NEW HAVEN HARBOR
CONNECTICUT
NAVIGATION IMPROVEMENT PROJECT

INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

APPENDIX K
SHIP SIMULATION REPORT

New Haven Harbor Feasibility Level Simulations Study Report

1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Engineer Research and Development Center (ERDC), Coastal and Hydraulics Laboratory (CHL) has completed a Feasibility Level Screening Simulation Program (FLSSP) to assist the USACE New England District (CENAE) and the New Haven Port Authority (NHPA) in evaluating proposed bend widening, channel widening, and turning basin dimensions in New Haven Harbor, Connecticut. The study was performed at CHL's ship/tow simulator on 13-16 February 2018.

2. OVERVIEW

New Haven Harbor (NHH) is a Federal Navigation Project on the northern side of Long Island Sound (LIS) (Figure 1). It is the largest deep draft port in Connecticut and the highest volume port on LIS. The NHH has 6 terminals and 12 berths with over 6,000 feet of quay length. Deep draft vessel traffic includes tankers and bulker carriers. The authorized depth for the channel and the existing turning basin is -35 feet at mean lower low water (MLLW). The project includes three offshore stone breakwaters at the entrance to the harbor. The entrance channel is 500 feet wide and the channel in the interior of New Haven Harbor is 400-feet-wide widening to 800 feet along the terminal to provide a maneuvering area. The draft plan prior to the FLSSP ship simulations was channel width of 600 feet in the entrance channel in LIS, and 700 feet at the breakwater bend tapering down to the 500 foot width in the inner harbor and includes the widening to 800 feet along the terminals (Figures 1 and 2). The proposed bend widening prior to ship simulations is illustrated in Figure 3. The proposed depths are between 37 feet and 42 feet MLLW.

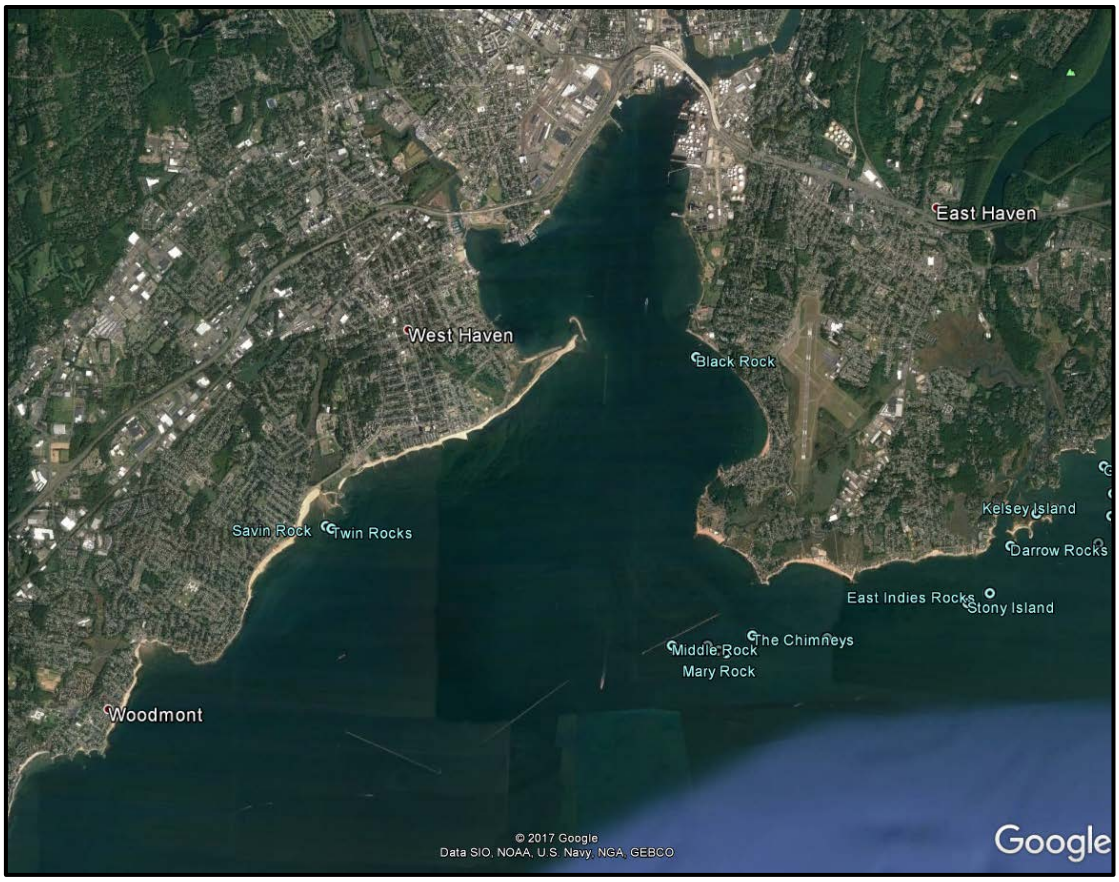


Figure 1. Location Map

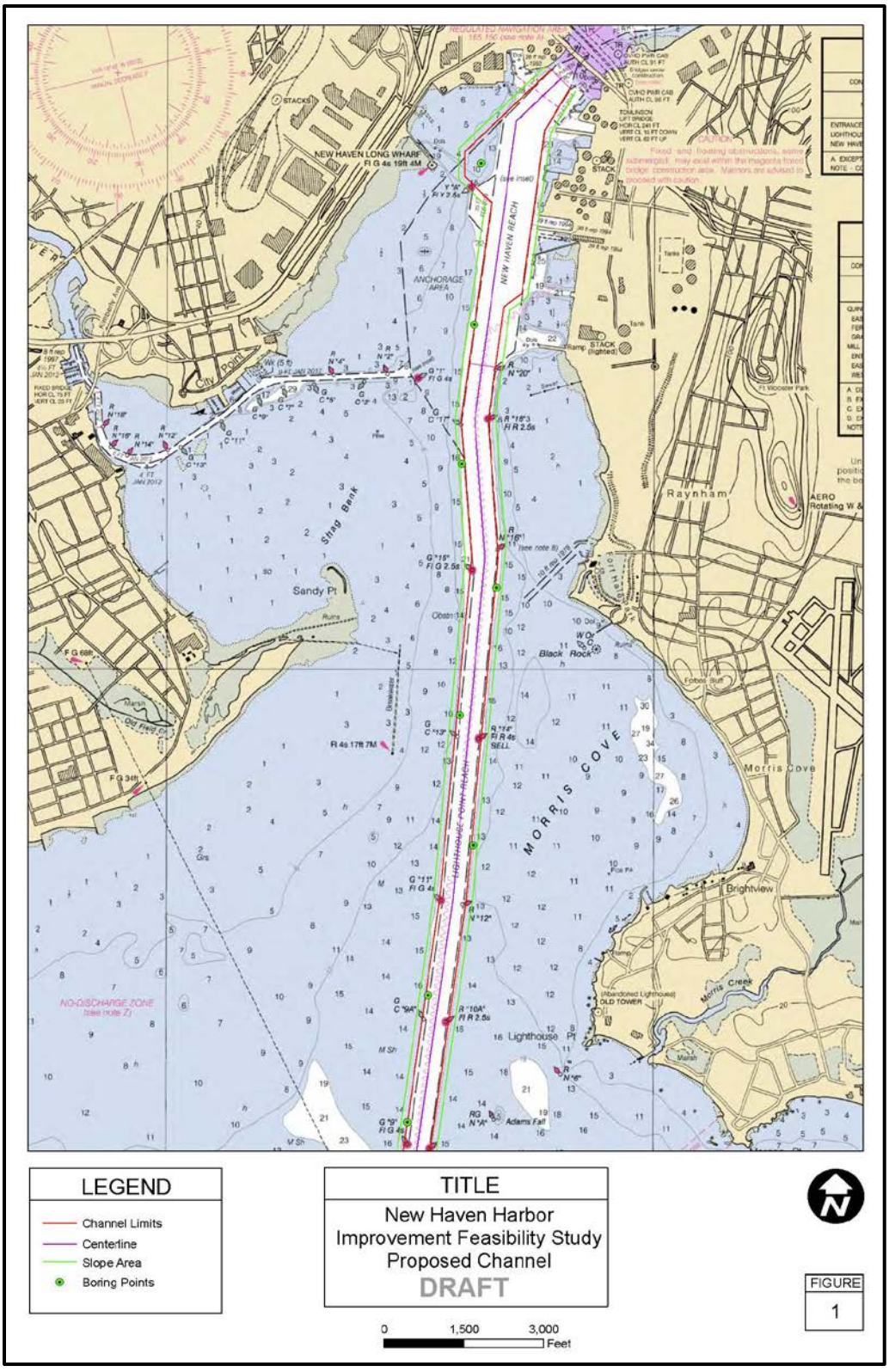


Figure 2. Draft Plan Prior to FLSSP Ship Simulations, Harbor Channel and Turning Basin

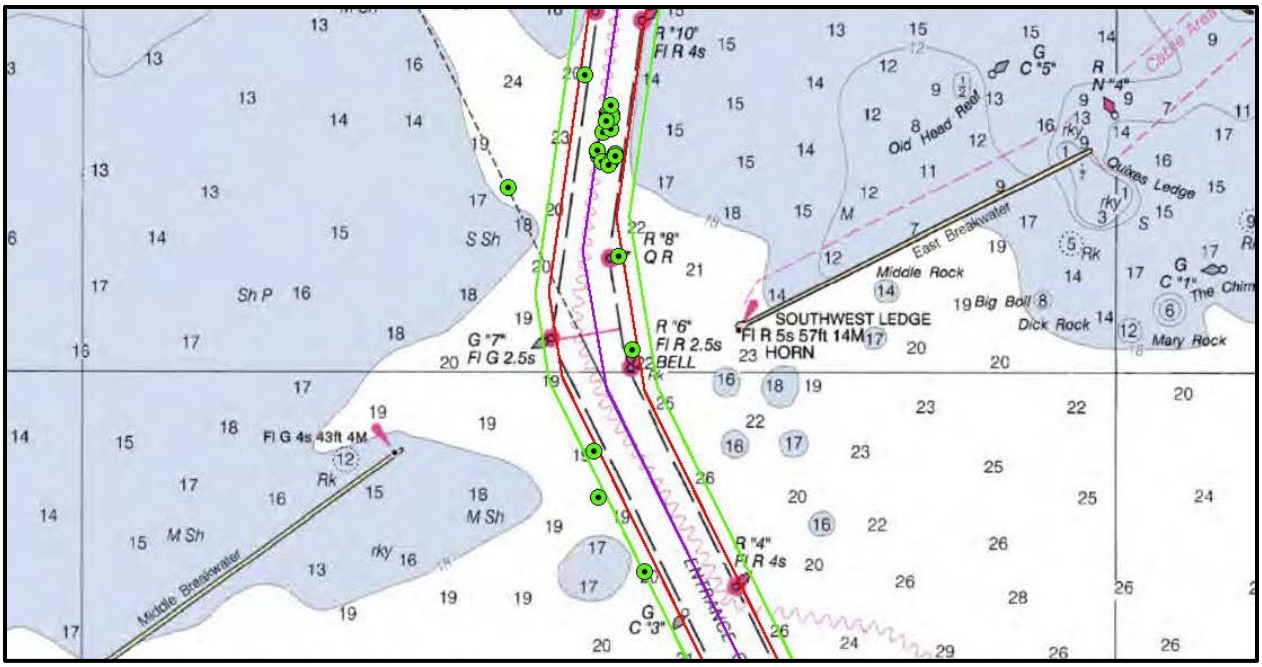


Figure 3. Draft Plan prior to FLSSP Ship Simulations, Entrance Channel and Bend

3. PURPOSE

The FLSSP provides a means of conducting expert elicitations. The use of real-time simulation provides an iterative framework within which to examine ideas and possible solutions within the confines of a laboratory experiment. At the conclusion of each simulation results from the simulation can be discussed, modifications made, and then rerun. The FLSSP is conducted in order to provide essential information for the study process and to stay within the time and cost constraints of USACE's SMART Planning. To reduce time and cost, lower resolution databases are used for ship simulation and data processing is minimized. Lower resolution databases require less costly database development and also allow database modification to be done quickly during the simulation week. A low resolution database can be modified (widened, re-aligned, tapered, etc.) within a few hours. This is critical so that ideas suggested by the pilots or others can actually be tested with the same pilots. Conclusions drawn from actual data should be limited and done very carefully due to the low resolution modeling and the assumptions used during modeling. In addition, once the meetings had occurred the pilots often performed "what if" tests to check bank effects or other forces. Data processing is limited to a presentation of track plots and run sheets, enclosed as Appendix A, to document what was done. The most important analysis is the group discussion at the conclusion of the FLSSP.

4. PARTICIPANTS

The FLSSP included representatives from ERDC, the Connecticut Pilots (CP), and CENAE. The individuals listed participated for the duration of the simulation testing unless otherwise noted.

ERDC: Keith Martin, Mary Claire Allison, Morgan Johnston, and Kiara Pazan

Pilots: Captain Charlie Jonas and Captain Donald J. Toby

CENAE: Barbara Blumeris and Lisa Winter

5. CONSIDERATIONS

For reasons previously stated, model development was done in fairly low resolution. Below are the parameters and assumptions used during testing

a. Currents for max ebb and flood were obtained from an ADCIRC model that had been run only for existing.

b.The visual scenes consisted of the background terrain and a few selected building/facility features.

c. Wind conditions were set at run time at 8 knots out of the Northwest.

d. Simulated ships were limited to ships already in ERDC's ship database. The ships used are shown in Table 1. Pilot cards are included in Appendix B. The container version of the M/S Magnitogorsk, CNTNR03L, was used to simulate the size of the medium range tankers and handy size bulk carriers calling on NHH. The bulker version of the M/S Magnitogorsk, BULKC06L, drafting 37.8 feet and M/T Danita, TANK10L, were used as the design ships for the FLSSP.

Table 1. Simulated Ships Used During Simulations

Model	Name	LOA (Feet)	BEAM (Feet)	DRAFT (Feet)
BULKC06L	M/S Magnitogorsk	705.4	104.3	37.8
TANK10L	M/T Danita	750.0	105.8	45.9
CNTNR03L	M/S Magnitogorsk	664.0	101.7	28.3

6. SIMULATED SCENARIOS

The draft plan channel widths, bend widener, and turning basin dimensions were developed by CENAE personnel in coordination with the Connecticut Pilots. The draft plan channel width is 600 feet in the entrance channel in LIS, and 700 feet at the breakwater tapering down to the 500 foot width in the harbor (Figures 2 and 3). The draft plan bend widening is illustrated in Figure 3. The channels would be widened equally to either side of the center line of the channels. The proposed depths tested ranged between 37 feet and 42 feet MLLW.

7. RESULTS

a. Tuesday morning was primarily devoted to pilot familiarization and model adjustment. Data was recorded during these exercises but it is of little value in channel width evaluation because the purpose of the runs was to evaluate the simulator databases and not the actual channel configurations. As such that is not included with this report. Four recorded testing runs were performed at the end of the day.

b. The visual and environmental (wind and currents) databases were deemed adequate for feasibility level testing. The currents were set by hand in the simulator software in the upper portion of the harbor as the ADCIRC model resolution did not have sufficient current resolution and the existing currents align with channel and are less than 0.5 knots in magnitude.

c. Tug operations were carried out by ERDC personnel at the simulator operational stations. The operator received tug commands from the pilots via radio as they would in real life.

d. Track plots and run sheets for the FLSSP are included as an attachment to this memorandum. All exercises were one-way transits either inbound or outbound. All turning basin runs sailed outbound from the docks. Figure 4 is a photograph taken from the bridge of the design ship entering the harbor.

e. On the run sheets, note that the “Time” blank is not always filled. This blank is merely used as bookkeeping tool for simulator personnel post-processing the data.

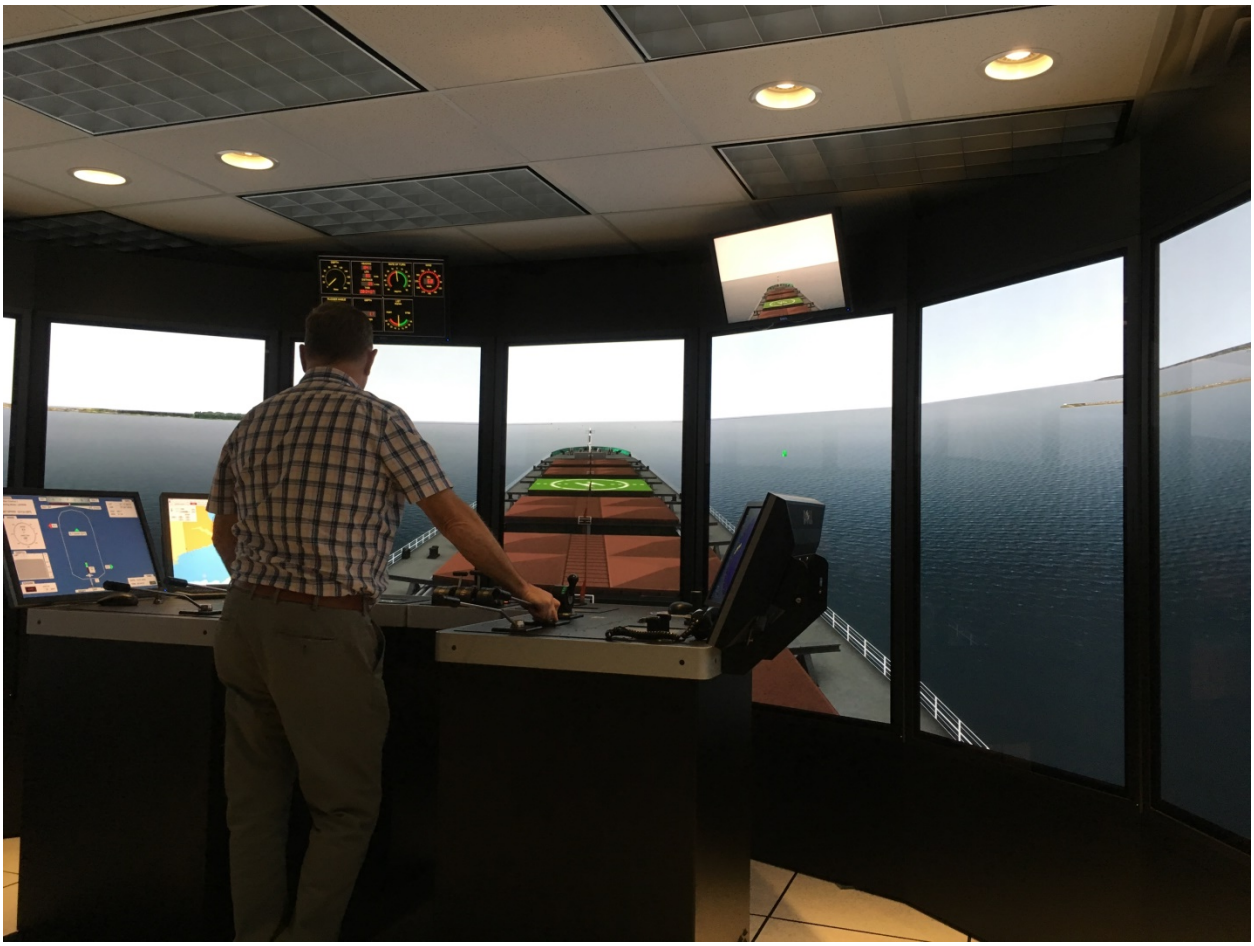


Figure 4. View from Bridge A. Inbound ship entering the harbor

8. DISCUSSION

The final FLSSP discussion was held on the Thursday afternoon, 15 February 2018, after completion of the exercises that morning. Everyone listed in paragraph 4 above attended this discussion.

