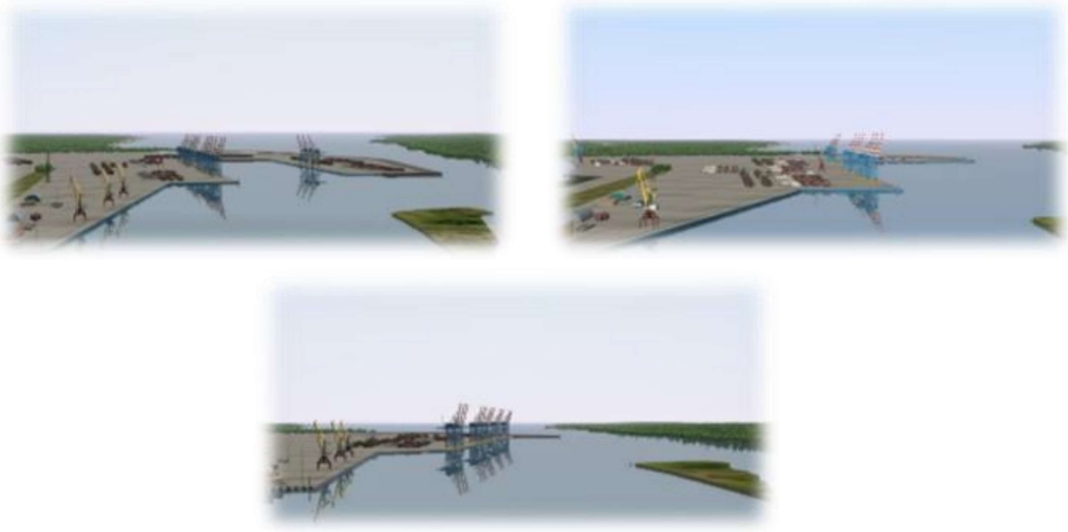
LITHUANIAN HIGHER SCHOOL OF NAVIGATION



ASSESSMENT OF NAVIGATIONAL CONDITIONS ON THE NAVIGATION BRIDGE-SIMULATOR WHILE OPERATING VESSELS OF VARIOUS TYPES AND SIZES DURING THE DEVELOPMENT OF THE SOUTHERN PART OF THE PORT OF KLAIPĖDA: A RESEARCH STUDY

REPORT

KLAIPĖDA
2022

The research study was conducted in accordance with the technical assignment "NAVIGATION CONDITIONS ASSESSMENT" under Contract No. 34-2021-210 of the Klaipėda State Seaport Authority dated August 16, 2021 CONDITIONS ASSESSMENT ON THE ON THE BRIDGE-TRAINING FACILITY, WHILE DEVELOPING THE SOUTHERN PART OF THE PORT OF KLAIPĖDA"

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CONCLUSIONS

At the request of the Klaipėda State Seaport Authority (hereinafter VJ), the Lithuanian Maritime Academy (hereinafter LAJM) conducted navigation training in its simulator together with pilots from the Klaipėda State Seaport Authority (hereinafter KVJUD) pilots, from May 26 to June 10, 2022, conducted ship handling tests in the southern part of the Port of Klaipėda at the newly developed container terminal and exit from the terminal as part of a pilot study in accordance with the agreed technical specifications.

The objective of the pilot study was to assess navigational and hydrometeorological conditions and potential restrictions when maneuvering and exiting container ships up to 400 meters in length and 60 meters in width under various weather conditions, in accordance with the three preliminary design alternatives (2A, 3A, and 4A) for the development of the southern part of the port submitted by KVJUD.

The objectives of the pilot study were:

- assess navigational and hydrometeorological conditions when guiding container ships up to 400 meters in length and 60 meters in width into and out of the newly developed container terminal, in accordance with the three preliminary design alternatives (2A, 3A, and 4A) proposed by KVJUD;
- to study the ship's behavior while approaching and departing the terminal, as well as when the navigational situation changes;
- assess the impact of currents while approaching and departing the terminal and while turning the vessel in the terminal turning basin;
- identify potential navigational restrictions;
- to investigate the possibilities for using a tugboat;
- determine the appropriate number of tugs required for the safe handling, mooring, and unmooring of vessels;
- assess the parameters of pre-design container terminal alternatives 2A, 3A, and 4A for the safe mooring of vessels up to 400 meters in length and 60 meters in width at the quay;
- assess the safety of vessel entry and exit, maintaining a safe distance, when passing a liquefied natural gas (LNG) storage vessel moored at the LNG terminal and a gas carrier moored alongside it.

1. METHODOLOGY

To prepare for and conduct the tests in order to achieve the test objectives, the following methodologies were applied:

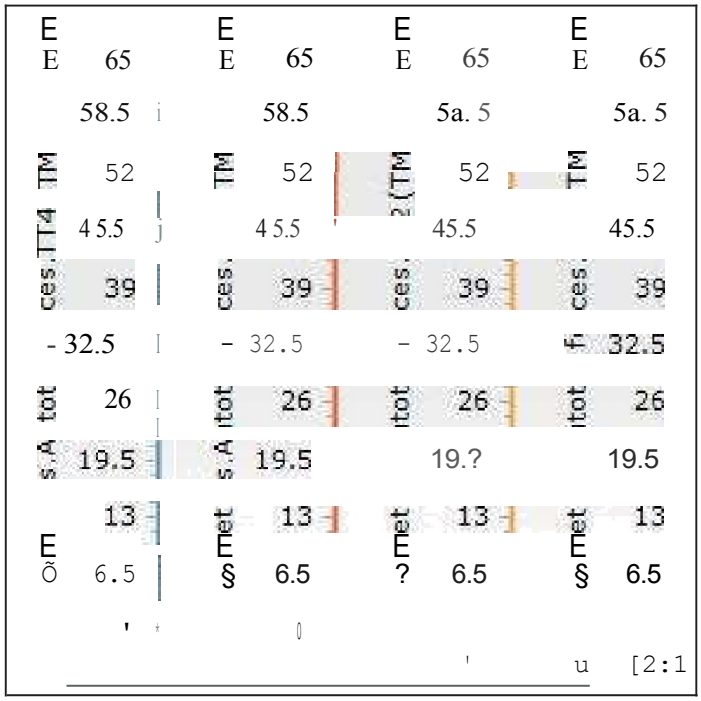
- simulation of test scenarios in accordance with the agreed technical specifications, using combinations of hydrometeorological parameters based on flow structure maps provided by the Lithuanian Energy Institute (LEI);
- conducting the tests in real time together with KVJUD pilots according to the scenarios presented in Chapter 6;
- analysis of the test vessel's behavioral parameters, measurement of the distance maintained up to the critical point;
- Expert assessments by KVJUD pilots.

During the tests, the navigation simulator was used to simulate a container ship up to 400 meters in length, 60 meters in width, with a loaded draft of up to 15.3 meters, 346 voyages to the terminal with docking at the quay and departures from the terminal, using 4–5 tugs. The most complex scenarios were selected for the tests, involving the maximum number of ships at the quay and the most challenging approach and mooring conditions from a navigational perspective under various hydrometeorological conditions.

Graphical representations of ship motion analysis from the TRANSAS NTPro 5000 ver. 5.35 simulator were used to analyze the test results, depicting the motion trajectory over time and empirical diagrams showing the dynamic behavior parameters of the ship and tugboat.

The tugboat's performance is depicted in the empirical diagrams (Fig. 1.1):

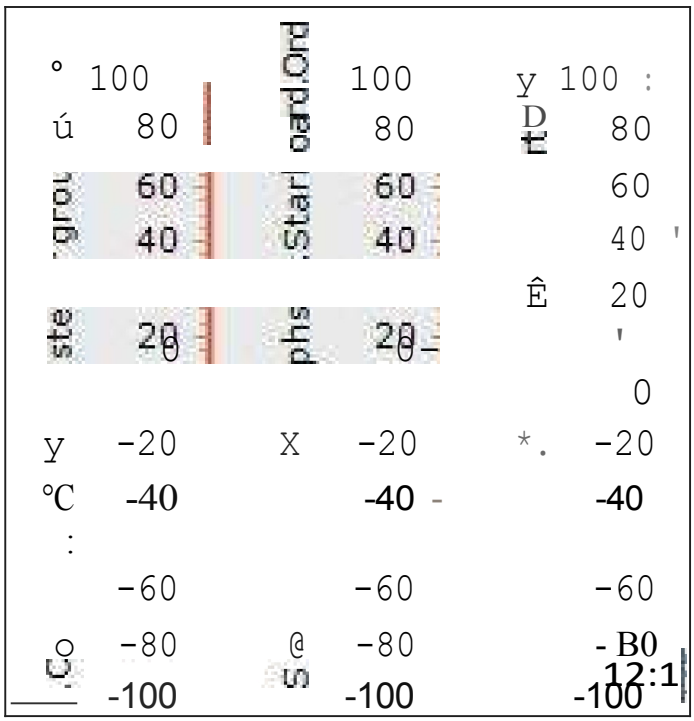
- tugboat No. 1 power setting — dark blue;
- tugboat No. 2 power setting — yellow;
- tugboat No. 3 power setting — red;
- Tractor No. 4 power curve — blue.



1.1 Fig. Parameters recorded for tractor behavior

The ship's power plant is depicted in the empirical diagrams (Fig. 1.2):

- ship's trim position—blue;
- ship's telegraph position — red and yellow (the ship was operated as a single-screw vessel).



1.2 Fig. Parameters recorded for the ship's engine behavior

One of the main aspects of the analysis was the measurement of the distance to the most important points:

- gas carriers moored at berth No. 157 of the LNG terminal;
- the 17.0-meter depth limit at berth No. 147;
- the pier at Berth No. 147;
- the 17.0-meter depth line at berths No. 149–152;
- buoys No. 31, 33, 35, 37, and 39;
- vessels moored at the container terminal berths;
- the ship's turning radius.

Distance measurements, an overview of the ship's drift parameters, and an analysis are presented in Chapter 8. The test report is presented with conclusions and recommendations (in Chapter 9).

The expert conclusions of the pilots participating in the tests allow for the prediction of the limiting conditions under which it is possible to navigate into the newly developed container terminal in the southern part of the Port of Klaipėda and to navigate container ships up to 400 meters in length, 60 meters wide, and loaded to a draft of up to 15.3 meters.

2. L SIMULATION OF THE PORT OF KLAIPĖDA

The modeling of the Port of Klaipėda was performed based on the following conditions:

1.1 2D nautical chart modeling based on charts from the Lithuanian Transport Safety Administration:

- LT 560710 "Klaipėda Seaport," 6.5 2017 edition;
- LT 562510 "Klaipėda Port Approaches," 8.5, 2017 edition. And

electronic charts:

- LT 660710 S-57 3.1.1, November 24, 2014 edition, with the proposed amendment incorporated;
- LT 562510 S-57 3.1.1, edition of December 1, 2014, with the planned amendment correction;

1.2 A 3D visualization of the model of the Klaipėda Port's main navigation area was created using high-quality, precisely geolocated photographs of the port's surroundings.

1.3 The coordinates of the modeled quays, piers, and terminals were refined based on topographic satellite imagery.

1.4 Navigational aids were modeled based on data from the Lithuanian Maritime Safety Administration's publication "Lithuanian Navigational Marks and Lights. Baltic Sea. 2017."

1.5 Navigational aids in the basin of the new container terminal were modeled based on plans provided by KVJUD.

1.6 The Klaipėda Port navigation channel was modeled according to the port plan and bathymetric data from the KVJUD Hydrographic Department, deepening the Klaipėda Port fairway and the new container terminal to 17 meters.

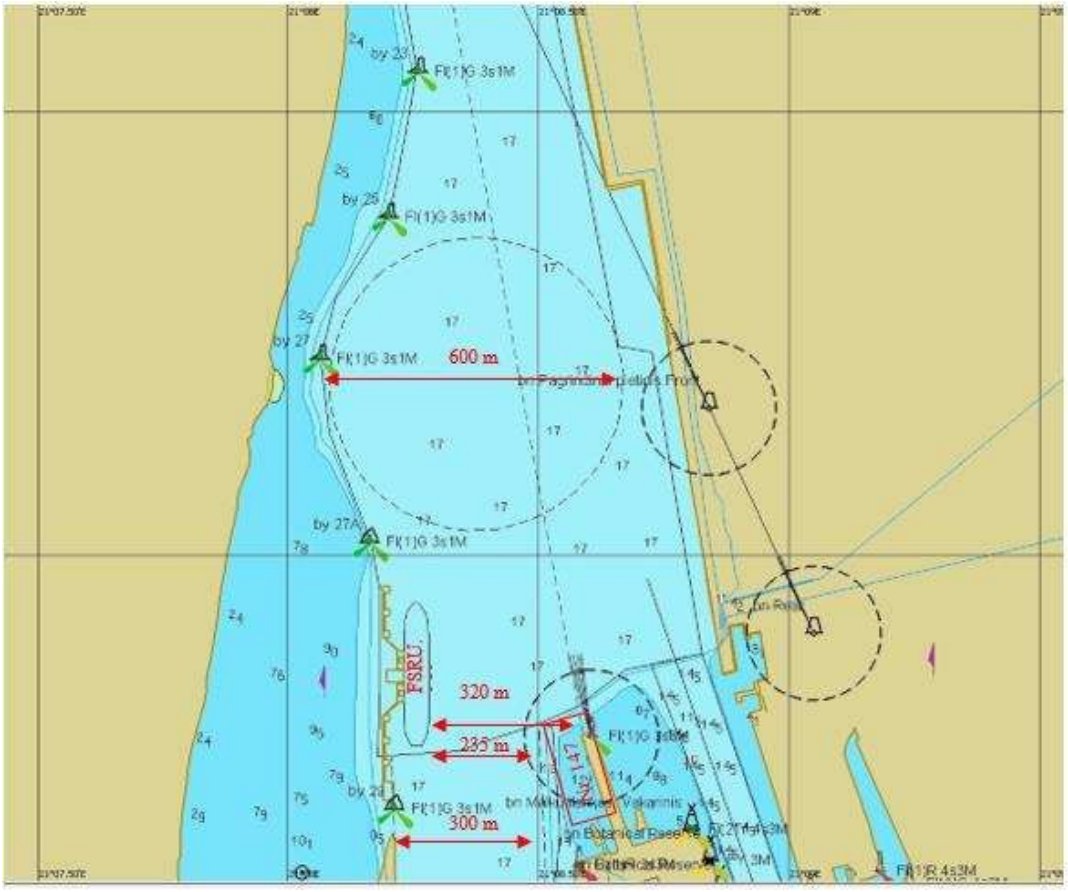
1.7 The Klaipėda Port models were created using TRANSAS "Model Wizard-Scene Editor Ver. 5.0".

The terminals in the newly developed preliminary design alternative were modeled based on the port plan provided by KVJUD and the technical drawings for the proposed changes in "KLAIPEDA SOUTH PORT PLANNING VISION."

2.1. ALTERNATIVE 2A " "

Alternative 2A provides for the construction of a new U-shaped terminal with a turning basin 600 meters in diameter. Under this alternative, two container ship berths are planned—1,000 meters and 803 meters in length. From berth No. 149 to berth No. 152, it is planned to form a continuous 815-meter quay with a depth of 14 meters alongside it. The total length of the container ship quays would be 1,803 meters, allowing for the mooring of three ships up to 400 meters in length. The container ship berthing locations in Alternative 2A are provisionally numbered: Nos. 1, 2, 3, and 4. The width between the eastern and western sections of the pier would be 305 meters.

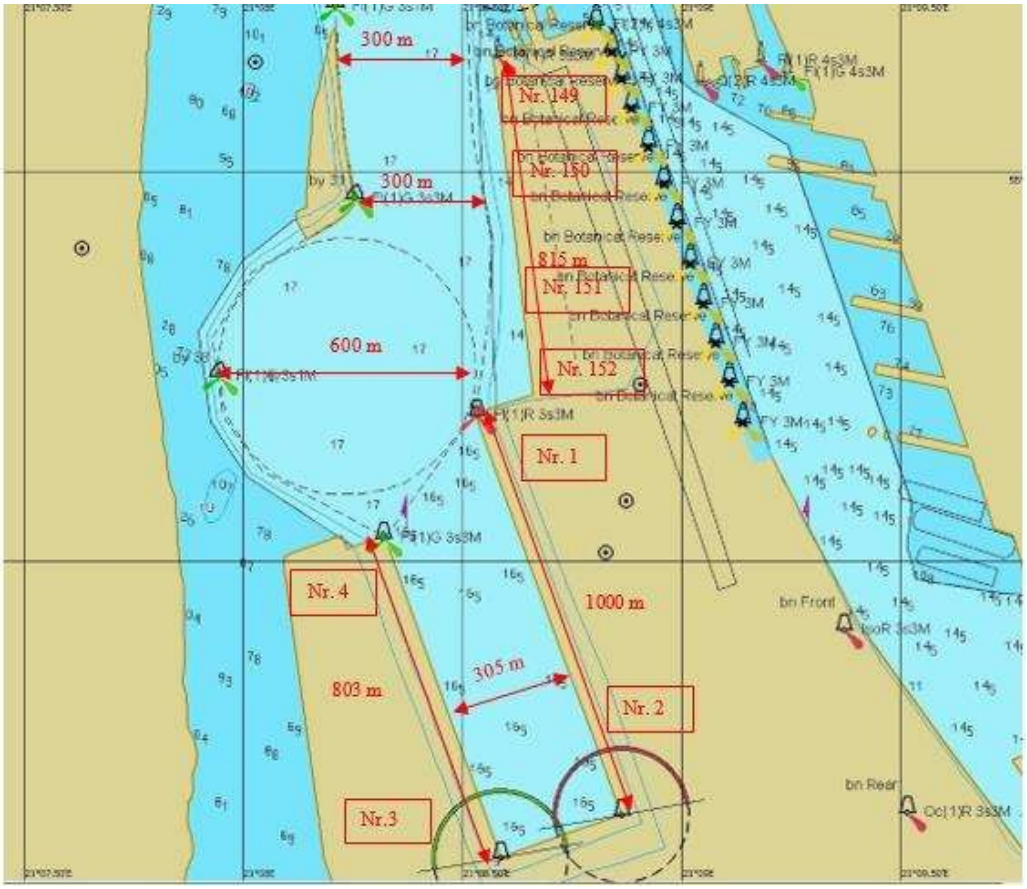
The width of the navigation channel at the terminal is 305 meters. Taking into account the fact that a *floating storage and regasification unit* (FSRU*)* "INDEPENDENCE," which is 46 meters wide, the width of the navigation channel is reduced to 235 meters. When a 46-meter-wide LNG vessel (gas carrier) is moored alongside the "INDEPENDENCE," as envisaged in the test scenario, the width of the navigation channel narrows to 190 meters (Fig. 2.1).



2.1 Fig. Smeltes turning basin alternative 2A, from buoy No. 23 to buoy No. 29

When passing the LNG terminal, the width of the 17.0-meter-deep navigation channel is 300 meters. The total width of the navigation channel from Kiaulės Nugaros Island to berths No. 149–152 is 350 meters.

The turned ship is guided to the container terminal's conditional berths No. 2. The navigation distance between the container terminal's berths is 305 meters. Taking into account that ships 400 meters long and 60 meters wide will be moored at berths No. 1, 3, and 4 of the container terminal, as provided for in the test scenario, the navigation width is reduced to 185 meters. Assuming a width of 60 meters for the leading vessel, 62 meters of space remains on each side of the vessel (Fig. 2.2).

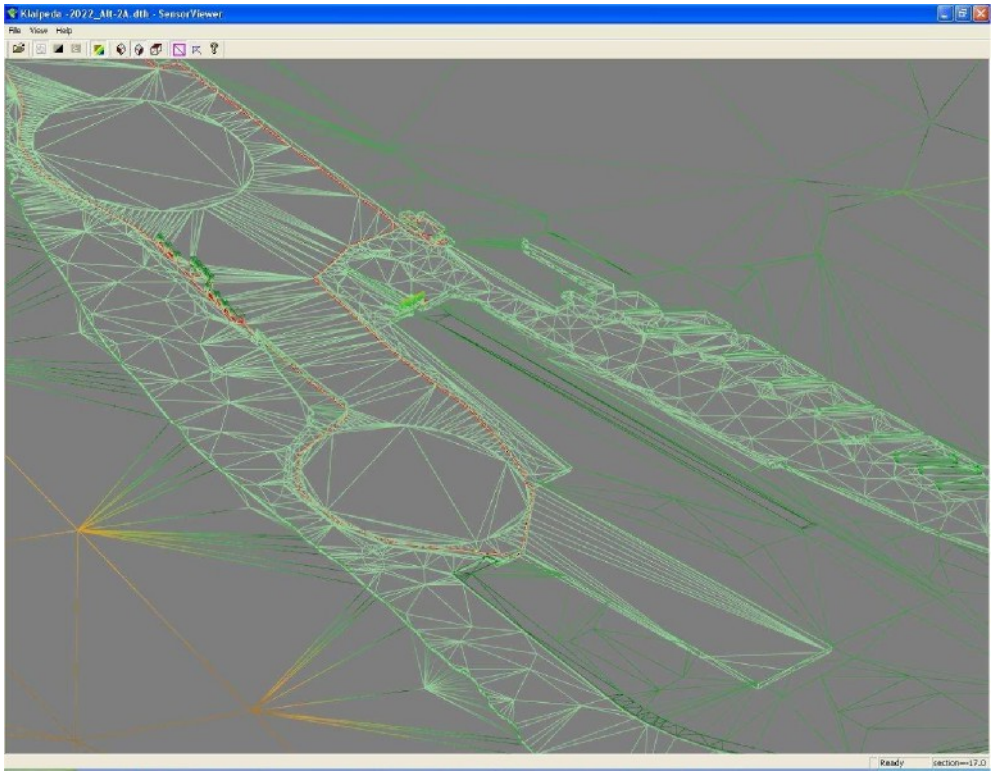


2.2 Fig. Container terminal — Alternative 2A, plan view

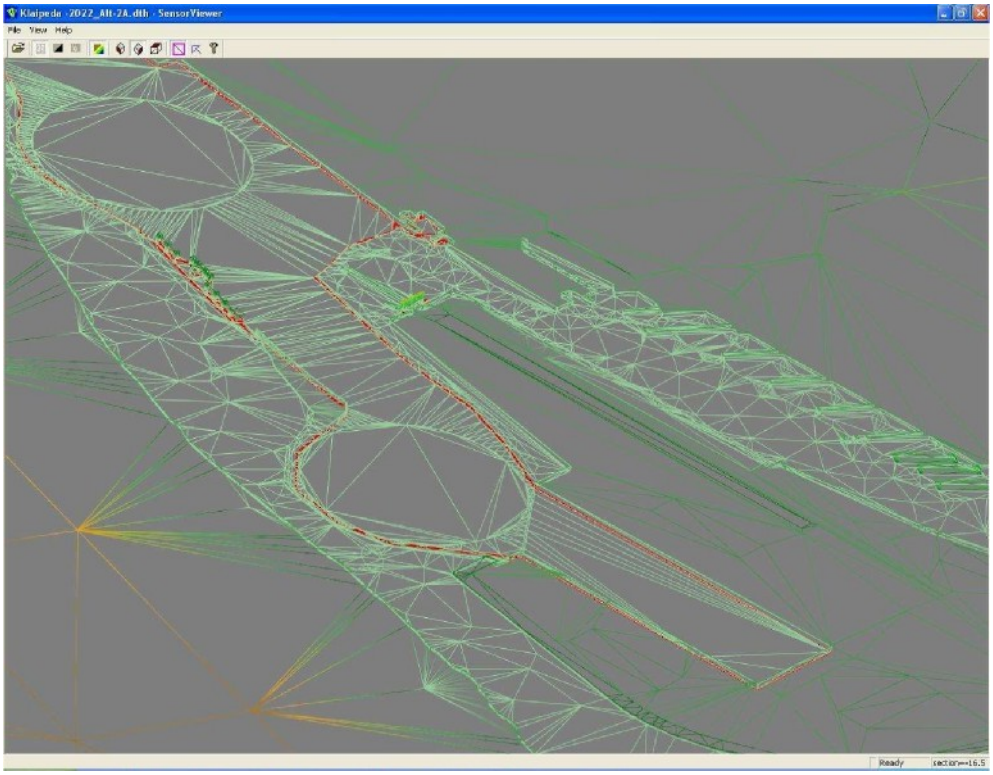
Under Alternative 2A, the navigation channel with a turning basin inside is planned to be deepened to 17.0 meters. A sensor-based graphic of the seabed relief at a depth of 17.0 meters is presented in the figure.

2.3. The seabed in the container ship mooring basin and along the quay is planned to be dredged to a depth of 16.5 meters. A sensory graphic of the seabed relief at a depth of 16.5 meters is presented in Figure 2.4.

Depths at berths No. 149–152 are planned to be up to 14.0 meters. The controlled depth level is shown in red on the sonar graph.

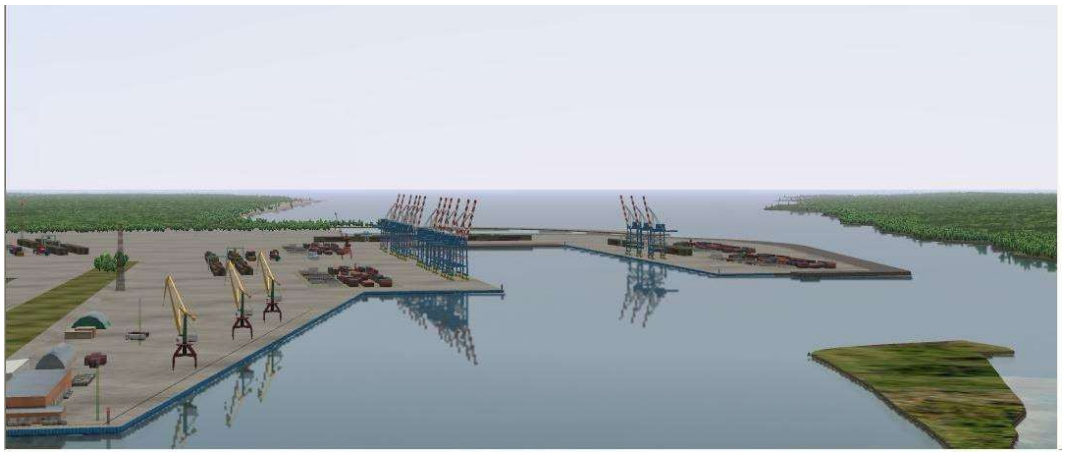


2.3 Fig. Container terminal — Alternative 2A, 17.0 m depth sensors



2.4 Fig. Container terminal — Alternative 2A, 16.5 m depth sensors

Figures 2.5a and 2.5b show bird's-eye views of the container terminal, Alternative 2A.



2.5 Fig. a. Container terminal — Alternative 2A, bird's-eye view

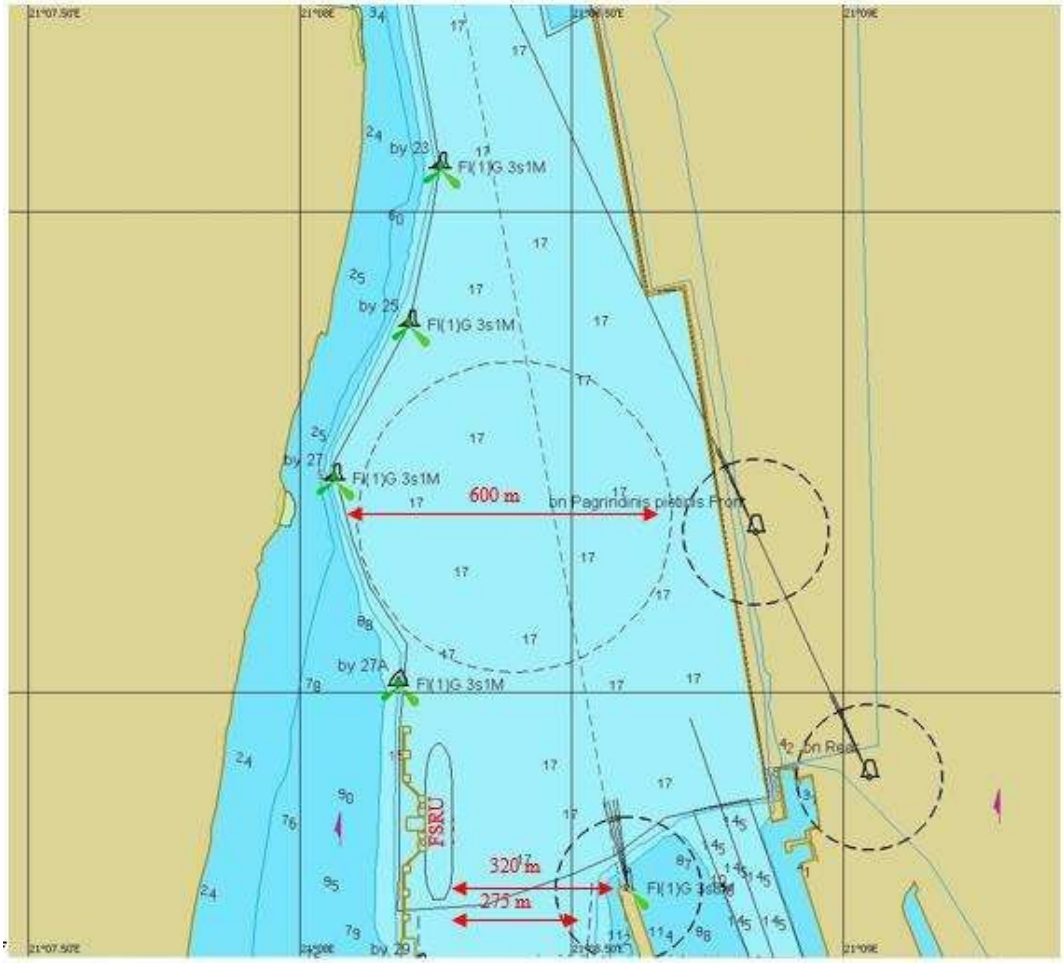


2.5 Fig. 2b. Container terminal — Alternative 2A, bird's-eye view

2.2. OPTION 3A

Alternative 3A involves the construction of a new L-shaped terminal with a turning basin 600 meters in diameter. The width of the channel leading to the terminal would be 336 meters. Given that the FSRU (*Floating Storage and Regasification Unit)* "INDEPENDENCE," which is 46 meters wide, is moored at the LNG terminal, the width of the navigation channel narrows to 275 meters. After mooring a 46-meter-wide LNG vessel with a second hull alongside

the "INDEPENDENCE," as envisaged in the test scenario, the width of the navigation channel narrows to 230 meters (Fig. 2.6).



2.6 Fig. Turning basin at Smeltiis – Alternative 3A, from Buoy No. 23 to Buoy No. 29

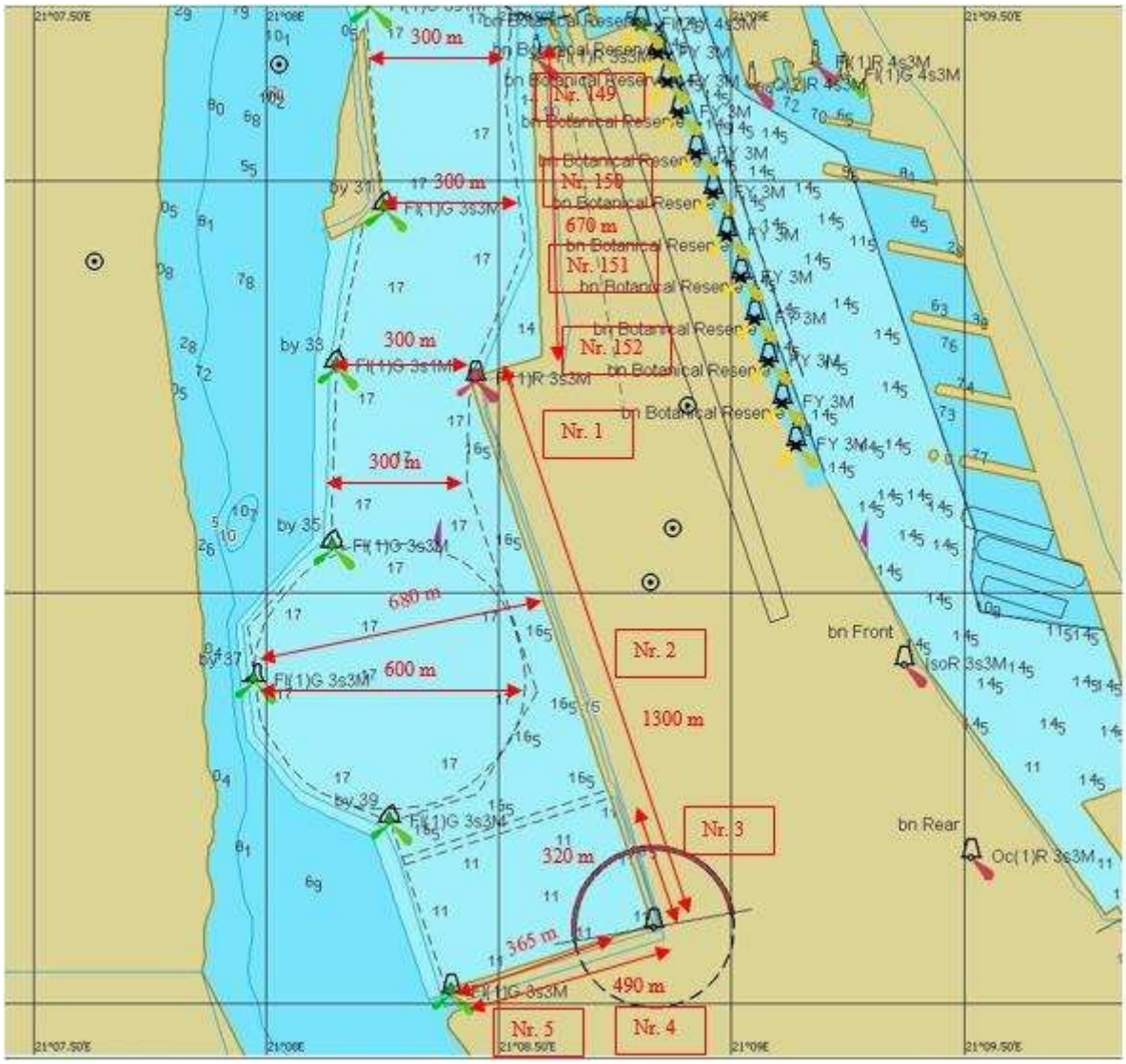
When passing the LNG terminal, the width of the navigation channel, limited by a depth of 17.0 meters, is 300 meters. The total width of the navigation channel from Kiaulės Nugaros Island to Pier No. 149

— 152 is 350 meters.

Alternative 3A provides for container ship berths—980 meters with a depth of 16.5 meters at berths No. 1 and 2, and 685 meters in length with a depth of 11.0 meters at berths No. 3, 4, and 5. From Quay No. 149 to Quay No. 152, it is planned to construct a continuous 670-meter quay with a depth of 14.0 meters at the water's edge. The length of the container ship berths with a depth of 16.5 meters would total 980 meters, at which two ships up to 400 meters in length could be moored. The length of the container ship quay with a depth of 11.0 meters would be 682 meters, at which up to three smaller ships could be moored. The container ship berthing locations in Alternative 3A are provisionally numbered: No. 1, 2, 3, 4, and 5. The navigation channel with the turning basin is planned to

be deepened to 17.0 meters.

The turning basin is located in front of the container terminal's conditional berths No. 1 and 2. An S-shaped channel, 1,300 m long, leads to the turning basin. After turning in the basin, the vessel is guided to the container terminal's conditional outermost berths No. 2 and 1 (Fig. 2.7).



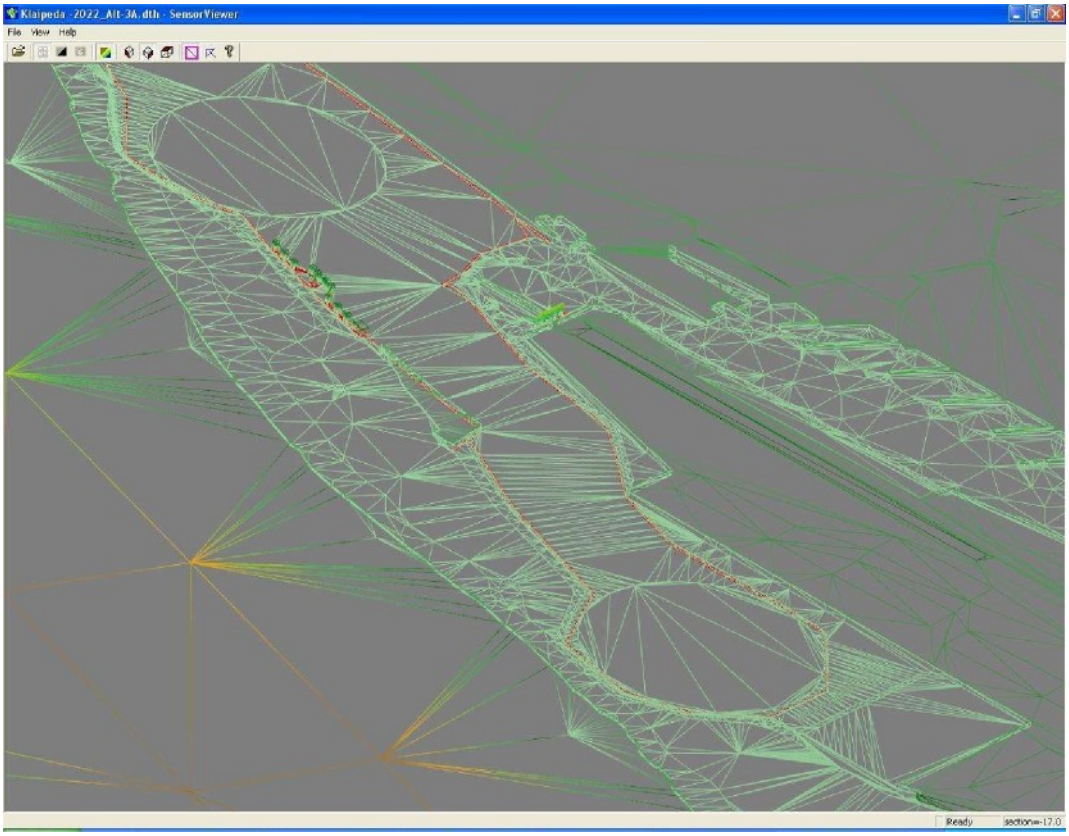
2.7 Fig. Container terminal — Alternative 3A, Section 1

Under Alternative 3A, the navigation channel with the turning basin is planned to be dredged to a depth of 17.0 meters. A sensory graphic of the bottom relief at a depth of 17.0 meters is presented in the figure.

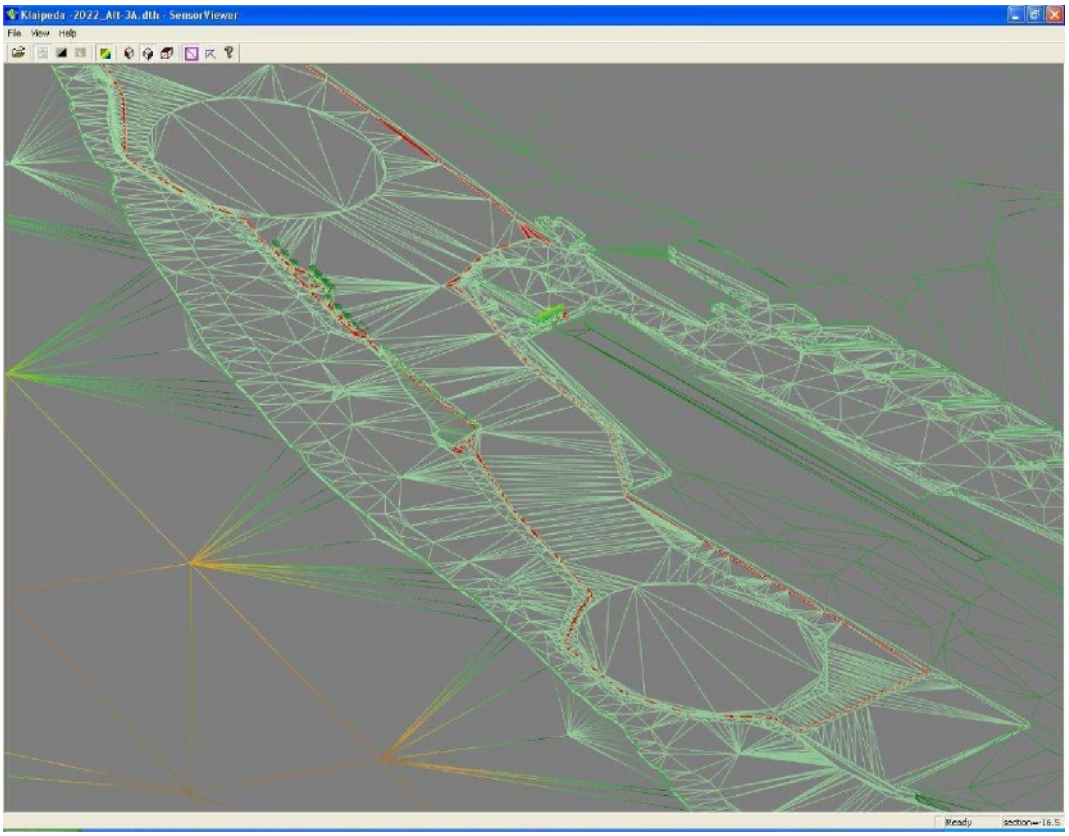
2.8. The seabed in the container ship mooring basin and along the quay is planned to be dredged to 11.0 and 16.5 meters. A sensory graphic of the bottom relief at a depth of 11.0 meters is presented in the figure.

2.10. A sensory graphic of the seabed relief at a depth of 16.5 meters is presented in the figure. 2.9. Depths at berths No. 149–152 are planned to reach 14.0 meters. The controlled

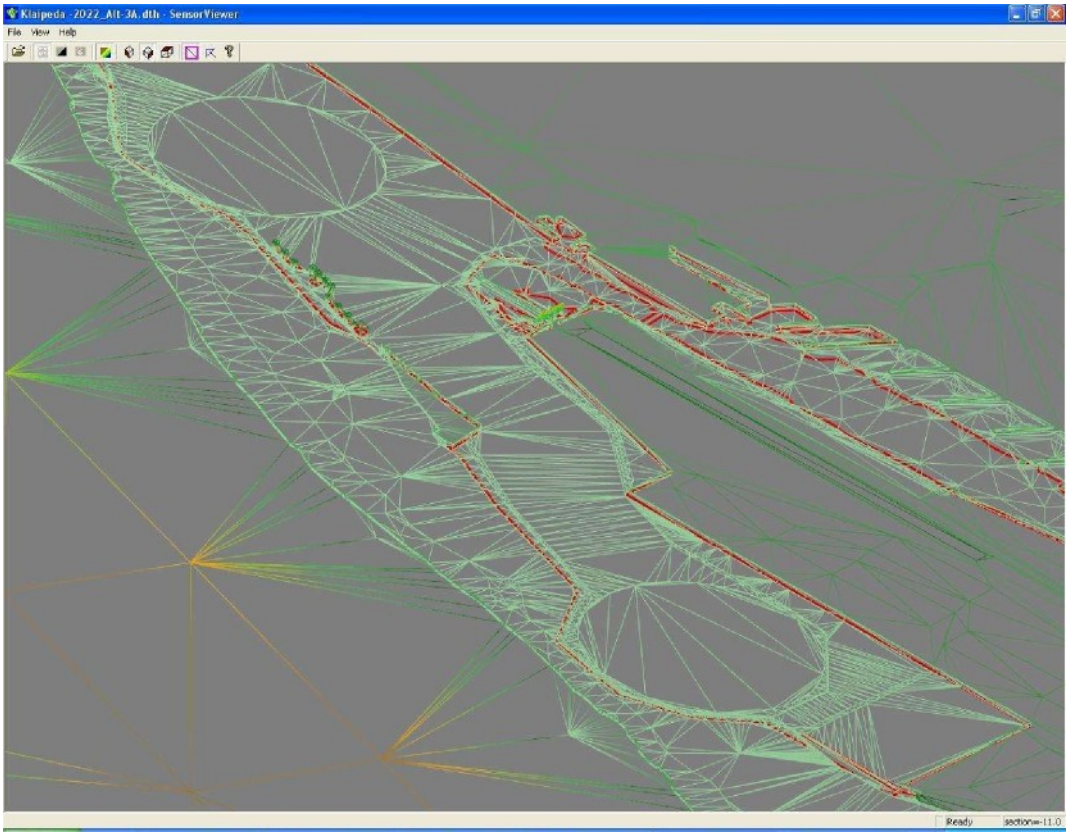
water level is shown in red on the sensory graphic.



2.8 Fig. Container terminal — Alternative 3A, depth 17.0 m sensors



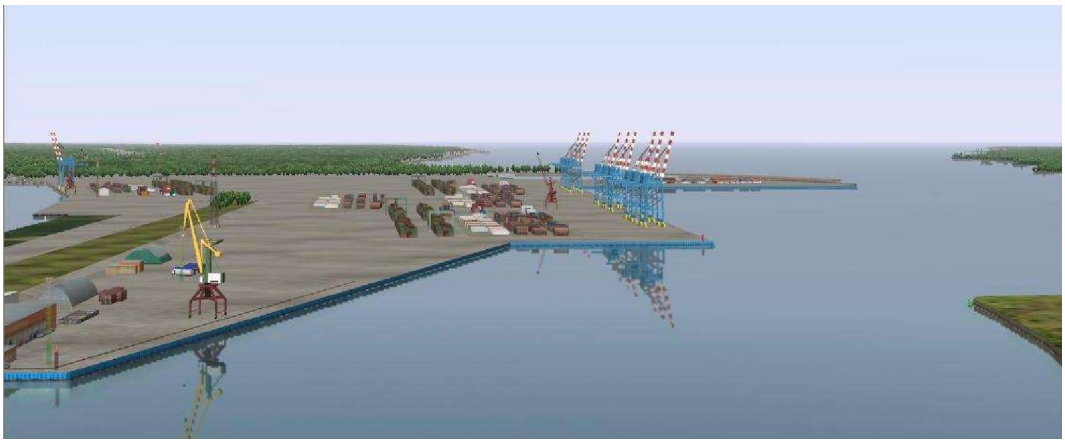
2.9 Fig. Container terminal — Alternative 3A, 16.5 m depth sensors



2.10 Fig. Container terminal — Alternative 3A, depth 11.0 m sensors

Figures 2.11a and 2.11b show visual representations of the Container Terminal, Alternative 3A,

from a bird's-eye view.



2.11 Fig. a. Container terminal — Alternative 3A, bird's-eye view

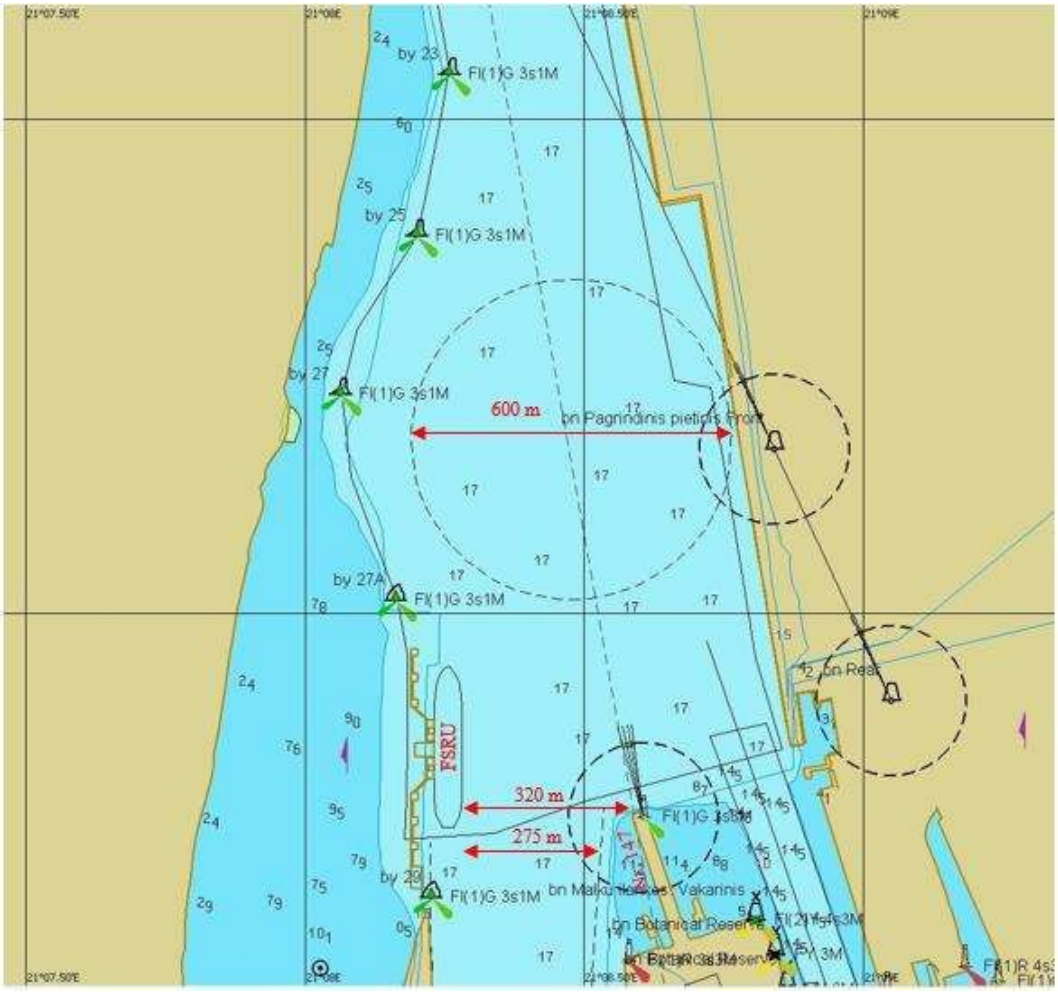


2.11 Fig. 2.11b. Container terminal — Alternative 3A, bird's-eye view

2.3. 4A ALTERNATIVE

Alternative 4A calls for the construction of a new L-shaped terminal with a turning basin 600 meters in diameter. Under this alternative, a 1,284-meter-long container ship berthing quay with a depth of 16.5 meters is planned, capable of accommodating two ships up to 400 meters in length and one smaller vessel, approximately 230 meters in length. From Quay No. 149 to Quay No. 152, it is planned to construct a continuous 670-meter quay with a water depth of 14.0 meters. The mooring berths for container ships in Alternative 4A are provisionally numbered: Nos. 1, 2, and 3. The navigation channel with a turning basin is planned to be dredged to a depth of 17.0 meters.

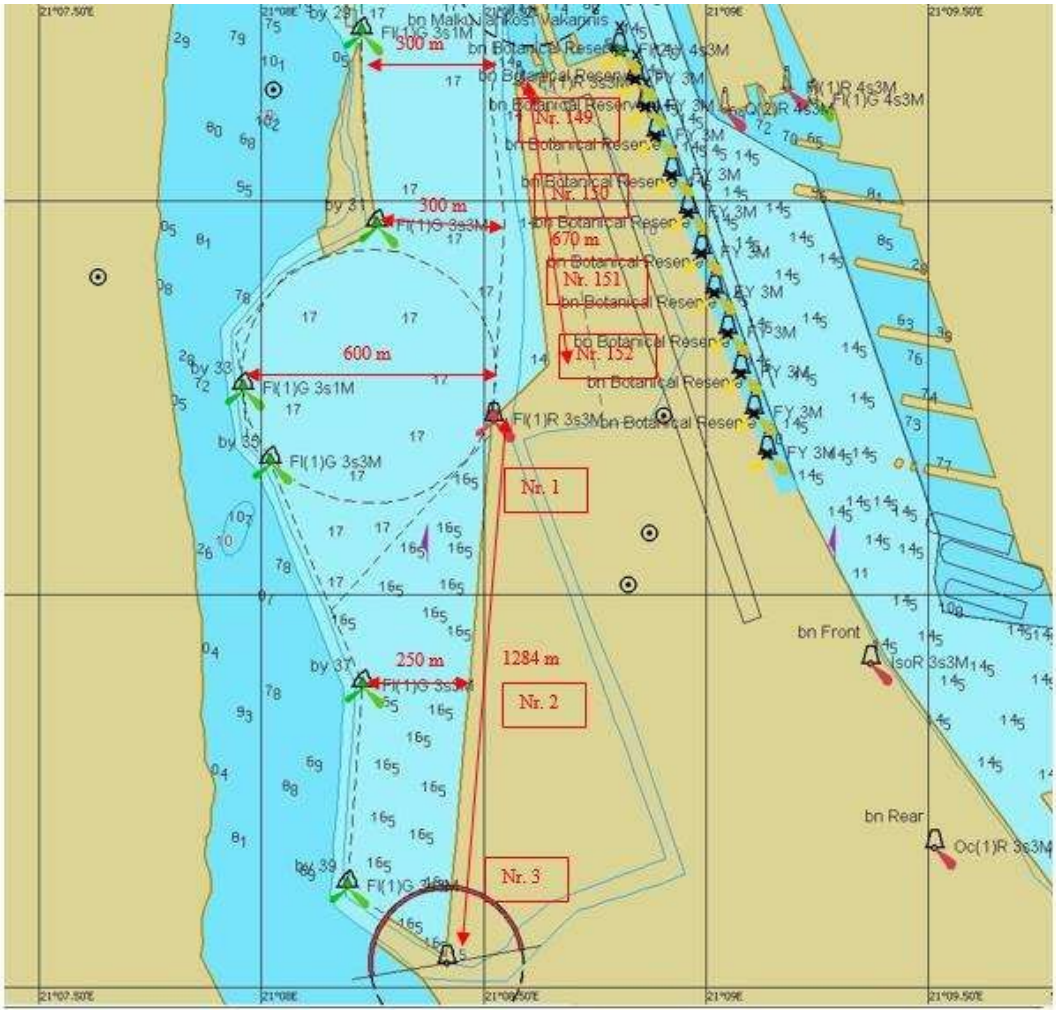
The width of the navigation channel and terminal will be 336 meters. Taking into account the fact that the FSRU (*Floating Storage and Regasification Unit)* "INDEPENDENCE," which is 46 meters wide, the width of the navigation channel is reduced to 275 meters. When a 46-meter-wide LNG vessel is moored alongside the "INDEPENDENCE" with its second hull, the width of the navigation channel narrows to 230 meters. (Fig. 2.12)



2.12 Fig. Smeltė turning—Alternative 4A, basin from buoy No. 23 to buoy No. 29

After passing the LNG terminal, the width of the navigation channel, limited by a depth of 17 meters, is 300 meters. The total width of the navigation channel from the Kiau1‹is Back Bay to berths No. 149–152 is 350 meters.

