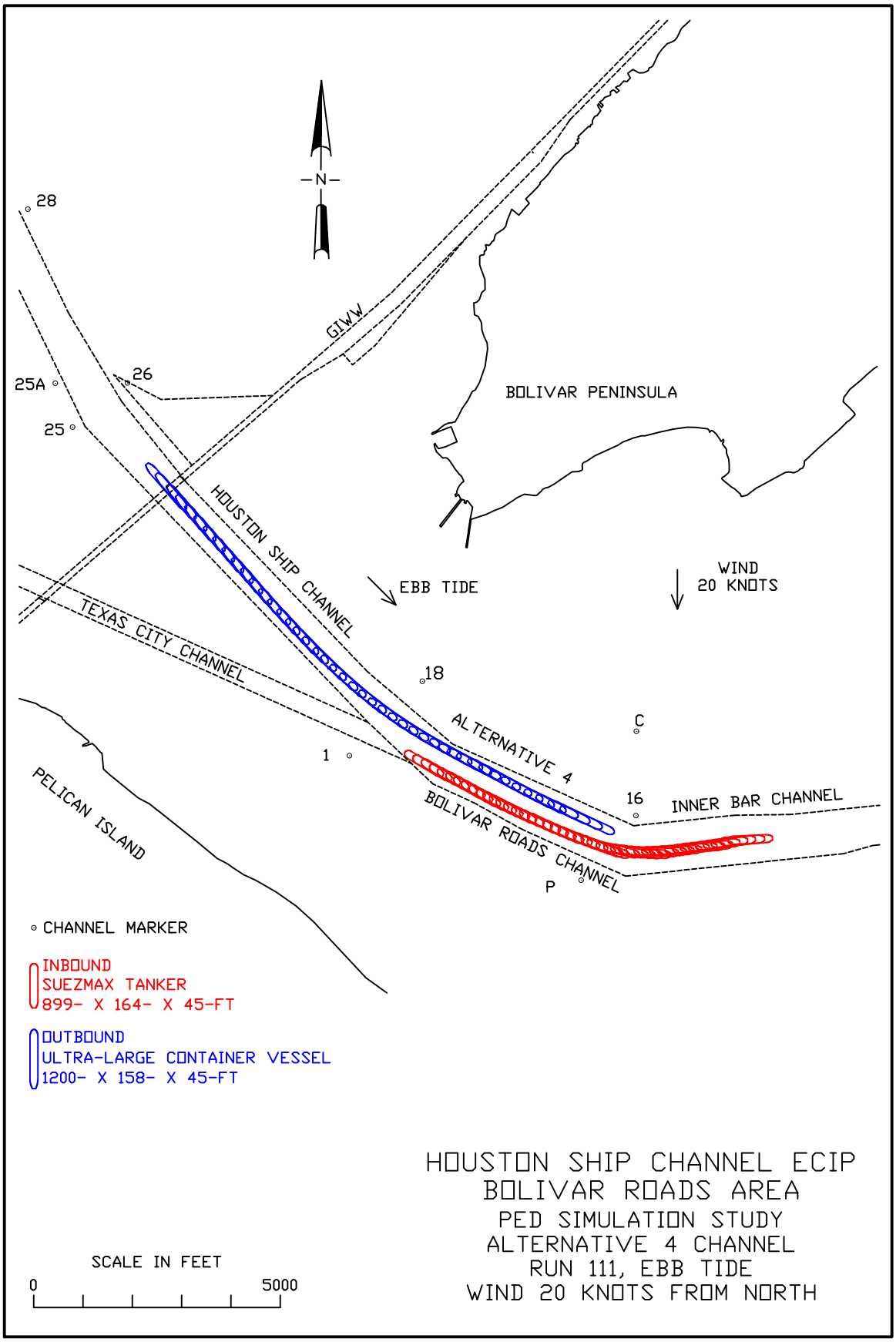

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
EBB TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
ALTERNATIVE 4
C
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 4 CHANNEL
RUN 111, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 25

Run **111**

Purpose Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City

Date 6/5/2020
Start Time 1325
End Time 1335
Plan EB-A4
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	SUEZ156R	44.1/13.7	267/11	12
Outbound	*ULCV366M	46.7/14.2	136/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	SUEZ156R	A	165	308		
Outbound	*ULCV366M	D	161			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Width of the channel.	Yes	Yes			Everything was as expected.
A	Outbound	Normal	Yes	Plenty of room.	Yes	Yes			Meeting Starboard-Starboard went smoothly in this area.

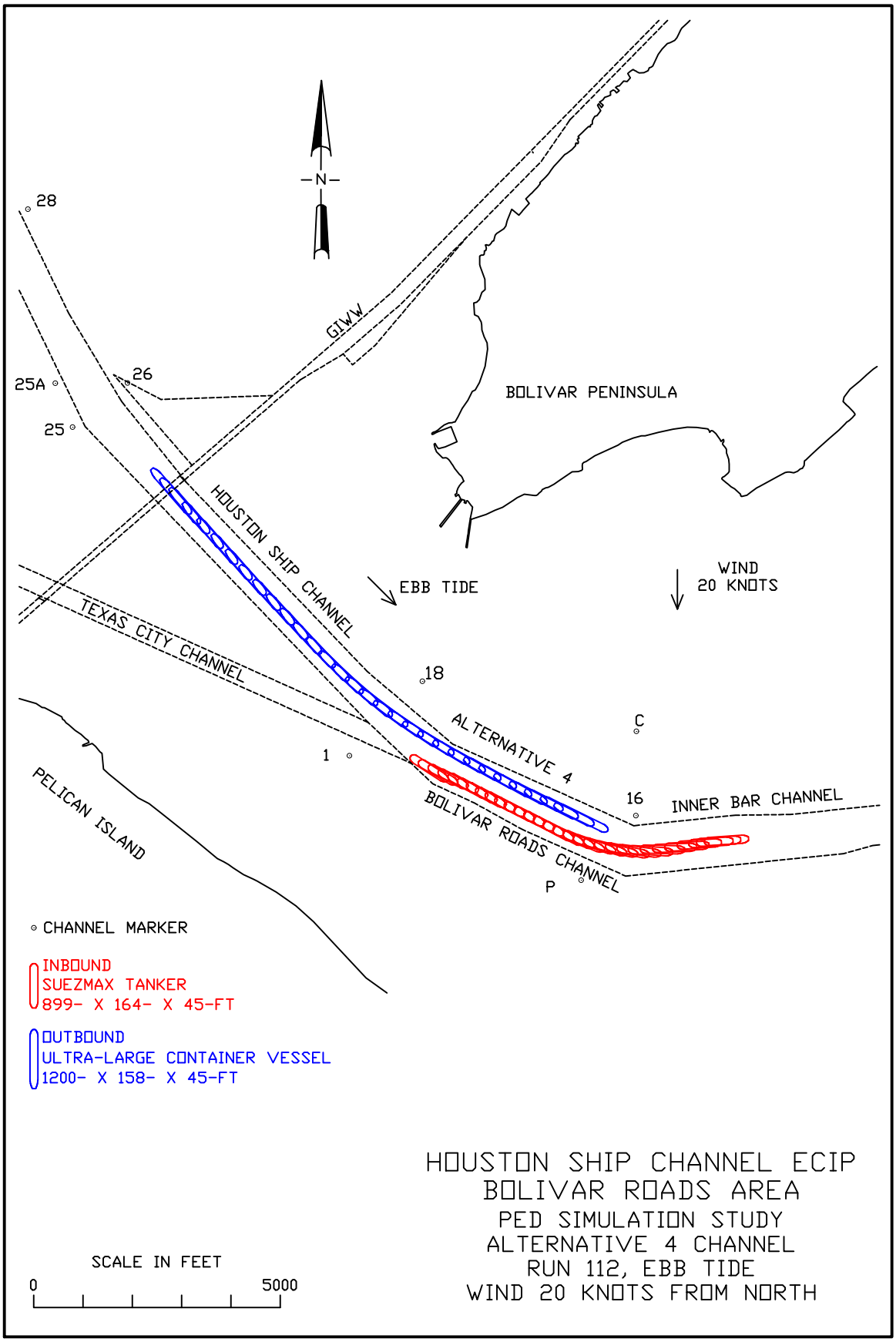

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
EBB TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
ALTERNATIVE 4
C
1
16
INNER BAR CHANNEL
PELICAN ISLAND
BOLIVAR ROADS CHANNEL
P
CHANNEL MARKER
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 4 CHANNEL
RUN 112, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 26

Run **112**

Purpose Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City

Date 6/5/2020
Start Time 1350
End Time 1400
Plan EB-A4
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	SUEZ156R	44.1/13.7	267/11	12
Outbound	*ULCV366M	46.7/14.2	136/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	SUEZ156R	C	192	296		
Outbound	*ULCV366M	A	164			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Inbound	Normal	Yes	Plenty of room.	Yes	Yes			Gated turns are better than Alt 4. A couple extra turns are required but it is easier to judge the turn and the area.
C	Outbound	Normal	Yes	Adequate room to maneuver.	Yes	Yes			Not much interaction between vessels.

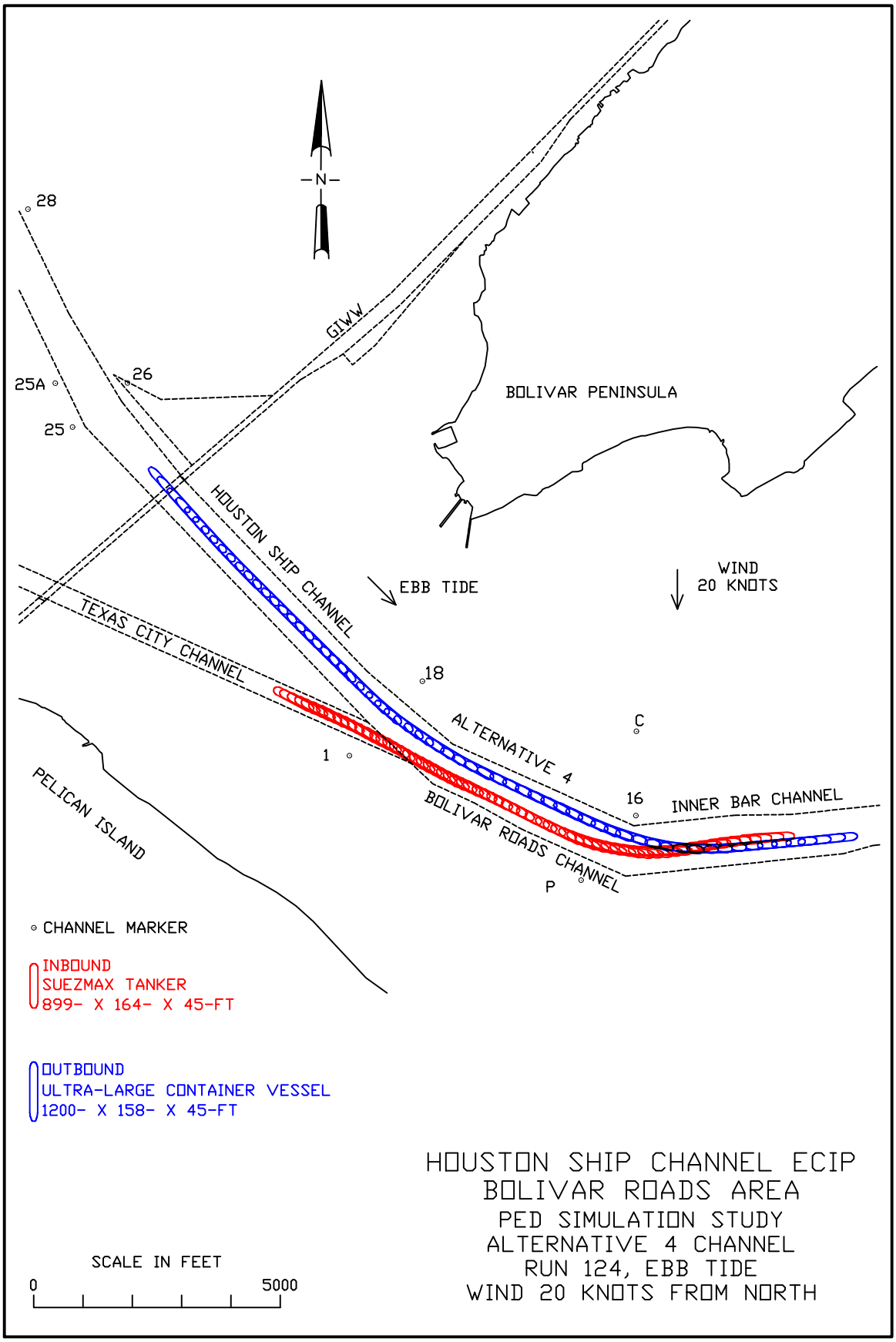

N
28
26
25A
25
GIWW
BOLIVAR PENINSULA
HOUSTON SHIP CHANNEL
EBB TIDE
WIND
20 KNOTS
TEXAS CITY CHANNEL
18
ALTERNATIVE 4
C
1
16
INNER BAR CHANNEL
BOLIVAR ROADS CHANNEL
P
PELICAN ISLAND
CHANNEL MARKER
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 158- X 45-FT
SCALE IN FEET
0
5000
HOUSTON SHIP CHANNEL ECIP
BOLIVAR ROADS AREA
PED SIMULATION STUDY
ALTERNATIVE 4 CHANNEL
RUN 124, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 27

Run **124**

Purpose Testing at Bolivar Roads - meet in the bend on the two whistle with the inbound vessel going to Texas City

Date 6/8/2020
Start Time 1320
End Time 1330
Plan EB-A4
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	SUEZ156R	44.1/13.7	267/15	12
Outbound	*ULCV366M	46.7/14.2	139/10	28

			Minimum Distances during meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	SUEZ156R	D	180	245	[redacted]	
Outbound	*ULCV366M	J	198	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real Life	Comments	First Meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Inbound	Easy	Yes	Wider channel allows for more separation between ships.	Yes	Yes	[redacted]		Prefers Alt 3 over 4 due to needing more rudder during the maneuver while making the turn. The cutout in Alt 3 allows for a smoother turn.
D	Outbound	Normal	Yes	There is enough room in this area to safely pass.	Yes	Yes			The vessel on the east side of the channel will have a harder turn in this layout due to it being sharper and needing more rudder. If the meeting would have occurred a little further north then the inbound pilot would have to be further over to avoid the stern of the outbound vessel. This would cause the Texas City pilot to have to go hard right to avoid the vessel then hard left to get to the channel. The cutout in Alt 3 eliminates this issue.

Redfish (Buoys 51–52)

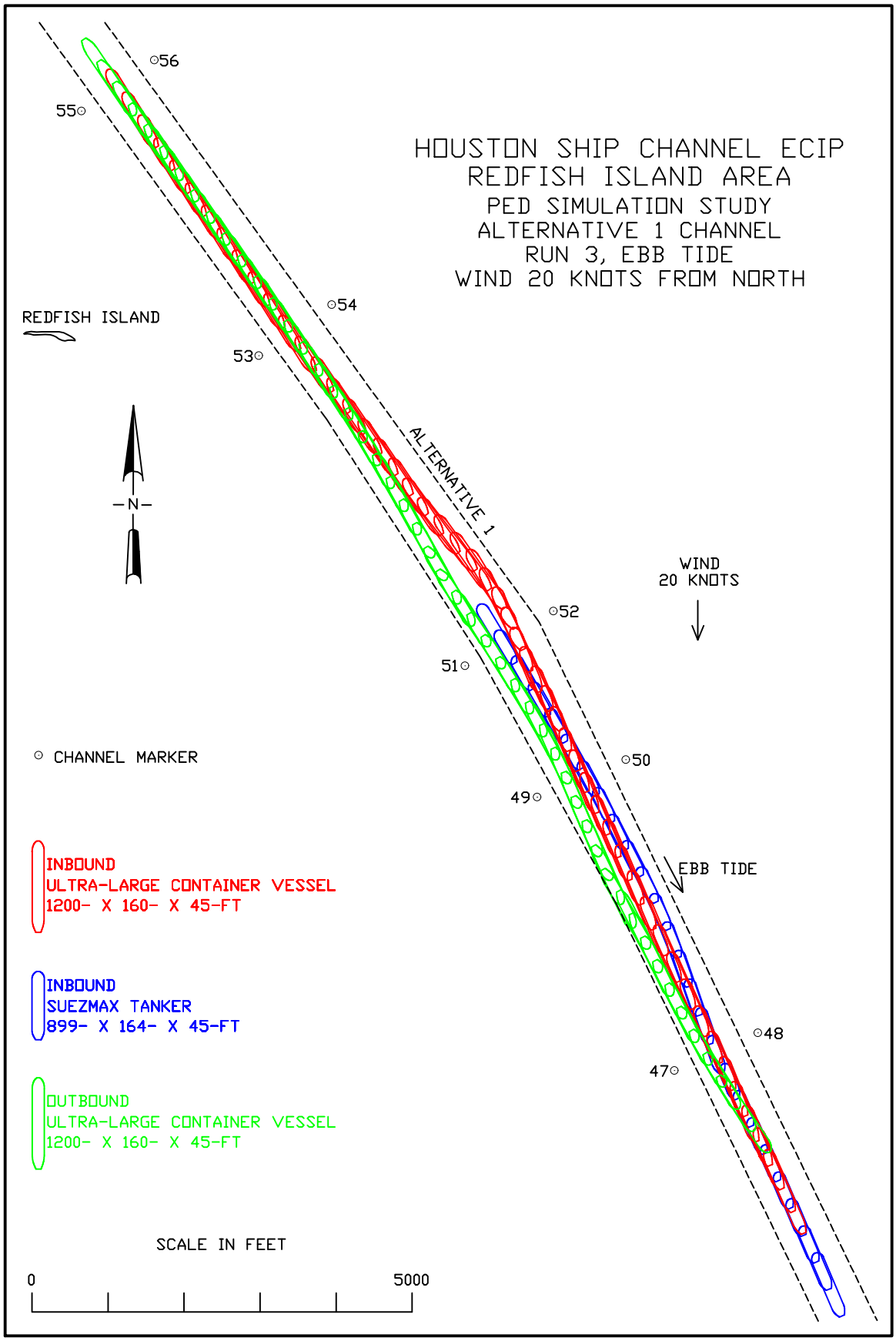

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 3, EBB TIDE
WIND 20 KNOTS FROM NORTH
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
ALTERNATIVE 1
N
WIND
20 KNOTS
EBB TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
SCALE IN FEET
0
5000

PLATE 28

Run **3**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 5/15/2020
Start Time 1005
End Time 1025
Plan RF-A1
Current Ebb
Tide (m) 1
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*MULCV14N	45.0/13.7	146/10	55-56
Inbound	MULCV14N	45.0/13.7	337/10	45-46
Inbound	SUEZ156R	44.1/13.7	336/10	41-42

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*MULCV14N	A	70	282	0	260
Inbound	MULCV14N	B	162			
Inbound	SUEZ156R	E			144	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Outbound	Normal	Yes	Plenty of room.	Yes	Yes	Yes	Yes	Feels right visibly but pilot notes that the screens do not seem accurate.
B	Inbound	Normal	Yes	Plenty of room and distances from bank and passing vessel.	Yes	Yes			Channel has plenty of room for manuevering.
E	Inbound	Normal	Yes	Vessel size in the wider channel made it safe.			Yes	Yes	

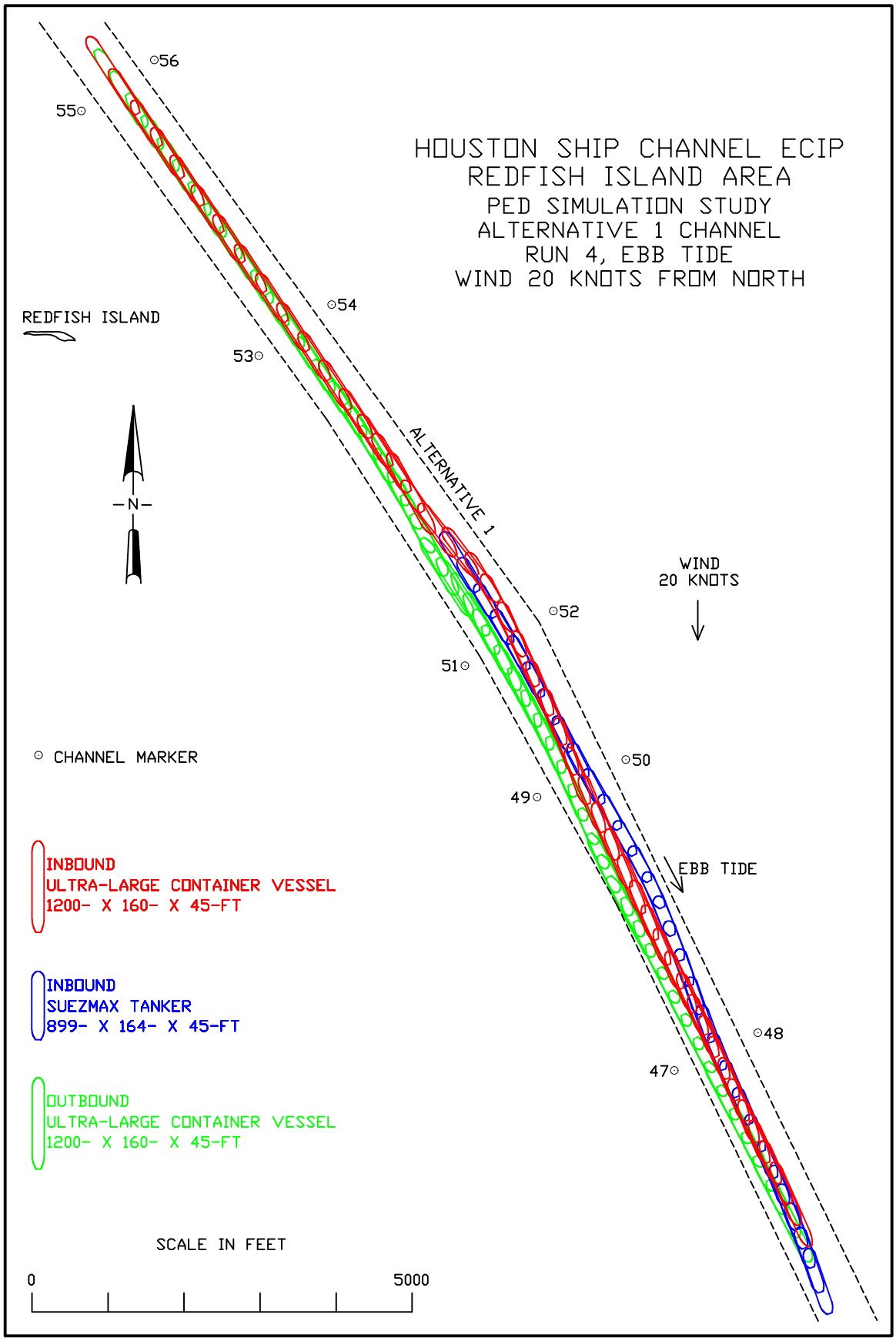

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 4, EBB TIDE
WIND 20 KNOTS FROM NORTH
REDFISH ISLAND
56
55
54
53
52
51
50
49
48
47
ALTERNATIVE 1
N
WIND
20 KNOTS
EBB TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
SCALE IN FEET
0
5000

PLATE 29

Run **4**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 5/15/2020
Start Time 1045
End Time 1100
Plan RF-A1
Current Ebb
Tide (m) 1
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*MULCV14N	45.0/13.7	146/10	55-56
Inbound	MULCV14N	45.0/13.7	337/10	45-46
Inbound	SUEZ156R	44.1/13.7	336/10	41-42

Run Comments
Pilots state "even with a big mistake the channel space allows for the manuever to happen".

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*MULCV14N	A	129	190	0	241
Inbound	MULCV14N	E	185			
Inbound	SUEZ156R	B			89	

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Outbound	Normal	Yes	Realiistic. Vessels were squeezed because of the space.	Yes	Yes	Yes	Yes	Wind and tide affected recovery. Recovery from first meet was controlable but tough because of being squeezed by the other vessel. Time allowed to recover but pilot did not completely anuever vessel back to center line after first meet.
E	Inbound	Difficult	Yes	With the wider channel this would be ok.	Yes	Yes			Pilot said the meet was more difficult because of the location and being forced to meet in the bend. The vessel handled well and there was enough room to manuever once comfortable.
B	Inbound	Normal	Yes	Plenty of room in channel.			Yes	Yes	Channel size is adequate and meeting location was good.

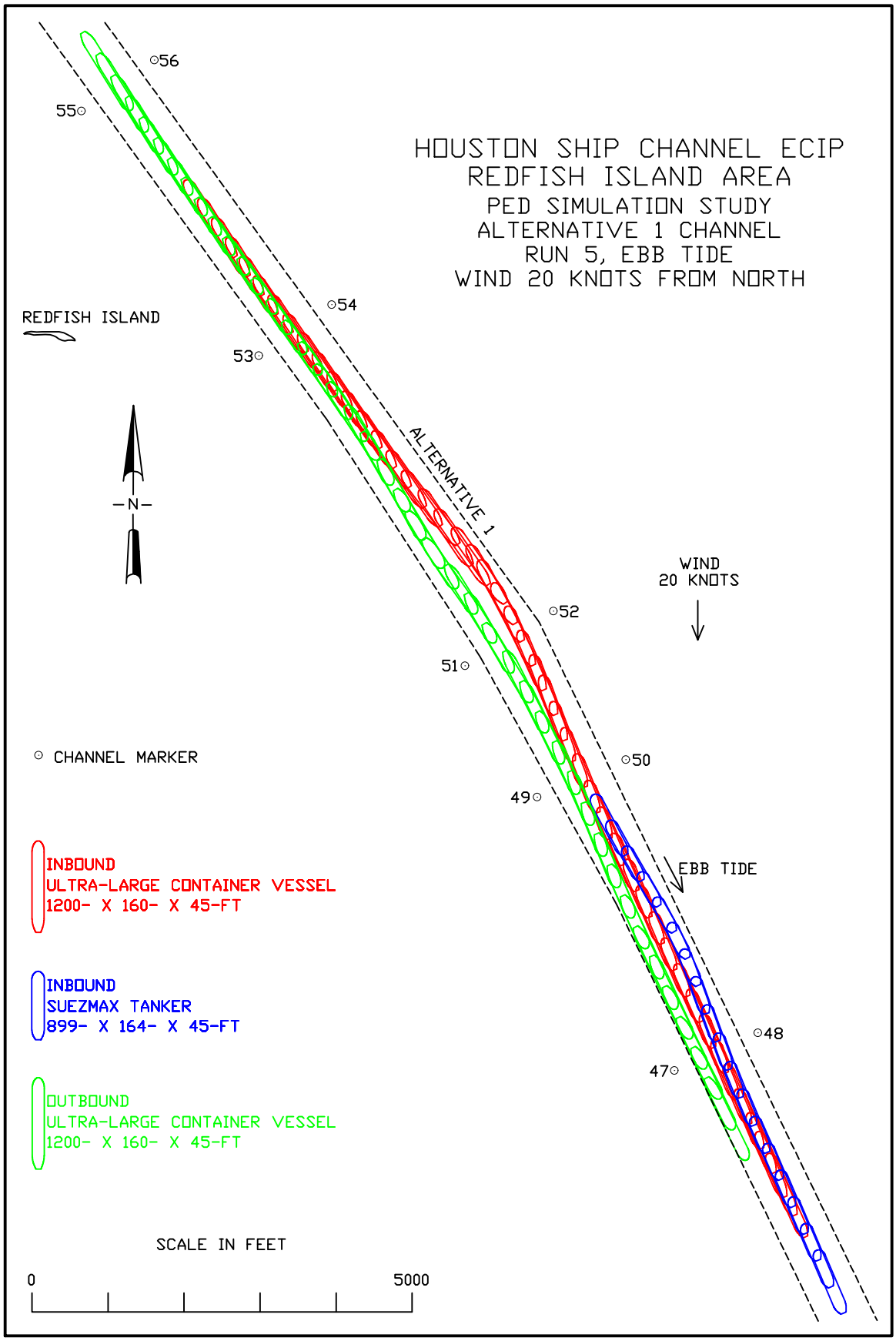

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 5, EBB TIDE
WIND 20 KNOTS FROM NORTH
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
ALTERNATIVE 1
N
WIND
20 KNOTS
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
EBB TIDE
SCALE IN FEET
0
5000

PLATE 30

Run **5**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 5/15/2020
Start Time 1115
End Time 1130
Plan RF-A1
Current Ebb
Tide (m) 1
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*MULCV14N	45.0/13.7	146/10	55-56
Inbound	MULCV14N	45.0/13.7	337/10	45-46
Inbound	SUEZ156R	44.1/13.7	336/10	41-42

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*MULCV14N	E	162	237	0	267
Inbound	MULCV14N	A	163			
Inbound	SUEZ156R	B			42	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
E	Outbound	Difficult	Yes	Size of vessel meeting in the turn makes the manuever difficult. Howver, the wider channel made it manageable.	Yes	Yes	Yes	Yes	Made mistakes in first meet that let to difficulty in the second but the larger channel made it easier to still recover.
A	Inbound	Normal	Yes	Plenty of room. Vessel handles well.	Yes	Yes			
B	Inbound	Normal	Yes	Lot of room			Yes	Yes	Channel has a good design.

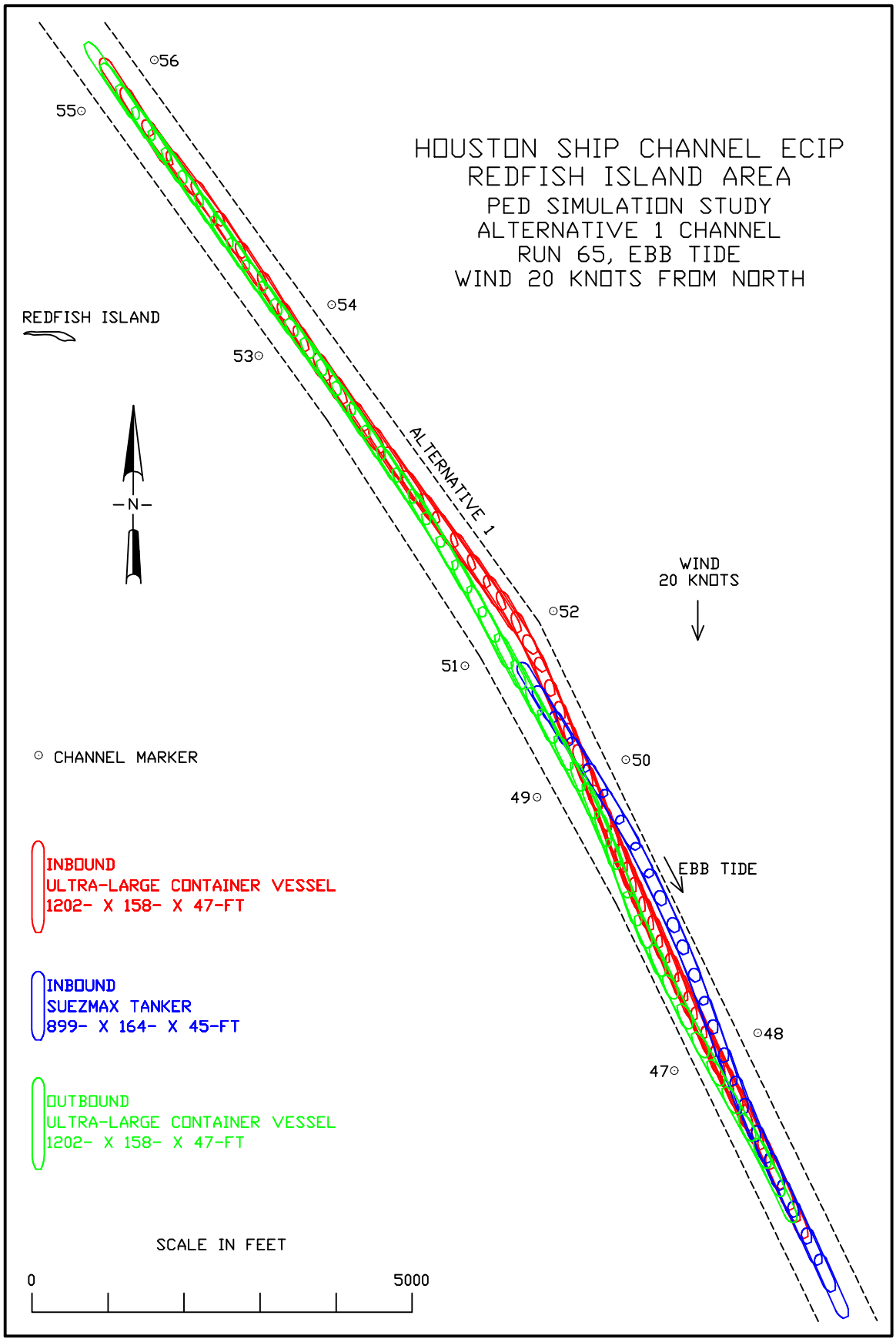

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 65, EBB TIDE
WIND 20 KNOTS FROM NORTH
REDFISH ISLAND
56
55
54
53
52
51
50
49
48
47
ALTERNATIVE 1
N
WIND
20 KNOTS
EBB TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
SCALE IN FEET
0
5000

PLATE 31

Run **65**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/1/2020
Start Time 1345
End Time 1400
Plan RF-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	J	230	174	94	241
Inbound	ULCV366M	J	163			
Inbound	SUEZ156R	47			61	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Outbound	Normal	Yes	Wider channel and bank cushion allows for the manuever to occur safely.	Yes	Yes	Yes	Yes	Pilot had to use some kick to get the model to behave how he wanted and maintain speed. Pilot did not notice the wind or current.
H	Inbound	Normal	Yes	No issues with the situation.	Yes	Yes			Normal day in the channel.
G	Inbound	Normal	Yes	More room between the vessels. Widener helps with turn.			Yes	Yes	Standard.

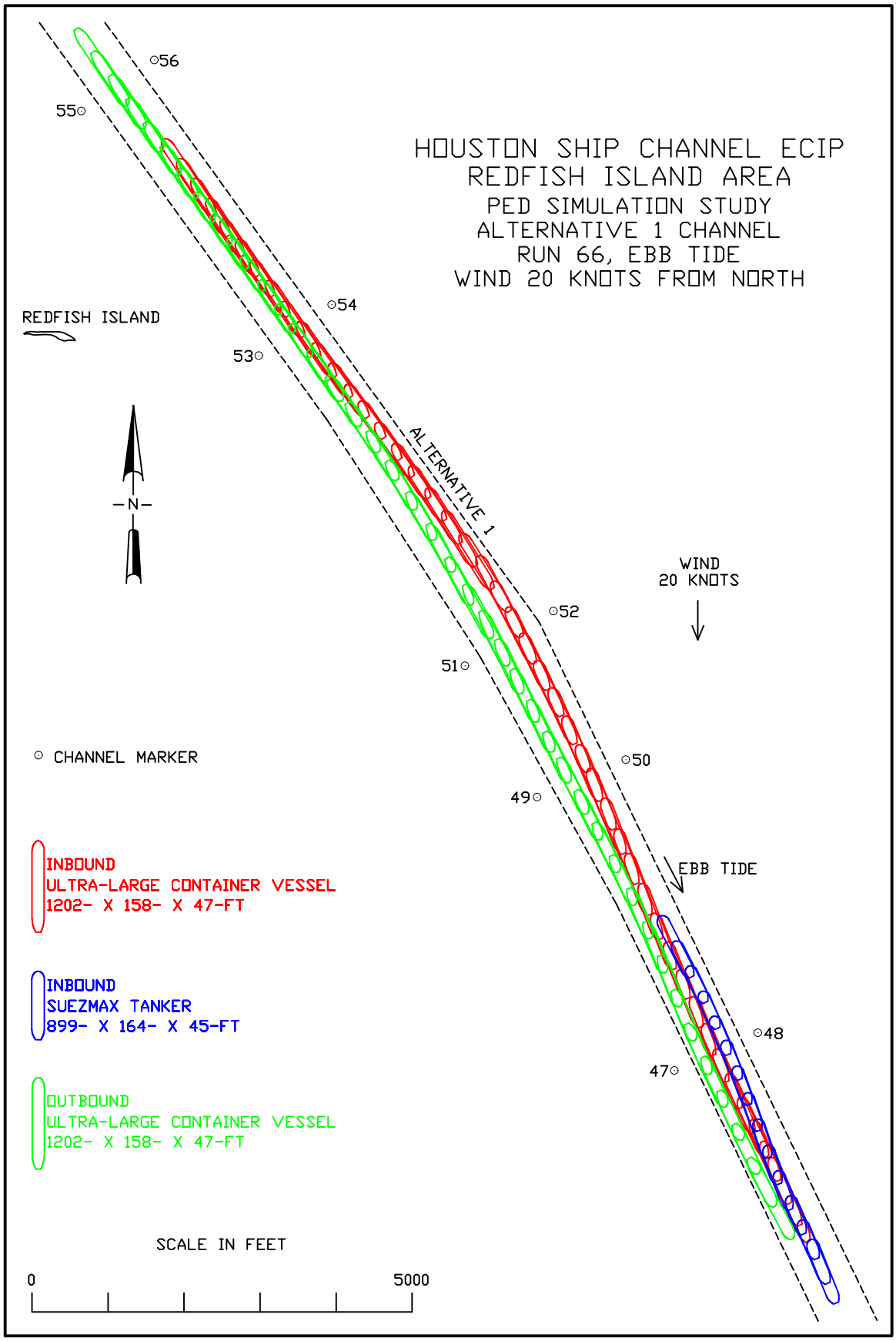

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 66, EBB TIDE
WIND 20 KNOTS FROM NORTH
REDFISH ISLAND
56
55
54
53
52
51
50
49
48
47
ALTERNATIVE 1
N
WIND
20 KNOTS
EBB TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
SCALE IN FEET
0
5000

PLATE 32

Run **66**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/1/2020
Start Time 1410
End Time 1425
Plan RF-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	H	190	173	74	161
Inbound	ULCV366M	H	80			
Inbound	SUEZ156R	47			145	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
H	Outbound	Normal	Yes	Nothing out of the ordinary.	Yes	Yes	Yes	Yes	Easy area to meet in. Pilot noted that he did notice the current and had to adjust the speed accordingly.
G	Inbound	Normal	Yes	Widener in the turn with the width of the channel makes it safe.	Yes	Yes			Wind and current were felt but manageable in this area.
J	Inbound	Normal	Yes	Wider channel and less bank affect.			Yes	Yes	Wind and current were felt but not strong.

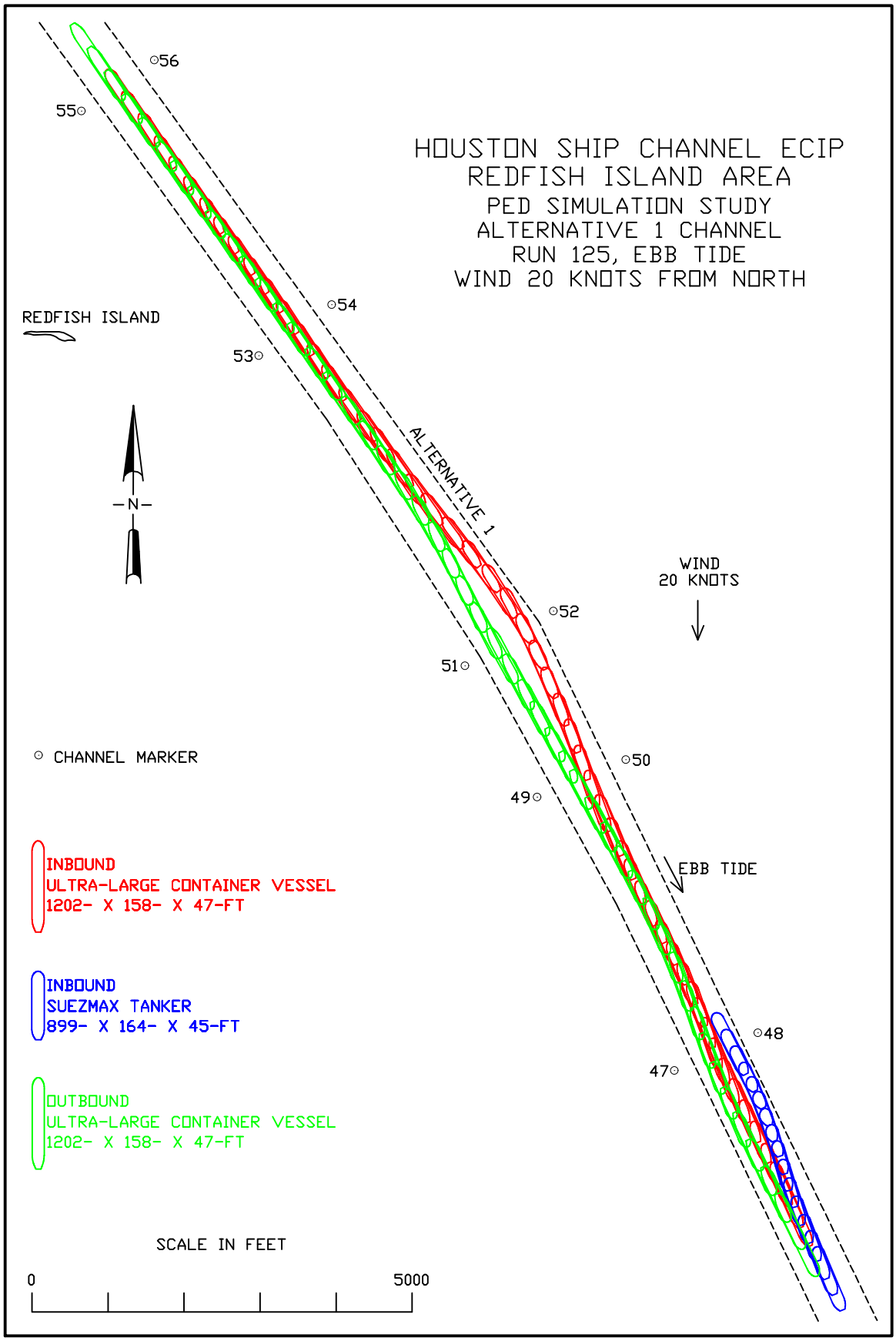

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 125, EBB TIDE
WIND 20 KNOTS FROM NORTH
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
N
ALTERNATIVE 1
WIND
20 KNOTS
EBB TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
SCALE IN FEET
0
5000

PLATE 33

Run **125**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/8/2020
Start Time 1350
End Time 1410
Plan RF-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	D	136	259	96	164
Inbound	ULCV366M	D	68			
Inbound	SUEZ156R	47			40	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Outbound	Normal	Yes	Plenty of space.	Yes	Yes	Yes	Yes	Wind and current did not affect the vessel.
J	Inbound	Normal	Yes	700 ft channel is much better than the current design.	Yes	Yes			An uneventful normal manuever.
B	Inbound	Normal	Yes	Plenty of room. Normal operation.			Yes	Yes	Everything felt like normal operations.

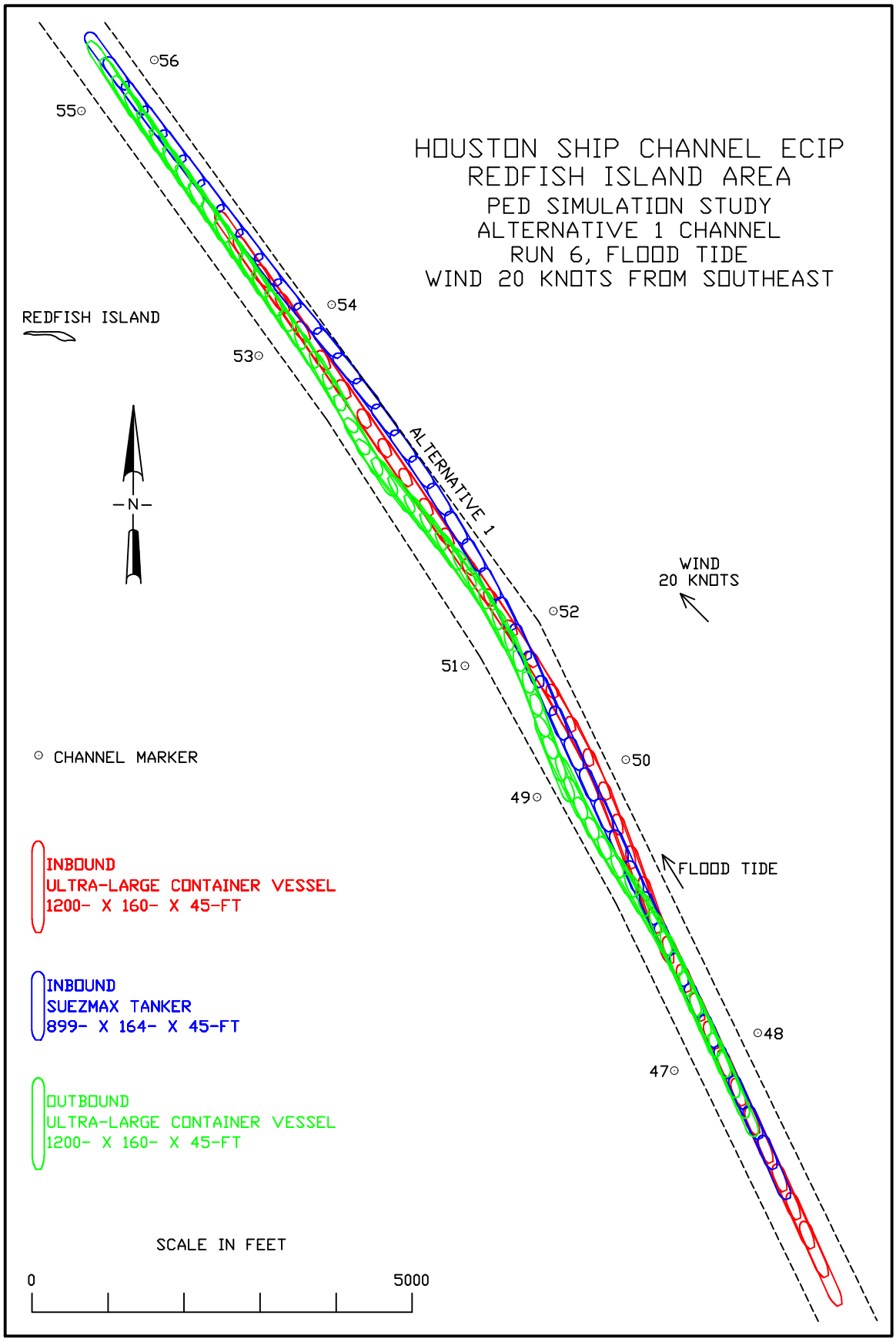

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 6, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST
REDFISH ISLAND
56
55
54
53
52
51
50
49
48
47
ALTERNATIVE 1
N
WIND
20 KNOTS
FLOOD TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
SCALE IN FEET
0
5000

PLATE 34

Run **6**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 5/15/2020
Start Time 1150
End Time 1210
Plan RF-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*MULCV14N	45.0/13.7	146/10	55-56
Inbound	SUEZ156R	44.1/13.7	337/10	45-46
Inbound	MULCV14N	45.0/13.7	336/10	41-42

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*MULCV14N	B	117	276	72	220
Inbound	SUEZ156R	A	0			
Inbound	MULCV14N	E			127	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
B	Outbound	Normal	Yes	Channel is wider and allows for the manuever.	Yes	Yes	Yes	Yes	Meeting locations were good and vessel handled well.
A	Inbound	Normal	Yes	Plenty of room in the channel.	Yes	Yes			Slow to recover. Pilot chose to slow down when starting to handle the vessel better.
E	Inbound	Normal	Yes	Width of the channel and vessel size made it managable.			Yes	Yes	Everything was normal.

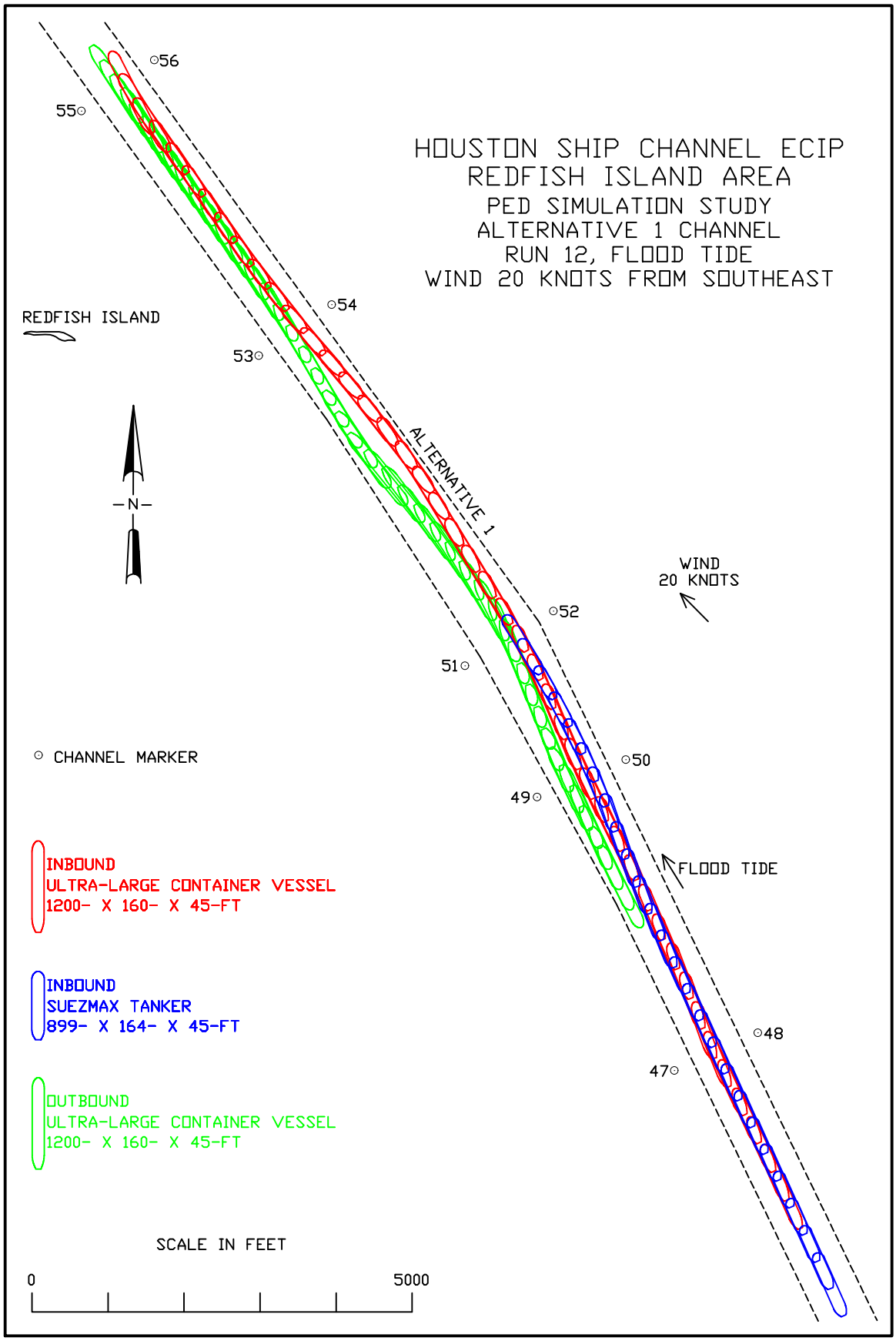

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 12, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
N
ALTERNATIVE 1
WIND
20 KNOTS
FLOOD TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
SCALE IN FEET
0
5000

PLATE 35

Run **12**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 5/15/2020
Start Time 1600
End Time 1615
Plan RF-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	copy
Outbound	*MULCV14N	45.0/13.7	146/10	w
Inbound	MULCV14N	45.0/13.7	337/10	45-46
Inbound	SUEZ156R	47.1/14.6	336/10	41-42

Run Comments
Pilots were playing around with the outbound container vessel after meet occured.

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*MULCV14N	A	82	235	134	188
Inbound	MULCV14N	B	50			
Inbound	SUEZ156R	E			169	

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Outbound	Normsl	Yes	There is adequate amount of space to perform both passings.	Yes	Yes	Yes	Yes	Vessel remained in the channel even though he was squeezed by the second inbound vessel.
B	Inbound	Normal	Yes	The width of the channel allows for the manuever to occur safely.	Yes	Yes			Different wind and current made no difference on the run.
E	Inbound	Easy	Yes	Width of the channel allows for space.			Yes	Yes	Squeezed the outbound vessel but the meet was controable.

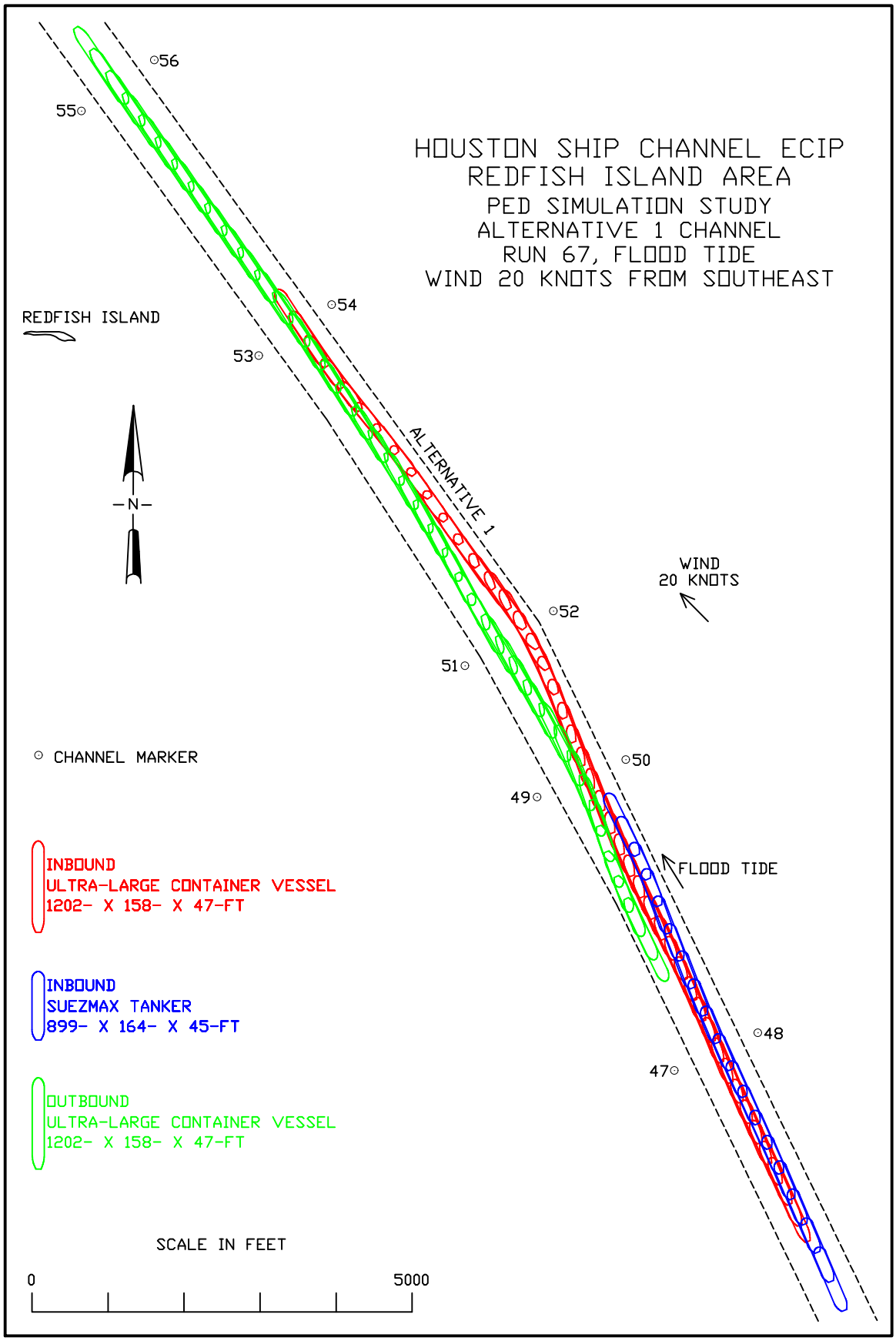

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 67, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
N
ALTERNATIVE 1
WIND
20 KNOTS
FLOOD TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
SCALE IN FEET
0
5000

PLATE 36

Run **67**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/1/2020
Start Time 1430
End Time 1445
Plan RF-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	G	196	228	66	191
Inbound	ULCV366M	G	114			
Inbound	SUEZ156R	47			110	

Run Comments
Soft grounding occured during run due to the draft of the vessel. Added a muddy bottom to prevent this from occuring again.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
G	Outbound	Normal	Yes	Widener and width of the channel allows for it to be safe normal.	Yes	Yes	Yes	Yes	Meeting the second vessel, the pilot was not in the middle due to turning. This made the manuever a little harder but they were able to still meet safely.
J	Inbound	Normal	Yes	Wider channel and less bank cushion make the manuever easier. More space between vessels makes it safer.	Yes	Yes			Felt the current so the pilot slowed down for the turn then had to speed up in the straightaway to stabilize the vessel.
H	Inbound	Normal	Yes	Channel width allows to safely pass.			Yes	Yes	Pilot should have slowed down to put a bigger space between him and the first inbound ship but even with a smaller space the pilot in the outbound vessel was able to make it safely around both vessels.

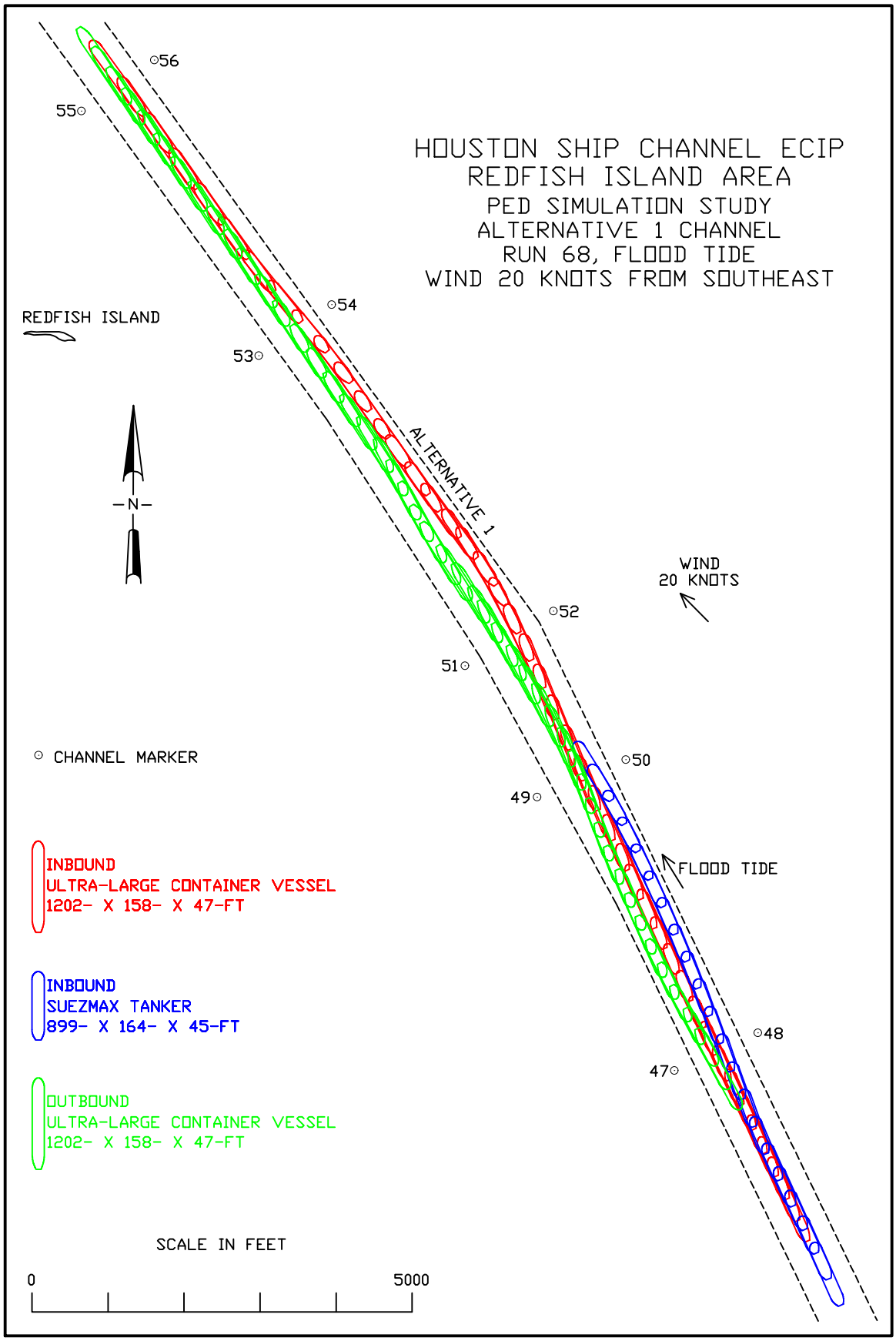

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 68, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
N
ALTERNATIVE 1
WIND
20 KNOTS
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
FLOOD TIDE
SCALE IN FEET
0
5000

PLATE 37

Run **68**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/1/2020
Start Time 1505
End Time 1520
Plan RF-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	J	214	207	99	186
Inbound	ULCV366M	J	99			
Inbound	SUEZ156R	47			85	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Outbound	Easy	Yes	Even steming the current the pilot had full control. A lot of space between vessel and banks.	Yes	Yes	Yes	Yes	Wind and current were negligible.
H	Inbound	Normal	Yes	Business as usual. Channel width makes the operation normal and safe.	Yes	Yes			
G	Inbound	Normal	Yes	Available space in the channel made it safe.			Yes	Yes	

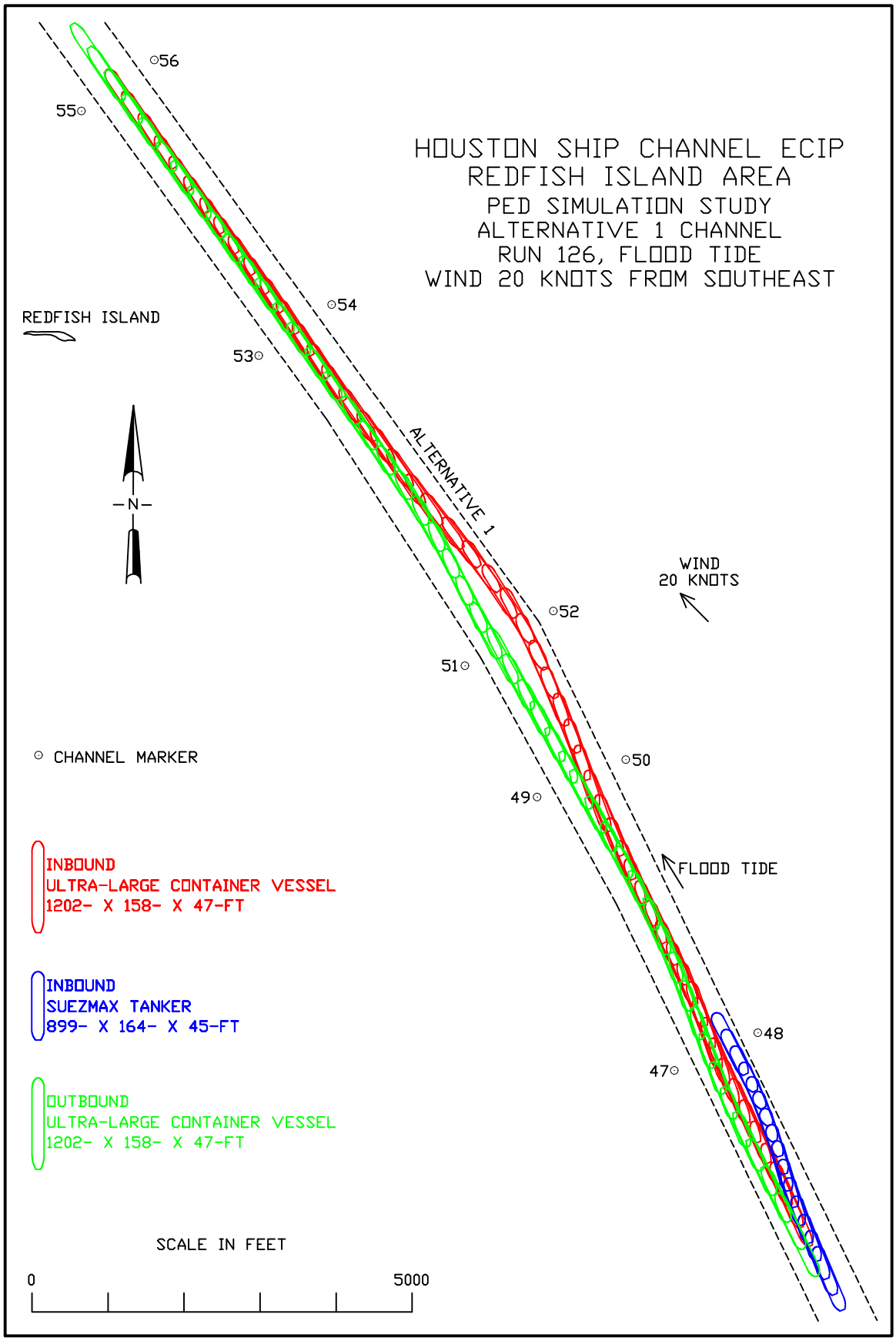

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 126, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
N
ALTERNATIVE 1
WIND
20 KNOTS
FLOOD TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
SCALE IN FEET
0
5000

PLATE 38

Run **126**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/8/2020
Start Time 1415
End Time 1430
Plan RF-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	J	153	256	74	185
Inbound	ULCV366M	J	82			
Inbound	SUEZ156R	47			121	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Outbound	Normal	Yes	Plenty of space and increased distances between vessels.	Yes	Yes	Yes	Yes	Wind and current did not make a difference.
B	Inbound	Normal	Yes	Slightly difficult due to the handling of the vessel.	Yes	Yes			Wind and current did not make a difference.
D	Inbound	Normal	Yes	Width of the channel allows for plenty of manuevering room.			Yes	Yes	Wind and current did not make a difference.

Bayport Intersection (Buoys 75–76)

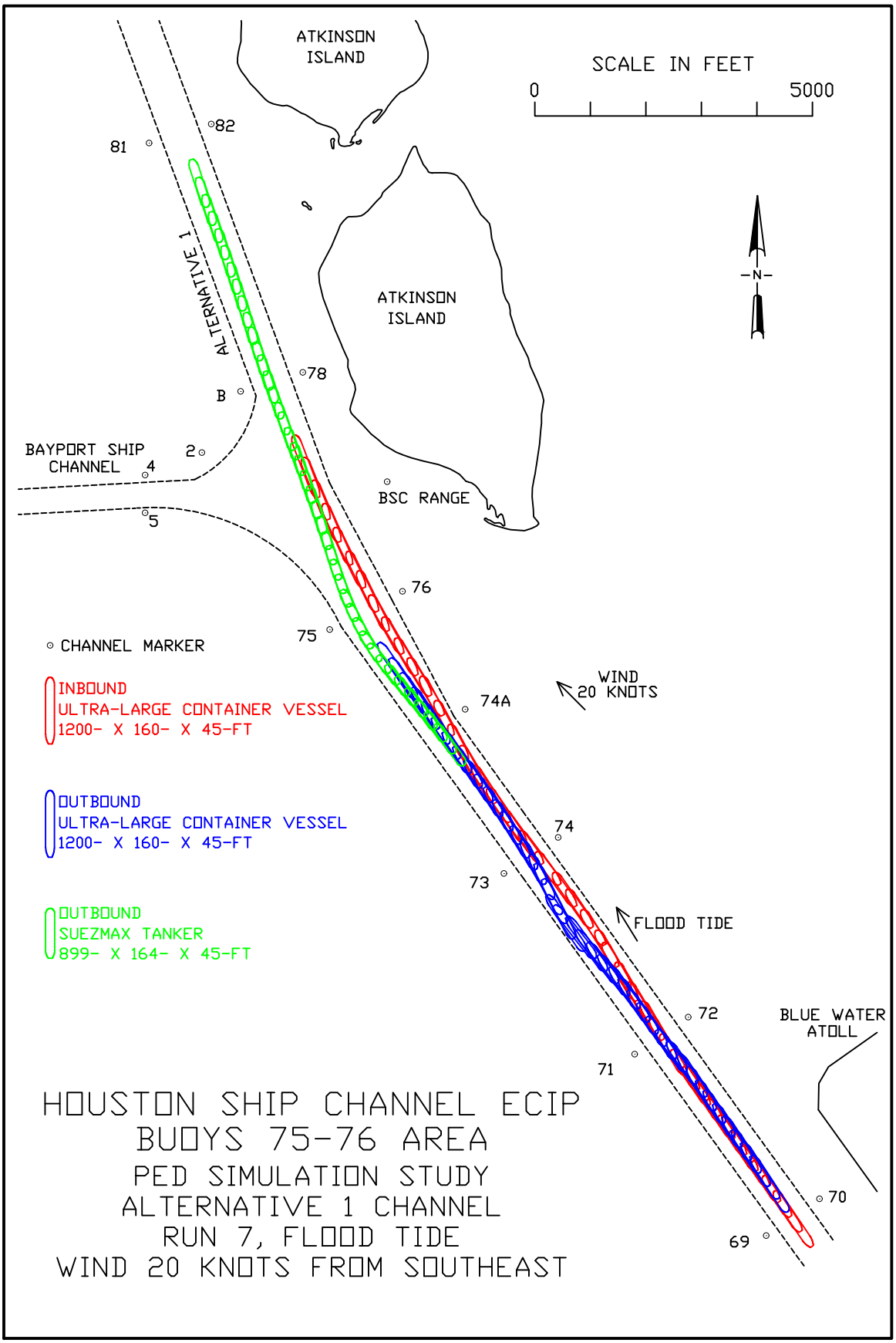

ATKINSON ISLAND
SCALE IN FEET
0
5000
82
81
ALTERNATIVE 1
ATKINSON ISLAND
N
78
B
BAYPORT SHIP CHANNEL
2
4
5
BSC RANGE
76
75
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
WIND
20 KNOTS
74A
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
74
73
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
FLOOD TIDE
72
BLUE WATER ATOLL
71
70
69
HOUSTON SHIP CHANNEL ECIP
BUOYS 75-76 AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 7, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 39

Run **7**

Purpose Testing around Bend @ 75-76 - Meet below and above the bend with turn between

Date 5/15/2020
Start Time 1345
End Time 1400
Plan BI-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14N	45.0/13.7	326/10	67
Outbound	MULCV14N	45.0/13.7	146.2/10	73-74
Outbound	SUEZ156R	47.1/14.6	162/10	81-82

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MULCV14N	E	144	193	197	302
Outbound	MULCV14N	B	46			
Outbound	SUEZ156R	A			132	

Run Comments
Looked at data base due to Inbound vessel hitting ground but did not find any high spots. Possible squat and caused the vessel to lose a knot. Continuing with runs with no changes made to system.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
E	Inbound	Normal	Yes	Wider channel allows for larger vessels to meet.	Yes	Yes	Yes	Yes	Safe place to meet due to channel size.
B	Outbound	Normal	Yes	No difficulty in handling and lots of room.	Yes	Yes			Everything was good and easy.
A	Outbound	Easy	Yes	Wide channel.			Yes	Yes	Perfect location for meeting.

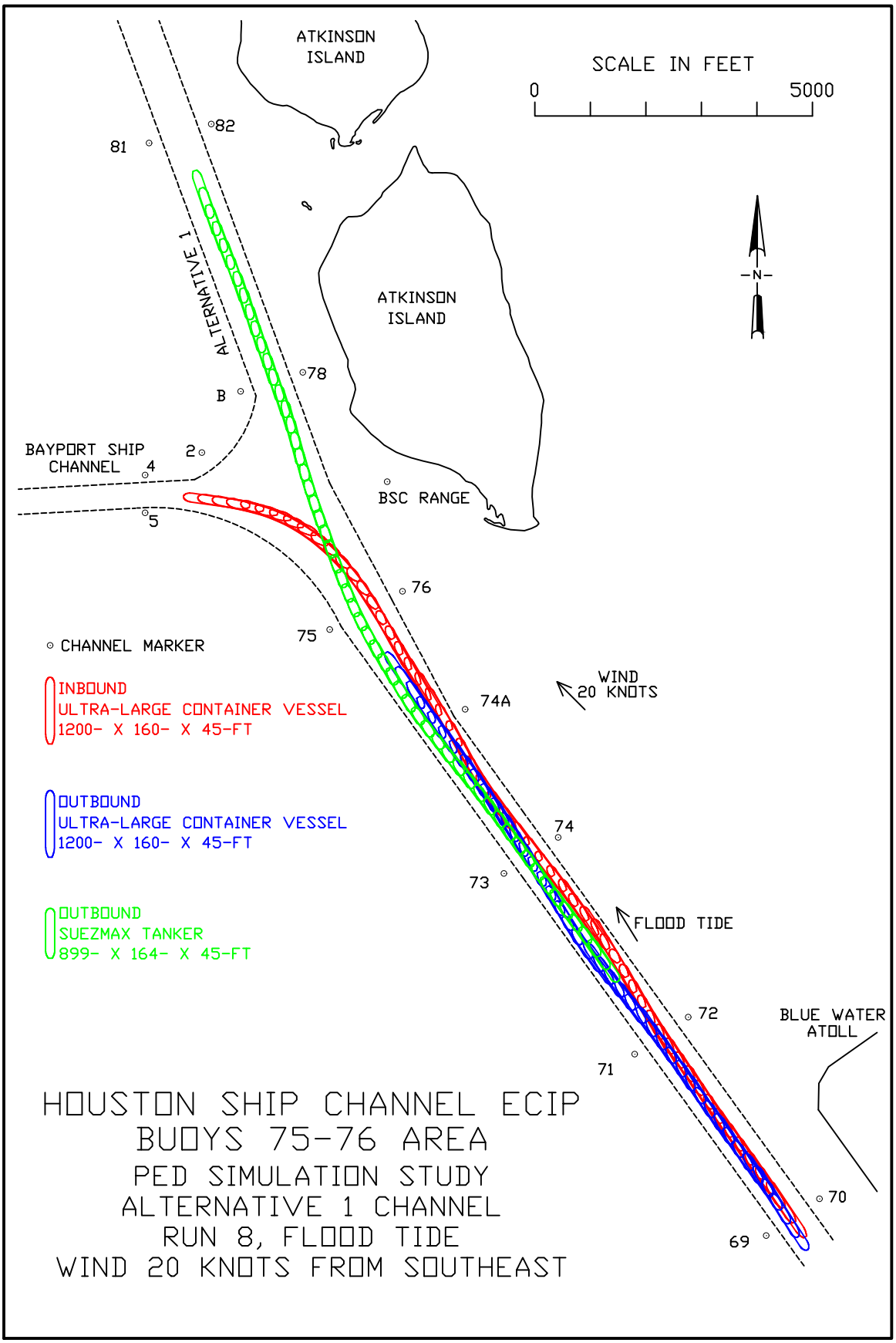

ATKINSON ISLAND
SCALE IN FEET
0
5000
82
81
ALTERNATIVE 1
ATKINSON ISLAND
N
78
B
BAYPORT SHIP CHANNEL
2
4
5
BSC RANGE
76
75
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
WIND
20 KNOTS
74A
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
74
73
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
FLOOD TIDE
72
BLUE WATER ATOLL
71
70
69
HOUSTON SHIP CHANNEL ECIP
BUOYS 75-76 AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 8, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 40

Run **8**

Purpose Testing around Bend @ 75-76 - Meet below and above the bend with turn between

Date 5/15/2020
Start Time 1405
End Time 1420
Plan BI-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14N	45.0/13.7	326/10	67
Outbound	MULCV14N	45.0/13.7	146.2/10	73-74
Outbound	SUEZ156R	47.1/14.6	162/10	81-82

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MULCV14N	B	58	175	82	187
Outbound	MULCV14N	A	80			
Outbound	SUEZ156R	E			102	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
B	Inbound	Normal	Yes	Channel width and the 5 mile cutout allow for easier maneuver.	Yes	Yes	Yes	Yes	Did not fully recover from first meet but still able to easily perform second maneuver. The location of the second meet made turning into Bayport easier and did not require the vessel to recover completely.
A	Outbound	Normal	Yes	A lot of room to maneuver and pilots are becoming familiar with the area, allowing them to tighten up their breaking and recovering.	Yes	Yes			Pilot is becoming farmilar with how to react on the ship and becoming more comfortable in the area with a vessel this size.
E	Outbound	Easy	Yes	Size of channel and location for meet was good.			Yes	Yes	All good.

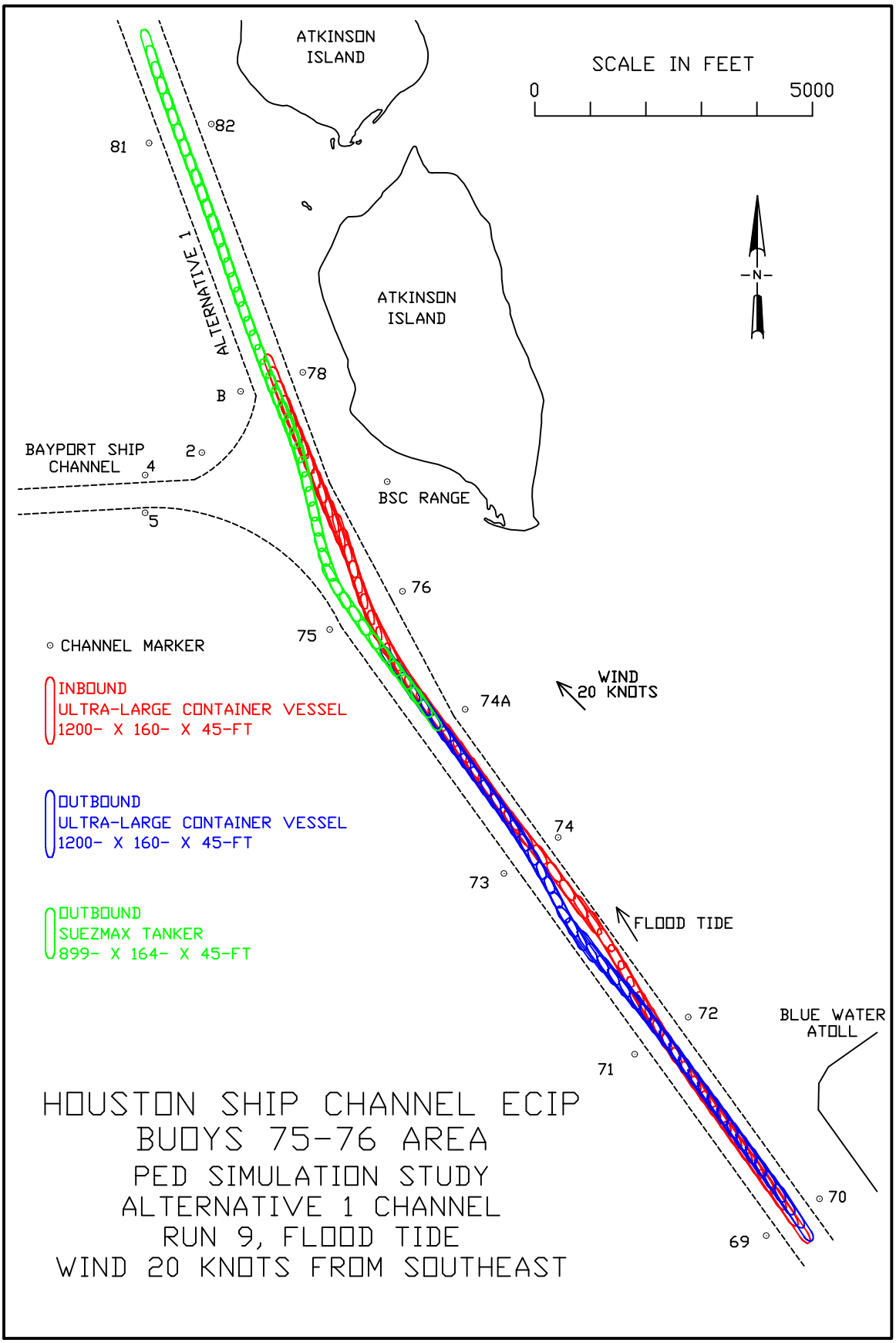

ATKINSON ISLAND
SCALE IN FEET
0
5000
82
81
ALTERNATIVE 1
ATKINSON ISLAND
N
78
B
BAYPORT SHIP CHANNEL
2
4
5
BSC RANGE
76
75
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
WIND
20 KNOTS
74A
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
74
73
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
FLOOD TIDE
72
BLUE WATER ATOLL
71
70
69
HOUSTON SHIP CHANNEL ECIP
BUOYS 75-76 AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 9, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 41

Run **9**

Purpose Testing around Bend @ 75-76 - Meet below and above the bend with turn between

Date 5/15/2020
Start Time 1445
End Time 1500
Plan BI-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14N	45.0/13.7	326/10	67
Outbound	MULCV14N	45.0/13.7	146.2/10	73-74
Outbound	SUEZ156R	47.1/14.6	162/10	81-82

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MULCV14N	A	50	215	123	244
Outbound	MULCV14N	B	96			
Outbound	SUEZ156R	E			205	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Inbound	Normal	Yes	Controlled maneuver and a lot of space for the ships to pass, especially in the turn.	Yes	Yes	Yes	Yes	Pilot had to adjust speed at the start and then sped up too much, messing up where the meet occurred.
B	Outbound	Normal	Yes	Ample amount of space.	Yes	Yes			Everything was good and easy.
E	Outbound	Normal	Yes	Amount of space allows for it to occur and the vessel was easy to handle.			Yes	Yes	

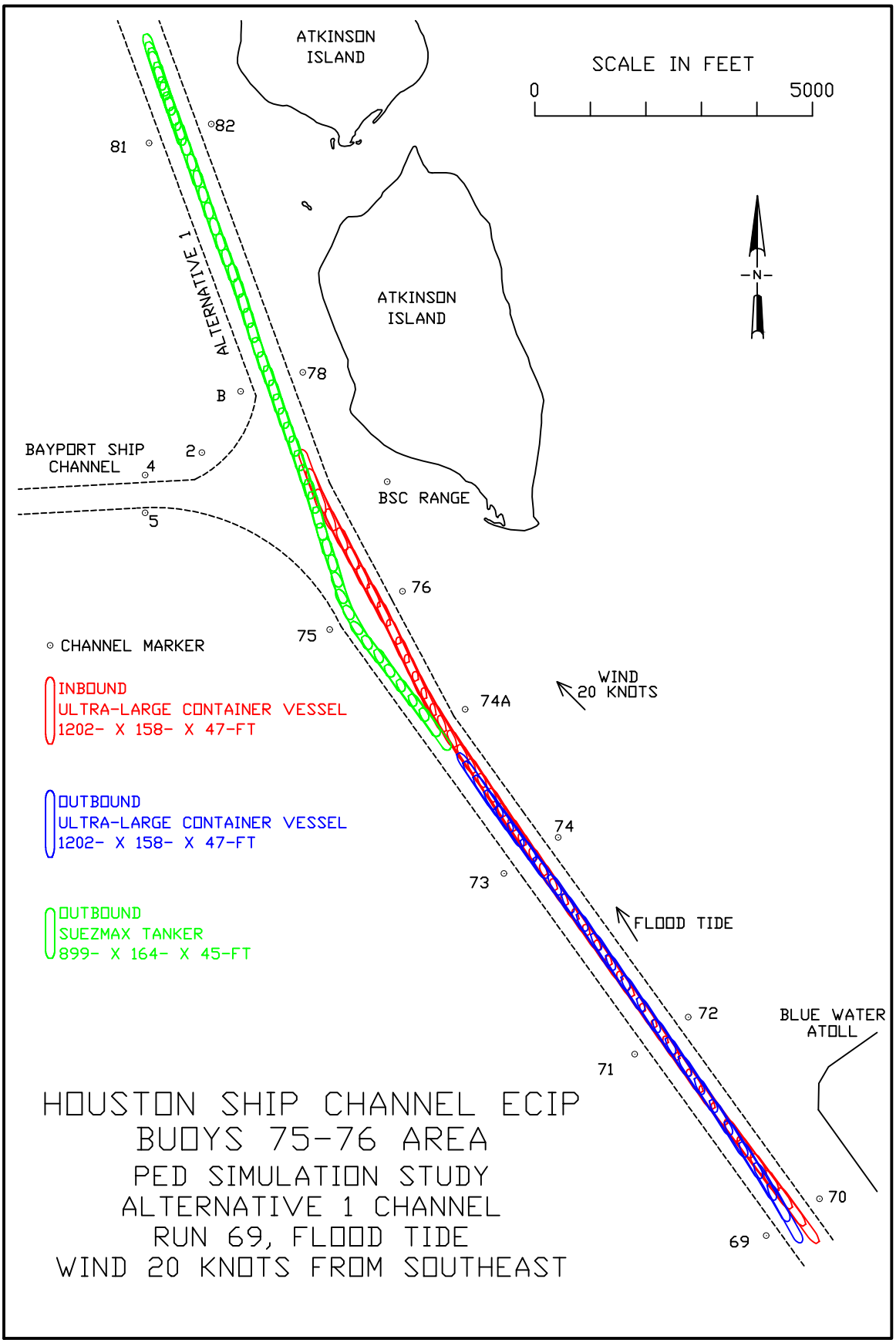

ATKINSON ISLAND
SCALE IN FEET
0
5000
82
81
ALTERNATIVE 1
ATKINSON ISLAND
N
78
B
BAYPORT SHIP CHANNEL
2
4
5
BSC RANGE
76
75
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
WIND
20 KNOTS
74A
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
74
73
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
FLOOD TIDE
72
BLUE WATER ATOLL
71
70
69
HOUSTON SHIP CHANNEL ECIP
BUOYS 75-76 AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 69, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 42

Run **69**

Purpose Testing around Bend @ 75-76 - First meet below bend and second at bend 75-76.

Date 6/1/2020
Start Time 1530
End Time 1555
Plan BI-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	326/10	65-66
Outbound	ULCV366M	46.7/14.2	146/10	73-74
Outbound	SUEZ156R	44.1/13.7	162/10	85-86

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	G	108	172	154	374
Outbound	ULCV366M	H	98			
Outbound	SUEZ156R	J			132	

Run Comments
SUEZ156R was relocated back further shortly after the run started.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
G	Inbound	Normal	Yes	Widener helped make the meet safer, along with the available space.	Yes	Yes	Yes	Yes	Meeting location was good for both encounters. Wind and current did not make a difference.
H	Outbound	Normal	Yes	Channel width and the size of the vessel allows for passing to safely occur.	Yes	Yes			Current sped the vessel up because it was going in the direction of the ship. This was beneficial to the pilot as the larger vessel is easier to handle in this location at a faster speed.
J	Outbound	Normal	Yes	Wider channel and less bank effect.			Yes	Yes	Meeting location was good and environmental factors worked in the favor of the vessel.

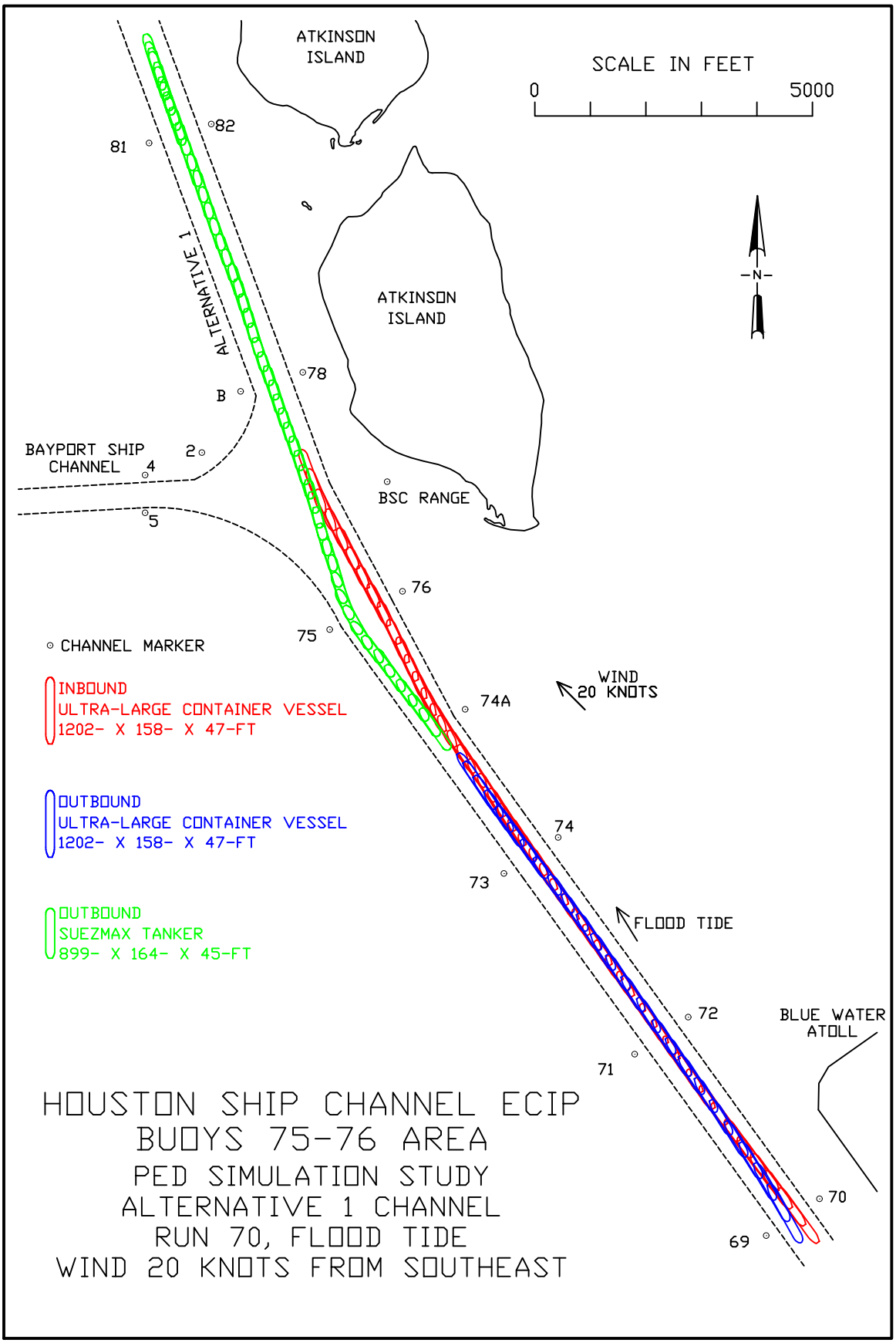

ATKINSON ISLAND
SCALE IN FEET
0
5000
82
81
ALTERNATIVE 1
ATKINSON ISLAND
N
78
B
BAYPORT SHIP CHANNEL
2
4
5
BSC RANGE
76
75
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
WIND
20 KNOTS
74A
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
74
73
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
FLOOD TIDE
72
BLUE WATER ATOLL
71
70
69
HOUSTON SHIP CHANNEL ECIP
BUOYS 75-76 AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 70, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 43

Run **70**

Purpose Testing around Bend @ 75-76 - First meet below bend and second at bend 75-76.

Date 6/1/2020
Start Time 1605
End Time 1625
Plan BI-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	326/10	65-66
Outbound	ULCV366M	46.7/14.2	146/10	73-74
Outbound	SUEZ156R	44.1/13.7	162/10	83-84

Run Comments
Inbound vessel had a soft grounding due to having a larger draft compared to the vessels that normally come into this area.

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	H	104	188	155	352
Outbound	ULCV366M	J	65			
Outbound	SUEZ156R	G			120	

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
H	Inbound	Normal	Yes	Normal operation.	Yes	Yes	Yes	Yes	Soft grounding decreased the speed drastically right before second meet but still manageable.
J	Outbound	Normal	Yes	Wider margin of safety due to the wider channel.	Yes	Yes			
G	Outbound	Normal	Yes	Room in the channel and the space between the vessels makes it safe.			Yes	Yes	Standard operation.

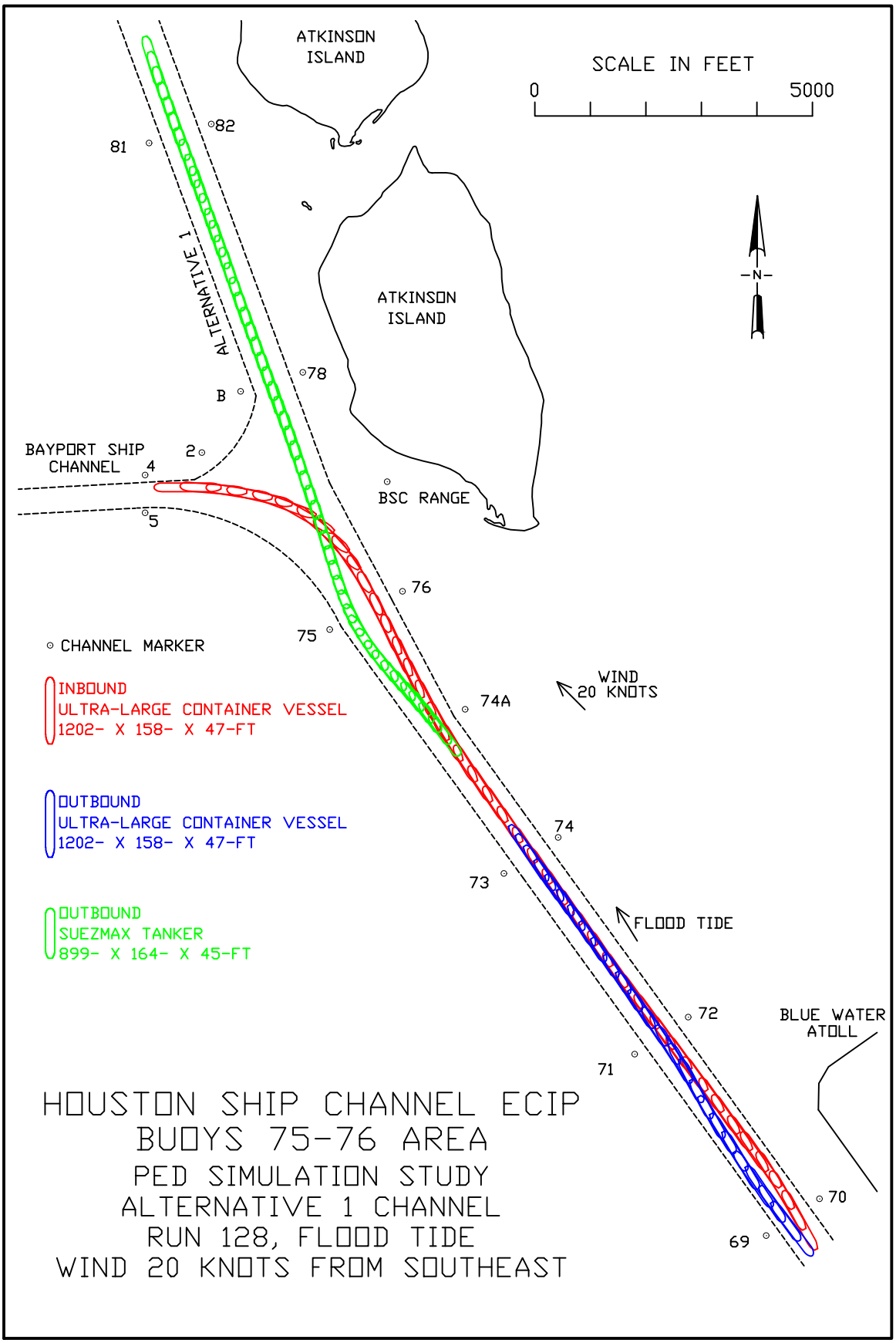

ATKINSON ISLAND
SCALE IN FEET
0
5000
82
81
ALTERNATIVE 1
ATKINSON ISLAND
N
78
B
BAYPORT SHIP CHANNEL
2
4
5
BSC RANGE
76
75
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
WIND
20 KNOTS
74A
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
74
73
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
FLOOD TIDE
72
BLUE WATER ATOLL
71
70
69
HOUSTON SHIP CHANNEL ECIP
BUOYS 75-76 AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 128, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 44

Run **128**

Purpose Testing around Bend @ 75-76 - First meet below bend and second at bend 75-76.

Date 6/8/2020
Start Time 1530
End Time 1545
Plan BI-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	326/10	65-66
Outbound	ULCV366M	46.7/14.2	146/10	73-74
Outbound	SUEZ156R	44.1/13.7	162/10	83-84

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	D	124	167	216	308
Outbound	ULCV366M	J	121			
Outbound	SUEZ156R	B			148	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	There is plenty of room in the channel for two large vessels to meet in a safe matter.	Yes	Yes	Yes	Yes	Pilot decided last minute to turn into Bayport and even with the last minute decision the turn was successful. Wind and current did not make a difference for the run.
J	Outbound	Easy	Yes	Then size of the channel allows for a lot of space between ships.	Yes	Yes			Did not notice the wind and current change.
B	Outbound	Normal	Yes	The channel allows for adequate space.			Yes	Yes	Did not notice the wind and current change.

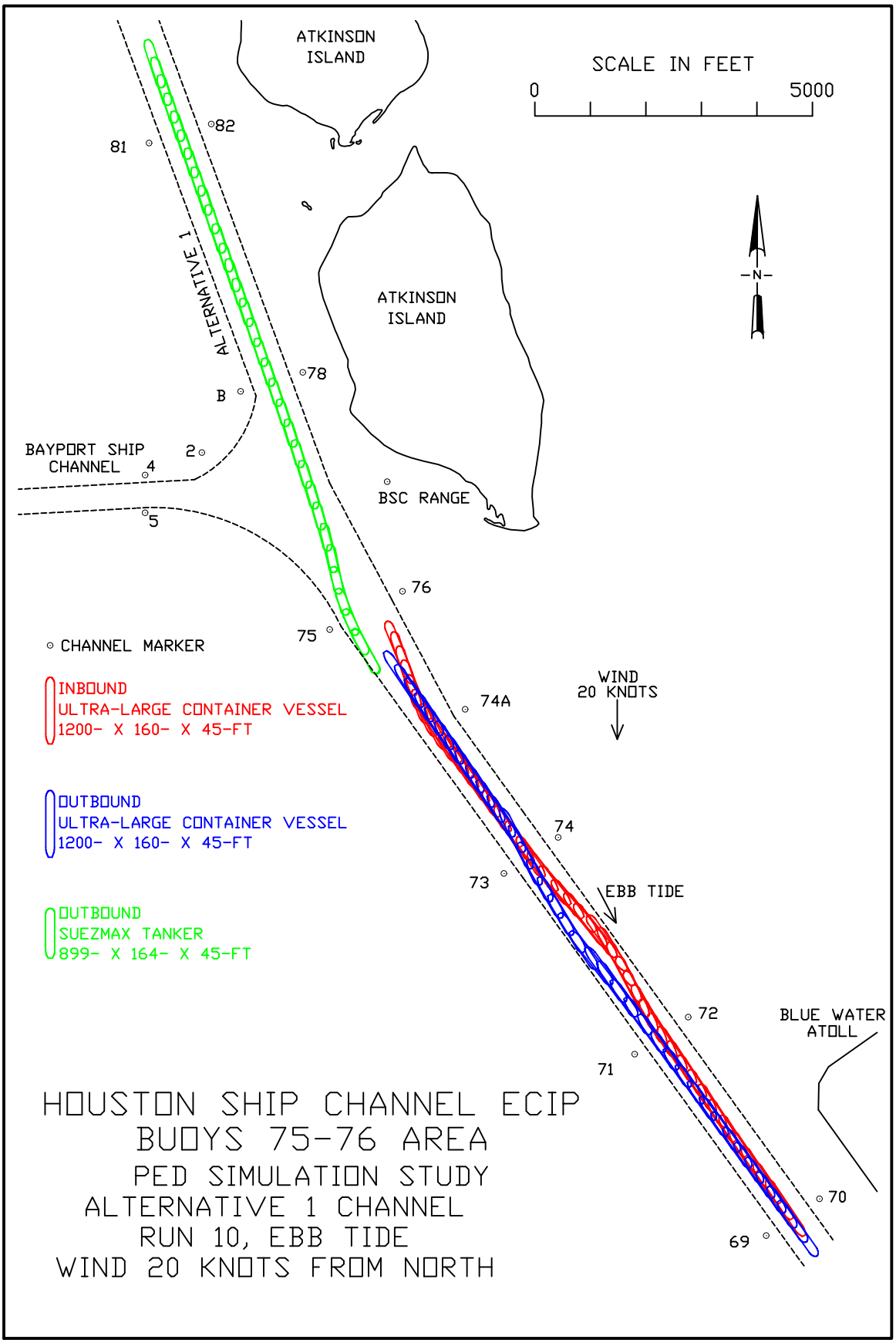

ATKINSON ISLAND
SCALE IN FEET
0
5000
82
81
ALTERNATIVE 1
ATKINSON ISLAND
N
78
B
BAYPORT SHIP CHANNEL
2
4
5
BSC RANGE
76
75
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
74A
WIND
20 KNOTS
74
73
EBB TIDE
72
BLUE WATER ATOLL
71
70
69
HOUSTON SHIP CHANNEL ECIP
BUOYS 75-76 AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 10, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 45

Run **10**

Purpose Testing around Bend @ 75-76 - Meet below and above the bend with turn between

Date 5/15/2020
Start Time 1510
End Time 1525
Plan BI-A1
Current Ebb
Tide (m) 1
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14N	45.0/13.7	326/10	67
Outbound	MULCV14N	45.0/13.7	146.2/10	73-74
Outbound	SUEZ156R	47.1/14.6	162/10	81-82

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MULCV14N	B	62	224	200	344
Outbound	MULCV14N	E	91			
Outbound	SUEZ156R	A			0	

Run Comments
Outbound Suez ran aground during meet.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
B	Inbound	Normal	Yes	Plenty of room to perform the maneuver.	Yes	Yes	Yes	N/A	Did not notice a difference with the current or wind.
E	Outbound	Normal	Yes	Width of the channel and the power of the vessel make the maneuver comfortable to perform.	Yes	Yes			Current did not make a difference but had to adjust at beginning of run with how the wind acted on the vessel.
A	Outbound	Difficult	Yes	Pilot moved further over causing him to run aground.			Yes	N/A	Ran aground. Broke too much and turned too late - pilot error, not a problem wtih the channel.

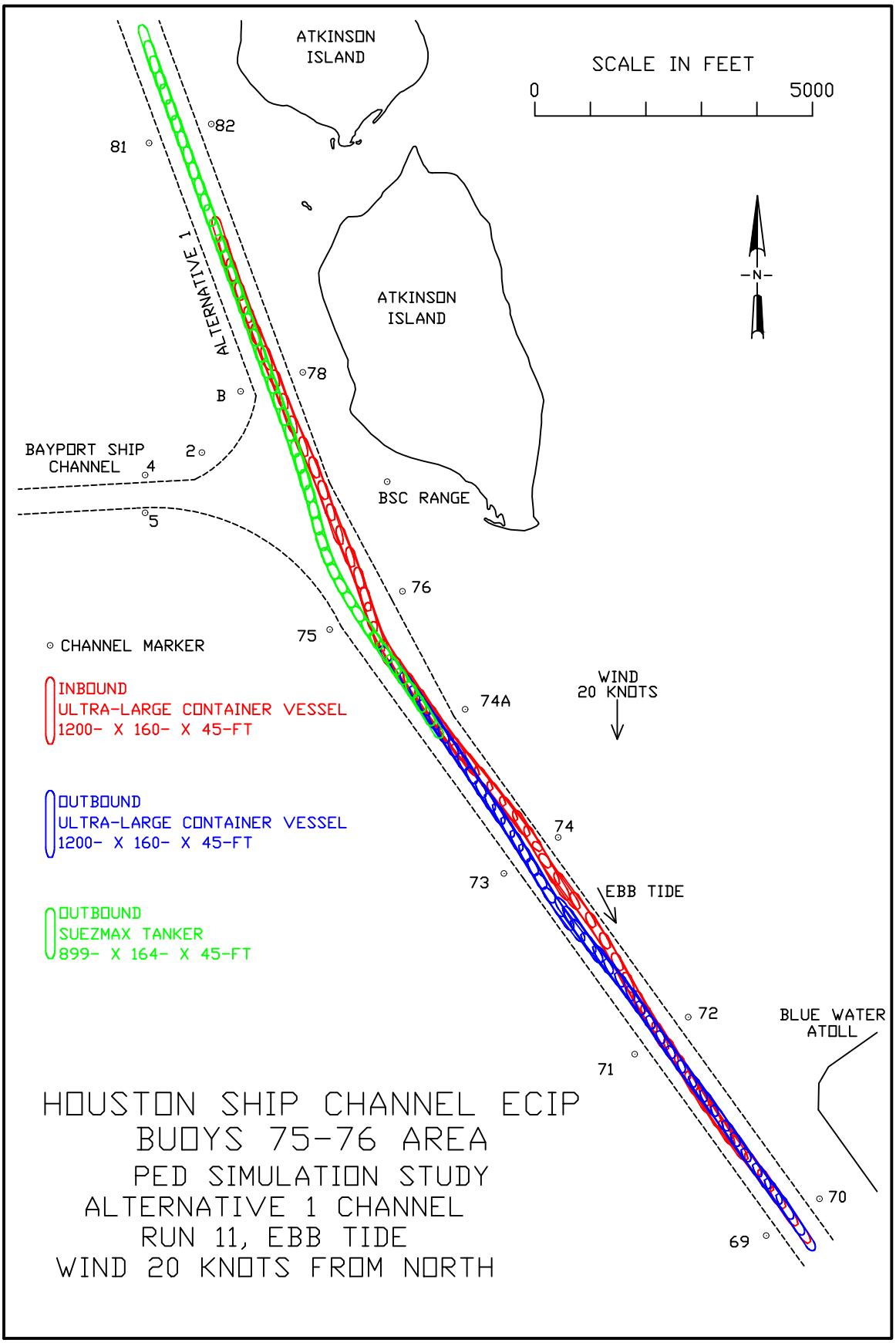

ATKINSON ISLAND
SCALE IN FEET
0
5000
82
81
ALTERNATIVE 1
ATKINSON ISLAND
N
78
B
BAYPORT SHIP CHANNEL
2
4
5
BSC RANGE
76
75
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
74A
WIND
20 KNOTS
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
74
73
EBB TIDE
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
72
BLUE WATER ATOLL
71
70
69
HOUSTON SHIP CHANNEL ECIP
BUOYS 75-76 AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 11, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 46

Run **11**

Purpose Testing around Bend @ 75-76 - Meet below and above the bend with turn between

Date 5/15/2020
Start Time 1530
End Time 1550
Plan BI-A1
Current Ebb
Tide (m) 1
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14N	45.0/13.7	326/10	67
Outbound	MULCV14N	45.0/13.7	146.2/10	73-74
Outbound	SUEZ156R	47.1/14.6	162/10	81-82

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MULCV14N	E	100	175	215	187
Outbound	MULCV14N	A	150			
Outbound	SUEZ156R	B			430	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
E	Inbound	Normal	Yes	The widener at 5 mile and the power of the ship allowed for a lot of space.	Yes	Yes	Yes	Yes	Pilot is using kick with the model due to not being familiar with the vessel. Pilot error during run but was able to successfully maneuver with the amount of space.
A	Outbound	Difficult	Yes	System error caused the pilot to lose view making the maneuver more difficult and him to break later.	Yes	Yes			Wind and current are felt on the vessel but still manageable. Pilot noted he needs to account for the change in current during the break as to not squeeze the passing vessel.
B	Outbound	Normal	Yes	Meeting at the flare allowed for more space. Normal situation.			Yes	Yes	Did not notice a change with the current and wind.

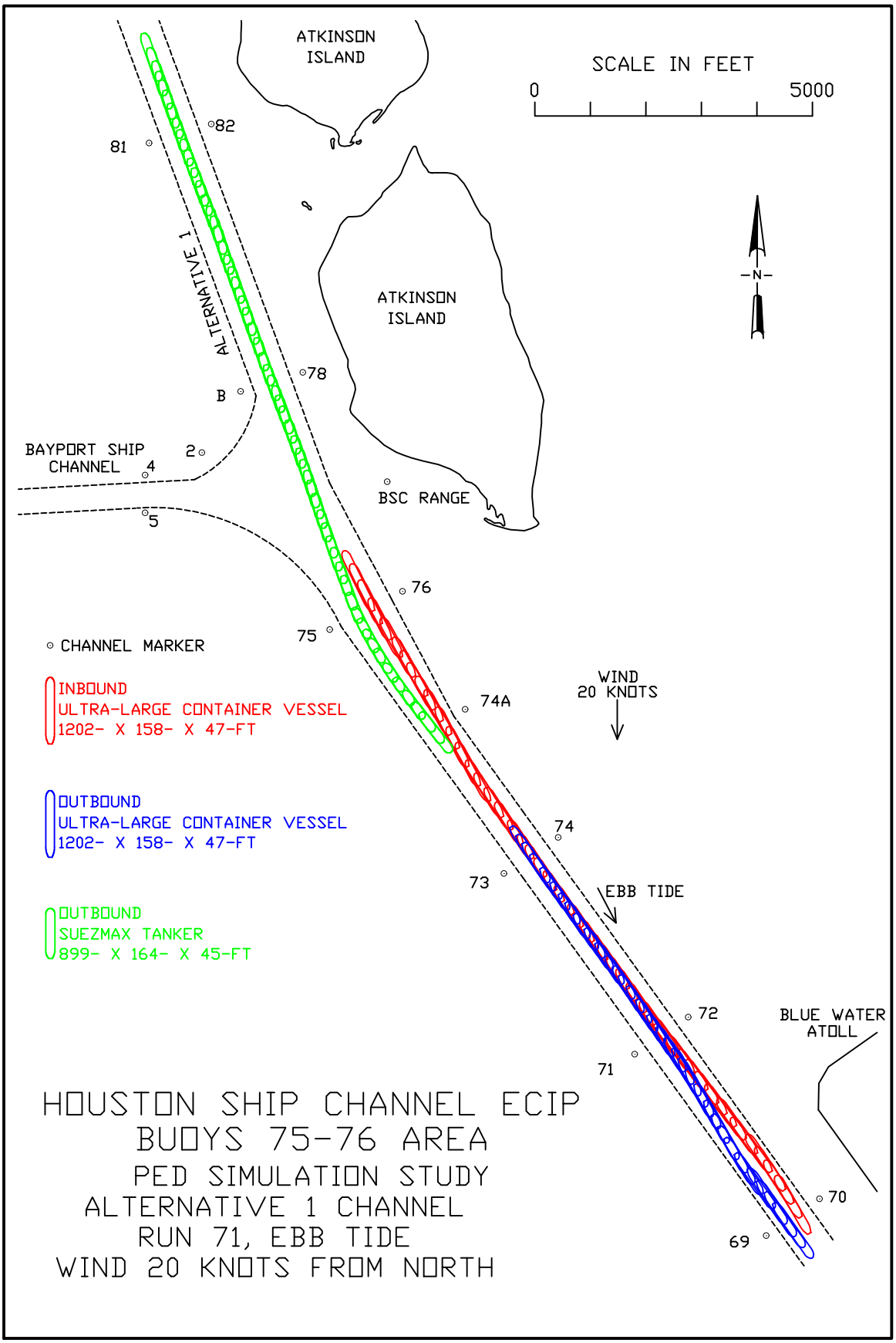

ATKINSON ISLAND
SCALE IN FEET
0
5000
82
81
ALTERNATIVE 1
ATKINSON ISLAND
N
78
B
BAYPORT SHIP CHANNEL
2
4
5
BSC RANGE
76
75
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
74A
WIND
20 KNOTS
74
73
EBB TIDE
72
BLUE WATER ATOLL
71
70
69
HOUSTON SHIP CHANNEL ECIP
BUOYS 75-76 AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 71, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 47

Run **71**

Purpose Testing around Bend @ 75-76 - First meet below bend and second at bend 75-76.

Date 6/1/2020
Start Time 1635
End Time 1655
Plan BI-A1
Current Ebb
Tide (m) 1.7
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	326/10	65-66
Outbound	ULCV366M	46.7/14.2	146/10	73-74
Outbound	SUEZ156R	44.1/13.7	162/10	83-84

Run Comments
Increased tide to 1.7 m to account for the soft grounding.

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	J	121	207	253	205
Outbound	ULCV366M	G	121			
Outbound	SUEZ156R	H			189	

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Inbound	Normal	Yes	A wider channel gives you a wider margin for bank affect.	Yes	Yes	Yes	Yes	Current gave the inbound vessel more control.
G	Outbound	Normal	Yes	Available room in the channel makes it safe.	Yes	Yes			Everything was normal and the environmental conditions did not make a difference.
H	Outbound	Normal	Yes	Availability in the channel makes for a safe operation.			Yes	Yes	The current and wind were noticed but made no difference.

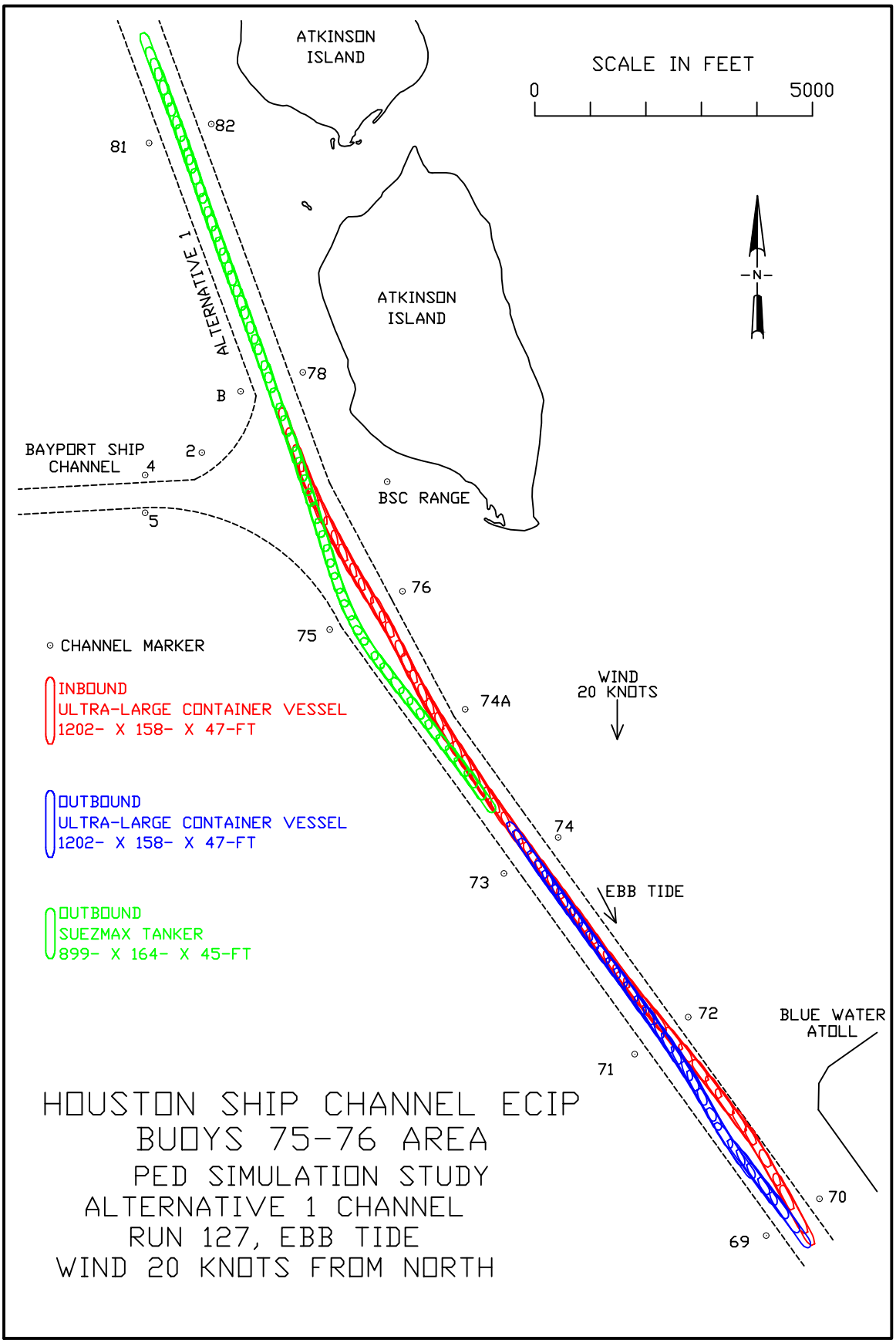

ATKINSON ISLAND
SCALE IN FEET
0
5000
82
81
ALTERNATIVE 1
ATKINSON ISLAND
N
78
B
BAYPORT SHIP CHANNEL
2
4
5
BSC RANGE
76
75
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
74A
WIND
20 KNOTS
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
74
73
EBB TIDE
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
72
BLUE WATER ATOLL
71
70
69
HOUSTON SHIP CHANNEL ECIP
BUOYS 75-76 AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 127, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 48

Run **127**

Purpose Testing around Bend @ 75-76 - First meet below bend and second at bend 75-76.

Date 6/8/2020
Start Time 1500
End Time 1520
Plan BI-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	326/10	65-66
Outbound	ULCV366M	46.7/14.2	146/10	73-74
Outbound	SUEZ156R	44.1/13.7	162/10	83-84

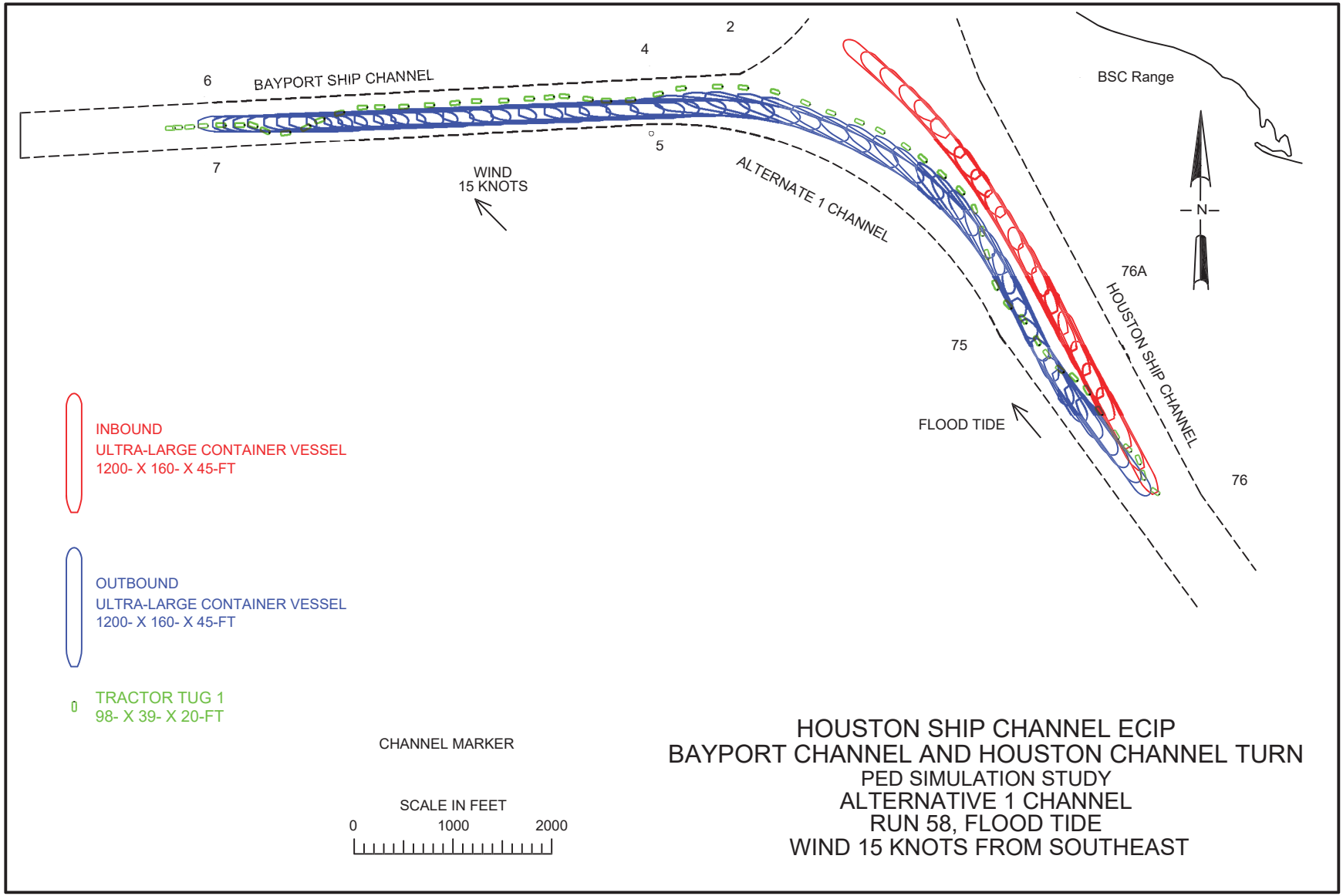
			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*ULCV366M	B	<20	233	201	325
Outbound	ULCV366M	D	125			
Outbound	SUEZ156R	J			97	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
B	Inbound	Normal	Yes	The channel has adequate space to pass.	Yes	Yes	Yes	Yes	First meet the pilot was too wide due to pilot error. Wind and current did not affect the pilot.
D	Outbound	Normal	Yes	The width of the channel is wide enough to meet.	Yes	Yes			Wind and current did not impact the vessel.
J	Outbound	Easy	Yes	Wider channel by the turns allows for an increased margin of safety.			Yes	Yes	The environmental factors were not felt.