The simulation program was a screening tool used to determine the channel width of the Tentatively Selected Plan (TSP). Thursday afternoon's discussion represent the conclusions of the FLSSP.

9. TURNING BASIN DISCUSSION

In the initial plan the turning basin in the upper section of the harbor had a proposed new location north of the existing turning basin (see Figure 1 above). After some preliminary simulation runs and discussions with the pilots, it was determined that with a small enlargement the present-day existing turning basin location better suited the ship maneuvering than relocating the turning basin as originally proposed. The enlargement of the existing turning basin would involve moving the northern angled line as shown by points 1 and 2 in Figure 5.

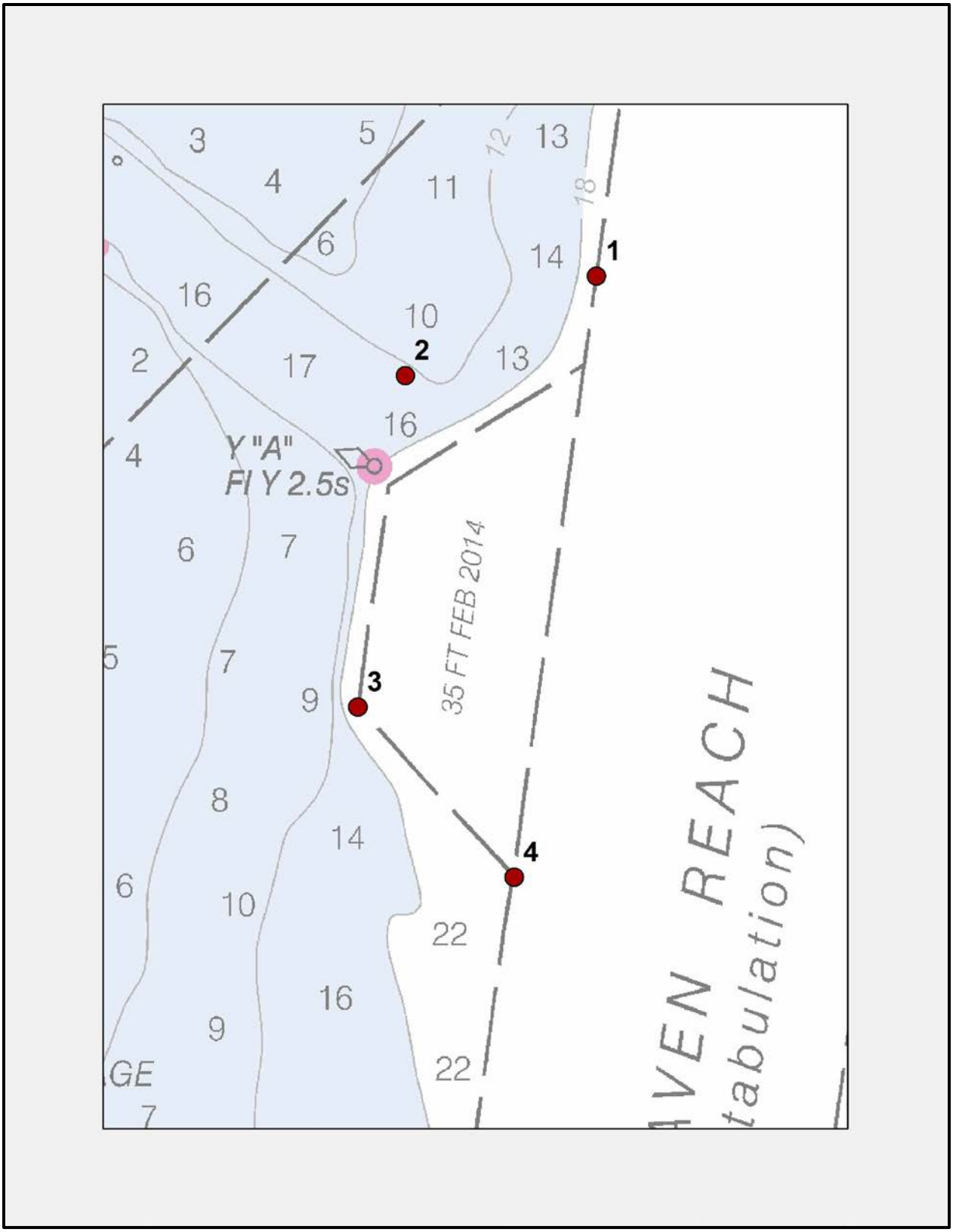


Figure 5. Proposed enlargement of the turning basin

10. CHANNEL DISCUSSION

The following conditions were agreed upon, discussed, and are recommended for the feasibility level design.

a. The proposed 600 foot channel width in the entrance channel was deemed feasible as a result of the simulations performed for the bend widening alternative which started or ended in the entrance channel.

b. The bend widening alternative was performed for the 37, 38, 40, and 42 foot depths. While the widened condition did allow the pilots to make the turn at the breakwater entrance, the pilots had to place the rudder in the “hard over” position leaving no additional room on the rudder control to respond to any unexpected change in environmental conditions (wind, waves, etc.).

c. As a result of the bend widener runs, buoys 6 and 8 were moved 100 feet directly east of the initially proposed position. The result was a bend width of 780 feet instead of the proposed 700-foot width. When tested these new positions allowed the pilots to hold a maximum of 20° rudder throughout the transit through the breakwaters leaving room on the rudder to respond to unexpected events. In Appendix A, runs with the 780 foot bend are referred to as the modified widener.

d. An additional two runs were performed on Friday, 16 February 2018 to test moving the 6 and 8 buoys 50 feet east from the originally proposed positions. This buoy alignment required more than 20° of rudder to complete the maneuver. While still feasible, these buoy locations allowed significantly less room on the rudder than the scenario where the buoys were moved 100 feet.

e. The harbor channel proposed width of 500 feet was deemed feasible as result of simulation testing. A 450 foot width was tested between buoy pairs 9/10 alpha and 13/14. The two runs tested showed the pilots were able to recover after the bend widener with the narrower channel but more testing in the design phase would need to be performed to determine the safety of this width.

f. , Pilots Jonas and Toby were comfortable with the design using the buoy movement described above in item c, the 600 foot entrance channel width, and the 500 foot harbor channel width. More testing in design would be required to determine if the narrower harbor channel described in item e is safe for navigation. The pilots were not comfortable with only a 50 foot eastward movement of the location of the 6 and 8 buoys.

g. The Turning Basin location indicated as the most practicable by the FLSSP is the (Existing Basin location or the Head of Harbor location) with the modification shown in Figure 5.

No data analysis was included as part of the FLSSP as the purpose was to examine the feasibility of various aspects of the New Haven Harbor proposed design in the CHL simulator and to use the pilot feedback as input for developing a range for feasible

widening. A more rigorous testing of the design will be conducted during the PED. The visual databases will be updated to include more detail.

11. FEASIBILITY PHASE RECOMMENDATIONS

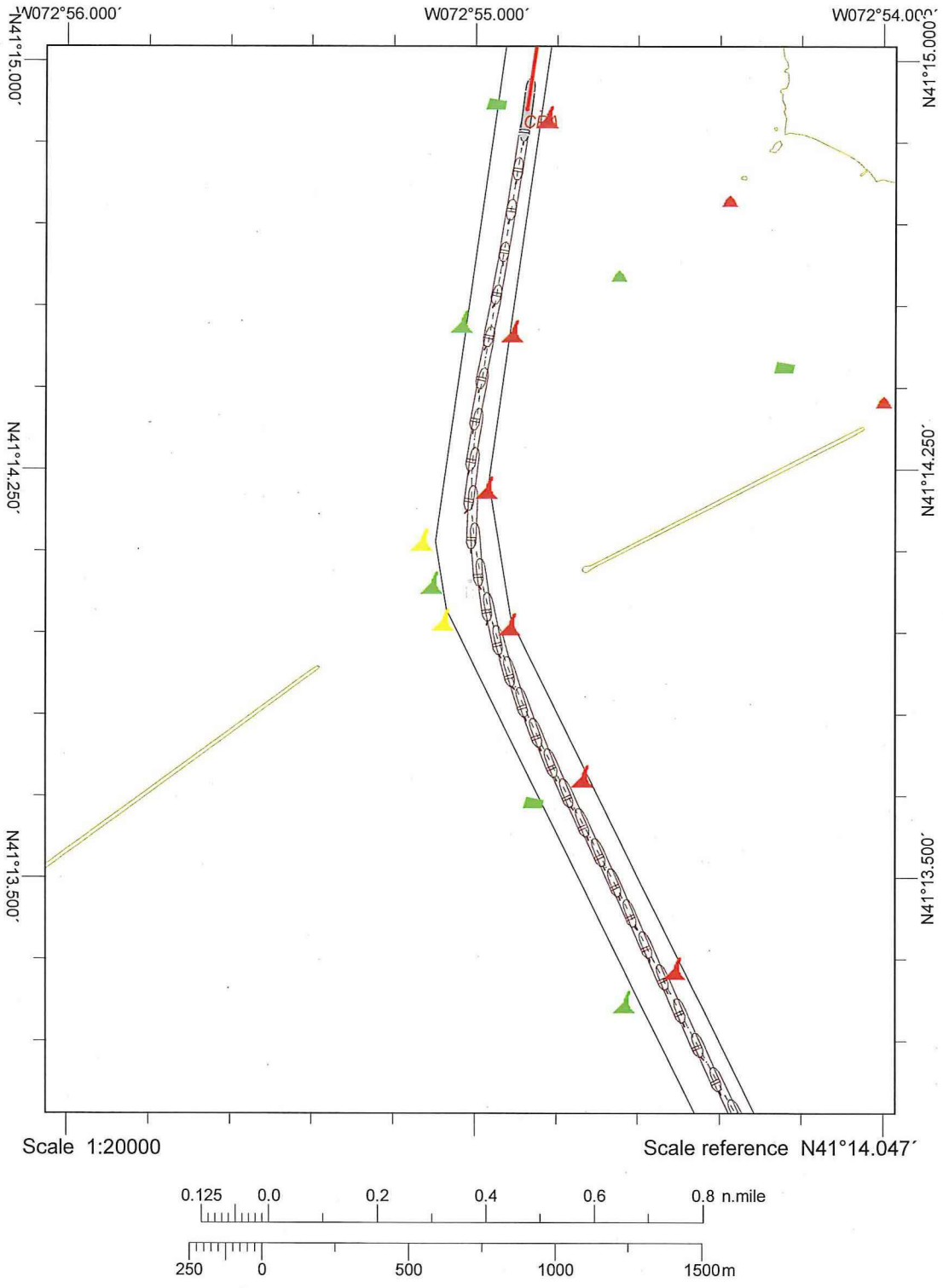
For the feasibility phase, USACE NAE and the NHPA should consider using the following project dimensions. These dimensions could be refined further in the PED phase ship simulations.

a. Entrance Channel Width – 600 Feet

b. Channel Width through the Breakwater Bend – 780 Feet

c. Channel Width through the Inner Harbor – 500 Feet

d. Turning Basin Location – Existing Basin with modification (see Figure 5)



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – 700 ft width*

Date: 02/13/18

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** 1.5 m

Wind Condition: 1 ~~NW8K~~ NW8K 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

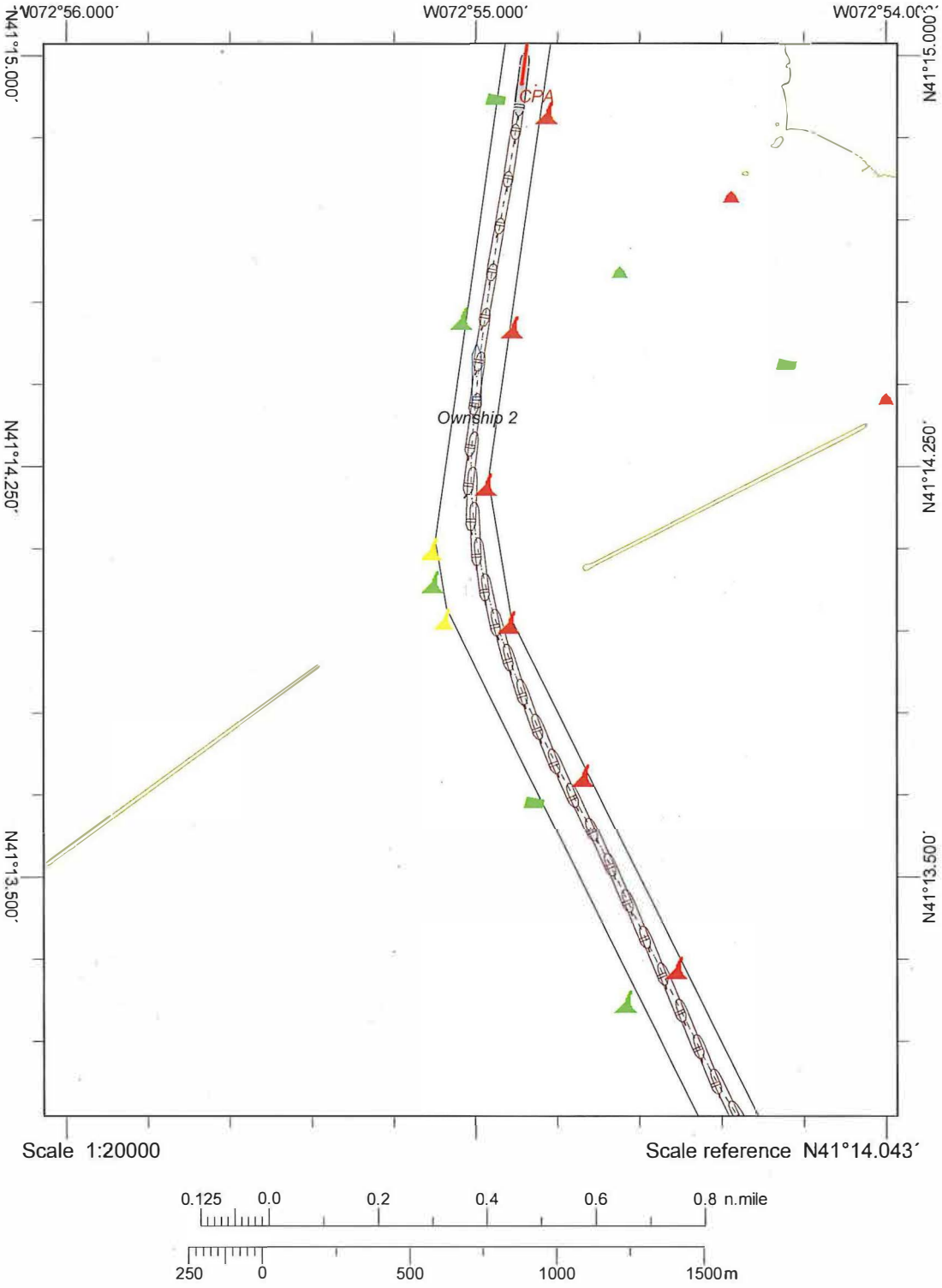
Filename: B-P2-F-NW8_I-1-1

Start Time: 15:03

End Time: 15:18

Comments:

DIDN'T EXPERIENCE ANY SUCTION IN VICINITY OF TURN (#3 BUOY) BECAUSE THE CHANNEL WAS WIDER — LESS EFFORT TO KEEP SHIP NEAR MIDDLE OF CHANNEL



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Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – 700 ft width*

