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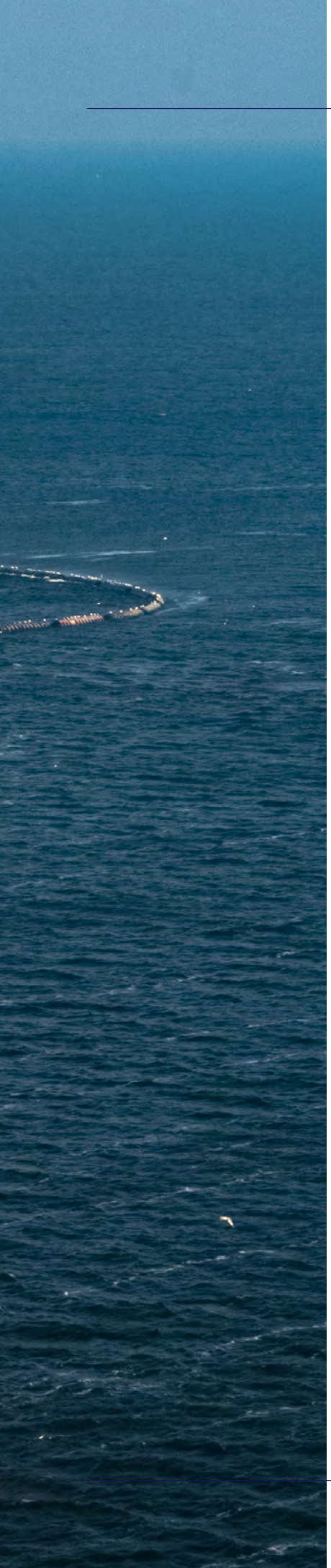
VOX AMALIA



MODERNISATION OF THE ŚWINOUJŚCIE – SZCZECIN FAIRWAY

The idea of a modern maritime access route from the Baltic Sea to the Port of Szczecin in Poland was already born towards the end of 20th century. Quay walls in the neighbouring Port of Police, built in the 80s, were already constructed to accommodate a depth of 12.5 metres and initial modernisation works commenced in the early 90s. On 28 September 2018 the "Modernisation of the Świnoujście – Szczecin Fairway to a depth of 12.5 m" became a reality with the signing of the design and build contract between the Maritime Office Szczecin and the DIVO consortium (Dredging International NV and Van Oord).

The fairway connects the two Polish ports of Szczecin and Świnoujście with the Baltic Sea. With its new dimension to a depth of 12.5 metres, it enables an effective marine transport of all types of goods from and to both cities and further, via well-established hinterland connections to the western part of Poland, Czech Republic and Slovakia.

The entire project area had been the location of intense fighting and bombing during the Second World War, which on its own, in order to guarantee the safe execution of the dredging works, proved to be a vast undertaking. However, despite this anticipated challenge as well as some exceptional events, such as working during a pandemic (COVID-19) and a difficult period of cold and ice, the ambitious project was completed on time and was handed over to the Maritime Office in Szczecin in the spring of 2022.

Design and engineering

The project was executed in a design and construct format, encompassing a wide array of design tasks, such as the fairway dredge design, two artificial islands with jetties, rock revetments, sheet piling, cable alterations, navigational aids and the implementation of a hydrometeo and Real Time Kinematic (RTK) system.

Design work in Poland is strictly regulated, permitting only certified designers to endorse design documentation. To handle the diverse range of design tasks and adhere to Polish design regulations, a consortium of Polish and Belgium design consultants was engaged. The design consortium together with designers of both dredging contractors worked together closely to complete the design.

The fairway remained open for other vessels during the marine works. This required special attention to ensure safe dredging operations, taking into account the dredging fleet deployed, without posing an obstruction to vessels calling at port. Nautical studies were performed, creating a framework of safe passing manoeuvres for other vessels during different dredging operations (dredging, sailing loaded and sailing empty). The nautical study along with clear communication with Vessel Traffic Services (VTS) and local pilots ensured safe vessel procedures and minimised delays in the dredging operations.

The dredged material was used to create two artificial islands, with diameters of approximately 1.25 kilometres and 1.8 kilometres respectively. In the north is a nature island with no infrastructure other than a jetty required to access the island for inspections. The southern "doughnut-shaped" island will serve as a reclamation area for future maintenance dredging on the fairway. Both artificial islands are located within the Szczecin Lagoon. The original bed level at the island locations was about -5 to -6 metres. Soil investigation campaigns revealed layers of soft soils, with thicknesses varying between 1 to 8 metres. The presence of these soft soil layers greatly influenced the design and construction of the artificial islands. A rubble mound bund with steep slopes proved to be unstable. Therefore, the design was adopted to ensure geotechnical stability of the works and optimise the volume of rock required for construction.

