



**OFFSHORE CONSTRUCTION SPECIALISTS**

**PIPELINE POST-TRENCHING  
PRE-QUALIFICATION DOCUMENT**



# PIPELINE POST-TRENCHING PRE-QUALIFICATION DOCUMENT

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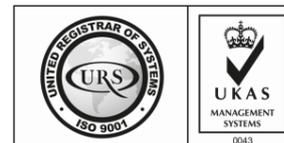
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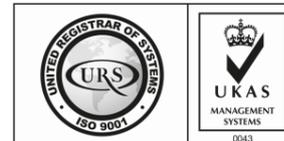
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## 1.0 INTRODUCTION

Offshore Construction Specialists (OCS) was formed in 2007 from a core group of experienced marine construction engineers with an extensive track record working with major contractors.

The company provides construction management, engineering and strategic support equipment services primarily to the offshore oil and gas sector focusing on the installation of pipelines, platforms, tanker moorings and related facilities. In addition to engineering, OCS also provides turnkey services for pipeline burial, pipeline pre-commissioning & drying, flexible flow line installation and umbilical installation on a subcontract basis to marine contractors.

The company has grown steadily since incorporation and now employs 60 personnel of whom over 30 are civil/structural and mechanical engineers along with an equipment group comprising of mechanics and technicians to operate in-house developed equipment. The engineers and technician work hand in hand to ensure all projects are properly engineered and operationally practical.

Pipeline Post trenching is a generic term for burial of the pipeline after the pipe has already been installed. It is a process where a cutting head is placed over the pipe and highly pressurised water pushed through jet nozzles to breaks up the material underneath the pipe. This material is lifted from the trench created by water eduction, airlifting or submersible pumping to create a clean trench into which the pipeline can fall.

OCS has invested considerably in water distribution systems and in pipeline post trenching burial equipment. The water distribution systems provide a high volume/pressure water supply that is used to facilitate the Company's pipeline post trenching, pipeline flooding, cleaning and gauging and pile remediation operations.

The main elements of any pipeline Post trenching system are summarised as follows. The equipment is listed upstream from the pipeline burial head. It should be noted that all OCS equipment skids and structural aids etc are designed to offshore DNV lifting codes by the OCS in-house engineering team ensuring all components are robust and able to withstand the rigours of offshore handling.

### 1.1 Pipeline Burial Sleds.

OCS operates the following sled arrangements.

#### i) Articulated Pontoon Sled

This sled is the most commonly used of OCS Jet sleds. Conceived, designed and fabricated by OCS it is deployed by crane or A frame and is self supporting on the seabed and uses articulated jetting arms with nozzle arrays to capture the pipe and direct the high pressure water at the material under the pipe. Hydraulic rams set the elevation of the arms and a further set of ancillary hydraulic arms can be directed at the soil plug directly under the pipe to prevent "wagon tracks". Eductor / Airlift arms lift the spoil from the trench and side cast it on each side.

This sled can be used from any vessel with a crane or A frame and sufficient space to accommodate OCS equipment. The sled floats and can pulled in to shallow areas to perform trenching in water depths the mother vessel cannot reach.

#### ii) Trailing Arm

This is a rigid arm designed for deployment from OCS Utility Barge UB-01 "Miss Pennie". The arm provides a rigid frame to deploy the cutting head and working in water depths to a maximum of 25 metres



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directs pressurised water air and hydraulics to the cutting head without the need for a hose umbilical. The system can be deployed diverlessly using scanners and does not require extensive hose umbilicals using Steel Chiksans to handle the degrees of freedom required to lower the arm and articulate the cutting head.

#### iii) Pipe Riding Sleds

The sleds ride on the pipeline with vertically extended jetting arms and educator/ Air lifts. They are lighter and require less deck space than the articulated pontoon sled. These sleds are deployed on a job specific basis.

#### 1.2 Deployment A frames

For 3<sup>rd</sup> Party vessels OCS provides deployment A frames that can be dedicated to the jet sled. This frees up the vessel crane for anchor running and other activities. (The trailing arm system does not require an A frame)

#### 1.3 Hose Spooler and Hoses.

For OCS Articulated Pontoon and Pipe riding jet sleds robust high pressure hose and a reliable hose deployment system are essential. OCS provides rugged hose and a deployment spooler with water Chicksan to facilitate the easy deployment and control of water, air and hydraulic hoses.

#### 1.4 Water Distribution Manifold

A dedicated water distribution manifold is provided to direct feed water to the pressure pumps and return pressurised water to the hose spooler / jet sled or trailing arm with an overboarding facility for pump testing. This manifold is configured with all the necessary valves

#### 1.5 High Pressure Pumps

The key to effective pipeline post trenching is the supply of high volumes of properly directed pressurised water. OCS has invested heavily in large pumping skids for this purpose. As noted above all pumps are contained in heavy duty structural skids. OCS has a total of seven (7) high volume / high pressure pumps skids in inventory. Four units are equipped with high spec solid stainless steel 5 stage centrifugal fluid ends while 3 are 4 stage centrifugal units with a lower pressure rating. The 5 stage pumps have a multiplier gear box between the power train and the fluid end to increase pump shaft revolutions.

Main Components of the high volume / pressure pump skids are described below:

##### i) Power Train

All pumps have a common diesel driven GM12V149 diesel driven engine power train. These engines generate over 900 Brake Horse power (BHP).

##### ii) Multiplier Gear Box.

5 stage pumps are equipped with a 1:1.5 step up gear box.

##### iii) Fluid Ends

Two fluid end configurations are available.



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- 5 stage pumps have an extremely high spec fluid end generating 600 psi as a single unit operating in parallel with other units at 2000 US GPM or 1200 psi when one skid is linked in Series with a second skid.
- 4 stage pumps generate the same flow at pressures of up to 350 psi.

Pressure pump skids are selected by OCS depending on the parameters of specific project such as pipe dia, burial length and depth and geotechnical conditions. Where hard material is anticipated 5 stage pumps provide an excellent solution where as for softer material the 4 stage pumps remain a very efficient option.

OCS will evaluate and make pump selection on a project case by case basis.

#### 1.6 Feed Pumps

Pressure pumps operate best when feed water is delivered to them at a positive pressure.

OCS provides options for electrically driven submersible pumps or diesel driven centrifugal pumps delivering water volumes to the capacity of the pressure pumps at approximately 30 psi

#### 1.7 Air Lift Compressors.

High volume compressors are required for efficient airlifting. OCS would normally provide 2 x 1070 x 350 cfm compressors from in-house inventory although 3<sup>rd</sup> party units can be provided where necessary.

#### 1.8 Power Generation.

3 phase power is required to power submersible pumps. OCS can utilise power from the mother barge or provide an in-house 150 kVa generators.

#### 1.9 Deployment Barge for Post Trenching Equipment.

OCS UB01 Miss Pennie has been constructed specifically for nearshore projects and to accommodate OCS Post trenching equipment. However the equipment is often deployed on 3<sup>rd</sup> party barges. A robust mooring system with centralised control is required ensure the vessel can track along the pipeline at an average speed of 1.0 metre/minute. In addition crange to handle OCS equipment packages, crew accommodation, power generation system are need to be considered during planning and preparation for post trenching projects.

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## 2.0 OCS PIPE BURIAL EXPERIENCE

OCS has undertaken nine (09) major post-trenching projects for different customers;

- APD/Salamander (Serica Kambuna Development project) 2009/10, 14" CWC pipeline x 13.000 km burial distance, 2.0m TOP cover. Nearshore north of Medan, Sumatra, Indonesia;
- HESS Indonesia (Ujung Pangkah Phase 1) 2010, 6" CWC, 12" CWC & 16" CWC pipelines x 5.500 km burial distance each line, 2.0m TOP cover. Nearshore north of Gresik/Surabaya, East Java, Indonesia;
- CSJV/Chevron Australia (DOMGAS 20" pipeline project) 2012, 20" CWC pipeline x 25km burial distance (in combination with intermittent rock bolting), 0.5/1.0m TOP cover. Karratha, Western Australia, Australia.
- Pertamina EP MOL 12" Pipeline near Cirebon in Central Java Indonesia. Pipeline was buried 2.0 metre TOP in highly cohesive clay for the most part in a single pass.
- Ketapang Petronas offshore Gresik in Surabaya, post trenching of 27km of 12" pipeline to 2m TOP
- Thai Binh for PVGAS, post trenching of 10km length of 12" pipeline for the gas distribution project, in Vietnam. Main contractor is Sapura Kencana.
- Jankrik for ENI. Burial of 32 km of 24" / 4" Piggy back to varying TOP from 0.5 metres to 2.0 metres using a pontoon articulated arm jet sled. Main contractor Timas Sapura Offshore JV. BD Project for Husky CNOOC Madura Ltd (HCML), post trenching of 1km of 16" pipeline with 2m cover from T.O.P at near shore location at Pasuran City Surabaya, Indonesia. Main Contractor is PT Timas.
- JAWA-1 COMBINED CYCLE GAS TURBINE POWER PLANT (1760MW) PROJECT, Cilamaya, burial of 10km of 20" pipeline to a 2m TOP, using OCS pontoon articulated arm jet sled deployed from the work barge Kalinda which is equipped with 8-point mooring system. Main contractor is PT Meindo Elang Indah.