Date: 13 Feb 2018

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** 1.5m

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

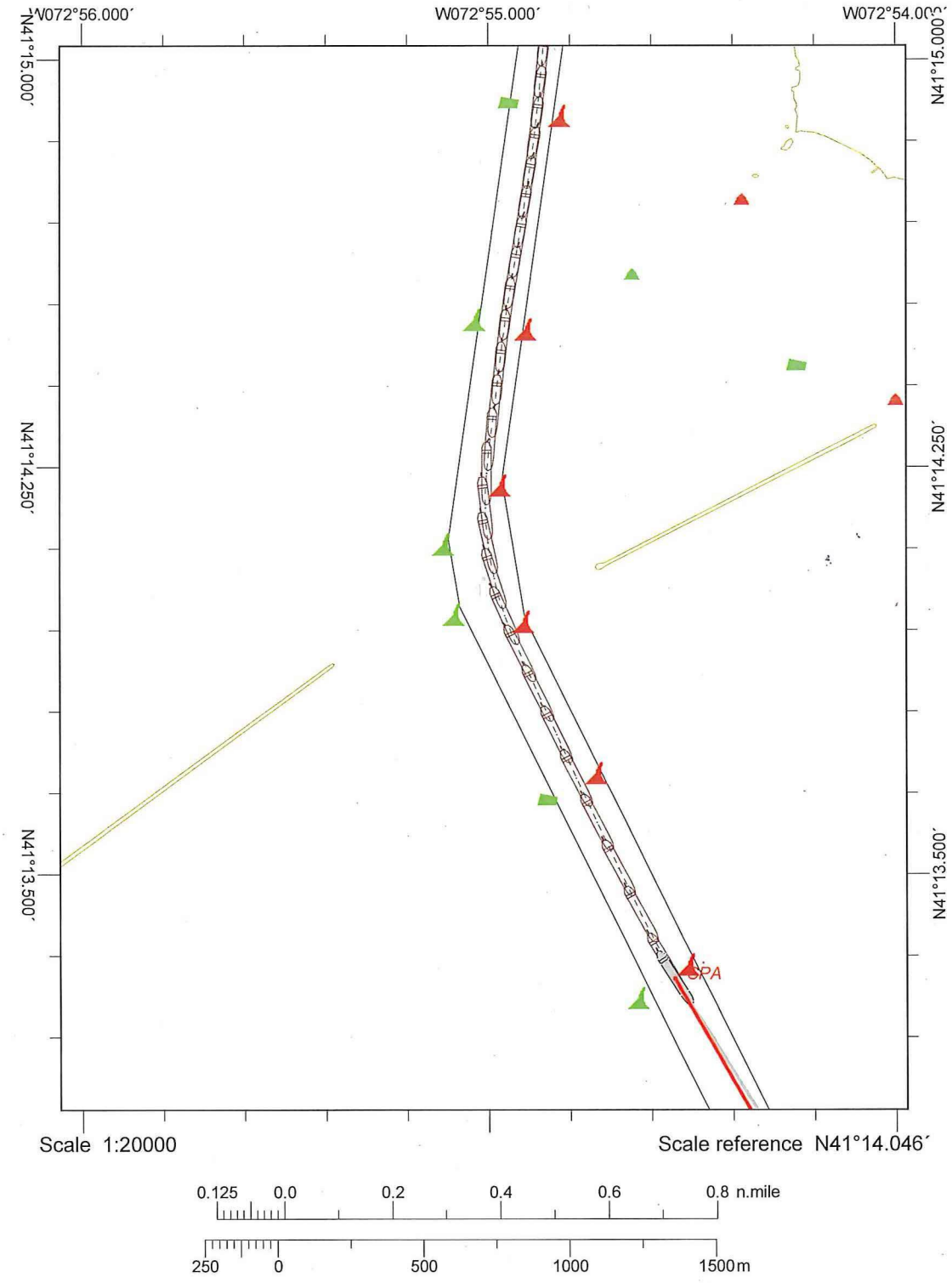
Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: B-P2-F-NW8-I-2-1

Start Time:

End Time:

Comments:
wider channel helped 100% with no suction during the turn after the #7 Buoy.



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – 700 ft width*

Date: 02/13/18

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** 1.5

Wind Condition: 1 **N 8K** (W) 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

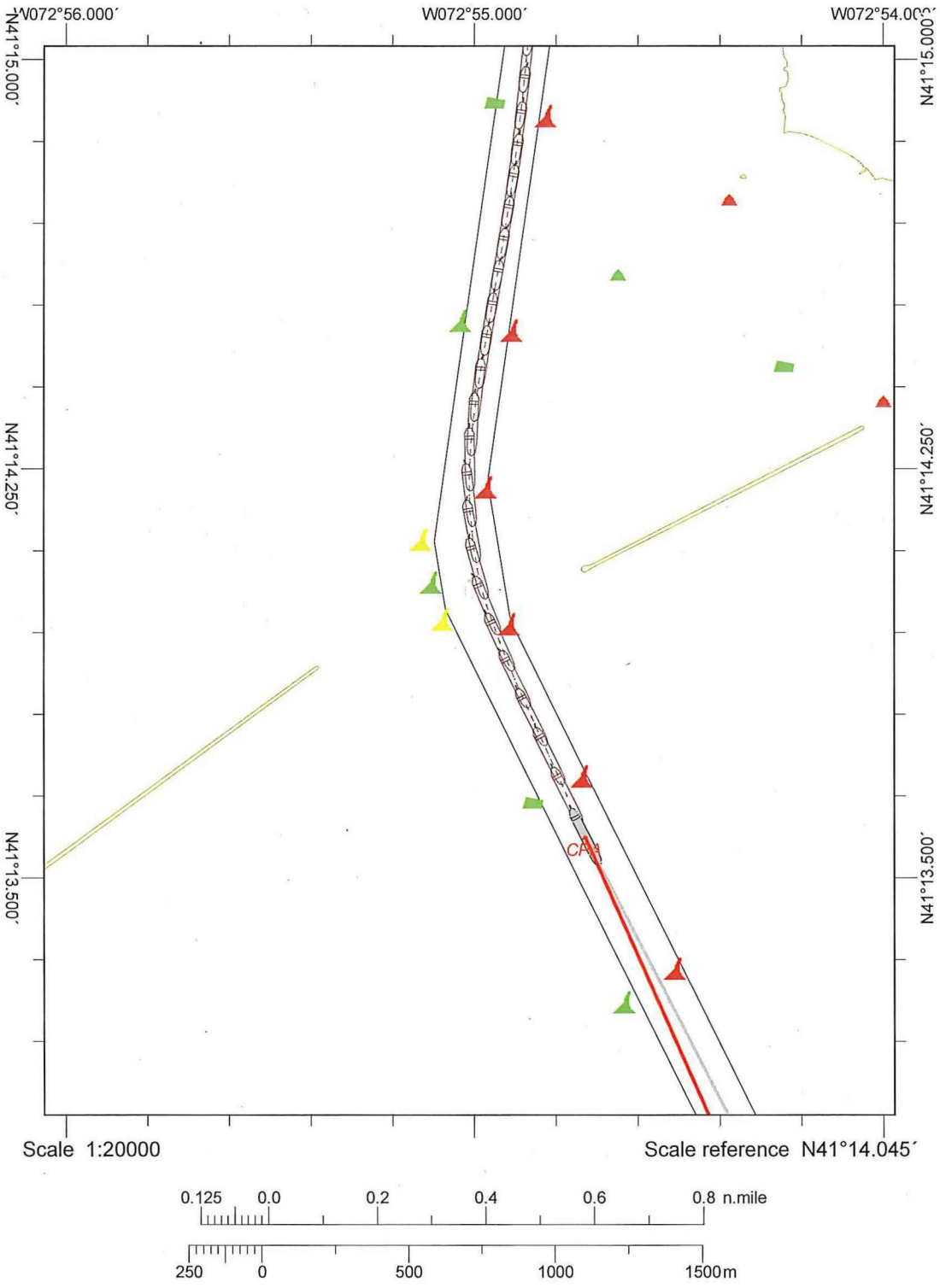
Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: B-P2-F-NW8-O-1-1

Start Time: 1524

End Time: 1609

Comments: ADDITIONAL WIDTH MADE TUG TURN @ #7 BUOY (JETTIES) A LOT EASIER



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – 700 ft width*

Date: 13 Feb 2018

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:**

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

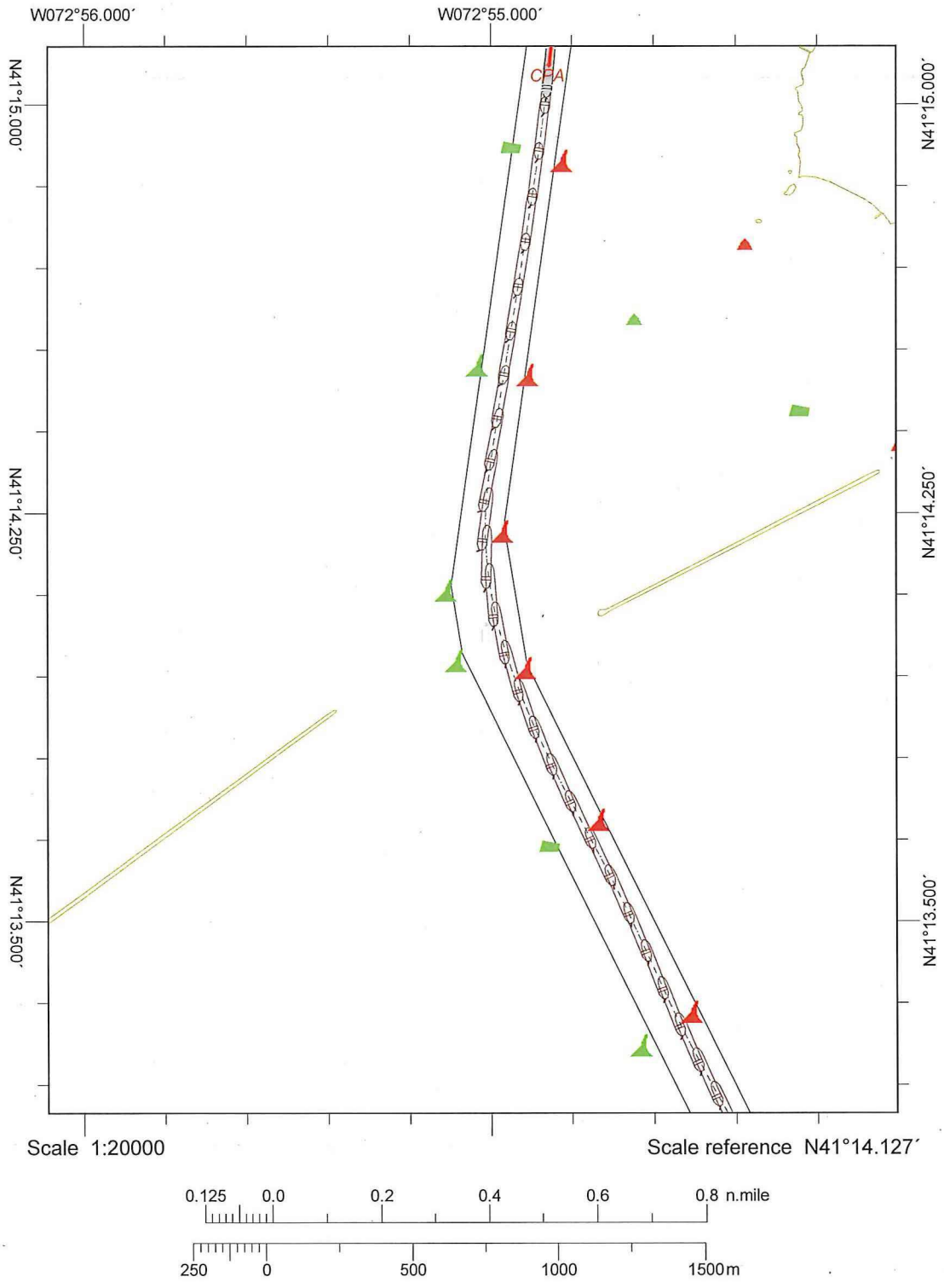
Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: B-P2-F-NW8-O-2-1

Start Time:

End Time:

Comments:



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – 700 ft width*

Date: 2/14/18

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide **Flood** ~~Ebb~~ **Added Tide:** 1.5m

Wind Condition: NW8 ~~1 N 8K~~ 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot ~~1~~) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

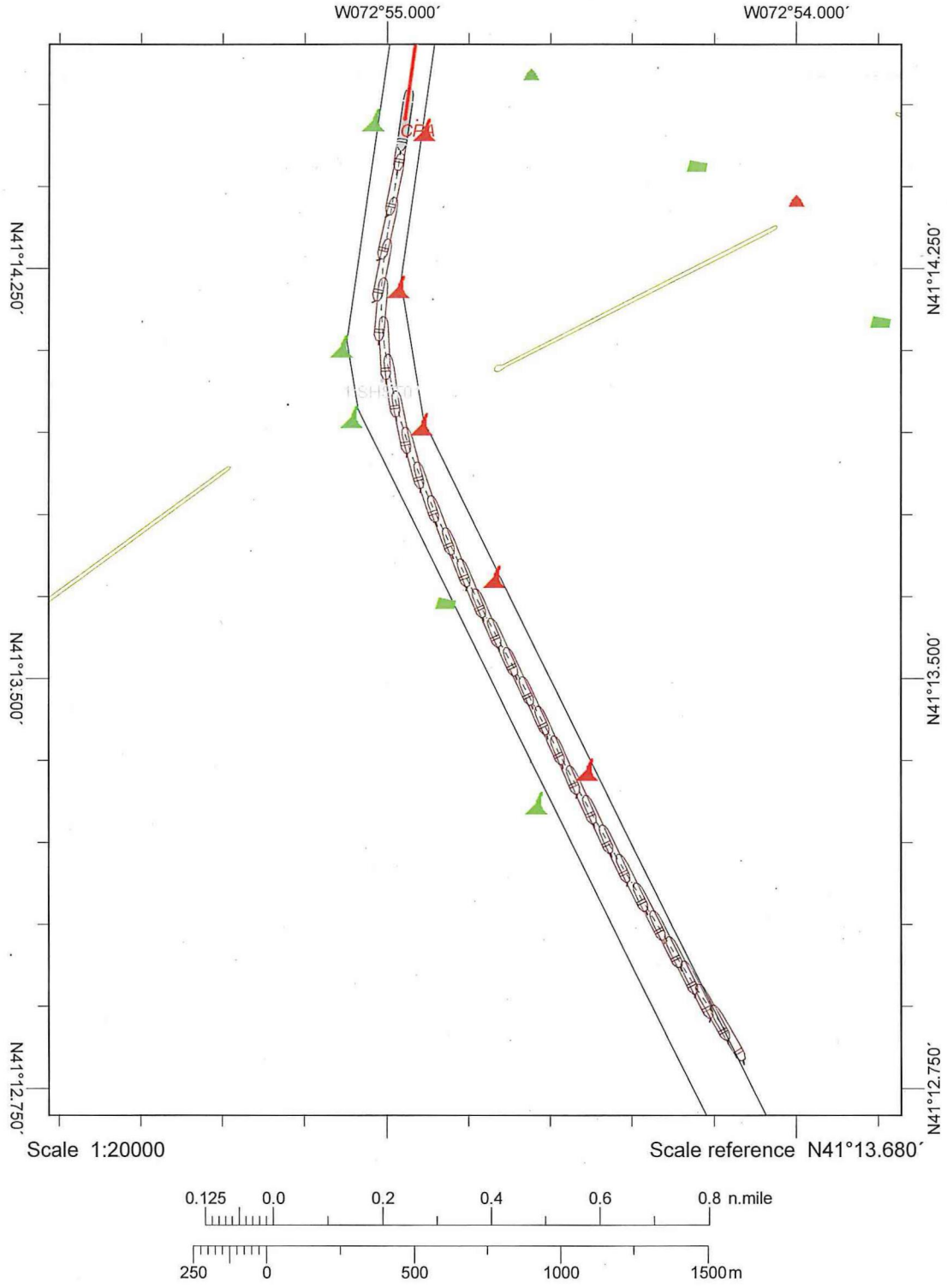
Filename: B-P3-F-NW8-I-1-1

Start Time:

End Time:

Comments:

THIS SIZE/DRAFT SHIP WAS FINE MAKING TURN AT JETTIES BUT TO BREAK TURN RUDDER WAS HARD TO PORT AND ENGINE ON FULL AHEAD.



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – 700 ft width*

Date: 14 Feb 2018

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** 1.5 m

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

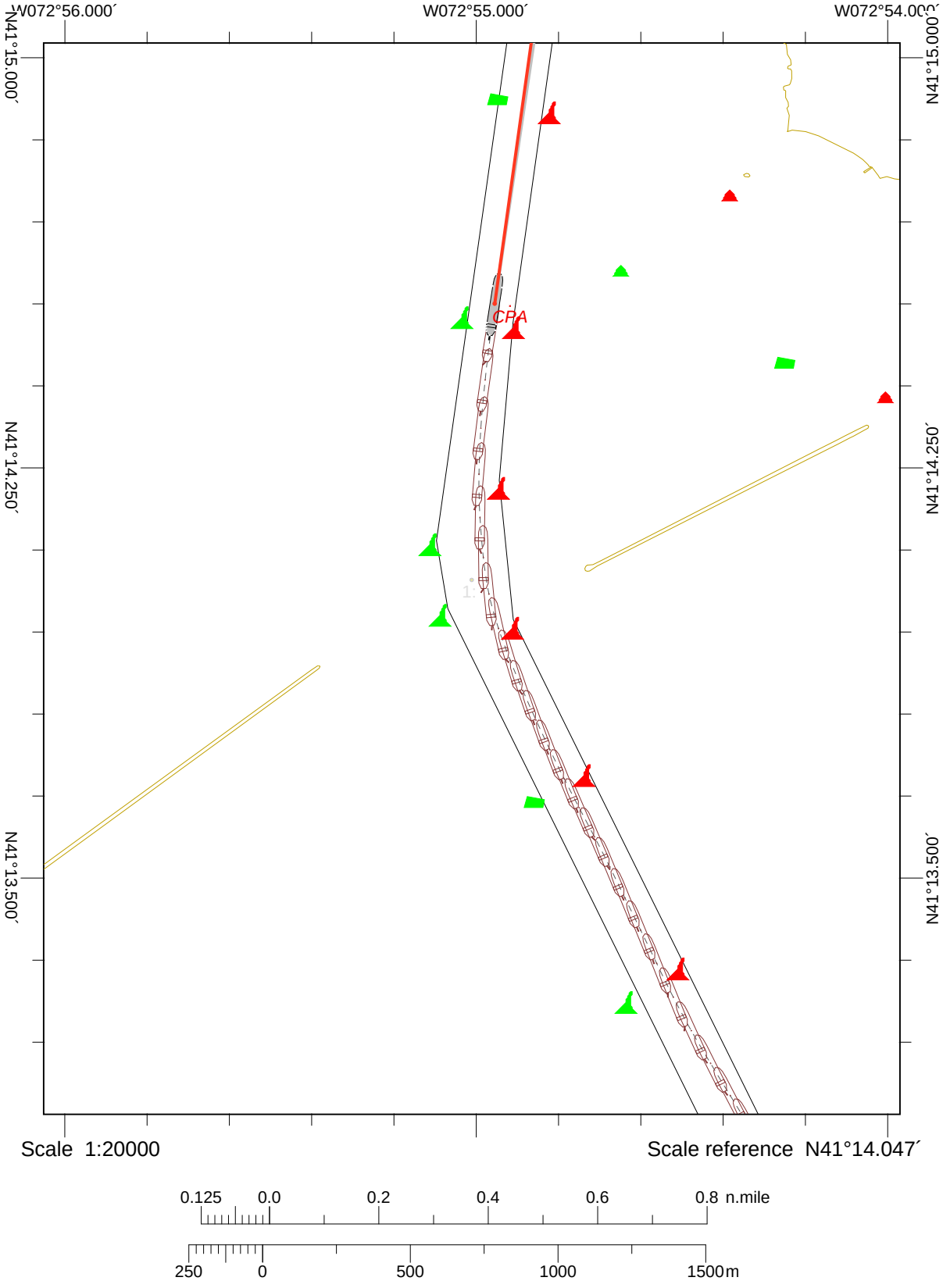
Filename: B-P3-F-NW8-I-2-1

Start Time: [redacted]

End Time:

Comments:

wider channel definitely helps.