The first step in the island construction was the installation of the sand foundation. The elevation of the foundation layer varies from -2 to -3 metres, depending on the hydraulic loading by waves after the island's completion. The foundation layers were installed by means of a spreader pontoon and followed by a consolidation period. The duration of the consolidation period varied based on the local subsoil conditions. During the second construction step, a sand bund was created reaching above water. Once dry land was formed, Cone Penetration Tests (CPT's) were performed. Over a hundred CPT's were conducted on both artificial islands to confirm the soil models used for calculating consolidation periods and to determine the degree of consolidation of the soft soil layers. Based on the CPT data, a second consolidation period was determined for every location along the island to ensure sufficient consolidation of the soft soil layer and increase the strength, enabling a safe raising of the reclamation levels to the design levels, up to +5 metres.

The construction sequencing of both islands, determined by the geotechnical stability and associated consolidation periods, is visualised with four satellite images shown in Figures 1A-D. Figure 1A, taken in October 2020, shows the submerged sand foundation layer at both islands. On the southern island, the western sector of the island was constructed above water first, since this part of the island required the longest consolidation period between the first and second above water

FIGURE 1A-D

Artificial islands: A) October 2020; B) 2 February 2021; C) 3 April 2021; and D) 4 May 2021.

reclamation step. At the northern island, the above water operations commenced.

Figure 1B, dated February 2021, shows the first step of the above water reclamation works performed along the entire perimeter in the north. The status of the southern island remained unchanged compared to the first image. The picture shows ice covering the entire lagoon, which resulted in a short interruption of the reclamation works. Figure 1C, April 2021, shows the progress on the above water works in the south. And the fourth image (Figure 1D) shows the artificial islands at the time of hand-over to the client in May 2022.

The newly designed fairway, with its increased dimensions, resulted in interfaces with the existing shoreline at a number of locations. At most locations no infrastructure was present, enabling the design of a small land cut with natural slopes. In the southern, more built-up area of the project, a number of interfaces with existing structures occurred. At four locations, the distance to existing quay walls was too limited to apply unprotected slopes, since these would affect the stability of the existing quay walls. At two locations, the fairway slope was reinforced with a revetment and at the other two locations, a combination of underwater sheet piles and a revetment was required to ensure the stability of the existing structures without reducing the navigational depth at the quay.

Furthermore, the project's impact on the flow of water from Przekop Mielenski into Lake Dąbie needed to be minimised in order to ensure unchanged environmental conditions in Lake Dąbie.

The lake entrance is in a narrow section of the fairway, thereby eliminating the possibility for natural slopes since these would widen the lake entrance. Both headlands adjacent to the lake entrance needed to be secured. At the southern headland a revetment solution was designed. Since the width of the northern headland was too small to apply a revetment solution, a sheet pile structure was designed as a combination of a sheet pile with ground anchors and a cofferdam.

The fairway modernisation also included an upgrade of the navigational aids, requiring the need to design buoys, navigation lights on structures on land and on the banks of the fairway. In total, six monopile structures were designed within the fairway banks to support