Appendix D: Track Plots and Run Sheets – Bayport Channel

BSC Entrance flare



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND HOUSTON CHANNEL TURN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 58, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 49

Run **58**

Purpose	Outbound vessel from Bayport meeting below the flare. One instructor controlled tug on inbound vessel.
Date	5/22/2020
Start Time	1455
End Time	1510
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	ULCV366M	49.6/14.2	324/6	71-72
Outbound	*ULCV366M	49.6/14.2	090/6	Midway

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	ULCV366M	B	650	125	[redacted]	
Outbound	*ULCV366M	A	473			

Run Comments
Inbound vessel became unstable after the meet and was not able to make the turn into Bayport.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Inbound	Normal	Yes	Plenty of room to turn. Pilot would slow down next time.	Yes	Yes	[redacted]		
B	Outbound	Normal	Yes	Vessel met at a good location, at the flare, allowing plenty of room to pass.	Yes	Yes			Model did not handle as expected. Hardover rudder did not turn the vessel. Able to successfully pass another ship but the vessel was sluggish.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments
H - MZ7505	Easy	Yes	No	No	Yes	

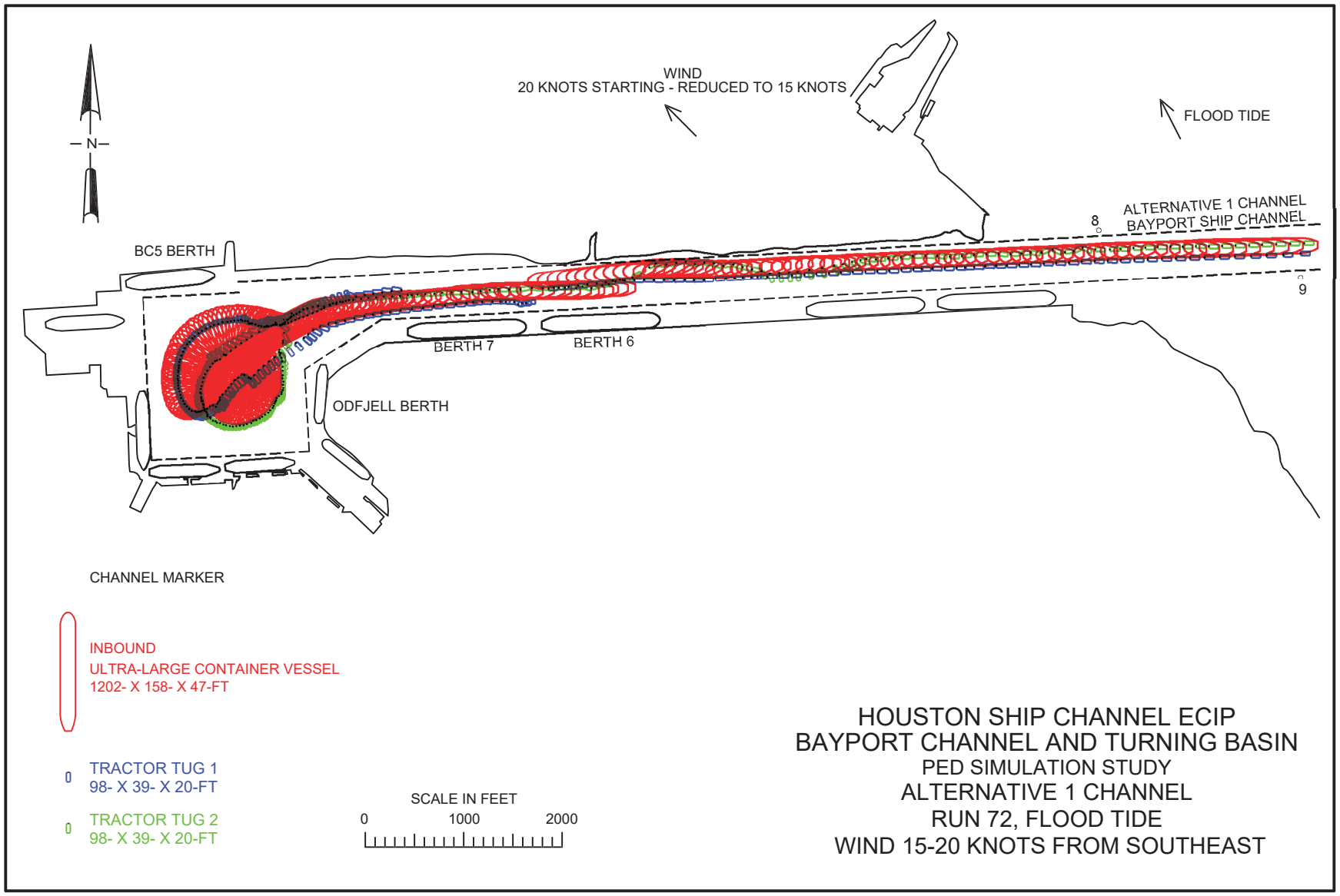

N
WIND
20 KNOTS STARTING - REDUCED TO 15 KNOTS
FLOOD TIDE
ALTERNATIVE 1 CHANNEL
BAYPORT SHIP CHANNEL
8
9
BC5 BERTH
BERTH 7
BERTH 6
ODFJELL BERTH
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 72, FLOOD TIDE
WIND 15-20 KNOTS FROM SOUTHEAST

PLATE 50

Run **72**

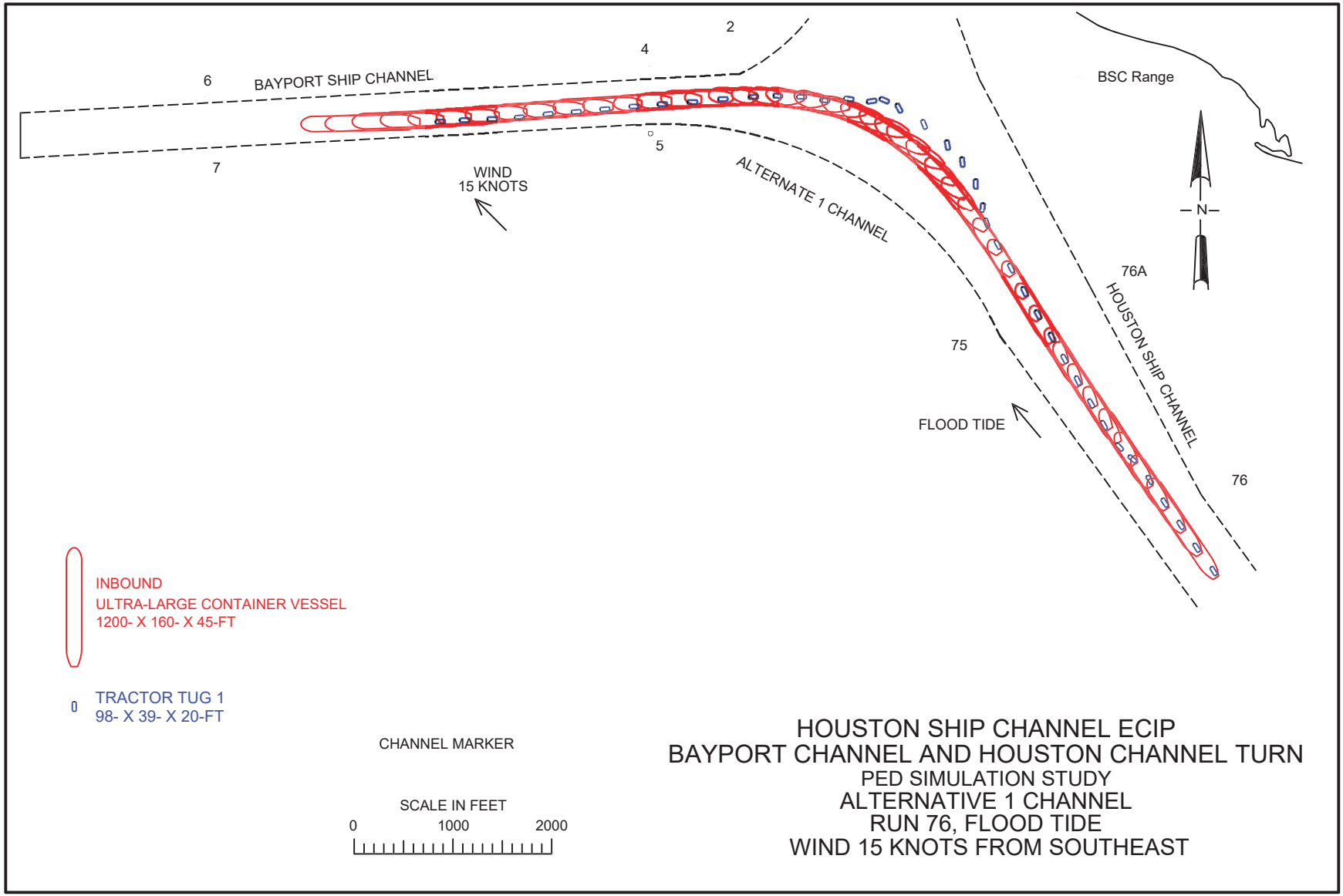
Purpose	Enter Bayport and turn in updated Turning Basin. Pilot made a decision to put a tug on the Port bow rather than through the stem like previous runs
Date	6/2/2020
Start Time	0905
End Time	1025
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/20
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	325/8	73-74

Run Comments
Decreased wind to 15 knots once in the terminal. 15 knots will be used as the maximum wind speed for the remaining runs in this area. Starboard quarter insturcot controlled tug bailled out during the run due to lack of space. Track plot will still show for the tug but it was not visible. Vessel's stern went outside of the federal channel prior to entering the turning basin. Simulation paused and repositioned vessel to center of channel to make the turn in the basin.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
L	Inbound	Difficult	Yes	Size of the vessel in the turning basin make the simulation difficult but it is something that can be done.	Yes	Wind did affect the vessel by pushing the stern close to the bank on the north side. Could of utilized the tugs differently during this time. Hugged the green side while turning into the terminal to offset the wind. Pilot let the ship advance further into the flare at the turning basin to decrease the degree of turn. Did use a half bell while leaving the turning basin.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Believes it would have been safer for the tug to have been located through the stem.	Got close to federal channel line while turning into the terminal but not in danger. Would have been able to operate through the stem during the simulation but while turning into the terminal the vessel speed would have been at the top end of there ideal speed.
2 - MS7505	Easy	Yes	No	No	Yes		Tugmaster does not feel like he was utilized well. Could of been used differently while entering the terminal and helped to pull the vessel away from the bank due to the wind.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND HOUSTON CHANNEL TURN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 76, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 51

Run **76**

Purpose Enter Bayport terminal.

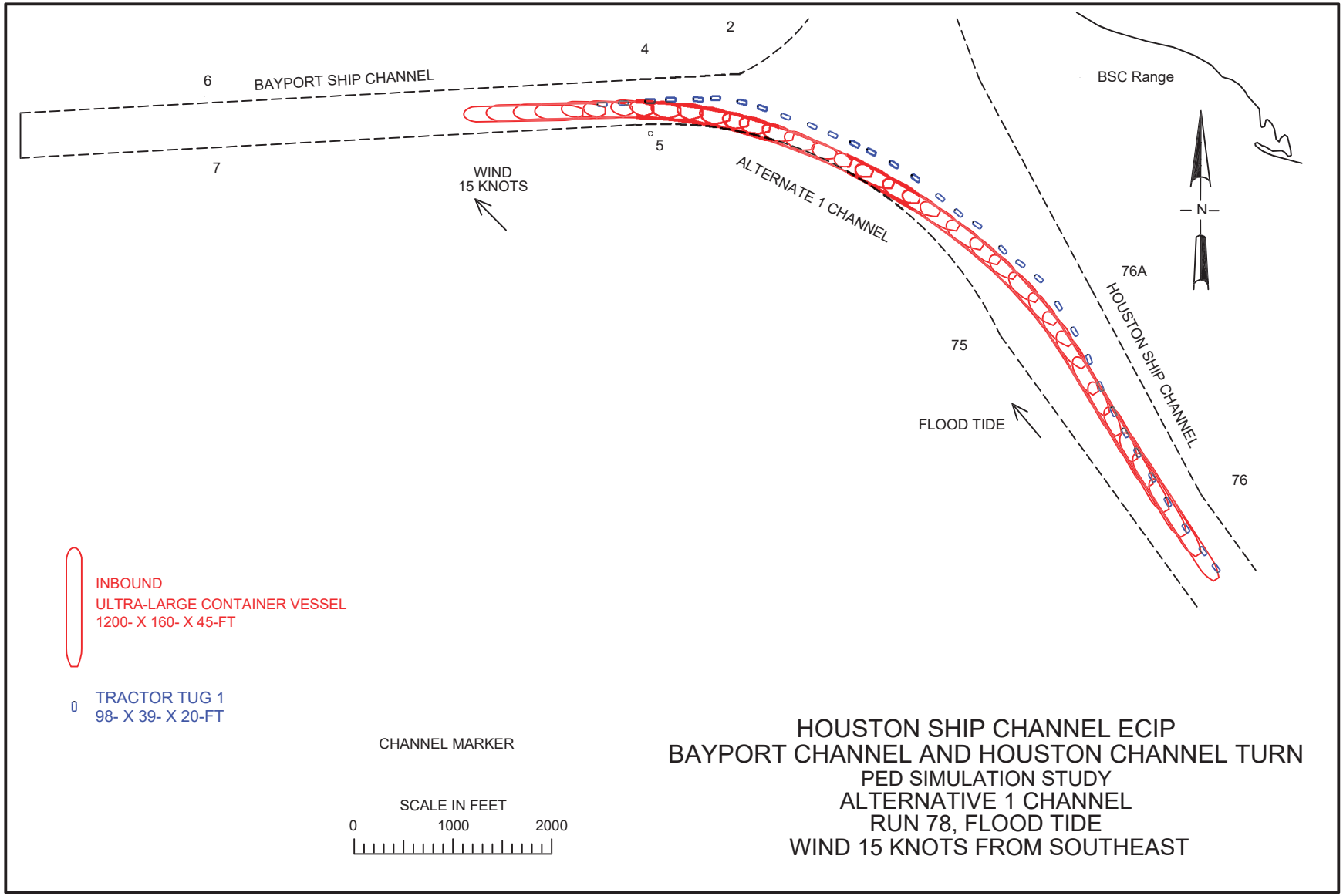
Date 6/2/2020
Start Time 1535
End Time 1550
Plan BS-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/15
Tugs 1

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	326/8	73-74

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
K	Inbound	Difficult	Yes	Large vessel in a small place.		Pilot did feel the wind and current but was able to adjust for it.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
2 - MS7505	Normal	Yes	No	No	Yes		Speed of the vessel while entering the terminal was a little fast for an indirect pull but overall it was safe and smooth.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND HOUSTON CHANNEL TURN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 78, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 52

Run **78**

Purpose Enter Bayport terminal.

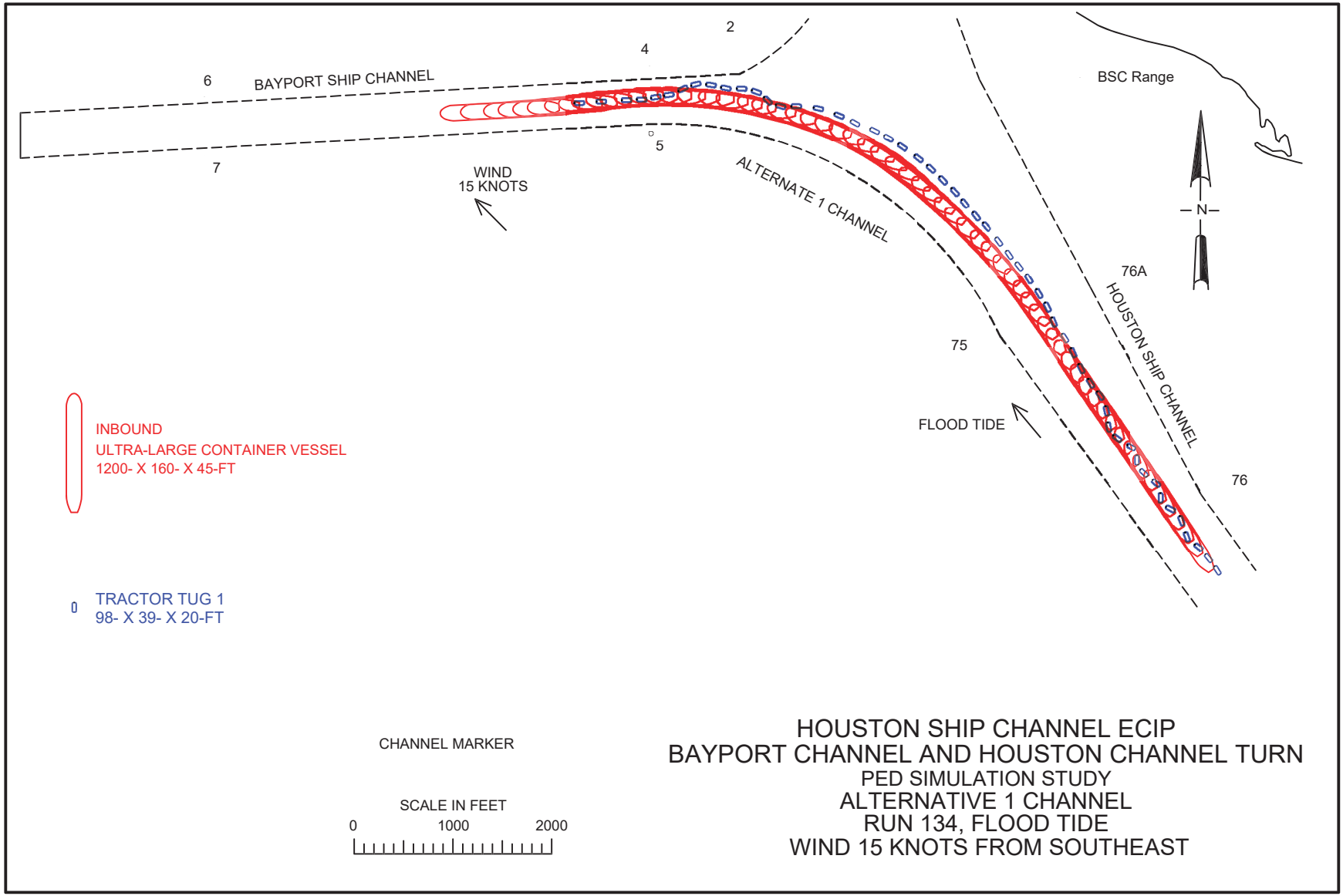
Date 6/2/2020
Start Time 1615
End Time 1625
Plan BS-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/15
Tugs 1

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	326/8	73-74

Run Comments
Vessel left federal channel while making the turn into the terminal.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
L	Inbound	Difficult	Yes	The size of the vessel creates little room for error.		Pilot noted he turned the vessel too early causing him to leave the federal channel. Can be done safely but pilot considers it not a successful turn due to exiting the channel.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MS7505	Easy	Yes	No	No	Yes		Tug was not used.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND HOUSTON CHANNEL TURN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 134, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 53

Run **134**

Purpose Enter Bayport Terminal.

Date 6/9/2020
Start Time 1515
End Time 1530
Plan BS-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/15
Tugs 1

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	326/10	73-74

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
J	Inbound	Easy	Yes	The extra space on the south part on the turn makes the turn a lot easier.		Wind and current did not affect the vessel.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MS7505	Normal	Yes	No	No	Yes		Tug only used to slow down after making the turn.

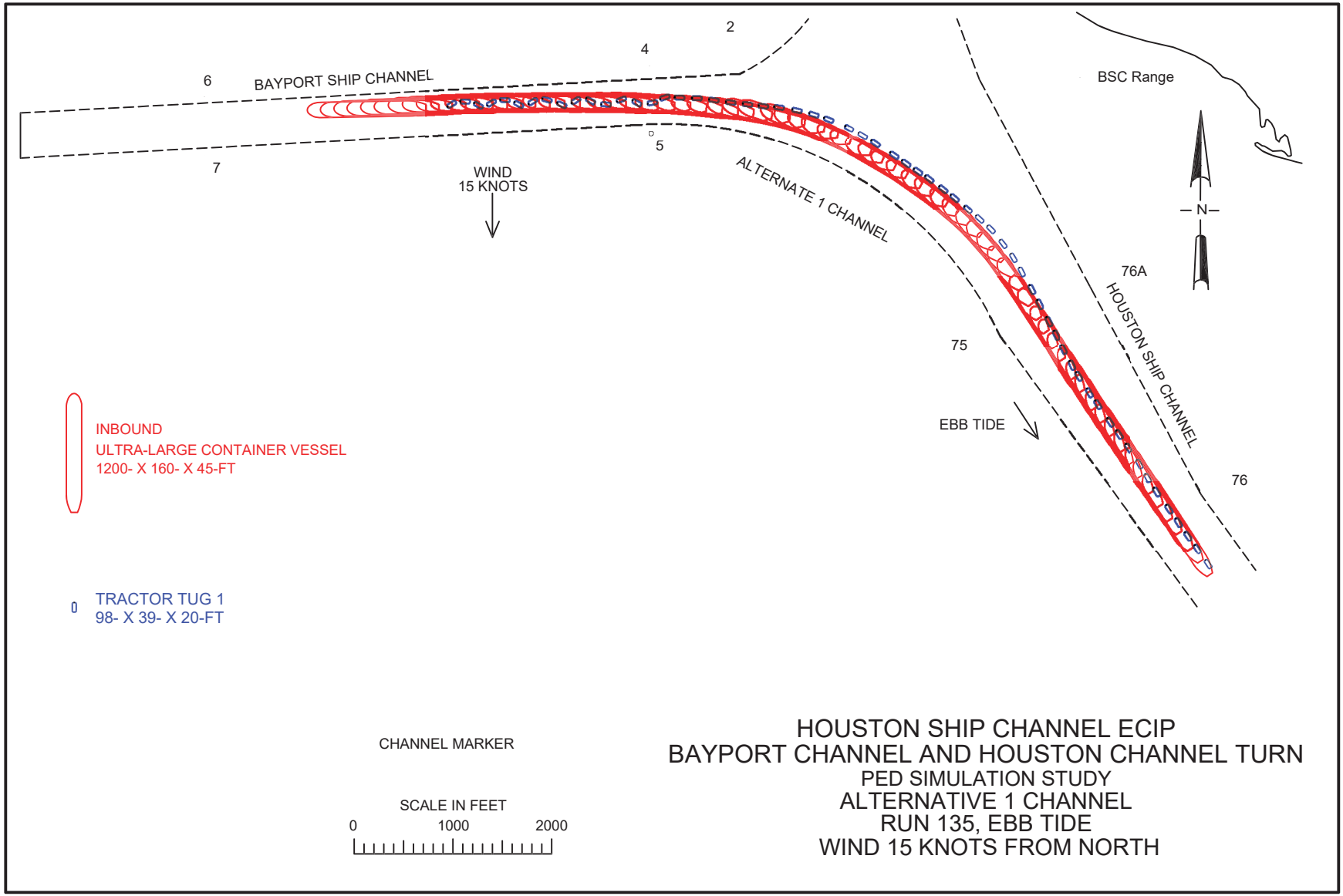

2
4
6
BAYPORT SHIP CHANNEL
BSC Range
5
7
WIND
15 KNOTS
ALTERNATE 1 CHANNEL
N
76A
HOUSTON SHIP CHANNEL
75
EBB TIDE
76
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
TRACTOR TUG 1
98- X 39- X 20-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND HOUSTON CHANNEL TURN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 135, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 54

Run **135**

Purpose Enter Bayport Terminal.

Date 6/9/2020
Start Time 1535
End Time 1550
Plan BS-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/15
Tugs 1

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	326/10	73-74

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
O	Inbound	Normal	Yes	The manuever can be completed without a tug.		The pilot began to turn too earlier and had to adjust accordingly due to the environmental factors but he was able to adjust and complete the turn successfully.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MS7505	Normal	Yes	No	No	Yes		Tug only used to slow down after making the turn.

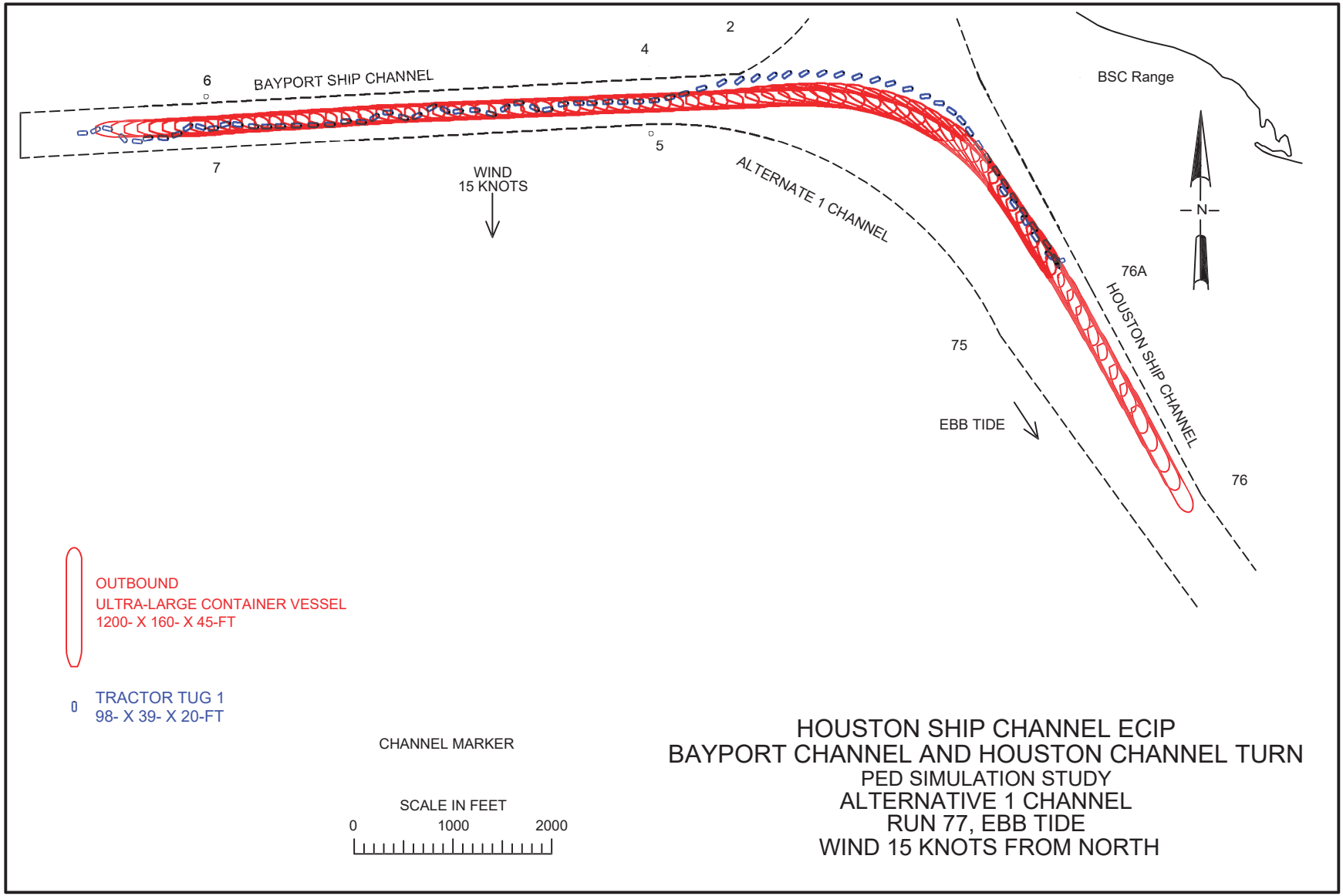

2
4
6
BAYPORT SHIP CHANNEL
BSC Range
5
7
WIND
15 KNOTS
ALTERNATE 1 CHANNEL
N
76A
HOUSTON SHIP CHANNEL
75
EBB TIDE
76
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
TRACTOR TUG 1
98- X 39- X 20-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND HOUSTON CHANNEL TURN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 77, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 55

Run **77**

Purpose Exiting Bayport terminal.

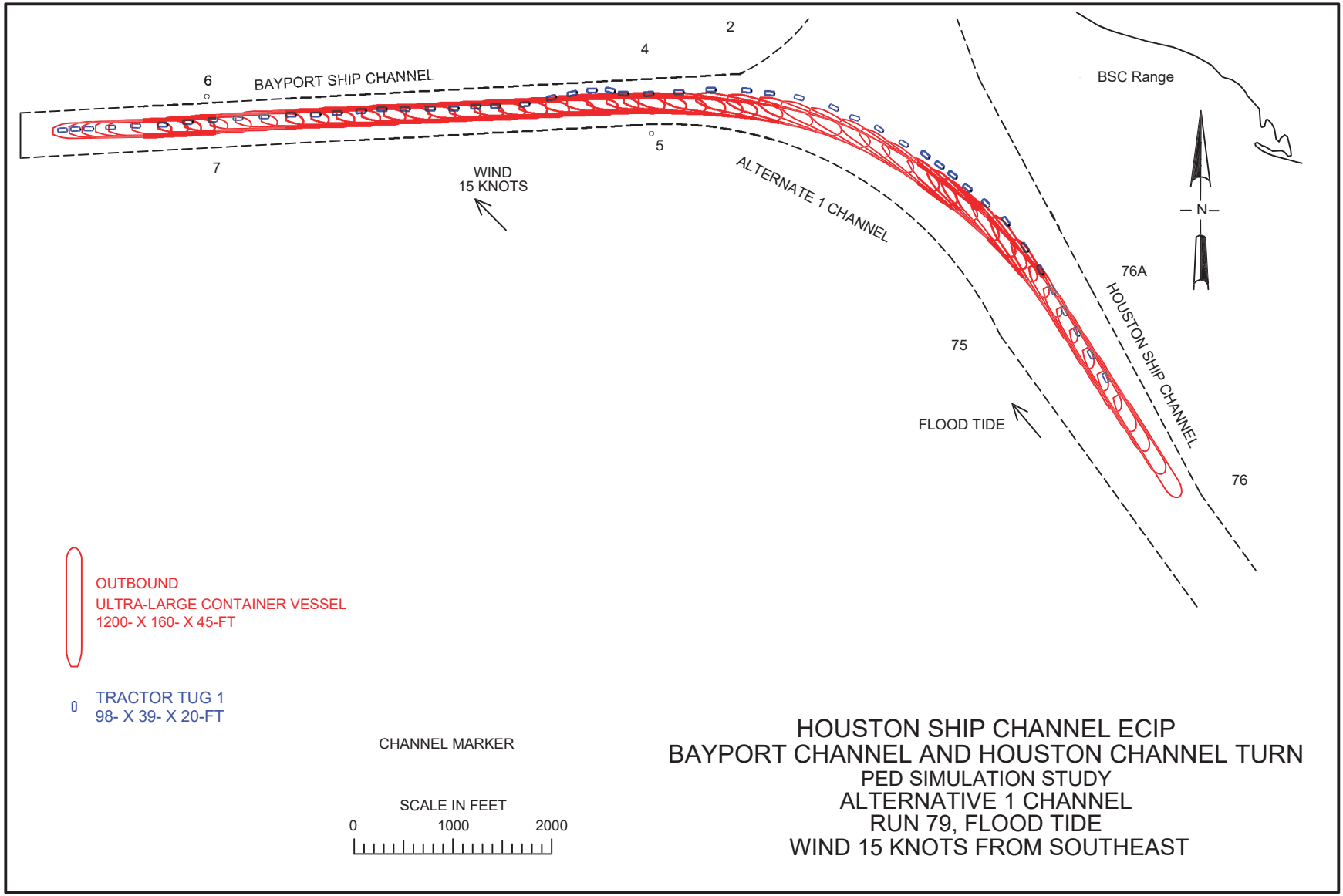
Date 6/2/2020
Start Time 1555
End Time 1610
Plan BS-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/15
Tugs 1

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	088/8	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
M	Outbound	Normal	Yes	Borderline difficult due to needing to use hard over while making the turn. Needed more power due to how large the vessel is.		Wind and current were felt but did not affect the pilot. Pilot noted that the hard over rudder is normal for him with a vessel this size.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
K - MS7505	Normal	Yes	No	No	Yes		



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND HOUSTON CHANNEL TURN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 79, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 56

Run **79**

Purpose Exiting Bayport terminal.

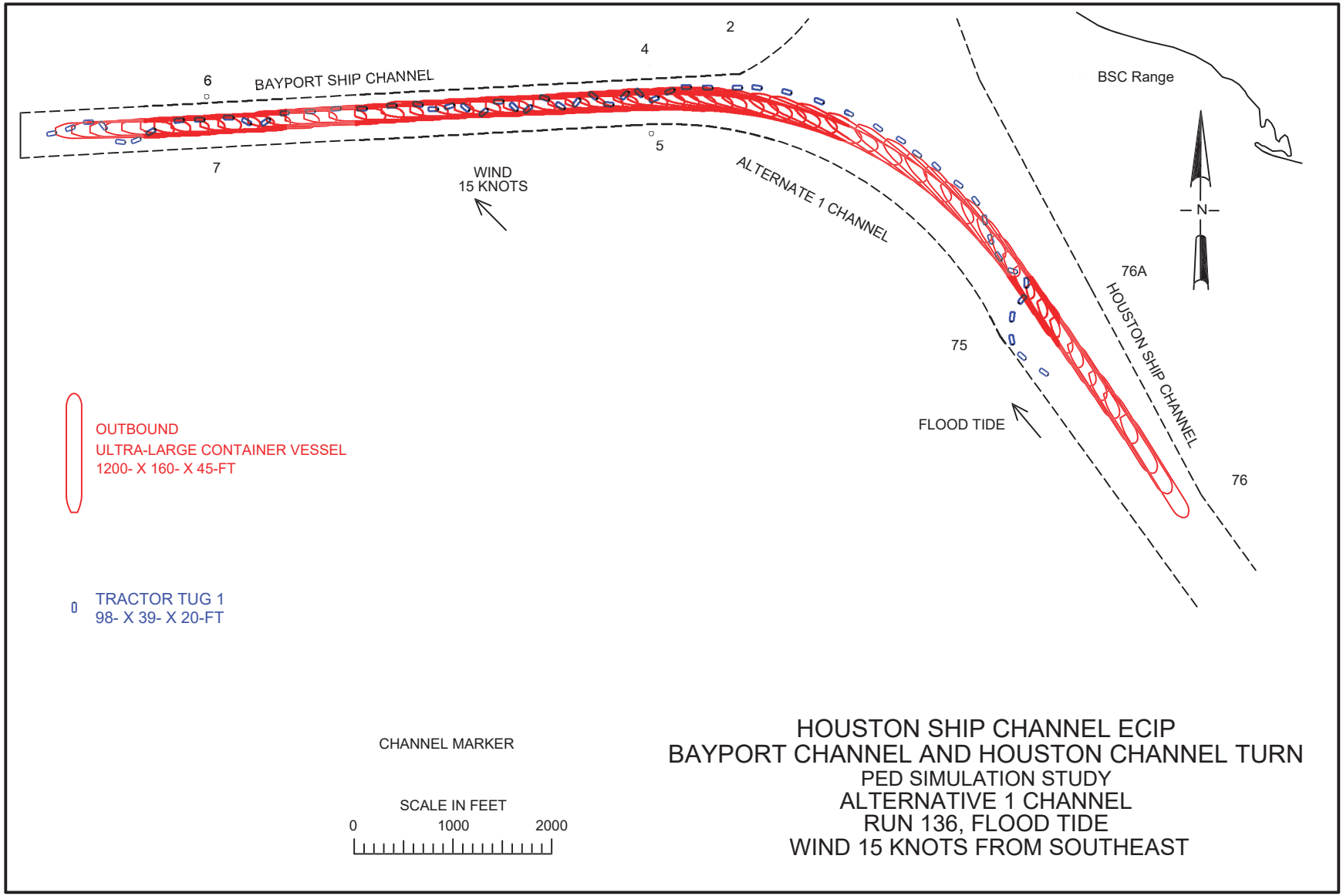
Date 6/2/2020
Start Time 1630
End Time 1645
Plan BS-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/15
Tugs 1

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	088/8	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
K	Outbound	Difficult	Yes	Vessel is large with a little bit of space.		Pilot did not have to use more than 20 degree rudder and had a low degree of turn.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MS7505	Easy	Yes	No	No	Yes		Tug was not used.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND HOUSTON CHANNEL TURN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 136, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 57

Run **136**

Purpose Exiting Bayport Terminal.

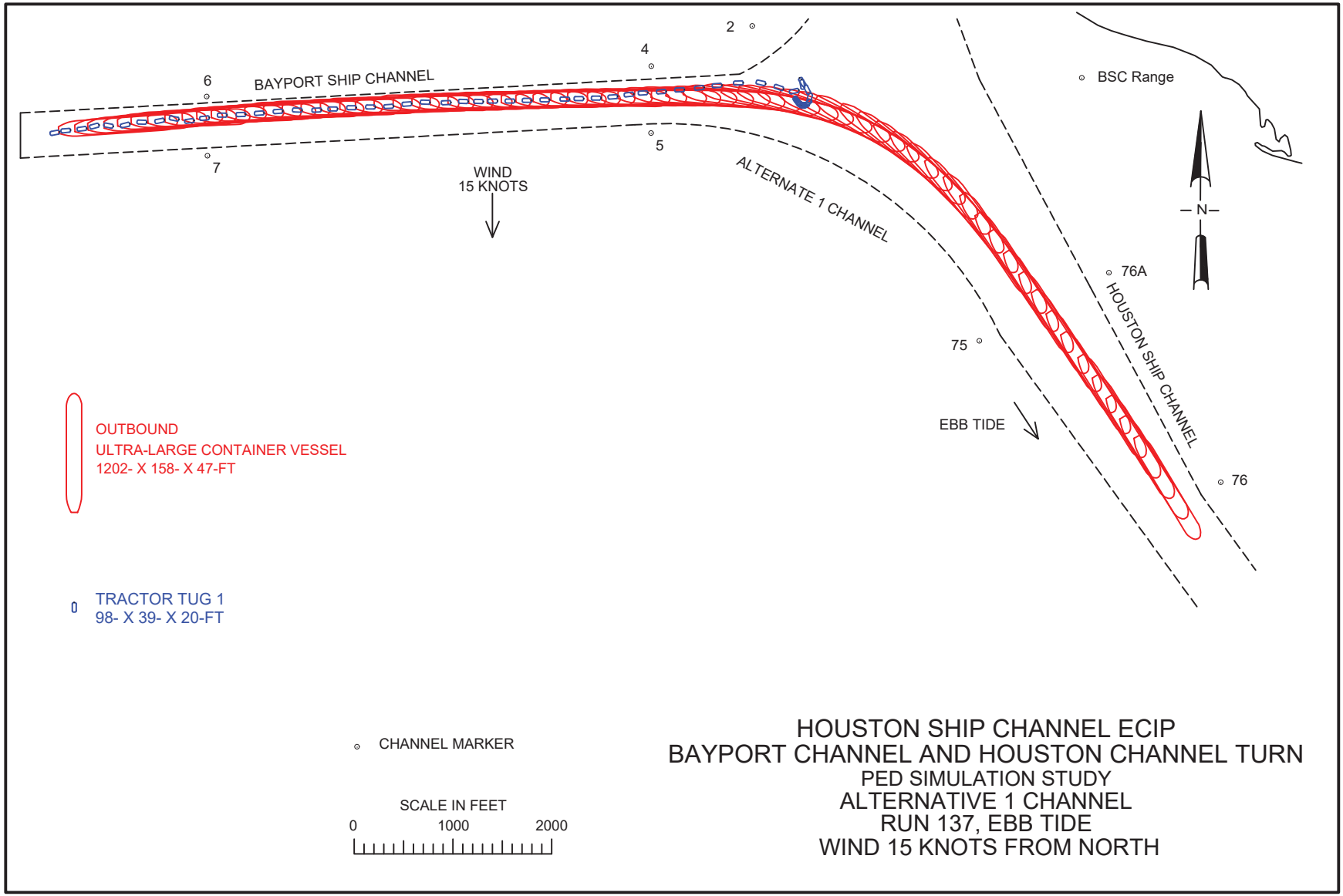
Date 6/9/2020
Start Time 1600
End Time 1615
Plan BS-A1
Current Fld
Tide (m) 1.5
Wind Direction
/Speed Knots SE/15
Tugs 1

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	088/8	Cruise Terminal

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Outbound	Normal	Yes	Plenty of room in the terminal, channel, and the flare.	Yes		Current and wind were felt but the pilot react as he would in a real life situation and was able to handle the vessel fine.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MS7505	Normal	Yes	No	No	Yes		Tug only used to slow down before making the turn.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND HOUSTON CHANNEL TURN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 137, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 58

Run **137**

Purpose Exiting Bayport Terminal.

Date 6/9/2020
Start Time 1620
End Time 1630
Plan BS-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/15
Tugs 1

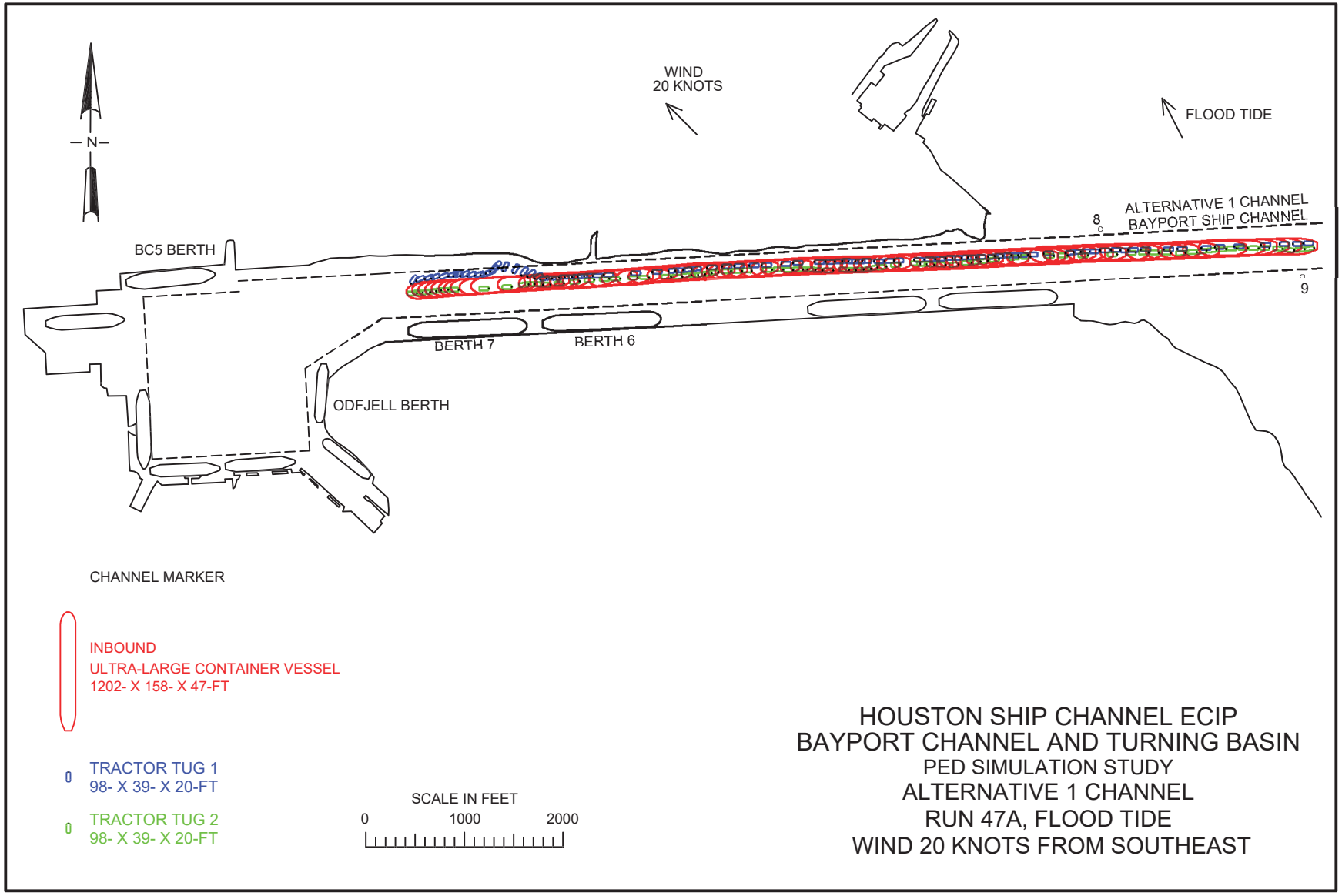
Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	086/8	Cruise Terminal

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
J	Outbound	Easy	Yes	Wider turn outbound allows for less rudder to be used and makes it easier.	Yes		The wind and current could be felt so the pilot had to use a little more rudder to bring the stern around.

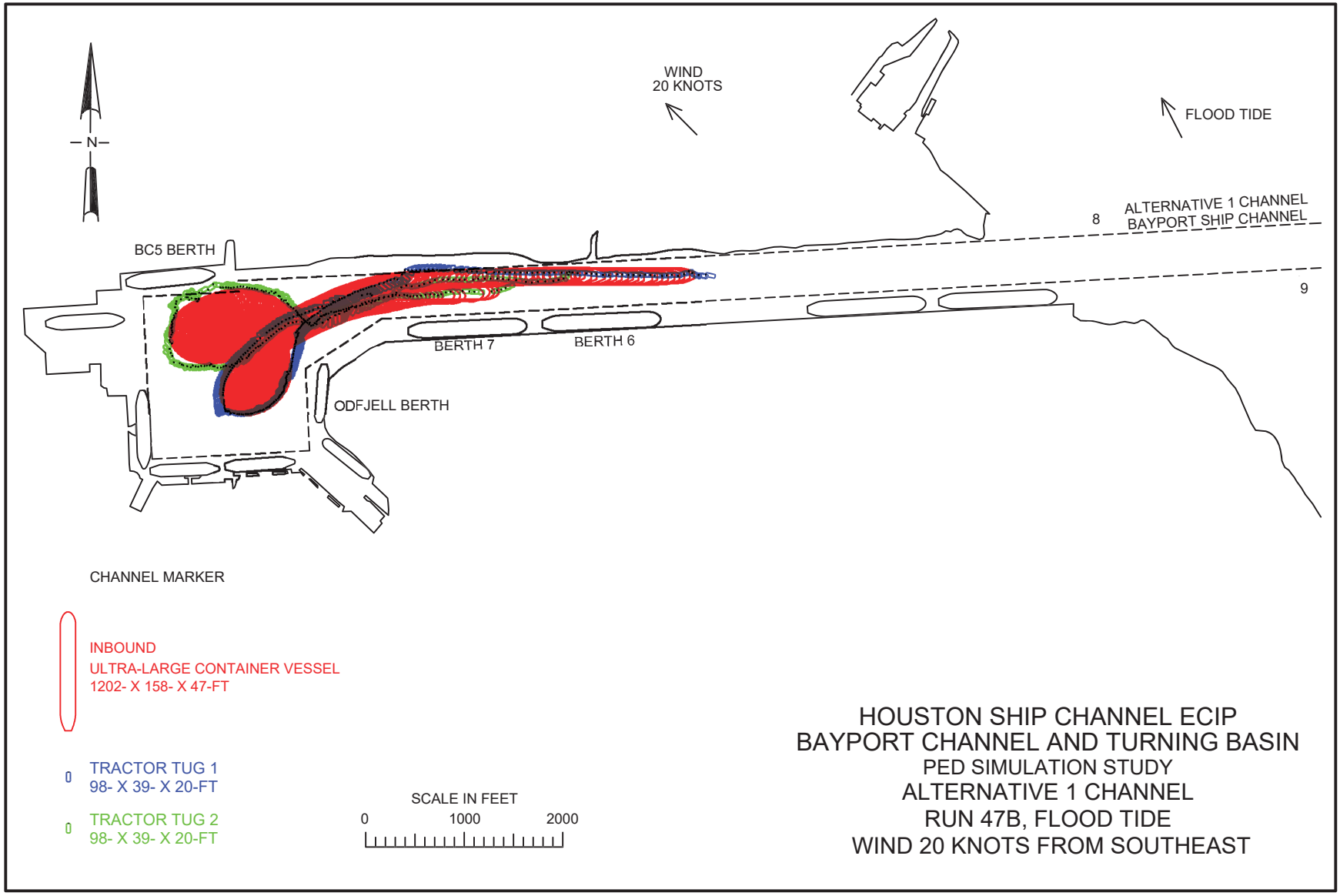
Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
2-MS7505	Normal	Yes	No	No	Yes		Tug was not used during the manuever.

Bayport Ship Channel and turning basin



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 47A, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 59A



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 47B, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 59B

Run **47**

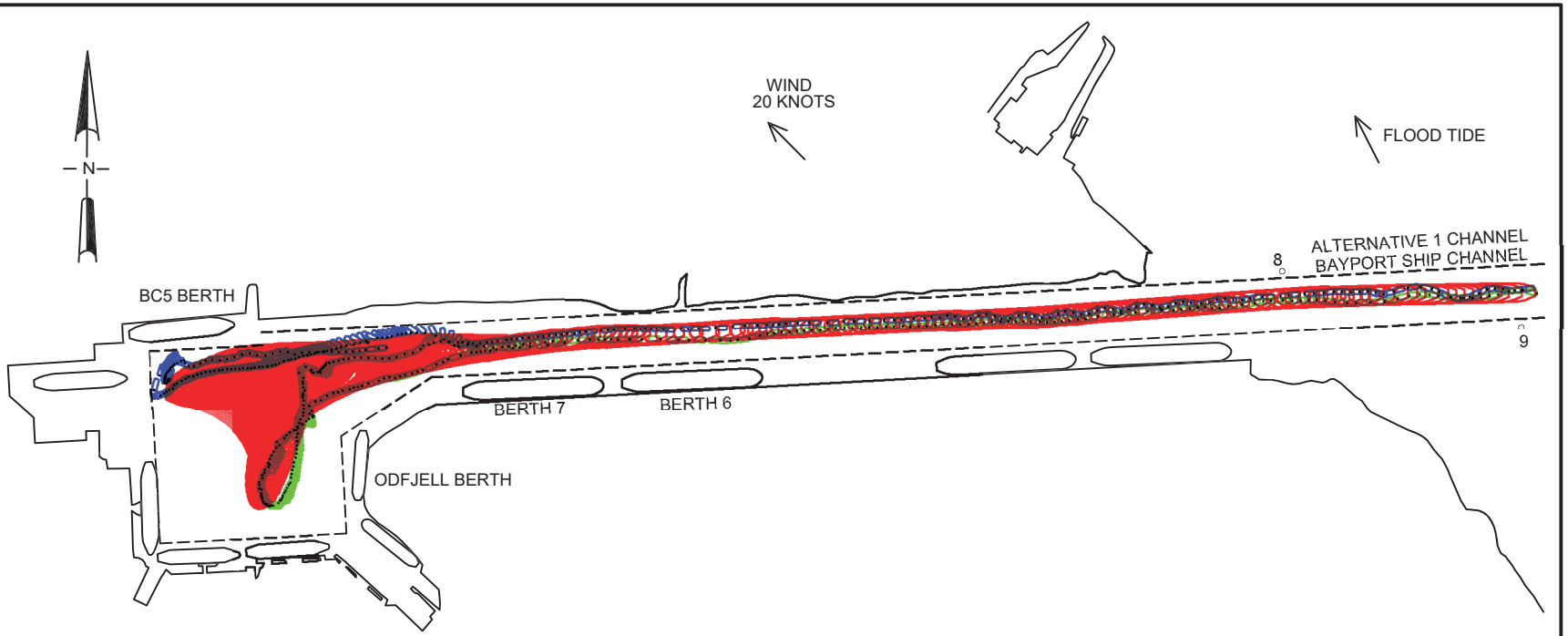
Purpose	Enter Bayport and Turn in Updated Turning Basin. Testing with normal operations if they have control while passing berthed vessels.
Date	5/21/2020
Start Time	0900
End Time	1025
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/20
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	269/6	Midway

Run Comments
n speed, even with all factors working to slow it down. Instructor moved ship back ou

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
H	Inbound	Difficult	Yes	Size of the vessel with berths completely filled makes it harder. Needs a minimum of three tugs - fourth tug was not used during this operation.	Yes	Stern went outside of the federal channel during entrance due to adapting to the beginning of the simulation. Did not occur due to lack of control.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Got tight near dock #5 but did not feel like the tug was in danger.	
2 - MS7505	Normal	Yes	No	No	Yes		Tug power was more then usual and could cause problems depending on the environmental situation.



CHANNEL MARKER

INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT

TRACTOR TUG 1
98- X 39- X 20-FT

TRACTOR TUG 2
98- X 39- X 20-FT

SCALE IN FEET
0 1000 2000

HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 48, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 60

Run **48**

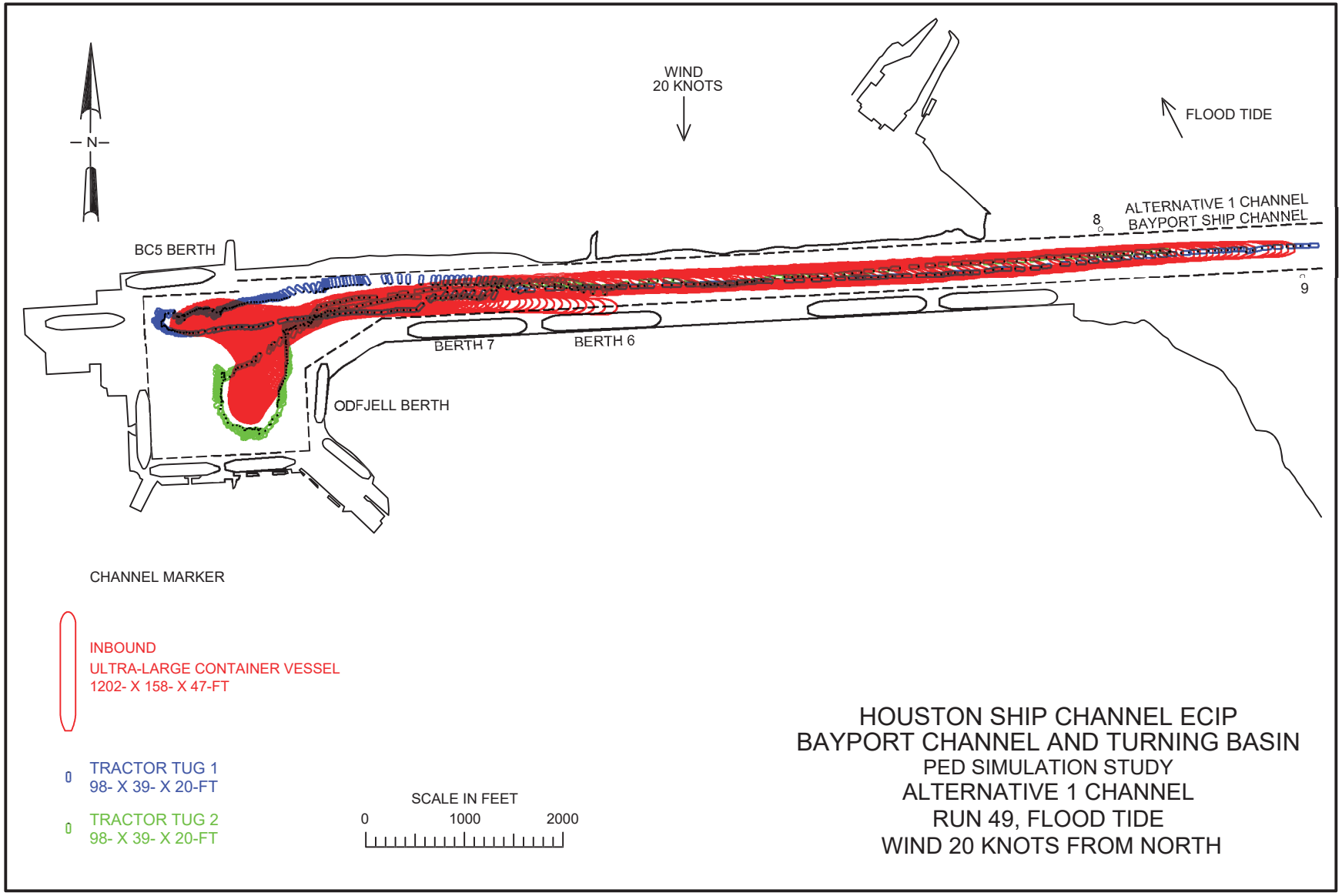
Purpose	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
Date	5/21/2020
Start Time	1035
End Time	1130
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/20
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	269/6	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
G	Inbound	Difficult	No	The approach to the turning basin is narrow so as you approach and slow down you lose directional ability. Same for the exit.	Yes	Pilot had to apply hard rudder to get the ship to behave as he wanted during the approach to the turning basin due to the slow speed. Wind did affect the vessel causing him to use the tugs more to square away. Amount of tugs made it doable but it is difficult.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		
2 - MS7505	Normal	Yes	No	No	Yes		



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 49, FLOOD TIDE
WIND 20 KNOTS FROM NORTH

PLATE 61

Run **49**

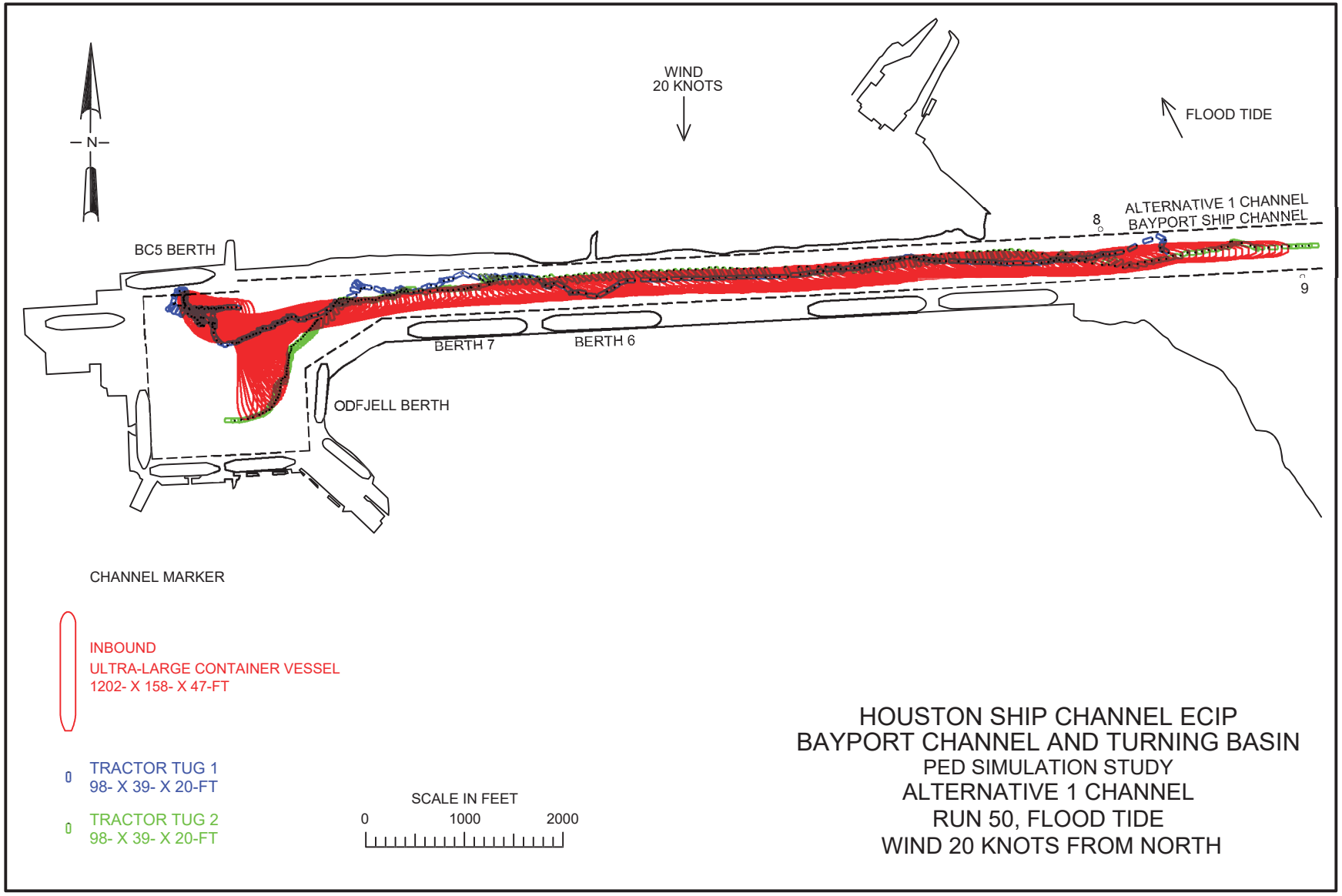
Purpose	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
Date	5/21/2020
Start Time	1235
End Time	1330
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	269/6	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
H	Inbound	Difficult	Yes	Pilot could have utilized the tugs differently to make the manuever go better. Could be done but not recommened.	Yes	Gaining headway after the turn with the North wind makes it difficult without getting too much headway.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		
2 - MS7505	Normal	No	No	No	Yes	Manuever not safe but the tug usage and position was never in danger.	Not able to move the ship from the starboard side towards the end of the operation.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 50, FLOOD TIDE
WIND 20 KNOTS FROM NORTH

PLATE 62

Run **50**

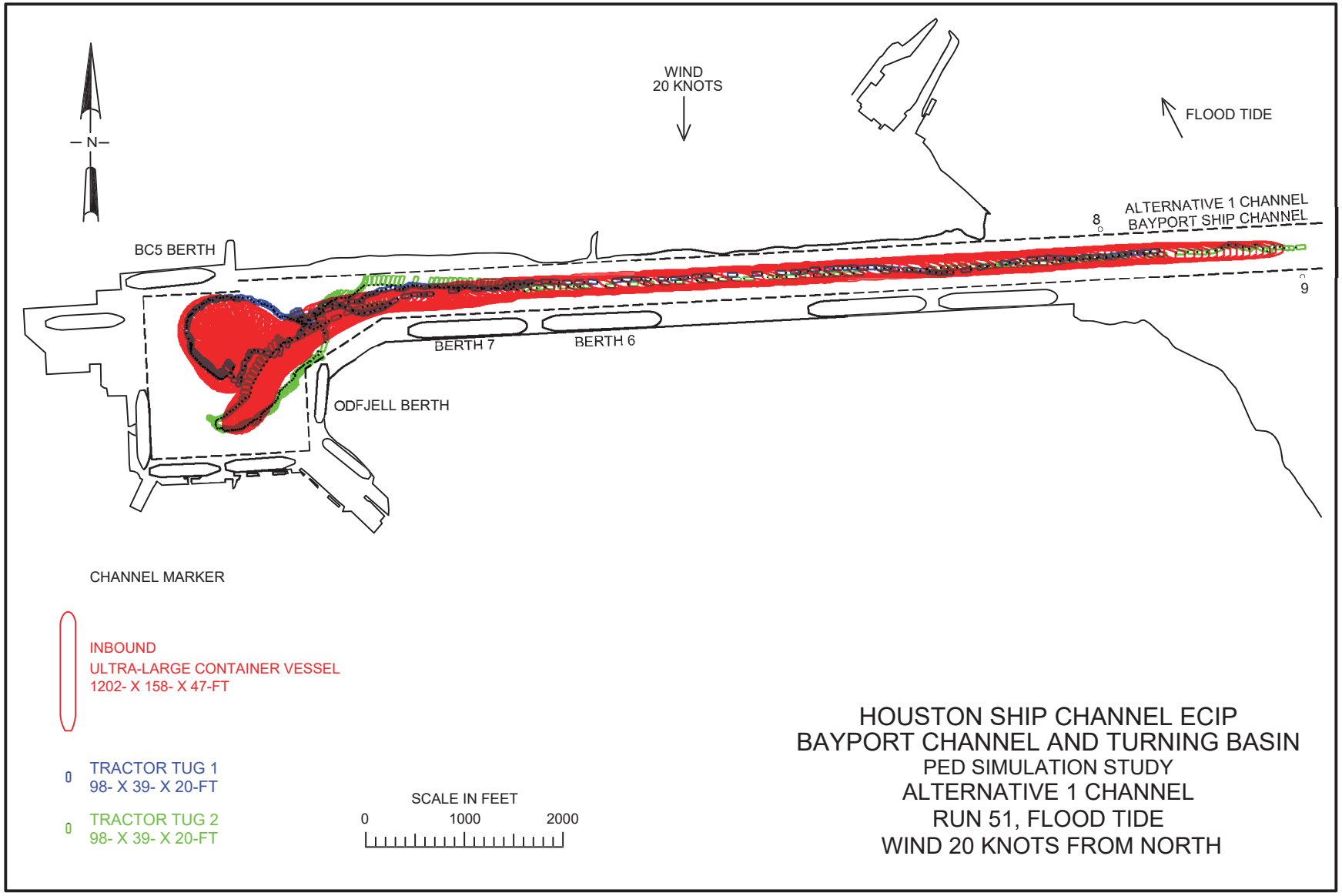
Purpose	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
Date	5/21/2020
Start Time	1340
End Time	1415
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	269/6	Midway

Run Comments
Line kept breaking for the Bow tug due to simulation error causing the pilot to be unable to use the tug while entering into the turning basin.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
G	Inbound	Difficult	No	Difficult to maintain heading in the cut and had more than 4 degrees. Setting down on the ships in the south because of this.	No	Ended up maxing out the larger tugs. This scenario with conditions is restricted for the current guidelines.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MST3080O	Difficult	Yes	Yes	No	No	Tug got too close to the berths and got close to running aground.	
2 - MZT3080O	Difficult	Yes	Yes	No	No	Entering the land cut, the tug changed to an indirect pull and with the clearance to the land the tug was put in danger.	



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 51, FLOOD TIDE
WIND 20 KNOTS FROM NORTH

PLATE 63

Run **51**

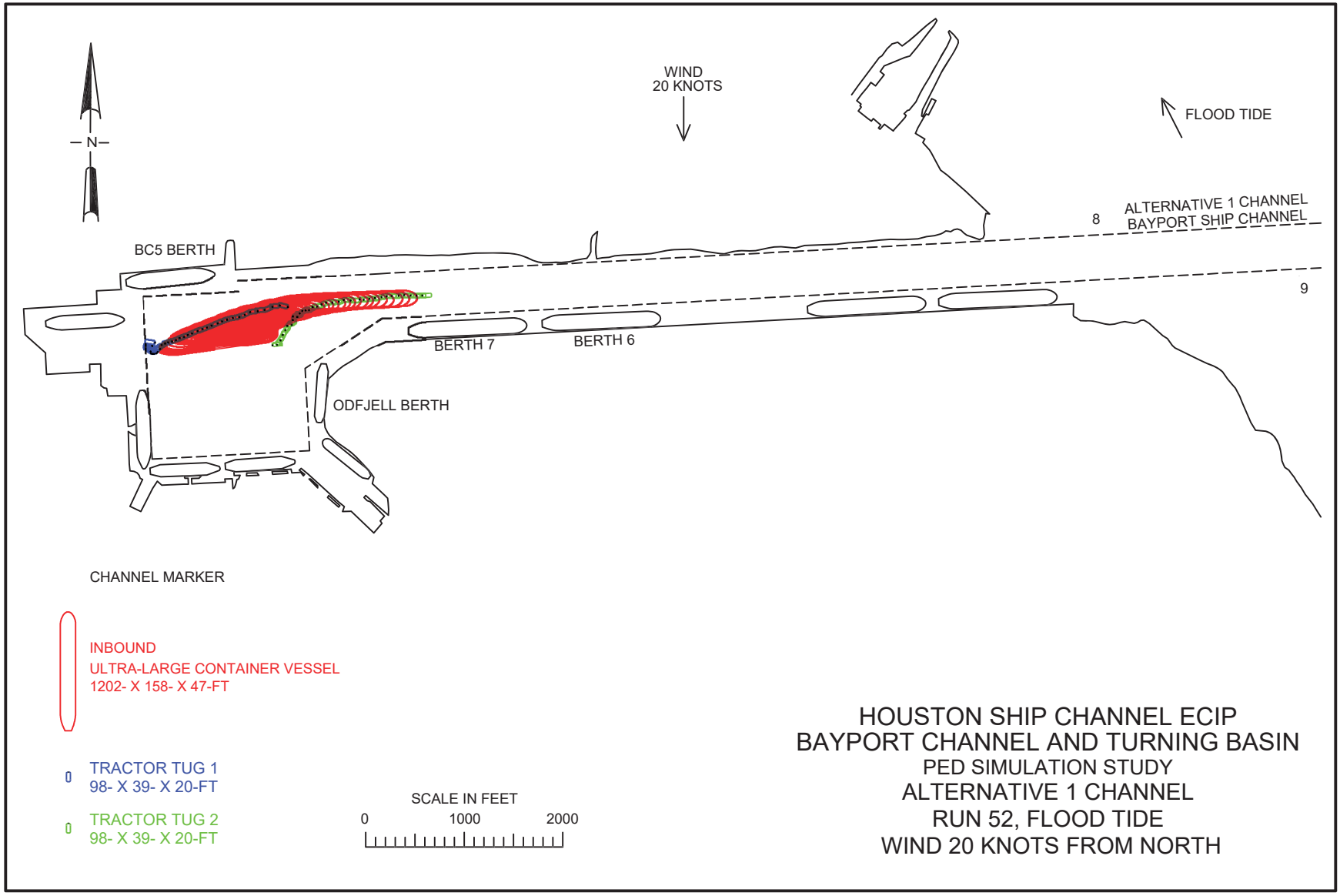
Purpose	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
Date	5/21/2020
Start Time	1440
End Time	1530
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	269/6	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
H	Inbound	Difficult	Yes	Tug arrangement and the decrease in wind made it safer.	Yes	Turning further south in the basin and driving right out did not feel as comfortable due to the 90 degree corner as turning higher and straightening out.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MST3080O	Normal	Yes	No	No	Yes	Felt good to you. Easier for tugs with less wind.	Remianined in the center of then channel most the
2 - MZT3080O	Normal	Yes	No	No	Yes	Pinched while entering the flare.	The tug needed the vessel to pull further into the basin for him to feel completely comfortable.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 52, FLOOD TIDE
WIND 20 KNOTS FROM NORTH

PLATE 64

Run **52**

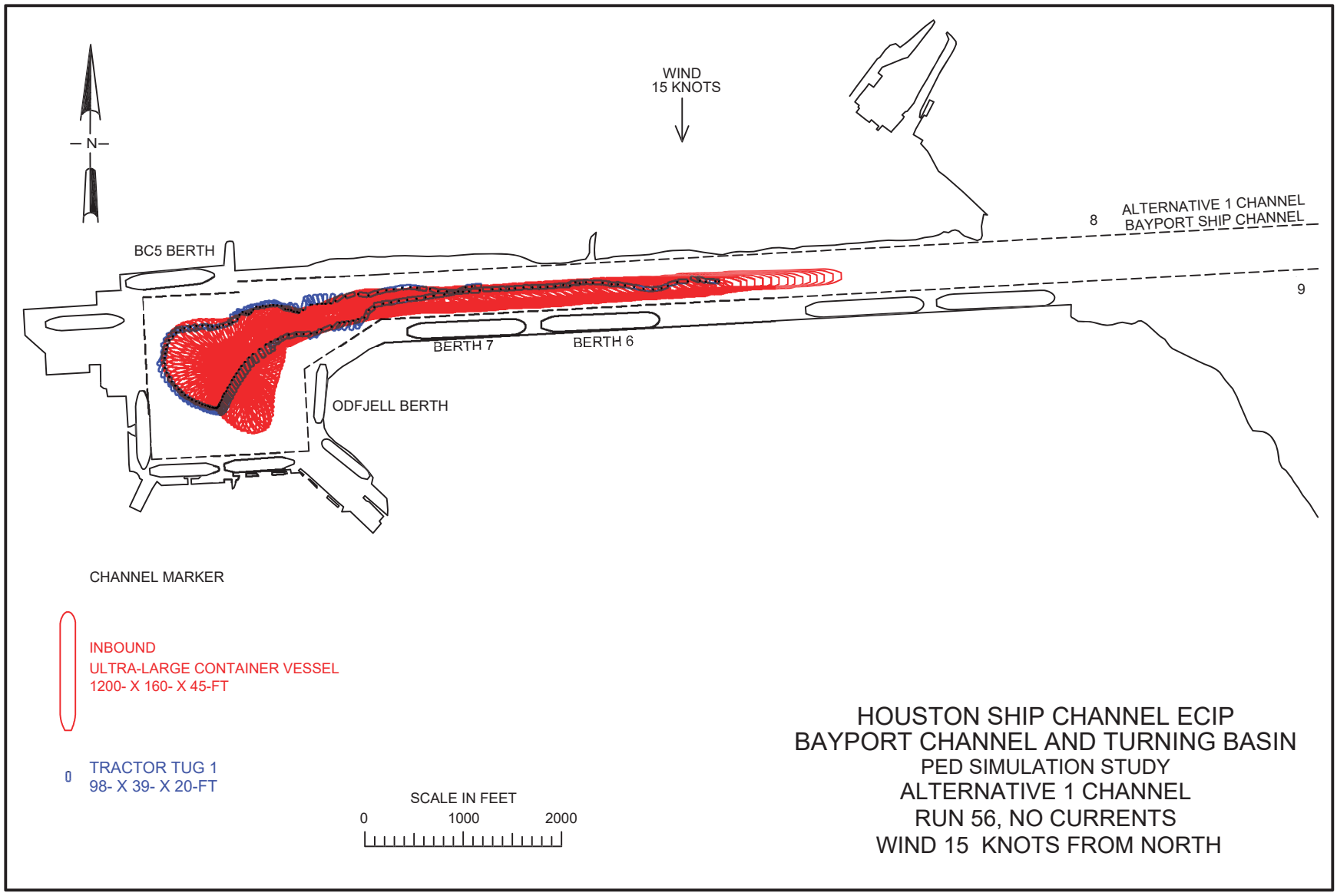
Purpose	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
Date	5/21/2020
Start Time	1540
End Time	1525
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	269/6	Midway

Run Comments
Wind accidentally started at 20 knots, pilot noticed and the changed was made. Starboard tug was made invisible while entering the flare because the pilot released him due to space. Track plot makes it look like the tug went through the berthed vessel. Tug returned after entering turning basin.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
G	Inbound	Difficult	Yes	At 15 knots of wind this manuever is possible. Starting at 20 knots made it hard to recover.	Yes	The turn was successful but the entry into the space was not. Vessel did leave the federal channel during entry. That is safe water but is not normally needed however the pilot had problems recovering after the wind decreased from 20 knots.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MST3080O	Normal	Yes	No	No	No	Even with 15 knot wind this was a difficult excercise.	Manuever did cause the tug to get close to the edge. If something were to go wrong there would be no chance of recovering.
2 - MZT3080O	Normal	Yes	No	No	Yes		



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 56, NO CURRENTS
WIND 15 KNOTS FROM NORTH

PLATE 65

Run **56**

Purpose	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
Date	5/22/2020
Start Time	1255
End Time	1335
Plan	BS-A1
Current	0
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	268.5/3	Midway

Run Comments
Using a different approach for these runs - going further into the turning basin to perform the turn. Sticking to a 15 knot wind limit for this area.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
G	Inbound	Difficult	Yes	The turning basin has enough space but the transistion from the channel to the basin is a little more cumberson and awkward.	Yes	Pilot feels like the flare could be opened up more to allow additional space when entering the turning basin. Turning in the middle of the basin allows for more headway.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
H - MZ7505	Normal	Yes	No	No	Yes		Pretty standard operation.

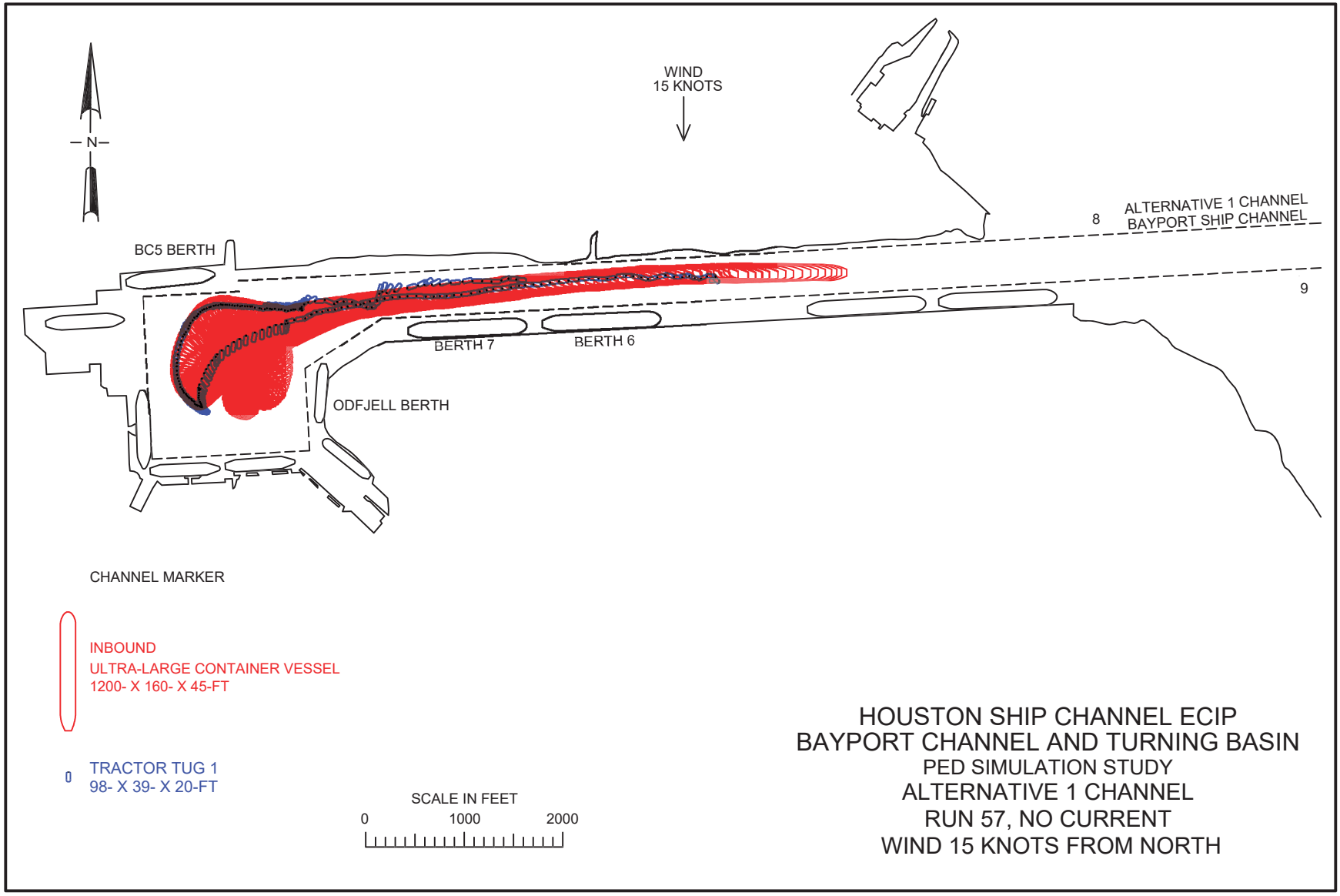

N
WIND
15 KNOTS
ALTERNATIVE 1 CHANNEL
BAYPORT SHIP CHANNEL
8
9
BC5 BERTH
BERTH 7
BERTH 6
ODFJELL BERTH
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
TRACTOR TUG 1
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 57, NO CURRENT
WIND 15 KNOTS FROM NORTH

PLATE 66

Run **57**

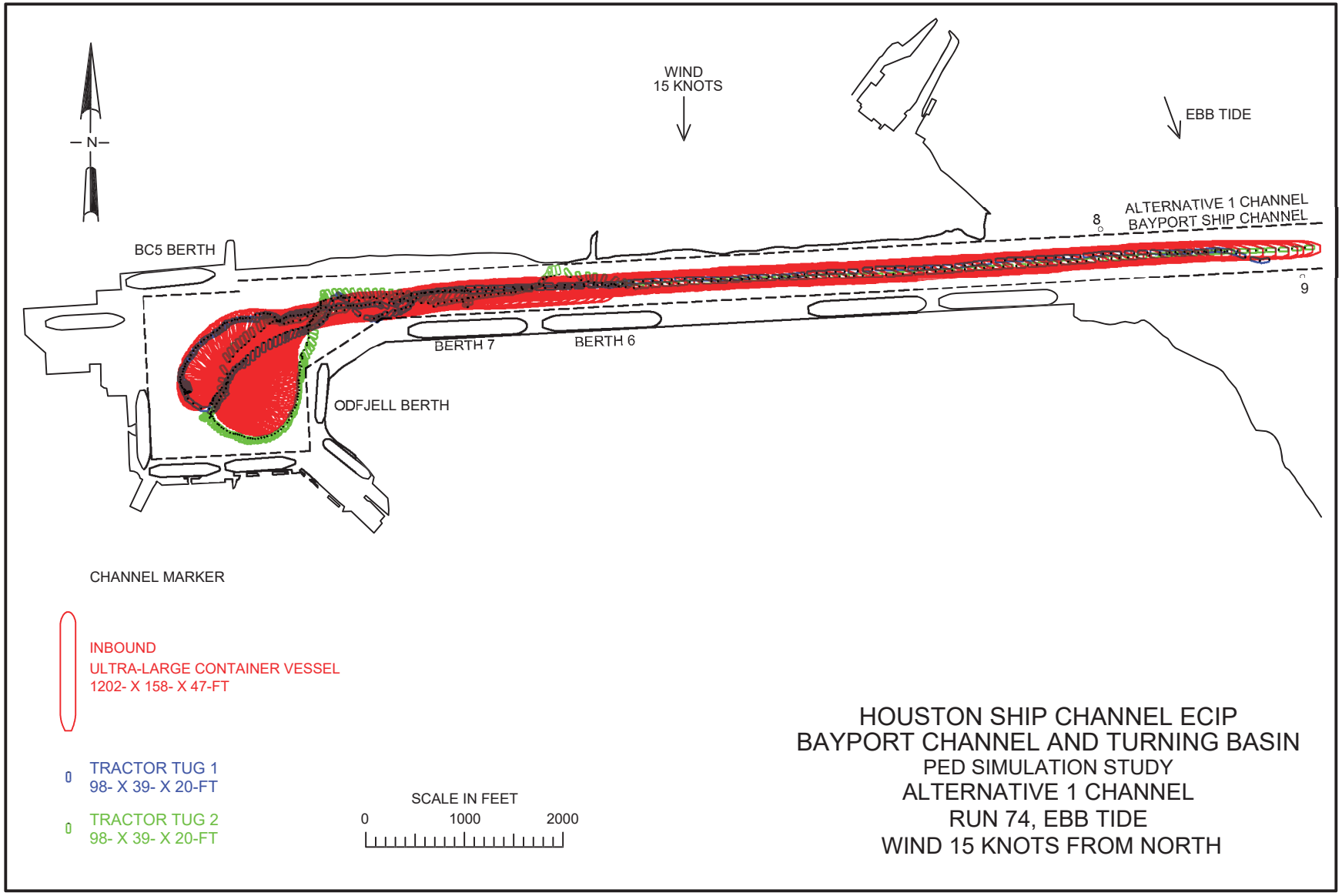
Purpose	Enter Bayport and Turn in Updated Turning Basin. Two instructor controlled tugs.
Date	5/22/2020
Start Time	1345
End Time	1435
Plan	BS-A1
Current	0
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	271/3	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
A	Inbound	Difficult	Yes	It is a normal operation but the wind affected the vessel.	Yes	Turning into the basin was more difficult due to the wind on the starboard quarter. However, 15 knot wind was manageable as long as the pilot catches the wind early enough.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
H - MZ7505	Normal	Yes	No	No	Yes		



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 74, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 67

Run **74**

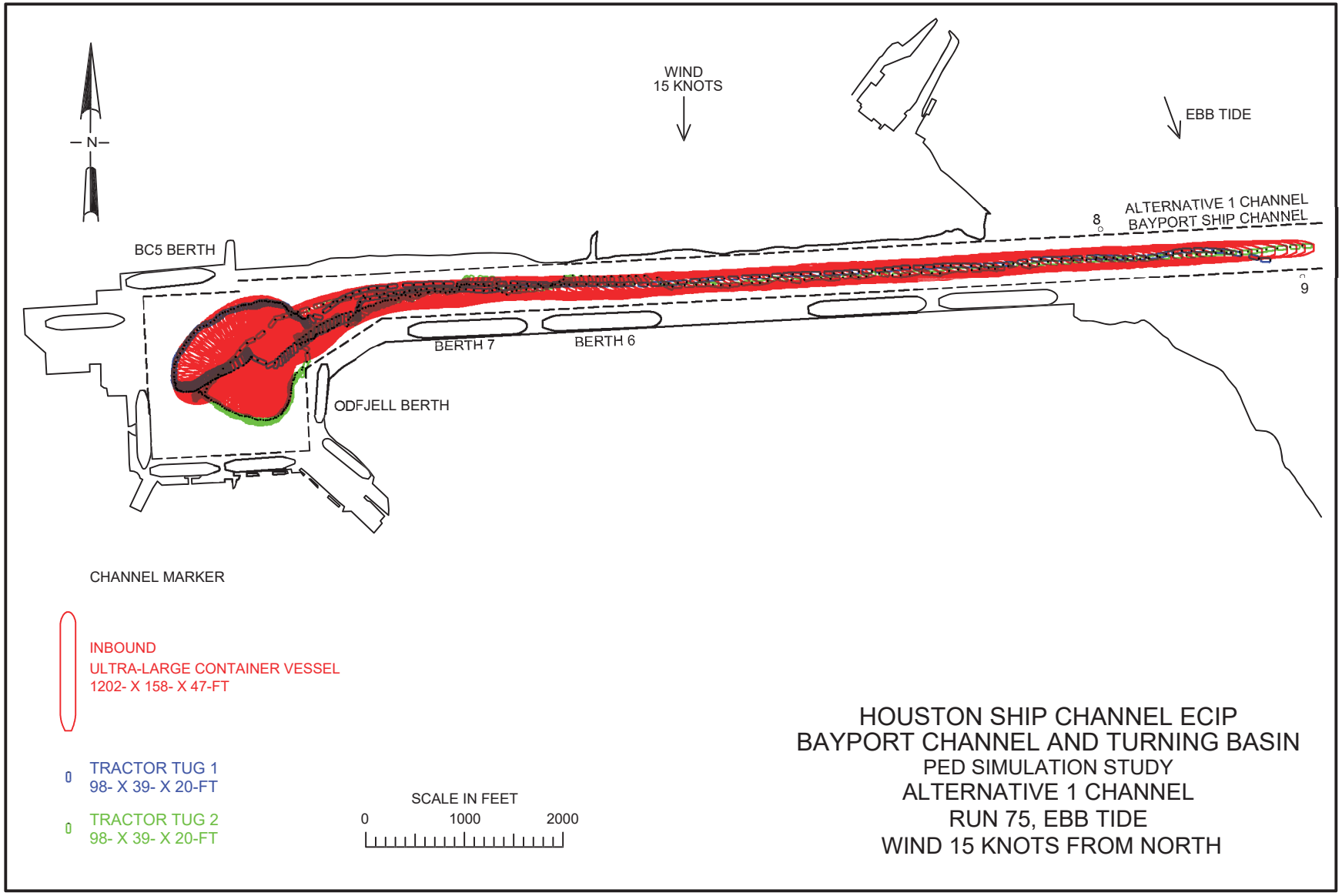
Purpose Turn in updated Turning Basin.
Two instructor controlled tugs invisible on the starboard side till the vessel entered the basin to simulate real life situation. Track plots will be shown during the entire run.
Date 6/2/2020
Start Time 1310
End Time 1405
Plan BS-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/15
Tugs 4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	270/3.5	Cruise Terminal

Run Comments
Instructor tugs released while the vessel was in the flare exiting the turning basin due to not being needed.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
M	Inbound	Difficult	Yes	Wind from the north causes the pilot to use more tug power to fight the wind.	Yes	Pilot would hold the vessel further to the north if he did it again so that he could use the tugs to slow down rather than hold him against the wind. Pilot also noted he would of like to keep the two starboard tugs when exiting the basin.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		Plenty of room during the manuever.
2 - MS7505	Normal	Yes	No	No	Yes	Not a unreasonable amount of power but did use a lot of power during the manuever.	Pilot did give different commands towards the end of the manuever to try new technicques. This did make it a little harder for the tugmaster and approached being difficult rather than normal.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 75, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 68

Run **75**

Purpose	Turn in updated Turning Basin. Two instructor controlled tugs invisible on the starboard side till the vessel entered the basin to simulate real life situation. Track plots will be shown during the entire run.
Date	6/2/2020
Start Time	1420
End Time	1525
Plan	BS-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	270/3.5	Cruise Terminal

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
L	Inbound	Difficult	Yes	The north wind was moving the ship bodily sideways during the manuever making it more difficult.	Yes	Tugs were in good position and utilized by the pilot when he needed help checking up due to the wind. Pilot noted that he would prefer a slower speed coming out of the turning basin but due to the wind he speed up so that he could maintain better control.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		Stayed in deep water and not put in any hazardous situation.
2 - MS7505	Normal	Yes	No	No	Yes		Tugmaster noted that this was the smoothest run of the day for his usage.

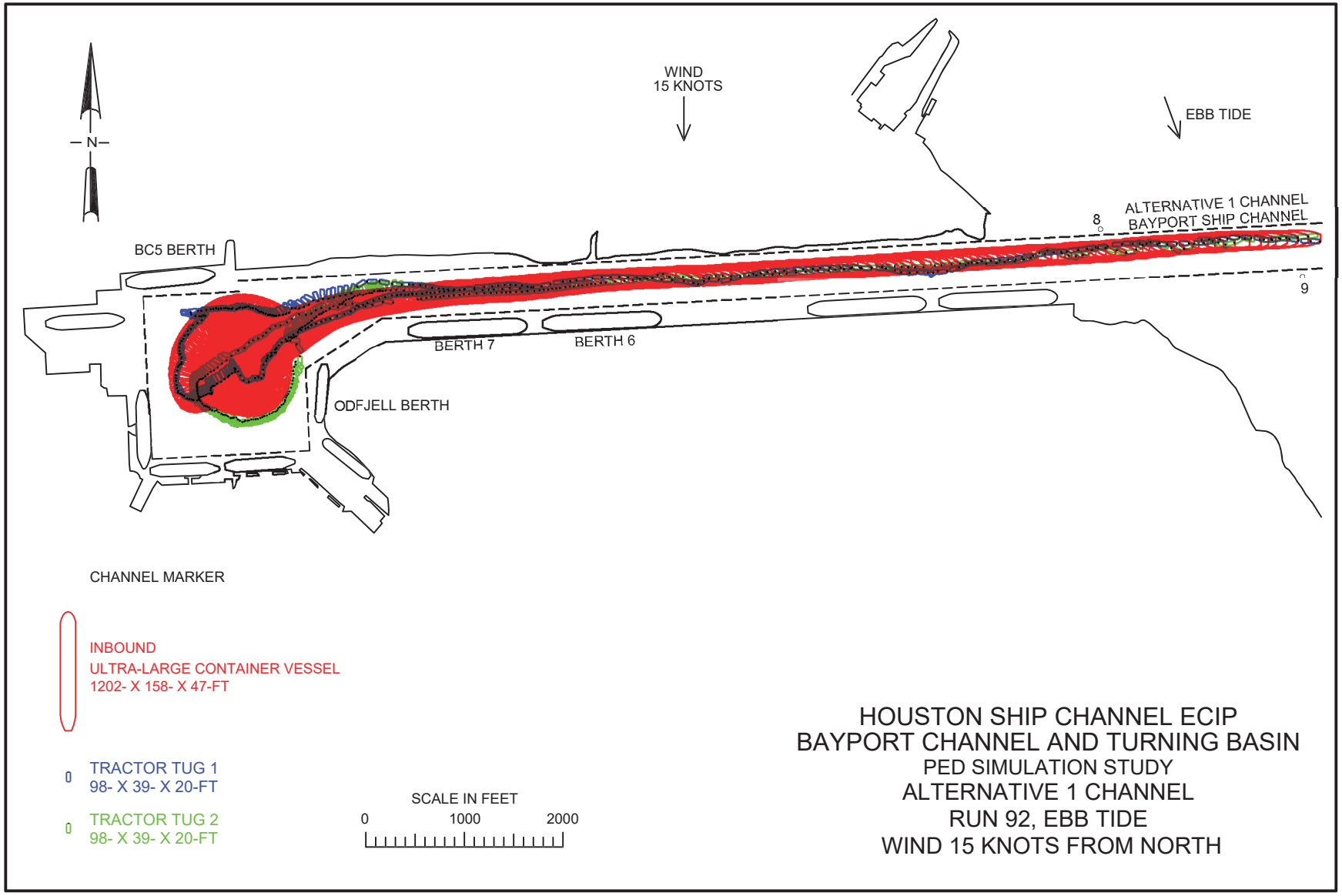

N
WIND
15 KNOTS
EBB TIDE
ALTERNATIVE 1 CHANNEL
BAYPORT SHIP CHANNEL
8
9
BC5 BERTH
BERTH 7
BERTH 6
ODFJELL BERTH
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 92, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 69

Run **92**

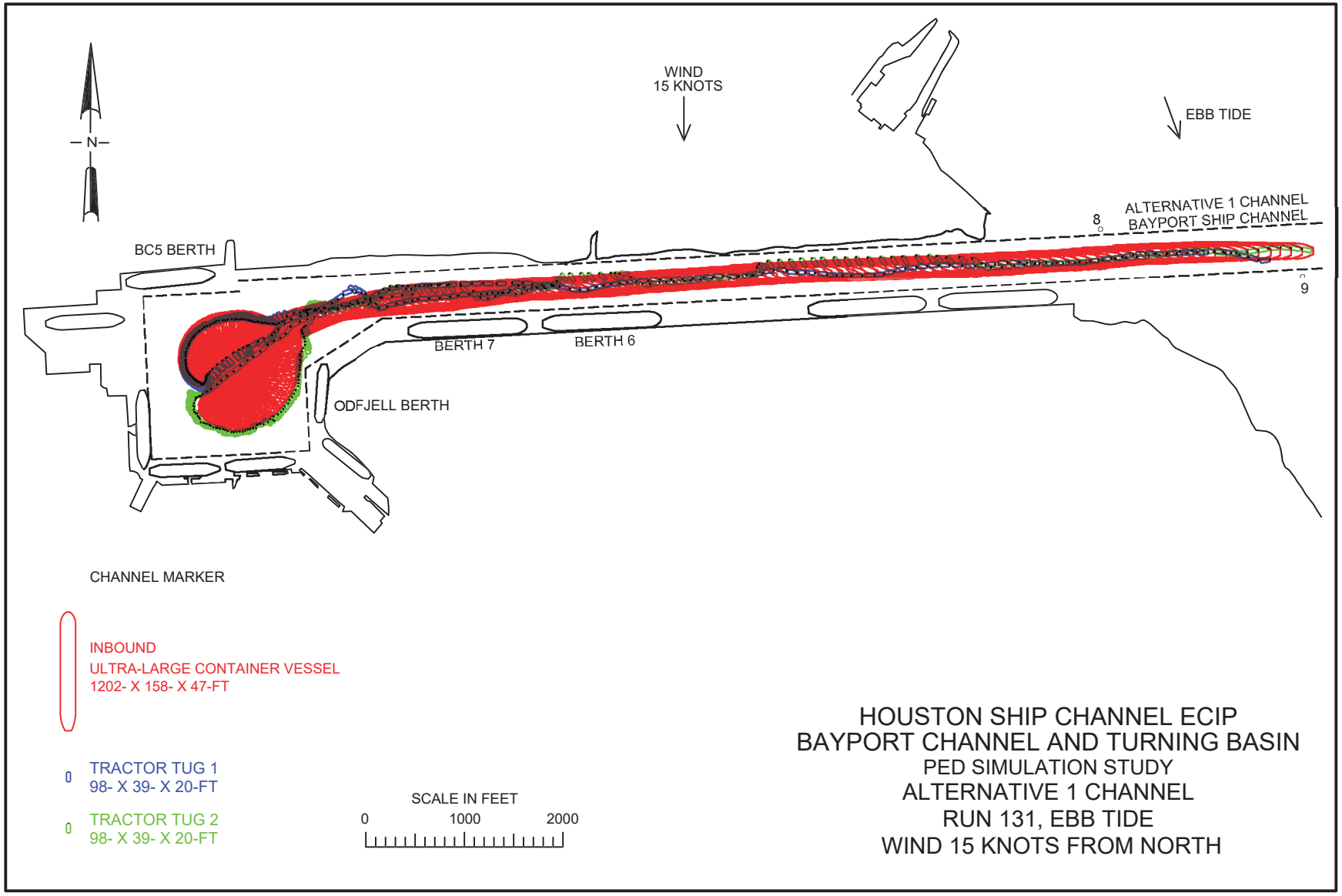
Purpose	Turn in Bayport Turning Basin. One instructor controlled tug.
Date	6/4/2020
Start Time	1015
End Time	1120
Plan	BS-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	271/5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
A	Inbound	Diffuclt	Yes	The manuever is difficult because it is tight in the turning basin for a 1200' vessel. There is room but tough.		Yes	Fighting the north wind and ensuring the bow is into the wind during the time. Pilot felt comfortable with 3 tugs, no need for the 4th due to the wind conditions.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MS7505	Normal	Yes	No	No	Yes		Vessel got a little close to the boundary line but the tug was never in danger or out of the federal channel.
2 - MS7505	Normal	Yes	No	No	Yes		



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 131, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 70

Run **131**

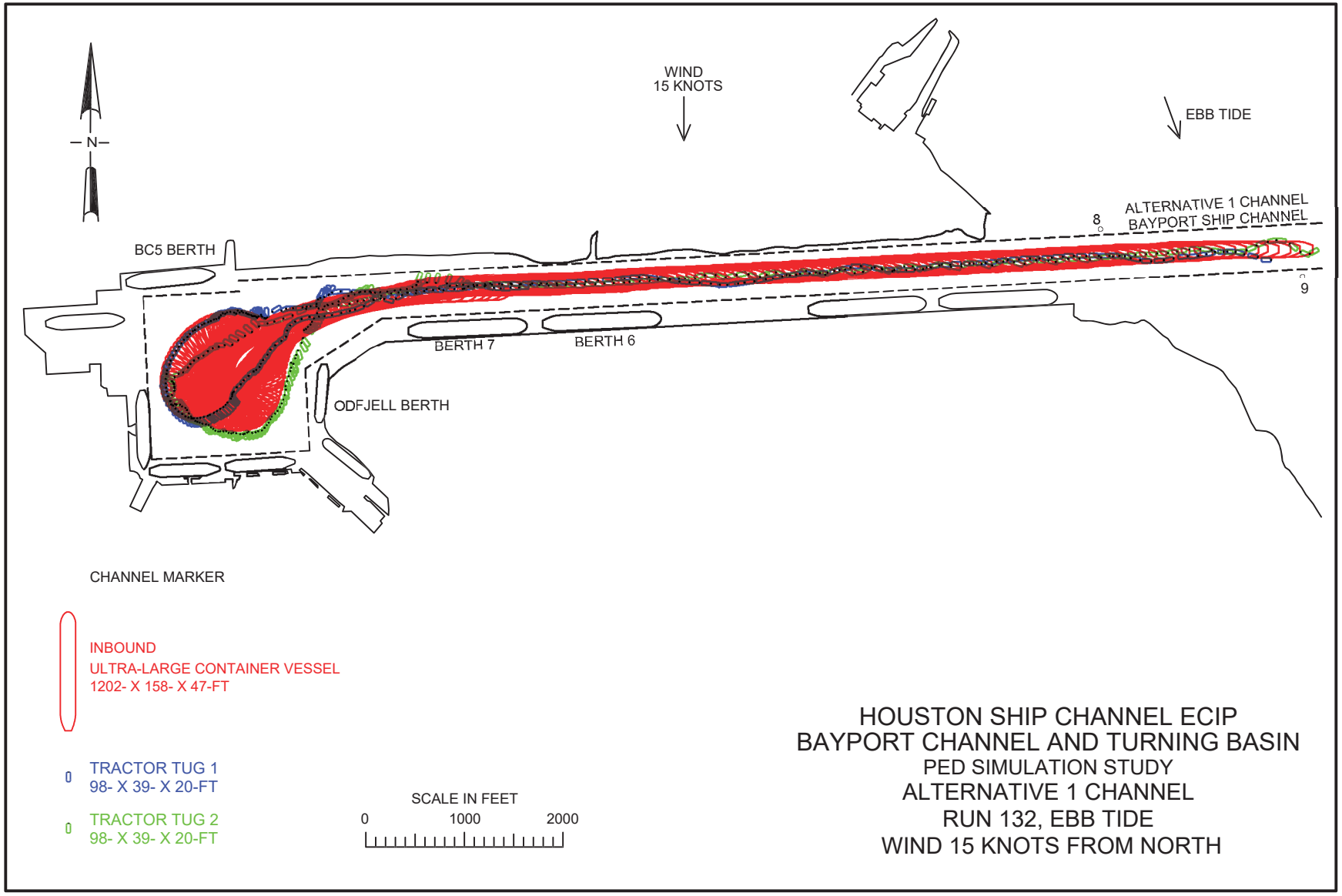
Purpose	Turn in Bayport Turning Basin. Two instructor controlled tug.
Date	6/9/2020
Start Time	1115
End Time	1210
Plan	BS-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	269/4	Cruise Terminal

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
A	Inbound	Difficult	Yes	Big ship in a small turning basin with wind on the beam. Plenty of room to do it but not easy.	Yes	Pilot made the turn too soon so the stern was closer to the dock on the south side than he wanted.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Stayed in safe water and was not overworked. Normal job for this tug.
2-MS7505	Normal	Yes	No	No	Yes		PIlot noted that he turned short, however the tug captain said that there was adequate room for him on the stern.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 132, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 71

Run **132**

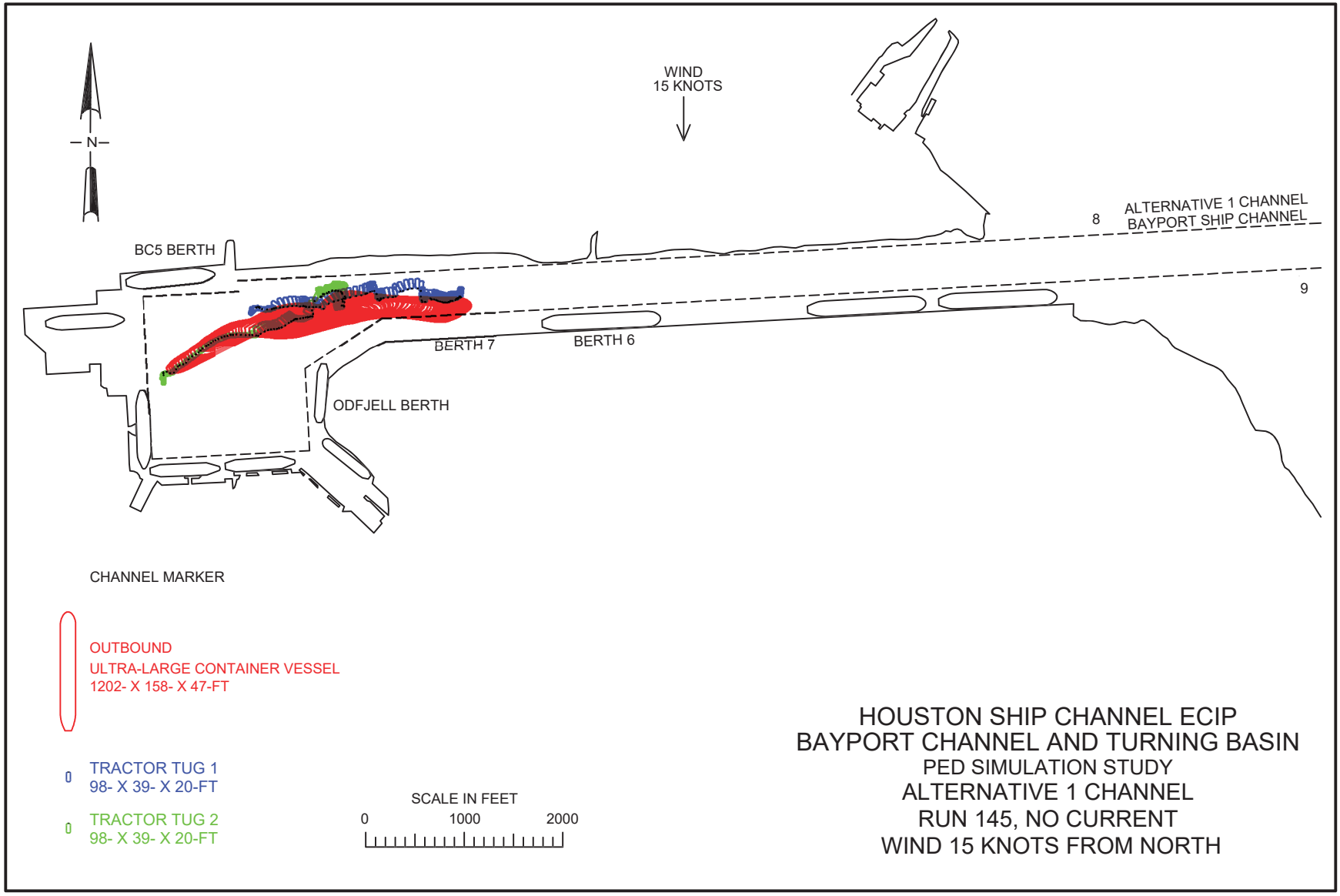
Purpose	Turn in Bayport Turning Basin. Two instructor controlled tug.
Date	6/9/2020
Start Time	1310
End Time	1405
Plan	BS-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	269/4	Cruise Terminal

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
J	Inbound	Difficult	Yes	You have to aim north when coming into the turning basin due to the wind. Aiming north in the basin makes you crowd the docks on the north so you really have to watch your location.	Yes	Rotating around 12 degrees/minute is ideal as it allows you to beable to stop before exiting the basin. Four tugs makes this manuever a lot more safe and doable.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes	Everything was safe and like a normal manuever.	While exiting the basin the tug did get a little close to the docks but had plenty of room. Still remained in the federal channel and stayed in deep water.
2-MS7505	Normal	Yes	No	No	Yes		This run gave the stern tug the most space while in the turning basin compared to all other runs. He was able to use less power for shorter amounts of time.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 145, NO CURRENT
WIND 15 KNOTS FROM NORTH

PLATE 72

Run **145**

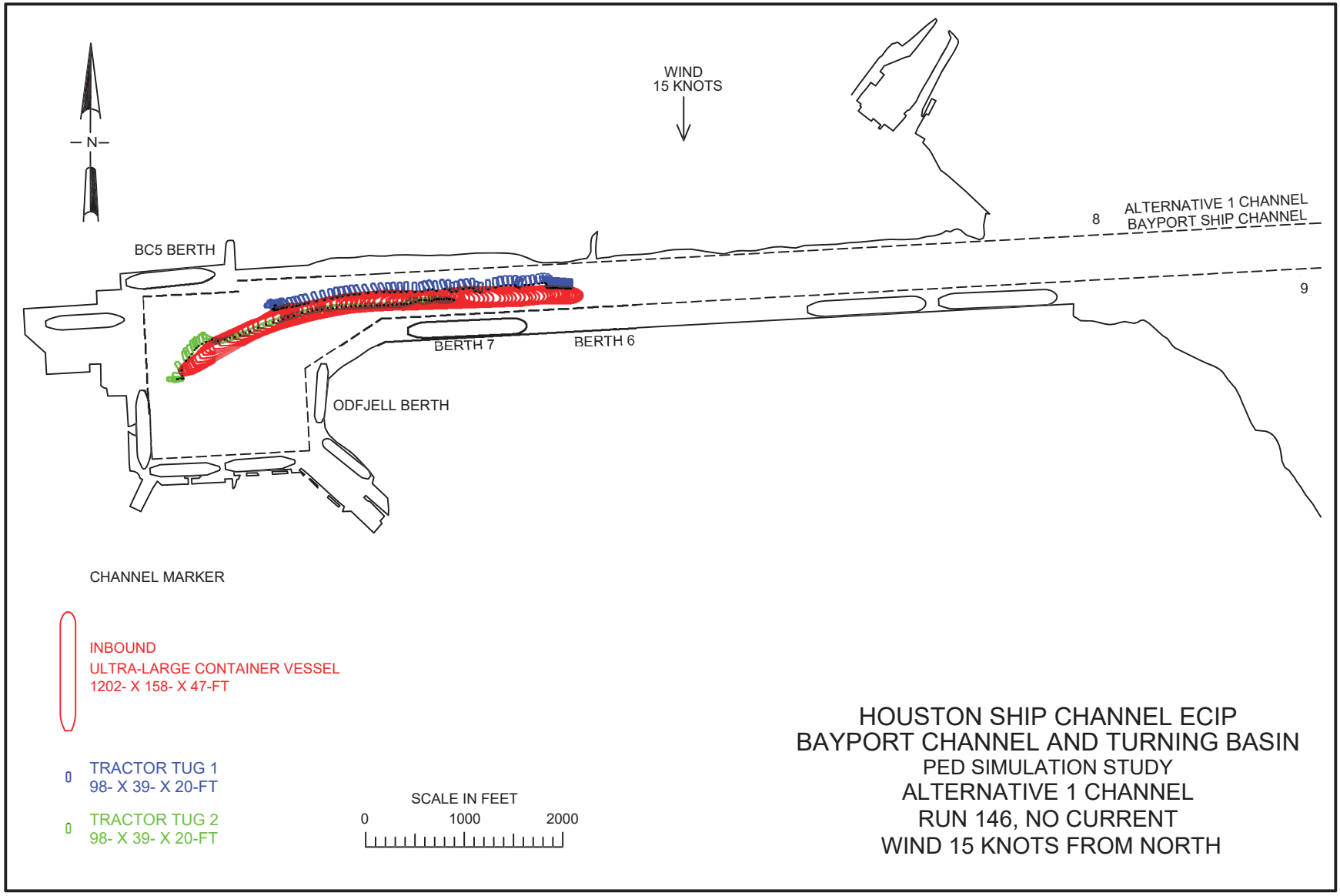
Purpose	Exiting the turning basin and berthing at dock 7. One instructor controlled tug.
Date	6/10/2020
Start Time	1535
End Time	1555
Plan	BS-A1
Current	0
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	062/1	Turning Basin

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Outbound	Difficult	Yes	At a slow speed with 15 knot wind, you have to use the tug boats to muscle the ship to get it to do what you want. The shallow water proximity to the dock 7 makes it more difficult because you have to manuever out of the turning basin and then move back down into			The area east of dock 7 should be dretched so that you can approach the dock easier from the basin rather than exiting the basin and coming back south to the berth. The extra space on the east would allow the tugs to remain in deep water while assiting the vessel.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes	Bow tug did get close to the channel but accounted for it and brought line in so that he remained in the federal channel.	He was able to remain in deep water and in a safe area during the manuever.
2-MS7505	Normal	Yes	No	No	Yes	There is no margin for error in this manuever.	The vessel barely fit with the tug on the bow and stern, and left little space for the tugs to work in (Less than 40 ft for the bow and stern tug each to work with.)



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 146, NO CURRENT
WIND 15 KNOTS FROM NORTH

PLATE 73

Run **146**

Purpose	Exiting the turning basin and berthing at dock 6. Two instructor controlled tugs.
Date	6/10/2020
Start Time	1605
End Time	1625
Plan	BS-A1
Current	0
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	060/1	Turning Basin

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Outbound	Normal	Yes	The pilot was able to maintain control by using the tugs to check the vessel against the wind.			Berthing at this dock is easier then dock 7 because the pilot was able to increase his speed slightly to overcome the weather conditions before slowing down to dock. The pilot did note that he was concerned about the closeness to the ship at dock 7 and he had to use a lot of tug power to overcome the north wind.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes	Bow tug was able to remain in safe water during the manuever.	
2-MS7505	Normal	Yes	No	No	Yes		More space in this area to dock than 7.