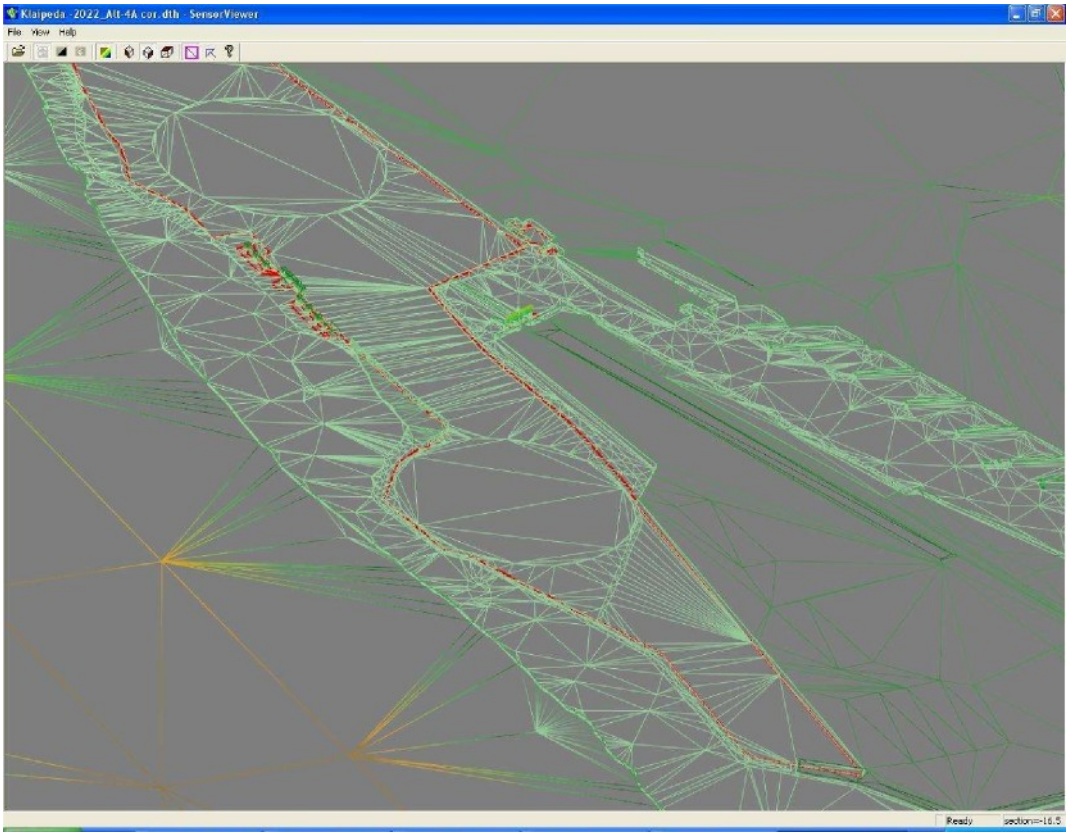
A ship that has turned in the turning basin is guided to the container terminal area near berths No. 2 and 1. A depth of 16.5 meters is provided beyond the turning circle, the boundary of which is marked by buoys No. 35, 37, and 39. The berthing quays are located to the south, downstream of the turning basin. The width from the berthing quays to the 16.5-meter depth limit is 250 meters (Fig. 2.13).



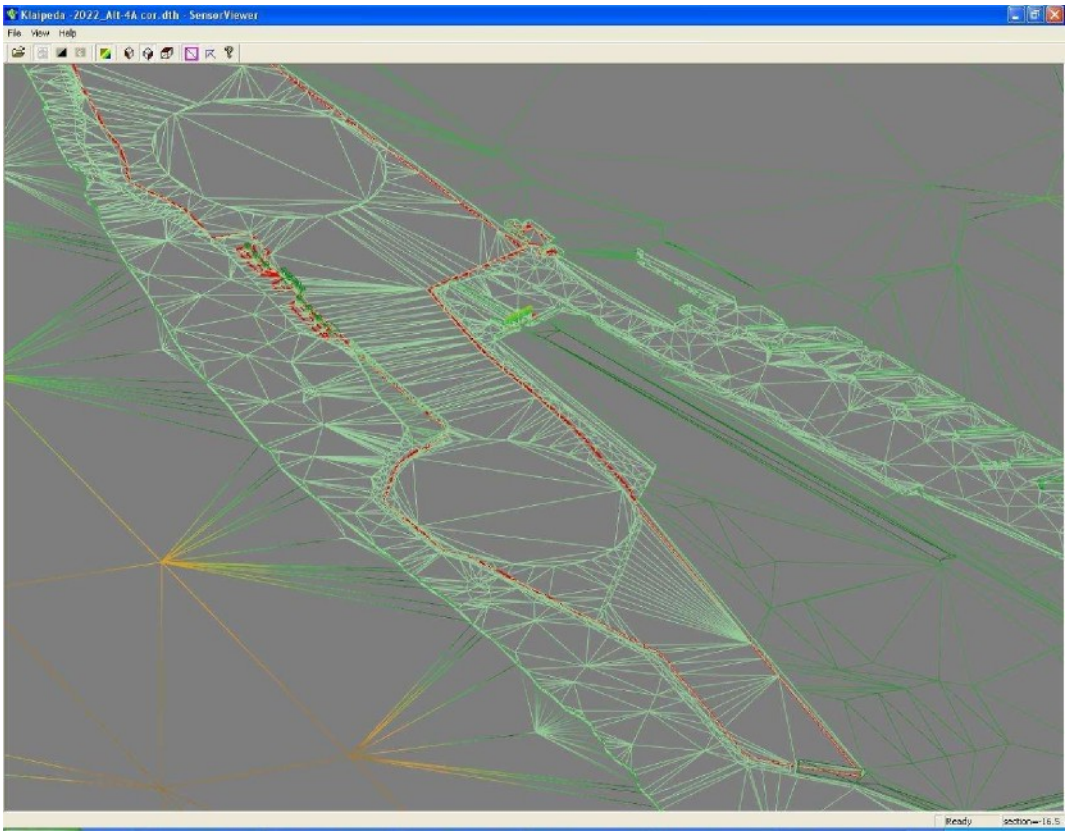
2.13 Fig. Container terminal — Alternative 4A, plan view

Under Alternative 4A, the navigation channel with the turning basin inside is planned to be deepened to 17.0 meters. A sensory graphic of the bottom relief at a depth of 17.0 meters is presented in Figure

2.14. The container ship mooring basin and the area near the quay are planned to be deepened to 16.5 meters. A sensory graphic of the bottom relief at a depth of 16.5 meters is presented in Figure 2.15. Depths at berths No. 149–152 are planned to be up to 14.0 meters. The controlled depth level is shown in red on the sonar image.



2.14 Fig. Container terminal — Alternative 4A, 17.0 m depth sensors



2.15 Fig. Container terminal — Alternative 4A, depth 16.5 m sensors

Figures 2.16a and 2.16b show bird's-eye views of the container terminal, Alternative 4A.



2.16 Fig. 2.16a. Container terminal — Alternative 4A, bird's-eye view



Fig. 2.16b. Container terminal — Alternative 4A, bird's-eye view

3. TEST EQUIPMENT AND MODELS MODELS

The tests utilized the NTPro 5000 ver. 5.35 six-bridge multifunctional navigation, radar, electronic charting, ship control, and radio communication simulator manufactured by TRANSAS. The TRANSAS modeling tool "Model Wizard-Scene Editor Ver. 5.0" was used to create electronic charts and visualizations of the Klaipėda Port navigation area.

The three-bridge NTPro 5000 ver. 5.35 integrated simulator used for testing consisted of:

- a ship control bridge with a five-channel projection visualization of a 180º horizon;
- 2 ship control bridges with a 135º horizontal three-channel (monitor) visualization;

two instructor stations.

All of the simulator's navigation bridges were equipped with real bridge instruments, such as an engine telegraph, a GYARSS communication system, and navigation and ship control equipment.

The NTPro 5000 ver. 5.35 multifunctional navigation simulator used for testing allows for the simulation of the following key functions and effects:

hydrodynamic interaction of the ship with the seabed;

- the effect of local currents on ship maneuvering;
- adjustable model motion (accelerated or decelerated) during the exercise;

loading of new ship models and modification of ship model parameters;

adjustment of ship maneuvering characteristics and interaction effects;

- adjustable "ship-to-ship" interaction;
- automatic tugs with an additional "push/pull" operation; ship-to-

ship mooring operation;

the ability to tow any ship with any other ship;

- anchoring in different anchor substrates (sand, gravel, silt, rocks);
- bird's-eye-view visualization

the ability to directly control anchoring, mooring, and towing equipment from the instructor's workstation;

- creation of new navigational objects (ships, tugs, barges, navigational aids, clouds, atmospheric zones, bathymetric data, etc.) during the task;

- the ability to disable navigation devices;
- the ability to generate a complete mission report;

changes in hydrometeorological conditions over time;

retrieval of information on tides and currents from the Navi-Sailor (ECDIS) database;

- Seven types of tugboats available for mooring operations;

six types of barges;

- 11 types of shore facilities (RL stations, watchtowers, hangars, radar stations, drilling platforms, explosion visualization, etc.);
- Vessel Traffic Service (VTS) stations;
- new rescue objects (life rafts, wrecked and sinking ships)
- sun and sunny sea, moon and moonlit sea, sunrise and sunset, reflections of objects on the sea surface, rain, four types of clouds, dynamic wave crests and spray;

other related effects.

A mathematical model of a 398.0-meter-long TRANSAS container ship loaded to a draft of 15.3 meters was used in the tests. The ship's main data are presented in Table 3.1 of the report.

3.1 Table

Key data of the ship model used in the tests Ship element

No.		Ship data
1.	Ship type	Container 32 (Full load)
	Length L, m	398
2.	Beam B, m	59
3.	Draft T, m	15.3
4.	Water	254,575
5.	displacement,	198,000
6.	t Deadweight,	fully loaded
7.	t	2 x 32,000
8.	Loading capacity Main	2 x 26,500
9.	engine, kW Propulsion	2 FPP
10.	mechanism Propeller	24.1
	Speed, knots	

Four TRANSAS automatic systems were used in container ship towing tests Mathematical models of an ASD (*Azimuth Stern Drive*) type tugboat, the data for which are presented in Table 3.2.

3.2 Table

Key data for the automatic tugboat model

No.	Tugboat type/model	Length, m	Width, m	Draft, m	Deadweight, t	Main engine, kW	Propeller
	ASD tug 5	25.3	10.4	4.3	60	2 x 2000	Z-drive, FPP

The mounting locations for the automatic tractor are shown in Table 3.3:

3.3 Table

Automatic tractor layout

Row No	Automatic tractor name carrier	Attachment point on the container
1	TT1	Center hatch at the bow
2	TT2	Port or starboard side of the ship's bow Port
3	TT3	or starboard side of the ship's stern Center
4	TT4	hatch of the ship's stern

According to the test scenario, target vessels were moored at the southern part of the port. 3.4 The table presents the main data on the target ships moored at the quay, up to which the passing distances were measured.

Table 3.4

Key data for the ship models moored at the quay

Quay No.	Vessel type/model	Length L, m	Width B, m
Draft	Container ship	398	59
147	Ro-ro passenger ferry 14	196	25
149–150	Bulk carrier	320	53
151-152	Bulk carrier	320	53
Container terminal	Container ship 20	397	56.4
	Containership16	363	45.6
157	LNGl7	299.9	45.8
	LNGl	297.5	45.8

4. REAL-TIME TESTS

Real-time tests for the planned container terminal in the southern part of the Port of Klaipėda, involving the berthing and unberthing of container ships, were conducted from May 23 to June 10, 2022.

The real-time tests were conducted by four KVJUD pilots:

1. Rimvydas Eitutis - Head of KVJUD LET – Chief Pilot;
2. Darius Stonkus – Senior Pilot at KVJUD;
3. Mindaugas Mozüras – Senior Pilot, KVJUD;
4. Igor Nasonov – KVJUD Senior Pilot;

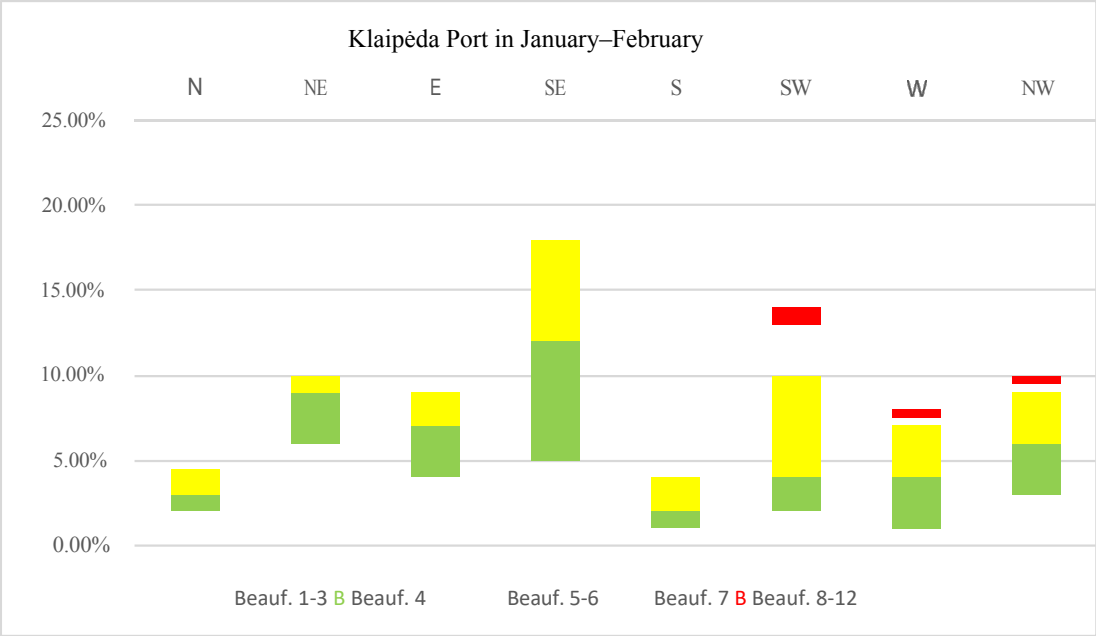
One of the key criteria for analysis, during real-time testing by KVJUD pilots, was the assessment of the complexity of maneuvering the vessel into and out of the container terminal—whether the maneuver

was successful or unsuccessful, the suitability of the three alternatives, and risk factors; The main focus was on critical points, maintaining the safest possible distance from them, applying the pilot's practical experience in guiding similar types of vessels in the Port of Klaipėda to successfully and safely carry out the task—

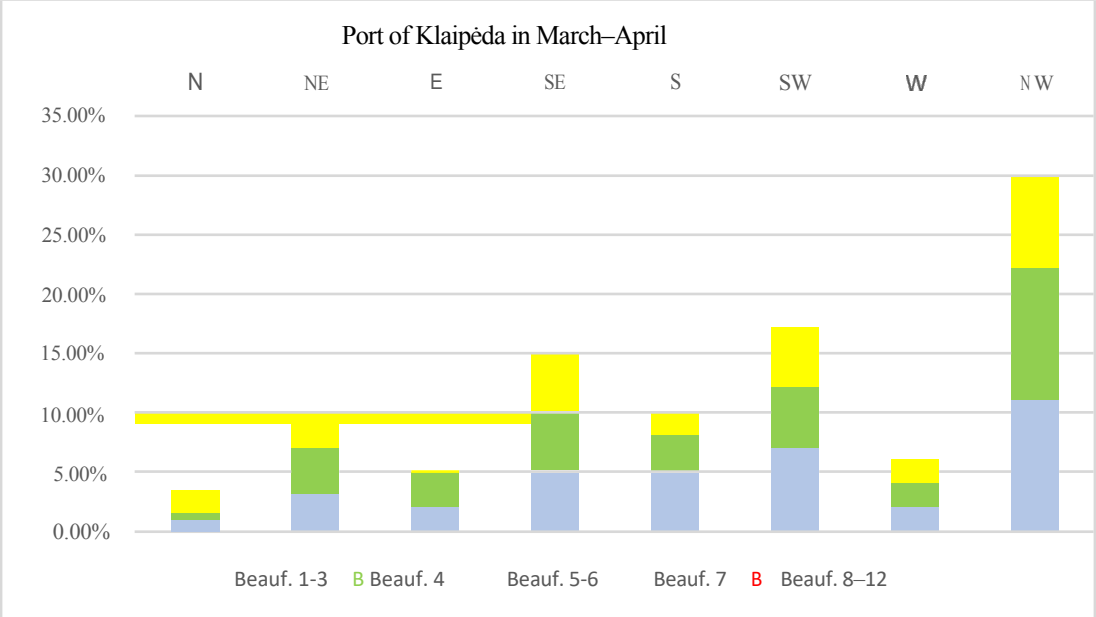
After each alternative scenario was carried out, a debriefing was conducted to identify the most pressing problems and risk factors.

5. HYDROMETEOROLOGICAL CONDITION MODELS

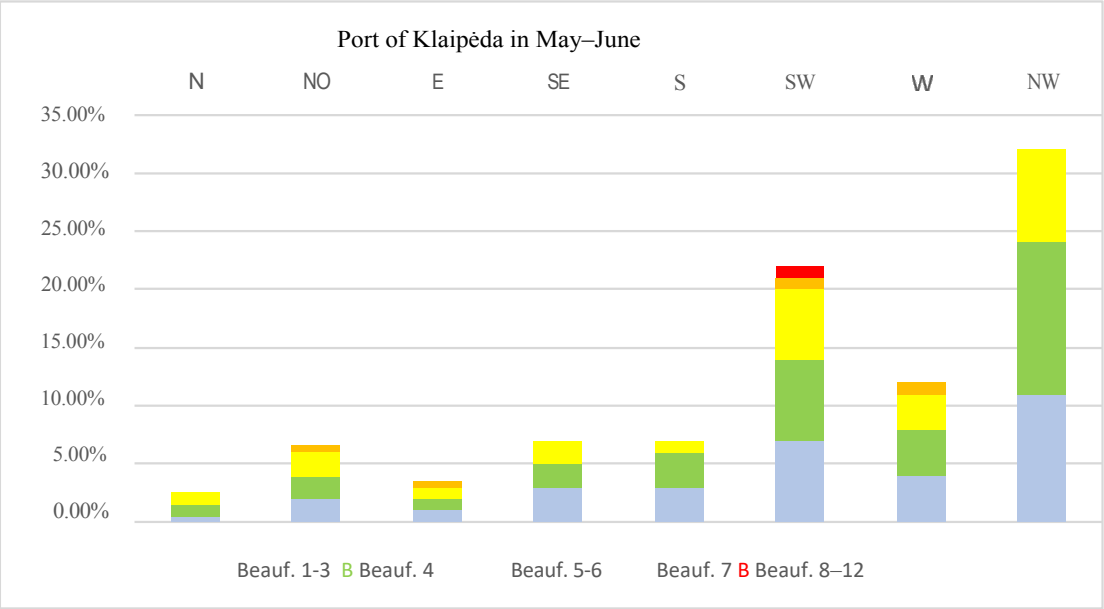
Based on meteorological data statistics for the Port of Klaipėda, according to Admiralty Sailing Directions No. NP19 (*ADMIRALTY Sailing Directions NP19),* the prevailing stronger winds are from the S, SW, W, NW, and N directions. Easterly winds are rare and usually do not exceed 10 m/s. Wind statistics are presented in Figures 5.1, 5.2, 5.3, 5.4, 5.5, and 5.6.



5.1 Fig. Wind data statistics for the Port of Klaipėda in January–February
(Source: ADMIRALTYNP19)

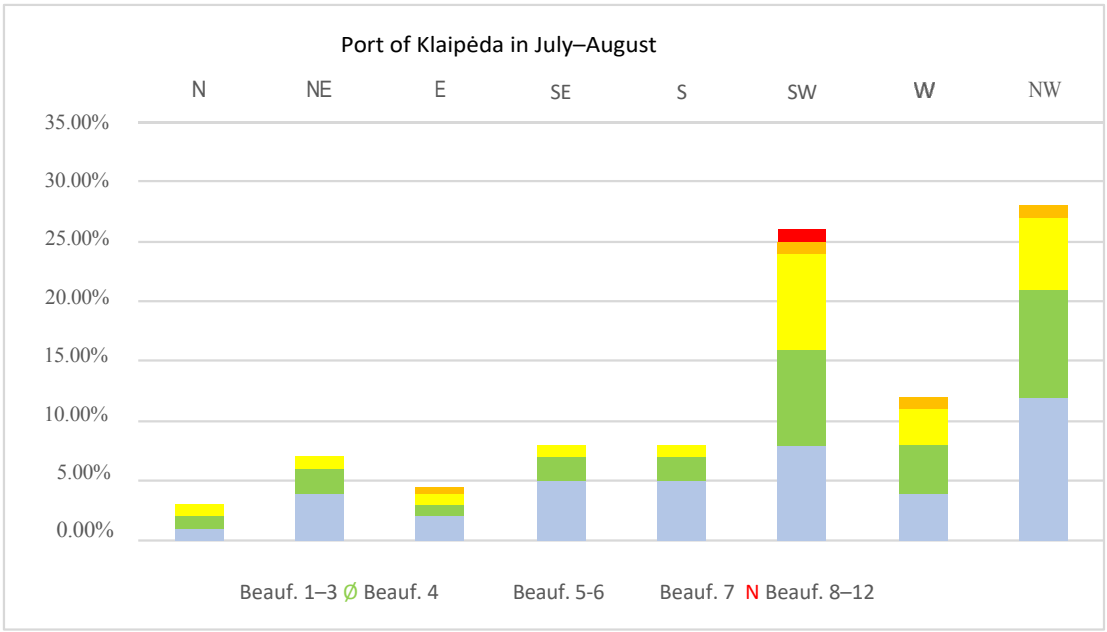


5.2 Fig. Wind data statistics for the Port of Klaipėda in March–April.
(Source: ADMIRALTYNP19)



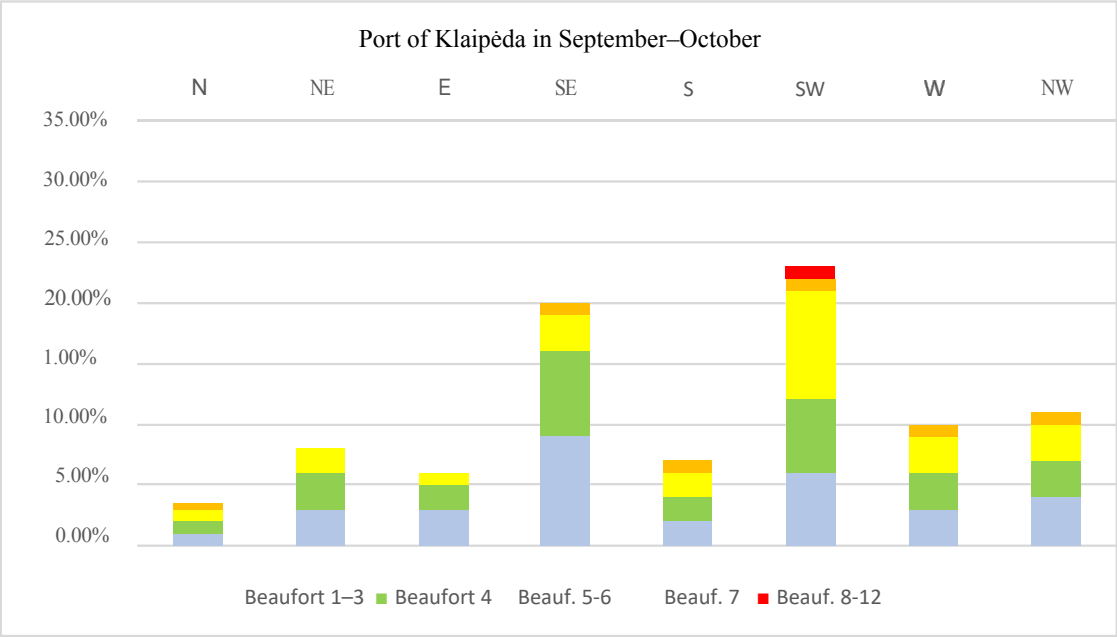
5.3 Fig. Wind data statistics for the Port of Klaipėda in May–June.

(Source: ADMIRALTYNPI9)

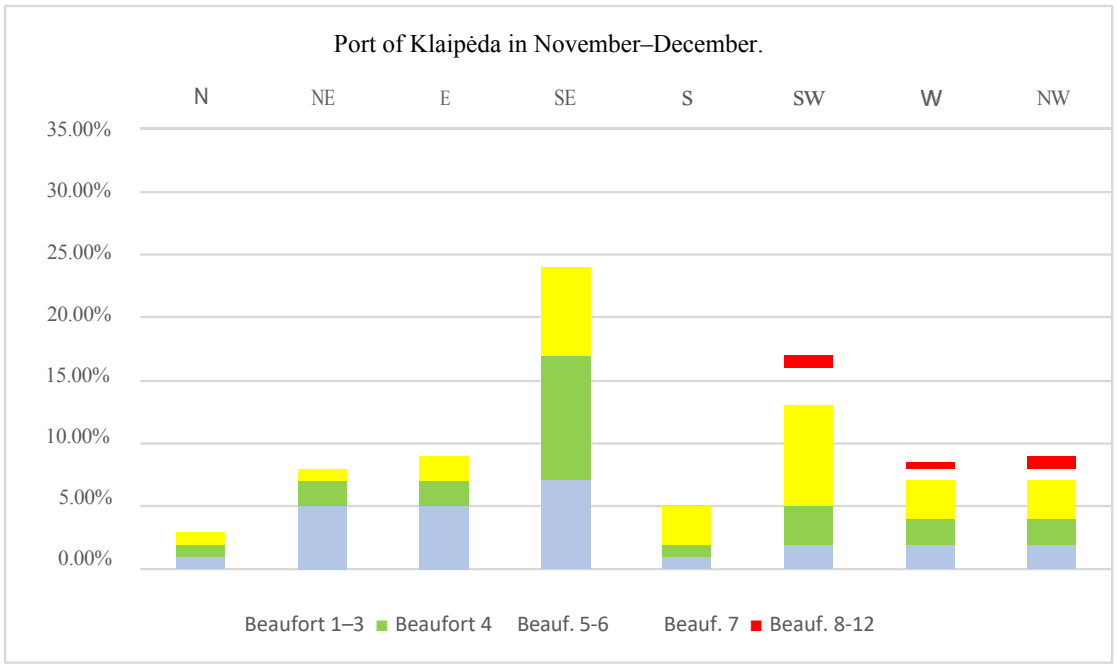


5.4 Fig. Wind data statistics for the Port of Klaipėda in July–August.

(Source: ADMIRALTYNP19)



5.5 Fig. Wind data statistics for the Port of Klaipėda in September–October.
(Source: ADMIRALTYNP19)



5.6 Fig. Wind data statistics for the Port of Klaipėda for November–December.
(Source: ADMIRALTYNP19)

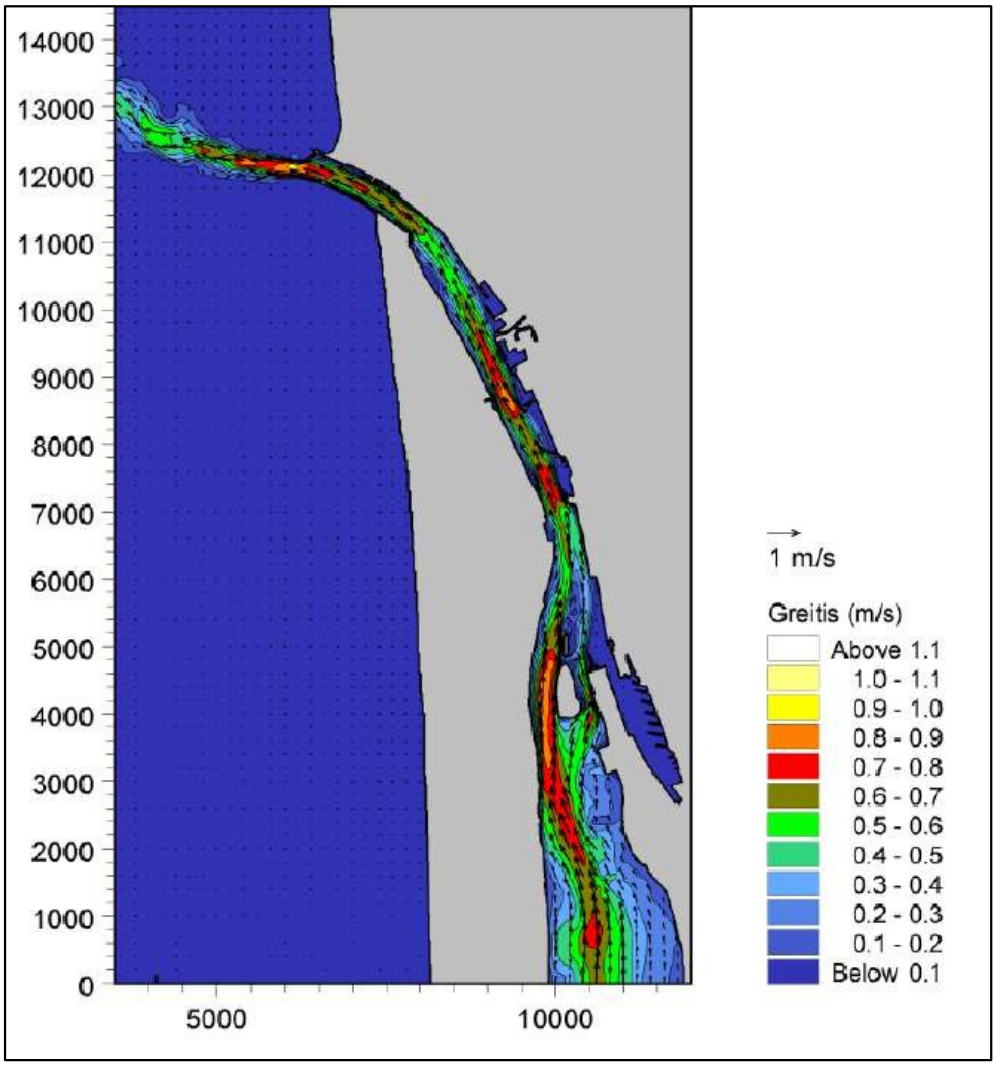
During the test the most unfavorable and relevant wind directions (N, NW, SW, W) and wind speeds of 10, 14, and 18 m/s were simulated.

Current directions and speeds were determined based on the Lithuanian Energy Institute (LEI) current structure maps, compiled by calculating the outflow to the sea or the inflow to the lagoon in m³/s.

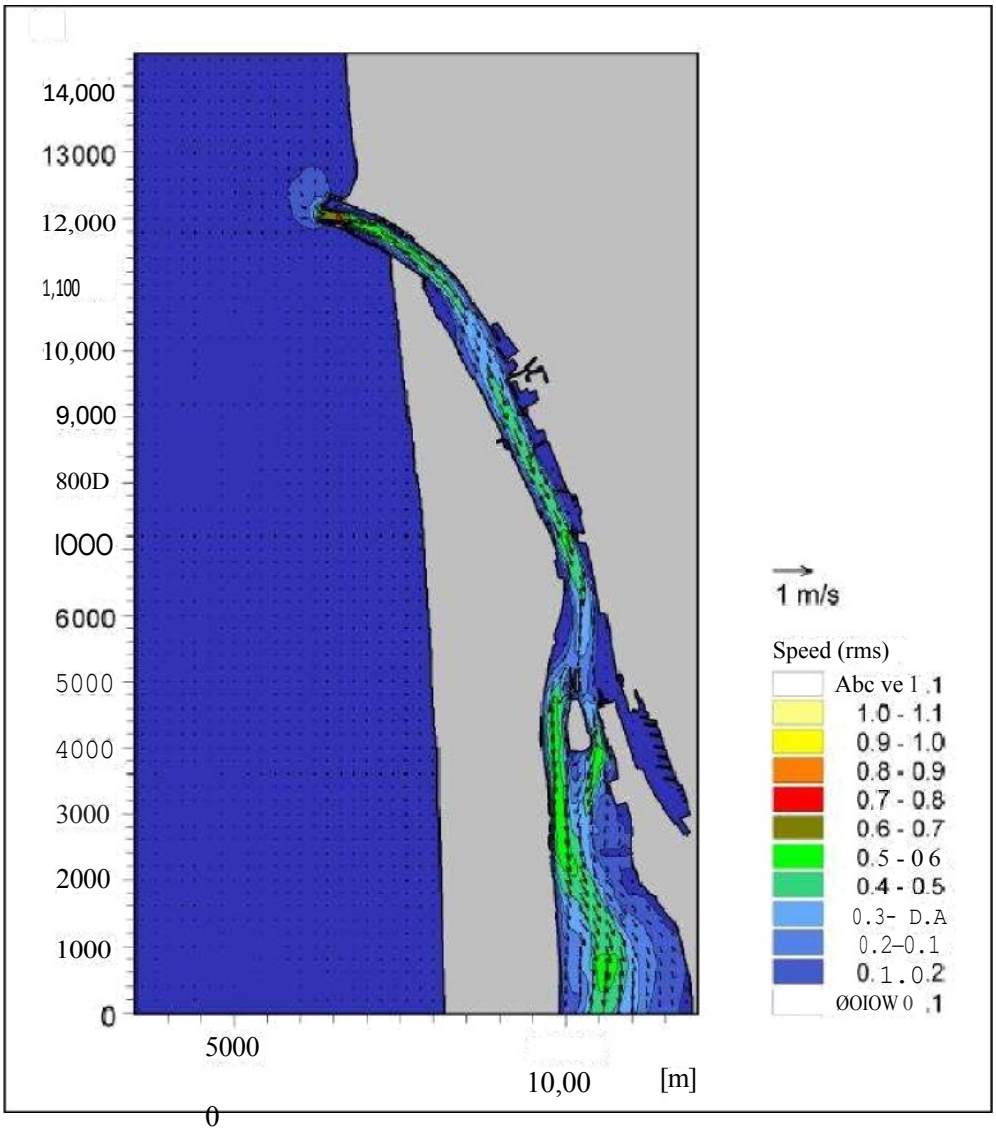
When S–SW winds blow, a current toward the sea is usually observed in the port. The prevailing current direction in the Port of Klaipėda is out to sea, typically ranging from 0.5 to 0.7 knots; with stronger southerly winds, it can increase to 1.5–2 knots.

With N–NW winds, the current in Klaipėda Port typically flows from the shore, ranging from 0.5 to 0.7 knots, but in some cases it can also increase to 1.5–2 knots.

The structure of the current in the Port of Klaipėda is shown in Figures 5.7 and 5.8.

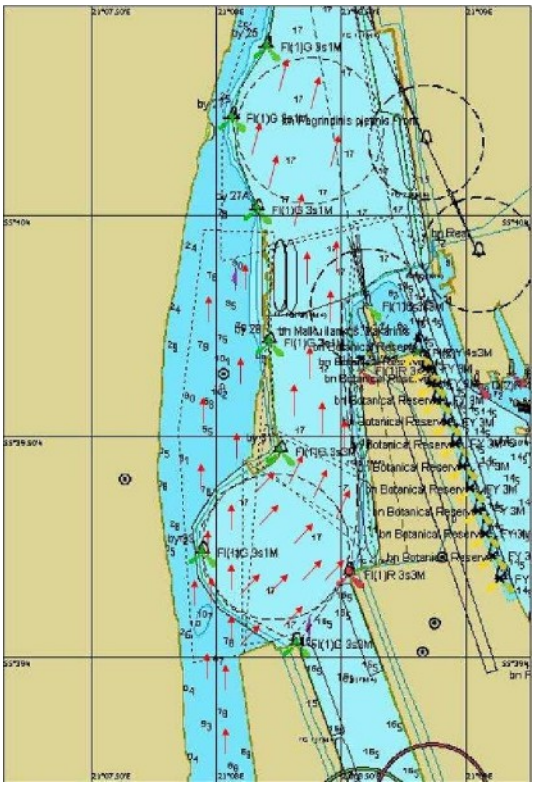


5.7 Fig. Structure of the current in the Klaipėda Strait, 2,700 m³/s discharge into the Curonian Lagoon and the Baltic Sea

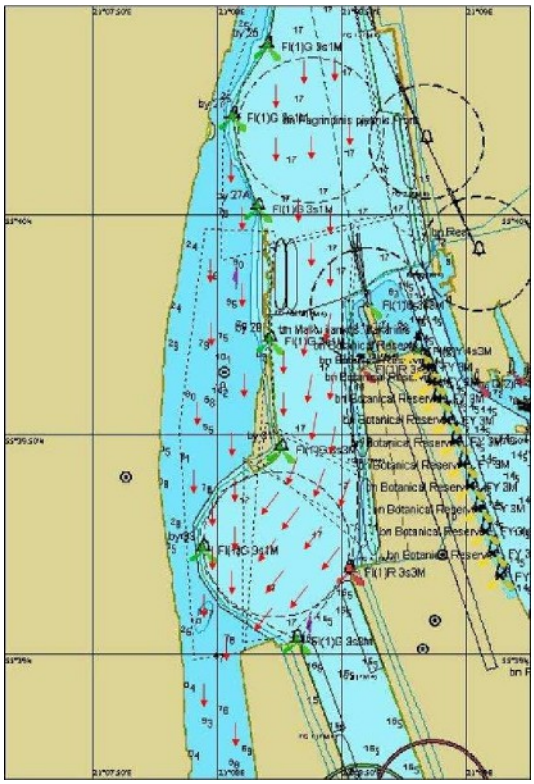


5.8 Fig. Structure of the Klaipėda Strait current, 1700 m/s flow rate from the Baltic Sea into the Curonian Lagoon

Taking into account the planned container terminal configurations and the presented alternatives, the expected current flow trajectories according to current directions are shown in Figures 5.9, 5.10, 5.11, 5.12, 5.13, and 5.14.



5.9 Fig. 2A Alternative: Current into the Sea



5.10 Fig. 2A: Alternative flow from the river

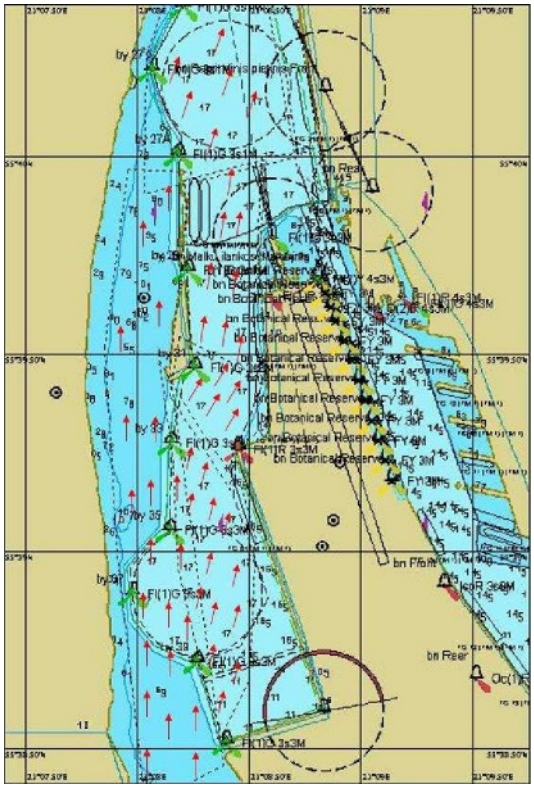
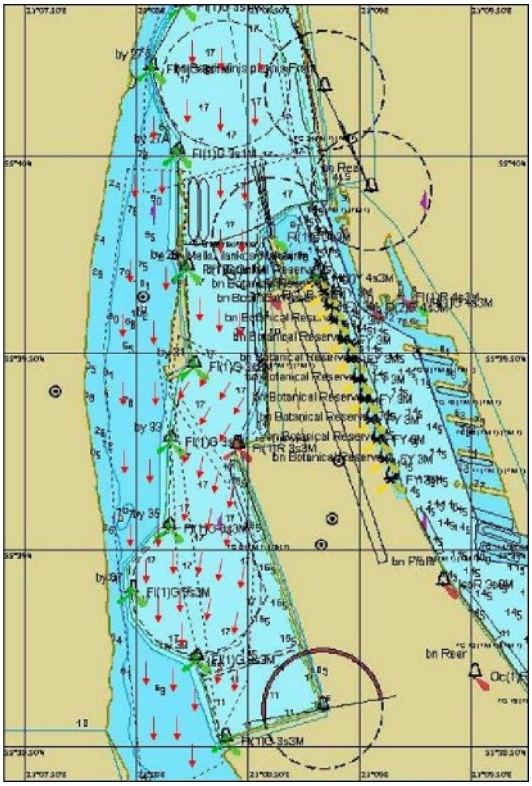
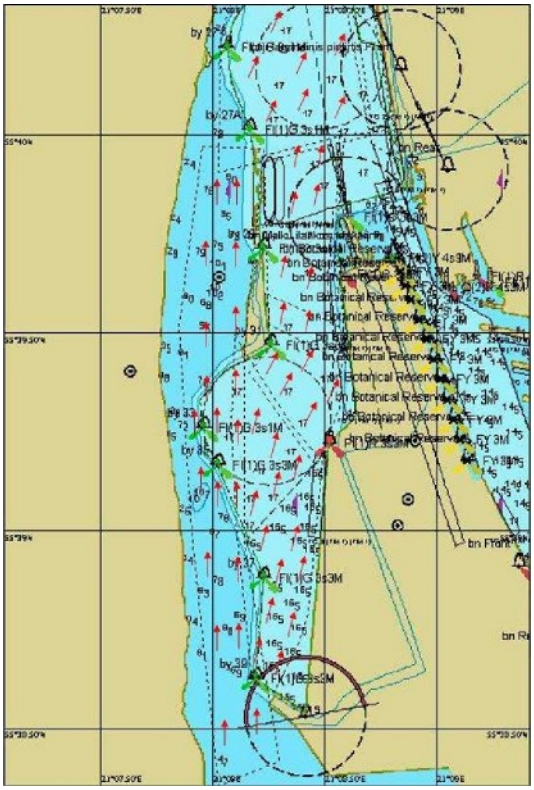


Fig. 5.11. Alternative 3A: Current into the sea



5.12 Fig. 3A: Alternative flow from the sea



5.13 Fig. 4A: Alternative flow into the river

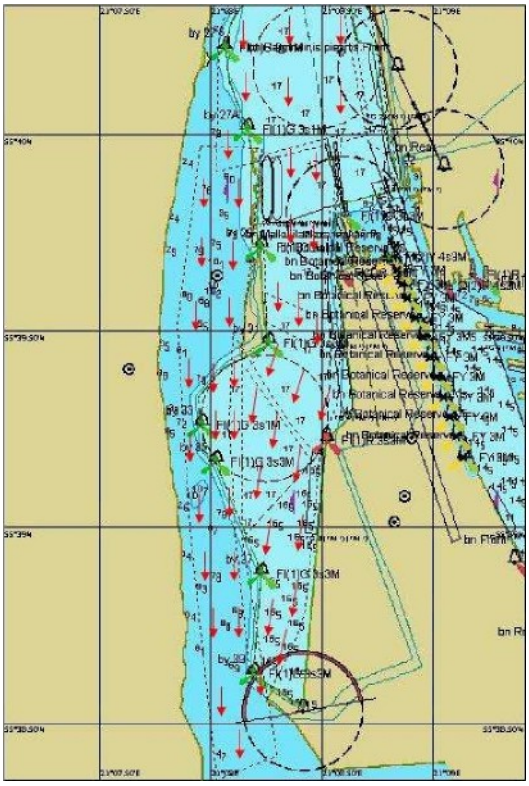


Fig. 5.14 Alternative 4A: current from the sea

6. TEST SCENARIOS

The test scenarios for Alternative 2A are presented in Table 6.1.

6.1 Table

Test scenarios for Alternative 2A

Scen. No.	Swim No.	Wind			Current		Notes
		Rumb/ mls	Direction	V, knots	Direction	V, knots	
1	1.1	SW/10	225º	20	°C	0.7	{swimming from buoy 21 to container terminal fees Parking space No. 2, with 4 trucks
	1.2	SW/10	225º	20	jjürą	0.7	
	1.3	SW/10	225º	20	jury	0.7	
2	2.1	W/10	270º	20	ţjfirą	0.7	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	2.2	W/10	270º	20	0.7	0.7	
	2.3	W/10	270º	20	at sea	0.7	
3	3.1	SW/10	225º	20	jury	1.5	Swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	3.2	SW/10	225º	20	°C	1.5	
	3.3	SW/10	225º	20	°C	1.5	
4	4.1	W/10	270º	20	jjürą	1.5	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	4.2	W/10	270º	20	°C	1.5	
	4.3	W/10	270º	20	tsjfirą	1.5	
5	5.1	SW/10	225º	20	ton	2.0	Swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	5.2	SW/10	225º	20	°C	2.0	
	5.3	SW/10	225º	20	°C	2.0	
6	6.1	W/10	270º	20	tons	2.0	{swimming from buoy 21 to container terminal Parking space No. 2, with 4 trucks
	6.2	W/10	270º	20	°C	2.0	
	6.3	W/10	270º	20	ţjfirą	2.0	
7	7.1	N/10	OOOº	20	iijüros	0.7	Sailing from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	7.2	N/10	000º	20	iijüros	0.7	
	7.3	N/10	000º	20	iijüros	0.7	
8	8.1	NW/10	315º	20	iijüros	0.7	{swim from buoy 21 to container terminal fees Parking space No. 2, with 4 trucks
	8.2	NW/10	315º	20	iijüros	0.7	
	8.3	NW/10	315º	20	iijüros	0.7	
9	9.1	N/10	000º	20	iijfiros	1.5	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	9.2	N/10	OOOº	20	iijüros	1.5	
	9.3	N/10	000º	20	offshore	1.5	
10	10.1	NW/10	315º	20	offshore	1.5	Swim from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	10.2	NW/10	315º	20	iijüros	1.5	
	10.3	NW/10	315º	20	iijüros	1.5	
11	11.1	N/10	000º	20	iijüros	2.0	

	11.2	N/10	000º	20	offshore	2.0	Navigation from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	11.3	N/10	OOO°	20	iijüros	2.0	
12	12.1	NW/10	315º	20	offshore	2.0	{sailing from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	12.2	NW/10	315º	20	exit	2.0	
	12.3	NW/10	315º	20	exit	2.0	
13	13.1	SW/14	225°	28	jury	0.7	Swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	13.2	SW/14	225º	28	°C	0.7	
	13.3	SW/14	225º	28	°C	0.7	
14	14.1	W/14	270º	28	jury	0.7	Sailing from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	14.2	W/14	270º	28	tsjiirą	0.7	
	14.3	W/14	270º	28	°C	0.7	
15	15.1	SW/14	225°	28	tjfirą	1.5	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	15.2	SW/14	225°	28	1.5	1.5	
	15.3	SW/14	225º	28	°C	1.5	
16	16.1	W/14	270º	28	jury	1.5	Swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	16.2	W/14	270º	28	°C	1.5	
	16.3	W/14	270°	28	ton	1.5	
17	17.1	SW/14	225º	28	tsfir	2.0	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	17.2	SW/14	225°	28	jury	2.0	
	17.3	SW/14	225º	28	°C	2.0	
18	18.1	W/14	270º	28	jury	2.0	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	18.2	W/14	270°	28	jury	2.0	
	18.3	W/14	270º	28	°C	2.0	
19	19.1	N/14	000º	28	iijüros	0.7	Sailing from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	19.2	N/14	000º	28	from the file	0.7	
	19.3	N/14	OOO°	28	iijüros	0.7	
20	20.1	NW/14	315º	28	iijüros	0.7	Swim from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	20.2	NW/14	315º	28	from the start	0.7	
	20.3	NW/14	315º	28	iijfiros	0.7	
21	21.1	N/14	OOO°	28	departures	1.5	{swimming from buoy 21 to container terminals Parking space No. 2, with 4 trucks
	21.2	N/14	000º	28	offshore	1.5	
	21.3	N/14	000º	28	from	1.5	
22	22.1	NW/14	315°	28	iijüros	1.5	Swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	22.2	NW/14	315º	28	offshore	1.5	
	22.3	NW/14	315º	28	offshore	1.5	
23	23.1	N/14	000º	28	iijüros	2.0	{swimming from buoy 21 to container terminal fees Parking space No. 2, with 4 trucks
	23.2	N/14	OOO°	28	izjfiros	2.0	
	23.3	N/14	000º	28	seaside	2.0	

	23.4	N/14	000º	28	from the sea	2.0	
24	24.1	NW/14	315º	28	ii jüros	2.0	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	24.2	NW/14	315º	28	from the sea	2.0	
	24.3	NW/14	315º	28	from jfiros	2.0	
	24.4	NW/14	315º	28	from Jfira	2.0	
	24.5	NW/14	315º	28	from the sea	2.0	
25	25.1	SW/18	225º	36	to the sea	0.7	Sailing from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	25.2	SW/18	225º	36	to the sea	0.7	
	25.3	SW/18	225º	36	jury	0.7	
26	26.1	W/18	270º	36	jury	0.7	{Sailing from buoy 21 to berth No. 2 at the container terminal, with 4 tugboats
	26.2	W/18	270º	36	°C	0.7	
	26.3	W/18	270º	36	jura	0.7	
	26.4	W/18	270º	36	¡jürą	0.7	
	26.5	W/18	270º	36	°C	0.7	
	26.6	W/18	270º	36	°C	0.7	
27	27.1	SW/18	225º	36	°C	1.5	Swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	27.2	SW/18	225º	36	ţjfirą	1.5	
	27.3	SW/18	225º	36	°C	1.5	
28	28.1	W/18	270º	36	jury	1.5	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	28.2	W/18	270º	36	jury	1.5	
	28.3	W/18	270º	36	°C	1.5	
29	29.1	SW/18	225º	36	jury	2.0	Swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	29.2	SW/18	225º	36	jury	2.0	
	29.3	SW/18	225º	36	°C	2.0	
30	30.1	W/18	270º	36	ţjfirą	2.0	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	30.2	W/18	270º	36	ţjfirą	2.0	
	30.3	W/18	270º	36	°C	2.0	
31	31.1	N/18	000º	36	exits	0.7	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	31.2	N/18	000º	36	iijfiros	0.7	
	31.3	N/18	OOOº	36	exports	0.7	
32	32.1	NW/18	315º	36	iijüros	0.7	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	32.2	NW/18	315º	36	from the start	0.7	
	32.3	NW/18	315º	36	iijüros	0.7	
33	33.1	N/18	000º	36	iijüros	1.5	Swimming from buoy 21 to container terminal conditions
	33.2	N/18	000º	36	iijüros	1.5	

	33.3	N/18	000º	36	iijfiros	1.5	Parking space No. 2, with 4 trucks
34	34.1	NW/18	315º	36	from the	1.5	{sailing from buoy 21 to container terminal temporary parking space No. 2, with 4 trucks
	34.2	NW/18	315º	36	sea II juros	1.5	

	34.3	NW/18	315º	36	from	1.5	
35	35.1	N/18	000º	36	Jfira ii jüros	290	Sailing from buoy 21 to temporary berthing area No. 2 at the container terminal, with 4 tugs
	35.2	N/18	000º	36	from the sea	2.0	
36	35.3	N/18	000º	36	from jfiros	2.0	{sailing from buoy 21 to container terminal temporary berth No. 2, with 4 tugs
	36.1	NW/18	315º	36	from jfiros	290	
	36.2	NW/18	315º	36	from the sea	2.0	Departure from the container terminal's designated berth No. 2, with 4 tugboats
	36.3	NW/18	315º	36	from the sea	2.0	
Departure 37*	37.1	W/18	270º	36	to the sea	2.0	

The scenarios tested for Alternative 3A are presented in Table 6.2.