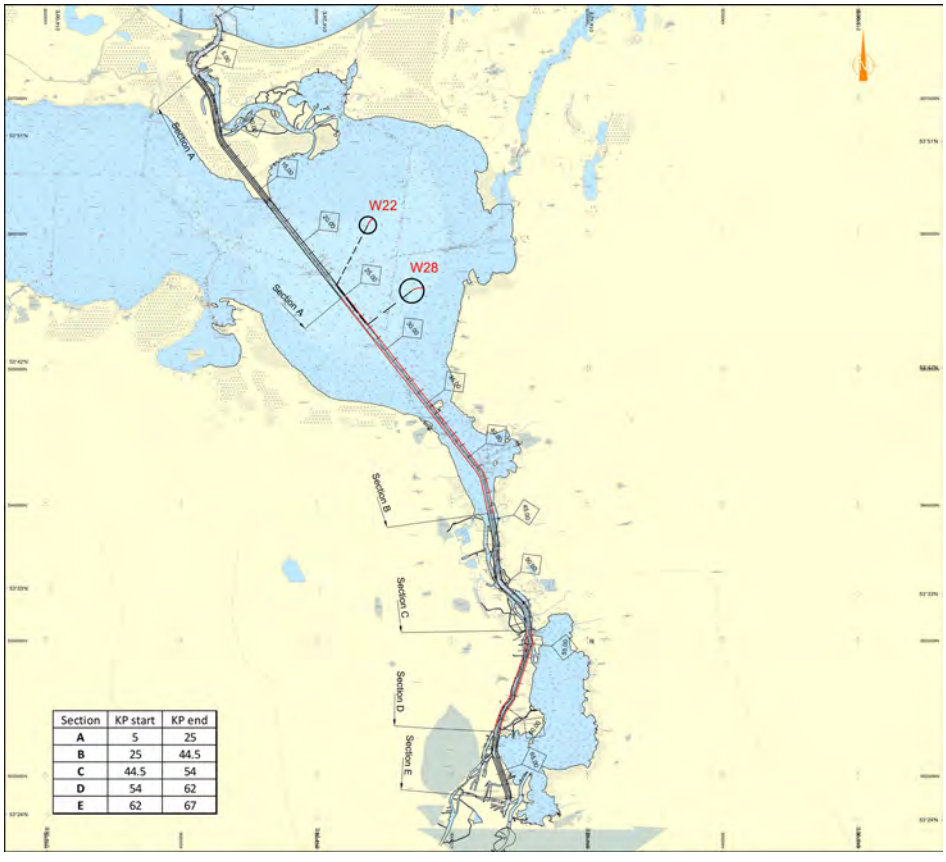


FIGURE 2

Overview of UXO removal sections in project area.

navigation lights, taking into account that winter periods with ice cover are common in the fairway. A design ice thickness of 0.35 to 0.6 metres depending on the location at the fairway proved to be the normative design load for these structures. Therefore, monopiles with a diameter of 1.0 to 1.4 metres were designed at the various locations.

Preparation works

The existing Świnoujście – Szczecin Fairway was subject to various aerial bombings, artillery, mining and other war related activities during the Second World War. Therefore, prior to the deepening and widening of the existing fairway, an extensive Unexploded Ordnance (UXO) investigation and removal campaign was executed to enable safe dredging and reclamation activities. This scope of works turned out to be a project itself within the project.

UXO investigation and removal campaign

Before actual commencement of the dredging and reclamation works, the working area had to be cleaned from hazardous objects to enable safe execution of dredging and all other marine related activities of the project. UXO presence along the existing fairway was considered a potential threat to:

- the workforce employed on board the various vessels and on the reclamation areas;
- main dredging equipment and auxiliary vessels to perform the dredging and reclamation works; and
- the marine construction works to be executed as part of the contracted project scope (i.e. cable removal and installation works, sheet and jetty piling and rock installation works).

UXO history working area

Based on historical research of the intensive war activities, the project area (with a total length over 60 kilometres) between Świnoujście and Szczecin was divided into three specific "UXO areas".

Świnoujście area

During the period between 1942 and 1945 the northern section of the existing fairway was

FIGURE 3

Aerial bombing of the German battleship "Lützow" (16 April 1945) in the existing fairway.

subject to various bombing and air defence of Świnoujście and British aerial mining of the waterways. Moreover, on 16 April 1945 the Royal Air Force executed an aerial attack on the German battleship "Lützow", stationed near Kasibor.

Within the northern part of the fairway, the UXO investigation and removal campaign focussed on the following expectations:

- High Explosive Fragmentation bombs up to 12,000 lbs;
- ground mines;
- artillery up to 300 mm; and
- munitions dumping.

Police area

Expected UXO's with the middle section of the existing fairway mainly had to do with the presence of a synthetic fuel factory, which became a target of the aerial raids. Between 1944 and 1945, repeated aerial bombing by the 8th United States Army Air Forces (USAAF) took place. Along with the bombing activities, this resulted in various planes being lost on 7 October 1944. These aerial bombing raids triggered air defence of the aforementioned factory, meaning there was potentially another source of UXO's within the project area.

Furthermore, throughout the period between 1942 and 1945 British forces executed aerial mining operations of the Polish waterways. Therefore, within this section of the fairway the campaign focussed on the following UXO's to be expected:

- High Explosive Fragmentation bombs up to 2,000 lbs;
- artillery shells up to 150 mm calibre; and
- ground mines.