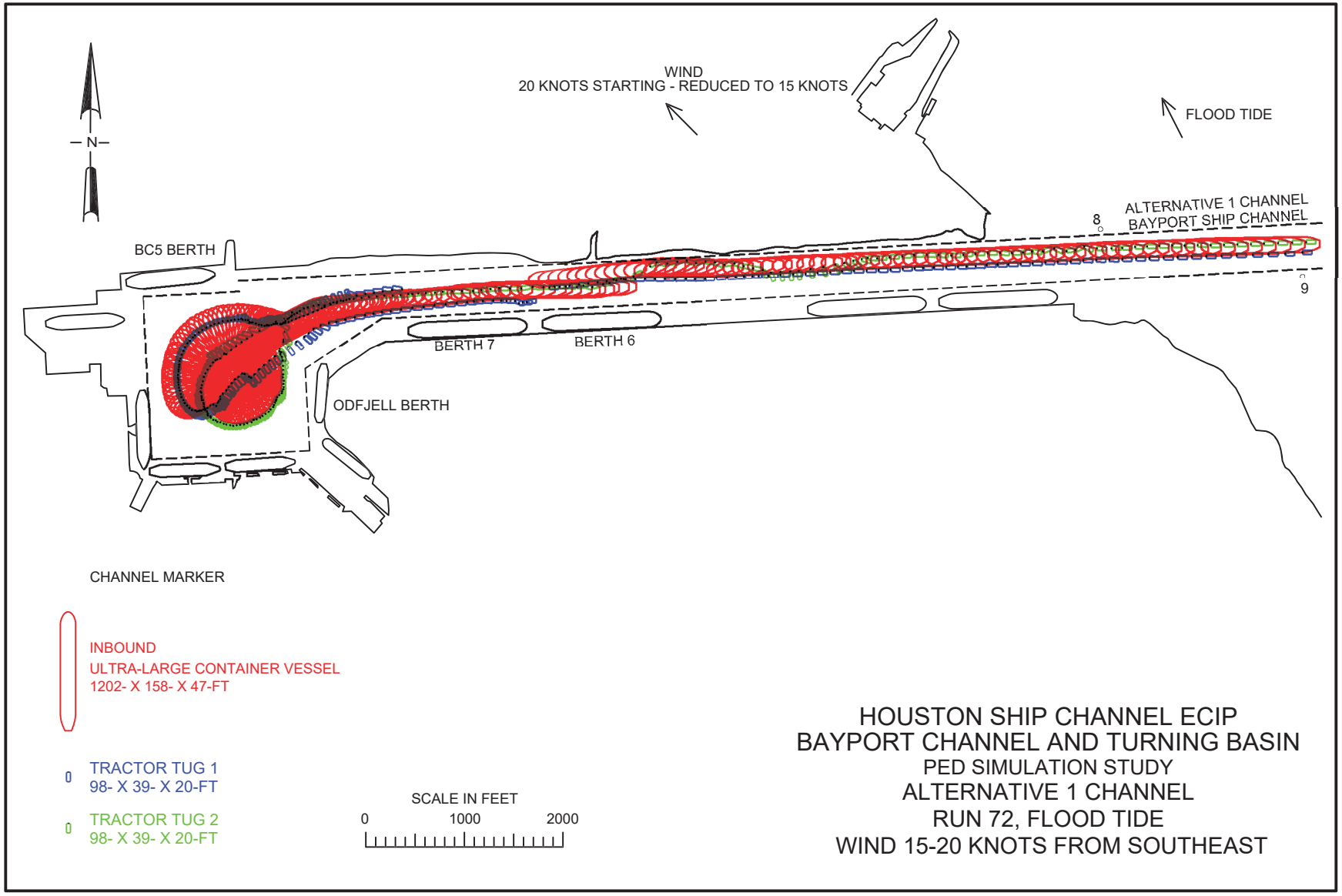

N
WIND
20 KNOTS STARTING - REDUCED TO 15 KNOTS
FLOOD TIDE
ALTERNATIVE 1 CHANNEL
BAYPORT SHIP CHANNEL
8
9
BC5 BERTH
BERTH 7
BERTH 6
ODFJELL BERTH
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 72, FLOOD TIDE
WIND 15-20 KNOTS FROM SOUTHEAST

PLATE 74

Run **72**

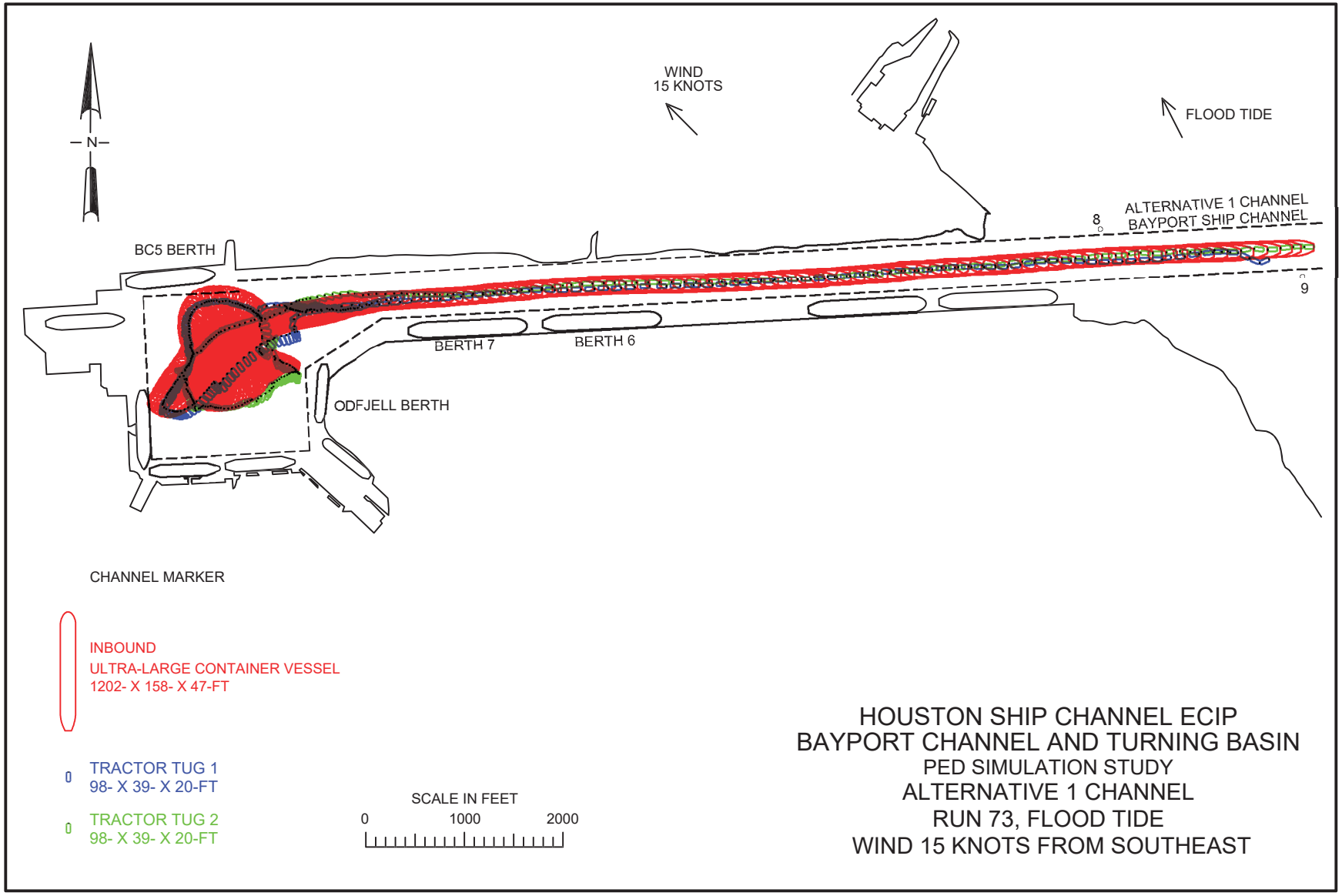
Purpose	Enter Bayport and turn in updated Turning Basin. Pilot made a decision to put a tug on the Port bow rather than through the stem like previous runs
Date	6/2/2020
Start Time	0905
End Time	1025
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/20
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	325/8	73-74

Run Comments
Decreased wind to 15 knots once in the terminal. 15 knots will be used as the maximum wind speed for the remaining runs in this area. Starboard quarter insturcot controlled tug bailled out during the run due to lack of space. Track plot will still show for the tug but it was not visible. Vessel's stern went outside of the federal channel prior to entering the turning basin. Simulation paused and repositioned vessel to center of channel to make the turn in the basin.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
L	Inbound	Difficult	Yes	Size of the vessel in the turning basin make the simulation difficult but it is something that can be done.	Yes	Wind did affect the vessel by pushing the stern close to the bank on the north side. Could of utilized the tugs differently during this time. Hugged the green side while turning into the terminal to offset the wind. Pilot let the ship advance further into the flare at the turning basin to decrease the degree of turn. Did use a half bell while leaving the turning basin.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Believes it would have been safer for the tug to have been located through the stem.	Got close to federal channel line while turning into the terminal but not in danger. Would have been able to operate through the stem during the simulation but while turning into the terminal the vessel speed would have been at the top end of there ideal speed.
2 - MS7505	Easy	Yes	No	No	Yes		Tugmaster does not feel like he was utilized well. Could of been used differently while entering the terminal and helped to pull the vessel away from the bank due to the wind.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 73, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 75

Run **73**

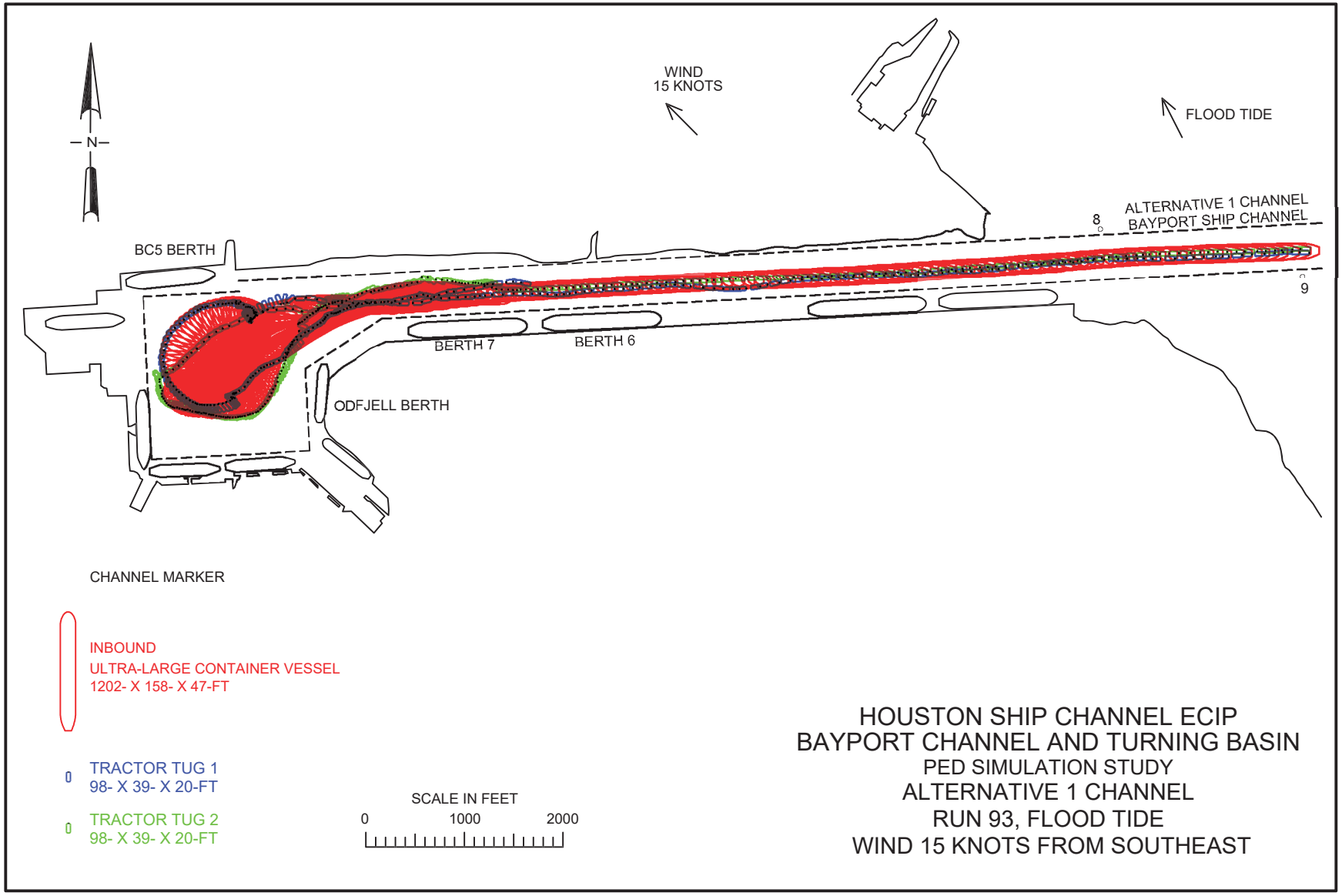
Purpose	Turn in updated Turning Basin. Two instructor controlled tugs invisible on the starboard side till the vessel entered the basin to simulate real life situation. Track plots will be shown during the entire run.
Date	6/2/2020
Start Time	1150
End Time	1255
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	268/3.5	Cruise Terminal

Run Comments
Vessel hit LBC 2 while in the turning basin. Continued run to finish the turn and exit basin. Vessel exited the federal channel in the north side of the basin. Instructor tugs were not used by the pilot during run.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
K	Inbound	Difficult	Yes	Extremely large ship in a small area makes it difficult.	Yes	Should have started the turn earlier and backed a little sooner. Pilot error during the manuever and inexperience with the vessel in the simulator is the reasoning for hitting the vessel berthed at LBC 2, not because the situation is unsafe.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		
2 - MS7505	Easy	Yes	No	No	Yes		Tugmaster feels like he wasn't utilized to his full ability.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 93, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 76

Run **93**

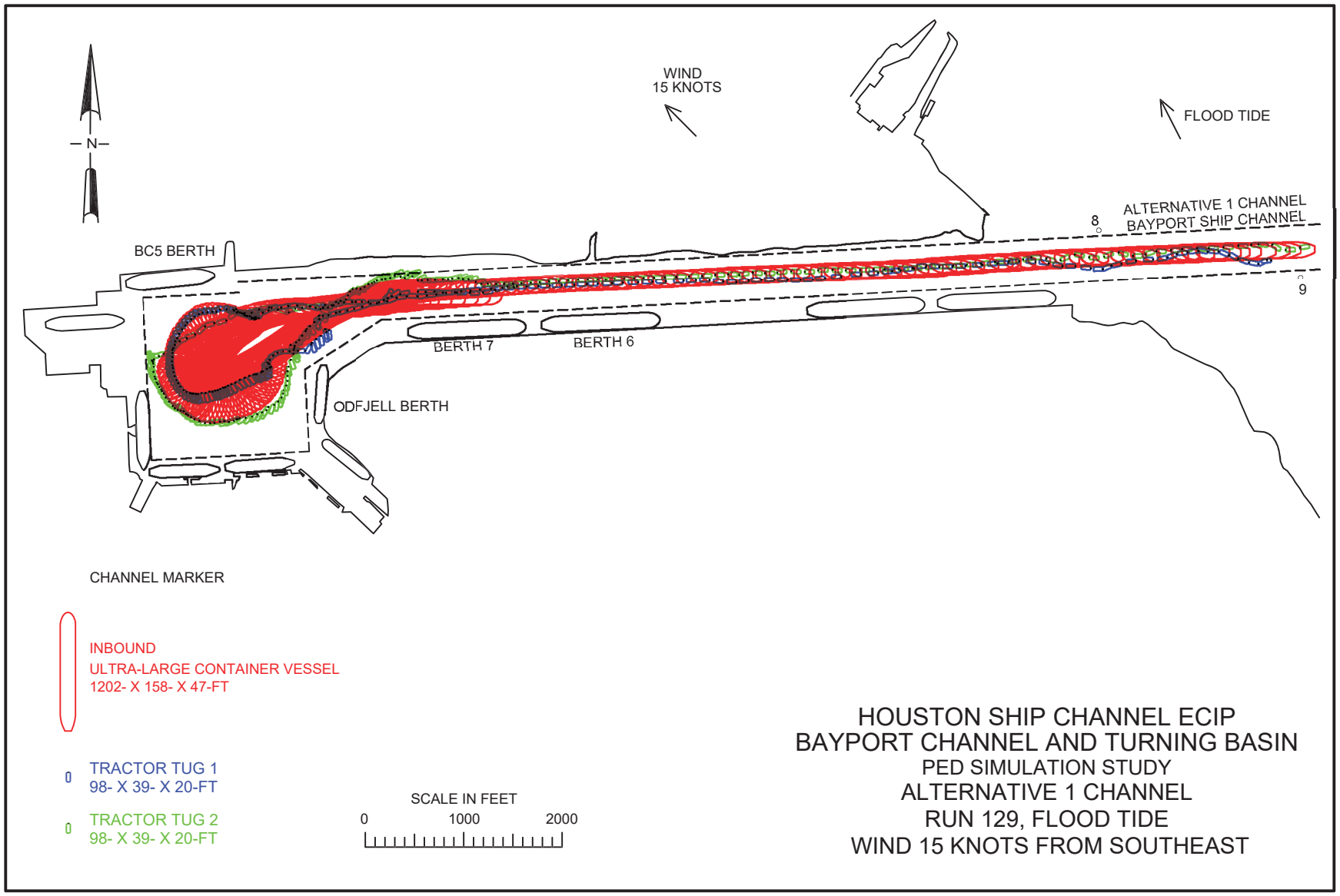
Purpose	Turn in Bayport Turning Basin. One instructor controlled tug.
Date	6/4/2020
Start Time	1205
End Time	1310
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	267/5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Plenty of room in the basin for a vessel this size.		Yes	Wind was felt and caused the pilot to adjust steering accordingly. The hardest part with the environmental conditions was lining back up to come out of the basin.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MS7505	Normal	Yes	No	No	Yes	Good speed and stayed in deep water.	Bow tug is in an very safe location and has no concerns in this area.
2 - MS7505	Normal	Yes	No	No	Yes		A lot of power but not unrealistic for the environmental conditions and vessel size.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 129, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 77

Run **129**

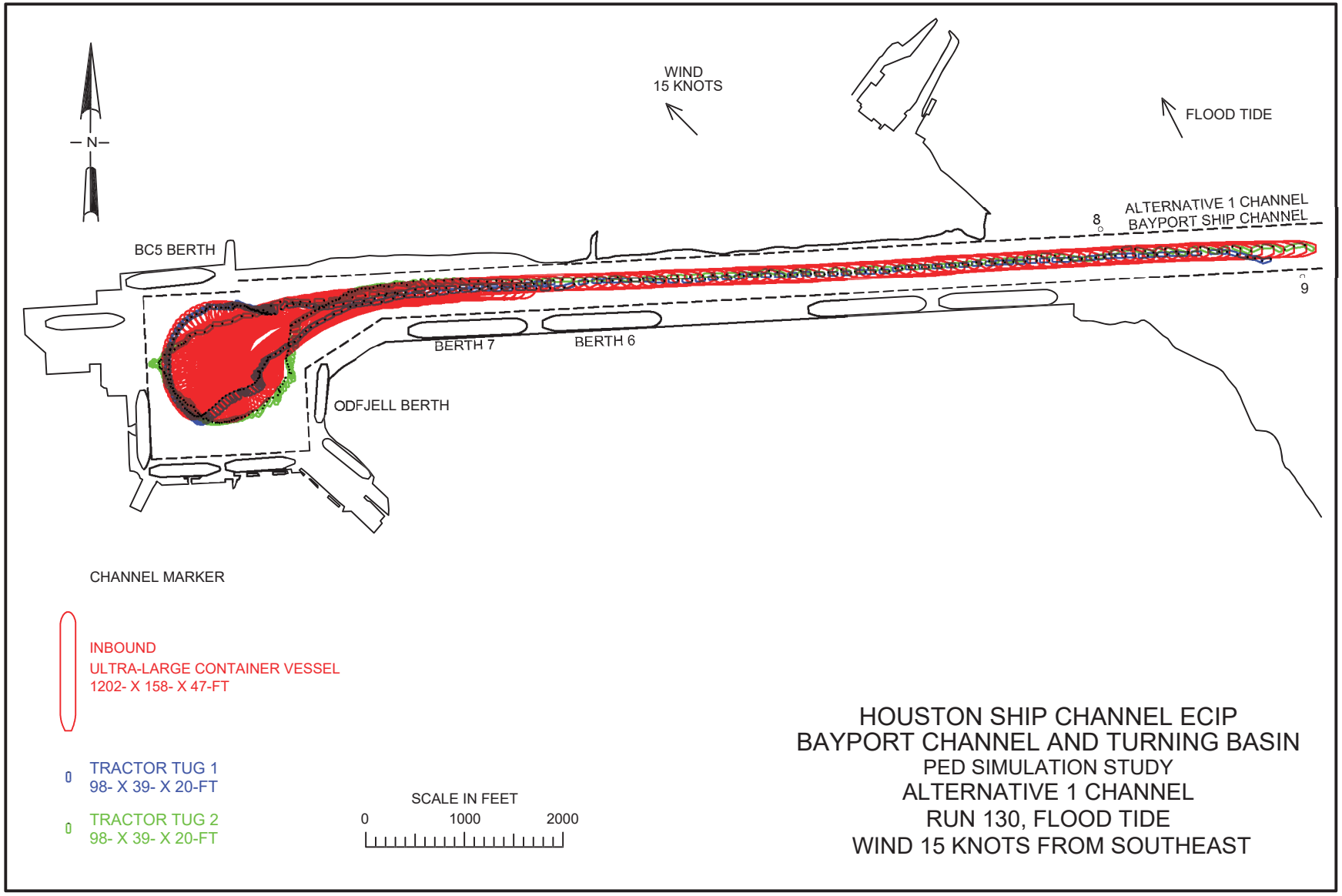
Purpose	Turn in Bayport Turning Basin. Two instructor controlled tug.
Date	6/9/2020
Start Time	0900
End Time	0955
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	269/4	Cruise Terminal

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
D	Inbound	Normal	Yes	There is plenty of room in the turning basin to make a safe manuever with a vessel this size.	Yes	Pilot recommends 4 tugs is needed to make the process quicker and easier.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Textbook manuever for the bow tug. Stayed within 100 ft of the boundary line and in deep water the entire time.
2-MS7505	Normal	Yes	No	No	Yes		



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 130, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

Run **130**

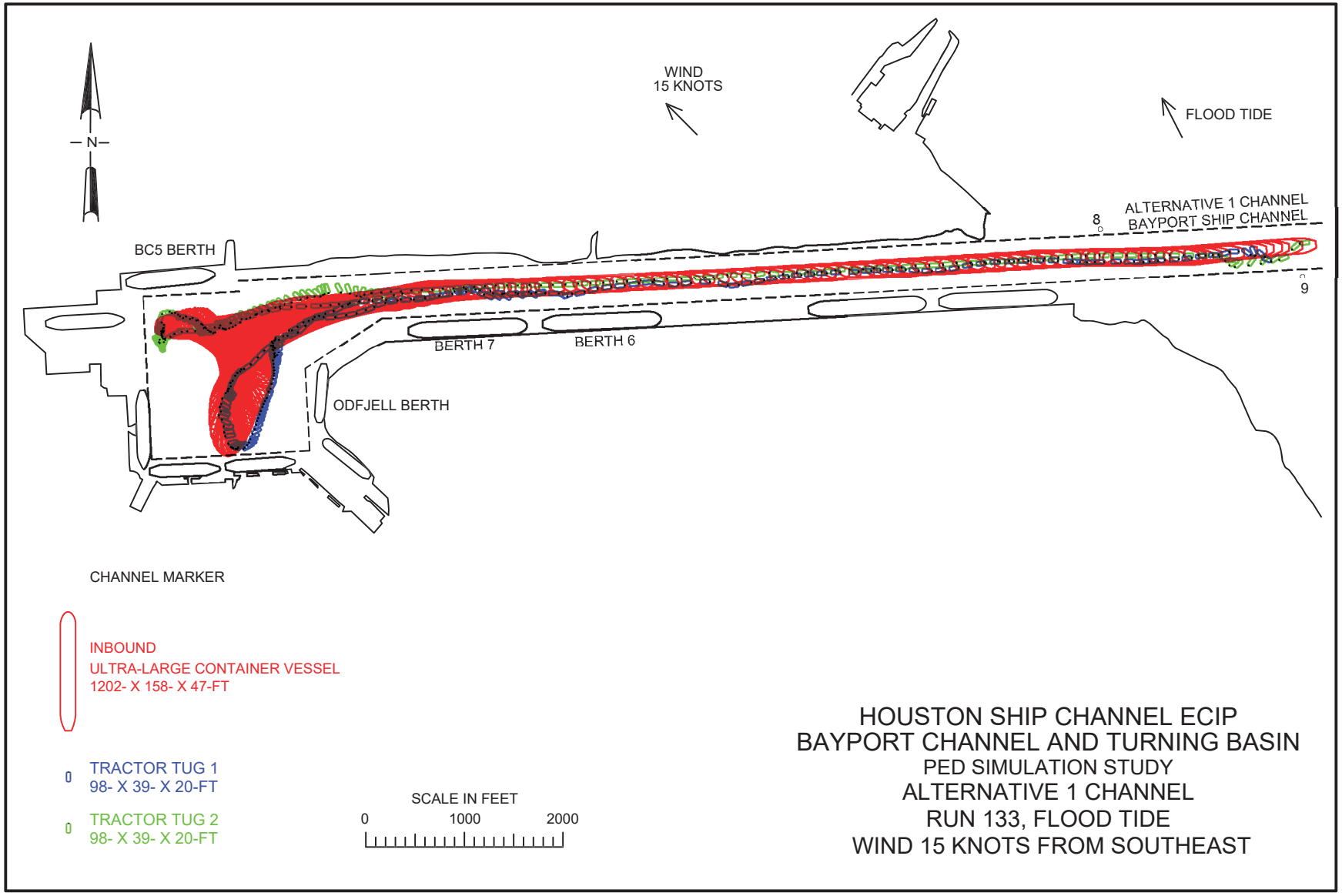
Purpose	Turn in Bayport Turning Basin. Two instructor controlled tug.
Date	6/9/2020
Start Time	1005
End Time	1105
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	269/4	Cruise Terminal

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
J	Inbound	Normal	Yes	Four tugs and maintaining a slow speed helps the manuever occur safely.	Yes	Keeping around 12 degrees/minute for the turn makes it easier to slow down and prepare for the exit.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Stayed in deep water and never got close to the federal channel line during the manuever.
2-MS7505	Normal	Yes	No	No	Yes		Everything was good.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 133, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

Run **133**

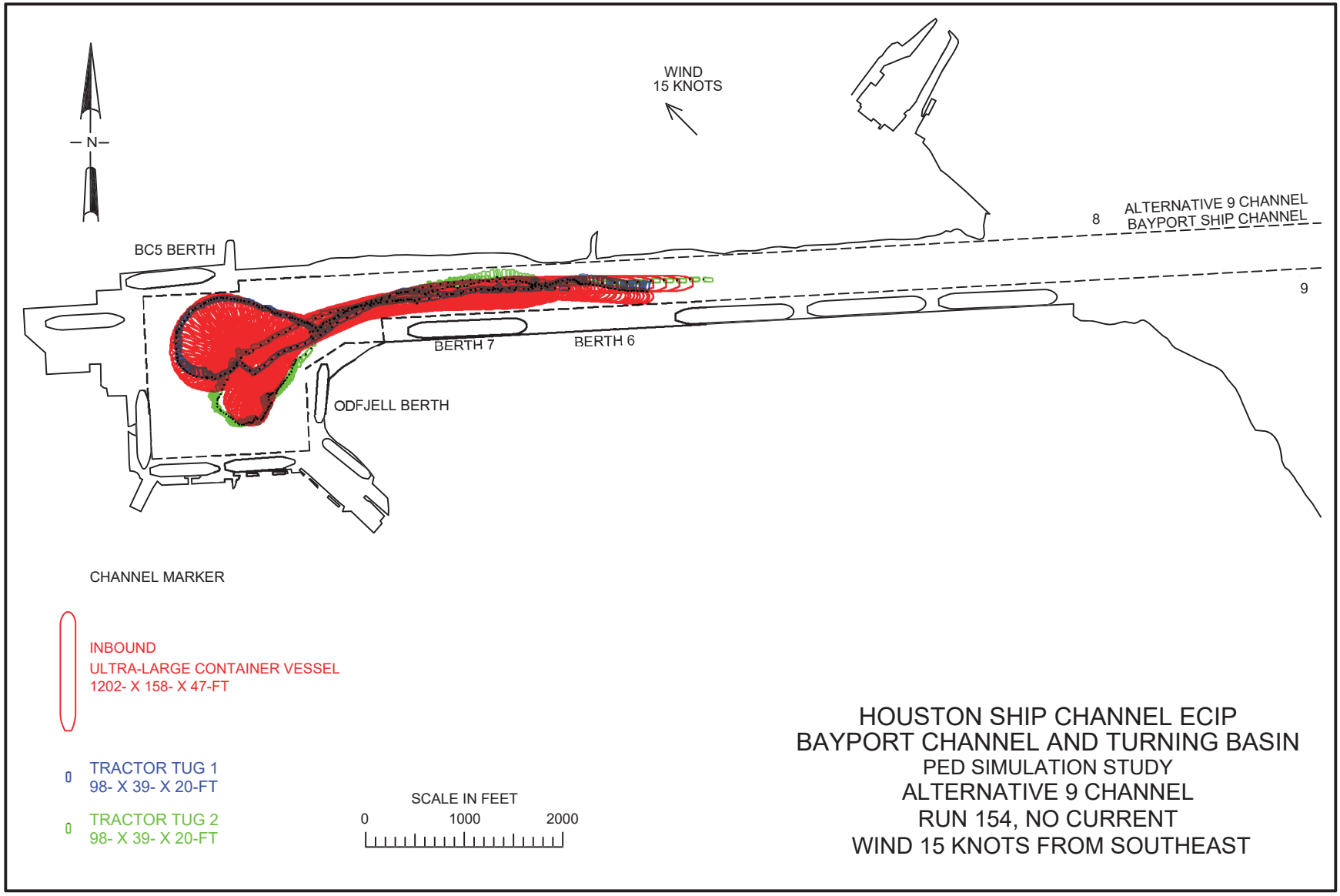
Purpose	Turn in Bayport Turning Basin. Two instructor controlled tug.
Date	6/9/2020
Start Time	1415
End Time	1505
Plan	BS-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	269/4	Cruise Terminal

Run Comments
Comments from tug operators show concern about tug positions in this area due to the idea of them starting to dock after turning in the basin and forcing the port quarter tug out of the federal channel and grounding. Recommendations is to change the port quarter tug to center line aft.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
O	Inbound	Difficult	Yes	Size of the vessel and the environmental conditions make this a difficult manuever.	Yes	Miscommincation while turning so the bow got close to LBC 1 but was able to recover. This was not due to the design of the turning basin, and the turn still occured succesffully without going outside of the federal channel.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		The bow did get close in the front but there was still space for the tug operate.
2-MS7505	Normal	Yes	No	No	Yes		Everything was like a normal operation.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 9 CHANNEL
RUN 154, NO CURRENT
WIND 15 KNOTS FROM SOUTHEAST

PLATE 80

Run **154**

Purpose	Turn in Bayport Turning Basin. Two instructor controlled tugs.
Date	6/11/2020
Start Time	1405
End Time	1450
Plan	BS-A9
Current	0
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	270/4	Berth 6

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
A	Inbound	Normal	Yes	The manuever is safe due to the amoun of room in the basin and having plenty o tug power to use.		Yes	Pilot started to turn the ship sooner when entering the terminal due to knowing about the extra deep water on the south side, however he did not use the additional water. He commented that the water made him feel more confident and increased his ability to handle a problem if one arose.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Stayed in deep water and out of harms way the entire time.
2-MS7505	Normal	Yes	No	No	Yes		Did get tight as the ship began making the approach to the dock. However, the tug captain said there was about 30 ft of space from the tugs stern to the ship so he did not feel like he was in an unsafe position.

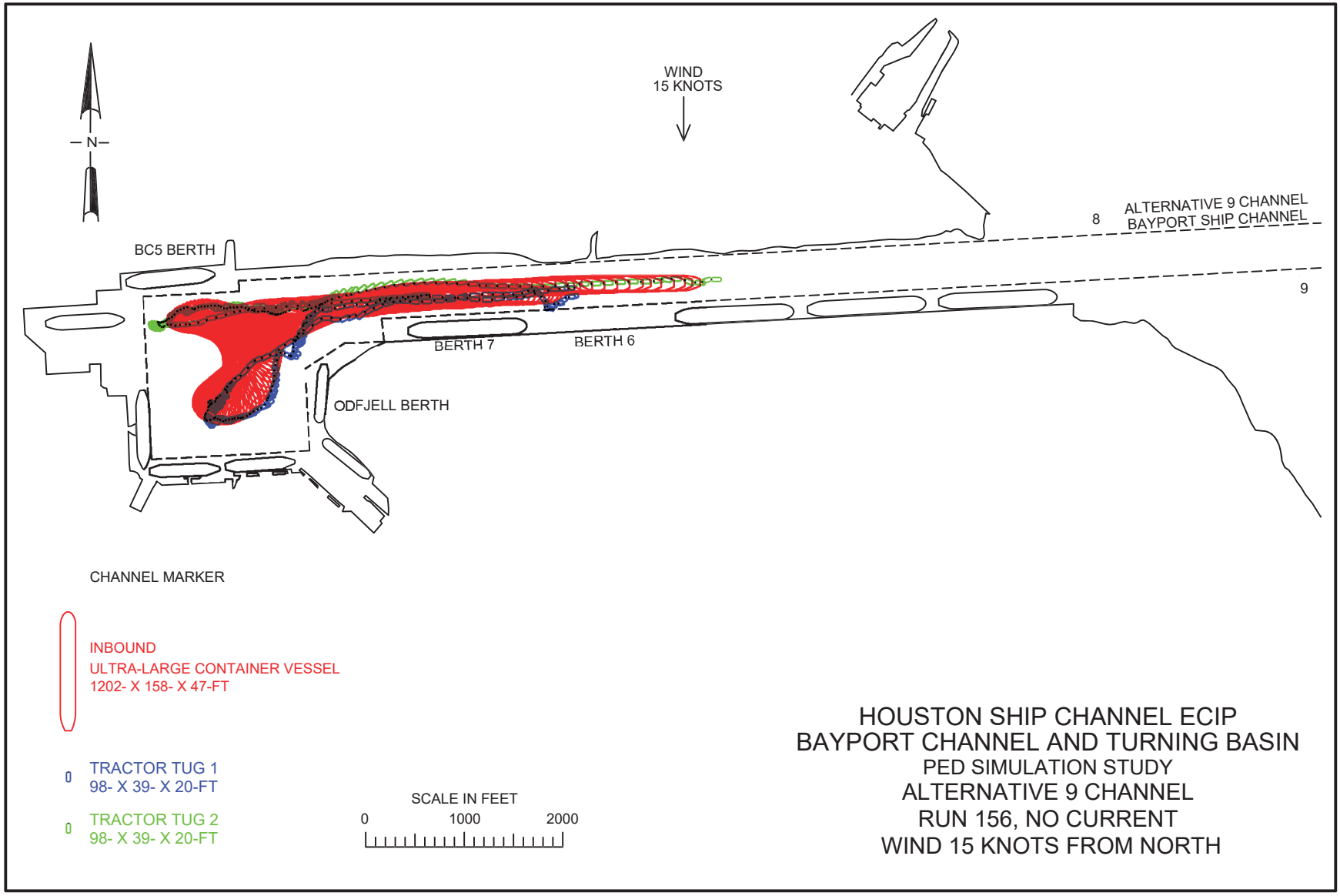

N
WIND
15 KNOTS
8
ALTERNATIVE 9 CHANNEL
BAYPORT SHIP CHANNEL
9
BC5 BERTH
BERTH 7
BERTH 6
ODFJELL BERTH
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 9 CHANNEL
RUN 156, NO CURRENT
WIND 15 KNOTS FROM NORTH

PLATE 81

Run **156**

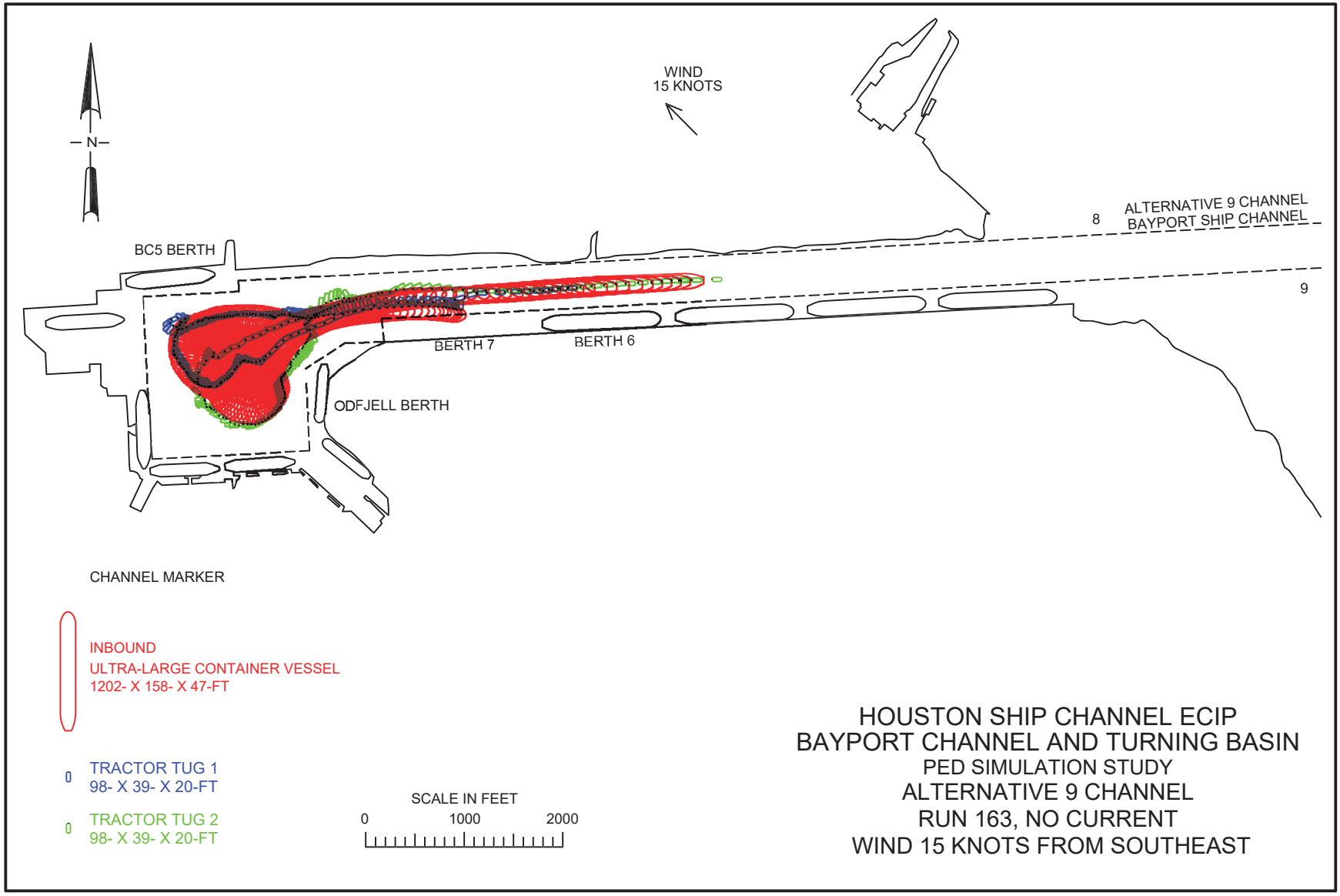
Purpose	Turn in Bayport Turning Basin. Two instructor controlled tugs.
Date	6/11/2020
Start Time	1555
End Time	1640
Plan	BS-A9
Current	0
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	270/4	Berth 6

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Inbound	Normal	Yes	There is plenty of room as long as you keep a focus on the wind and how it is moving the ship.		Yes	Pilot went a little further to the west before making the turn compared to the last run. South wind helped line up the ship when exiting the basin.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		The tug was never put in shallow water and never worked over half.
2-MS7505	Normal	Yes	No	No	Yes		Had good water during the entire manuever.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 9 CHANNEL
RUN 163, NO CURRENT
WIND 15 KNOTS FROM SOUTHEAST

Run **163**

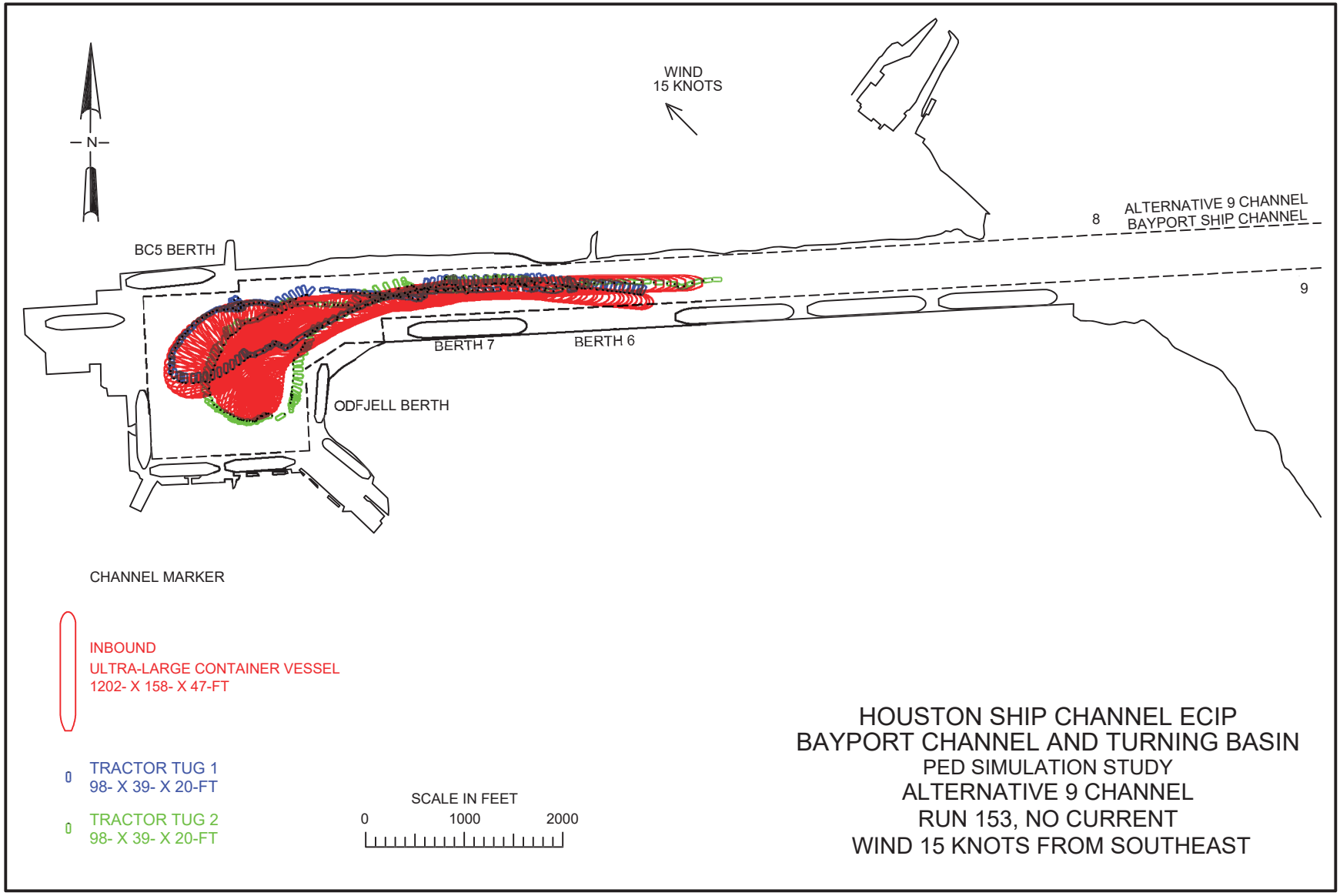
Purpose	Turn in Bayport Turning Basin and dock at Berth 7 Two instructor controlled tugs.
Date	6/12/2020
Start Time	1340
End Time	1425
Plan	BS-A9
Current	0
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	268/4	Berth 6

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	TB Turn Safe	Comments
A	Inbound	Diffcult	Yes	Pilot had to use the tugs at full capacity. There is plenty of room to complete the turn but till they get use to working with a vessel this size it will be difficult.	Yes	Bow started swinging too fast so it was harder to check up and striaghten out when leaving. The opened flare to dock at 7 makes it easier to be able to see the area and not worry about the wind.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Stayed in deep water and did not feel that he was used excessively.
2-MS7505	Normal	Yes	No	No	Yes		Tug does not feel like he was overused and used as needed for a vessel this size.



HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 9 CHANNEL
RUN 153, NO CURRENT
WIND 15 KNOTS FROM SOUTHEAST

Run **153**

Purpose	Turn in Bayport Turning Basin. Two instructor controlled tugs.
Date	6/11/2020
Start Time	1310
End Time	1350
Plan	BS-A9
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	270/4	Berth 6

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
O	Inbound	Difficult	Yes	The wind and the size of the vessel make it hard. No room for mistakes in a situation like this.		Yes	The south bank being opened was nice to have due to the wind conditions.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		At the end of the turn, the tug did get close to the edge of the federal channel on the north side but he felt like h still had room. The tug also got close to the bank when passing dock 7.
2-MS7505	Difficult	Yes	No	No	Yes	Stern of the tug did not get closer than 20 ft to the channel line, felt like there was plenty of room to operate.	The tug captain was asked to do a manuever but the ship was going to fast to perform the manuever. Tug was not as effective as it could have been due to this and not being able to use full force.

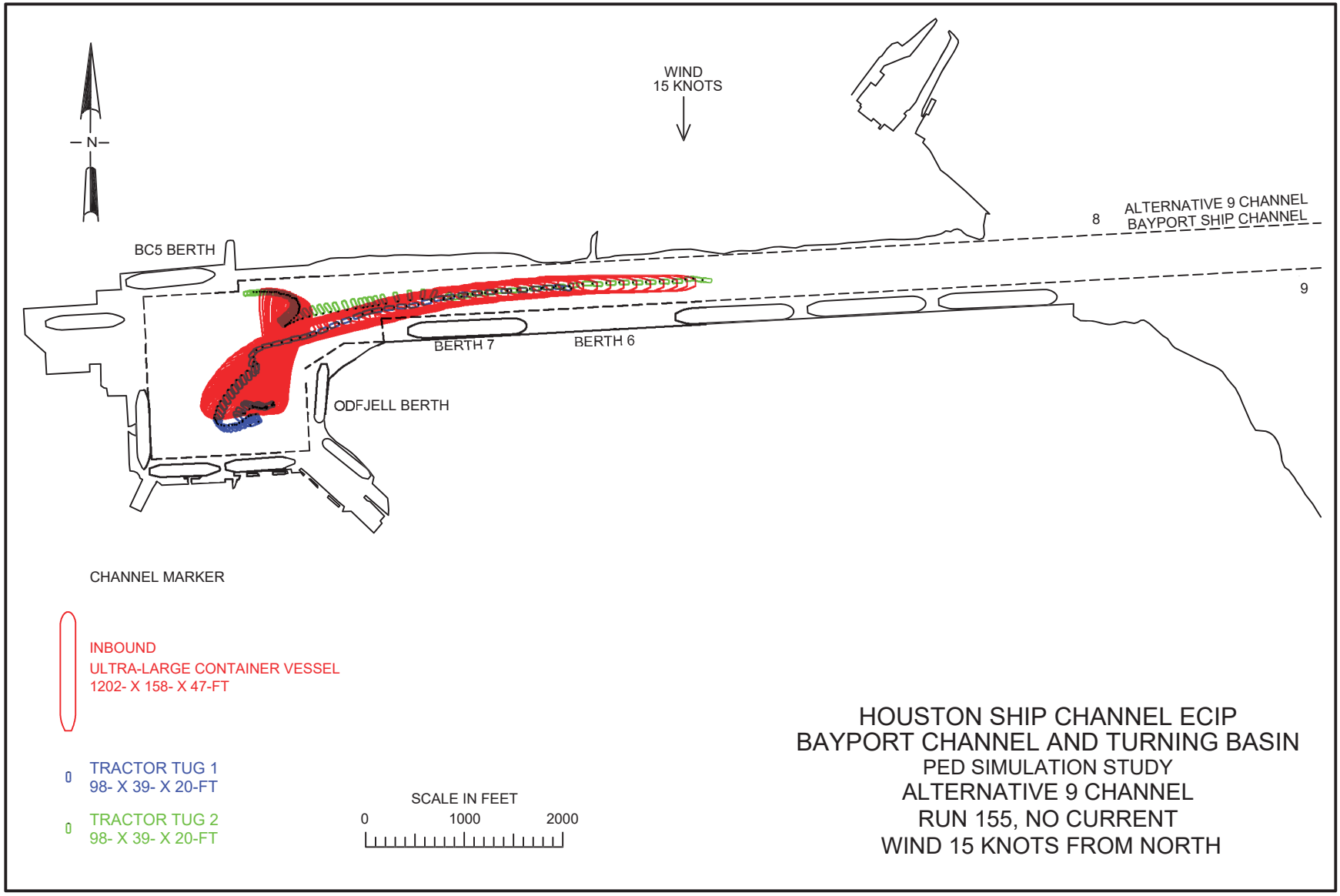

N
WIND
15 KNOTS
8
ALTERNATIVE 9 CHANNEL
BAYPORT SHIP CHANNEL
9
BC5 BERTH
BERTH 7
BERTH 6
ODFJELL BERTH
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 9 CHANNEL
RUN 155, NO CURRENT
WIND 15 KNOTS FROM NORTH

PLATE 84

Run **155**

Purpose	Turn in Bayport Turning Basin. Two instructor controlled tugs.
Date	6/11/2020
Start Time	1525
End Time	1550
Plan	BS-A9
Current	0
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	270/4	Berth 6

Run Comments
Pilot misjudged the entry into the turning basin and ended up in a position where th turn could not be completed. The run was stopped early.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Inbound	Diffcult	Yes	Pilot believes it is safe but he did not take advantage of the available room in the turning basin. He believes he could have recevered and completed the turn but it would have taken a much longer time.		No	PIlot planned on turning on left wheel but ended up getting blocked in the corner due to turning to early to keep the stern off the north bank. He ended up too far east in the basin. There is room to turn on left wheel but it needs to be done correctly.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes	For the tugs postiion this was a safe manuever.	The tug was starting to use an excessie amount of power when the run was stopped.
2-MS7505	Easy	Yes	Yes	No	Yes	Safe to do but the turn needs to be further into the turning basin to assure that the tug has plenty of room to operate.	Tug did tough the edge of the channel on the north side of the basin and if the run wouldn't have stopped he would have had to use evasive action to recover. The tu was able to handle the task but just barely.

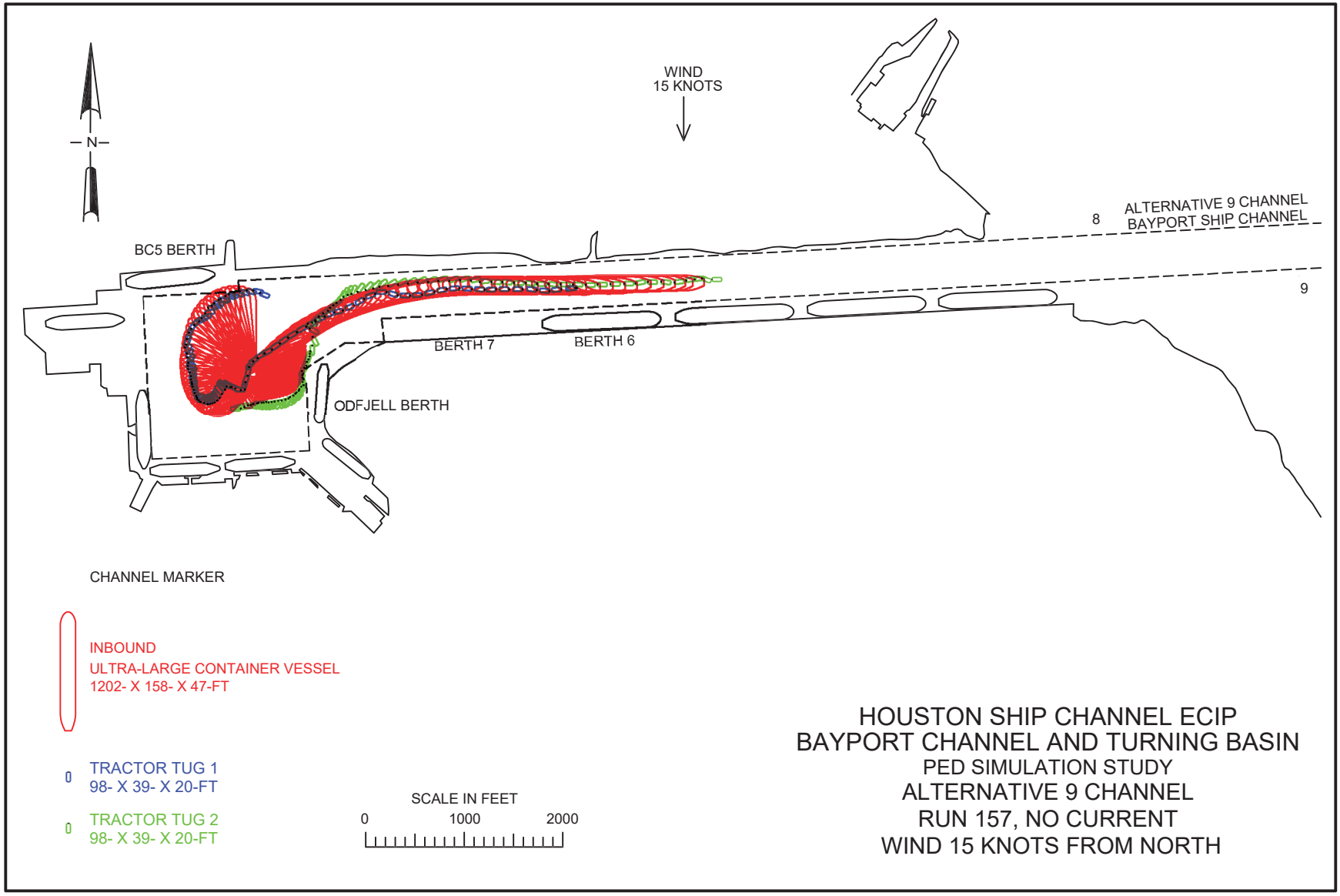

N
WIND
15 KNOTS
ALTERNATIVE 9 CHANNEL
BAYPORT SHIP CHANNEL
8
9
BC5 BERTH
BERTH 7
BERTH 6
ODFJELL BERTH
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 9 CHANNEL
RUN 157, NO CURRENT
WIND 15 KNOTS FROM NORTH

PLATE 85

Run **157**

Purpose	Turn in Bayport Turning Basin. Two instructor controlled tugs.
Date	6/12/2020
Start Time	0850
End Time	0915
Plan	BS-A9
Current	0
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	270/4	Berth 6

Run Comments
Vessel went outside of the federal channel in the north side of the turning basin. Run was stopped. Pilot does believe that he would have been able to recover and successfully complete the turn to exit the basin.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
M	Inbound	Normal	Yes	There is a lotf of room in the basin to turn and a lot of tugs to assist.		Yes	The bow did go outside of the marked channel. Pilot noted that he did not utilize the entire basin when making the turn and if he would have then his bow would not have gone outside the channel on the north side of the basin. Pilot believes he would have been able to complete the turn and successfully get out of the basin.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Tug captain felt like he had plenty of room to manuever and he was able to remain in the federal channel on the north side of the channel even when the vessel did not.
2-MS7505	Normal	No	Yes	No	No	The pilot needs to go further into the channel before starting to turn so that there is more space between the tug and the Odjfell docks. Tug captain did not feel like he had space to operate and was concerned about the manuever.	Tug was pinched while entering the basin by the Odfjell dock 7 and had to get extremely close to the vessel to b able to make it through the opening. He was not able to perform the task requested by the pilot while in that area

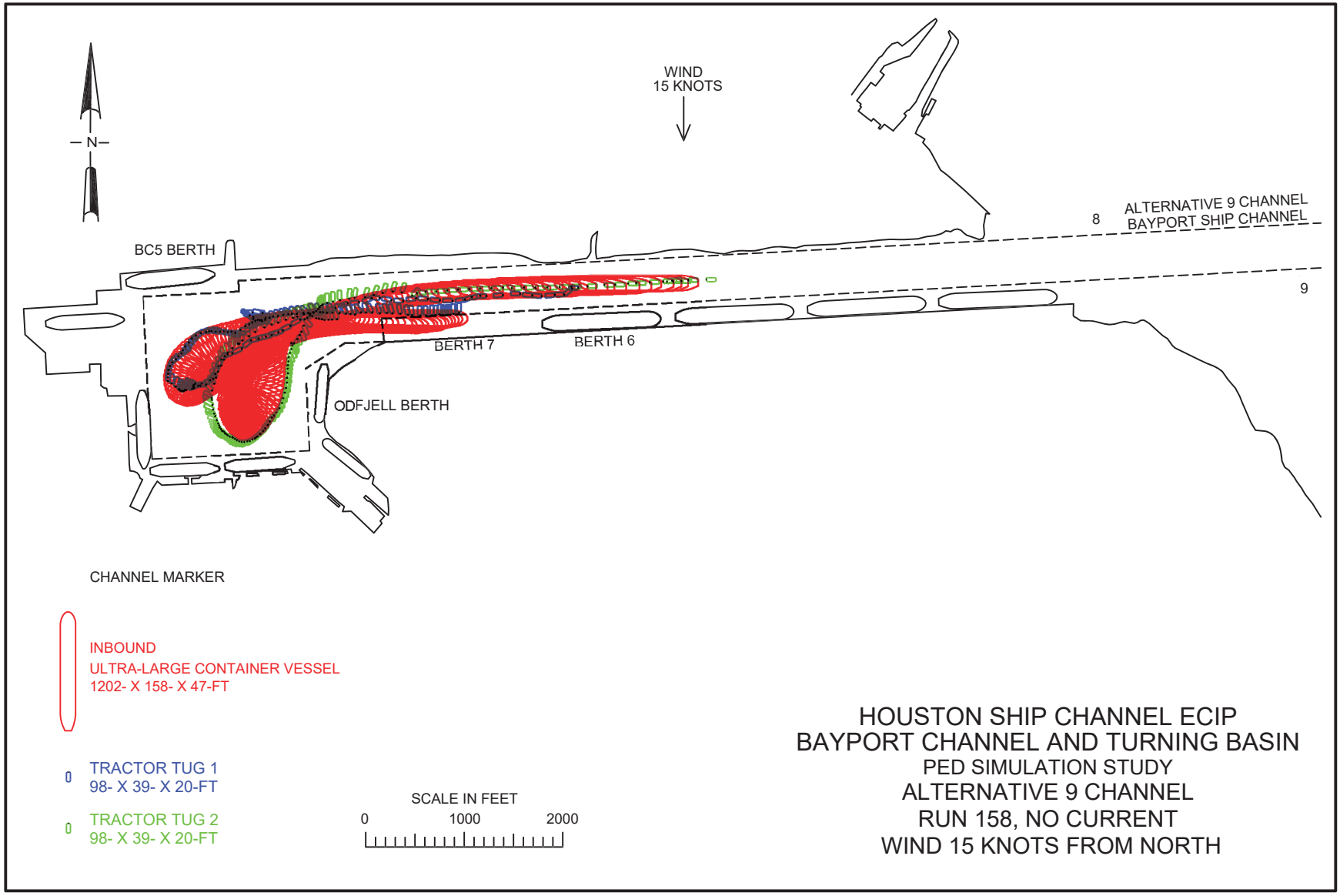

N
WIND
15 KNOTS
ALTERNATIVE 9 CHANNEL
BAYPORT SHIP CHANNEL
8
9
BC5 BERTH
BERTH 7
BERTH 6
ODFJELL BERTH
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYPORT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 9 CHANNEL
RUN 158, NO CURRENT
WIND 15 KNOTS FROM NORTH

PLATE 86

Run **158**

Purpose	Turn in Bayport Turning Basin. Two instructor controlled tugs.
Date	6/12/2020
Start Time	0935
End Time	1015
Plan	BS-A9
Current	0
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	270/4	Berth 6

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
M	Inbound	Normal	Yes	With four tugs and utliizing the center of the baisn.		Yes	Pilot believes that a SE wind would not make this manuever any harder. Docking at Odjfell 7 with the cutout to the East is very important to allow the ship to get closer to the dock and keep the tugs off the north bank. Able to drive the ship straight into the dock.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Stayed in deep water and away from federal channel. Driving straight into the dock allowed for the tug to have more space.
2-MS7505	Normal	Yes	No	No	Yes		Better than the last run, more space. There was no additional manuevering to change direction for the tug while going to dock 7 and this creates less problems.

Appendix E: Track Plots and Run Sheets – Barbour's Cut

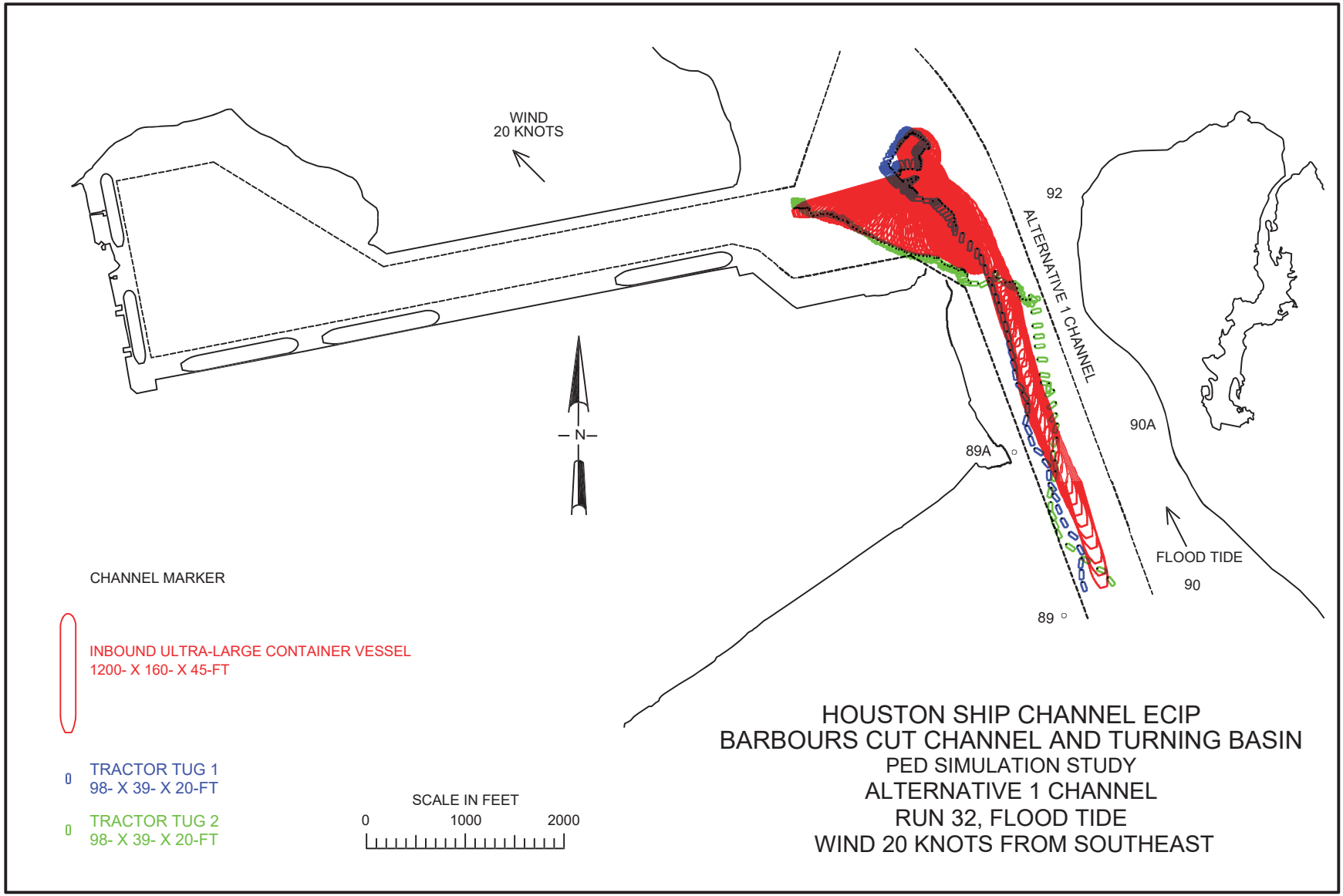

WIND
20 KNOTS
N
92
ALTERNATIVE 1 CHANNEL
90A
89A
FLOOD TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 32, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 87

Run **32**

Purpose Entrance to Barbour's Cut - Turn at Entrance TB.

Date 5/19/2020
Start Time 0940
End Time 1000
Plan BC-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14Z	45.0/13.7	340/8	87-88

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Plenty of room to complete the manuever.		Yes	Pilot mentioned that he would go further into the turning basin during the next run.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Easy	Yes	No	No	Yes	Normal job.	Tug was able to remain inside the federal channel during the manuever.
2 - MS7505	Normal	Yes	No	No	Yes		Stern tug did get close to the bank but tugmaster did not believe that it was unsafe or a manuever that could not be completed.

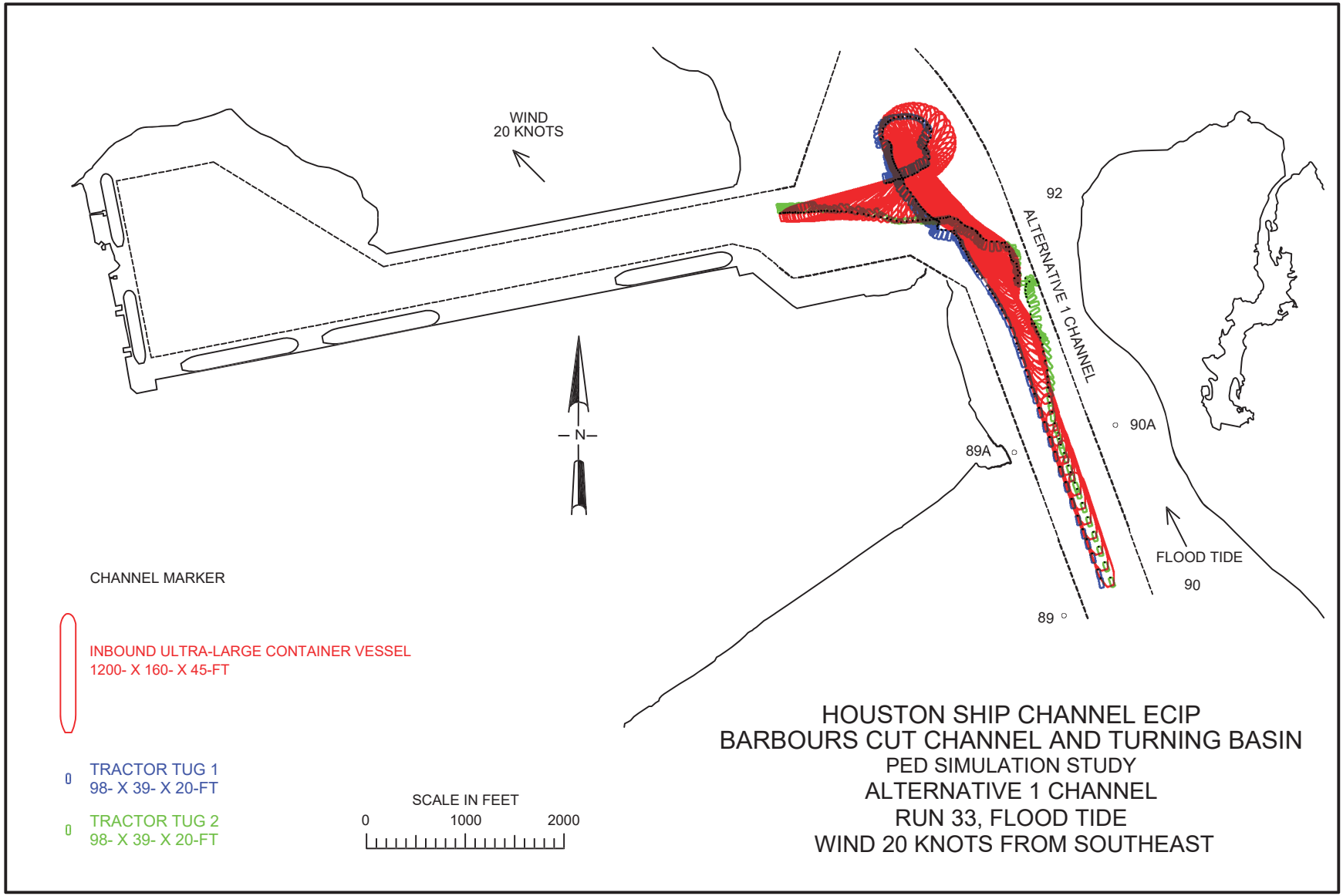

WIND
20 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
FLOOD TIDE
90
89
N
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 33, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 88

Run **33**

Purpose Entrance to Barbour's Cut - Turn at Entrance TB.
Adding a third instructor controlled tug to eliminate the use of the bow thruster on the main vessel.
Date 5/19/2020
Start Time 1015
End Time 1045
Plan BC-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14Z	49.6/14.2	340/5	87-88

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Inbound	Normal	Yes	Sufficient room for the manuever.		Yes	Pilot noted that he would rather perform the turn closer to Barbours cut instead of near the channel. Pilot also commented that the vessel was not acting completely realistic.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Easy	Yes	No	No	Yes	Had deep water during the entire manuever and never felt like the tug was in danger.	Easy operation for the tugmaster.
2 - MS7505	Easy	Yes	No	No	Yes	Tug never got close to objects that would cause danger and had plenty of water to work.	

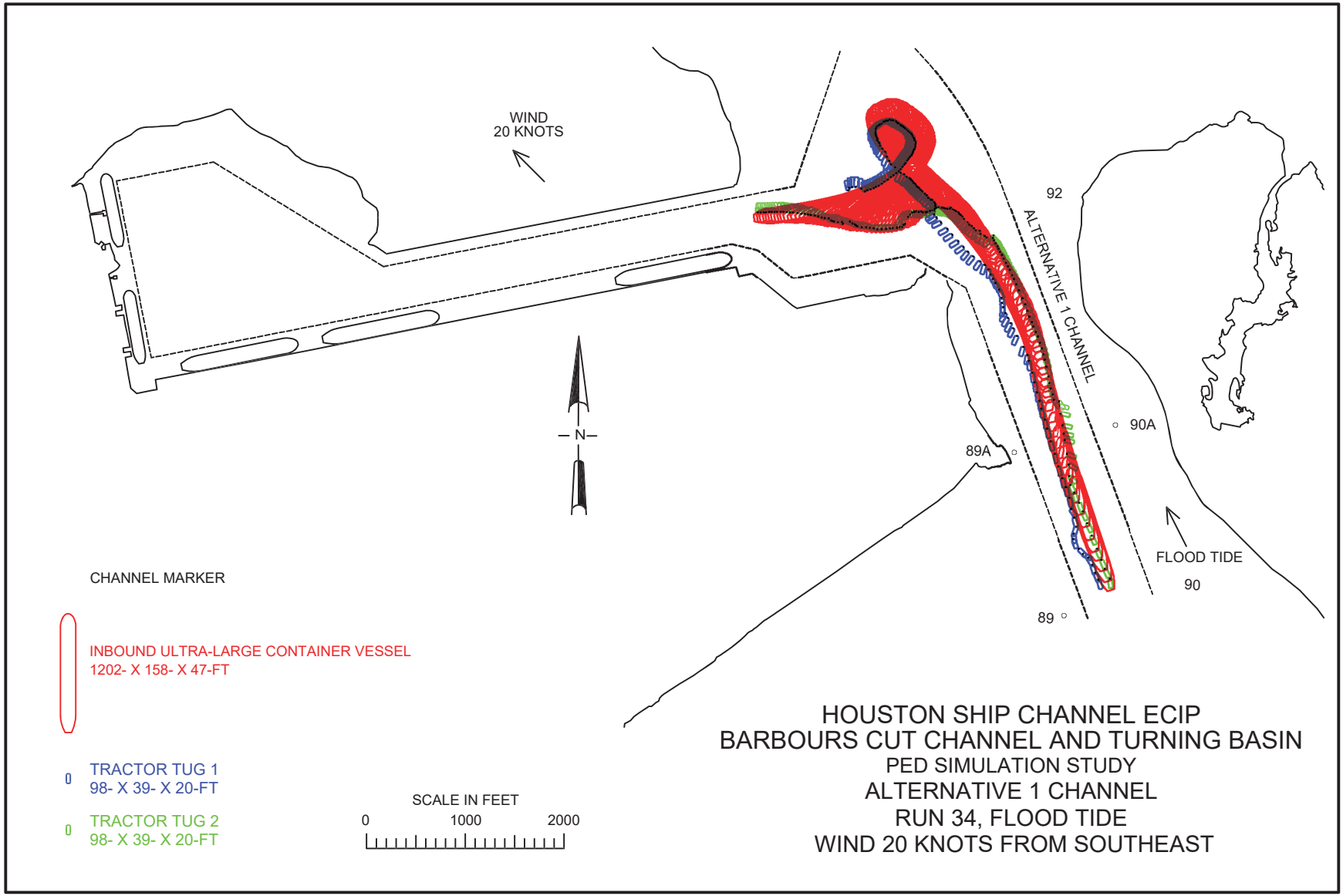

WIND
20 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
FLOOD TIDE
90
89
N
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 34, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 89

Run **34**

Purpose Entrance to Barbour's Cut - Turn at Entrance TB.

Date 5/19/2020
Start Time 1135
End Time 1215
Plan BC-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	341/5	87-88

Run Comments
Vessel was changed from previous runs to try and make the manuever more realistic. Successful run.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Turning area has plenty of space.		Yes	Vessel handled much more realistically.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Easy	Yes	No	No	Yes	Hand plenty of water	Able to maintain control the entire time.
2 - MS7505	Easy	Yes	No	No	Yes	Used more power than previous runs but it is realistic because of the heavy vessel being used.	

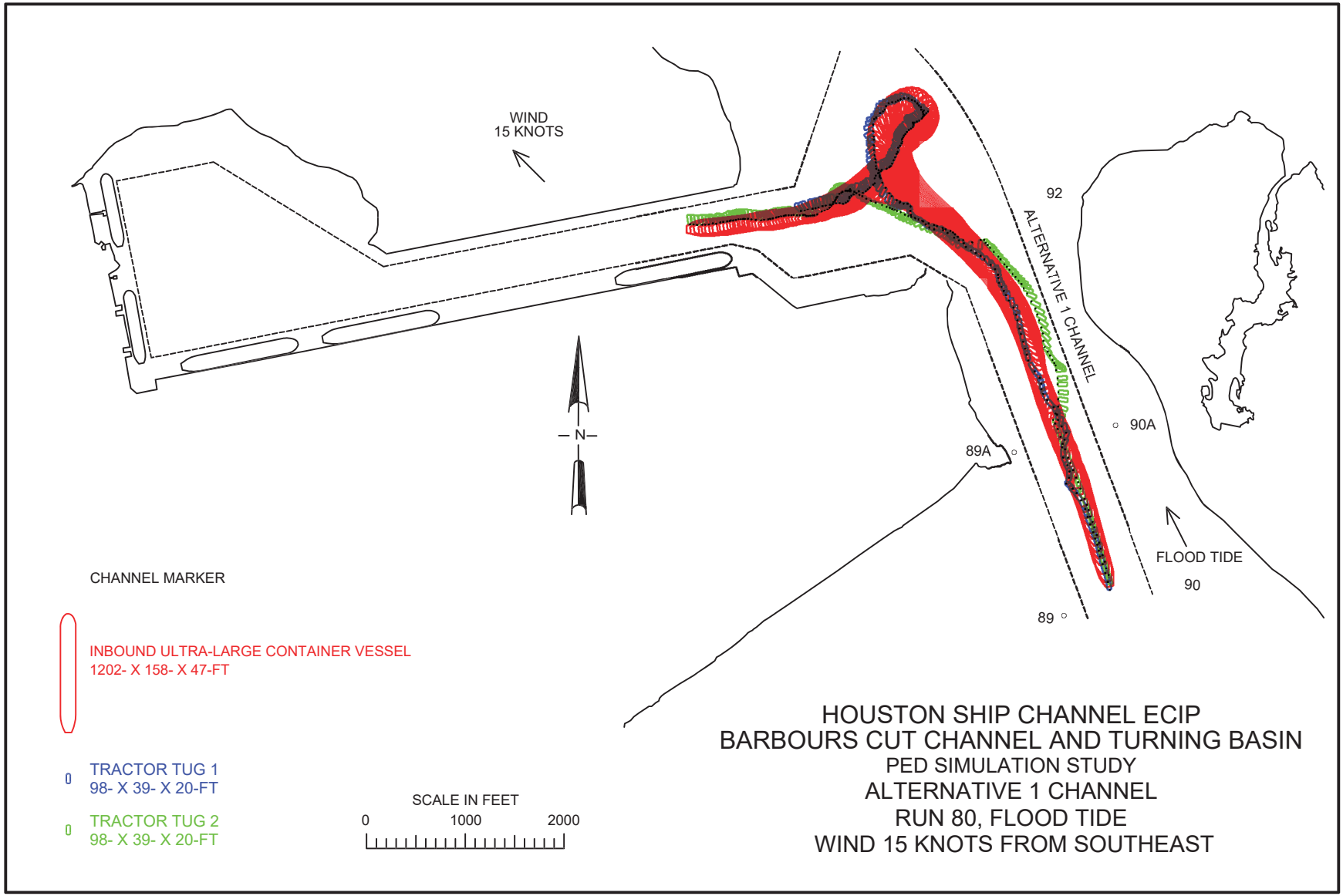

WIND
15 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
FLOOD TIDE
90
89
N
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 80, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 90

Run **80**

Purpose	Entrance to Barbour's Cut - Turn at Entrance TB Two instructor controlled tugs.
Date	6/3/2020
Start Time	0930
End Time	1005
Plan	BC-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	342/4	89-90

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
J	Inbound	Normal	Yes	A lot of control and with four tugs allows you to handled the vessel easier.		Yes	Wind and current were manageable, even with the most extreme case used for the simulation.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		Normal job.
2 - MS7505	Normal	Yes	No	No	Yes		A lot of power used but not unrealistic due to the size of the vessel and the conditions.

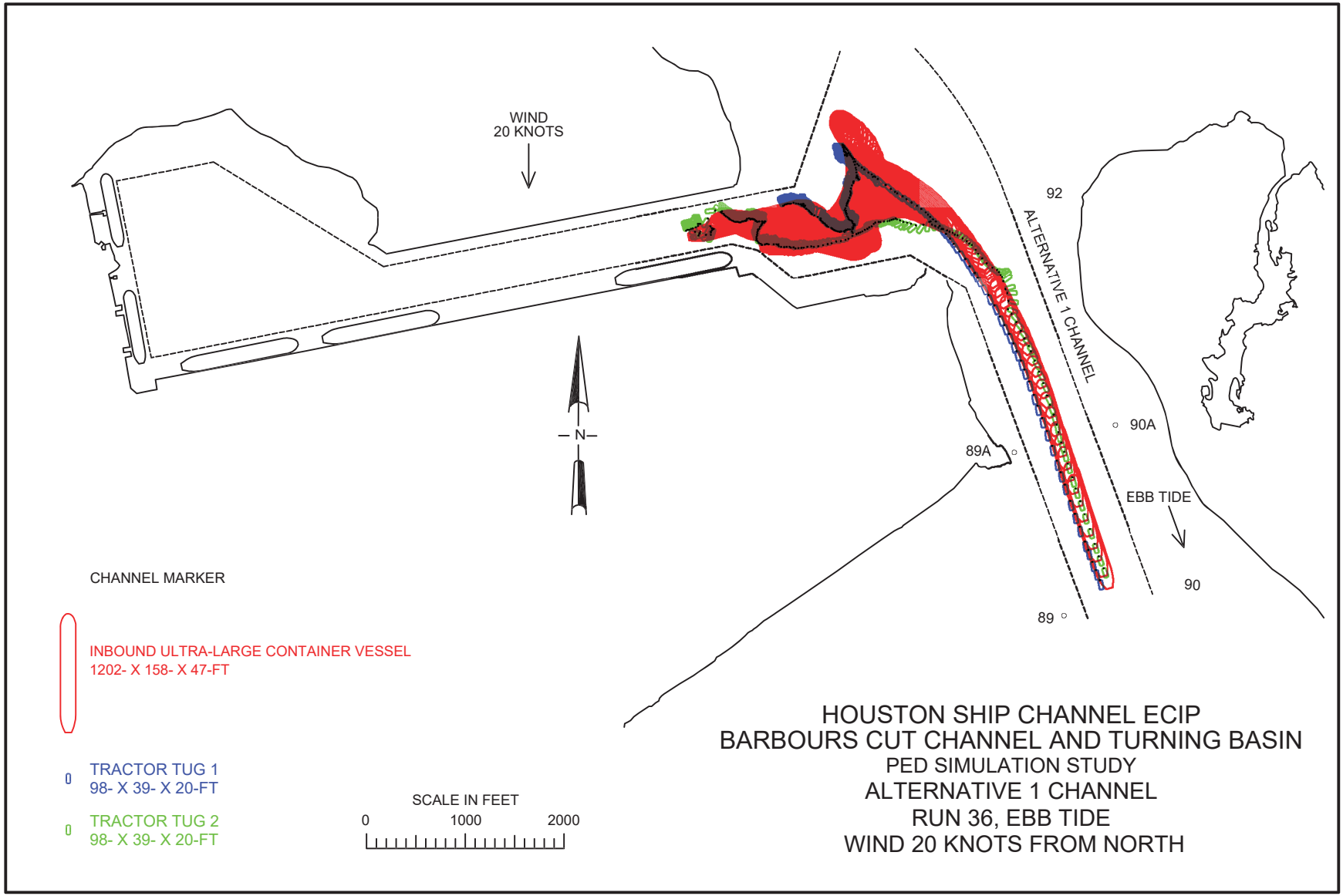

WIND
20 KNOTS
N
92
ALTERNATIVE 1 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 36, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 91

Run **36**

Purpose Entrance to Barbour's Cut - Turn at Entrance TB.

Date 5/19/2020
Start Time 1335
End Time 1430
Plan BC-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	341/5	87-88

Run Comments
Pilot performed the turn on the west side of the turning area to minimize the vessel time in the channel. Reasoning for trying the manuever in this way is to not impede on traffic in the channel for too long.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Inbound	Normal	Yes	Plenty of room in the flare in make the turn.		Yes	Pilot error made by accidentally going slow stern instead of slow ahead.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Easy	Yes	No	No	Yes	Plenty of deep water.	
2 - MS7505	Easy	Yes	No	No	Yes	Good water under the boat even when approaching the north end of the channel.	

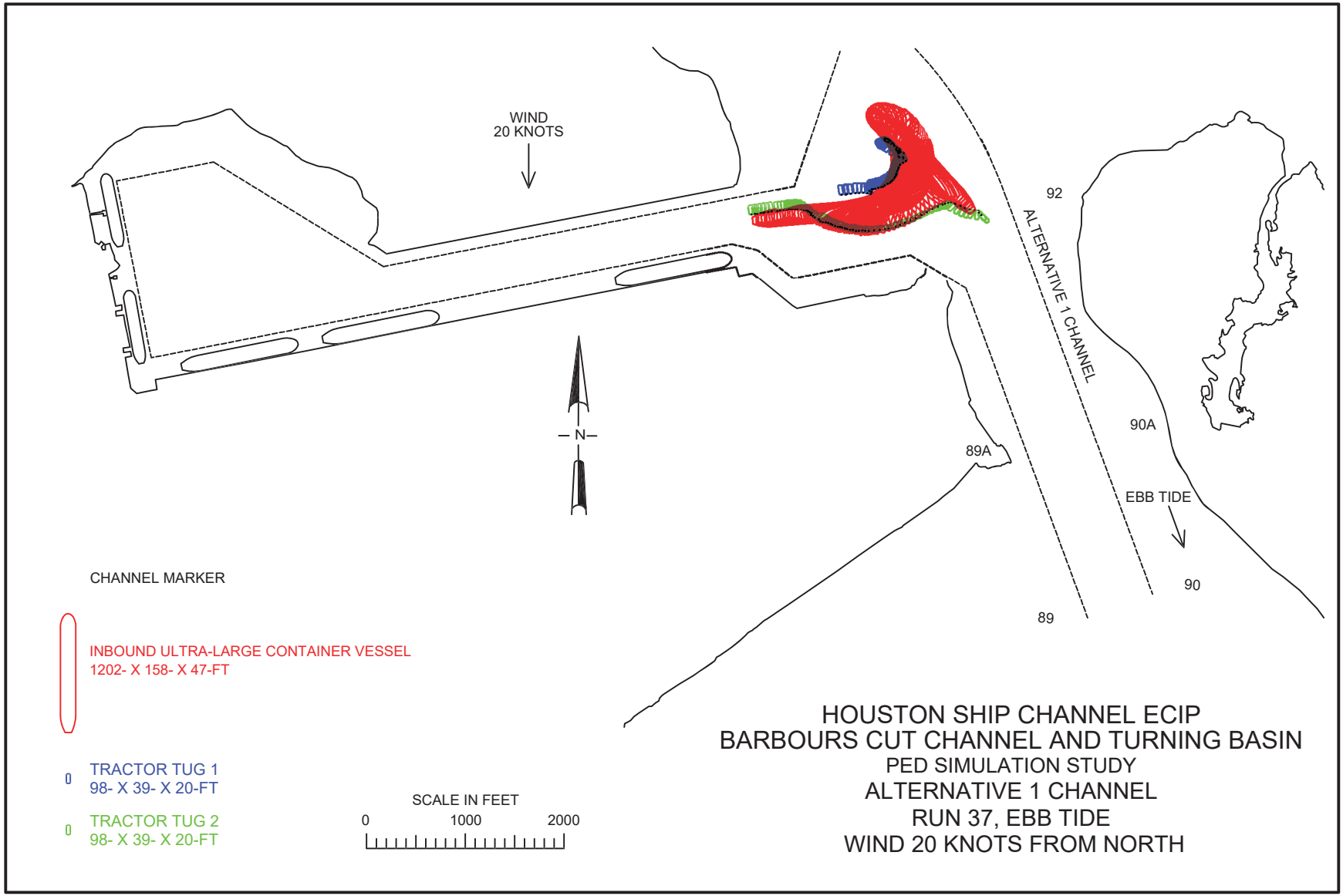

WIND
20 KNOTS
N
92
ALTERNATIVE 1 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 37, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 92

Run **37**

Purpose Entrance to Barbour's Cut - Turn at Entrance TB.

Date 5/19/2020
Start Time 1445
End Time 1515
Plan BC-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	341/5	87-88

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Size of the turning basin allows for a lot fo room to turn.		Yes	

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Easy	Yes	No	No	Yes	Plenty of deep water.	It was a slow evolution and never felt danger on the tug.
2 - MS7505	Easy	Yes	No	No	Yes		

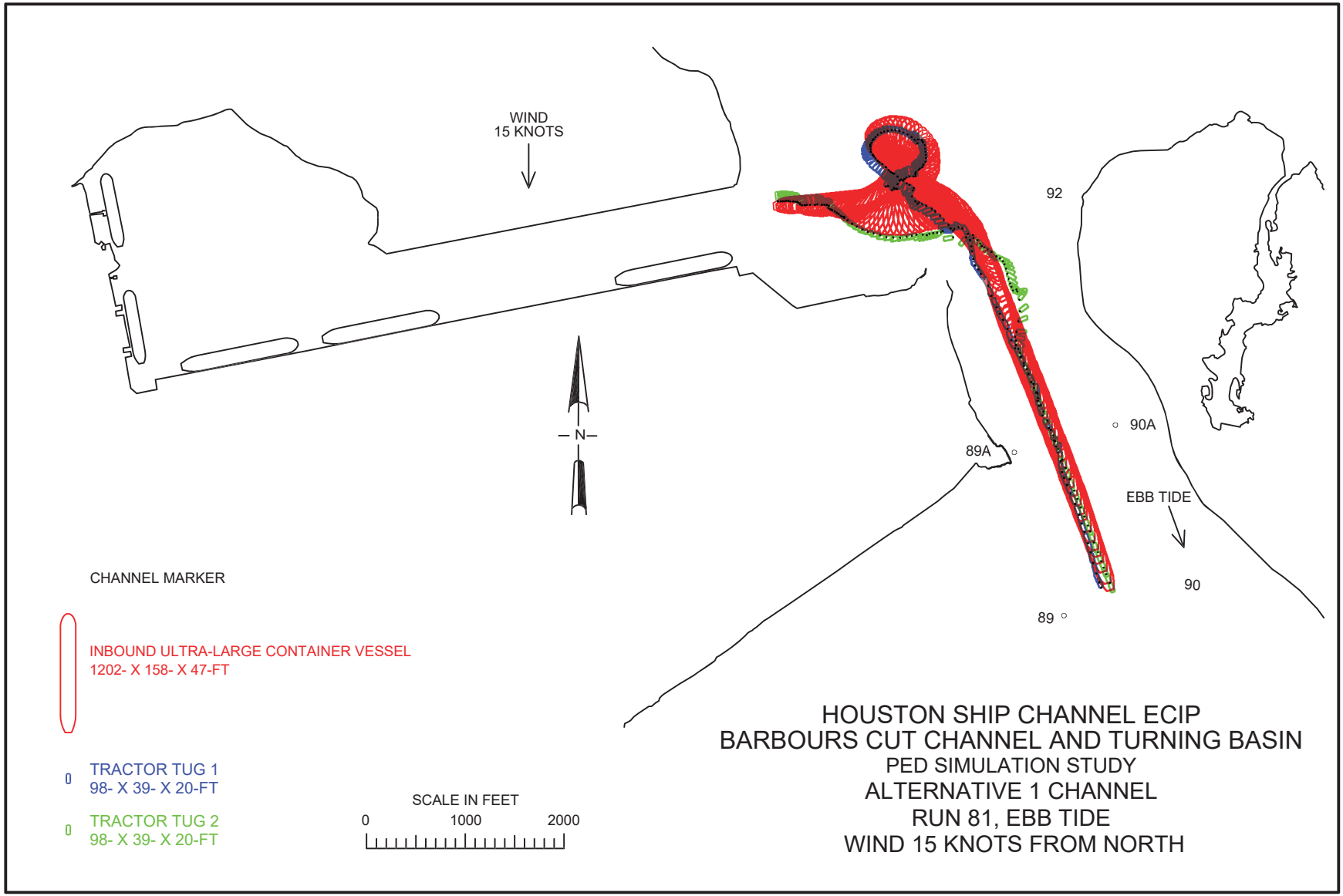

WIND
15 KNOTS
92
90A
89A
EBB TIDE
90
89
N
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 81, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 93

Run **81**

Purpose	Entrance to Barbour's Cut - Turn at Entrance TB Two instructor controlled tugs.
Date	6/3/2020
Start Time	1015
End Time	1045
Plan	BC-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	342/4	89-90

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Plenty of room to manuever and amount of tugs increased safety.		Yes	Depending on the conditions 3 to 4 tugs are needed. Felt the wind and current but managed to maintain positive control with the tugs assistance.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Plenty of room and never got close to the edge of the channel.	
2 - MS7505	Normal	Yes	No	No	Yes		Tugmaster noted that the tug usage and power used was done very well during this simulation.

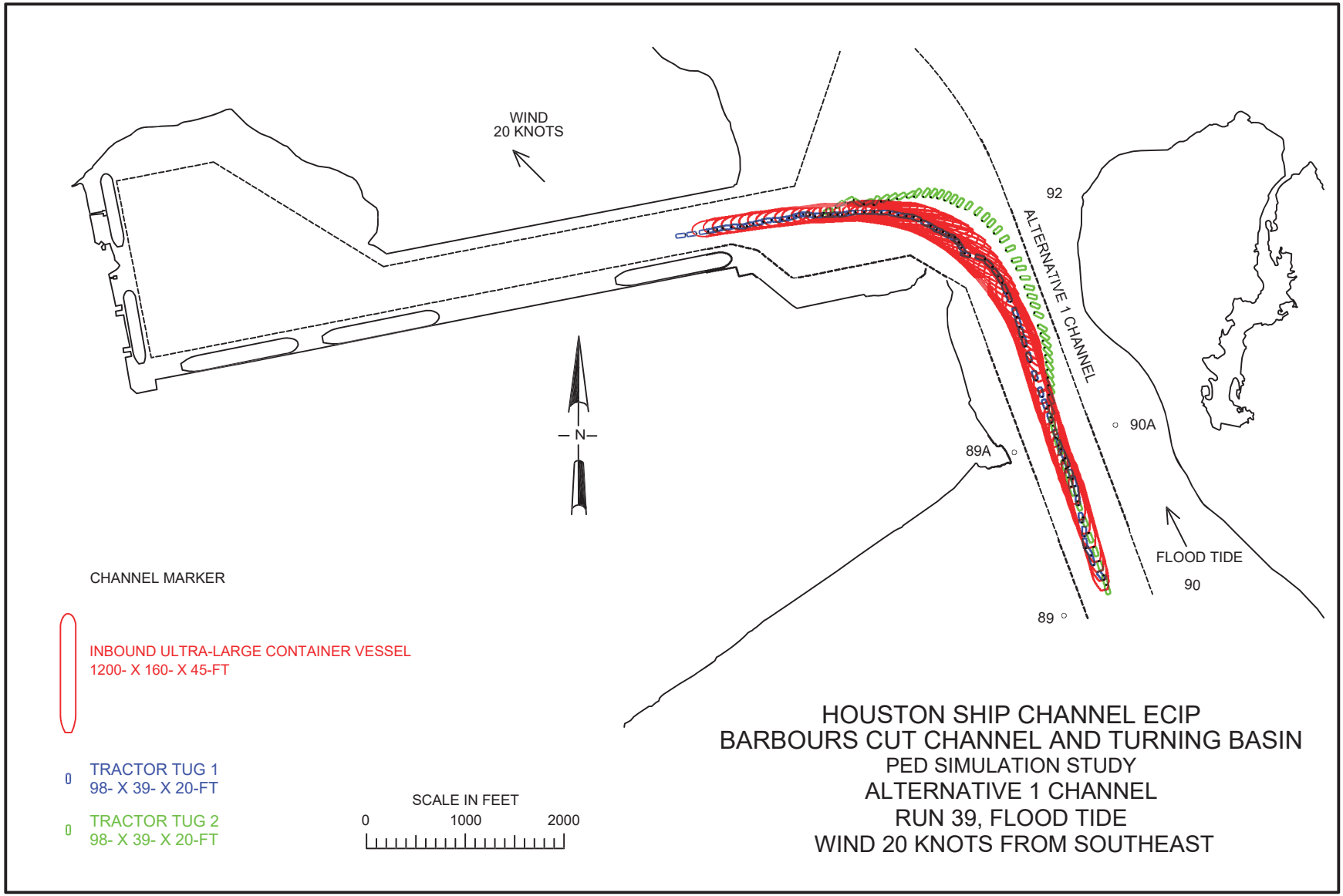

WIND
20 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
FLOOD TIDE
90
89
N
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 39, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 94

Run **39**

Purpose Inbound turn into Barbours Cut.

Date 5/19/2020
Start Time 1605
End Time 1625
Plan BC-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MULCV14Z	45.0/13.7	341/5	87-88

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Channel is much wider and allows for enough space for a larger vessel. Makes it easier to position the vessel.	Yes		

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Easy	Yes	No	No	Yes		Barely used the tug during the operation.
2 - MS7505	Easy	Yes	No	No	Yes		The vessel sped up during the run and it made it easier for the tug to assist during the turn.

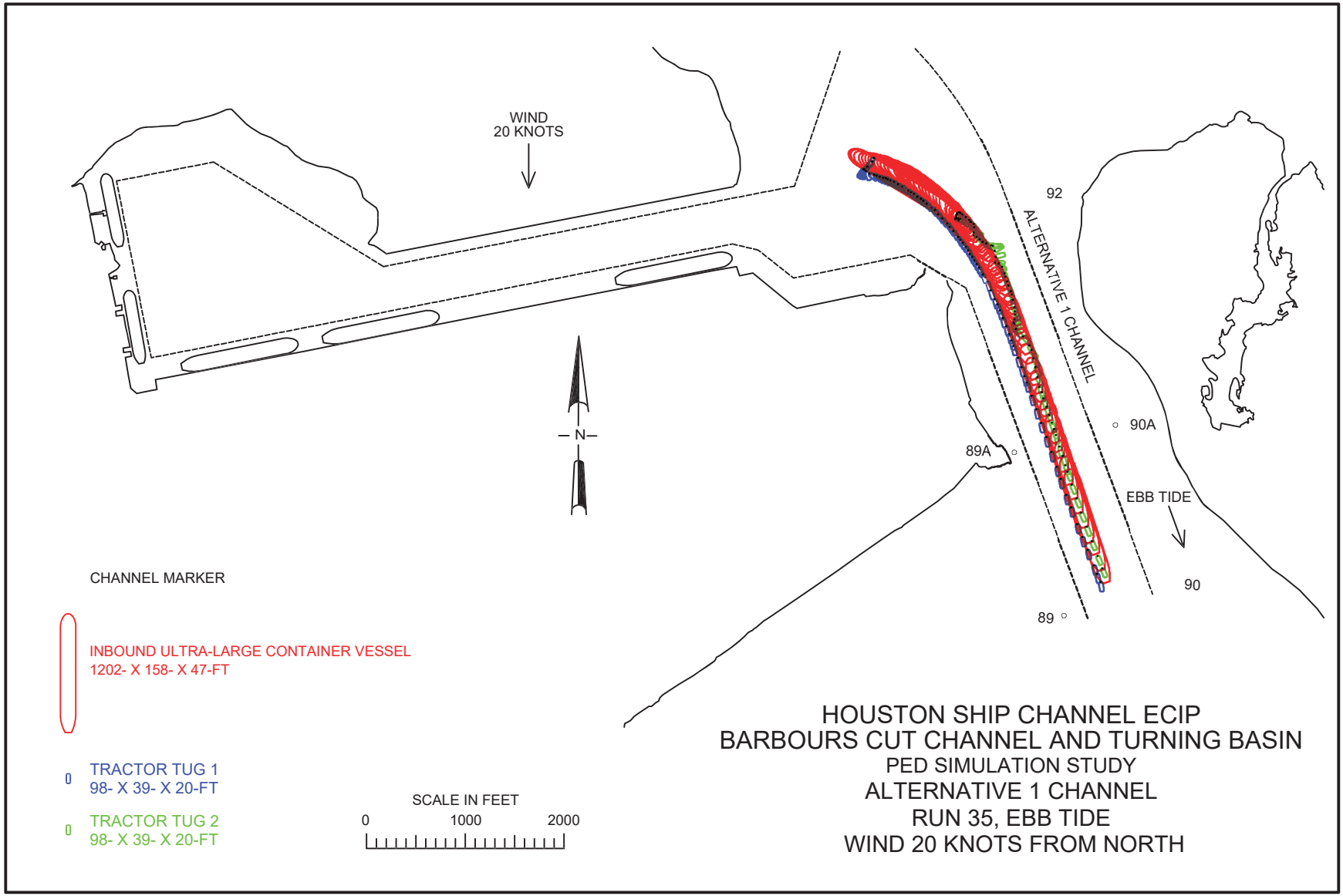

WIND
20 KNOTS
N
92
ALTERNATIVE 1 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 35, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 95

Run **35**

Purpose Entrance to Barbour's Cut - Turn at Entrance TB.

Date 5/19/2020
Start Time 1310
End Time 1330
Plan BC-A1
Current Ebb
Tide (m) 1
Wind Direction /Speed Knots N/20
Tugs 3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	341/5	87-88

Run Comments
Vessel is deeper than previous ones used in this location (15 m) and caused the ship to ground in the turning basin. Interviews not completed. Stopped and added an additional 0.5 m of tide to resolved the problem for the next run.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
	Inbound						

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments

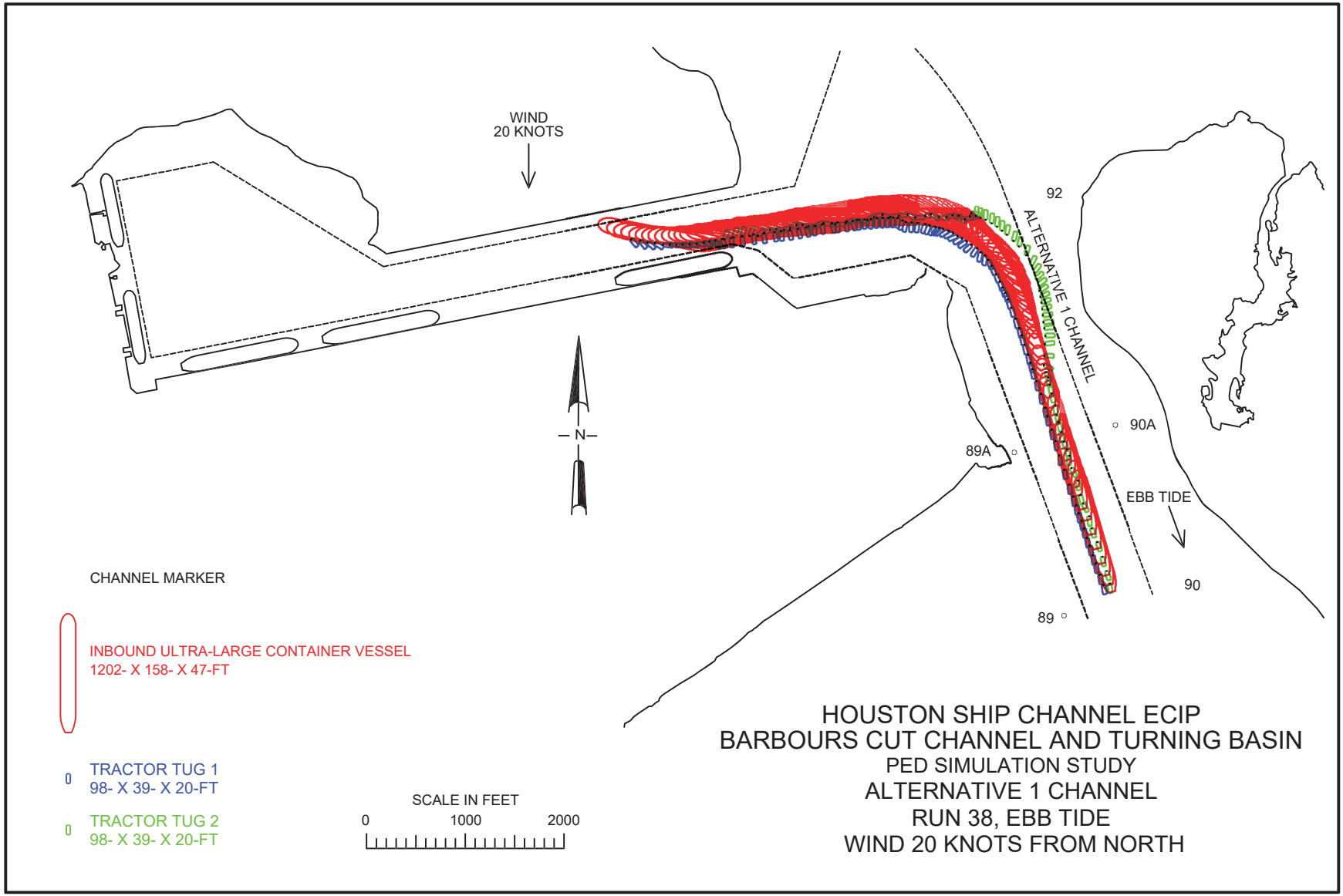

WIND
20 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
EBB TIDE
90
89
N
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 38, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 96

Run **38**

Purpose Inbound turn into Barbours Cut.

Date 5/19/2020
Start Time 1530
End Time 1550
Plan BC-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	341/5	87-88

Run Comments
Vessel interaction to docked vessel was too strong. Swtiching vessels for next run.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Inbound	Normal	Yes	Adequate manuevering room.	Yes		Have to be aware of the starboard quarter on red side while turning but pilot noted that is a doable manuever if you pay attention to that end.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Plenty of room on the bow and plenty of water.	Never was put in danger during the manuever.
2 - MS7505	Normal	Yes	No	No	Yes		Recommend changing the speed of the vessel while making the turn because this effects whether the tug will do a direct pull or indirect. Adjusting speed would remove the grey area of what to do.

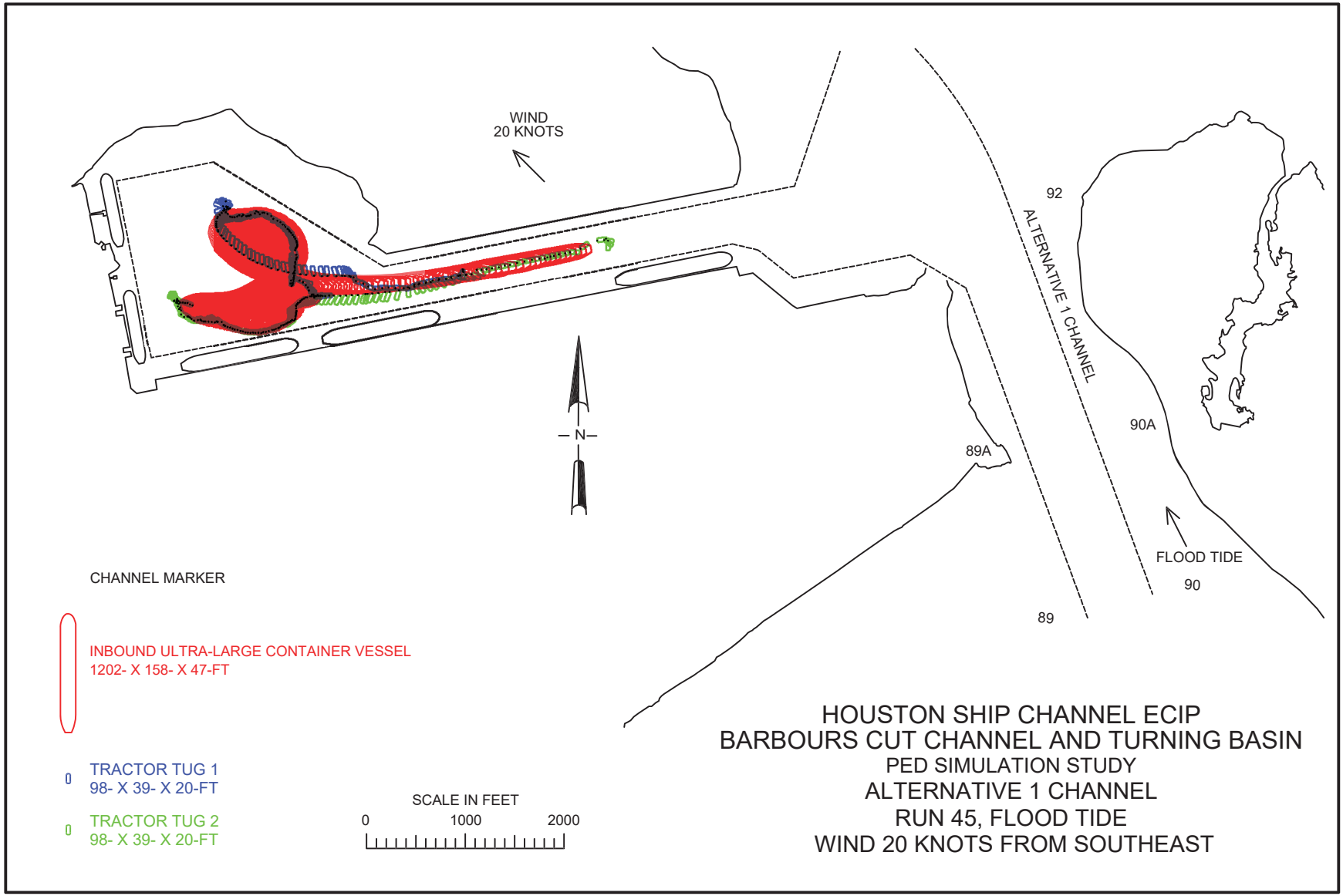

WIND
20 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
FLOOD TIDE
90
89
N
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 45, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 97

Run **45**

Purpose Turn in basin at Barbours Cut.

Date 5/20/2020
Start Time 1500
End Time 1525
Plan BC-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	260/3	Midway

Run Comments
0

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Inbound	Normal	Yes	Adeqaute room. Didn't use all of the space given in the turning basin.		Yes	Pilot mentioned he would go further west into the basin if he did it again. Would rather put the ship in the center of the basin to perform the turn.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Plenty of water and slow speed to manuever.	Normal job.
2 - MS7505	Easy	Yes	No	No	Yes	Had room to get by the docked vessell so it did not make the tugmaster nervous.	Called out the distance between the vessel stern and the docked vessel just to ensure the pilot has the information. However, felt like there was plenty of space for the tug operations and did not show concern.

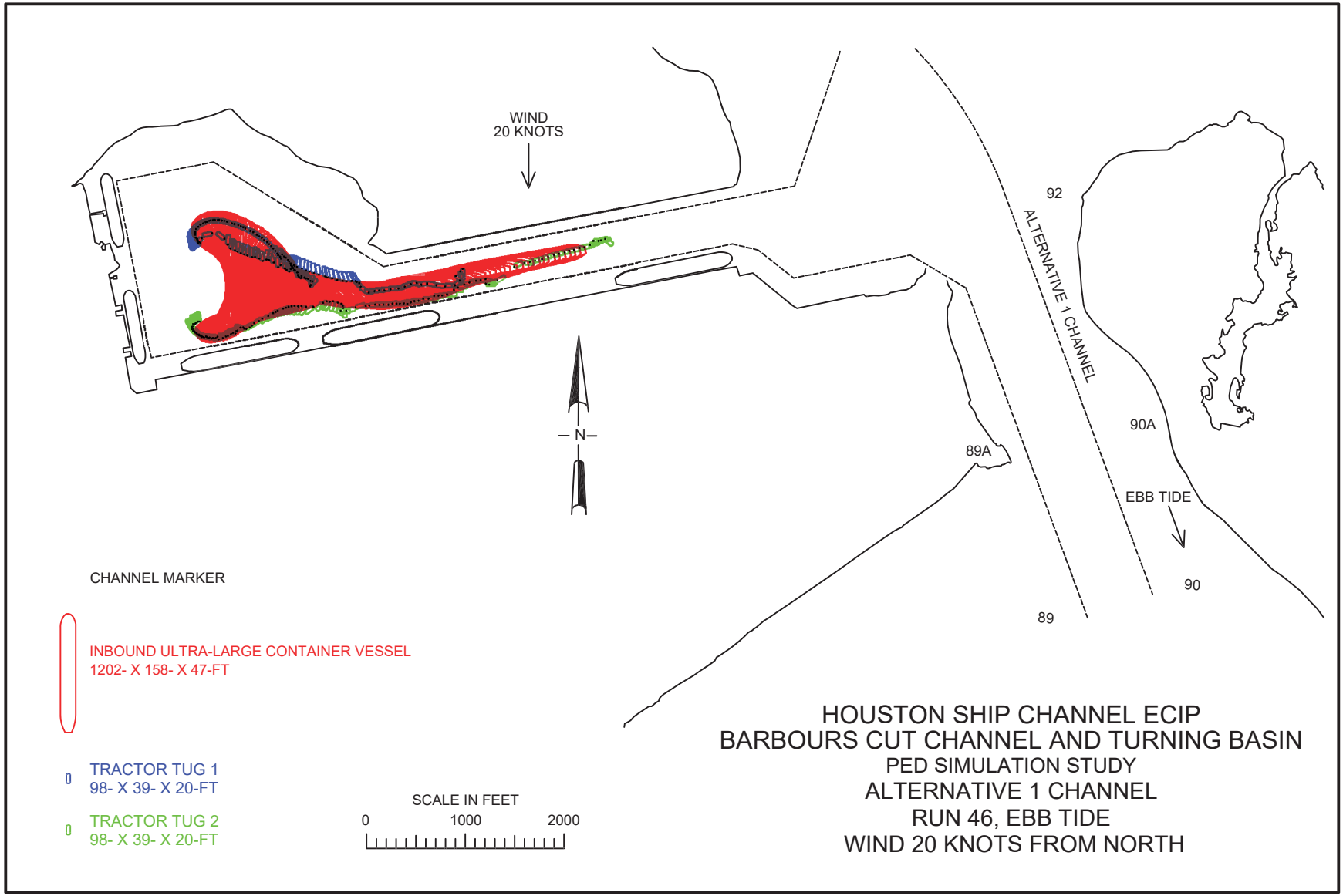

WIND
20 KNOTS
N
92
ALTERNATIVE 1 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 46, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 98

Run **46**

Purpose Turn in basin at Barbours Cut.

Date 5/20/2020
Start Time 1535
End Time 1600
Plan BC-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	49.6/14.2	260/3	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Plenty of room.		Yes	Felt the wind towards the end of the turn but the pilot did not have a problem handling the vessel.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		
2 - MS7505	Easy	Yes	No	No	Yes		Easy manuever.

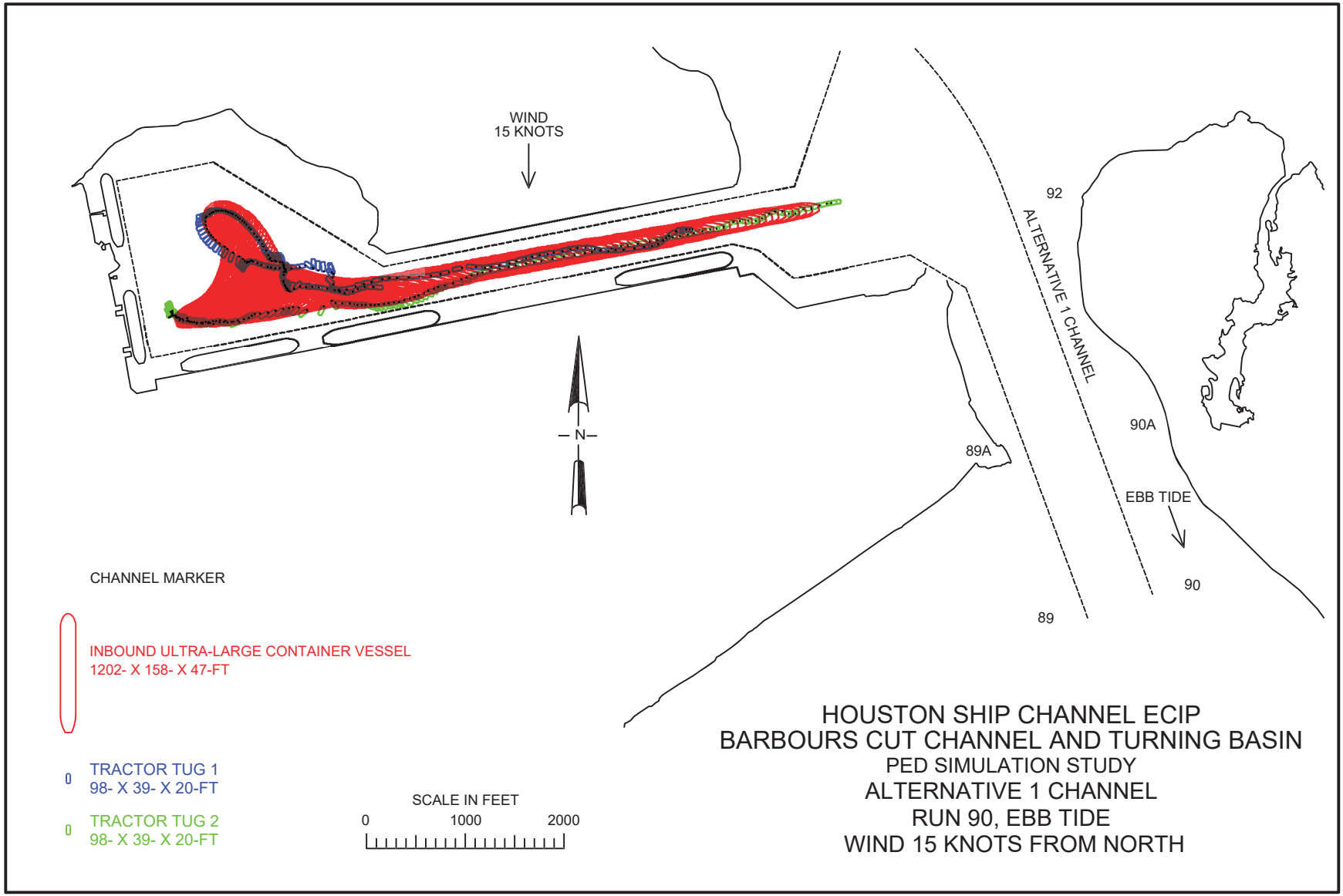

WIND
15 KNOTS
N
92
ALTERNATIVE 1 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 90, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 99

Run **90**

Purpose	Enter Barbours Cut and turn in Turning Basin. One instructor controlled tug.
Date	6/4/2020
Start Time	0855
End Time	0930
Plan	BC-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	261/4	Midway

Run Comments
Run was originally started in the channel at 89-90 and the pilot had successfully made the turn it to Barbours Cut. Once the turn was completed there was a computer failure so the run was stopped. Run was restarted at midway so the pilot could make the turn in the basin. Images were captured of the turn and the pilot was interviewed on the turn it.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Turning basin has plenty of room to perform the turn.	Yes	Yes	Plenty of room to make the turn in with the RP layout. Pilot did feel that north wind and adjust his placement to avoid being pushed to the south. Pilot noted that a 4th tug could be useful in the situation but that it is possible with three tugs.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Stayed in good water in the basin.	Textbook manuever.
2 - MS7505	Normal	Yes	No	No	Yes		

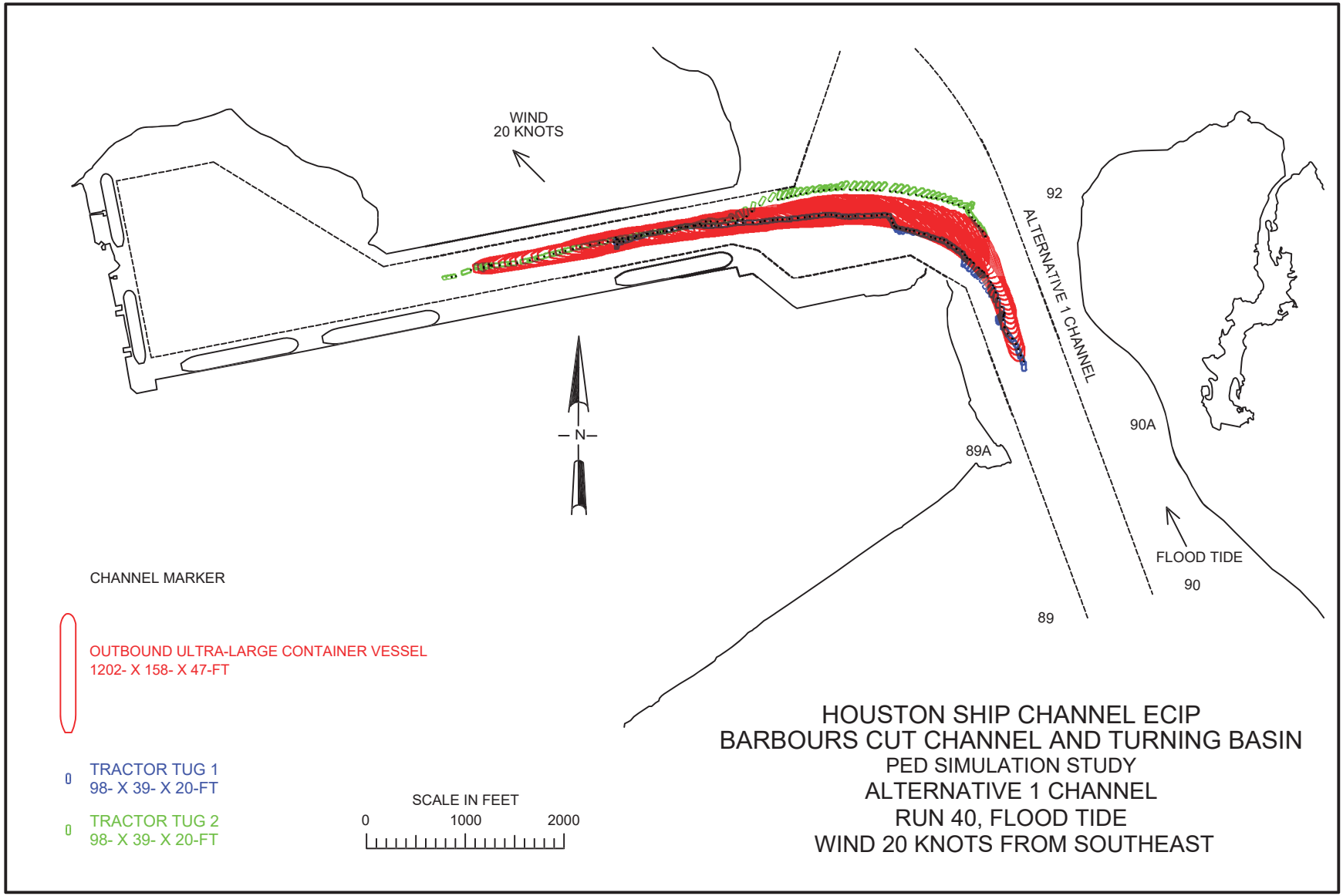

WIND
20 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
FLOOD TIDE
90
89
N
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 40, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 100

Run **40**

Purpose Outbound turn into Barbours Cut.

Date 5/20/2020
Start Time 1235
End Time 1255
Plan BC-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	49.6/14.2	081/3	Midway

Run Comments
Pilot stated during the run that he felt the eddy at the entrance. Manuever completed by getting into the turning circle before completing the turn while maintaining a slower speed.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
G	Outbound	Normal	Yes	Cutting out the point at the flare makes it a lot easier to make the turn and requires less tug power.	Yes		Vessel handled well. Pilot felt lateral movement on the vessel from the wind and current.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Plenty of water and clearances during the manuever.	
2 - MS7505	Easy	Yes	No	No	Yes	All within normal operations.	0

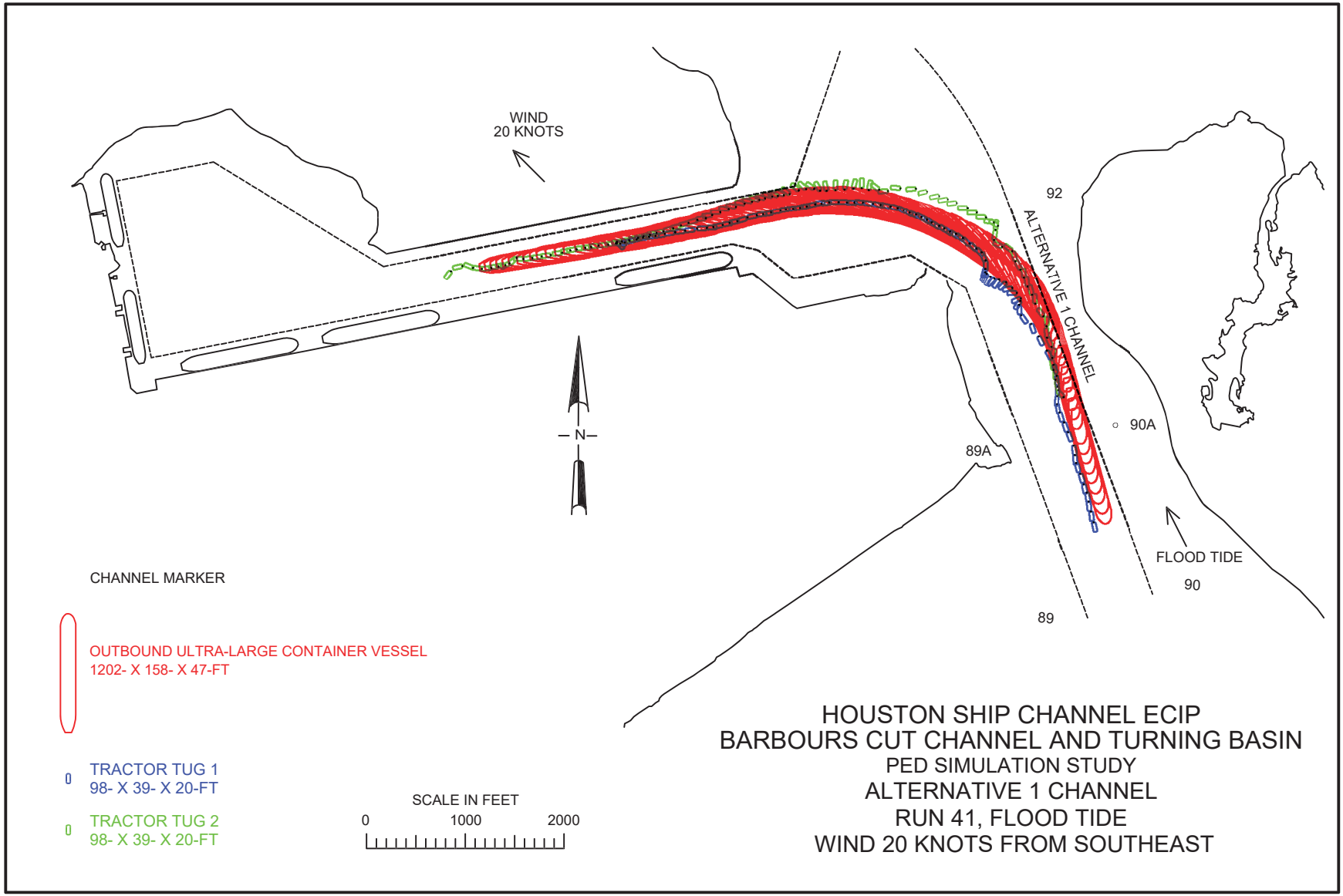

WIND
20 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
N
FLOOD TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 41, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 101

Run **41**

Purpose Outbound turn into Barbours Cut.

Date 5/20/2020
Start Time 1300
End Time 1320
Plan BC-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	49.6/14.2	081/3	Midway

Run Comments
Vessel did leave the federal channel after the turn.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Outbound	Difficult	No	Pilot said that he was going to fast during the manuever.	No		Pilot asked for a command for the stern tug but the tug was unable to get into position due to the speed during the turn. Need to slow down the turn.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Difficult	Yes	Yes	No	No	Once the vessel was halfway out the turn, the ship was moving too fast so the tug was unable to remain in front of the vessel.	Tug had to release the rope to get back in position.
2 - MS7505	Difficult	Yes	No	No	Yes	Manuevr could have went better if they had planned better due to not being able to do a direct pull.	

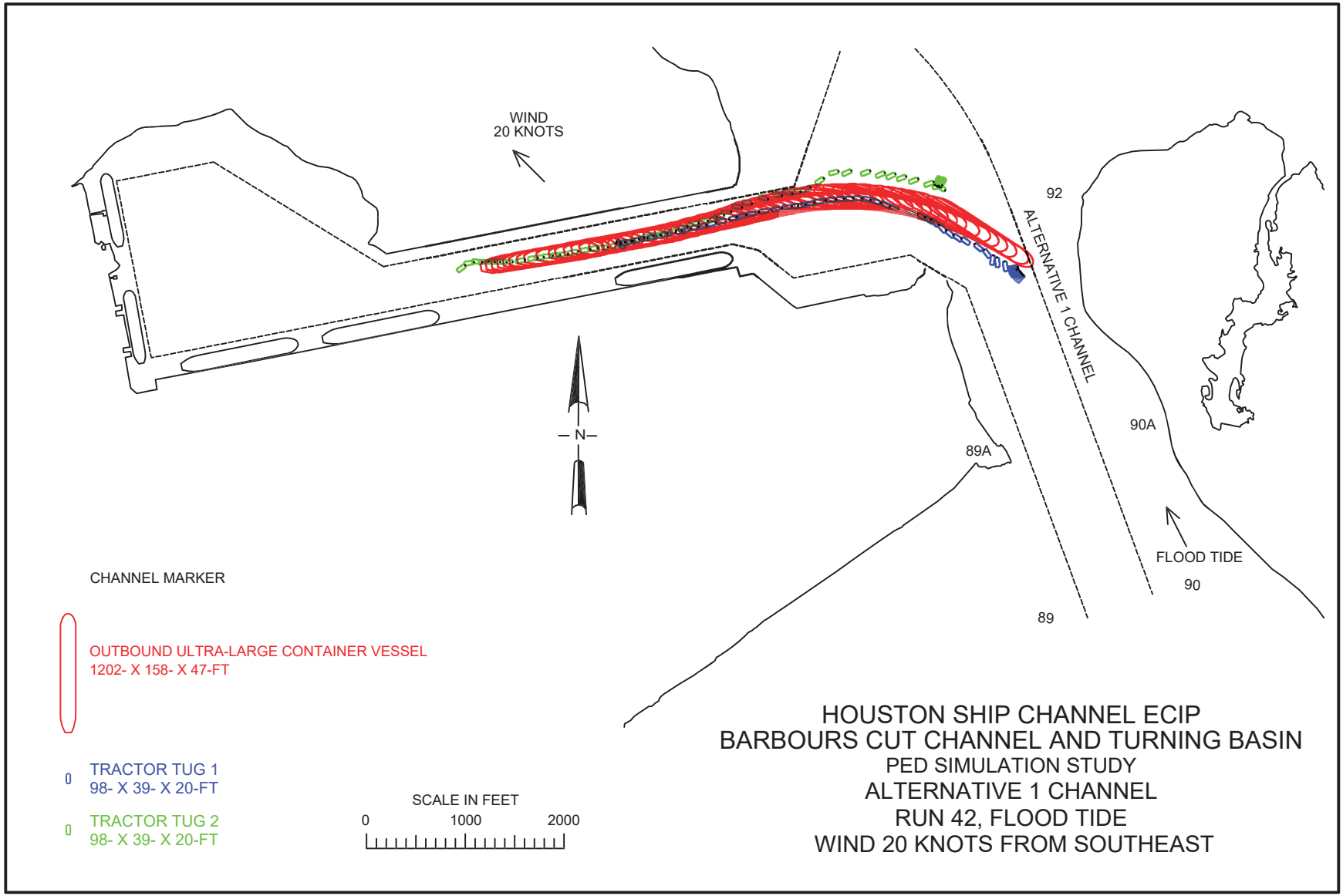

WIND
20 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
N
FLOOD TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 42, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 102

Run **42**

Purpose Outbound turn into Barbours Cut.

Date 5/20/2020
Start Time 1325
End Time 1335
Plan BC-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	49.6/14.2	081/3	Midway

Run Comments
Vessel grounded.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Outbound	Difficult	Yes	Manuever is safe but pilot feels that the behavior of the model is not acting realistically.	No		Possibly moving the turning circle into Barbours cut further so that the vesssel can start turning sooner.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Nomal	Yes	No	No	Yes	Tugmaster agrees that the stern does not seem to have space.	
2 - MS7505	Normal	Yes	No	No	Yes	0	Moving the turning circle further into Barbours cut could ensure that the tugs have the space and time to get into position.

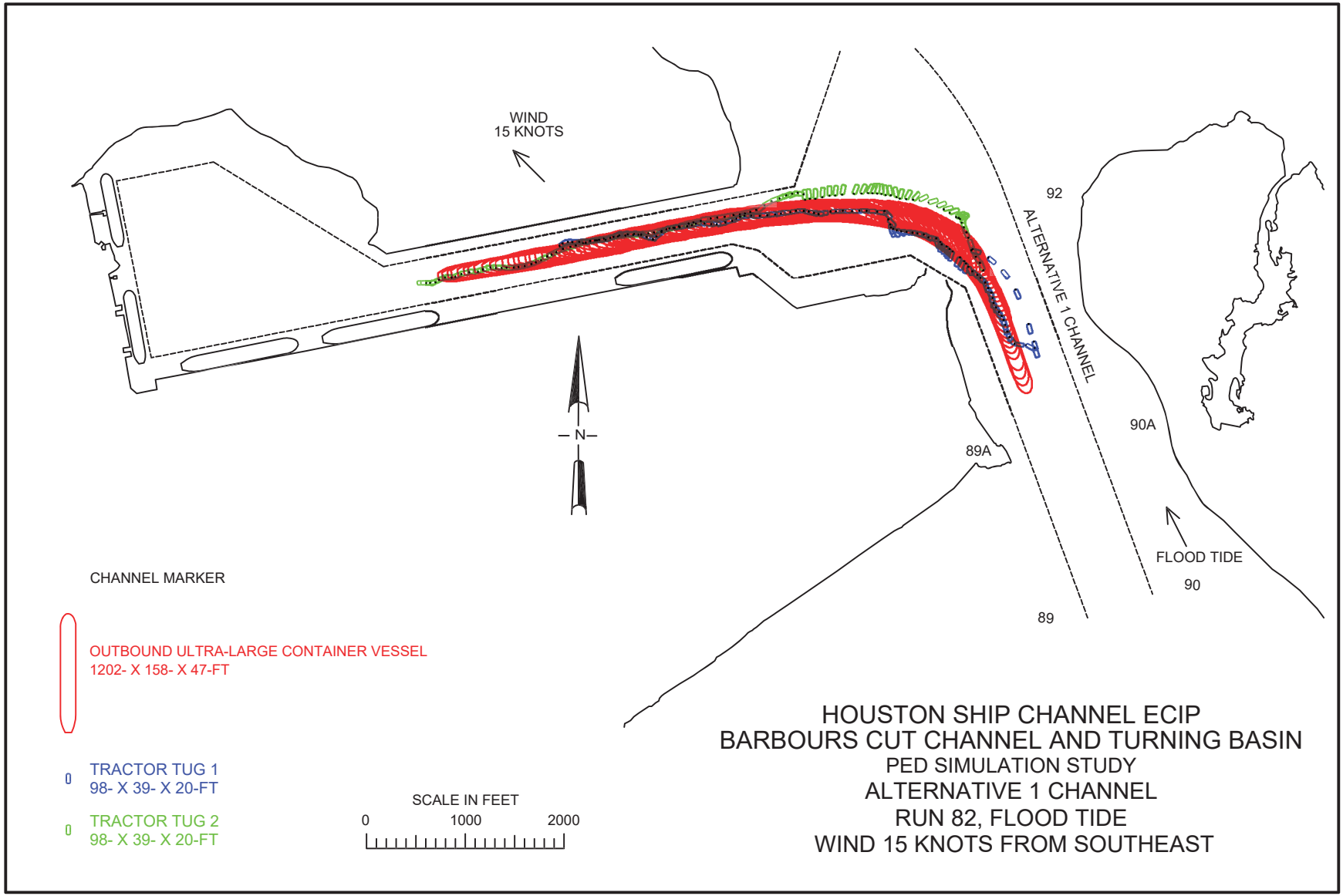

WIND
15 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
FLOOD TIDE
90
89
N
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 82, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 103

Run **82**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tug was included just in case pilot needed it but invisible during the run. Track plot will show but tug was not used.
Date	6/3/2020
Start Time	1100
End Time	1120
Plan	BC-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	081/2.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
A	Outbound	Normal	Yes	Plenty of room in the opening to the channel.	Yes		Wind conditions did cause the pilot to adjust his angle to the south sooner than normal to avoid sweeping his stern on the north side. Pilot had to start turning a little earlier with full rudder and make the turn in increments to avoid the wind and stay in the channel. South cutout is critical.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Plenty of room and never got close to the edge of the channel.	Normal job.
2 - MS7505	Normal	Yes	No	No	Yes		Very easy and normal job.