6.2 Table

Scenarios tested for Alternative 3A

Scenario No.	Voyage No.	Wind			Current		Notes
		Course/miles	Direction	V, knots	Direction	V, knots	
1	1.1	SW/10	225º	20	tjfirą	0.7	{swimming from buoy 21 to container terminal conditions Berth No. 2, with 4 tugboats
	1.2	SW/10	225º	20	to the sea	0.7	
	1.3	SW/10	225º	20	°C	0.7	
2	2.1 *	W/10	270º	20	to the sea	0.7	{sailing from buoy 21 to container terminal berth No. 2, with 4 tugs and departure
	2.2	W/10	270º	20	to the sea	0.7	{sailing from buoy 21 to the container terminal's temporary Parking space No. 2, with 4 trucks
	2.3	W/10	270º	20	to sea	0 7	
3	3.1	SW/10	225º	20	1.5	1.5	Sailing from buoy 21 to the container terminal Berth No. 2, with 4 tugboats {sailing from buoy 21 to Container terminal temporary berthing area No. 2, with 4 tugs and departure
	3.2	SW/10 jfirą	225º	20	to the	195	
	3.3	SW/10	225º	20	j jürą	1.5	
4	4.1	W/10	270º	20	tjfirą	1.5	{sailing from buoy 21 to container terminal temporary berthing area No. 2, with 4 tugs {sailing from buoy 21 to container terminal temporary berth No. 2, with 4 tugs and departure
	4.2	W/10	270º	20	the sea	1.5	
	4.3 '	W/10	270º	20	°C	1.5	
$	5.1*	SW/10	225º	20	to the sea	2.0	Sailing from buoy 21 to temporary berth No. 2 at the container terminal, with 4 tugboats and departure
	5.2	SW/10	225º	20	°C	2.0	

	5.3	SW/10	225º	20	ţjfirą	2.0	Sailing from buoy 21 to the designated berthing area No. 2 at the container terminal, with 4 tugboats
	5.4	SW/10	225º	20	to the sea	2.0	
	6.1 ’	W/10	270º	20	to the sea	2.0	{Sailing from buoy 21 to temporary berth No. 2 at the container terminal, with 4 tugs, and departure
6	6.2’	W/10	270º	20	ţjfirą	2.0	
	6.3’	W/10	270º	20	°C	2.0	Sailing from buoy 21 to temporary berth No. 2 at the container terminal, with 4 tugs Sailing from buoy 21 to temporary berth No. 2 at the container terminal, with 4 tugs and departure
	7.1	N/10	OOOº	20	from the sea	0.7	
	7.2	N/10	000º	20	from the sea	0.7	
7							
	7.3 *	N/10 0.7	000º	20	from the sea		Sailing from buoy 21 to temporary berthing area No. 2 at the container terminal, with 4 tugboats and departure
	8.1	NW/10	315º	20	II Jura	0.7	Voyage from Buoy 21 to the container terminal's designated berthing area No. 2, with 4 tugboats
8							
	8.2	NW/10	315º 0.7	20	from the sea		Voyage from Buoy 21 to the container terminal's designated berthing area No. 2, with 4 tugboats
	9.1	N/10	000º 1.5	20	from the sea		{Sailing from buoy 21 to temporary berth No. 2 at the container terminal, with 4 tugs, and departure
	9.2 *	N/10	000º	20	from jfiros	1.5	{sailing from buoy 21 to the container terminal’s temporary berthing area No. 2, with 4 tugboats
	9.3 ’	N/10	000º	20	ii jüros	1.5	{sailing from buoy 21 to container terminal temporary berthing area No. 2, with 4 tugboats
	10.1	N/10	000º	20	offshore	2.0	
10	10.2	N/10	000º	20	offshore	2.0	
	10.3	N/10	OOOº	20	offshore	2.0	{sailing from buoy 21 to conditional berth No. 2 at the container terminal, with 4 tugboats
	11.1	N/Wl0	315º	20	iijüros	1.5	
11	ll.2	N/W10	315º	20	out of range	1.5	
	11.3	N/W10	315º	20	iijüros	1.5	{sailing from buoy 21 to temporary berthing area No. 2 at the container terminal, with 4 tugboats
12.1	NW/10	315º	20	from the shore		2.0	
	12.2	NW/10	315º	20	išjfiros	2.0	
12	12.3	NW/10	315º	20	exit	2.0	
	12.4	NW/10	315º	20	iijüros	2.0	
	13.1	SW/14	225º	28	°	0.7	
13	13.2	SW/14	225º	28	ţjfirą	0.7	
	13.3	SW/14	225º	28	°C	0.7	
	14.1	W/14	270º	28	¡ jürą	0.7	{sailing from buoy 21 to container terminal temporary parking area No. 2, with 4 tugs

14	14.2’	W/14	270º	28	to sea	0.7	Sailing from buoy 21 to the designated parking area No. 2 at the container terminal, with 4 tugs and departure

	14.3	W/14	270º	28	to the sea	0.7	Swimming from buoy 21 to container terminal conditions berth No. 2, with 4 tugs
15	15.1	SW/14	225º	28	to the sea	1.5	{sailing from buoy 21 to container terminal berth No. 2, with 4 tugs
	15.2*	SW/14	225º	28	tjürą	1.5	{sailing from buoy 21 to container terminal temporary berth No. 2, with 4 tractors and departure
	15.3	SW/14	225º	28	to the sea	1.5	Departure from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
16	16.1	W/14	270º	28	jury	1.5	{swimming from buoy 21 to container terminal conditions berth No. 2, with 4 tugboats
	16.2	W/14	270º	28	1.5	1.5	
	16.3	W/14	270º	28	1,5	1.5	
	17.1	SW/14	225º	28	¡ sea	2.0	{sailing from buoy 21 to container terminal parking space No. 2, with 4 trucks
17	17.2‘	SW/14	225º	28	tjürą	2.0	Sailing from buoy 21 to the container terminal’s reference
	17.3'	SW/14	225°	28	tsea	2.0	Berth No. 2, with 4 tugboats and departure
18	18.1’	W/14	270º	28	tjfirą	2.0	{sailing from buoy 21 to container terminal temporary berth No. 2, with 4 tractors and departure
	18.2	W/14	270º	28	turbo	2.0	{sailing from buoy 21 to container terminal under standard
	18.3	W/14	270º	28	into the sea	2.0	Parking space No. 2, with 4 trucks
19	19.1	N/14	OOO°	28	offshore	0.7	Sailing from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	19.2	N/14	000º	28	iijüros	0.7	
	19.3	N/14	000º	28	exports	0.7	
20	20.1	NW/14	315º	28	iijüros	0.7	{swimming from buoy 21 to from the container terminal’s
	20.2	NW/14	315º	28	from the buoy	0.7	Parking space No. 2, with 4 trucks
21	21.1	N/14	000º	28	exits	1.5	{swimming from buoy 21 to container terminal conditions Berth No. 2, with 4 tugboats
	21.2	N/14	000º	28	from jfiros	1.5	
	21.3	N/14	OOO°	28	iijüros	1.5	
22	22.1	NW/14	315º	28	ijjüros	1.5	Navigation from buoy 21 to the container terminal Parking space No. 2, with 4 trucks
	22.2	NW/14	315º	28	iijfiros	1.5	
23	23.1	N/14	000º	28	iijüros	2.0	Swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	23.2	N/14	000º	28	from the file	2.0	
	23.3	N/14	000º	28	offshore	2.0	
24	24.1	NW/14	315º	28	offshore	2.0	Sailing from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	24.2	NW/14	315º	28	iijüros	2.0	
	24.3	NW/14	315º	28	offshore	2.0	
25	25.1	SW/18	225º	36	tsjiira	0.7	

	25.2	SW/18	225º	36	to sea	0.7
	26.1	W/18	270º	36	to the sea	0.7
26	26.2	W/18	270º	36	ţjfirą	0.7
	26.3	W/18	270º	36	°C	0.7
	27.1	SW/18	225º	36	to the sea	1.5
	27.2	SW/18	225º	36	°C	1.5
27						
	27.3 *	SW/18	225º	36	to the sea	1.5
28	28.1	W/18	270º	36	to the sea	1.5
	29.1	SW/18	225º	36	°C	2.0
	29.2	SW/18	225º	36	to the right	2.0
29						
	29.3 *	SW/18	225º	36	to the sea	2.0
	30.1	N/18	000º 0.7	36	from the sea	
	30.2	N/18	OOOº	36	iijüros	0.7
30	30.3	N/18	000º	36	offshore	0.7
	~~30.4~~	~~N/18~~	~~000º~~	~~36~~	~~offshore~~	~~0.7~~
	31.1 *	W/18	270º	36	°C	2.0
	31.2	W/18	270º	36	°C	2.0
31	31.3*	W/18	270º	36	ţjfirą	2.0
	31.4 ‘	W/18	270º	36	ţjfirą	2.0
	31.5 ‘	W/18	270º	36	ţjfirą	2.0
	31.6 ‘	W/18	270º	36	jury	2.0
	~~31.7 ’~~	~~W/18~~	~~270º~~	~~36~~	~~°C~~	~~2.0~~
32	32.1	NW/18	315º	36	ii jüros	0.7
	33.1	N/18	000º	36	from jfiros	1.5
	33.2	N/18	000º 1.5	36	from the sea	
33						
	33.3 ’	N/18	000º	36	ii jüros	1.5
	~~34~~	~~34.1~~	~~NW/18~~	~~315º~~	~~36~~	ii jüros 1.5

Navigation from buoy 21 to the designated berthing area No. 2 at the container terminal, with 4 tugboats

{Sailing from buoy 21 to temporary berth No. 2 at the container terminal, with 4 tugs

Sailing from buoy 21 to container terminal temporary berth No. 2, with 4 tugs Sailing from buoy 21 to container terminal temporary berth No. 2, with 4 tugs and departure

{Sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats

{Sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats J Sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats and departure

{sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats

Sailing from buoy 21 to the container terminal's designated berthing area No. 2, with 4 tugboats, and departure

{Sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats

Sailing from buoy 21 to the container terminal's designated berthing area No. 2, with 4 tugboats, and departure

{Sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugs

{Sailing from buoy 21 to the container terminal's designated berthing area No. 2, with 4 tugboats Sailing from buoy 21 to the container terminal's designated berthing area No. 2, with 4 tugboats, and departure

	34.2	NW/18	315°	36	ii jüros	1.5	Navigation from buoy 21 to the container terminal's designated berth No. 2, with 4 tugs
	34.3‘	NW/18	315º	36	ii jüros	1.5	{sailing from buoy 21 to the designated berthing spot No. 2 at the container terminal, with 4 tugs and departure
35	35.1	N/18	000º	36	ii jüros	2–0	Swimming from buoy 21 to container terminal conditions berth No. 2, with 4 tugboats
	35.2	N/18	000º	36	from the sea	2.0	
	35.3	N/18	000º	36	from the sea	2.0	
36	36.1‘	NW/18	315⁰	36	ii jüros	2.0	Sailing from buoy 21 to the designated berthing spot No. 2 at the container terminal, with 4 tugs and departure
	36.2	NW/18	315⁰	36	iijfiros	2.0	Swim from buoy 21 to Parking space No. 2, with 4 trucks from the container terminal's temporary
	36.3	NW/18	315º	36	iijüros	2.0	
	36.4	NW/18	315º	36	offshore	2.0	
	36.5	NW/18	315º	36	offshore	2.0	
	36.6	NW/18	315º	36	ii jüros	2.0	
	36.7	NW/18	315º	36	2.0	2.0	
	36.8	NW/18	315º	36	exit	2.0	
	36.9	NW/18	315⁰	36	iijüros	2.0	
	36.10	NW/18	315º	36	offshore	2.0	
departure	36.ll	NW/18	315º	36	offshore	2.0	

The scenarios for performing the 4A test are presented in Table 6.3.

6.3 Table

Scenarios for Alternative 4A

Seen. No.	Swim No.	Véjas			Current		Notes
		Rumb/ mph	Direction	V, knots	Direction	V, knots	
1	1.1	SW/10	225º	20	°C	0.7	Swimming from buoy 21 to container terminal conditions Parking space No. 2, with 4 trucks
	1.2	SW/10	225⁰	20	jury	0.7	
	1.3	SW/10	225º	20	°C	0.7	
2	2.1	W/10	270º	20	jfirą	0.7	{sailing from buoy 21 to the container terminal's designated berth No. 2, with 4 tugs
	2.2’	W/10	270º	20	ţjfirą	0.7	{swimming from buoy 21 to container terminal conditions Berth No. 2, with 4 tugs and departure
	2.3*	W/10	270º	20	to the sea	0.7	
3	3.1*	SW/10	225º	20	to sea	1.5	Sailing from buoy 21 to container terminal conditions Berth No. 2, with 4 tugs and departure
	3.2’	SW/10	225⁰	20	j jfirą	1.5	

	3.3	SW/10	225º	20	to sea	1.5	Navigation from buoy 21 to the container terminal's designated berth No. 2, with 4 tugs
4	4.1	W/10	270º	20	the sea	1.5	{sailing from buoy 21 to the container terminal's designated berth No. 2, with 4 tugs
	4.2	W/10	270º	20	tjfirą	1.5	
	4.3'	W/10	270º	20	to the sea	1.5	{sailing from buoy 21 to the designated berth No. 2 at the container terminal, with 4 tugs, and departure
5	5.1	SW/10	225º	20	the sea	2.0	Sailing from buoy 21 to the designated parking area No. 2 at the container terminal, with 4 tractors
	5.2	SW/10	225º	20	tjürą	2.0	
	5.3	SW/10	225º	20	to sea	2.0	{sailing from buoy 21 to the container terminal's designated berth No. 2, with 4 tugs, and departure
6	6.1	W/10	270º	20	¡jura	2.0	{sailing from buoy 21 to the container terminal's designated berth No. 2, with 4 tugs
	6.2	W/10	270º	20	jura	2.0	
	6.3*	W/10	270º	20	to the sea	2.0	Sailing from buoy 21 to the designated berth No. 2 at the container terminal, with 4 tugs and departure
7	7.1	N/10	000º	20	ii jfiros	0.7	{sailing from buoy 21 to the designated berthing spot No. 2 at the container terminal, with 4 tugboats
	7.2	N/10	000º	20	ii jüros	0.7	
	7.3	N/10	000º	20	from juros	0.7	
8	8.1	N/10	000º	20	offshore	1.5	{sailing from buoy 21 to container terminal designated parking space No. 2, with 4 tractors
	8.2	NW/10	000º	20	out	1.5	
9	9.1	NW/10	315º	20	offshore	0.7	{sailing from buoy 21 to container terminal designated parking space No. 2, with 4 tugboats
	9.2	NW/10	315º	20	iijüros	0.7	
10	10.1	NW/10	315º	20	from the	1.5	{Sailing from buoy 21 to designated berth No. 2 at the container terminal, with 4 tugs
	10.2	NW/10	315º	20	sea	1.5	
	10.3	NW/10	315º	20	išjfiros	1.5	
11	ll.1	W/10	270º	20	from jfiros	2.0	{sailing from buoy 21 to the container terminal's designated berth No. 2, with 4 tugs
	11.2	W/10	270º	20	išjfiros	2.0	
	11.3'	W/10	270º	20	ii jüros	2.0	{sailing from buoy 21 to the designated berth No. 2 at the container terminal, with 4 tugs and departure
12	12.1	NW/10	315º	20	from jfiros	2.0	{sailing from buoy 21 to the container terminal's designated berth No. 2, with 4 tugs
	12.2*	NW/10	315º	20	from the sea	2.0	Sailing from buoy 21 to the temporary berthing area No. 2 at the container terminal, with 4 tugboats, and departure
	12.3	NW/10	315º	20	from the sea	2.0	Sailing from buoy 21 to container terminal parking area No. 2, with 4 tugs

13	13.1	SW/14	225º	28	to the sea	0.7

	13.2	SW/14	225º	28	°C	0.7	Navigation from buoy 21 to the designated berthing area No. 2 at the container terminal, with 4 tugboats
	13.3	SW/14	225⁰	28	jura	0.7	
	14.1	W/14	270º	28	°C	0.7	{Sailing from buoy 21 to temporary berth No. 2 at the container terminal, with 4 tugs
14	14.2	W/14	270º	28	ţjfirą	0.7	
	14.3	W/14	270º	28	°C	0.7	
	15.1 *	SW/14	225⁰	28	to the sea	1.5	J-sailing from buoy 21 to container terminal temporary berthing area No. 2, with 4 tugs and departure
15							J-sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats
	15.2	SW/14	225º	28	to the sea	1.5	
	15.3	SW/14	225º	28	°C	1.5	Sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats, and departure
	16.1	W/14	270º	28	°C	1.5	
	16.2	W/14	270º	28	°C	1.5	Sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats
16	16.3	W/14	270⁰	28	jury	1.5	
	16.4	W/14	270º	28	°C	1.5	Sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats, and departure
	16.5 *	W/14	270º	28	j jürą	1.5	{Sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats and departure
	17.1 '	SW/14	225º	28	to the sea	2.0	{Sailing from buoy 21 to the container terminal's designated berthing area No. 2, with 4 tugboats
	17.2	SW/14	225⁰	28	jura	2.0	{sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats and departure
17	17.3	SW/14	225º	28	to the sea	2.0	Sailing from buoy 21 to temporary berth No. 2 at the container terminal, with 4 tugs
	17.4 *	SW/14	225º	28	ţjfirą	2.0	
	17.5	SW/14	225⁰	28	jura	2.0	Navigation from Buoy 21 to the designated berthing area No. 2 at the container terminal, with 4 tugboats
	17.6	SW/14	225º	28	°C	2.0	
	18.1	W/14	270⁰	28	jjürą	2.0	
18	18.2	W/14	270º	28	ţjfirą	2.0	{Sailing from buoy 21 to temporary berthing spot No. 2 at the container terminal, with 4 tugboats
	18.3	W/14	270⁰	28	ţjfirą	2.0	
	18.4	W/14	270º	28	°C	2.0	
	19.1	N/14	000º	28	from the well	0.7	Sailing from buoy 21 to temporary berth No. 2 at the container terminal, with 4 tugboats
19	19.2	N/14	000º	28	from the sea	0.7	
	19.3	N/14	000º	28	from the sea	0.7	
	20.1	NW/14	315º	28	from the sea	0.7	
20	20.2	NW/14	315º	28	from jfiros	0.7	
	20.3	NW/14	315⁰	28	ii jüros	0.7	
21	21.1	N/14	000º	28	ii jüros	1.5	

	21.2	N/14	000º	28	offshore	1.5	J-voyage from buoy 21 to container terminal temporary berthing spot No. 2, with 4 tugboats
	21.3	N/14	OOO°	28	iijuros	1.5	
	22.1	NW/14	315º	28	offshore	1.5	{Sailing from buoy 21 to temporary berthing spot No. 2 at the container terminal, with 4 tugboats
22	22.2	NW/14	315º	28	from the start	1.5	
	22.3	NW/14	315º	28	exit	1.5	
	23.1	N/14	OOO°	28	offshore	2.0	J-sailing from buoy 21 to container terminal temporary berthing area No. 2, with 4 tugs
23	23.2	N/14	000º	28	offshore	2.0	
	23.3	N/14	000º	28	offshore	2.0	
	24.1	NW/14	315º	28	ii jüros	2.0	J-sailing from buoy 21 to container terminal temporary berth No. 2, with 4 tugs
24	24.2*	NW/14	315º	28	ii jüros	2.0	Sailing from buoy 21 to the container terminal's temporary berth No. 2, with 4 tugboats, and departure
	24.3‘	NW/14	315º	28	ii jüros	2.0	
	25.1	SW/18	225º	36	°C	0.7	Sailing from buoy 21 to the container terminal's temporary berth No. 2, with 4 tugboats
25	25.2	SW/18	225°	36	jury	0.7	
	26.1	W/18	270º	36	°C	0.7	Sailing from buoy 21 to the container terminal's temporary berth No. 2, with 4 tugs
26	26.2	W/18	270º	36	jury	0.7	
	26.3	W/18	270º	36	°C	0.7	{Sailing from buoy 21 to the container terminal's temporary berth No. 2, with 4 tugboats
	27.1	SW/18	225°	36	jura	1.5	
27	27.2	SW/18	225º	36	°C	1.5	{Sailing from buoy 21 to the container terminal's designated berthing area No. 2, with 4 tugboats, and departure
	27.3’	SW/18	225º	36	to the sea	1.5	
							Sailing from buoy 21 to the container terminal's temporary berthing area No. 2, with 4 tugboats
	28.1	W/18	270º	36	°C	1.5	
	28.2	W/18	270º	36	°C	1.5	{Sailing from buoy 21 to the container terminal's designated berthing area No. 2, with 4 tugboats, and departure
28	28.3‘	W/18	270°	36	1.5	1.5	
							Sailing from buoy 21 to the container terminal's designated berthing area No. 2, with 4 tugs Sailing from buoy
	28.4	W/18	270º	36	°C	1.5	21 to the container terminal's designated berthing area No. 2, with 5 tugs
	29.1	SW/18	225º	36	the sea	2.0	
	29.2	SW/18	225º	36	°C	2.0	Sailing from buoy 21 to the container terminal's designated berth No. 2, with 5 tugboats, and departure
29							
	29.3‘	SW/18	225°	36	to the sea	2.0	Sailing from buoy 21 to the container terminal's designated parking area No. 2, with 5 tugs
	30.1	W/18	270º	36	°C	2.0	
	30.2	W/18	270º	36	°	2.0	
30	30.3	W/18	270º	36	jury	2.0	
	30.4‘	W/18	270°	36	jury	2.0	

	30.5’	W/18	270º	36	°	2.0	{Sailing from buoy 21 to designated berth No. 2 at the container terminal, with 5 tugboats, and departure
	30.6‘	W/18	270º	36	jury	2.0	
	30.7’	W/18	270º	36	°C	2.0	{sailing from buoy 21 to temporary
31	31.1	N/18	000º 0.7	36	from the well		berth No. 2 at the container terminal, with 4 tugboats
	31.2	N/18	000º	36	exit	0.7	
32	32.1	NW/18	315º	36	offshore	0.7	Navigation from buoy 21 to the container terminal’s designated berth No. 2, with 4 tugboats
	32.2	NW/18	315º	36	out	0.7	
33	33.1	N/18	000º	36	offshore	1.5	{swimming from buoy 21 to container terminal temporary Parking space No. 2, with 5 trucks
	33.2	N/18	000º	36	iijüros	1.5	
34	34.1	NW/18	315º	36	ii jüros	1.5	{sailing from buoy 21 to the container terminal’s designated berth No. 2, with 5 tugs
35	35.1	NW/18	315º	36	iijfiros	2.0	{swimming from buoy 21 to container terminal conditions Parking space No. 2, with 5 trucks
	35.2	NW/18	315º	36	offshore	2.0	
	35.3	NW/18	315º	36	offshore	2.0	
36	36.1	N/18	000º	36	offshore	2.0	Sailing from buoy 21 to container terminal conditions Parking space No. 2, with 5 trucks
	36.2	N/18	000º	36	iijüros	2.0	
	36.3	N/18	OOOº	36	ii jüros	2.0	

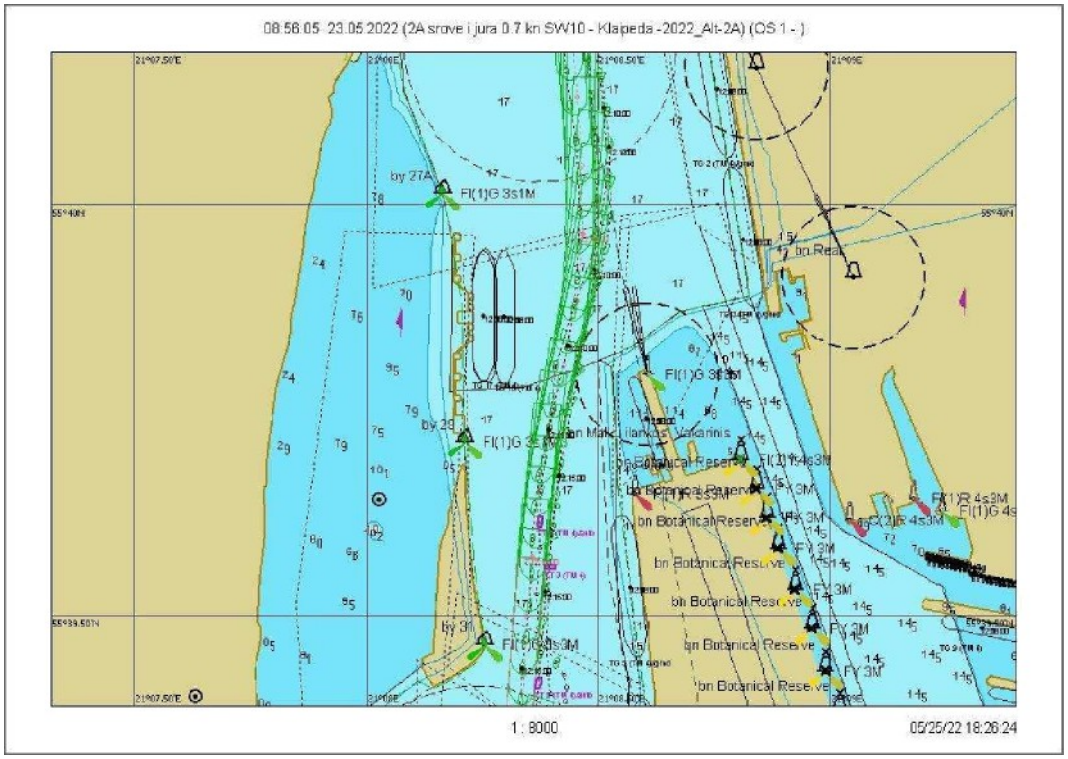
iiplaukirnas

7. VISUAL REPRESENTATION OF THE TEST SAILING

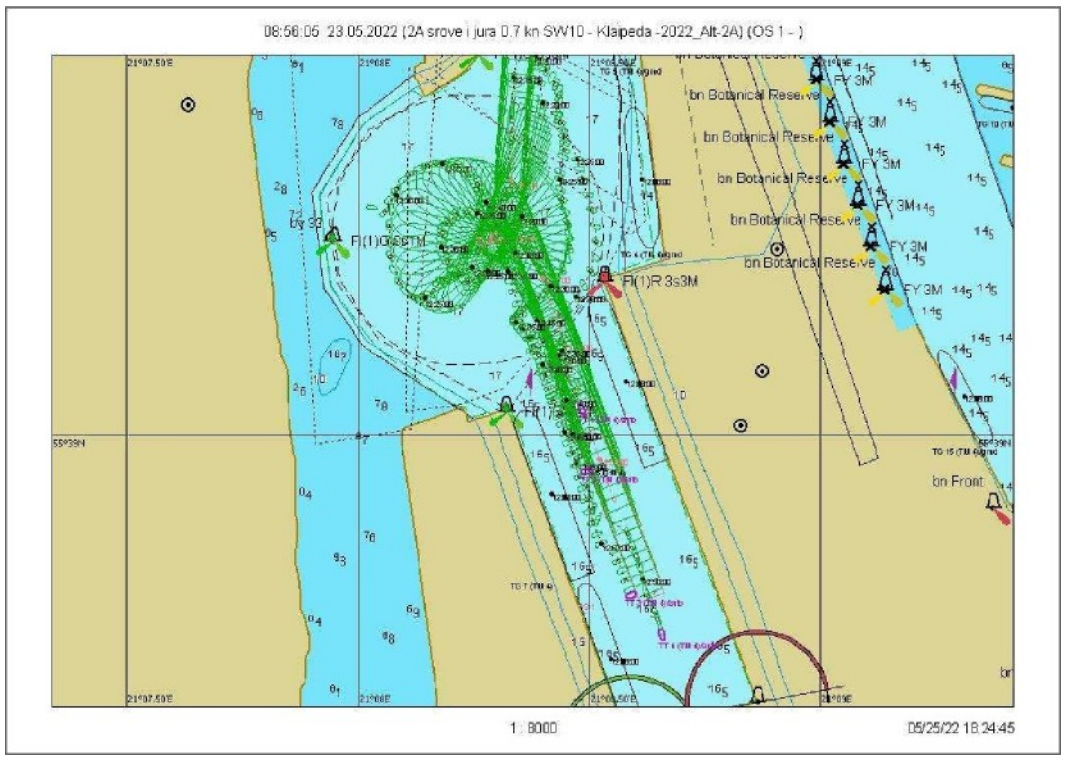
7.1. Graphical representations of the 2A alternative route

Scenario 1. {Sailing: wind SW/10 m/s, current toward Jfira 0.7 knots

Swim 1.1



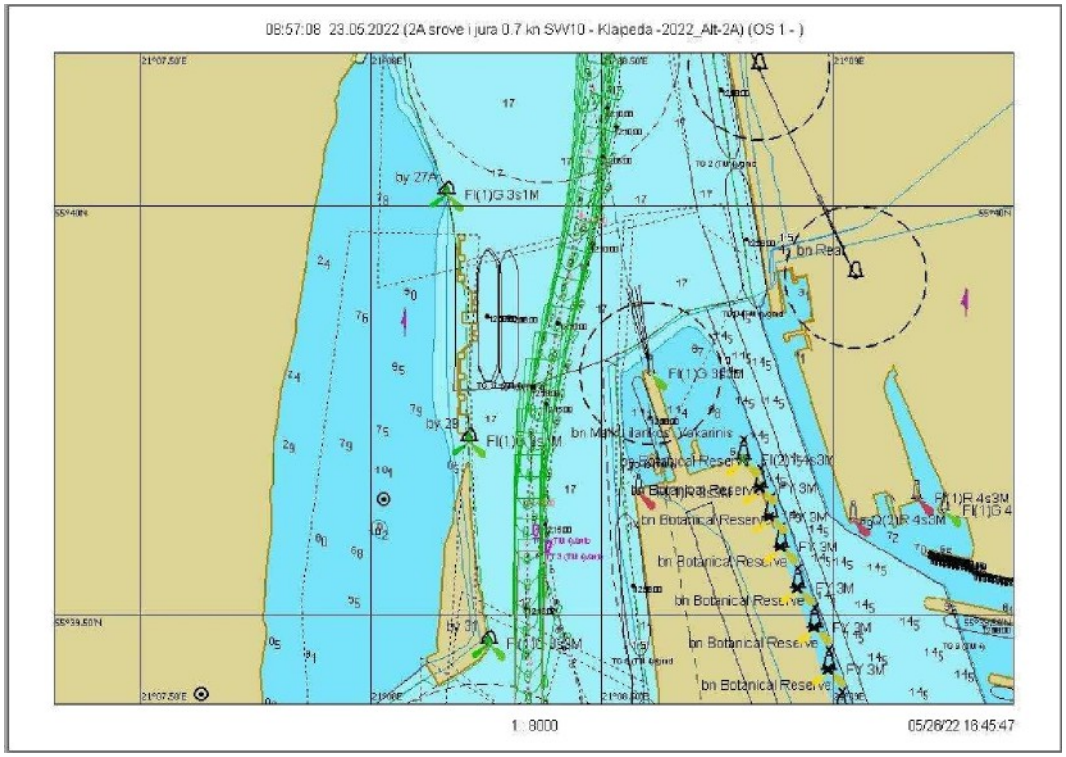
7.1.1 Fig. Route 1.1 – Graphical representation of the route from buoy No. 27A to No. 31



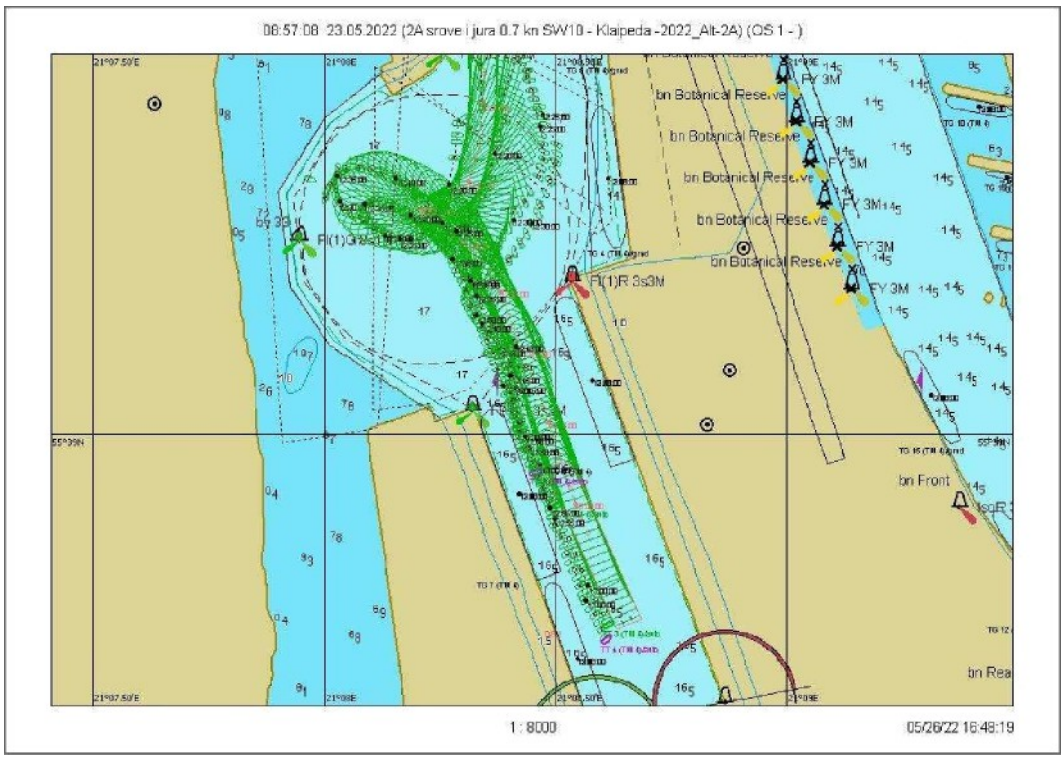
7.1.2 Fig. Route 1.1 - Ship turning trajectory

Scenario 1. {Sailing: wind SW/10 m/s, current toward Jfir 0.7 knots

Swim 1.2



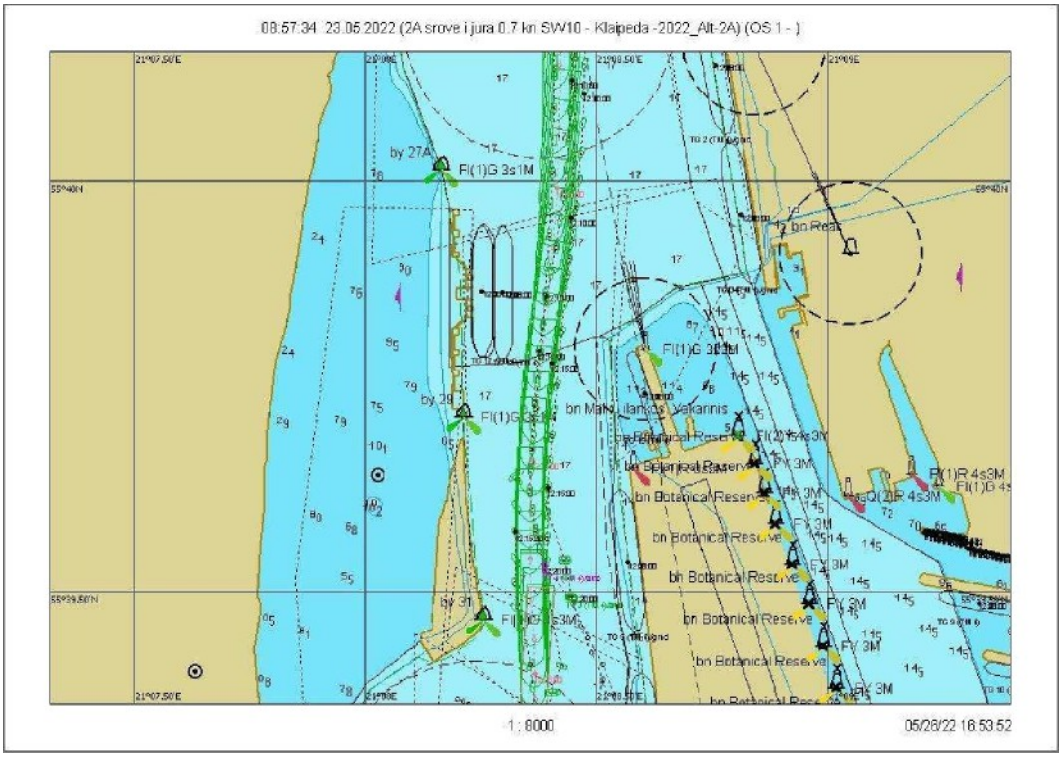
7.1.3 Fig. Voyage 1.2 - Graphical representation of the voyage from buoy No. 27A to No. 31



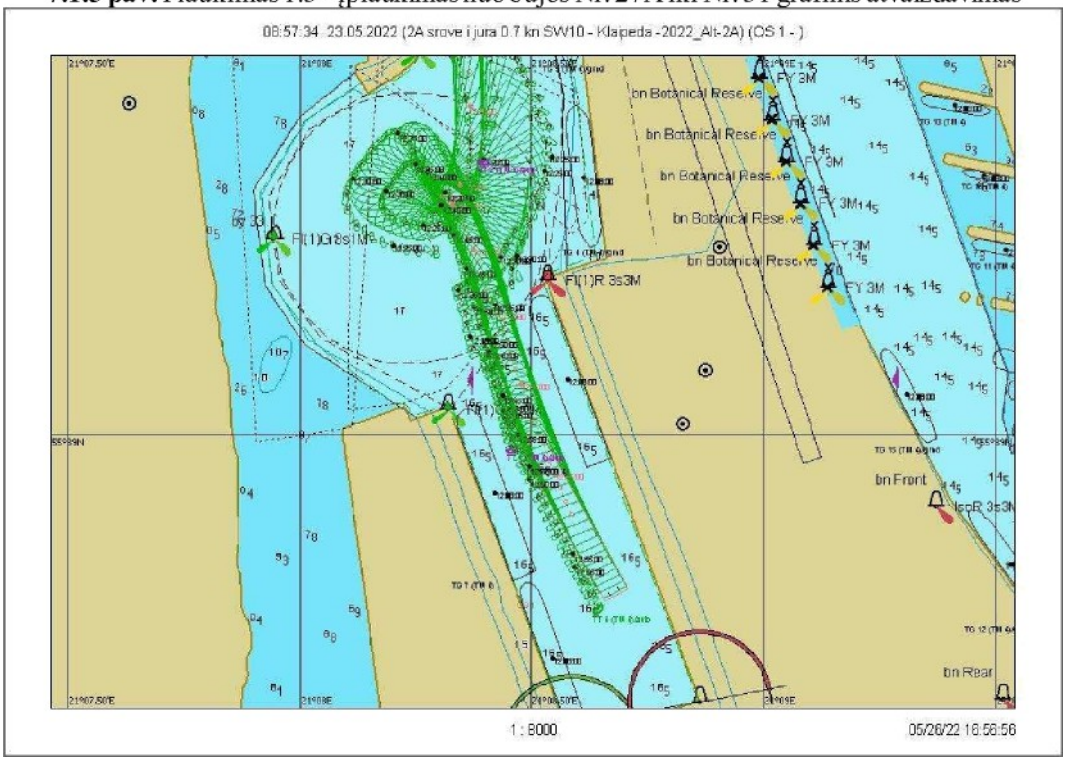
7.1.4 Fig. Voyage 1.2 - Ship's turning trajectory

Scenario 1. {Sailing: wind SW/10 m/s, current toward Jfir 0.7 knots

Swim 1.3



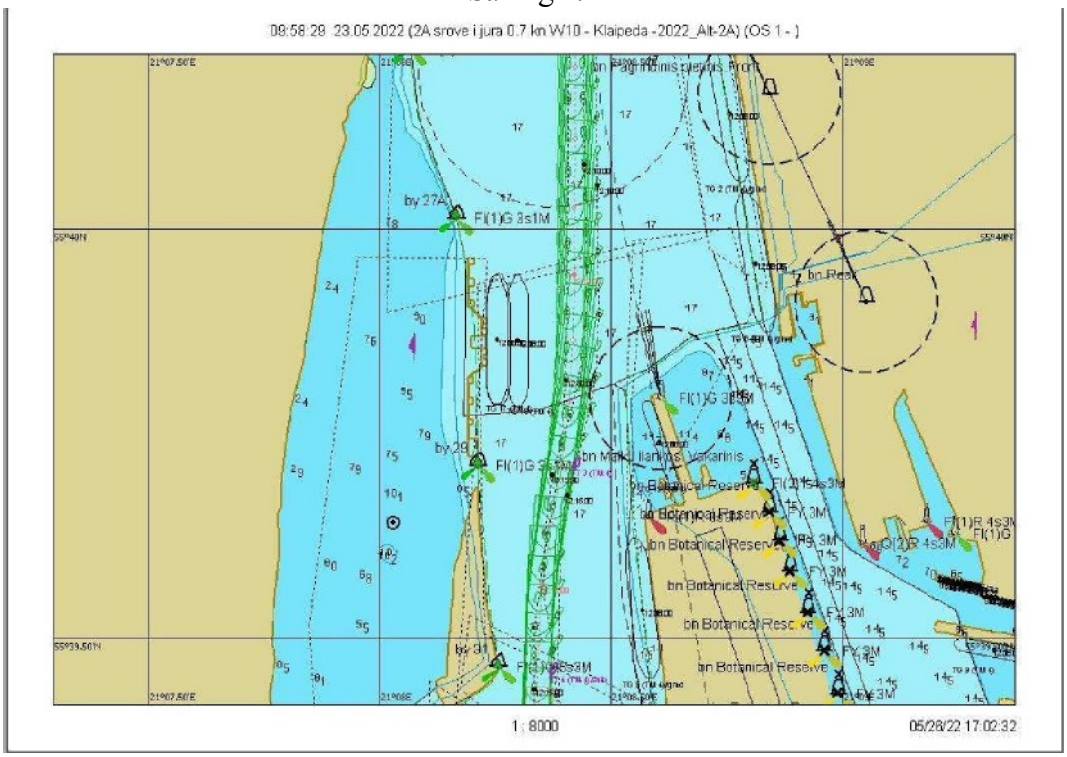
7.1.5 pav. Plaukimas 1.3 - įplaukimas nuo bujos Nr. 27A iki Nr. 31 grafinis atvaizdavimas



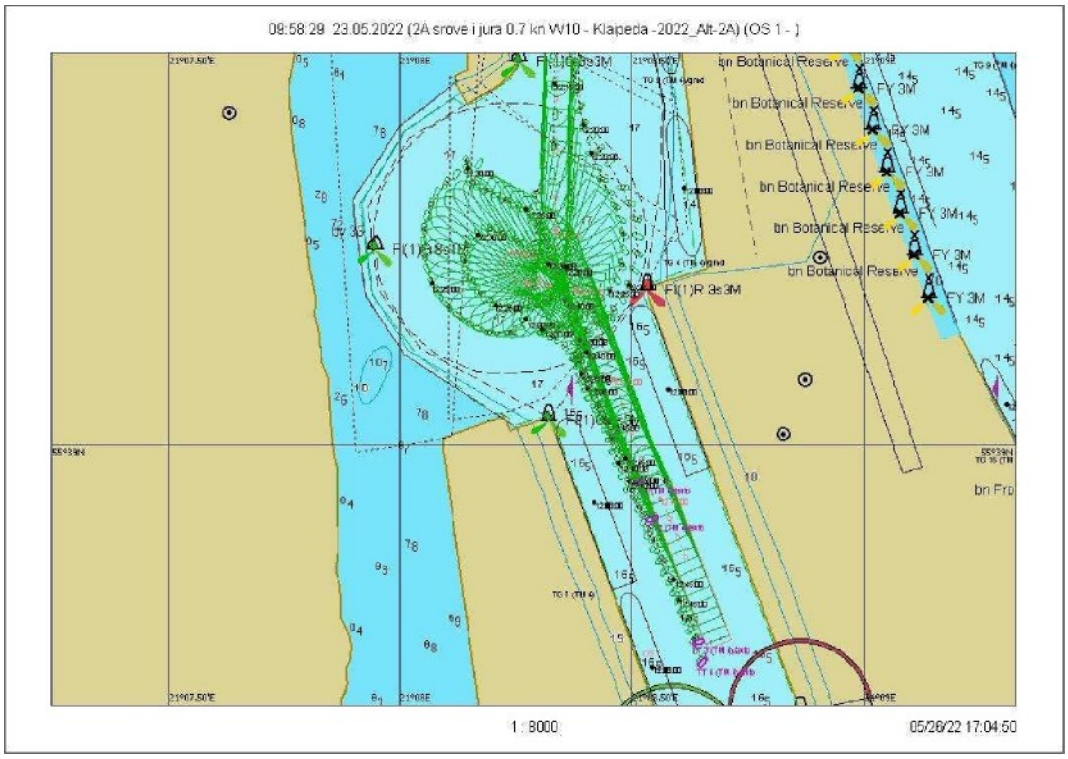
7.1.6 Fig. Course 1.3 – Ship's turning trajectory

Scenario 2. Sailing: wind W at 10 m/s, current at 0.7 knots

Sailing 2.1



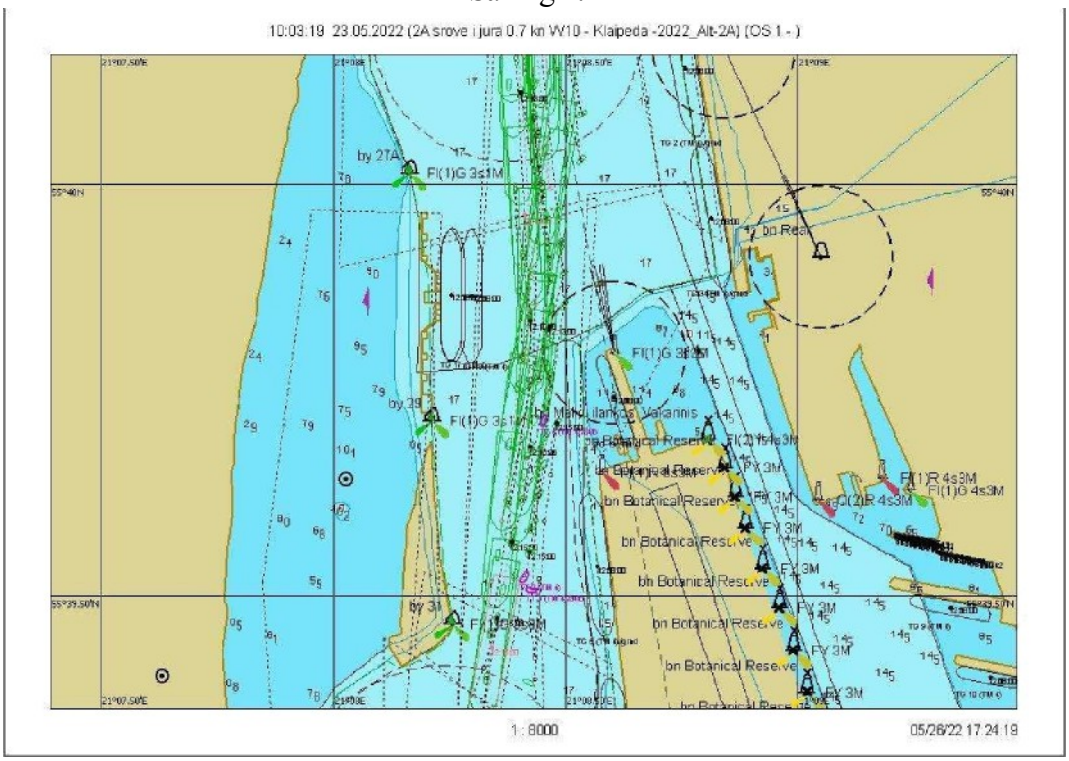
7.1.7 Fig. Voyage 2.1 - Graphical representation of the voyage from buoy No. 27A to No. 31



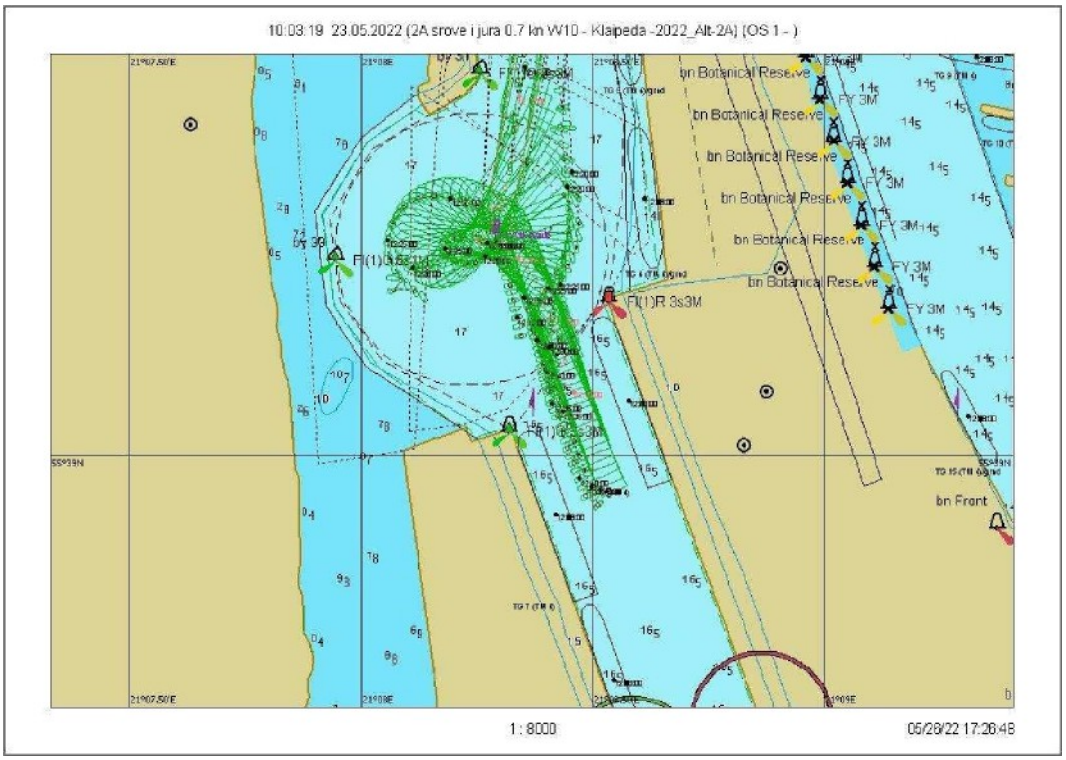
7.1.8 Fig. Course 2.1 – Ship's turning trajectory

Scenario 2. Sailing: wind W/10 m/s, current | 0.7 knots

Sailing 2.2



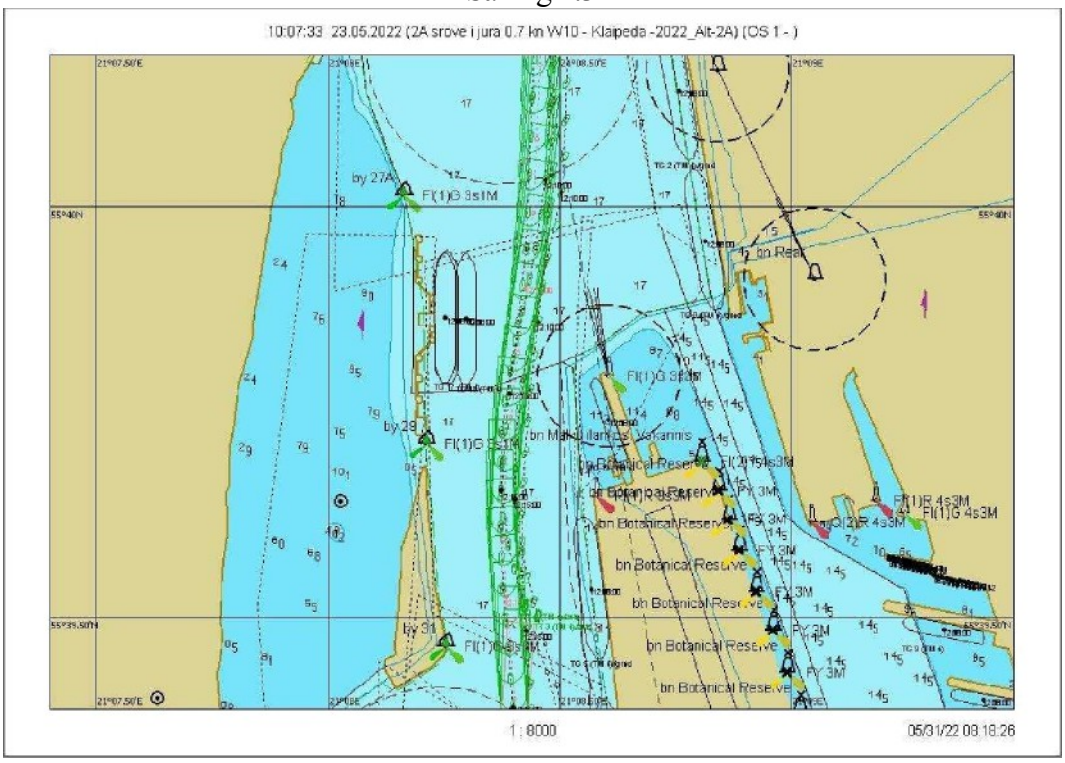
7.1.9 Fig. Voyage 2.2 – Graphical representation of the voyage from buoy No. 27A to No. 31



