Boskalis
Dredging & Marine Experts

PROJECT SHEET

DANA MEDWAY PROJECT
SEABED PREPARATION FOR FLOWLINE INSTALLATION AND BURIAL

BOSKALIS OFFSHORE: SKILLS, RESOURCES, EXPERIENCE

Boskalis Offshore brings together the offshore skills, resources and experience of Royal Boskalis Westminster. The group's offshore capabilities include seabed rectification works for pipeline/ cable and platform installation, construction of pipeline shore approaches and landfalls, offshore mineral mining, offshore supply and support services and decommissioning services. Boskalis provides clients with tailored, project-specific solutions for above dredge related offshore services, as illustrated by the following project summary.

PRECISION DREDGING ON THE DANA MEDWAY PROJECT

Dana Petroleum Netherlands B.V. is the operator of the Pllb De Ruyter field and oil-producing platform located in the Dutch section of the North Sea.

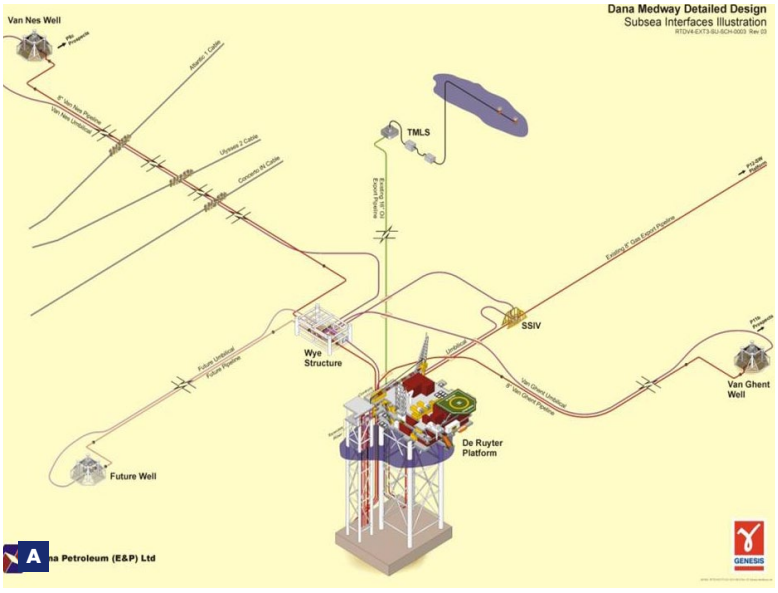
Several small oil and gas prospects lie within Pllb and adjacent blocks. Dana Petroleum planned initially to develop two confirmed small oil and gas fields as part of the Dutch gas development strategy, with other fields being developed over time to increase gas production. The two initial wells Van Nes and Van Ghent, combined referred to as the Medway Development, are developed as tie-back to the existing De Ruyter platform. Subsea 7 was awarded the Subsea EPIC Contract for the Medway Development, consisting of trenching, installing, backfilling and commissioning of the tie-back flowlines to the De Ruyter GBS platform.

Subsea 7 subcontracted Boskalis Offshore to execute the following seabed preparatory works:

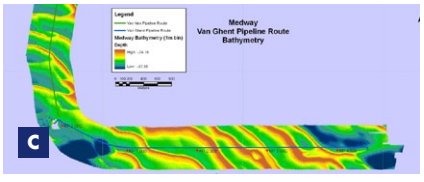
- Pre-sweeping of a 30 meter wide corridor to modify existing seabed features with the aim of

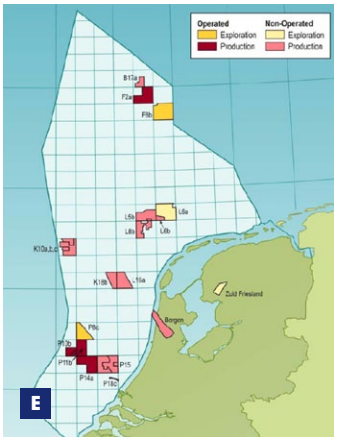
FEATURES

Client	Dana Petroleum Netherlands B.V.
Location	Pllb De Ruyter field, The Netherlands
Period	June 2011 – August 2011
Main Contractor	Subsea 7
Contractor	Boskalis Offshore B.V.



A Field layout Dana Medway
B Inspection ROV
C Medway Bathymetry
D TSHD 'Oranje' close to De Ruyter platfom
E Location map





reducing freespans;
- Peak shaving to reduce the steepness of slopes in order to aid pipeline trenching;
- Complete route survey work at specified stages to confirm the seabed profile.