Our in-house equipment spread is described in detail in this document. OCS is equipped to handle the full range of post-trenching activities with depth of cover ranges from one (1) to three (3) metres on pipeline diameters up to 48". Additionally the jet sled unit can be modified to further suit more demanding or special project requirements with sufficient planning. Our high pressure high flow rate centrifugal pump spread is suitable for material up to 200kPa with the correct nozzle configuration, however the most efficient burial operations are conducted where the seabed material is less than 40kPa. For harder formations a separate jetting arm and ultra high pressure pump can be incorporated.

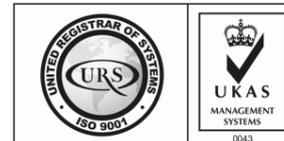
Furthermore where water depths are shallow (less than 2m) and vessel access is restricted an alternative jet sled configuration (Pontoon Articulated Arm Jet Sled) is available that can be floated into position and ballasted over the pipeline. This sled was used successfully on the Jangkrik Piggy back pipeline, BD Project for HCML and the Cilamaya Jawa-1 projects mentioned above.

OCS is equipped to handle large projects or discrete project elements depending on the specific needs of the customer. During the preparation for pipe burial or any offshore work the safety of personnel, equipment and environment plays a vital role in the success of a project and as such, HAZID's shall be conducted prior to any operations. These meetings are attended by key engineers and supervisors and all potential risks are identified and mitigation measures put in place to ensure they are as low as reasonably practicable.



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### 3.0 KEY PERSONNEL CONTACTS

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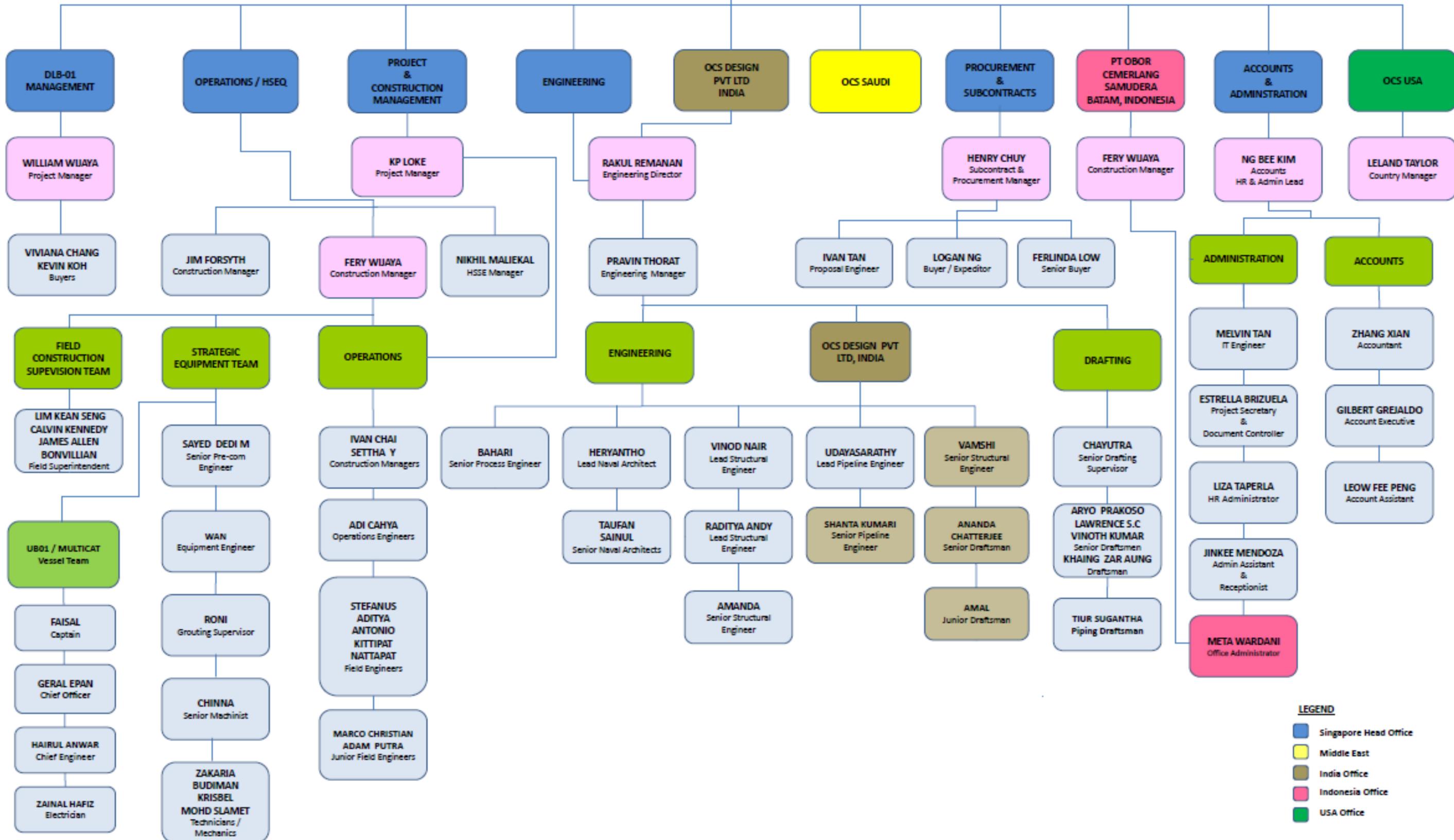
### 4.0 OCS ORGANISATION CHART

Refer to the next page for OCS Organisation Chart



# OCS ORGANISATION CHART

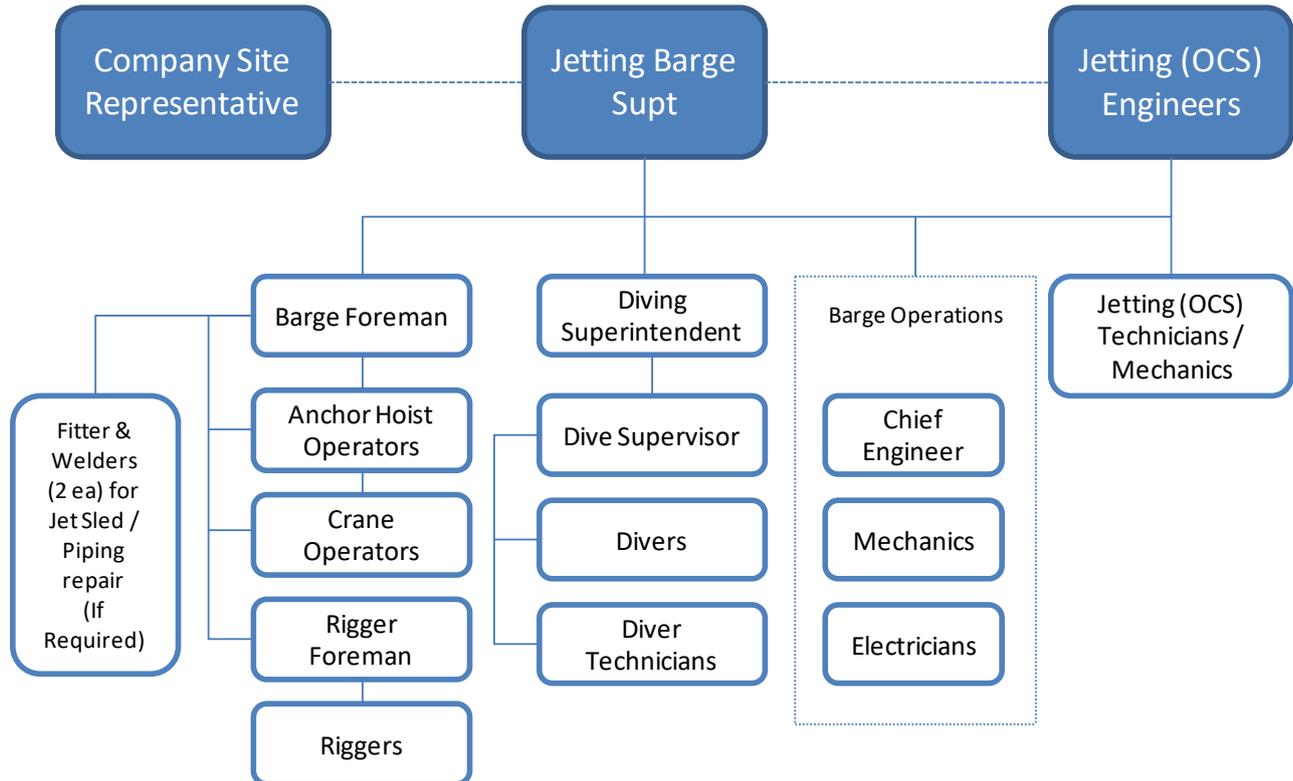
**KEITH JACKSON**  
Managing & Technical Director



- LEGEND**
- Singapore Head Office
  - Middle East
  - India Office
  - Indonesia Office
  - USA Office

### 3.0 TYPICAL POST-TRENCHING ORGANISATION CHART

OCS Post-Trenching Offshore Team



Personnel requirements for 24 hour operations specifically for operating the pipe burial equipment spread are as follows:

- 1 x Jetting Supervisor/Superintendent
- 1 X Jetting Engineer.
- 4 x Technicians/Mechanic (2 per shift)
- 4 x Winch Operator / General Helpers(2 per shift)

OCS normally provides personnel specifically associated with the operation of the jet sled and associated water distribution systems only.