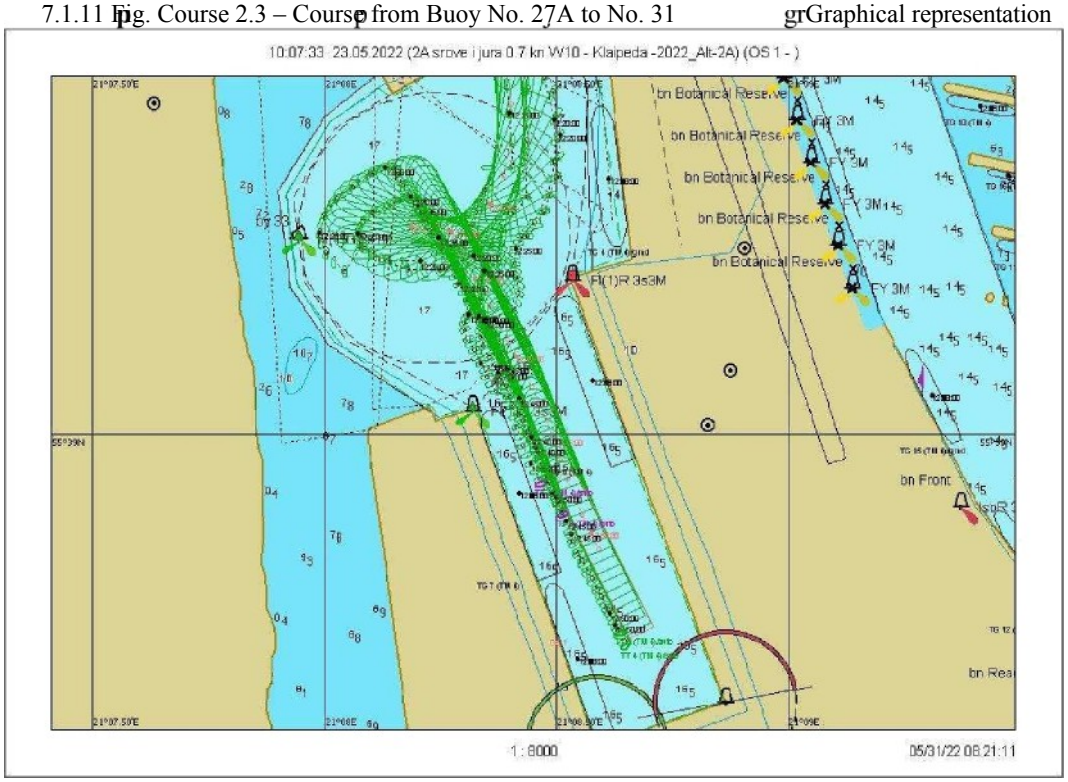
7.1.10 Fig. Voyage 2.2 - Ship's turning trajectory

Scenario 2. Sailing: wind W/10 m/s, current | 0.7 knots

Sailing 2.3



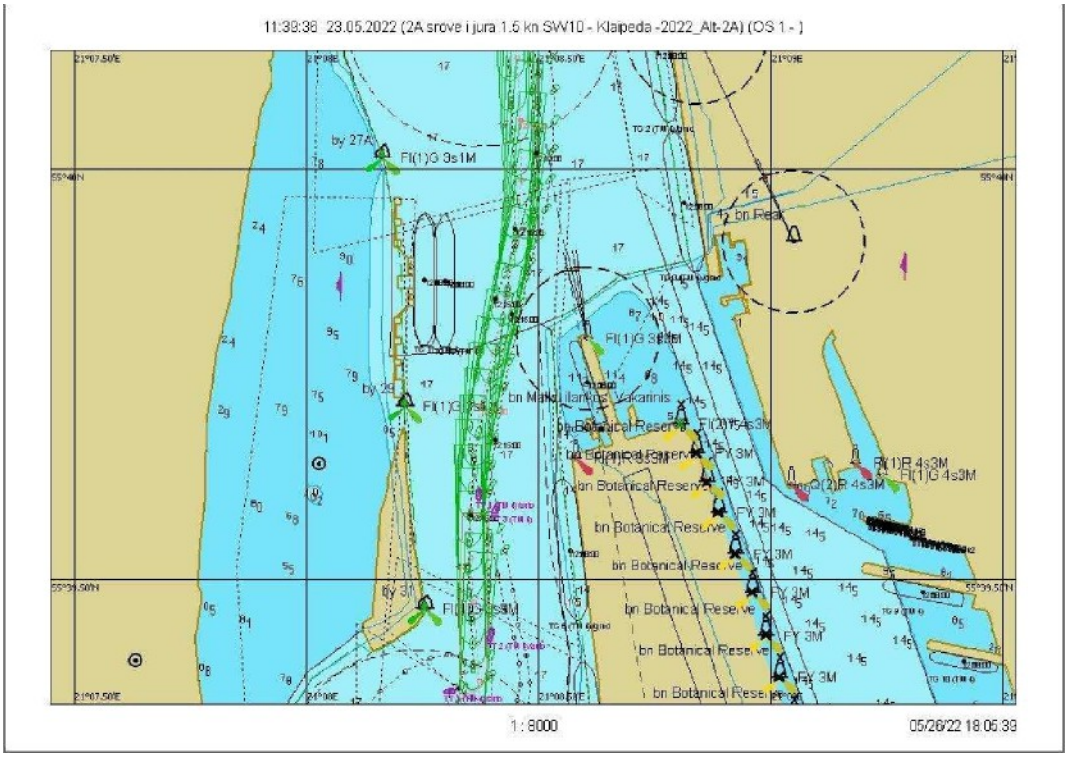
7.1.11 Fig. Course 2.3 – Course from Buoy No. 27A to No. 31 Graphical representation



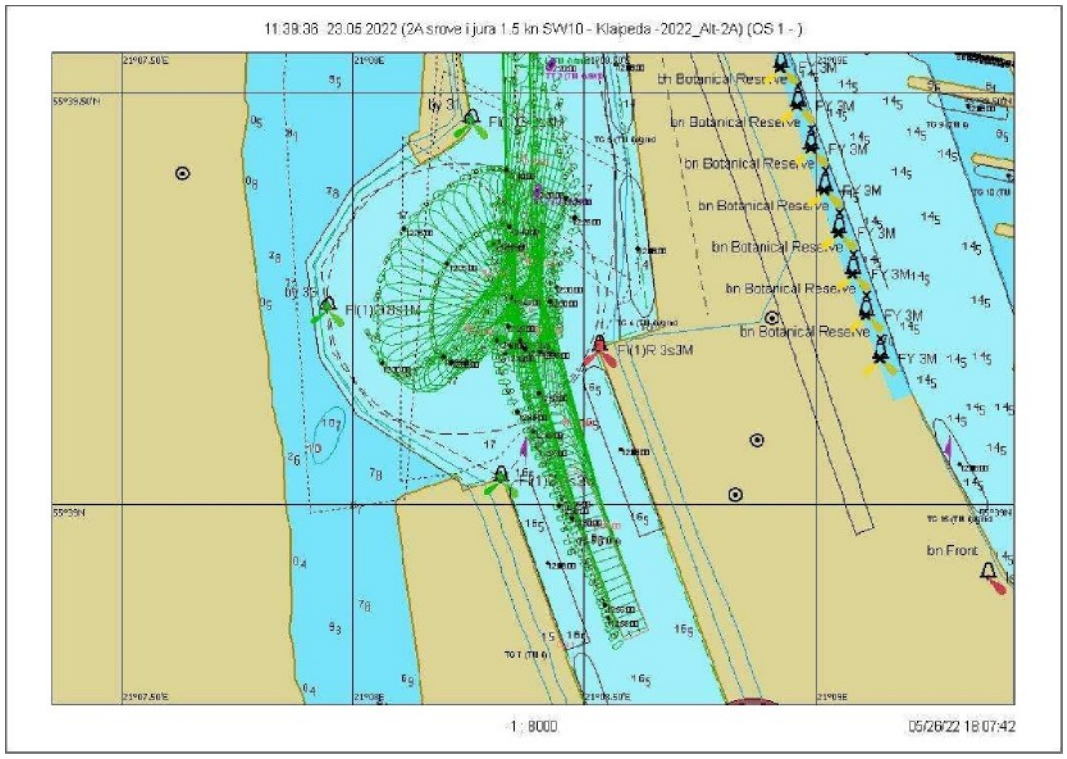
7.1.12 Fig. Course 2.3 Ship turning trajectory

Scenario 3. {Sailing: wind SW/10 m/s, current toward Jfir 1.5 knots

Swim 3.1



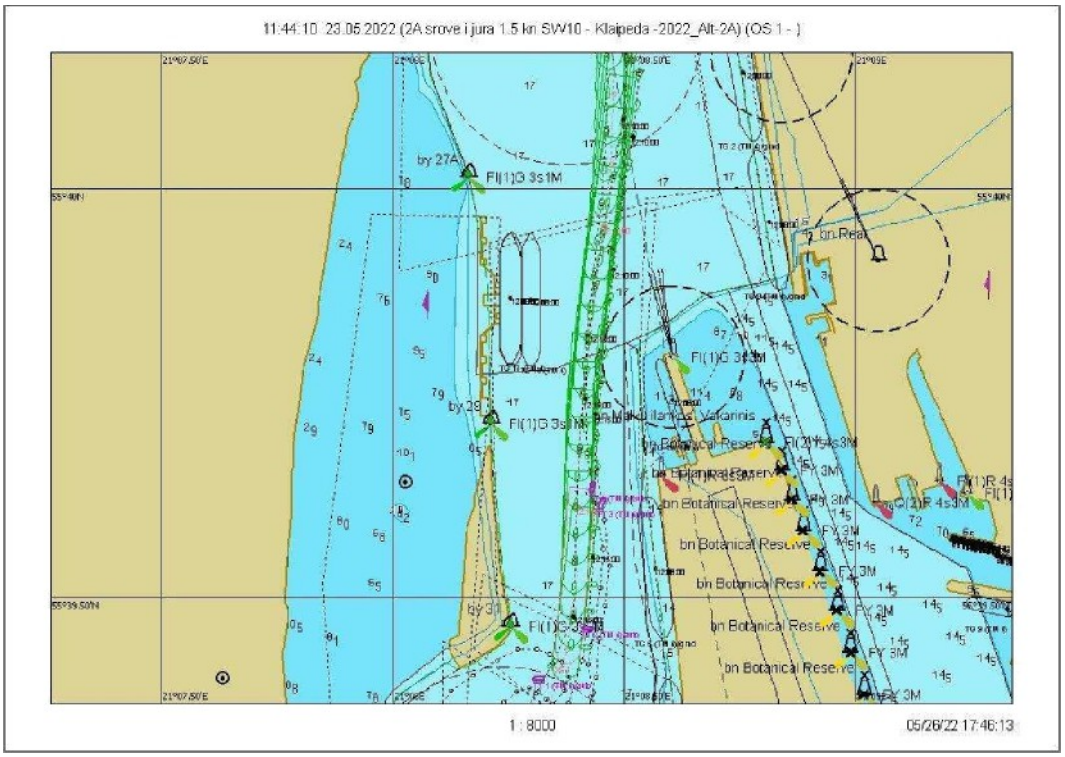
7.1.13 Fig. Course 3.1 - Course from buoy No. 27A to No. 31 graphical representation



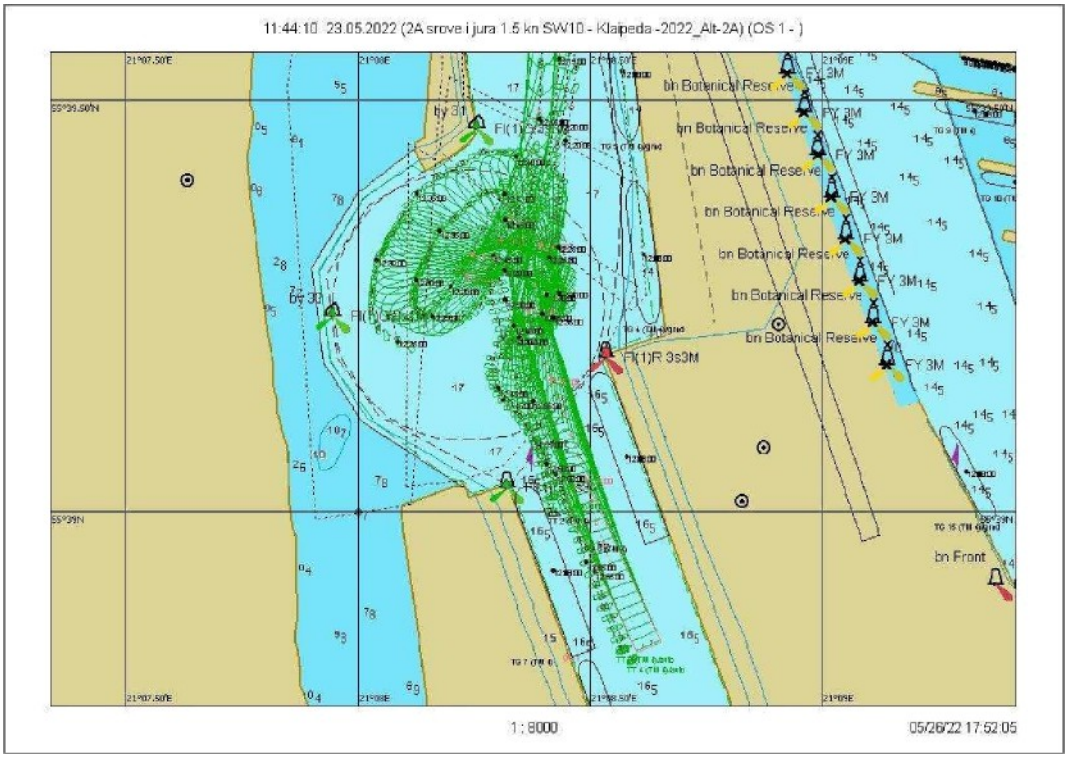
7.1.14 Fig. Course 3.1 - Ship's turning trajectory

Scenario 3. {Sailing: wind SW/10 m/s, current | 1.5 knots

Swim 3.2



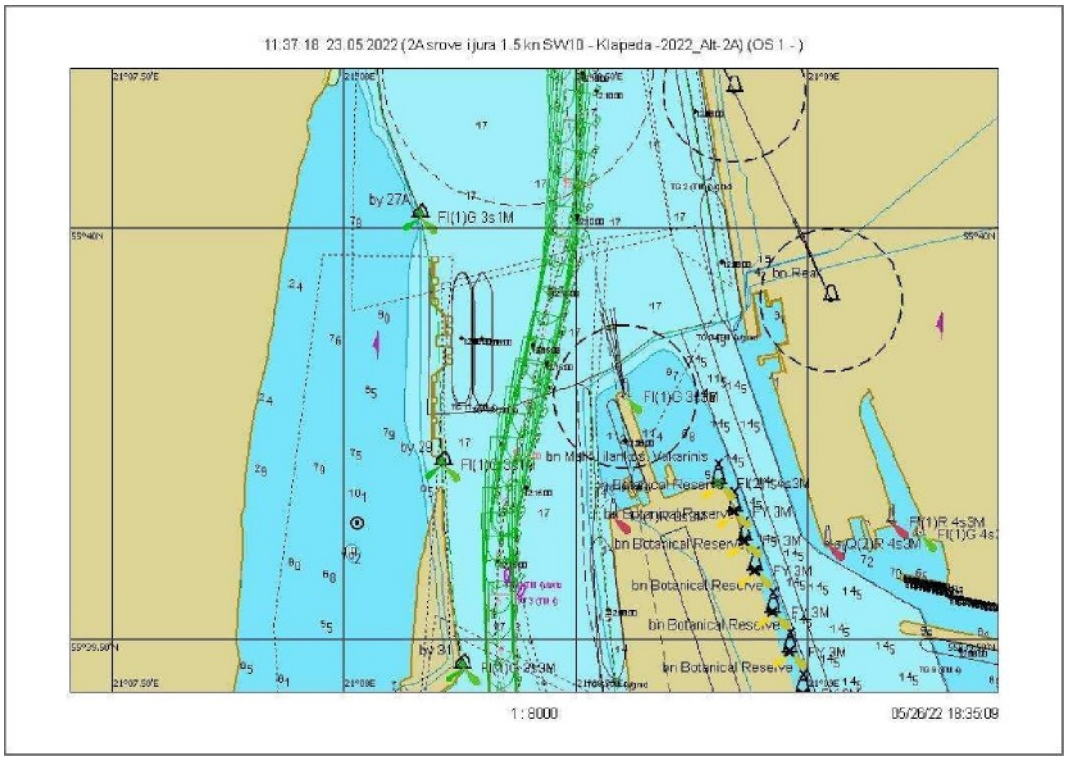
7.1.15 Fig. Voyage 3.2 - Voyage from buoy No. 27A to No. 31 graphical representation



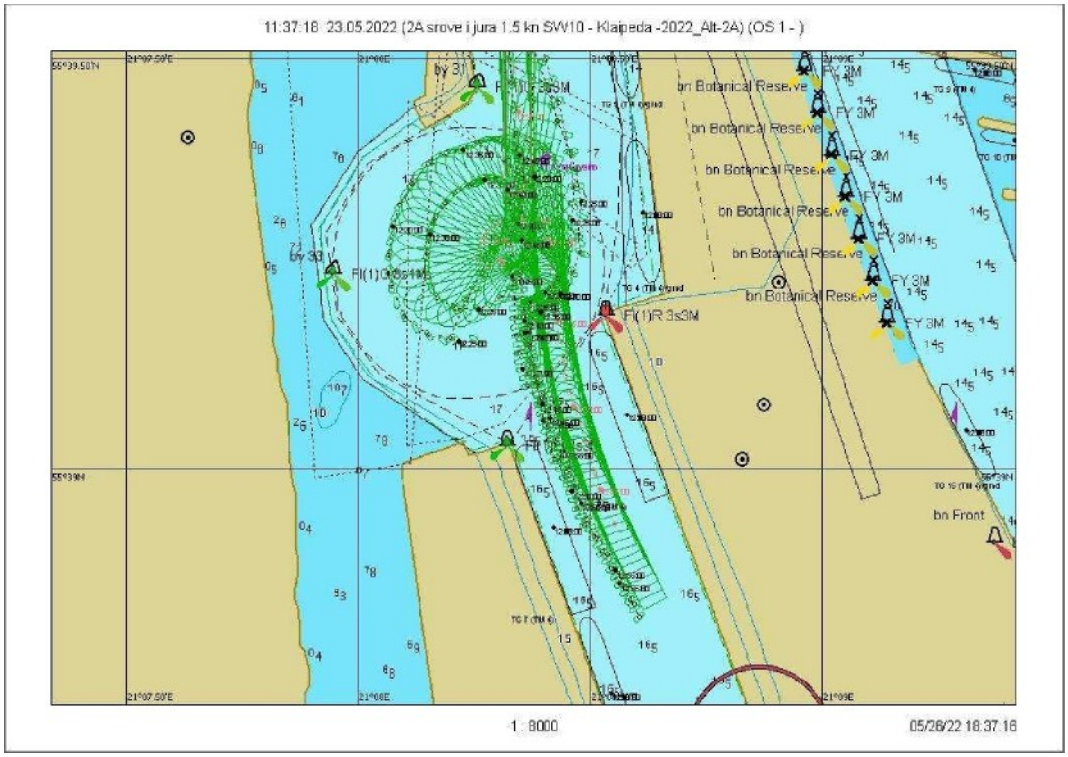
7.1.16 Fig. Course 3.2 – Ship turning trajectory

Scenario 3. {Sailing: wind SW/10 m/s, current | 1.5 knots

Swim 3.3



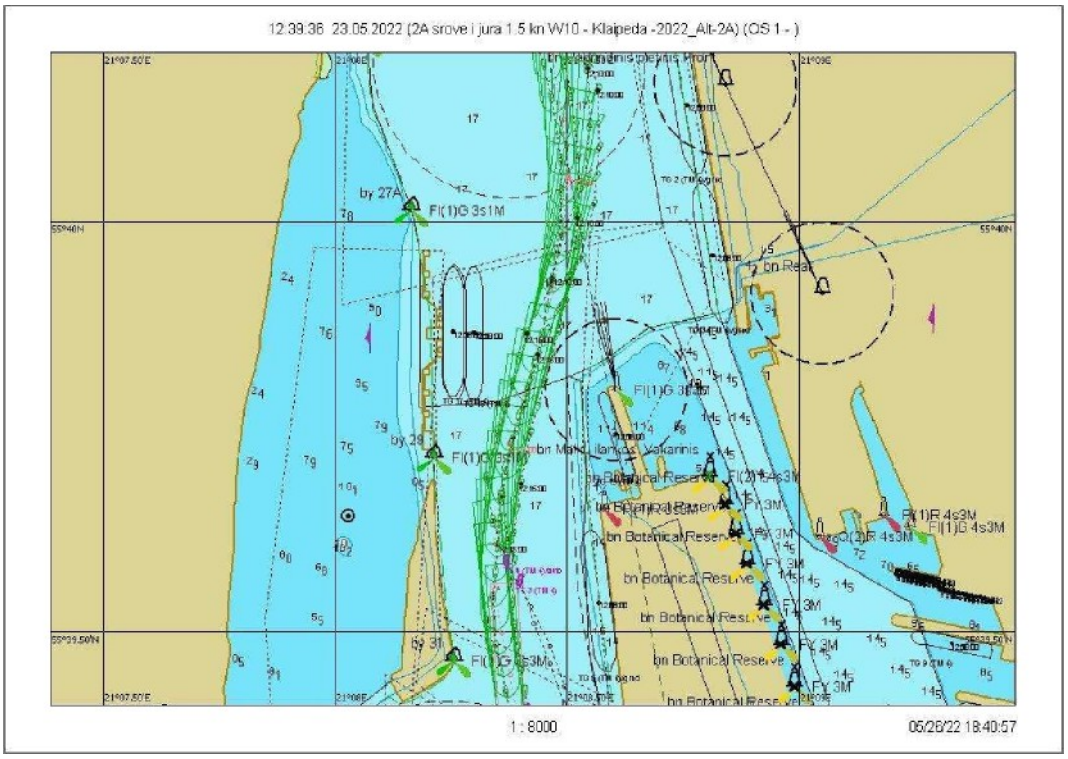
7.1.17 Fig. Course 3.3 - Graphical representation of the course from buoy No. 27A to No. 31



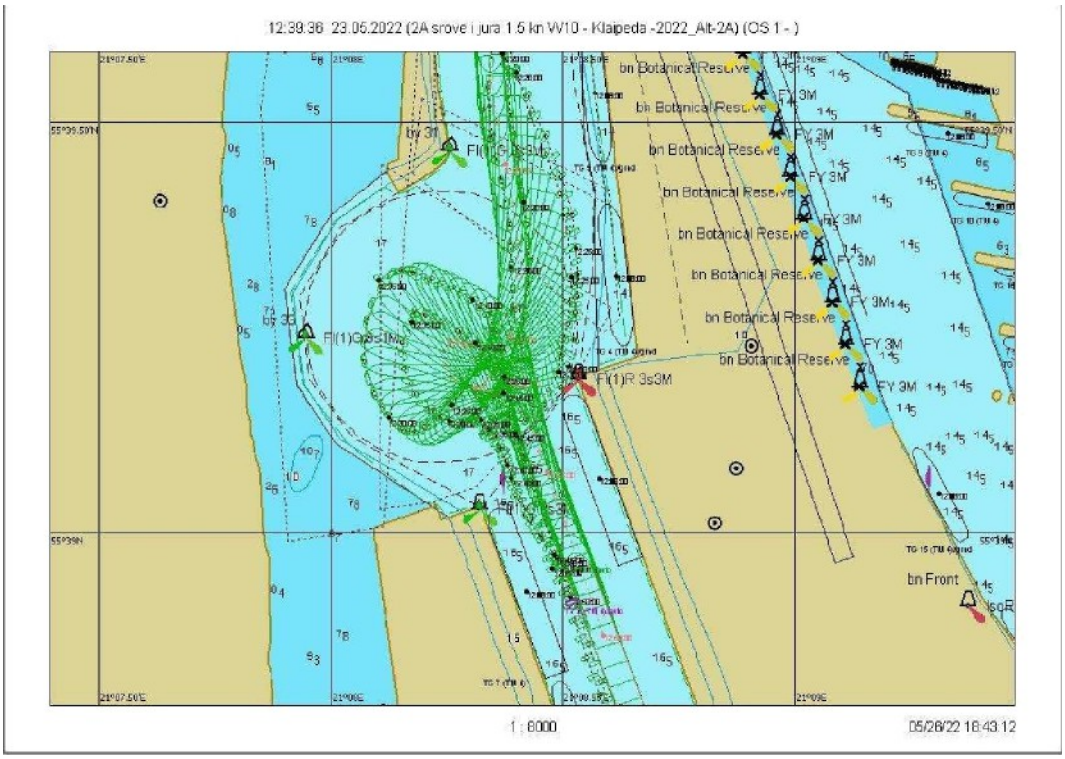
7.1.18 Fig. Course 3.3 – Ship's turning trajectory

Scenario 4. Sailing: wind W at 10 m/s, current at 1.5 knots

Sailing 4.1



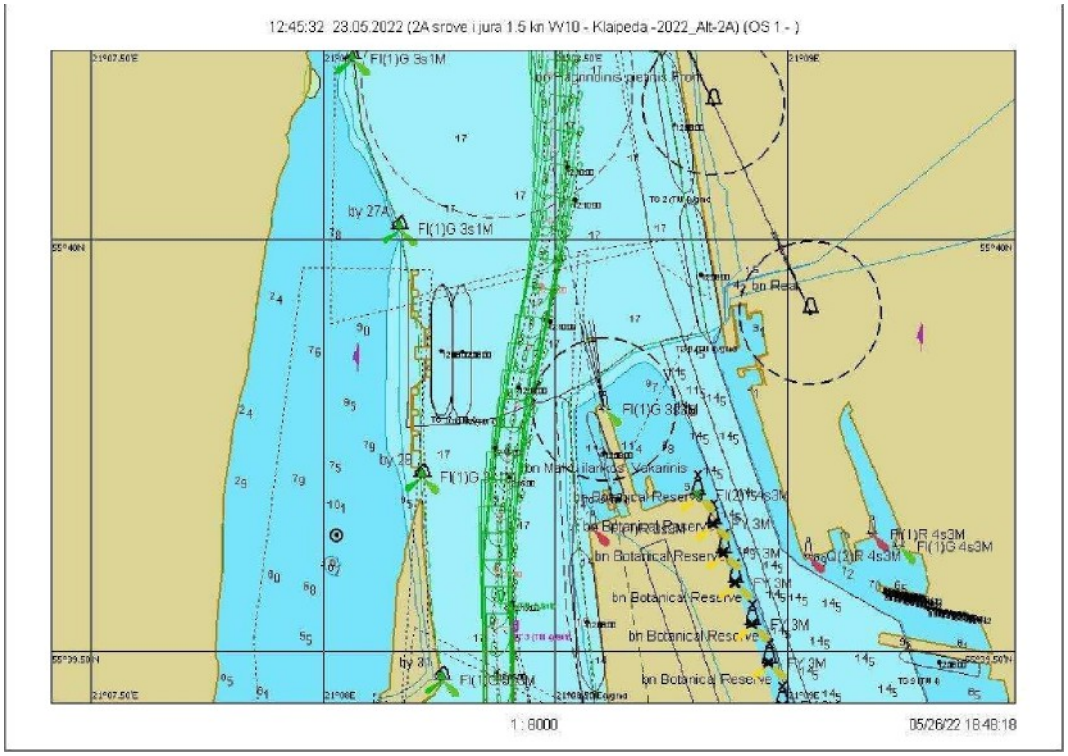
7.1.19 Fig. Voyage 4.1 - Graphical representation of the voyage from buoy No. 27A to No. 31



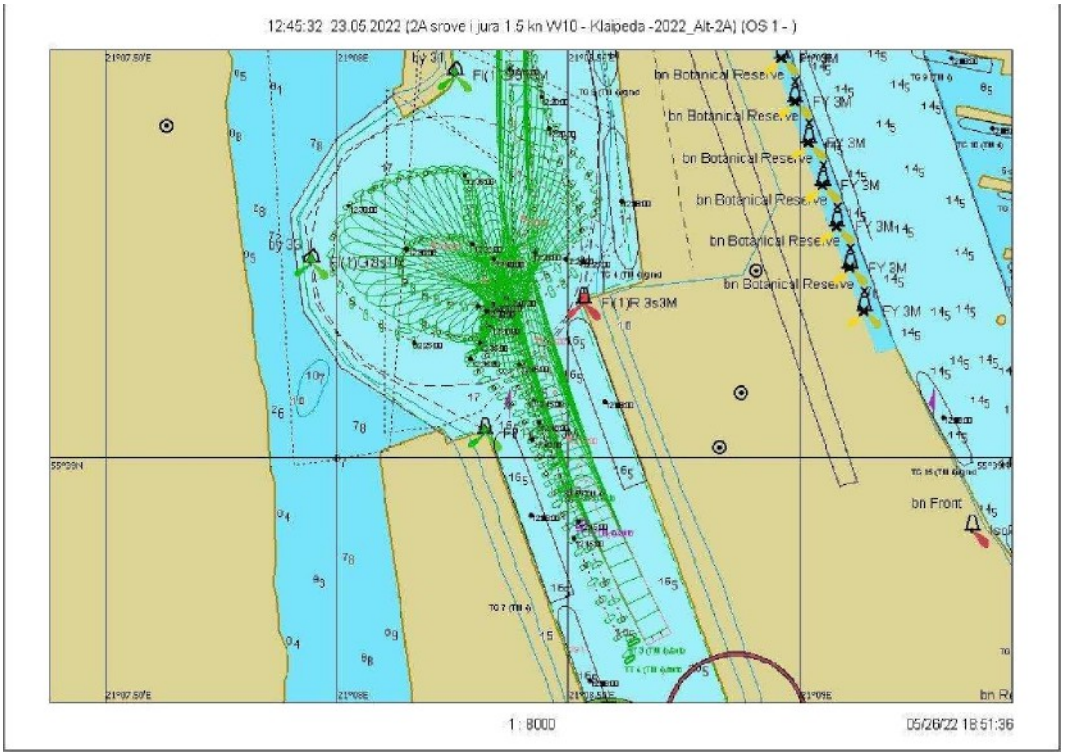
7.1.20 Fig. Voyage 4.1 - Ship's turning trajectory

Scenario 4. Sailing: wind W/10 m/s, current | 1.5 knots

Sailing 4.2



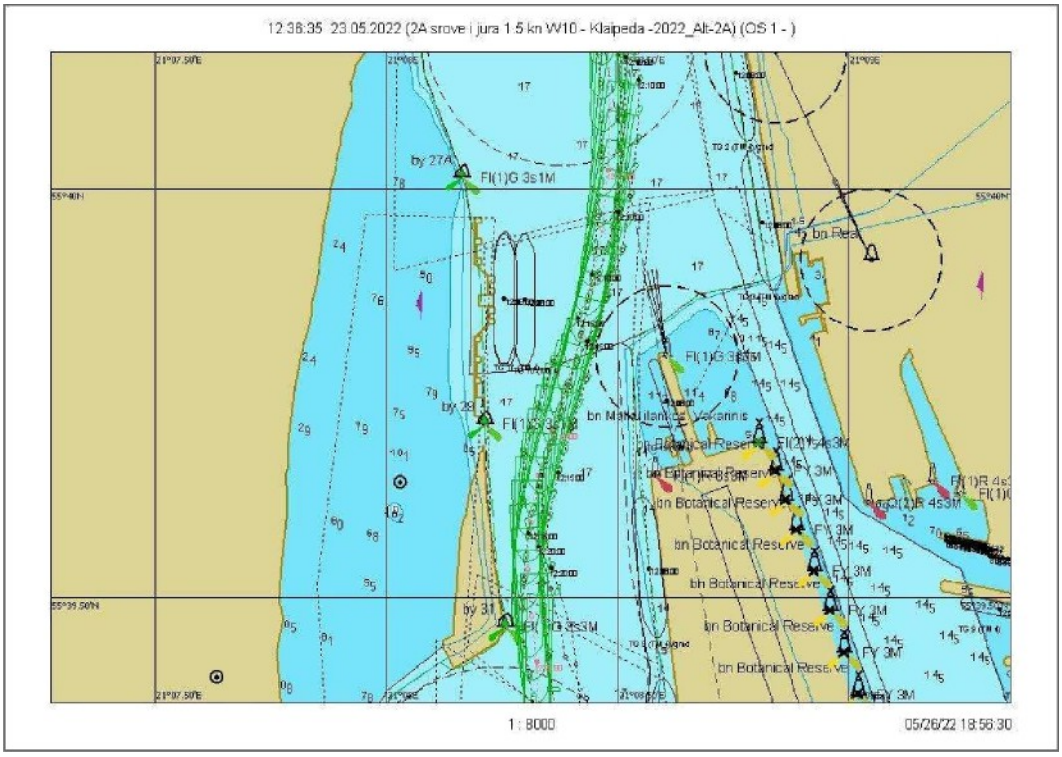
7.1.21 Fig. Course 4.2 - Graphical representation of the course from buoy No. 27A to No. 31



7.1.22 Fig. Voyage 4.2 - Ship's turning trajectory

Scenario 4. Sailing: wind W/10 m/s, current 1.5 knots

Sailing 4.3



7.1.23 Fig. Course 4.3 - }Graphical representation of the course from buoy No. 27A to No. 31

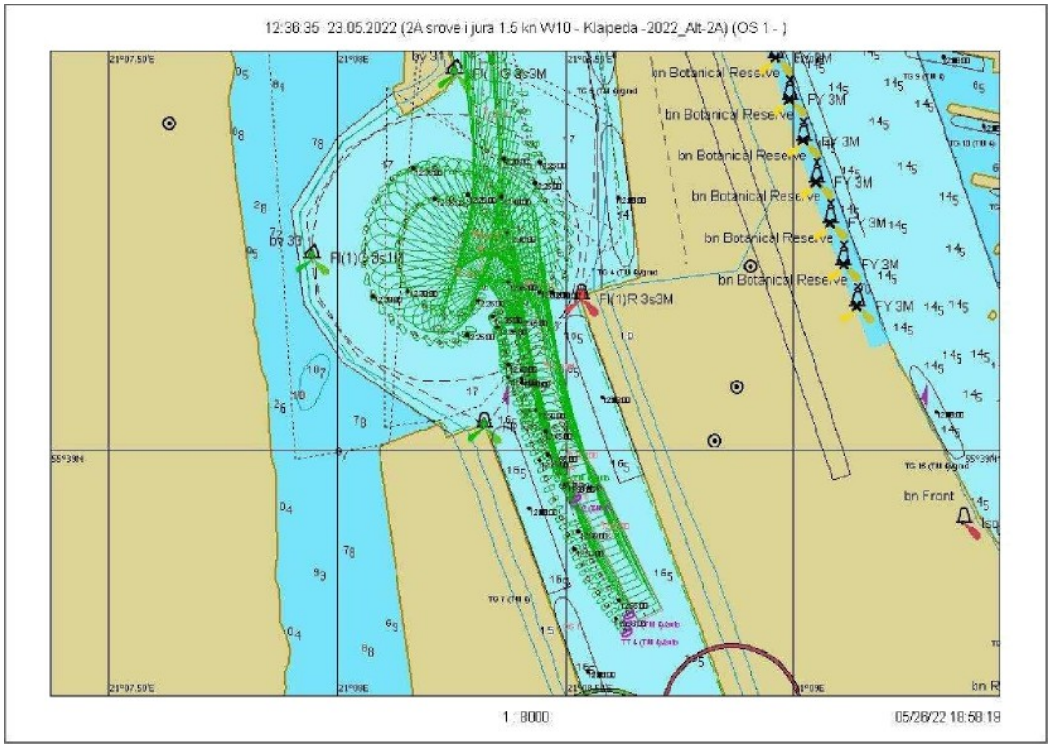


Fig. 7.1.24. Maneuver 4.3 – Ship Turning Trajectory

Scenario 5. Sailing: wind SW/10 m/s, current 2.0 knots

Sailing 5.1

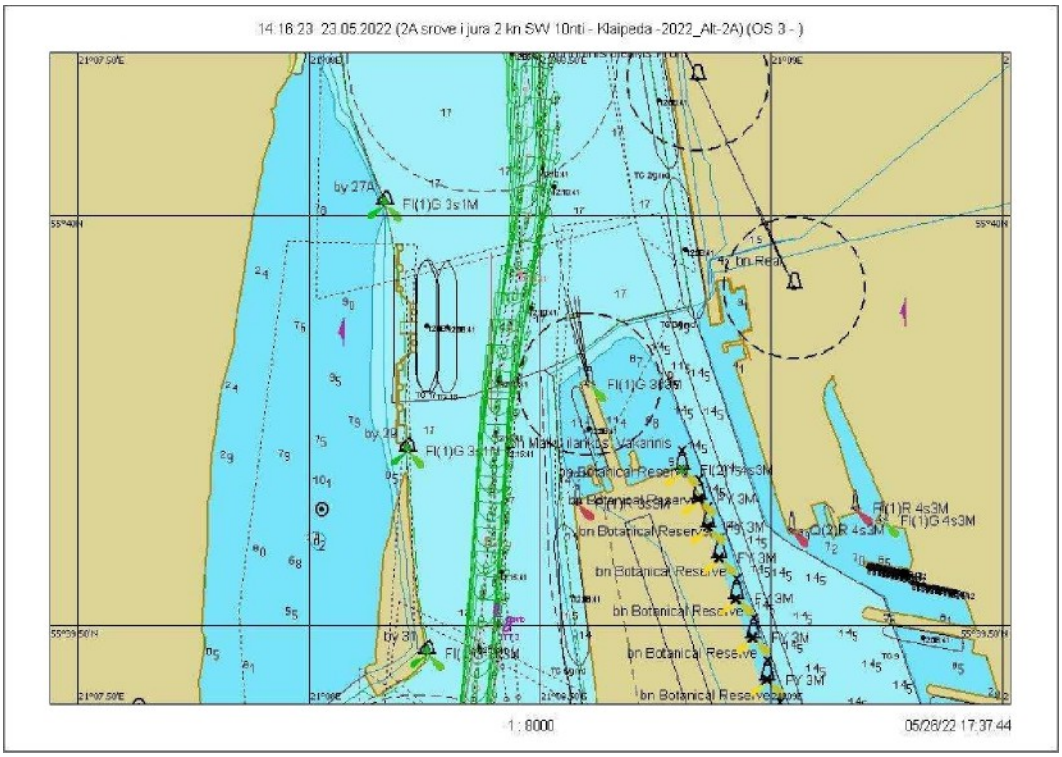


Fig. 7.1.25 Voyage 5.1 - }graphical representation of the voyage from buoy No. 27A to No. 31

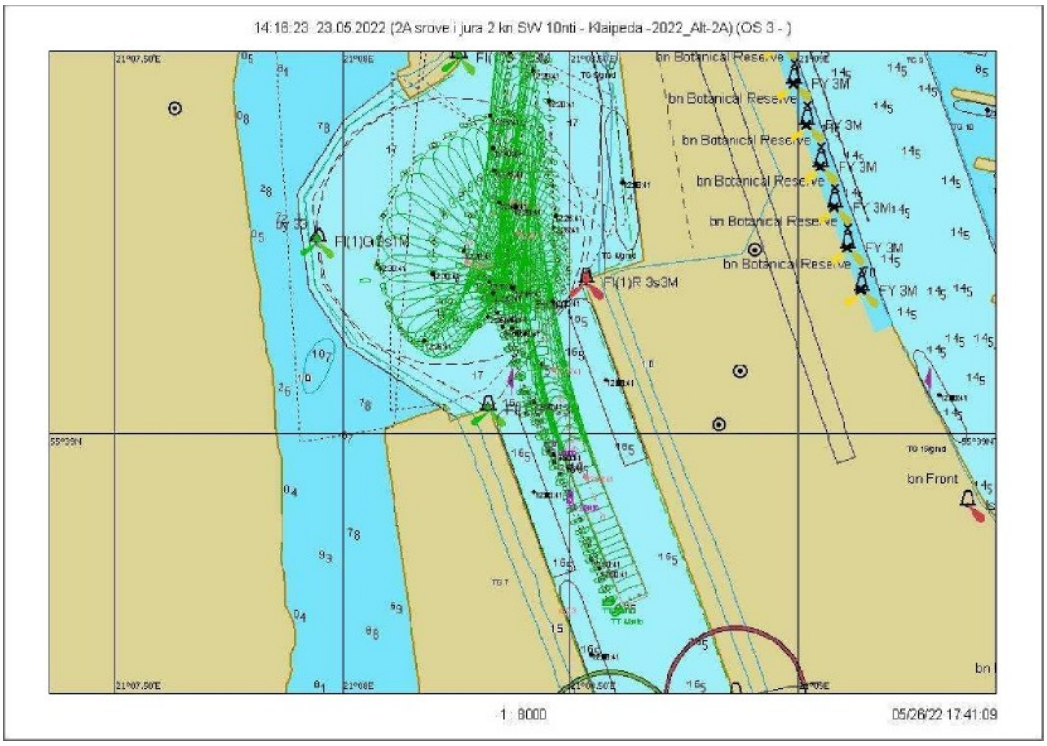


Fig. 7.1.26. Maneuver 5.1 – Ship Turning Trajectory

Scenario 5. Sailing: wind SW/10 m/s, current 2.0 knots

Sailing 5.2

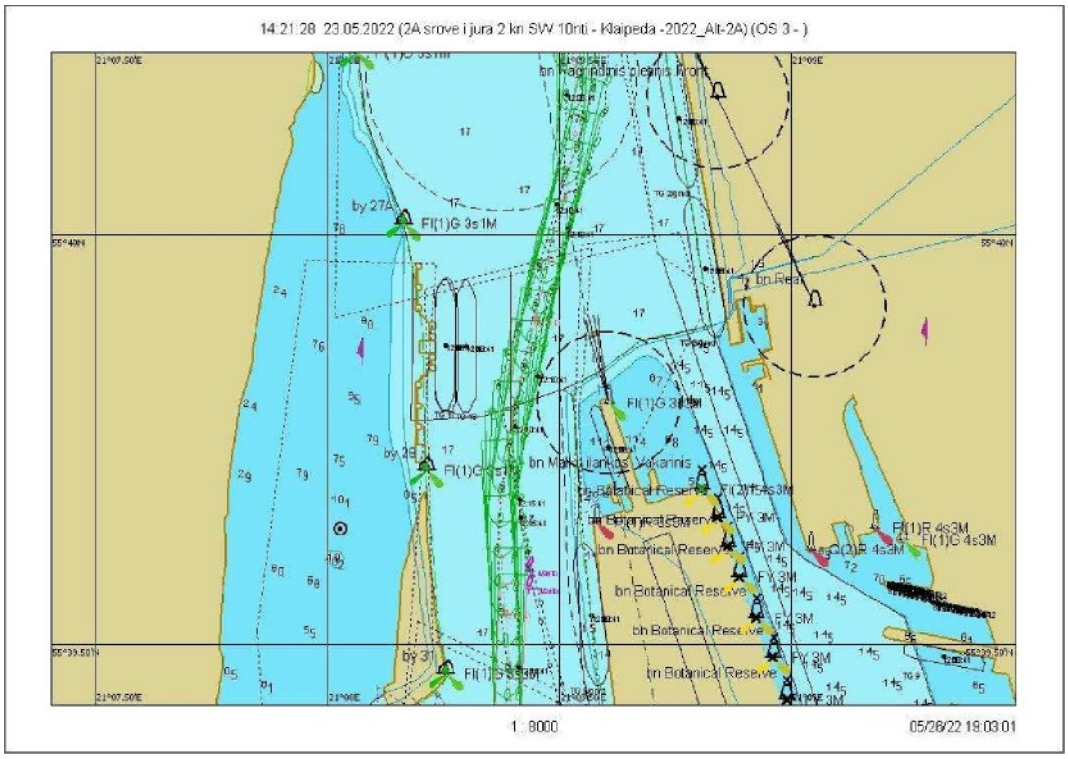


Fig. 7.1.27 Voyage 5.2 - }graphical representation of the voyage from buoy No. 27A to No. 31

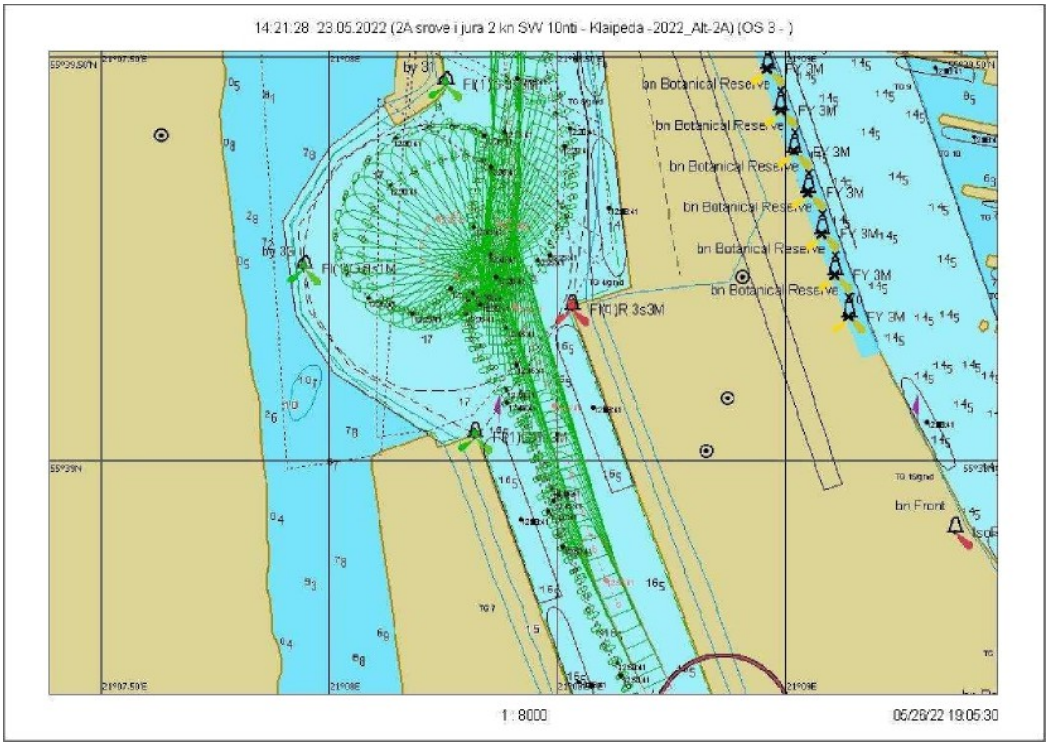


Fig. 7.1.28. Maneuver 5.2 – Ship Turning Trajectory

Scenario 5. Sailing: wind SW/10 m/s, current 2.0 knots

Sailing 5.3

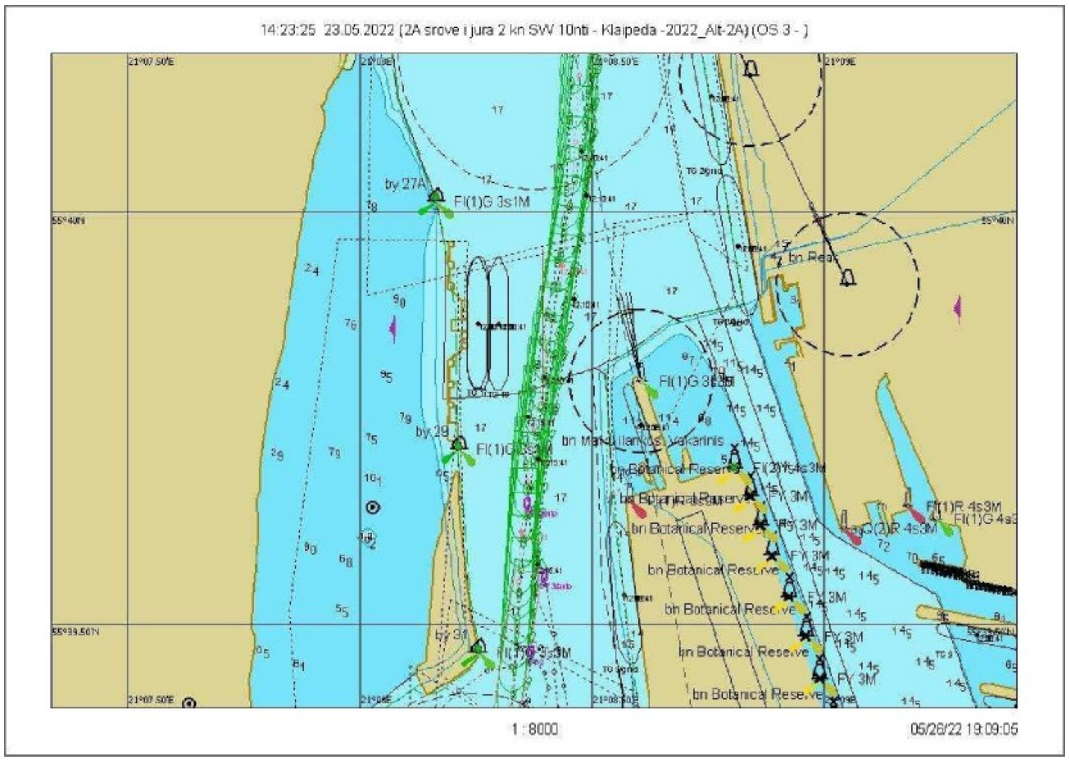


Fig. 7.1.29. Course 5.3 - }graphical representation of the course from buoy No. 27A to No. 31

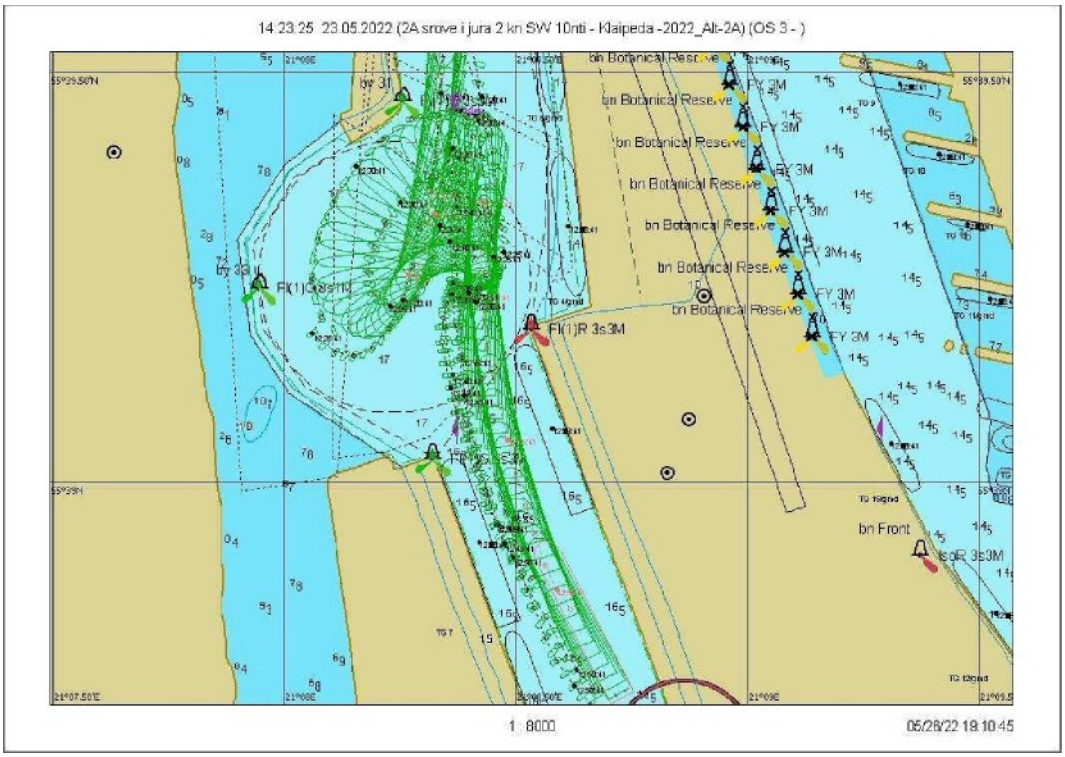
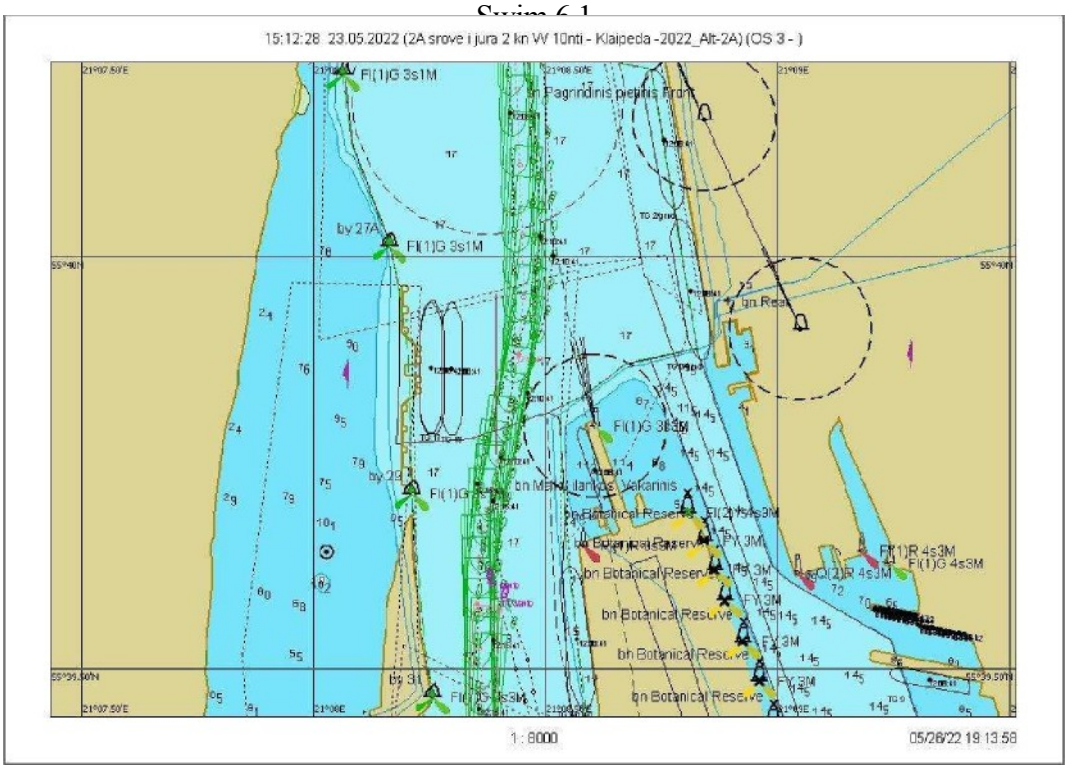