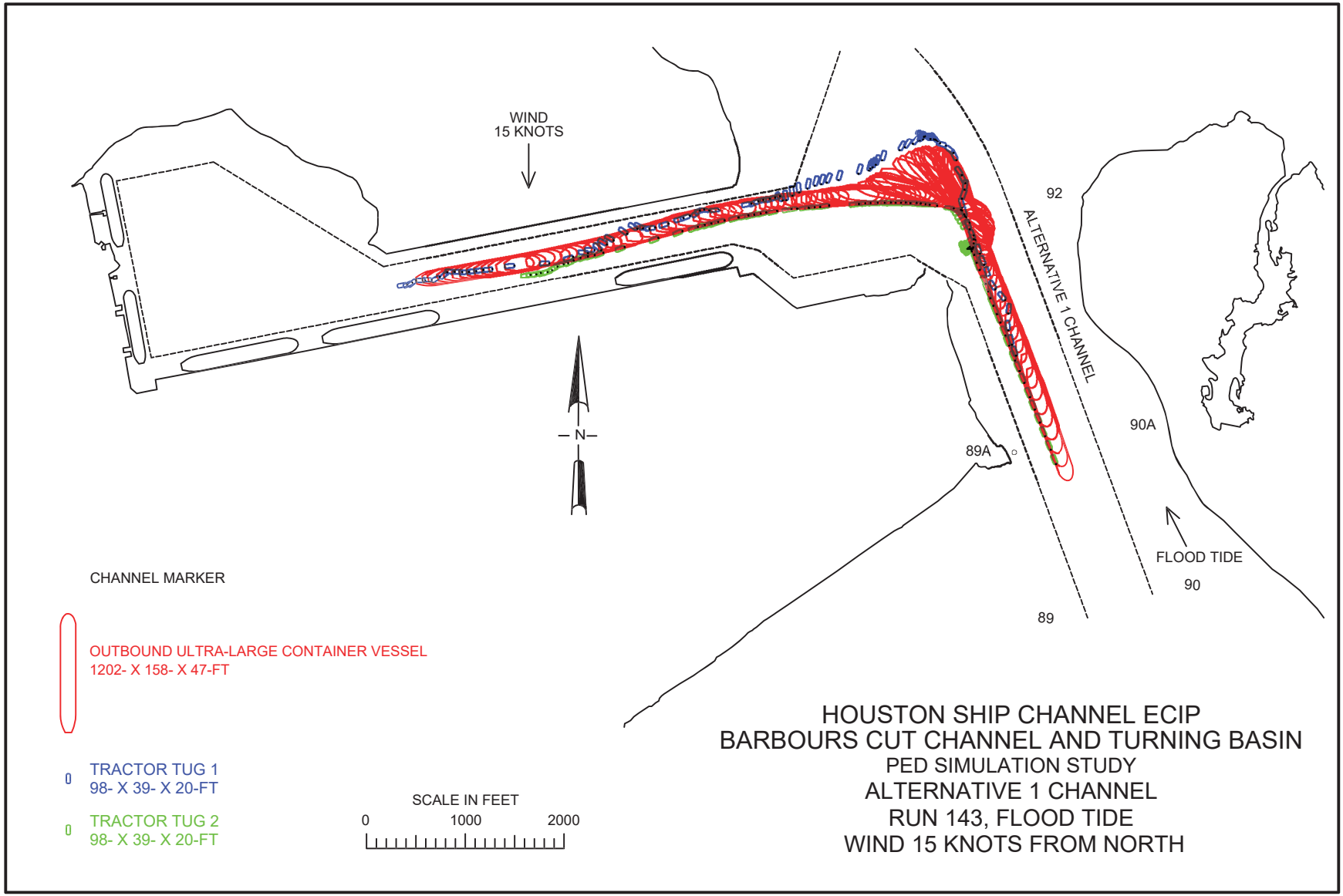

WIND
15 KNOTS
N
92
ALTERNATIVE 1 CHANNEL
90A
89A
FLOOD TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 143, FLOOD TIDE
WIND 15 KNOTS FROM NORTH

PLATE 104

Run **143**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tugs.
Date	6/10/2020
Start Time	1410
End Time	1430
Plan	BC-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	081/3.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Outbound	Diffcult	Marginally	With the north wind you favor the north side of the channel and this causes you to make the turn later than normal. The ship ends up in the main channel before being able to start turning and then requires about a 15 degree turn to complete the turn in the short time	Yes		The turn was successfull but not safe. The ship has to come to a complete stop in the channel to be able to complete the turn and this impedes traffic. The objective for the manuever is to remain in the center due to space on the north side of the channel and to ensure that the stern tug has space to work without leaving the channel. Pilot prefers Alt 6 because he is able to start the turn sooner, impede less on traffic in the channel, and utilizied the stern tug to its full ability.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Plenty of safe water for the bow tug.
3-MS7505	Difficult	Yes	No	Yes	No	There is not enough room to safely manuever for the stern tug and follow commands of the vessel. This manuever has little room for error and could go wrong for the stern tug.	~~With a large vessel and the layout into the channel, the~~ stern tug does not have enough room to operate during the turn. The power requested by the pilot had to be delayed by the tug captain due to not have deep water and safe space to work in. The pilot requested port 90 half but the tug had to operate at full aft due to not having ~~enough deep water to be at a 90 degree angle from the~~

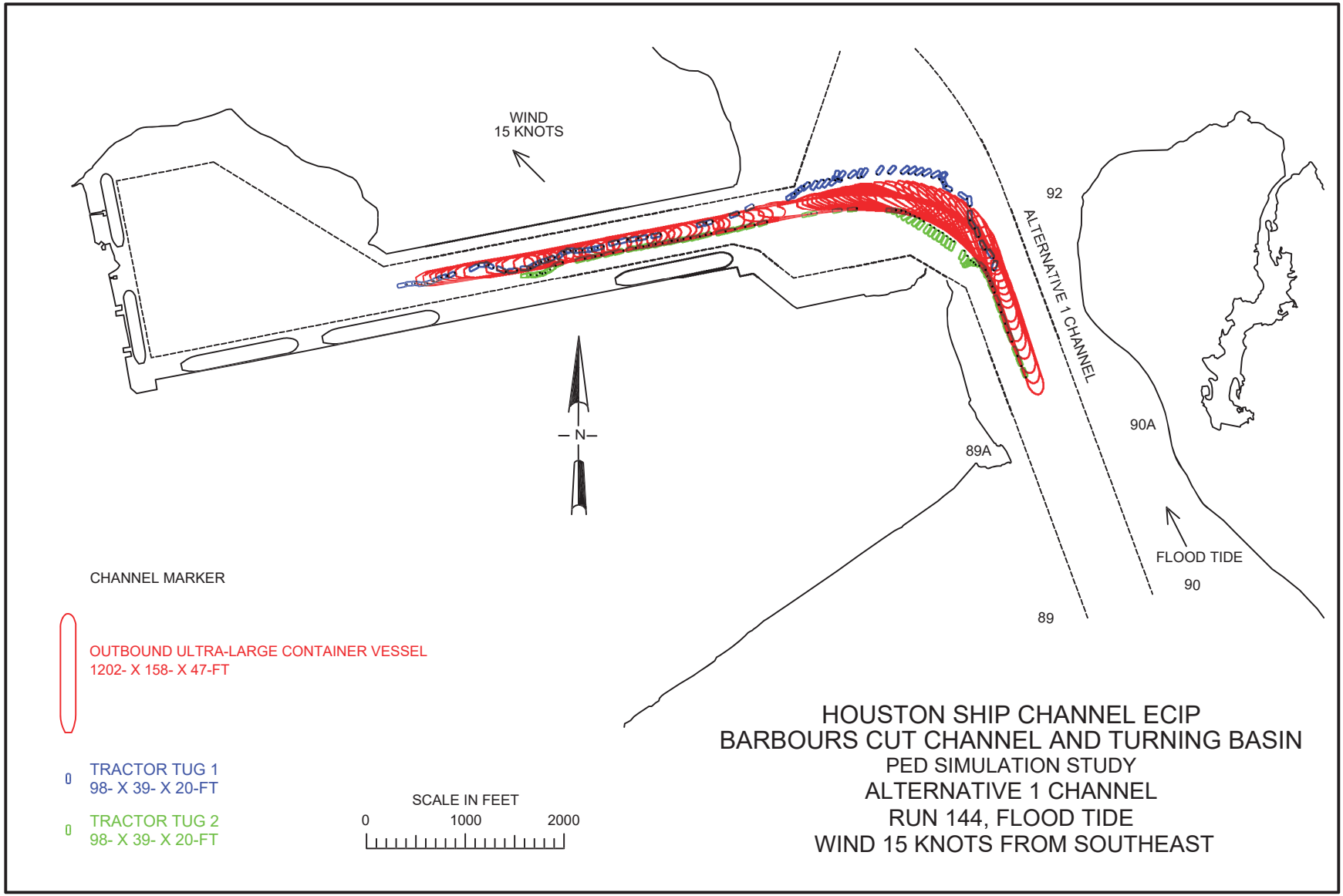

WIND
15 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
FLOOD TIDE
90
89
N
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 144, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 105

Run **144**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tugs.
Date	6/10/2020
Start Time	1445
End Time	1505
Plan	BC-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	081/3.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Outbound	Normal	Yes	Leaning towards difficult because it can be completed but everything was maxed out. Everything has to go the correct way for it to work but if any other factor changed or appeared it would not be successful. Tugs used to full, pilot did have more engine to use but he	Yes		The sooner you can start the turn the safer the manuever. Pilot chose to stay towards the middle of the channel even with the environmental factors working against him so that he could make his turn sooner and not decrease his speed as much as the previous run. Pilot prefers Alt 6 over Alt 1.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	Yes	Yes	The tug at the bow could go back along side if a problem did occur with the engine due to the full power for an extended period of time so he still considered it safe.	Remained back full for the entire manuever until the turn was completed. This does cause concern for the tug as it could experience engine problems with this much power.
3-MS7505	Difficult	Yes	No	No	Yes	Tug captain said it was a safe manuever but there is a very small margin for error and the manuever could easily go wrong.	Tug used a lot of power and had difficultly trying to figure out what position to be in because of the lack of space near the stern. The speed of the vessel was borderline for indirect and direct by the tug so the tug was not as effective. The power used was realistic but not effective due to positoning.

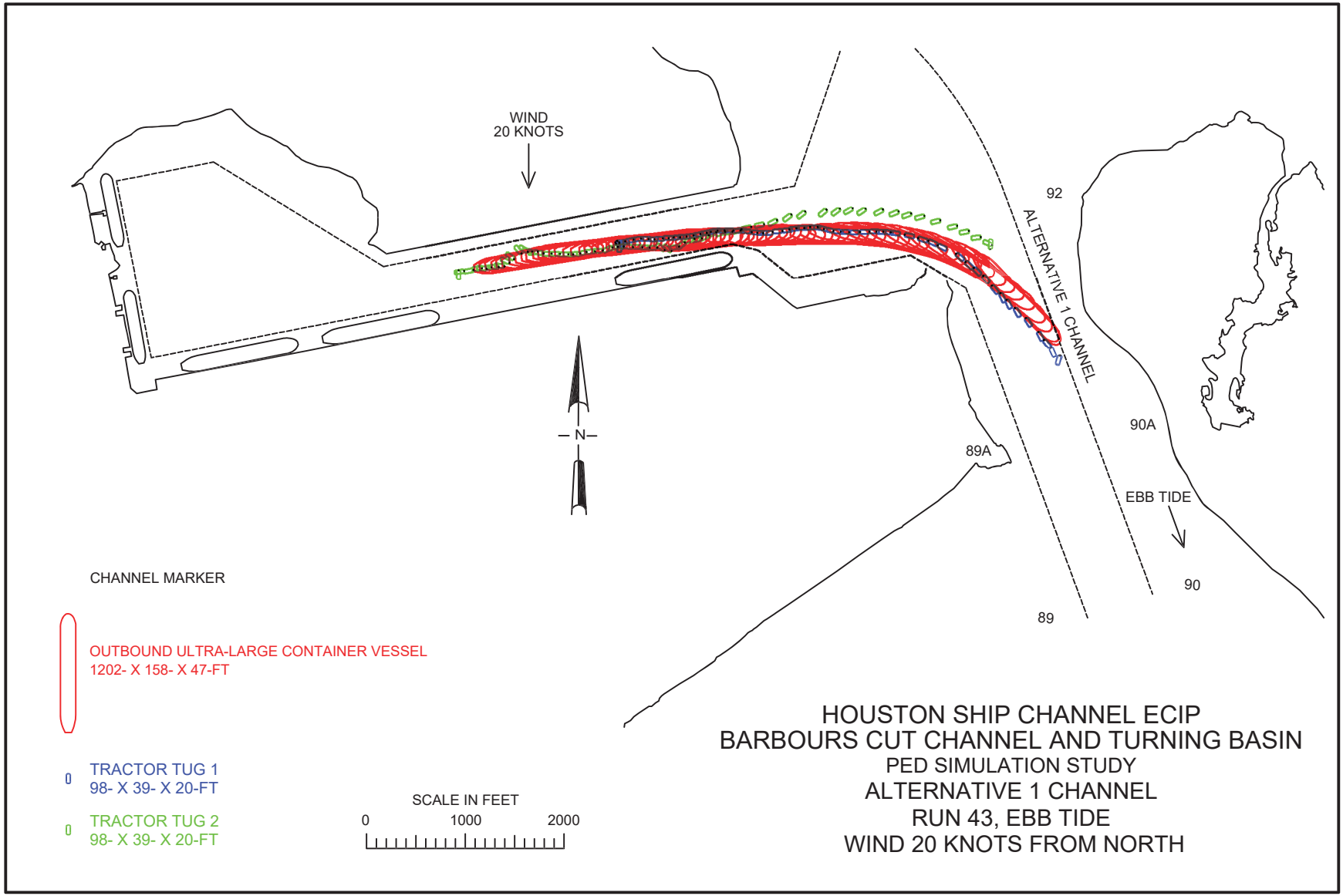

WIND
20 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
EBB TIDE
90
89
N
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 43, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 106

Run **43**

Purpose Outbound turn into Barbours Cut.

Date 5/20/2020
Start Time 1400
End Time 1410
Plan BC-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	49.6/14.2	081/3	Midway

Run Comments
Bow went outside of the federal channel causing the vessel to ground.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
H	Outbound	Difficult	No	More tugs would make the job safe. Pilot recommends at least 3 tugs with the wind and current.	No	0	

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		Tug was not used.
2 - MS7505	Normal	No	No	No	Yes	The parameters for tugs were within reason and never outside of the comfort zone.	The tug was unable to get into position to turn the vessel that was requested by the pilot.

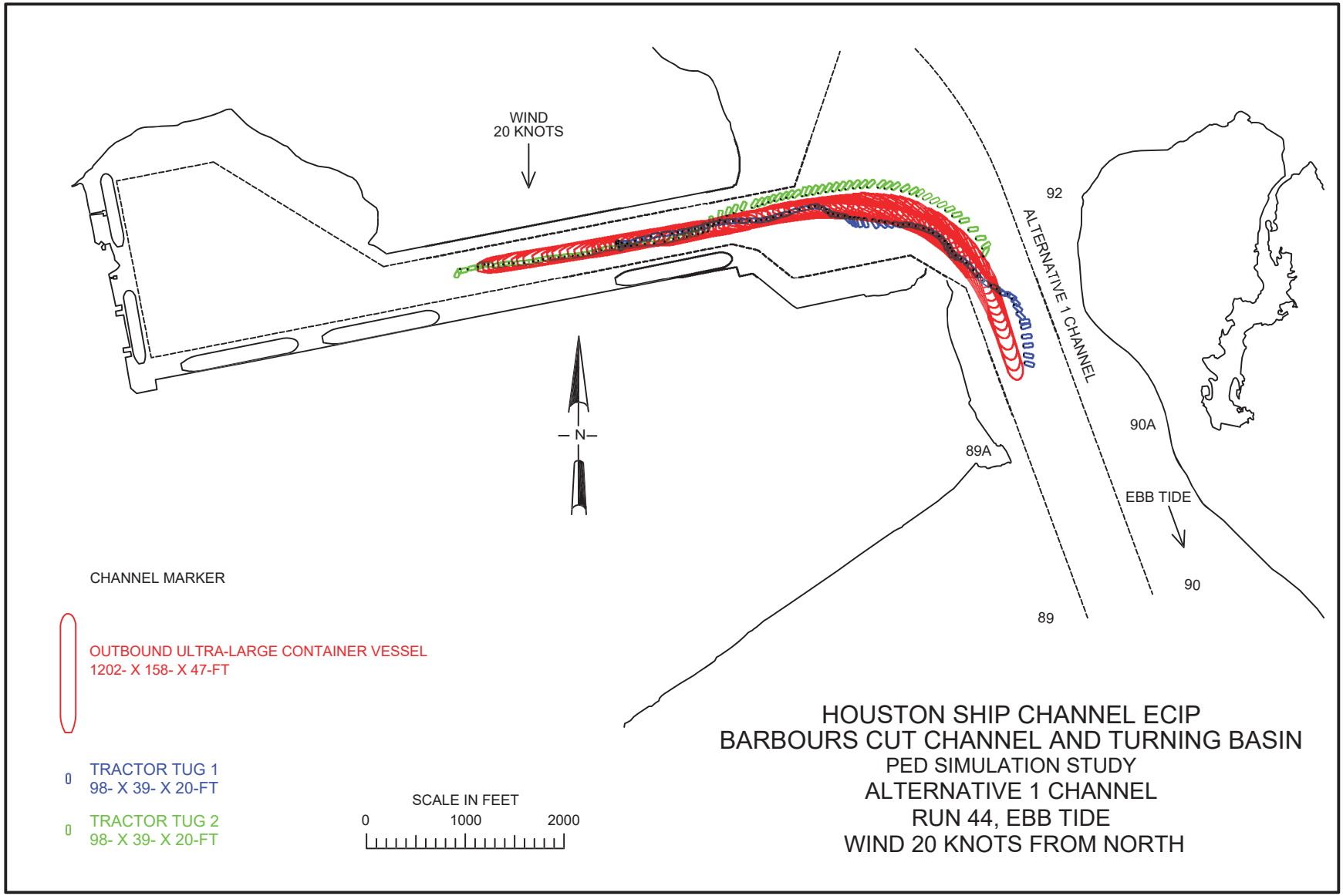

WIND
20 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
EBB TIDE
90
89
N
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 44, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 107

Run **44**

Purpose Outbound turn into Barbours Cut. Adding two instructor controlled tugs for this run.

Date 5/20/2020
Start Time 1425
End Time 1440
Plan BC-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	49.6/14.2	081/3	Midway

Run Comments
Run completed by trying to wait till the stern cleared the area before turning.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
G	Outbound	Diffcult	No	Strong wind and the amount of sail area on the ship make it hard. The majority of the maneuver the tugs were used at full power.	Yes		Not necessarily safe. Pilot said this type of manuever requires 4 tugs. Maintained around 3 knots and pilot notes the slower speed made it easier to do.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		
2 - MS7505	Normal	Yes	No	No	Yes	Placement was good.	Effectiveness of the tugs was not as usefull when the the speed of the vessel increased. Tugs as to switch to an indirect pull.

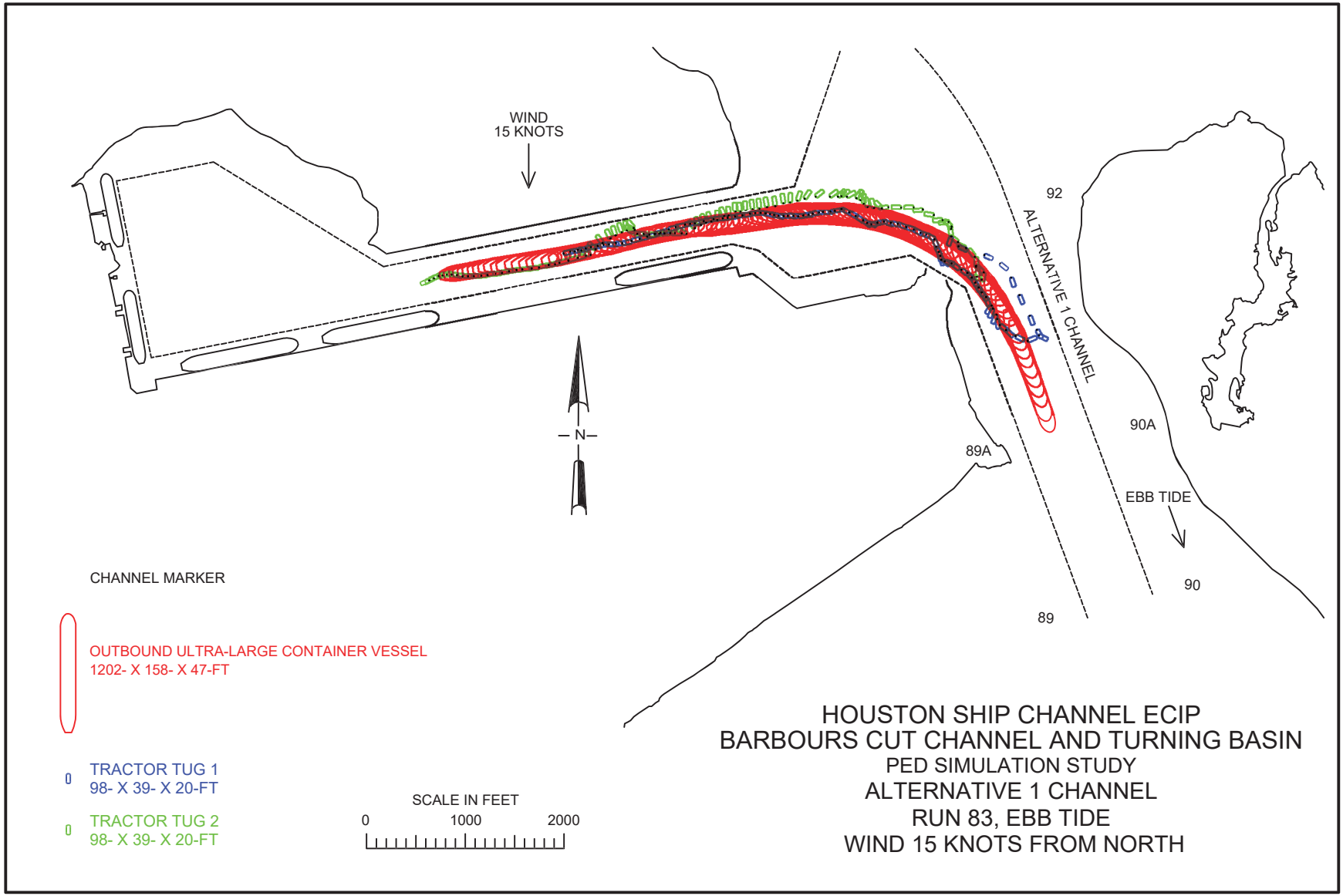

WIND
15 KNOTS
92
ALTERNATIVE 1 CHANNEL
90A
89A
EBB TIDE
90
89
N
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 83, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 108

Run **83**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tug was included just in case pilot needed it but invisible during the run. Track plot will show but tug was not used.
Date	6/3/2020
Start Time	1130
End Time	1150
Plan	BC-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	081/2.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
J	Outbound	Normal	Yes	Good tug control and plenty of space in the flare for the turn.	Yes		Pilot wishes he would have been further to the north to make the turn wider and higher but the wind caught him before he was able to. He also was concerned that being further north would put the tug in danger, instead he gave the vessel more kick to make the turn in safe water with the conditions. South cutout is critical.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		Plenty of room for the tug operator.
2 - MS7505	Difficult	Yes	No	No	Yes		Speed of the ship and the location of the tug made it very hard to do a direct pull that was being ask for by the pilot. He was not able to be completely effective for the vessel and was only giving about 10 tons during the manuever.

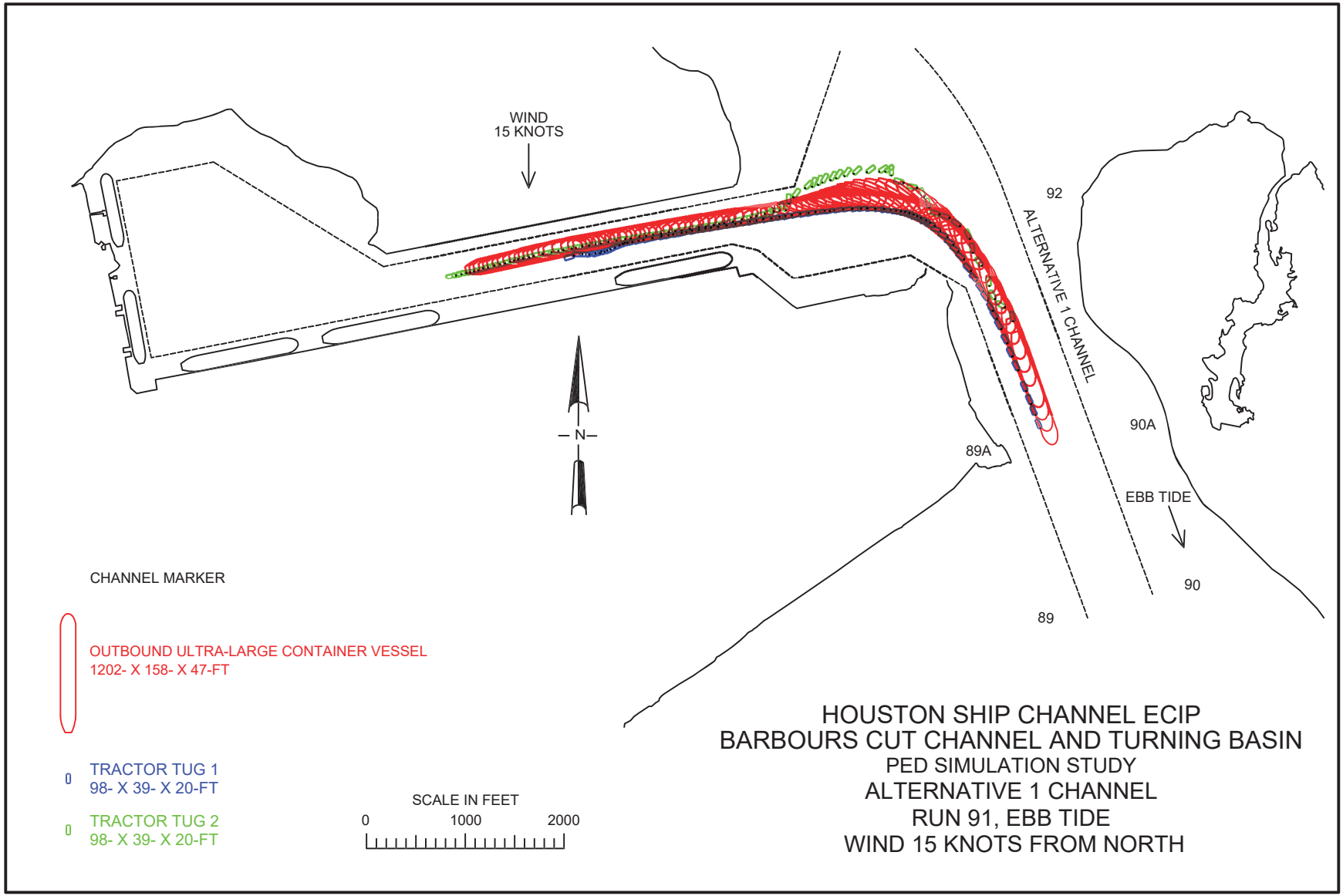

WIND
15 KNOTS
N
92
ALTERNATIVE 1 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 91, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 109

Run **91**

Purpose Depart Barbour's Cut from Mid-channel.

Date 6/4/2020
Start Time 0940
End Time 1000
Plan BC-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/15
Tugs 3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	078/2.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Outbound	Normal	Yes	Borderline difficult due to the vessel configuration (1/3 ship of the ship is located in front of you). Pilot commented that you have to be aware of the vessel length when you're starting to make the turn so that you don't get to close to the north bank.	Yes		PIlot noted it would be easier if the north bank was cut back so that you could start the turn earlier. Wind and current did not make much of a difference.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Plenty of water and never got close to the bank.	Standard job.
2 - MS7505	Normal	Yes	No	No	Yes		Had space during the turn and did not get close to the channel line.

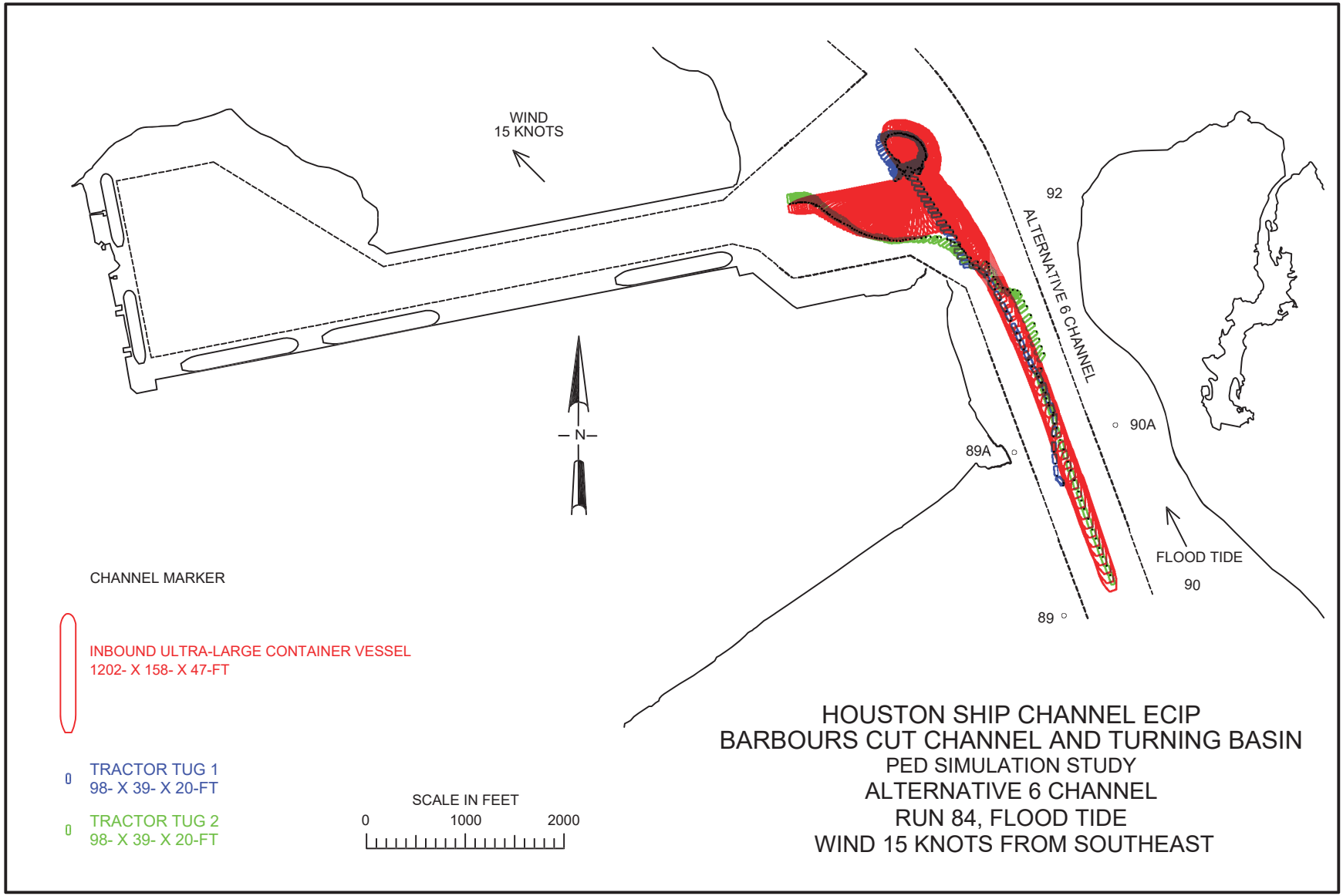

WIND
15 KNOTS
N
92
ALTERNATIVE 6 CHANNEL
90A
89A
FLOOD TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 84, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 110

Run **84**

Purpose Entrance to Barbour's Cut - Turn at Entrance TB

Date 6/3/2020
Start Time 1240
End Time 1305
Plan BC-A6
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/15
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	342/4	89-90

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Amount of space available in the turning area makes it safe even with the environmental conditions.		Yes	Pilot noted that the vessel would not slow down so it did make the turn a little bit harder. With the conditions given during the simulations, two tugs is definitely the bare minimum.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		"Everyday job"
2 - MS7505	Normal	Yes	No	No	Yes		

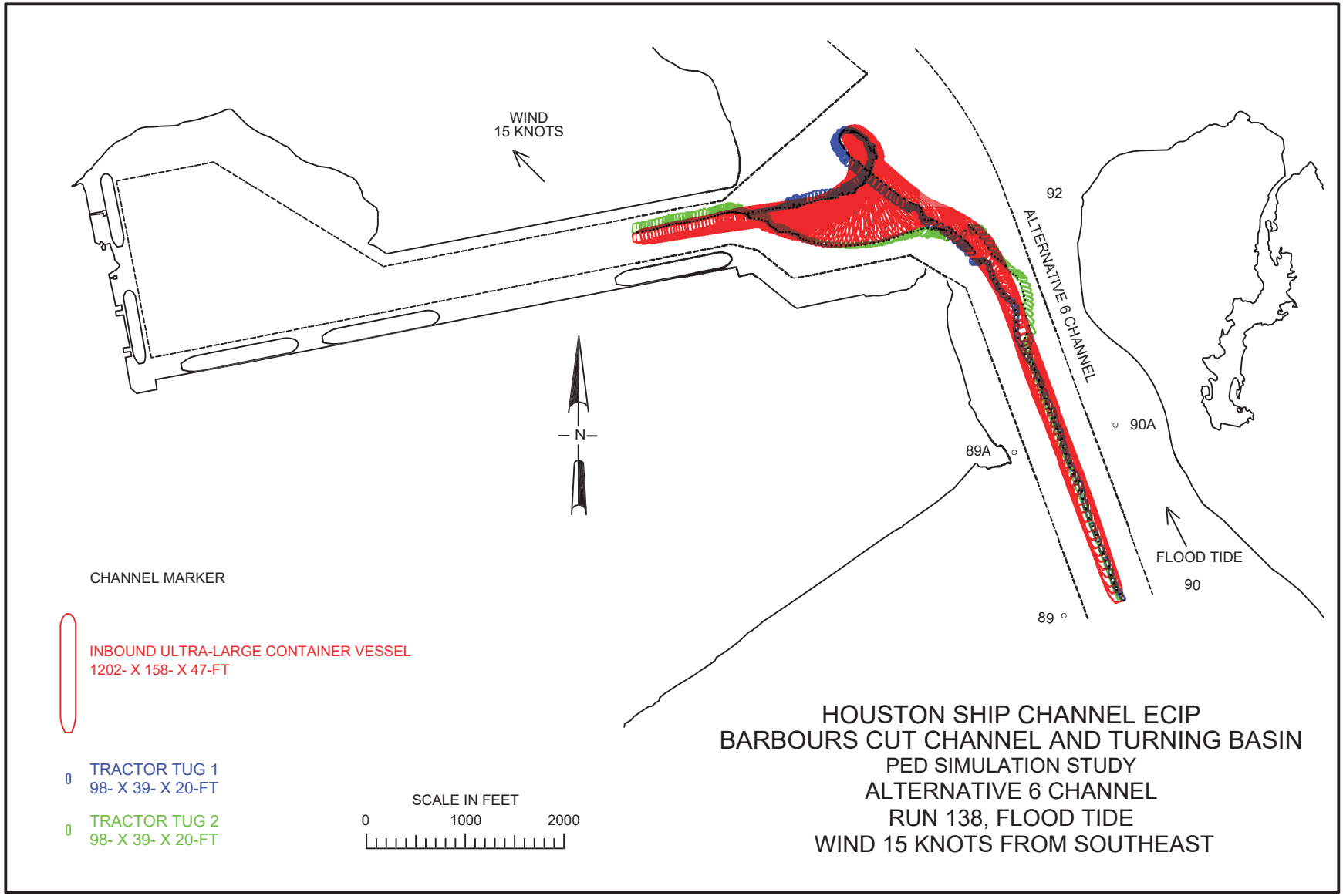

WIND
15 KNOTS
N
92
ALTERNATIVE 6 CHANNEL
90A
89A
FLOOD TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 138, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 111

Run **138**

Purpose	Entrance to Barbour's Cut - Turn at Entrance TB Two instructor controlled tugs.
Date	6/10/2020
Start Time	0850
End Time	0935
Plan	BC-A6
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	342/4	87-88

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Size of the flare on the north side of the entrance allows for a large vessel to get out of the channel and not impeded traffic while safely backing in to Barbours Cut.		Yes	The current caused the pilot to use the tugs more to stop the vessel from setting up to the north.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		As the vessel starts backing in at around 2 knots, the location of the bow tug causes it to not be helpful due to not being able to stay with the vessel. Captain noted it is more noticeable in the simulation and in real life he would be able to adjust and help better.
2-MS7505	Normal	Yes	No	No	Yes		Captain noted that the way the entrance to Barbours Cut is set up now the stern tug normally gets close to the north bank but with the cutout as it is done in Alt 6 this issue was removed. The cutout made it safer and easier for the stern tug to operate.

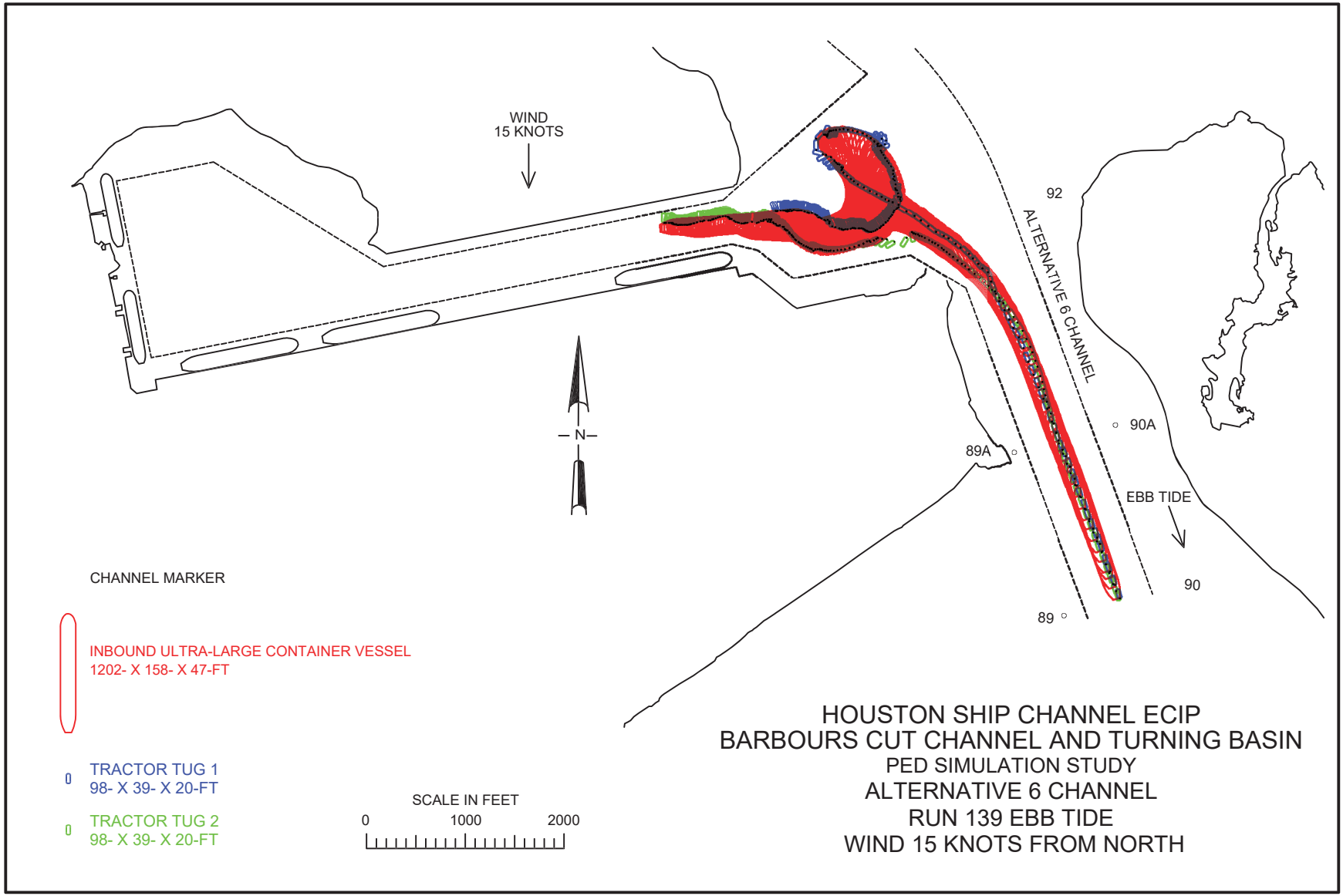

WIND
15 KNOTS
N
92
ALTERNATIVE 6 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 139 EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 112

Run **138**

Purpose	Entrance to Barbour's Cut - Turn at Entrance TB Two instructor controlled tugs.
Date	6/10/2020
Start Time	0850
End Time	0935
Plan	BC-A6
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	342/4	87-88

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Inbound	Normal	Yes	Size of the flare on the north side of the entrance allows for a large vessel to get out of the channel and not impeded traffic while safely backing in to Barbours Cut.		Yes	The current caused the pilot to use the tugs more to stop the vessel from setting up to the north.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		As the vessel starts backing in at around 2 knots, the location of the bow tug causes it to not be helpful due to not being able to stay with the vessel. Captain noted it is more noticeable in the simulation and in real life he would be able to adjust and help better.
2-MS7505	Normal	Yes	No	No	Yes		Captain noted that the way the entrance to Barbours Cut is set up now the stern tug normally gets close to the north bank but with the cutout as it is done in Alt 6 this issue was removed. The cutout made it safer and easier for the stern tug to operate.

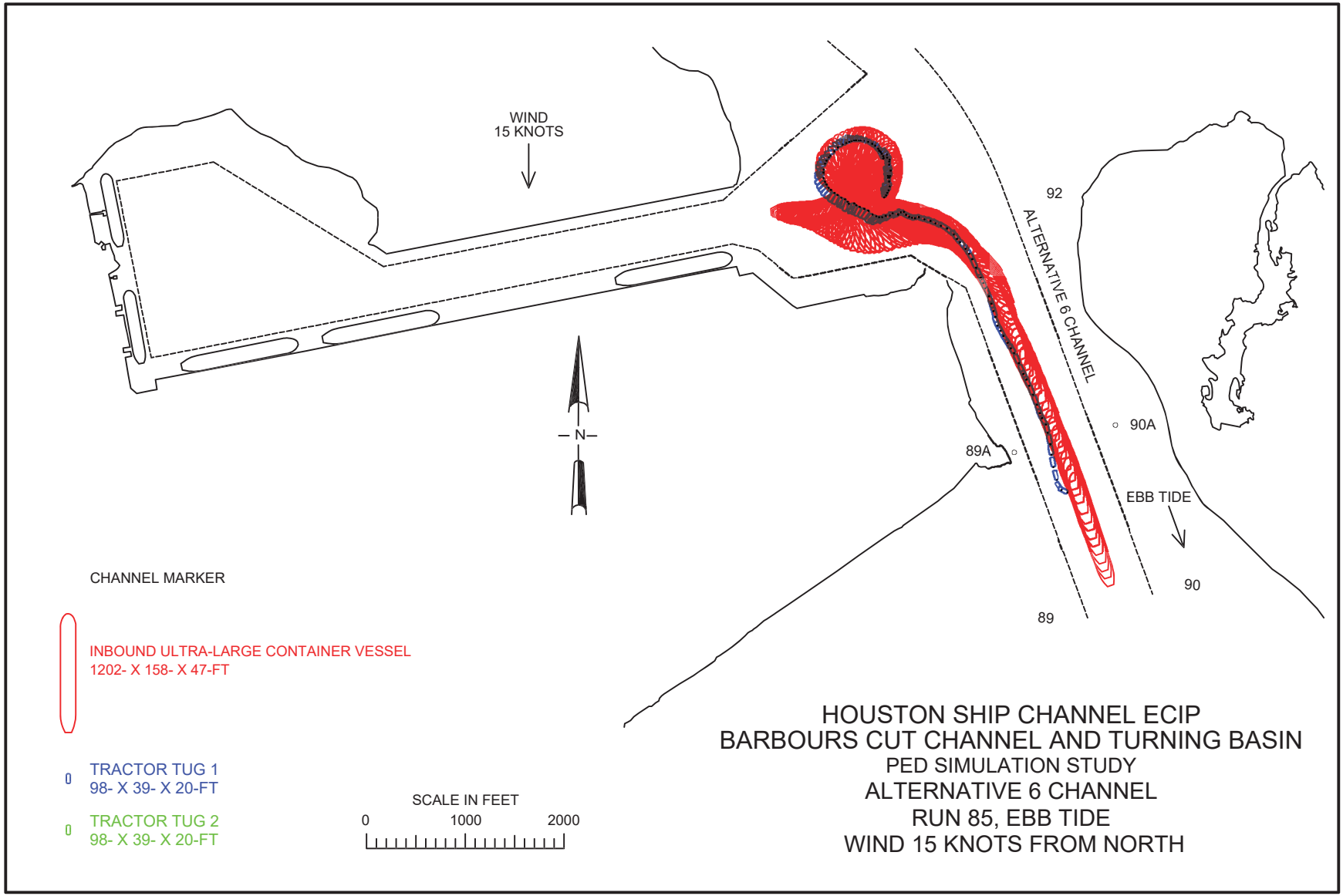

WIND
15 KNOTS
N
92
ALTERNATIVE 6 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 85, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 113

Run **85**

Purpose	Entrance to Barbour's Cut - Turn at Entrance TB Two instructor controlled tugs.
Date	6/3/2020
Start Time	1315
End Time	1340
Plan	BC-A6
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	342/4	89-90

Run Comments
Run specifically made by going further left before turning around to try and get out of the federal channel.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
J	Inbound	Normal	Yes	Extra tugs and the current made a good margin of safety. Easier to get into the flare and out 0f the way of the traffic.	0	Yes	

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Tug stayed in good water and in safe area.	
2 - MS7505	Normal	Yes	No	No	Yes		Did get tight during the turn but never exceeded the operating parameters. No danger. Used a lot of power but not unreasonable for the vessel size and the environmental conditions.

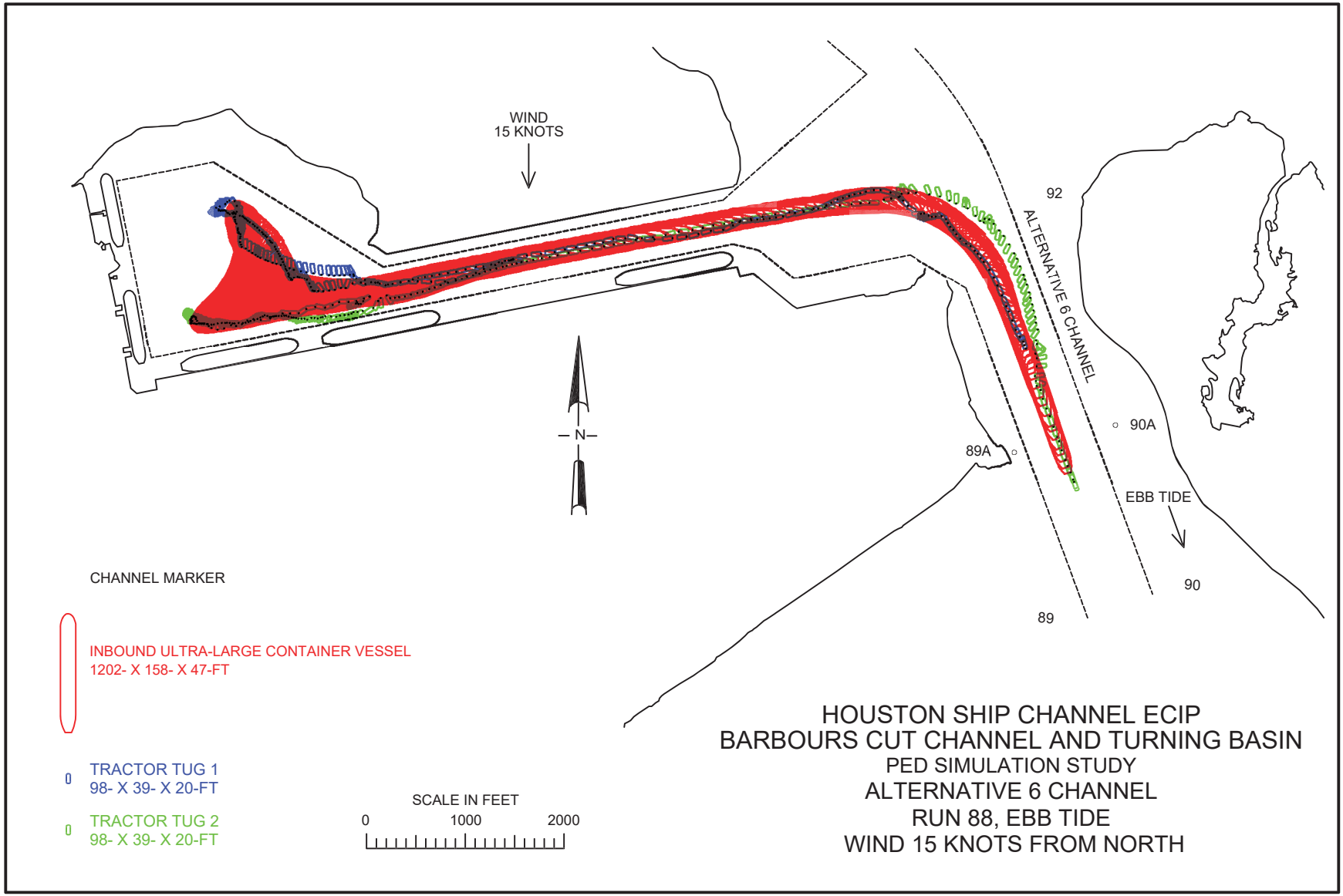

WIND
15 KNOTS
N
92
ALTERNATIVE 6 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 88, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 114

Run **88**

Purpose	Enter Barbours Cut and turn in Turning Basin Two instructor controlled tugs.
Date	6/3/2020
Start Time	1515
End Time	1605
Plan	BC-A6
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	4

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	342/4	89-90

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
A	Inbound	Normal	Yes	The wind conditions did make the rating borderline difficult.	Yes	Yes	Having four tugs during the operation was useful and helped for the turn. The extra cutout on the north side while turning into the flare helped make the turn smoother instead of doing a 3 point turn.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		
2 - MS7505	Normal	Yes	No	No	Yes		Tight while turning into the basin but tug was able to squeeze through without getting too close to berthed vessels.

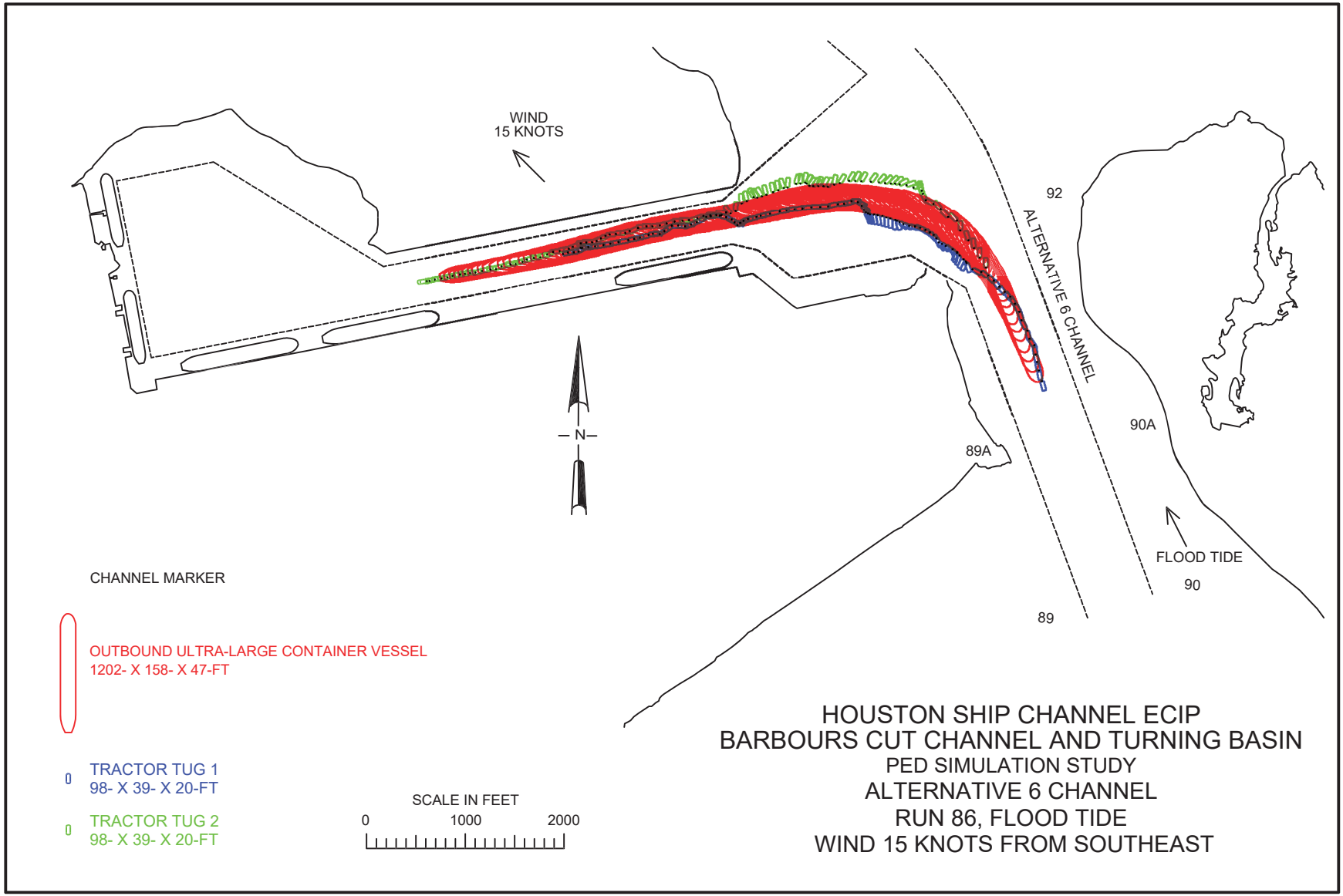

WIND
15 KNOTS
92
ALTERNATIVE 6 CHANNEL
90A
89A
N
FLOOD TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 86, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 115

Run **86**

Purpose Depart Barbour's Cut from Mid-channel.

Date 6/3/2020
Start Time 1405
End Time 1420
Plan BC-A6
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/15
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	081/2.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Outbound	Normal	Yes	Plenty of space due to the widener.	Yes		Extra space on the north side of the flare allowed the pilot to speed up and make the turn faster and sooner, which would impeed less on the traffic in the channel. Extra space for the stern and the tug allows for the manuever to occur easier rather than a three point turn. Safe manuever as you pick up speed. Pilot noted that he prefers Alt 6 over the RP layourt.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes	Plenty of water and a safe speed.	Changing layout did not make a difference for the bow tug operator.
2 - MS7505	Normal	Yes	No	No	Yes		The chart plotter that the tug operator was originally using was the RP verision so he signalled to the pilot he could not preform the task being ask. When the chart plotter was changed to Alt 6 it allowed the tug to have more than enough space to perform the task.

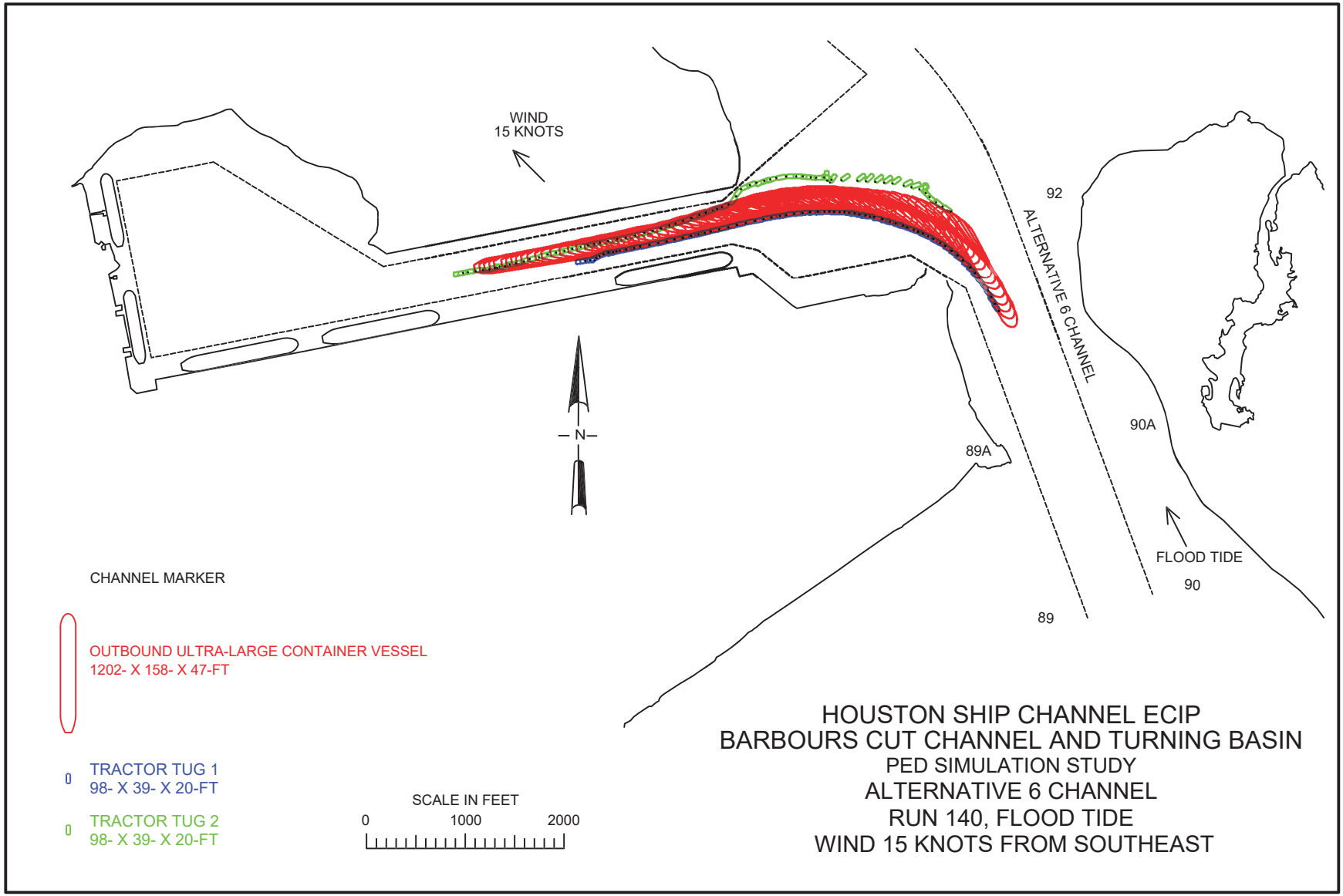

WIND
15 KNOTS
92
ALTERNATIVE 6 CHANNEL
90A
89A
FLOOD TIDE
90
89
N
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 140, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 116

Run **140**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tugs.
Date	6/10/2020
Start Time	1100
End Time	1115
Plan	BC-A6
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	081/2.5	Midway

Run Comments
Vector tug was not used. System crashed at the end of the run. 14 of the 16 minutes was captured in the Run Log, however a record file will not be available for replay.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Outbound	Normal	Yes	The cutut on the north side makes it significatnly easier. Make the turn as if it was a smaller size ship in today's configureation. Essential for making safe.	Yes		Pilot set up with the current and adjusted as he would normally, it did not make a strong imapct on the run.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Normal job for the bow tug.
2-MS7505	Normal	Yes	No	No	Yes		The cutout allowed the tug to work less than normal because the ship was able to do more on his own.

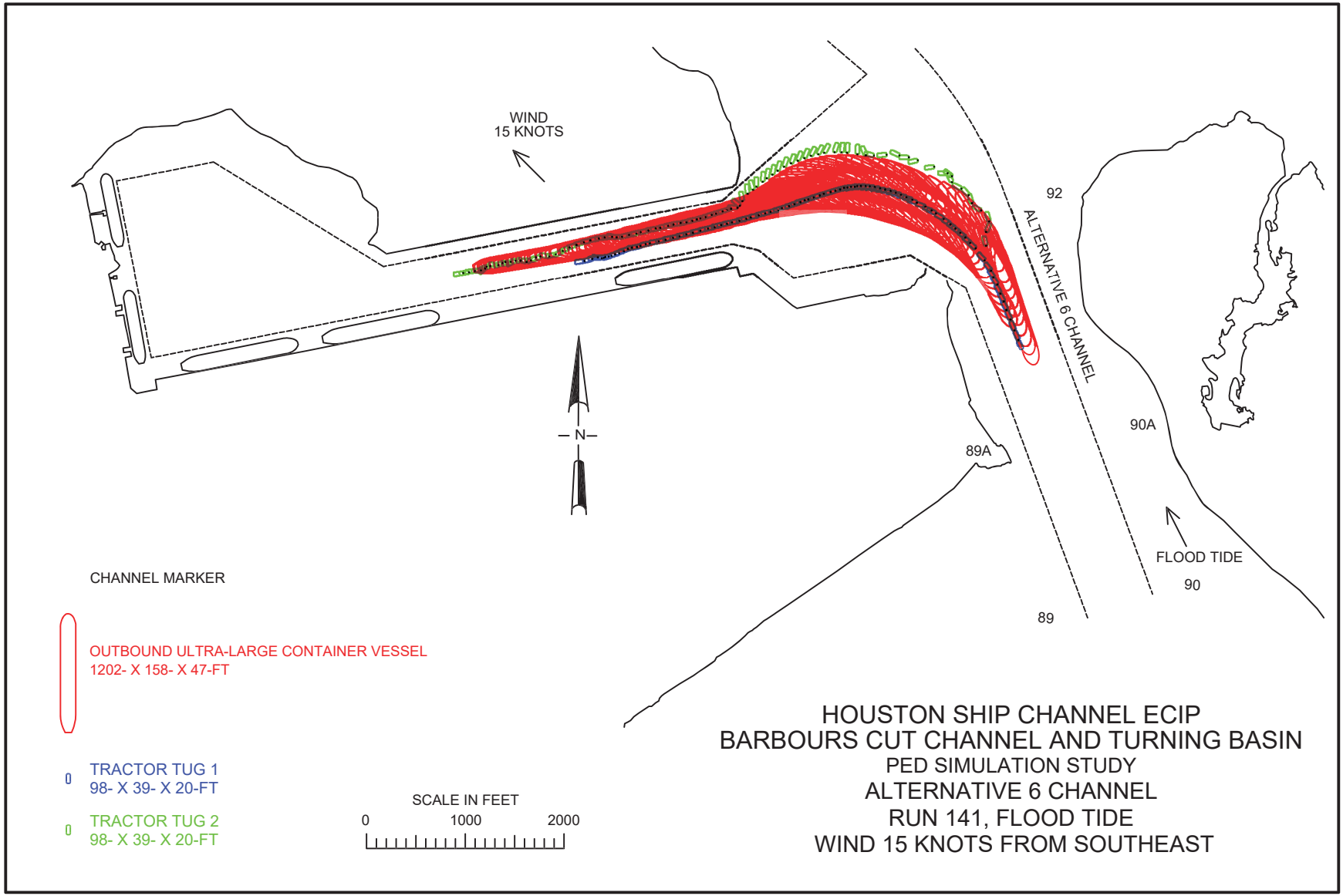

WIND
15 KNOTS
92
ALTERNATIVE 6 CHANNEL
90A
89A
FLOOD TIDE
90
89
N
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 141, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 117

Run **141**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tugs.
Date	6/10/2020
Start Time	1215
End Time	1235
Plan	BC-A6
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	081/2.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Outbound	Normal	Yes	With the cutout further west it allows the ship to have more space for the stern to turn out.	Yes		Wind set the ship to the north so the pilot had to use the tugs and extra rudder to stay off the north bank but it was controlable.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Normal job for the bow tug. Never worked over half.
2-MS7505	Normal	Yes	No	No	Yes		

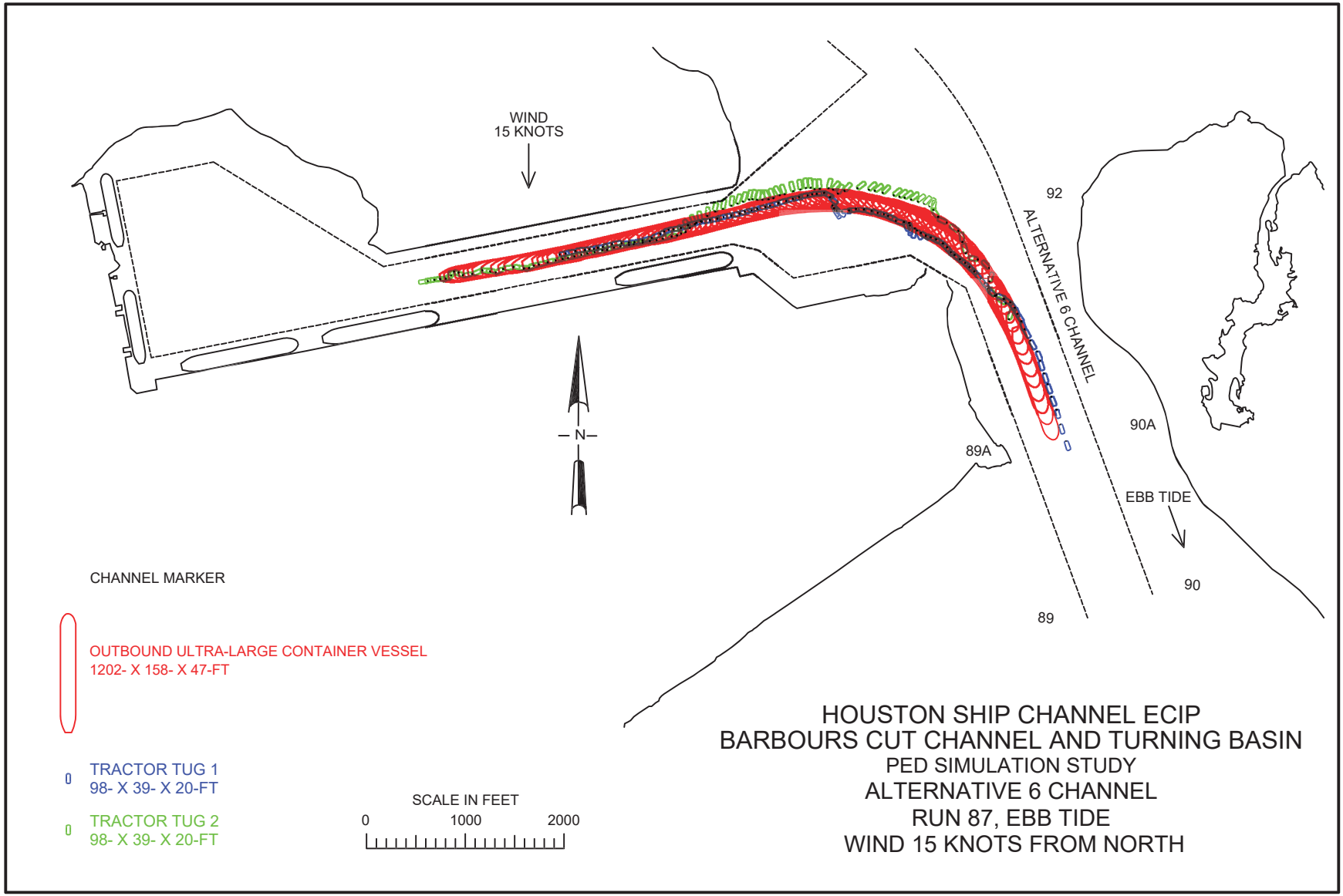

WIND
15 KNOTS
N
92
ALTERNATIVE 6 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 87, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 118

Run **87**

Purpose Depart Barbour's Cut from Mid-channel.

Date 6/3/2020
Start Time 1435
End Time 1455
Plan BC-A6
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/15
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	081/2.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
J	Outbound	Normal	Yes	Wider margin on the north flare allows for more space for the stern, allows the pilot to start the turn earlier, and for the tugs to have room to operate.	Yes		Pilot was closer to the south bank then wanted due to the wind but was still able to remain further away from the bank then previous runs because of the extra cutout. The cutout allowed for the pilot to set further North before turning just in case of a gust of wind, this allowed for a greater margin of safety in accounting for the environmental factors. Pilot prefers this layout over the RP.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		Changing layout did not make a difference for the bow tug operator.
2 - MS7505	Easy	Yes	No	No	Yes		Tug did get close to the edge but not outside of the boundaries. Extra space allows for the tug to start turning an extra 300-400 ft earlier then in the RP layout.

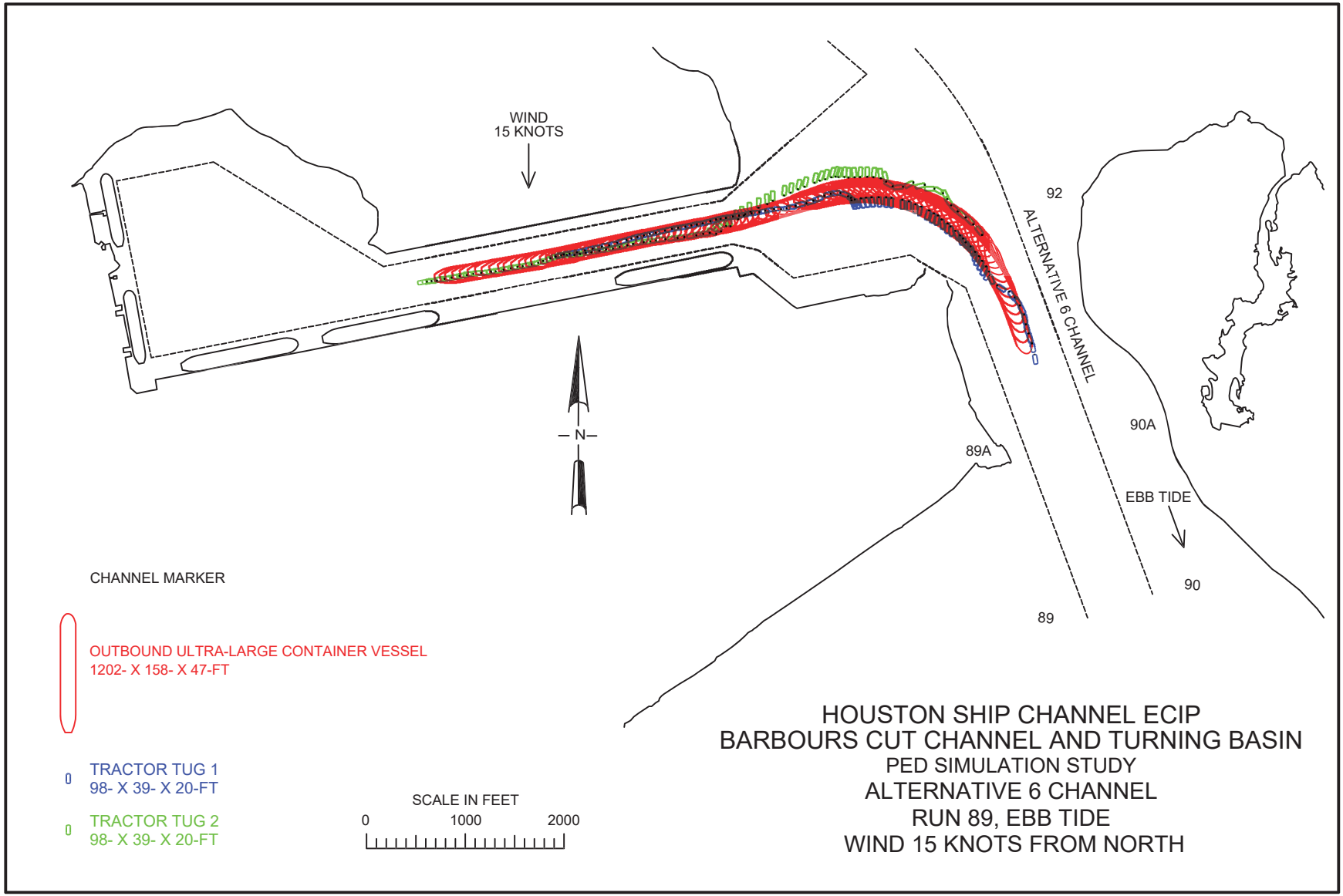

WIND
15 KNOTS
N
92
ALTERNATIVE 6 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 89, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 119

Run **89**

Purpose Depart Barbour's Cut from Mid-channel.

Date 6/3/2020
Start Time 1615
End Time 1630
Plan BC-A6
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/15
Tugs 2

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	081/2.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Outbound	Normal	Yes	The room on the north side and the cut out on the south side allow for adequate space.	Yes		North wind played a role but due to the extra space it was still a very comfortable manuever. Extra space makes a huge difference compared to the original.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1 - MZ7505	Normal	Yes	No	No	Yes		Had plenty of water and everything went smootly.
2 - MS7505	Easy	Yes	No	No	Yes		Extra room on the north side makes a huge difference.

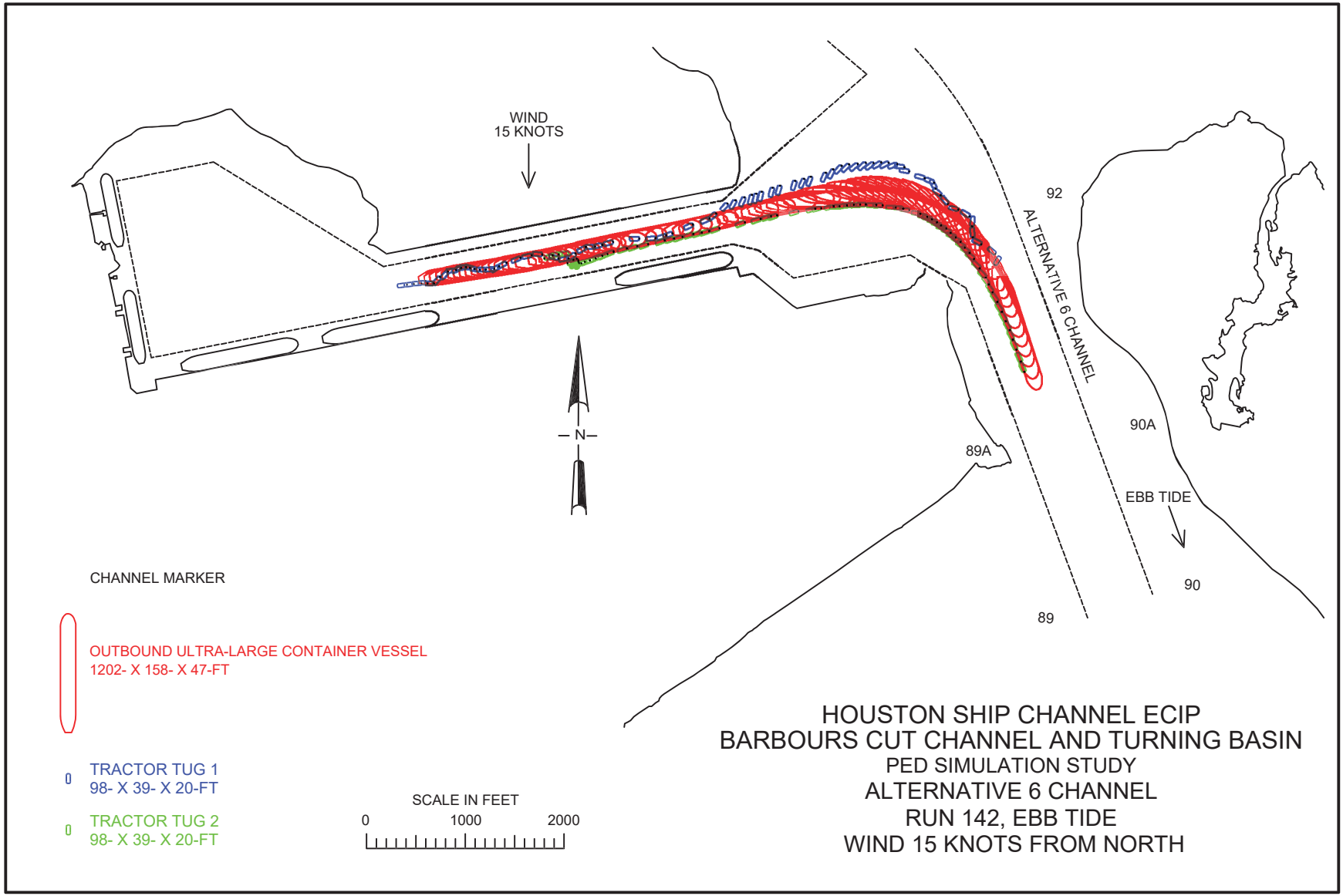

WIND
15 KNOTS
N
92
ALTERNATIVE 6 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 6 CHANNEL
RUN 142, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 120

Run **142**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tugs.
Date	6/10/2020
Start Time	1340
End Time	1400
Plan	BC-A6
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	081/3.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
D	Outbound	Normal	Yes	The north cutout allows for the ship to turn sooner without worrying about the stern hitting.	Yes		PIlot took the wind and current into account and adjusted the ship direction further north to account for the wind.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Normal job. Never used over half.
2-MS7505	Normal	Yes	No	No	Yes		Tug is able to get in position for turning a lot sooner due to the extra space. The cutout allows the stern tug to start assisting in the turn about 400 ft sooner then he can in the current channel layout.

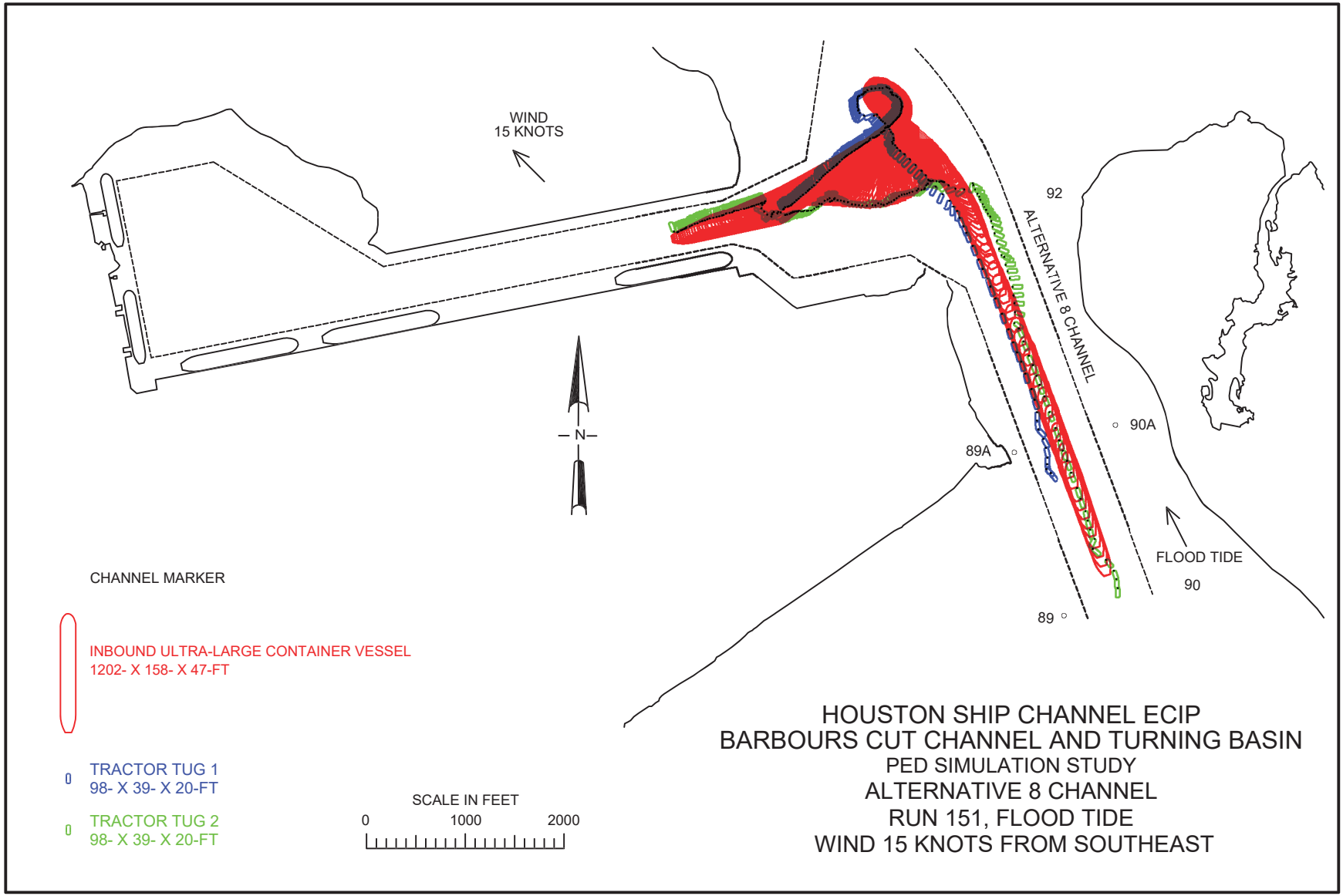

WIND
15 KNOTS
N
92
ALTERNATIVE 8 CHANNEL
90A
89A
FLOOD TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 8 CHANNEL
RUN 151, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 121

Run **151**

Purpose	Entrance to Barbour's Cut - Turn at Entrance TB One instructor controlled tug.
Date	6/11/2020
Start Time	1045
End Time	1125
Plan	BC-A8
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	342/5	87-88

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Inbound	Normal	Yes	Leaning towards difficult due to a faster speed then desired so the pilot had to take more time to slow down. This caused him to not be able to go as deep into the flare and had to make his turn in the channel. It was safe, just need to start a slower speed.		Yes	The wind was manageable.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Remained in deep water and not overused during the manuever.
2-MS7505	Normal	Yes	No	No	Yes		Simulation error did cause the tug to not have power for part of the run. However, he was still used and helpful when he did have power.

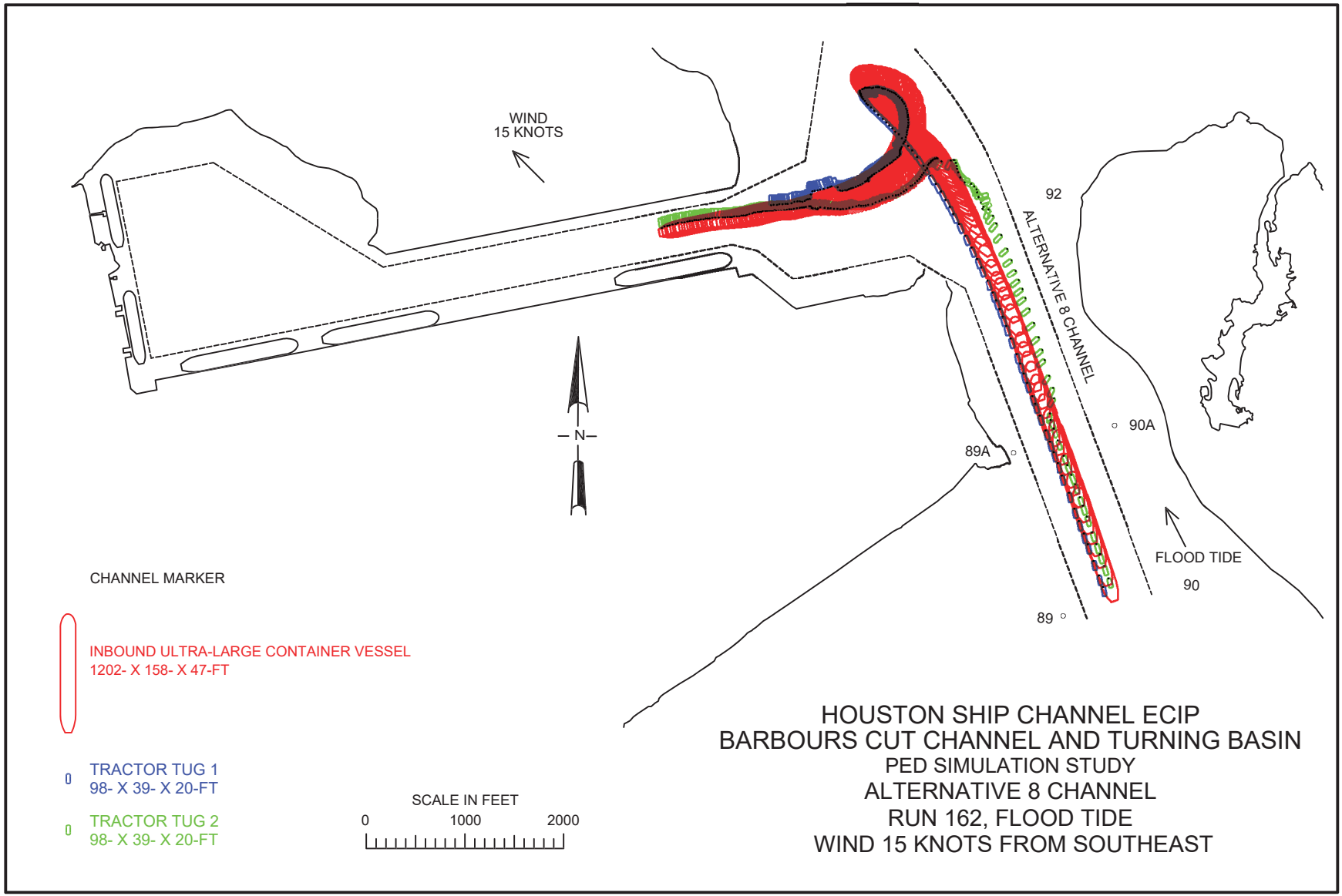

WIND
15 KNOTS
N
92
ALTERNATIVE 8 CHANNEL
90A
89A
FLOOD TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 8 CHANNEL
RUN 162, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 122

Run **162**

Purpose	Enter Barbours Cut. One instructor controlled tug.
Date	6/12/2020
Start Time	1250
End Time	1330
Plan	BC-A8
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	340/5	87-88

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Inbound	Normal	Yes	There is adequate space and tug usage for a vessel this size.		Yes	The following current did make it harder because it made it harder to slow down. Pilot went a little bit higher into the channel before turning then he would have liked because he couldn't slow down (was going about 4.5 knots when he slowed down). He would have liked to be further south and west to get out of the channel. Using tugs though he was able to control the turn and still straighten up.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Plenty of room for the bow tug due to the cutout. Never got close to the edge.
2-MS7505	Normal	Yes	No	No	Yes		Plenty of room.

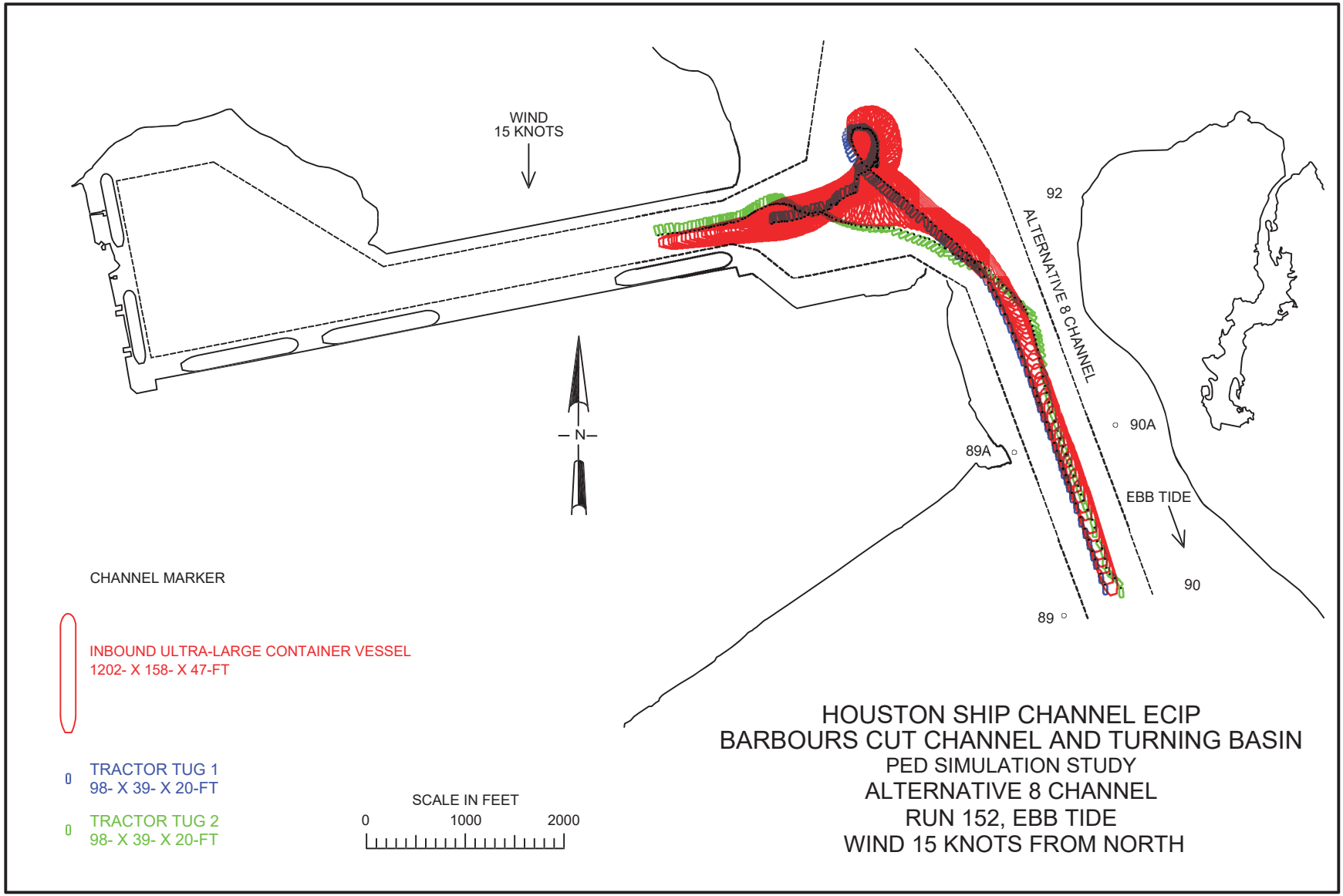

WIND
15 KNOTS
N
92
ALTERNATIVE 8 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 8 CHANNEL
RUN 152, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 123

Run **152**

Purpose	Entrance to Barbour's Cut - Turn at Entrance TB One instructor controlled tug.
Date	6/11/2020
Start Time	1210
End Time	1250
Plan	BC-A8
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	342/5	87-88

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
M	Inbound	Normal	Yes	Leaning towards difficult due to the north conditions setting down the vessel towards dock 1. This requires you to have to set up higher for your turn and anticipate the wind.		Yes	The cutout allows for plenty of room to perform the manuever.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Safe water and never got close to the channel line. No excessive amount of force use.
2-MS7505	Normal	Yes	No	No	Yes		

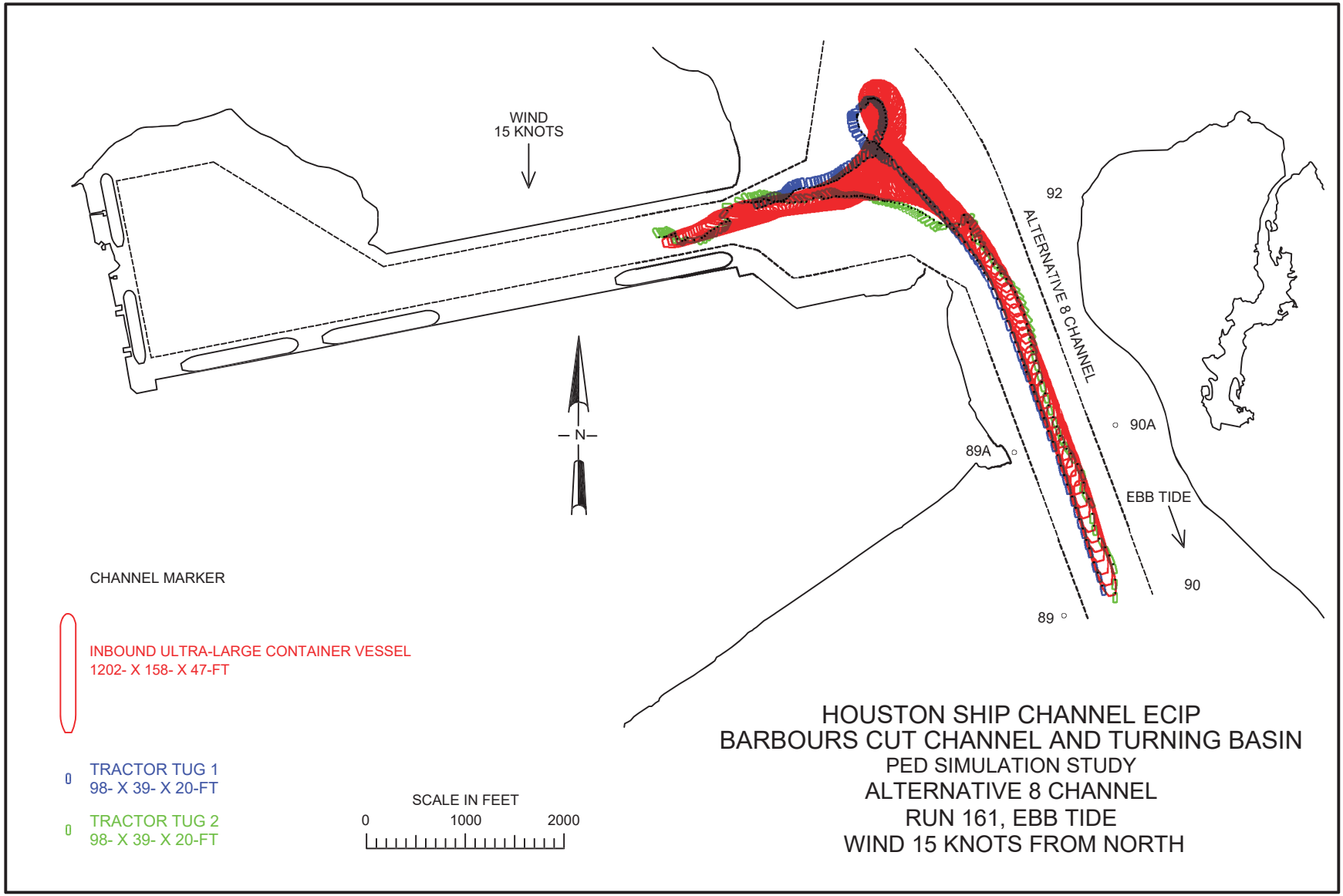

WIND
15 KNOTS
N
92
ALTERNATIVE 8 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 8 CHANNEL
RUN 161, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 124

Run **161**

Purpose	Enter Barbours Cut. One instructor controlled tug.
Date	6/12/2020
Start Time	1200
End Time	1235
Plan	BC-A8
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	340/5	87-88

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
M	Inbound	Normal	Yes	The flare in this layout allows for plenty of room for this manuever. In real life this mnauever would have the 3 tugs and use of th bow thruster, so it would be even easier in real life.		Yes	The north wind affects the vessel when backing into the terminal because the bow is still in the channel getting caught by the current. With use of the tugs, the pilot was able to get the bow back up and straighten out in the terminal.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		The cutout on the north side of the channel gave plenty of room for the tugboat to operate during the turn.
2-MS7505	Normal	Yes	No	No	Yes		In this area in real life, the stern tug is the fist on backing into the terminal and the transition from the the flare to the channel is one of the most dangerous parts. However, with this layout the tug felt more comfortable i the area and felt like he could recover easily if somethin went wrong.

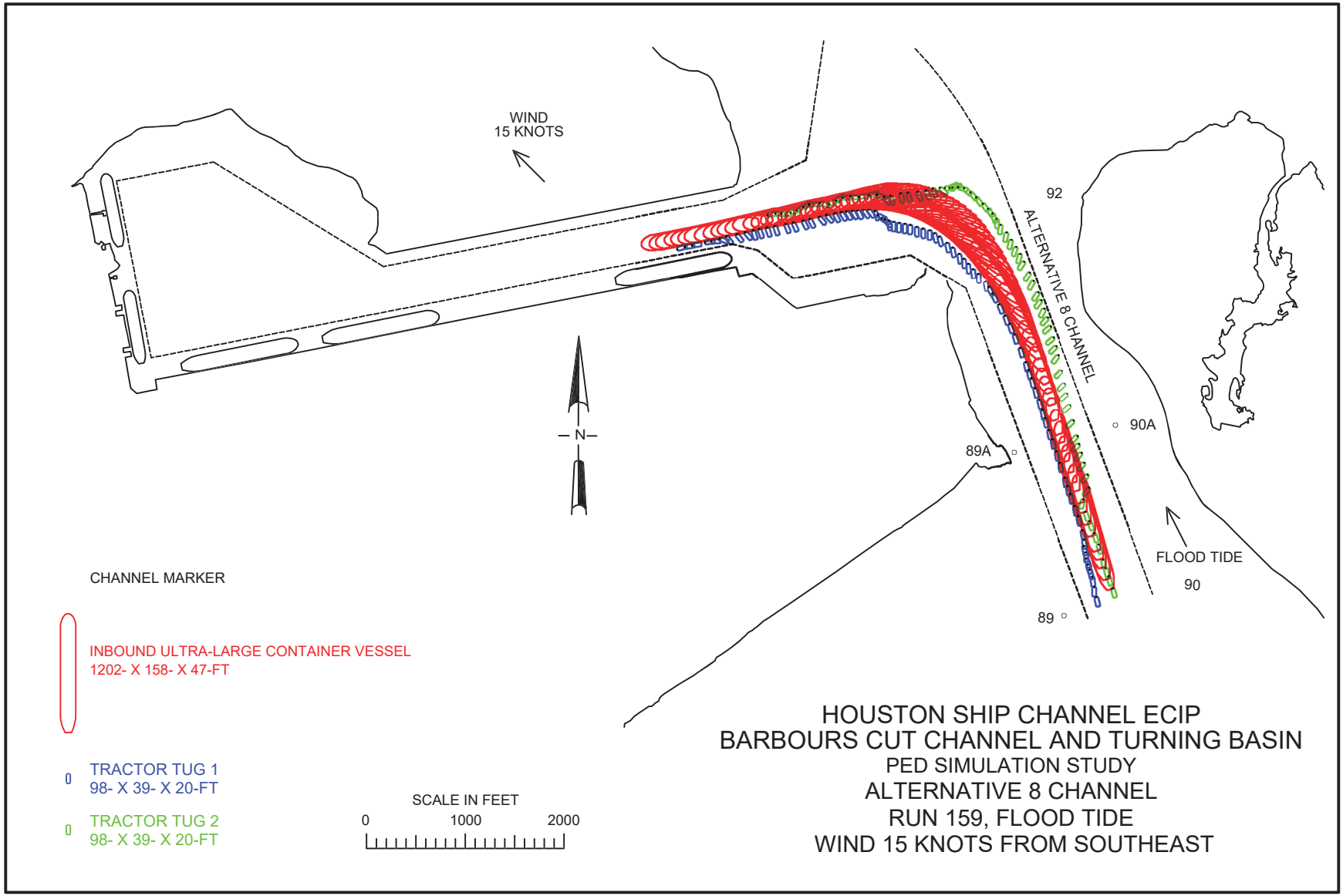

WIND
15 KNOTS
N
92
ALTERNATIVE 8 CHANNEL
90A
89A
FLOOD TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 8 CHANNEL
RUN 159, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 125

Run **159**

Purpose	Enter Barbours Cut. One instructor controlled tug.
Date	6/12/2020
Start Time	1035
End Time	1055
Plan	BC-A8
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	340/5	87-88

Run Comments
Instructor controlled tug was not used.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
A	Inbound	Difficult	Yes	Difficult due to the conditions. The current in this area does not seem realistic to the pilot. After making the turn the currents were still hitting the port side and with hard rudder the vessel still did not check up as he expected. Had to be aggressive with the	Yes		The south wind caused the pilot to turn sooner and slide over as he made the turn so he did not use the extra cutout on the north side for this turn.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Tug was in the south cutout during the turn and felt like he had plenty of room.
2-MS7505	Normal	Yes	No	No	Yes		Tug captain did note during the run he had the incorrect screen up so he thought that he had left the federal channel but in reality he had plenty of safe water to manuever in.

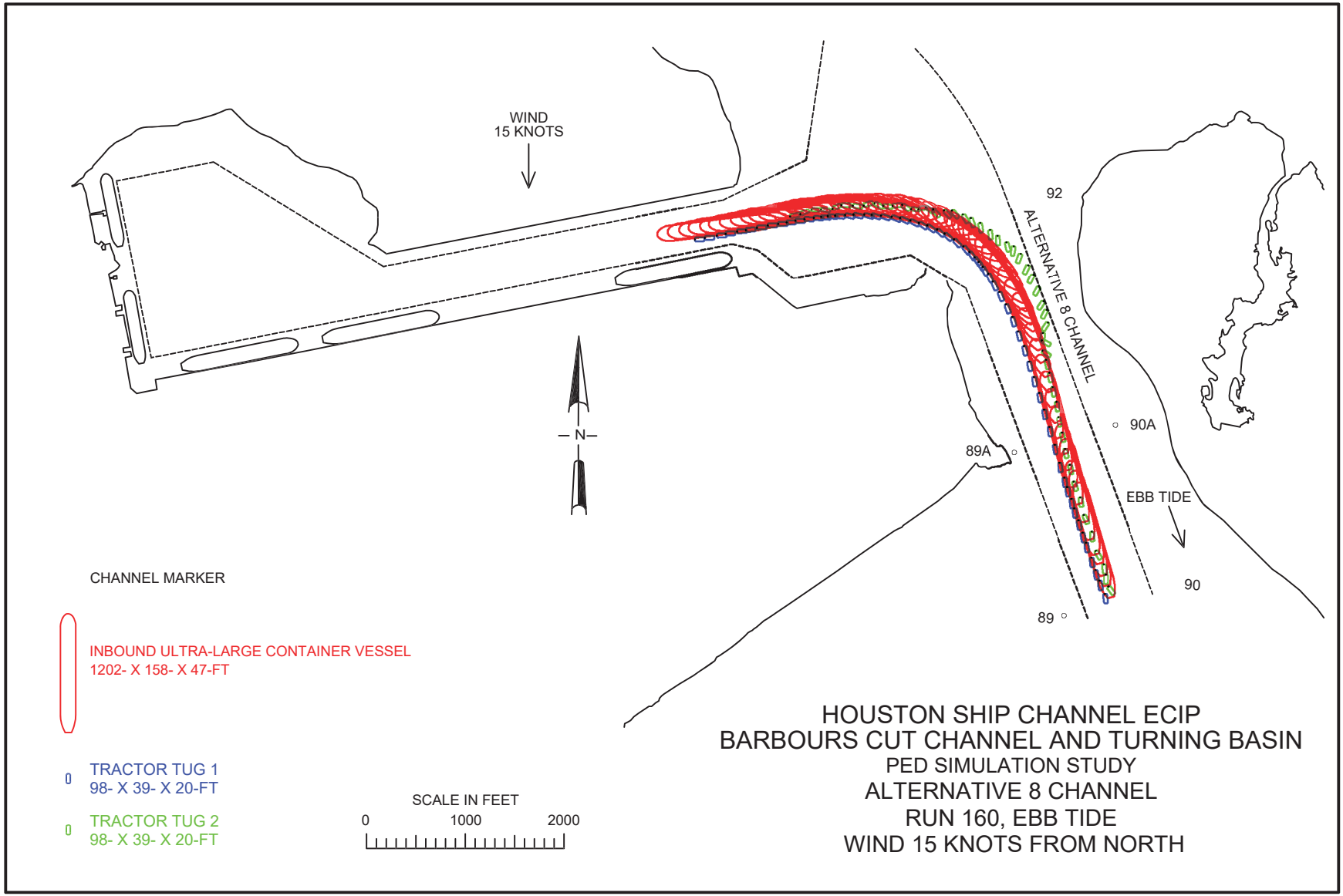

WIND
15 KNOTS
N
92
ALTERNATIVE 8 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
INBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 8 CHANNEL
RUN 160, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 126

Run **160**

Purpose	Enter Barbours Cut. One instructor controlled tug.
Date	6/12/2020
Start Time	1110
End Time	1125
Plan	BC-A8
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*ULCV366M	46.7/14.2	340/5	87-88

Run Comments
Instructor controlled tug was not used.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Inbound	Normal	Yes	There is plenty of available manuevering space and plenty of tug usage.	Yes		The starting speed was a little fast for this area and the pilot had to use the tugs more to slow down the vessel. He drifted for about two ship lengths while slowing down. However, the manuever was still able to occur smoothly.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Easy and good job. Stayed in safe water and never worked over 3/4.
2-MS7505	Normal	Yes	No	No	Yes		Routine.

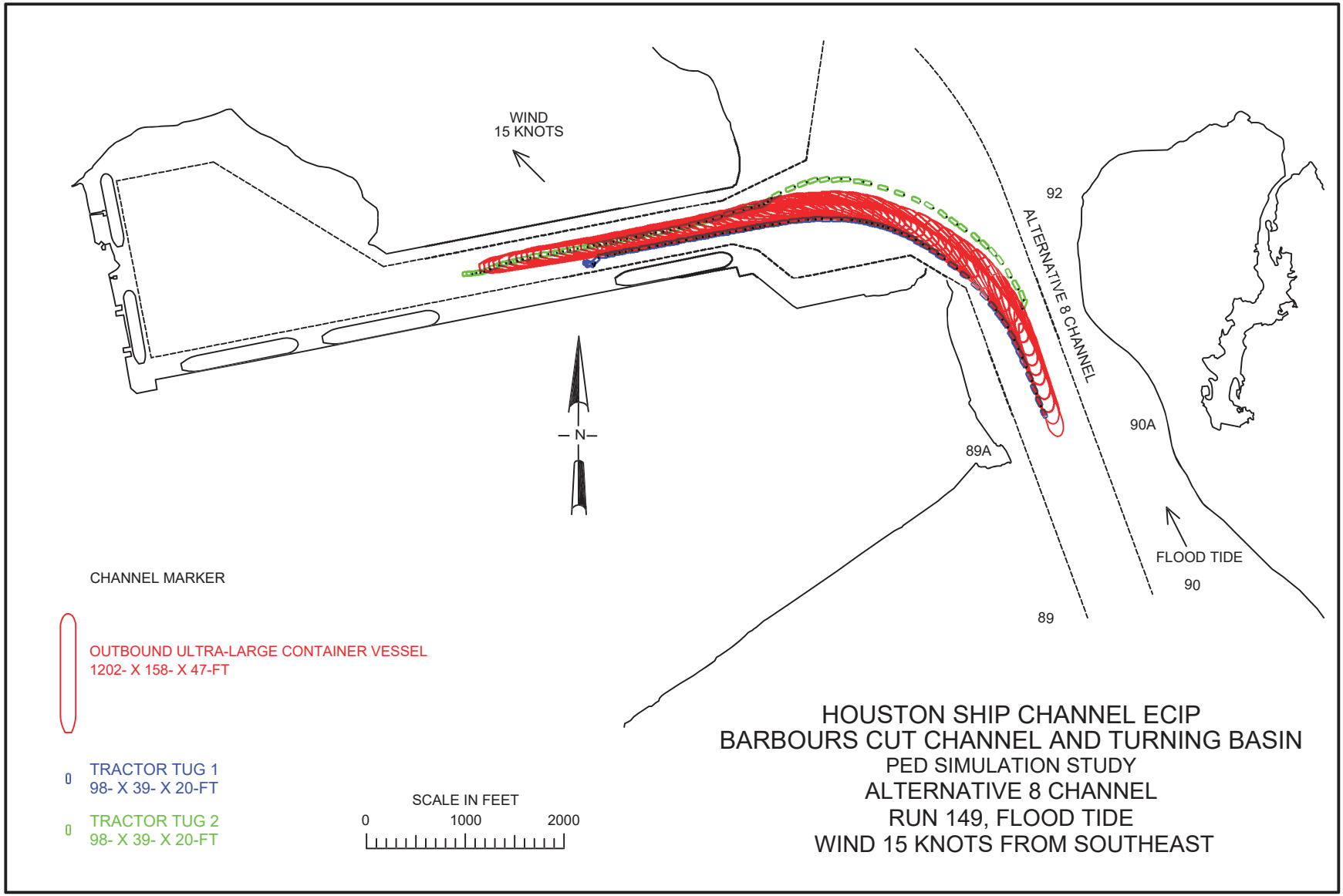

WIND
15 KNOTS
92
ALTERNATIVE 8 CHANNEL
90A
89A
N
FLOOD TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 8 CHANNEL
RUN 149, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 127

Run **149**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tug.
Date	6/11/2020
Start Time	0955
End Time	1010
Plan	BC-A8
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	082/2.5	Midway

Run Comments
Instructor controlled tug was not used.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
O	Outbound	Normal	Yes	With the amount of tugs available and the environmental conditions in the favor of the ship, the manuever was very safe.	Yes		The cutout helped with the turn and allowed for plenty of space on the stern.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Plenty of space.
2-MS7505	Easy	Yes	No	No	Yes		Tug was not used during the manuever.

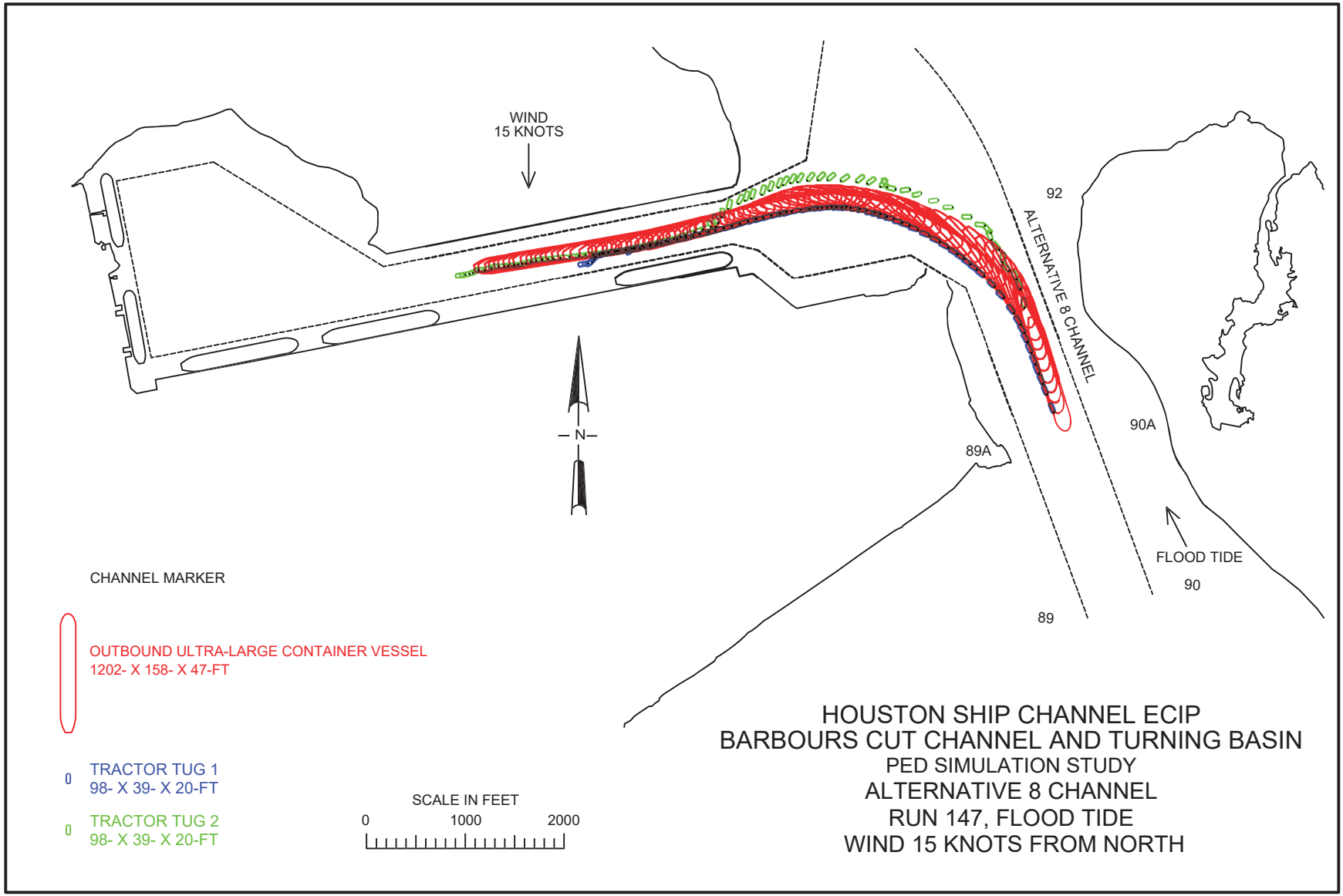

WIND
15 KNOTS
N
92
ALTERNATIVE 8 CHANNEL
90A
89A
FLOOD TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 8 CHANNEL
RUN 147, FLOOD TIDE
WIND 15 KNOTS FROM NORTH

PLATE 128

Run **147**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tug.
Date	6/11/2020
Start Time	0900
End Time	0920
Plan	BC-A8
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	082/2.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
C	Outbound	Normal	Yes	The cutout is better than Alt 1 due to being able to start the turn earlier allowing you to control the ship better.	Yes		Current did affect the rate of turn when the bow got into the channel but the ship was going fast enough that he could overcome the current. Pilot prefers this layout over Alt 1 as it gave more space to start the turn earlier instead of waiting and turning in the channel.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Layout change does not affect the bow tug.
2-MS7505	Normal	Yes	No	No	Yes		This layout allowed the tug to have about 20 ft behind him to the federal channel and the captain noted that is the minimum space he would feel comfortable in this area. He believes this layout is better and the tug could stay in safe water the entire time while assisting the ship.

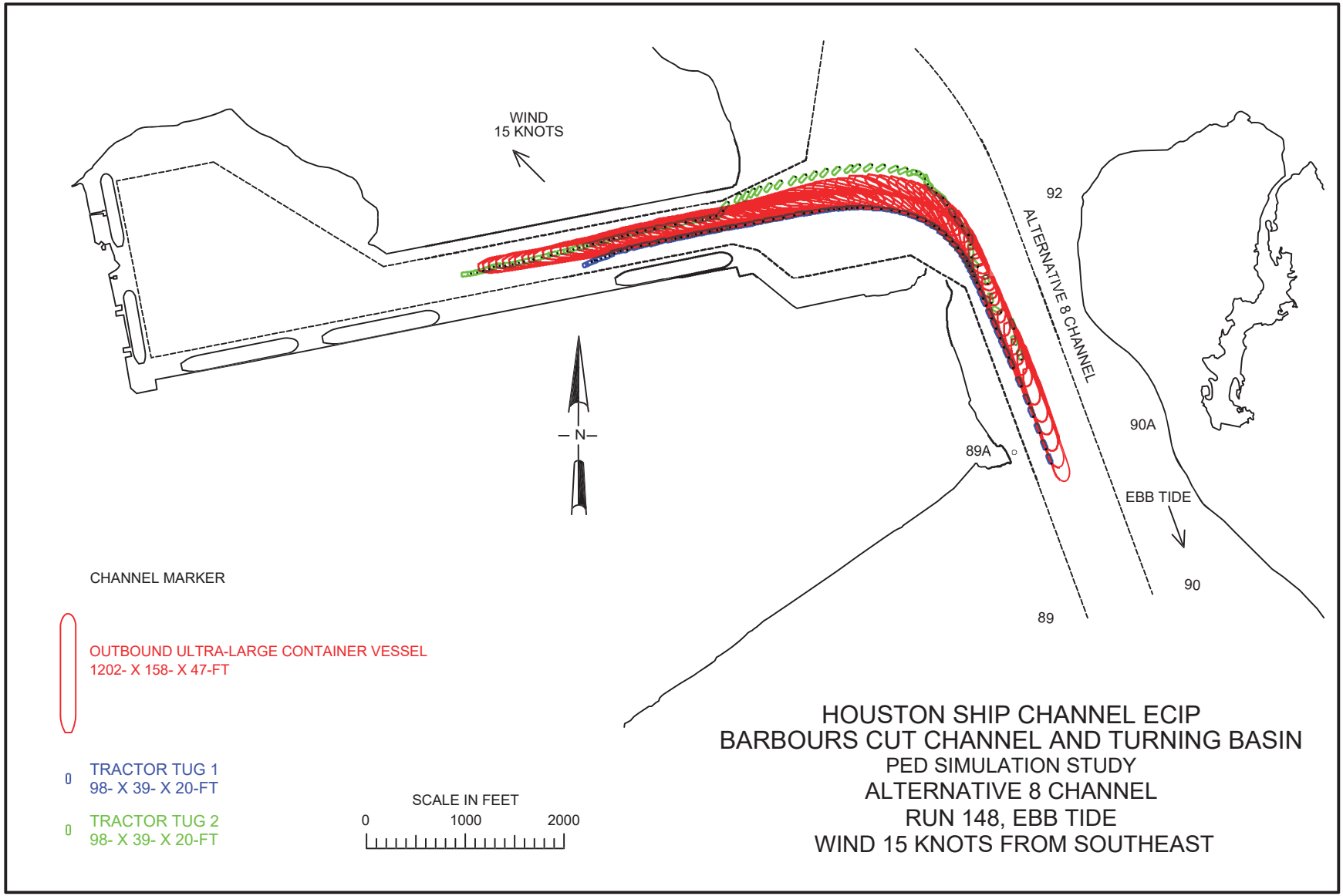

WIND
15 KNOTS
N
92
ALTERNATIVE 8 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 8 CHANNEL
RUN 148, EBB TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 129

Run **148**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tug.
Date	6/11/2020
Start Time	0930
End Time	0945
Plan	BC-A8
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	SE/15
Tugs	3

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	082/2.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
M	Outbound	Normal	Yes	PIlot was able to start the turn earlier. He did turn a little too shallow but it still was successful, showing that there is plenty of space in this layout to make the turn. Tugs were not used to the max during the turn.	Yes		South wind makes it easier to make the turn outbound. Pilot did not drive in Alt 1 but does like this layout and feels like he has plenty of room to turn.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Normal	Yes	No	No	Yes		Plenty of safe water and never worked over half.
2-MS7505	Normal	Yes	No	No	Yes		Pilot started the turn earlier and a little high on the north side, so the tug had to pay a more attention to the federal channel line but it was still managable. The layout still gave plenty of safe water for him to work.

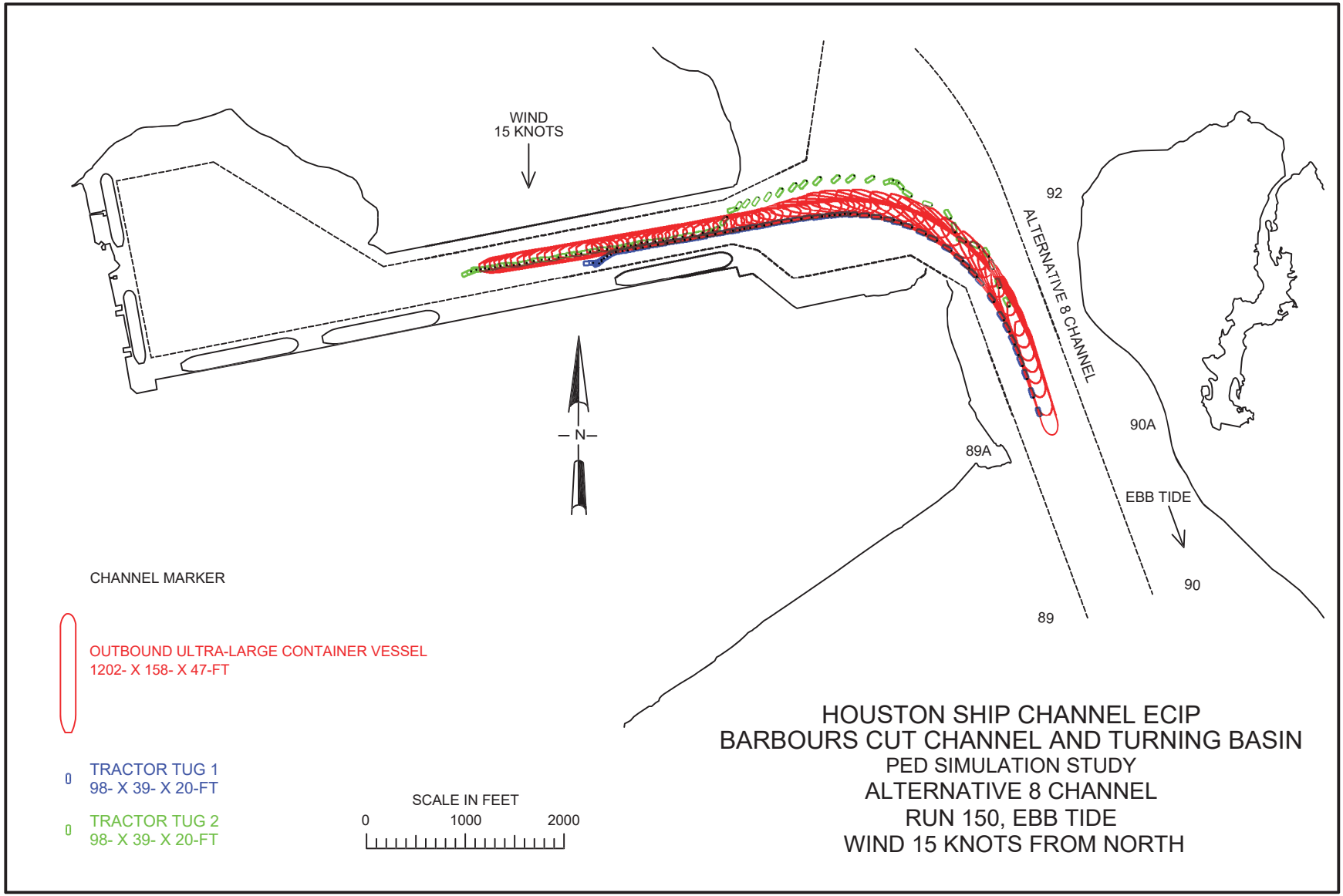

WIND
15 KNOTS
N
92
ALTERNATIVE 8 CHANNEL
90A
89A
EBB TIDE
90
89
CHANNEL MARKER
OUTBOUND ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
TRACTOR TUG 1
98- X 39- X 20-FT
TRACTOR TUG 2
98- X 39- X 20-FT
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BARBOURS CUT CHANNEL AND TURNING BASIN
PED SIMULATION STUDY
ALTERNATIVE 8 CHANNEL
RUN 150, EBB TIDE
WIND 15 KNOTS FROM NORTH

PLATE 130

Run **150**

Purpose	Depart Barbour's Cut from Mid-channel. One instructor controlled tug.
Date	6/11/2020
Start Time	1015
End Time	1030
Plan	BC-A8
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/15
Tugs	3

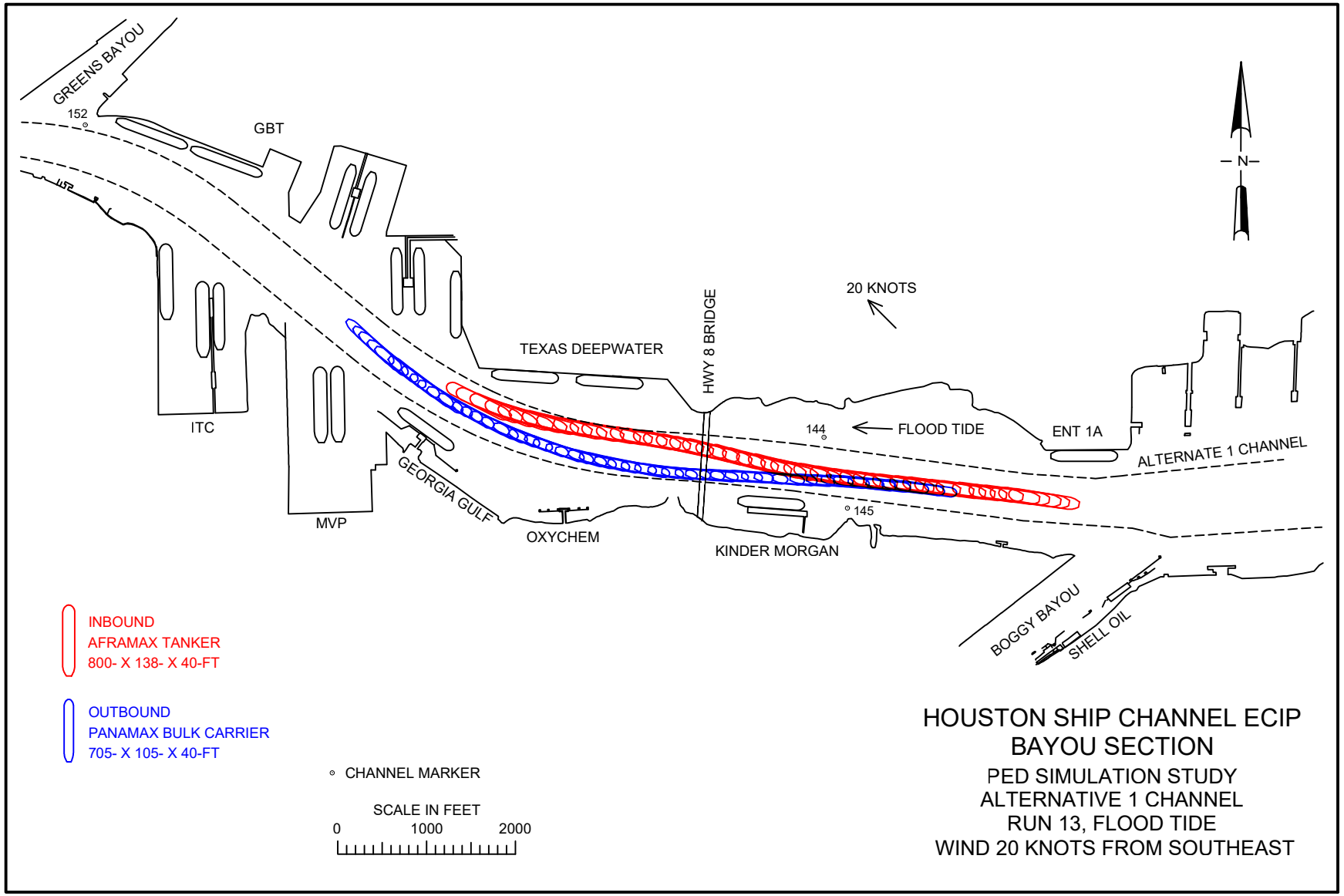
Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	082/2.5	Midway

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	In/Out Safe	TB Turn Safe	Comments
A	Outbound	Normal	Yes	Pilot used a different technique for this run, he drove out with the conditions and used the driving forces of the ship with the current and wind.	Yes		Able to drive the vessel out of the terminal instead of creeping out. Did not have to use the tugs as much and drove out with a faster speed. Pilot felt like there was enough space to turn, Alt 6 would be better due to being able to start the turn sooner.