Craneage, rigging and welding support along with key subcontract support including diving and survey services are usually provided by the vessel operator or main contractor. OCS can provide additional personnel as required.

Where specifically required, OCS can provide an option for provision of the entire support vessel. Customer requirements for this option can be discussed on a case by case basis.

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#### **4.0 PLANNING AND EXECUTION**

OCS will cover the following scope areas during planning and execution of post trenching projects.

##### **4.1 Pipeline Burial Scope**

OCS will review the scope of work taking particular note of the following:

- Pipeline outside diameter inclusive of all coating/s;
- Burial depth (coverage) required with reference to top-of-pipe (TOP);
- Burial distance required, inclusive of transition zones
- Seabed material properties, and seabed bathymetry/features
- Operating water depth, inclusive of tidal considerations
- Supporting equipment requirement

##### **4.2 Equipment Assignment and Layout**

Based on a review of the scope of work and the other critical parameters listed in 4.1 above OCS will assign the most appropriate equipment spread to the work. If there is hard material in some locations, consideration will be given to the mobilisation of dedicated super high pressure pumps and high pressure jetting arms specifically to deal with these areas and or to provide a suite of smaller nozzles to direct more pressure to the hard material. Jetting nozzle sizes and configurations will be determined such that they are specific to the nature of the seabed material to be jetted. The operating draft of the assigned support vessel and the operating water depth are also considerations. If the water is particularly shallow in close proximity to the beach, OCS will provide a specific sled that can be floated into position and ballasted down onto the pipe with extension hoses used to provide water and air to the spread.

Based on the assessment of equipment required OCS will provide a layout of the barge assigned by the client.

In certain cases OCS can provide the operating vessel on which to base the equipment depending on the specific needs of the client although it is our experience that it is most cost effective to use a vessel that is already engaged in other areas of the project.

##### **4.3 Execution Procedures**

OCS will provide project specific execution procedures for every project which address all elements of the project. These procedures must be approved by the client. OCS will ensure that the procedures address all constraints posed by individual project site conditions and the specific scope of work.

##### **4.4 Equipment Testing**

OCS will ensure that all equipment is fully tested before leaving the OCS facility. Client representatives will be invited to witness the testing programme. For more difficult jobs, further specific testing may be required which will be determined on a case by case basis.

##### **4.5 HAZID**

Specific HAZID and risk identification sessions will be conducted to identify and propose mitigation measures for site hazards which may be posed by operations.

##### **4.6 Equipment Mobilisation and Demobilisation**



OCS will provide a procedure for equipment mobilization and demobilisation which will be in accordance with client requirements. The procedure will ensure the right equipment, properly prepared is in the right place at the right time.

**4.7 Personnel**

OCS will provide a team of qualified personnel to co-ordinate and operate the equipment on a 24 hour basis. Key personnel will be the same as those who tested and mobilized the equipment. The OCS proposed organization chart is in section 2.

**4.8 Site Operations**

Typical procedures for site operations are included in this document. OCS will work closely with the client to ensure post trenching activities are closely coordinated with other activities on the project.

**4.9 Surveys**

Typically an surface air diving spread is utilised with regular trench profile checks behind the jet sled, particularly upon start up until jetting parameters are optimised to complete the required pipe burial depth in one pass (where possible).

On completion of burial operations the pipeline will be surveyed using client approved equipment and procedure such as side scan survey and sub-bottom profiling. Any anomalies or deficiencies in meeting the required pipeline burial depth will be corrected in an expedient manner.

**5.0 OCS CLIENT BASE**

OCS has built up a significant customer base during fifteen (15) years of operations. OCS past and present clients are listed below. References can be provided on request:

NO	CLIENT NAME
1	Asia Petroleum Developments / Salamander Energy (Indonesia) [*]
2	Bumi Armada
3	Chevron (Thailand)
4	Clough Sapura JV (Australia) [*]
5	DOF Subsea.
6	EMAS (Singapore)
7	Franklin Offshore (Singapore)
8	Galoc ( Philippines)
9	GFI (Thailand)
10	Global Industries (Malaysia)/Technip
11	Hako Offshore (Singapore)
12	Heerema (Netherlands)
13	HESS (Indonesia) [*]
14	Kangean Energy (Indonesia)



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NO	CLIENT NAME
15	Larsen & Toubro (Malaysia/ India)
16	M3 Energy (Malaysia)
17	McConnell Dowell CCC JV (Australia)
18	MRTS Engineering Ltd (Russia)
19	Newfield Peninsula Malaysia (Malaysia)
20	Nippon Steel (Indonesia)
21	NorCE (Singapore)
22	NuCoastal (Thailand)
23	Offshore Marine Contractors
24	Origin Energy (Australia)
25	PT Timas Suplindo (Indonesia)
26	Petronas Carigali Ketapang 2 Ltd (Indonesia) – PCK2L
27	Sapura Acergy (Malaysia)
28	Sarku (Malaysia)
29	Sea Drill (Singapore)
30	Star Petroleum (Indonesia)
31	TLO Sapura Crest (Malaysia)
32	Vietsovetro (VSP) (Vietnam)
33	PT. Meindo Elang Indah (Indonesia)
34	Esso Thailand Ltd

## 6.0 PIPE BURIAL - TRACK RECORD

YEAR	PROJECT	CLIENT / OPERATOR	SCOPE OF WORK
2021	JAWA-1 COMBINED CYCLE GAS TURBINE POWER PLANT (1760MW) PROJECT	CLIENT: PT. MEINDO ELANG INDAH (Sub contractor) OPERATOR: JAWA SATU POWER	OCS was contracted by PT Meindo for the provision of post trenching scope for the 20" pipeline from KP0.175 to KP 10.775 approximately 10.6km distance with 2.0m TOP at around 6.5 - 16m water depth (LAT).
2016	BD PROJECT INDONESIA)	CLIENT: PT TIMAS SUPLINDO (Sub contractor) MAIN CONTRACTOR: HCM (HUSKY CNOOC MADURA	OCS was contracted by Timas for the provision of Post Trenching scope for the 16" pipeline for 1km with 2m cover from T.O.P. Near shore location at Pasuran City Surabaya, Indonesia.



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YEAR	PROJECT	CLIENT / OPERATOR	SCOPE OF WORK
		LTD)	
2016	JANGKRIK (ENI INDONESIA)	CLIENT : PT TIMAS SUPLINDO (sub contractor)  MAIN CONTRACTOR: TECHNIP  OPERATOR : ENI, Muara Bakau Indonesia	Technip was contracted by ENI Muara Bakau, Indonesia for the EPCI for the subsea package for Jangkrik project for installation of 24"/4" piggy back x 72km pipeline in water depths up to of 430m. PT Timas was subcontracted (by Technip) to perform the pipe laying at the shallow section between KP61.3 and KP 37.79 to water depths up to 30m. Part of the requirement for pipelay at the shallow water depth includes the post trenching of ~32km with a trench depth ranging from 0.5m to 2m T.O.P, from water depth ranges from less than 2m to 30m. PT Timas subcontracted the post trench scope to OCS.  OCS's Pontoon Articulated Arm Jet Sled (PAAJS) is used due to the piggy back pipeline configuration to avoid contact during post trenching operation
2015	THAI BINH (VIETNAM)	CLIENT: SAPURA KENCANA  OPERATOR: PVGAS	OCS was contracted by SAPURA KENCANA for the provision of post trenching support on board SK vessel. A total of 10km of pipeline was post trench to 1m BOP mostly performed in a single pass
2014	PETRONAS KETAPANG (INDONESIA)	CLIENT : PT TIMAS SUPLINDO  OPERATOR : PETRONAS (PCK2L) INDONESIA	OCS was contracted by PT Timas to post trench 27 km of 12" pipe to be buried to 2.0 metres TOP from the beach area till offshore. The pipeline length is 110km. 2 passes were required at most section of the route. The work was completed in 2014
2013	PERTAMINA MOL PIPELINE (INDONESIA)	CLIENT: LEIGHTON OFFSHORE.  OPERATOR : PERTAMINA EP	8.5 km of 12" pipeline buried 2.0 metres TOP in highly cohesive clay. Trench completed mostly in one pass. Progress average 1.0 km per day.
2012	GORGON DOMGAS 20IN PIPELINE	CLIENT: CLOUGH SAPURA JV (Australia)  OPERATOR: GUFT / CHEVRON (Australia)	CSJV was contracted by Chevron Australia Pty Ltd for the installation of the 20" x 59.4 km long offshore DOMGAS pipeline from Barrow Island to mainland Australia for the Gorgon Upstream Project.  In order to achieve required permanent stability of the DOMGAS 20in pipeline, a combination of pre/post pipelay trenching and rock bolting were deployed. OCS was contracted by CSJV to perform post pipelay trenching for specific sections which were carried out in two phases; trenching between KP18.200-34.300 (with DLB Java Constructor), and post trenching between KP 48.414-57.014 (with SWLB Geoccean Kalinda).  <ul style="list-style-type: none"> <li>• Seabed: Coarse calcareous sand (semi-compact)</li> <li>• Progress: 1000m per day, dual pass</li> </ul>
2010	UJUNG PANGKAH	CLIENT: PT TIMAS  OPERATOR: HESS	<ul style="list-style-type: none"> <li>• PMT for T&amp;I for P1 development consisting of 3ea x infield pipelines and 1ea x WHP</li> </ul>