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – [redacted] ft width*

Date: 2-14-18

Test Matrix Run Number: **Repetition:** 2

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** 1.5

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

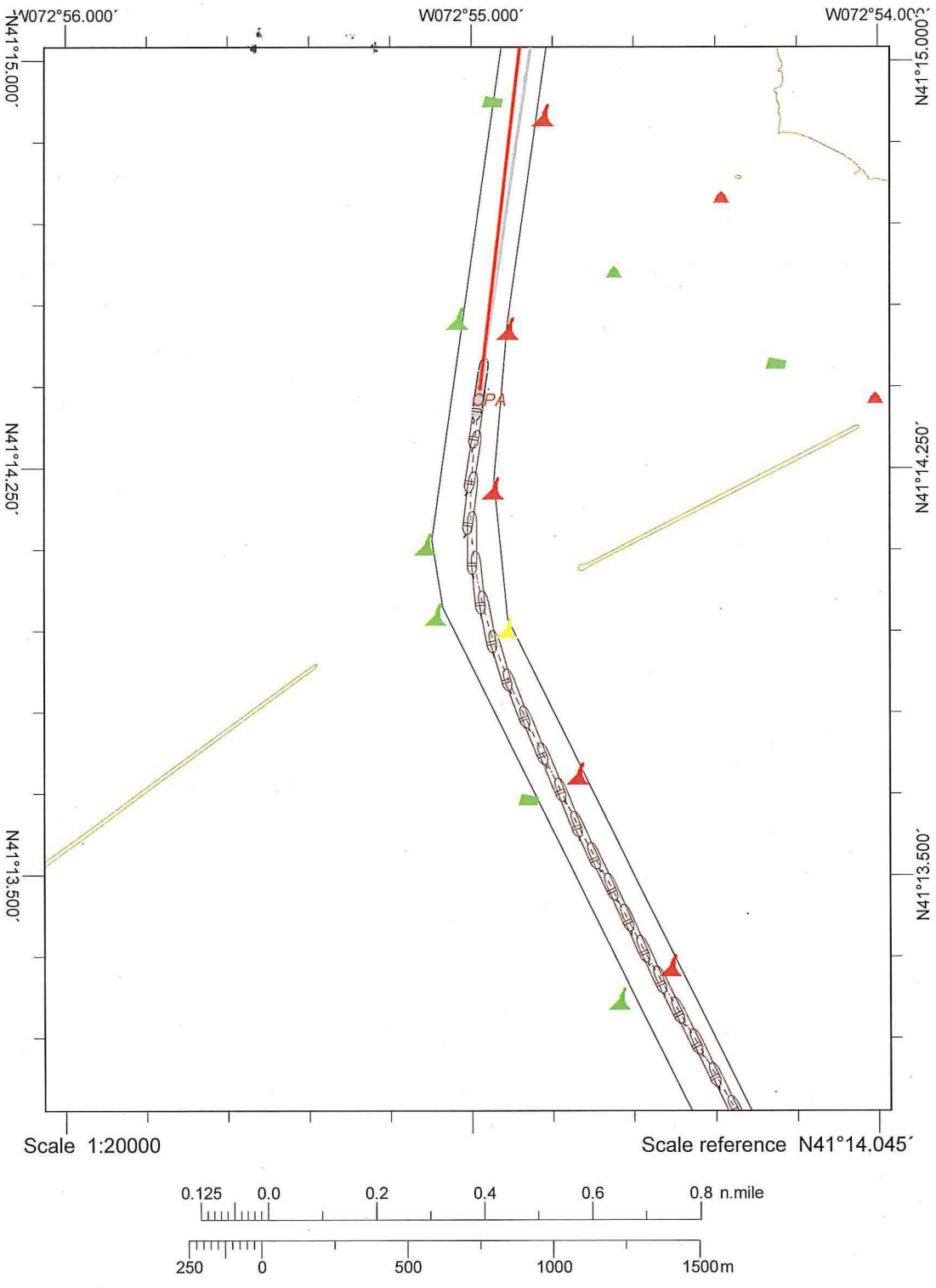
Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: B-P3-F-NW8K-I-1-2

Start Time:

End Time:

Comments: moved 8 buoy 100 ft to east



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – ~~700 ft width~~*

Date: 2/14/18

Test Matrix Run Number: **Repetition:** 2

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide (**F**lood **E**bb **Added Tide:** 1.5

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

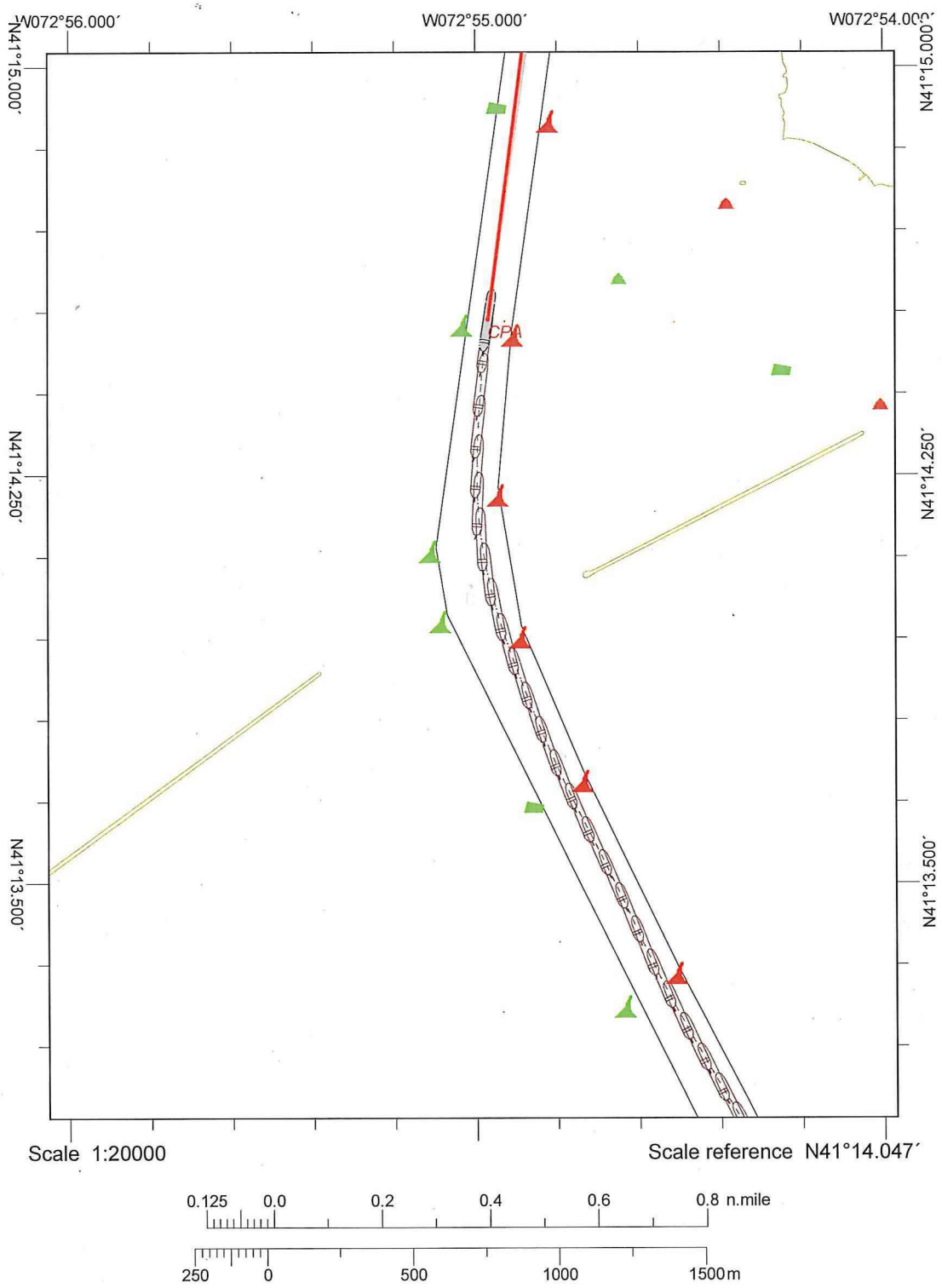
Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: B-P3-F-NW8-I-2-2

Start Time:

End Time:

Comments: Moved 8 buoy east 100 ft



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – 700 ft width*

Date: 2-14-18

Test Matrix Run Number: **Repetition:** 3

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** 1.5

Wind Condition: 1 ~~N 8K~~ NW 8K 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

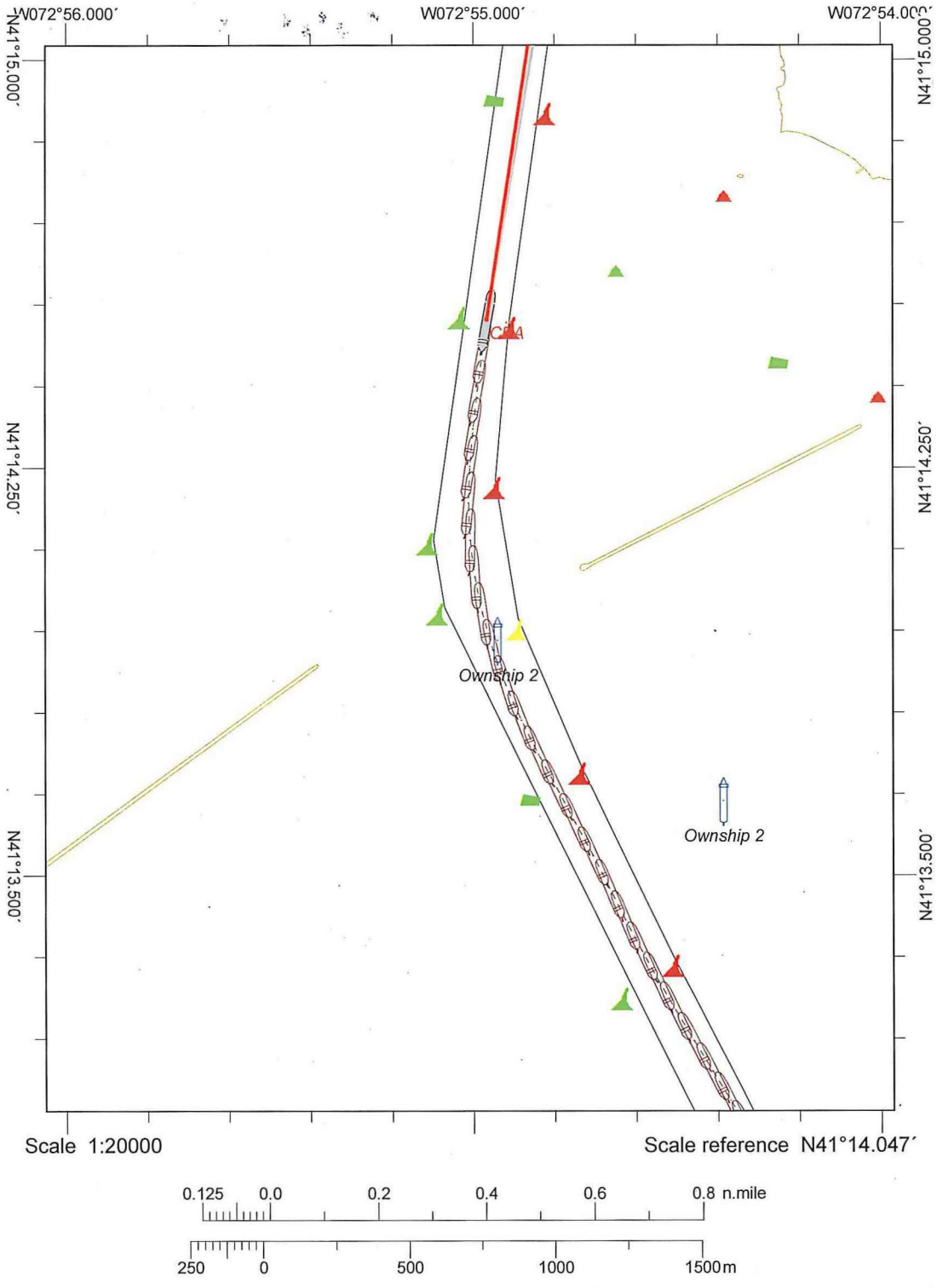
Filename: B-P3-F-NW8 -I-1-3

Start Time:

End Time:

Comments: Moved buoy 6-8 100 ft to east.

MOVING THE 6Y & BUOYS TO THE EAST MADE THE TURN EASIER TO CHECK— 20% RUDDER MAX NO COUNTER TURN Y— LESS THAN 8 KNOTS



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener –* [redacted]

Date: 14 Feb 2018

Test Matrix Run Number: **Repetition:** 3

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** 1.5

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: B-P3-F-NW8-2-3

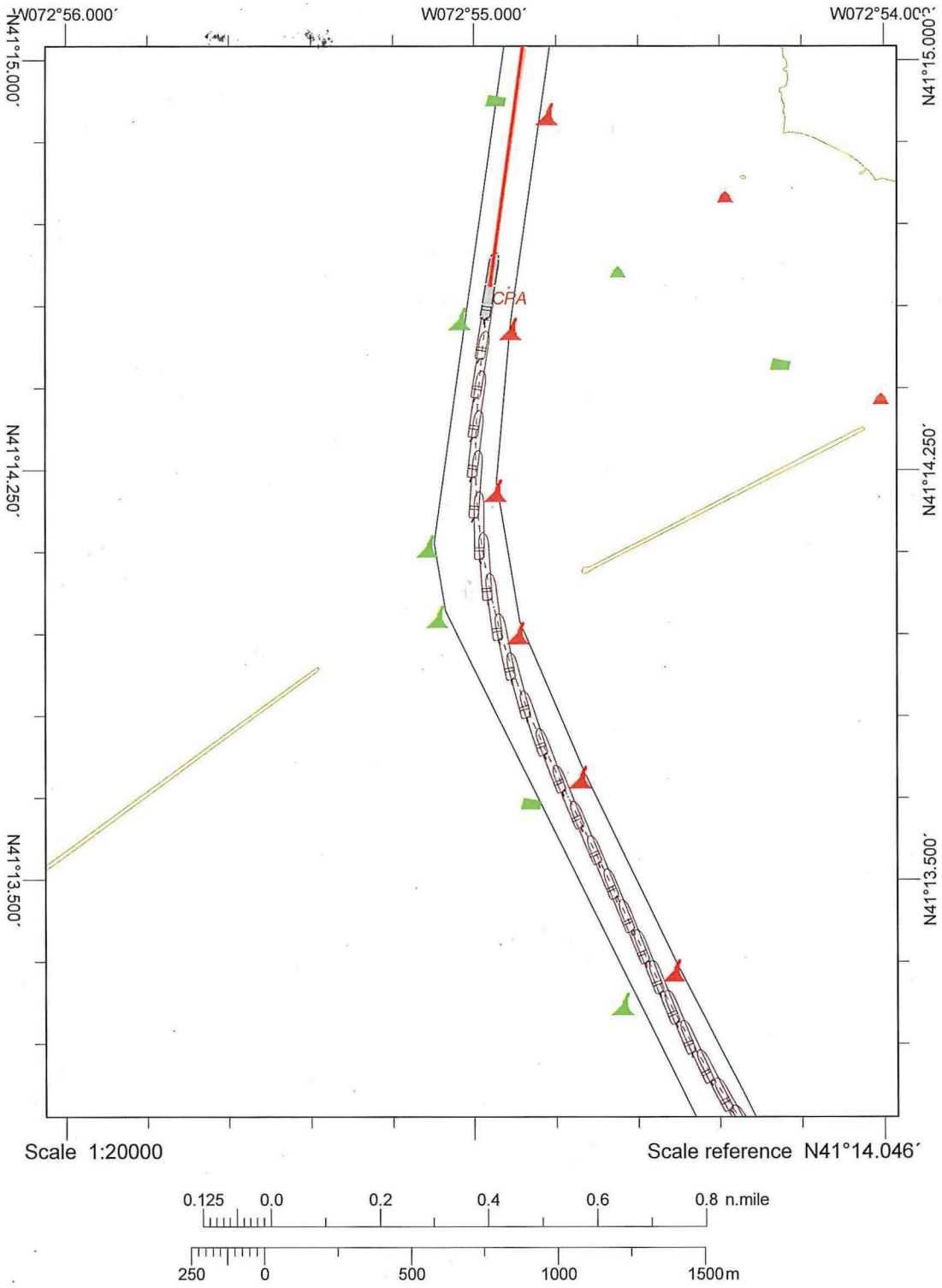
Start Time:

End Time:

Comments: Buoys 6 & 8 moved 100 ft to the east

N41.13.973
W72.54.888

N41.14.227
W72.54.944



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – [redacted]*

Date: 2-14-18

Test Matrix Run Number: **Repetition:** 4

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : Flood Ebb **Added Tide:** 1.5

Wind Condition: 1 **N 8K** (NW) 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: Inbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

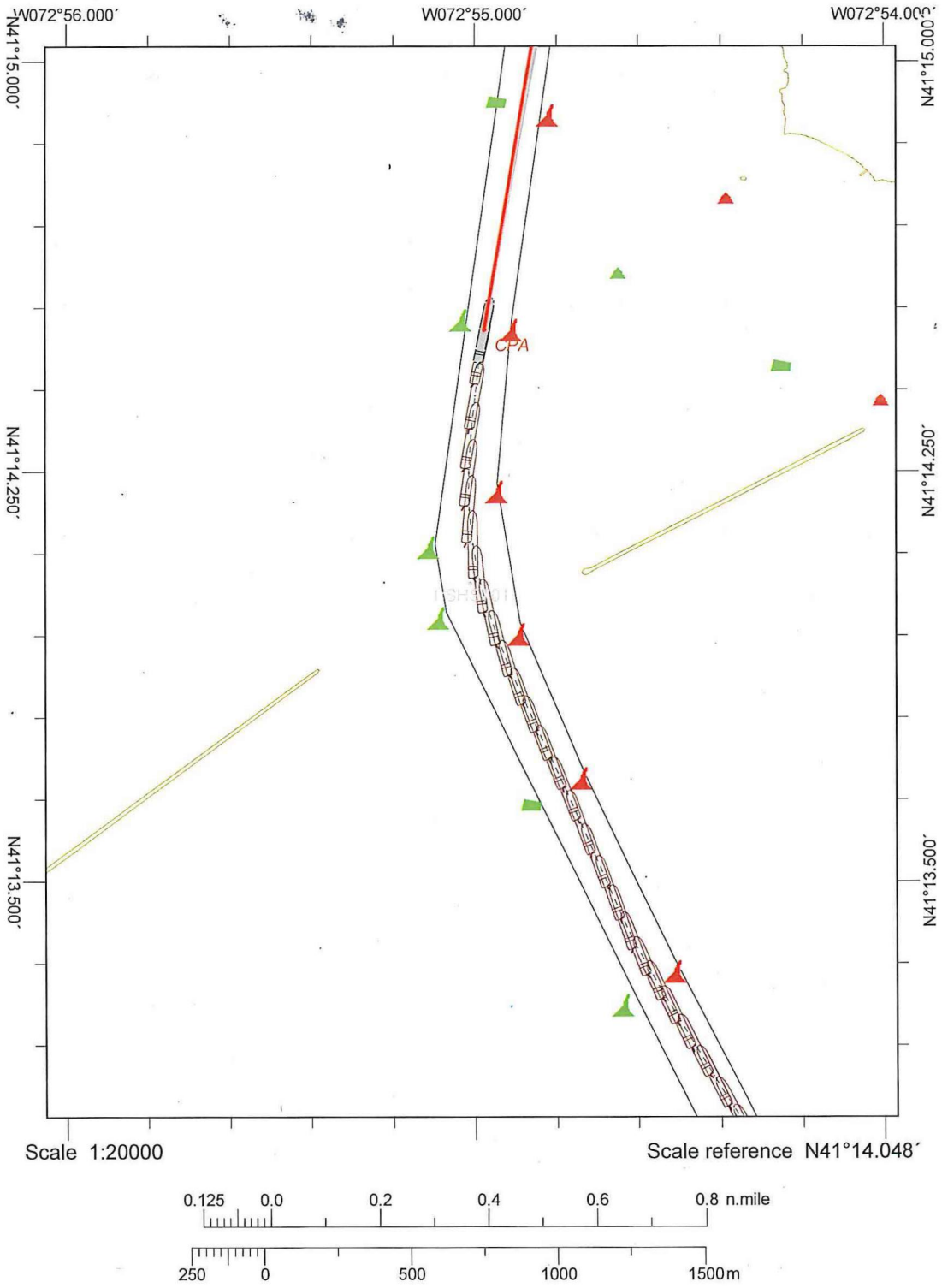
Filename: B-P3-F-NW8K-I-1-4

Start Time:

End Time:

Comments:

THIS LENGTH / DRAFT HANDLED TURN. CHECK UP OK — USED ONLY 20° LEFT RUDDER AT 8 KNOTS TO COUNTER SWING AFTER MAKING TURN



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener* - [redacted]

Date: 14 Feb 2018

Test Matrix Run Number: **Repetition:** 4

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : Flood Ebb **Added Tide:** 1.5

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: Inbound Outbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

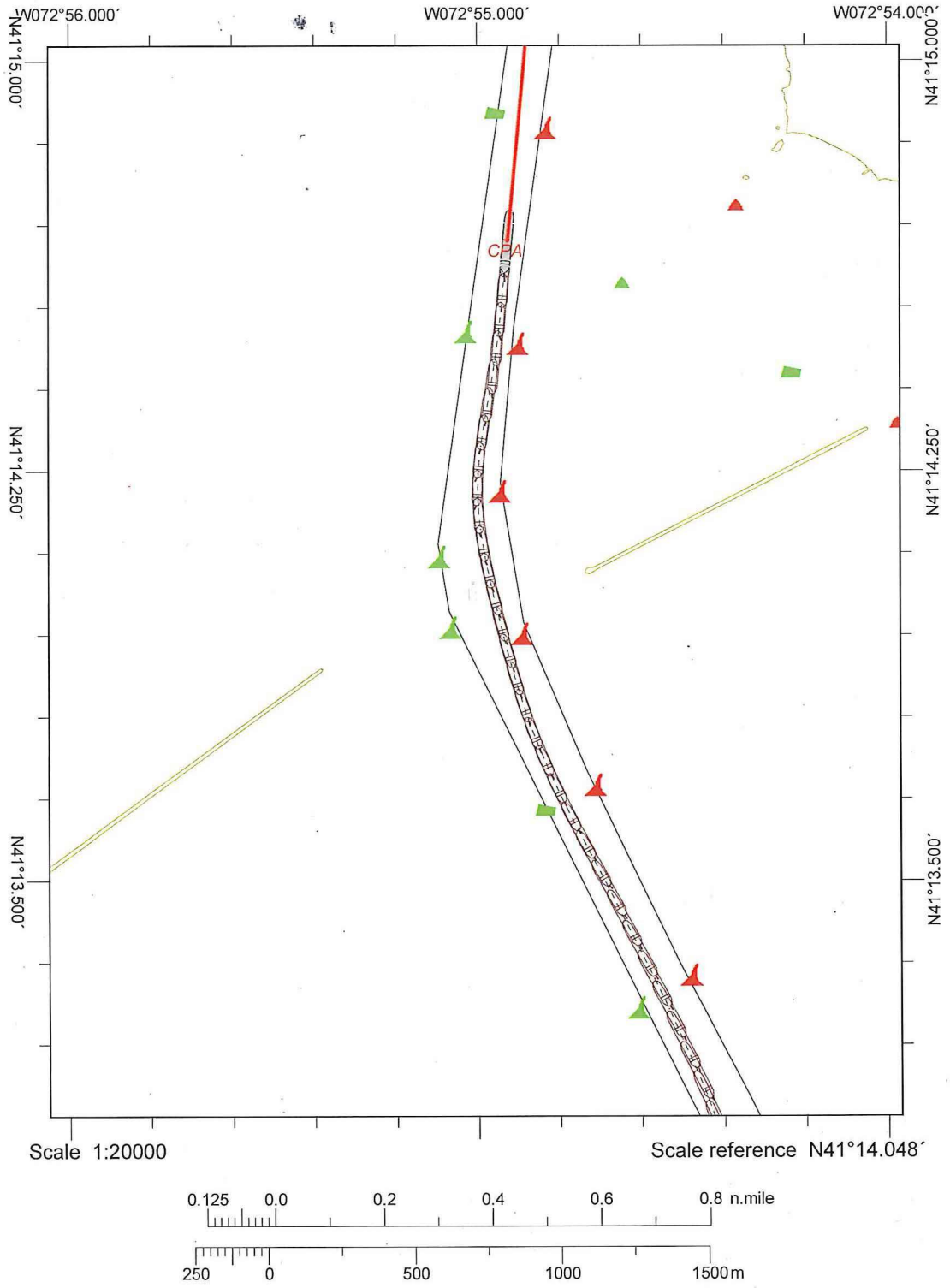
Filename: B-P3-F-NW8-I-2-4

Start Time:

End Time:

Comments:

With Deeper ship: Tried using 20° rudder to stbd But felt I had to put hard rudder to complete turn. got set a lil bit to green side after turn but it was not horrible with 20° rudder to stop swing with a kick ahead. Wide channel is alot Better With 6 & 8 Buoy 100 ft wide.



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener - [redacted]th*

Date: 2-15-18

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(37ft) **P2**(38ft) **P3**(41ft) **P4**(42ft) P7 (42 ft) modified widener

Test Matrix Run Number: **Repetition:**

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** —

Wind Condition: 1 ~~N~~ NW **8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

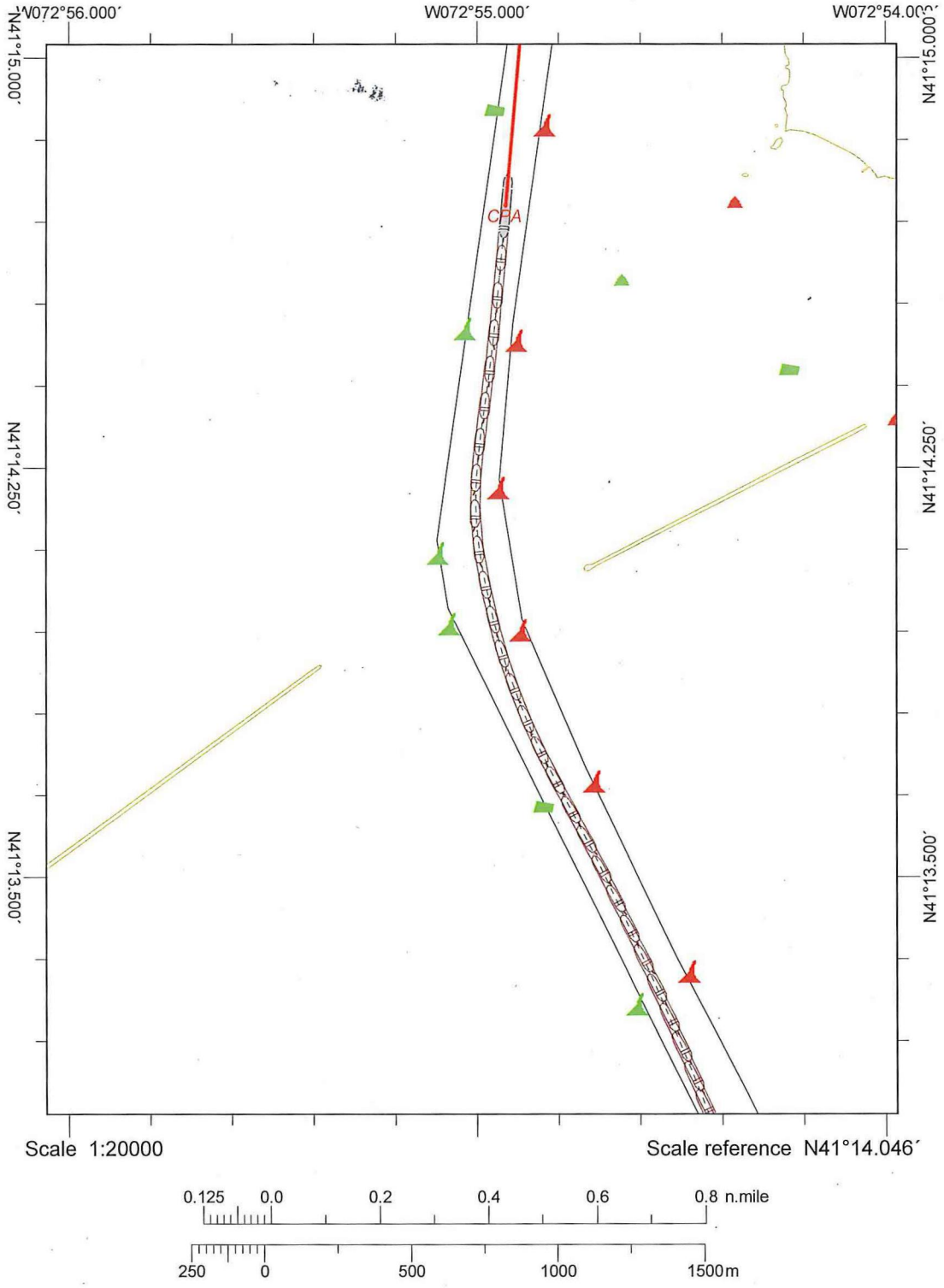
Filename: B-P7-E-NW8-I-1-1

Start Time:

End Time:

Comments:

VESSEL HANDLED GOOD AT THIS DRAFT — USED ONLY 20° OF RUDDER TO MAKE & BREAK THE TURN AT THE VERTICES — ALSO MADE TURN MANEUVER @ 7.0 KTS



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener* [redacted]

Date: 15 Feb 2018

Test Matrix Run Number: **Repetition:**

Channel Alternative: **P0**(Ex) **P1**(37ft) **P2**(38ft) **P3**(41ft) **P4**(42ft) P7-42' modified widener

Test Matrix Run Number: **Repetition:** 1

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:**

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

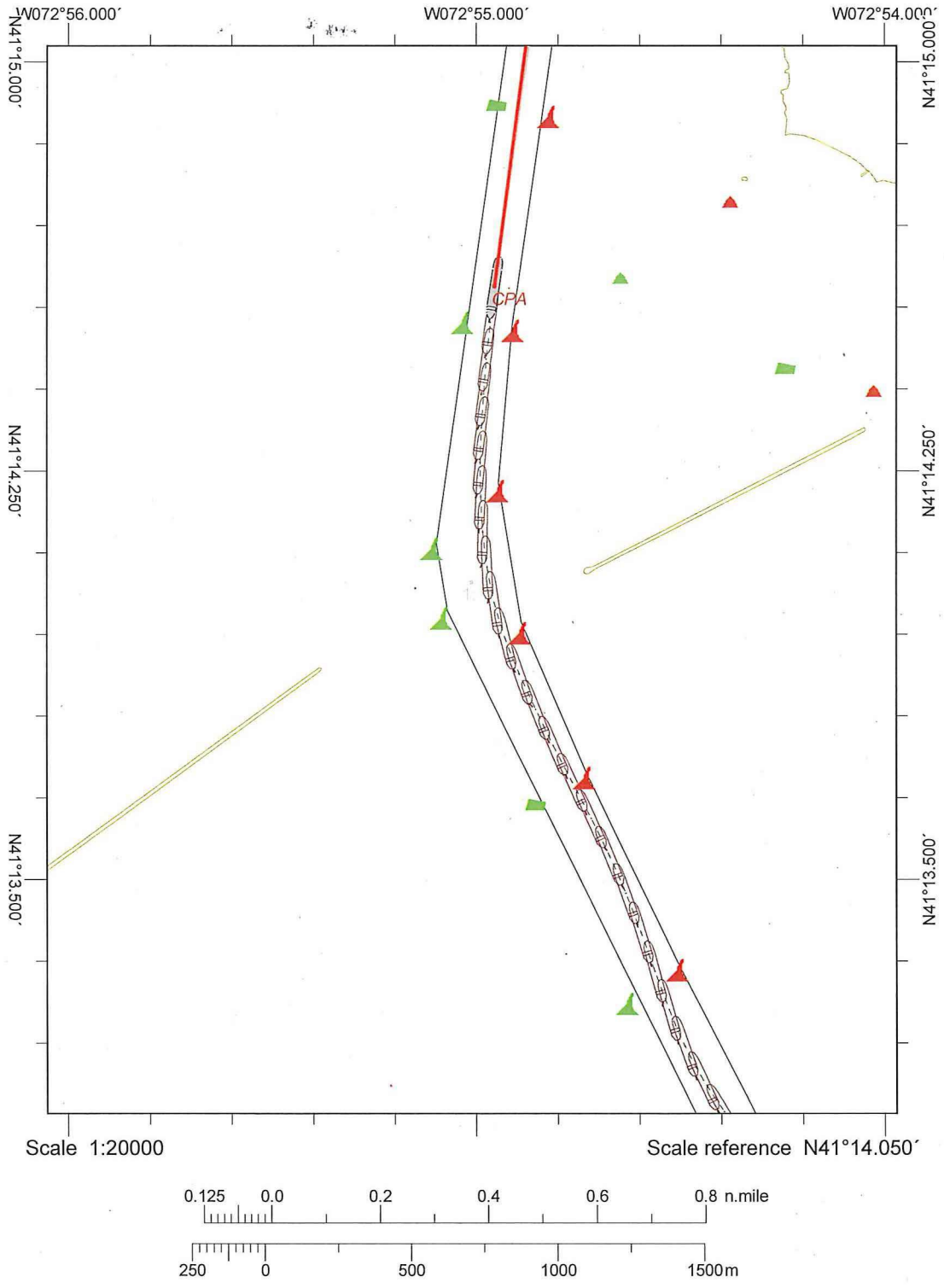
Filename: B-P7-E-NW8-I-2-1

Start Time: 1055

End Time:

Comments:

Nice & easy turn of 20° rudder with no major kicks ahead. had to check ~~[illegible]~~ swing once but shifting rudder but shorter normal.