Tug Captain	Job Rating	Tug Able	Danger	Realistic Operation	Safe/Do in Real life	Safety Comments	Comments
1-MZ7505	Easy	Yes	No	No	Yes		Tug was not used during the manuever.
2-MS7505	Normal	Yes	No	No	Yes		The speed of the ship and ship placement was ideal for the tug. This setup allowed the tug to preform an effective manuever instead of doing one manuever at half effectiveness.

Appendix F: Track Plots and Run Sheets – Bayou Section



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 13, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 131

Run **13**

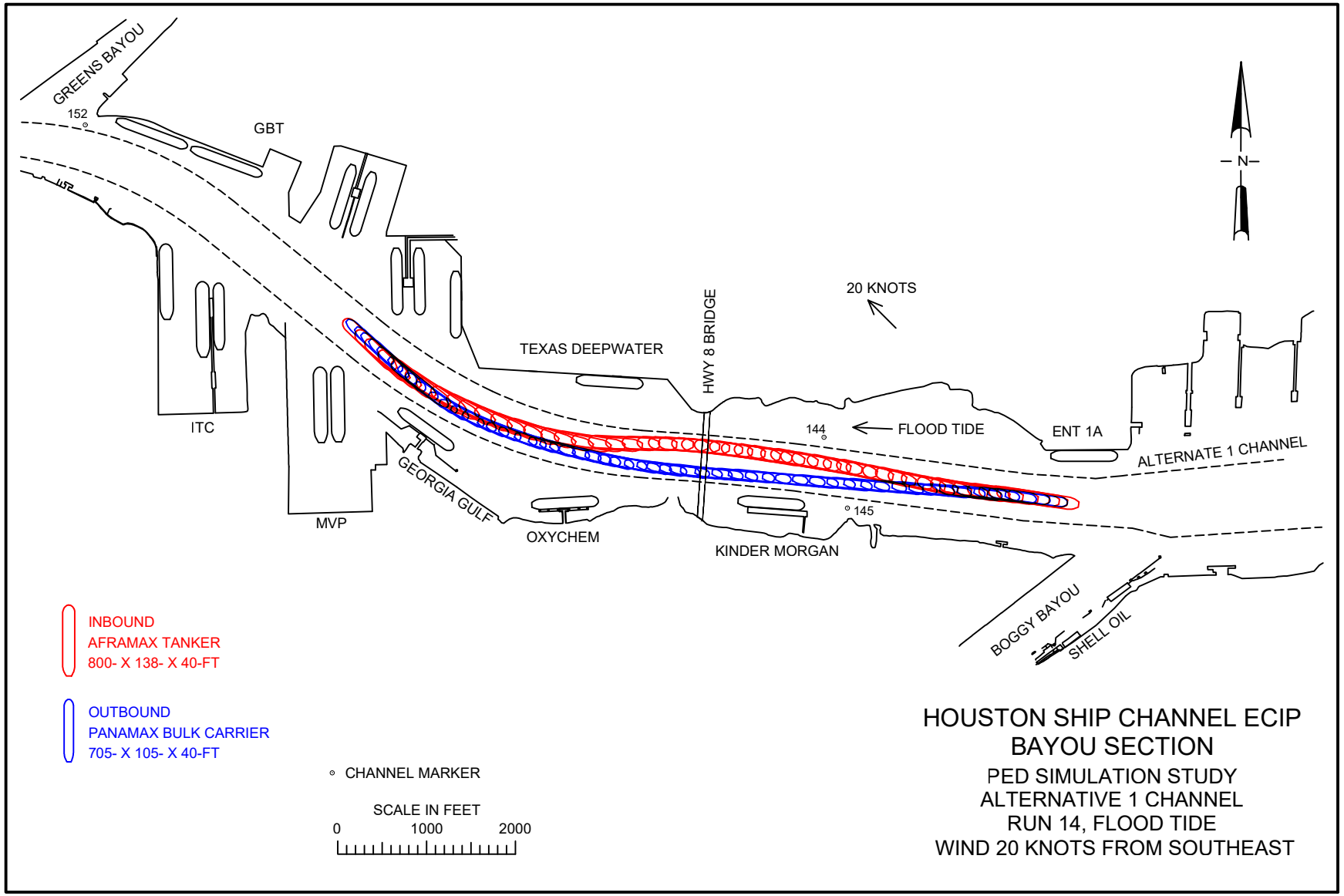
Purpose	Meet loaded Aframax/Panamax by the Bridge. Instructor controlled tug used.
Date	5/18/2020
Start Time	0905
End Time	0925
Plan	BG-A1
Current	Fld
Tide (m)	1
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MTKM107X	40.0/12.2	278.6/5.5	Enterprise
Outbound	MBULK32N	40.0/12.2	133/5.5	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MTKM107X	D	0	191	[redacted]	
Outbound	MBULK32N	C	23	[redacted]		

Run Comments
Run performed with intentions that the inbound vessel would be preparing to dock at ITC or GBT.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Difficult	Yes	It is manageable in real life, however, you need to ensure that all variables are properly maintained, including tugs, meeting position, speed, etc.	Yes	Yes	[redacted]		There were visual issues when the run first started so the pilot said they would have reacted differently during the break.
C	Outbound	Normal	Yes	Adequate amount of space.	Yes	Yes			



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 14, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 132

Run **14**

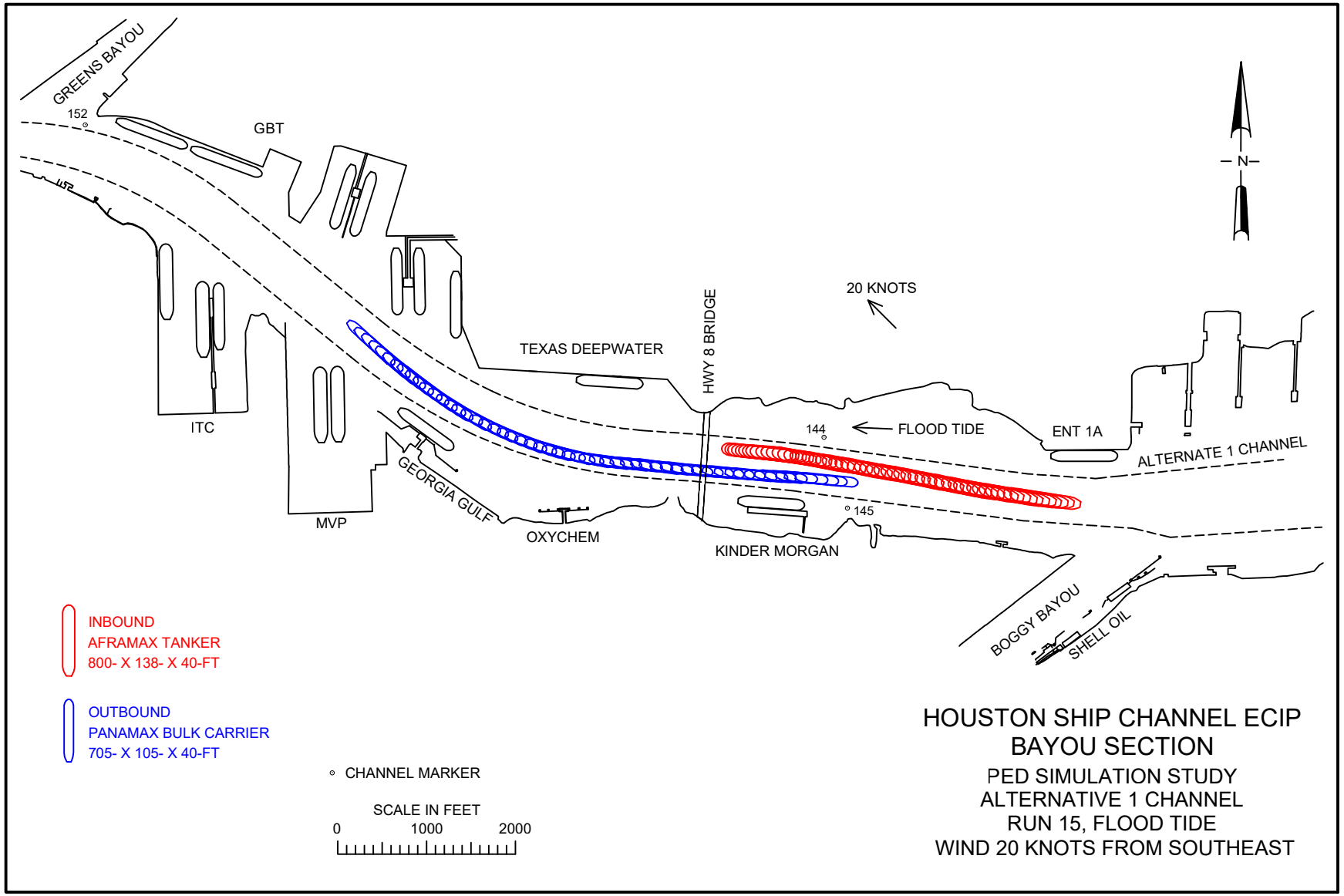
Purpose	Meet loaded Aframax/Panamax by the Bridge. Instructor controlled tug used.
Date	5/18/2020
Start Time	0930
End Time	0945
Plan	BG-A1
Current	Fld
Tide (m)	1
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MTKM107X	40.0/12.2	278.6/5.5	Enterprise
Outbound	MBULK32N	40.0/12.2	133/5.5	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MTKM107X	C	56	164	[redacted]	
Outbound	MBULK32N	D	63	[redacted]		

Run Comments
Run performed with intentions that the inbound vessel would be preparing to dock at ITC or GBT.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Adequate room to perform the meet. Borderline difficult.	Yes	Yes	[redacted]		Meeting location would be different in real life but even with the difficult meeting location it was manageable.
D	Outbound	Normal	Yes	How vessel handled and the meeting location made it doable.	Yes	Yes			Pilot noted that he did not feel the bank affect or interaction from passing vessel that he expected to feel on a vessel this size.



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 15, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 133

Run **15**

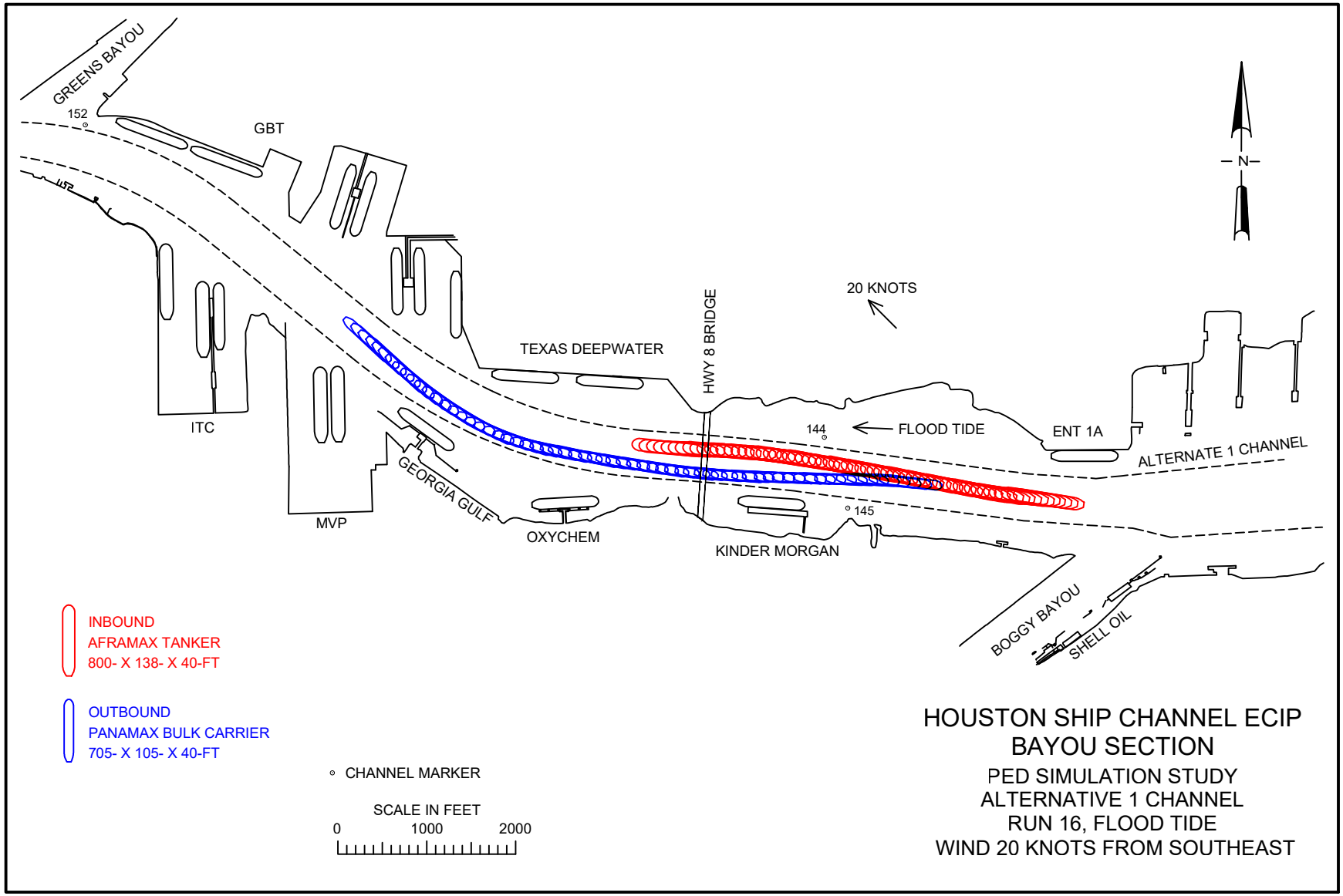
Purpose	Meet loaded Aframax/Panamax by the Bridge. Instructor controlled tug used.
Date	5/18/2020
Start Time	0950
End Time	1000
Plan	BG-A1
Current	Fld
Tide (m)	1
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MTKM107X	40.0/12.2	278.6/3.5	Enterprise
Outbound	MBULK32N	40.0/12.2	133/5.5	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MTKM107X	D	62	131		
Outbound	MBULK32N	C	86			

Run Comments
Decreased the starting speed for the inbound vessel.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Able to maintain control and maintain space on the North side of the channel while meeting. The vessel would typically have two tugs while heading inbound and noted that even with the one tug the situation was very controllable.	Yes	Yes			Successful run. Decreased speed doesn't affect the run, just how to ensure that you react correctly for the speed.
C	Outbound	Normal	Yes	Adequate room.	Yes	Yes			Meeting location is not ideal for loaded ships but it is doable.



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 16, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 134

Run **16**

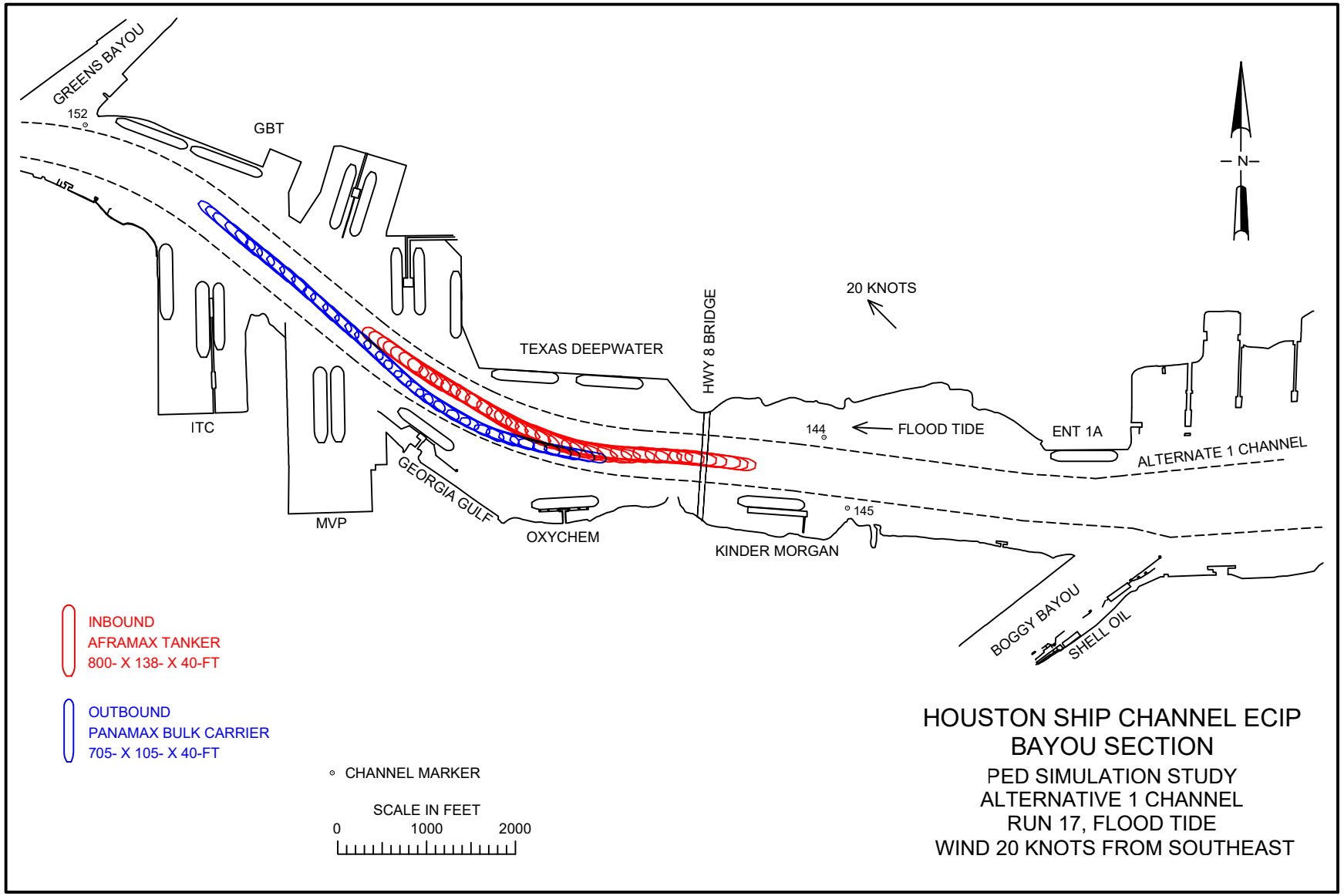
Purpose	Meet loaded Aframax/Panamax by the Bridge. Instructor controlled tug used.
Date	5/18/2020
Start Time	1015
End Time	1025
Plan	BG-A1
Current	Fld
Tide (m)	1
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MTKM107X	40.0/12.2	278.6/3.5	Enterprise
Outbound	MBULK32N	40.0/12.2	133/5.5	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MTKM107X	C	84	132	[redacted]	
Outbound	MBULK32N	D	62	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Adequate room to perform the maneuver.	Yes	Yes	[redacted]		Decreased speed doesn't make much of a difference.
D	Outbound	Normal	Yes	Plenty of space for safe passing.	Yes	Yes			



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 17, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 135

Run **17**

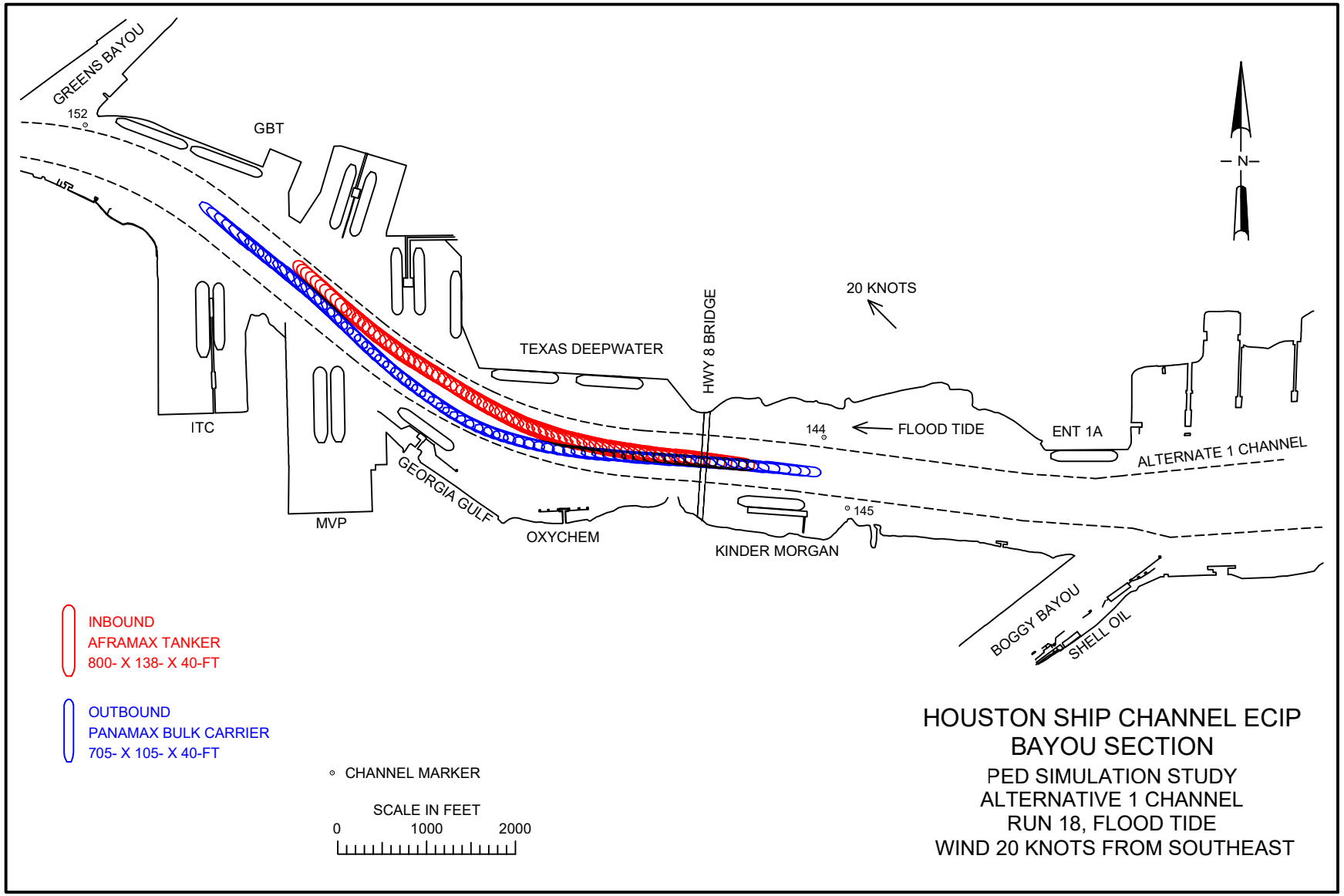
Purpose	Meet loaded Aframax/Panamax at the bend between the bridge and ITC. Instructor controlled tug used.
Date	5/18/2020
Start Time	1050
End Time	1055
Plan	BG-A1
Current	Fld
Tide (m)	1
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MTKM107X	40.0/12.2	277.6/4.5	Bridge
Outbound	MBULK32N	40.0/12.2	130.8/5.5	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MTKM107X	D	108	121	[redacted]	
Outbound	MBULK32N	C	59	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Felt like there is plenty of room for passing and recovering while still staying in the federal channel.	Yes	Yes	[redacted]		
C	Outbound	Normal	Yes	Adequate room for the maneuver.	Yes	Yes			Pilot felt like the vessel was close to the edge of the channel while passing but was still able to maintain control and stay inside of the channel.



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 18, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 136

Run **18**

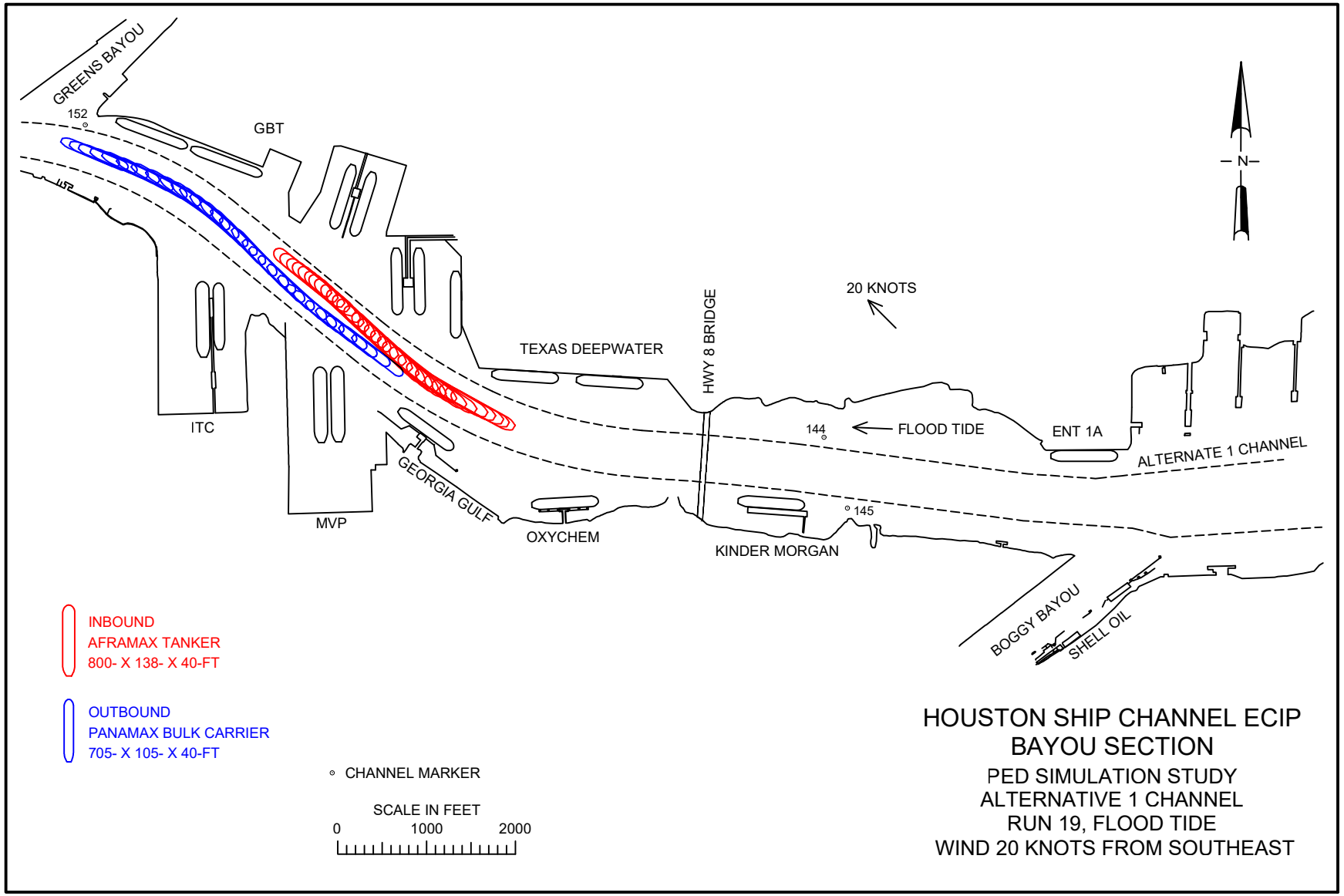
Purpose	Meet loaded Aframax/Panamax at the bend between the bridge and ITC. Instructor controlled tug used.
Date	5/18/2020
Start Time	1110
End Time	1120
Plan	BG-A1
Current	Fld
Tide (m)	1
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MTKM107X	40.0/12.2	277.6/4.5	Bridge
Outbound	MBULK32N	40.0/12.2	130.8/5.5	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MTKM107X	C	133	129		
Outbound	MBULK32N	D	40			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Adequate room for the maneuver to occur even with it happening right off of the berth.	Yes	Yes			Not a challenging maneuver to perform.
D	Outbound	Normal	Yes	Plenty of room to get over and safely maneuver around the other vessel without any excessive forces.	Yes	Yes			Felt good.



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 19, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 137

Run **19**

Purpose	Meet loaded Aframax/Panamax at the bend between the bridge and ITC. Instructor controlled tug used.
Date	5/18/2020
Start Time	1125
End Time	1135
Plan	BG-A1
Current	Fld
Tide (m)	1
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MTKM107X	40.0/12.2	298/3.5	Texas Deepwater
Outbound	MBULK32N	40.0/12.2	112/5	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MTKM107X	D	75	178		
Outbound	MBULK32N	C	107			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Felt like there was plenty of room and maintained conrol.	Yes	Yes			Changing the speed did not affect the pilot and felt like the location was okay for the meet.
C	Outbound	Normal	Yes	Adequate room for the vessels to meet in this area.	Yes	Yes			Pilot felt like they could have made it further over but the meet was still comfortable.

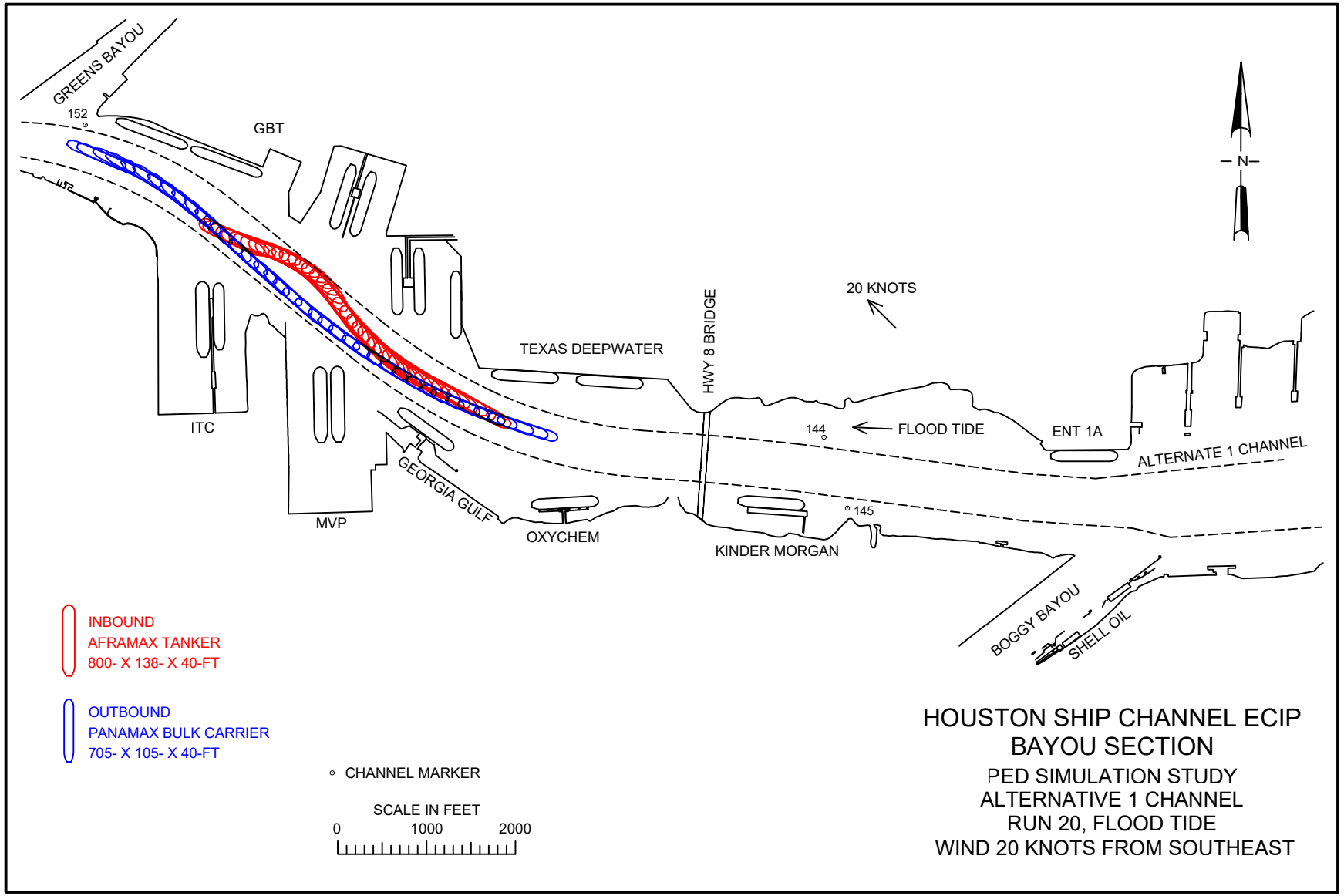

GREENS BAYOU
152
GBT
152
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
20 KNOTS
144
FLOOD TIDE
ENT 1A
ALTERNATE 1 CHANNEL
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
N
INBOUND
AFRAMAX TANKER
800- X 138- X 40-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 20, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 138

Run **20**

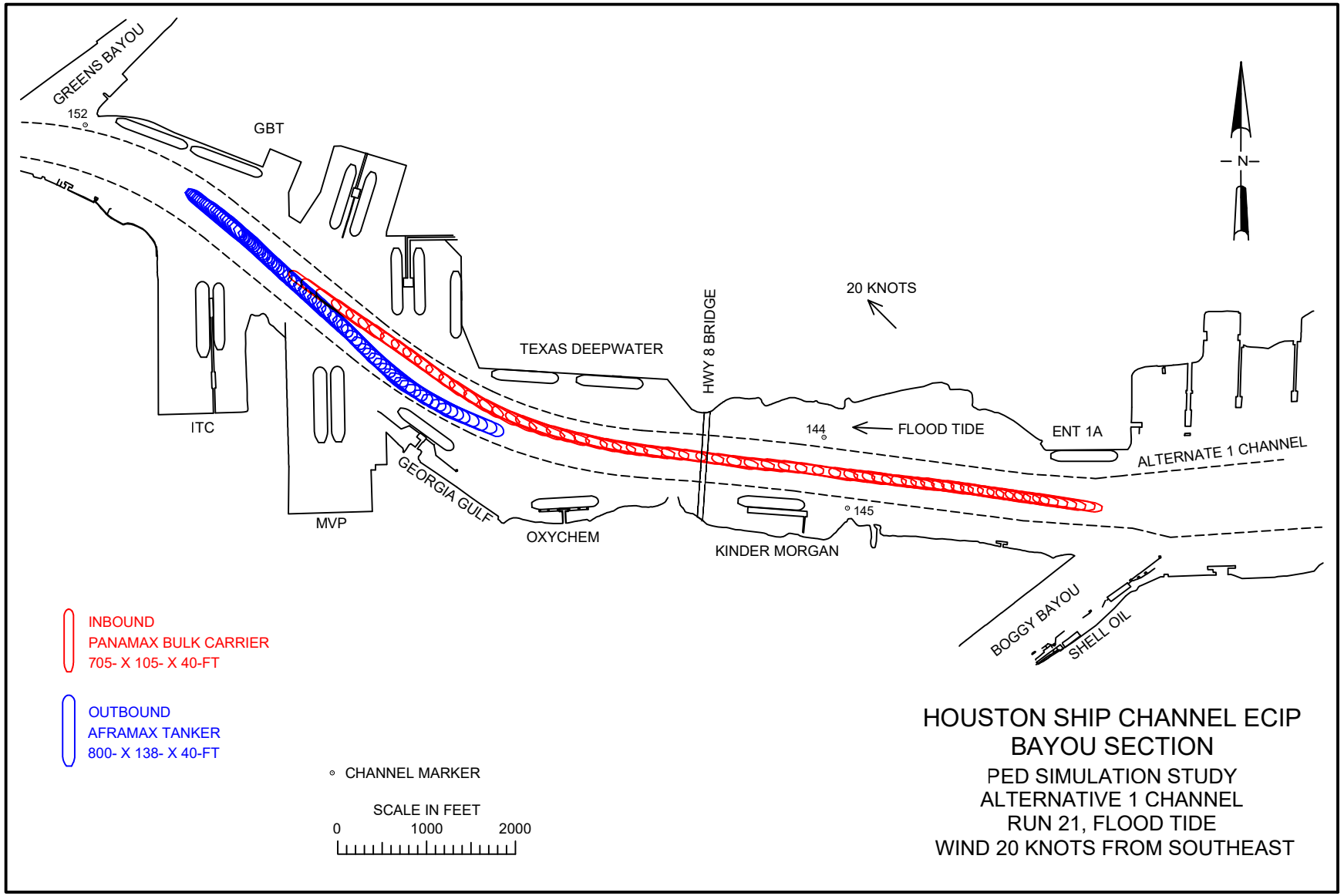
Purpose	Meet loaded Aframax/Panamax at the bend between the bridge and ITC. Instructor controlled tug used.
Date	5/18/2020
Start Time	1140
End Time	1150
Plan	BG-A1
Current	Fld
Tide (m)	1
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*MTKM107X	40.0/12.2	298/3.5	Texas Deepwater
Outbound	MBULK32N	40.0/12.2	112/5	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*MTKM107X	C	0	108		
Outbound	MBULK32N	D	70			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Difficult	Yes	Plenty of room. Difficult due to the starting location and slower speed.	Yes	Yes			Pilot had to give hard rudder as soon as simulation started to ensure he could get over in time for the meet due to the slower starting speed.
D	Outbound	Normal	Yes	Plenty of space. Felt like they had plenty of space from the tow line on the south.	Yes	Yes			



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 21, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 139

Run **21**

Purpose	Meet loaded Aframax/Panamax at the bend between the bridge and ITC. Instructor controlled tug used.
Date	5/18/2020
Start Time	1305
End Time	1320
Plan	BG-A1
Current	Fld
Tide (m)	1
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	MBULK32X	40.0/12.2	279/5	Enterprise
Outbound	*MTKM107X	40.0/12.2	130/1	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	MBULK32X	C	70	160	[redacted]	
Outbound	*MTKM107X	D	47	[redacted]		

Run Comments
MBULK32N and MTCM107N models updated to strength the passing interaction forces (Both are Model X now).

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Outbound	Normal	Yes	Lots of space.	Yes	Yes	[redacted]		Leaning towards difficult due to the slower speed making it harder to get over. The pilot is required to get over earlier and slower so that they give enough space to the meeting vessel.
C	Inbound	Normal	Yes	Adequate maneuvering room.	Yes	Yes			Interaction between vessels was felt. Lots of room for meet.

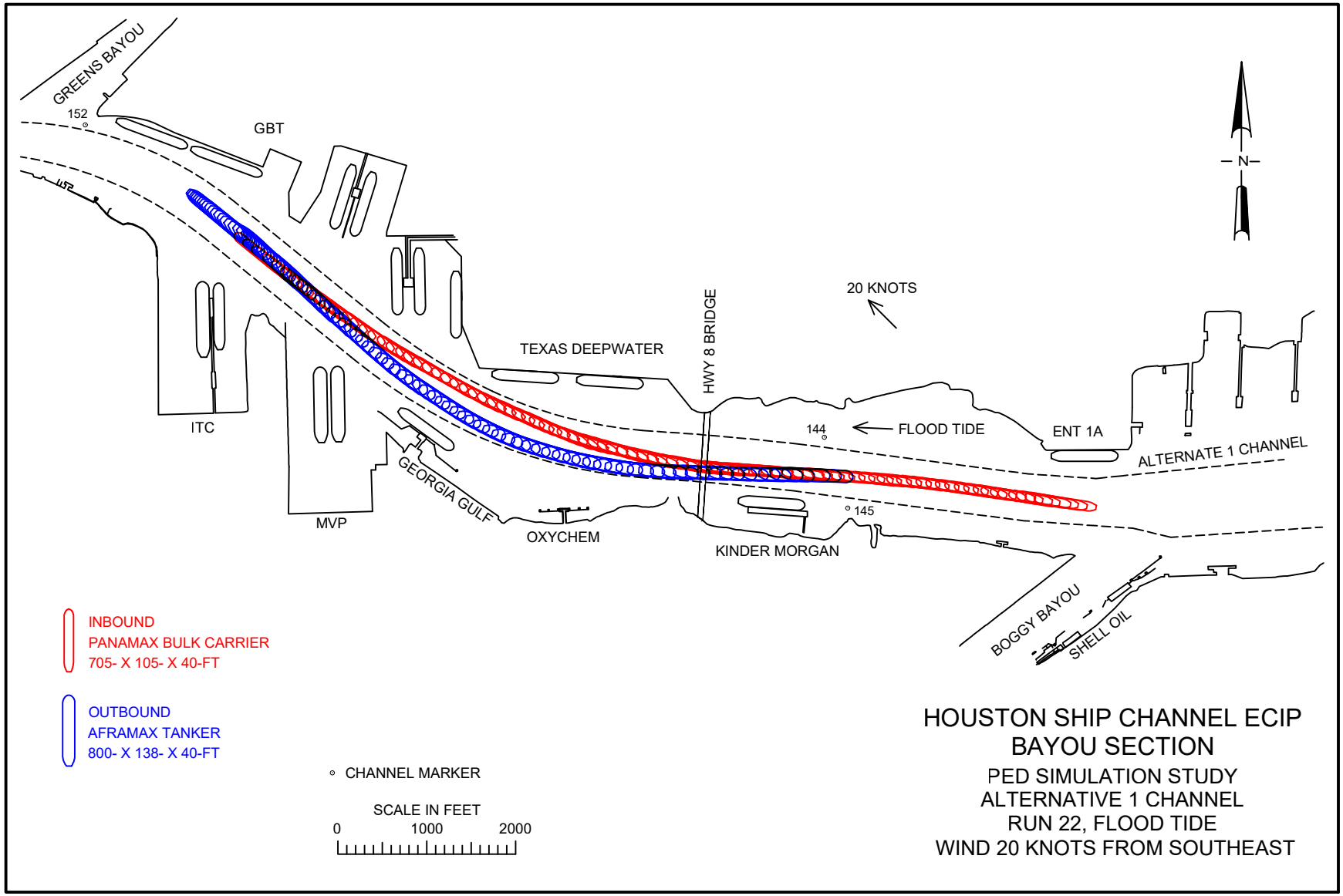

GREENS BAYOU
152
GBT
N
20 KNOTS
HWY 8 BRIDGE
TEXAS DEEPWATER
ITC
144
FLOOD TIDE
ENT 1A
ALTERNATE 1 CHANNEL
GEORGIA GULF
MVP
OXYCHEM
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
AFRAMAX TANKER
800- X 138- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 22, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 140

Run **22**

Purpose	Meet loaded Aframax/Panamax at the bend between the bridge and ITC. Instructor controlled tug used.
Date	5/18/2020
Start Time	1325
End Time	1340
Plan	BG-A1
Current	Fld
Tide (m)	1
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	MBULK32X	40.0/12.2	279/5	Enterprise
Outbound	*MTKM107X	40.0/12.2	130/1	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	MBULK32X	D	65	162		
Outbound	*MTKM107X	C	64			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Adequate maneuvering room. Pilot felt close to the edge of the channel prior to the meet but was able to remain inside the federal channel.	Yes	Yes			Vessel came up to speed quickly and the maneuver felt good.
D	Outbound	Normal	Yes	Plenty of room to maneuver.	Yes	Yes			

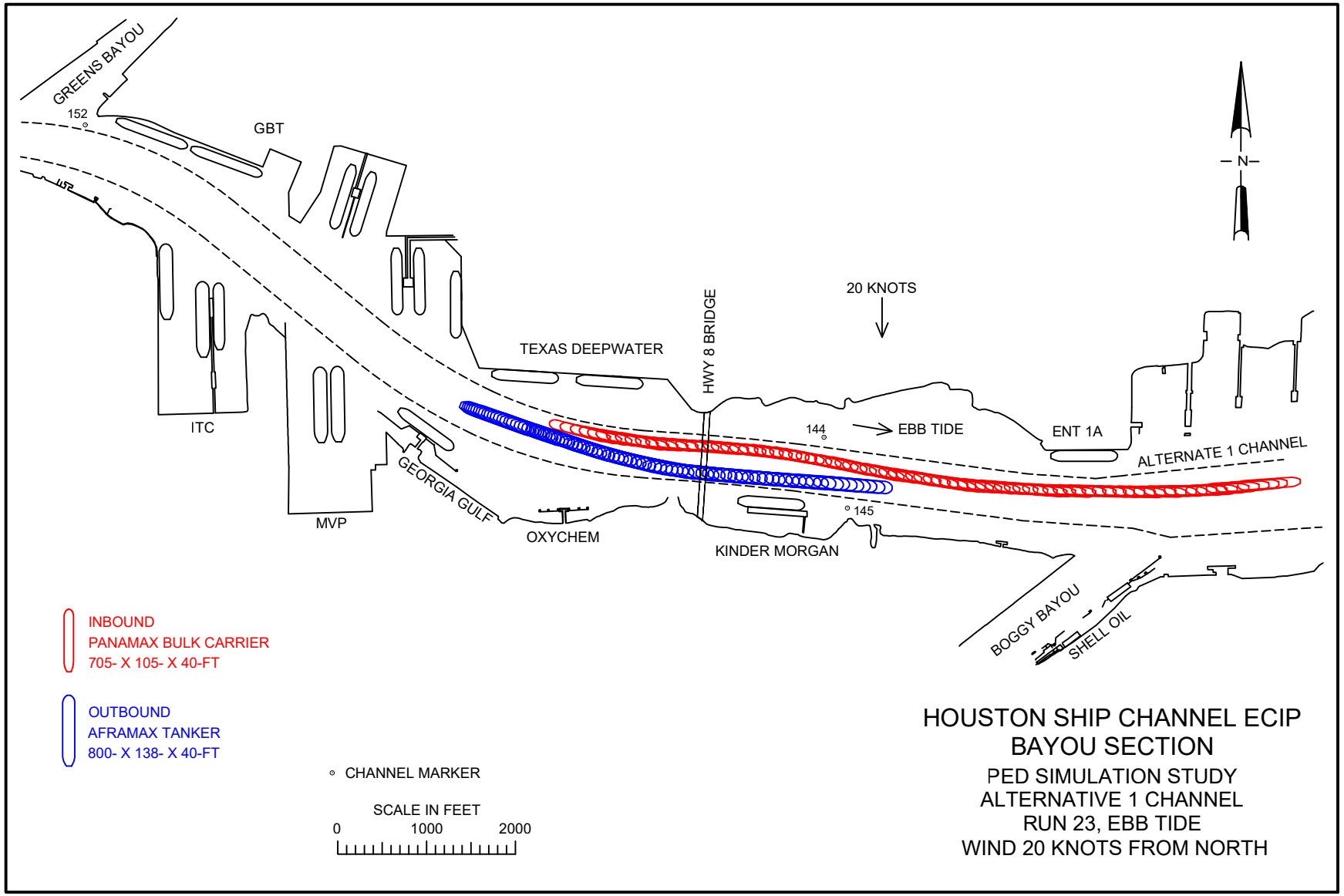

GREENS BAYOU
152
GBT
152
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
KINDER MORGAN
20 KNOTS
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
145
BOGGY BAYOU
SHELL OIL
N
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
AFRAMAX TANKER
800- X 138- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 23, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 141

Run **23**

Purpose	Meet loaded Aframax/Panamax by the bridge. Instructor controlled tug used.
Date	5/18/2020
Start Time	1410
End Time	1420
Plan	BG-A1
Current	Ebb
Tide (m)	1
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	MBULK32X	40.0/12.2	265.7/5.5	Enterprise
Outbound	*MTKM107X	40.0/12.2	110/1	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	MBULK32X	C	69	184		
Outbound	*MTKM107X	D	23			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Plenty of room. Difficult due to the starting location and slower speed.	Yes	Yes			Pilot felt a little close to the vessel docked at Deep Water. Pilot was able to maintain inside the federal channel but still didn't want to be that close.
C	Outbound	Easy	Yes	More than adequate room for the meet.	Yes	Yes			Pilot noted that he would be going slower in real life while passing the berths but sped up to ensure he didn't meet the outbound vessel by the berth.

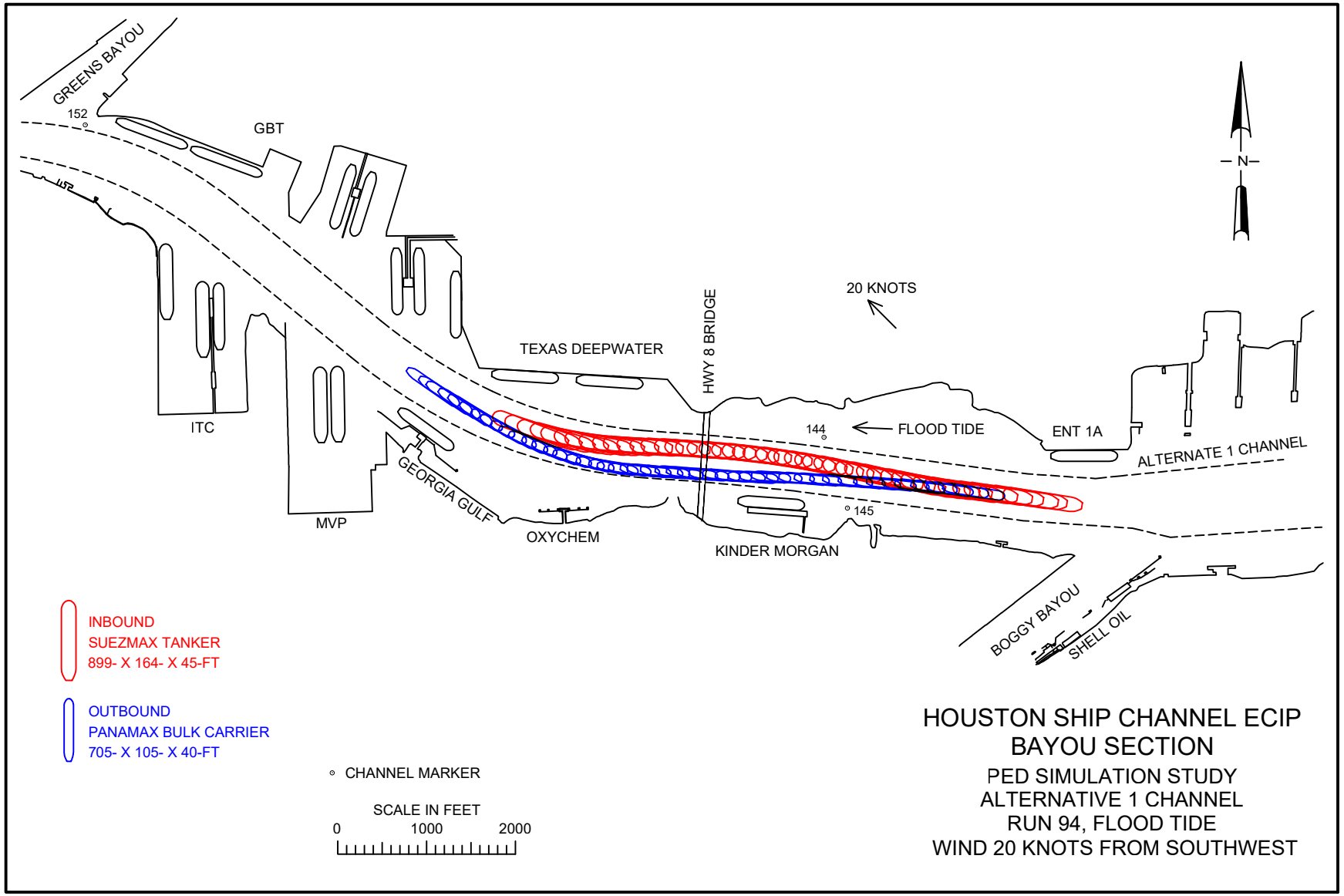

GREENS BAYOU
152
GBT
N
20 KNOTS
HWY 8 BRIDGE
TEXAS DEEPWATER
ITC
144
FLOOD TIDE
ENT 1A
ALTERNATE 1 CHANNEL
GEORGIA GULF
MVP
OXYCHEM
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 94, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHWEST

PLATE 142

Run **94**

Purpose	Meet loaded Suezmax/Panamax by the Bridge. Instructor controlled tug used.
Date	6/4/2020
Start Time	1345
End Time	1355
Plan	BG-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	279/5	Enterprise
Outbound	MBULK32X	40.0/12.2	125/5	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	C	91	151		
Outbound	MBULK32X	A	44			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Adequate sea room for the maneuver and the vessel handled as expected. Other ship gave plenty of space.	Yes	Yes			Not an ideal meeting situation but with controllable speed it is okay.
A	Outbound	Easy	Yes	Wide channel.	Yes	Yes			With low speed and getting over far enough, the maneuver is very safe and easy.

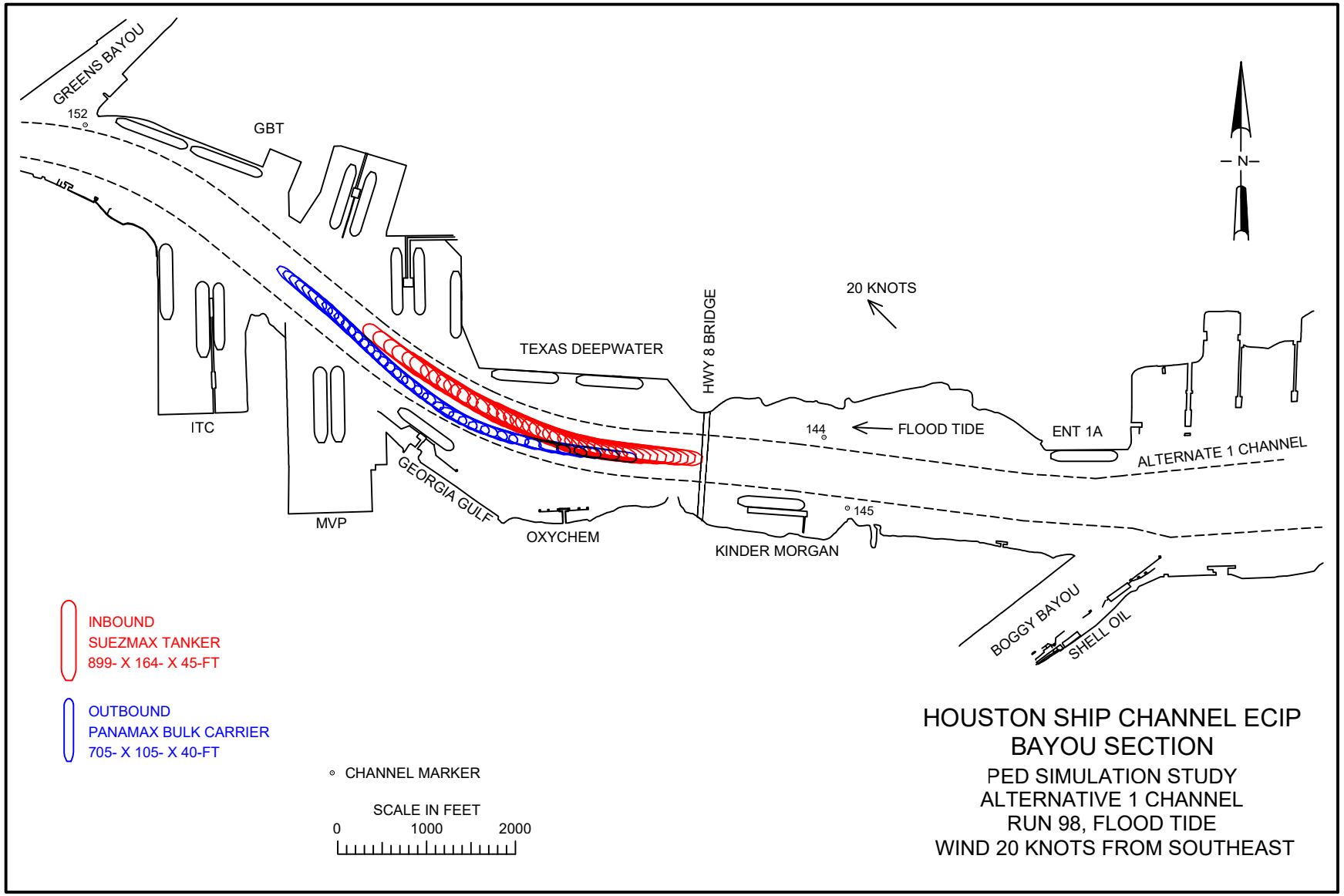

GREENS BAYOU
152
GBT
152
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
20 KNOTS
144
FLOOD TIDE
ENT 1A
ALTERNATE 1 CHANNEL
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
N
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 98, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 143

Run **98**

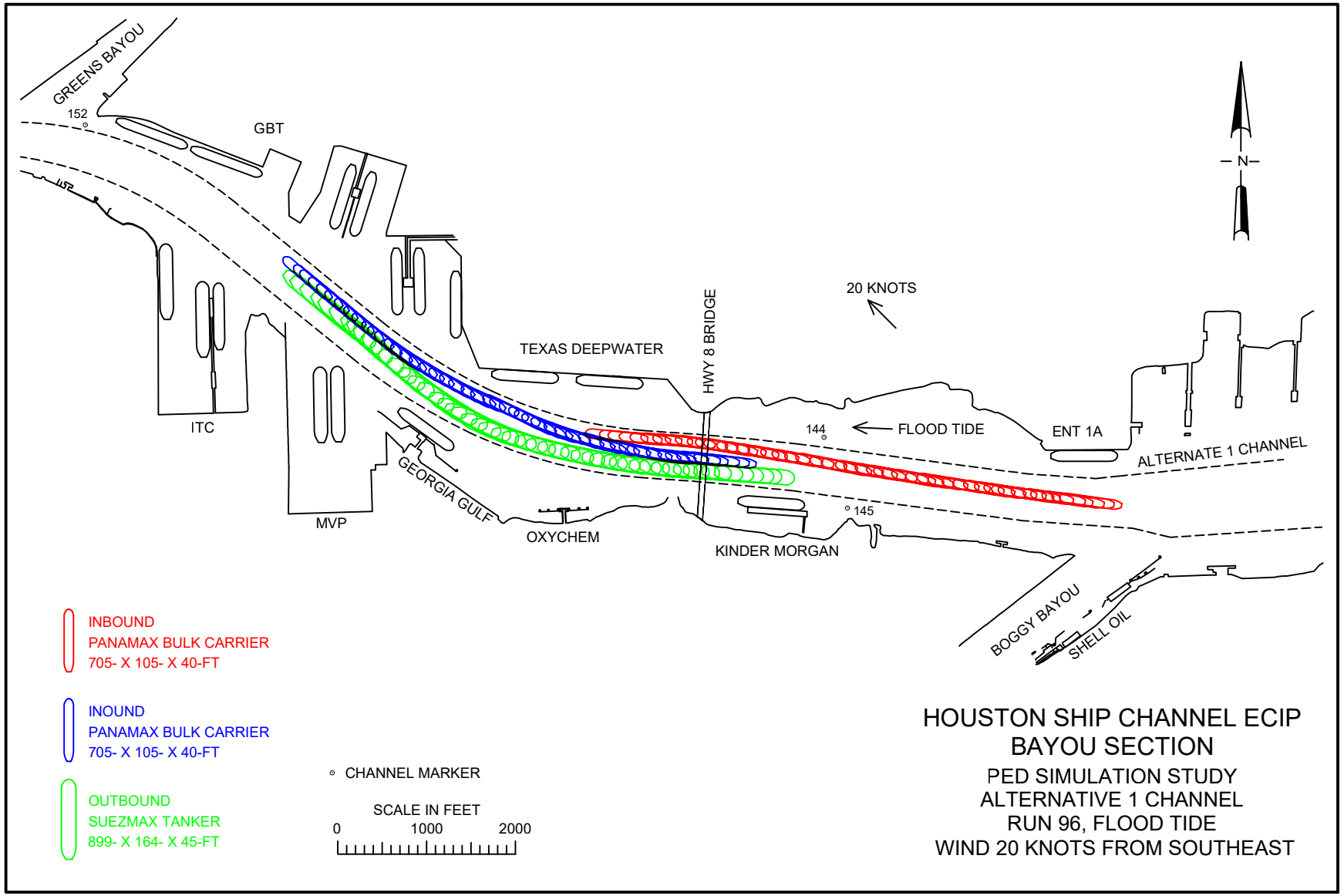
Purpose	Meet loaded Suezmax/Panamax by Georgia Gulf. Instructor controlled tug used.
Date	6/4/2020
Start Time	1510
End Time	1520
Plan	BG-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	277/4	Bridge
Outbound	MBULK32X	40.0/12.2	131/4	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	C	120	113		
Outbound	MBULK32X	D	28			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Plenty of room in the channel to pass.	Yes	Yes			Everything was good.
D	Outbound	Normal	Yes	The width of the channel made it safe to do.	Yes	Yes			



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 96, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 144

Run **96**

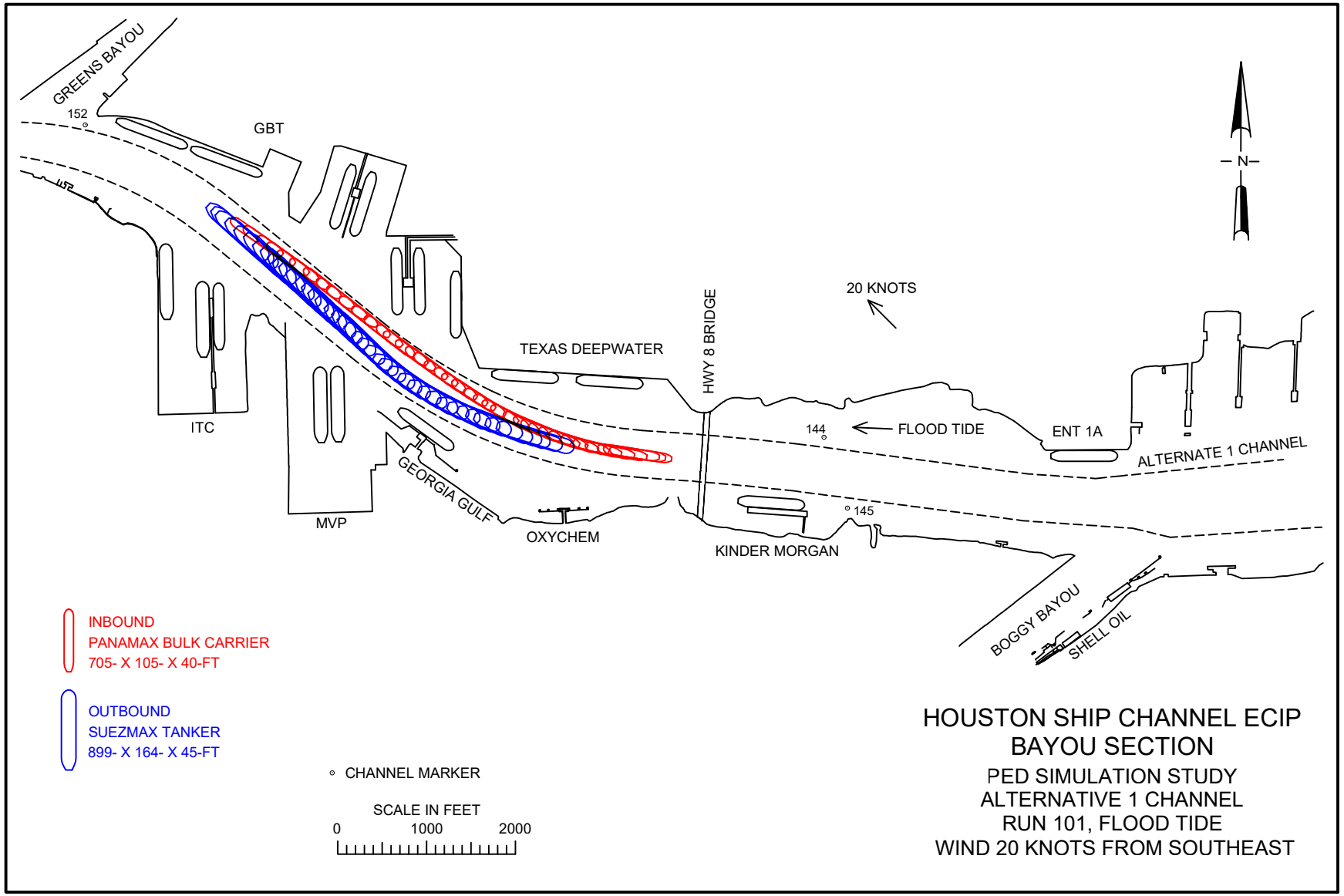
Purpose	Meet loaded Suezmax/Panamax by Texas Deepwater and Bridge. Instructor controlled tug used.
Date	6/4/2020
Start Time	1430
End Time	1440
Plan	BG-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*SUEZ156R	44.1/13.7	130/5	Texas Deepwater
Inbound	MBULK32X	40.0/12.2	277/4	Bridge
Inbound	MBULK32X	40.0/12.2	279/4	Enterprise

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*SUEZ156R	D	30	136	45	183
Inbound	MBULK32X	C	65			
Inbound	MBULK32X	A			46	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Outbound	Normal	Yes	There is plenty of room in the area.	Yes	Yes	Yes	Yes	Went well.
C	Inbound	Normal	Yes	Plenty of room for the ships to meet and recover.	Yes	Yes			
A	Inbound	Normal	Yes	Plenty of room.			Yes	Yes	The two inbound vessels were traveling a little closer than they would be in real life but it was still manageable and gave time to recover.



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 101, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 145

Run **101**

Purpose	Meet loaded Suezmax/Panamax by Georgia Gulf. Instructor controlled tug used.
Date	6/4/2020
Start Time	1550
End Time	1600
Plan	BG-A1
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	MBULK32X	40.0/12.2	276/4	Bridge
Outbound	*SUEZ156R	44.1/13.7	132/4	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	MBULK32X	C	37	140		
Outbound	*SUEZ156R	D	91			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Plenty of room to maneuver.	Yes	Yes			Wind and current did not make a differnece.
C	Outbound	Normal	Yes	Adequate room for the maneuver and the meet to occur.	Yes	Yes			Wind and current have minimal effect on vessel's ability.

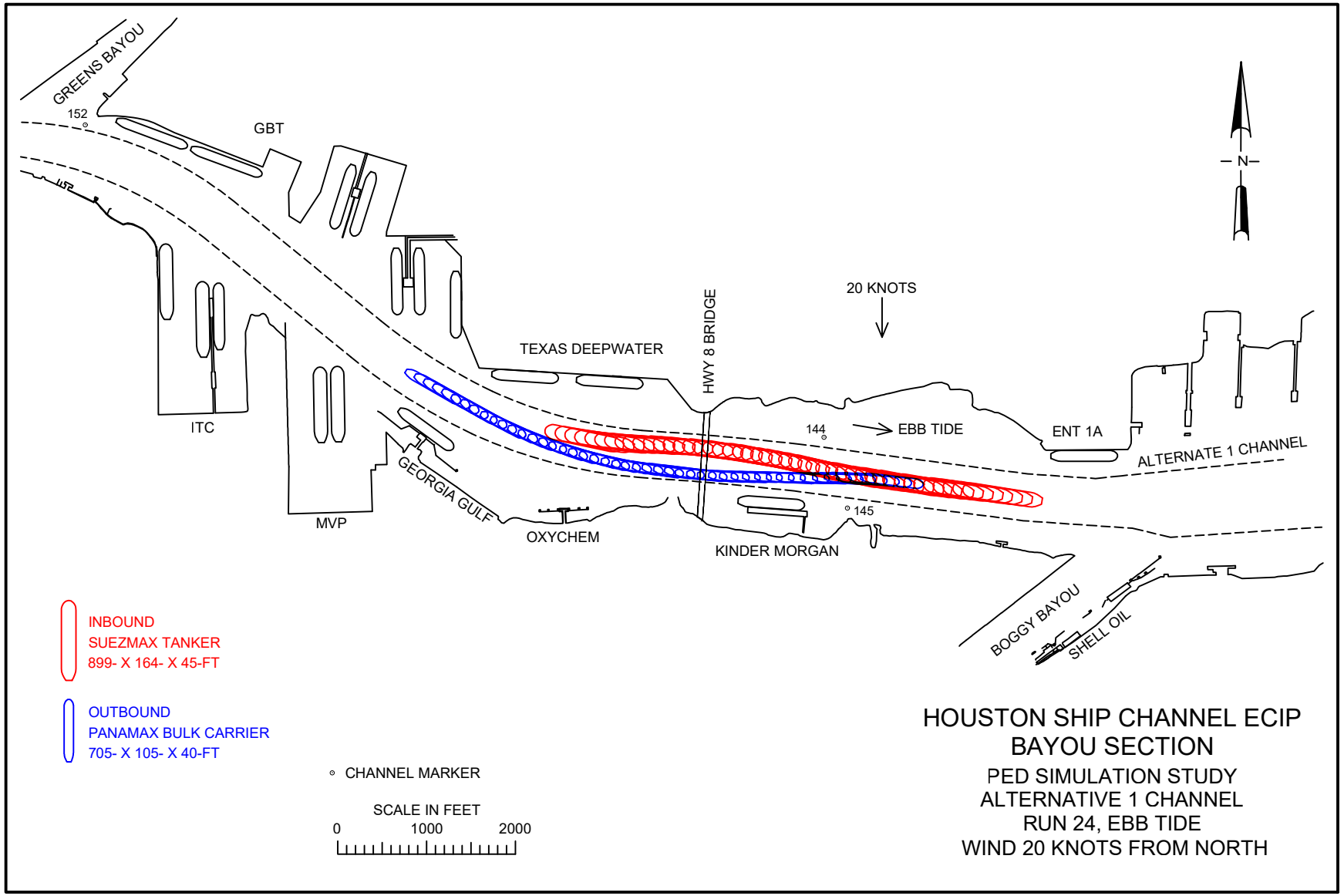

GREENS BAYOU
152
GBT
N
20 KNOTS
HWY 8 BRIDGE
TEXAS DEEPWATER
ITC
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
GEORGIA GULF
MVP
OXYCHEM
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 24, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 146

Run **24**

Purpose	Meet loaded Suezmax/Panamax by the bridge. Instructor controlled tug used.
Date	5/18/2020
Start Time	1435
End Time	1440
Plan	BG-A1
Current	Ebb
Tide (m)	1
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	278/5.5	Enterprise
Outbound	MBULK32X	40.0/12.2	119.7/5.5	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	C	76	153	[redacted]	
Outbound	MBULK32X	D	24	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	There is adequate space from the wider channel.	Yes	Yes	[redacted]		Larger vessel did not make a difference.
D	Outbound	Normal	Yes	Plenty of room.	Yes	Yes			Meeting location not ideal becasue of Kinder Morgan dock but the meet is manageable.

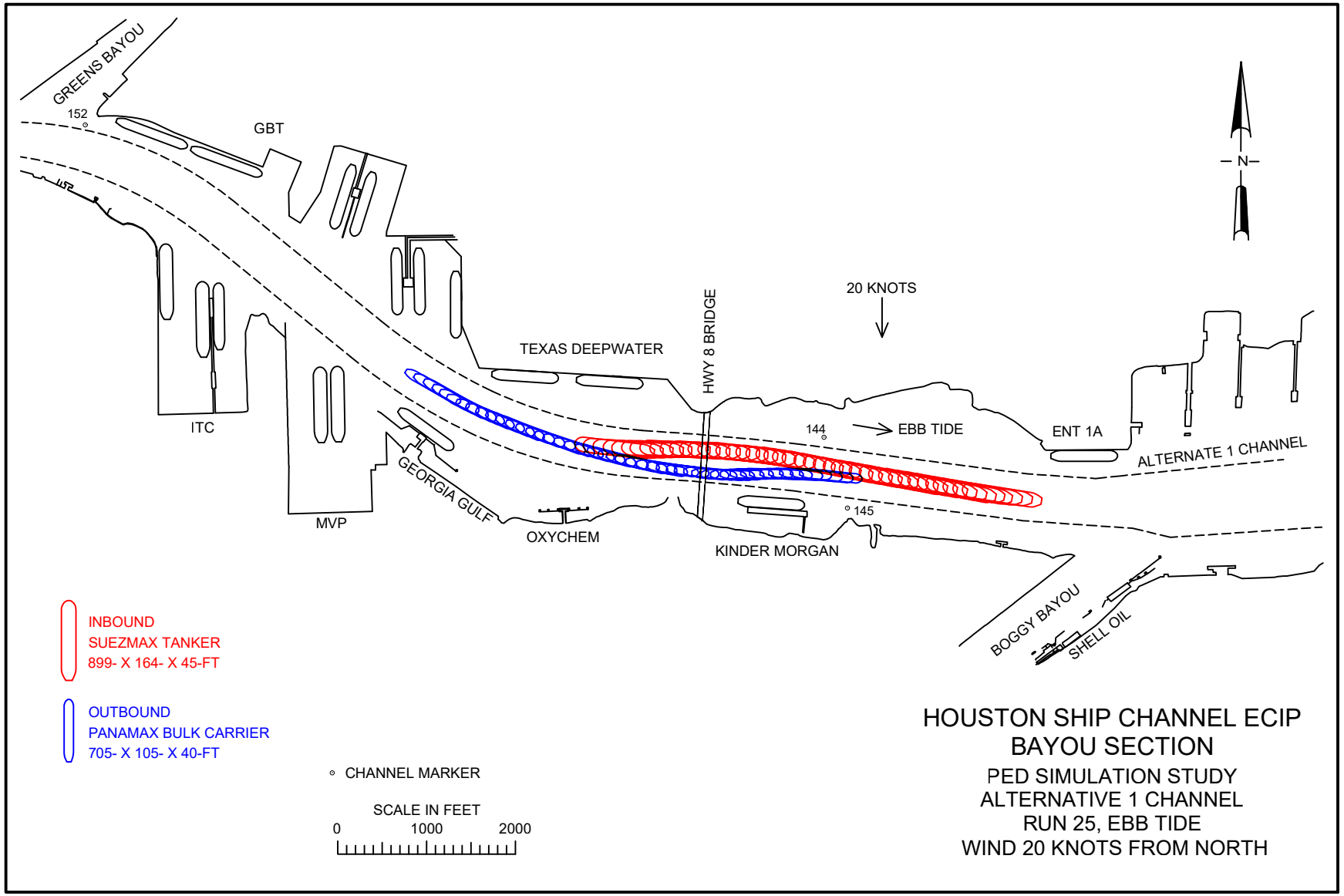

GREENS BAYOU
152
GBT
N
20 KNOTS
HWY 8 BRIDGE
TEXAS DEEPWATER
ITC
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
GEORGIA GULF
MVP
OXYCHEM
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 25, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 147

Run **25**

Purpose	Meet loaded Suezmax/Panamax by the bridge. instructor controlled tug used.
Date	5/18/2020
Start Time	1445
End Time	1455
Plan	BG-A1
Current	Ebb
Tide (m)	1
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	278/5.5	Enterprise
Outbound	MBULK32X	40.0/12.2	119.7/5.5	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	D	76	92		
Outbound	MBULK32X	C	40			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Leaning towards difficult because of the meeting location. Inbound vessel has to get over for meet and then make the right hand turn.	Yes	Yes			Larger vessel did not make a difference.
C	Outbound	Normal	Yes	Adequate room and minimal interaction between the two vessels.	Yes	Yes			Meeting the larger vessel did not make a difference.

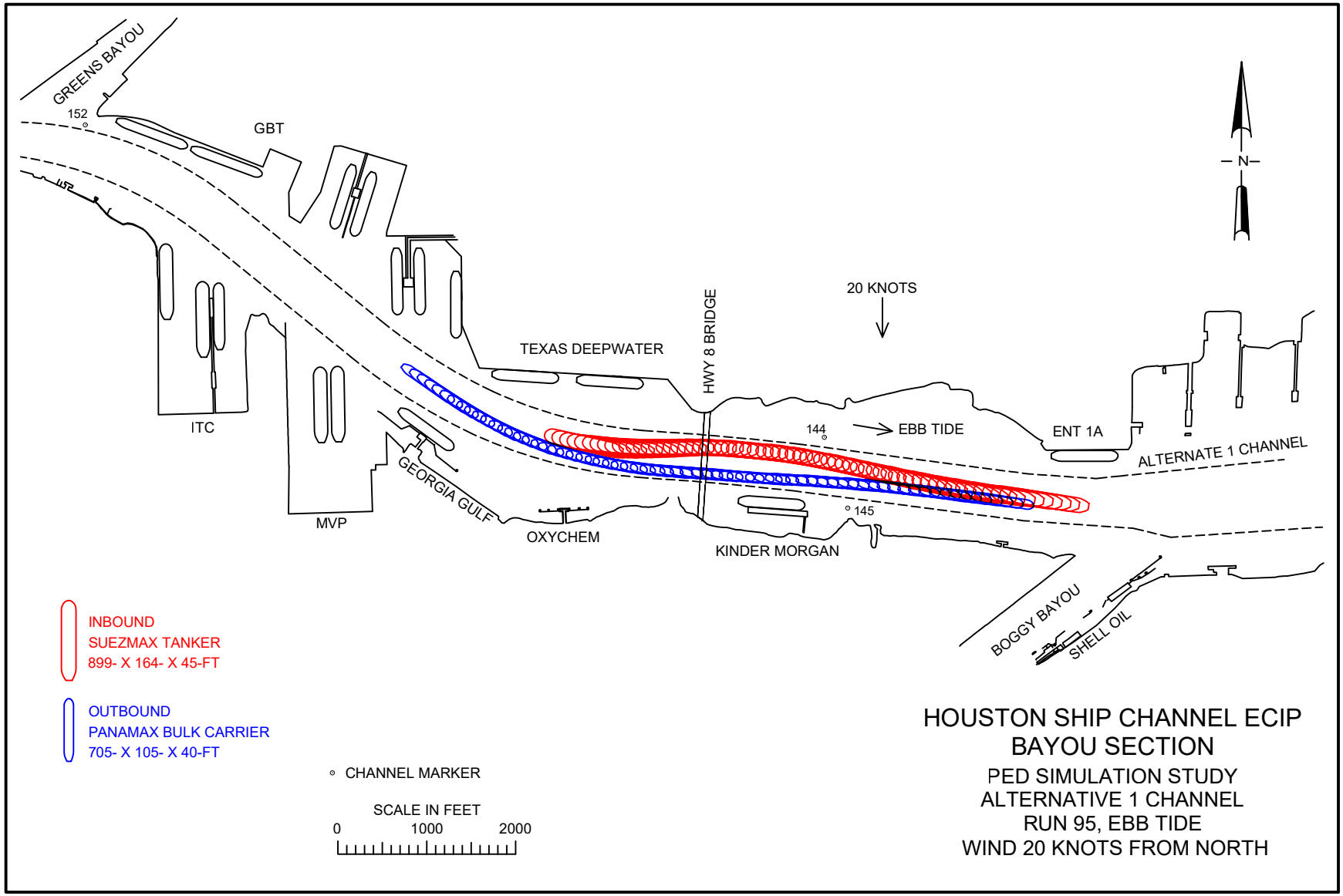

GREENS BAYOU
152
GBT
152
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
KINDER MORGAN
20 KNOTS
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
145
BOGGY BAYOU
SHELL OIL
N
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 95, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 148

Run **95**

Purpose	Meet loaded Suezmax/Panamax by the Bridge. Instructor controlled tug used.
Date	6/4/2020
Start Time	1400
End Time	1415
Plan	BG-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	279/5	Enterprise
Outbound	MBULK32X	40.0/12.2	125/5	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	A	44	166		
Outbound	MBULK32X	D	40			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Inbound	Normal	Yes	Plenty of room in the channel.	Yes	Yes			Got over a little wide during the meet and felt bank suction by the bridge but it was not enough to hinder the recovery because he was able to maintain low speed. No difference from wind or current.
D	Outbound	Normal	Yes	Plenty of room.	Yes	Yes			Everything felt good.

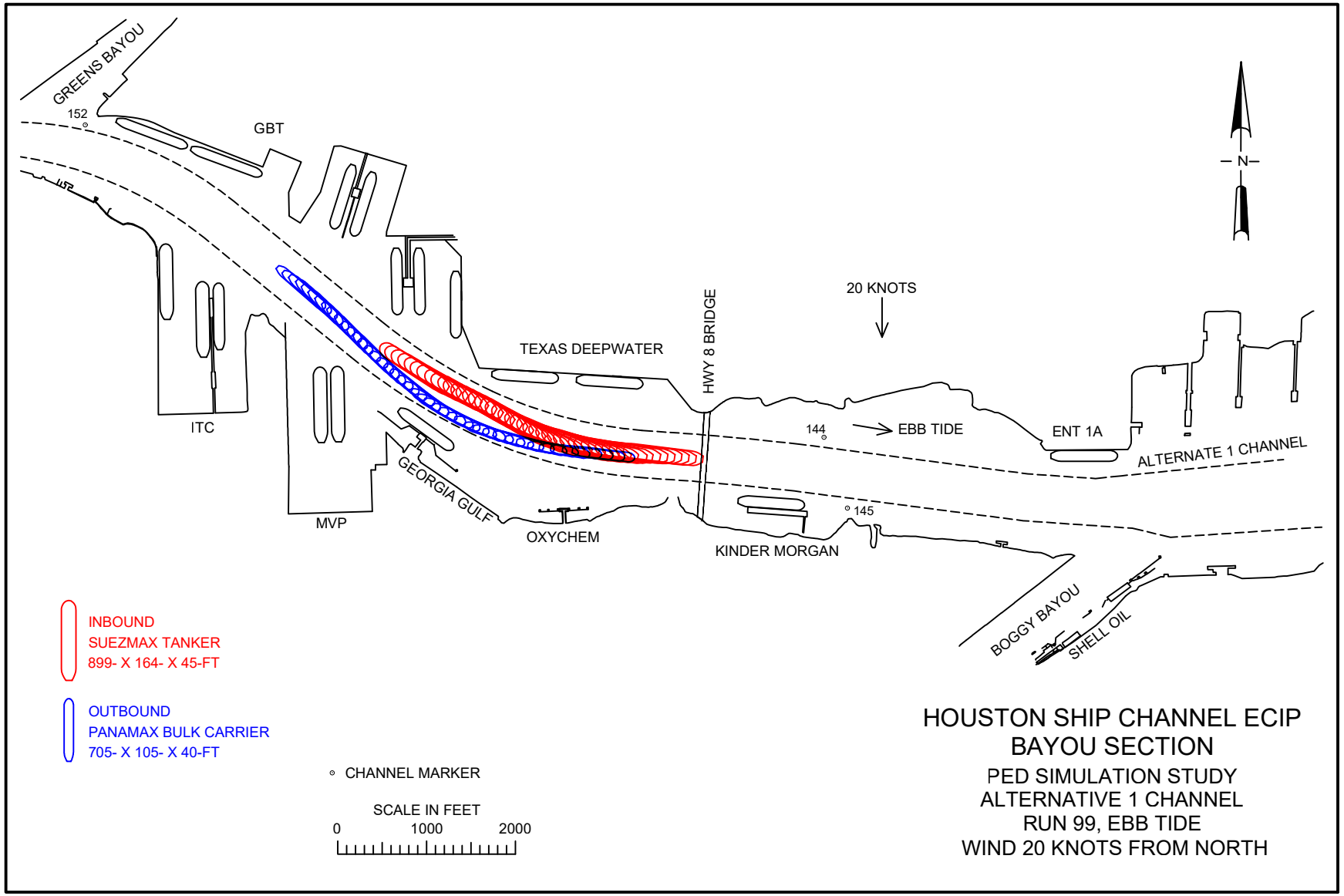

GREENS BAYOU
152
GBT
152
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
20 KNOTS
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
N
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 99, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 149

Run **99**

Purpose	Meet loaded Suezmax/Panamax by Georgia Gulf. Instructor controlled tug used.
Date	6/4/2020
Start Time	1525
End Time	1530
Plan	BG-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	277/4	Bridge
Outbound	MBULK32X	40.0/12.2	131/4	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	A	101	111		
Outbound	MBULK32X	D	<25			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Inbound	Normal	Yes	Plenty of space.	Yes	Yes			Beginning of the maneuver was difficult due to the speed so the pilot had to give more rudder than usual.
D	Outbound	Normal	Yes	The amount of space in the channel.	Yes	Yes			Wind and current did not make a difference.

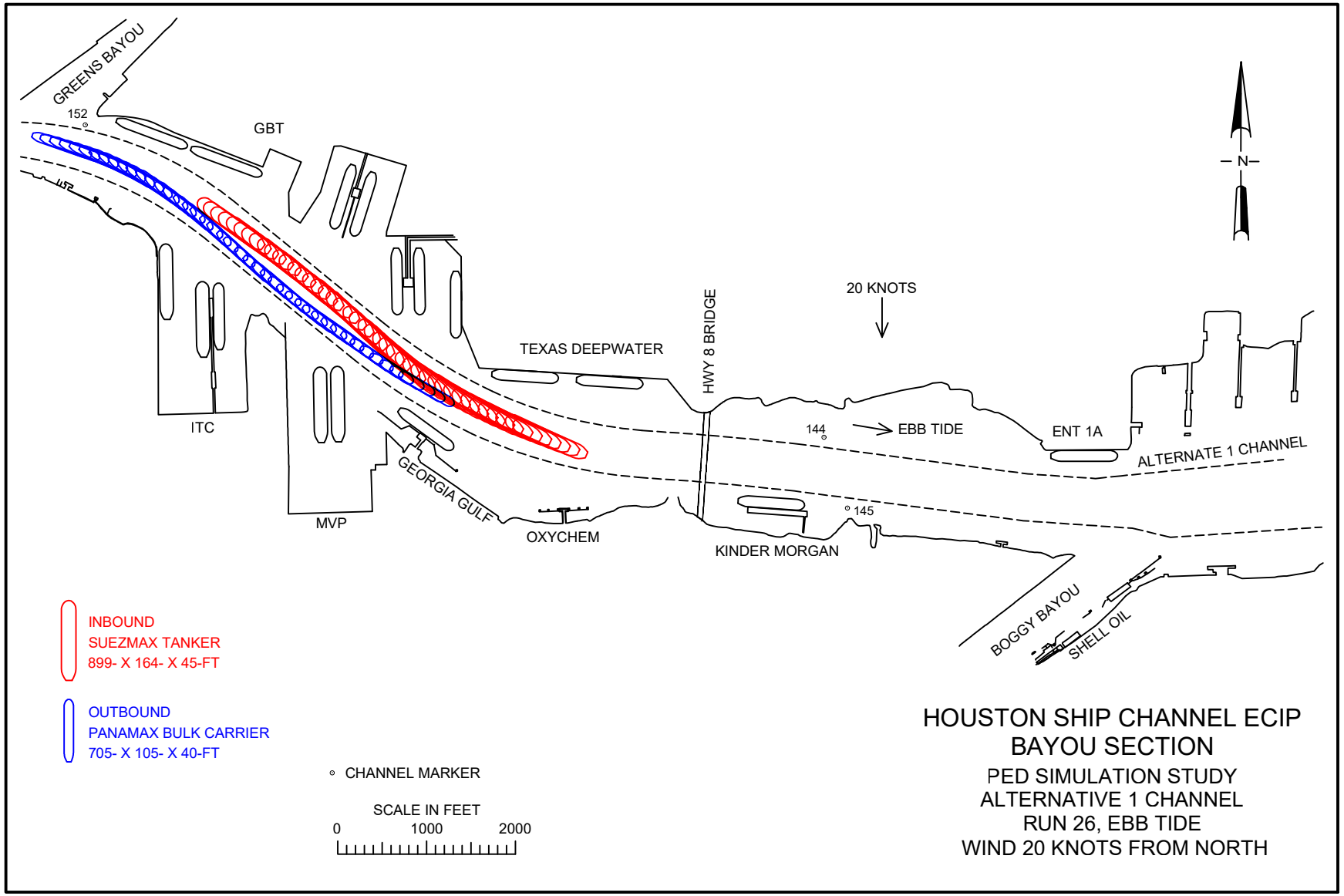

GREENS BAYOU
152
GBT
152
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
20 KNOTS
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
N
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 26, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 150

Run **26**

Purpose	Meet loaded Suezmax/Panamax between the bridge and ITC. Instructor controlled tug used.
Date	5/18/2020
Start Time	1500
End Time	1505
Plan	BG-A1
Current	Ebb
Tide (m)	1
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	294/5.5	Texas Deepwater
Outbound	MBULK32X	40.0/12.2	109/5.5	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	C	86	132	[redacted]	
Outbound	MBULK32X	D	54	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Adequate maneuvering room.	Yes	Yes	[redacted]		Good location to meet in.
D	Outbound	Normal	Yes	Plenty of space to meet.	Yes	Yes			Better location for the meet than near the bridge.

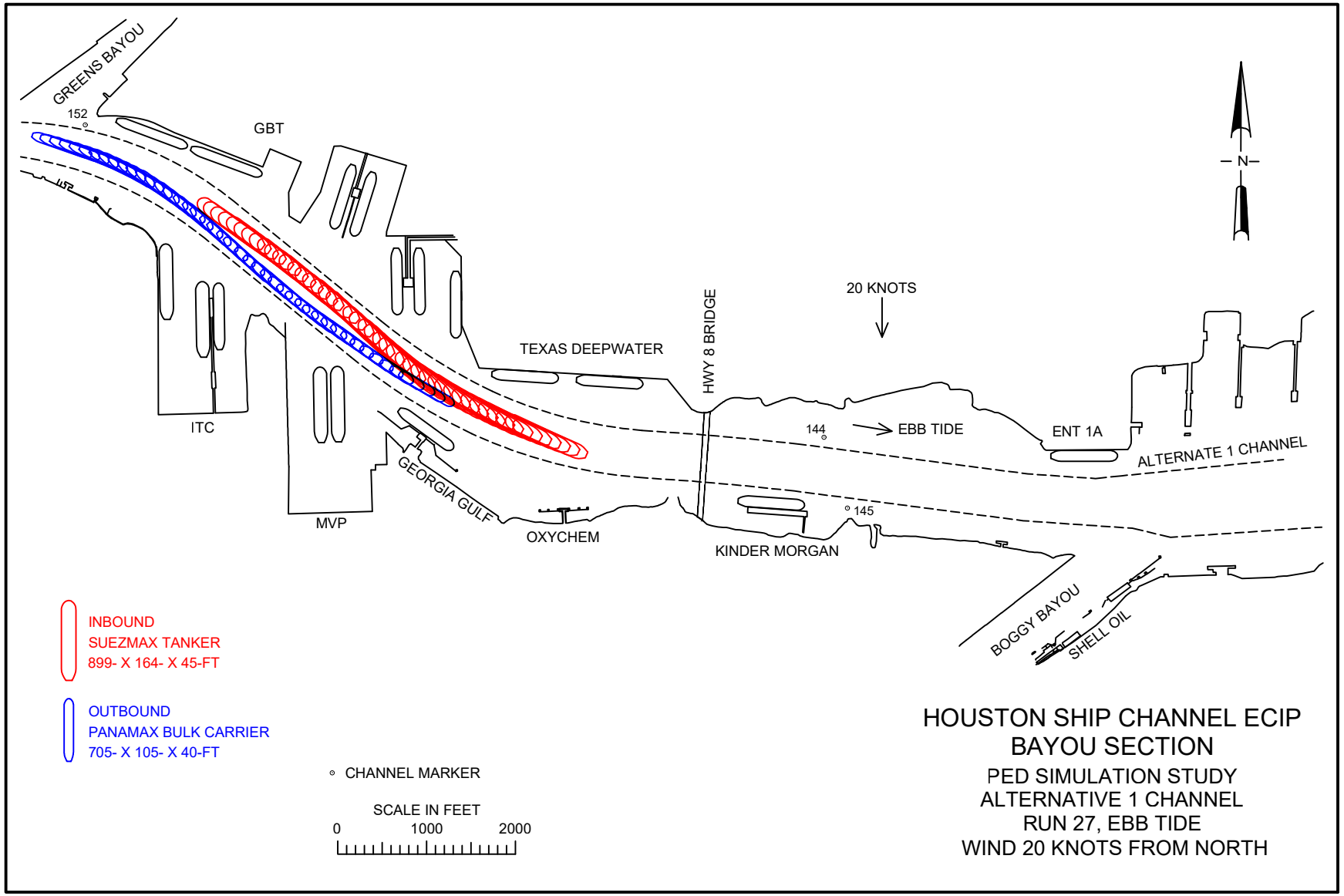

GREENS BAYOU
152
GBT
152
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
20 KNOTS
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
N
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 27, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 151

Run **27**

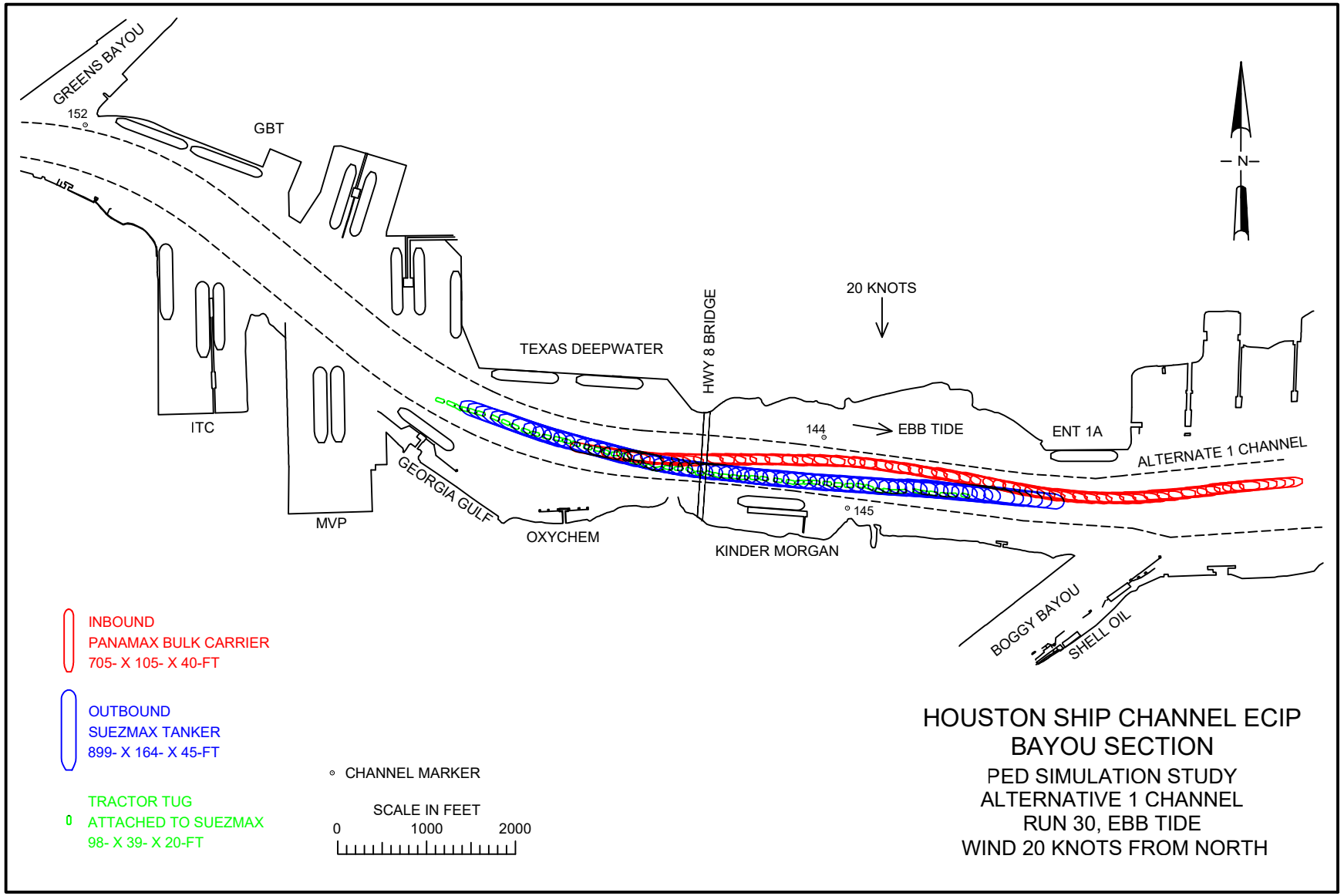
Purpose	Meet loaded Suezmax/Panamax between the bridge and ITC. Instructor controlled tug used.
Date	5/18/2020
Start Time	1510
End Time	1520
Plan	BG-A1
Current	Ebb
Tide (m)	1
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	294/5.5	Texas Deepwater
Outbound	MBULK32X	40.0/12.2	109/5.5	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	D	51	110		
Outbound	MBULK32X	C	116			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Plenty of room to get around the vessel without encroaching on the north side of the tow.	Yes	Yes			Pilot noted that he would have had a slower speed because he would normally be getting ready to dock at the location. However, the meet was manageable at this speed.
C	Outbound	Normal	Yes	Adequate space to pass.	Yes	Yes			



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 30, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 152

Run **30**

Purpose	Meet loaded Suezmax/Panamax by the bridge. Man tug used for this run instead of computer.
Date	5/19/2020
Start Time	0855
End Time	0905
Plan	BG-A1
Current	Ebb
Tide (m)	1
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Outbound Vessel

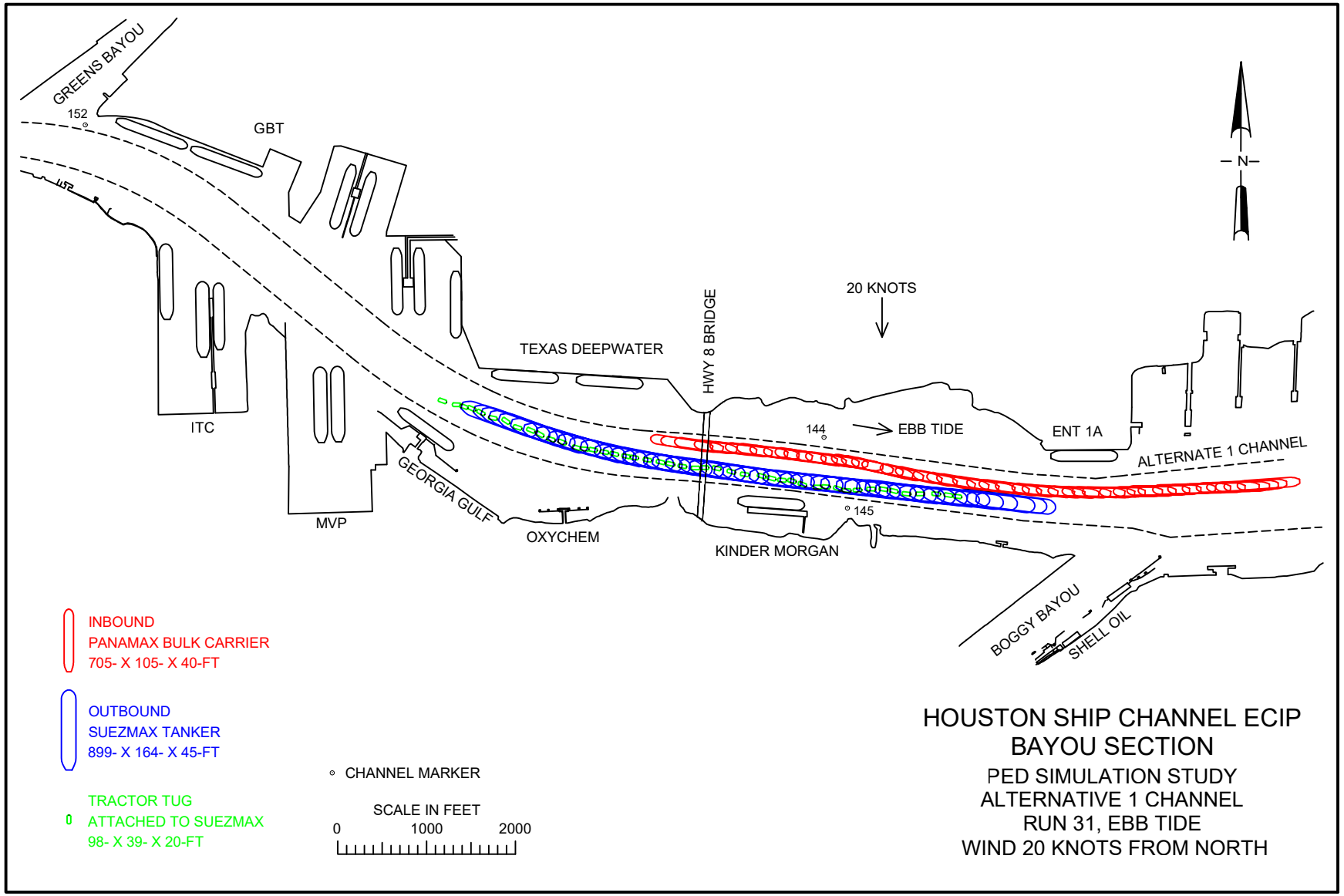
Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	MBULK32X	40.0/12.2	265.7/5.5	Enterprise
Outbound	*SUEZ156R	44.1/13.7	110/5.5	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	MBULK32X	D	62	120	[redacted]	
Outbound	*SUEZ156R	C	46	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Location is not ideal for meet due to being right next to Kinder Morgan Dock but it can occur safely.	Yes	Yes	[redacted]		Even with the difficult meeting location, there is still plenty of space for the meet to occur.
D	Outbound	Normal	Yes	Plenty of room.	Yes	Yes			

Tug Captain	Job Rating	Tug Able	Danger	Unrealistic Operation	Safe/Do in Real life	Safety Comments
2 - MZ7505	Easy	Yes	No	No	Yes	Nothing out of the ordinary for the tug operations.



HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION

PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 31, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 153

Run **31**

Purpose	Meet loaded Suezmax/Panamax by the bridge. Man tug used for this run instead of instructor.
Date	5/19/2020
Start Time	0910
End Time	0925
Plan	BG-A1
Current	Ebb
Tide (m)	1
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	MBULK32X	40.0/12.2	265.7/5.5	Enterprise
Outbound	*SUEZ156R	44.1/13.7	110/5.5	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	MBULK32X	C	82	143	[redacted]	
Outbound	*SUEZ156R	D	48	[redacted]		

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	The channel width allows for it to be safe, however the meeting location with the vessel size makes it a little more difficult.	Yes	Yes	[redacted]		
C	Outbound	Normal	Yes	Smaller vessel inbound had a lot more space and there was no vessel on the other side to worry about.	Yes	Yes			

Tug Captain	Job Rating	Tug Able	Danger	Unrealistic Operation	Safe/Do in Real life	Safety Comments
2 - MZ7505	Easy	Yes	No	No	Yes	Tug had no commands during the run.

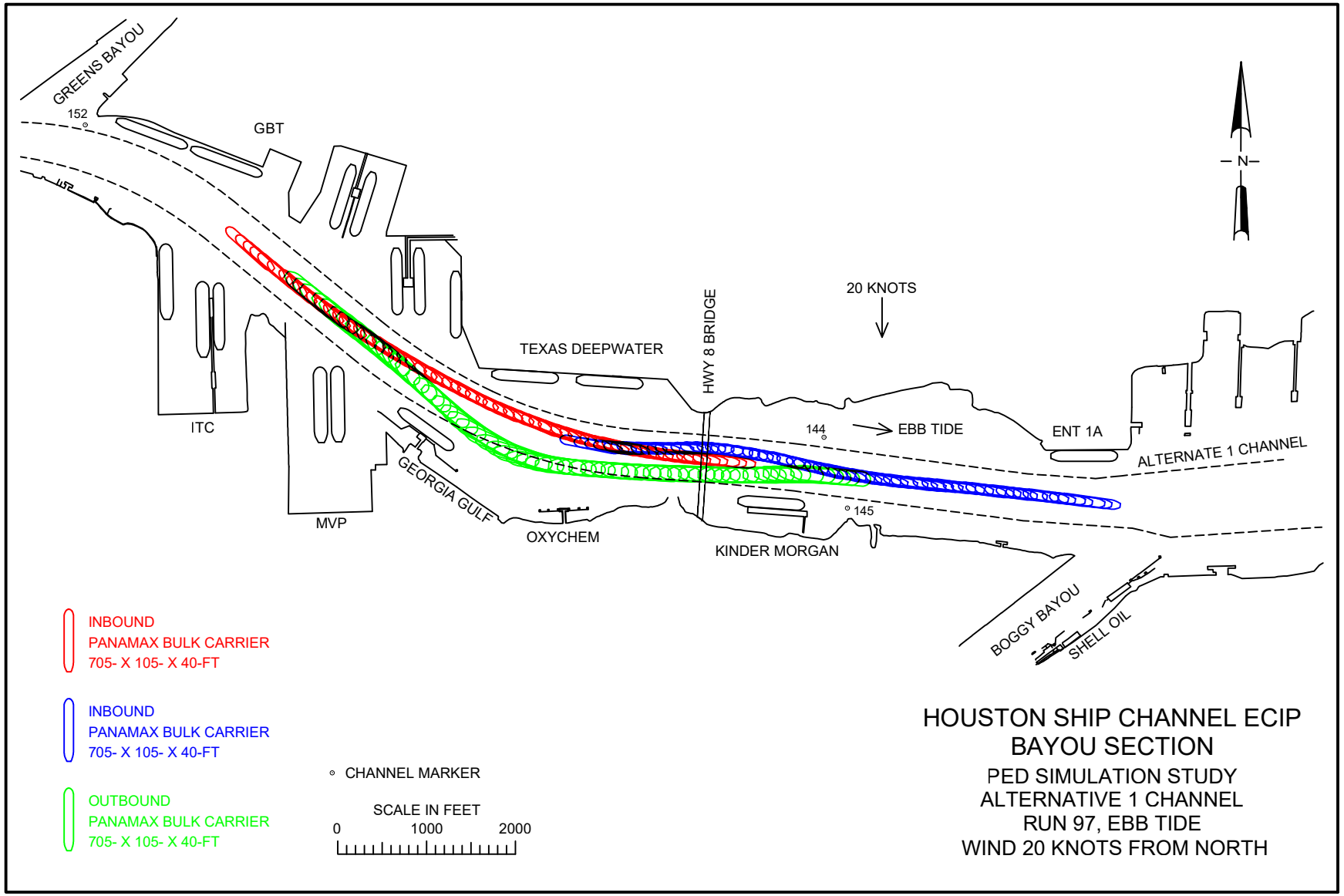

GREENS BAYOU
152
GBT
N
20 KNOTS
HWY 8 BRIDGE
TEXAS DEEPWATER
ITC
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
GEORGIA GULF
MVP
OXYCHEM
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 97, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 154

Run **97**

Purpose	Meet loaded Suezmax/Panamax by Texas Deepwater and the bridge. Instructor controlled tug used.
Date	6/4/2020
Start Time	1450
End Time	1500
Plan	BG-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*SUEZ156R	44.1/13.7	130/5	Texas Deepwater
Inbound	MBULK32X	40.0/12.2	277/4	Bridge
Inbound	MBULK32X	40.0/12.2	279/4	Enterprise

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*SUEZ156R	C	0	272	0	147
Inbound	MBULK32X	A	92			
Inbound	MBULK32X	D			94	

Run Comments
Over 50% of outbound vessel was outside the federal channel during the first meet. There is deep water in that area so the vessel did not ground.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Outbound	Normal	Yes	Plenty of room to maneuver as long as the ships are not too close.	Yes	Yes	Yes	Yes	Pilot left the marked channel due to previous trails remaining on the PPU and mixing them up with his prediction trails. This caused confusion and for him to leave the channel. Not a design issue.
A	Inbound	Normal	Yes	Plenty of room in the wide channel.	Yes	Yes			Wind and current did not make a difference.
D	Inbound	Normal	Yes	The channel width allows for the suezmax and panamax to meet comfortably.			Yes	Yes	Wind and current did not make a difference.

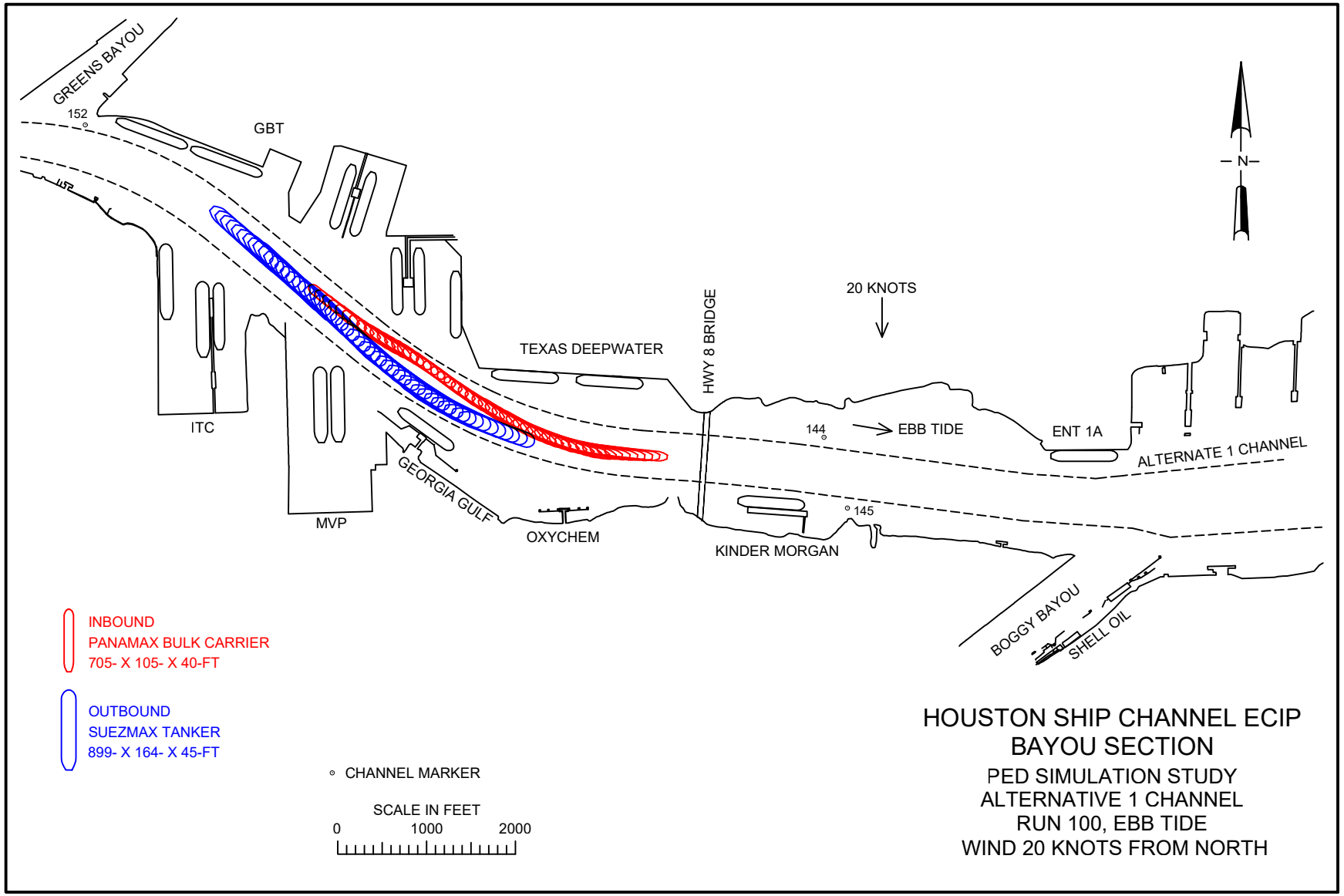

GREENS BAYOU
152
GBT
N
20 KNOTS
HWY 8 BRIDGE
TEXAS DEEPWATER
ITC
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
GEORGIA GULF
MVP
OXYCHEM
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 100, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 155

Run **100**

Purpose	Meet loaded Suezmax/Panamax by Georgia Gulf. Instructor controlled tug used.
Date	6/4/2020
Start Time	1535
End Time	1545
Plan	BG-A1
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	MBULK32X	40.0/12.2	276/4	Bridge
Outbound	*SUEZ156R	44.1/13.7	132/4	Texas Deepwater

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	MBULK32X	A	59	121		
Outbound	*SUEZ156R	C	98			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Outbound	Normal	Yes	Adequate room to maneuver.	Yes	Yes			Meeting location is not ideal due to the berthed vessel but with the larger channel it is easier.
A	Inbound	Normal	Yes	Plenty of room in the channel.	Yes	Yes			Meeting went smooth.

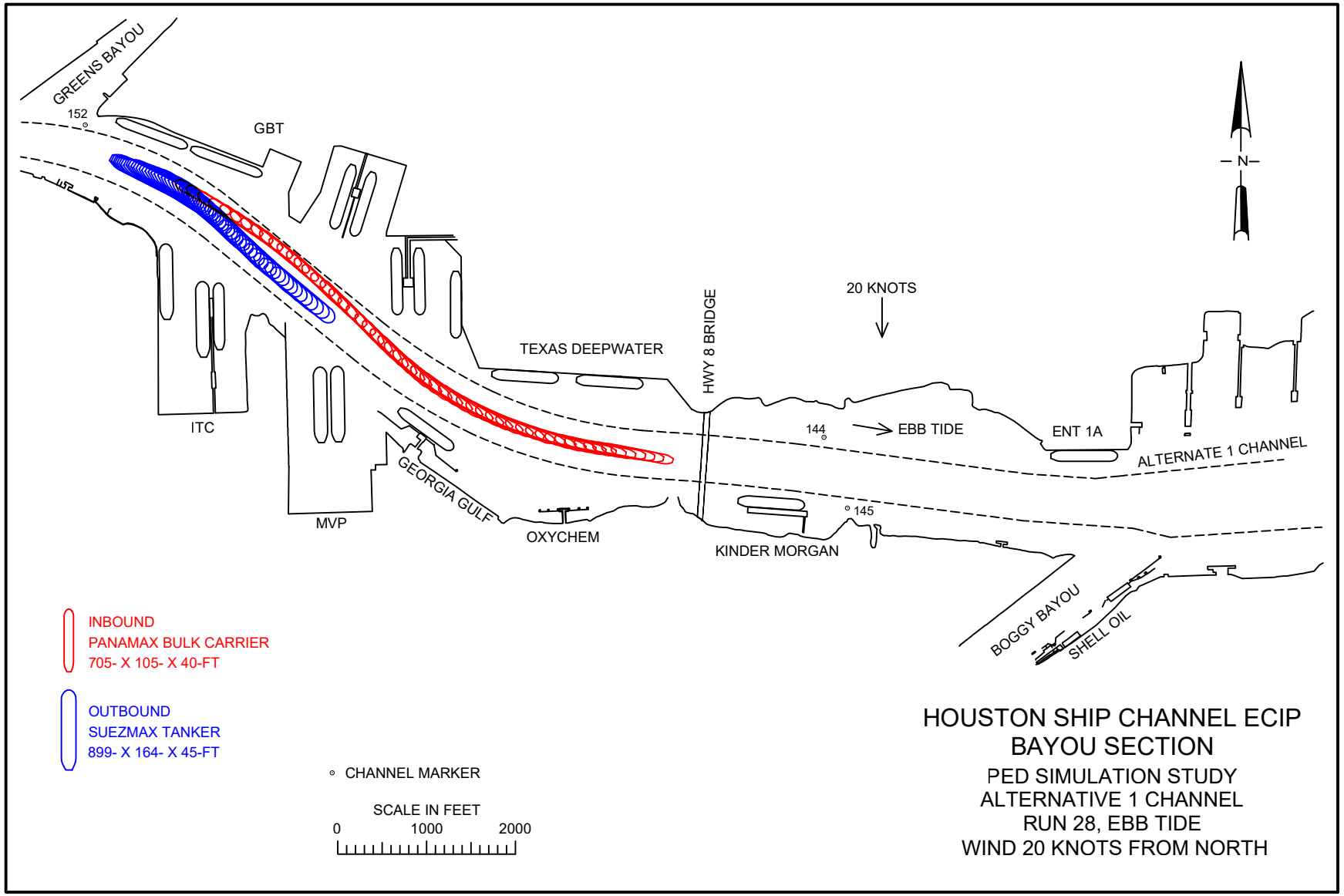

GREENS BAYOU
152
GBT
N
20 KNOTS
HWY 8 BRIDGE
TEXAS DEEPWATER
ITC
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
GEORGIA GULF
MVP
OXYCHEM
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 28, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 156

Run **28**

Purpose	Meet loaded Suezmax/Panamax between the bridge and ITC. Instructor controlled tug used.
Date	5/18/2020
Start Time	1530
End Time	1540
Plan	BG-A1
Current	Ebb
Tide (m)	1
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	MBULK32X	40.0/12.2	281/5	Texas Deepwater
Outbound	*SUEZ156R	44.1/13.7	117/1	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	MBULK32X	D	48	92		
Outbound	*SUEZ156R	C	116			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	A little more difficult to get over because of the slow starting speed.	Yes	Yes			Meeting location had plenty of space to pass by the other vessel.
D	Outbound	Normal	Yes	Plenty of room.	Yes	Yes			Switching the SUEZMAX to outbound did not make a difference during the meet.

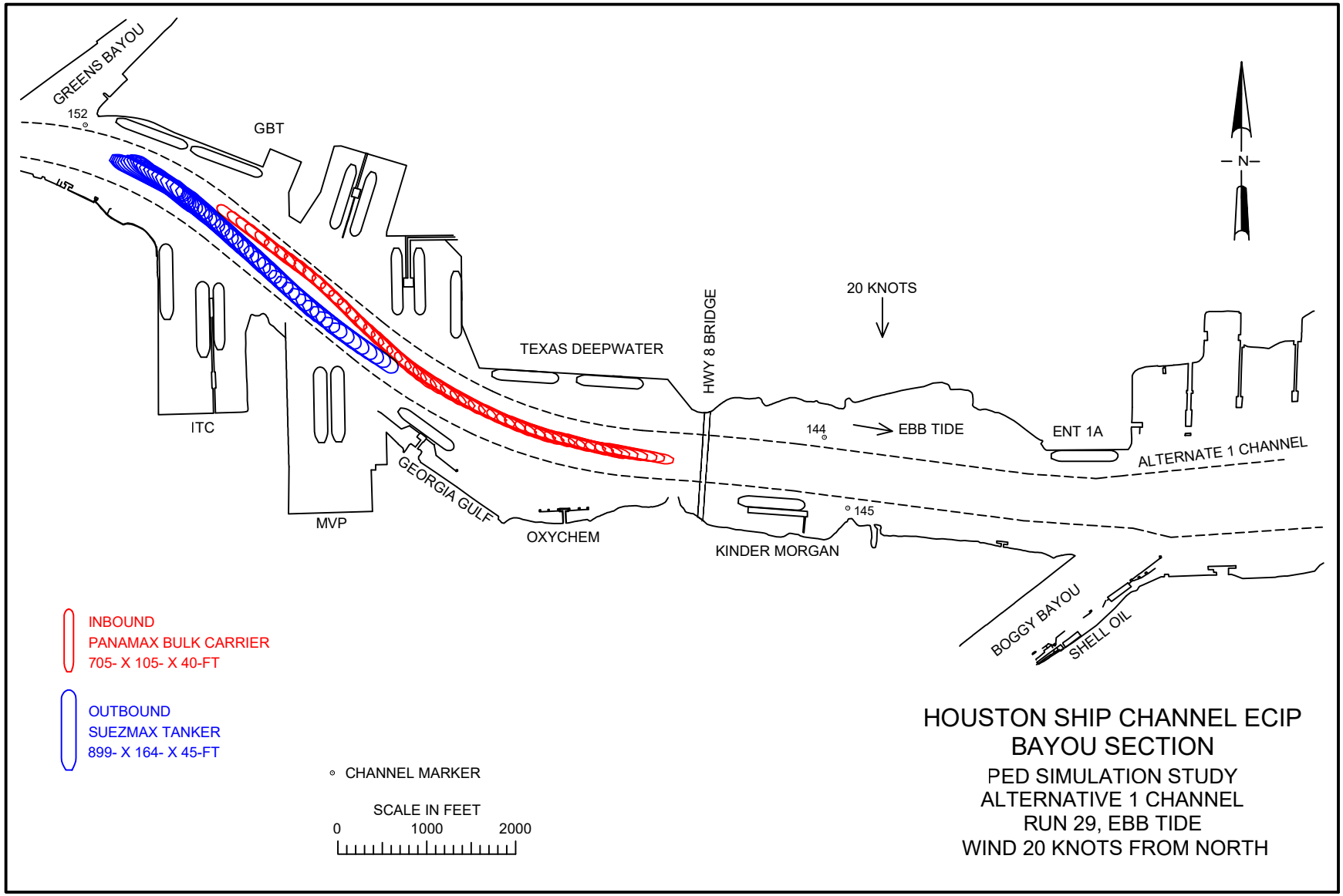

GREENS BAYOU
152
GBT
152
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
20 KNOTS
144
EBB TIDE
ENT 1A
ALTERNATE 1 CHANNEL
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
N
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 29, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 157

Run **29**

Purpose	Meet loaded Suezmax/Panamax between the bridge and ITC. Instructor controlled tug used.
Date	5/18/2020
Start Time	1550
End Time	1600
Plan	BG-A1
Current	Ebb
Tide (m)	1
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	MBULK32X	40.0/12.2	281/5	Texas Deepwater
Outbound	*SUEZ156R	44.1/13.7	117/1	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	MBULK32X	C	60	152		
Outbound	*SUEZ156R	D	71			

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Inbound	Normal	Yes	Width of the channel in relation to the size of the vessel made the passing occurring smoothly.	Yes	Yes			
C	Outbound	Easy	Yes	Adequate maneuvering room.	Yes	Yes			

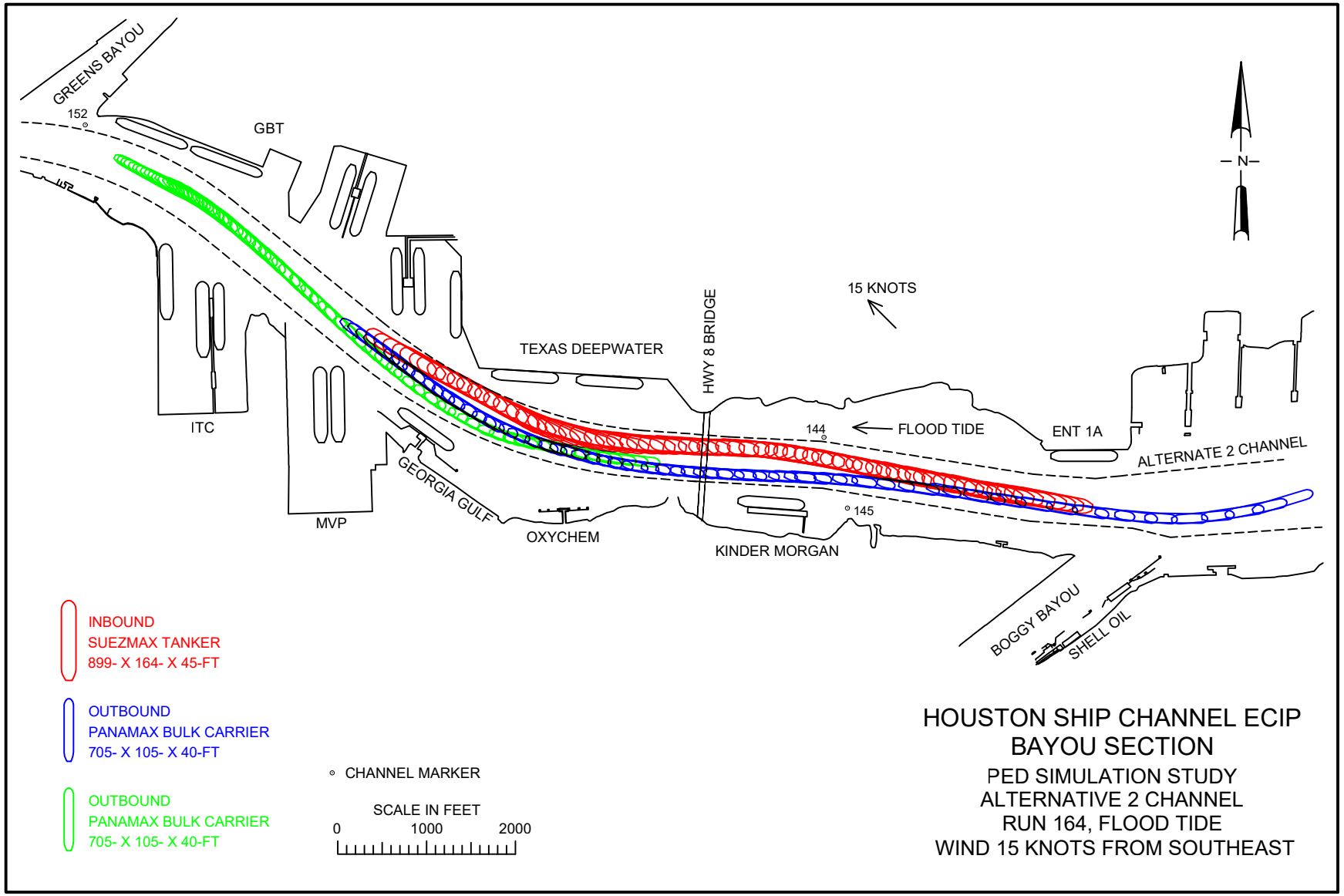

GREENS BAYOU
152
GBT
N
15 KNOTS
HWY 8 BRIDGE
TEXAS DEEPWATER
ITC
144
FLOOD TIDE
ENT 1A
ALTERNATE 2 CHANNEL
GEORGIA GULF
MVP
OXYCHEM
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 2 CHANNEL
RUN 164, FLOOD TIDE
WIND 15 KNOTS FROM SOUTHEAST

PLATE 158

Run **164**

Purpose	Meet loaded Suezmax/Panamax by the bridge and Texas Deepwater. Instructor controlled tug used.
Date	6/12/2020
Start Time	1440
End Time	1455
Plan	BG-A2
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	279/5	Enterprise
Outbound	MBULK32X	40.0/12.2	131/5	Texas Deepwater
Outbound	MBULK32X	40.0/12.2	123/2	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	M	31	170	<20	178
Outbound	MBULK32X	D	45			
Outbound	MBULK32X	A			65	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
M	Inbound	Normal	Yes	The pilot was able to control the vessel and the width of the channel. Escort tug.	Yes	Yes	Yes	Yes	Wind and current did not effect the vessel.
A	Outbound	Easy	Yes	There is plenty of room to pass safely.	Yes	Yes			It is not an easy maneuver.
C	Outbound	Normal	Yes	Adequate room to meet in this area.			Yes	Yes	Pilot felt like he had plenty of space between the vessels and to the federal channel line.