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YEAR	PROJECT	CLIENT / OPERATOR	SCOPE OF WORK
	PHASE 1	INDONESIA	<ul style="list-style-type: none"> <li>• Detail engineering for three (3) infield lines, 16in Gas, 12in Liquid, and 6in Gas Lift. 5500m each from WHP-A (existing) to new WHP-B</li> <li>• Linepipe coating - AE, CWC, FBE, neoprene</li> <li>• Installation engineering for the T &amp; I scope</li> <li>• Transport and install WHP-B; 370t 8-leg jacket, piles (3 section), and 1500MT topside</li> <li>• Transport and install of three (3) infield pipelines (inclusive of expansion spools and risers)</li> <li>• Pipeline pre-commissioning (flood, pig, testing)</li> <li>• Pipe burial of all three (3) infield pipelines to 2.0m TOP coverage up to 13m LAT water depth. Total burial distance - 15.5km</li> <li>• Seabed: Soft silt, varying to soft green clay</li> <li>• Progress: 1500m per day single pass</li> </ul>
2009	SERICA KAMBUNA FIELD DEVELOPMENT	CLIENT: PT TIMAS OPERATOR: ASIA PETROLEUM DEVELOPMENT (APD) SALAMANDER ENERGY	<ul style="list-style-type: none"> <li>• 14" x 39.0 km pipeline, including 5500m beach pull section for nearshore approach</li> <li>• Super duplex pipeline section, expansion spool and riser in the platform approach area (400m)</li> <li>• Unmanned 150MT topside onto existing tripod jacket with live conductor well assemblies with hook-up completions</li> <li>• Pipeline pre-commissioning (flood, pig, testing)</li> <li>• Pre-trenching and pipe burial (jet) for 13.0 km section of 14" pipeline, 2.0m TOP cover</li> <li>• Seabed: Black stiff consolidated silt clay</li> <li>• Progress: 500-800m per day</li> </ul>

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## 7.0 POST TRENCHING EQUIPMENT GENERAL DESCRIPTION

OCS operates a comprehensive range of post trenching equipment. Each piece of equipment has its own equipment passport which is maintained from project to project. This helps to ensure that only appropriately maintained equipment is supplied to projects.

The key equipment components of our post trenching are as follows:

### i) Suction Feeder Pumps

These pumps provide high volumes of water at a positive head to the pressure pumps. This water supply ensures the pressure pumps work at optimal efficiency giving maximum jetting nozzle pressure and volume output.

OCS stocks both electric and diesel driven suction feeder pumps, Diesel units produce 1500 m3 per hour at 50 psi. Submersible pumps produce 6000 m3 per hour at 50 psi.

### ii) High Pressure Pumps

The key to effective pipeline post trenching is the supply of high volumes of properly directed pressurised water. OCS has invested heavily in large pumping skids for this purpose. As noted above all pumps are contained in heavy duty structural skids. OCS has a total of seven (7) high volumes / high pressure pumps skids in inventory. Four units are equipped with high spec solid stainless steel 5 stage centrifugal fluid ends while 3 are 4 stage centrifugal units with a lower pressure rating. The 5 stage pumps have a multiplier gear box between the power train and the fluid end to increase pump shaft revolutions.

Main components of the high volume / pressure pump skids are described below:

#### a) Power Train

All pumps have a common diesel driven GM12V149 diesel driven engine power train. These engines generate over 900 Brake Horse power (BHP).

#### b) Multiplier Gear Box.

5 stage pumps are equipped with a 1:1.5 step up gear box.

#### c) Fluid Ends

Two fluid end configurations are available.

- 5 stage pumps have an extremely high spec fluid end generating 600 psi as a single unit operating in parallel with other units at 2000 US GPM or 1200 psi when one skid is linked in Series with a second skid.
- 4 stage pumps generate the same flow at pressures of up to 350 psi.

Pressure pump skids are selected by OCS depending on the parameters of specific project such as pipe diameter, burial length and depth and geotechnical conditions. Where hard material is anticipated 5 stage pumps provide an excellent solution where as for softer material the 4 stage pumps remain a very efficient option.

OCS will evaluate and make pump selection on a project case by case basis.

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**iii) Water Distribution Manifold**

A dedicated water distribution manifold is provided to direct feed water to the pressure pumps and return pressurised water to the hose spooler / jet sled or trailing arm with an overboarding facility for pump testing. This manifold is configured with all the necessary valves.

**iv) Hose Deployment Spooler**

A hydraulically powered hose spooler unit equipped with a pressure rated chiksan swivel joint is used for water / air and hydraulic hose deployment and control. Heavy duty water jetting hose is used for water supply to the jet sled and airlifting and jack hydraulic hoses are also accommodated. The spooler ensures that the optimum amount of hose only is deployed adjusting for water depth as required.

**v) Jet Sled Deployment A-frame**

A-frame is used to deploy and recover the unit, freeing up the crane for other operations. OCS has several A frames in its inventory.

**vi) Pipeline Burial Sleds.**

OCS operates the following sled burial design arrangements.

**a) Pontoon Articulated Arm Jet Sled (PAAJS)**

This sled is the most commonly used of OCS Jet sleds. Conceived, designed and fabricated by OCS it is deployed by crane or A frame and is self supporting on the seabed and uses articulated jetting arms with nozzle arrays to capture the pipe and direct the high pressure water at the material under the pipe. Hydraulic rams set the elevation of the arms and a further set of ancillary hydraulic arms can be directed at the soil plug directly under the pipe to prevent "wagon tracks". Eductor / Airlift arms lift the spoil from the trench and side cast it on each side.

This sled can be used from any vessel with a crane or A frame and sufficient space to accommodate OCS equipment. The sled floats and can be pulled in to shallow areas to perform trenching in water depths the mother vessel cannot reach.

OCS pipe riding jet sleds are very efficient but have some drawbacks in that they must be supported by an A frame during trenching operations with consequent limitations on operations in extreme shallow water. A new proposed Articulated Jet Sled (AJS) does not ride on the pipeline but it is supported on either side on buoyancy tank skids while a rotating arm is fitted that is equipped with jetting nozzles and an educting/air lifting facility to remove jetted spoil.

The OCS PAAJS is equipped with ballastable pontoons and floats in sea water. The unit can be floated into shallow water before being ballasted over the pipe for trenching operations. In this way the entire tidal zone can be covered by the sled where necessary.

This design of sled does not make hard contact with the pipeline being trenched and can thus be used on piggy back pipeline configurations such as on the Jangkrik Project (24"/4") to avoid damage to the piggy back pipeline.

Specific unique features of the PAAJS are summarized as follows:

- The PAAJS is designed to be used in all depths of water but is particularly relevant for extreme shallow water in areas which are not accessible by the attendant barge due to draft limitations.
- The PAAJS does not make hard contact with the pipe so can be utilized on piggy back pipelines avoiding damage to the pipelines and associated blocks used for tie in.





Figure 7.2 Articulated Jet Sled in operation mode

**b) Trailing Arm**

This is a rigid arm designed for deployment from OCS Utility Barge UB-01 “Miss Pennie”. The arm provides a rigid frame to deploy the cutting head and working in water depths to a maximum of 30 metres directs pressurised water air and hydraulics to the cutting head without the need for a hose umbilical. The system can be deployed diverlessly using scanners and does not require extensive hose umbilicals using Steel Chiksans to handle the degrees of freedom required to lower the arm and articulate the cutting head.

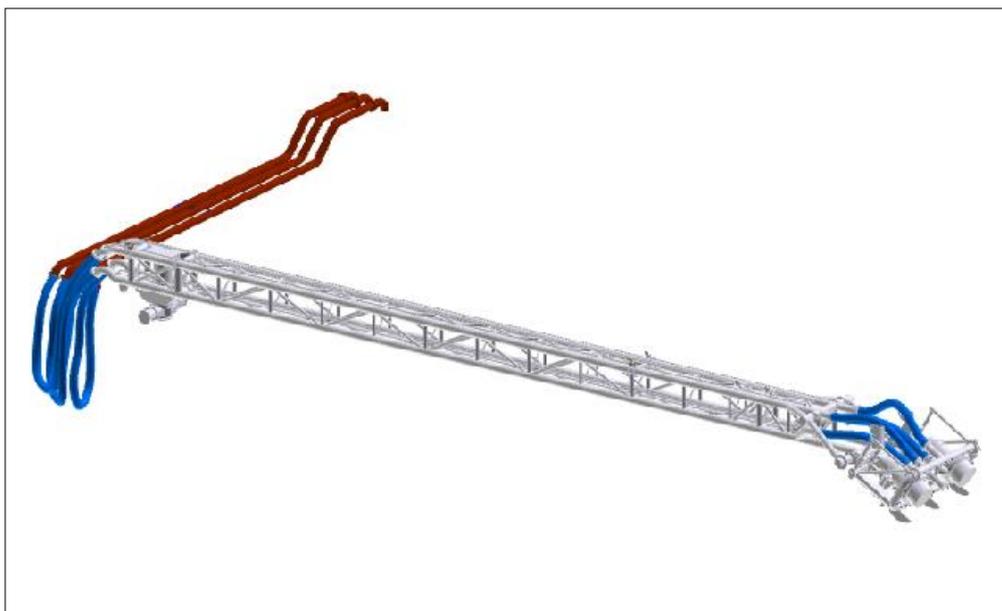


Figure 7.3 Trailing Arm Illustration



Figure 7.4 Trailing Arm pre-installed on UB01

### c) Pipe Riding Sleds

The sleds ride on the pipeline with vertically extended jetting arms and educator/ Air lifts. They are lighter and require less deck space than the articulated pontoon sled.