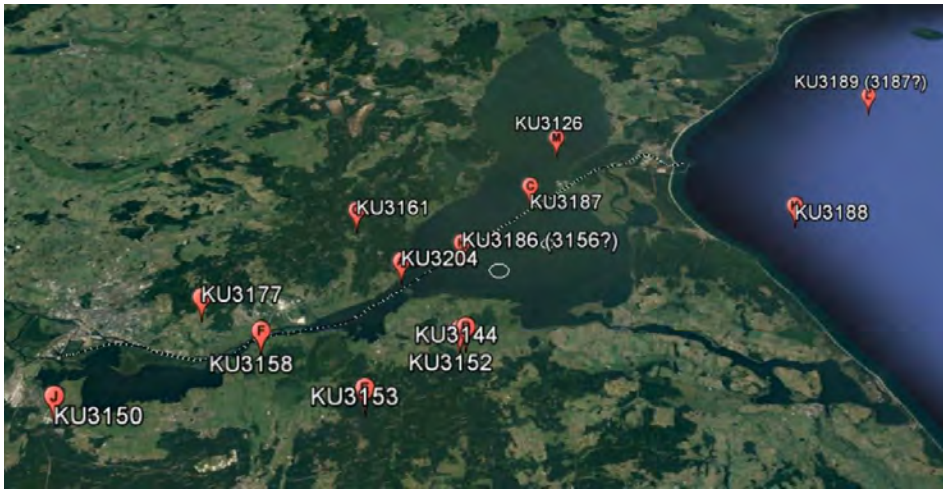


FIGURE 4

Indication of crash locations of USAAF bomber airplanes.

Szczecin area

Similar to the aforementioned sections, between 1942 and 1945, the southern section of the fairway around the city of Szczecin experienced mining performed by the British Army and aerial bombing. Furthermore, artillery barrages, tactical bombing by the Soviets and amphibious assaults by the Soviet forces over the Odra river (the German and Polish name for the existing fairway) were recorded.

FIGURE 5

Aerial photo of the bombing of the refinery in Police.

FIGURE 6 & 7

Aerial photos of the bombardments Police. Source: NARA, Record Group 341, Entry 217, Box 580: Military Intelligence Photographic Interpretation Report 21325.

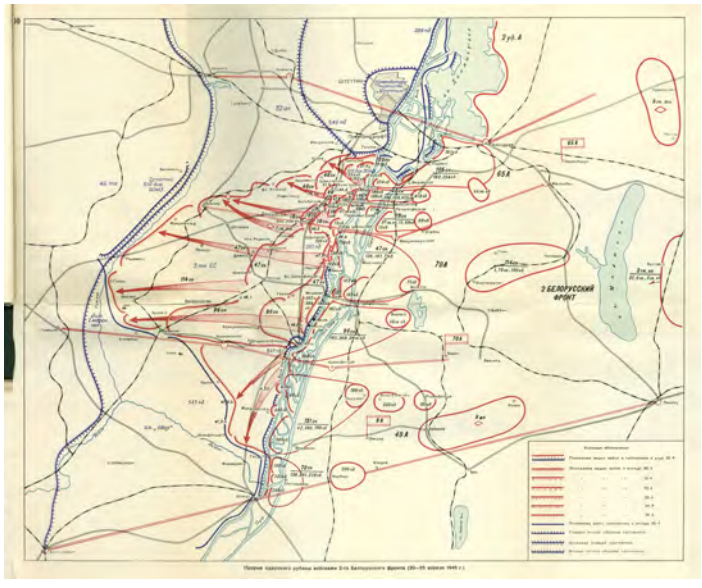


FIGURE 8

Soviet situation map of the battle of Szczecin between 20-25 April 1945.

FIGURE 9

Aerial photo of the bombing of the Szczecin area.

FIGURE 10 & 11

Bombing of the city of Szczecin.

For the southern section of the fairway, the campaign focussed on the expectation of the following UXOs:

- bombs up to 1,000 kg;
- UK and German (aluminium) ground mines; and
- artillery up to 203 mm.

Specific challenges

The historical research concerned the main "foundation" for the investigation and removal campaign. Second "pilar" concerned the requirements and parameters under the main contract. Especially in the Szczecin region where various shipyards do exist and extensive port activities take place, clustered areas of ferrous objects could be expected on the fairway bottom. All in all this resulted in an extensive campaign within an active fairway.