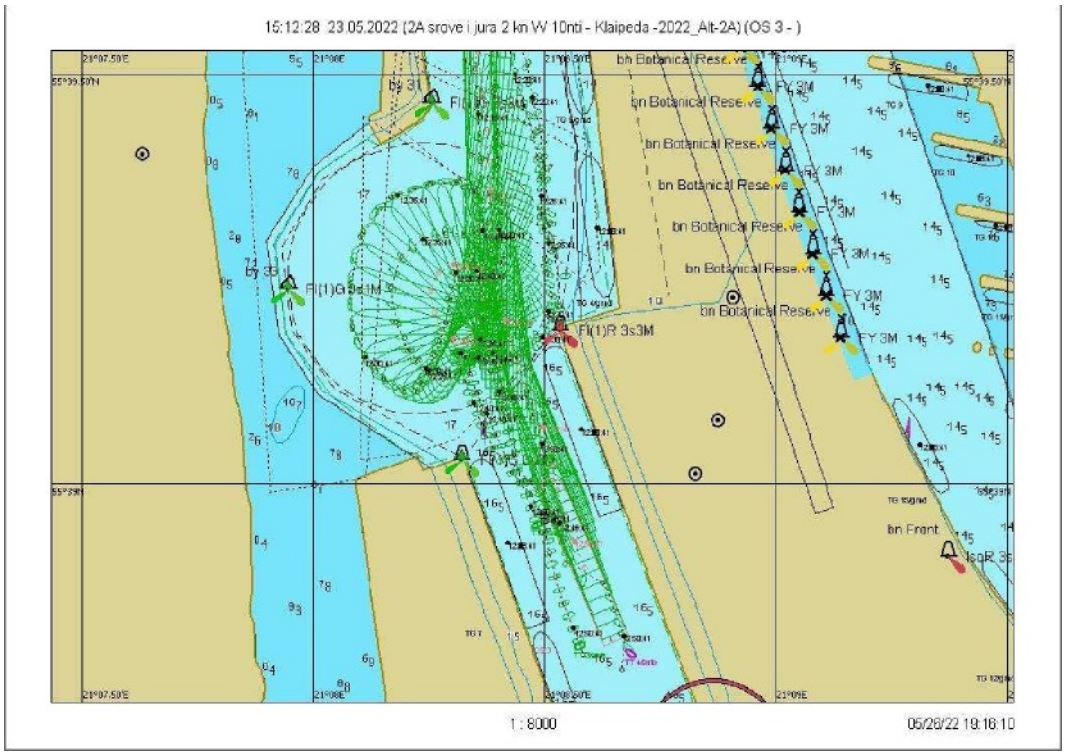
Fig. 7.1.30. Maneuver 5.3 – Ship Turning Trajectory

Scenario 6. {Swimming: wind W/10 m/s, current toward Jfir 2 knots

Swim 6.1



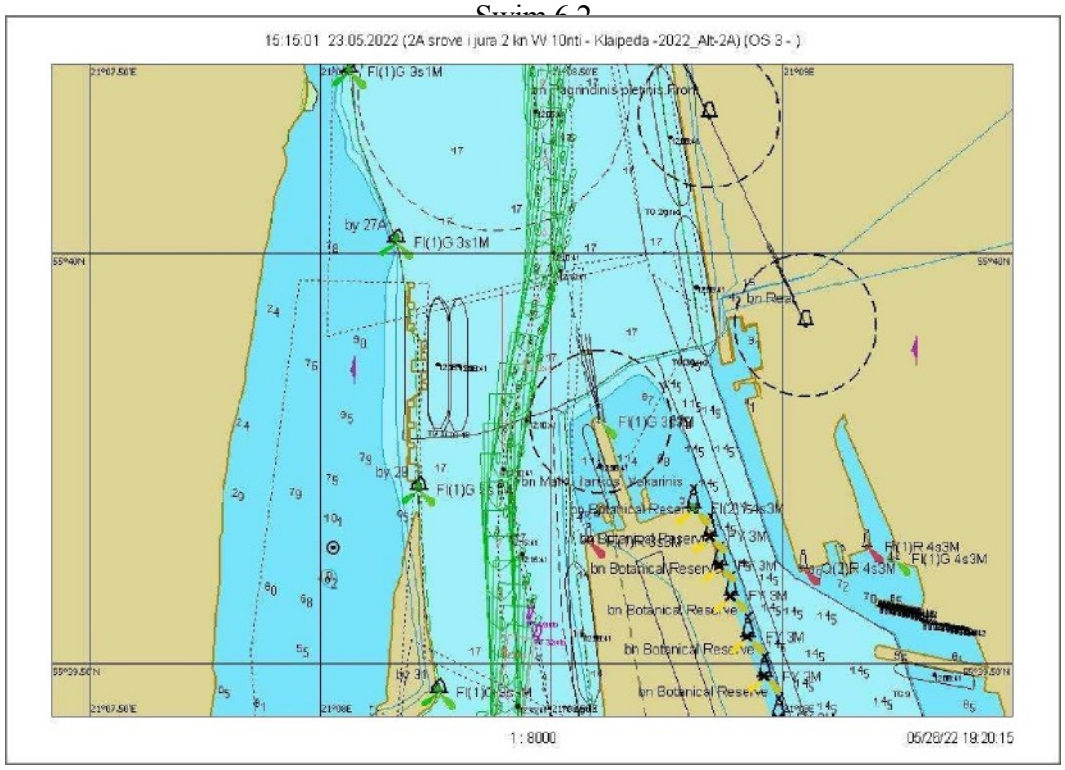
7.1.31 Fig. Course 6.1 - }Graphical representation of the course from buoy No. 27A to No. 31



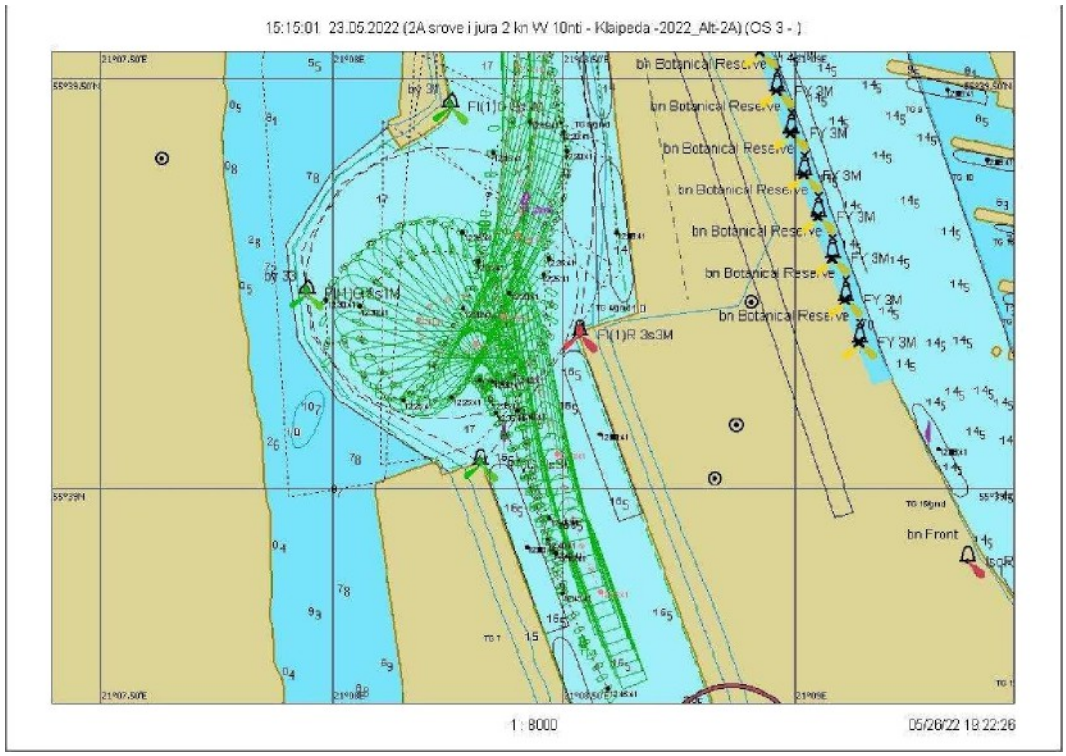
7.1.32 Fig. Course 6.1 - Ship turning trajectory

Scenario 6. {Swimming: wind W/10 m/s, current toward Jfir 2 knots

Swim 6.2



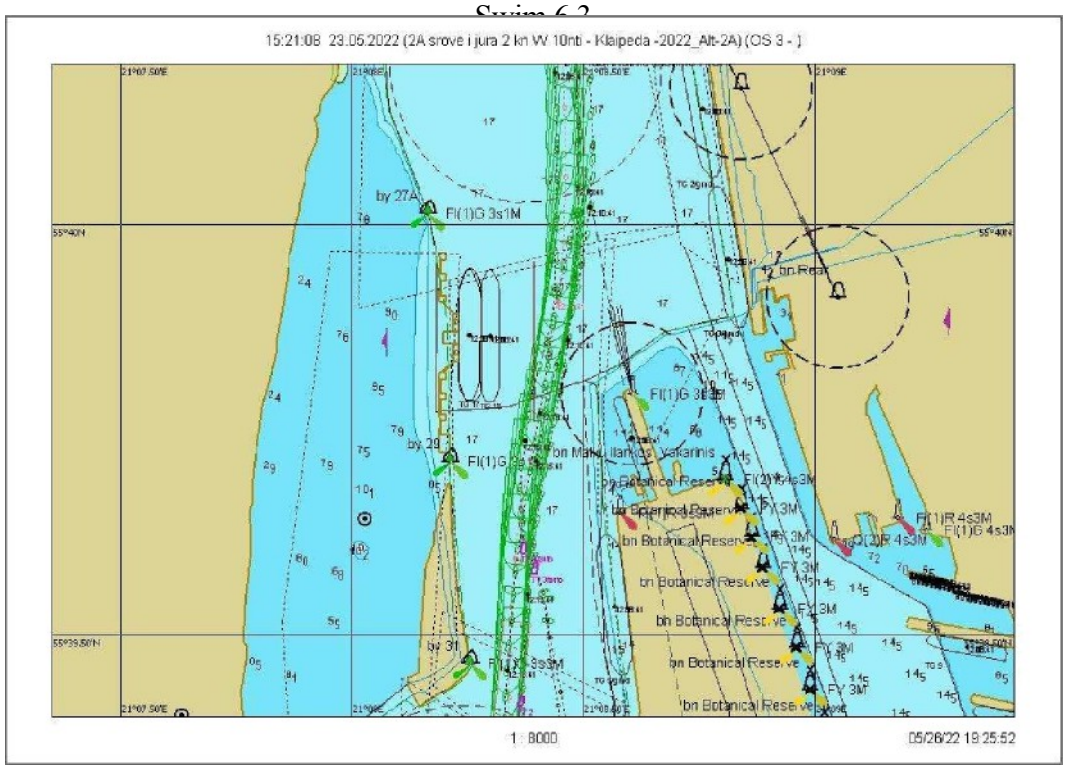
7.1.33 Fig. Course 6.2 - }graphical representation of the course from buoy No. 27A to No. 31



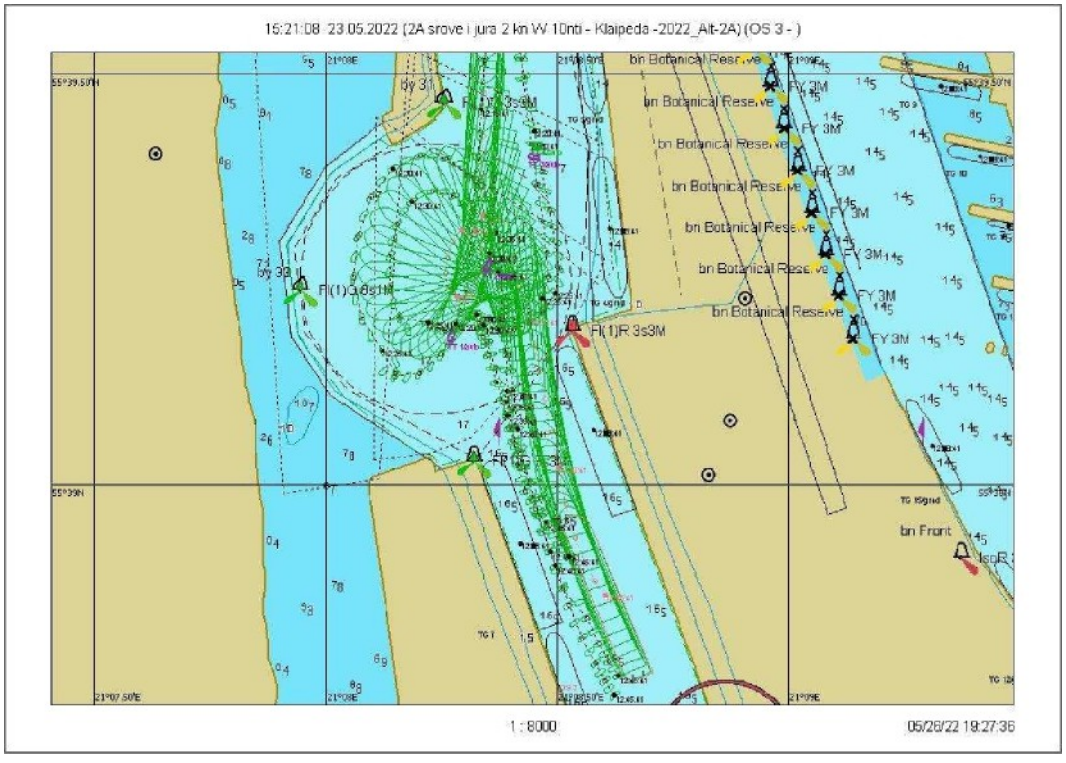
7.1.34 Fig. Course 6.2 - Ship's turning trajectory

Scenario 6. {Swimming: wind W/10 m/s, current toward Jfir 2 knots

Swim 6.3



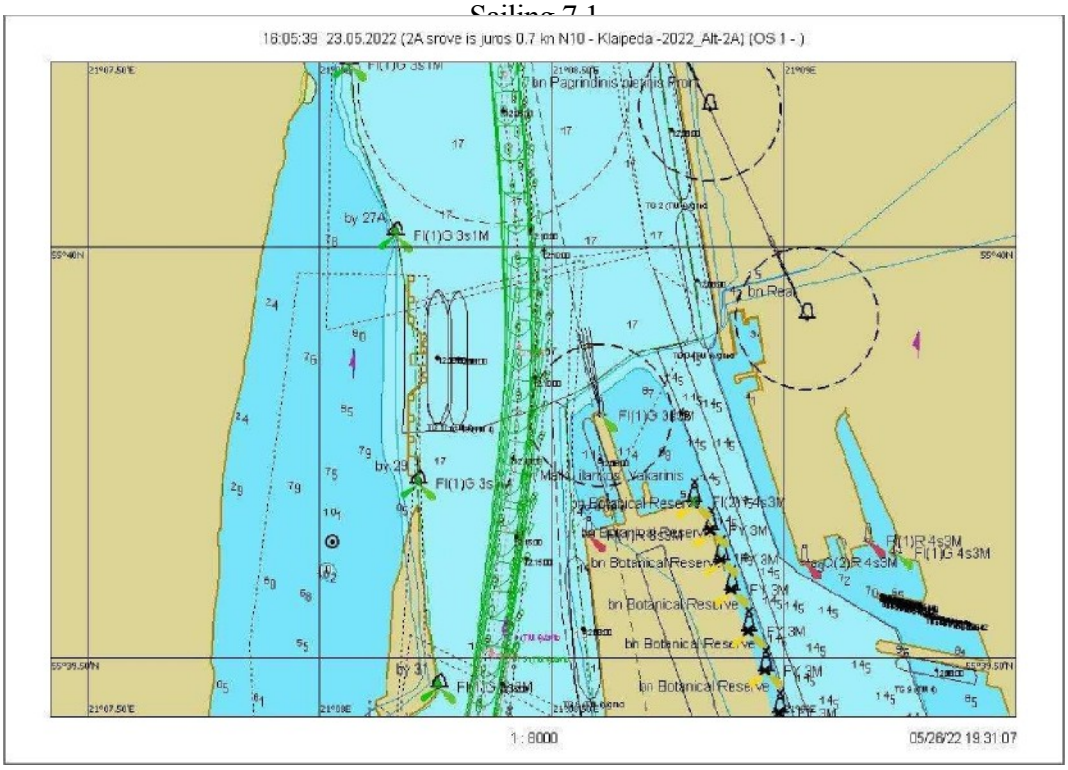
7.1.35 Fig. Course 6.3 - Graphical representation of the course from buoy No. 27A to No. 31



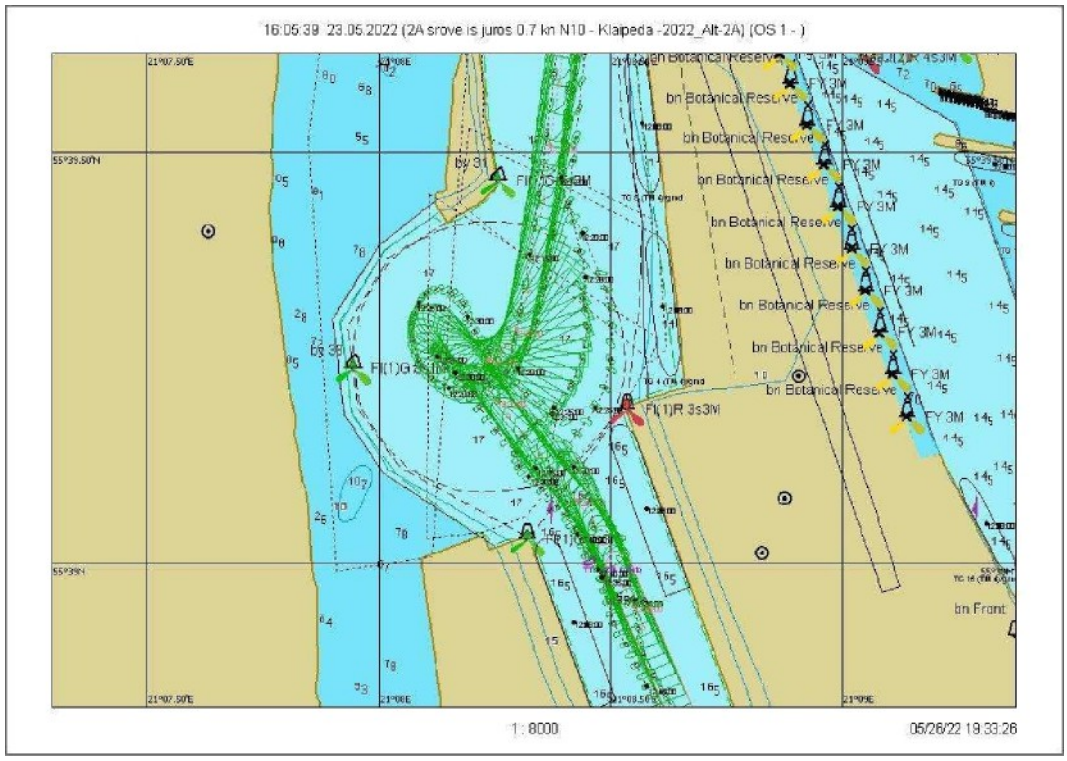
7.1.36 Fig. Voyage 6.3 - Ship's turning trajectory

Scenario 7. Sailing: wind N at 10 m/s, current from the shore at 0.7 knots

Sailing 7.1



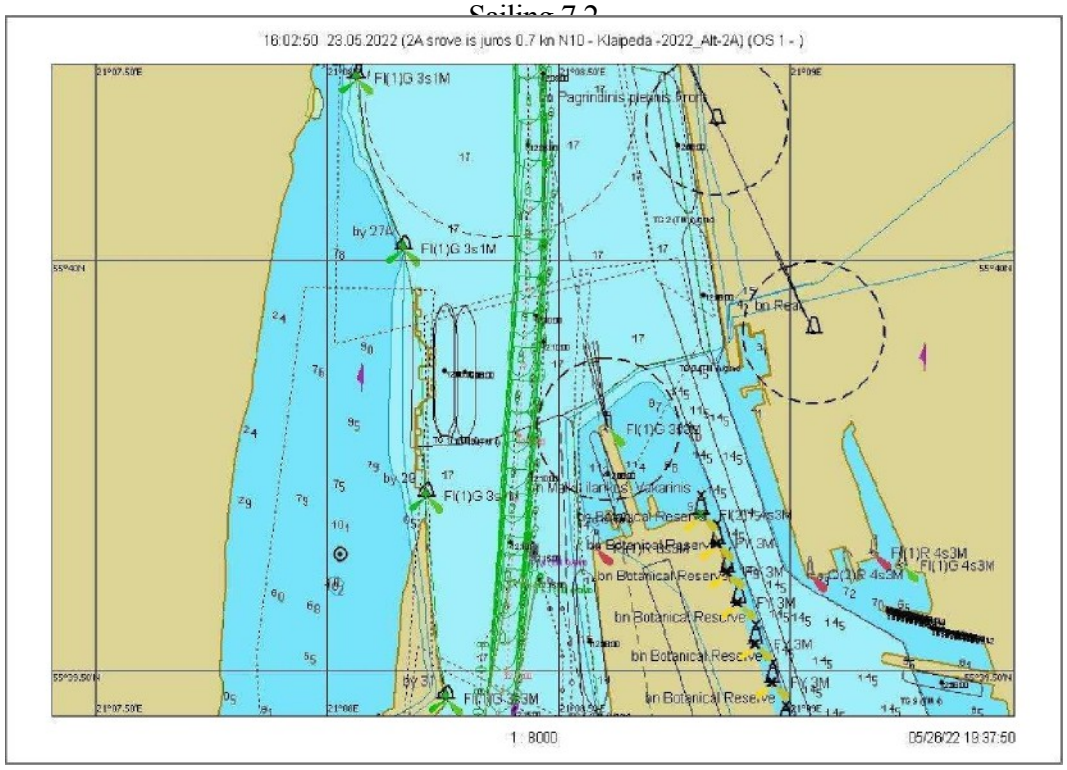
7.1.37 Fig. Course 7.1 - Graphical representation of the course from buoy No. 27A to No. 31



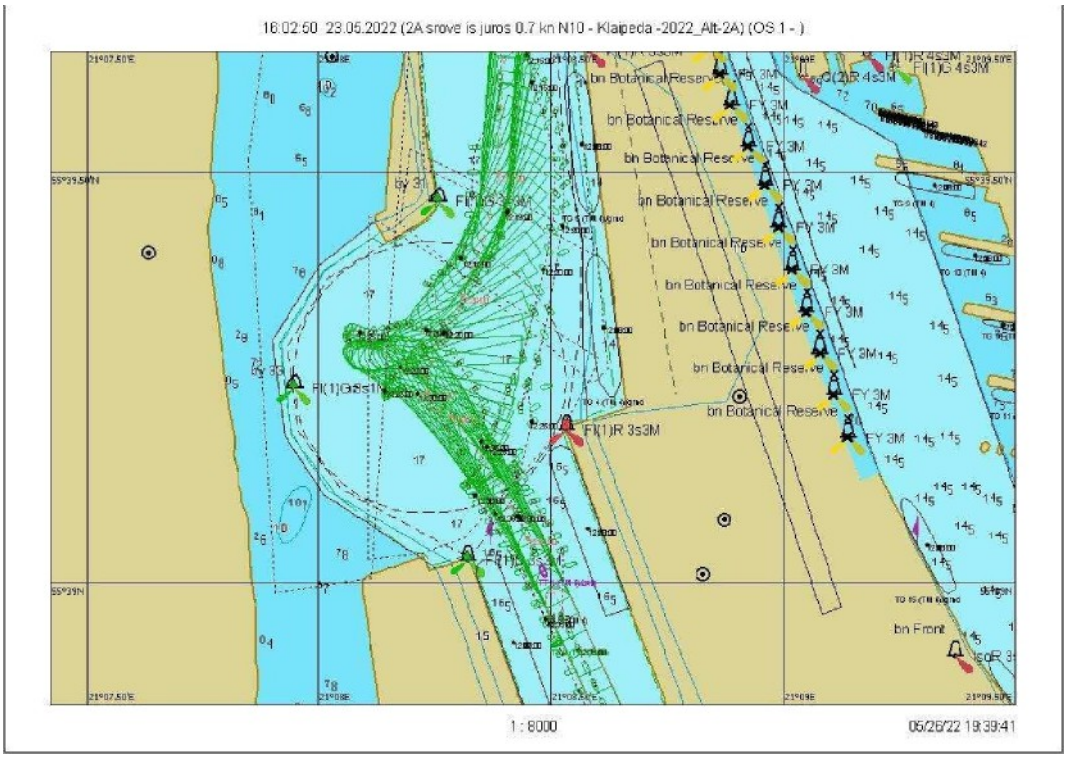
7.1.38 Fig. Voyage 7.1 - Ship's turning trajectory

Scenario 7. Sailing: wind N at 10 m/s, current from the shore at 0.7 knots

Sailing 7.2



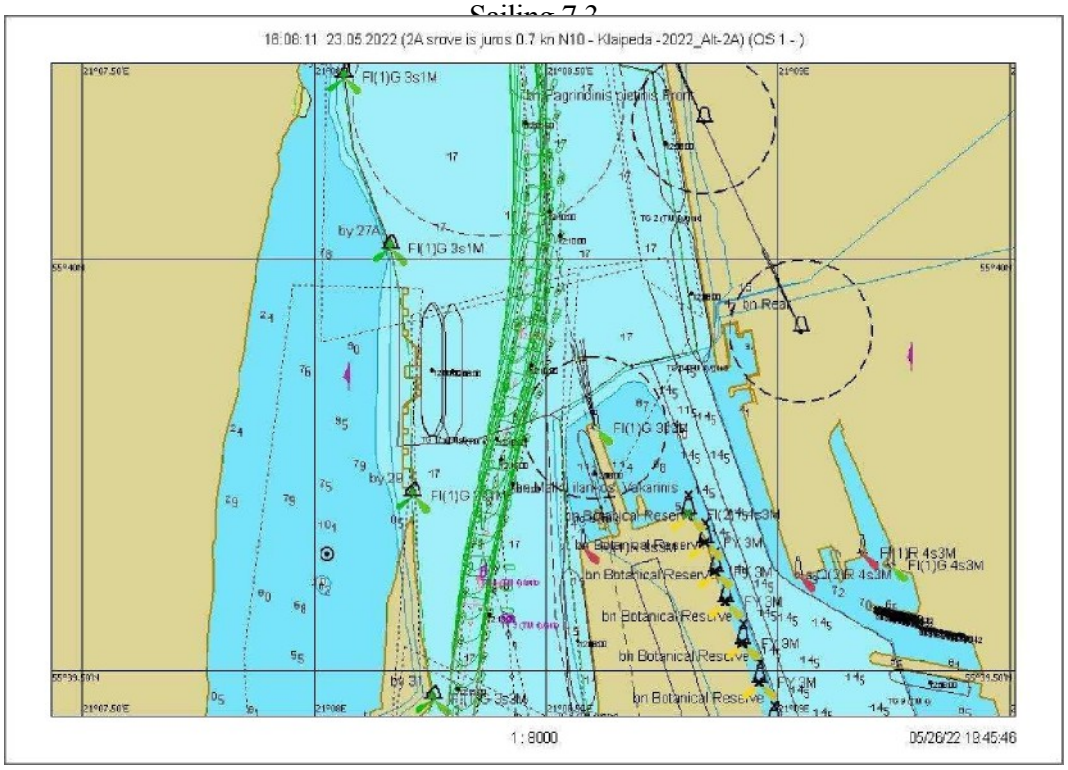
7.1.39 Fig. Course 7.2 - Graphical representation of the course from buoy No. 27A to No. 31



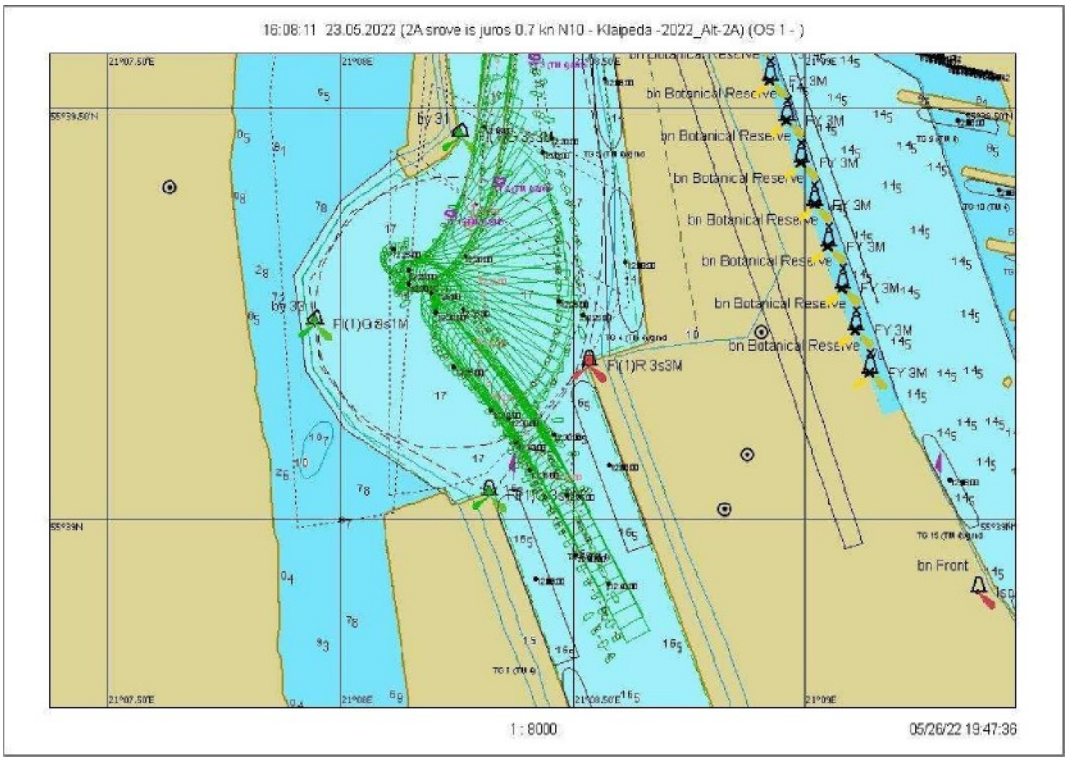
7.1.40 Fig. Voyage 7.2 - Ship's turning trajectory

Scenario 7. Sailing: wind N at 10 m/s, current from the sea at 0.7 knots

Sailing 7.3



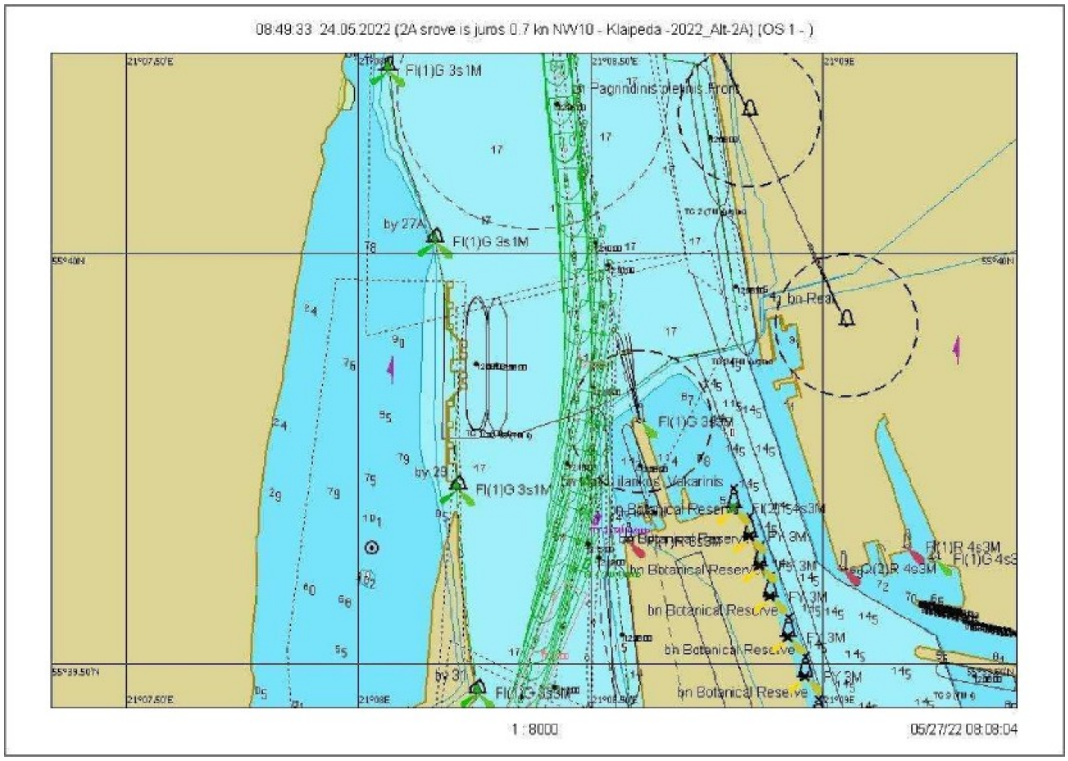
7.1.41 Fig. Course 7.3 – Graphical representation of the course from buoy No. 27A to No. 31



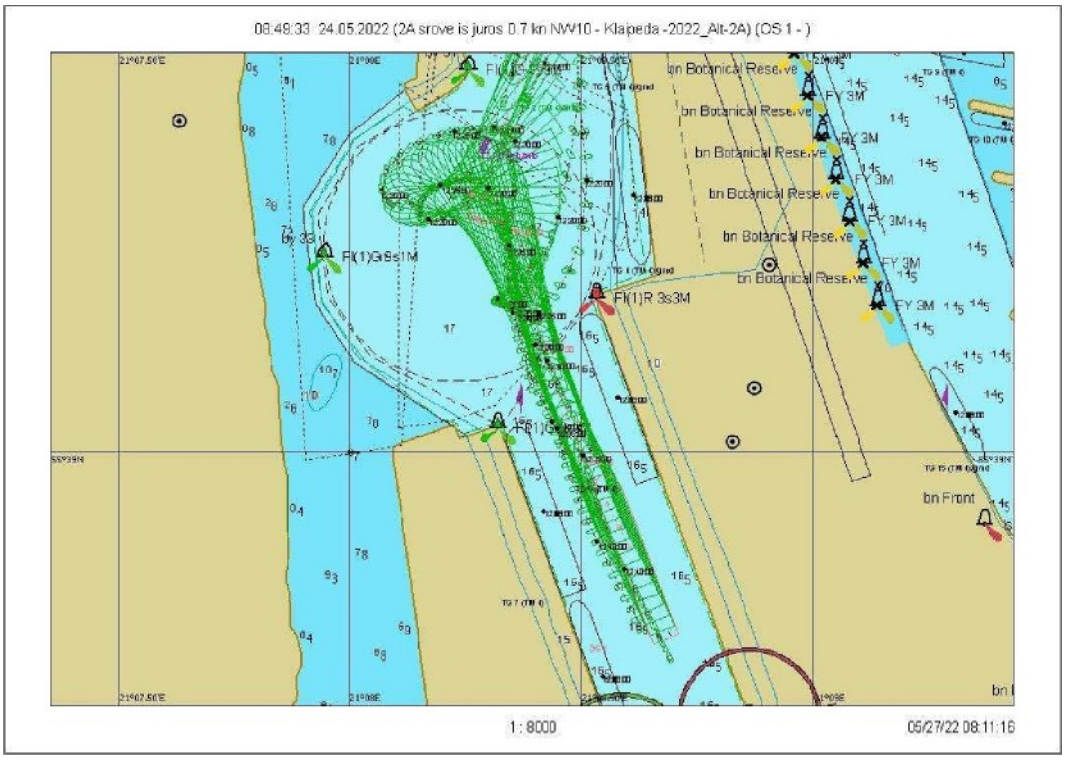
7.1.42 Fig. Course 7.3 - Ship's turning trajectory

Scenario 8. {Sailing: wind NW/10 m/s, current from the sea 0.7 knots

Sailing 8.1



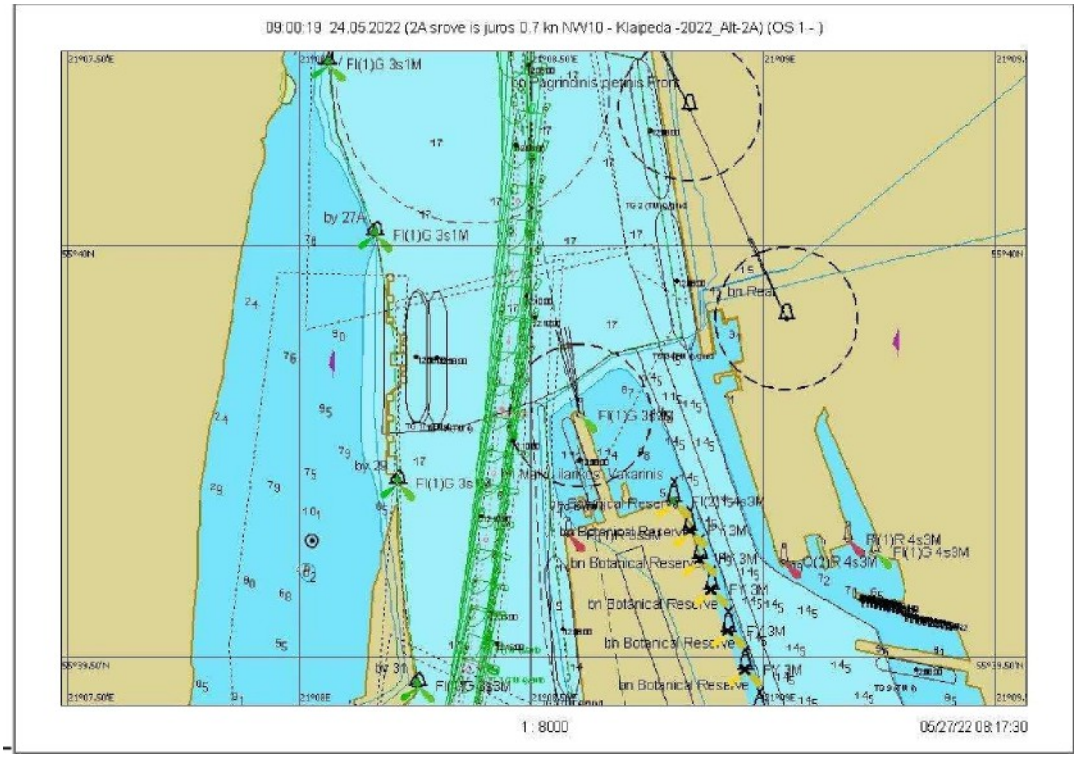
7.1.43 Fig. Course 8.1 – Graphical representation of the course from buoy No. 27A to No. 31



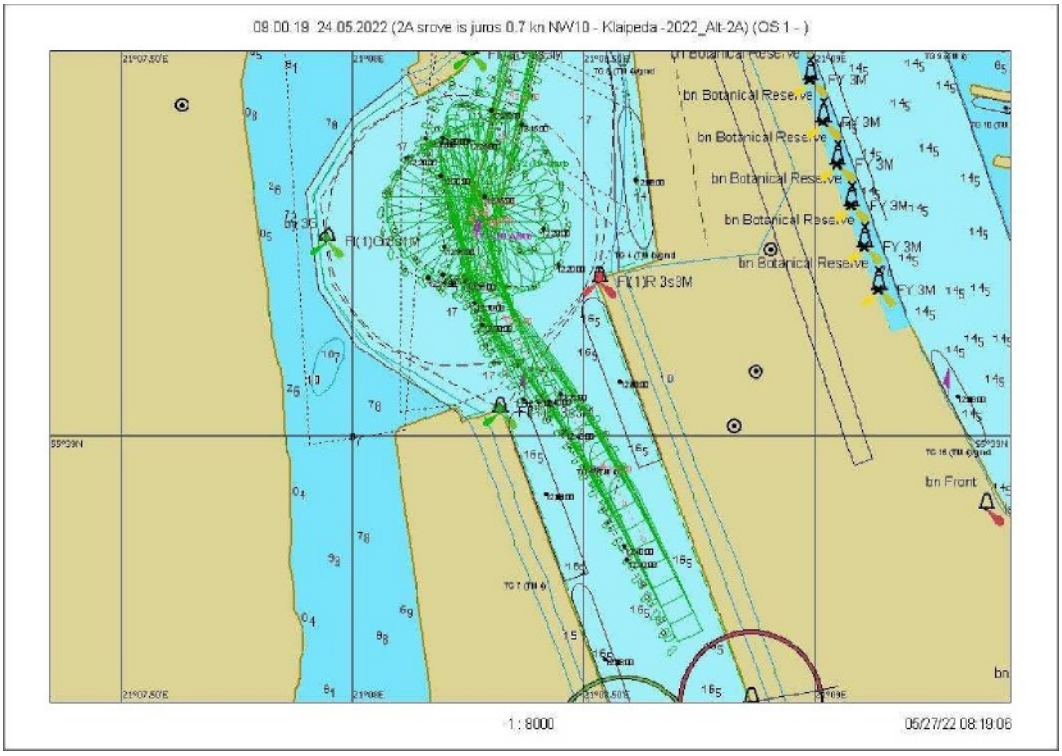
7.1.44 Fig. Voyage 8.1 - Ship's turning trajectory

Scenario 8. {Sailing: wind NW/10 m/s, current from the sea 0.7 knots

Sailing 8.2



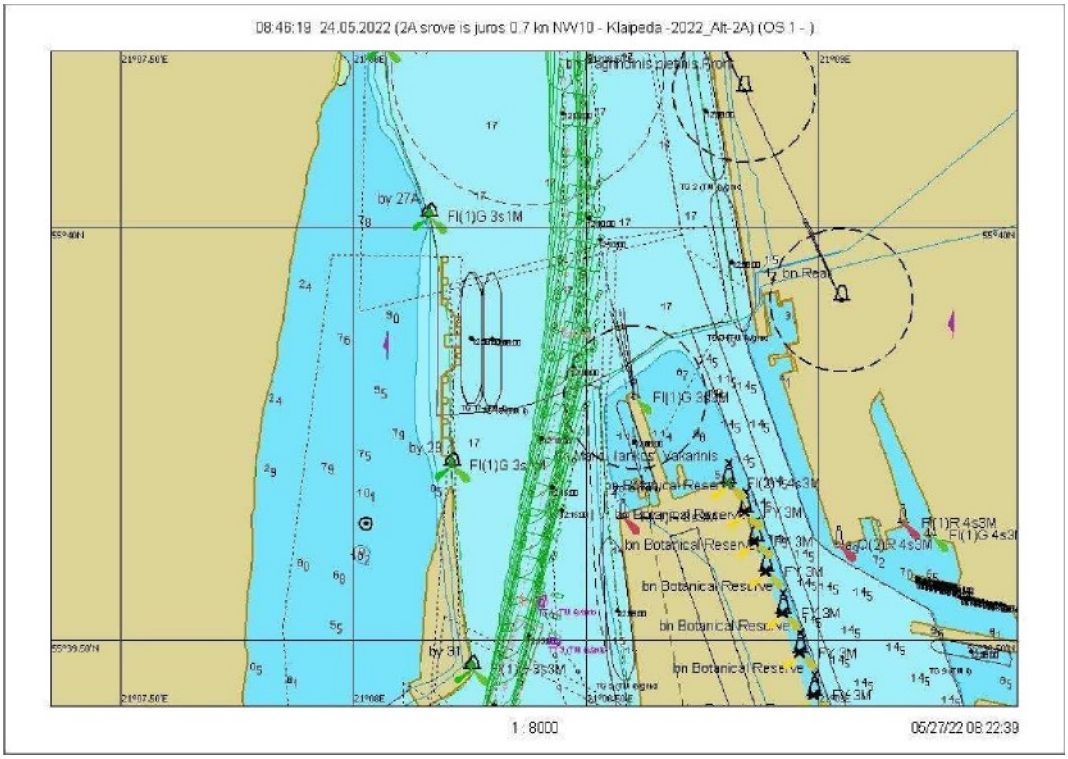
7.1.45 Fig. Course 8.2 – Graphical representation of the course from buoy No. 27A to No. 31



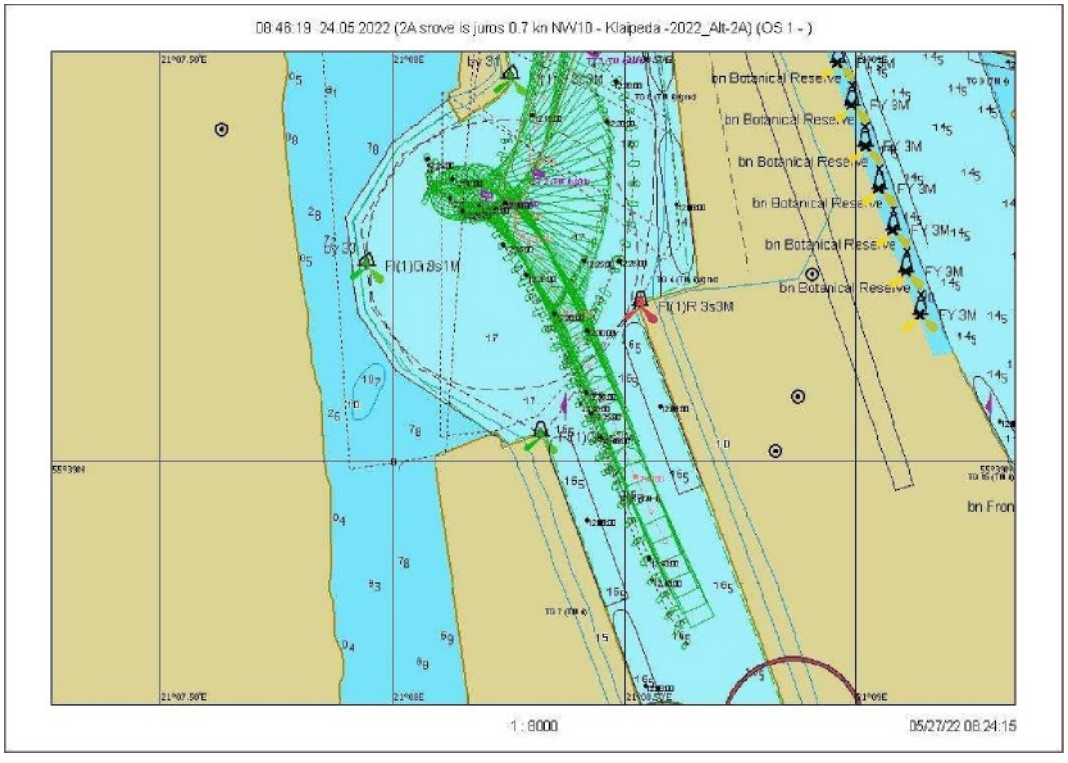
7.1.46 Fig. Voyage 8.2 - Ship's turning trajectory

Scenario 8. {Sailing: wind NW/10 m/s, current from the sea 0.7 knots

Sailing 8.3



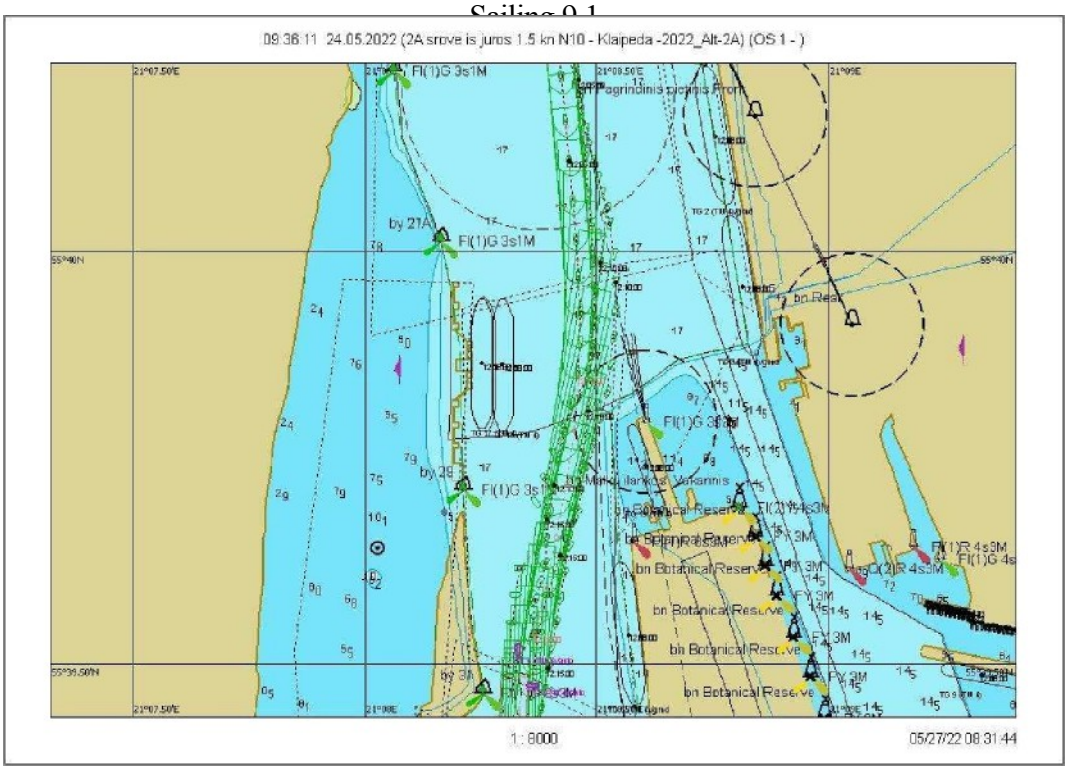
7.1.47 Fig. Course 8.3 - Graphical representation of the course from buoy No. 27A to No. 31



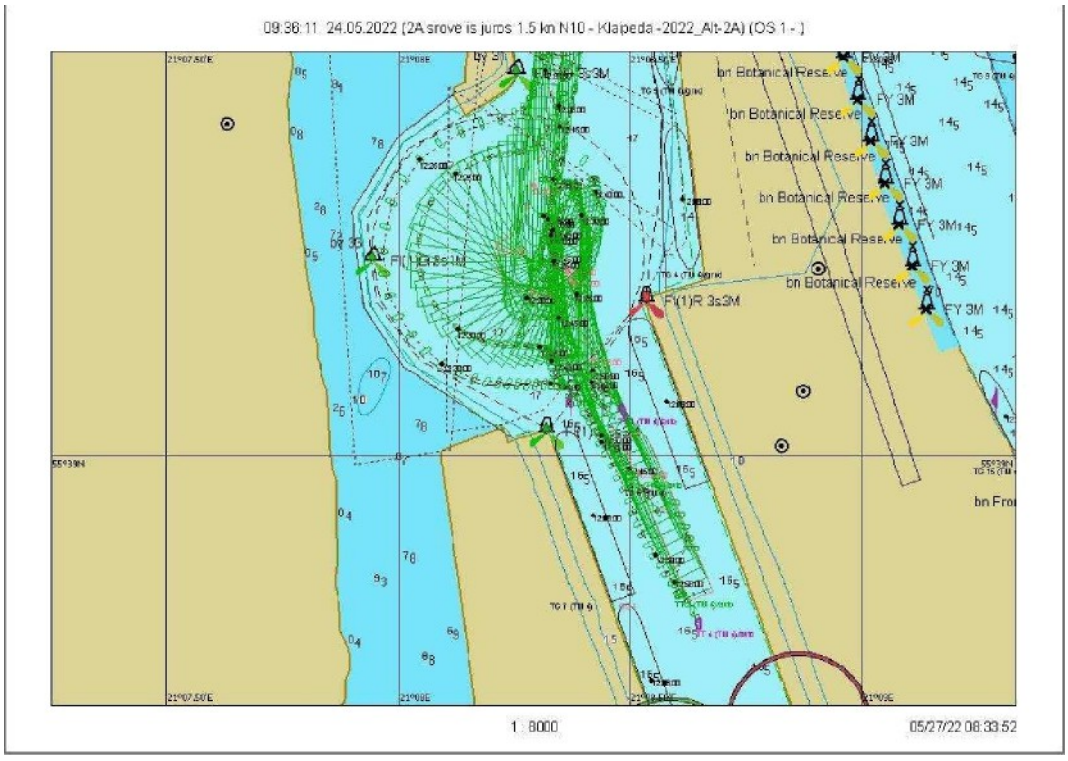
7.1.48 Fig. Voyage 8.3 - Ship's turning trajectory