Figure 7.4 Pipe Riding Sled

These sleds are deployed on a job specific basis. Refer also to Section 9.2 for more details

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## 8.0 POST TRENCHING EQUIPMENT SPECIFIC DESCRIPTION

The following is a general description of the equipment supplied by OCS for pipeline post burial:

NO	DESCRIPTION	CAPACITY / DIMENSION (mm)	WEIGHT	QTY
01A	SUCTION FEEDER PUMP DIESEL(complete with suction piping, foot valve and strainer assembly)	1500 m3 / hr at 50psi 4500L x 1600W x 2400H	7.000 MT	02 EA
01B	SUCTION FEEDER PUMP ELECTRIC(complete with Switch board for powering by a 75 kVA x 380Volt generator)	6000 m3 / hour at 50 psi. 4500L x 1600W x 2400H	2 MT	7 EA
02	5 STAGE HIGH PRESSURE/VOLUME CENTRIFUGAL PUMPS	2000 USGPM at 600 psi (parallel) & 1200 psi in series 6100L x 2450W x 2650H	28.000 MT	4 EA
04	4 STAGE CENTRIFUGAL	2000 USGPM (350 psi)	18mT	03 EA
05	JET SLED 001 - Pipe-rider (configured for specific seabed material)	Configured for 12-48in pipelines 5500L x 2000W x 4500H	12.000 MT	01 EA
06	JET SLED 002 - Pipe-rider (configured for specific seabed material)	Configured for 6-16in pipelines 3500L x 1800W x 3000H	4.500 MT	01 EA
07	JET SLED 003 – Pontoon Articulated Arm (PAAJS) (configured for specific seabed mat'l)	Configured for 12-48in pipelines 11400L x 9310 x 2545 (assembled dimension)  Transportable in 2 x 20' Open Top Containers and 1 x 20' Open top Half height container	18 mT	01 EA
08	JET SLED Support/Transport frame	1500L x 2000W x 1500H	2.500 MT	01 EA
09	JET SLED Deployment A- Frame (Hydraulic operated)	8000L x 6000W x 10000H	15.000 MT	01 EA
10	JET HOSE Spooler unit (8" & 2")	5000L x 3000W x 3500H	5.000 MT	01 EA
11	JET HOSE Ø8in x 100ft c/w rated ends	n/a	2.300 MT	02 LGT
12	AIR HOSE Ø2in x 100ft c/w rated ends	n/a	0.400 KG	02 LGT
13	Air Volume Tank c/w rated ports	4000L x 1200W x 1400H	3.300 MT	01 EA
14	Half Height Container (misc. rigging, hoses, fittings, pipe sections)	Various	N/A	02 EA
15	Towing Outrigger	4500L x 2500W x 0.400H	0.250 MT	01 EA
16	Hydraulic Power Unit - complete with control valve (66kW)	Powers tugger winches, spooler and A-frame	3.500 MT	02 EA



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NO	DESCRIPTION	CAPACITY / DIMENSION (mm)	WEIGHT	QTY
17	Hydraulic Tugger Winch (10MT)	Complete with 28mm wire	4.100MT	02 EA
18	JET piping manifold (skid)	6100L x 2400W x 2400H	20.000 MT	01 EA
19	Workshop Container (20ft sea type)	Complete with tooling, spares 6100L x 2450W x 2550H	10.000 MT	01 EA

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**9.0 PRINCIPAL EQUIPMENT DATA SHEETS**

**9.1 UB01 Miss Pennie**

OCS owns utility barge “UB01 Miss Pennie” which is designed and configured specifically for post trenching and includes built in piping for delivery of pressurised air and water to the sled along with an efficient centrally controlled mooring system and sled deployment system.

For further details of the utility barge refer to our separate pre-qualification document “Utility Barge & MultiCat Pre-Qualification”.



Figure 9.1.1 UB01 Ms Pennie General View

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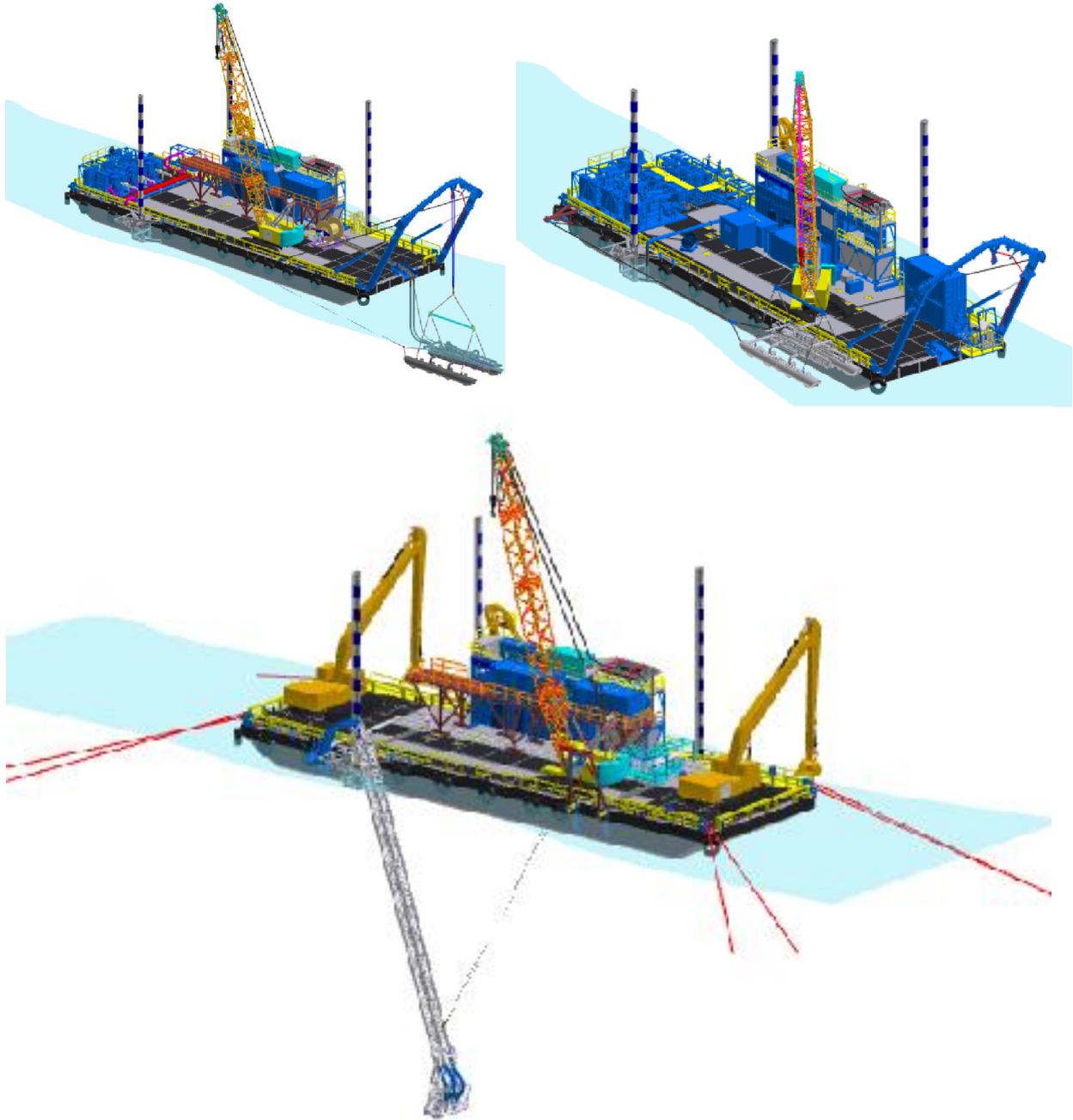


Figure 9.1.2 Configurations for UB01 Ms Pennie for Post Trenching

## 9.2 Jet Sled

OCS owns 2 units of Pipe-rider type Jet Sled, suitable for 12 - 48in pipeline sizes.