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener* ~~700 ft width~~

Date: 2-15-18

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(37ft) **P2**(38ft) **P3**(41ft) **P4**(42ft) P7 (42 ft)

Modified widener

Test Matrix Run Number: **Repetition:**

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:**

Wind Condition: 1 ~~N 8K~~ NW **SW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

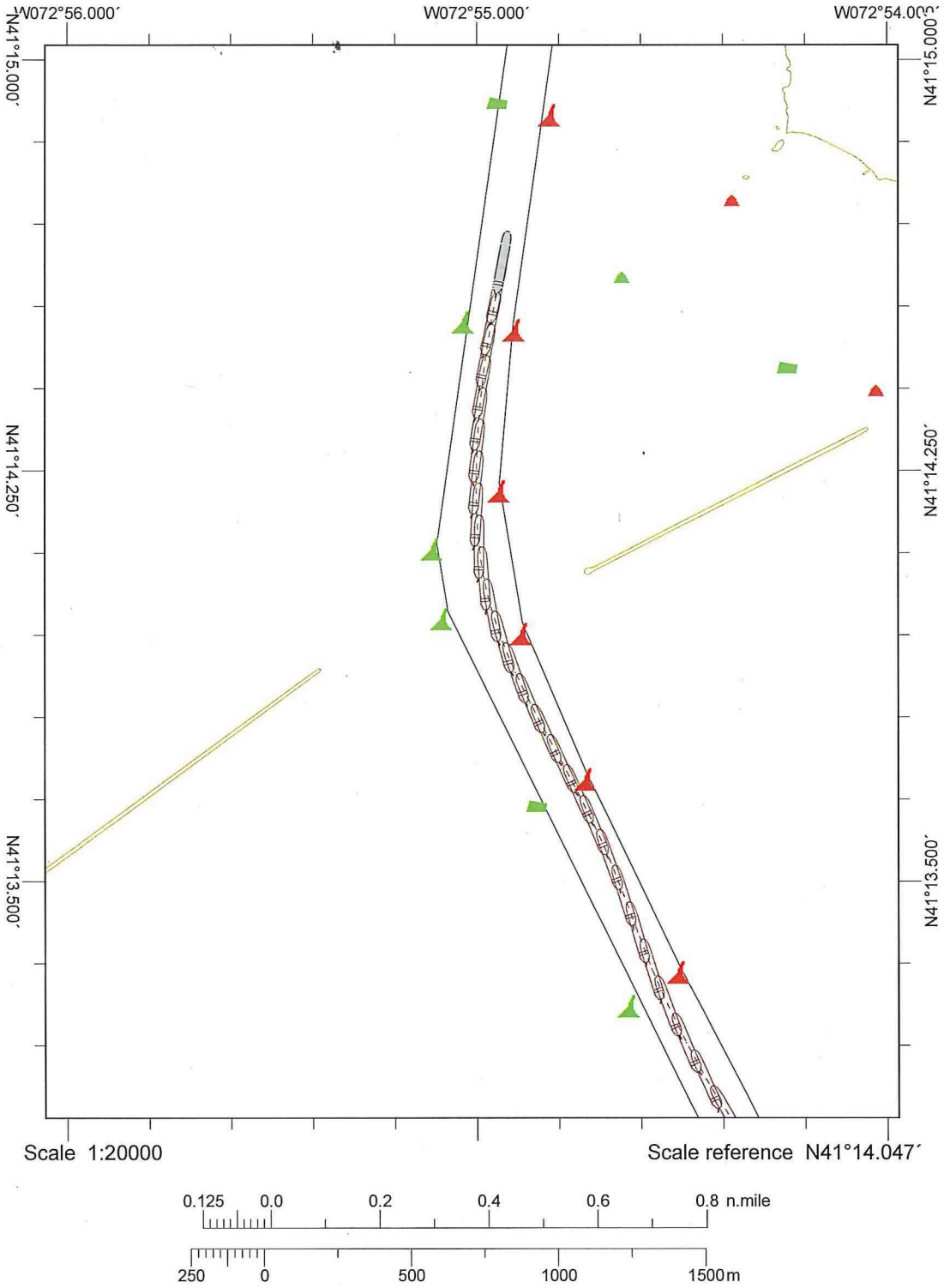
Filename: B-P7-F-NW8-I-1-1

Start Time:

End Time:

Comments:

SHIP HANDLED GOOD AT 8 KNOTS
ONLY NEED 30° OF RUDDER + 7-8 KNOTS



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener* – [redacted]

Date: 15 Feb 2018

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(37ft) **P2**(38ft) **P3**(41ft) ~~**P4**(42ft)~~ P7 modified widener

Test Matrix Run Number: **Repetition:**

Design Ship: (**1** *BULK06L*) **2** *TANK10L*

Tide : (**F**lood) **E**bb **Added Tide:** 0

Wind Condition: (NW) 1 ~~N~~ **8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: (**I**nbound) **O**utbound

PILOT: ~~Capt. Charles Jonas (Pilot 1)~~ (Capt. Donald Toby (Pilot **2**))

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

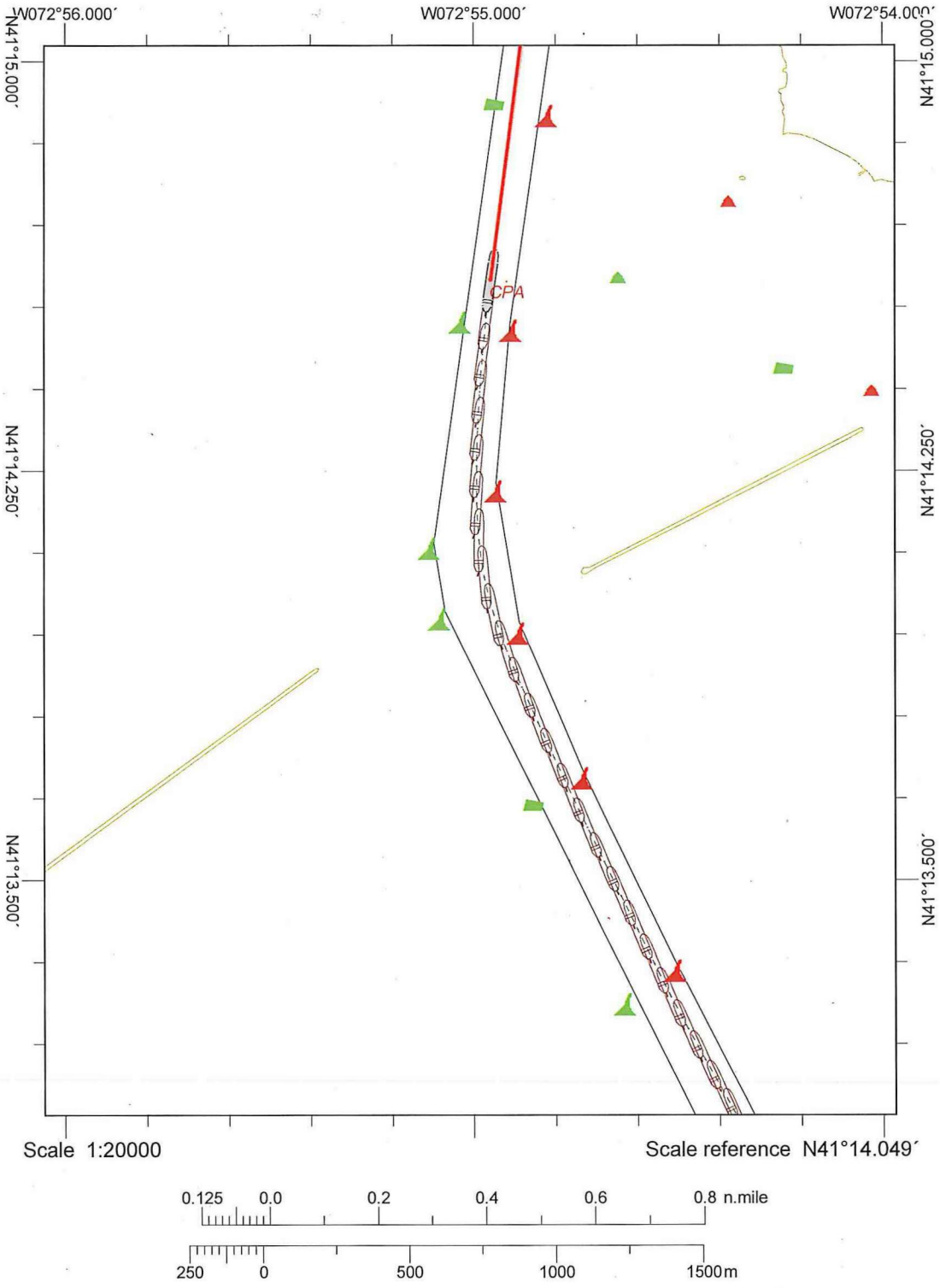
Filename: B-P7-F-NW8-I-2-1

Start Time: 1135

End Time:

Comments:

extra depth helped, nice easy turn 20° whole time no kicks ahead. didnt have to use hard to port and kick ahead to full to stop the swing.



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener* ~~700 ft width~~

Date: 2-15-18

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L* modified widener

Tide : Flood Ebb **Added Tide:** 1.0

Wind Condition: 1 ~~N~~ NW **8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: Inbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: B-P5-F-NW8-I-1-1

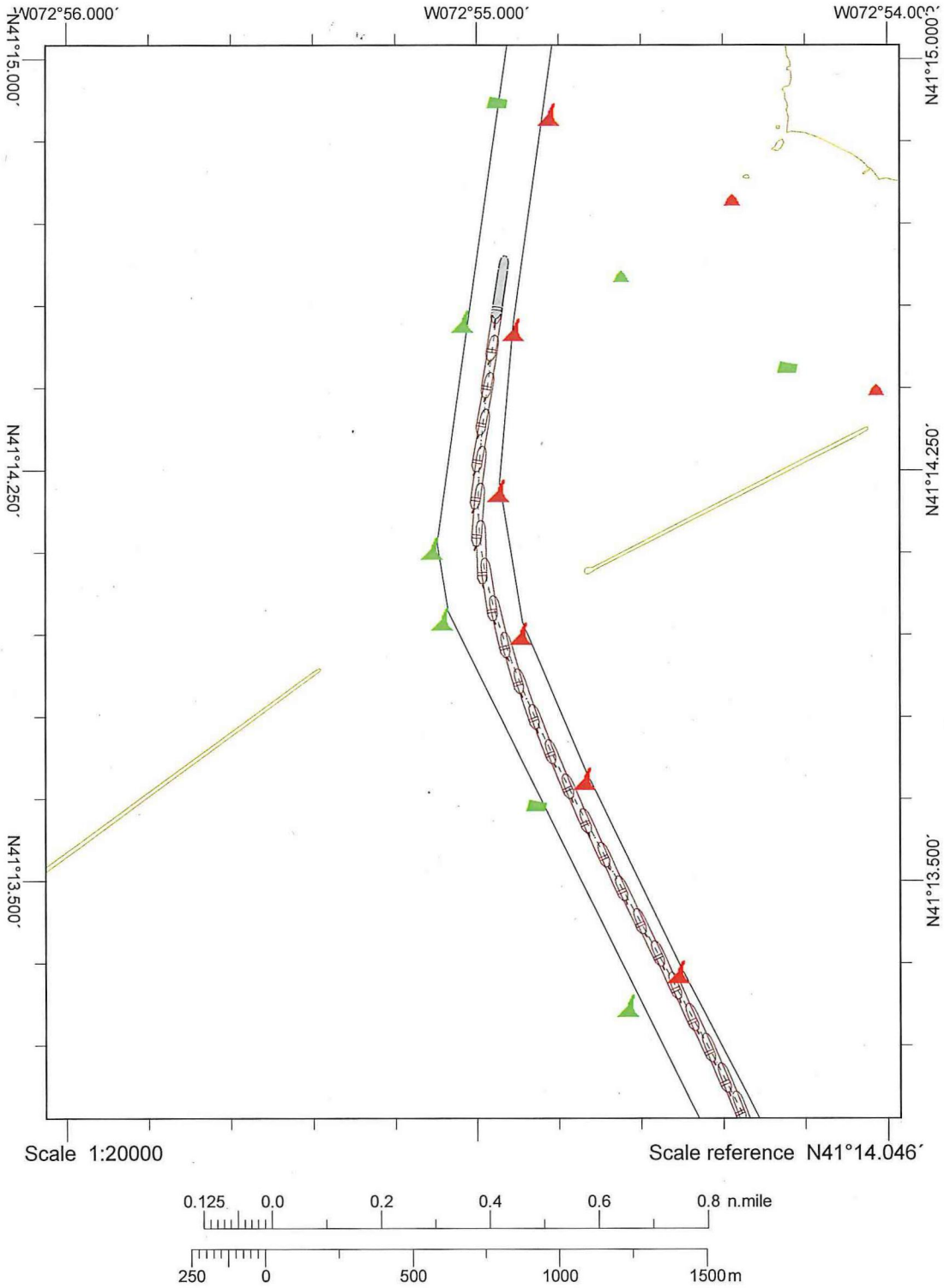
Start Time:

End Time:

Comments:

ONLY USED 20° RUDDER & MADE TURNAT +/- 8 KNOTS

— CONFORTABLE MANEUVER



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – 700 ft width*

Date: 15 Feb 2018

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) ~~**P7**(42ft)~~

Design Ship: **1** *BULK06L* **2** *TANK10L* modified widener

Tide : Flood Ebb **Added Tide:** 1.0

Wind Condition: 1 **N 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K** (NW)

Heading: Inbound Outbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

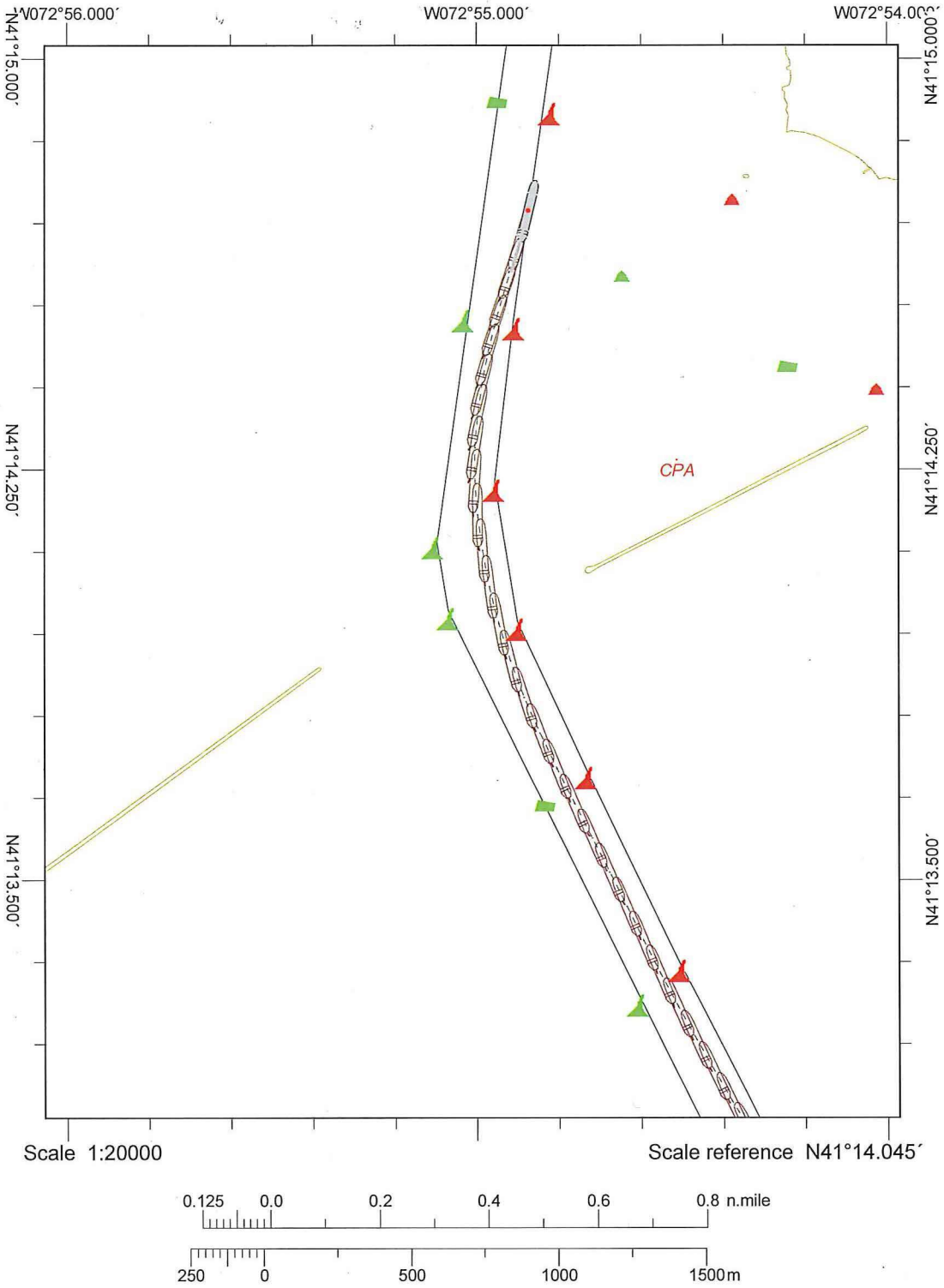
Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: B-P5-F-NW8-I-2-1

Start Time: 1205

End Time:

Comments:



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener* - [redacted]

Date: 16 Feb 2018

Test Matrix Run Number: **Repetition:** 2

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : Flood Ebb **Added Tide:**

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: Inbound Outbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