UXO approach

As part of the preparations of the investigation and removal works the following approach was taken:

1. Research of historic events to identify expected UXO's in areas.

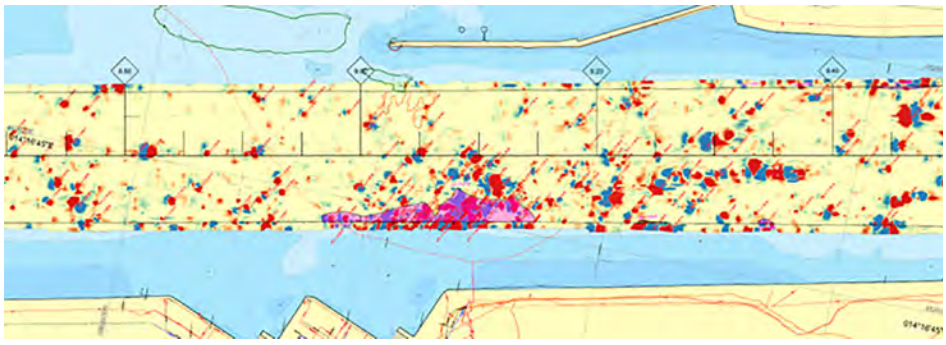


FIGURE 12

Combined overview magnetometer results.

FIGURE 13

UXO trained diver using handheld magnetometer.

FIGURE 14

Investigation and removal by remote operating device (ROD).

FIGURE 15

Executing the clearance works in the fairway.

2. Project specific UXO Risk Assessment (URA)
   - Evaluate risk to crew and equipment per activity and assess the impact.
   - Trailer suction hopper dredger/cutter suction dredger/backhoe dredger.
   - Cable removal and installation works/ sheet and jetty pile installation/rock installation.
3. Evaluate site conditions (water depth, soils, morphology) to determine penetration depths.
4. Define threshold values.
5. Produce Master Target List (MTL).

The Master Target List(s) concerned the main output of the investigation campaign and the starting point for the clearance works.

Investigation and preparation

To obtain the required Master Target List (MTL), as part of the UXO investigation works, a large-scale survey campaign took place. This campaign covered the full footprint of the existing fairway between Świnoujście and Szczecin, and consisted of the performance of various survey methods:

- a bathymetric (multi-beam) survey to determine the existing seabed depths;
- a magnetometer (MAG) survey to detect the ferrous objects of interest; and
- a side scan sonar (SSS) survey and (for specific sections of the fairway) a time-frequency electromagnetic (TFEM) survey to detect large non-ferrous objects of interest (e.g. aluminium mines).

With the survey data obtained, a Master Target List (MTL) was created for the various dredging sections of the fairway.

Throughout the preparations of the clearance campaign, it was decided to divide the project area into separate sub-areas and to appoint the subcontractors performing the removal works accordingly. This allowed for more efficient follow up and increase productivity accordingly. These subcontractors were allowed to work in the various sections at the same time – a chosen strategy which worked out well.

Removal works

Two different removal methods were used to execute the clearance works: removal by UXO trained divers with a handheld magnetometer and investigation and removal by means of a remote operating device (ROD).

Mainly in the southern part of the working area near the city of Szczecin, areas with ferrous objects were tackled in a two-phase approach. After approaching and removal of the initial number of targets on the Master Target List, a second survey by means of magnetometer was performed and the remainder of ferrous objects removed.

Overall, an astonishing 1,800 unexploded ordnances and related items were removed as part of the removal campaign.

Mitigation measures during dredging

Upon completion of the clearance works, a third-party UXO clearance certificate for the various fairway sections was obtained. To cater for any potential threat, which would have been undiscovered by the extensive clearance campaign, some further additional mitigation measurements were implemented throughout the deepening and widening of the fairway.

Among others, this included:

- UXO awareness training for both staff and crew directly involved in the dredging campaign;
- a bomb grid in the drag head of each trailing suction hopper dredger employed;
- 24/7 third-party EOD experience and supervision on board of the main dredging equipment; and
- UXO storage containers on board of the main dredging equipment to store any UXO's encountered.

One of the third-party UXO experts described the campaign as "likely the most comprehensive and largest UXO clearance project ever realised in inland waterways". It can be concluded that the dredging and reclamation activities and other related work scopes have been executed

FIGURE 16

Polluted areas showing the extensive amount of objects in the city of Szczecin.