Figure 9.2.1 Pipe Riding Sleds

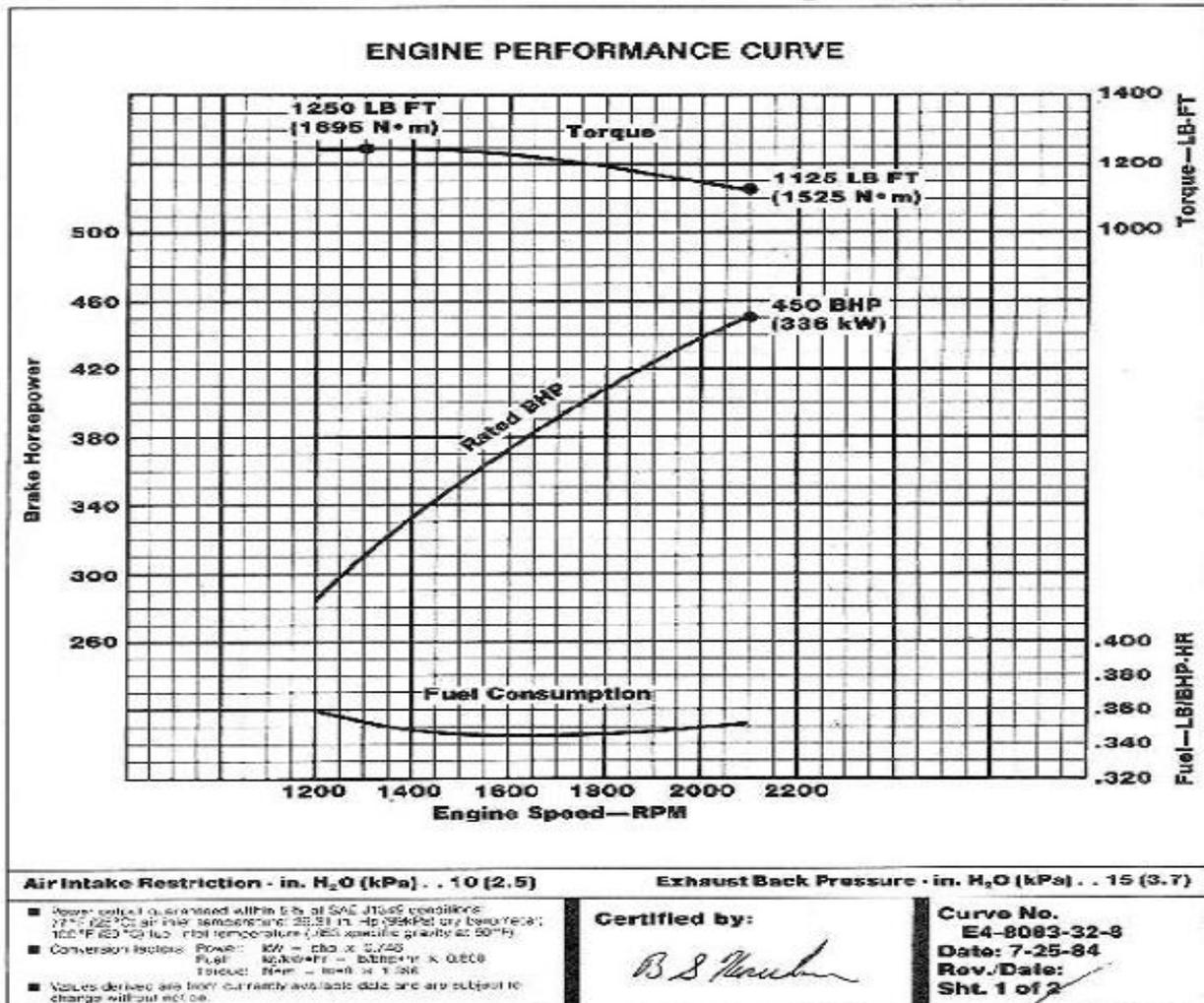
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**9.3 Suction Feeder Pumps**

FLOODING PUMP	- 02 Nos.
Capacity	1590 Cu.m / Hr (7000 US GPM)
Maximum Head	25 meters
Engine Make	Detroit Diesel 8V-92TA 450BHP
Pump Make	SLOW350-380B



**8V-92TA**  
Industrial  
Rated BHP  
450 BHP @ 2100 RPM  
1250 LB-FT @ 1300 RPM  
Injector: 9G85  
Turbocharger: TV8511 (1.39 A/R)



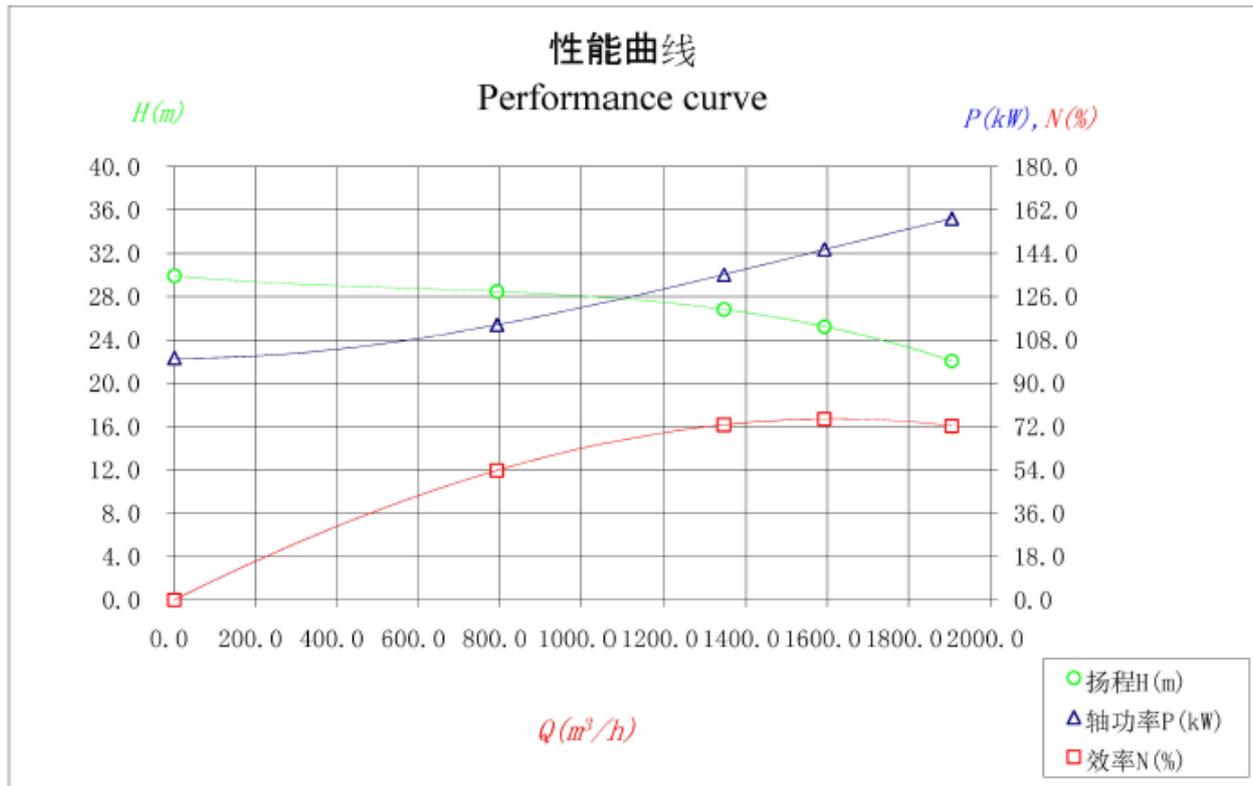
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**水泵检测数据表**

水泵编号Number:

**(PUMP INSPECTION REPORT)**

水泵型号type pump	SL0W350-380B	流量 (m <sup>3</sup> /h) Capacity	1590	功率 (kW) Power	174
泵效率Pump Eff (%)	75.0%	扬程 (m) Head	25	转速 (r/min) Speed	1800
序号NO	流量 Capacity (m <sup>3</sup> /h)	扬程 Head (m)	轴功率 Driver shaft power (kw)	泵效 Pump Eff (%)	换算至额定转速 transfer to rating speed
1	0.0	29.91	100.48	0.0	
2	792.5	28.46	114.24	53.8	
3	1345.6	26.81	135.05	72.7	
4	1592.2	25.22	145.58	75.1	
5	1905.2	22.05	158.28	72.3	