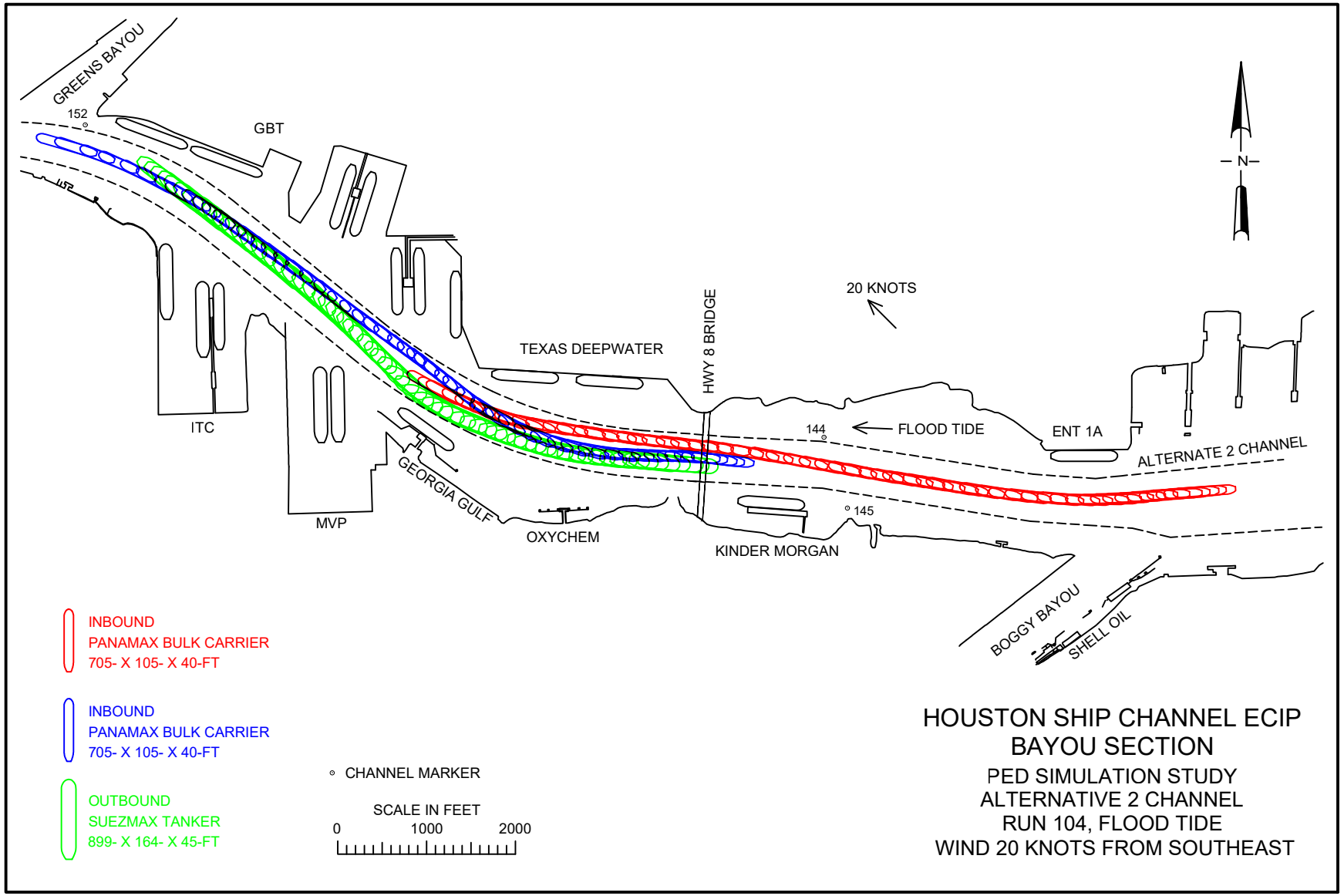

GREENS BAYOU
152
GBT
N
20 KNOTS
HWY 8 BRIDGE
TEXAS DEEPWATER
ITC
144
FLOOD TIDE
ENT 1A
ALTERNATE 2 CHANNEL
GEORGIA GULF
MVP
OXYCHEM
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 2 CHANNEL
RUN 104, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST

PLATE 159

Run **104**

Purpose	Meet loaded Suezmax/Panamax by Texas Deepwater and the bridge. Instructor controlled tug used.
Date	6/5/2020
Start Time	1010
End Time	1025
Plan	BG-A2
Current	Fld
Tide (m)	1.5
Wind Direction /Speed Knots	SE/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*SUEZ156R	44.1/13.7	128/5	ITC
Inbound	MBULK32X	40.0/12.2	277/5	Bridge
Inbound	MBULK32X	40.0/12.2	266/5	Enterprise

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*SUEZ156R	C	127	129	40	140
Inbound	MBULK32X	D	46			
Inbound	MBULK32X	A			59	

Run Comments
Outbound vessel left the federal channel by Georgia Gulf and was about 106 ft away from the berthed vessel.

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Outbound	Difficult	Yes	Difficult due to simulation problems during the first part of the run.	No	Yes	Yes	Yes	When the simulation started there was a simulation error with the engine setting. This caused the pilot to not have control during the first part of the run and is the reason the first meet was not controllable.
D	Inbound	Normal	Yes	Plenty of space.	Yes	Yes			Meeting location was good and did not feel the environmental factors.
A	Inbound	Normal	Yes	Plenty of space.			Yes	Yes	Safe and simple maneuver.

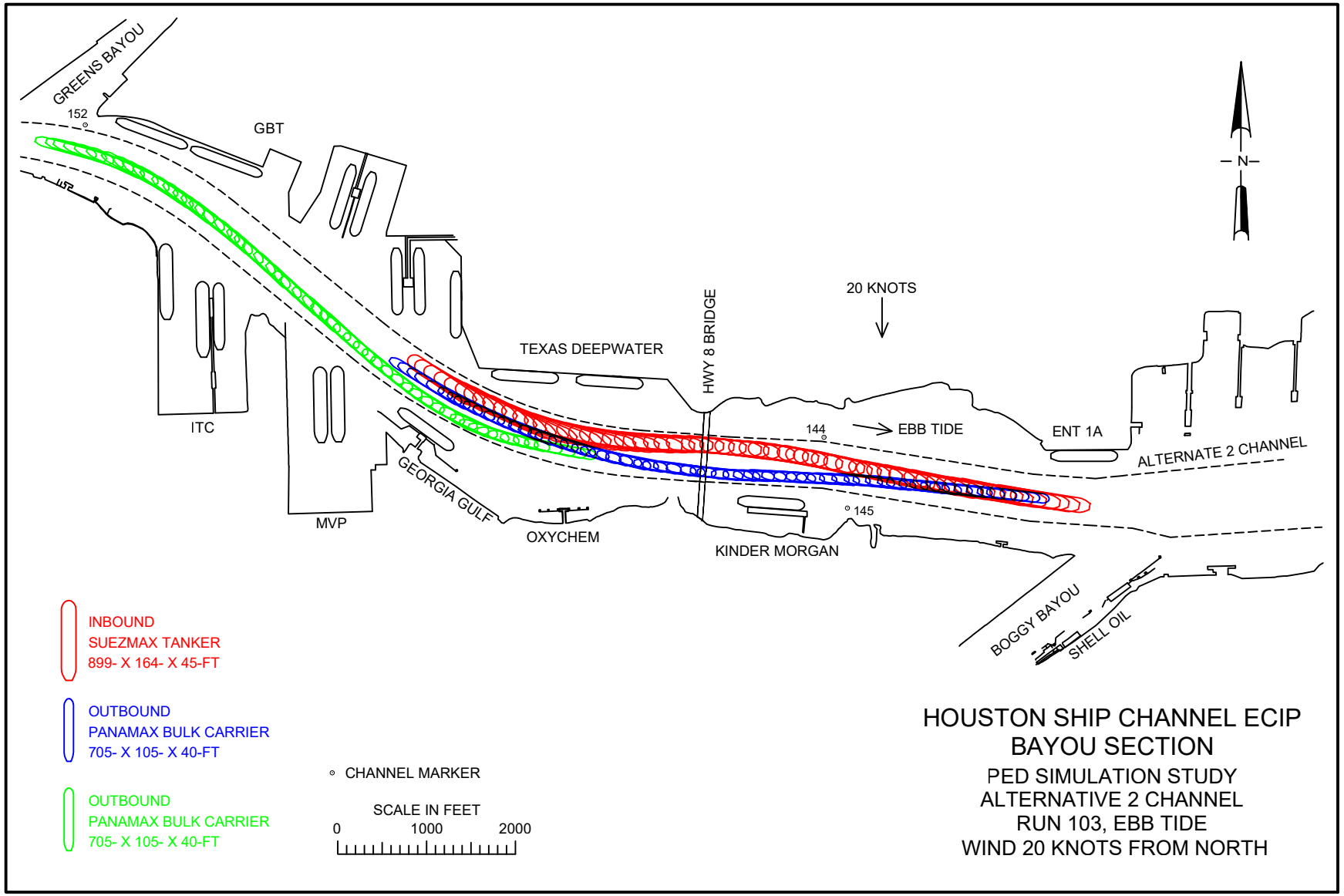

GREENS BAYOU
152
GBT
N
20 KNOTS
HWY 8 BRIDGE
TEXAS DEEPWATER
ITC
144
EBB TIDE
ENT 1A
ALTERNATE 2 CHANNEL
GEORGIA GULF
MVP
OXYCHEM
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 2 CHANNEL
RUN 103, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 160

Run **103**

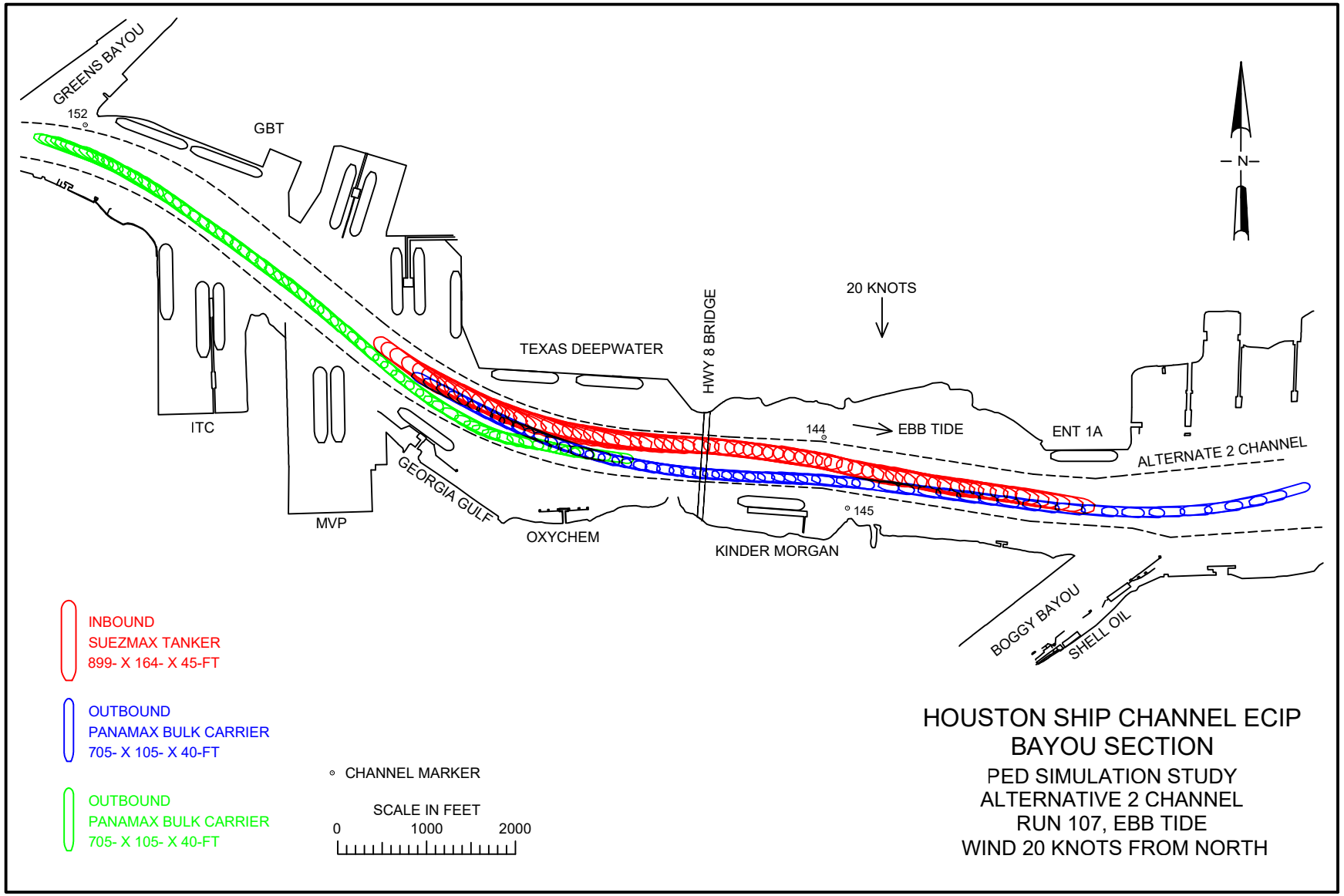
Purpose	Meet loaded Suezmax/Panamax by the bridge and Texas Deepwater. Instructor controlled tug used.
Date	6/5/2020
Start Time	0940
End Time	0955
Plan	BG-A2
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Inbound Vessel0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	279/5	Enterprise
Outbound	MBULK32X	40.0/12.2	122/5	Texas Deepwater
Outbound	MBULK32X	40.0/12.2	098/5	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	A	35	171	75	146
Outbound	MBULK32X	C	63			
Outbound	MBULK32X	D			25	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Inbound	Normal	Yes	Plenty of room and the model change made the run a lot better.	Yes	Yes	Yes	Yes	Wind and current did not effect the pilot.
C	Outbound	Normal	Yes	There is plenty of room in the channel.	Yes	Yes			Everything was good.
D	Outbound	Normal	Yes	The width of the channel allows for plenty of room to maneuver.			Yes	Yes	Wind and current did not effect the pilot.


GREENS BAYOU
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GBT
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
KINDER MORGAN
20 KNOTS
144
EBB TIDE
ENT 1A
ALTERNATE 2 CHANNEL
145
BOGGY BAYOU
SHELL OIL
N
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 2 CHANNEL
RUN 107, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 161

Run **107**

Purpose	Meet loaded Suezmax/Panamax by the bridge and Texas Deepwater. Instructor controlled tug used.
Date	6/5/2020
Start Time	1130
End Time	1145
Plan	BG-A2
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Inbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Inbound	*SUEZ156R	44.1/13.7	279/5	Enterprise
Outbound	MBULK32X	40.0/12.2	122/5	Texas Deepwater
Outbound	MBULK32X	40.0/12.2	098/5	ITC

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Inbound	*SUEZ156R	C	62	158	87	145
Outbound	MBULK32X	D	33			
Outbound	MBULK32X	A			<20	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
C	Inbound	Normal	Yes	Plenty of maneuvering room and the outbound vessels gave a lot of space to the larger vessel while passing.	Yes	Yes	Yes	Yes	In real life, it would be better to have more space between the outbound vessels so that you have time to recover before meeting another ship. However, even with the closeness of the two meets, the pilot was able to maintain control and stay in the federal channel. Wind and current have little to no effect on the vessel
D	Outbound	Normal	Yes	Width of the channel allows for more passing space.	Yes	Yes			
A	Outbound	Normal	Yes	Plenty of room.			Yes	Yes	Pilot gave a lot of space to the larger vessel so he was close to the edge but still maintained control during the recovery.

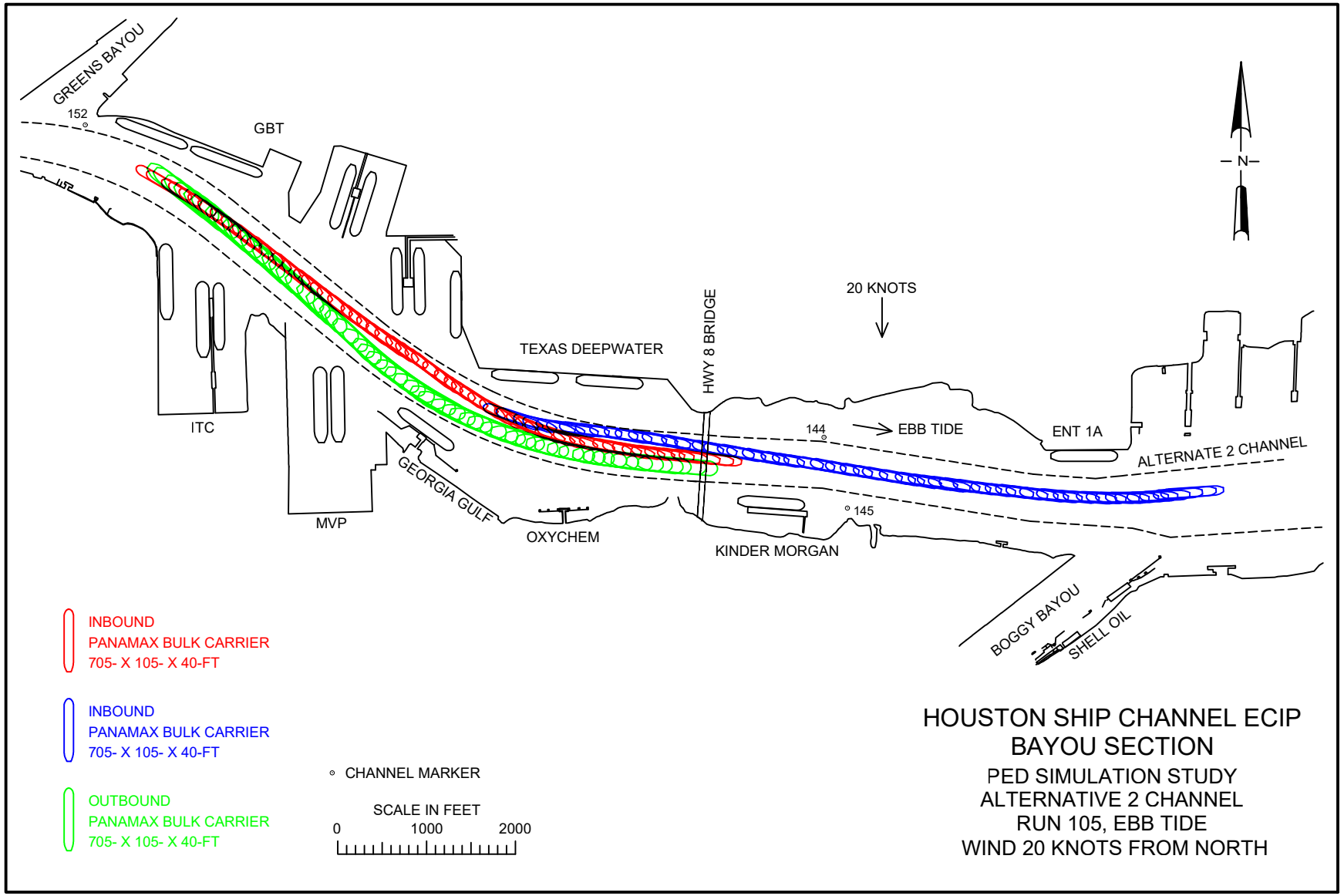

GREENS BAYOU
152
GBT
152
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
20 KNOTS
144
EBB TIDE
ENT 1A
ALTERNATE 2 CHANNEL
145
KINDER MORGAN
BOGGY BAYOU
SHELL OIL
N
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 2 CHANNEL
RUN 105, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 162

Run **105**

Purpose	Meet loaded Suezmax/Panamax by Texas Deepwater and the bridge. Instructor controlled tug used.
Date	6/5/2020
Start Time	1040
End Time	1055
Plan	BG-A2
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*SUEZ156R	44.1/13.7	128/5	ITC
Inbound	MBULK32X	40.0/12.2	277/5	Bridge
Inbound	MBULK32X	40.0/12.2	266/5	Enterprise

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*SUEZ156R	D	68	140	92	155
Inbound	MBULK32X	A	55			
Inbound	MBULK32X	C			<20	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Outbound	Normal	Yes	Plenty of space.	Yes	Yes	Yes	Yes	No difference with the wind and current change. Width of the channel allows for the vessels to safely meet in locations that they would normally not choose to meet in.
A	Inbound	Normal	Yes	Plenty of space in the channel.	Yes	Yes			Met a little bit above Georgia Gulf in this run so it was a good spot for the meet to occur and allowed the pilot to give the larger vessel more room.
C	Inbound	Easy	Yes	The 530 ft channel provides adequate sea room for passing.			Yes	Yes	Wind and current change had no effect on the vessel. Vessel got close to the federal channel during the meet. Pilot commented that since he was on the smaller vessel and had deepwater outside of the channel he wanted to get over as far as possible for the larger vessel.

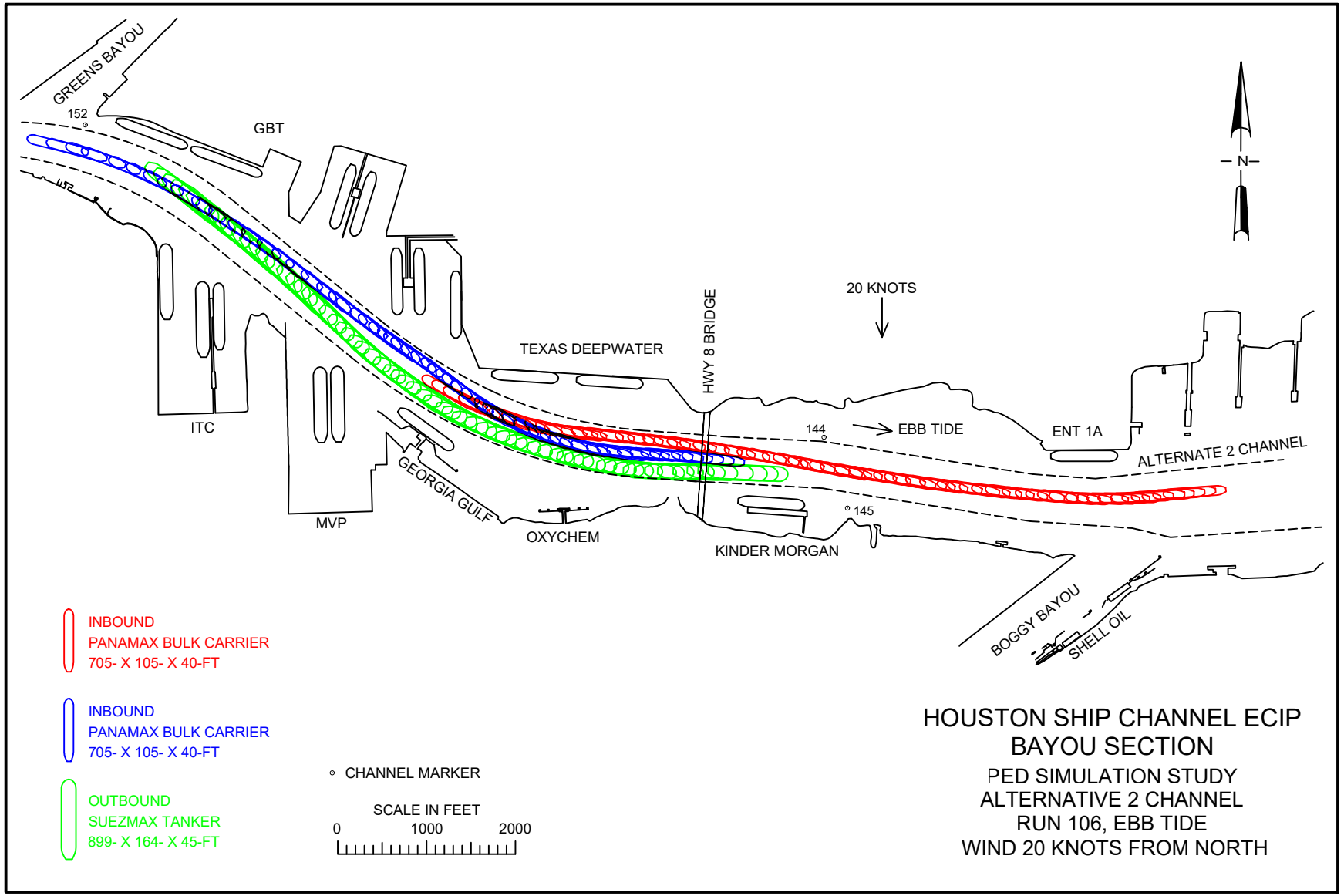

GREENS BAYOU
152
GBT
152
ITC
MVP
GEORGIA GULF
OXYCHEM
TEXAS DEEPWATER
HWY 8 BRIDGE
KINDER MORGAN
20 KNOTS
144
EBB TIDE
ENT 1A
ALTERNATE 2 CHANNEL
145
BOGGY BAYOU
SHELL OIL
N
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
INBOUND
PANAMAX BULK CARRIER
705- X 105- X 40-FT
OUTBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
CHANNEL MARKER
SCALE IN FEET
0
1000
2000
HOUSTON SHIP CHANNEL ECIP
BAYOU SECTION
PED SIMULATION STUDY
ALTERNATIVE 2 CHANNEL
RUN 106, EBB TIDE
WIND 20 KNOTS FROM NORTH

PLATE 163

Run **106**

Purpose	Meet loaded Suezmax/Panamax by Texas Deepwater and the bridge. Instructor controlled tug used.
Date	6/5/2020
Start Time	1105
End Time	1120
Plan	BG-A2
Current	Ebb
Tide (m)	1.5
Wind Direction /Speed Knots	N/20
Tugs	1 (MZ7505) - Outbound Vessel

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*SUEZ156R	44.1/13.7	128/5	ITC
Inbound	MBULK32X	40.0/12.2	277/5	Bridge
Inbound	MBULK32X	40.0/12.2	266/5	Enterprise

			Minimum Distances During Meetings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*SUEZ156R	A	73	149	0	206
Inbound	MBULK32X	D	39			
Inbound	MBULK32X	C			55	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Outbound	Normal	Yes	Pilot says borderline difficult due to still getting familiar with the area so he gave the first ship too much room and turned too late for the second. This caused him to go outside of the federal channel during the second meet.	Yes	Yes	Yes	No	Pilot says no to recovering from the second meet due to being out of position, however he did have control of the vessel during the time.
D	Inbound	Normal	Yes	Plenty of space.	Yes	Yes			Everything went smoothly.
C	Inbound	Easy	Yes	Plenty of maneuvering room.			Yes	Yes	Pilot noted he did not get over as far as his previous run but he did still had plenty of passing space and the larger vessel had plenty of space as well.

Appendix G: Pilot Cards

PILOT CARD

BULKC06L
Version 15

Ship's name M/S Magnitogorsk

Call Sign A8IS3 **Deadweight** 22691 tonnes **Year built** 1976

Draught aft 11.5 m / 37 ft 9 in **Forward** 11.5 m / 37 ft 9 in **Displacement** 60920 tonnes

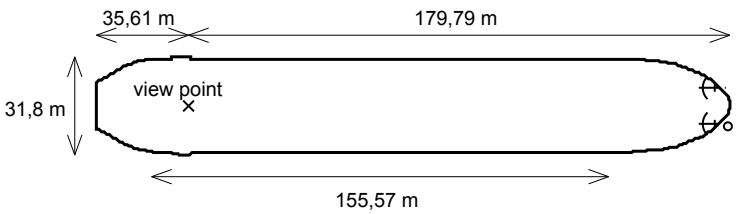
SHIP'S PARTICULARS

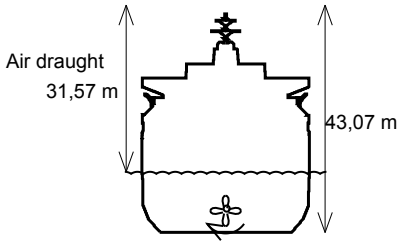
Length overall 215.4 m **Anchor chain:** **Port** 10.9 shackles **Starboard** 10.9 shackles

Breadth 31.8 m

Bulbous bow No

(1 shackle = 27,432 m = 15 fathoms)





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 9180 kW (12481 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots)	
				Loaded	Ballast
Full sea speed	**1**	120.0	N/A	16.0	N/A
Full Ahead	**0.8**	108.6	N/A	14.4	N/A
Half Ahead	**0.5**	96.0	N/A	12.8	N/A
Slow Ahead	**0.25**	76.2	N/A	10.1	N/A
Dead Slow Ahead	**0.125**	45.0	N/A	6.0	N/A
Dead Slow Astern	**-0.125**	-45.0	N/A		
Slow Astern	**-0.25**	-70.2	N/A		
Half Astern	**-0.5**	-89.4	N/A		
Full Astern	**-1**	-96.0	N/A		

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 15.6 s

Rudder angle for neutral effect -0.2 °

Thruster: **Bow** N/A kW (N/A hp) **Stern** N/A kW (N/A hp)

CHECKED IF ABOARD AND READY

Anchors ☐

Whistle ☐

Radar ☐ 3 cm ☐ 10 cm

ARPA ☐

Speed log ☐ **Doppler:** Yes / No

Water speed ☐

Ground speed ☐

Dual-axis ☐

Engine telegraphs ☐

Steering gear ☐

Number of power units operating ☐

Indicators: ☐

Rudder ☐

Rpm/pitch ☐

Rate of turn ☐

Compass system ☐

Constant gyro error ± ____ °

VHF ☐

Elec. pos. fix. system ☐

Type ____

OTHER INFORMATION:

PILOT CARD

BULKC07L
Version 7

Ship's name M/S Star Hardanger

Call Sign 9VAW6 **Deadweight** 46580 tonnes **Year built** 1995

Draught aft 12.02 m / 39 ft 5 in **Forward** 12.02 m / 39 ft 5 in **Displacement** 58350 tonnes

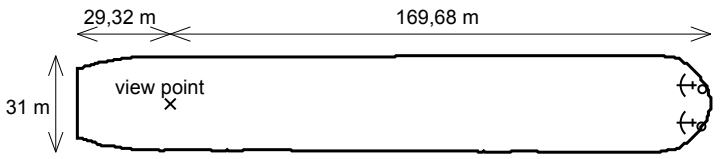
SHIP'S PARTICULARS

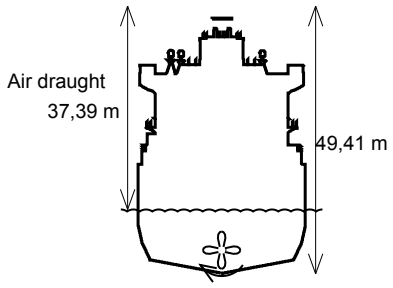
Length overall 199 m **Anchor chain:** **Port** 22.1 shackles **Starboard** 22.1 shackles

Breadth 31 m

Bulbous bow Yes

(1 shackle = 27,432 m = 15 fathoms)





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 11505 kW (15642 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots)	
				Loaded	Ballast
Full sea speed	**1**	101.8	N/A	16.6	N/A
Full Ahead	**0.8**	90.0	N/A	15.2	N/A
Half Ahead	**0.5**	70.0	N/A	12.0	N/A
Slow Ahead	**0.25**	48.0	N/A	8.1	N/A
Dead Slow Ahead	**0.125**	30.0	N/A	5.0	N/A
Dead Slow Astern	**-0.125**	-30.0	N/A		
Slow Astern	**-0.25**	-48.0	N/A		
Half Astern	**-0.5**	-65.0	N/A		
Full Astern	**-1**	-77.0	N/A		

STEERING PARTICULARS

Type of rudder Becker **Maximum angle** 65 °

Hard-over to hard-over 43.6 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** 1470 kW (1999 hp) **Stern** 735 kW (999 hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm	**Rpm/pitch**		
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±**		°
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type**		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

PILOT CARD

BULKC16
Version 1

Ship's name Fraiser River **Date**

Call Sign V7NS1 **Deadweight** 75000 tonnes **Year built** 1982

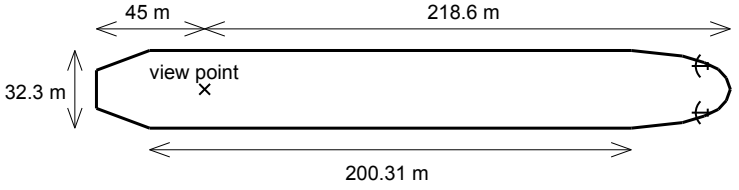
Draught aft 12.5 m / 41 ft 0 in **Forward** 12.5 m / 41 ft 0 in **Displacement** 85005 tonnes

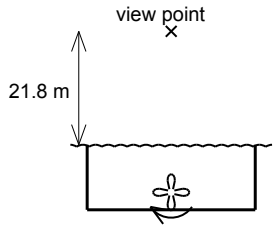
SHIP'S PARTICULARS

Length overall 265 m **Anchor chain:** **Port** 25.1 shackles **Starboard** 25.1 shackles

Breadth 32.3 m **Stern** shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 10860 kW (14564 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Ballast
Full sea speed	**1**	94.0		14.5	
Full Ahead	**0.8**	81.0		12.6	
Half Ahead	**0.5**	60.0		9.3	
Slow Ahead	**0.25**	40.0		6.1	
Dead Slow Ahead	**0.125**	28.0		4.2	
Dead Slow Astern	**-0.125**	-28.0			
Slow Astern	**-0.25**	-40.0			
Half Astern	**-0.5**	-54.0			
Full Astern	**-1**	-81.0			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 14 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** _____ kW (_____ hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** _____ °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

PILOT CARD

MBULK32N
Version 1

Ship's name WMI? **Date**

Call Sign **Deadweight** 0 tonnes **Year built**

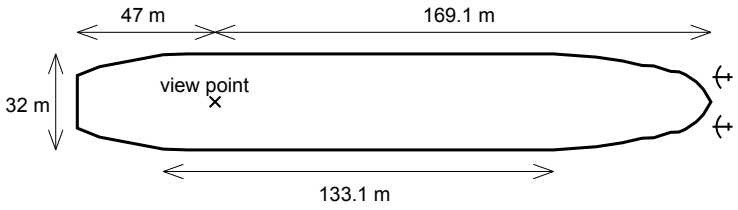
Draught aft 12.2 m / 40 ft 0 in **Forward** 12.2 m / 40 ft 0 in **Displacement** 60920 tonnes

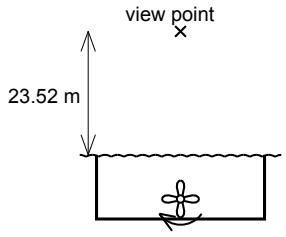
SHIP'S PARTICULARS

Length overall 215 m **Anchor chain:** **Port** 13.0 shackles **Starboard** 13.0 shackles

Breadth 32 m **Stern** shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 13557 kW (18432 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Ballast
Full sea speed	**1**	101.0		14.9	
Full Ahead	**0.8**	75.0		11.2	
Half Ahead	**0.5**	62.0		9.2	
Slow Ahead	**0.25**	42.0		6.2	
Dead Slow Ahead	**0.125**	35.0		5.1	
Dead Slow Astern	**-0.125**	-35.0			
Slow Astern	**-0.25**	-42.0			
Half Astern	**-0.5**	-62.0			
Full Astern	**-1**	-75.0			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 18 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** _____ kW (_____ hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** _____ °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

PILOT CARD

MBULK32X
Version 1

Ship's name WMI? **Date**

Call Sign **Deadweight** 0 tonnes **Year built**

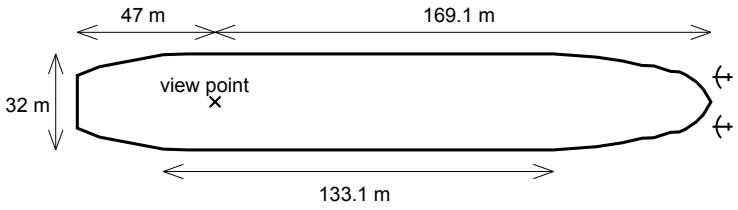
Draught aft 12.2 m / 40 ft 0 in **Forward** 12.2 m / 40 ft 0 in **Displacement** 60920 tonnes

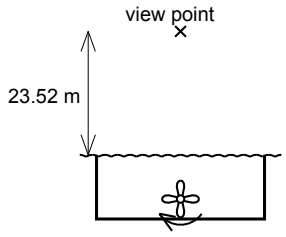
SHIP'S PARTICULARS

Length overall 215 m **Anchor chain:** **Port** 13.0 shackles **Starboard** 13.0 shackles

Breadth 32 m **Stern** shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 13557 kW (18432 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Ballast
Full sea speed	**1**	101.0		14.9	
Full Ahead	**0.8**	75.0		11.2	
Half Ahead	**0.5**	62.0		9.2	
Slow Ahead	**0.25**	42.0		6.2	
Dead Slow Ahead	**0.125**	35.0		5.1	
Dead Slow Astern	**-0.125**	-35.0			
Slow Astern	**-0.25**	-42.0			
Half Astern	**-0.5**	-62.0			
Full Astern	**-1**	-75.0			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 18 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** _____ kW (_____ hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** _____ °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

PILOT CARD

MS 7505
Version 5

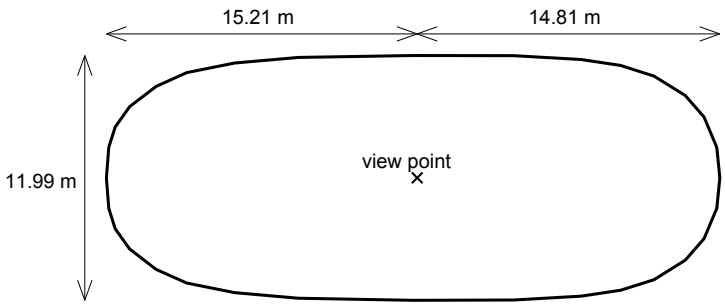
Ship's name THOR

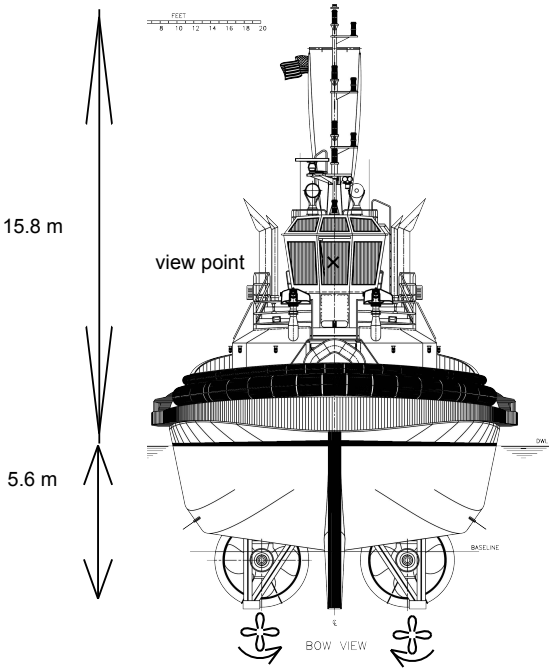
Call Sign WDD 8608 **Deadweight** 189 tonnes **Year built:** 2007

Draught aft 5.99 m / 19 ft 8 in **Forward** 5.85 m / 19 ft 2 in **Displacement** 733 tonnes

SHIP'S PARTICULARS

Length overall	30.02 m	**Anchor chain:**	**Port**	N/A shackles	**Starboard**	N/A shackles
Breadth	11.99 m		**Stern**	N/A shackles		
Bulbous bow	No				**(1 shackle = 27.432 m = 15 fathoms)**	





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 4633 kW (6299 hp)

Manoeuvring engine order		RPM Shaft	RPM Engine	Speed (knots) Loaded	Ballast
Full speed	**1**	200.0	1800	12.2	12.2
Ahead	**0.8**	168.0	1500	10.5	10.5
Half Ahead	**0.5**	130.0	1200	8.7	8.7
Quarter Ahead	**0.25**	100.0	950	6.5	6.5
Slow Ahead	**0.125**	70.0	650	5.3	5.3

Time limit astern _____ min:sec

Full ahead to full astern _____ min:sec

Max. No. of consecutive starts N/A

Minimum RPM 1800 12.2 knots

Astern power 100 % ahead

STEERING PARTICULARS

Type of rudder Azipod **Maximum angle** 180 °

Hard-over to hard-over 31 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** _____ kW (_____ hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**		
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** _____ °	
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____	
Steering gear				
Number of power units operating				

OTHER INFORMATION:

PILOT CARD

MST3080O Version 1

Ship's name Ted C. Litton **Date**

Call Sign **Deadweight** 557 tonnes **Year built** 2019

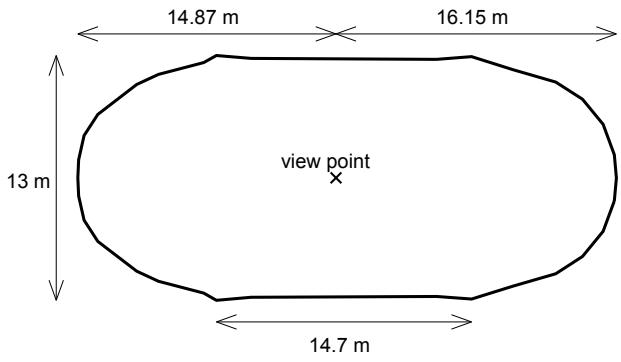
Draught aft 6.27 m / 20 ft 7 in **Forward** 5.6 m / 18 ft 4 in **Displacement** 741 tonnes

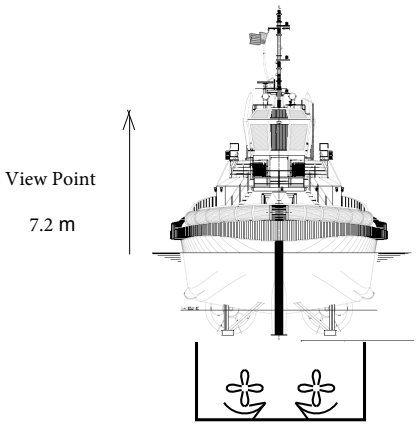
SHIP'S PARTICULARS

Length overall 30.02 m **Anchor chain:** **Port** shackles **Starboard** shackles

Breadth 13 m **Stern** shackles

Bulbous bow No **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 5,052 kW (7,032 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Ballast
Full sea speed	**1**	230.0		13.2	
Full Ahead	**0.8**	198.0		12.6	
Half Ahead	**0.5**	160.0		9.9	
Slow Ahead	**0.25**	120.0		7.9	
Dead Slow Ahead	**0.125**	95.0		6.6	
Dead Slow Astern	**-0.125**	95.0		6.6	
Slow Astern	**-0.25**	120.0			
Half Astern	**-0.5**	160.0			
Full Astern	**-1**	230.0			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Azipod **Maximum angle** 180 °

Hard-over to hard-over 33.4 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** _____ kW (_____ hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**		
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** _____ °	
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____	
Steering gear				
Number of power units operating				

OTHER INFORMATION:

PILOT CARD

MTK300H
Version 1

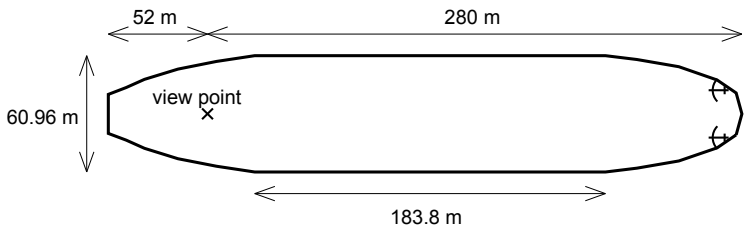
Ship's name MTK300 **Date**

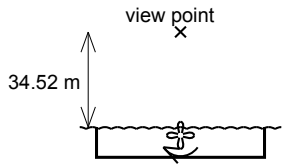
Call Sign **Deadweight** 135341 tonnes **Year built**

Draught aft 10.97 m / 35 ft 12 in **Forward** 10.97 m / 35 ft 12 in **Displacement** 177669 tonnes

SHIP'S PARTICULARS

Length overall	332 m	**Anchor chain:**	**Port**	28.1 shackles	**Starboard**	28.1 shackles
Breadth	60.96 m		**Stern**	shackles		
Bulbous bow	Yes				**(1 shackle = 27.432 m = 15 fathoms)**	





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 29431 kW (40015 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Speed (knots) Ballast
Full sea speed	**1**	76.0			13.4
Full Ahead	**0.8**	57.0			9.7
Half Ahead	**0.5**	47.0			7.8
Slow Ahead	**0.25**	33.0			5.4
Dead Slow Ahead	**0.125**	28.0			4.5
Dead Slow Astern	**-0.125**	-28.0			
Slow Astern	**-0.25**	-33.0			
Half Astern	**-0.5**	-47.0			
Full Astern	**-1**	-57.0			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 25 s

Rudder angle for neutral effect -0.3 °

Thruster: **Bow** _____ kW (_____ hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**		
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** _____ °	
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____	
Steering gear				
Number of power units operating				

OTHER INFORMATION:

PILOT CARD

MTKM107N
Version 5

Ship's name 107 K **Date**

Call Sign **Deadweight** 107481 tonnes **Year built**

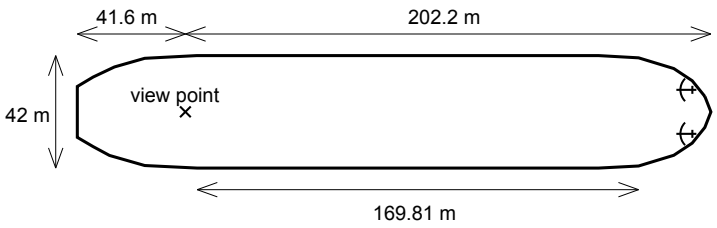
Draught aft 12.2 m / 40 ft 0 in **Forward** 12.2 m / 40 ft 0 in **Displacement** 99250 tonnes

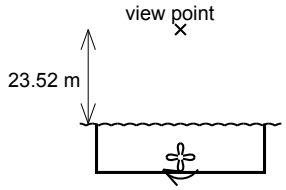
SHIP'S PARTICULARS

Length overall 243.8 m **Anchor chain:** **Port** 13.0 shackles **Starboard** 13.0 shackles

Breadth 42 m **Stern** shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 13557 kW (18432 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Ballast
Full sea speed	**1**	101.0		15.0	
Full Ahead	**0.8**	75.0		11.2	
Half Ahead	**0.5**	62.0		9.2	
Slow Ahead	**0.25**	42.0		6.2	
Dead Slow Ahead	**0.125**	35.0		5.1	
Dead Slow Astern	**-0.125**	-35.0			
Slow Astern	**-0.25**	-42.0			
Half Astern	**-0.5**	-62.0			
Full Astern	**-1**	-75.0			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 18 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** _____ kW (_____ hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** _____ °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

PILOT CARD

MTKM107X
Version 5

Ship's name 107 K **Date**

Call Sign **Deadweight** 107481 tonnes **Year built**

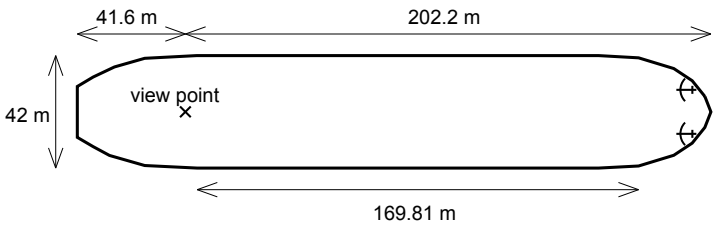
Draught aft 12.2 m / 40 ft 0 in **Forward** 12.2 m / 40 ft 0 in **Displacement** 99250 tonnes

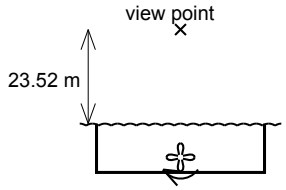
SHIP'S PARTICULARS

Length overall 243.8 m **Anchor chain:** **Port** 13.0 shackles **Starboard** 13.0 shackles

Breadth 42 m **Stern** shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 13557 kW (18432 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Ballast
Full sea speed	**1**	101.0		15.0	
Full Ahead	**0.8**	75.0		11.2	
Half Ahead	**0.5**	62.0		9.2	
Slow Ahead	**0.25**	42.0		6.2	
Dead Slow Ahead	**0.125**	35.0		5.1	
Dead Slow Astern	**-0.125**	-35.0			
Slow Astern	**-0.25**	-42.0			
Half Astern	**-0.5**	-62.0			
Full Astern	**-1**	-75.0			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 18 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** _____ kW (_____ hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** _____ °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

PILOT CARD

MULCV14N
Version 6

Ship's name 1200 by 158 by 45 feet **Date**

Call Sign MPI1 **Deadweight** 133500 tonnes **Year built** 2017

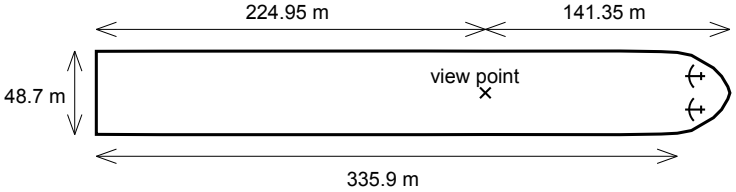
Draught aft 13.716 m / 45 ft 0 in **Forward** 13.716 m / 45 ft 0 in **Displacement** 157281 tonnes

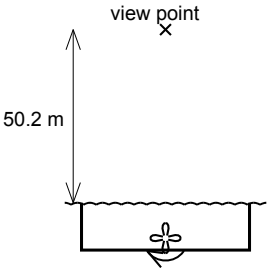
SHIP'S PARTICULARS

Length overall 365.7 m **Anchor chain:** **Port** 28.0 shackles **Starboard** 28.0 shackles

Breadth 48.7 m **Stern** shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 67699 kW (92045 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Speed (knots) Ballast
Full sea speed	**1**	101.7			24.8
Full Ahead	**0.8**	89.8			22.4
Half Ahead	**0.5**	59.9			15.3
Slow Ahead	**0.25**	31.0			7.3
Dead Slow Ahead	**0.125**	20.0			4.9
Dead Slow Astern	**-0.125**	-20.0			
Slow Astern	**-0.25**	-31.0			
Half Astern	**-0.5**	-50.9			
Full Astern	**-1**	-66.9			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 25 s

Rudder angle for neutral effect -1 °

Thruster: **Bow** 3600 kW (4895 hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**
ARPA			**Rate of turn**		
Speed log		**Doppler:**	Yes / No		**Compass system**
Water speed			**Constant gyro error ±** _____ °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

PILOT CARD

MULCV14Z
Version 6

Ship's name 1200 by 158 by 45 feet **Date**

Call Sign MPI1 **Deadweight** 133500 tonnes **Year built** 2017

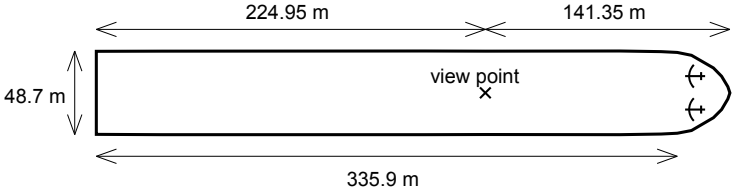
Draught aft 13.716 m / 45 ft 0 in **Forward** 13.716 m / 45 ft 0 in **Displacement** 157281 tonnes

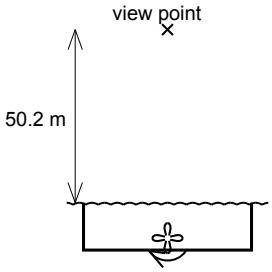
SHIP'S PARTICULARS

Length overall 365.7 m **Anchor chain:** **Port** 28.0 shackles **Starboard** 28.0 shackles

Breadth 48.7 m **Stern** shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 67699 kW (92045 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Speed (knots) Ballast
Full sea speed	**1**	101.7			24.8
Full Ahead	**0.8**	89.8			22.4
Half Ahead	**0.5**	59.9			15.3
Slow Ahead	**0.25**	31.0			7.3
Dead Slow Ahead	**0.125**	20.0			4.9
Dead Slow Astern	**-0.125**	-20.0			
Slow Astern	**-0.25**	-31.0			
Half Astern	**-0.5**	-50.9			
Full Astern	**-1**	-66.9			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 25 s

Rudder angle for neutral effect -1 °

Thruster: **Bow** 3600 kW (4895 hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**
ARPA			**Rate of turn**		
Speed log		**Doppler:**	Yes / No		**Compass system**
Water speed			**Constant gyro error ±** _____ °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

PILOT CARD

MZ 7505
Version 5

Ship's name WESLEY A

Call Sign WDE 2433 **Deadweight** 189 tonnes **Year built:** 2007

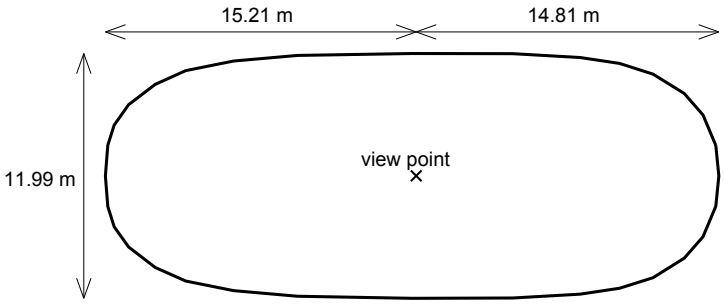
Draught aft 5.99 m / 19 ft 8 in **Forward** 5.85 m / 19 ft 2 in **Displacement** 733 tonnes

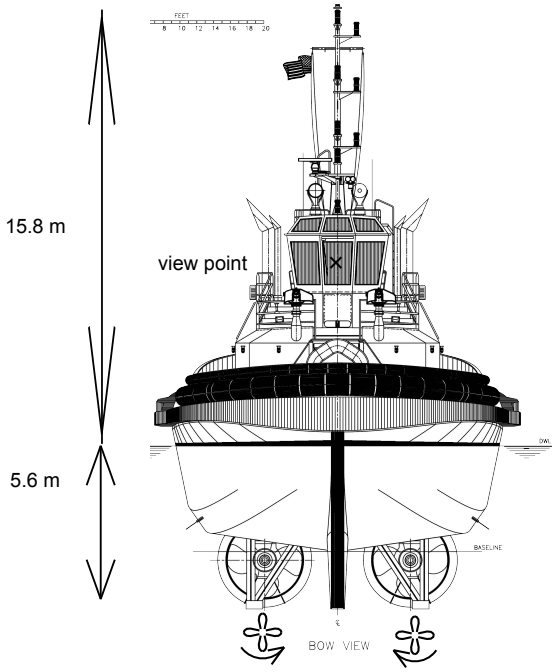
SHIP'S PARTICULARS

Length overall 30.02 m **Anchor chain:** **Port** N/A shackles **Starboard** N/A shackles

Breadth 11.99 m **Stern** N/A shackles

Bulbous bow No **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 4633 kW (6299 hp)

Manoeuvring engine order		RPM Shaft	RPM Engine	Speed (knots) Loaded	Speed (knots) Ballast
Full speed	**1**	200.0	1800	12.2	12.2
Ahead	**0.8**	168.0	1500	10.5	10.5
Half Ahead	**0.5**	130.0	1200	8.7	8.7
Quarter Ahead	**0.25**	100.0	950	6.5	6.5
Slow Ahead	**0.125**	70.0	650	5.3	5.3

Time limit astern _____ min:sec

Full ahead to full astern _____ min:sec

Max. No. of consecutive starts N/A

Minimum RPM 1800 12.2 knots

Astern power 100 % ahead

STEERING PARTICULARS

Type of rudder Azipod **Maximum angle** 180 °

Hard-over to hard-over 31 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** _____ kW (_____ hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**		
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** _____ °	
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____	
Steering gear				
Number of power units operating				

OTHER INFORMATION:

PILOT CARD

MZT3080O Version 1

Ship's name Mark E. Kuebler **Date** _____

Call Sign _____ **Deadweight** 557 tonnes **Year built** 2019

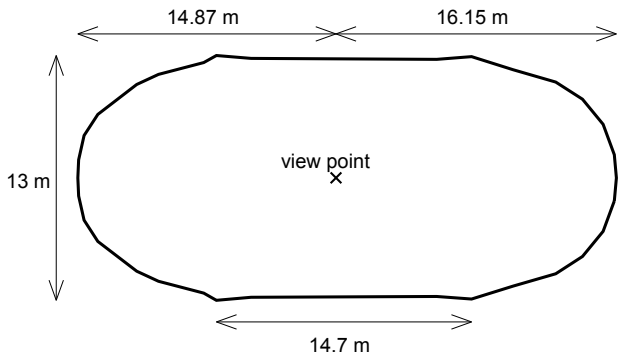
Draught aft 6.27 m / 20 ft 7 in **Forward** 5.6 m / 18 ft 4 in **Displacement** 741 tonnes

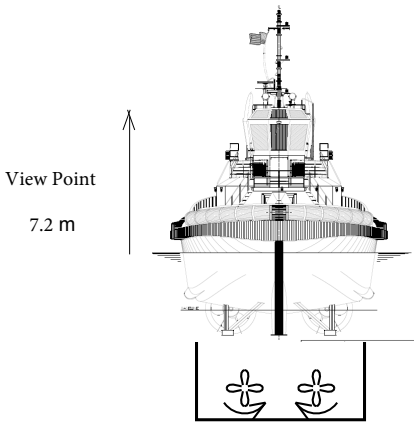
SHIP'S PARTICULARS

Length overall 30.02 m **Anchor chain:** **Port** _____ shackles **Starboard** _____ shackles

Breadth 13 m **Stern** _____ shackles

Bulbous bow No **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 5,052 kW (7,032 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Ballast
Full sea speed	**1**	230.0		13.2	
Full Ahead	**0.8**	198.0		12.6	
Half Ahead	**0.5**	160.0		9.9	
Slow Ahead	**0.25**	120.0		7.9	
Dead Slow Ahead	**0.125**	95.0		6.6	
Dead Slow Astern	**-0.125**	95.0		6.6	
Slow Astern	**-0.25**	120.0			
Half Astern	**-0.5**	160.0			
Full Astern	**-1**	230.0			

Time limit astern _____ min:sec

Full ahead to full astern _____ min:sec

Max. No. of consecutive starts _____

Minimum RPM _____ _____ knots

Astern power _____ % ahead

STEERING PARTICULARS

Type of rudder Azipod **Maximum angle** 180 °

Hard-over to hard-over 33.4 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** _____ kW (_____ hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**		
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** _____ °	
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____	
Steering gear				
Number of power units operating				

OTHER INFORMATION:

PILOT CARD

SUEZ156N
Version 0

Ship's name Suez 156 **Date**

Call Sign **Deadweight** 147600 tonnes **Year built**

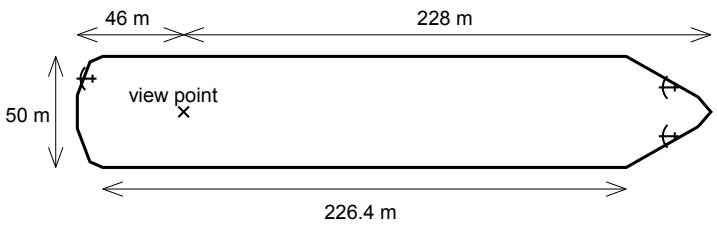
Draught aft 13.7 m / 44 ft 11 in **Forward** 12.7 m / 41 ft 8 in **Displacement** 170655 tonnes

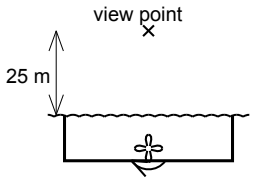
SHIP'S PARTICULARS

Length overall 274 m **Anchor chain:** **Port** 12.0 shackles **Starboard** 12.0 shackles

Breadth 50 m **Stern** 12.0 shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 16857 kW (22920 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Speed (knots) Ballast
Full sea speed	**1**	91.6			15.7
Full Ahead	**0.8**	68.0			11.7
Half Ahead	**0.5**	52.0			8.8
Slow Ahead	**0.25**	35.0			5.8
Dead Slow Ahead	**0.125**	28.0			4.6
Dead Slow Astern	**-0.125**	-28.0			
Slow Astern	**-0.25**	-35.0			
Half Astern	**-0.5**	-52.0			
Full Astern	**-1**	-68.0			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 26.9 s

Rudder angle for neutral effect -0.2 °

Thruster: **Bow** 1103 kW (1500 hp) **Stern** 1103 kW (1500 hp)

CHECKED IF ABOARD AND READY

Anchors		**Indicators:**	
Whistle		**Rudder**	
Radar	3 cm / 10 cm	**Rpm/pitch**	
ARPA		**Rate of turn**	
Speed log	**Doppler:** Yes / No	**Compass system**	
Water speed		**Constant gyro error ±** °	
Ground speed		**VHF**	
Dual-axis		**Elec. pos. fix. system**	
Engine telegraphs		**Type**	
Steering gear			
Number of power units operating			

OTHER INFORMATION:

PILOT CARD

SUEZ156R
Version 0

Ship's name Suez 156 **Date** _____

Call Sign _____ **Deadweight** 147600 tonnes **Year built** _____

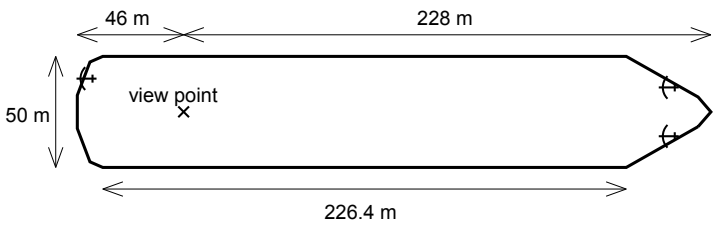
Draught aft 13.7 m / 44 ft 11 in **Forward** 12.7 m / 41 ft 8 in **Displacement** 170655 tonnes

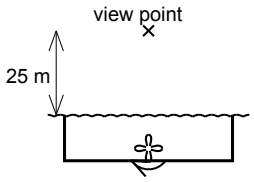
SHIP'S PARTICULARS

Length overall 274 m **Anchor chain:** **Port** 12.0 shackles **Starboard** 12.0 shackles

Breadth 50 m **Stern** 12.0 shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 16857 kW (22920 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Speed (knots) Ballast
Full sea speed	**1**	91.6			15.7
Full Ahead	**0.8**	68.0			11.7
Half Ahead	**0.5**	52.0			8.8
Slow Ahead	**0.25**	35.0			5.8
Dead Slow Ahead	**0.125**	28.0			4.6
Dead Slow Astern	**-0.125**	-28.0			
Slow Astern	**-0.25**	-35.0			
Half Astern	**-0.5**	-52.0			
Full Astern	**-1**	-68.0			

Time limit astern _____ min:sec

Full ahead to full astern _____ min:sec

Max. No. of consecutive starts _____

Minimum RPM _____ _____ knots

Astern power _____ % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 35 s

Rudder angle for neutral effect -0.2 °

Thruster: **Bow** 1103 kW (1500 hp) **Stern** 1103 kW (1500 hp)

CHECKED IF ABOARD AND READY

Anchors		**Indicators:**	
Whistle		**Rudder**	
Radar	3 cm / 10 cm	**Rpm/pitch**	
ARPA		**Rate of turn**	
Speed log	**Doppler:** Yes / No	**Compass system**	
Water speed		**Constant gyro error ±** °	
Ground speed		**VHF**	
Dual-axis		**Elec. pos. fix. system**	
Engine telegraphs		**Type**	
Steering gear			
Number of power units operating			

OTHER INFORMATION:

PILOT CARD

TANK10L
Version 7

Ship's name M/T Danita II

Call Sign _____ **Deadweight** 0 tonnes **Year built** _____

Draught aft 14 m / 45 ft 11 in **Forward** 14 m / 45 ft 11 in **Displacement** 82970 tonnes

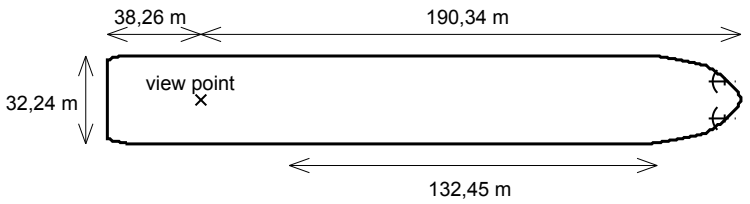
SHIP'S PARTICULARS

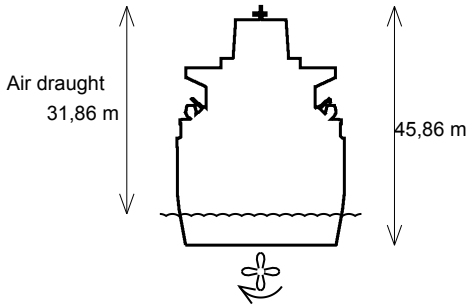
Length overall 228.6 m **Anchor chain:** **Port** 26.1 shackles **Starboard** 26.1 shackles

Breadth 32.24 m

Bulbous bow No

(1 shackle = 27,432 m = 15 fathoms)





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 7000 kW (9518 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots)	
				Loaded	Ballast
Full sea speed	**1**	84.0	N/A	13.9	N/A
Full Ahead	**0.8**	72.0	N/A	11.9	N/A
Half Ahead	**0.5**	54.0	N/A	8.9	N/A
Slow Ahead	**0.25**	39.1	N/A	6.4	N/A
Dead Slow Ahead	**0.125**	27.1	N/A	4.5	N/A
Dead Slow Astern	**-0.125**	-27.1	N/A		
Slow Astern	**-0.25**	-36.0	N/A		
Half Astern	**-0.5**	-47.0	N/A		
Full Astern	**-1**	-58.8	N/A		

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 15.6 s

Rudder angle for neutral effect 0.2 °

Thruster: **Bow** N/A kW (N/A hp) **Stern** N/A kW (N/A hp)

CHECKED IF ABOARD AND READY

Anchors ☐

Whistle ☐

Radar ☐ 3 cm ☐ 10 cm

ARPA ☐

Speed log ☐ **Doppler:** Yes / No

Water speed ☐

Ground speed ☐

Dual-axis ☐

Engine telegraphs ☐

Steering gear ☐

Number of power units operating ☐

Indicators: ☐

Rudder ☐

Rpm/pitch ☐

Rate of turn ☐

Compass system ☐

Constant gyro error ± ____ °

VHF ☐

Elec. pos. fix. system ☐

Type ____

OTHER INFORMATION:

PILOT CARD

ULCV366Z
Version 1

Ship's name 366 ULCV 14K **Date**

Call Sign **Deadweight** 133500 tonnes **Year built**

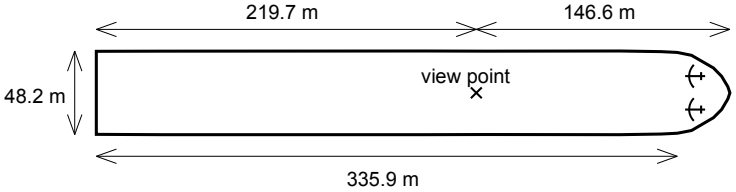
Draught aft 14.2 m / 46 ft 7 in **Forward** 14.2 m / 46 ft 7 in **Displacement** 178766 tonnes

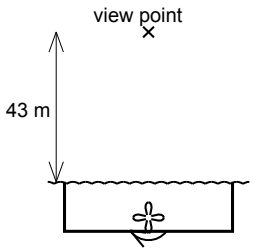
SHIP'S PARTICULARS

Length overall 366.5 m **Anchor chain:** **Port** 28.0 shackles **Starboard** 28.0 shackles

Breadth 48.2 m **Stern** shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 91000 kW (123726 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Ballast
Full sea speed	**1**	88.9		25.3	
Full Ahead	**0.8**	88.9		25.3	
Half Ahead	**0.5**	60.0		18.4	
Slow Ahead	**0.25**	31.0		8.4	
Dead Slow Ahead	**0.125**	20.0		5.8	
Dead Slow Astern	**-0.125**	-20.0			
Slow Astern	**-0.25**	-31.0			
Half Astern	**-0.5**	-51.0			
Full Astern	**-1**	-67.0			

Time limit astern min:sec

Full ahead to full astern min:sec

Max. No. of consecutive starts

Minimum RPM knots

Astern power % ahead

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 13.2 s

Rudder angle for neutral effect -1.2 °

Thruster: **Bow** 3600 kW (4895 hp) **Stern** _____ kW (_____ hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**
ARPA			**Rate of turn**		
Speed log		**Doppler:**	Yes / No		**Compass system**
Water speed			**Constant gyro error ±** _____ °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** _____		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

Appendix H: Study Participants

HSC ECIP simulation study participants.

Participant	Affiliation	Code
Pilots		
Capt. Chad Prejean	HPA	A
Capt. Robert Thompson	HPA	B
Capt. Jim Concagh	HPA	C
Capt. John Bratcher	HPA	D
Capt. Jason Briones	HPA	E
Capt. George Burkley	HPA	F
Capt. Marcus Maher	HPA	G
Capt. Billy Kern	HPA	H
Capt. Matthew Bush	GALTEX	I
Capt. Brandon Bass	HPA	J
Capt. Kevin Kirk	HPA	K
Capt. Brian Saba	HPA	L
Capt. Justin Phillips	HPA	M
Capt. Clint Winegar	HPA	N
Capt. Brad Miller	HPA	O
Tug Masters		
Capt. Bobby Pytka	G&H	1
Capt. John Gunning	G&H	2
Capt. Robin Sarvis	G&H	3

Simulation Team	
Larry Daggett	WST
J. Christopher Hewlett	WST
Dennis Webb	Webb Simulation Consulting
George Burkley	LOCUS LLC
Fernando Lagunes	LOCUS LLC
Ashley Stauffer	LOCUS LLC
Renee Hendrix	LOCUS LLC
Capt. John Gregg	San Jacinto College MTTC
Steven Huttman	G&H
J J Plunkett	HPA

Observer	Affiliation
Lori Brownell	PHA
Richard Ruchhoeft	PHA
Charlie Jenkins	PHA
Keith Martin	ERDC
Morgan Johnston	ERDC
Mario Sanchez	ERDC
Kiara Pazan	ERDC
Dana L. Cheney	GBA
Neil McLellan	HDR
Cameron Perry	HDR
Andrea K. Catanzaro	CESWG
Nancy Young	CESWG

Appendix I: Houston Pilots' Letter to Port of Houston Authority – Update with New Letter

HOUSTON PILOTS

203 DEERWOOD GLEN DRIVE/ DEER PARK, TEXAS 77536

February 4, 2021

Commander
U.S. Anny Corps of Engineers, Galveston District
P.O. Box 1229
Galveston, TX 77553-1229

Via email: Timothv.R.Vail0 'llsace. armv.mil

Dear Colonel Vail,

Houston Pilots participated in the ERDC led PED level simulations documented in the "Houston Ship Channel Expansion Improvement Project- Navigation Improvement Study, Simulation Report August 2020, Final Draft". Houston Pilots concurs that the simulation report includes accurate representations of the simulation runs conducted.

If you have any questions or need additional information, please do not hesitate to call me.

Respectfully,

Captain Robert Thompson
Presiding Officer, Houston Pilots

Copy: Executive Director, Port of Houston Authority

Appendix J: Memorandum for Record of Test Plans

April 3, 2020

Waterway Simulation Technology, Inc.

❖❖❖

Columbia Office
158 Hampton Crest Trail
Columbia, SC 29209
Phone: 803-783-2118
Fax: 803-783-8236
Email: jchewlett@wst.ms
Attn: J. Christopher Hewlett

Vicksburg Office
2791 Burnt House Rd
Vicksburg, MS 39180
Phone: 601-638-4226
Fax: 601-630-9017
Email: lldaggett@wst.ms
Attn: Larry L. Daggett

Memorandum for Record

Subject: Results of the Web Meeting on the Proposed Ship Simulation Study of the Houston Ship Channel ECIP

Introduction

On March 31, 2020, a web meeting was hosted by ERDC (Keith Martin) to discuss the proposed test matrix for the subject simulation study. An attendance list is attached. Larry Daggett led the discussion beginning with a discussion of the rationale and basis of the test matrix development and how, since the time the proposal was prepared, changes have emerged in the project designs that were not part of the studies Feasibility Study simulations. This was followed by a discussion of each reach laying out the original project design, the changes that have occurred and the optional design layouts that are being considered, and the proposed test pattern for each bay bend, terminal channel, and the bayou section. With each there was a very helpful discussion of the pros and cons of the proposed design layouts and the proposed test procedures. It was most helpful to have the input from the Houston Pilots and the engineering designers in understanding the purpose and basis for their decisions and suggestions and recommendations. It was also noted that WST had an error in the total time estimated for the tests and the proposed test set would require much longer than 5 days. These have formed the basis for this MFR summarizing the agreements and test procedures and design layouts.

Basic Chanel Dimensions

The widened channel that would be tested would be a 700' channel up to Barbours Cut Ship Channel. The basic dimensions of each portion of the ECIP are shown in Table 1. Houston Ship Channel Widths and Depths by Station along with a typical cross-section in the bay as shown in Figure 1. Bay Reach Widening 700 Feet Bolivar Roads to BCC Cross Section.

Galveston Bay Channels and Bends

The channels in the Galveston Bay (Segment 1) will be 700' wide and have a depth of 46' MLLW to Beacon 75-76 and 46.5' MLLW to Morgans Point. The bends in the Feasibility Study had an Apex

Widener with a maximum width at the apex of 1,028'. This design meets the Corps of Engineer's design standard of an incremental increase in width of 2xB; i.e., 700'+2*164'. The Houston Pilots have expressed a concern about this design including: 1) difficulty in visualizing the position of the vessel in the bend, particularly the vessel turning on the inside of the bend, 2) difficulty managing the turn; 3) desiring a "gated" marking for the turn, and 4) noting that tow pilots have difficulty making the bend with this design.

Table 1. Houston Ship Channel Widths and Depths by Station

Project Segment	HSC Channel Section	Start Station	End Station	Existing Width	Proposed Width	Authorized Depth	Advanced Maintenance	Allowable Overdepth	Proposed Deepening	Proposed AM	Proposed OD
Segment 1	Bolivar Roads to Red Fish Light 1	138+369.011	78+844.001	530	700	46	48	50			
	Redfish Light 1 to Beacon 76	78+844.001	28+605.055	530	700	46	48	50			
	Beacon 76 to Lower End Morgans Point Cut	28+605.055	-0+3.94	530	700	46.5	48.5	50.5			
	Morgans Point to Exxon	0+05	295+00	530-600		46.5	50.5	51.5			
		280+05	295+00	530-600		46.5	48.5	49.5			
	Exxon to Carpenter's Bayou	295+00	520+00	530-600		46.5	48.5	49.5			
	Carpenter's Bayou to Boggy Bayou	520+00	684+03.19	530-600		46.5	48.5	49.5			
Segment 2	Bayport Ship Channel	25+58	241+87.31	350-400	455	46.5	48.5	50.5			
Segment 3	Barbours Cut Channel	10+13	91+98	300	455	46.5	48.5	50.5			
Segment 4	Boggy Bayou to Greens Bayou	684+03.19	833+05.17	300	530	41.5	43.5	44.5	46.5	48.5	49.5
	Greens Bayou to Washburn Tunnel	833+05.17	930+00	300	-	41.5	43.5	44.5	46.5	48.5	49.5
		930+00	974+07.5	300	-	41.5	43.5	44.5			
	Washburn Tunnel	974+07.5	977+92.5	300	-	38.5	40.5	41.5			
	Washburn Tunnel to Sims Bayou	977+92.5	1110+77.54	300	-	41.5	43.5	44.5			
Segment 5	Sims Bayou to I-610 Bridge	1110+77.54	1160+62.20	300	-	37.5	39.5	40.5	41.5	43.5	44.5
Segment 6	I-610 Bridge to Main Turning Basin	1160+60.20	1266+48	300	-	37.5	39.5	40.5	41.5	43.5	44.5
	Main Turning Basin	0	30+95.06	400-932	-	37.5	39.5	40.5	41.5	43.5	44.5

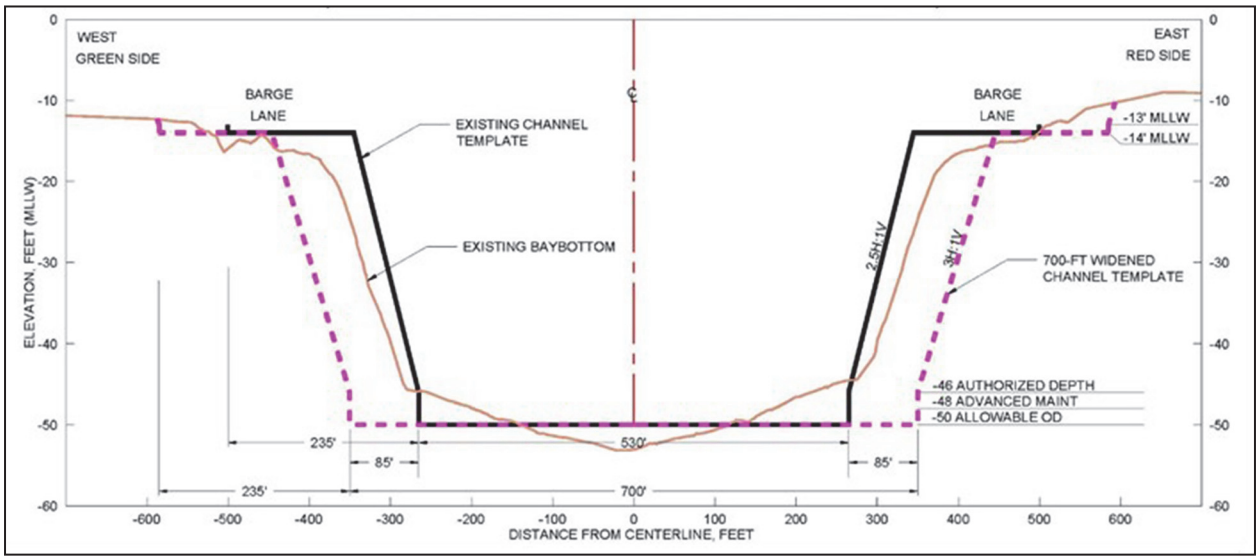


Figure 1. Bay Reach Widening 700 Feet Bolivar Roads to BCC Cross Section

Three additional bend layouts have been proposed. These are shown in Figure 2. During the discussion it was agreed that the Angle Turn with a modified Cutoff that comes to an apex opposite the Angle Turn apex was preferred by the pilots. It was agreed that this should be the design used for the simulation tests. The widener is 700' + 200'= 900'; i.e., 200'/164' or 1.2 times the beam. These bends will be marked with gated markers at the beginning and end of the flare and at the apex of the turn.

The bends will be tested with multiple encounters. When two ships meet, they must recover before meeting another. Three ownships will be used for these exercises. Two ships heading in one direction will meet one ship heading in the opposite direction. The single vessel is the critical ship since it has

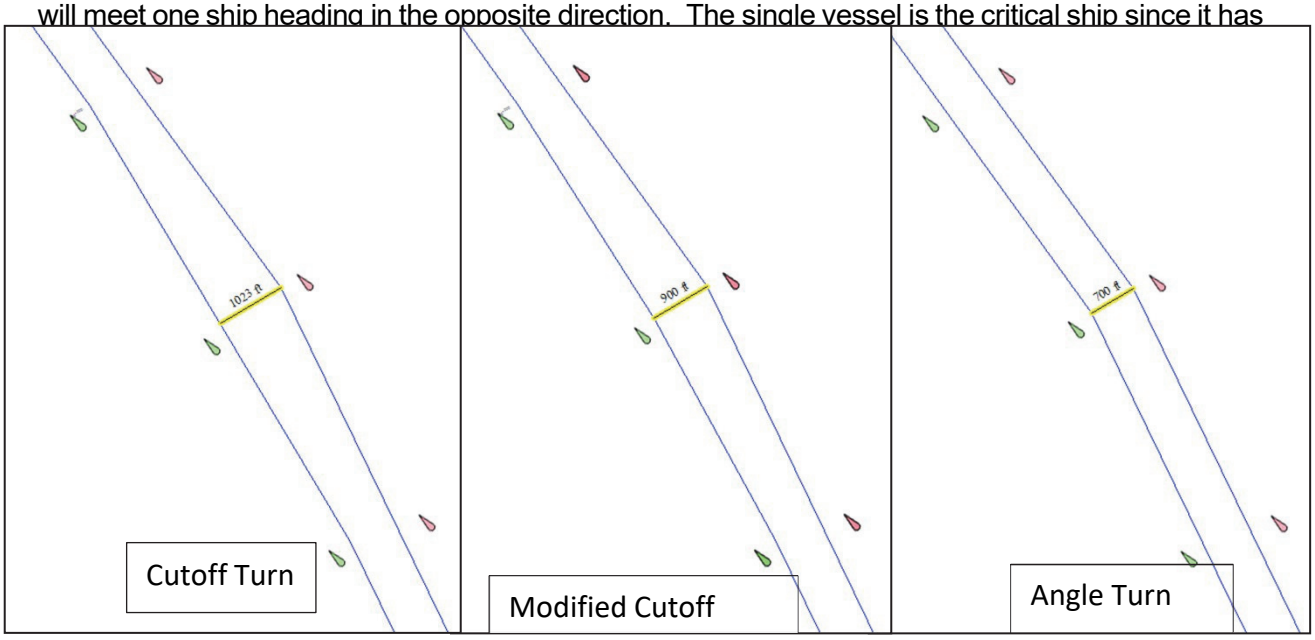


Figure 2. Turn Designs Considered for the Galveston Bay Bends

to recover from meeting the first ship before meeting the second ship. Just after two ships meeting (assuming typical port-to-port meetings) the forces turn the ship to the left. The ship facing a turn to the right just after meeting is a "worst case scenario." Therefore, for these tests the single ship will oriented inbound or outbound such that it will face a turn to the right at the bend.

Currents are aligned with the channel in most cases. When a ship is going in the same direction as the current, this is referred to as "fair tide." Ships going against the currents are said to be running in "opposing tide." Fair tide runs are considered more difficult because there is less flow going past the rudder. In order to reduce the number of simulations, the exercises will focus on the single ship operating in fair tide. This means if the single ship is inbound, the worst case for the currents is flood tide. If the ship is outbound, the worst case is ebb tide. Three exercises will be conducted for the single ship in fair tide and one for the single ship in opposing tide. Additional runs with the single ship in opposing tide will be given a lower priority and only conducted if time allows.

Bolivar Roads

Due to the increase in current velocities in this reach, it is important to model the maneuvers through the 700' channel and bend design. It was agreed to model this with an inbound VLCV meeting an outbound VLCC as it is completing the turn at Markers 25-26 and the inbound VLCV is beginning to enter the turn. The outbound tanker would be met following the turn. The position of the vessels for this series of runs is shown in Figure 3 and the series of runs to be completed are shown Table 2.

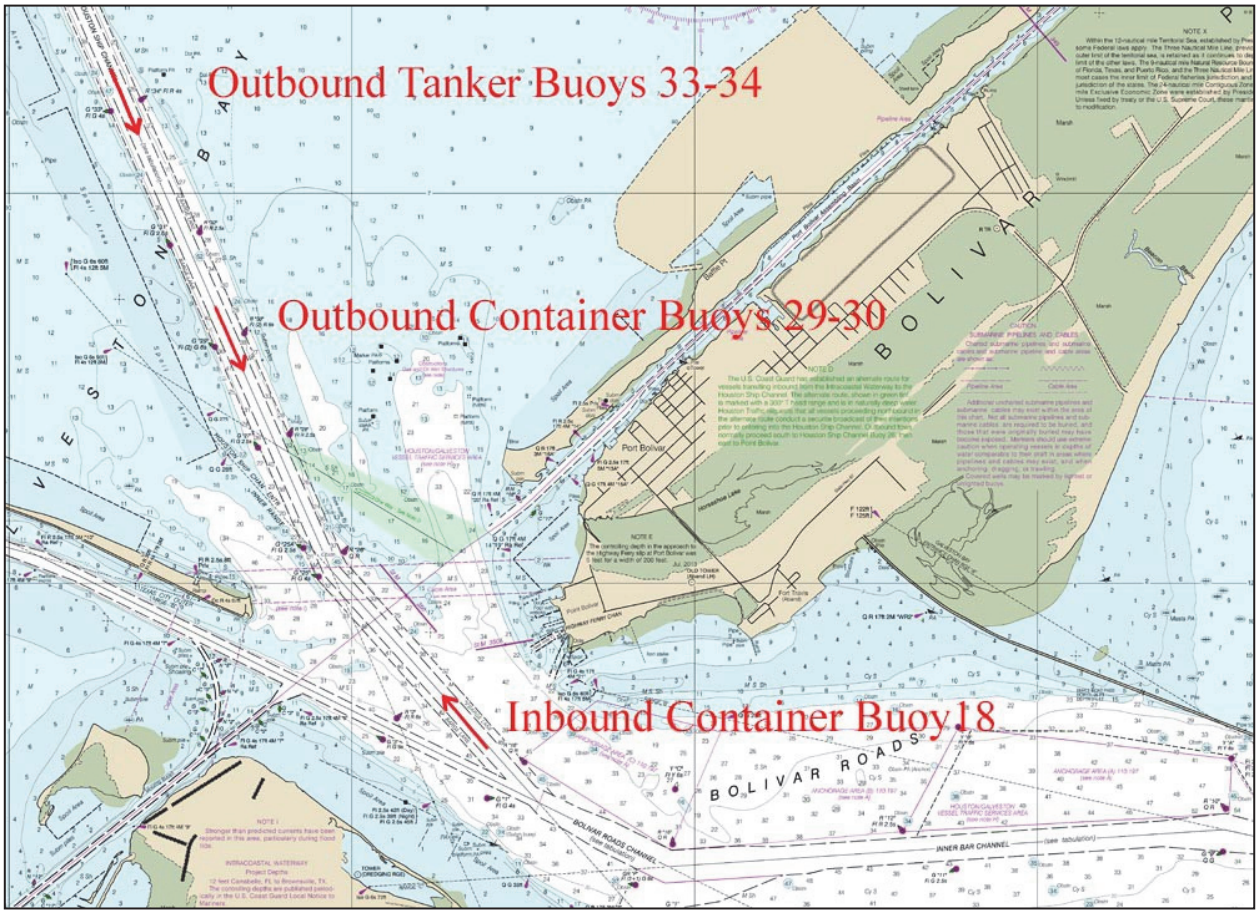


Figure 3. Location of Starting Positions for Bolivar Road.

Table 2. Test Runs for Bolivar Roads

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
700 ft	Container	44/13.4	324.5/10	18	A	Container	44/13.4	147.7/10	29-30	B	Fld	SE/20	0	30	Testing at Bolivar Roads - meet as outbound ship clears bend and after bend
						Tanker	44/13.4	146.0/10	33-34	C					
700 ft	Container	44/13.4	324.5/10	18	B	Container	44/13.4	147.7/10	29-30	A	Fld	SE/20	0	30	
						Tanker	44/13.4	146.0/10	33-34	C					
700 ft	Container	44/13.4	324.5/10	18	C	Container	44/13.4	147.7/10	29-30	A	Fld	SE/20	0	30	
						Tanker	44/13.4	146.0/10	33-34	B					
700 ft	Container	44/13.4	324.5/10	18	A	Container	44/13.4	147.7/10	29-30	B	Ebb	N/20	0	30	
						Tanker	44/13.4	146.0/10	33-34	C					
700 ft	Container	44/13.4	324.5/10	18	B	Container	44/13.4	147.7/10	29-30	A	Ebb	N/20	0	30	2nd priority
						Tanker	44/13.4	146.0/10	33-34	C					
700 ft	Container	44/13.4	324.5/10	18	C	Container	44/13.4	147.7/10	29-30	A	Ebb	N/20	0	30	
						Tanker	44/13.4	146.0/10	33-34	B					

Redfish

For Redfish Bend, the location of the vessel's starting position are shown in Figure 4 and the runs for this reach are shown in Table 3. It is proposed that the ebb runs be changed for this bend so that the outbound vessel would make the complete run meeting the inbound vessels. Therefore, the outbound vessel would be the VLCV and would start at markers 57-58 and would meet the tanker prior to the

bend and the VLCV at the bend. This would take place during the ebb tide and would involve a right hand turn which the pilots consider the more critical maneuver. It also provides a variation of the inbound vessel having multiple meetings and involves a meeting prior to making the bend rather than after the turn.

Beacons 75-76

The bend at Beacons 75-76 is different from the other two due to the improvements made at the Bayport Ship Channel which include addition of a flare on the green side of the HSC channel and a widener on the red side. See Figure 5 for the start locations for the series of test runs and Table 4.

Barbours Cut Channel

There have been significant changes to the proposed entrance to this channel from that tested in the Feasibility Study. Two changes have been proposed for testing. These changes are shown in Figure 6 and involve modifications to the plan to make use of the area on the south side of the channel at the entrance by removing the LASH dock and developing a new berth at that location. This required changing the southern flare used in the previous study. During the discussions, it was agreed that the priority would be to test the “HDR” plan because it is expected to be preferable for navigation and because it will require less structural work to protect the point - which was the reason this plan was requested by POHA. The starting locations of the vessels for the various test runs are shown in Figure 7 and the test runs are listed in Table 5. Again, the lower priority runs are identified by highlighting with the runs involving flood currents prioritized. It should also be noted that if the simulator will not permit a change during runtime from a ship bridge to a tug bridge following the meeting of a tanker on approach to the entrance, then a meeting will not be included in these runs. This was identified as not an issue since the pilots are aware of the meeting traffic and the vessel approaching the channel entrance will maneuver to avoid a meeting at this location. Doing this will allow the inbound ship to be moved closer to the entrance, reducing the time for the simulated maneuver, and also allow the use of two tugs operated by tug masters.

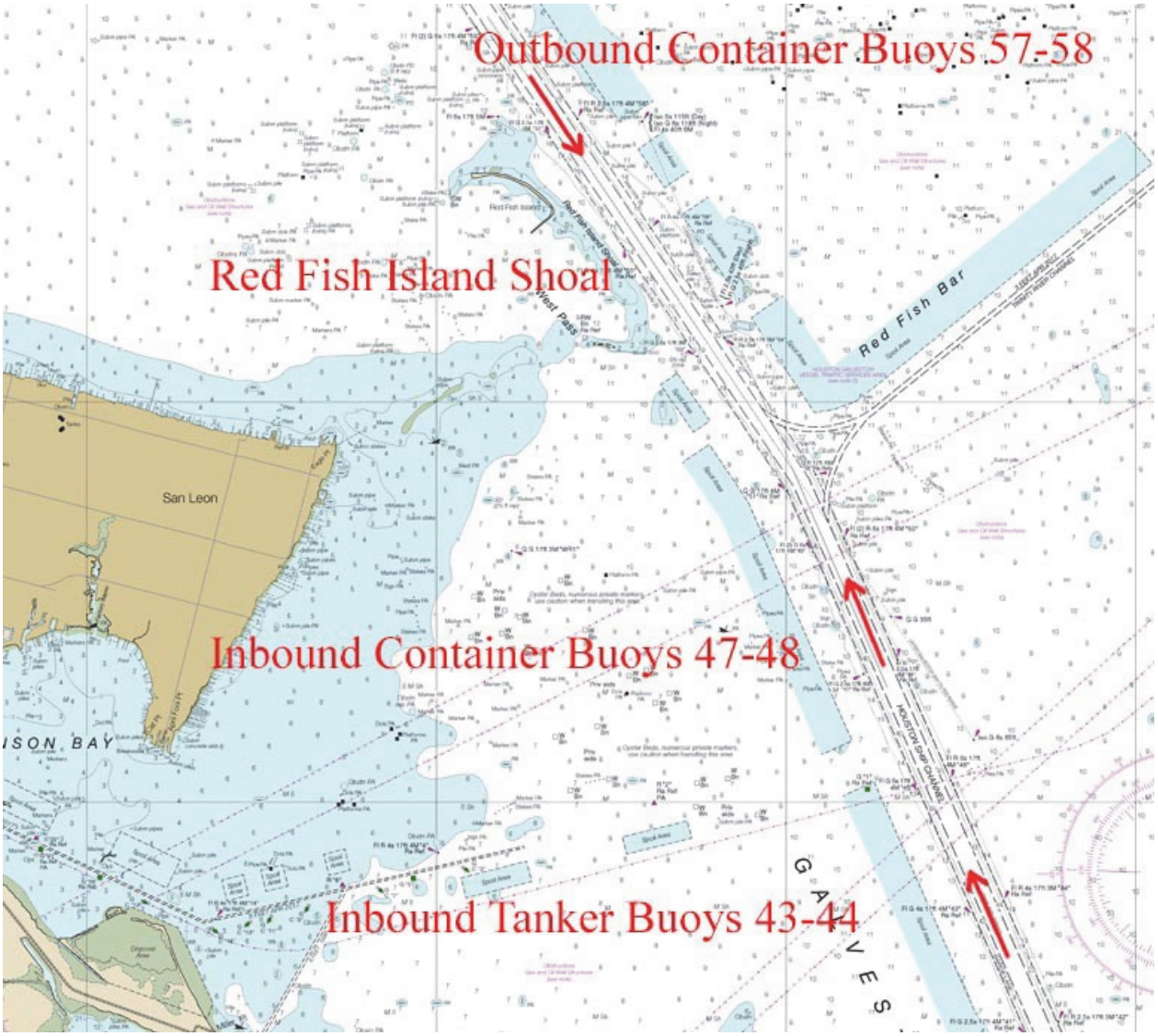


Figure 4. Starting Locations for Vessels at Redfish

Table 3. Test Runs for Redfish

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
700 ft	Container	44/13.4	336.5/10	43-44	A	Container	44/13.4	146.5/10	53-54	B	Fld	SE/20	0	30	Testing at Redfish - Meet in the bend and after the bend
						Tanker	44/13.4	146.5/10	57-58	C					
700 ft	Container	44/13.4	336.5/10	43-44	B	Container	44/13.4	146.5/10	53-54	A	Fld	SE/20	0	30	
						Tanker	44/13.4	146.5/10	57-58	C					
700 ft	Container	44/13.4	336.5/10	43-44	C	Container	44/13.4	146.5/10	53-54	A	Fld	SE/20	0	30	
						Tanker	44/13.4	146.5/10	57-58	B					
700 ft	Container	44/13.4	146.5/10	57-58	A	Tanker	44/13.4	326.5/10	53-54	B	Ebb	N/20	0	30	
						Container	44/13.4	336.5/10	43-44	C					
700 ft	Container	44/13.4	146.5/10	57-58	B	Container	44/13.4	326.5/10	53-54	A	Ebb	N/20	0	30	2nd priority
						Tanker	44/13.4	336.5/10	43-44	C					
700 ft	Container	44/13.4	146.5/10	57-58	C	Container	44/13.4	336.5/10	53-54	A	Ebb	N/20	0	30	
						Tanker	44/13.4	336.5/10	43-44	B					

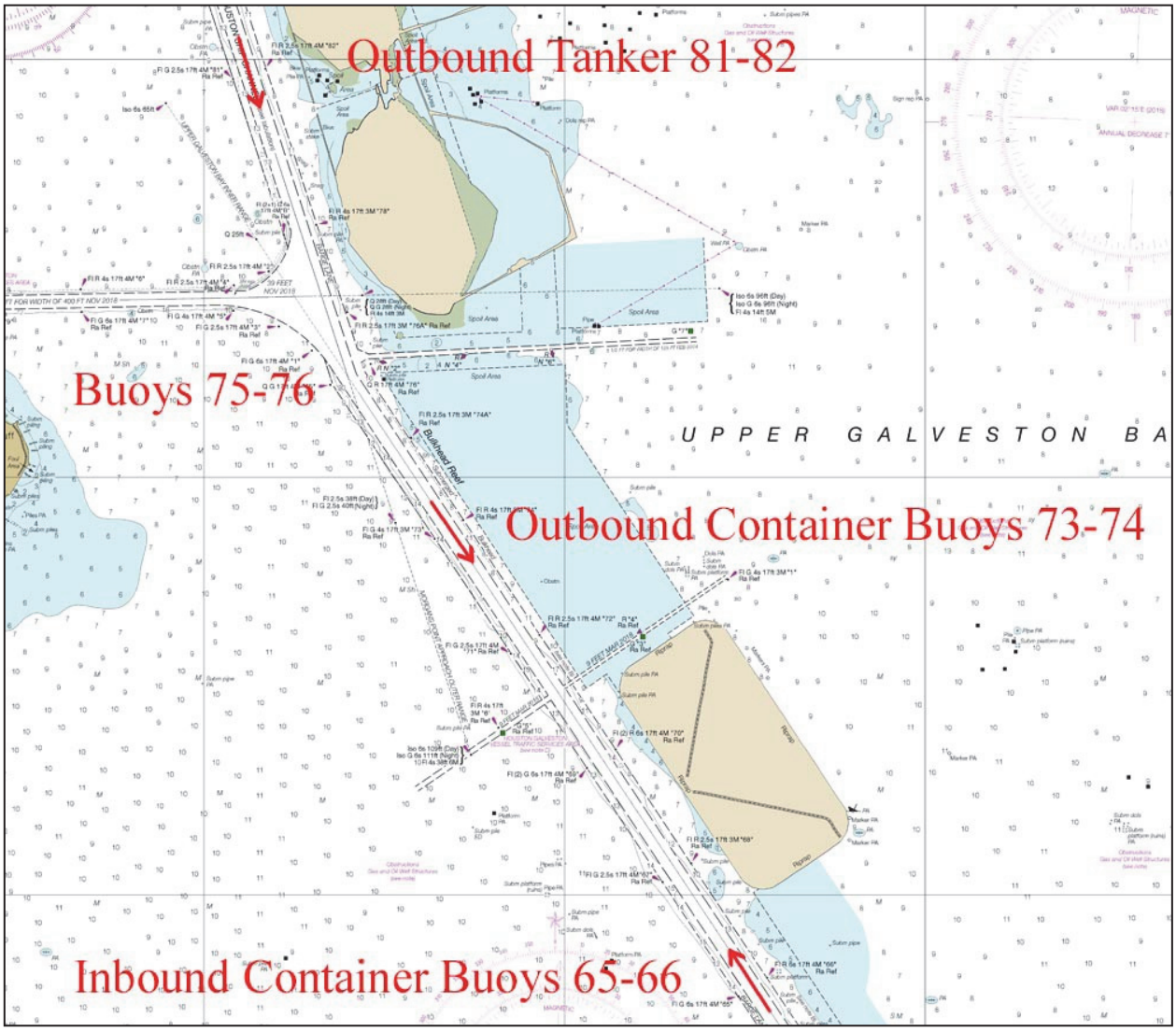


Figure 5. Starting Locations for the Bend at Beacons 75-76

Table 4. Test Runs at Beacons 75-76

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
700 ft	Container	44/13.4	326.2/10	65-66	A	Container	44/13.4	146.5/10	73-74	B	Fld	SE/20	0	30	Testing around Bend @ 75-76 - Meet below and above the bend with turn between
						Tanker	44/13.4	161.8/10	81-82	C					
700 ft	Container	44/13.4	326.2/10	65-66	B	Container	44/13.4	146.5/10	73-74	C	Fld	SE/20	0	30	
						Tanker	44/13.4	161.8/10	81-82	A					
700 ft	Container	44/13.4	326.2/10	65-66	C	Container	44/13.4	146.5/10	73-74	A	Fld	SE/20	0	30	
						Tanker	44/13.4	161.8/10	81-82	B					
700 ft	Container	44/13.4	326.2/10	65-66	A	Container	44/13.4	146.5/10	73-74	B	Ebb	N/20	0	30	
						Tanker	44/13.4	161.8/10	81-82	C					
700 ft	Container	44/13.4	326.2/10	65-66	B	Container	44/13.4	146.5/10	73-74	C	Ebb	N/20	0	30	2nd priority
						Tanker	44/13.4	161.8/10	81-82	A					
700 ft	Container	44/13.4	326.2/10	65-66	C	Container	44/13.4	146.5/10	73-74	A	Ebb	N/20	0	30	
						Tanker	44/13.4	161.8/10	81-82	B					

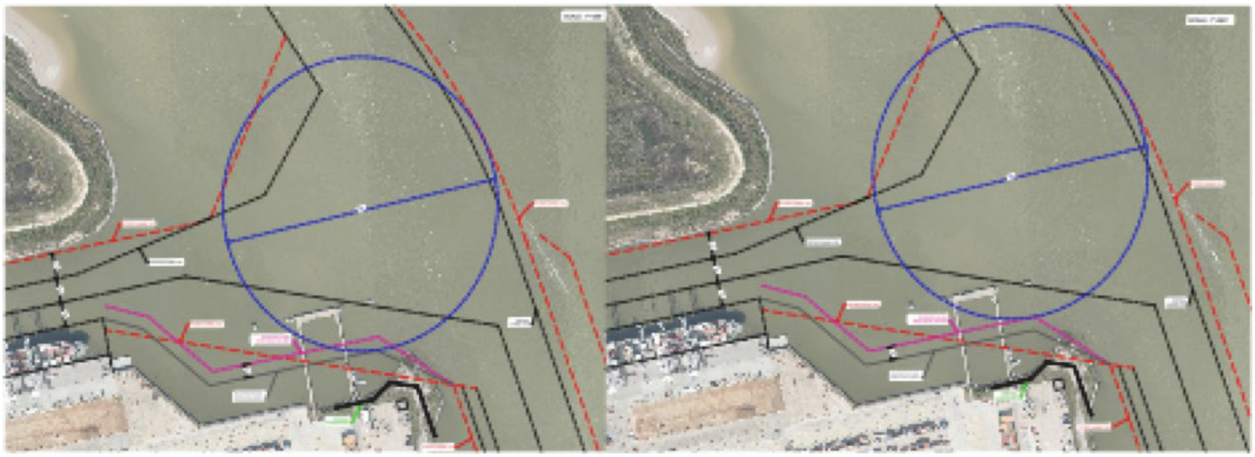


Figure 6. Two Options for the Design of the Entrance to Barbours Cut Channel

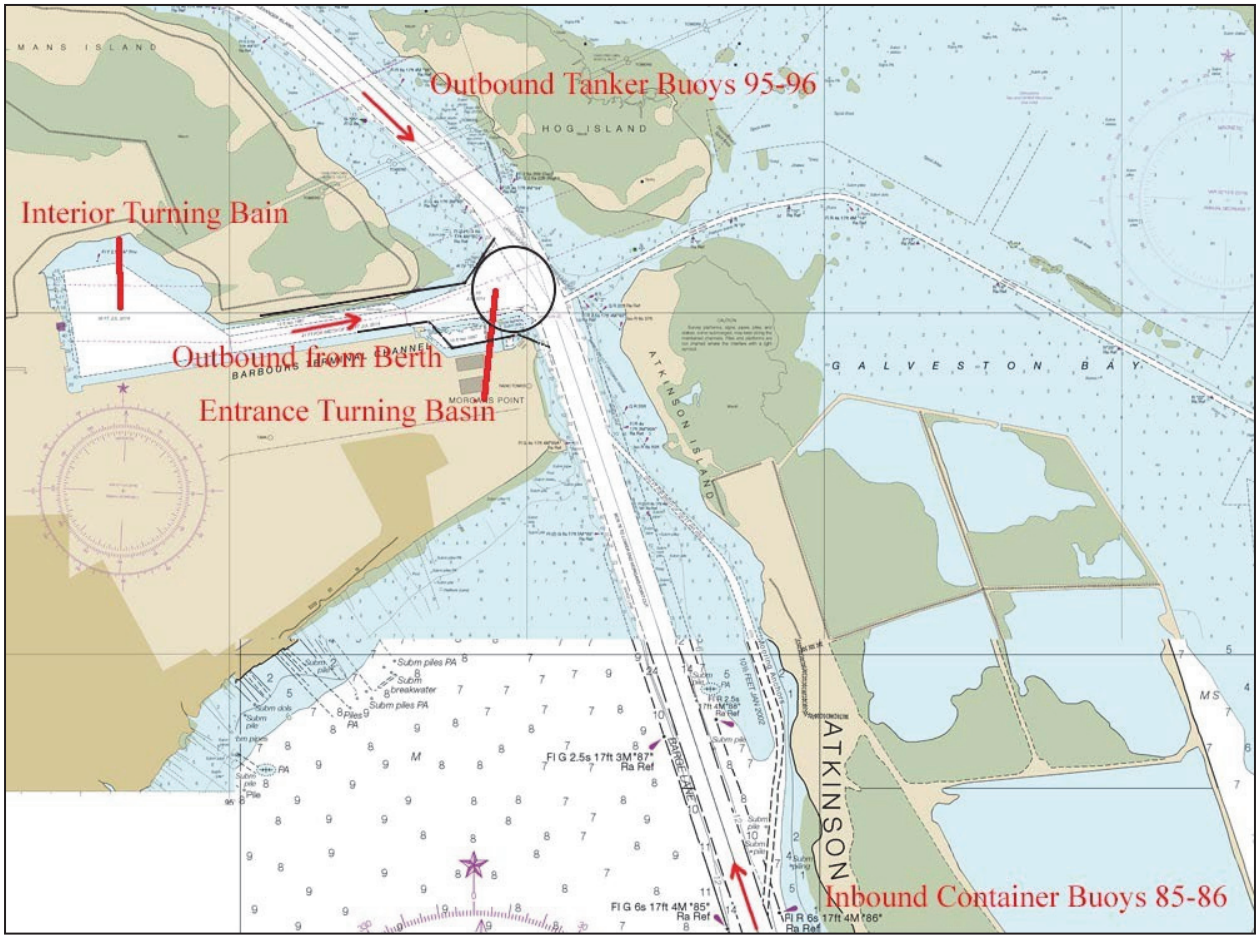


Figure 7. Start Locations for Barbours Cut Channel

Table 5. Test Runs for Barbours Cut Channel

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
700ft/455ft	Container	44/13.4	342/10	85-86	A	Tanker	44/13.4	131/8	95-96	B	Fld	SE/20	2	40	Entrance to Barbour's Cut - Turn at Entrance TB
700ft/455ft	Container	44/13.4	342/10	85-86	B	Tanker	44/13.4	131/8	95-96	C	Fld	SE/20	2	40	
700ft/455ft	Container	44/13.4	342/10	85-86	C	Tanker	44/13.4	131/8	95-96	A	Fld	SE/20	2	40	
700ft/455ft	Container	44/13.4	342/10	85-86	A	Tanker	44/13.4	131/8	95-96	B	Ebb	N/20	2	40	
700ft/455ft	Container	44/13.4	342/10	85-86	B	Tanker	44/13.4	131/8	95-96	C	Ebb	N/20	2	40	2nd priority
700ft/455ft	Container	44/13.4	342/10	85-86	C	Tanker	44/13.4	131/8	95-96	A	Ebb	N/20	2	40	
700ft/455ft	Container	44/13.4	342/10	85-86	A	Tanker	44/13.4	131/8	95-96	B	Fld	SE/20	2	60	Entrance to Barbour's Cut - Turn at Interior TB: Consider breaking transit to enter land cut and reduce transit time
700ft/455ft	Container	44/13.4	342/10	85-86	B	Tanker	44/13.4	131/8	95-96	C	Fld	SE/20	2	60	
700ft/455ft	Container	44/13.4	342/10	85-86	C	Tanker	44/13.4	131/8	95-96	A	Fld	SE/20	2	60	
700ft/455ft	Container	44/13.4	342/10	85-86	A	Tanker	44/13.4	131/8	95-96	B	Ebb	N/20	2	60	
700ft/455ft	Container	44/13.4	342/10	85-86	B	Tanker	44/13.4	131/8	95-96	C	Ebb	N/20	2	60	2nd priority
700ft/455ft	Container	44/13.4	342/10	85-86	C	Tanker	44/13.4	131/8	95-96	A	Ebb	N/20	2	60	
700ft/455ft	Tanker	44/13.4	342/8	85-86	A	Container	44/13.4	80/0	Berth	B	Fld	SE/20	2	30	Depart Barbour's Cut
700ft/455ft	Tanker	44/13.4	342/8	85-86	B	Container	44/13.4	80/0	Berth	C	Fld	SE/20	2	30	
700ft/455ft	Tanker	44/13.4	342/8	85-86	C	Container	44/13.4	80/0	Berth	A	Fld	SE/20	2	30	
700ft/455ft	Tanker	44/13.4	342/8	85-86	A	Container	44/13.4	80/0	Berth	B	Ebb	N/20	2	30	
700ft/455ft	Tanker	44/13.4	342/8	85-86	B	Container	44/13.4	80/0	Berth	C	Ebb	N/20	2	30	2nd priority
700ft/455ft	Tanker	44/13.4	342/8	85-86	C	Container	44/13.4	80/0	Berth	A	Ebb	N/20	2	30	

Bayport Ship Channel

The Bayport Ship Channel Feasibility Study design has been changed to follow the recommendations and continue the widening of the channel to 455' through the land cut to the turning basin. However, a change has taken place in the turning basin with the addition of a new terminal berth at the northwestern corner of the basin; thus, preventing the widening to continue all the way through the basin. This effectively places that terminal and any ship berthed at the terminal into the earlier turning basin. Two approaches to terminating the widener have been proposed and are shown in Figure 8. Following discussion during the online meeting it was agreed that the taper layout should be tested with the taper starting at the beginning of the opening to the turning basin to the point shown in the figure.

In addition, the recommendation to include the RO/RO turning basin to allow ULCVs to turn and back into the terminal has been eliminated.

Therefore, the simulation test runs shown in **Error! Reference source not found.** were agreed to with the starting locations shown in Figure 9. Like Barbour Cut Channel, meetings in the HSC will only be performed if the simulator bridge can be readily converted from ship to tug during the run so that two tugs operated by tug masters can be involved in maneuvering the ship through the Bayport Ship Channel. As before, the time for these runs can be reduced if no meeting occurs and if the run through the long bay channel can be broken to jump to the land cut.

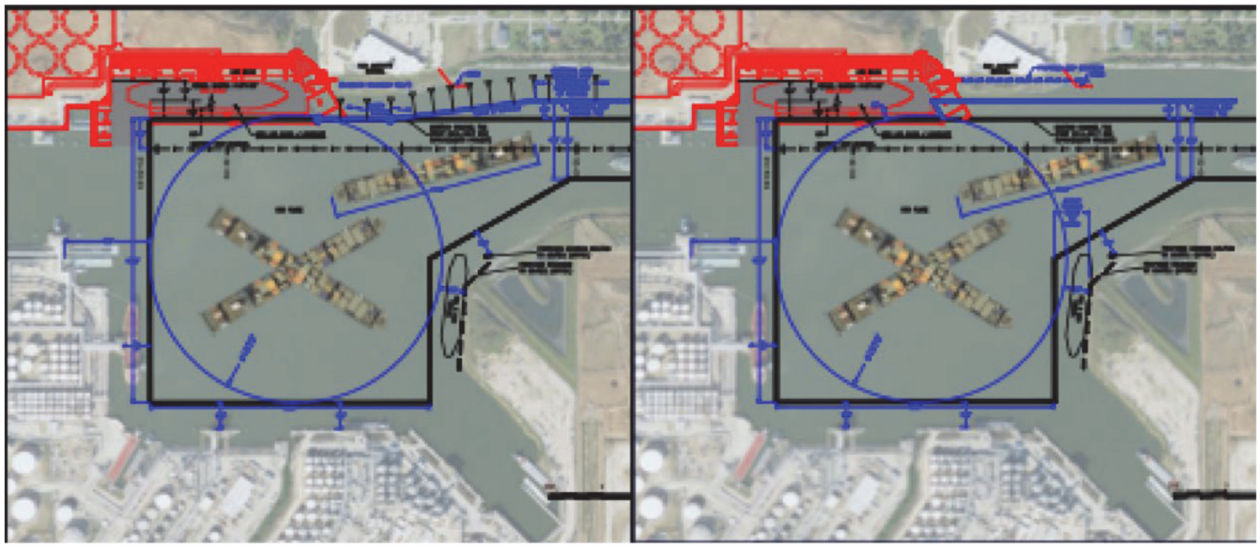


Figure 8. Two Options for Terminating the Widener in the Bayport Ship Channel Turning Basin

Table 6. Test Runs for Bayport Ship Channel

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
700ft/455ft	Container	44/13.4	326/10	69-70	A	Container	44/13.4	160/10	81-82	B	Fld	SE/20	2	45	Enter Bayport and Turn in Updated Turning Basin: Consider breaking transit to enter land cut and reduce transit time
700ft/455ft	Container	44/13.4	326/10	69-70	B	Container	44/13.4	160/10	81-82	C	Fld	SE/20	2	45	
700ft/455ft	Container	44/13.4	326/10	69-70	C	Container	44/13.4	160/10	81-82	A	Fld	SE/20	2	45	
700ft/455ft	Container	44/13.4	326/10	69-70	A	Container	44/13.4	160/10	81-82	B	Ebb	N/20	2	45	
700ft/455ft	Container	44/13.4	326/10	69-70	B	Container	44/13.4	160/10	81-82	C	Ebb	N/20	2	45	2nd priority
700ft/455ft	Container	44/13.4	326/10	69-70	C	Container	44/13.4	160/10	81-82	A	Ebb	N/20	2	45	
700ft/455ft	Container	44/13.4	326/10	69-70	A	Container	44/13.4	0	Berth	B	Fld	SE/20	2	45	Departing Bayport/Meeting below Entrance
700ft/455ft	Container	44/13.4	326/10	69-70	B	Container	44/13.4	0	Berth	C	Fld	SE/20	2	45	
700ft/455ft	Container	44/13.4	326/10	69-70	C	Container	44/13.4	0	Berth	A	Fld	SE/20	2	45	
700ft/455ft	Container	44/13.4	326/10	69-70	A	Container	44/13.4	0	Berth	B	Ebb	N/20	2	45	
700ft/455ft	Container	44/13.4	326/10	69-70	B	Container	44/13.4	0	Berth	C	Ebb	N/20	2	45	2nd priority
700ft/455ft	Container	44/13.4	326/10	69-70	C	Container	44/13.4	0	Berth	A	Ebb	N/20	2	45	

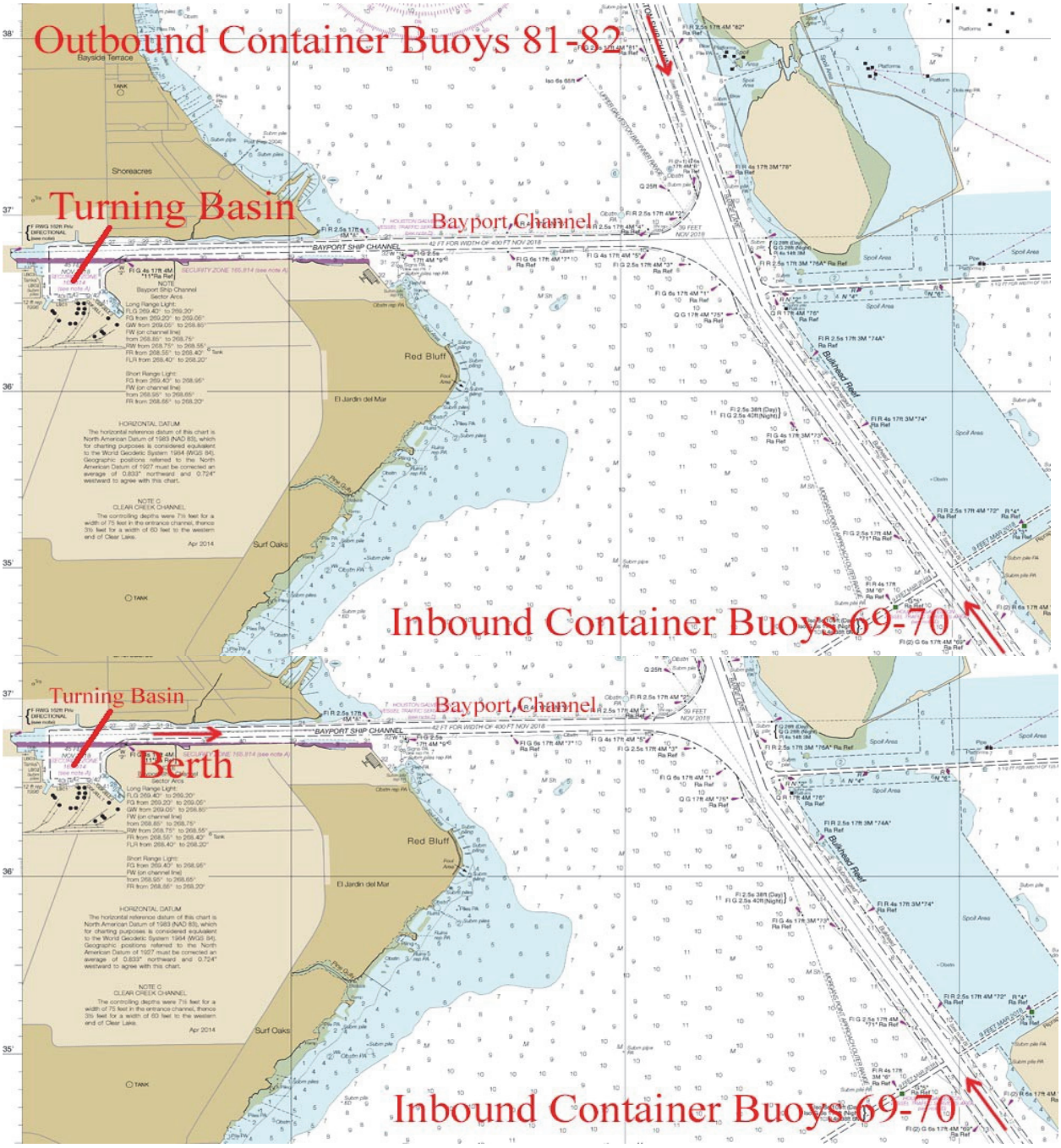


Figure 9. Starting Locations for Bayport Ship Channel

Boggy Bayou to Greens Bayou – Segment 4

The reach from Boggy Bayou to Greens Bayou experienced difficulties with large vessels meeting Panamax bulk carriers in the widened and deepened (530’ wide by 46.5’ MLLW deep) during the

Feasibility Study. After reviewing those results, a recommendation was made to widen the inside of the bend immediately above the Texas 8 bridge (that bridge is being replaced with a bridge that spans the entire waterway). This layout can be seen in Figure 10. Texas Deepwater Proposed Terminal Relative to Proposed Bend Widener in Segment 4. A thorough discussion was had during the online meeting concerning the possibility of moving the widening to the green side of the channel encroaching on the areas in front of the ITCC and Magellan terminals. Concerns were voiced about the Texas Deepwater terminal's application and the impacts that such a widening on the red side of the channel would have on that project. So, an investigation was undertaken to determine what was the best option to consider in this reach.

Also discussed was which terminals in this reach were expected to handle the Aframax and Suezmax tankers. It was determined that the ITCC and Magellan terminals were expected to service Aframax tankers with the Texas Deepwater terminal being the only one serving the Suezmax tankers.

Considering this information, it is suggested that only the Aframax tankers would be expected to meet Panamax vessels in the bend above the bridge and below the bridge. The Suezmax tankers would not be expected to meet Panamax Vessels above the bridge since the terminal is immediately above the bridge and would be expected to wait to enter the channel after traffic had cleared. The only reach where a Suezmax would be expected to meet a Panamax vessel would be in the reach between Shell and the Bridge.

In addition, widening the bend on the green side of the channel would impact the terminal directly opposite the Texas Deepwater proposed terminal and, therefore, might not be advisable. If the Pilot's Setback of 119' is taken from the available 233' clearance to the toeline, this would only allow a Panamax vessel to be berthed at this dock. So, it would require an exception to the setback to make it possible to widen on the green side of the channel.

Therefore, it is recommended that the Feasibility Study 530' channel be tested in this reach with an Aframax tanker meeting a Panamax vessel - both inbound and outbound combinations at the two locations. Only an inbound Suezmax tanker meeting an outbound Panamax vessel between the bridge and Shell should considered for testing. The starting position locations are shown in Figure 11 and the test runs are presented in Table 7.

Currents are nearly negligible in this area (maximum flood = 0.2 knts; ebb=0.6 knts). Ebb and flood currents will be simulated to correspond with the appropriate wind directions during simulations.