The modern state of the art trailing suction hopper dredger 'Oranje' was selected to execute the works. As part of the project preparation the project scope was replicated on the hopper simulator at Boskalis' head office training facilities in Papendrecht, The Netherlands. The project team and key crew members together with the project teams from Dana Petroleum and Subsea 7 participated in several test trials. The results of these trials provided detailed insight what could be expected as best result and led to operational recommendations for the execution of the work. These trials also highlighted potential risks that were further discussed during the project hazard identification risk assessment.

The project area is known to contain several charted remnants from military activity in the past. As a mitigation a side scan sonar was installed on board the 'Oranje' to identify potential UXO in the sweep trajectory. To further inspect any suspect finds an inspection ROV was also on board.

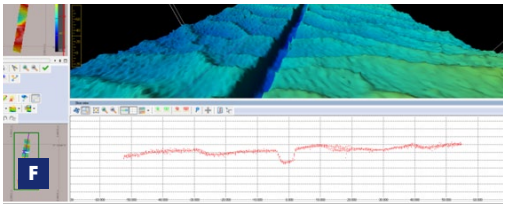
The accuracy of pre-sweeping is governed by:
- Vessel behavior as a result of current, waves wind;
- Orientation of seabed features relative to the pipeline route;
- Soil characteristics and layer thickness;
- Geometry, tools and hydraulics of the draghead.

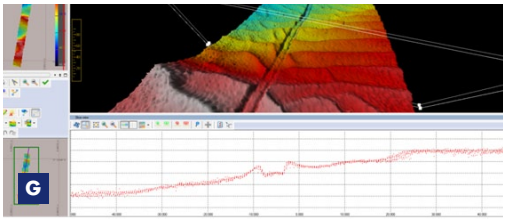
In preparation a statistical data review was prepared by Boskalis' in-house workability desk; together with the simulator trials this analysis aims at identifying the critical parts of the SOW to ensure the available weather windows are
exploited to gain the best result. Tables right (picture e) demonstrate that workability shrinks with increasing precision.

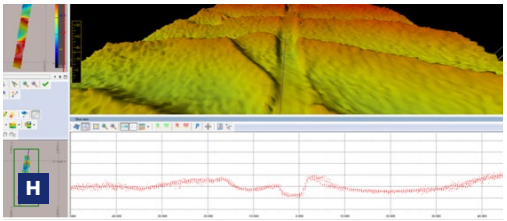
During the work, depending on the design dredge depth at each specific location the most suitable dredging method was chosen varying orientation of the vessel, use of pump/jetpump capacity and fitting different cutting tools. Progress and accomplishment of accuracy were closely monitored and documented for future reference.

Approximately 250,000 m^3 of soil was removed and stored in a designated location within the field boundaries where it was spread in a controlled fashion to avoid any significant material build up.
The thorough preparation and selection of the best suited equipment in combination with best practice and performing in-field tests resulted in an extremely high level of accuracy. Ultimately a precision of approximately 25cm was achieved in the critical areas, with tolerances 50% tighter than those commonly accepted within the industry. By making use of the lessons learned and several developments arising out of the experience obtained on this project we believe we can make
this high accuracy available to clients on future projects requiring pre-installation seabed interventions.

As part of Boskalis Offshore's ongoing safety program over 45 safety observations (leading safety indicators) were raised and followed up on board in cooperation with shore based offices. Very positive safety behavior was observed amongst the crew in line with the project safety vision 'To complete the Project without harm to people or damage to equipment or the environment'. The constructive cooperation of all parties involved made it possible to complete the project with No Injuries and No Accidents.







accuracy	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	all months
0.50m	62	57	71	77	87	89	91	88	80	61	65	56	74
0.40m	56	51	64	71	80	84	87	83	75	54	58	49	68
0.30m	50	45	55	63	71	76	80	75	68	46	49	41	60
0.25m	45	40	50	58	66	72	76	70	63	41	45	37	55

Workability De Ruyter - Van Nes (in %)

accuracy	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	all months
0.50m	56	53	60	63	70	73	80	73	67	57	56	50	63
0.40m	50	47	54	58	65	68	75	69	62	51	50	45	58
0.30m	43	41	46	51	57	63	69	64	56	44	43	38	51
0.25m	40	36	42	46	53	60	65	60	51	39	39	34	47

Workability De Ruyter - Van Ghent (in %)

I

F A combination of jet pumps with suction dredging was applied to remove layers with a thickness of 50 to 100 cm.
G Suction dredging without jet pumps was applied to remove layers of less than 50 cm
H Only the jet pumps were used without suction dredging to perform minor corrections.
I Workability analysis

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