结论: 合格

测试: 胡学刚

日期: 2010年1月

Conclusion: conformity

testing: HXG

date: Jan/10

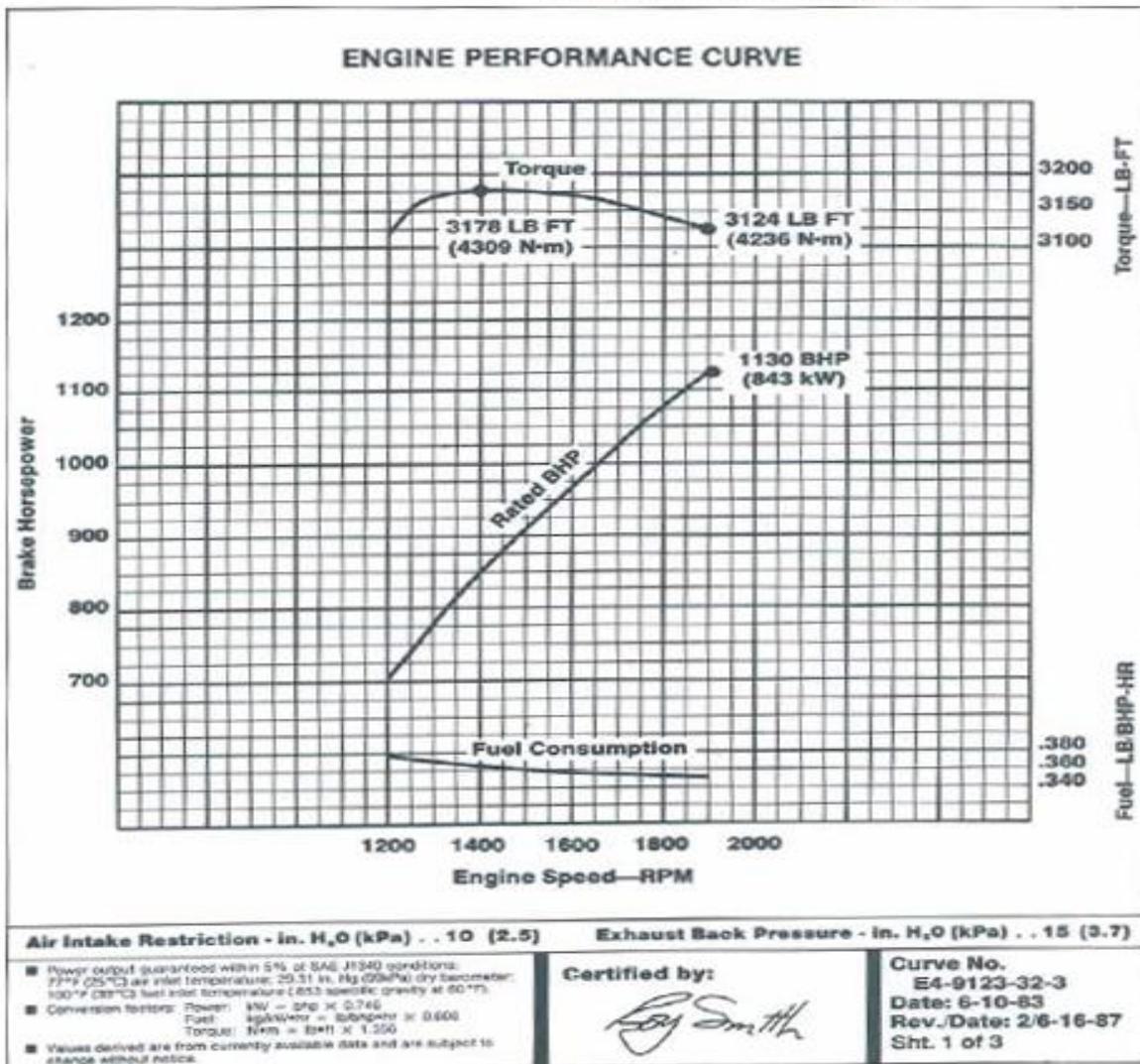
**PIPELINE POST-TRENCHING  
PRE-QUALIFICATION DOCUMENT**

**9.4 4 Stage Centrifugal Pumps**

FLOODING PUMP		- 02 Nos.
Capacity	513Cu.m / Hr (2257 US GPM)	
Maximum Head	367 meters (532 psi)	
Engine Make	Detroit Diesel 12V-149TI 1130BHP	
Pump Make	250SLD 450-60 4	



**12V-149TI  
Industrial  
Rated BHP  
1130 BHP @ 1900 RPM  
3178 LB-FT @ 1400 RPM  
Injector: 150  
Turbocharger: TV7111 (1.08 A/R)**



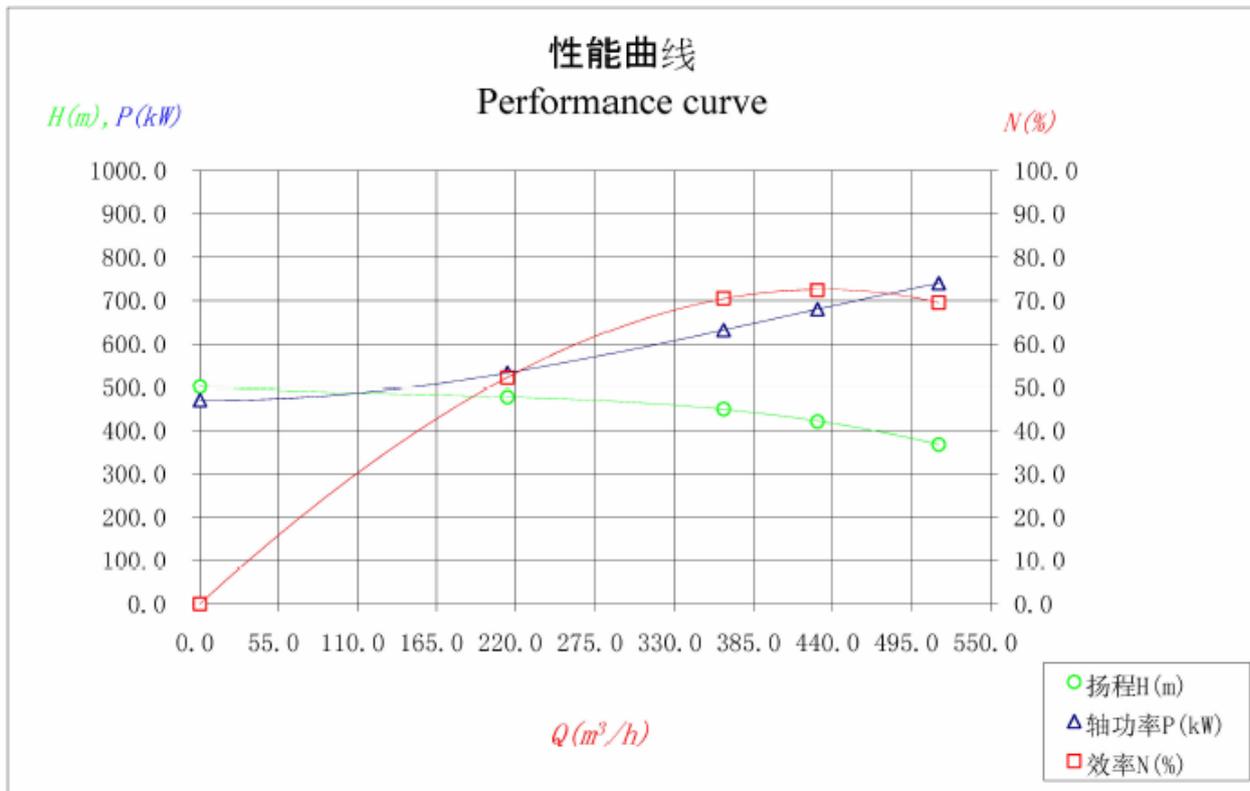
**PIPELINE POST-TRENCHING  
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**水泵检测数据表**

水泵编号Number:

**(PUMP INSPECTION REPORT)**

水泵型号type pump	250SLD450-60*4	流量 (m <sup>3</sup> /h) Capacity	429	功率 (kW) Power	843
泵效率Pump Eff (%)	72.0%	扬程 (m) Head	420	转速 (r/min) Speed	1900
序号NO	流量 Capacity (m <sup>3</sup> /h)	扬程 Head (m)	轴功率 Driver shaft power (kw)	泵效 Pump Eff (%)	换算至额定转速 transfer to rating speed
1	0.00	501.95	470.07	0.0	
2	214.44	477.06	533.17	52.3	
3	363.83	449.74	631.76	70.5	
4	429.29	420.91	679.87	72.4	
5	513.83	367.60	739.81	69.5	



**结论: 合格**  
Conclusion: conformity

**测试: 胡学刚**  
testing: HXG

**日期: 2010年1月**  
date: Jan/10



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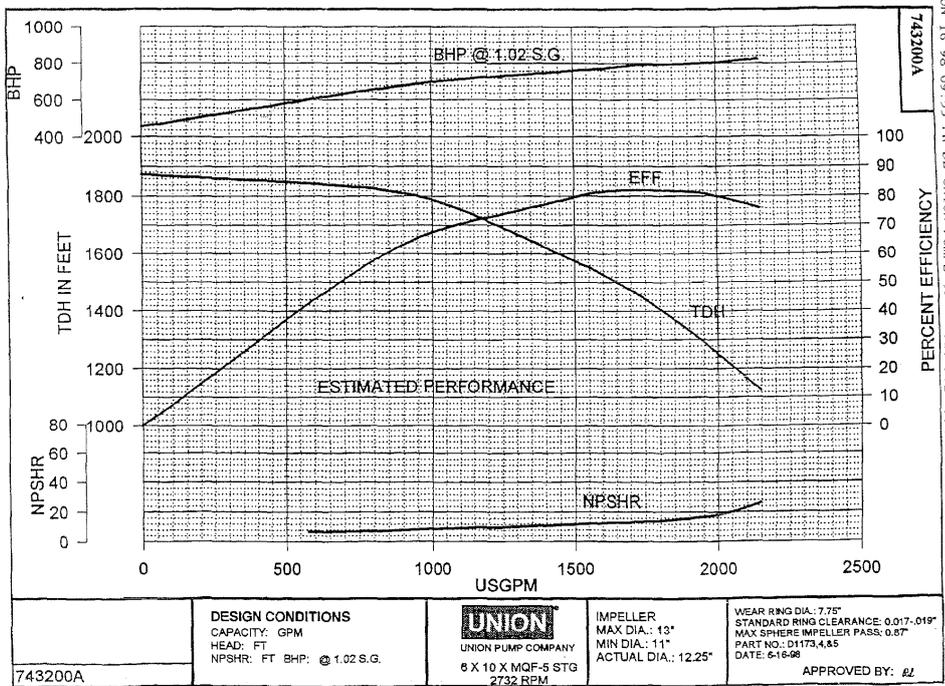


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### 9.5 5 Stage Centrifugal Pumps

OCS owned 5 stage pumps are heavy duty centrifugal pumps which are specialized for FCG and Pipeline Burial projects. These pumps have 5-stage water compression that can produce up to 600psi of pressurized water. It can be used together with other pumps to be put in parallel and series that can even produce up to 1200psi of pressurized water.