Scenario 9. Sailing: wind N at 10 m/s, current from the sea at 1.5 knots

Sailing 9.1



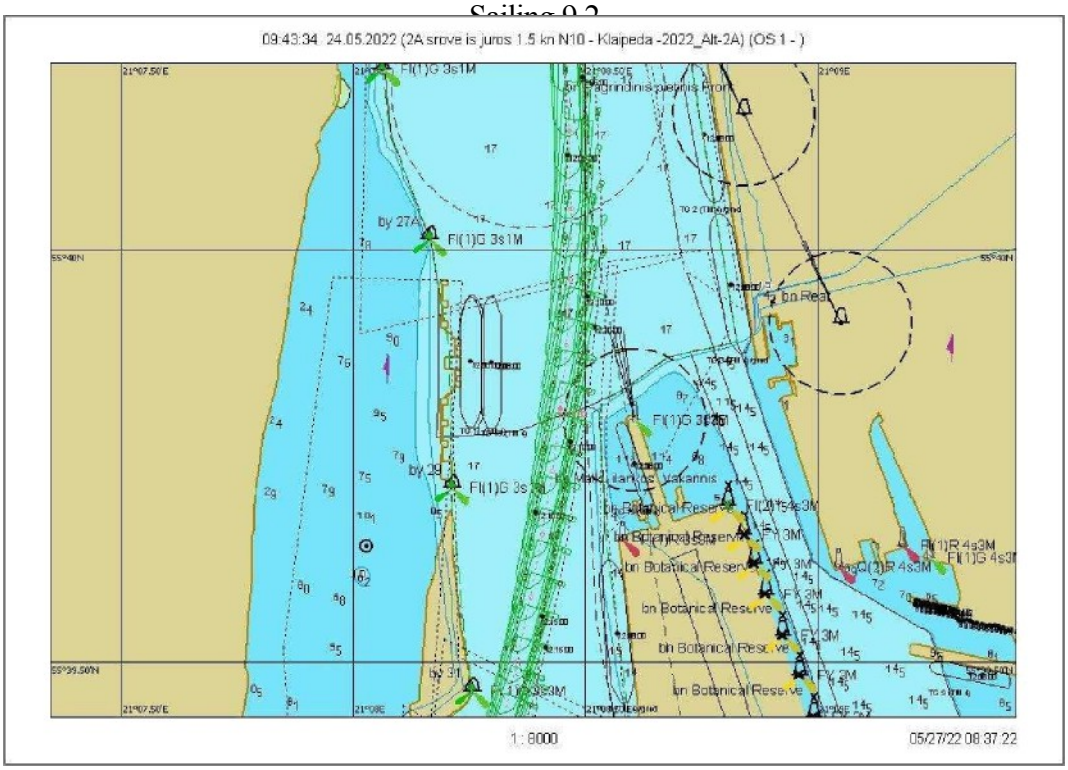
7.1.49 Fig. Course 9.1 - Graphical representation of the course from buoy No. 27A to No. 31



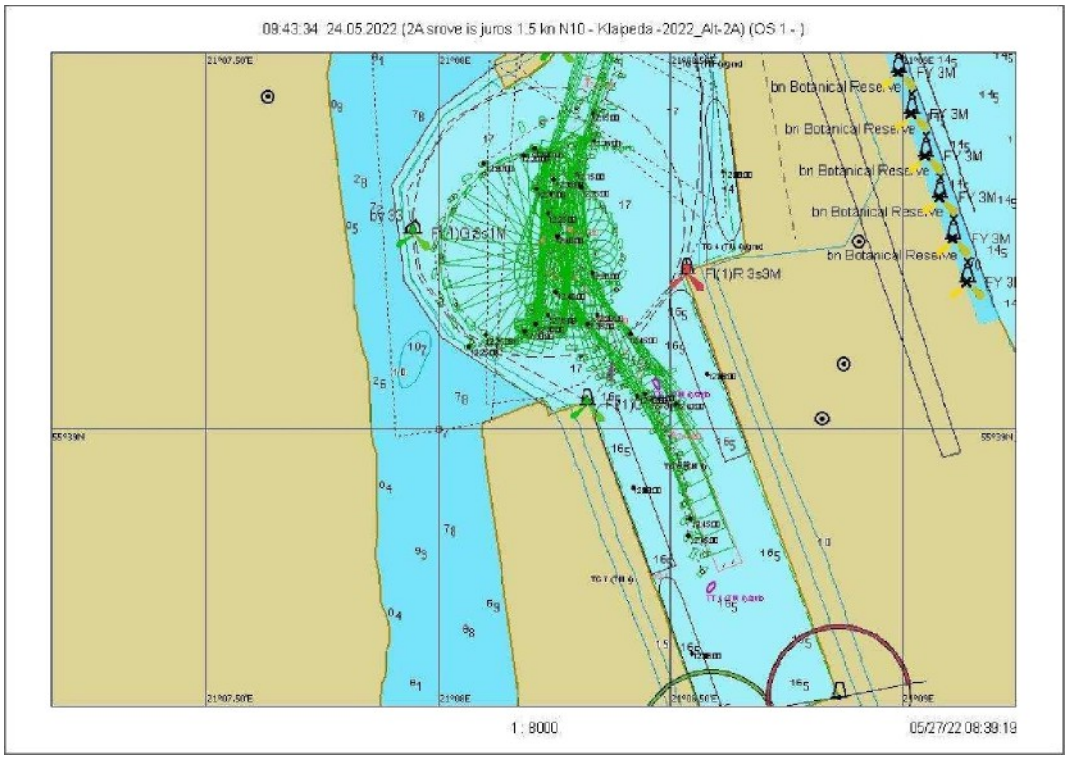
7.1.50 Fig. Course 9.1 - Ship's turning trajectory

Scenario 9. Sailing: wind N at 10 m/s, current from the sea at 1.5 knots

Sailing 9.2



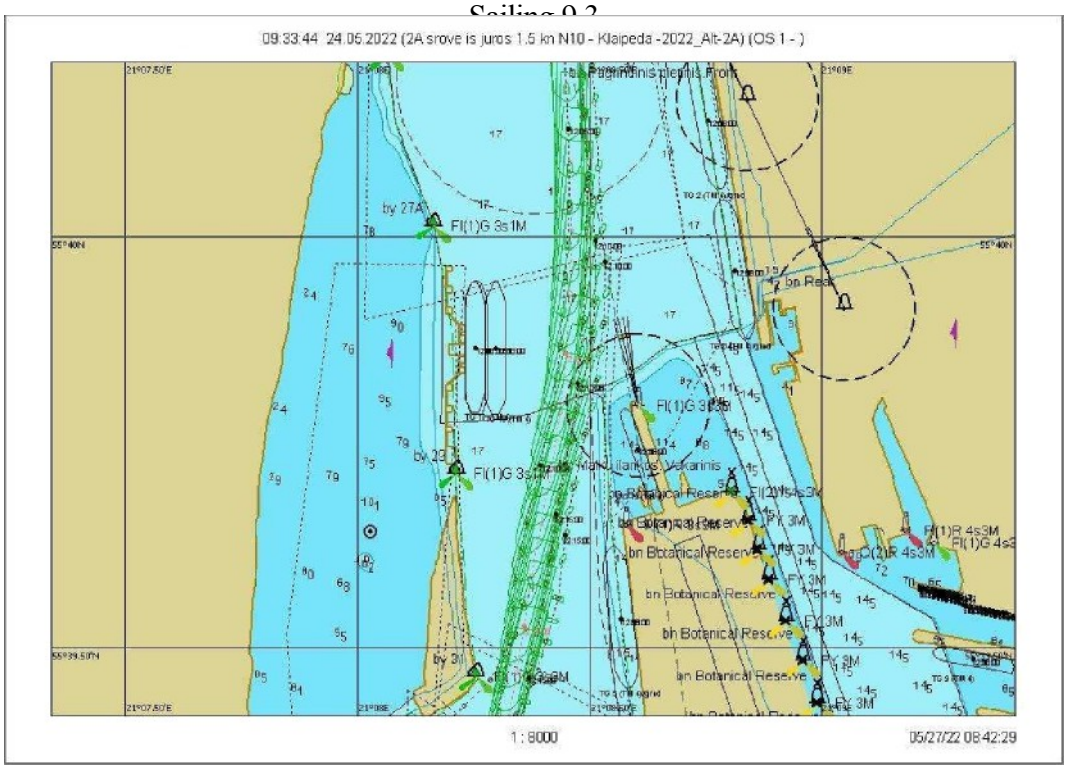
7.1.51 Fig. Course 9.2 – Graphical representation of the course from buoy No. 27A to No. 31



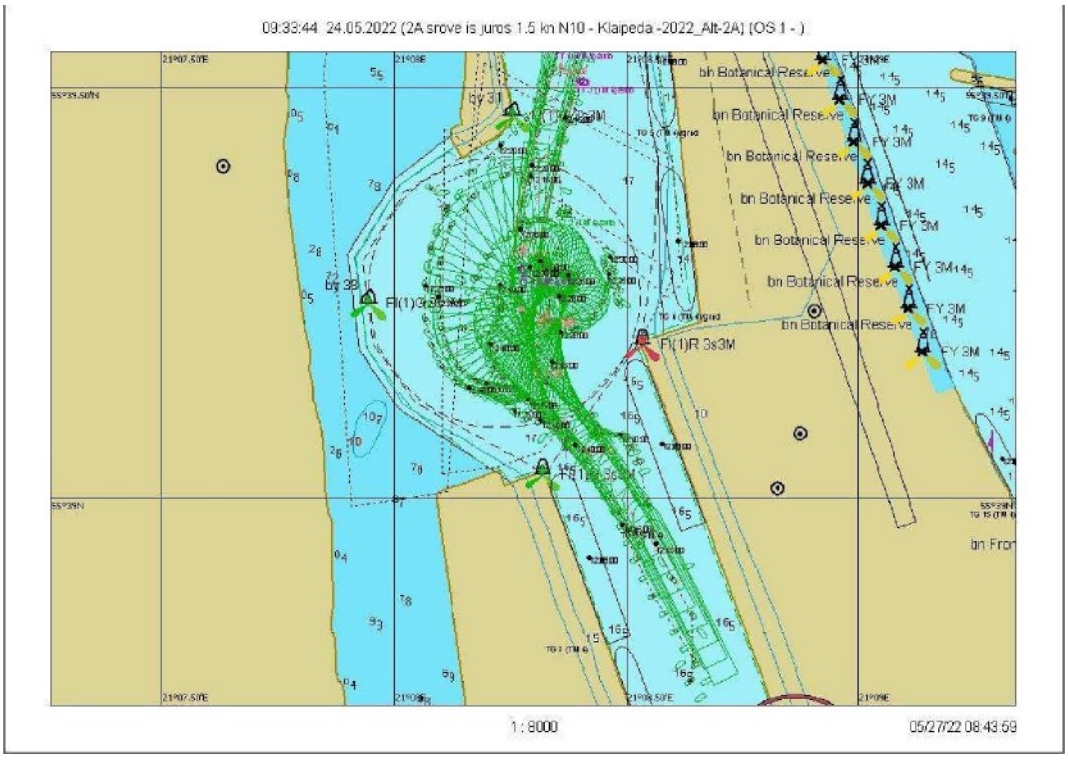
7.1.52 Fig. Voyage 9.2 - Ship's turning trajectory

Scenario 9. Sailing: wind N at 10 m/s, current from the sea at 1.5 knots

Sailing 9.3



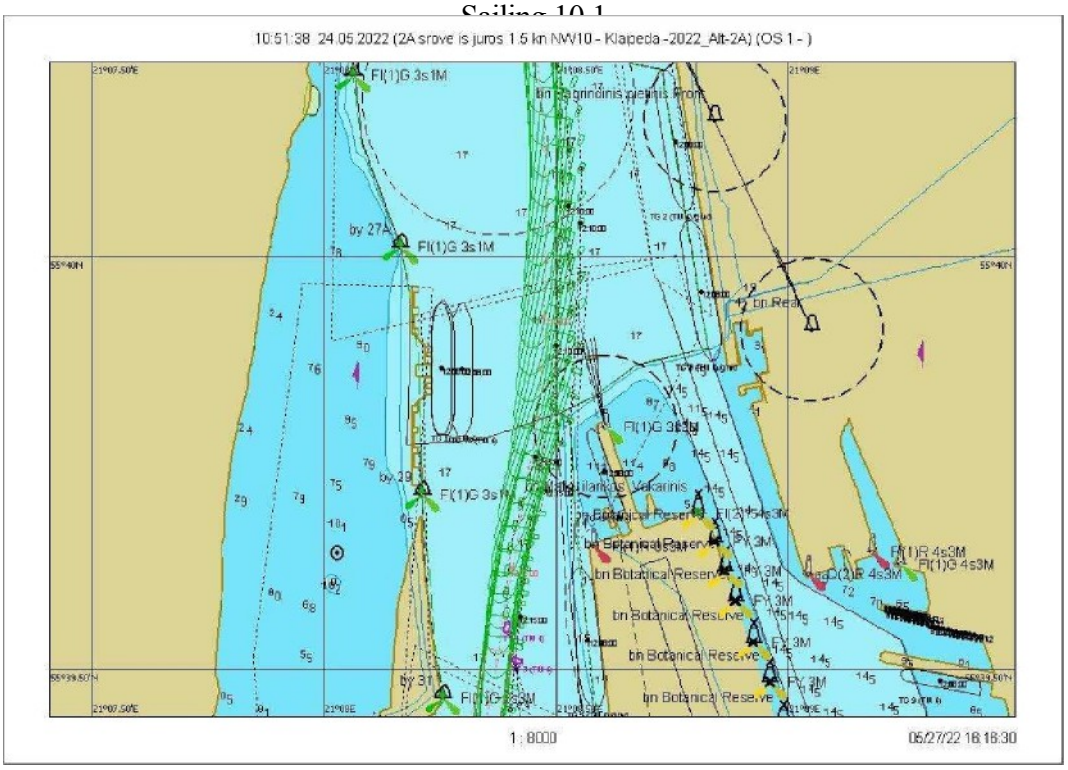
7.1.53 Fig. Course 9.3 - Graphical representation of the course from buoy No. 27A to No. 31



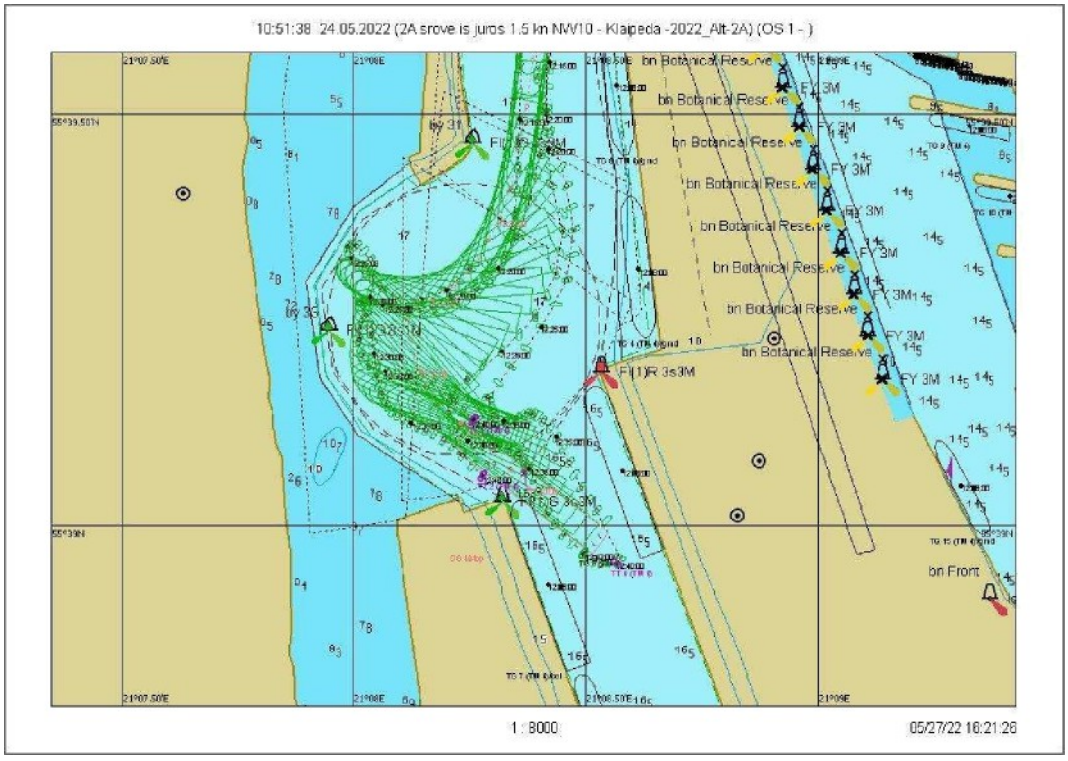
7.1.54 Fig. Voyage 9.3 - Ship's turning trajectory

Scenario 10. Sailing: wind NW/10 m/s, current from the shore at 1.5 knots

Sailing 10.1



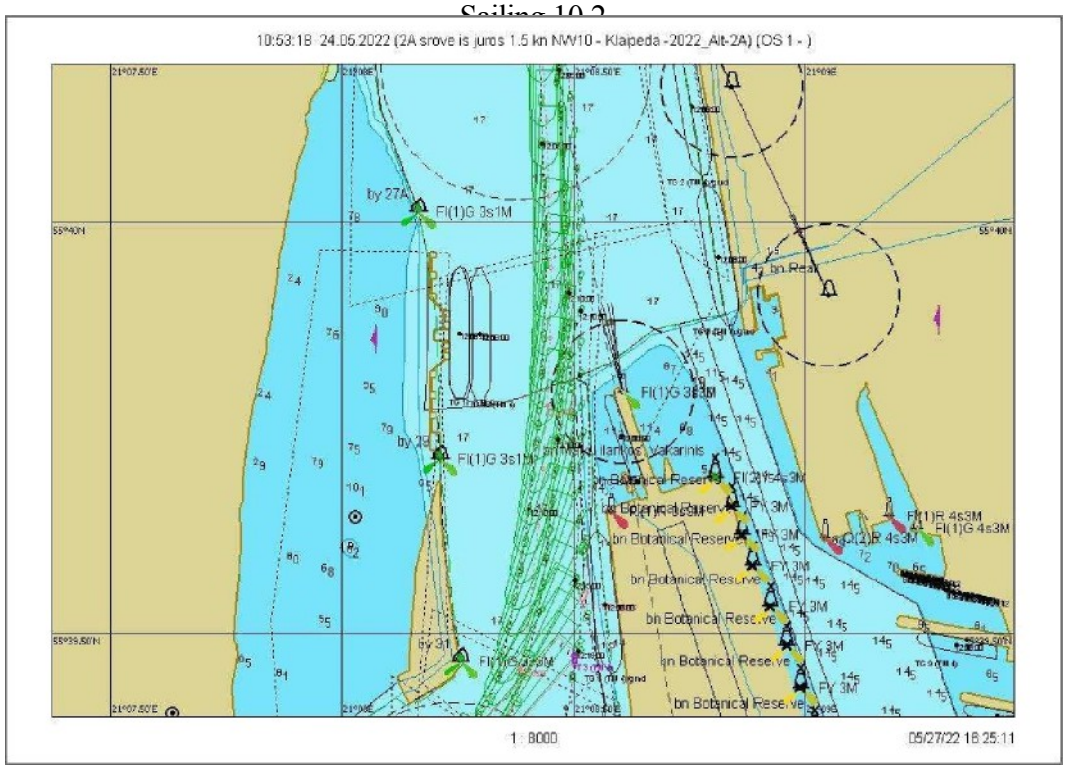
7.1.55 Fig. Course 10.1 – Graphical representation of the course from buoy No. 27A to No. 31



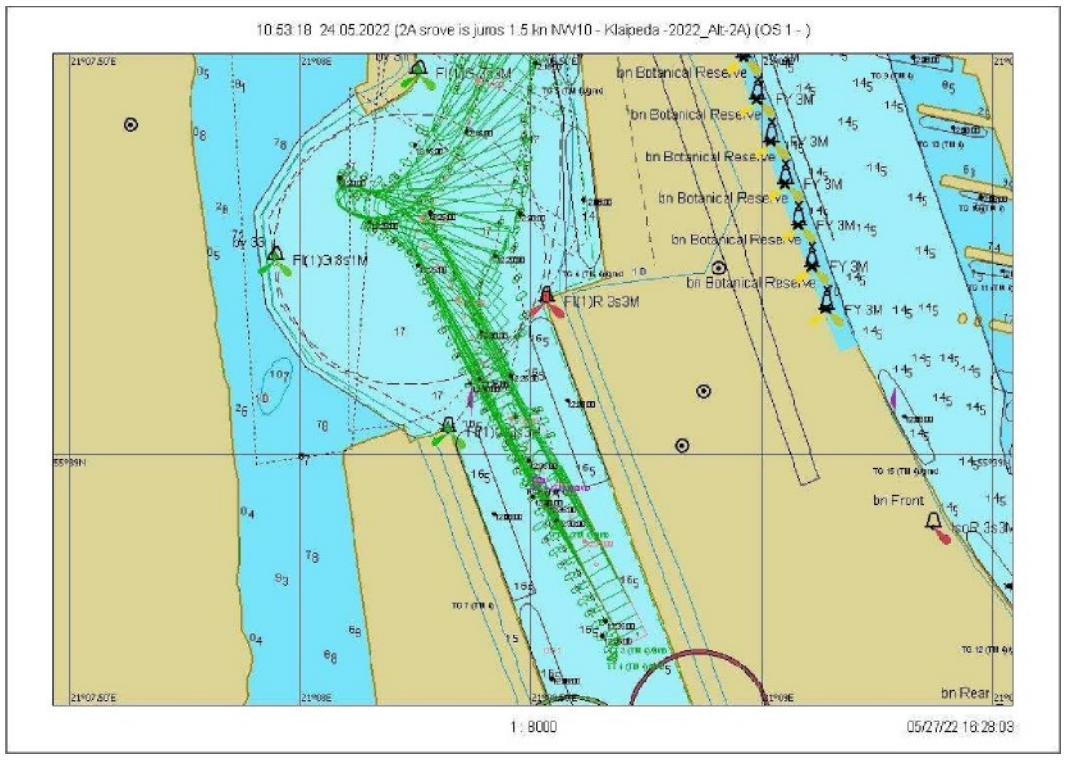
7.1.56 Fig. Course 10.1 - Ship's turning trajectory

Scenario 10. Sailing: wind NW/10 m/s, current from the shore at 1.5 knots

Sailing 10.2



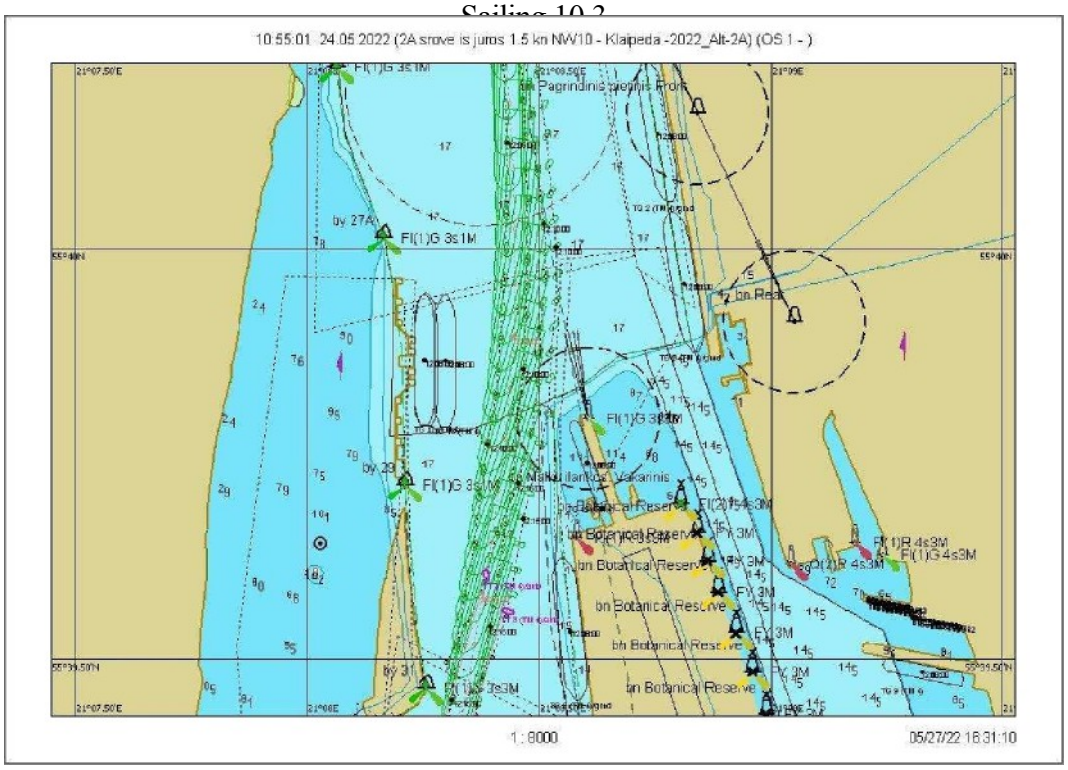
7.1.57 Fig. Course 10.2 – Graphical representation of the course from buoy No. 27A to No. 31



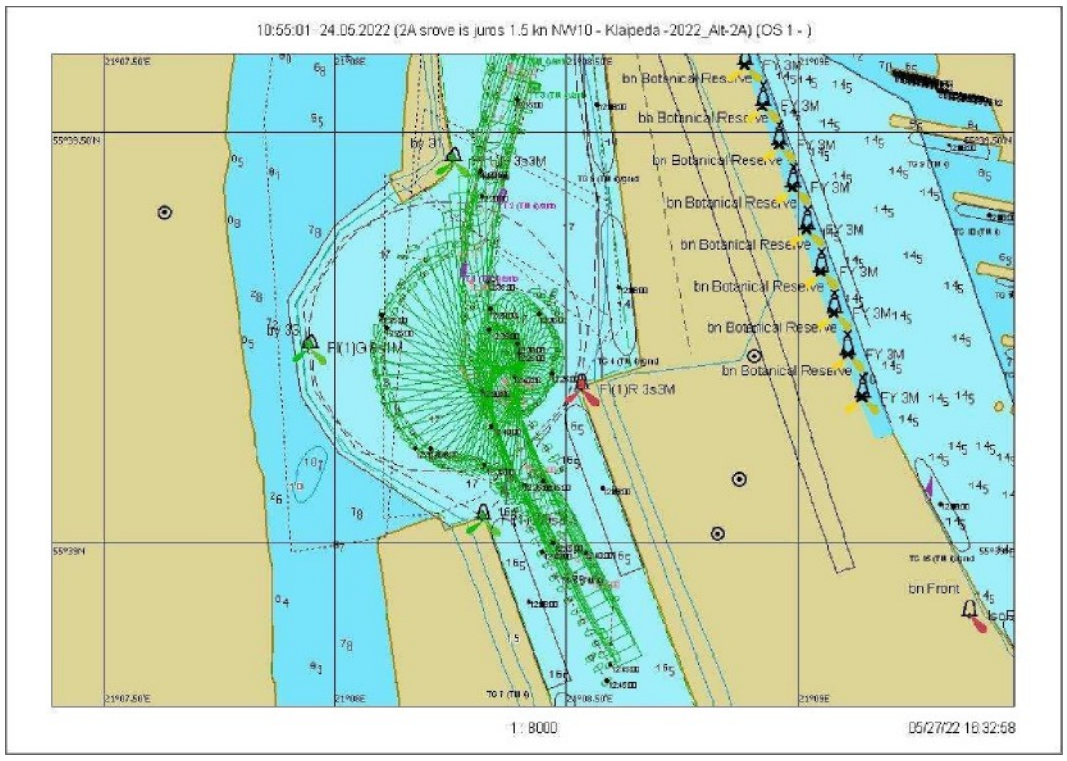
7.1.58 Fig. Course 10.2 - Ship turning trajectory

Scenario 10. Sailing: wind NW/10 m/s, current from the shore at 1.5 knots

Sailing 10.3



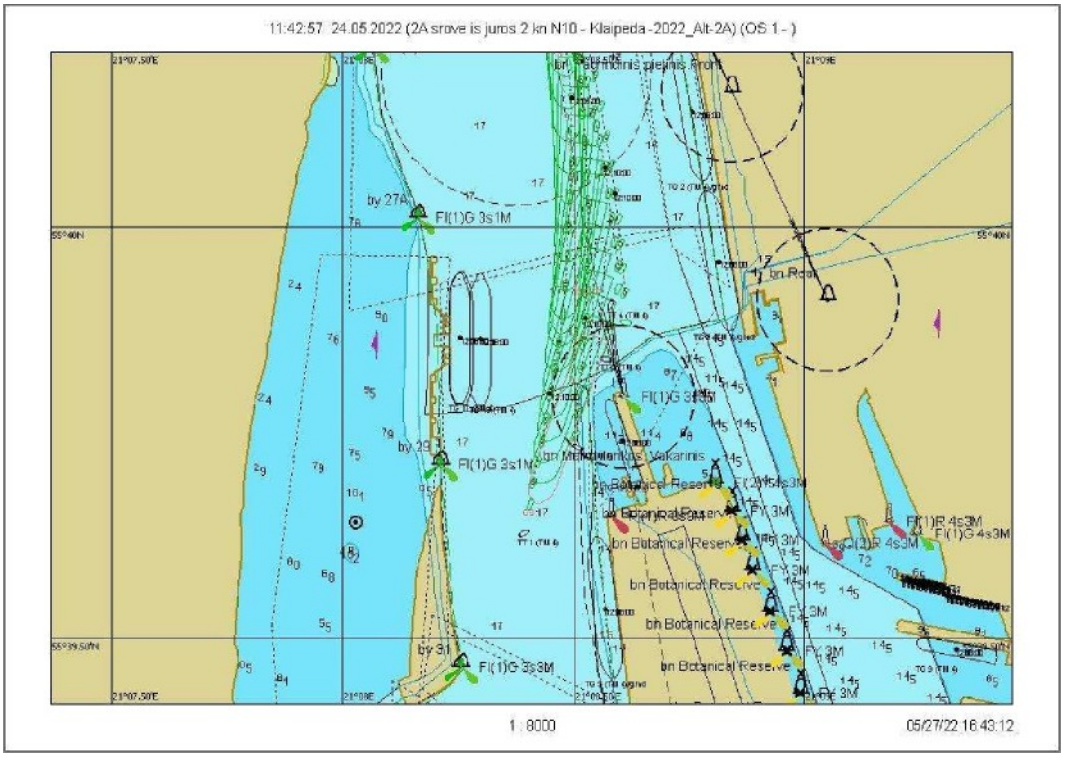
7.1.59 Fig. Course 10.3 – Graphical representation of the course from buoy No. 27A to No. 31



7.1.60 Fig. Course 10.3 - Ship turning trajectory

Scenario 11. Sailing: wind N at 10 m/s, offshore current at 2 knots

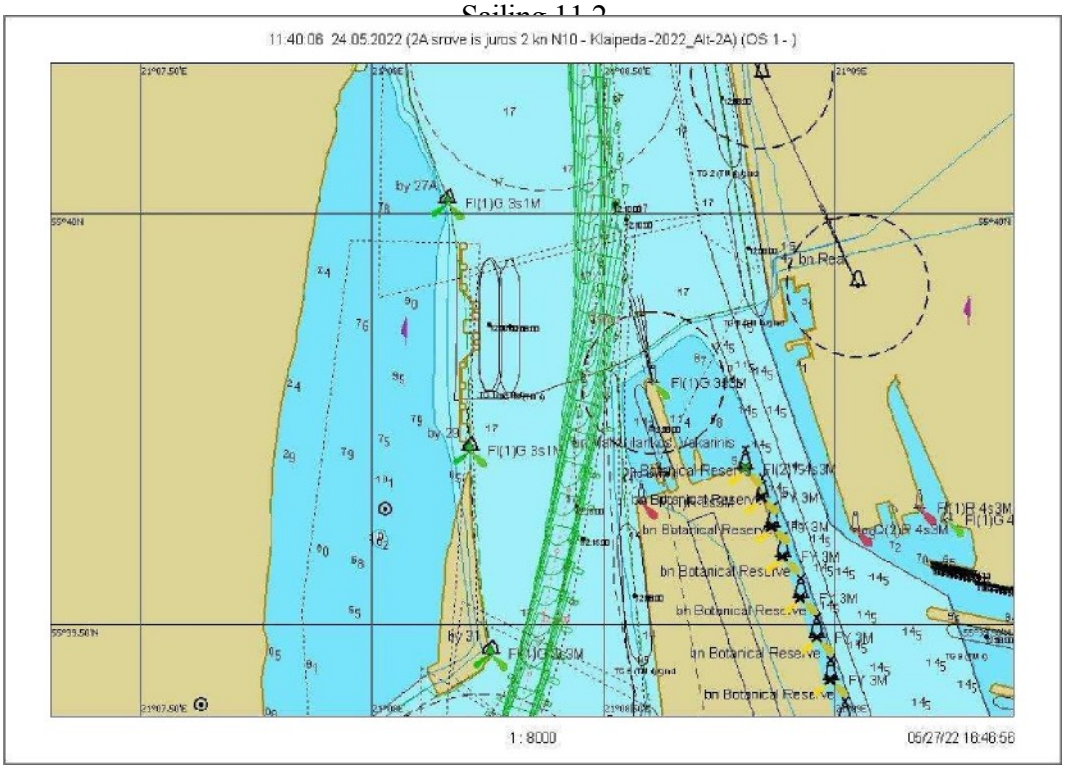
Sail 11.1 (on the shoal)



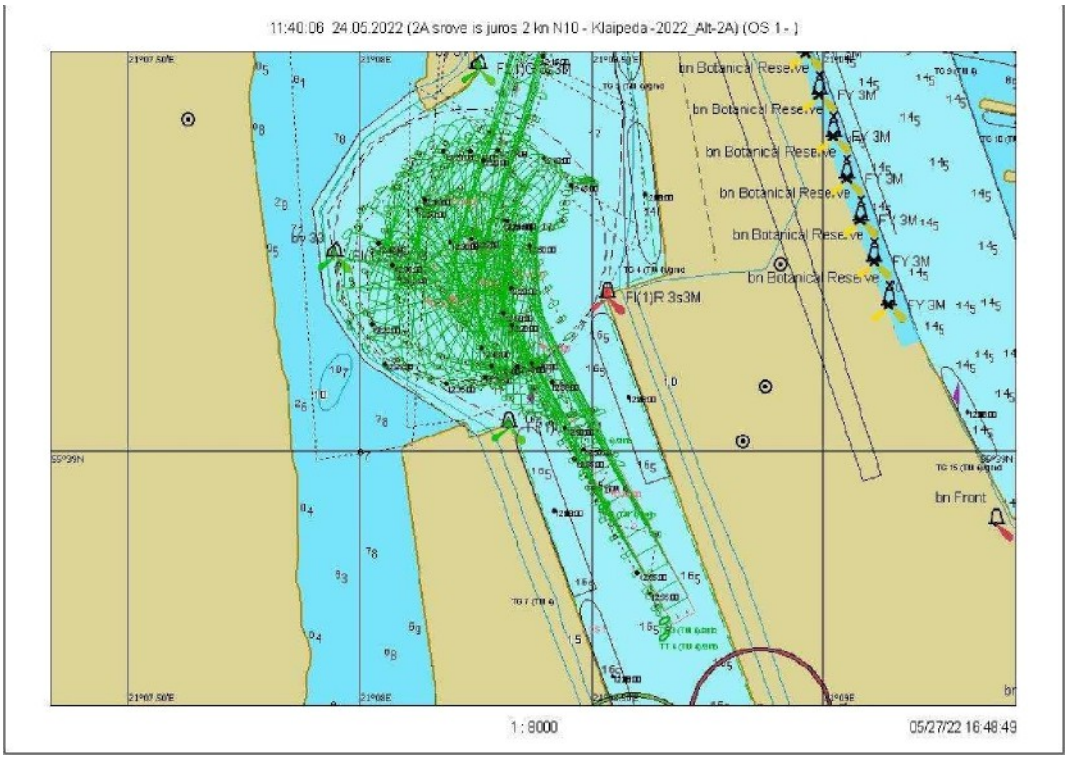
7.1.61 Fig. Course 11.1 - Graphical representation of the course from buoy No. 27A to No. 31

Scenario 11. Sailing: wind N at 10 m/s, current from the sea at 2 knots

Sailing 11.2



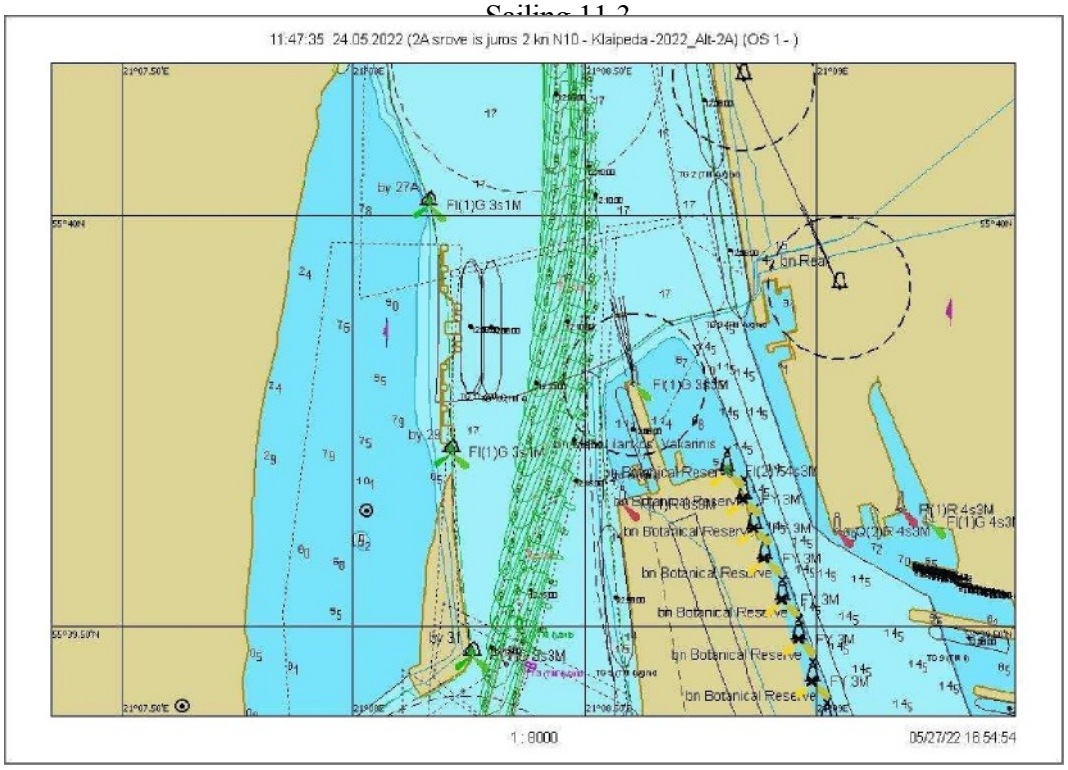
7.1.62 Fig. Course 11.2 - Graphical representation of the course from buoy No. 27A to No. 31



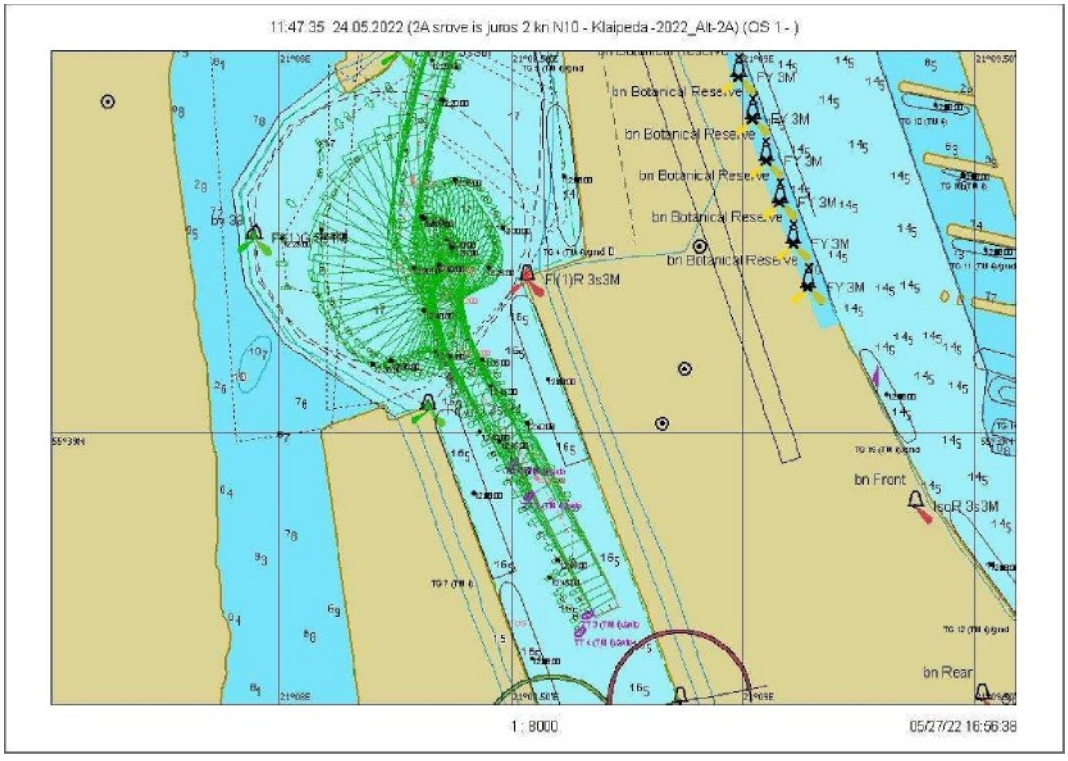
7.1.63 Fig. Course 1 1.2 - Ship's turning trajectory

Scenario 11. Sailing: wind N at 10 m/s, current from the sea at 2 knots

Sailing 11.3



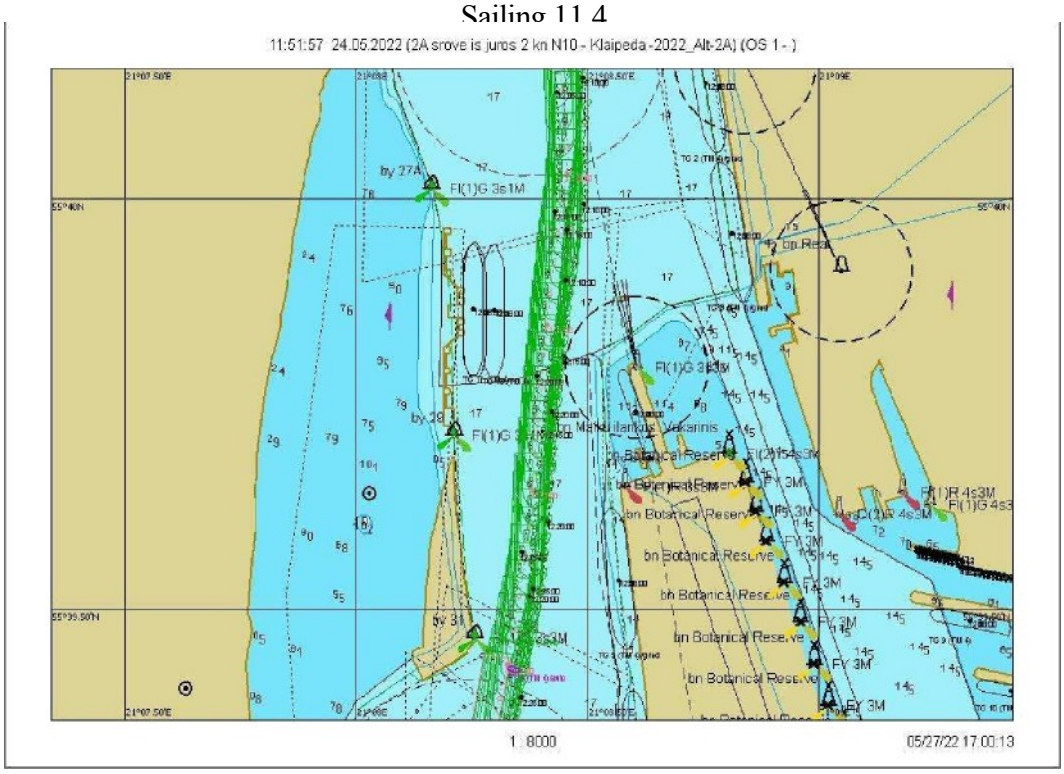
7.1.64 Fig. Course 11.3 - Graphical representation of the course from buoy No. 27A to No. 31



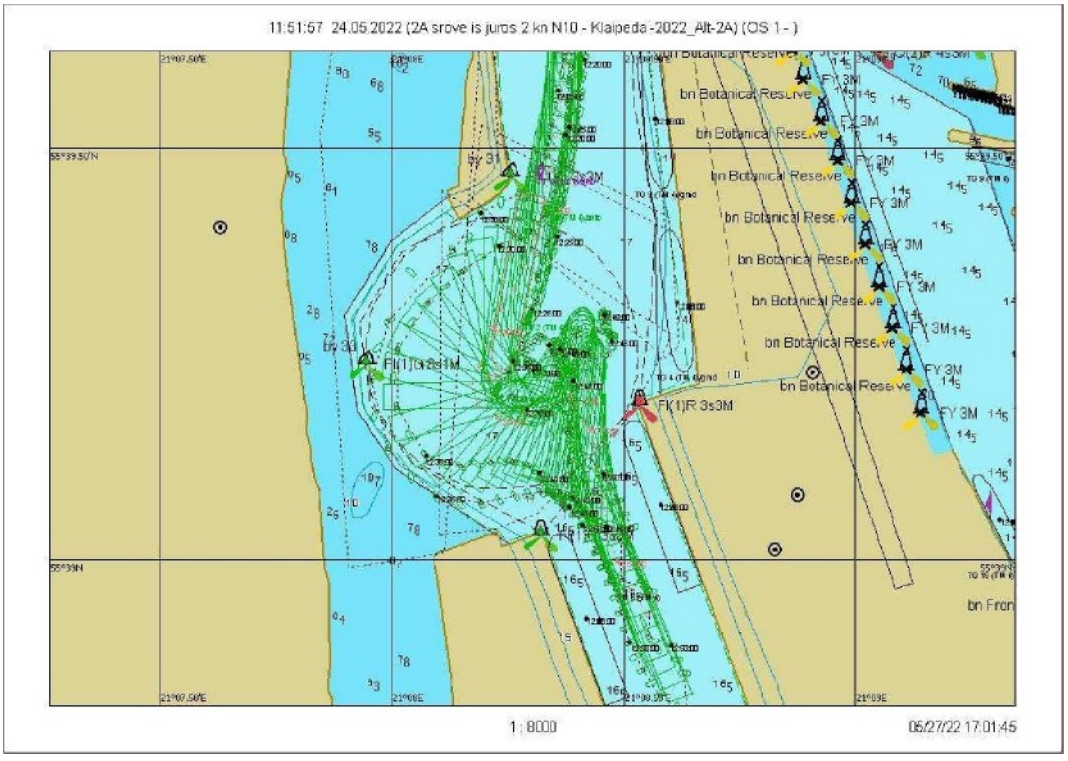
7.1.65 Fig. Course 1 1.3 - Ship's turning trajectory

Scenario 11. Sailing: wind N at 10 m/s, current from the sea at 2 knots

Sailing 11.4



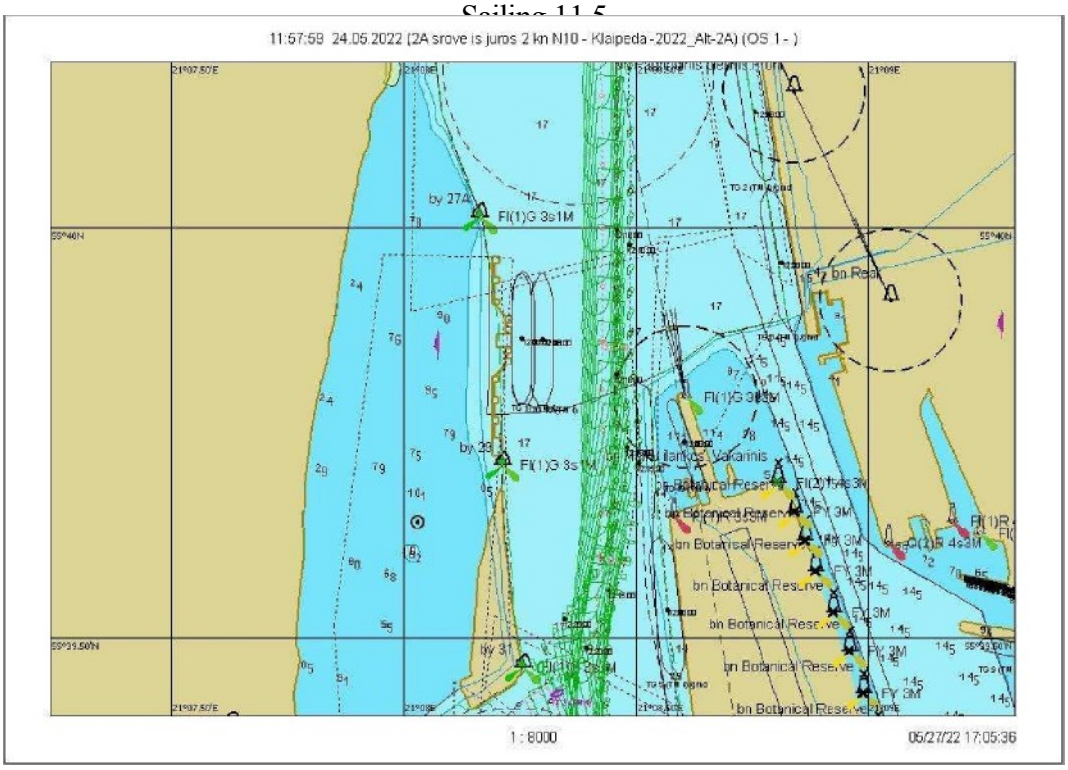
7.1.66 Fig. Voyage 11.4 - Graphical representation of the voyage from buoy No. 27A to No. 31



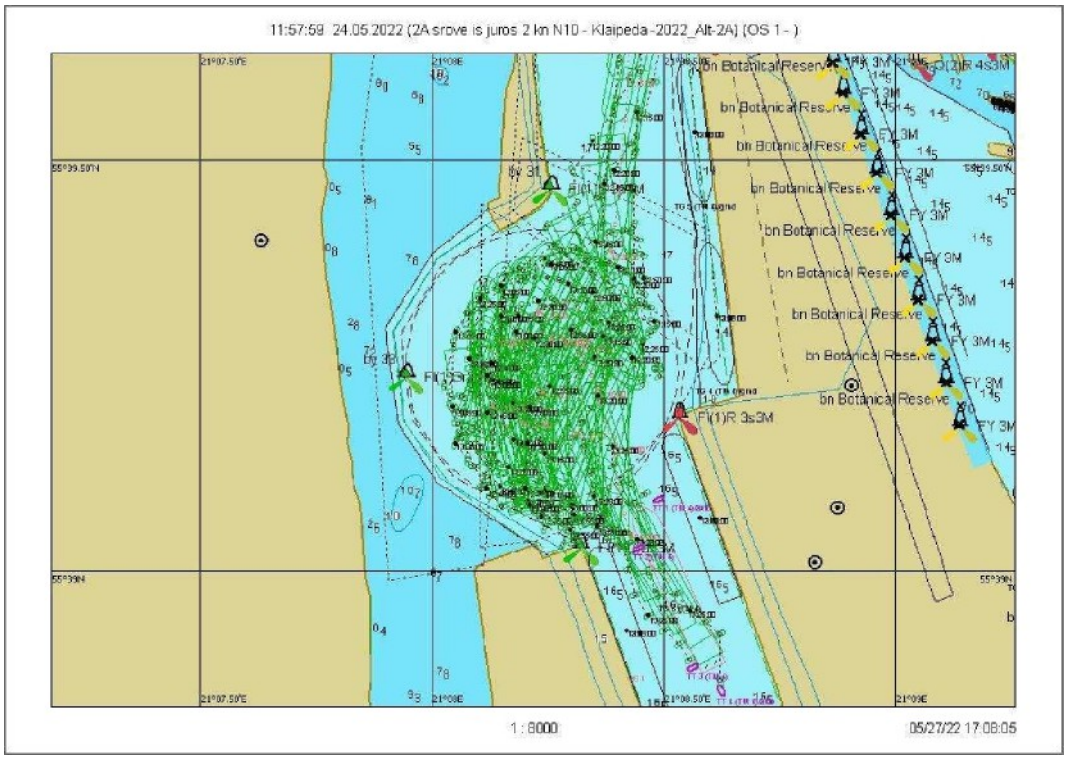
7.1.67 Fig. Course 11.4 - Ship turning trajectory

Scenario 11. Sailing: wind N at 10 m/s, current from the sea at 2 knots

Sailing 11.5



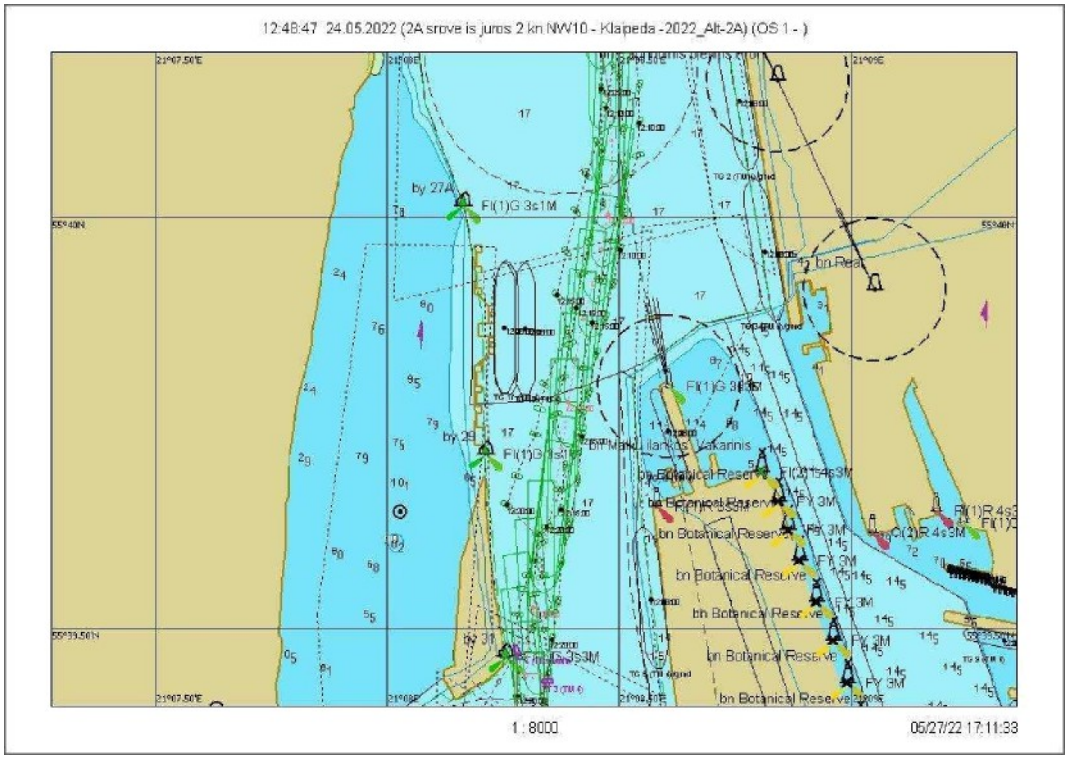
7.1.68 Fig. Voyage 11.5 - Graphical representation of the voyage from buoy No. 27A to No. 31