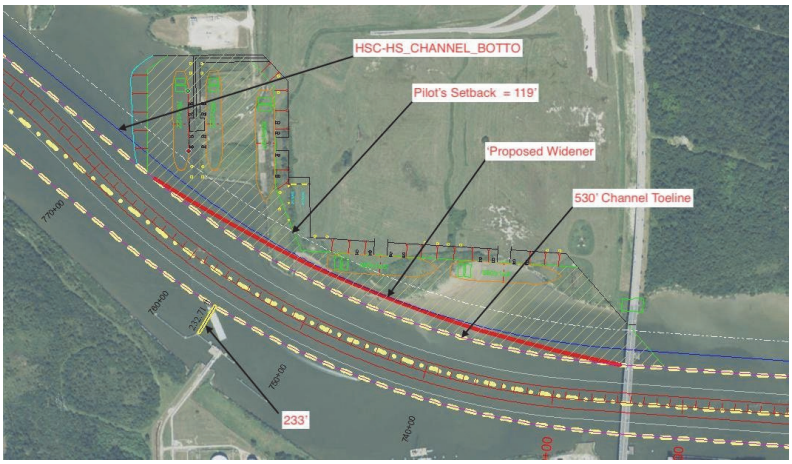


Figure 10. Texas Deepwater Proposed Terminal Relative to Proposed Bend Widener in Segment 4

Figure 11. Test Run Start Locations for Boggy Bayou to Greens Bayou

Table 7. Test Runs in Boggy Bayou to Greens Bayou

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Shell	A	Bulker	41/12.5	133/6.5	Bridge	B	Fld	SE20	1	20	Meet loaded Aframax/Panamax Between Shell and the Bridge
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Shell	B	Bulker	41/12.5	133/6.5	Bridge	C	Fld	SE20	1	20	
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Shell	C	Bulker	41/12.5	133/6.5	Bridge	A	Fld	SE20	1	20	
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Shell	A	Aframax	40/12.2	133/6.5	Bridge	B	Ebb	N20	1	20	
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Shell	B	Aframax	40/12.2	133/6.5	Bridge	C	Ebb	N20	1	20	
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Shell	C	Aframax	40/12.2	133/6.5	Bridge	A	Ebb	N20	1	20	
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Bridge	A	Bulker	41/12.5	130/6.5	ITTC	B	Fld	SE20	1	20	Meet loaded Aframax/Panamax above Bridge & below ITTC
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Bridge	B	Bulker	41/12.5	130/6.5	ITTC	C	Fld	SE20	1	20	
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Bridge	C	Bulker	41/12.5	130/6.5	ITTC	A	Fld	SE20	1	20	
530ft/46.5 ft	Suezmax	41/12.5	245/6.5	Shell	A	Bulker	44/13.4	133/6.5	Bridge	B	Ebb	N20	1	20	Meet loaded Suezmax/Panamax between Shell and the Bridge
530ft/46.5 ft	Suezmax	41/12.5	245/6.5	Shell	B	Bulker	44/13.4	133/6.5	Bridge	C	Ebb	N20	1	20	
530ft/46.5 ft	Suezmax	41/12.5	245/6.5	Shell	C	Bulker	44/13.4	133/6.5	Bridge	A	Ebb	N20	1	20	

Other Considerations

Focusing on the preferred designs and limiting the runs in Segment 4 based on expected operations of the large vessels reduced the anticipated days of simulation to 4.6 days.

All the berths, except the destination berth for the principal ship, in each reach being tested will be occupied by relevant vessels for that berth during the simulations of that reach.

There will be three (3) weeks of testing with at least three (3) pilots participating for the full week. During each week the full array of test runs will be repeated. All data will be recorded and the experience and opinions of each pilot participating in each run will be recorded following each run. When tugs are to be used in the simulated run, a tug bridge will be conned by a tugmaster. If more than two tugs are required, the extra tug(s) will be instructor operated. Relevant data and notes will be recorded for each run. If a design appears to be faulty, a decision will be made by the responsible team on the appropriate action including modifying the design and rerunning the simulation tests.

While a discussion has not taken place concerning the data to be analyzed in making the evaluation of the runs, it is proposed that the following be considered:

- Any allision, grounding, or collision
- Closest Point of Approach (CPA) to the toe of the channel
- CPA between vessels when meeting
- Heading of vessel relative to the channel course when the vessel center is at the channel centerline following a meeting situation
- Excessive use of tug power, detachment of a tug line, grounding of a tug, requiring a tug to operate in water less than -25' MLLW, or requiring a tug to abandon the operation

Larry L. Daggett, Engineer

Attendees on 3-31-2020 Webb Meeting – Subject: Houston Ship Channel ECIP Simulation Test Matrix

Keith Martin

Morgan Johnston

Kiara Pazan

Mario Sanchez

Lori Brownell

Richard Ruchhoeft

Larry Daggett

Dennis Webb

Dana Cheney

George Burkley

JJ Plunkett

Chad Prejean

May 7, 2020

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Memorandum for Record

Subject: Results of the Web Meeting on the Proposed Ship Simulation Study of the Houston Ship Channel ECIP

Introduction

On March 31, 2020, a web meeting was hosted by ERDC (Keith Martin) to discuss the proposed test matrix for the subject simulation study. An attendance list is attached. Larry Daggett led the discussion beginning with a discussion of the rationale and basis of the test matrix development and how, since the time the proposal was prepared, changes have emerged in the project designs that were not part of the studies Feasibility Study simulations. This was followed by a discussion of each reach laying out the original project design, the changes that have occurred and the optional design layouts that are being considered, and the proposed test pattern for each bay bend, terminal channel, and the bayou section. With each there was a very helpful discussion of the pros and cons of the proposed design layouts and the proposed test procedures. It was most helpful to have the input from the Houston Pilots and the engineering designers in understanding the purpose and basis for their decisions and suggestions and recommendations.

Since that first discussion, several changes have been made to the plans and a second web meeting was held on April 30, 2020 to discuss possible changes to the testing program. First and most significant were the addition of two proposed terminals and expansions of two existing terminals to handle Aframax and Suezmax tankers. The fact that terminals near Greens Bayou requires that Suezmax tankers be included in meeting situations between Greens Bayou and the beginning of the deepening and widening of the Houston Ship Channel.

The second modification was a change in the taper design from the 455’ Bayport Ship Channel widening to the turning basin and the addition of new terminals in the Bayport Turning Basin.

Basic Chanel Dimensions

The widened channel that would be tested would be a 700' channel up to Barbours Cut Ship Channel. The basic dimensions of each portion of the ECIP are shown in Table 1. Houston Ship Channel Widths and Depths by Station along with a typical cross-section in the bay as shown in Figure 1. Bay Reach Widening 700 Feet Bolivar Roads to BCC Cross Section.

Table 8. Houston Ship Channel Widths and Depths by Station

Project Segment	HSC Channel Section	Start Station	End Station	Existing Width	Proposed Width	Authorized Depth	Advanced Maintenance	Allowable Overdepth	Proposed Deepening	Proposed AM	Proposed OD
Segment 1	Bolivar Roads to Red Fish Light 1	138+369.011	78+844.001	530	700	46	48	50			
	Redfish Light 1 to Beacon 76	78+844.001	28+605.055	530	700	46	48	50			
	Beacon 76 to Lower End Morgans Point Cut	28+605.055	-0+3.94	530	700	46.5	48.5	50.5			
	Morgans Point to Exxon	0+05	295+00	530-600		46.5	50.5	51.5			
		280+05	295+00	530-600		46.5	48.5	49.5			
	Exxon to Carpenter's Bayou	295+00	520+00	530-600		46.5	48.5	49.5			
	Carpenter's Bayou to Boggy Bayou	520+00	684+03.19	530-600		46.5	48.5	49.5			
Segment 2	Bayport Ship Channel	25+58	241+87.31	350-400	455	46.5	48.5	50.5			
Segment 3	Barbours Cut Channel	10+13	91+98	300	455	46.5	48.5	50.5			
Segment 4	Boggy Bayou to Greens Bayou	684+03.19	833+05.17	300	530	41.5	43.5	44.5	46.5	48.5	49.5
	Greens Bayou to Washburn Tunnel	833+05.17	930+00	300	-	41.5	43.5	44.5	46.5	48.5	49.5
		930+00	974+07.5	300	-	41.5	43.5	44.5			
	Washburn Tunnel	974+07.5	977+92.5	300	-	38.5	40.5	41.5			
	Washburn Tunnel to Sims Bayou	977+92.5	1110+77.54	300	-	41.5	43.5	44.5			
Segment 5	Sims Bayou to I-610 Bridge	1110+77.54	1160+62.20	300	-	37.5	39.5	40.5	41.5	43.5	44.5
Segment 6	I-610 Bridge to Main Turning Basin	1160+60.20	1266+48	300	-	37.5	39.5	40.5	41.5	43.5	44.5
	Main Turning Basin	0	30+95.06	400-932	-	37.5	39.5	40.5	41.5	43.5	44.5

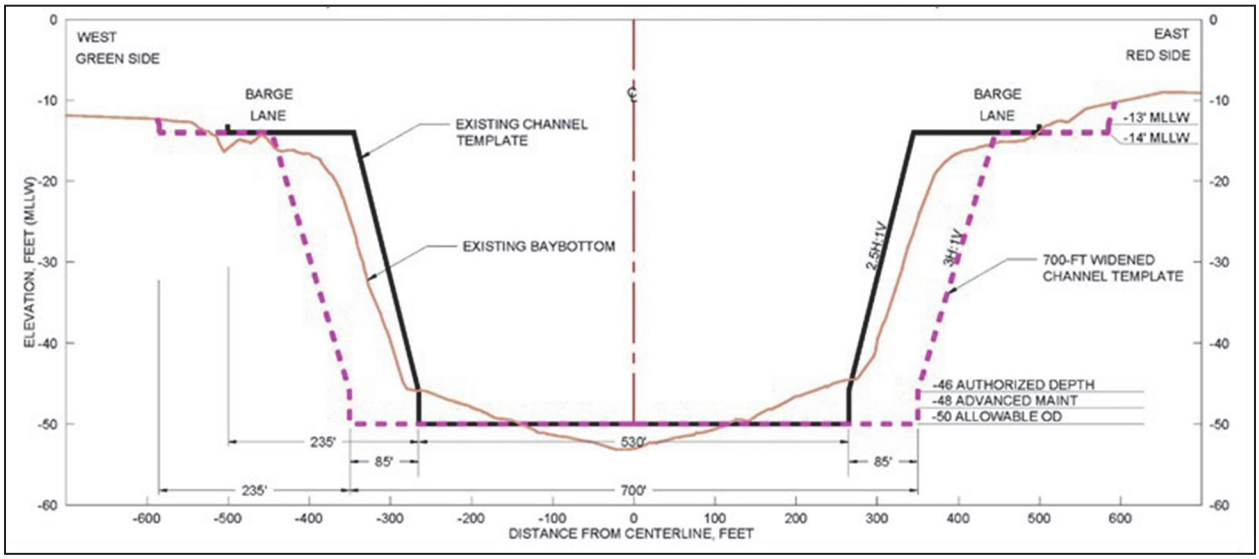

Figure 12. Bay Reach Widening 700 Feet Bolivar Roads to BCC Cross Section

Galveston Bay Channels and Bends

The channels in the Galveston Bay (Segment 1) will be 700' wide and have a depth of 46' MLLW to Beacon 75-76 and 46.5' MLLW to Morgans Point. The bends in the Feasibility Study had an Apex Widener with a maximum width at the apex of 1,028'. This design meets the Corps of Engineer's

design standard of an incremental increase in width of 2xB; i.e., 700'+2*164'. The Houston Pilots have expressed a concern about this design including: 1) difficulty in visualizing the position of the vessel in the bend, particularly the vessel turning on the inside of the bend, 2) difficulty managing the turn; 3) desiring a "gated" marking for the turn, and 4) noting that tow pilots have difficulty making the bend with this design.

Three additional bend layouts were considered. These are shown in Figure 2. During the discussion it was agreed that the Angle Turn with a modified Cutoff that comes to an apex opposite the Angle Turn apex was preferred by the pilots. This is shown as the Modified Angle Turn in Figure 2. It was agreed that this should be the design used for the simulation tests. The widener is 700' + 200'= 900'; i.e., 200'/164' or 1.2 times the design ship's beam. These bends will be marked with gated markers at the beginning and end of the flare and at the apex of the turn.

The bends will be tested with multiple encounters. When two ships meet, they must recover before meeting another. Three ownships will be used for these exercises. Two ships heading in one direction will meet one ship heading in the opposite direction. The single vessel is the critical ship since it has

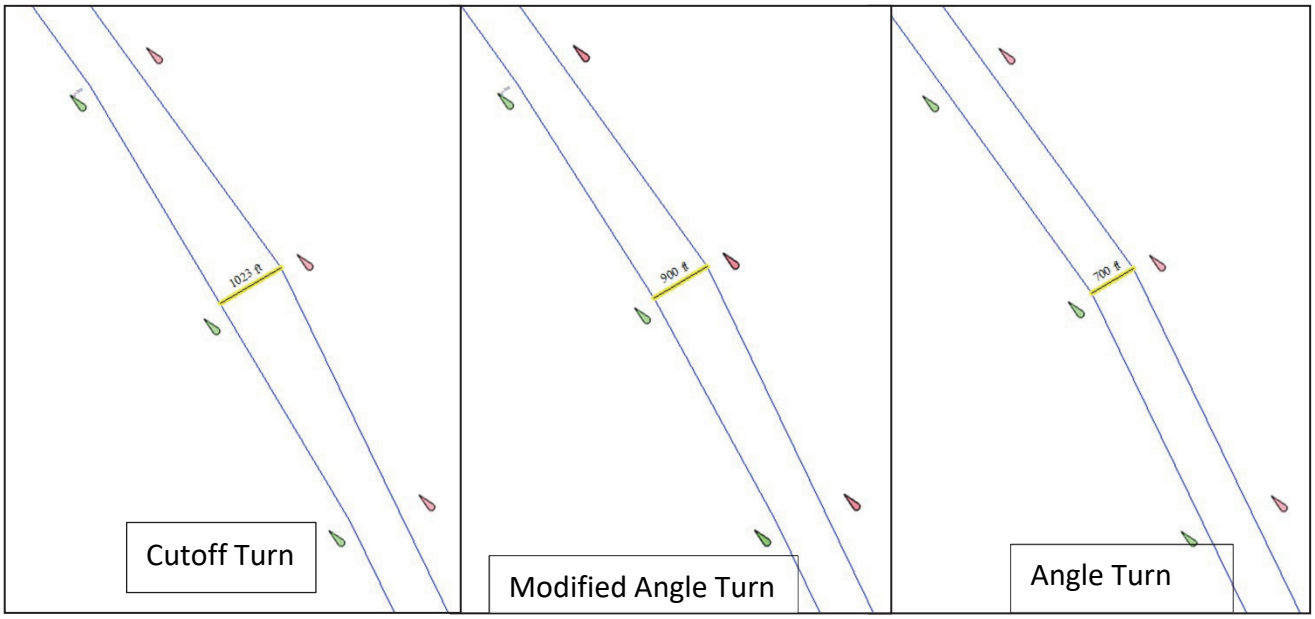

Figure 13. Turn Designs Considered for the Galveston Bay Bends

to recover from meeting the first ship before meeting the second ship. Just after two ships meeting (assuming typical port-to-port meetings) the forces turn the ship to the left. The ship facing a turn to the right just after meeting is a "worst case scenario." Therefore, for these tests the single ship will oriented inbound or outbound such that it will face a turn to the right at the bend.

Currents are aligned with the channel in most cases. When a ship is going in the same direction as the current, this is referred to as "fair tide." Ships going against the currents are said to be running in "opposing tide." Fair tide runs are considered more difficult because there is less flow going past the rudder. In order to reduce the number of simulations, the exercises will focus on the single ship

operating in fair tide. This means if the single ship is inbound, the worst case for the currents is flood tide. If the ship is outbound, the worst case is ebb tide. Three exercises will be conducted for the single ship in fair tide and one for the single ship in opposing tide. Additional runs with the single ship in opposing tide will be given a lower priority and only conducted if time allows.

It should be noted that it is common to change test matrices during the simulation sessions to refocus priorities based upon observations during the runs. Any changes made to the test matrix will be discussed and agreed upon by both representatives of the Port of Houston, the Pilots, and ERDC.

Bolivar Roads

Due to the increase in current velocities in this reach, it is important to model the maneuvers through the 700' channel and bend design. There are two turns being widened in proximity; one at the end of the Entrance Channel that is widened with the 1100' cutoff widener and one above the GIWW crossing that is widened with the modified 900' wide angle bend. It was agreed to model this with an inbound VLCV meeting an outbound VLCC and the inbound VLCV is beginning to enter the turn. The outbound tanker would be met as it is entering the turn at Markers 25-26. The position of the vessels for this series of runs is shown in Figure 3 and the series of runs to be completed are shown Table 2**.** The highlighted runs (yellow) are runs that can be eliminated if necessary due to limited time and are also shown in the following tables.

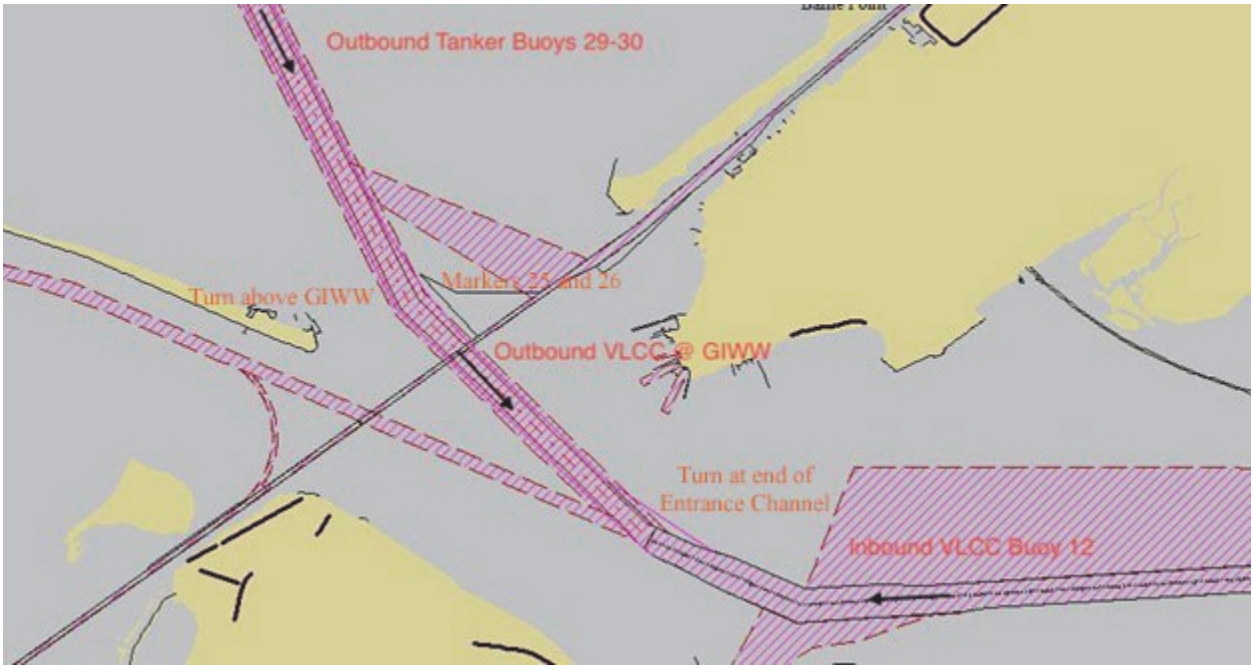

Figure 14. Location of Starting Positions for Bolivar Road.

Table 9. Test Runs for Bolivar Roads

700 ft	Container	44/13.4	324.5/10	12	A	Container	44/13.4	147.7/10	12	B	Fld	SE/20	0	30	Testing at Bolivar Roads - meet one ship in each bend
						Tanker	44/13.4	146.0/10	29-30	C					
700 ft	Container	44/13.4	324.5/10	12	B	Container	44/13.4	147.7/10	12	A	Fld	SE/20	0	30	
						Tanker	44/13.4	146.0/10	29-30	C					
700 ft	Container	44/13.4	324.5/10	12	C	Container	44/13.4	147.7/10	12	A	Fld	SE/20	0	30	
						Tanker	44/13.4	146.0/10	29-30	B					
700 ft	Container	44/13.4	324.5/10	12	A	Container	44/13.4	147.7/10	12	B	Ebb	N/20	0	30	
						Tanker	44/13.4	146.0/10	29-30	C					
700 ft	Container	44/13.4	324.5/10	12	B	Container	44/13.4	147.7/10	12	A	Ebb	N/20	0	30	2nd priority
						Tanker	44/13.4	146.0/10	29-30	C					
700 ft	Container	44/13.4	324.5/10	12	C	Container	44/13.4	147.7/10	12	A	Ebb	N/20	0	30	
						Tanker	44/13.4	146.0/10	29-30	B					

Redfish

The critical ship for the Redfish scenarios is the outbound ship, which will make the righthand turn after meeting the first inbound ship. Priority will be given to ebb tide. The outbound ship will meet the inbound containership north of the bend and meet the inbound tanker just after making the turn. The location of the vessel's starting position are shown in Figure 4 and the runs for this reach are shown in Table 3.

Beacons 75-76

The bend at Beacons 75-76 is different from the other two due to the improvements made at the Bayport Ship Channel which include addition of a flare on the green side of the HSC channel and a widener on the red side. See Figure 5 for the start locations for the series of test runs and Table 4.

Barbours Cut Channel

There have been significant changes to the proposed entrance to this channel from that tested in the Feasibility Study. Two changes have been proposed for testing. These changes are shown in Figure 6 and involve modifications to the plan to make use of the area on the south side of the channel at the entrance by removing the LASH dock and developing a new berth at that location. This required changing the southern flare used in the previous study. During the discussions, it was agreed that the priority would be to test the "HDR" plan because it is expected to be preferable for navigation and because it will require less structural work to protect the point - which was the reason this plan was requested by POHA. The design layout of this plan is shown in Figure 7. It should also be noted that if the simulator will not permit a change during runtime from a ship bridge to a tug bridge following the meeting of a tanker on approach to the entrance, then a meeting will not be included in these runs. This was identified as not an issue since the pilots are aware of the meeting traffic and the vessel approaching the channel entrance will maneuver to avoid a meeting at this location. Doing this will allow the inbound ship to be moved closer to the entrance, reducing the time for the simulated maneuver, and, also, allow the use of two tugs operated by tug masters. Therefore the starting location of the inbound VLCCs can be closer to the entrance, above Buoys 87-88 near the ending of the west barge lane for the various test runs as shown in Figure 8 and the test runs are listed in Table 5.

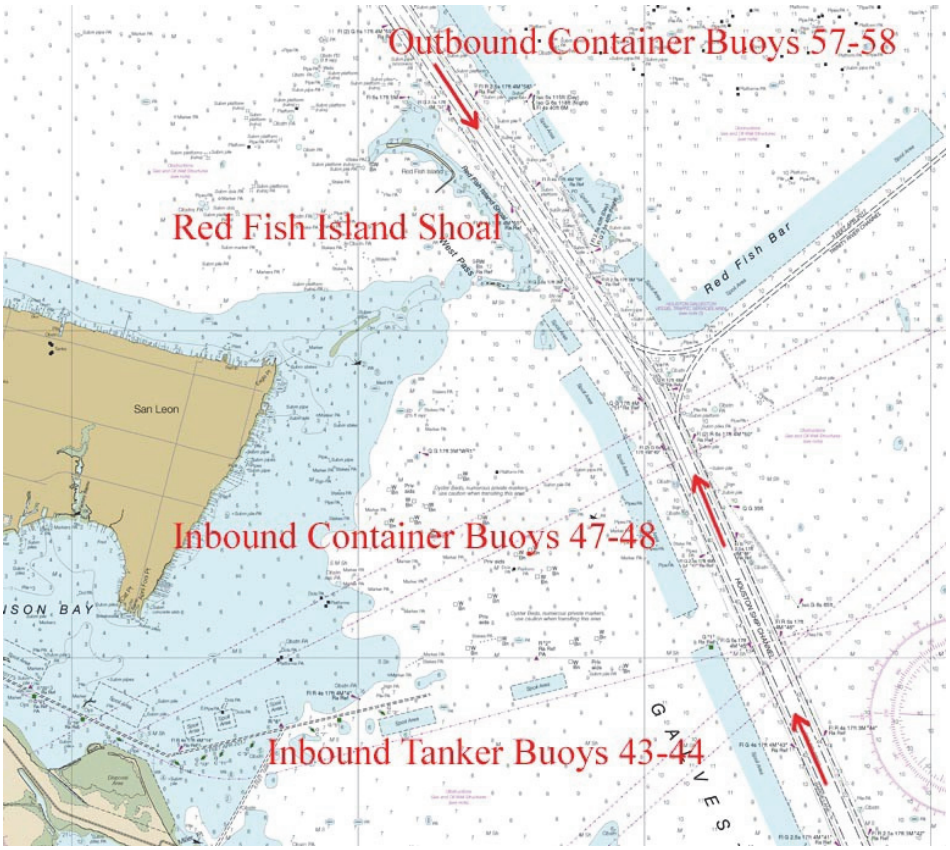

Figure 15. Starting Locations for Vessels at Redfish

Table 10. Test Runs for Redfish

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
700 ft	Container	44/13.4	146.5/10	53-54	B	Container	44/13.4	336.5/10	43-44	A	Ebb	N/20	0	30	Testing at Redfish - Meet in the bend and after the bend
	Tanker	44/13.4	146.5/10	57-58	C										
700 ft	Container	44/13.4	146.5/10	53-54	A	Container	44/13.4	336.5/10	43-44	B	Ebb	N/20	0	30	
	Tanker	44/13.4	146.5/10	57-58	C										
700 ft	Container	44/13.4	146.5/10	53-54	A	Container	44/13.4	336.5/10	43-44	C	Ebb	N/20	0	30	
	Tanker	44/13.4	146.5/10	57-58	B										
700 ft	Tanker	44/13.4	326.5/10	53-54	B	Container	44/13.4	146.5/10	57-58	A	Fld	SE/20	0	30	
	Container	44/13.4	336.5/10	43-44	C										
700 ft	Container	44/13.4	146.5/10	57-58	B	Container	44/13.4	326.5/10	53-54	A	Fld	SE/20	0	30	2nd priority
						Tanker	44/13.4	336.5/10	43-44	C					
700 ft	Container	44/13.4	146.5/10	57-58	C	Container	44/13.4	336.5/10	53-54	A	Fld	SE/20	0	30	
						Tanker	44/13.4	336.5/10	43-44	B					

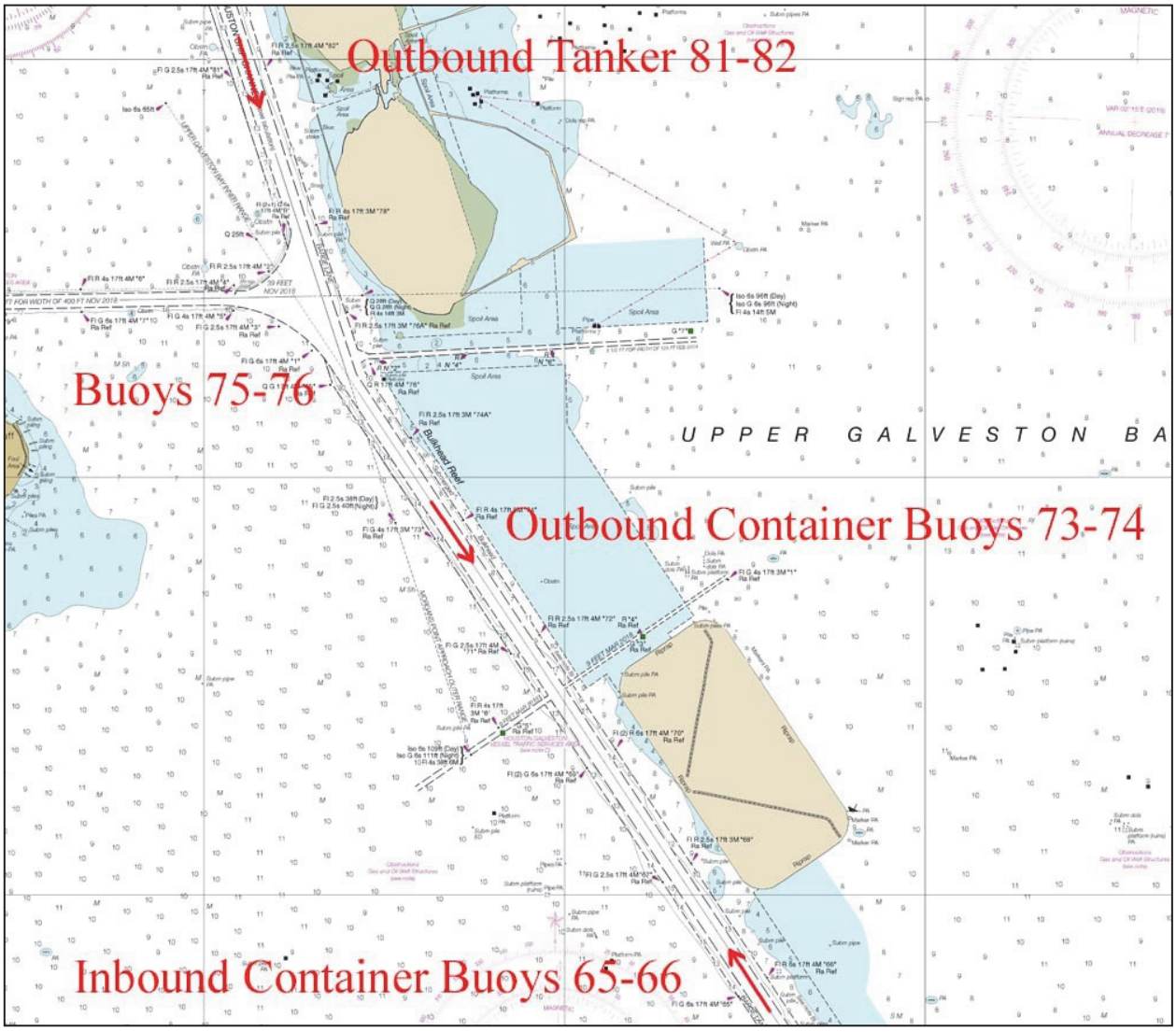

Figure 16. Starting Locations for the Bend at Beacons 75-76

Table 11. Test Runs at Beacons 75-76

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
700 ft	Container	44/13.4	326.2/10	65-66	A	Container	44/13.4	146.5/10	73-74	B	Fld	SE/20	0	30	Testing around Bend @ 75-76 - Meet below and above the bend with turn between
						Tanker	44/13.4	161.8/10	81-82	C					
700 ft	Container	44/13.4	326.2/10	65-66	B	Container	44/13.4	146.5/10	73-74	C	Fld	SE/20	0	30	
						Tanker	44/13.4	161.8/10	81-82	A					
700 ft	Container	44/13.4	326.2/10	65-66	C	Container	44/13.4	146.5/10	73-74	A	Fld	SE/20	0	30	
						Tanker	44/13.4	161.8/10	81-82	B					
700 ft	Container	44/13.4	326.2/10	65-66	A	Container	44/13.4	146.5/10	73-74	B	Ebb	N/20	0	30	
						Tanker	44/13.4	161.8/10	81-82	C					
700 ft	Container	44/13.4	326.2/10	65-66	B	Container	44/13.4	146.5/10	73-74	C	Ebb	N/20	0	30	2nd priority
						Tanker	44/13.4	161.8/10	81-82	A					
700 ft	Container	44/13.4	326.2/10	65-66	C	Container	44/13.4	146.5/10	73-74	A	Ebb	N/20	0	30	
						Tanker	44/13.4	161.8/10	81-82	B					

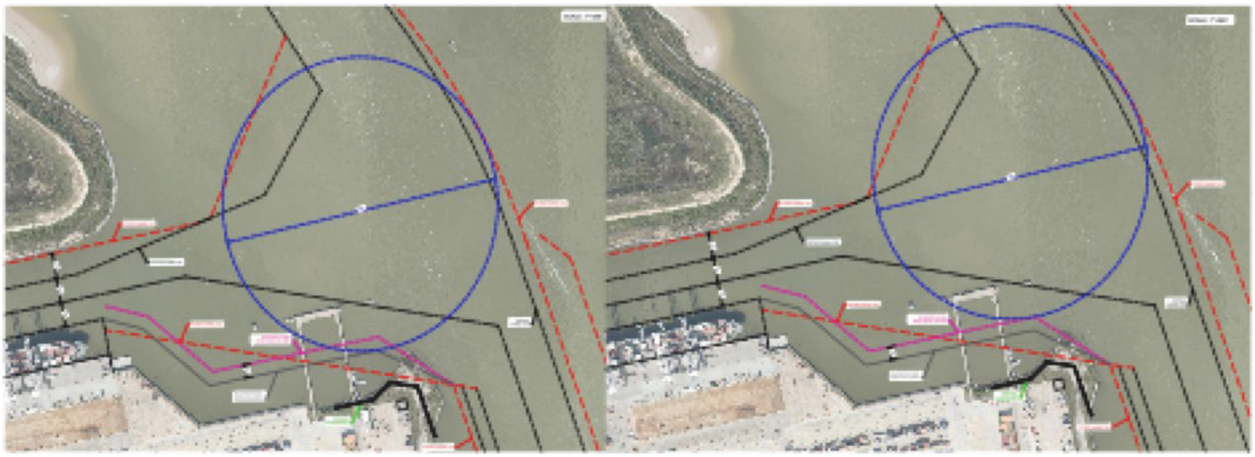

Figure 17. Two Options for the Design of the Entrance to Barbours Cut Channel

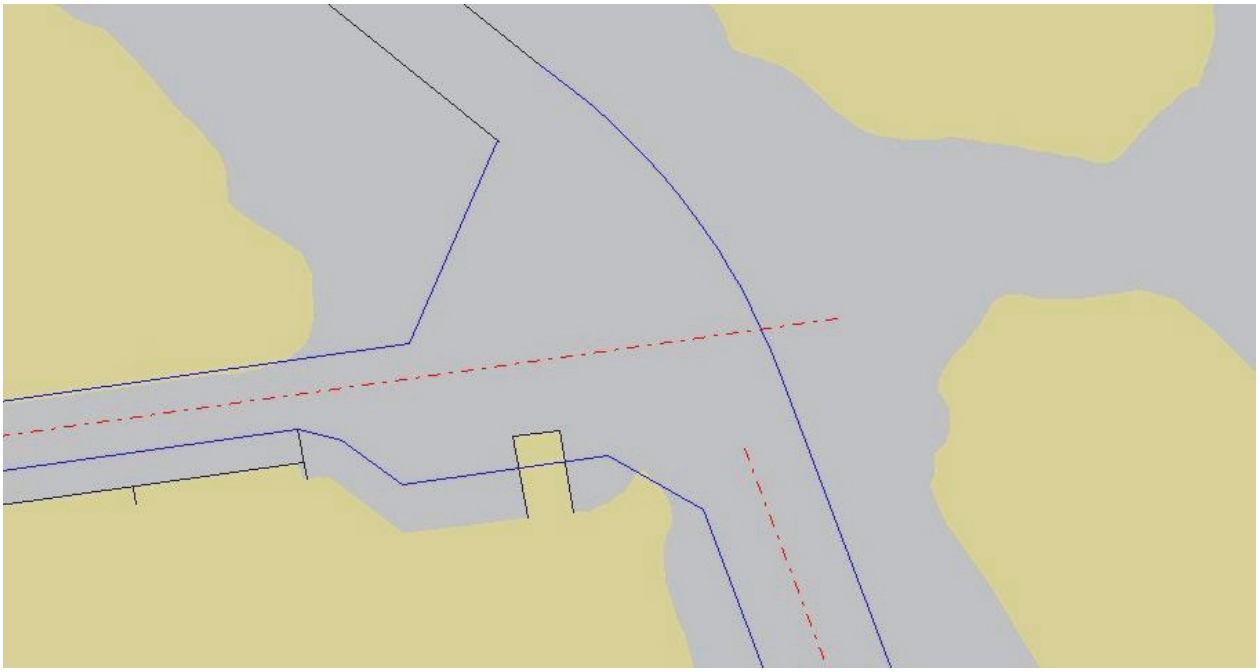

Figure 18. Design Layout of Barbours Cut Channel Entrance Turning Area

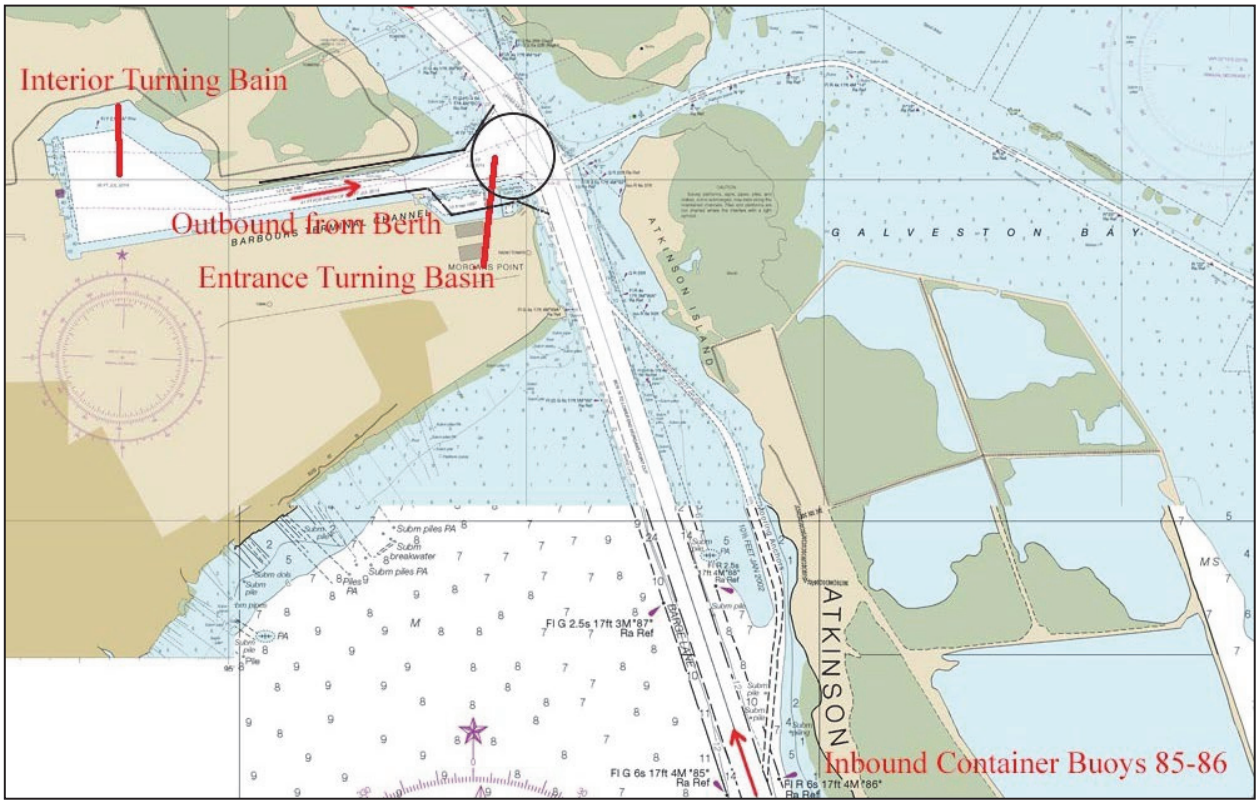

Figure 19. Start Locations for Barbours Cut Channel

Table 12. Test Runs for Barbours Cut Channel

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
700ft/455ft	Container	44/13.4	342/10	85-86	A						Fld	SE/20	2	40	Entrance to Barbour's Cut - Turn at Entrance TB
700ft/455ft	Container	44/13.4	342/10	85-86	B						Fld	SE/20	2	40	
700ft/455ft	Container	44/13.4	342/10	85-86	C						Fld	SE/20	2	40	
700ft/455ft	Container	44/13.4	342/10	85-86	A						Ebb	N/20	2	40	
700ft/455ft	Container	44/13.4	342/10	85-86	B						Ebb	N/20	2	40	2nd priority
700ft/455ft	Container	44/13.4	342/10	85-86	C						Ebb	N/20	2	40	
700ft/455ft	Container	44/13.4	342/10	85-86	A						Fld	SE/20	2	60	Entrance to Barbour's Cut - Turn at Interior TB
700ft/455ft	Container	44/13.4	342/10	Midway	B						Fld	SE/20	2	60	Start Mid-channel to save time
700ft/455ft	Container	44/13.4	342/10	Midway	C						Fld	SE/20	2	60	
700ft/455ft	Container	44/13.4	342/10	Midway	A						Ebb	N/20	2	60	
700ft/455ft	Container	44/13.4	342/10	85-86	B						Ebb	N/20	2	40	2nd priority
700ft/455ft	Container	44/13.4	342/10	85-86	C						Ebb	N/20	2	40	
700ft/455ft	Container	44/13.4	80.9/5	Midway	A						Fld	SE/20	2	30	Depart Barbour's Cut from Mid-channel
700ft/455ft	Container	44/13.4	80.9/5	Midway	B						Fld	SE/20	2	30	
700ft/455ft	Container	44/13.4	80.9/5	Midway	C						Fld	SE/20	2	30	
700ft/455ft	Container	44/13.4	80.9/5	Midway	A						Ebb	N/20	2	30	
700ft/455ft	Tanker	44/13.4	342/8	85-86	B	Container	44/13.4	80/0	Berth	C	Ebb	N/20	2	30	2nd priority
700ft/455ft	Tanker	44/13.4	342/8	85-86	C	Container	44/13.4	80/0	Berth	A	Ebb	N/20	2	30	

Bayport Ship Channel

The Bayport Ship Channel Feasibility Study design has been changed to follow the recommendations and continue the widening of the channel to 455' through the land cut to the turning basin. However, a change has taken place in the turning basin with the addition of a new terminal berth at the northwestern corner of the basin; thus, preventing the widening to continue all the way through the basin. This effectively places that terminal and any ship berthed at the terminal into the earlier turning basin. Two approaches to terminating the widener have been proposed and are shown in Figure 9. Following discussion during the online meeting it was agreed that the taper layout should be tested with the taper starting at the beginning of the opening to the turning basin to the point shown in the figure.

In addition, the recommendation to include the RO/RO turning basin to allow ULCVs to turn and back into the terminal has been eliminated. Therefore, the simulation test runs shown in Table 6 were agreed to with the starting locations shown in Figure 10. The final layout of the turning basin with the taper from the 455' wide Bayport Ship Channel to the Turning Basin, a full buildout of the Bayport Container Terminal, the LBC 5 terminal, and a proposed terminal on the east side of the Turning Basin are shown in Figure 11.

Meetings in the HSC will only be performed for the outbound runs. As before, the time for these runs can be reduced if no meeting occurs. Only the first and four inbound runs will be conducted from the HSC with the second and third inbound runs starting just outside the land cut.

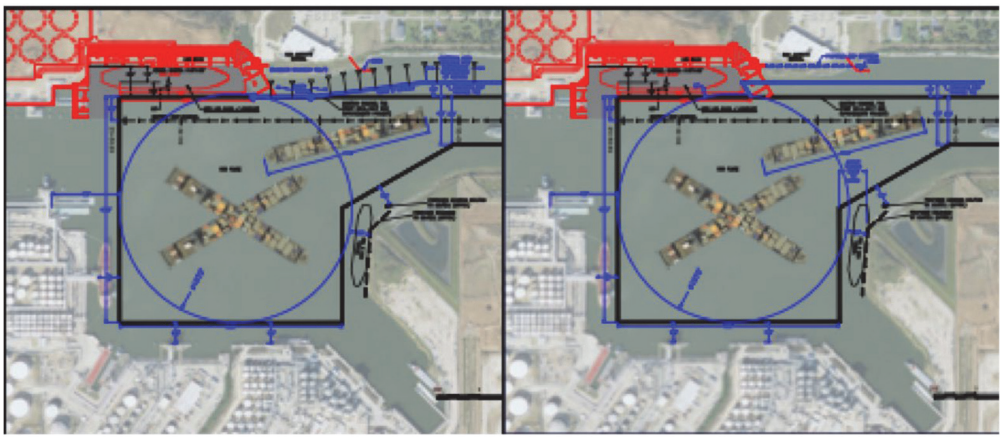

Figure 20. Two Options for Terminating the Widener in the Bayport Ship Channel Turning Basin

Table 13. Test Runs for Bayport Ship Channel

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
sting Widened HSC Channel to 700 ft - Entrance to Bayport Ship Channel to 455 ft Width with 4,000 ft Radius Flare on South Side of Entrance - Turning Basin with tapered Transition @LCC															
700ft/455ft	Container	44/13.4	326/10	69-70	A						Fld	SE/20	2	45	Enter Bayport and Turn in Updated Turning Basin
700ft/455ft	Container	44/13.4	326/10	69-70	B						Fld	SE/20	2	30	Start Mid-channel to save time
700ft/455ft	Container	44/13.4	326/10	69-70	C						Fld	SE/20	2	30	
700ft/455ft	Container	44/13.4	326/10	69-70	A						Ebb	N/20	2	45	Enter Bayport and Turn in Updated Turning Basin
700ft/455ft	Container	44/13.4	326/10	69-70	B						Ebb	N/20	2	30	2nd priority
700ft/455ft	Container	44/13.4	326/10	69-70	C						Ebb	N/20	2	30	
700ft/455ft	Container	44/13.4	88.9/0	Term	A	Container	44/13.4	0	Berth	B	Fld	SE/20	2	45	Departing Bayport/Meeting below Entrance
700ft/455ft	Container	44/13.4	88.9/0	Term	B	Container	44/13.4	0	Berth	C	Fld	SE/20	2	45	
700ft/455ft	Container	44/13.4	88.9/0	Term	C	Container	44/13.4	0	Berth	A	Fld	SE/20	2	45	
700ft/455ft	Container	44/13.4	88.9/0	Term	A	Container	44/13.4	0	Berth	B	Ebb	N/20	2	45	
700ft/455ft	Container	44/13.4	326/10	69-70	B	Container	44/13.4	0	Berth	C	Ebb	N/20	2	45	2nd priority
700ft/455ft	Container	44/13.4	326/10	69-70	C	Container	44/13.4	0	Berth	A	Ebb	N/20	2	45	

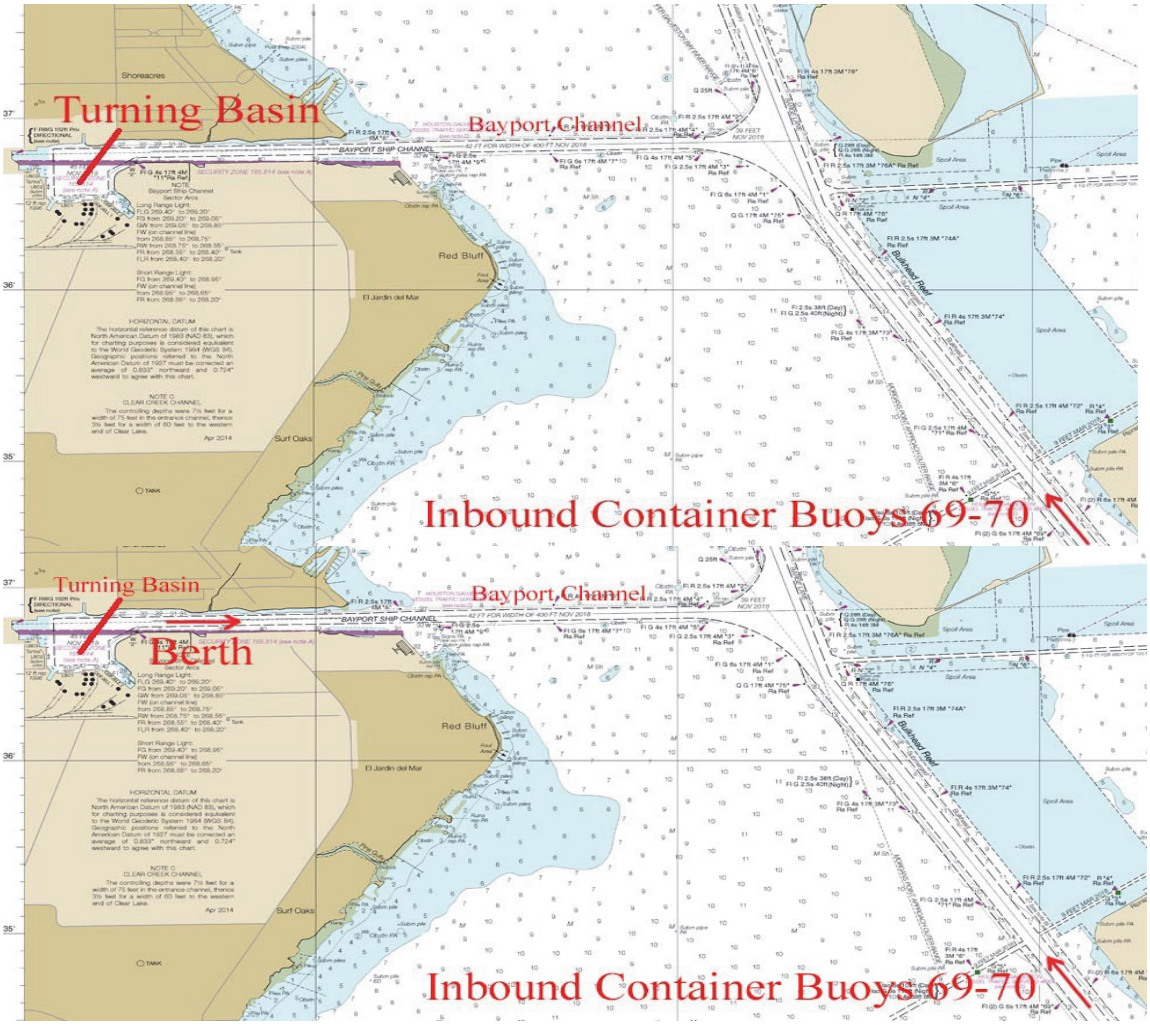

Figure 21. Starting Locations for Bayport Ship Channel

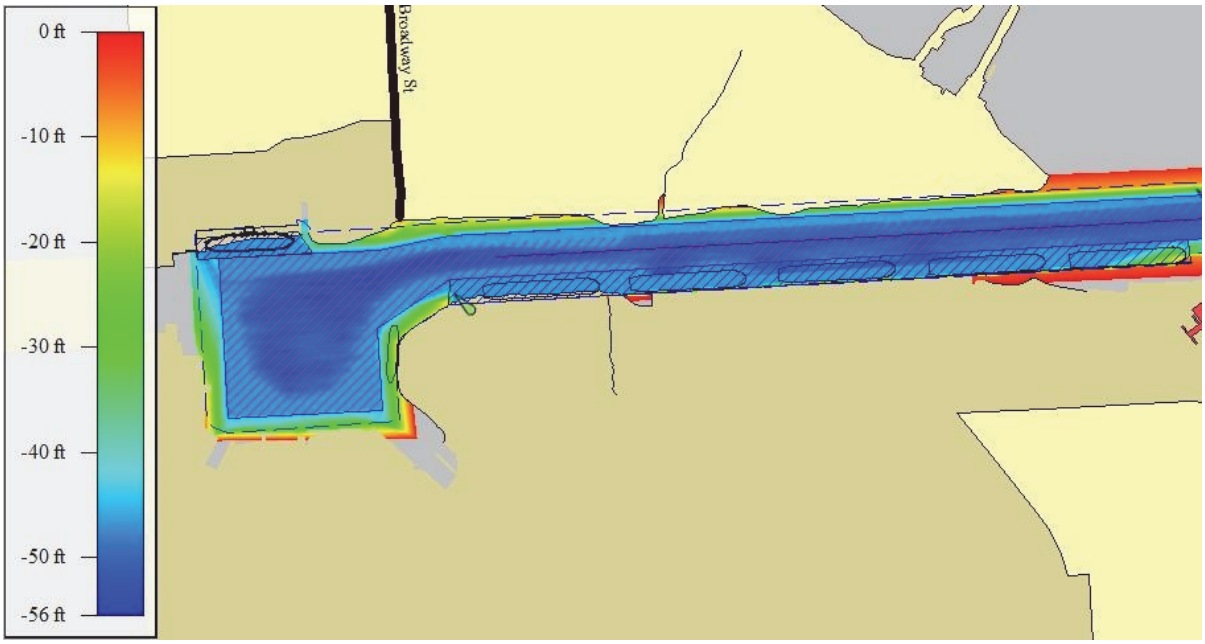

Figure 22. 455' Bayport Ship Channel with Transition to the Turning Basin and Terminals

Boggy Bayou to Greens Bayou – Segment 4

The reach from Boggy Bayou to Greens Bayou experienced difficulties with large vessels meeting Panamax bulk carriers in the widened and deepened (530' wide by 46.5' MLLW deep) during the Feasibility Study. After reviewing those results, a recommendation was made to widen the inside of the bend immediately above the Texas 8 bridge (that bridge is being replaced with a bridge that spans the entire waterway). This layout can be seen in Figure 12. Texas Deepwater Proposed Terminal Relative to Proposed Bend Widener in Segment 4. A thorough discussion was had during the online meeting concerning the possibility of moving the widening to the green side of the channel encroaching on the areas in front of the ITC and Magellan terminals. Concerns were voiced about the Texas Deepwater terminal's application and the impacts that such a widening on the red side of the channel would have on that project. So, an investigation was undertaken to determine what was the best option to consider in this reach.

Also discussed was which terminals in this reach were expected to handle the Aframax and Suezmax tankers. It was determined that the ITC and Magellan terminals were expected to service Aframax tankers with the Texas Deepwater terminal being the only one serving the Suezmax tankers. This changed with later discussions that raised the possibility that other terminals in this reach would also anticipate servicing Suezmax tankers. In addition, a terminal that had been permitted on the north side of the channel and which had reverted to the Port of Houston also was considering servicing Suezmax tankers. Therefore, four major terminals are expected to service these large vessels and consideration of meeting situations must account for this. The layout of the Segment 4 channels and terminals is shown in Figure 13.

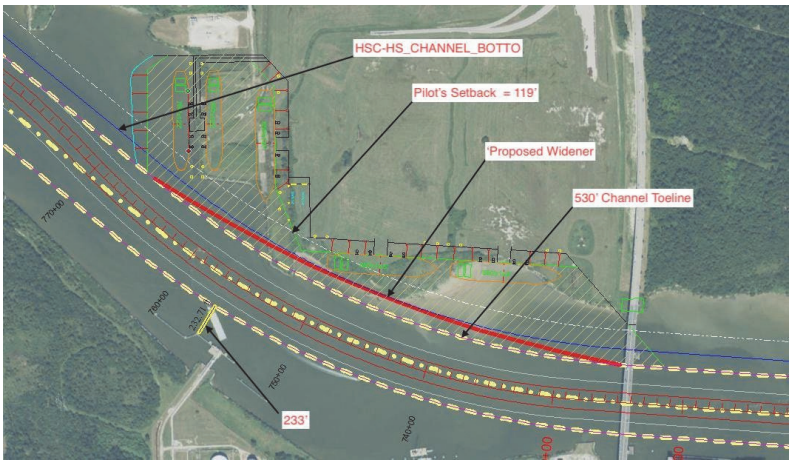

Figure 23. Texas Deepwater Proposed Terminal Relative to Proposed Bend Widener in Segment 4

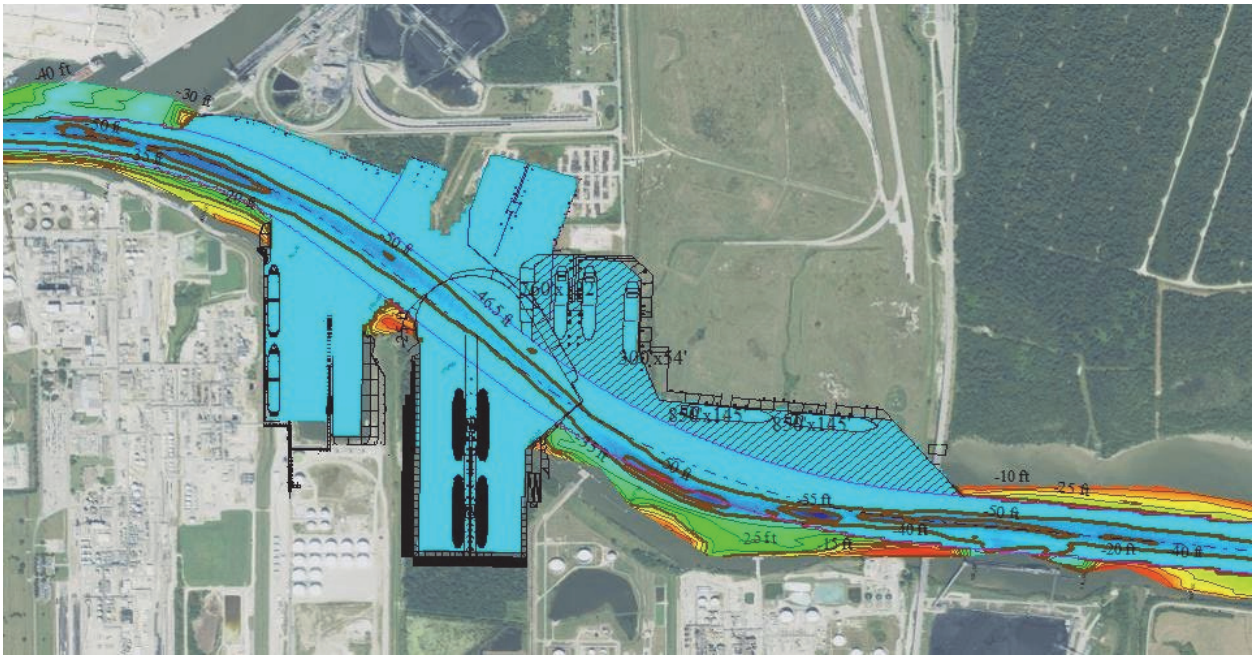

Figure 24. Segment 4 Reach with 530' Channel and Terminals

Based on discussions following the preliminary testing of the Feasibility 530’ channel, a redesign of the channel from the Georgia Pacific terminal east to the end of the widening and deepening project was developed and denoted as Alterative 1 in order to provide adequate clearance to the Kinder Morgan Deepwater terminal, see Figure 14. Therefore, it is recommended that the Feasibility Study 530’ channel be tested in this reach with both Aframax and Suezmax tankers meeting a Panamax vessel - both inbound and outbound combinations at the two locations. Consideration will be given to the destination or arrival terminal is setting up the speed of the large vessels; e.g., if the meeting is to take place between the terminal near Greens Bayou and the Bridge, and the departing vessel is leaving the upper terminal, the the large vessel will be

started with a slow initial speed. The starting position locations are shown in Figure 15 and the test runs are presented in Table 7.

Currents are nearly negligible in this area (maximum flood = 0.2 knts; ebb=0.6 knts). Ebb and flood currents will be simulated to correspond with the appropriate wind directions during simulations.

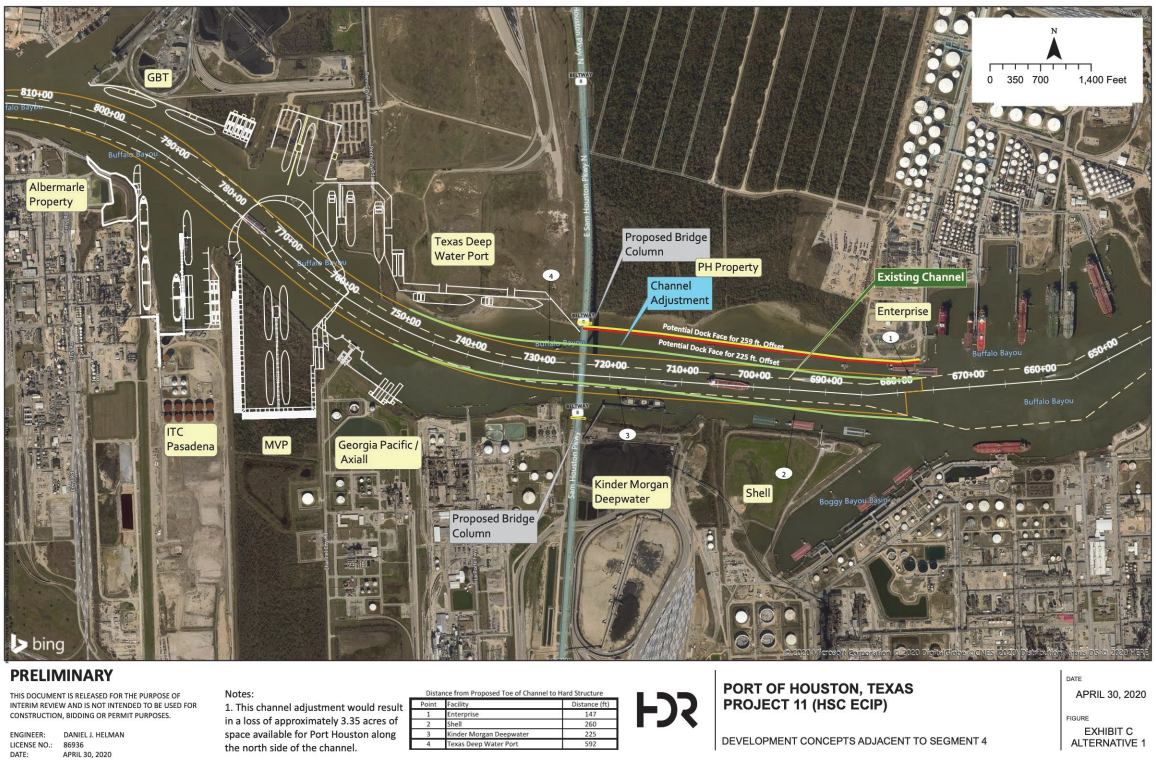

Figure 25. Alternative 530' Boggy Bayou to Greens Bayou Channel

Table 14. Test Runs in Boggy Bayou to Greens Bayou

Channel Condition	Inbound Ship					Outbound Ship					Tide	Wind Direction/ Speed (knts)	Tugs	Estimated Transit Time (min)	Notes
	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot	Type	Draft (ft/m)	Heading (deg) Initial Speed (knts)	Initial Position	Pilot					
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Shell	A	Bulker	41/12.5	133/6.5	Bridge	B	Fld	SE20	1	20	Meet loaded Aframax/Panamax Between Shell and the Bridge
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Shell	B	Bulker	41/12.5	133/6.5	Bridge	C	Fld	SE20	1	20	
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Shell	C	Bulker	41/12.5	133/6.5	Bridge	A	Fld	SE20	1	20	
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Shell	A	Aframax	40/12.2	133/6.5	Bridge	B	Ebb	N20	1	20	2nd priority
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Shell	B	Aframax	40/12.2	133/6.5	Bridge	C	Ebb	N20	1	20	
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Shell	C	Aframax	40/12.2	133/6.5	Bridge	A	Ebb	N20	1	20	
530ft/46.5 ft	Suezmax	41/12.5	245/6.5	Shell	A	Bulker	44/13.4	133/6.5	Bridge	B	Fld	SE/20	1	20	Meet loaded Suezmax/Panamax between Shell and the Bridge
530ft/46.5 ft	Suezmax	41/12.5	245/6.5	Shell	B	Bulker	44/13.4	133/6.5	Bridge	C	Fld	SE/20	1	20	
530ft/46.5 ft	Suezmax	41/12.5	245/6.5	Shell	C	Bulker	44/13.4	133/6.5	Bridge	A	Fld	SE/20	1	20	
530ft/46.5 ft	Bulker	44/13.4	245/6.5	Shell	A	Suezmax	41/12.5	133/6.5	Bridge	B	Fld	SE/20	1	20	2nd priority
530ft/46.5 ft	Bulker	44/13.4	245/6.5	Shell	B	Suezmax	41/12.5	133/6.5	Bridge	C	Fld	SE/20	1	20	
530ft/46.5 ft	Bulker	44/13.4	245/6.5	Shell	C	Suezmax	41/12.5	133/6.5	Bridge	A	Fld	SE/20	1	20	
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Bridge	A	Bulker	41/12.5	130/6.5	ITTC	B	Fld	SE20	1	20	Meet loaded Aframax/Panamax above the Bridge & below ITC
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Bridge	B	Bulker	41/12.5	130/6.5	ITTC	C	Fld	SE20	1	20	
530ft/46.5 ft	Aframax	40/12.2	245/6.5	Bridge	C	Bulker	41/12.5	130/6.5	ITTC	A	Fld	SE20	1	20	
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Bridge	A	Aframax	40/12.2	130/6.5	ITTC	B	Fld	SE20	1	20	2nd priority
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Bridge	B	Aframax	40/12.2	130/6.5	ITTC	C	Fld	SE20	1	20	
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Bridge	C	Aframax	40/12.2	130/6.5	ITTC	A	Fld	SE20	1	20	
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Shell	A	Suezmax	44/13.4	133/6.5	Bridge	B	Ebb	SE20	1	20	Meet loaded Suezmax/Panamax above the Bridge & below ITC
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Shell	B	Suezmax	44/13.4	133/6.5	Bridge	C	Ebb	SE20	1	20	
530ft/46.5 ft	Bulker	41/12.5	245/6.5	Shell	C	Suezmax	44/13.4	133/6.5	Bridge	A	Ebb	SE20	1	20	
530ft/46.5 ft	Suezmax	44/13.4	245/6.5	Shell	A	Bulker	41/12.5	133/6.5	Bridge	B	Ebb	SE20	1	20	2nd priority
530ft/46.5 ft	Suezmax	44/13.4	245/6.5	Shell	B	Bulker	41/12.5	133/6.5	Bridge	C	Ebb	SE20	1	20	
530ft/46.5 ft	Suezmax	44/13.4	245/6.5	Shell	C	Bulker	41/12.5	133/6.5	Bridge	A	Ebb	SE20	1	20	

Figure 26. Test Run Start Locations for Boggy Bayou to Greens Bayou

Other Considerations

Focusing on the preferred designs and limiting the runs in Segment 4 based on expected operations of the large vessels reduced the anticipated days of simulation to 4.6 days.

All the berths, except the destination berth for the principal ship, in each reach being tested will be occupied by relevant vessels for that berth during the simulations of that reach.

There will be three (3) weeks of testing with at least three (3) pilots participating for the full week. During each week the full array of test runs will be repeated. All data will be recorded and the experience and opinions of each pilot participating in each run will be recorded following each run. When tugs are to be used in the simulated run, a tug bridge will be conned by a tugmaster. If more than two tugs are required, the extra tug(s) will be instructor operated. Relevant data and notes will be recorded for each run. If a design appears to be faulty, a decision will be made by the responsible team on the appropriate action including modifying the design and rerunning the simulation tests.

While a discussion has not taken place concerning the data to be analyzed in making the evaluation of the runs, it is proposed that the following be considered:

- Any allision, grounding, or collision
- Closest Point of Approach (CPA) to the toe of the channel
- CPA between vessels when meeting
- Heading of vessel relative to the channel course when the vessel center is at the channel centerline following a meeting situation
- Overshoot of channel centerline
- Excessive use of rudder and/or engine thrust
- Excessive use of tug power, detachment of a tug line, grounding of a tug, requiring a tug to operate in water less than -25' MLLW, or requiring a tug to abandon the operation

Larry L. Daggett, Engineer

S. Keith Martin

Attendees on 4-30-2020 Webb Meeting – Subject: Houston Ship Channel ECIP Simulation Test Matrix

Keith Martin

Morgan Johnston

Kiara Pazan

Mario Sanchez

Lori Brownell

Richard Ruchhoeft

Larry Daggett

Dennis Webb

Dana Cheney

George Burkley

JJ Plunkett

Chad Prejean

May 18, 2020

Waterway Simulation Technology, Inc.

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MEMO FOR RECORD

Subject: Changes in Simulation Test Program

Bolivar Roads

The first two simulation runs in the Bay (Section 1) were executed in the Entrance or Bolivar Roads reach. The pilots quickly identified that there was an issue with the way the widener was laid out where the HSC meets the Entrance Channel. The design layout resulted in a number of channel toeline changes and resulted in difficulty for the pilots identifying the turn(s). As a result, WST made two proposed design changes that were discussed in a noon briefing discussion with the Houston Pilots, GBA, ERDC, and WST on May 15, 2020. These alternatives are shown in Figure 1. Alternative two results in a common design layout with the other bends in the Galveston Bay and minimizes any possible dredging as the 46' contour is mostly outside the navigation channel and is recommended. In addition, to simplify the channel alignment, the channel toeline on the green side of the Entrance Channel is straightened to intersect the green side of the 700' HSC channel at the bend apex. Finally, since there is an offset to the north of the bend apex to the green toe of the Texas City Channel intersection with the HSC, a short flare is proposed to tie the that channel to the bend apex to eliminate confusion. Since the west side of the channels is deep, it is anticipated that this would result in no additional dredging.

Testing Changes in the Bayou (Section 4) Reach

As testing proceeded in the Bayou reach, some changes in the testing matrix became evident. As the large inbound vessel (Aframax or Suezmax) entered the widened and deepened reach and was meeting an outbound Panamax Bulk Carrier, there could be two scenarios. The inbound vessel could be bound for the TDWP and would be slowing to 3.5 knots or it could be proceeding to the upper terminals (ITC or GBT) and would be proceeding at 5.5 knots. Therefore, two runs for each condition with two pilots conning will be performed with these conditions meeting near or at the bridge,

Likewise, rather than running ebb and flood currents for the meeting above the Texas 8 Bridge, two runs with meetings occurring in the vicinity of Georgia Gulf and the vicinity of MPI will be run with inbound large vessel speeds of 4.5 knots and 3.5 knots, respectively, to represent meeting while bound for the upper two terminals.

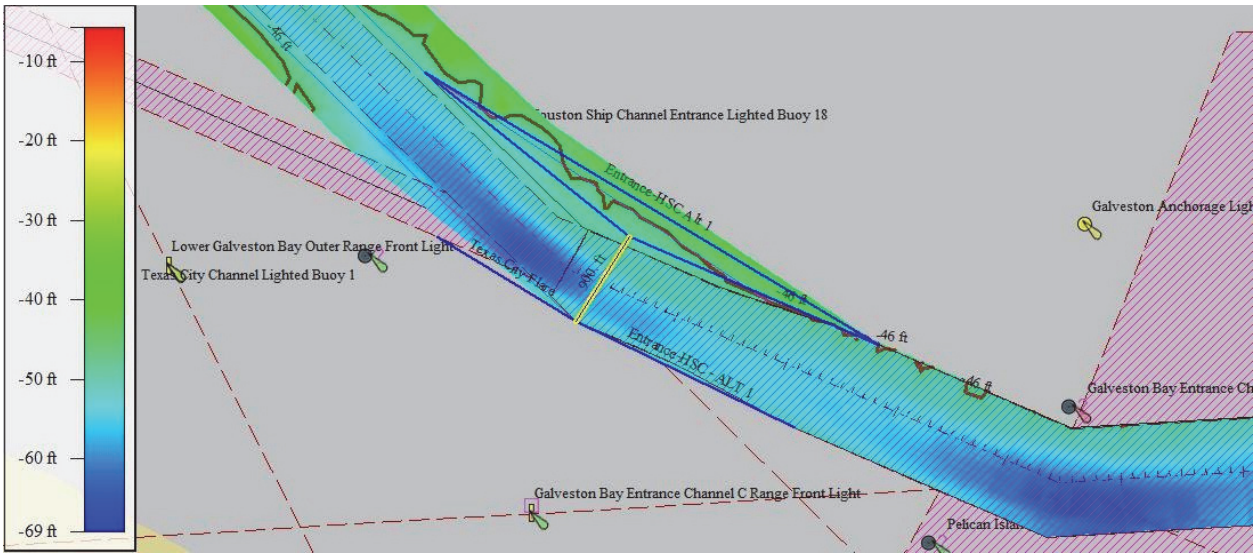

Figure 27. Proposed Alternatives to the Bend Widening at the HSC-Entrance Channel intersection

Larry L. Daggett, Engineer

S. Keith Martin

Appendix K: LOCUS LLC - HPA Project Report - 216 PED Area 4 Berths - Suezmax Simulations

Report

Simulation Evaluation of Suezmax Berthing in Area 4 of the Pending USACE 216-PED Simulations: A focus on future designs for ITC/MVP/Texas Deepwater and GBT Berths

Conducted by LOCUS LLC on behalf of the Houston Pilots at San Jacinto Maritime College, La Porte, Texas

April 22-23, 2020

Version 1

Prepared by:
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and Ashley Stauffer, BSc.

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Run 6b: Docking at GBT 4, Day Time, No Wind, No Current 26

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Run 7b: Docking at GBT 4, Day Time, No Wind, No Current 28

Run 8a: Docking at Texas Deepwater 1, Day Time, No Wind, No Current 29

Run 8b: Docking at Texas Deepwater 1, Day Time, No Wind, No Current 30

Run 9: Undocking at Texas Deepwater 1, Day Time, No Wind, No Current 31

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Run 10b: Docking at GBT 2, Day Time, No Wind, No Current 33

Run 11: Undocking at ITC 2, Day Time, No Wind, No Current 34

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Disclaimer

This report does not constitute the approval of the Houston Pilots for larger vessels at any of the docks considered in this research. If dock owners would like HP to consider larger vessels at their berths, they should submit an official request along with the appropriate supporting documentation to HP.

DRAFT

Summary

On April 22-23, 2020 the Houston Pilots Association and LOCUS LLC conducted simulation-based research using the Houston Pilots Ship Simulator located at San Jacinto Maritime College. The purpose of the simulations is to inform the 216-PED area 4 research for equitable use of the waterway and ability of adjacent berths to maneuver to and from existing and/or planned berths. Specifically, the Houston Pilots desired to maneuver Suezmax class vessels in and out of berths adjacent to the planned 216-PED channel considering Intercontinental Terminals Company, Pasadena (ITC), MVP Terminalling, LLC / Magellan Terminals Holdings, LP (MVP), Greens Bayou Terminals (GBT) and Texas Deepwater Terminals (TX-DPWTR). The primary objective was to investigate the ability of various berth to accommodate Suezmax class vessels while informing the 216 process for fair and equitable use of the waterway given the proposed redesign of the federal channel.

Overall, the research found piloting to be successful to all berths expected to be able to service Suezmax vessels. This research found the following:

1. ITC #2 is limited to Aframax-class vessels due to limitations in water depth along the east side of the terminal.
2. Recommend widening the flare entrance into ITC #7 along the north side of the approach to the berth to allow for better access to ITC #7 and to improve turning room for future Suezmax operations at GBT #4 opposite the ITC berth.
3. GBT #1 and #2 can accommodate a Suezmax vessel as long as the opposite berth is empty.
4. Maneuvering room in the approach to GBT #2 was found to be open and therefore could potentially accommodate larger beam vessels at TX-DPWTR #5.
5. The turning basin space provided opposite MVP is adequate to safely turn Suezmax-class vessels out of MVP.
6. The proposed expanded channel is close to the berth at Kinder Morgan Deepwater. The Pilots recommend moving the proposed channel to the north to avoid surge from passing vessels at the KMD berth.

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Summary of Simulation Comments by Facility Berth

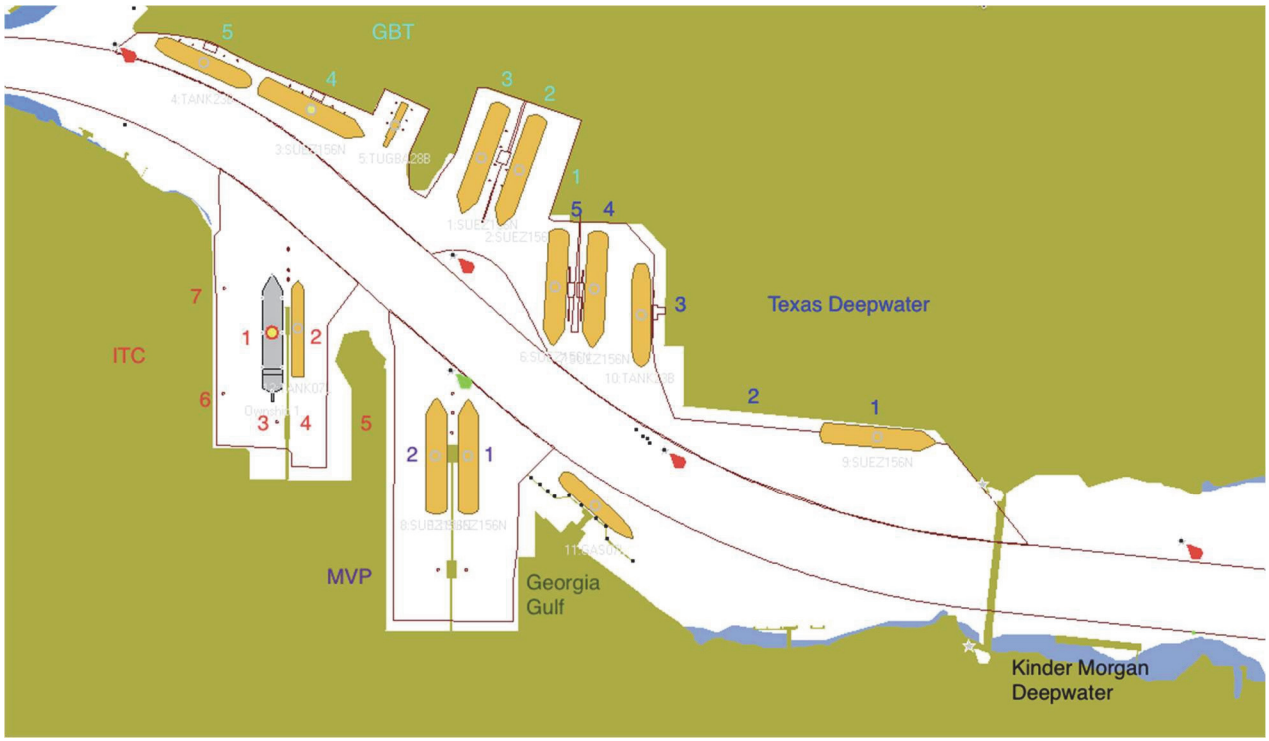
Berth	Maximum Ship Size	Note
ITC		
ITC 1	Suezmax	Plenty of space to maneuver with minimal tug assistance
ITC 2	Aframax	Plenty of space to maneuver
	Suezmax	Additional water required by the northern pipeline crossing More space between dock and the eastern edge of the departure from the slope
ITC 3	LR with stipulations	Ship sizes at ITC 3,4 and 6 are as per existing HPA rules. These were not evaluated in this research.
ITC 4	Barges	
ITC 5	Barges	
ITC 6	Barges (likely)	
ITC 7	Suezmax	Comparable to maneuvering from ITC 1. Suezmax vessels berthed at either ITC 7 or ITC 1 breast-out into the slip and initiate their outbound maneuver from approximately the same location, and thus are treated as departing from the same location.
MVP		
MVP 1	Suezmax	No issues as drawn, successful maneuver
MVP 2	Suezmax	No issues as drawn; ensure turning basin is maintained, outbound maneuver requires turning basin space.
GBT		
GBT 1	LR 750’ x 106’	
GBT 2	Aframax	Performed with BULK106B (750 x 106) at TX Deepwater 5 Plenty of room to perform the maneuver
GBT 3	LR 750’ x 106’	
GBT 4	Suezmax	Plenty of room to perform the maneuver while remaining inside the federal channel Not recommended to turn on right wheel towards the dock with a vessel of this size
GBT 5	LR 750’ x 106’	
TX Deepwater (TX-DPWTR)		
TX-DPWTR 1	Suezmax	No issues: plenty of water and plenty of room to maneuver in and out

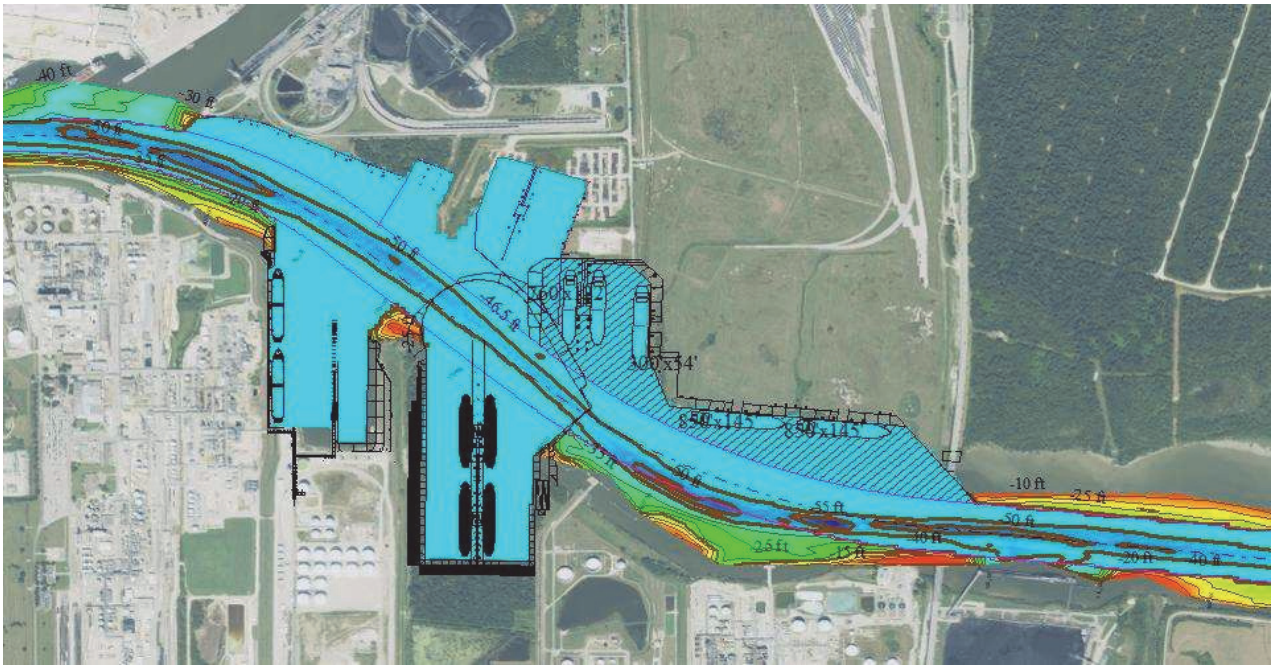
DRAFT

TX-DPWTR 2	Aframax	Concern for projection of the starboard quarter of the moored ship with respect to clearance to the proposed channel toe. Recommend moving channel away from Texas Deepwater to increase clearance with moored Aframax at TX-DPWTR#2
TX-DPWTR 3	Aframax	
TX-DPWTR 4	LR 760' x 122' (Beam may increase, discussions pending)	
TX-DPWTR 5	LR 760' x 125' (Beam may increase, discussions pending)	
Kinder Morgan Deepwater	Aframax	Recommended that the proposed channel be expanded completely on the north side to preserve existing distance between channel toe and KMD

DRAFT

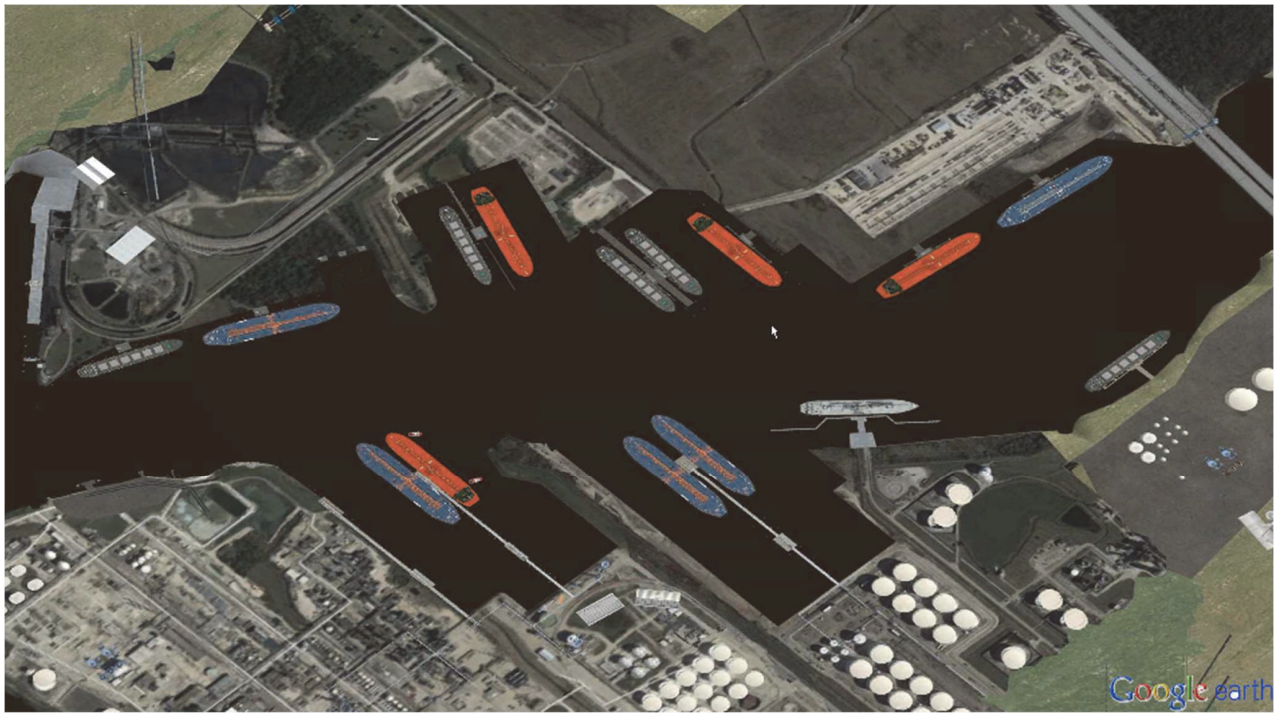
Proposed Berth Locations and Berth Numbers





DRAFT

Simulation Images



DRAFT

Vessel Pilot Cards

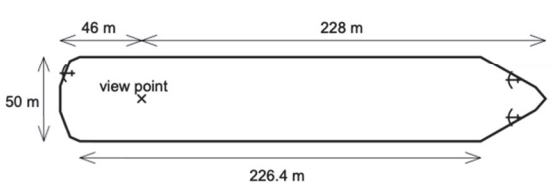
PILOT CARD

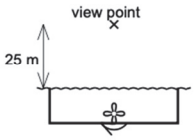
SUEZ156N
Version 0

Ship's name Suez 156 **Date** _____
Call Sign _____ **Deadweight** 147600 tonnes **Year built** _____
Draught aft 13.7 m / 44 ft 11 in **Forward** 12.7 m / 41 ft 8 in **Displacement** 170655 tonnes

SHIP'S PARTICULARS

Length overall 274 m **Anchor chain:** **Port** 12.0 shackles **Starboard** 12.0 shackles
Breadth 50 m **Stern** 12.0 shackles
Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 16857 kW (22920 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Speed (knots) Ballast
Full sea speed	**1**	91.6			15.7
Full Ahead	**0.8**	68.0			11.7
Half Ahead	**0.5**	52.0			8.8
Slow Ahead	**0.25**	35.0			5.8
Dead Slow Ahead	**0.125**	28.0			4.6
Dead Slow Astern	**-0.125**	-28.0			
Slow Astern	**-0.25**	-35.0			
Half Astern	**-0.5**	-52.0			
Full Astern	**-1**	-68.0			

Time limit astern _____ min:sec
Full ahead to full astern _____ min:sec
Max. No. of consecutive starts _____
Minimum RPM _____ _____ knots
Astern power _____ % ahead

DRAFT

PILOT CARD

TANK23B
Version 0

Ship's name Eagle Kangar

Call Sign 9V8472 **Deadweight** 107481 tonnes **Year built** 2010

Draught aft 8.573 m / 28 ft 2 in **Forward** 5.965 m / 19 ft 7 in **Displacement** 56442 tonnes

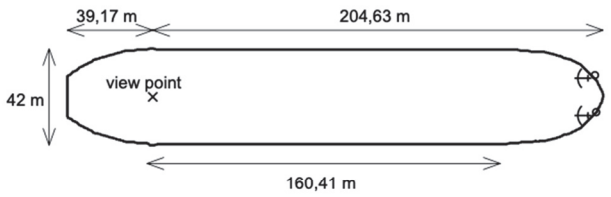
SHIP'S PARTICULARS

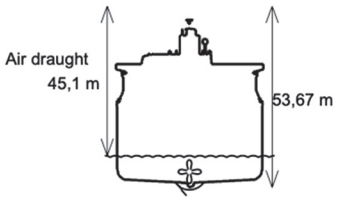
Length overall 243.8 m **Anchor chain:** **Port** 12.0 shackles **Starboard** 12.0 shackles

Breadth 42 m

Bulbous bow Yes

(1 shackle = 27,432 m = 15 fathoms)





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 14712 kW (20003 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots)	
				Loaded	Ballast
Full sea speed	**1**	101.0	N/A	N/A	16.2
Full Ahead	**0.8**	75.0	N/A	N/A	12.2
Half Ahead	**0.5**	62.0	N/A	N/A	10.1
Slow Ahead	**0.25**	42.0	N/A	N/A	6.9
Dead Slow Ahead	**0.125**	35.0	N/A	N/A	5.8
Dead Slow Astern	**-0.125**	-35.0	N/A		
Slow Astern	**-0.25**	-42.0	N/A		
Half Astern	**-0.5**	-62.0	N/A		
Full Astern	**-1**	-75.0	N/A		

DRAFT

PILOT CARD

MTKM107N
Version 5

Ship's name 107 K **Date** _____

Call Sign _____ **Deadweight** 107481 tonnes **Year built** _____

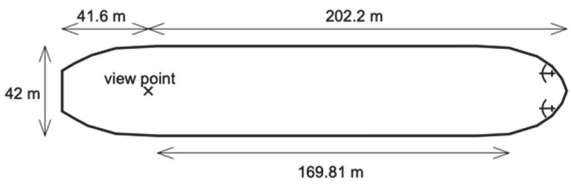
Draught aft 12.2 m / 40 ft 0 in **Forward** 12.2 m / 40 ft 0 in **Displacement** 99250 tonnes

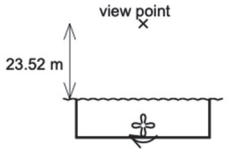
SHIP'S PARTICULARS

Length overall 243.8 m **Anchor chain:** **Port** 13.0 shackles **Starboard** 13.0 shackles

Breadth 42 m **Stern** _____ shackles

Bulbous bow Yes **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 13557 kW (18432 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots) Loaded	Ballast
Full sea speed	1	101.0		15.0	
Full Ahead	0.8	75.0		11.2	
Half Ahead	0.5	62.0		9.2	
Slow Ahead	0.25	42.0		6.2	
Dead Slow Ahead	0.125	35.0		5.1	
Dead Slow Astern	-0.125	-35.0			
Slow Astern	-0.25	-42.0			
Half Astern	-0.5	-62.0			
Full Astern	-1	-75.0			

Time limit astern _____ min:sec

Full ahead to full astern _____ min:sec

Max. No. of consecutive starts _____

Minimum RPM _____ _____ knots

Astern power _____ % ahead

DRAFT

PILOT CARD

MS 7505
Version 5

Ship's name THOR

Call Sign WDD 8608 **Deadweight** 189 tonnes **Year built:** 2007

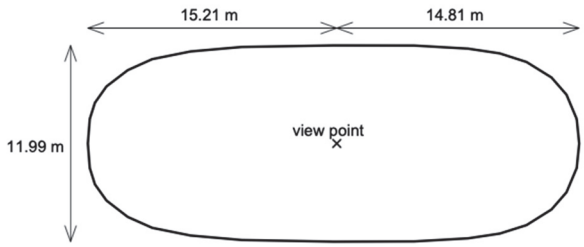
Draught aft 5.99 m / 19 ft 8 in **Forward** 5.85 m / 19 ft 2 in **Displacement** 733 tonnes

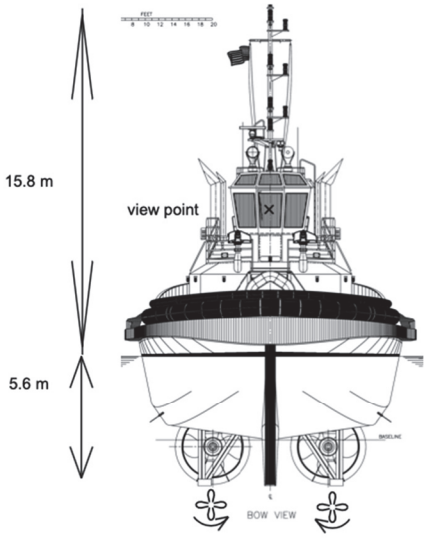
SHIP'S PARTICULARS

Length overall 30.02 m **Anchor chain:** **Port** N/A shackles **Starboard** N/A shackles

Breadth 11.99 m **Stern** N/A shackles

Bulbous bow No **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 4633 kW (6299 hp)

Manoeuvring engine order		RPM Shaft	RPM Engine	Speed (knots) Loaded	Ballast
Full speed	**1**	200.0	1800	12.2	12.2
Ahead	**0.8**	168.0	1500	10.5	10.5
Half Ahead	**0.5**	130.0	1200	8.7	8.7
Quarter Ahead	**0.25**	100.0	950	6.5	6.5
Slow Ahead	**0.125**	70.0	650	5.3	5.3

Time limit astern _____ min:sec

Full ahead to full astern _____ min:sec

Max. No. of consecutive starts N/A

Minimum RPM 1800 12.2 knots

Astern power 100 % ahead

DRAFT

PILOT CARD

MZ 7505
Version 5

Ship's name WESLEY A

Call Sign WDE 2433 **Deadweight** 189 tonnes **Year built:** 2007

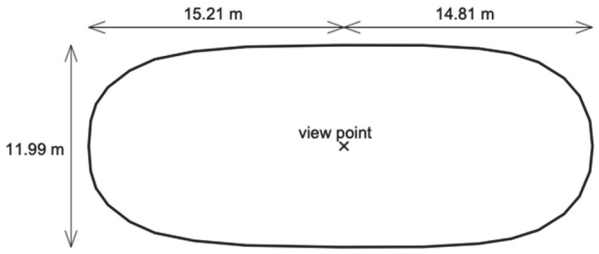
Draught aft 5.99 m / 19 ft 8 in **Forward** 5.85 m / 19 ft 2 in **Displacement** 733 tonnes

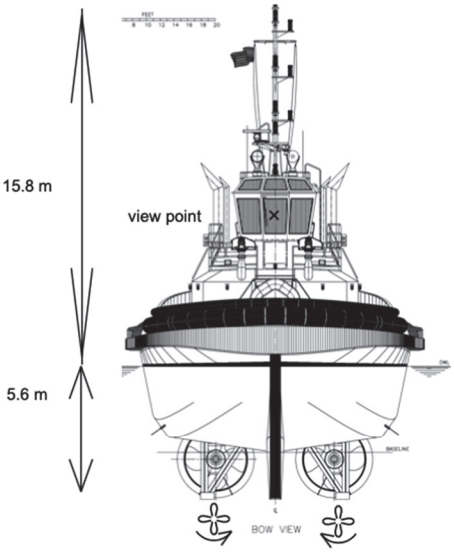
SHIP'S PARTICULARS

Length overall 30.02 m **Anchor chain:** **Port** N/A shackles **Starboard** N/A shackles

Breadth 11.99 m **Stern** N/A shackles

Bulbous bow No **(1 shackle = 27.432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 4633 kW (6299 hp)

Manoeuvring engine order		RPM Shaft	RPM Engine	Speed (knots) Loaded	Speed (knots) Ballast
Full speed	**1**	200.0	1800	12.2	12.2
Ahead	**0.8**	168.0	1500	10.5	10.5
Half Ahead	**0.5**	130.0	1200	8.7	8.7
Quarter Ahead	**0.25**	100.0	950	6.5	6.5
Slow Ahead	**0.125**	70.0	650	5.3	5.3

Time limit astern _____ min:sec

Full ahead to full astern _____ min:sec

Max. No. of consecutive starts N/A

Minimum RPM 1800 12.2 knots

Astern power 100 % ahead

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Simulation Run Matrix

	Run# Ship Model A	Tug Model A	Tug Model B	Current	Wind Dir / kn	Day/Night	Run Type / Setup	Project Comments
1	SUEZ156N	MZ7505	MS7505	N/A	N/A	Day	Undocking from ITC 1	Plenty of space for the stern and bow. Bow never went past the tow on the north side. Keep head way down and maneuver is doable. Minimal tug usuage during maneuver.
2	SUEZ156N	MZ7505	MS7505	N/A	N/A	Day	Undocking from ITC 2	Pilot felt the maneuver was very tight and unnatural to perform with little room for error. Bow tug felt he had plenty of water during mauenver. Stern tug felt it was tight by the bulkhead and had difficulty staying in safe waters.
3	SUEZ156N	MZ7505	MS7505	N/A	N/A	Day	Undocking from MVP 2	Concerned about water in port quarter for port tug but overall maneuver went well and felt doable. Tugs remained in design plan for space and felt things went smoothly.
4	SUEZ156N	MZ7505	MS7505	N/A	N/A	Day	Undocking from MVP 1	Plenty of room to perform the turn and no concern for space of tugs. Overall, pilot felt that it was a very safe maneuver.
5	SUEZ156N	MZ7505	MS7505	N/A	N/A	Day	Docking at GBT 4	The pilot felt that there was plenty of room to perform the maneuver. Note: Run stopped early due to system crash.
6	SUEZ156N	MZ7505	MS7505	N/A	N/A	Day	Docking at GBT 4	Slight challenge to get the ship to stop and go to stern because of draft but overall the maneuver was simple to perform. It was the pilots choice to use area outside of federal waterway for bow, the maneuver did not force this to occur.
7	SUEZ156N	MZ7505	MS7505	N/A	N/A	Day	Docking at GBT 4	Pilot feels there is plenty of room to turn but it was hard to get the head way on the ship to stop during maneuver. Right wheel turn into this dock is unconventional for a ship this size.
8	SUEZ156N	MZ7505	MS7505	N/A	N/A	Day	Docking at TX Deepwater 1	Successful maneuver. Distances to surrounding banks and vessels were comfrotable and easy to maintain.
9	SUEZ156N	MZ7505	MS7505	N/A	N/A	Day	Undocking at TX Deepwater 1	Very straight forward maneuver with plenty of water and plenty of room for the vessel.
10	TANK23B	MZ7505	MS7505	N/A	N/A	Day	Docking at GBT 2	Performed with BULK106B (750 x 106) at TX Deepwater 5. Pilot felt there was plenty of room to perform the maneuver and did not show concern with the vessel at TX 5.
11	MTKM107	MZ7505	MS7505	N/A	N/A	Day	Undocking at ITC 2	SUEZ stationed at GBT 4, located opposite from the departing berth. Pilot felt comforable and that there was more space to maneuver for the vessel and the tugs with an AFRA compared to a SUEZ.

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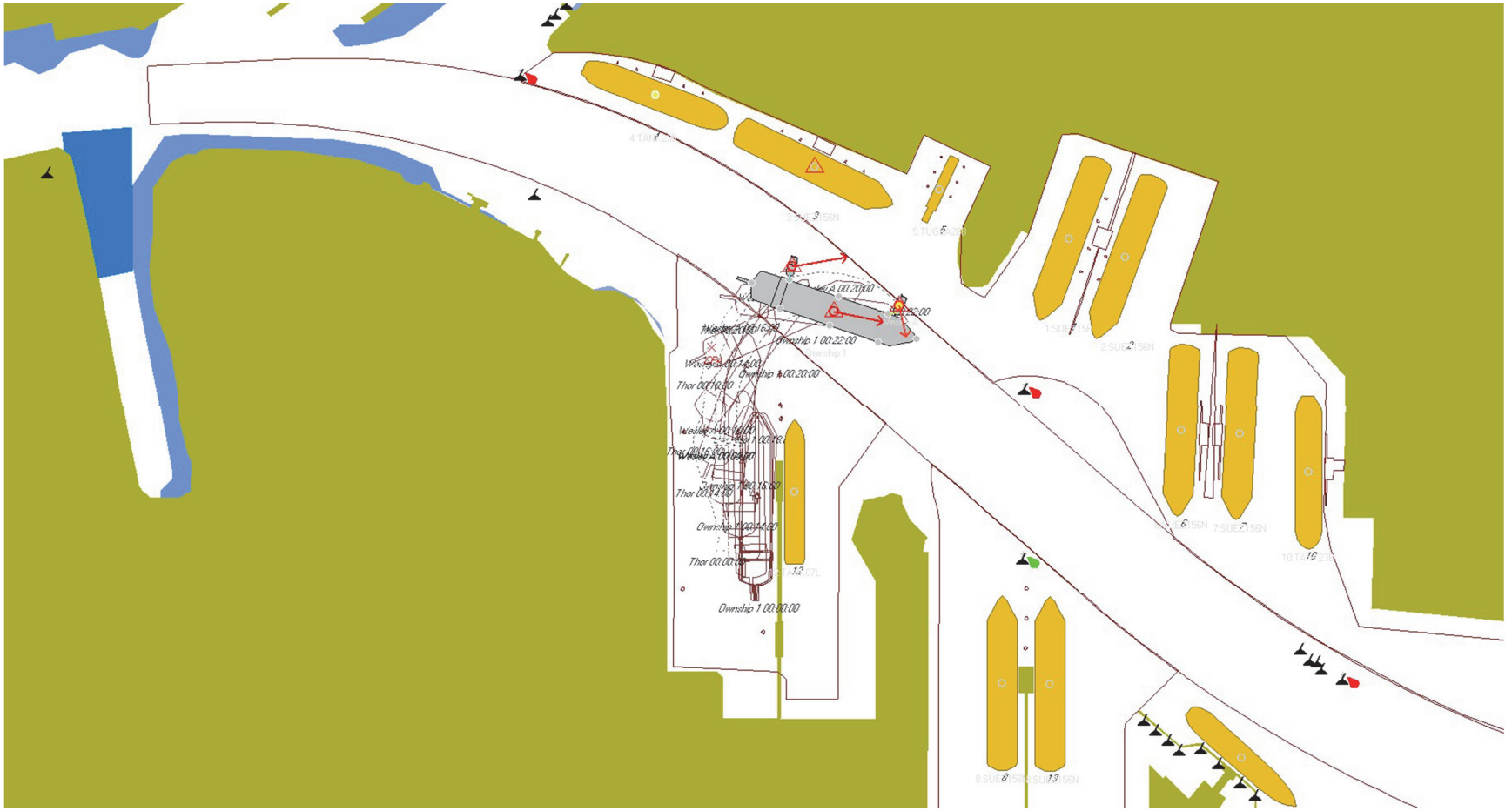
Simulation Screenshots

Run 1a: Undocking from ITC 1, Day Time, No Wind, No Current



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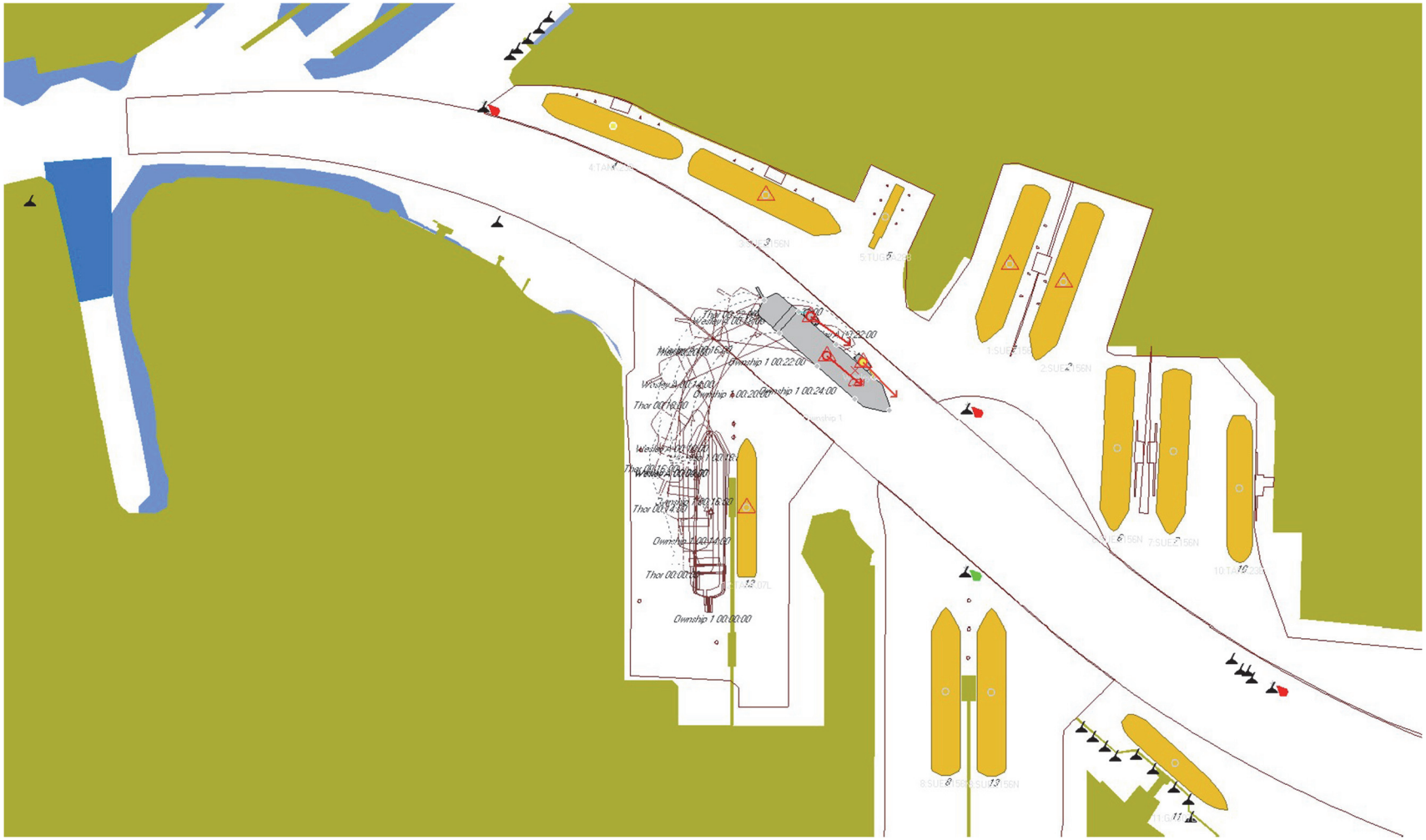
Run 1b: Undocking from ITC 1, Day Time, No Wind, No Current



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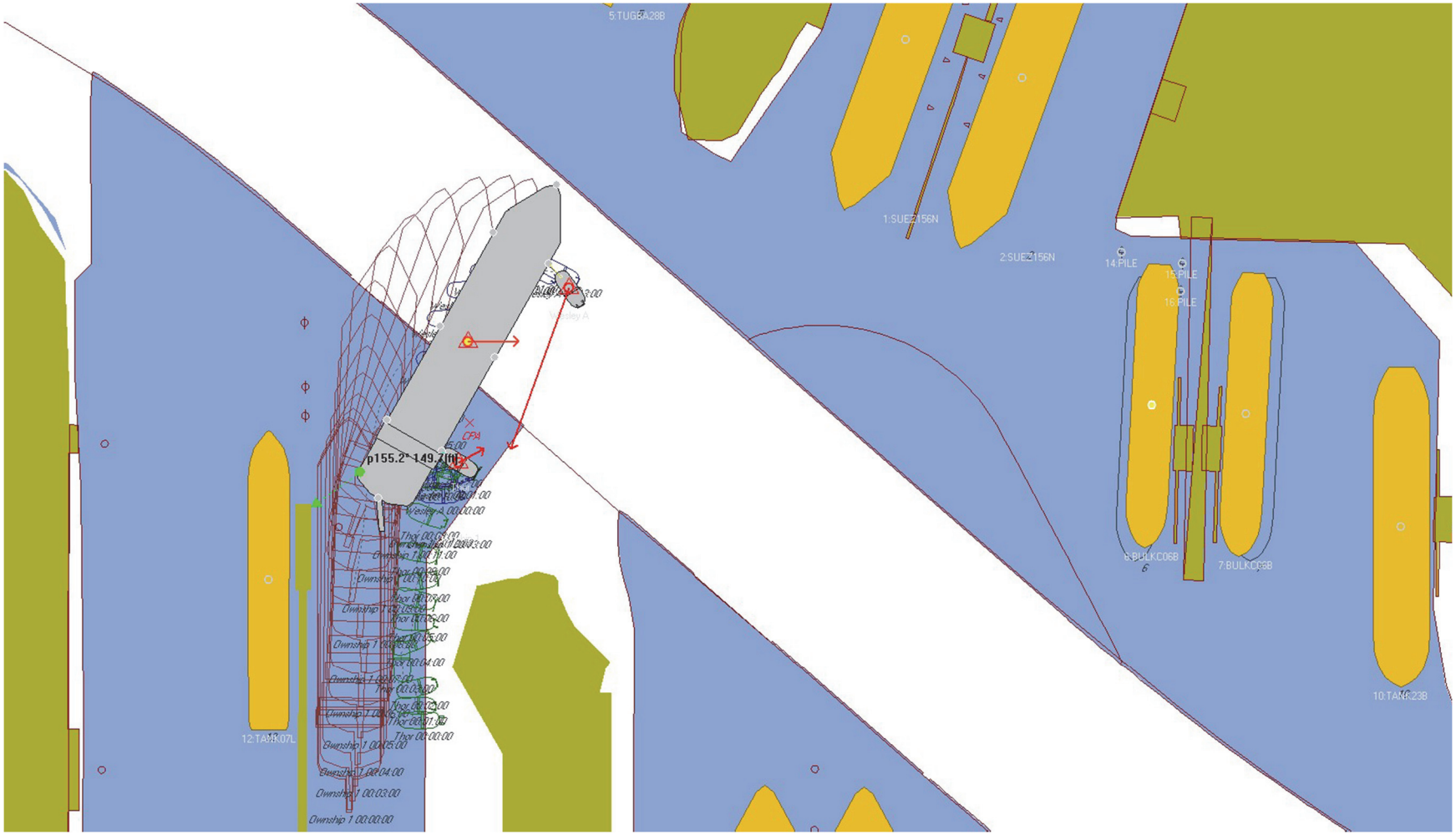
Run 2a: Undocking from ITC 2, Day Time, No Wind, No Current



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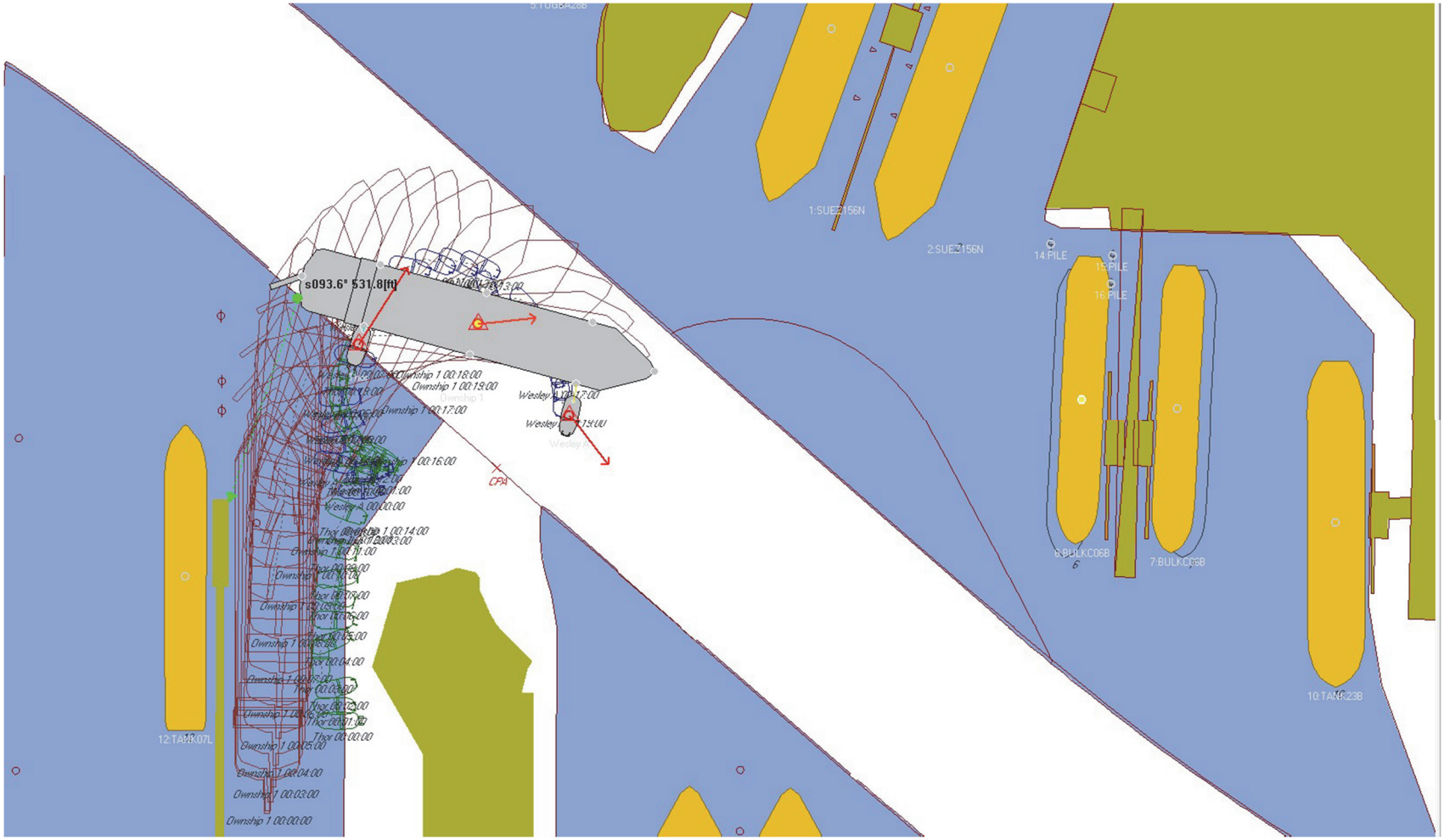
Run 2b: Undocking from ITC 2, Day Time, No Wind, No Current



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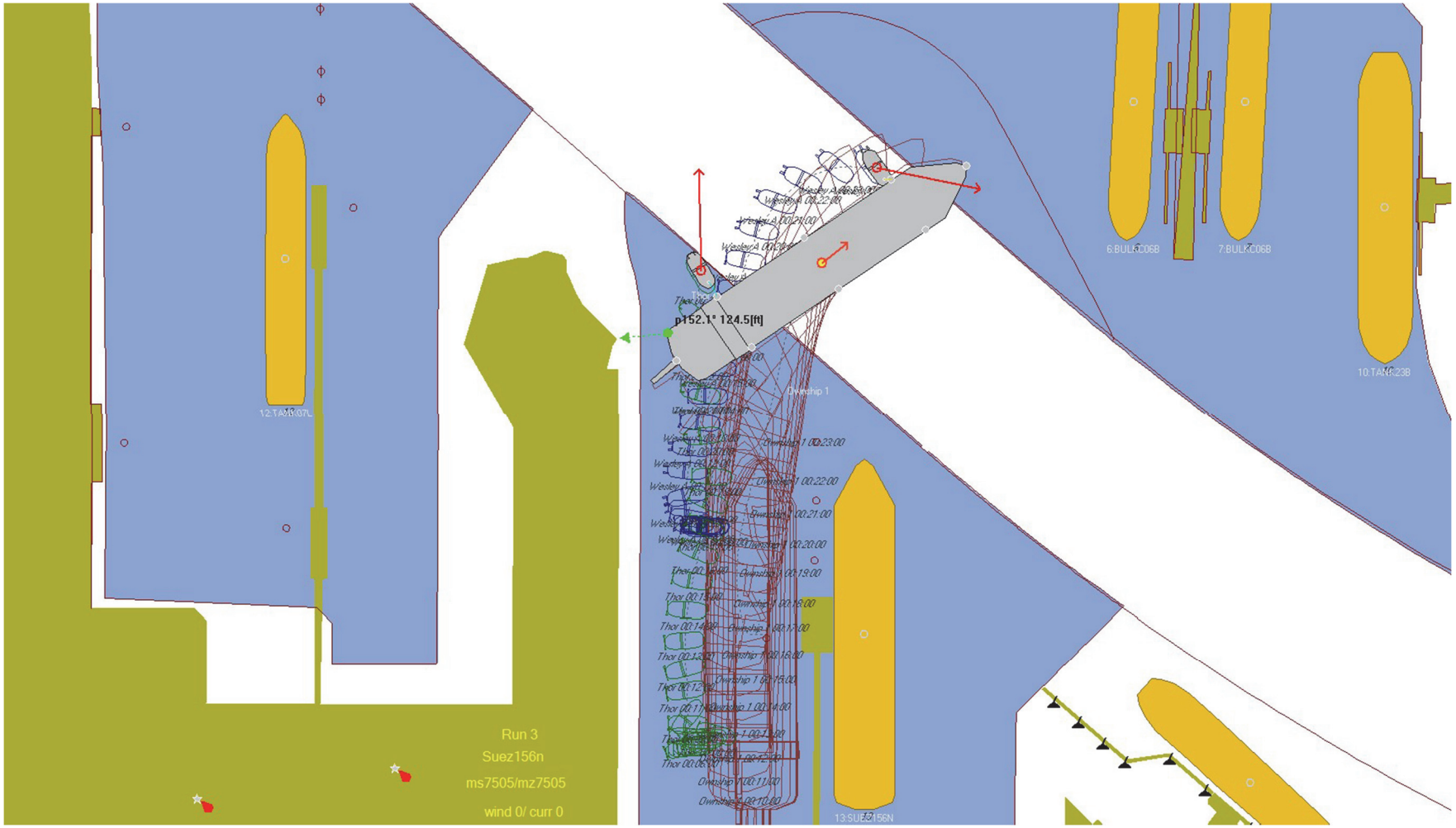
Run 3a: Undocking from MVP 2, Day Time, No Wind, No Current



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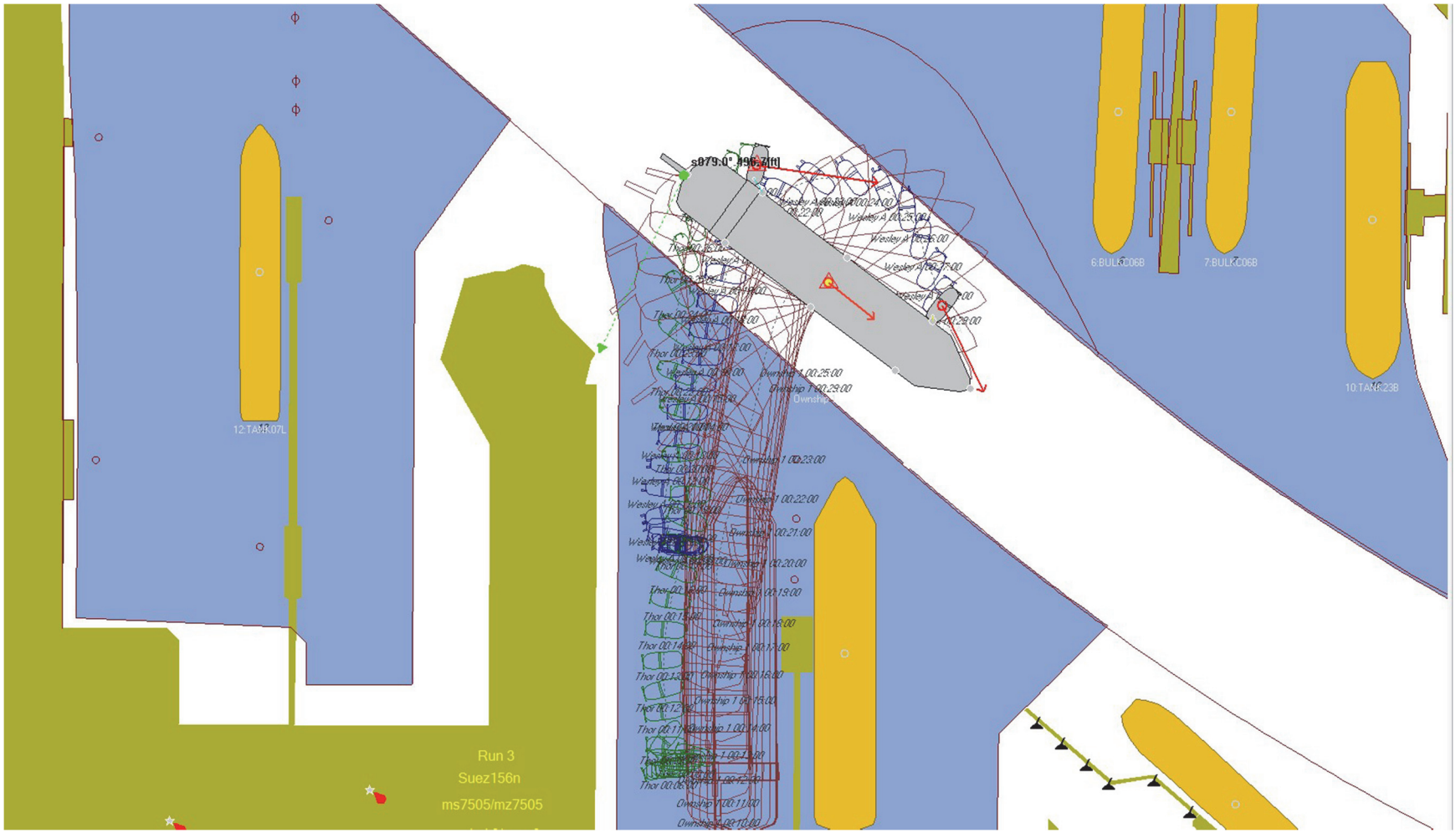
Run 3b: Undocking from MVP 2, Day Time, No Wind, No Current