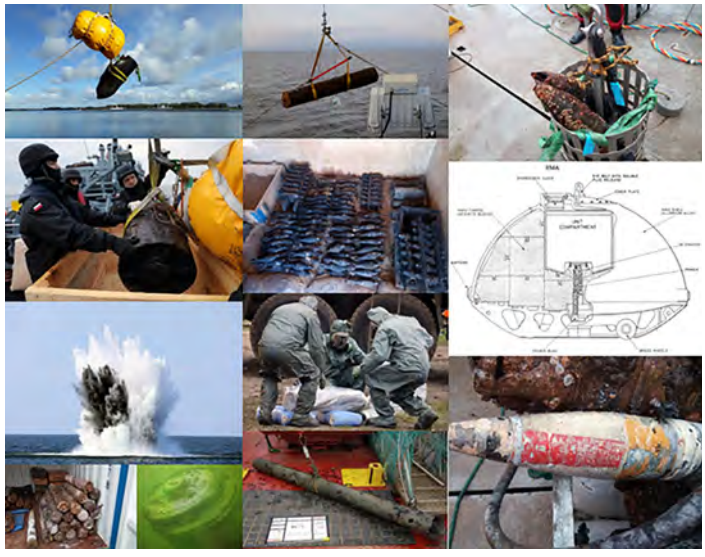


FIGURE 17

Impression of UXO findings in fairway removal campaign.

in an environment without any potential UXO threat to the workforce and equipment employed.

Dredging and reclamation

The dredging works within the project area were spread over a channel length of approximately 62 kilometres and took place over a period of two years (Q2 2020 to Q1 2022).

TSHD Scheldt River, Meuse River and Vox Amalia, as well as CSD Amazone and Spreader barge HAM 1208 were, among other auxiliaries, deployed to dredge and reclaim approximately 24.5 million m3. All of the dredged material was reclaimed within two artificial islands in the middle of the Szczecin Lagoon and most of the material was pumped hydraulically from the fairway to the islands by use of pipelines.

At the island of Ostrow Gabrowski in the Port of Szczecin, a new turning circle to accommodate the larger vessels was also envisioned. This involved the removal and capital dredging of the existing headland by grab, bucket and backhoe dredger. All material was transported with barges and dumped inside of one the islands.

FIGURE 18

Detonation "Tallboy" in fairway on 13 October 2020.

Challenges

Although the dredging and reclamation scope within this project might have seemed straightforward, there were several challenging elements to overcome:

- **COVID-19 pandemic:** The COVID-19 pandemic that began in March 2020 could not have come at a worse time since preparations were ongoing to mobilise the CSD Amazone and kick-off the long-awaited dredging campaign. Thanks to the relentless efforts within the joint venture and good cooperation with the client, the works began in May 2020. During the entire dredging campaign, additional measures were implemented in the site offices and on the islands to limit the exposure and spread of COVID-19, including daily PCR testing, no visitors on board the vessels, crew travelling in "bubbles", etc. As a result, the impact of the pandemic on operations was limited.
- **Active fairway:** Although it was known during the preparation phase that the fairway would remain active during the entire dredging campaign, the coordination

efforts were elevated due to a more extensive than expected UXO removal campaign, which continued during the dredging works.

- **Long pumping distances:** Again, a challenge which was foreseen during the preparation phase and required dedicated TSHD's that were both versatile enough for the narrower and shallower parts of the channel as well as outfitted for the pumping distances up to 6.5 kilometres (8 kilometres for the CSD). Thanks to the modern fleet of both Van Oord and DEME, the right equipment was available within the joint venture and no booster stations had to be deployed during any phase of the project. A total of 10 kilometres of sinker line and floating pipelines were mobilised to accommodate the long pumping distances.

- **Environmental requirements and restrictions:** The environmental sustainability and cooperation with all project stakeholders played an important role during execution. Several dredging areas were restricted during fish spawning period and the water quality within the full project area was monitored during the whole execution phase. On the islands and along the fairway trees and bushes were planted and various habitats were created to compensate for the impact of the deepening works on the environment. Especially for the islands this required several additional design alterations to include all environmental needs.

- **Ice period:** Over the winter of 2020–2021, the whole fairway and lagoon froze during the peak of dredging and reclamation works. Two TSHD's (Scheldt River and Vox Amalia) were working at that moment and reclamation was ongoing on both islands. So operations had to be paused, vessels were demobilised during that period and works could only be resumed when the channel was approachable again. Several rectification works were required along both islands due to the ice impact.

Environmental aspects

The Szczecin lagoon is a Natura 2000 area and also large parts of the riverbanks are protected nature reserves. Of course, and as a minimum, all works were done in line with the environmental permit obtained by the client.

The entire dredge volume was used for the establishment of two artificial islands, which represents a very sustainable and environmentally advantageous concept. This solution was developed by the initiators of the fairway project from the start.