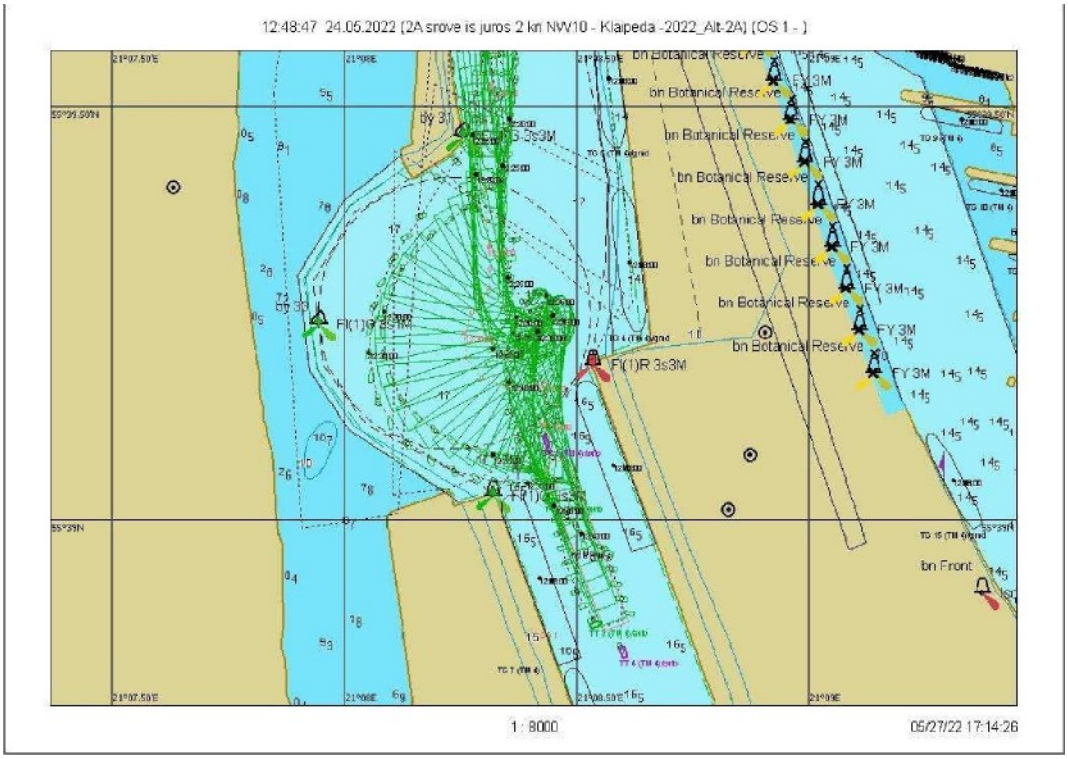
7.1.69 Fig. Course 11.53 – Ship's turning trajectory

Scenario 12. {Sailing: wind NW/10 m/s, current from the sea 2 knots

Sailing 12.1



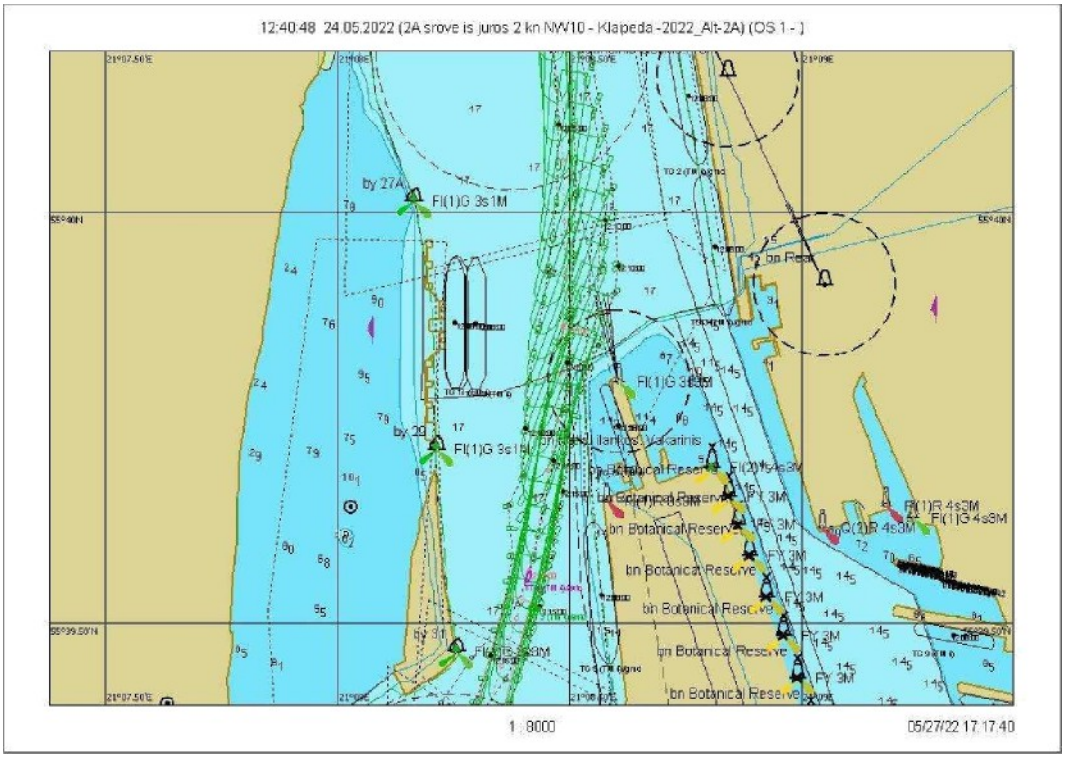
7.1.70 Fig. Course 12.1 – Graphical representation of the course from buoy No. 27A to No. 31



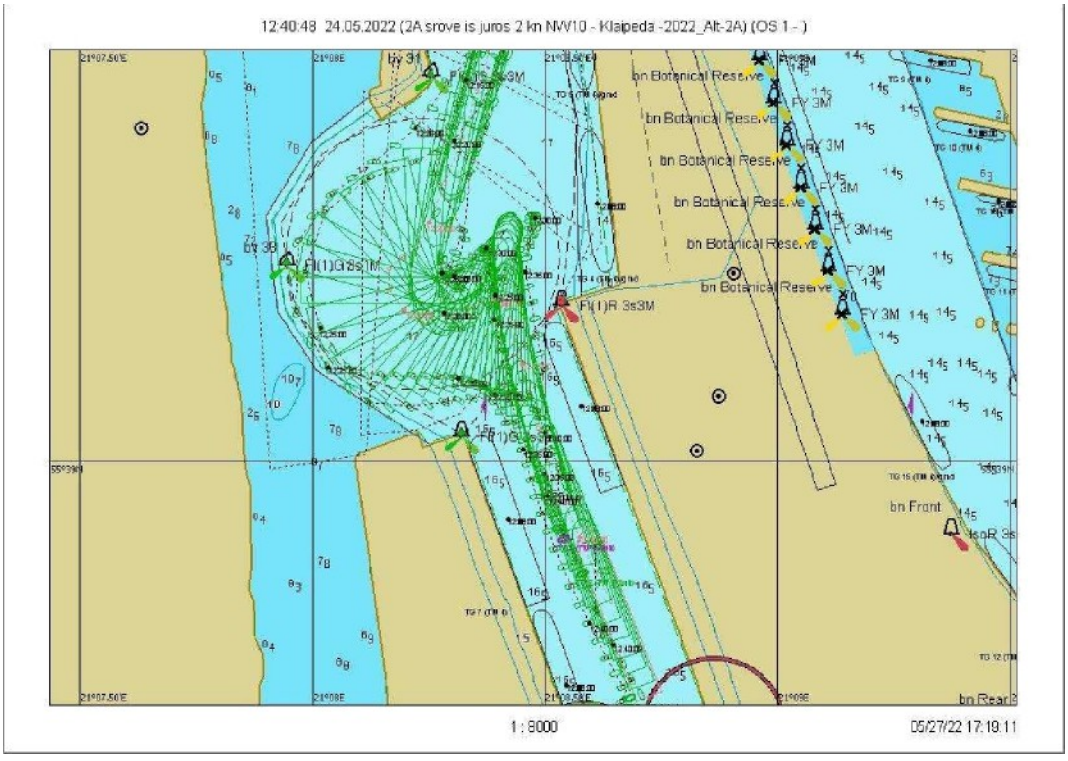
7.1.71 Fig. Voyage 1 2.1 – Ship's turning trajectory

Scenario 12. {Sailing: wind NW/10 m/s, current from the sea 2 knots

Sailing 12.2



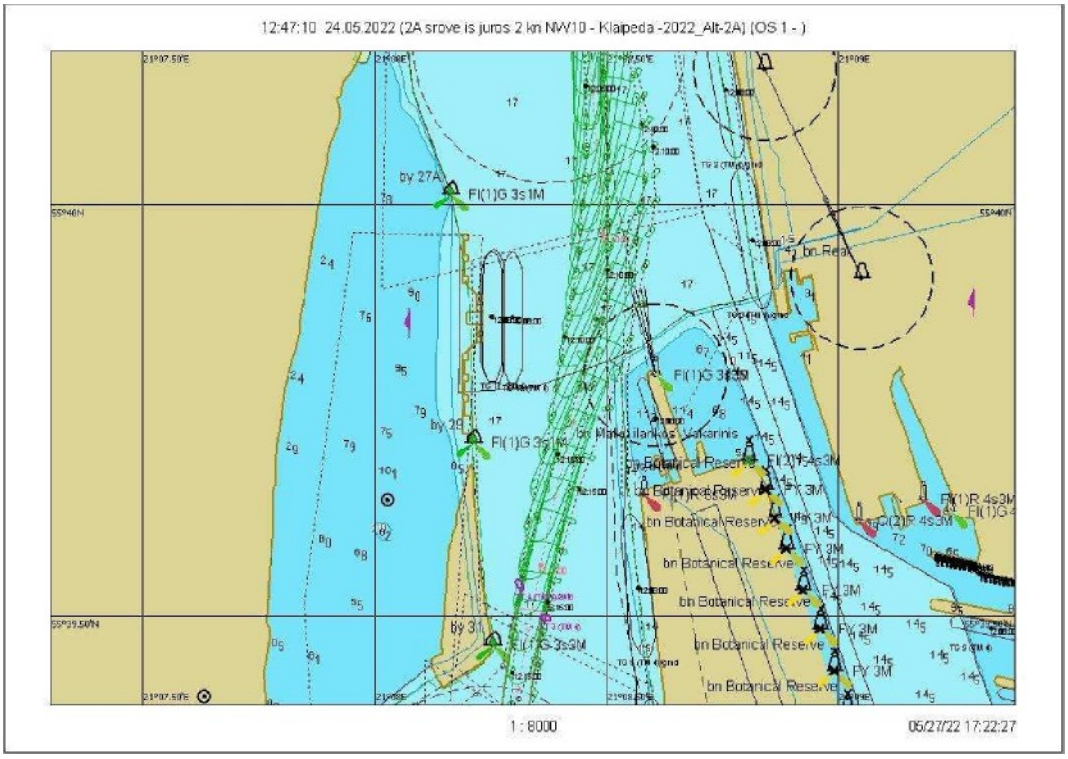
7.1.72 Fig. Voyage 12.2 – Graphical representation of the voyage from buoy No. 27A to No. 31



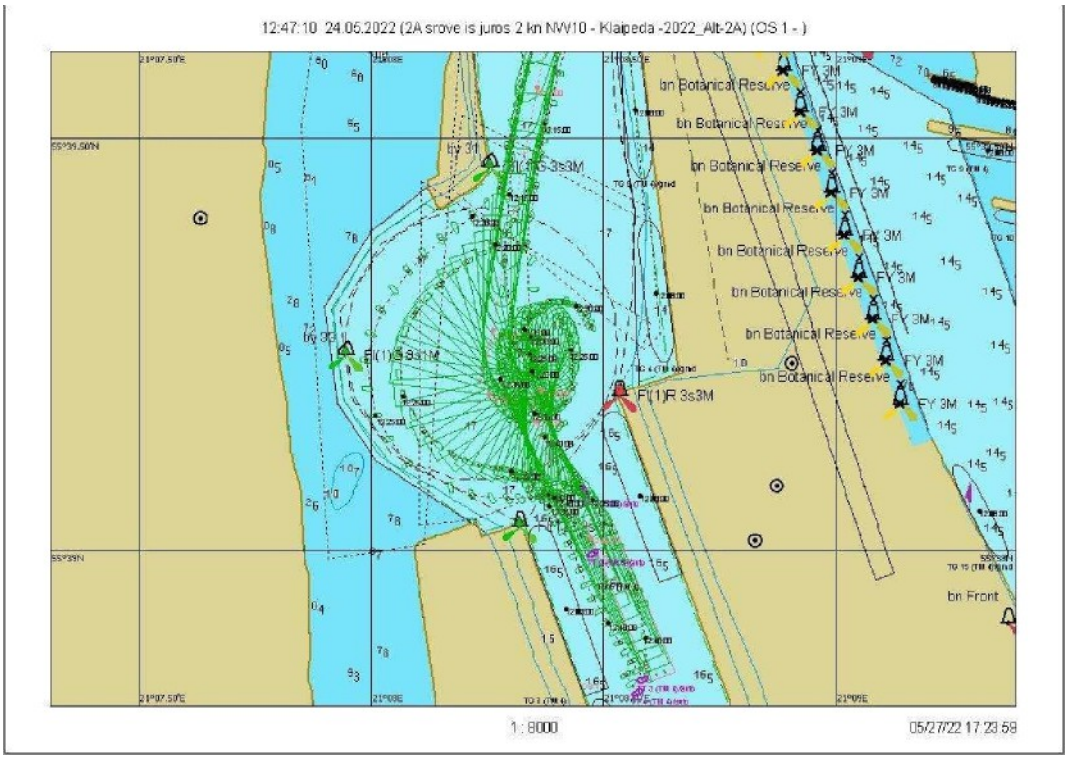
7.1.73 Fig. Course 12.2 - Ship turning trajectory

Scenario 12. {Sailing: wind NW/10 m/s, current from the sea 2 knots

Sailing 12.3



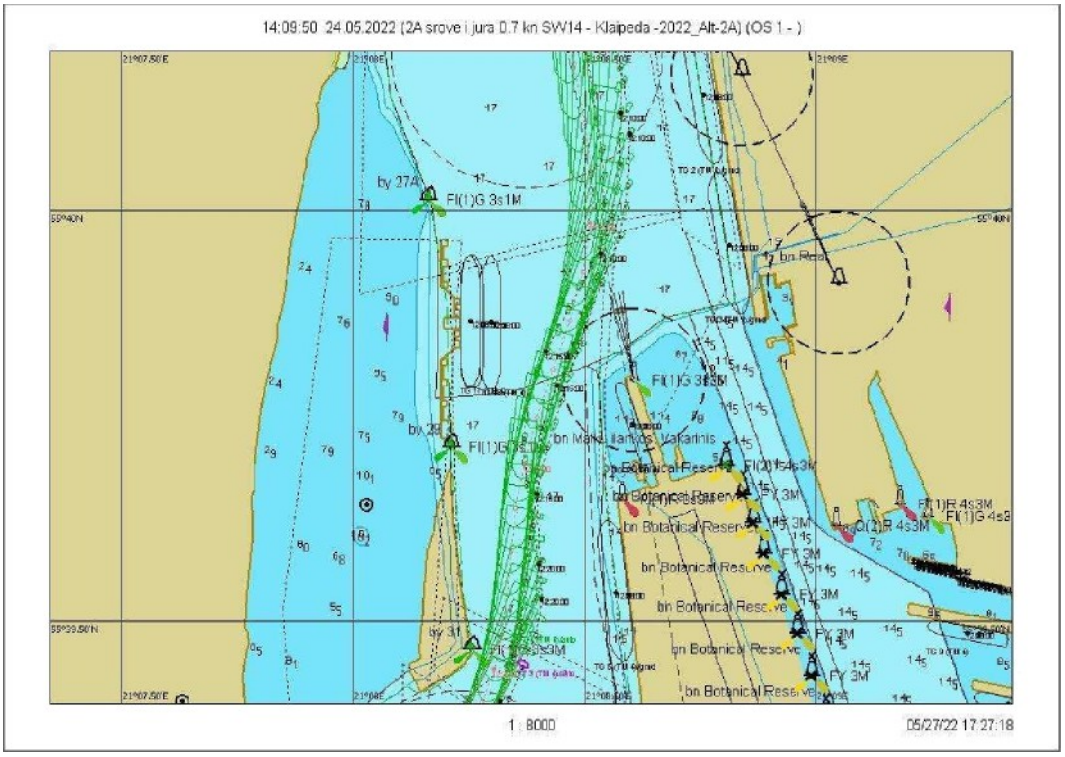
7.1.74 Fig. Voyage 12.3 - Graphical representation of the voyage from buoy No. 27A to No. 31



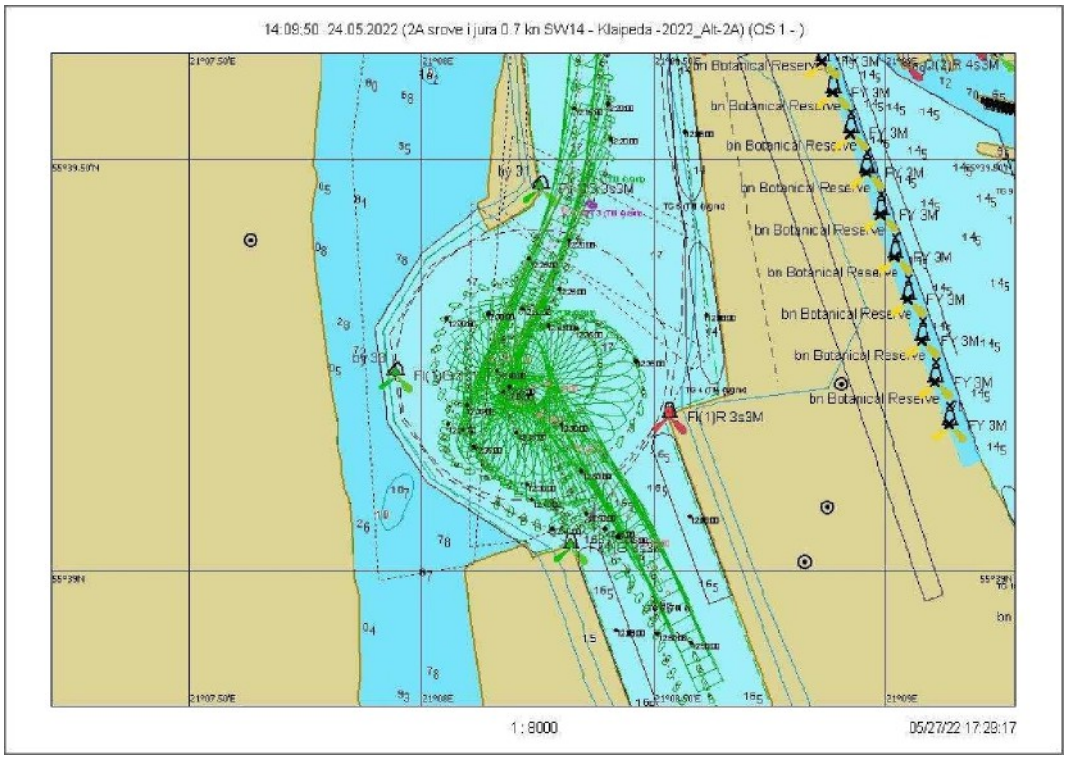
7.1.75 Fig. Course 12.3 - Ship turning trajectory

Scenario 13. Sailing: wind SW/14 m/s, current 0.7 knots

Sailing 13.1



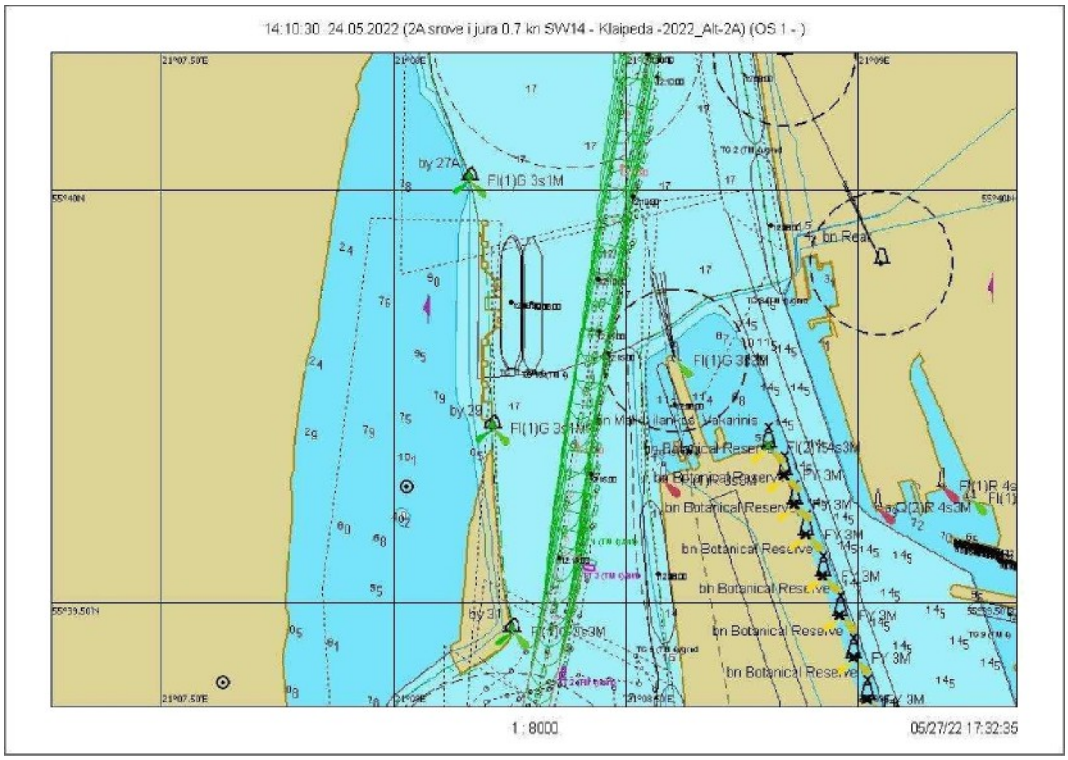
7.1.76 Fig. Course 13.1 - Graphical representation of the course from buoy No. 27A to No. 31



7.1.77 Fig. Course 13.1 - Ship turning trajectory

Scenario 13. Sailing: wind SW/14 m/s, current 0.7 knots

Sailing 13.2



7.1.78 Fig. Course 13.2 - Graphical representation of the course from buoy No. 27A to No. 31

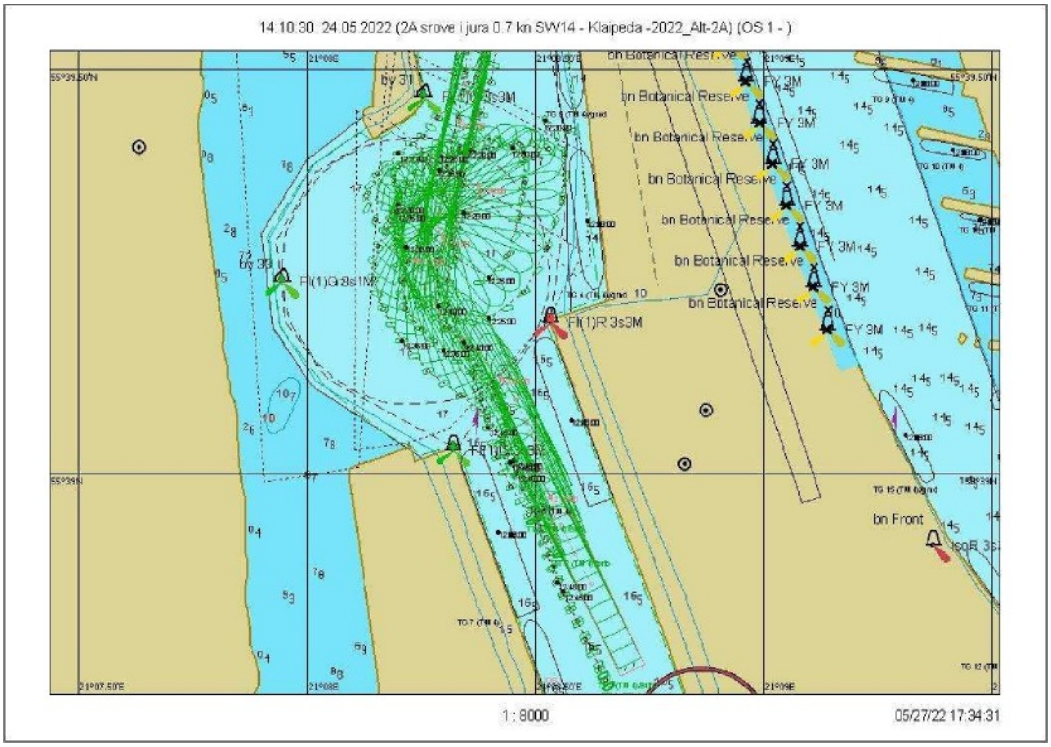
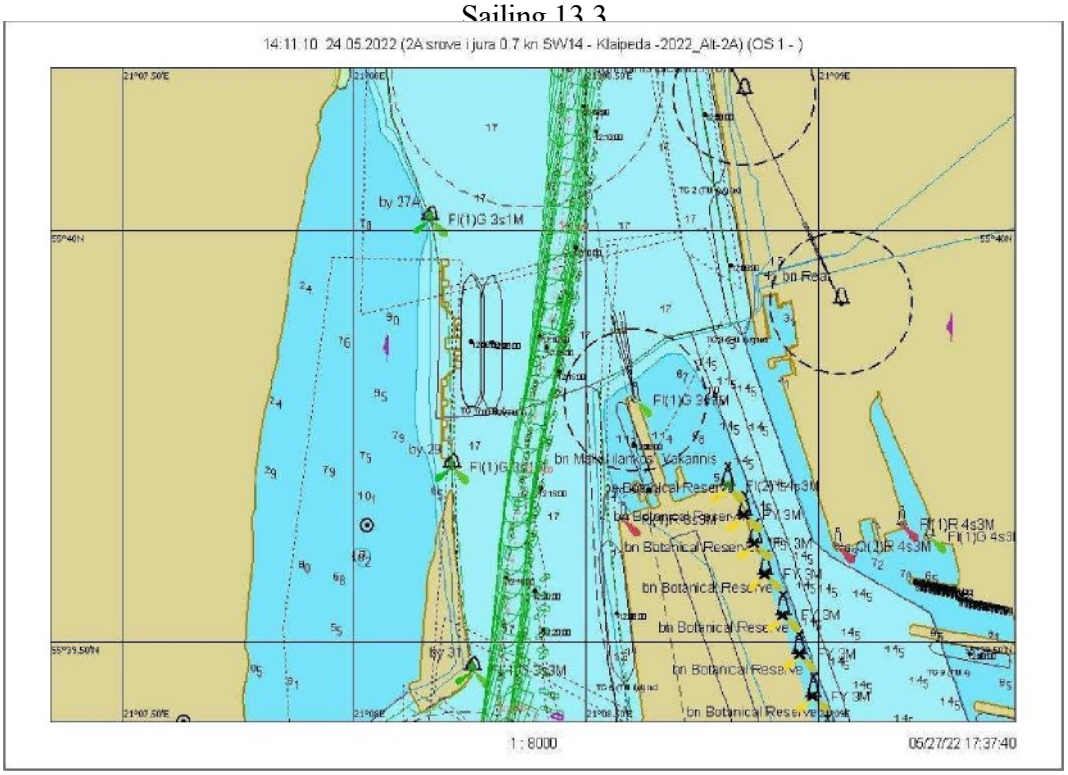


Fig. 7.1.79. Voyage 13.2 – Ship's turning trajectory

Scenario 13. Sailing: wind SW/14 m/s, current toward the shore 0.7 knots

Sailing 13.3



7.1.80 Fig. Course 13.3 - Graphical representation of the course from buoy No. 27A to No. 31

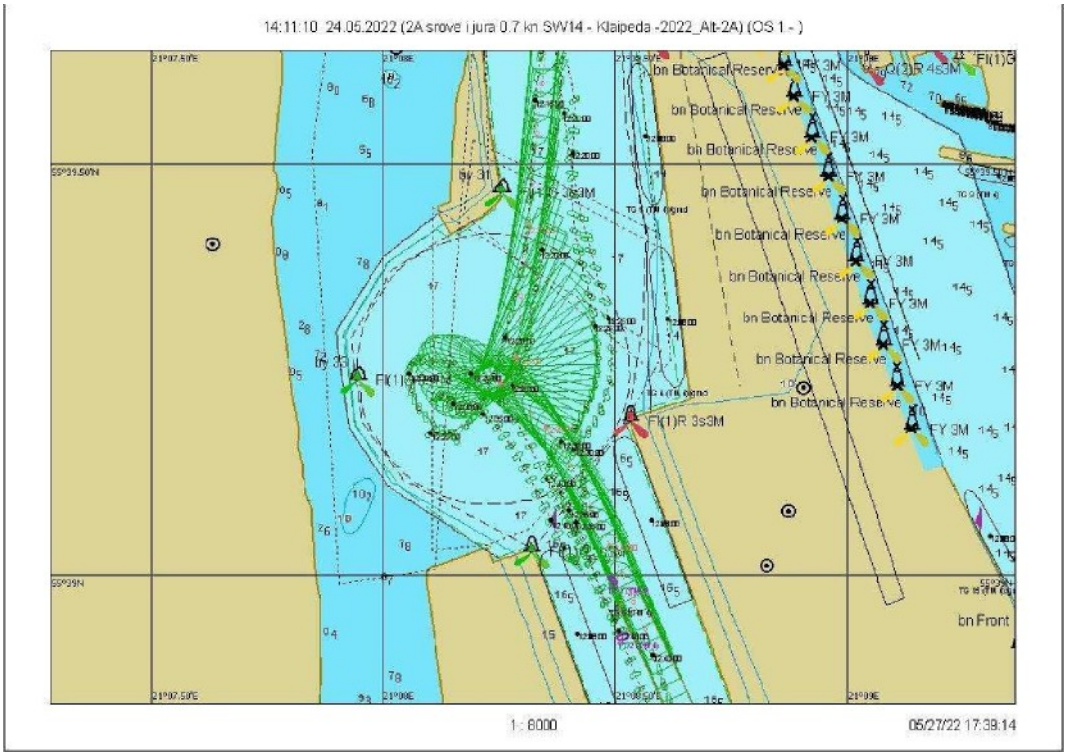


Fig. 7.1.81. Voyage 13.3 – Ship's turning trajectory

Scenario 14. {Sailing: wind W/14 m/s, current ¡ jfirą 0.7 knots

Sailing 14.1

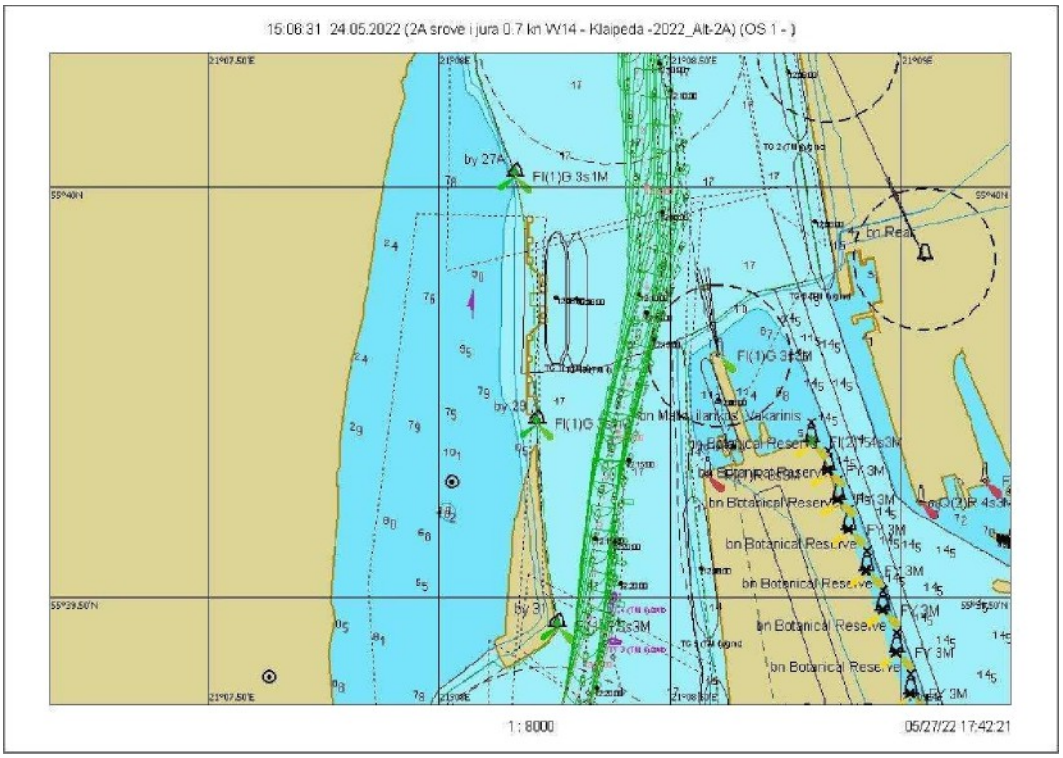


Fig. 7.1.82. Course 14.1 – graphical representation of the course from buoy No. 27A to No. 31

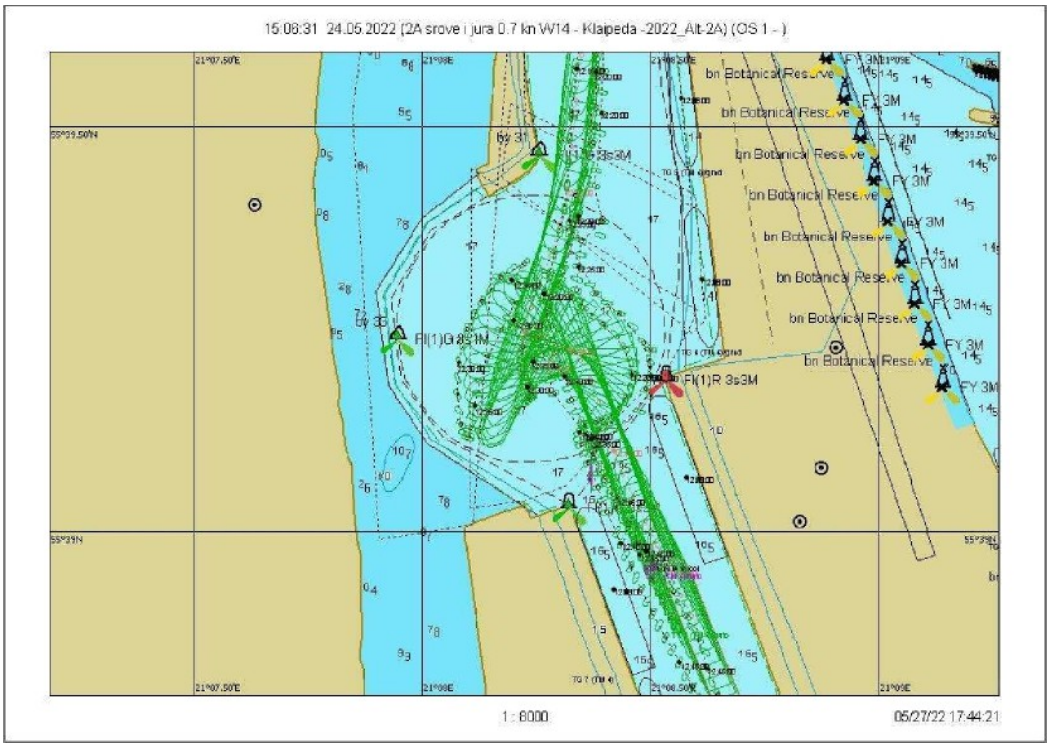


Fig. 7.1.83. Maneuver 14.1 – Ship Turning Trajectory

Scenario 14. {Sailing: wind W/14 m/s, current ¡ jfirą 0.7 knots

Sailing 14.2

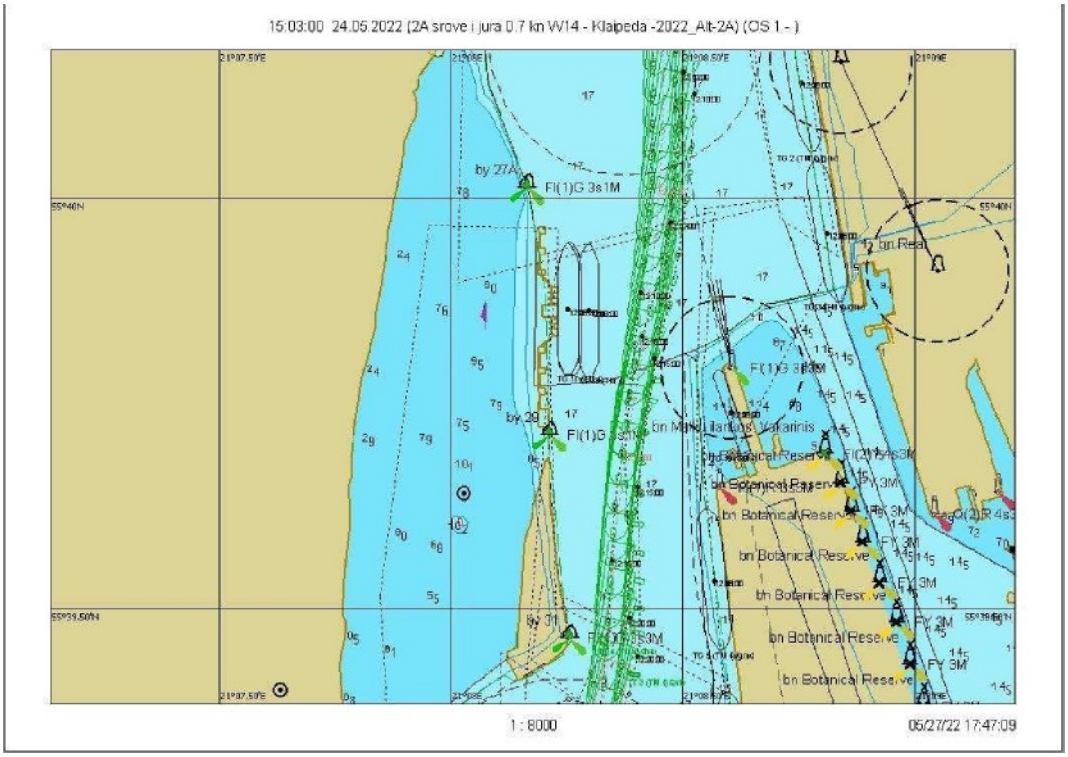


Fig. 7.1.84. Course 14.2 – graphical representation of the course from buoy No. 27A to No. 31

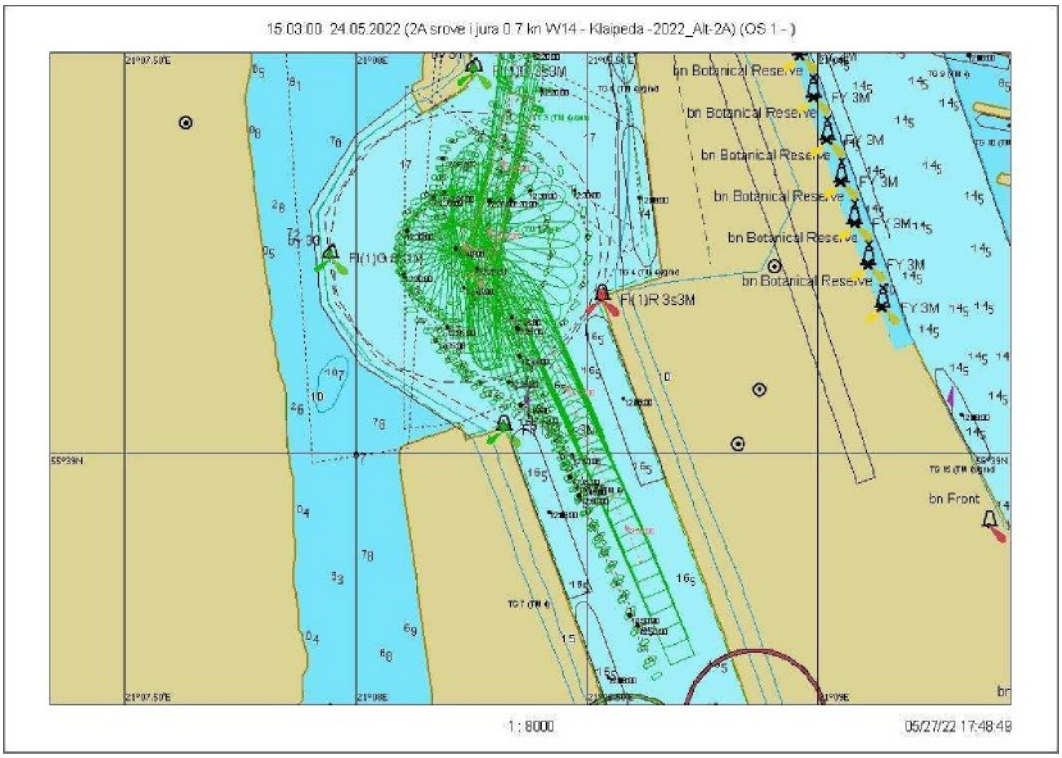


Fig. 7.1.85. Maneuver 14.2 – Ship Turning Trajectory

Scenario 14. {Sailing: wind W/14 m/s, current į jfirą 0.7 knots

Sailing 14.3

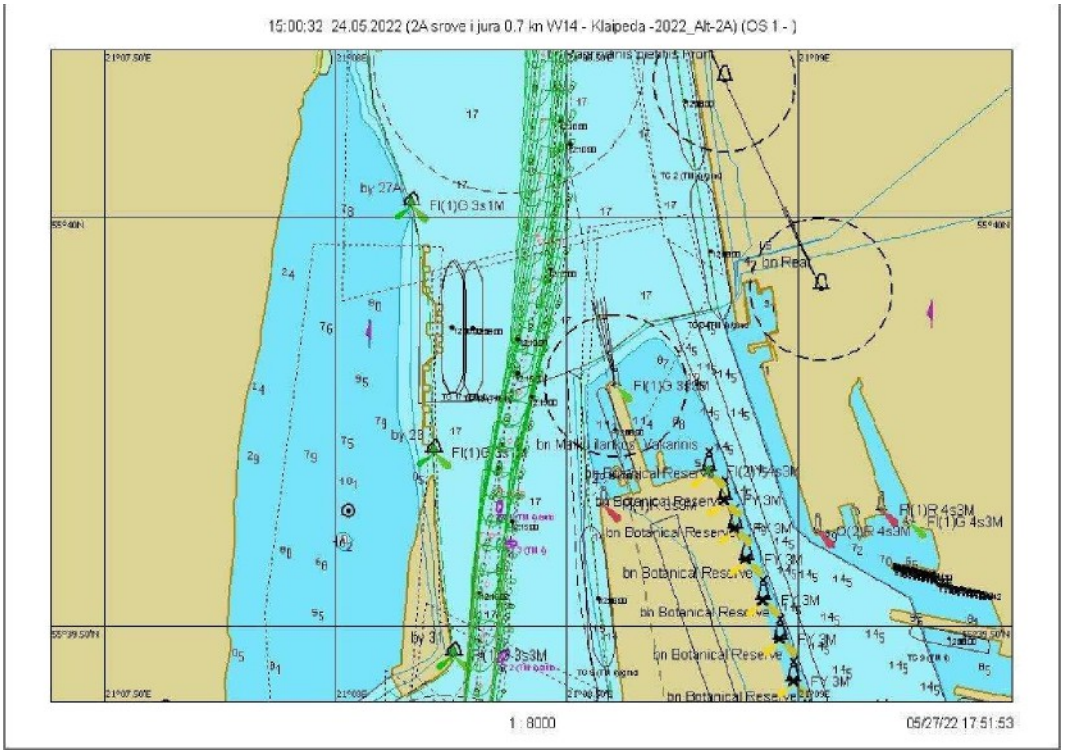


Fig. 7.1.86. Course 14.3 – graphical representation of the course from buoy No. 27A to No. 31

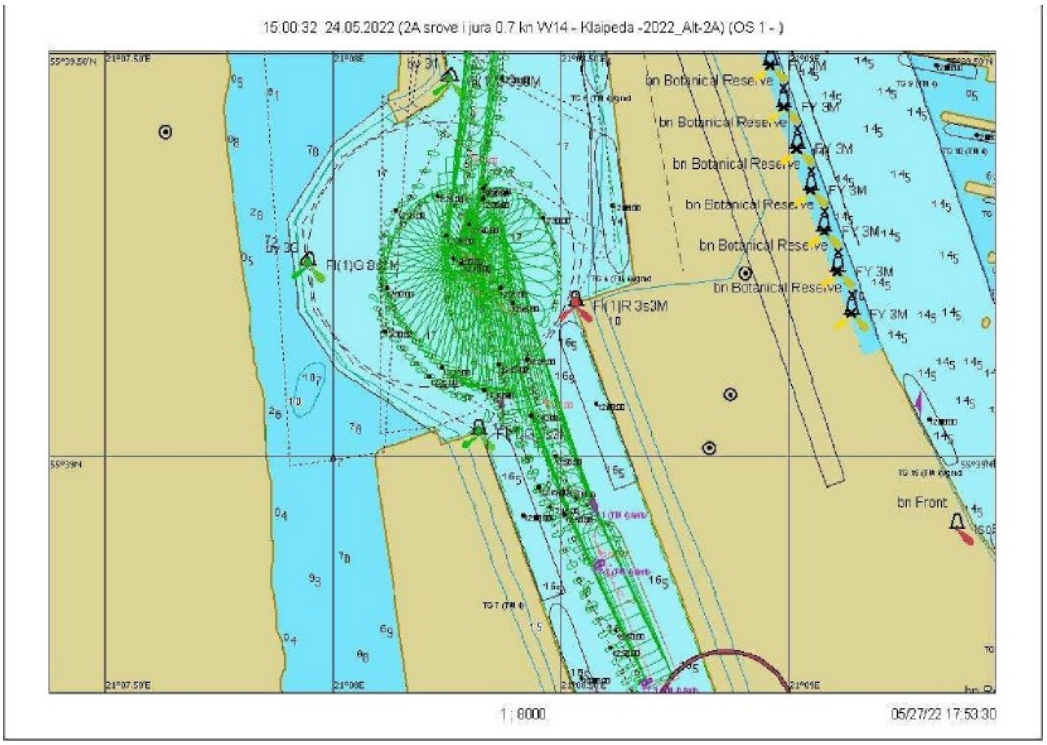


Fig. 7.1.87. Maneuver 14.3 – Ship's turning trajectory

Scenario 15. Sailing: wind SW/14 m/s, current 1.5 knots

Sailing 15.1

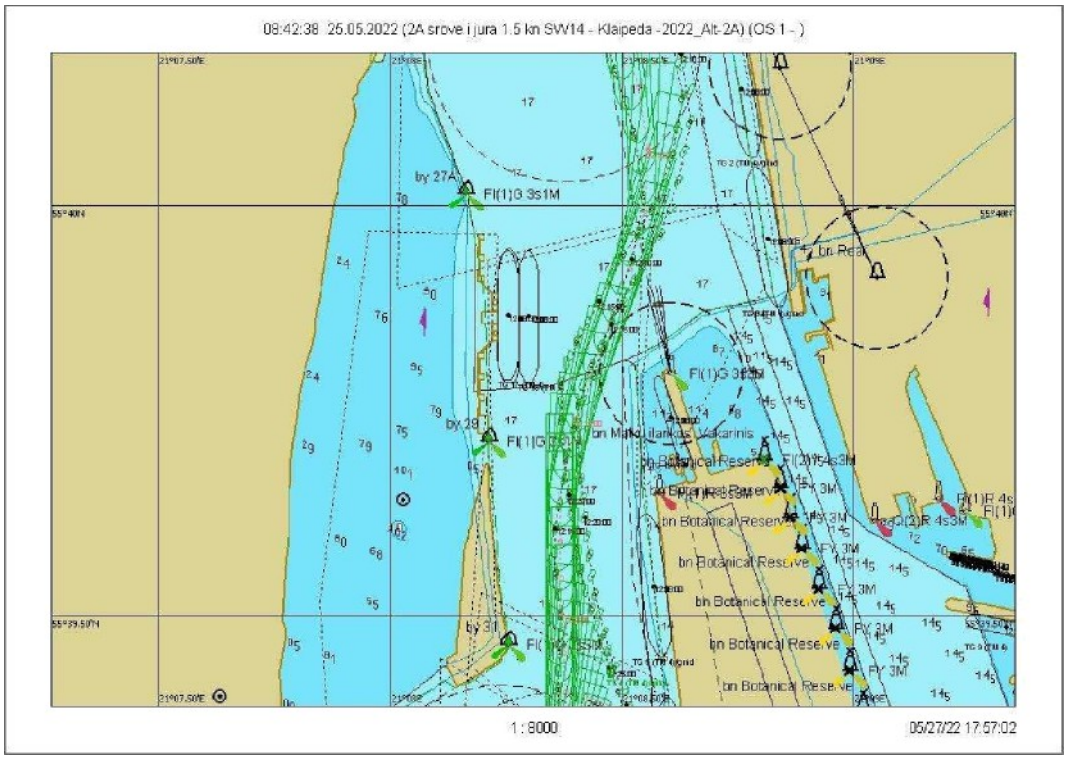


Fig. 7.1.88. Course 15.1 – graphical representation of the course from buoy No. 27A to No. 31

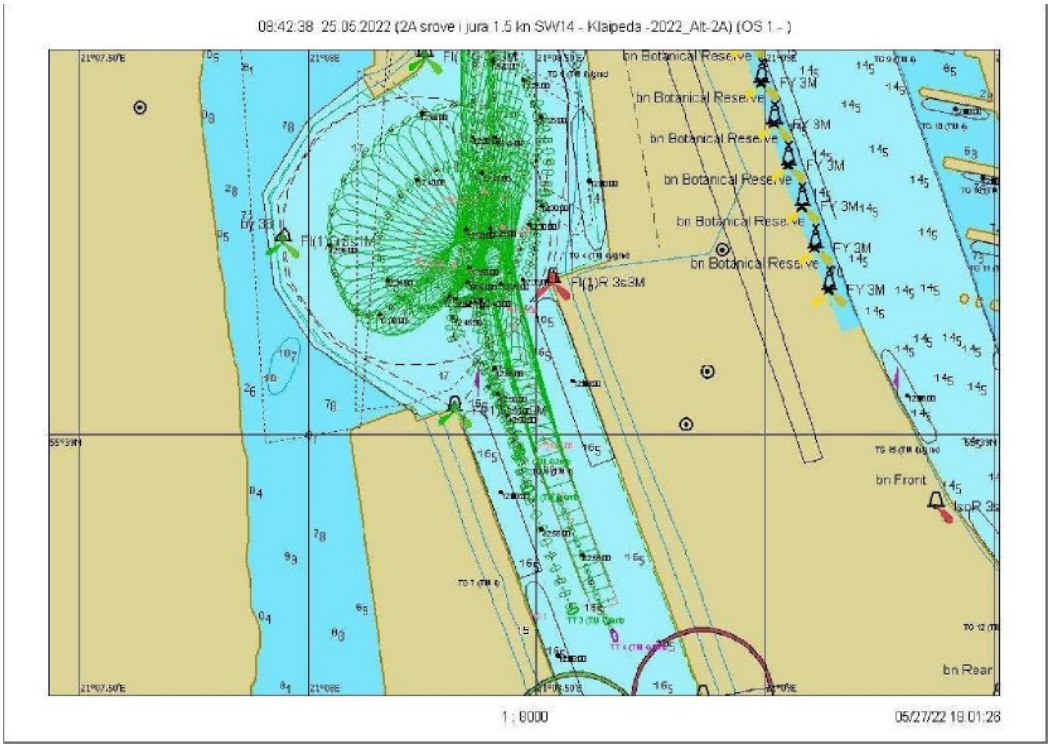


Fig. 7.1.89. Maneuver 15.1 – Ship's turning trajectory

Scenario 15. Sailing: wind SW/14 m/s, current 1.5 knots

Sailing 15.2

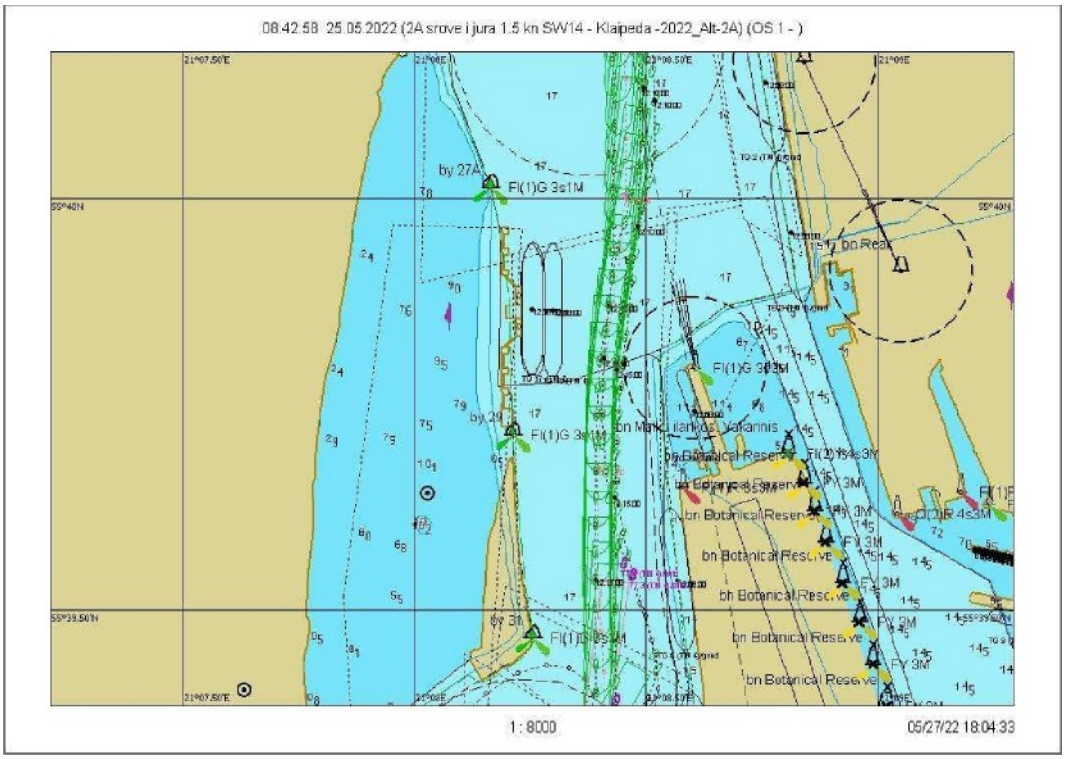


Fig. 7.1.90. Course 15.2 – graphical representation of the course from buoy No. 27A to No. 31