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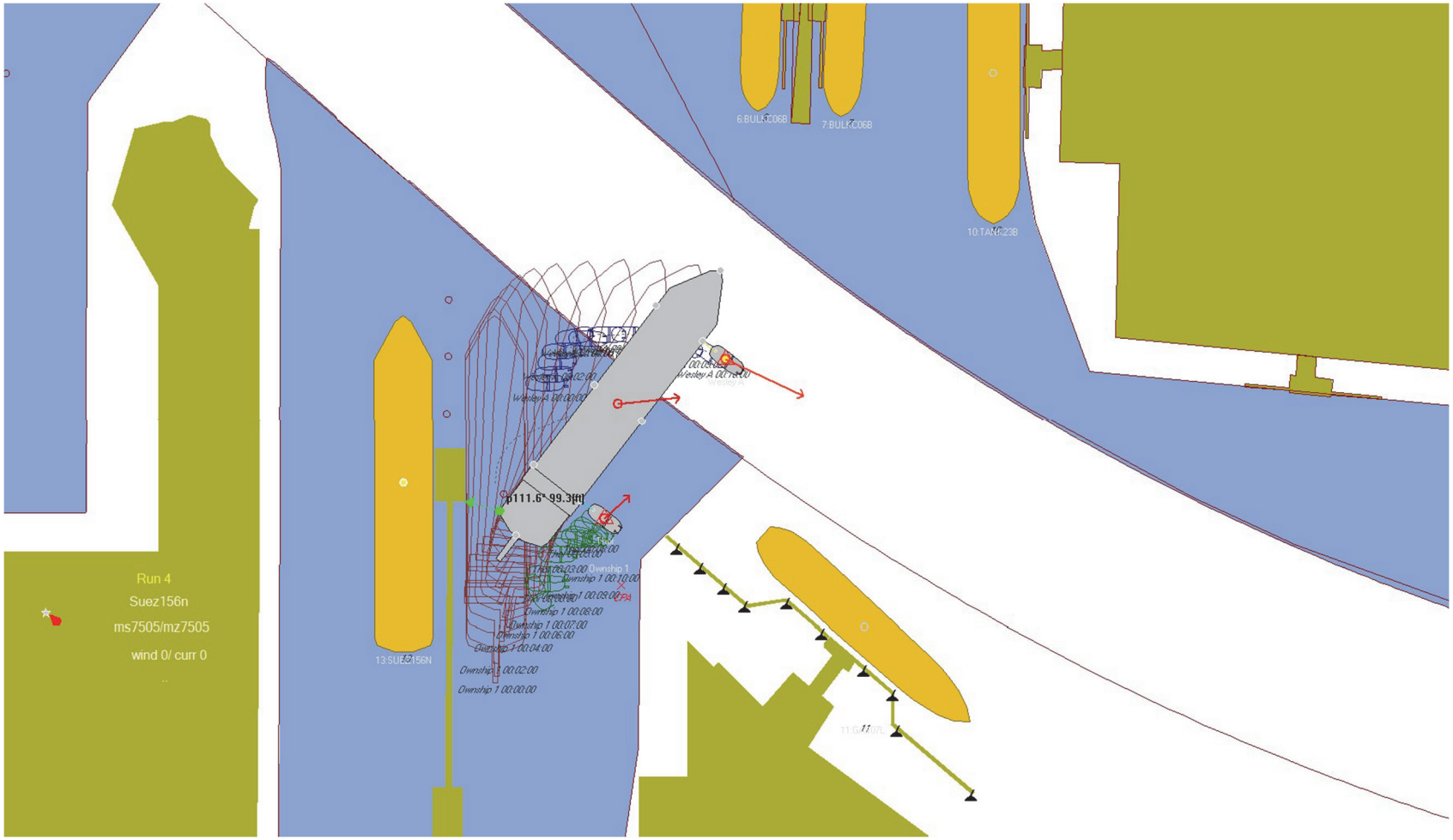
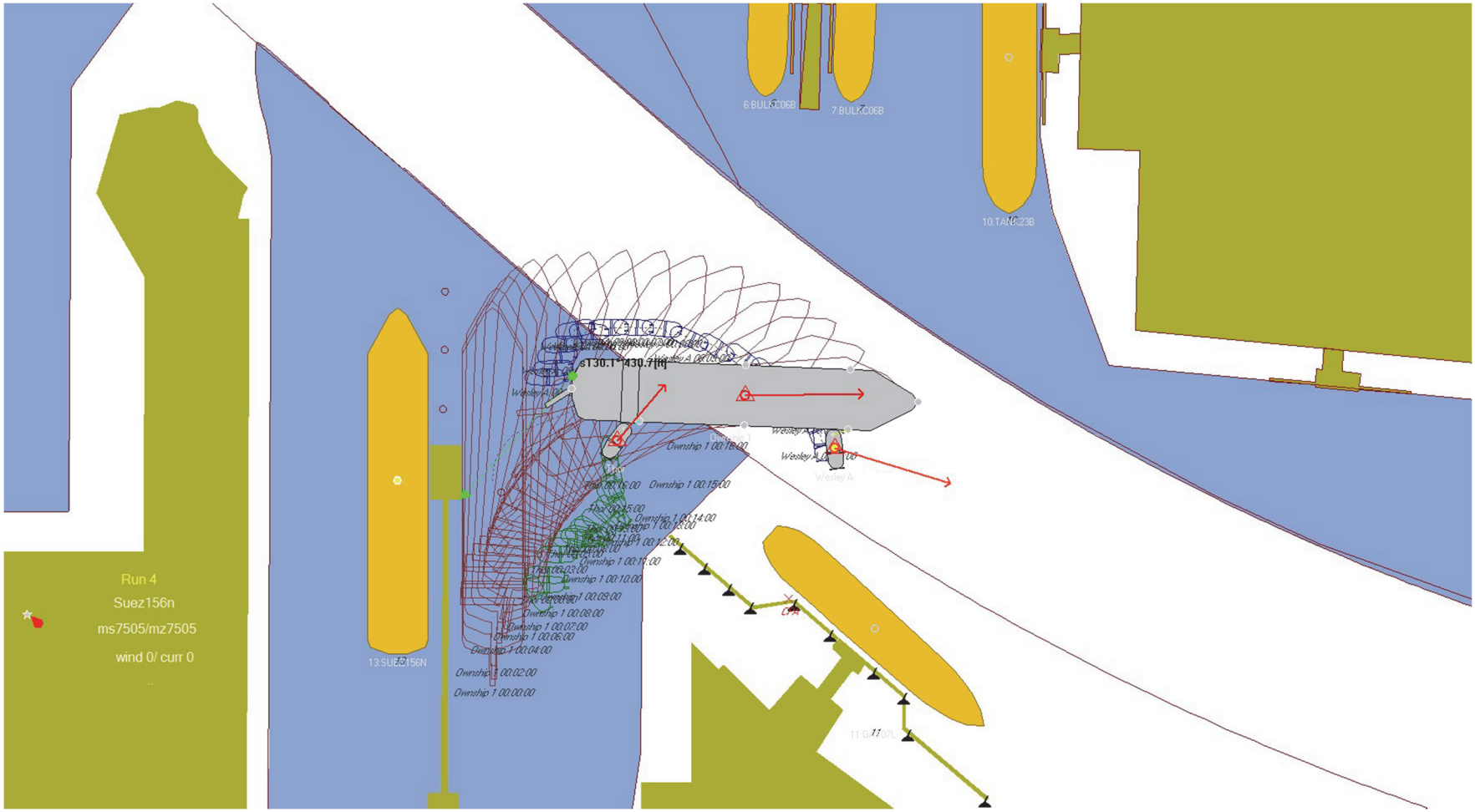
Run 4a: Undocking from MVP 1, Day Time, No Wind, No Current



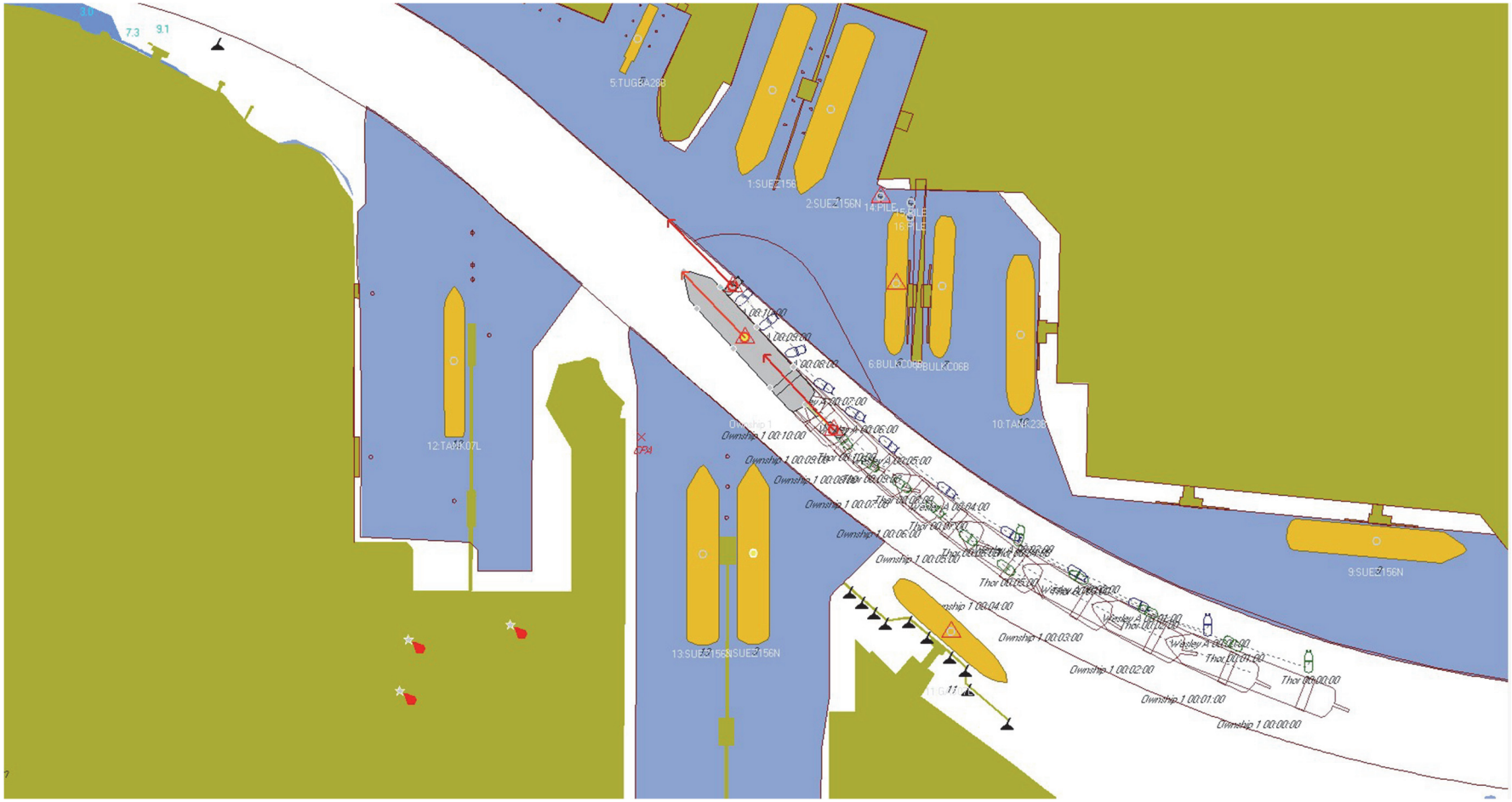
DRAFT

Run 4b: Undocking from MVP 1, Day Time, No Wind, No Current



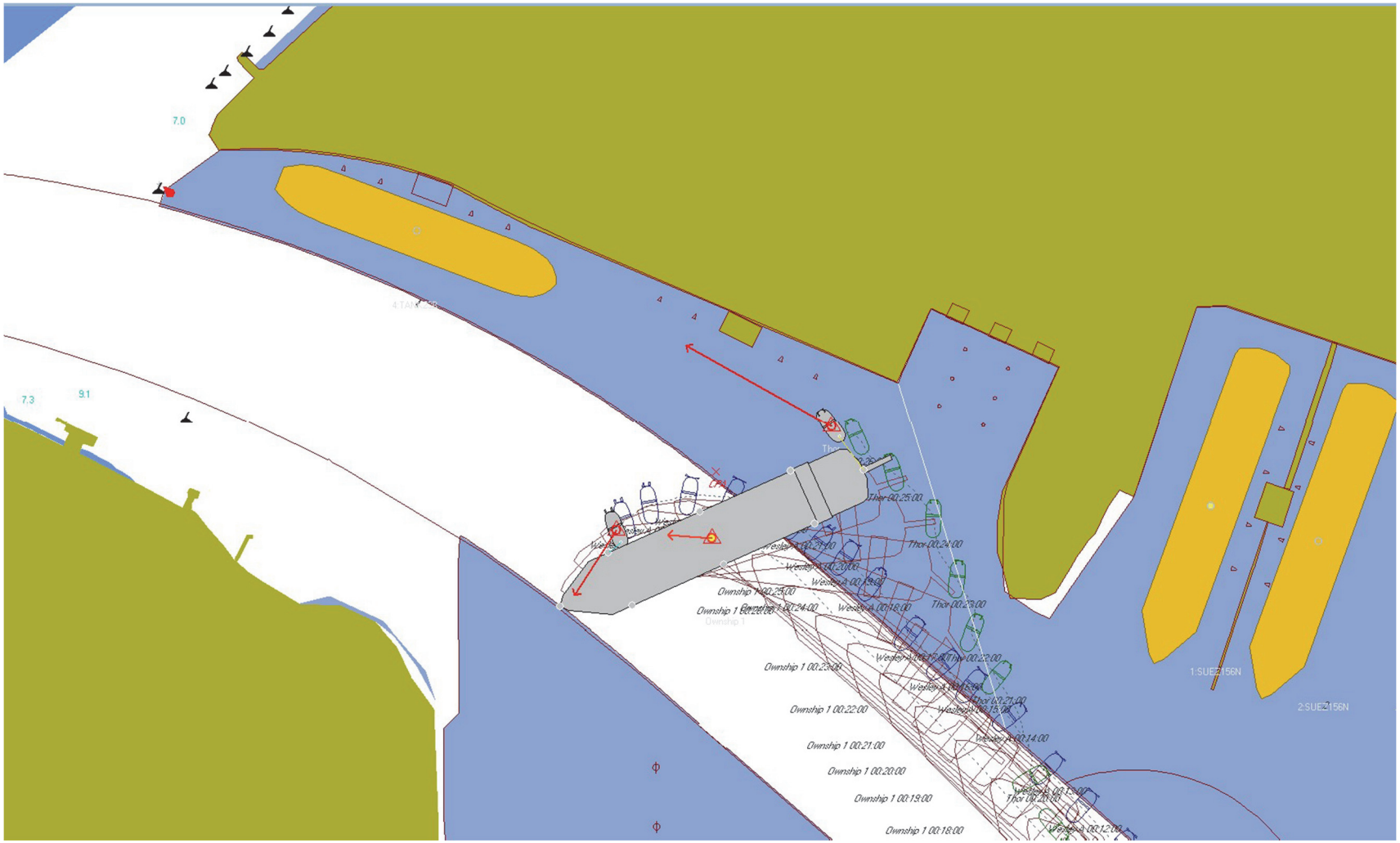
DRAFT

Run 5a: Docking at GBT 4, Day Time, No Wind, No Current



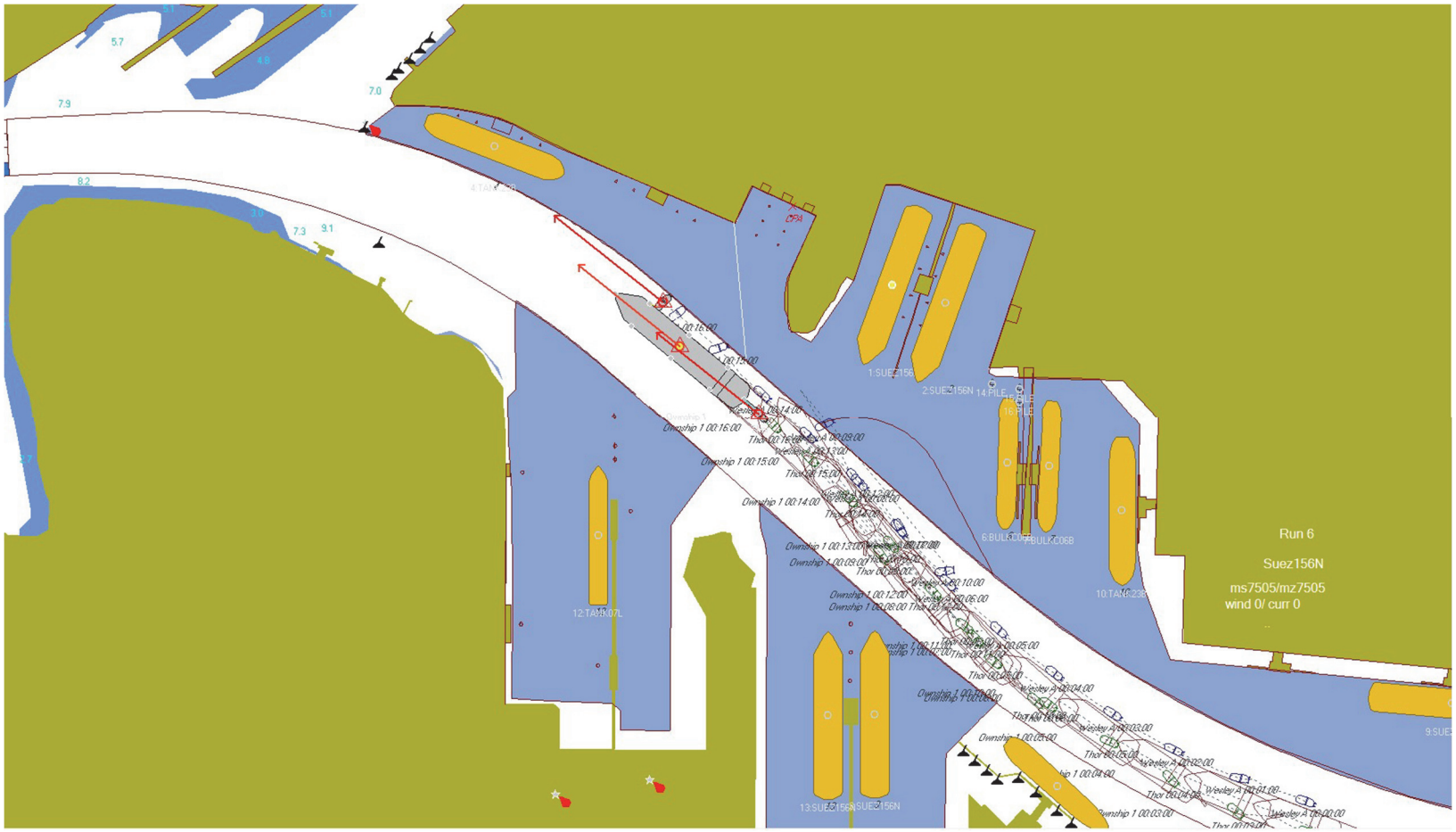
DRAFT

Run 5b: Docking at GBT 4, Day Time, No Wind, No Current



DRAFT

Run 6a: Docking at GBT 4, Day Time, No Wind, No Current



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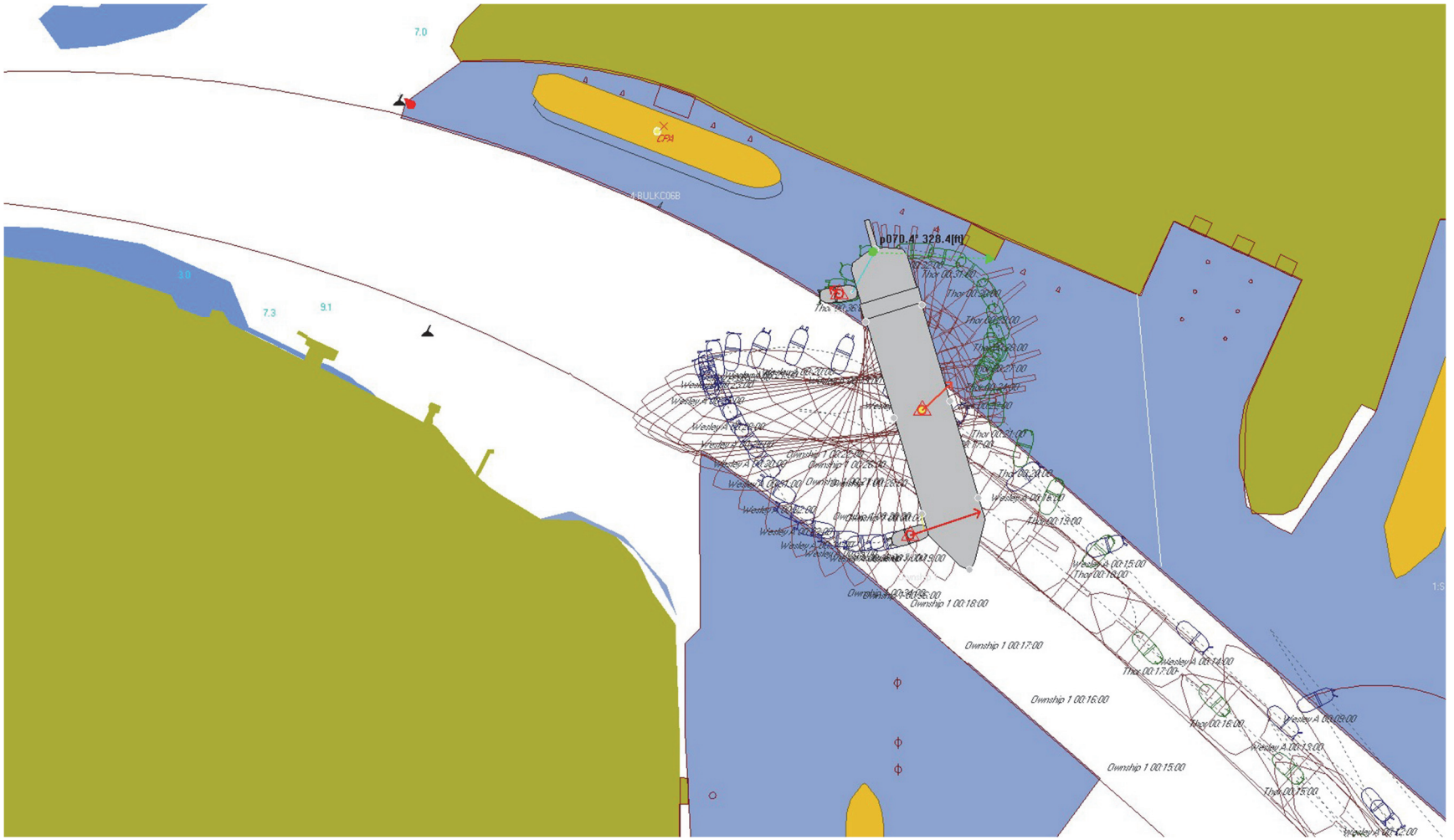
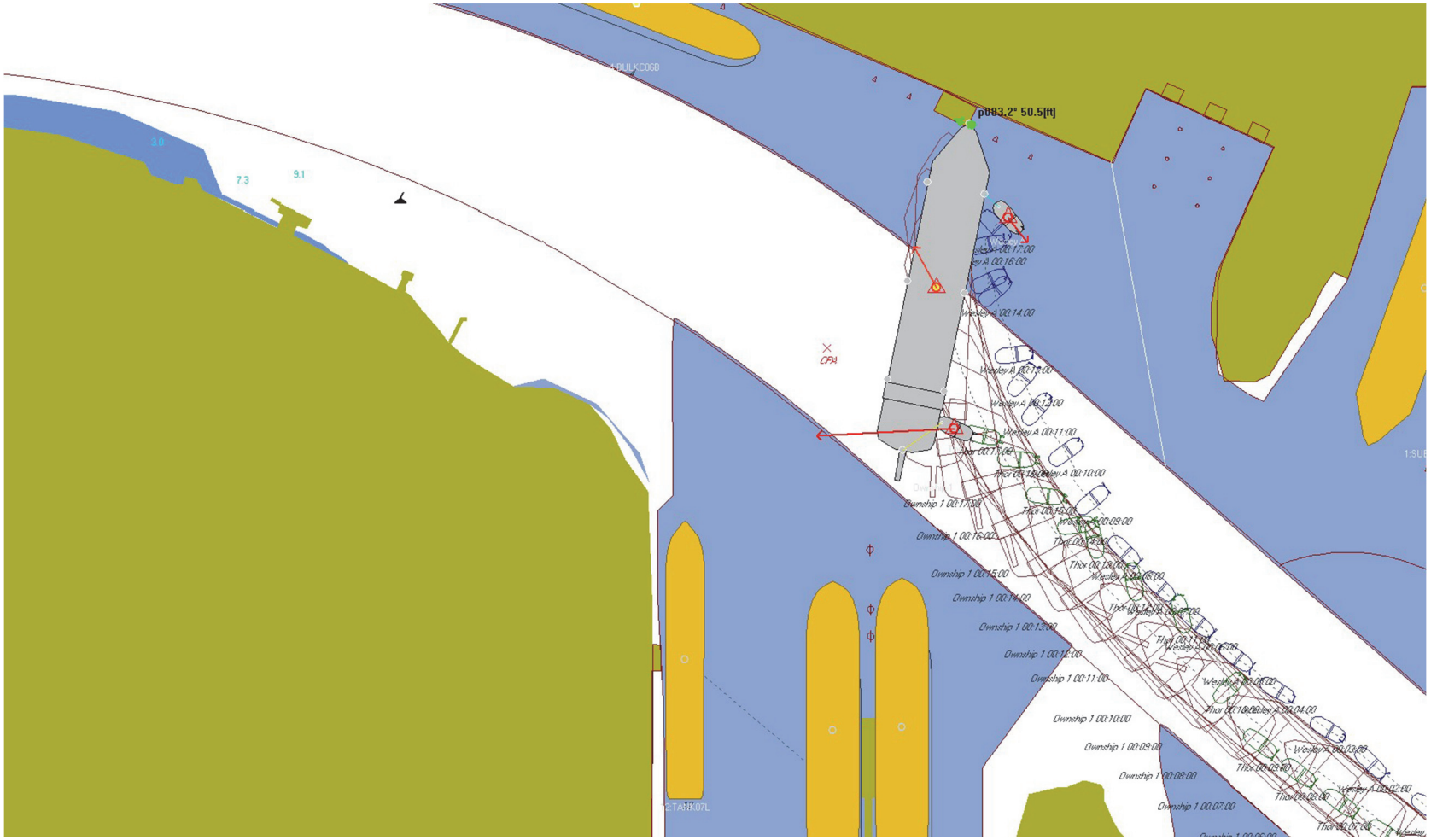
Run 6b: Docking at GBT 4, Day Time, No Wind, No Current



DRAFT

Run 7a: Docking at GBT 4, Day Time, No Wind, No Current



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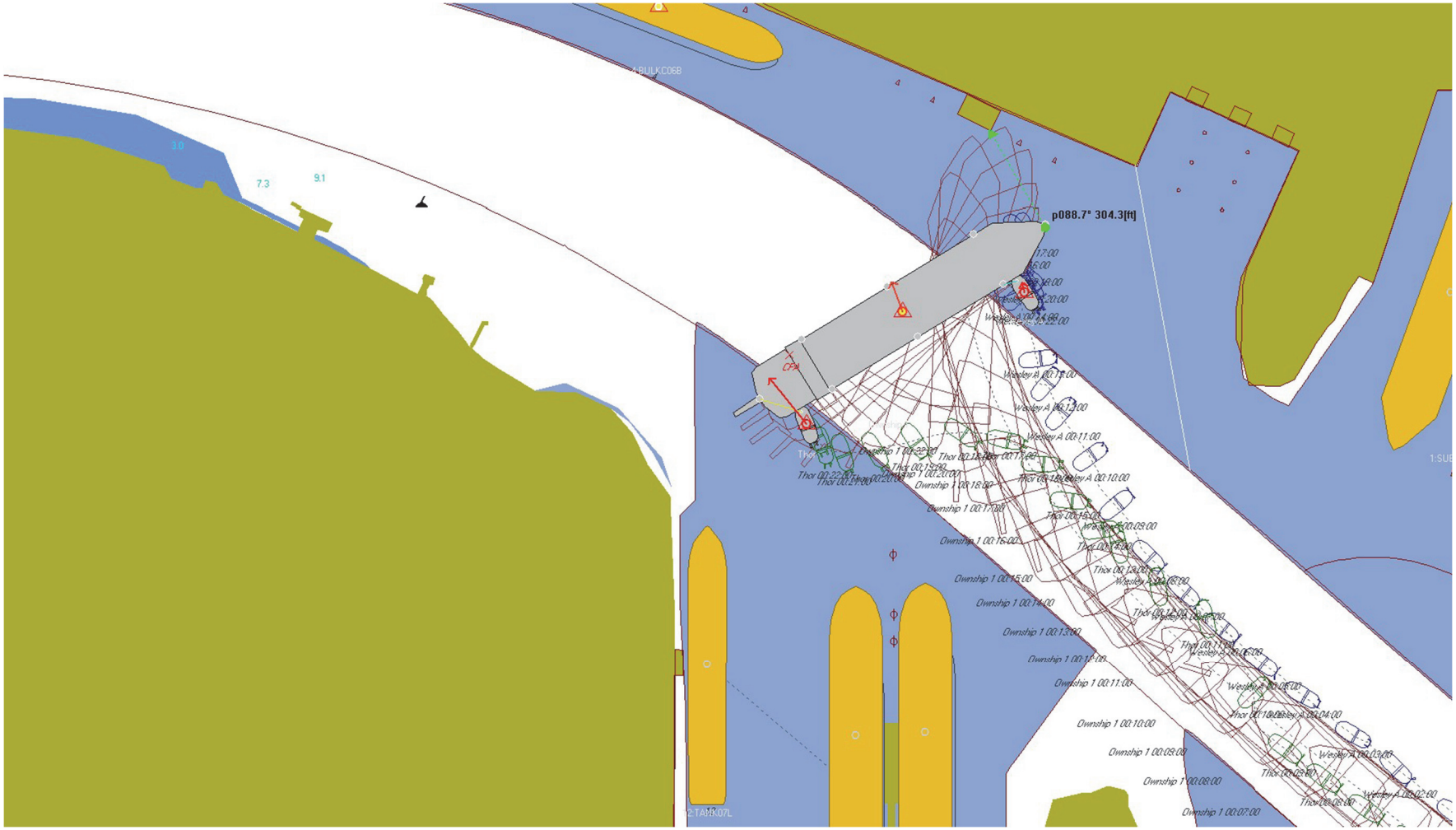
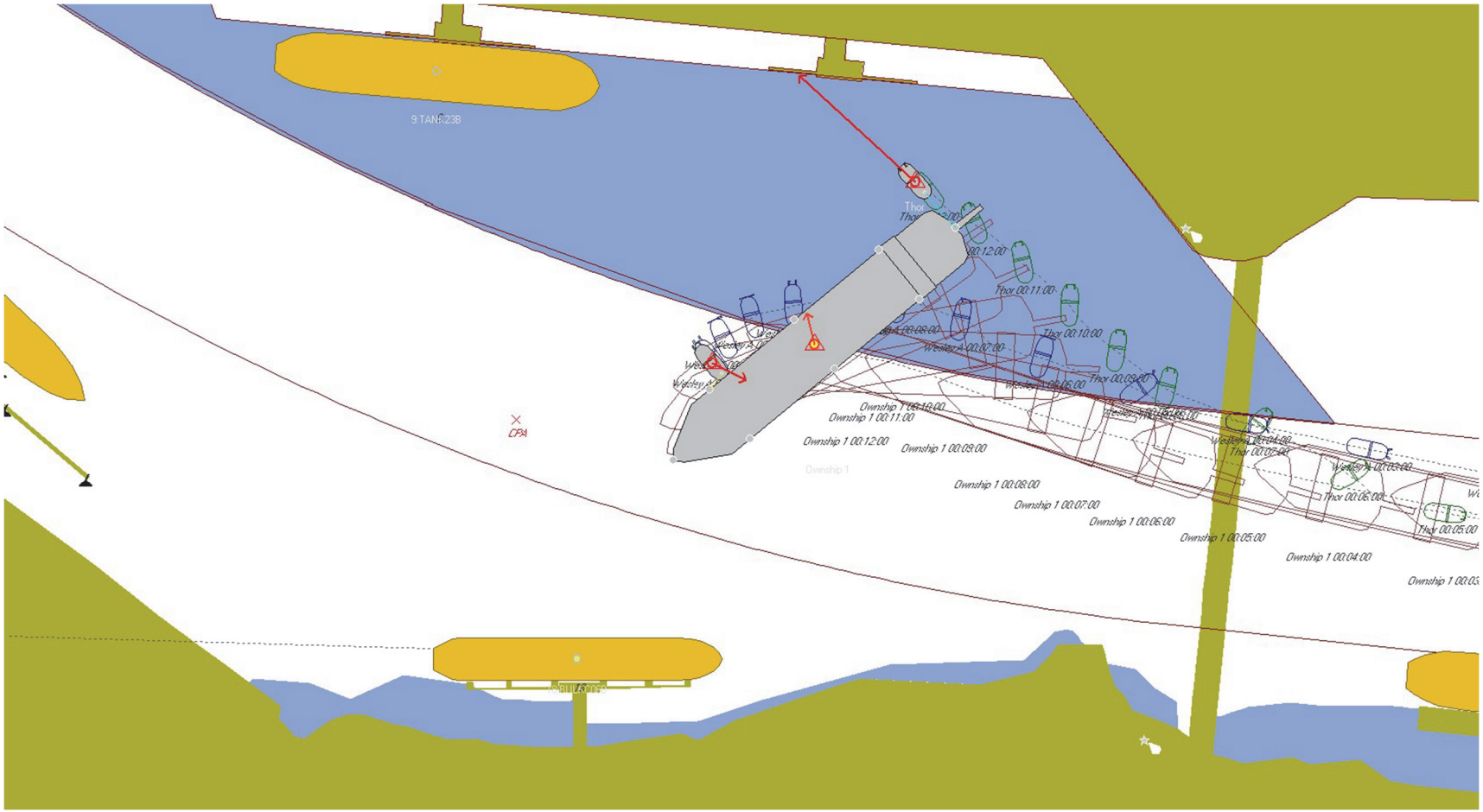
Run 7b: Docking at GBT 4, Day Time, No Wind, No Current



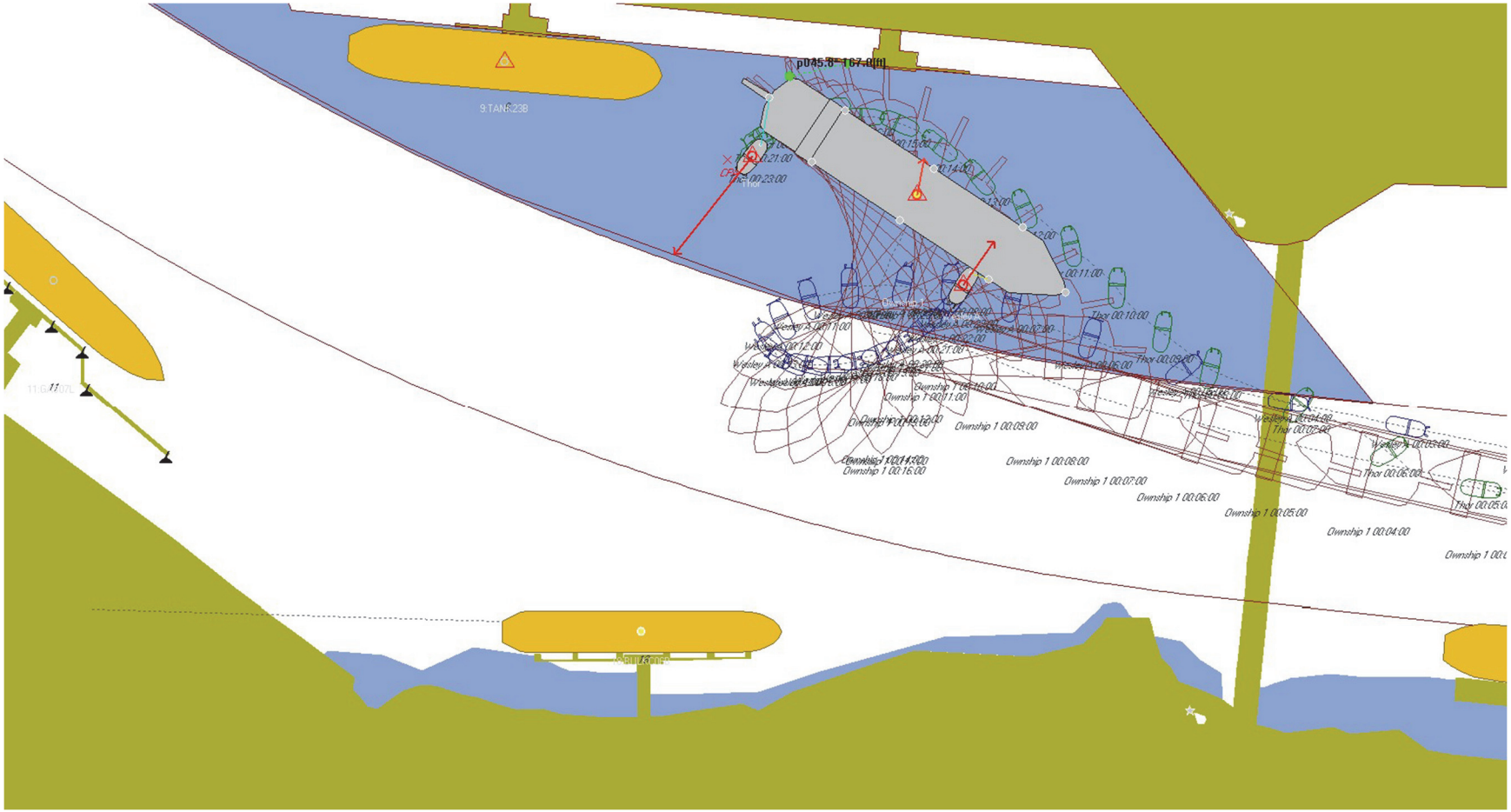
DRAFT

Run 8a: Docking at Texas Deepwater 1, Day Time, No Wind, No Current



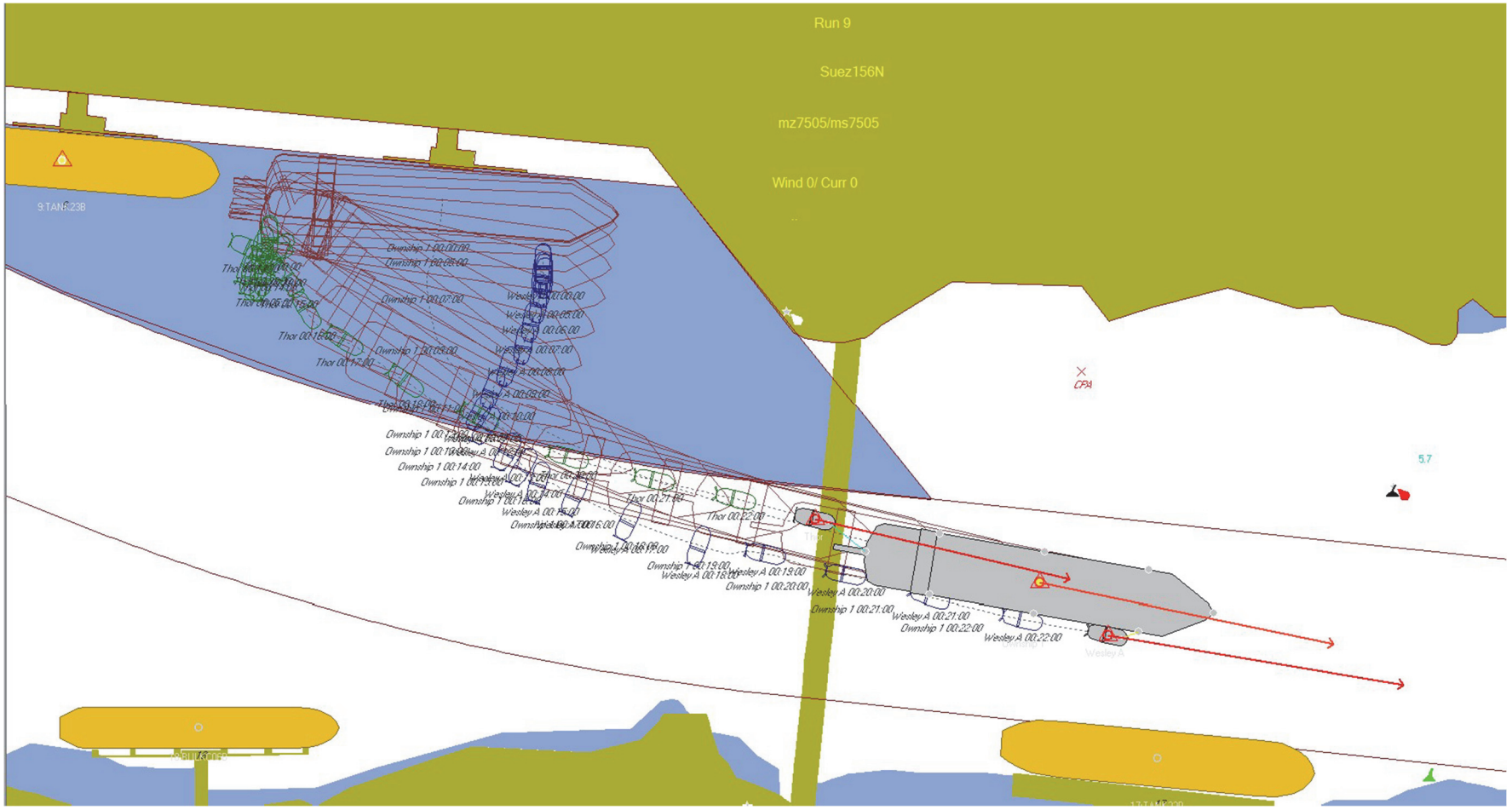
DRAFT

Run 8b: Docking at Texas Deepwater 1, Day Time, No Wind, No Current



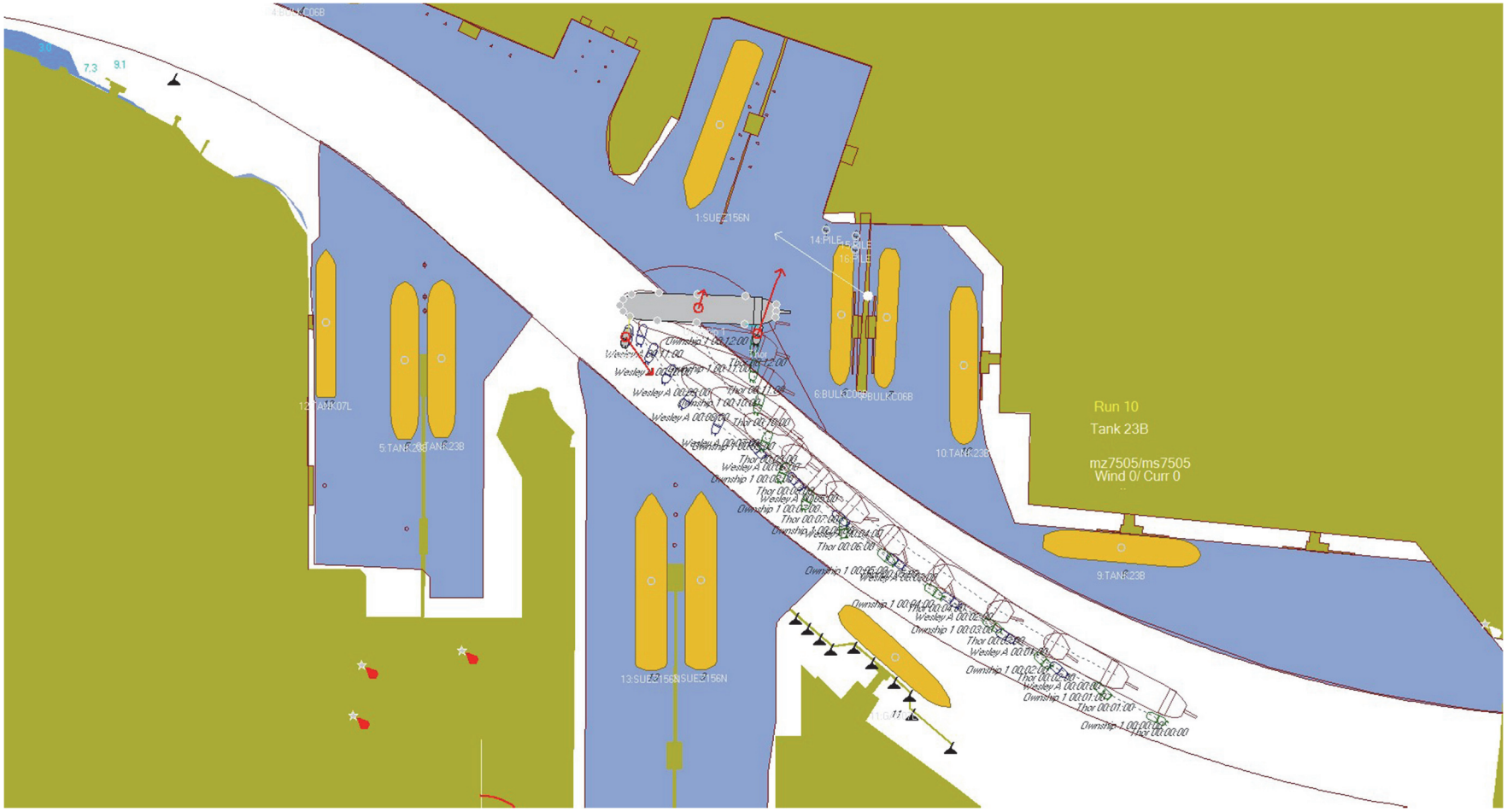
DRAFT

Run 9: Undocking at Texas Deepwater 1, Day Time, No Wind, No Current



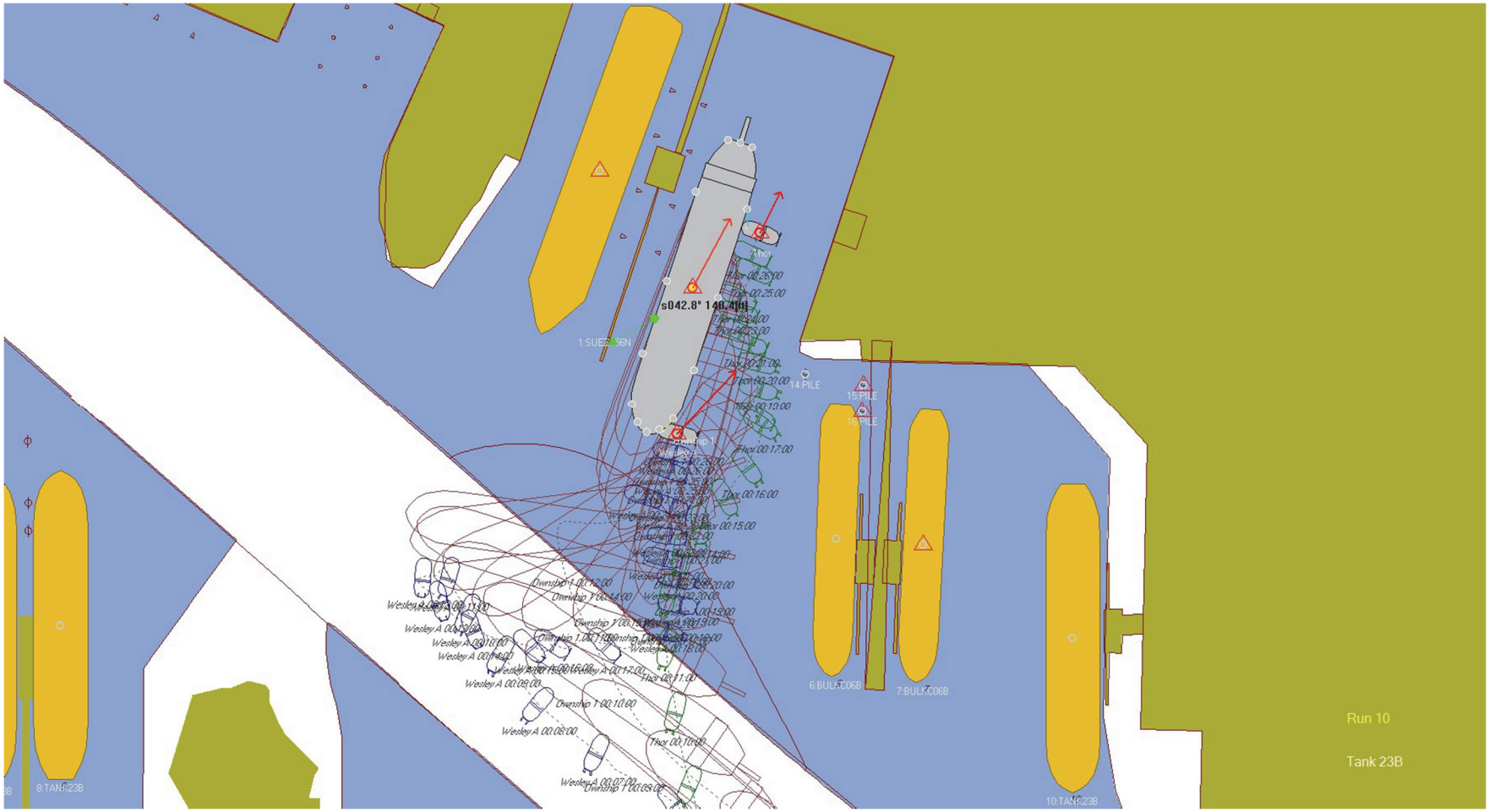
DRAFT

Run 10a: Docking at GBT 2, Day Time, No Wind, No Current



DRAFT

Run 10b: Docking at GBT 2, Day Time, No Wind, No Current



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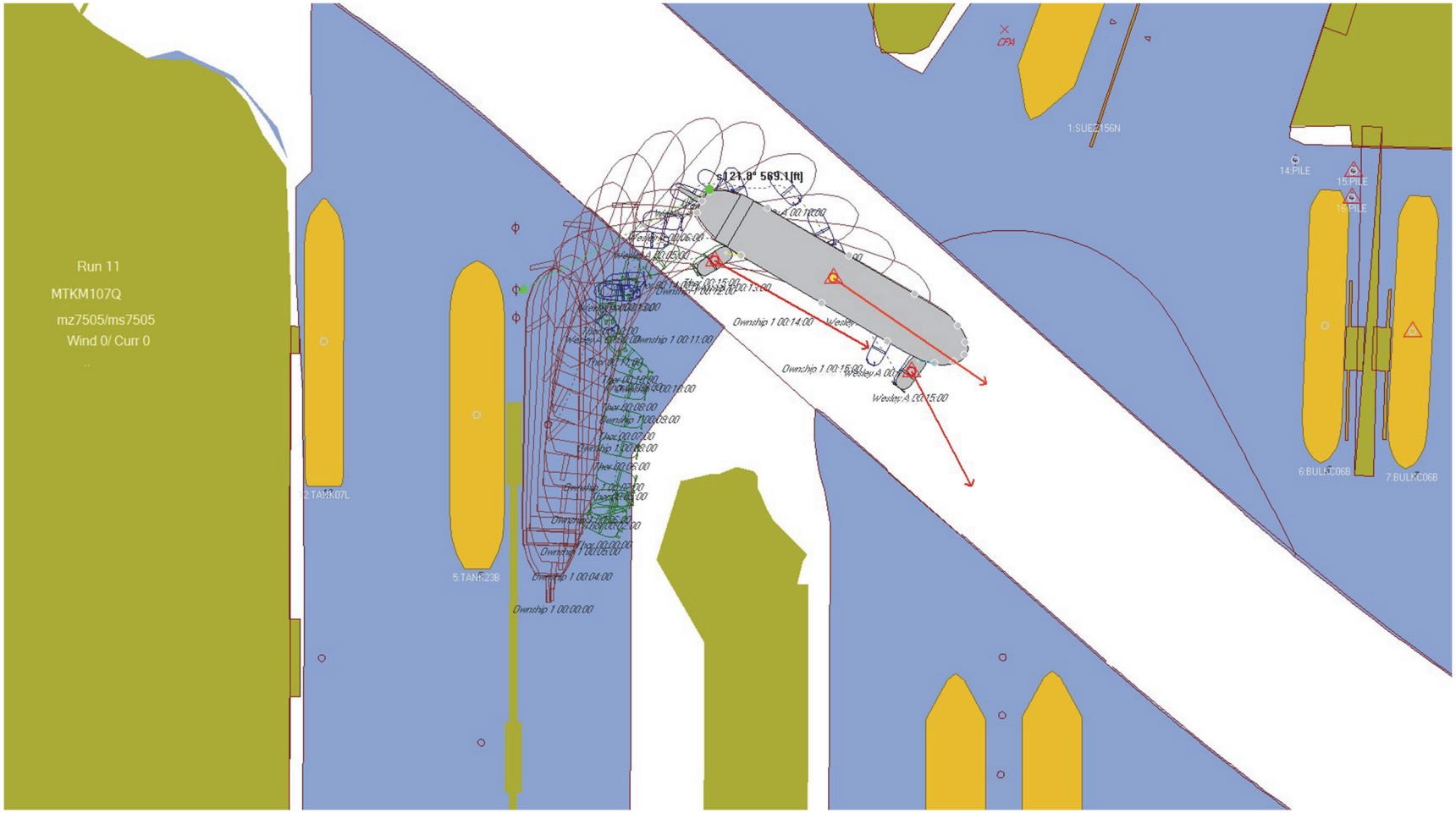
Run 11: Undocking at ITC 2, Day Time, No Wind, No Current



DRAFT

Run 11: Undocking at ITC 2, Day Time, No Wind, No Current

End of Report

LOCUS LLC: G. Burkley, A. Stauffer, 2020

Appendix L: Updates to Redfish Reach

Locus

Thursday, July 15, 2021

Dana Cheney
Gahagan & Bryant Associates, Inc.
9330 Kirby Drive
Suite 100
Houston, TX 77054

MEMORANDUM FOR RECORD

RE: Houston Ship Channel Expansion Improvement Project – Navigation Channel Improvement Project (HSC – ECIP) Channel Design Update at Redfish Bend

1. Introduction

Houston Ship Channel (HSC) Expansion Channel Improvement Project (ECIP) Feasibility Report (FR) and Environmental Impact Statement (EIS) have been completed and a Chief's Report was signed on April 23, 2020. The project was authorized in the Water Resources Development Act (WRDA) 2020. At the time the study was completed, the project began the Preconstruction Engineering Design (PED) phase. The U.S. Army Engineer Research and Development Center (ERDC), in collaboration with Waterway Simulation Technology, Inc. (WST), LOCUS LLC, the Houston Pilots, and G&H Towing, conducted ship simulations to more rigorously test the HSC ECIP FR EIS Recommended Plan channel dimensions in May and June of 2020. The results of those simulations can be found in Houston Ship Channel Expansion Improvement Project – Navigation Channel Improvement Project (HSC – ECIP), Ship Simulation Study, August 2020 (ERDC/CHL TR-XX). The results of the simulations indicated a safe channel 700-feet wide through Galveston Bay with 4 gated turns at 900 feet wide.

2. Problem

After and concurrent to simulation, pipelines along the channel were further investigated. Results of these investigations found that the Energy Transfer Corporation (ETC) pipeline (24-in Florida Gas Transmission Pipeline) located near the station 78+844 channel bend easing encroaches into the minimum required clearances of the improved channel template. Since the line is in service and could potentially take years to be relocated at a significant cost, structural and non-structural alternatives were generally evaluated. A brief summary of alternatives is as follows:

Structural Alternatives:

- Relocate the pipeline - This alternative could take up to 3 years to permit that would significantly delay the beginning of construction of the HSC ECIP with a cost of relocation ranging from $36 to $56 million.
- Relocate the channel – Several alternatives were explored but would require a total channel redesign as well as its mitigation because moving the bend would alter the channel azimuths

above and below the currently designed bend after the project had reached the 95% design. Additionally, this would require a new ship simulation study, and an updated EA. This process would delay the project up to a year and add an approximate $6M in redesign, simulation, and survey costs. Likely to change or increase oyster mitigation acreage and costs.

Non-Structural Alternatives:

- Alter only the bend on the southern green side to avoid the pipeline so that the channel template complies with the Department of the Army Regional General Permit (RGP) SWG-1998-02413 guidance (Section B, Part 2, a. as attached, signed 21 May 2020, effective 1 June 2020, expiring 31 December 2025).

The Houston Pilots were consulted aboutl the alternatives discussed above. The Pilots did not favor moving the bend that would also modify the azimuth of the channel that could also adjust the bends above and below the redfish bend. The pilots preferred a modified channel bend on the inside (green side) toe of the Redfish Bend.

After several surveys and consultation with ETC the pipeline was successfully located as documented in the Houston Ship Channel, Texas – Expansion Channel Improvement Project Task 015 – Pipeline Coordination, Segment 1 (HDR, 7/1/2021). By altering the PED simulated channel bend as shown on Figure 1 below, the problem can be solved at no cost. As discussed in Section 3, the 2020 simulations were reviewed and the Houston Pilots were consulted to determine if this channel design modification would be acceptable and ERDC staff were consulted to determine if additional simulation was necessary.

3. Review of New Channel Bend in Conjunction with Previous Simulation Runs

The purpose of this section is to clarify the ship plot diagrams and behavior of the vessels from the HSC ECIP 2020 simulation track plots versus the proposed new channel design for the Redfish area of the HSC.

As seen below in the illustration, the aggregate ship plots from the PED simulations show that several outbound ship positions came near the “red polygon” representing the proposed channel redesign, as noted inside the dashed white circle. For the purpose of this memo this area will be termed the Area of Interest. This analysis will identify the vessels in the noted ship plots and describe the situation which caused the ship to be near the Area of Interest. Run specifics and details are provided in the appendix Awhich is an extract from the larger Ship Simulation Report for the Redfish area.

Illustration: HSC ECIP 2020 Ship Simulation ship track plots overlayed on channel redesign “Area of Interest”

Locus

July 8, 2021

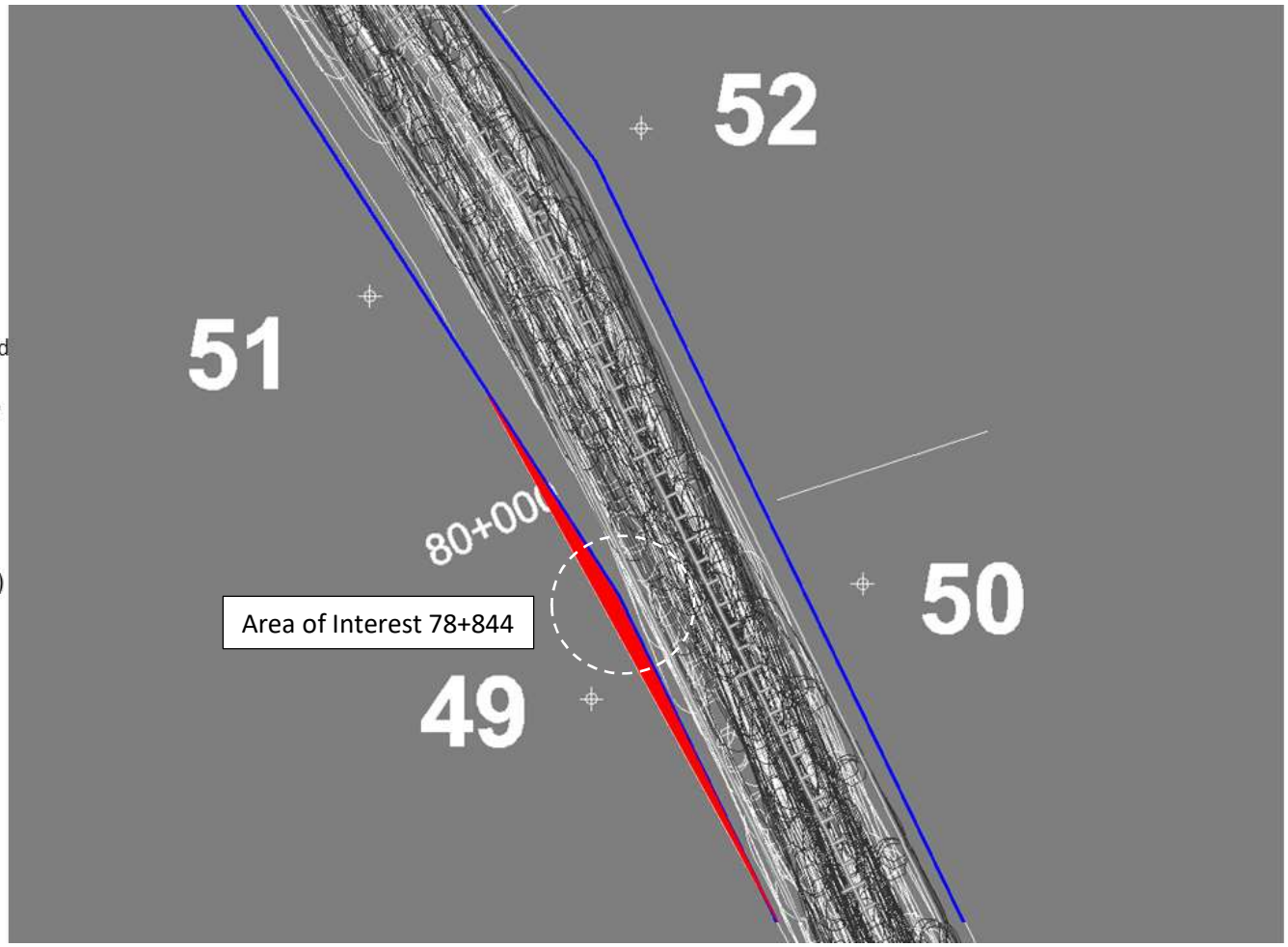
Illustration of Redfish Area 216 PED Channel Redesign

All 216 PED simulation runs overlayed

Red triangle is new channel design to accommodate a pipeline crossing between 49-51

Data sources:
Blue: New Modified Channel (JV)
Red: PED Ship Simulated Channel (JV)
Channel old (white) WST
Outbound ships (white) WST
Inbound ships (black) WST

Prepared by George B. Burkley, LOCUS LLC



Locus

Table of 216 Simulation Runs with Analysis

Note: All Runs are with an outbound Ultra Large Container Vessel (ULVC) meeting an inbound ULCV followed by a Suezmax class tanker

216 PED Run Number	Pilot Comments Abridged	Analysis Regarding Area of Interest	Current	Wind	Vessel Locations in the Area of Interest
Run 3, Plate 28	"Feels Right"	Vessels clear of area of interest	Ebb	North 20kn	All three vessel meetings were near the middle of the channel
Run 4, Plate 29	"Squeezed by inbound traffic"	Vessel was on the edge of the channel after the meet. All vessels passed clear of the area of interest.	Ebb	North 20kn	All three vessel meetings were near the middle of the channel. Outbound ULCV was near channel edge after the meet and south of the area of interest.
Run 5, Plate 30	"Difficult, made mistake in first meet which caused me to be wide (west) in the second."	All vessels clear of area of interest. Outbound ULCV near left descending bank south of redfish turn area.	Ebb	North 20kn	All three vessel meetings were near the middle of the channel. Second meeting was just below #49, south of the area of interest. All clear of area.
Run 65, Plate 31	Normal, used engine kick	Vessels clear of area of interest	Ebb	North 20kn	All three vessel meetings were near the middle of the channel.
Run 66, Plate 32	Ordinary, easy	Vessels clear of area of interest	Ebb	North 20kn	One meeting near area of interest, all vessels in the middle of channel, equidistant from each other
Run 125, Plate 33	Plenty of space, normal	Vessels clear of area of interest	Ebb	North 20kn	One meeting near area of interest, middle of channel, equidistant from each other
Run 6, Plate 34	Plenty of space, normal	Vessel stern near area of interest due to high angle of recovery back to center of channel after second meeting	Flood	SE 20kn	Vessels met above the area of interest, upon returning to the center of the channel, the outbound ULVC passed near the west edge of the channel, near the area of interest.
Run 12, Plate 35	Adequate space, normal	Vessels passed near area of interest	Flood	SE 20kn	During the second meet, the outbound ULCV passed near the area of interest.
Run 67, Plate 36	Adequate space, normal	Vessels clear of area of interest	Flood	SE 20kn	All vessels passed clear of the area in the middle of the channel

216 PED Run Number	Pilot Comments Abridged	Analysis Regarding Area of Interest	Current	Wind	Vessel Locations in the Area of Interest
Run 68, Plate 37	Adequate space, normal	Vessels clear of area of interest	Flood	SE 20kn	All vessels passed clear of the area in the middle of the channel
Run 126, Plate 38	Adequate space, normal	Vessels clear of area of interest	Flood	SE 20kn	All vessels passed clear of the area in the middle of the channel

Analysis

In three of the eleven runs completed for the HSC ECIP PED simulations, the outbound Ultra-Large Container Vessel (ULCV) came close to the Area of Interest in the redesigned channel.

- In the first instance in Run 4, Plate 29, the ULCV was reported "squeezed" by the first inbound ship and thus was "wide" prior to the second meeting. This caused the ship to be nearer the west edge of the channel.
- In the second instance, in Run 5, Plate 30, the pilot made an error in the meet with the first vessel which caused his ship to be "wide" in the second meeting.
- In the third instance, Run 6, Plate 34, the pilot made an aggressive turn back to the middle of the channel which cause the stern of the ship to sweep nearer to the west bank.
- In all cases the simulations were successful.
- In no instance of the 11 simulations conducted for this area did a ship depart from the channel confines, nor did any of the ship plots run over the new, redesigned channel layout.
- Changes to the channel in this location would move the position of the bank towards the channel. Accordingly, the bank effect upon passing ships would be encountered earlier than at the bank area above and below this location. Pilots transiting the area would consider this a shallow "point" and would likely not run as far west in this widened part of the channel.
- It is important to note that this bank change is in a widened part of the channel, along the shallow turn angle of the inside of the redfish turn. Most vessels transiting the area will use the space of the center and/or tending towards the outside of the channel in the turn, naturally staying clear of this shallow point.

Conclusion

In conclusion, none of the ship plots from the 216 PED runs crossed over into the proposed redesign channel area. It is important to recognize that the ship pilots were required to meet in this location, with the largest ships possible for the channel, given two-way traffic. Many pilots participating in the HSC ECIP PED simulations reported in the group debriefs:

1. Pilots would generally avoid meeting in this area, preferring to meet in the symmetrical straight channel areas as opposed to the asymmetrical Redfish turn widener.
2. They agreed these simulations were a "worst case scenario", given the large vessels and forced location of the meets.
3. They noted that, despite the circumstances of the location and vessel sizes, nearly all of the simulation runs were classified as "easy" and as having "plenty of room".

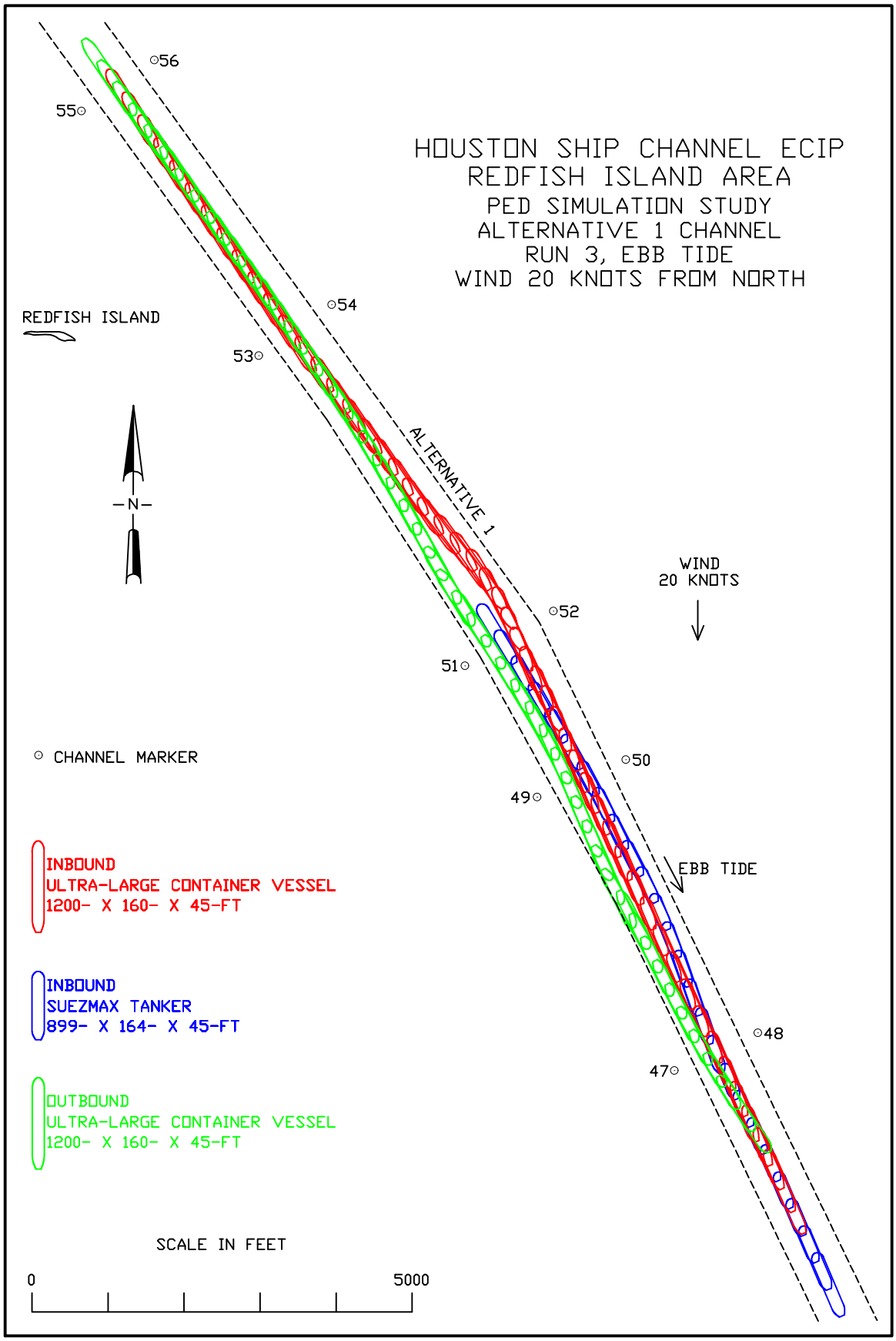
The Houston pilots, after review of this data, report that there is available space to meet ships of this size further East of this shallow area in the redesign. Noting this information, including a review of the track plots and proposed new channel design, the Houston Pilots have written a letter stating they have no issue with the redesigned channel and do not feel it is necessary to re-simulate the area of interest. This letter is attached as Appendix B. This review of the simulation data concurs with the opinion of the Pilots.

Details and plots are available in the attached appendix extracted from the HSC ECIP 216 PED Ship Simulation Report.

Respectfully,

George B. Burkley, LOCUS LLC

Redfish (Buoys 51-52)


HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 3, EBB TIDE
WIND 20 KNOTS FROM NORTH
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
ALTERNATIVE 1
N
WIND
20 KNOTS
EBB TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
SCALE IN FEET
0
5000

Run **3**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 5/15/2020
Start Time 1005
End Time 1025
Plan RF-A1
Current Ebb
Tide (m) 1
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*MULCV14N	45.0/13.7	146/10	55-56
Inbound	MULCV14N	45.0/13.7	337/10	45-46
Inbound	SUEZ156R	44.1/13.7	336/10	41-42

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*MULCV14N	A	70	282	0	260
Inbound	MULCV14N	B	162			
Inbound	SUEZ156R	E			144	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Outbound	Normal	Yes	Plenty of room.	Yes	Yes	Yes	Yes	Feels right visibly but pilot notes that the screens do not seem accurate.
B	Inbound	Normal	Yes	Plenty of room and distances from bank and passing vessel.	Yes	Yes			Channel has plenty of room for manuevering.
E	Inbound	Normal	Yes	Vessel size in the wider channel made it safe.			Yes	Yes	

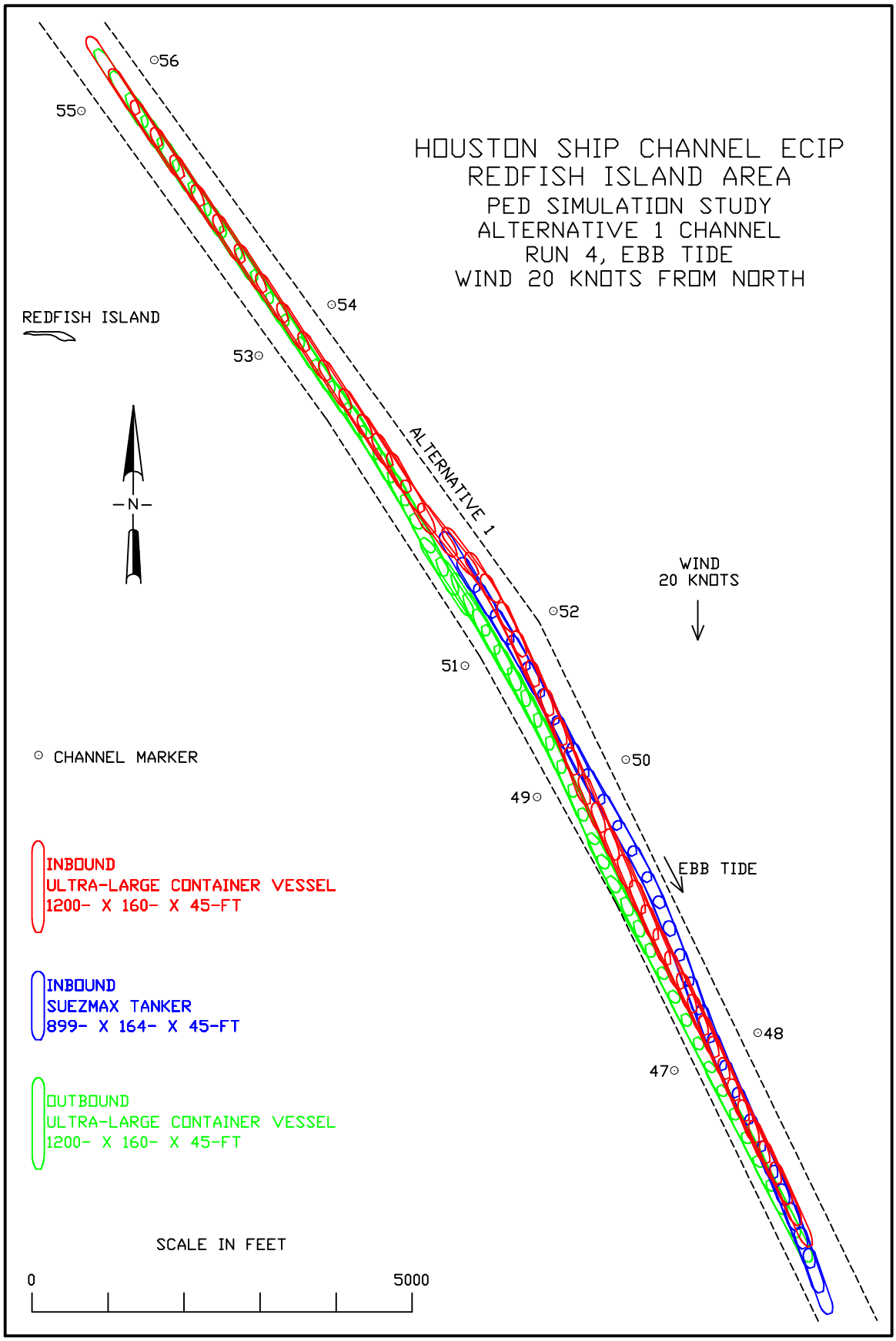

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 4, EBB TIDE
WIND 20 KNOTS FROM NORTH
REDFISH ISLAND
56
55
54
53
52
51
50
49
48
47
ALTERNATIVE 1
N
WIND
20 KNOTS
EBB TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
SCALE IN FEET
0
5000

PLATE 29

Run **4**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 5/15/2020
Start Time 1045
End Time 1100
Plan RF-A1
Current Ebb
Tide (m) 1
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*MULCV14N	45.0/13.7	146/10	55-56
Inbound	MULCV14N	45.0/13.7	337/10	45-46
Inbound	SUEZ156R	44.1/13.7	336/10	41-42

Run Comments
Pilots state "even with a big mistake the channel space allows for the manuever to happen".

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*MULCV14N	A	129	190	0	241
Inbound	MULCV14N	E	185			
Inbound	SUEZ156R	B			89	

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Outbound	Normal	Yes	Realiistic. Vessels were squeezed because of the space.	Yes	Yes	Yes	Yes	Wind and tide affected recovery. Recovery from first meet was controlable but tough because of being squeezed by the other vessel. Time allowed to recover but pilot did not completely anuever vessel back to center line after first meet.
E	Inbound	Difficult	Yes	With the wider channel this would be ok.	Yes	Yes			Pilot said the meet was more difficult because of the location and being forced to meet in the bend. The vessel handled well and there was enough room to manuever once comfortable.
B	Inbound	Normal	Yes	Plenty of room in channel.			Yes	Yes	Channel size is adequate and meeting location was good.

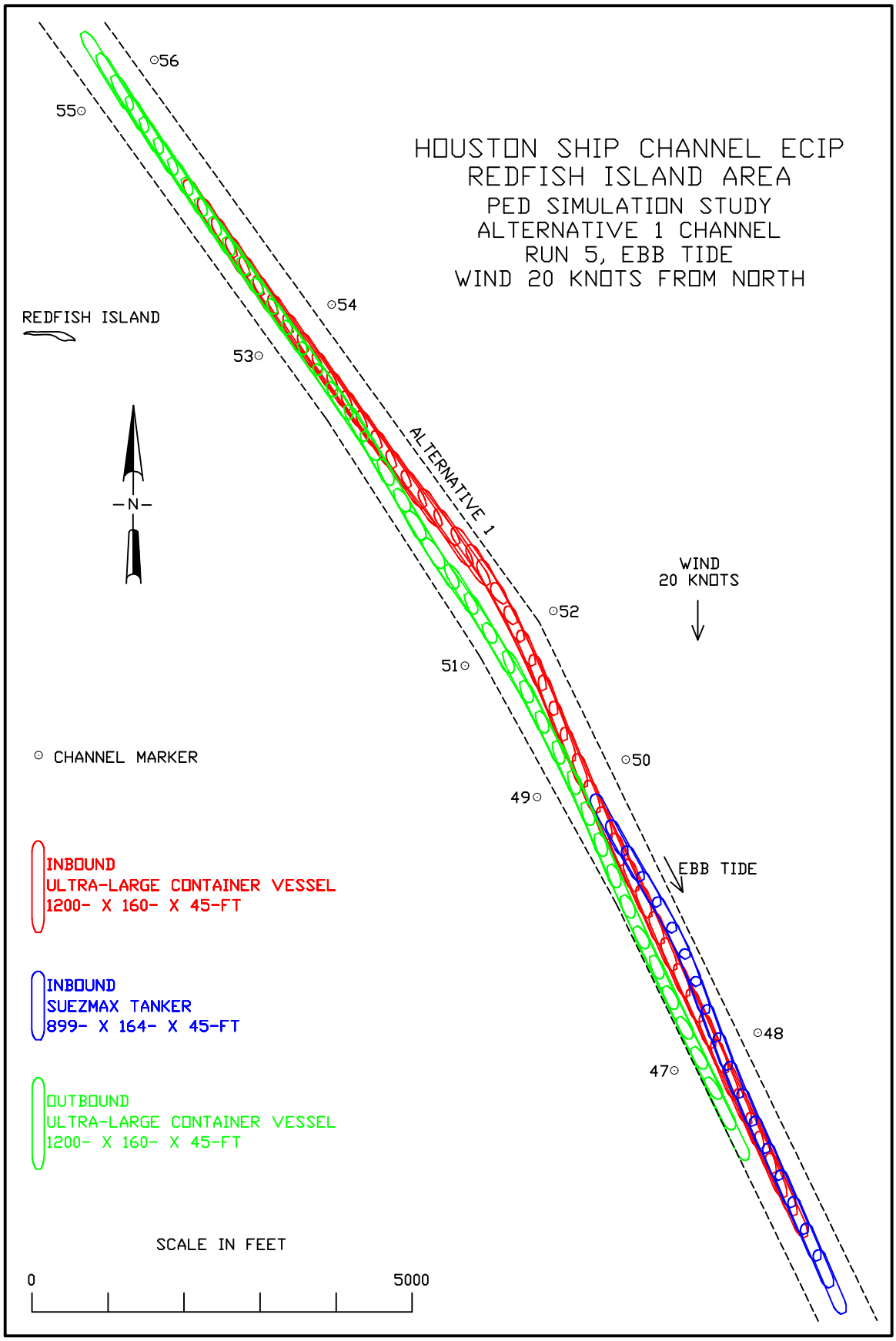

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 5, EBB TIDE
WIND 20 KNOTS FROM NORTH
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
ALTERNATIVE 1
N
WIND
20 KNOTS
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
EBB TIDE
SCALE IN FEET
0
5000

PLATE 30

Run **5**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 5/15/2020
Start Time 1115
End Time 1130
Plan RF-A1
Current Ebb
Tide (m) 1
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*MULCV14N	45.0/13.7	146/10	55-56
Inbound	MULCV14N	45.0/13.7	337/10	45-46
Inbound	SUEZ156R	44.1/13.7	336/10	41-42

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*MULCV14N	E	162	237	0	267
Inbound	MULCV14N	A	163			
Inbound	SUEZ156R	B			42	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
E	Outbound	Difficult	Yes	Size of vessel meeting in the turn makes the manuever difficult. Howver, the wider channel made it manageable.	Yes	Yes	Yes	Yes	Made mistakes in first meet that let to difficulty in the second but the larger channel made it easier to still recover.
A	Inbound	Normal	Yes	Plenty of room. Vessel handles well.	Yes	Yes			
B	Inbound	Normal	Yes	Lot of room			Yes	Yes	Channel has a good design.

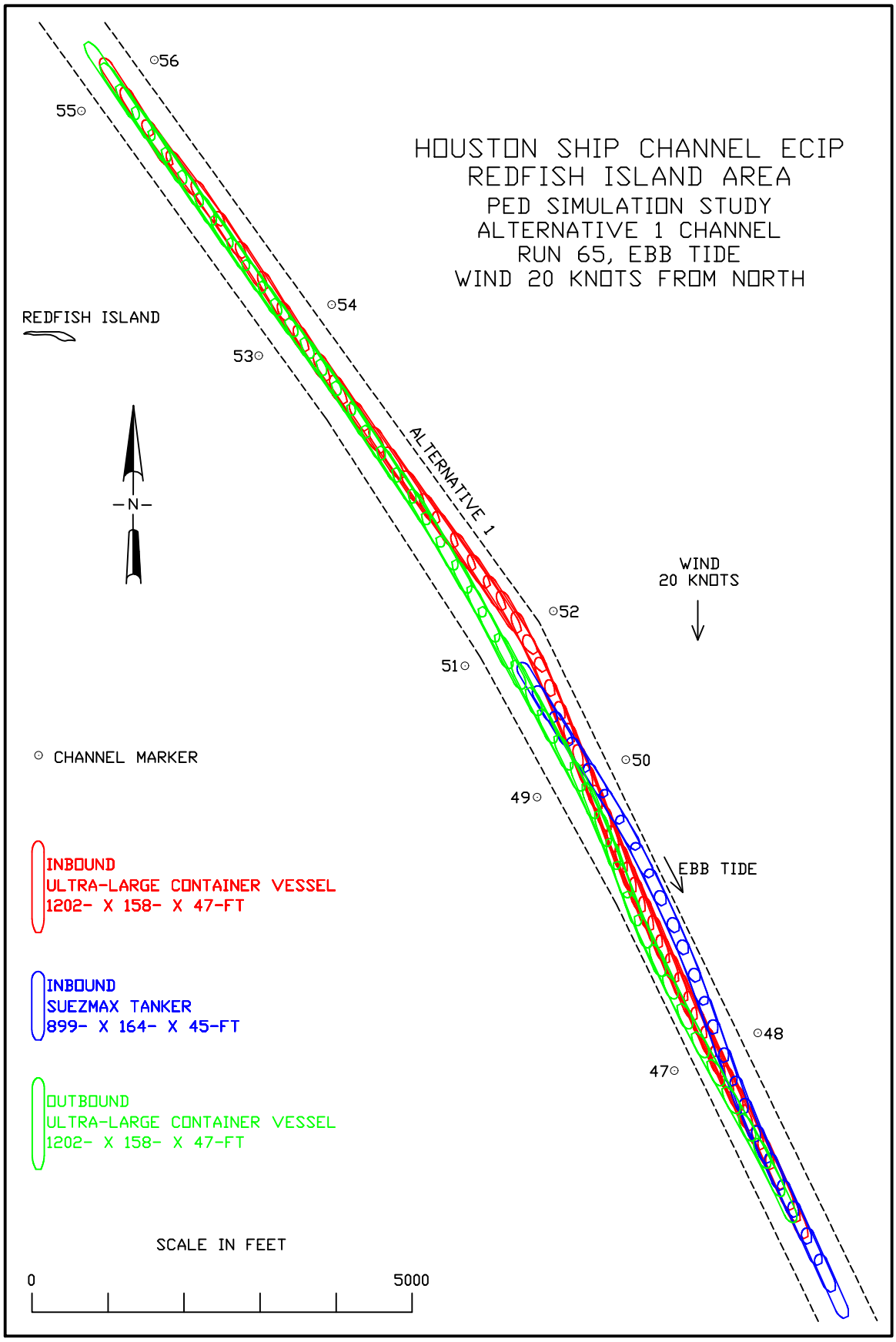

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 65, EBB TIDE
WIND 20 KNOTS FROM NORTH
REDFISH ISLAND
56
55
54
53
52
51
50
49
48
47
ALTERNATIVE 1
N
WIND
20 KNOTS
EBB TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
SCALE IN FEET
0
5000

PLATE 31

Run **65**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/1/2020
Start Time 1345
End Time 1400
Plan RF-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	J	230	174	94	241
Inbound	ULCV366M	J	163			
Inbound	SUEZ156R	47			61	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Outbound	Normal	Yes	Wider channel and bank cushion allows for the manuever to occur safely.	Yes	Yes	Yes	Yes	Pilot had to use some kick to get the model to behave how he wanted and maintain speed. Pilot did not notice the wind or current.
H	Inbound	Normal	Yes	No issues with the situation.	Yes	Yes			Normal day in the channel.
G	Inbound	Normal	Yes	More room between the vessels. Widener helps with turn.			Yes	Yes	Standard.

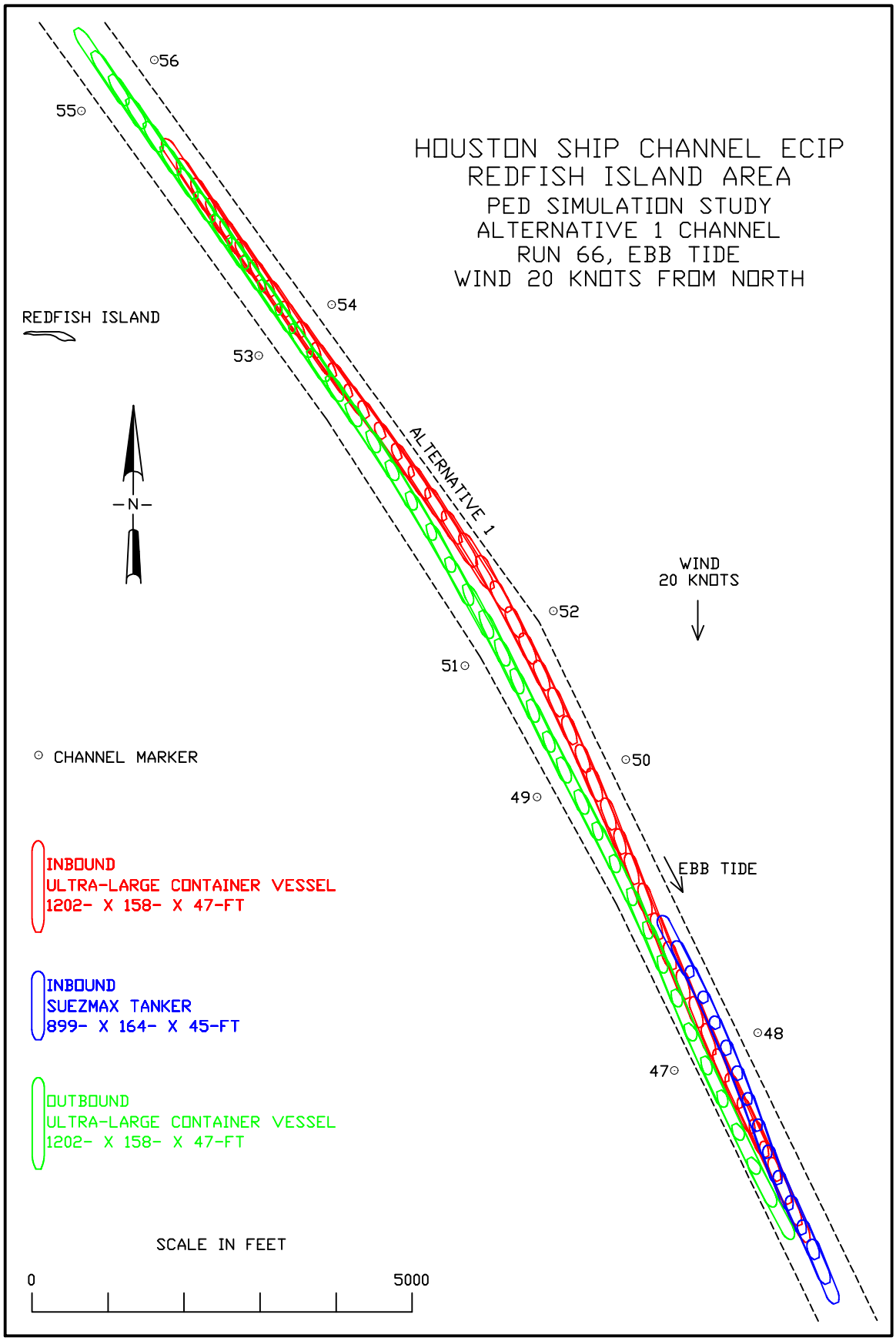

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 66, EBB TIDE
WIND 20 KNOTS FROM NORTH
REDFISH ISLAND
56
55
54
53
52
51
50
49
48
47
ALTERNATIVE 1
N
WIND
20 KNOTS
EBB TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
SCALE IN FEET
0
5000

PLATE 32

Run **66**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/1/2020
Start Time 1410
End Time 1425
Plan RF-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	H	190	173	74	161
Inbound	ULCV366M	H	80			
Inbound	SUEZ156R	47			145	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
H	Outbound	Normal	Yes	Nothing out of the ordinary.	Yes	Yes	Yes	Yes	Easy area to meet in. Pilot noted that he did notice the current and had to adjust the speed accordingly.
G	Inbound	Normal	Yes	Widener in the turn with the width of the channel makes it safe.	Yes	Yes			Wind and current were felt but manageable in this area.
J	Inbound	Normal	Yes	Wider channel and less bank affect.			Yes	Yes	Wind and current were felt but not strong.

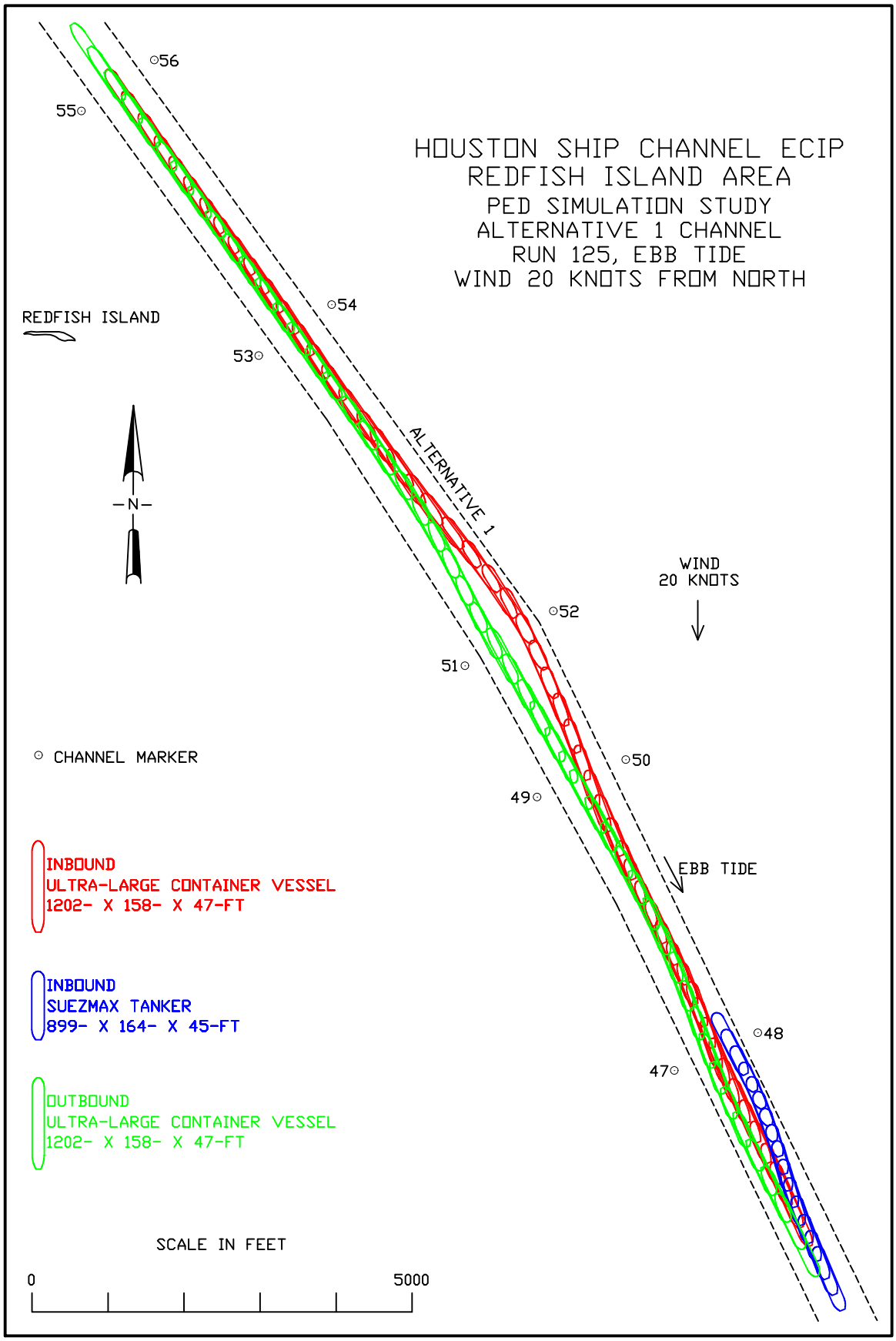

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 125, EBB TIDE
WIND 20 KNOTS FROM NORTH
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
N
ALTERNATIVE 1
WIND
20 KNOTS
EBB TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
SCALE IN FEET
0
5000

PLATE 33

Run **125**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/8/2020
Start Time 1350
End Time 1410
Plan RF-A1
Current Ebb
Tide (m) 1.5
Wind Direction /Speed Knots N/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	D	136	259	96	164
Inbound	ULCV366M	D	68			
Inbound	SUEZ156R	47			40	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
D	Outbound	Normal	Yes	Plenty of space.	Yes	Yes	Yes	Yes	Wind and current did not affect the vessel.
J	Inbound	Normal	Yes	700 ft channel is much better than the current design.	Yes	Yes			An uneventful normal manuever.
B	Inbound	Normal	Yes	Plenty of room. Normal operation.			Yes	Yes	Everything felt like normal operations.

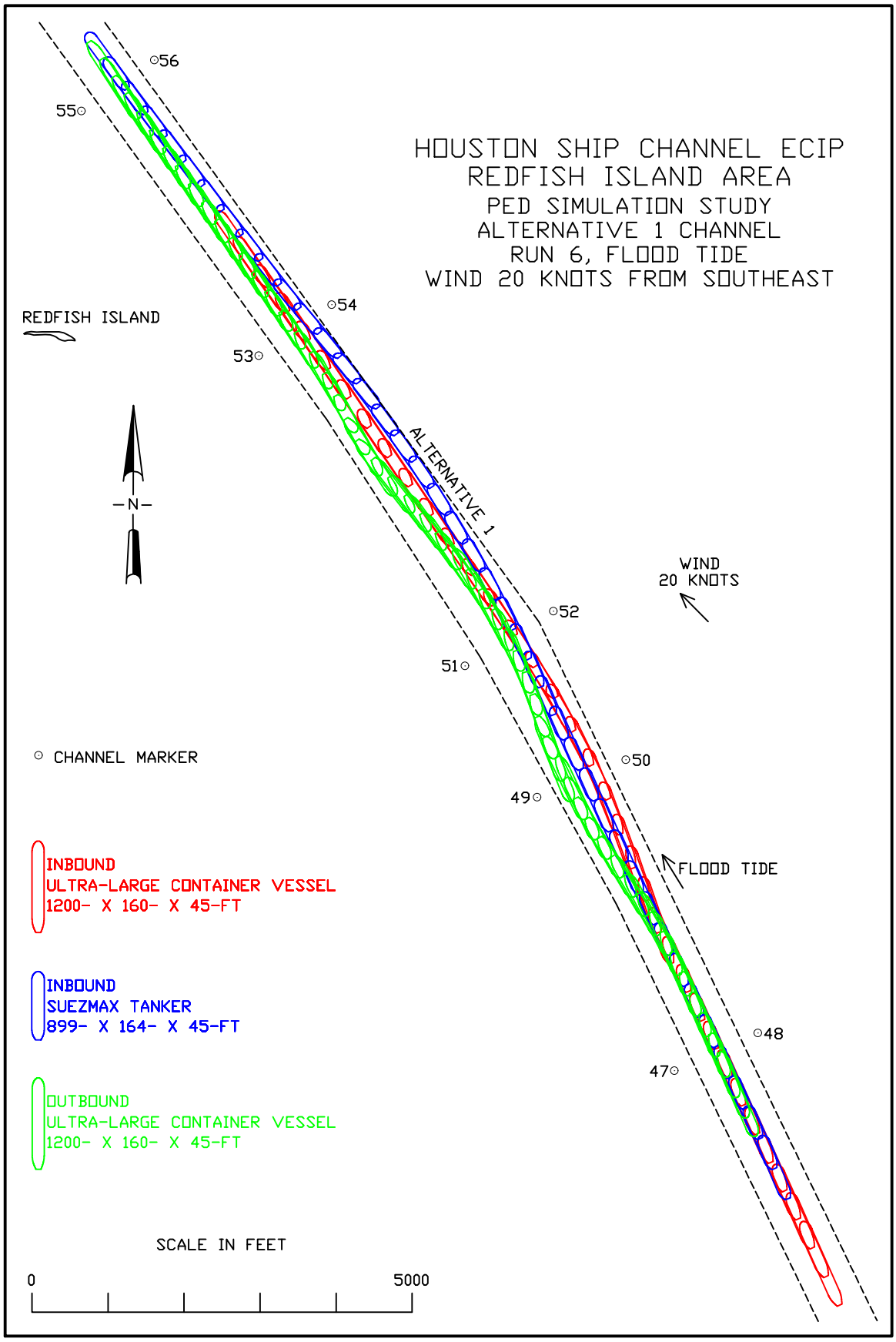

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 6, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST
REDFISH ISLAND
56
55
54
53
52
51
50
49
48
47
ALTERNATIVE 1
N
WIND
20 KNOTS
FLOOD TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
SCALE IN FEET
0
5000

PLATE 34

Run **6**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 5/15/2020
Start Time 1150
End Time 1210
Plan RF-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*MULCV14N	45.0/13.7	146/10	55-56
Inbound	SUEZ156R	44.1/13.7	337/10	45-46
Inbound	MULCV14N	45.0/13.7	336/10	41-42

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*MULCV14N	B	117	276	72	220
Inbound	SUEZ156R	A	0			
Inbound	MULCV14N	E			127	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
B	Outbound	Normal	Yes	Channel is wider and allows for the manuever.	Yes	Yes	Yes	Yes	Meeting locations were good and vessel handled well.
A	Inbound	Normal	Yes	Plenty of room in the channel.	Yes	Yes			Slow to recover. Pilot chose to slow down when starting to handle the vessel better.
E	Inbound	Normal	Yes	Width of the channel and vessel size made it managable.			Yes	Yes	Everything was normal.

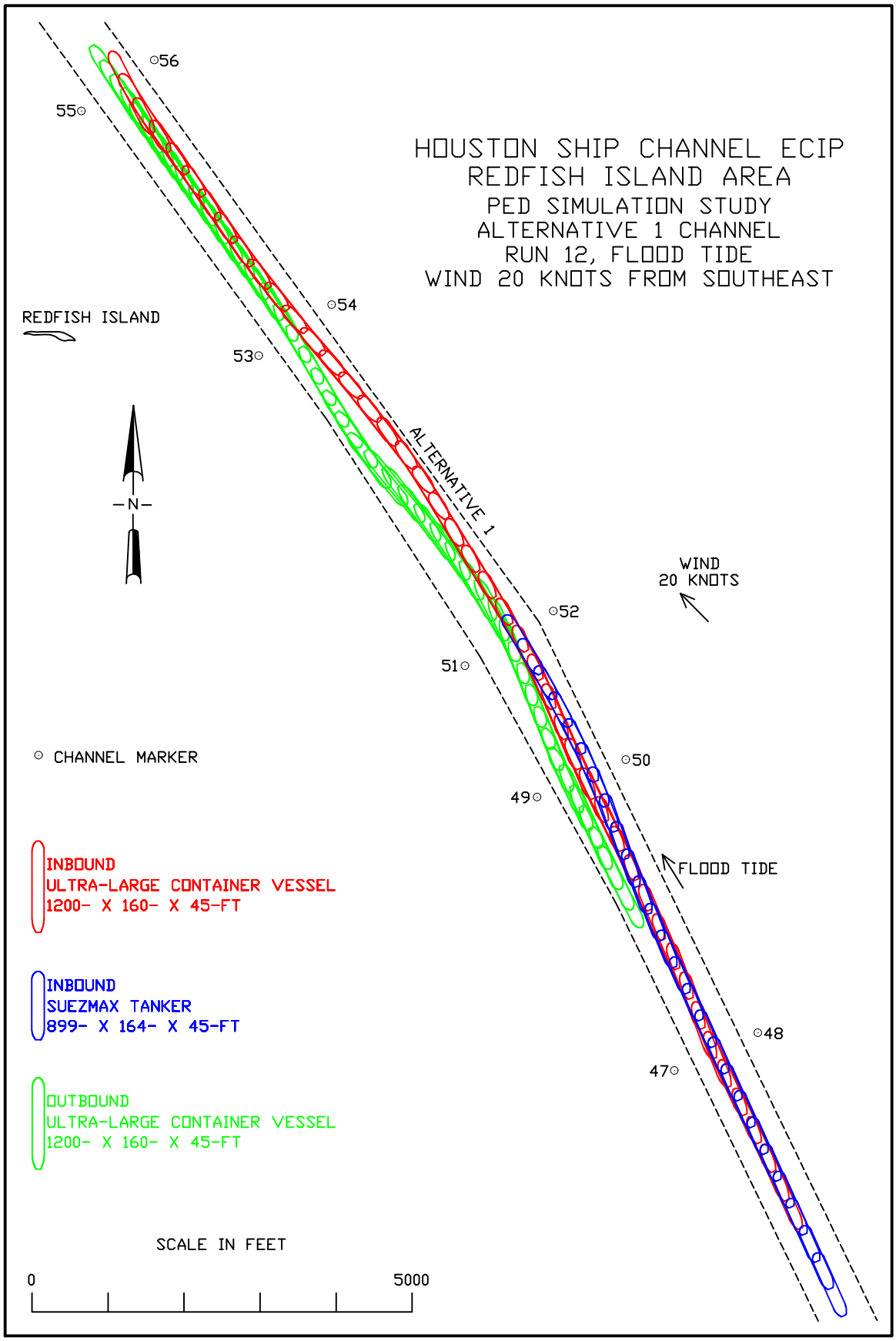

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 12, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
N
ALTERNATIVE 1
WIND
20 KNOTS
FLOOD TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1200- X 160- X 45-FT
SCALE IN FEET
0
5000

PLATE 35

Run **12**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 5/15/2020
Start Time 1600
End Time 1615
Plan RF-A1
Current Fld
Tide (m) 1
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	copy
Outbound	*MULCV14N	45.0/13.7	146/10	w
Inbound	MULCV14N	45.0/13.7	337/10	45-46
Inbound	SUEZ156R	47.1/14.6	336/10	41-42

Run Comments
Pilots were playing around with the outbound container vessel after meet occured.

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*MULCV14N	A	82	235	134	188
Inbound	MULCV14N	B	50			
Inbound	SUEZ156R	E			169	

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
A	Outbound	Normsl	Yes	There is adequate amount of space to perform both passings.	Yes	Yes	Yes	Yes	Vessel remained in the channel even though he was squeezed by the second inbound vessel.
B	Inbound	Normal	Yes	The width of the channel allows for the manuever to occur safely.	Yes	Yes			Different wind and current made no difference on the run.
E	Inbound	Easy	Yes	Width of the channel allows for space.			Yes	Yes	Squeezed the outbound vessel but the meet was controable.

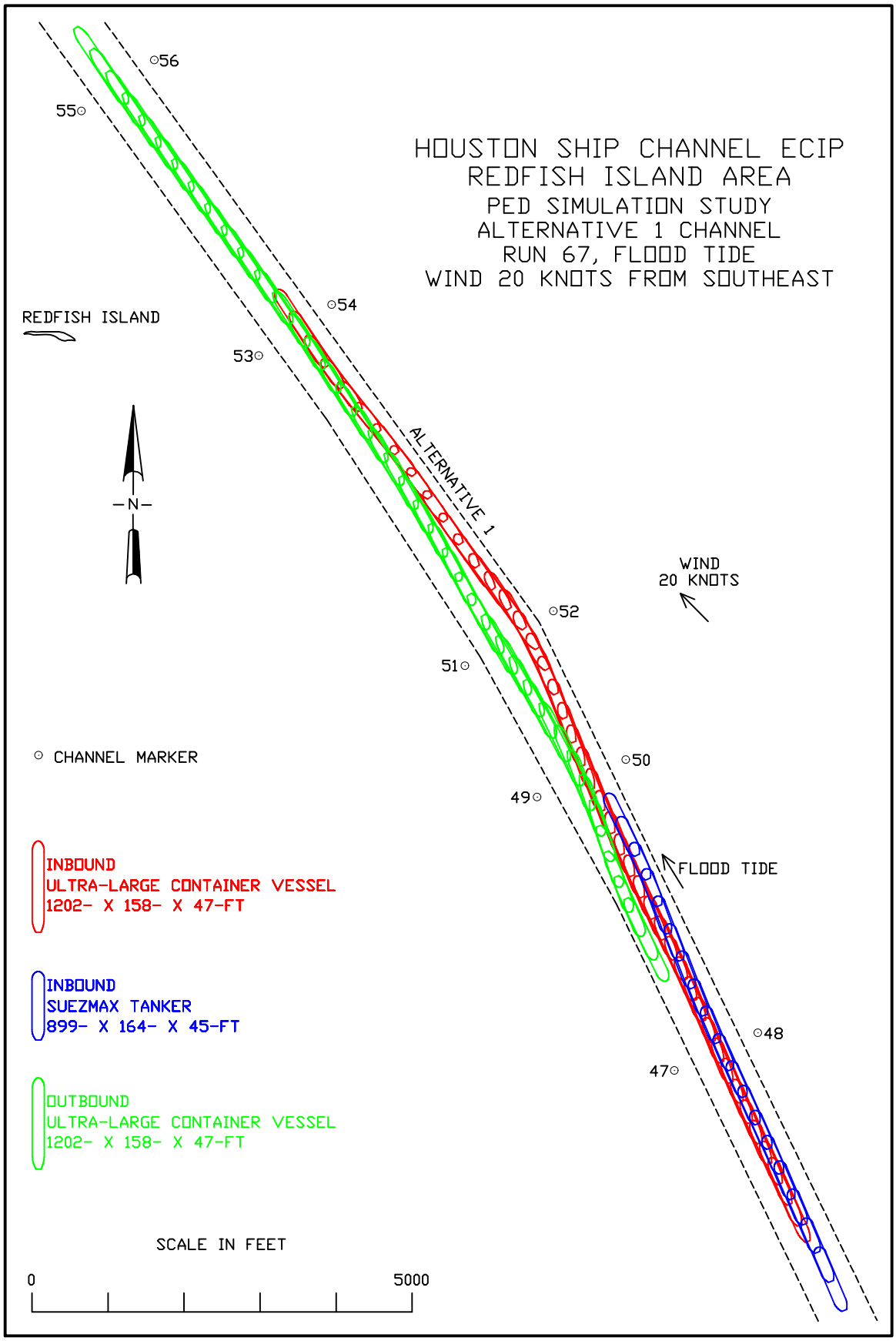

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 67, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
N
ALTERNATIVE 1
WIND
20 KNOTS
FLOOD TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
SCALE IN FEET
0
5000

PLATE 36

Run **67**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/1/2020
Start Time 1430
End Time 1445
Plan RF-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

Run Comments
Soft grounding occured during run due to the draft of the vessel. Added a muddy bottom to prevent this from occuring again.

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	G	196	228	66	191
Inbound	ULCV366M	G	114			
Inbound	SUEZ156R	47			110	

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
G	Outbound	Normal	Yes	Widener and width of the channel allows for it to be safe normal.	Yes	Yes	Yes	Yes	Meeting the second vessel, the pilot was not in the middle due to turning. This made the manuever a little harder but they were able to still meet safely.
J	Inbound	Normal	Yes	Wider channel and less bank cushion make the manuever easier. More space between vessels makes it safer.	Yes	Yes			Felt the current so the pilot slowed down for the turn then had to speed up in the straightaway to stabilize the vessel.
H	Inbound	Normal	Yes	Channel width allows to safely pass.			Yes	Yes	Pilot should have slowed down to put a bigger space between him and the first inbound ship but even with a smaller space the pilot in the outbound vessel was able to make it safely around both vessels.

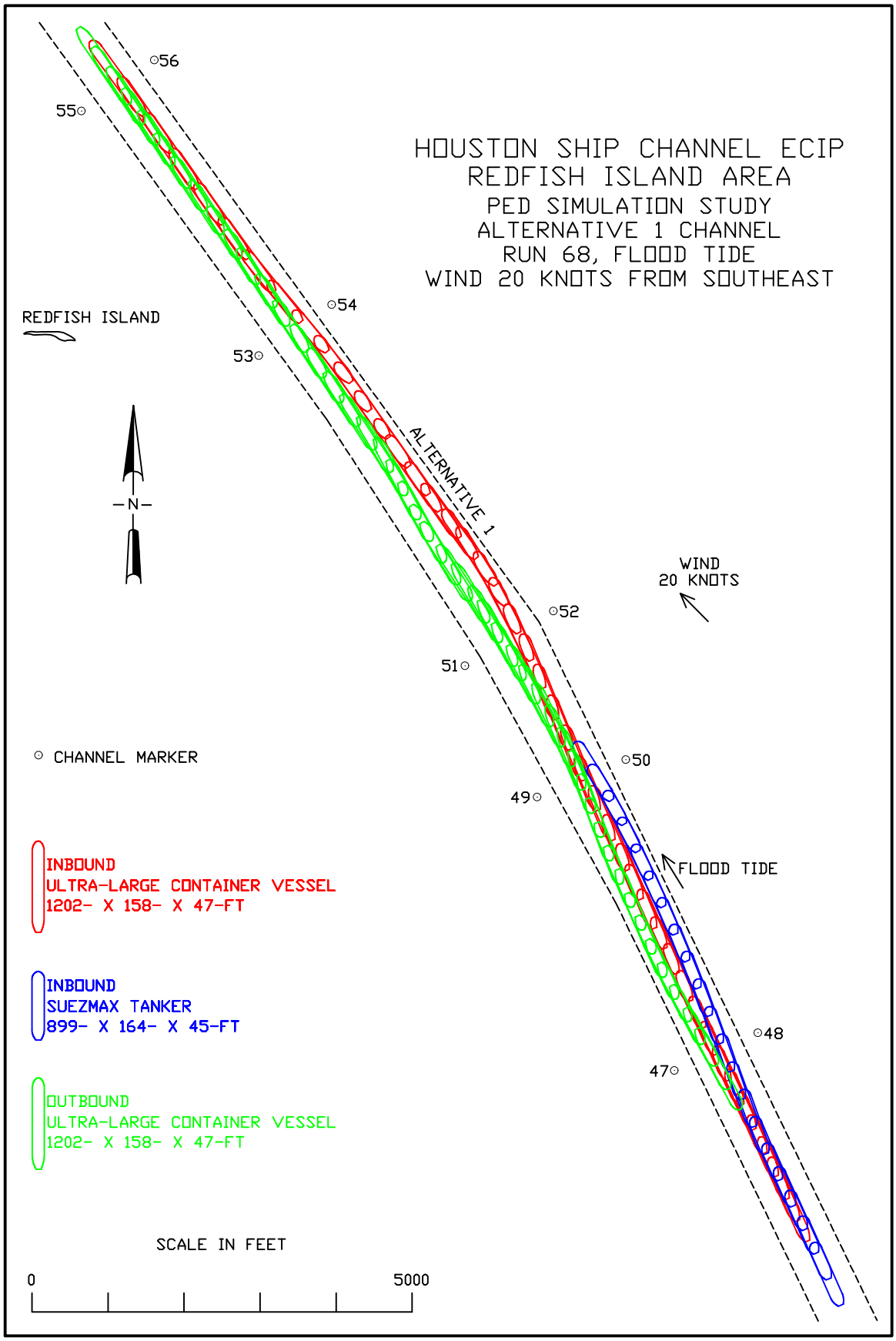

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 68, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
N
ALTERNATIVE 1
WIND
20 KNOTS
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
FLOOD TIDE
SCALE IN FEET
0
5000

PLATE 37

Run **68**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/1/2020
Start Time 1505
End Time 1520
Plan RF-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	J	214	207	99	186
Inbound	ULCV366M	J	99			
Inbound	SUEZ156R	47			85	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Outbound	Easy	Yes	Even steming the current the pilot had full control. A lot of space between vessel and banks.	Yes	Yes	Yes	Yes	Wind and current were negligible.
H	Inbound	Normal	Yes	Business as usual. Channel width makes the operation normal and safe.	Yes	Yes			
G	Inbound	Normal	Yes	Available space in the channel made it safe.			Yes	Yes	

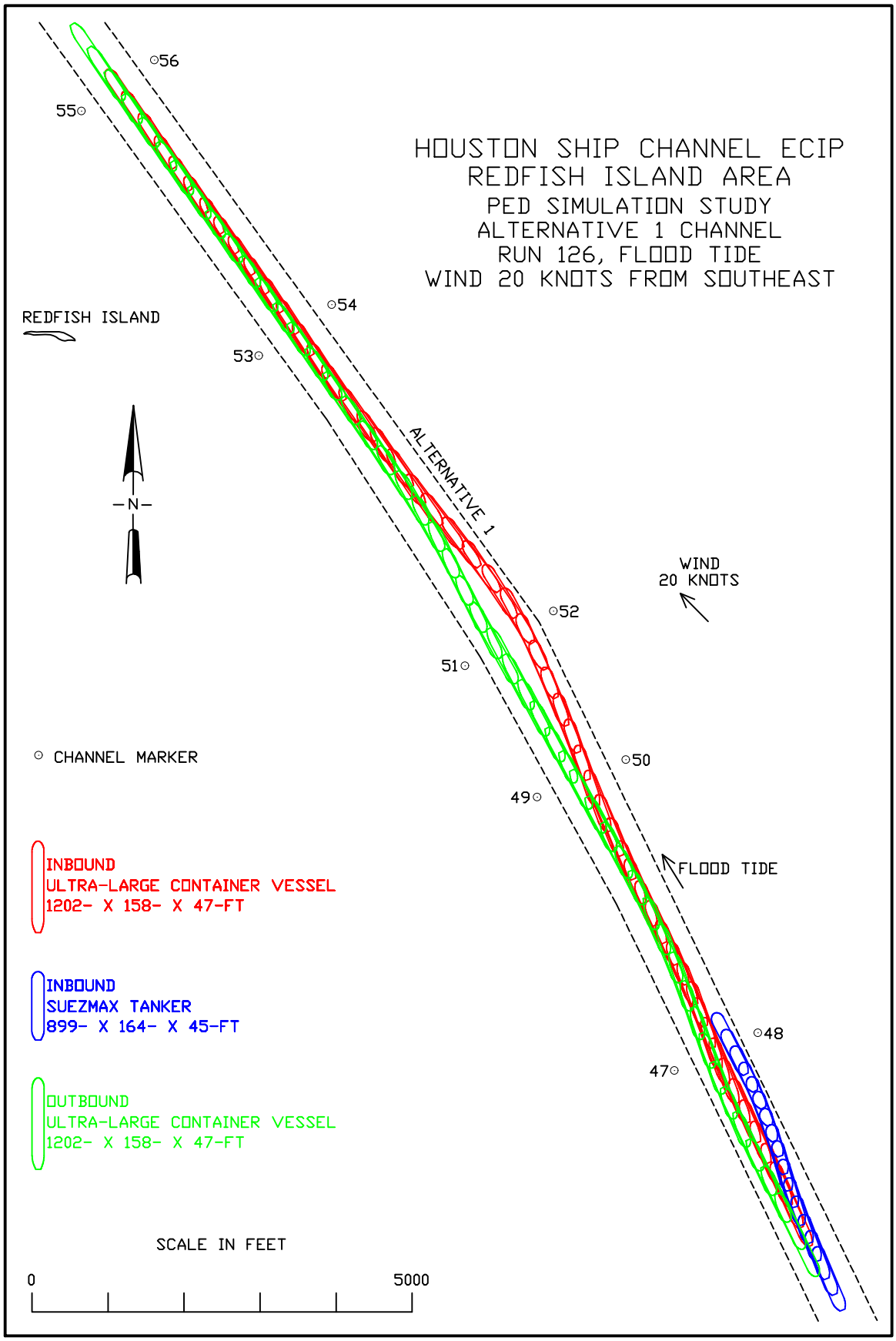

HOUSTON SHIP CHANNEL ECIP
REDFISH ISLAND AREA
PED SIMULATION STUDY
ALTERNATIVE 1 CHANNEL
RUN 126, FLOOD TIDE
WIND 20 KNOTS FROM SOUTHEAST
56
55
54
53
52
51
50
49
48
47
REDFISH ISLAND
N
ALTERNATIVE 1
WIND
20 KNOTS
FLOOD TIDE
CHANNEL MARKER
INBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
INBOUND
SUEZMAX TANKER
899- X 164- X 45-FT
OUTBOUND
ULTRA-LARGE CONTAINER VESSEL
1202- X 158- X 47-FT
SCALE IN FEET
0
5000

PLATE 38

Run **126**

Purpose Testing at Redfish - Meet in the bend and after the bend

Date 6/8/2020
Start Time 1415
End Time 1430
Plan RF-A1
Current Fld
Tide (m) 1.5
Wind Direction /Speed Knots SE/20
Tugs 0

Heading	Ship	Draft (ft/m)	Heading/ Init Speed	Init Pos
Outbound	*ULCV366M	46.7/14.2	146/10	55
Inbound	ULCV366M	46.7/14.2	336/10	50
Inbound	SUEZ156R	44.1/13.7	336/10	47

			Minimum Distances during metings			
			First Meeting		Second Meeting	
Heading	Ship	Pilot	Channel	Skin to Skin	Channel	Skin to Skin
Outbound	*ULCV366M	J	153	256	74	185
Inbound	ULCV366M	J	82			
Inbound	SUEZ156R	47			121	

Run Comments

Pilot	Heading	Job Rating	Safe/Do in Real life	Comments	First meet Control	Recovery Control	Second Meet Control	Recovery Control	Comments
J	Outbound	Normal	Yes	Plenty of space and increased distances between vessels.	Yes	Yes	Yes	Yes	Wind and current did not make a difference.
B	Inbound	Normal	Yes	Slightly difficult due to the handling of the vessel.	Yes	Yes			Wind and current did not make a difference.
D	Inbound	Normal	Yes	Width of the channel allows for plenty of manuevering room.			Yes	Yes	Wind and current did not make a difference.

HOUSTON PILOTS
203 DEERWOOD GLEN DRIVE / DEER PARK, TEXAS 77536

July 16, 2021

Ms. Lori Brownell, P.E.
Director, Channel Development
Port Houston
111 East Loop North
Houston, Texas 77029

Dear Ms. Brownell,

This is in response to your request for comments from the Houston Pilots regarding your proposal to make a slight modification to the bend at STA 78+844 for the Houston Ship Channel - Expansion Channel Improvement Project (Project 11). Houston Pilots understands that the bend in the proposed widening of the Houston Ship Cannel is to be narrowed as compared to the original design which was tested in full mission bridge simulations in May and June of 2020. The narrowing of the bend is required to allow an existing 24" gas pipeline to not be impacted and relocated because of the project improvements.

Houston Pilots has reviewed the drawing "Port of Houston Authority, Houston Ship Channel, Expansion Channel Improvement Project" dated 01-13-21 that was submitted by the Joint Venture (Turner Collie & Braden, Inc. and Gahagan & Bryant and Associates, Inc.) for the proposal.

Based on our experience navigating a wide variety of ships under differing weather and traffic density conditions, the Houston Pilots have no objections to the proposal, and submit the following comments:

1. During the ship simulations, vessels were allowed to meet at the bend, with some simulations also allowing for multiple vessel meets in quick succession. Typically, Pilots will work from the middle of the channel, and prefer not to meet in bends unless necessary. However, for the sake of the simulations, Pilots met in the bends and used all available space (not out of necessity, but to test the design as presented).

2. Without performing additional ship simulations, Houston Pilots can confirm that all proposed vessels, including the proposed ultra-large container vessels, can be piloted safely through the narrowed bend under all existing operating conditions and the conditions under which the ship simulations noted above were conducted.

3. The modification as proposed nearly presents a "gate" for the bend (which is preferred) and is in no case less than 700' wide. As such, this configuration is satisfactory and could provide a permanent solution for this bend.

If you have any questions, or need any amplifying information, please do not hesitate to call me.

Respectfully,

Captain Chad Prejean
Executive Committee, Houston Pilots

Unit Conversion Factors

Multiply	By	To Obtain
cubic feet	0.02831685	cubic meters
cubic yards	0.7645549	cubic meters
degrees (angle)	0.01745329	radians
feet	0.3048	meters
horsepower (550 foot-pounds force per second)	745.6999	watts
knots	0.5144444	meters per second
miles (nautical)	1,852	meters
square feet	0.09290304	square meters
tons (2,000 pounds, mass)	907.1847	kilograms

Acronyms and Abbreviations

BC	Barbours Cut
BCC	Barbours Cut Channel
BSC	Bayport Ship Channel
ECIP	Expansion Channel Improvement Project
EIS	Environmental Impact Statement
ERDC	US Army Engineer Research and Development Center
FR	Feasibility Report
FS	Feasibility Study
GBT	Greens Bayou Terminal
GIWW	Gulf Intracoastal Waterway
HSC	Houston Ship Channel
Hwy	Highway
ITC	Intercontinental Terminals Company
LASH	Lighter Aboard Ship
LBC	LBC Tank Terminals
LOA	Length overall
MLLW	Mean lower low water
MVP	Magellan Valero Pasadena
N	North
NE	Northeast
NED	National Economic Development
NOAA	National Oceanic and Atmospheric Administration
PED	Preconstruction Engineering Design
PHA	Port of Houston Authority
PPU	Portable Pilot Units
RF	Redfish
RP	Recommend Plan

SE	Southeast
SJCMTTC	San Jacinto Maritime Technology and Training Center
STS	Ship-Tug Simulator
TCC	Texas City Channel
ULCV	Ultra Large Container Vessels
VLCC	Very Large Crude Carrier
WB	Wide body
WST	Waterway Simulation Technology, Inc.

REPORT DOCUMENTATION PAGE

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1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED *(From - To)*
October 2021	Final Report	

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Houston Ship Channel Expansion Improvement Project – Navigation Channel Improvement Study: Ship Simulation Results

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5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
S. Keith Martin, Larry L. Daggett, Morgan M. Johnston, Chris Hewlett, Kiara I. Pazan, Mario J. Sanchez, Dennis W. Webb, Mary C. Allison, and George Burkley

5d. PROJECT NUMBER

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5f. WORK UNIT NUMBER

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Port of Houston Authority
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Houston TX 77029

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14. ABSTRACT

In 2020, the US Army Engineer Research and Development Center (ERDC), Coastal and Hydraulics Laboratory, provided technical oversight during a navigation study to assist the Galveston District evaluation of different channel widening alternatives for larger ships transiting the Houston Ship Channel (HSC), Texas. The widening proposals encompassed several areas of the HSC including the Bay Section, the Bayport Ship Channel, Barbours Cut Channel, and the Bayou Section. The study was performed at the San Jacinto College Maritime Technology and Training Center (SJCMTTC) Ship/Tug Simulator (STS) Facility in La Porte, TX.

The SJCMTTC STS is a real-time simulator; therefore, events on the simulator happen at the same time rate as real life. A variety of environmental forces act upon the ship during the simulation transit. These include currents, wind, waves, bathymetry, and ship-to-ship interaction.

Online simulations of the project were conducted at SJCMTTC over a 3 week period – May through June 2020. Several mariners including Houston Pilots and G&H tugboat Captains participated in the testing and validation exercises. ERDC oversight was performed remotely because of the COVID-19 pandemic.

Results in the form of engineering observations, track plots, and pilot interviews were reviewed to develop final conclusions and recommendations regarding the final design.

15. SUBJECT TERMS
Channels (Hydraulic engineering), Houston Ship Channel (Tex.), Inland navigation, Ships—Maneuverability—Computer simulation

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			S. Keith Martin
Unclassified	Unclassified	Unclassified	SAR		19b. TELEPHONE NUMBER *(Include area code)* 601-634-3019

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