Additionally, in striving to go a step beyond the formal requirements, the joint venture looked for possibilities to do better, promoting "green initiatives" focusing on using sustainable resources to limit the impact of the works as much as possible. Some of the implemented measures included:

- **Greenery design:** on the island envisioned as a bird habitat, a greenery design was made as nature compensation (planting of tree, shrubs, etc.), including the creation of an internal lake. Even during the works, the island already proved very attractive as a bird habitat, to the extent that part of the works had to be replanned/scheduled to fence off areas where birds had started to nest.

- **Logistics hub:** the small port and marina of Trzebież was used as a site office and logistics hub. Located 30 kilometres

FIGURE 19

New habit for flora and fauna on the northern island.

FIGURE 20

New donut-shaped soil depot on the southern island.

	Location	Indication length to be removed (m)	Indication length to be installed (m)
01	KP9 - marine	325 m1	1,000 m1
02	KP9 - land	-	1,100 m1
03	KP40	1,100 m1	1,100 m1

TABLE 1

Vessel Traffic Services (VTS) cable scope (KP9 and KP40).

	Description	KP	Overall length of sheet piles (top view)
01	Bon Wharf	60,800 - 61,200	95 m1
02	Zeglarskie Wharf	60,100 - 60,300	207 m1
03	Radolin	62,700 - 63,500	530 m1
		TOTAL	832 m1

TABLE 2

Overview of overall length of sheet pile works.

closer than Szczecin to both islands, this reduced the transport distances for all supplies and resources from and to the islands. Solar panels were installed in the marina of Trzebież to encourage the use of renewable energy.

- **Use of LNG as fuel:** TSHD Scheldt River is an innovative dual fuel trailing suction hopper dredger that executed a large part of the dredging works. In cooperation with the Maritime Office in Szczecin, the first LNG bunkering of a dredging vessel in Polish waters was completed in the Port of Szczecin in 2020.

- **Bunkering within the lagoon:** to avoid the mob/demob of CSD Amazone from the dredging area in the centre of the Szczecin Lagoon to the nearest port, a procedure was developed that allowed bunkering next to the fairway.

- **Fish spawning and water quality monitoring:** an ichthyologist was hired by the project to monitor the fish spawning in the lagoon and river. Continuous sampling was done to monitor the siltation.

- **Spreader HAM1208:** during the underwater bund construction of both islands, a dedicated spreader pontoon was used by both CSDs and TSHDs to limit any siltation plume within the lagoon.

- **Reclamation equipment:** hybrid Caterpillar D6 bulldozers were deployed to reduce the fuel consumption of the dry earth moving equipment.

- **Water usage:** instead of ferrying potable water from the shore to both islands for the reclamation crew, pumps and filters were installed so the water from the lagoon could be used for sanitary purposes.

Other construction works

In addition to the above mentioned works, there were many other auxiliary scopes that were executed under the contract. Although proportionally smaller in size, they were at times very complicated and thus created their own challenges which, with the help of local subcontractors who shared their local know how and expertise, had to be addressed.

Cables installation and removal

As part of the full project scope of works, at various locations along the fairway, inactive cables crossing the fairway near Szczecin harbour had to be removed.

Furthermore, due to the deepening and widening of the fairway, the existing Vessel Traffic Services (VTS) cable had to be partly removed and reinstalled, all while maintaining this important communication method for active shipping traffic. One of the installation techniques used alongside Debina Island was HDD – Horizontal Directional Drilling. Table 1 shows the exemplary lengths of VTS cables used for the works.

Sheet piling

As mentioned under the design, in order to protect existing structures from the deepening works, sheet pile walls had to be installed along the fairway near the city of Szczecin at the berths of Bon, Zeglarskie and Radolin.

At Bon and Zeglarskie, sheet piles were driven into the bottom of the fairway and backfilling works behind the new sheet pile wall were executed to provide protection. At Radolin (cofferdam construction) sheet-piles were driven into the bottom of the fairway.

Thereafter installation of the anchors, waling beam, capping plate and tie-rods in the cofferdam area was completed, followed by the installation of the shore lights and backfilling works of the cofferdam area. Table 2 provides general details on locations and quantities of sheet piling.

Navigational aids

Various navigational aid related works were part of the full project scope of works. This included:

- removal of an existing beacon and supply and installation of a new beacon at the Ostrow Gabrowski peninsula;
- removal of existing dolphins and installation of new dolphins as a result of the widening of the fairway at some locations;
- supply and installation of shore lights along the fairway at Radolin and Wielka Kepa islands;
- supply and installation of navigational aids at the jetty structures on the artificial islands;
- supply of buoys for the widening of the fairway at the Szczecin lagoon and around the artificial islands; and
- renovation of the power supply at Gate IV of the fairway.