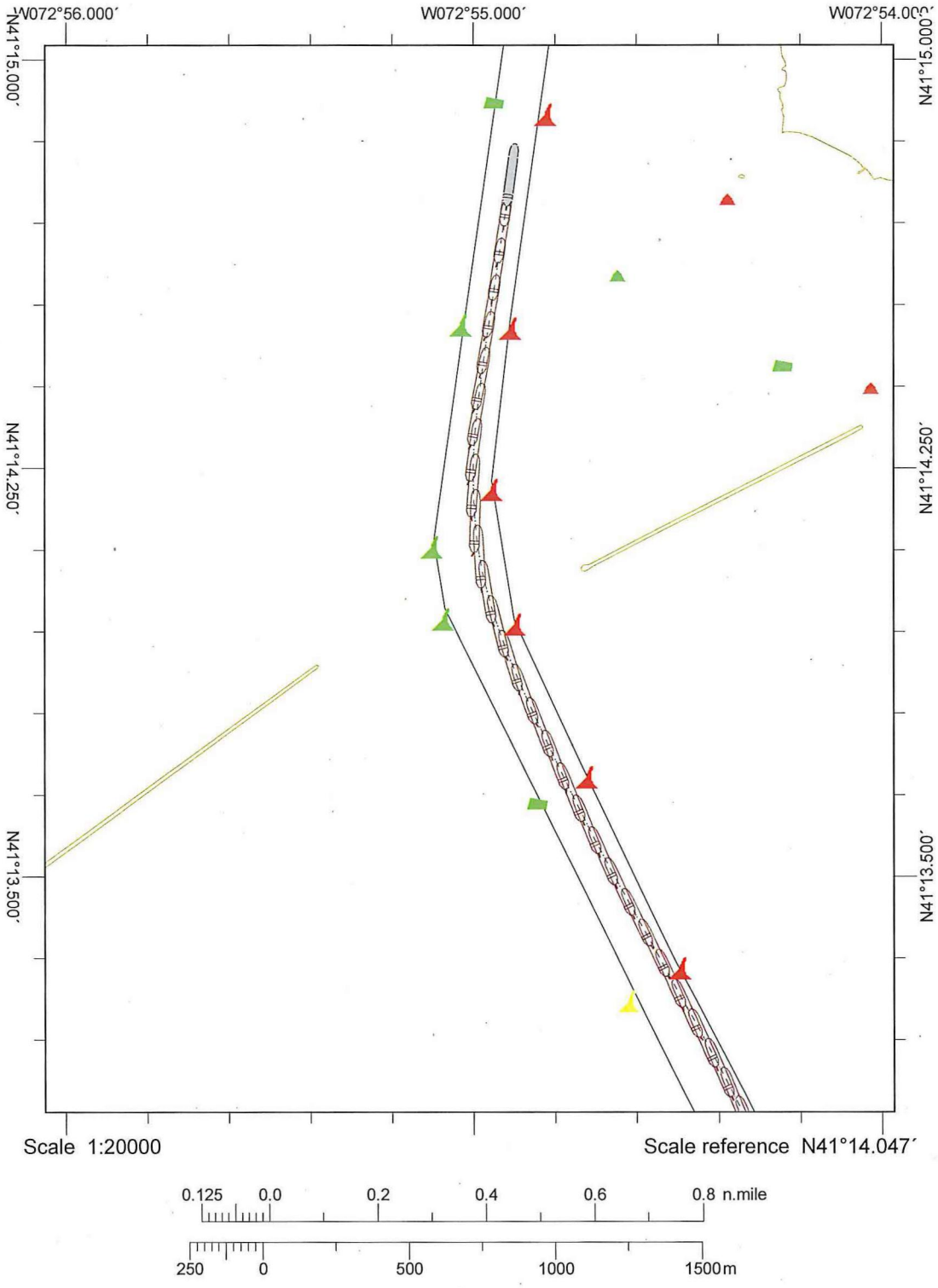
Filename: B-P7-F-NW8-I-1-2

Start Time:

End Time:

Comments: Buoys 6/8 only moved 50 ft to east

THERE IS NO SAFETY FACTOR ON THIS ROUTE — USED 20° OF RUDDER FOR TURN & CHECK UP — 20° WAS NOT ADEQUATE TO CHECK UP SWING



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area B: *Bend Widener – 700 ft width*

Date: Feb 16, 2018

Test Matrix Run Number: **Repetition:** 2

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : Flood Ebb **Added Tide:**

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: Inbound Outbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

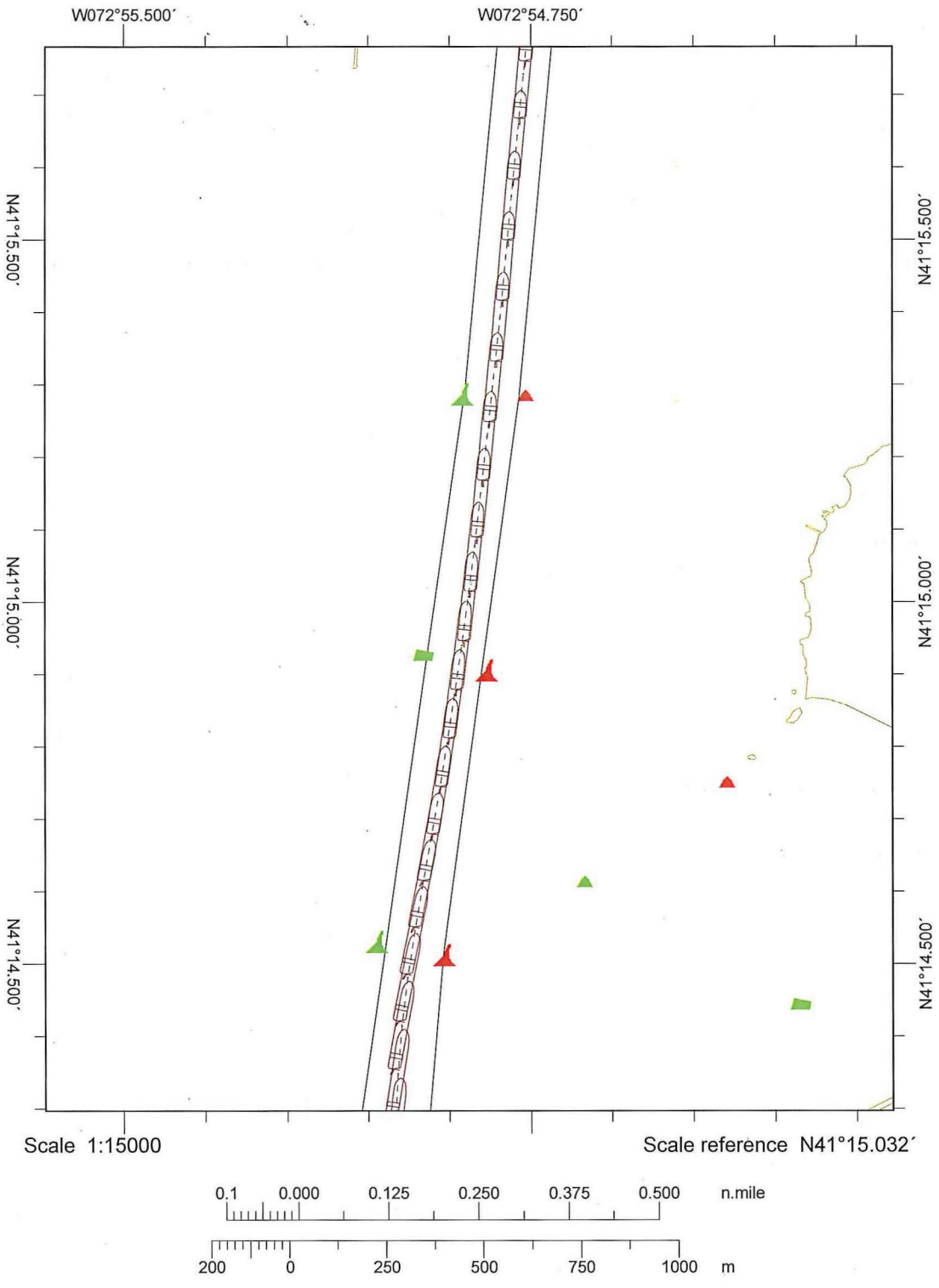
Filename: B - P7 - F - NW 8 - I - 2 - 2

Start Time:

End Time:

Comments: Buoys 6+8 only moved 50ft to east

Turn went well [redacted] but the #8 Buoy having 50ft made a difference for the last part of turn b/c it did not open up like before and had to get a lot closer to the 6+8 buoy to complete the turn.



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area C: *Harbor Channel ~~500~~ 450 ft width* From 9/10a to 15/16

Date: 2-14-18

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** 1.5

Wind Condition: 1 **N** ~~**8K**~~ NW **8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

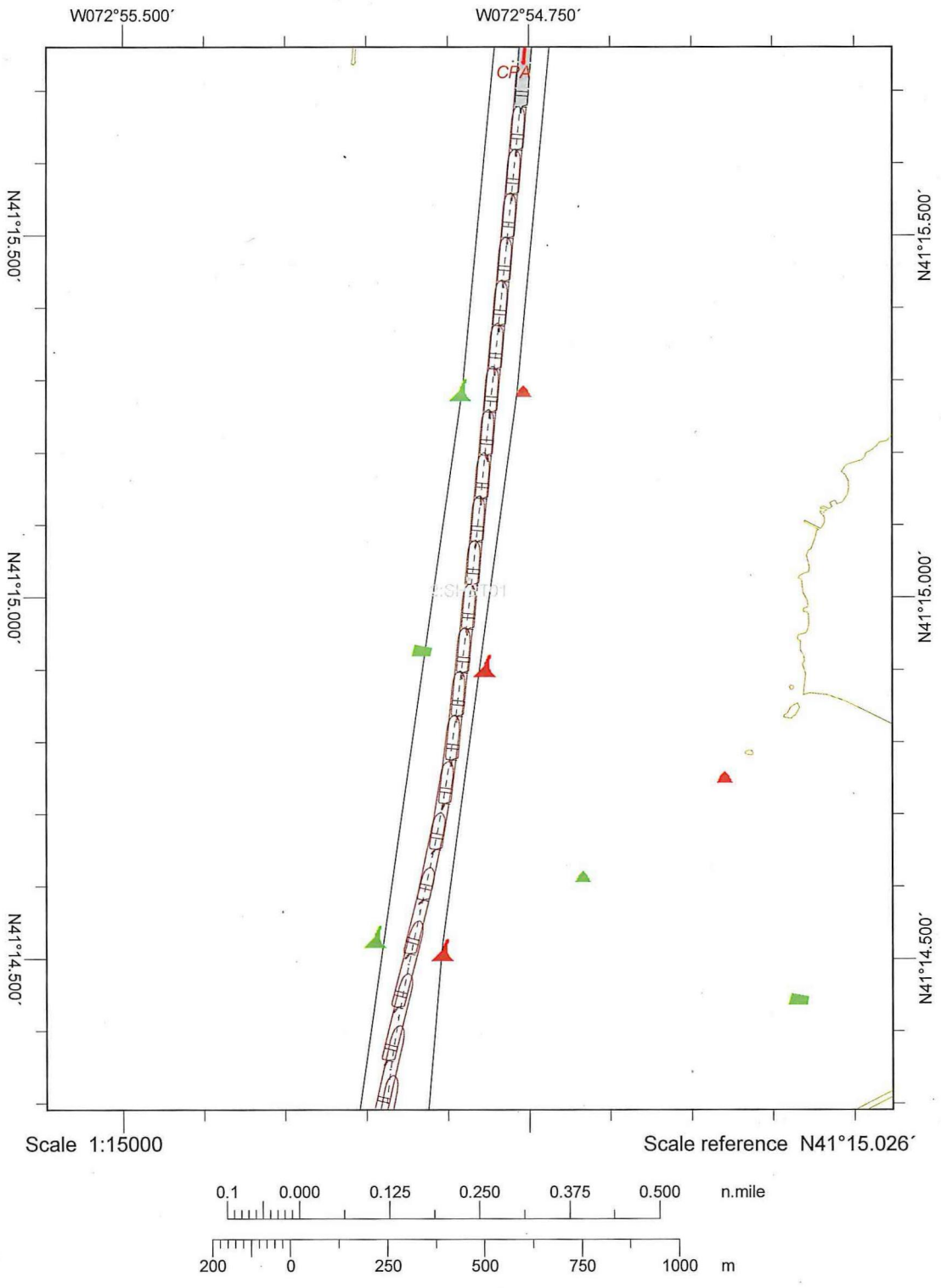
Filename: C-P3-F-NWX—I-1-1

Start Time:

End Time:

Comments:

THIS LOA/DRAFT IS OK IN THE 450ft CHANNEL HOWEVER, IN THIS AREA THE HORIZONTAL CLEARANCE IS ALSO REDUCED BY 70 to 80ft FOR BEAM OF TUGS + WHEN THE TUGS ARE COMING A/S THEY CREATE SOME SUCTION



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area C: *Harbor Channel – ~~500 ft~~ 750 width* from 9/10a to 15/16

Date: 14 Feb 2014

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** 1.5

Wind Condition: 1 **N 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

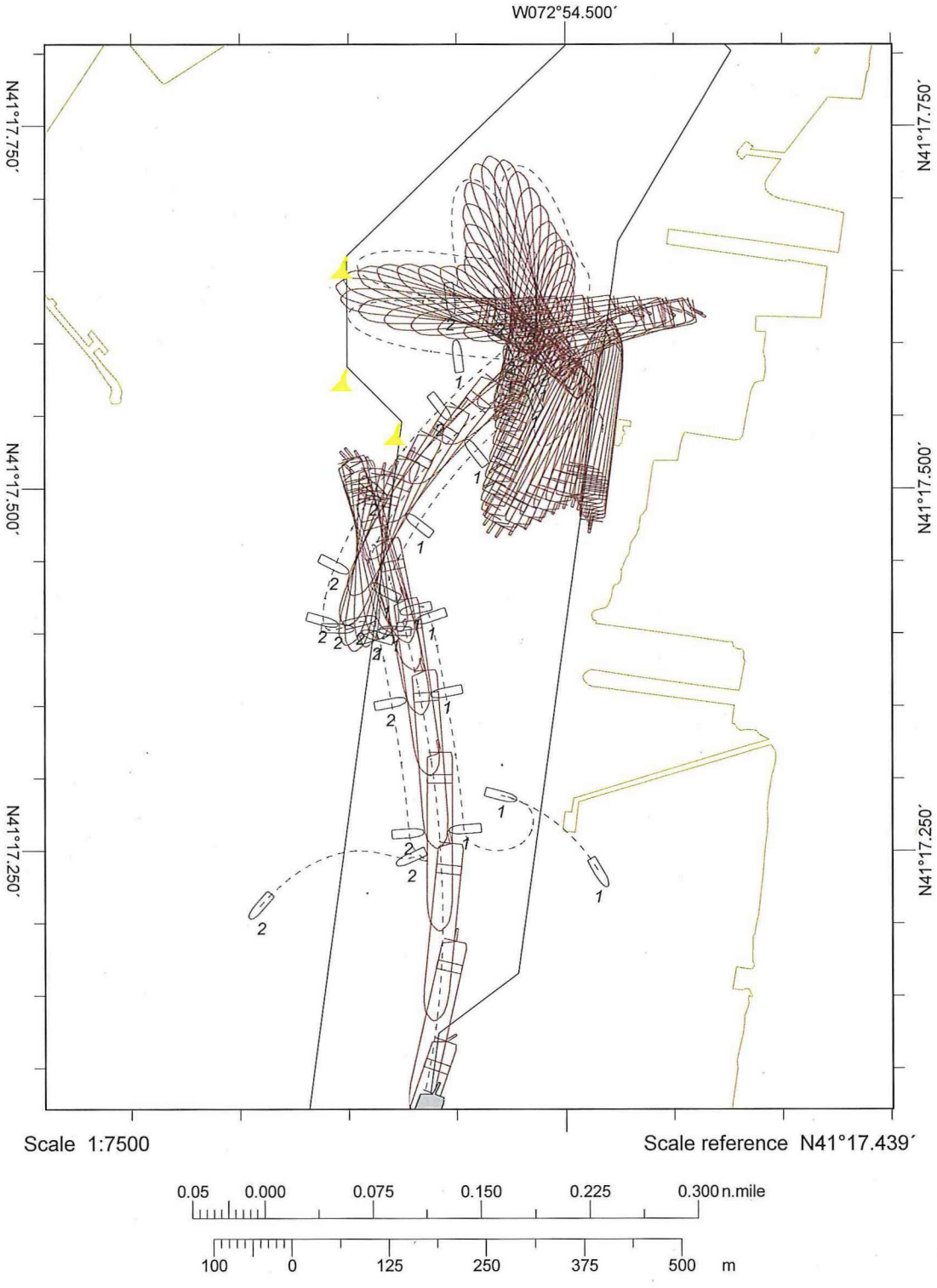
Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: C - P3 - F - NW8 - I - 2 - 1

Start Time:

End Time:

Comments:



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area D: *Turning Basin*

Date: 02/13/18

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) (**P2**(37ft)) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft) FB 20M

Design Ship: **1** *BULK06L* (**2** *TANK10L*)

Tide : (**F**lood) **E**bb **Added Tide:**

Wind Condition: ~~1 N 8K~~ (NW 8K) 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound (**O**utbound)

PILOT: (Capt. Charles Jonas (Pilot **1**)) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: D - ~~P3~~ P2 - F - NW8 - O - 1 - 1

Start Time: 1646

End Time: ~~1646~~ 1747

Comments: MODEL WAS WAY TOO SLUGGISH, THE DRAFT ON THE MODEL WAS WAY TOO DEEP FOR THIS MANEUVER.

Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area D: *Turning Basin*

Date: 13 Feb 2018

Test Matrix Run Number: **Repetition:** 1

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** Flat Bottom

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

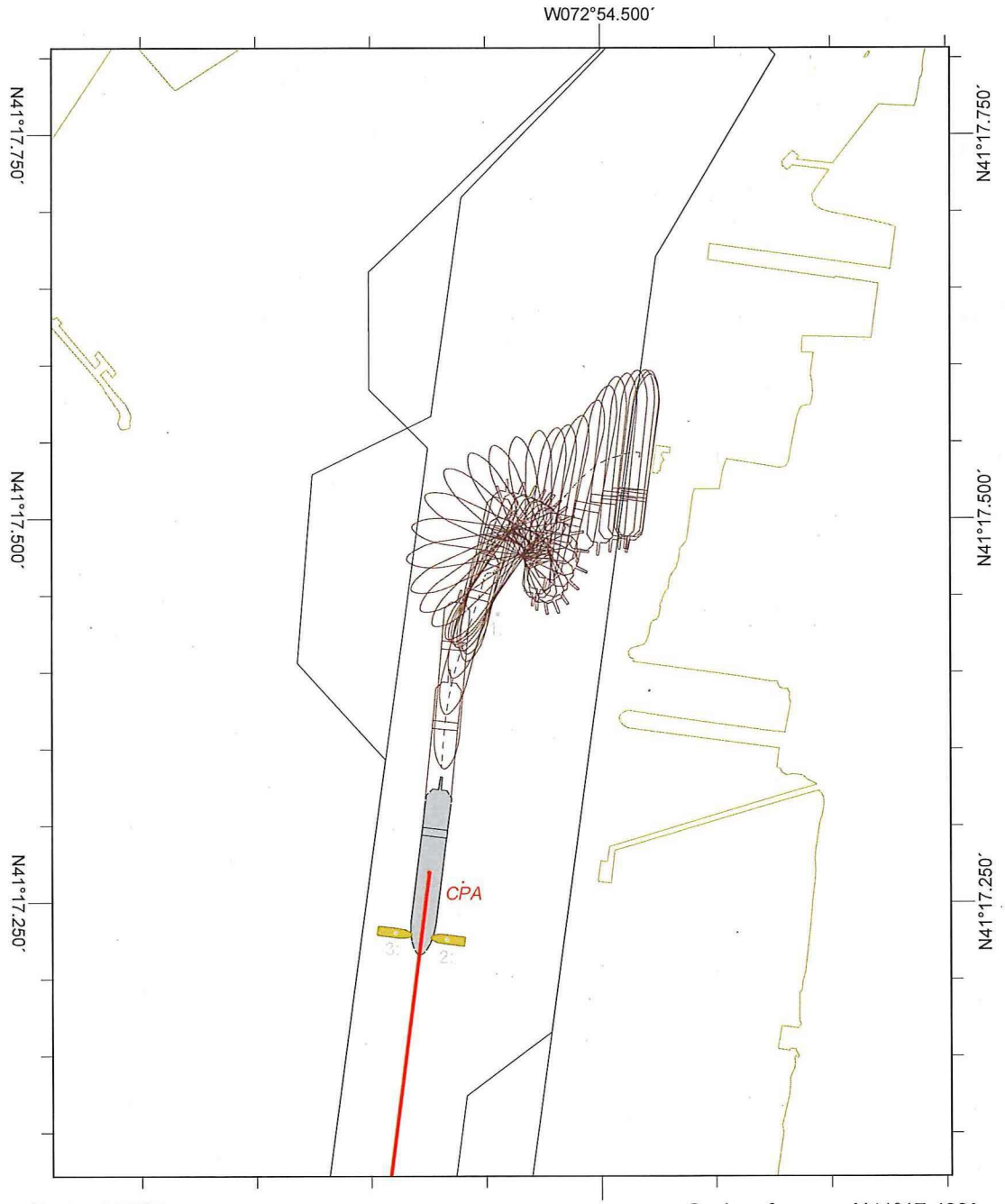
Filename: D-P2-F-NW8-O-2-1

Start Time:

End Time:

Comments:

Turned ship like normal at Magellan T. Dock. RPM/Bell commands were very sluggish and slow to respond with giving kicks. Tugs were very slow pushing ship around with ship at draft of 37'.



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area D: *Turning Basin*

Date: 02/14/18

Test Matrix Run Number: **Repetition:** 2

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft) FB 15M ~~38FT~~

Design Ship: **1** *BULK06L* **2** *TANK10L* 3. CNTNR03L

Tide : Flood Made **Ebb** **Added Tide:**

Wind Condition: ~~1 N 8K~~ NW8K 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: Inbound Outbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

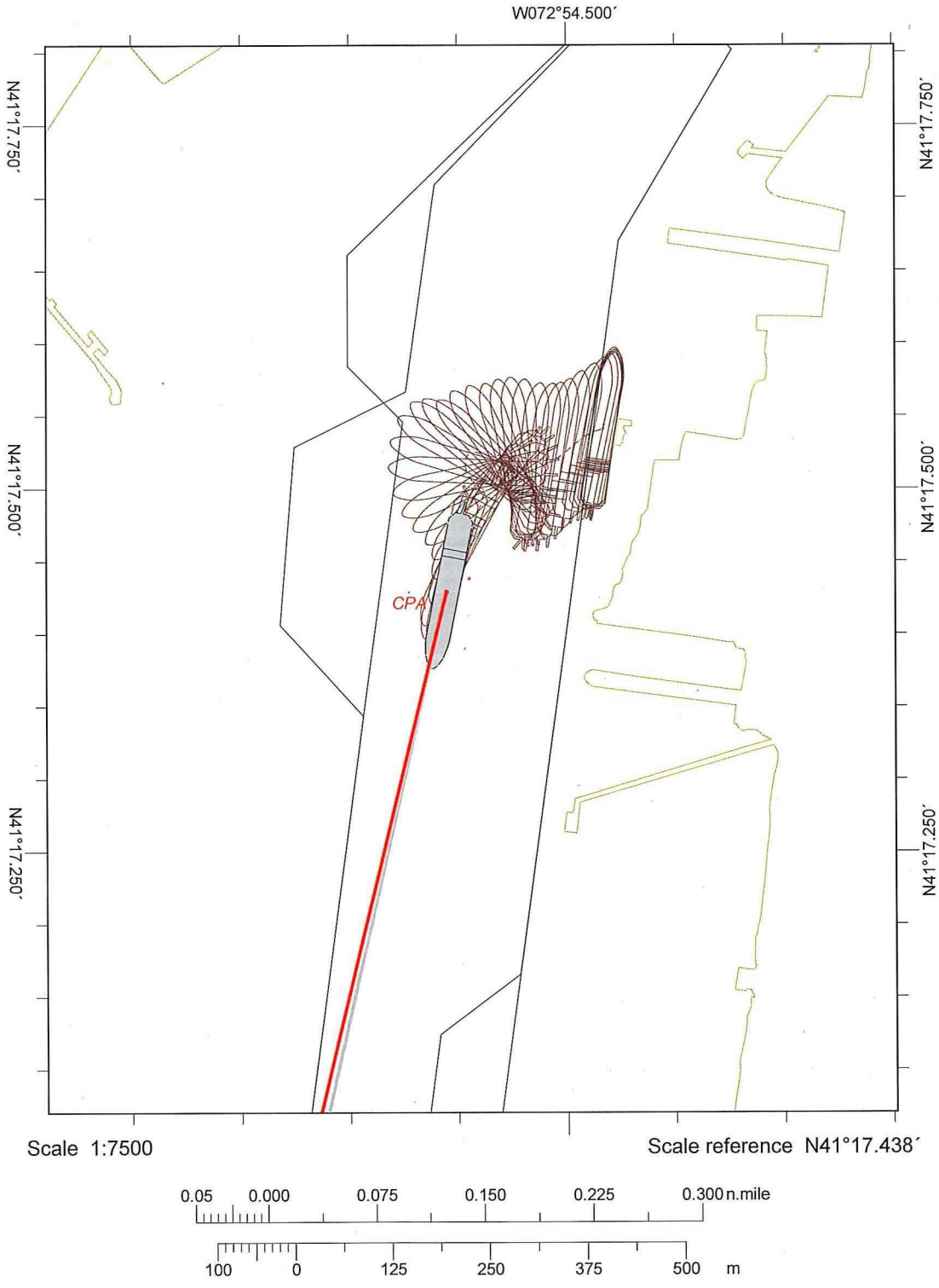
Filename: D - P2 - F - NW8 - O - 1 - 2

Start Time:

End Time:

Comments:

*USing 30 Ton max fog — TURNING BASIN WAS MORE THAN ADEQUATE FOR THIS SIZE/DRAFT SHIP —



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area D: *Turning Basin*

Date: 14 Feb 2018

Test Matrix Run Number: **Repetition:** 2

Channel Alternative: **P0**(Ex) **P1**(36ft) (**P2**(37ft)) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L* 3 CNTNR03L

Tide : (**F**lood) **E**bb **Added Tide:** Flat Bottom 15m

Wind Condition: (1 **N 8K**) 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound (**O**utbound)

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

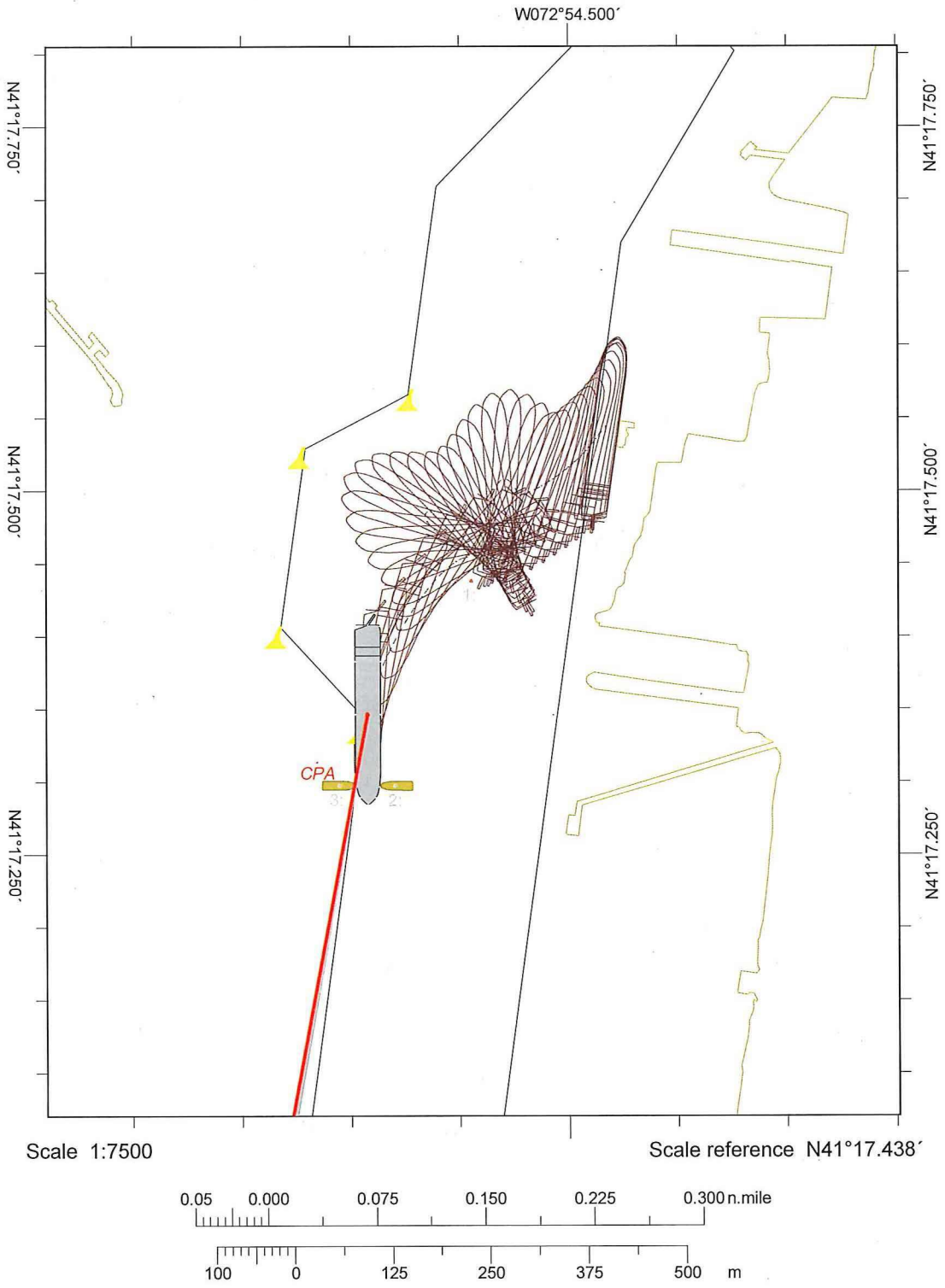
Filename: D-P2-F-NW8-O-2-2

Start Time:

End Time:

Comments: USING CNTNR03L as it better represents draft of ships using turning basin and 40-ton tug (4000Hp)

* Changed turning Basin was useful in not having to worry about Stern getting close to dock with ship at 660 ft long.



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area D: *Turning Basin*

Date: 02/14/18

Test Matrix Run Number: **Repetition:** 3

Channel Alternative: **P0**(Ex) ~~**P1**(36ft)~~ **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft) FD 15.5m

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : Made **F**lood **E**bb **Added Tide:**

Wind Condition: NW8 ~~1 N 8K~~ 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

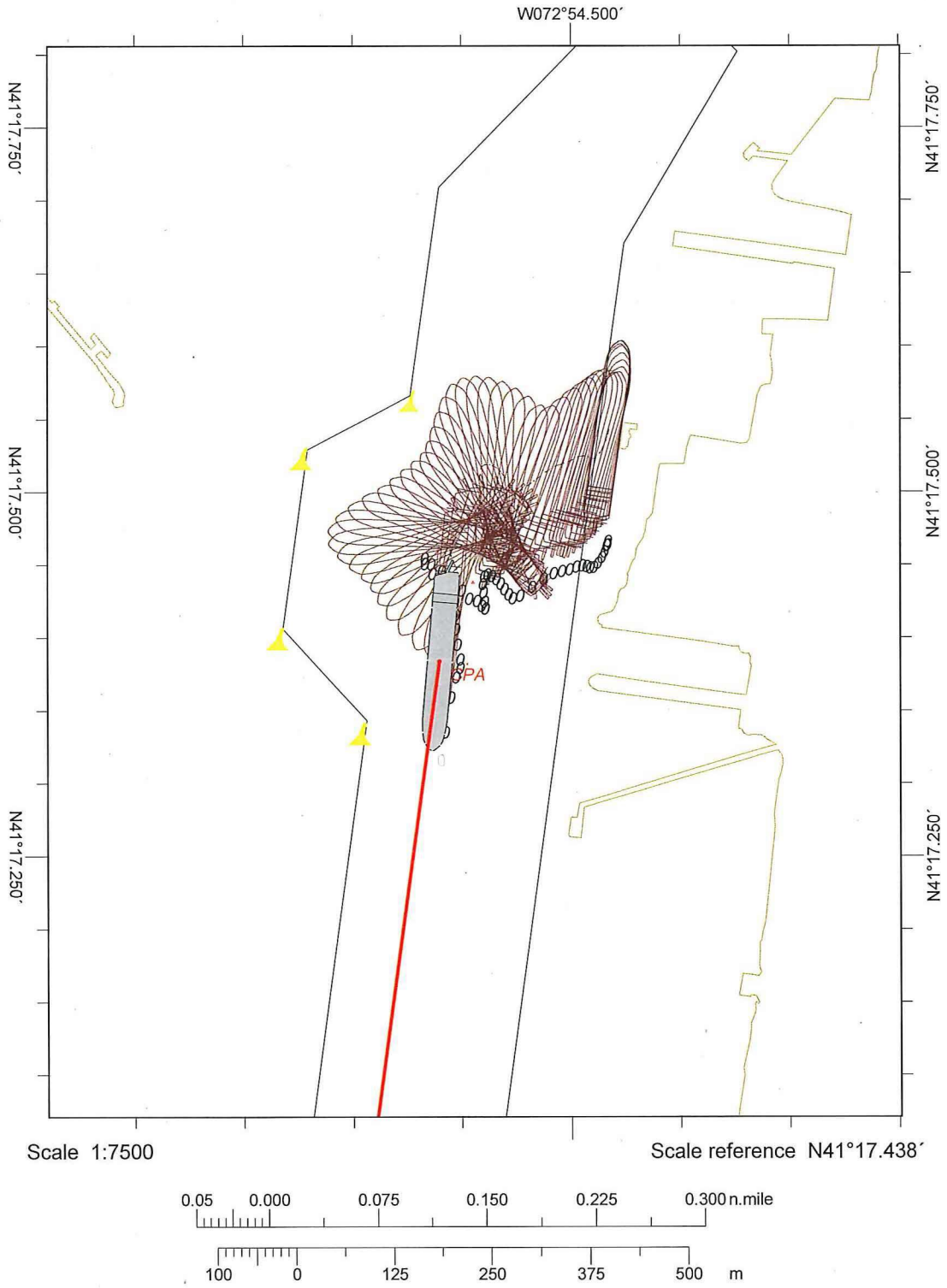
Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: D - P2 - F - NW8 - O - 1 - 3

Start Time: 1058

End Time: 1135

Comments: NEW TURNING BASIN IS ADEQUATE FOR THIS SIZE/DRAFT SHIP



Line sample period (s)	30
Course marker every	00:30
Heading marker period (s)	30
Shape outline every	00:30

New Haven Harbor Feasibility Study

Area D: *Turning Basin*

Date: 2/14/18

Test Matrix Run Number: **Repetition:** 3

Channel Alternative: **P0**(Ex) **P1**(36ft) **P2**(37ft) **P3**(38ft) **P4**(39ft) **P5**(40ft) **P6**(41ft) **P7**(42ft)

Design Ship: **1** *BULK06L* **2** *TANK10L*

Tide : **F**lood **E**bb **Added Tide:** 15.5 flat bottom

Wind Condition: 1 **NW 8K** 2 **SW 8K** 3 **SW 13K** 4 **WNW 13K**

Heading: **I**nbound **O**utbound

PILOT: Capt. Charles Jonas (Pilot **1**) Capt. Donald Toby (Pilot **2**)

Filename = Area + Alternative + Tide + Wind + Heading +Pilot + Repetition

Filename: D-P2-F-NW8-O-2-3

Start Time:

End Time:

Comments: Larger ship (TANK10L) and 4000 Hp Tugs
Extra Room preferred