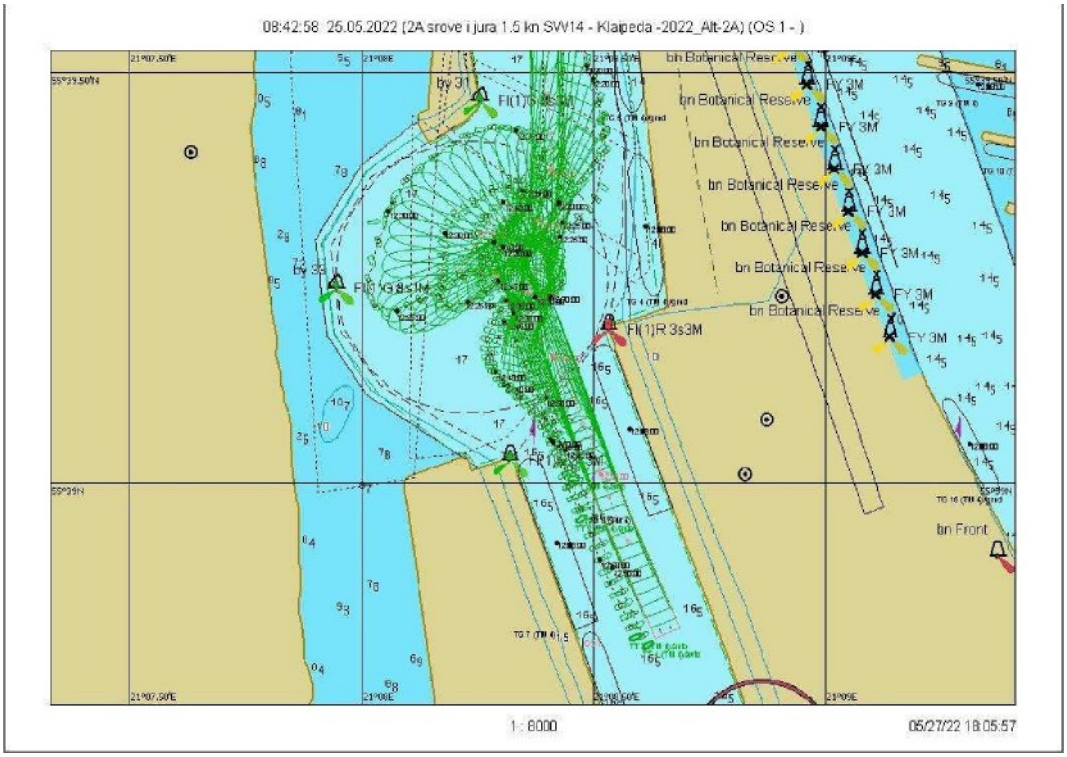


Fig. 7.1.91. Maneuver 15.2 – Ship's turning trajectory

Scenario 15. Sailing: wind SW/14 m/s, current 1.5 knots

Sailing 15.3

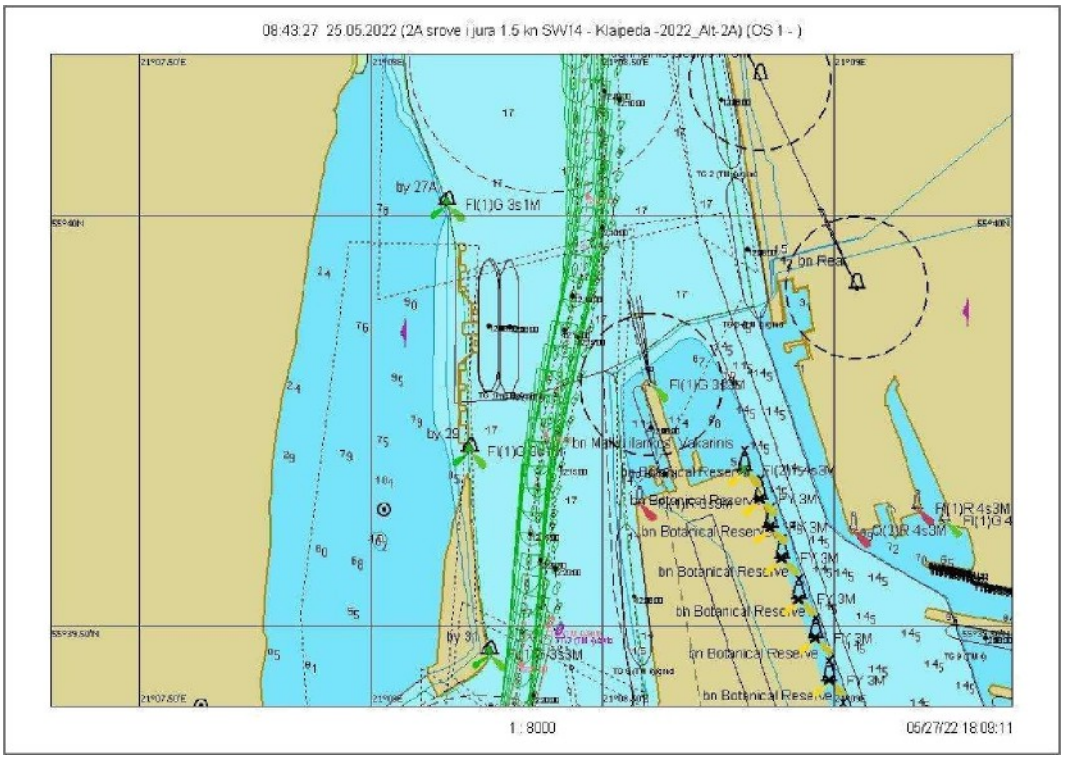


Fig. 7.1.92. Course 15.3 – graphical representation of the course from buoy No. 27A to No. 31

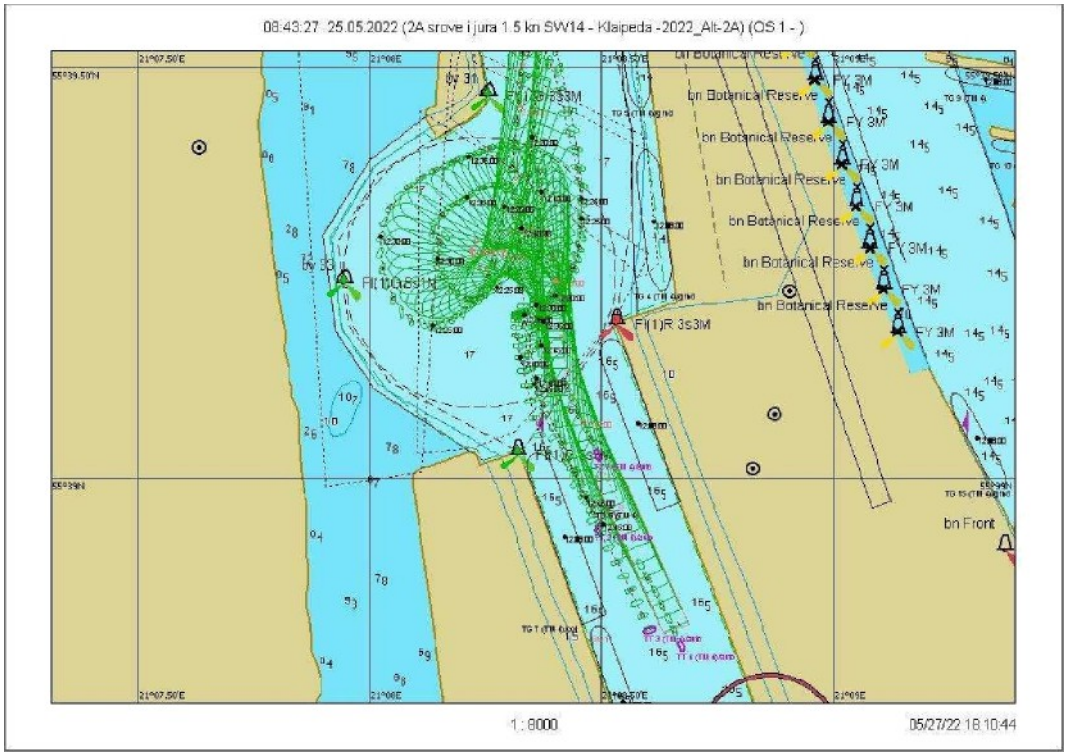


Fig. 7.1.93. Run 1 5.3 – Ship Turning Trajectory

Scenario 16. {Sailing: wind W/14 m/s, current ¡ 1.5 knots

Sailing 16.1

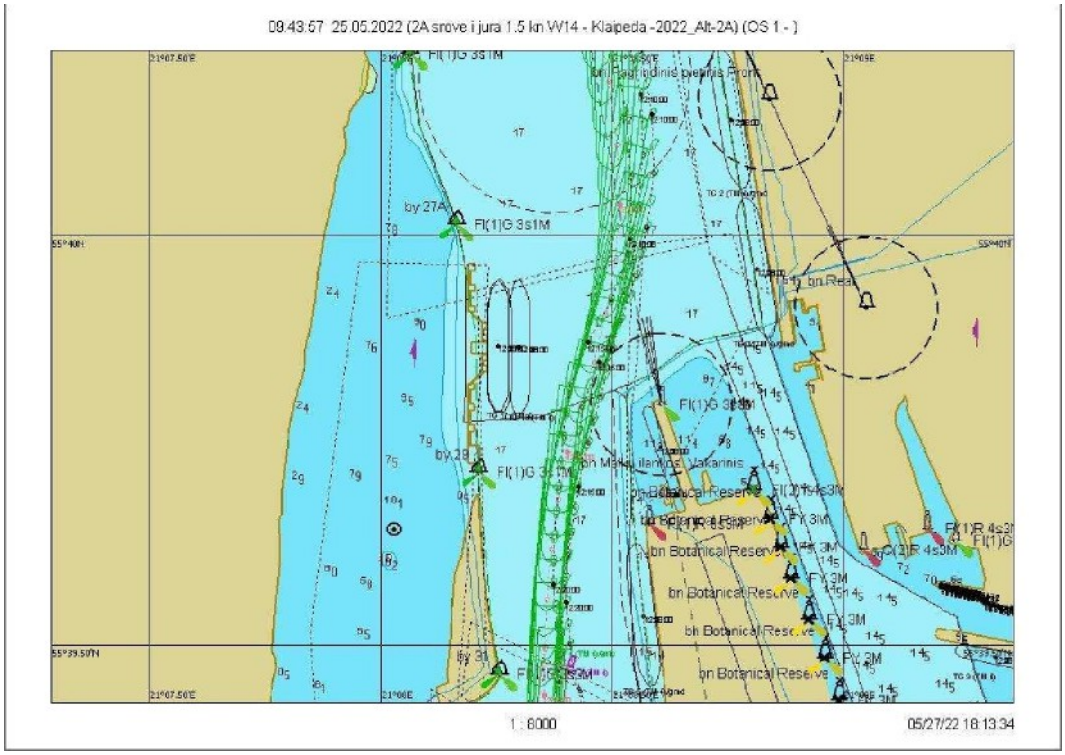


Fig. 7.1.94. Course 16.1 – graphical representation of the course from buoy No. 27A to No. 31

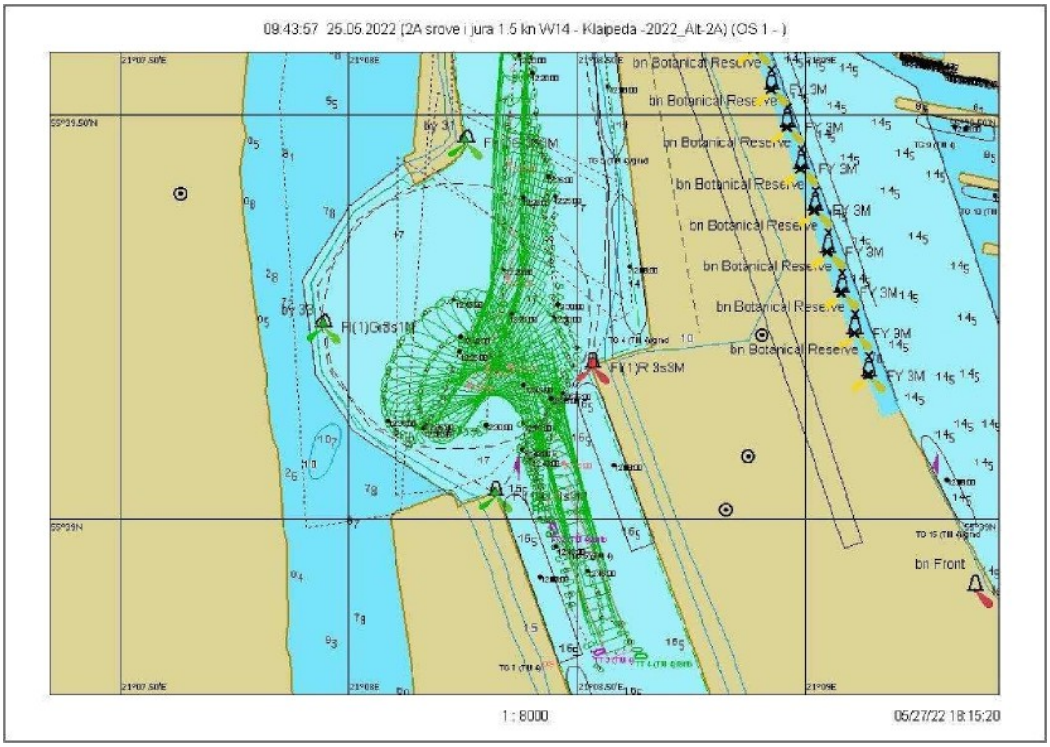


Fig. 7.1.95. Maneuver 16.1 – Ship Turning Trajectory

Scenario 16. {Sailing: wind W/14 m/s, current ¡ 1.5 knots

Sailing 16.2

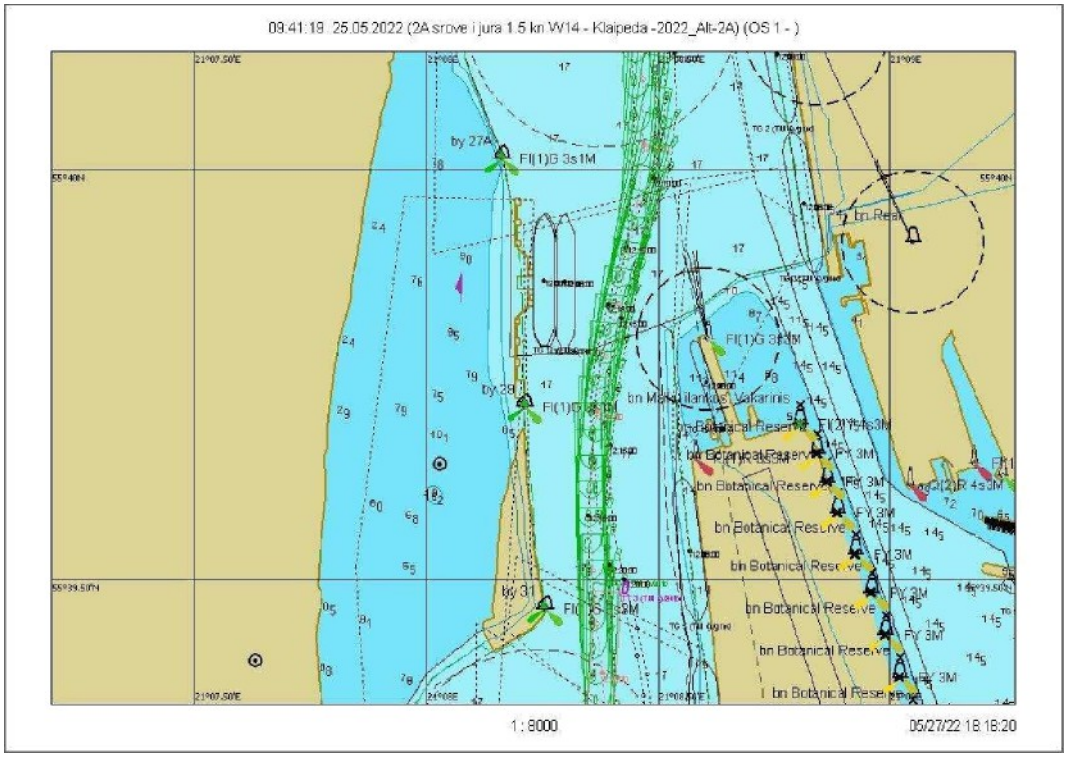


Fig. 7.1.96. Course I 6.2 – graphical representation of the course from buoy No. 27A to No. 31

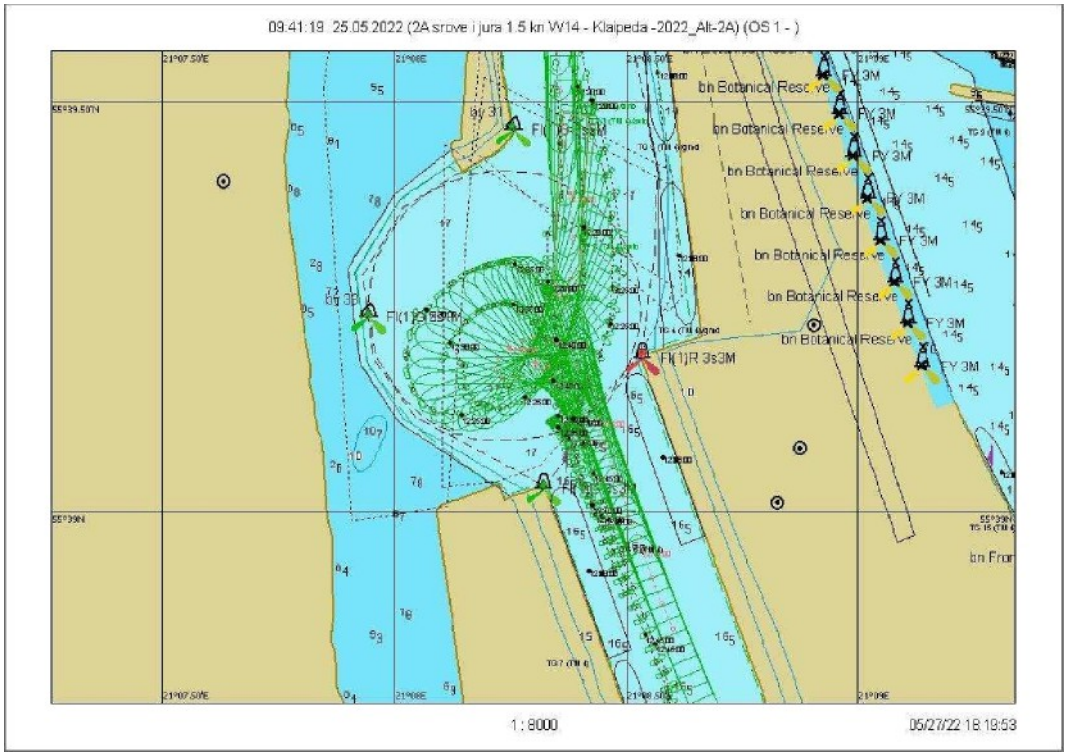


Fig. 7.1.97. Run 1 6.2 – Ship turning trajectory

Scenario 16. {Sailing: wind W/14 m/s, current ¡ jfirą 1.5 knots

Sailing 16.3

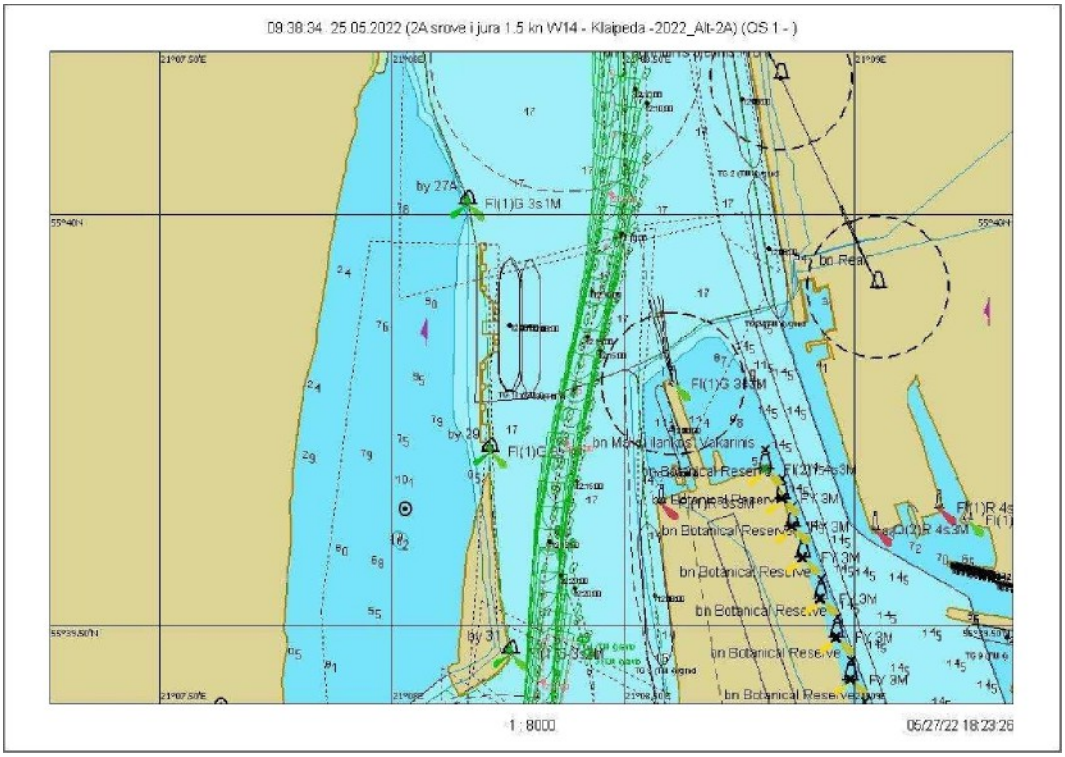


Fig. 7.1.98. Course 16.3 – graphical representation of the course from buoy No. 27A to No. 31

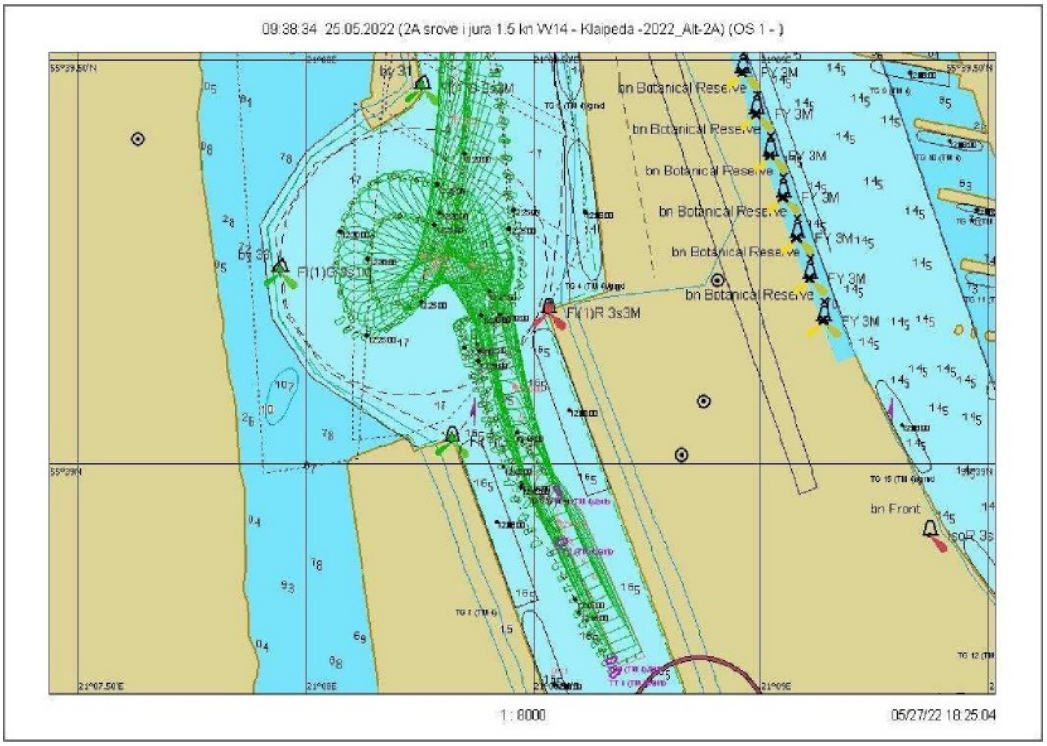


Fig. 7.1.99. Run 1 6.3 – Ship Turning Trajectory

Scenario 16. {Sailing: wind W/14 m/s, current ¡ jfirą 1.5 knots

Sailing 16.4 (on a shoal)

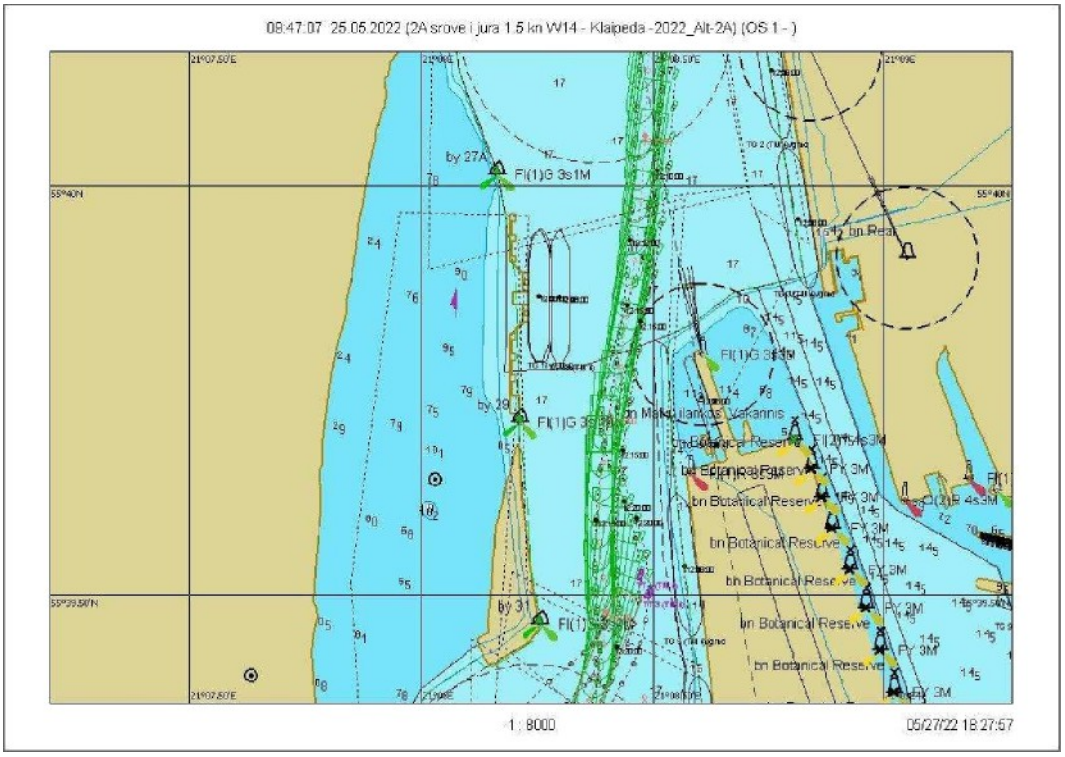


Fig. 7.1.100. Course 16.4 – graphical representation of the course from buoy No. 27A to No. 31

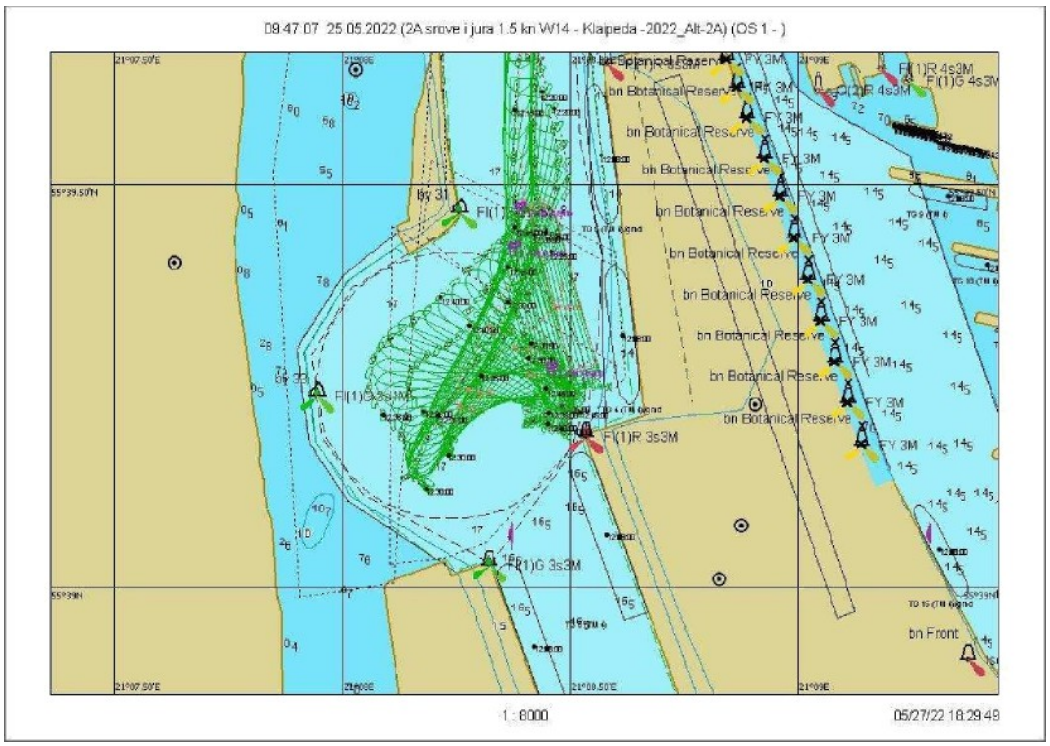


Fig. 7.1.101. Course 1 6.4 – Ship's turning trajectory

Scenario 17. {Sailing: wind SW/14 m/s, current} 2 knots

Sail 17.1 (collision with a ship)

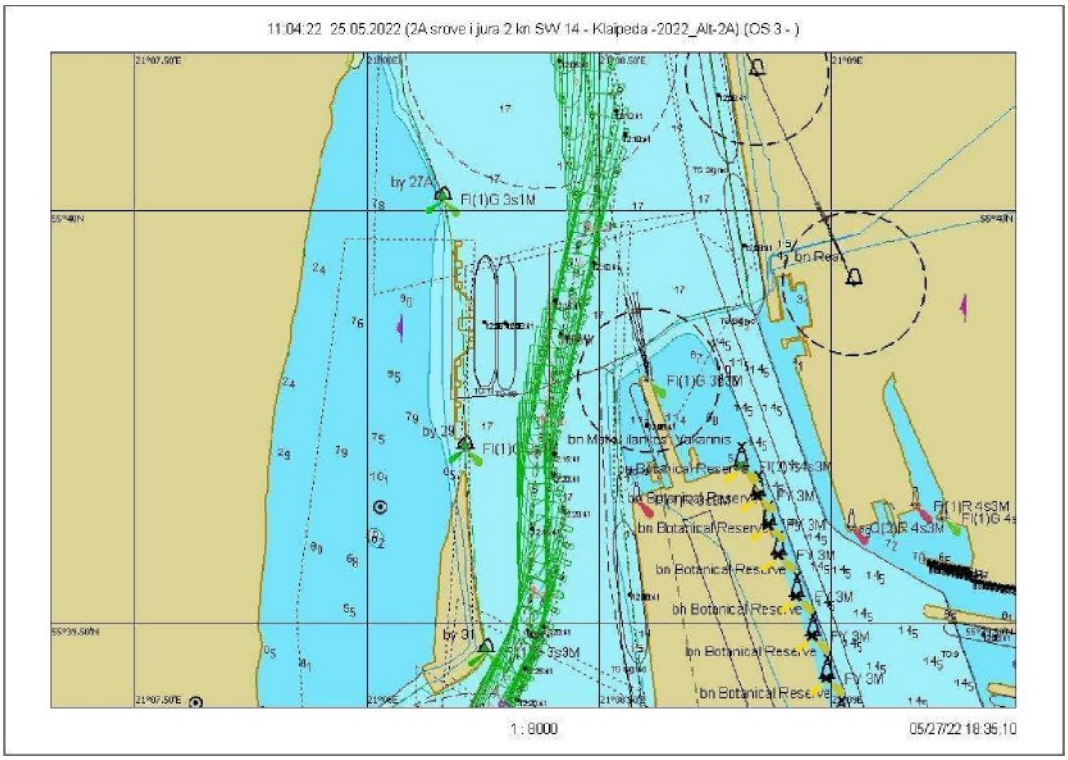


Fig. 7.1.102. Course 17.1 – graphical representation of the course from buoy No. 27A to No. 31

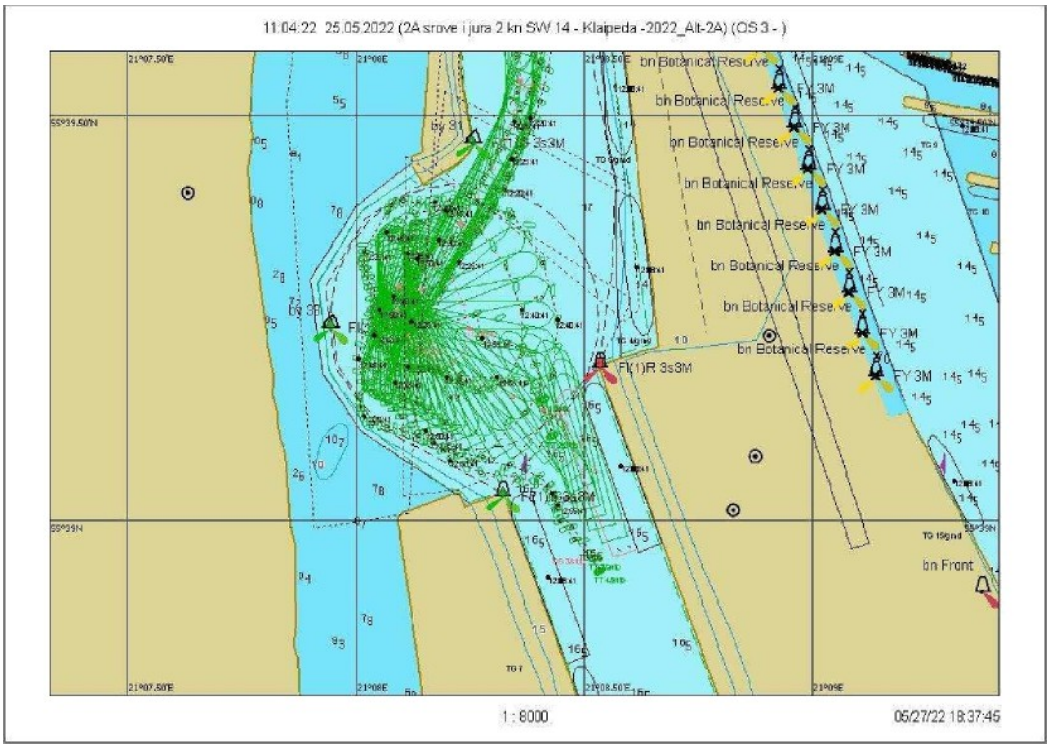


Fig. 7.1.103. Maneuver 17.1 – Ship's turning trajectory

Scenario 17. {Sailing: wind SW/14 m/s, current} 2 knots

Sailing 17.2

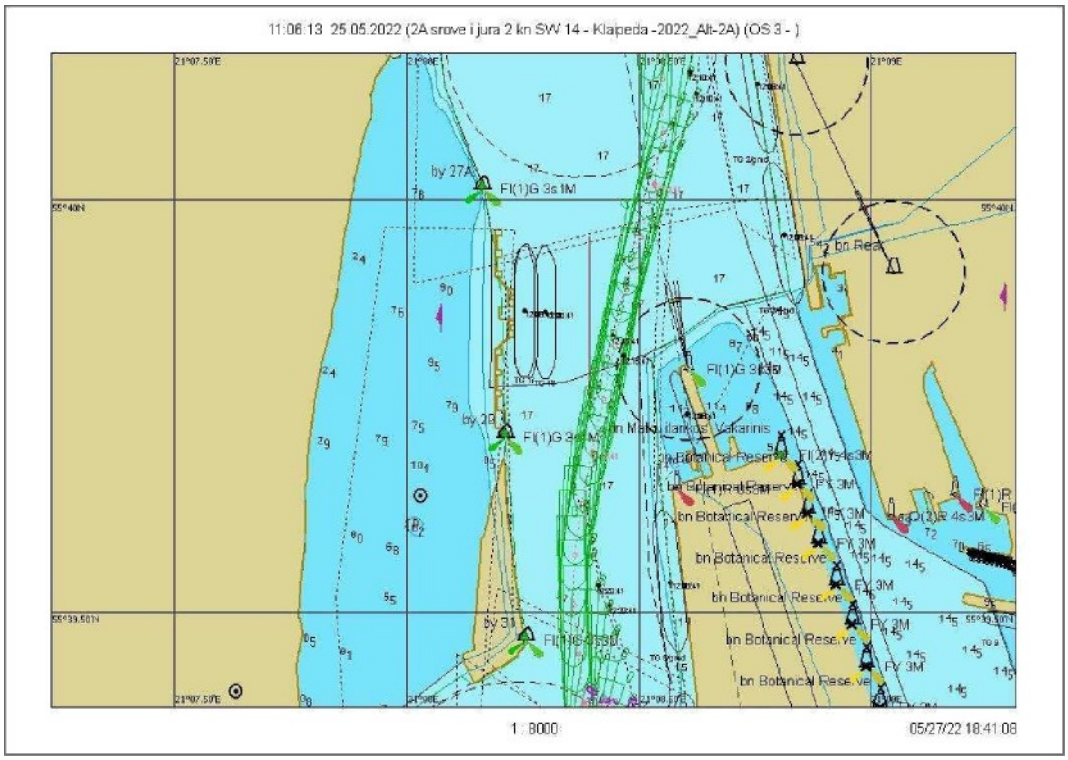


Fig. 7.1.104. Course 17.2 – graphical representation of the course from buoy No. 27A to No. 31

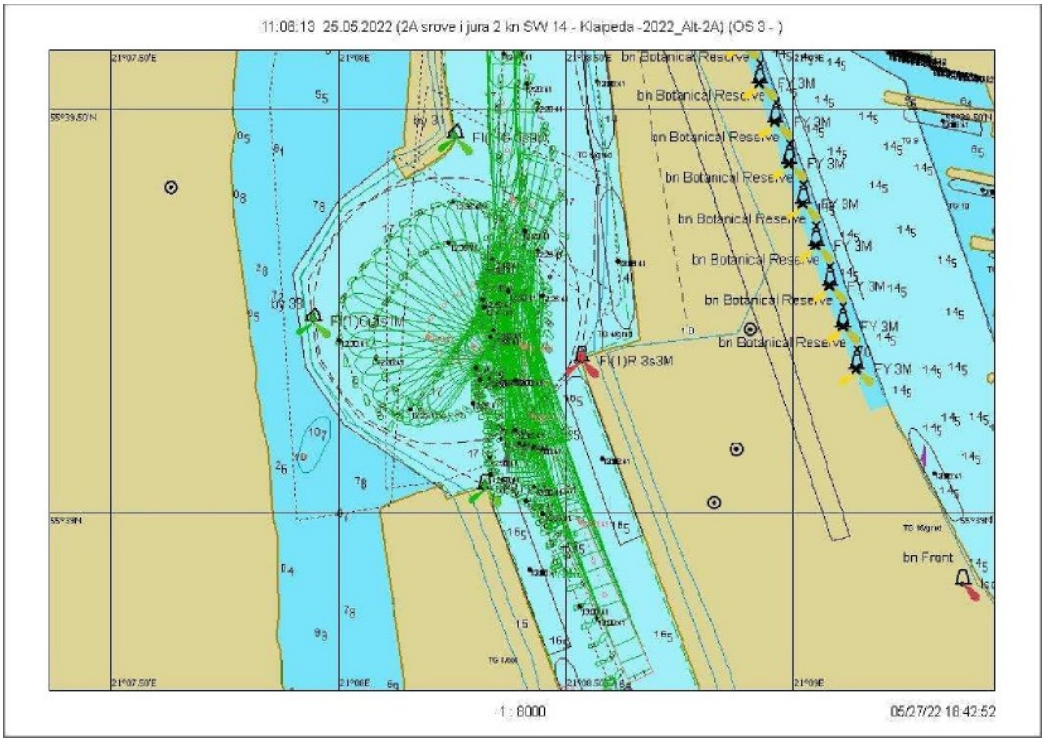


Fig. 7.1.105. Maneuver 17.2 – Ship Turning Trajectory

Scenario 17. {Sailing: wind SW/14 m/s, current} 2 knots

Sail 17.3

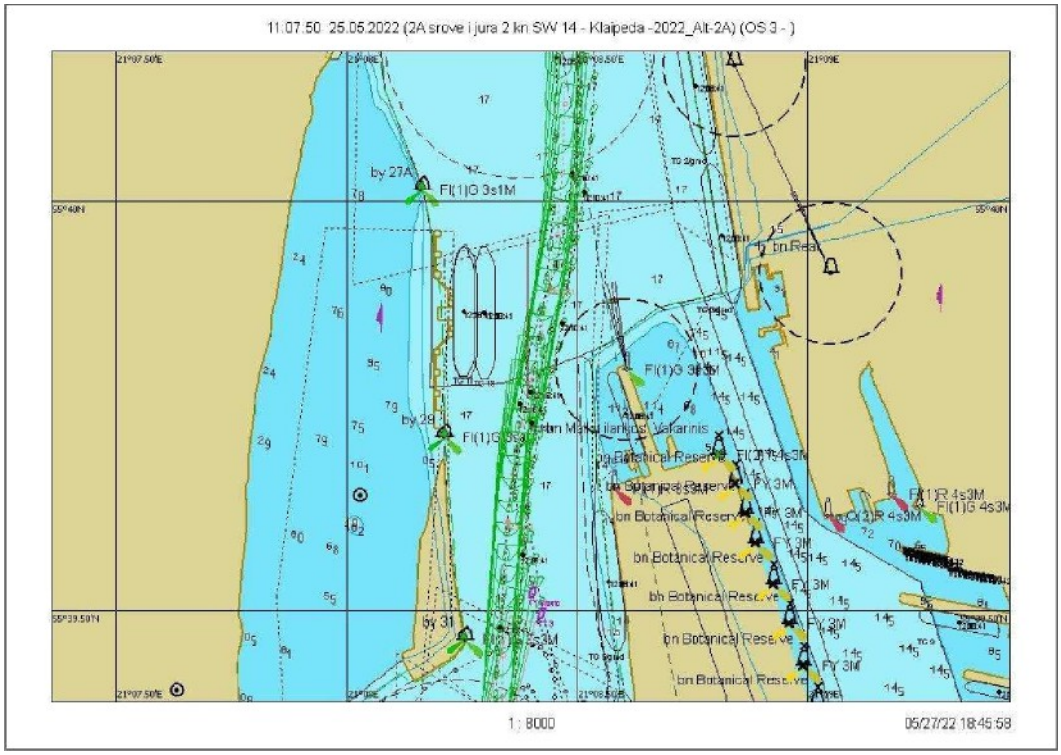


Fig. 7.1.106. Course 17.3 – graphical representation of the course from buoy No. 27A to No. 31

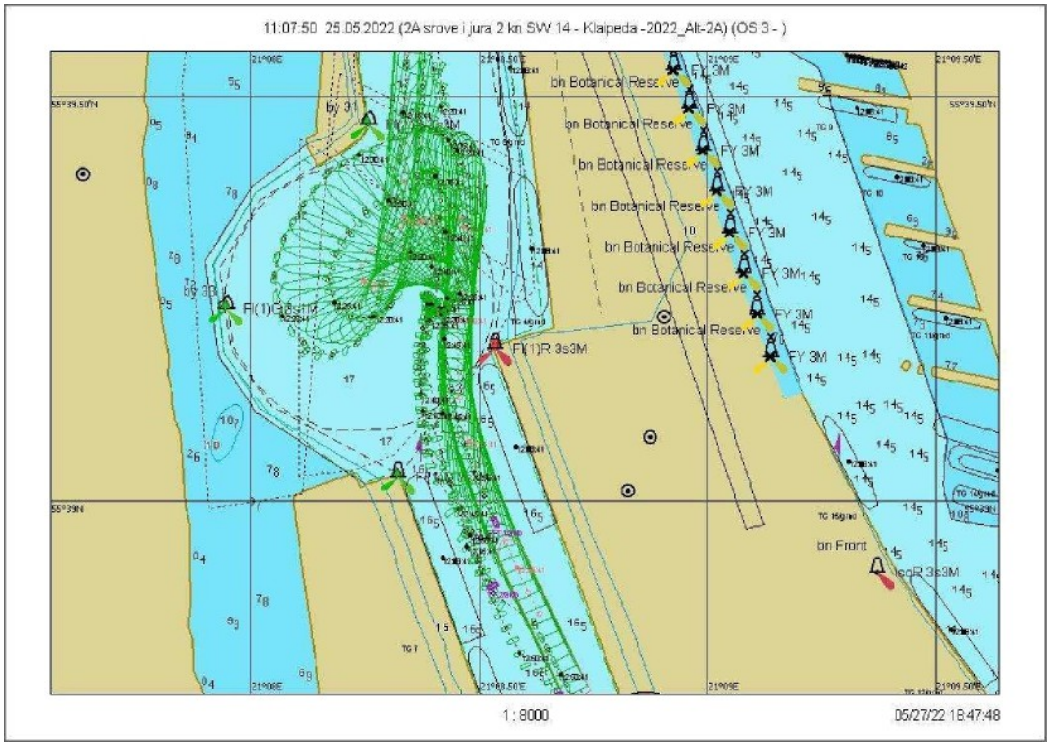


Fig. 7.1.107. Maneuver 17.3 – Ship Turning Trajectory

Scenario 17. {Sailing: wind SW/14 m/s, current} 2 knots

Sailing 17.4

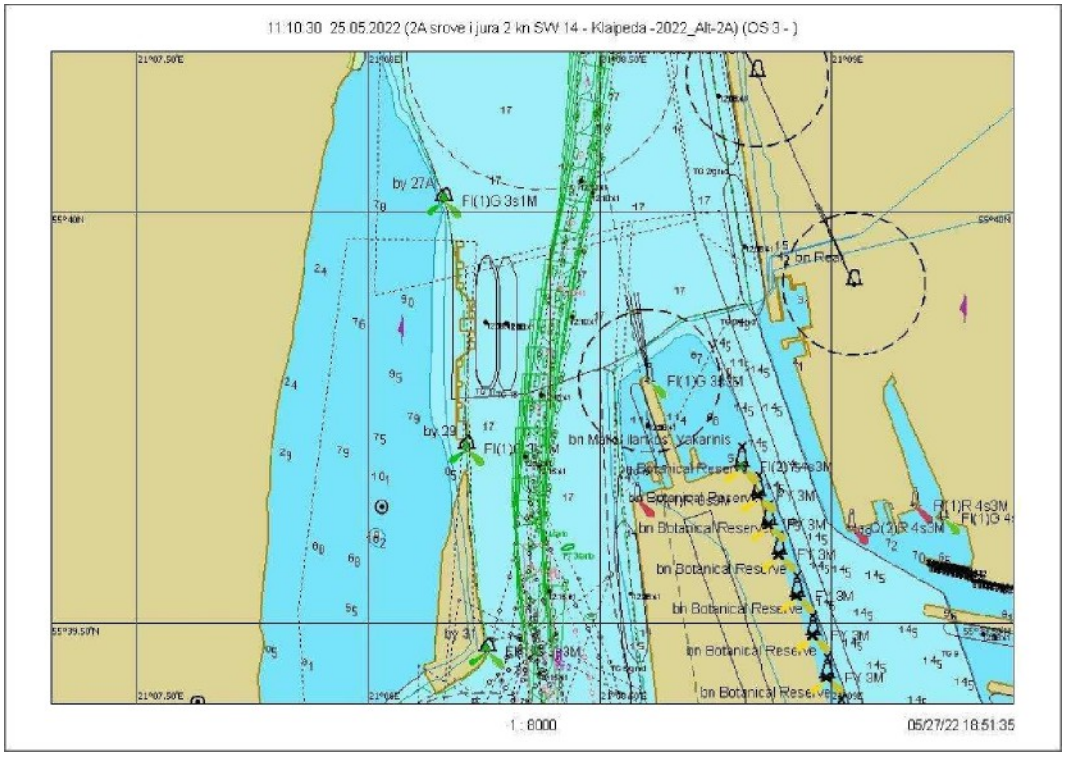


Fig. 7.1.108. Course 17.4 – graphical representation of the course from buoy No. 27A to No. 31

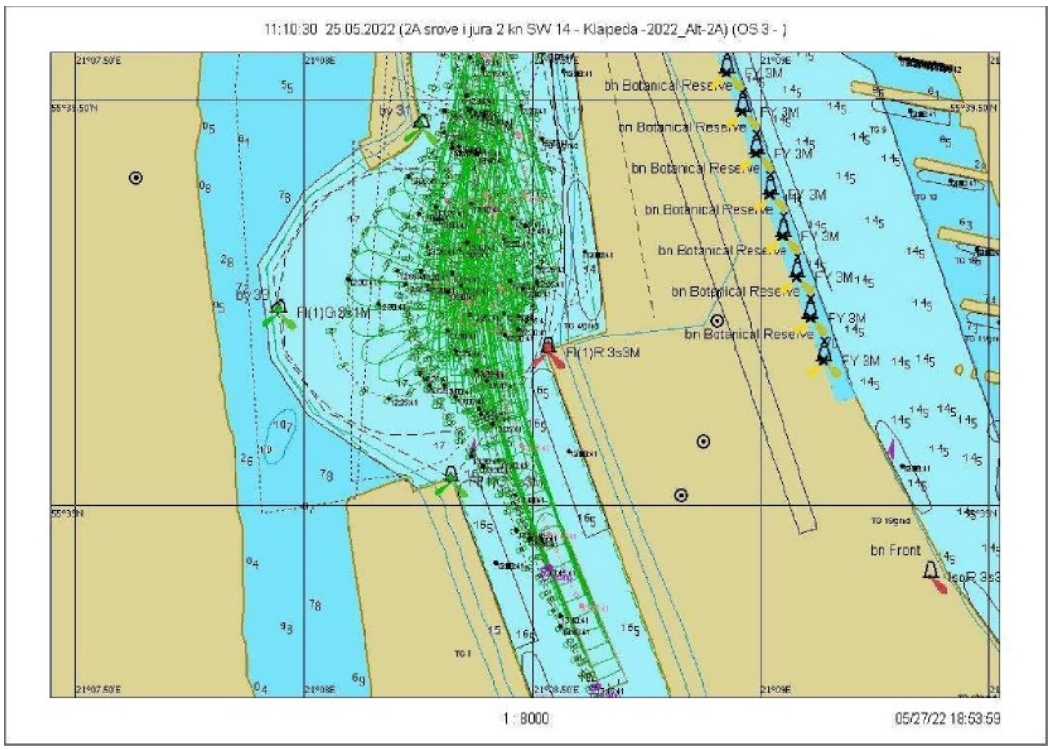


Fig. 7.1.109. Maneuver 17.4 – Ship Turning Trajectory