Conclusions

The dredging and reclamation scope of the project was one of the biggest capital dredging projects within Europe over the past 20 years.

FIGURE 21

Aerial view of the work harbour in Trzebież during the ice period in 2021.

The combination of the largest UXO investigation and removal campaign, the creation of two islands (approx. 3 kilometres and approx. 8 kilometres from the nearest shore), the onset of COVID-19 and a harsh winter created exceptional challenges that the project team had to overcome.

The joint venture succeeded in building the two islands within Szczecin lagoon and deepen the fairway between Świnoujście and Szczecin to -12,5 metres within three years. This was accomplished by great teamwork between DEME and Van Oord and an excellent cooperation with the client – the Maritime Office in Szczecin.

The modernisation of the fairway from Świnoujście to Szczecin takes the performance of this waterway to the next level and ensures environmentally friendly, effective transport of goods to the hinterland of Western Pomerania and further south for years to come.

With the reuse of the dredged soil as building material for the two artificial islands in the Szczecin lagoon, the gentle and careful integration of the existing bank structures into the new infrastructure and the cleaning of the canal from polluting residues from the last century, the principles of sustainability were followed in an exemplary manner and excellent ecological accents set.

The idea of the founders of this groundbreaking project therefore became reality in two senses, being both a win for the economy and a win for nature.

Summary

The deepening of the Świnoujście – Szczecin Fairway is one of the most important dredging projects in Poland's history. Providing access from the Baltic Sea, the fairway runs between the city of Świnoujście and the Port of Szczecin. With more approximately 24 million m³ of material dredged, the channel was deepened by 2 metres to -12.5 metres, enabling the port of Szczecin to handle the next generation of vessels.Despite exceptional challenges, including carrying out most of the work during the pandemic and the presence of large amounts of unexploded ordnance, as well as thick ice in winter, the ambitious project was completed on time, highlighting the tremendous efforts of the JV team, and was handed over to the Maritime Office in Szczecin in the spring of 2022.

Benny Anthonissen

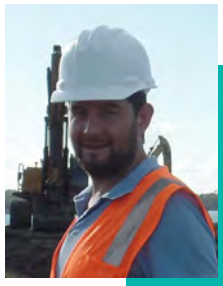
Benny joined DEME in 2008 and for the first part of his career worked all over the world on board Trailing Suction Hopper Dredgers as Chief Mate. In 2015, he changed career path and became a superintendent on the Tuas Terminal Phase 1 project in Singapore. From 2018-2022 he was Head of Operations for all dredging and reclamation works on the Świnoujście – Szczecin Fairway project for DIVO. Currently Benny is working as Construction Manager for the Darsena Europa port expansion project in Livorno, Italy.

Boris Vandekerckhove

Boris studied industrial engineering in Belgium and joined DEME group in 2012 as a cost estimation engineer within the tender department. Within this role he also spent some time abroad to assist ongoing projects. At the beginning of 2018, Boris became the Tender Manager for DIVO, for the Świnoujście – Szczecin Fairway project. He joined the project after the award and became the head of the Project Controls Department until the end of the project. Currently Boris works as a Programme Manager on internal DEME projects.

Gijs van Zalk

Gijs studied civil engineering in the Netherlands and the United Kingdom, and joined Van Oord in 2002 as a Project Engineer. During his career, he has worked in various operational roles on dredging and marine projects around the globe. Since 2011, Gijs has worked as a project manager in India, Australia, Indonesia, Maldives, the Netherlands, Poland, Kingdom of Saudi Arabia and the United Arab Emirates. On behalf of the DIVO joint venture he was responsible for the execution of the UXO investigation and removal campaign, the construction works and the greenery scope. Currently Gijs is working as Project Manager in Dubai.



Hugo Lavies

Hugo studied hydraulic engineering at Delft University of Technology, in the Netherlands. In 2015, he joined Van Oord and after a year as a technical trainee he started working for the coastal engineering department. He supported on multiple projects in both tender, preparation and execution stage. In early 2020, Hugo joined the DIVO project team as Design Manager, continuing the work of his predecessors and worked for and at the project till its finalisation in 2022. Currently Hugo is working on the design for the protection and rehabilitation projects in Constanta, Romania.

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