ENGINE GM DETROIT DIESEL (POWER TRAIN)	
Model	GM 12-V-149 TI Series
Engine S/N	
Power Output bhp (kW) / Speed (RPM)	1130 bhp (843kW) @ 1900 RPM
Peak Torque lb-ft (Nm)	3178 lb-ft (4309Nm) @ 1400 RPM
LUFKIN GEARBOX (RATIO GEARBOX)	
Model	NM 1000C
Gearbox S/N	
Gear Ratio	1:1.518
UNION PUMP (FLUID-END)	
Model	6x10 MOF-5 STG
Pump S/N	
Flow Rating	454 m <sup>3</sup> /h (2000 USGPM); Head 1250ft @ 2732 RPM (Power Train 1800 RPM) 10" #900 Suction – 6" #900 Discharge
SKID FRAMING	
Dimension (L x W x H)	8534 x 2439 x 3048 mm
Working Weight	~28 ton
No of Unit	4



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**9.6 Hose Deployment Spooler**

OCS's hydraulically powered hose spoolers are an important part of the jetting spread as it houses the 8" water supply hose (fed from the jet pump) & 4" air-hose, configured in a chiksan such that the water/air supply are continuous as the spooler reels out the hoses. The water supply hose is of high strength anti-kink type where it is durable and prevents kinking/collapse during operation. In order to keep less tension on the hose and protect the hose, the deployment and recovery should be assisted by deck crane. A pressure gauge is installed on the inlet of the spooler to obtain the direct pressure reading before the water enters the jet sled.

The specification of the Hose spooler employed in OCS's post trenching spread is as follows:

Hose Spooler Specifications	
Water Hose	8" Thermoid hose
Air Hose	4" Thermoid hose
Water suction/Discharge	8" hammer union
Air suction/Discharge	4" hammer union
Dimensions	5500 x 4000 x 4200 mm x 12MT



Spooler General View/Arrangement  
Figure 9.6.1 Spooler



Spooler with 8" water and 4" air hose laid out

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9.6.2 Layout of Spooler and other equipment on Jetting Barge (DOMGAS Project - Western Australia 2012)

9.7 Jetting Sled Portable Handling A-Frame

**Hydraulically controlled Jet SLED Lifting A-Frame – 40T capacity**

Dimension:-  
Height = 12 m  
Width = 6 m  
Length = 8 m

Weight:  
Base frame = 7 mT  
A-Frame = 7 mT



A-Frame folded for transport



Lifting A-Frame



A-Frame Set up and load test



A-Frame boom out/set up over side of barge with spooler

**9.8 Hydraulic Sled Handling Winch**

**90 hp Power Pack**

Dimension:-

Length:2520mm

Width:1200mm

Height:2040mm

Weight:

Approx. 3.0 ton (dry)

Approx. 3.5 ton (filled)



**10 mT Hydraulic Winch**

Dimension:-

Length:2100mm

Width:1470mm

Height:1322mm

Weight:

Approx. 2.5 tons (no rope)

Approx. 4.1 tons(with 32mm x 360m rope)





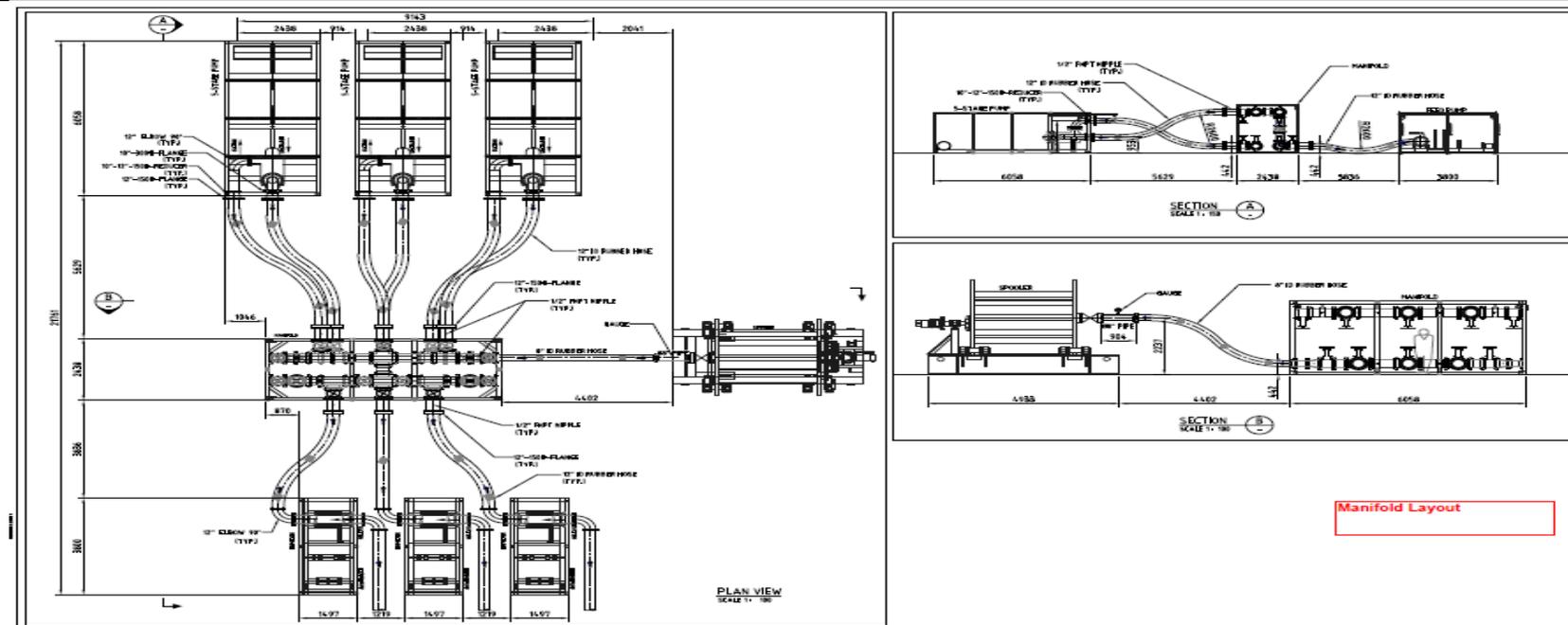
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9.9 Jet Piping Manifold (SKID)

Dimension:- Weight:  
Length: 6058mm Approx. 20 ton (dry)  
Width: 2438mm Approx. 22.5 ton (filled)  
Height: 2890mm



Manifold Layout

NO.	REV.	DATE	DESCRIPTION	BY	CHECKED	DATE	DESCRIPTION
A	001	24/02/08	ISSUED FOR REVIEW				

	DESIGNER	I. KZA	DATE	22/02/08
	CHECKER	L. JES	DATE	22/02/08
DISSEMINATION RESPONSIBILITY	ENGINEER	I. RAMALE	DATE	22/02/08
	DRAWN	APPJ	DATE	

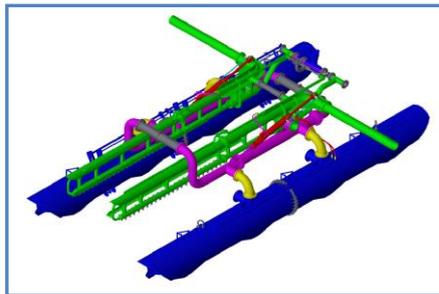
PIGGING/JETTING MANIFOLD LAYOUT (SHEET 1 OF 2)	
SCALE	AS SHOWN
FIG NO	DRW-005-20-CS-JM-02
REV	A3
REV	A

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9.10 Articulated Jet Sled

**General Dimension**

11400L x 9310 x 2545 (assembled dimension)



**Overview**



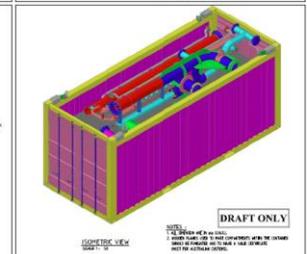
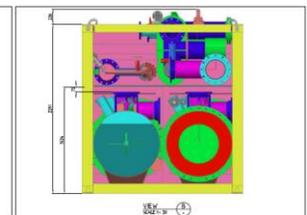
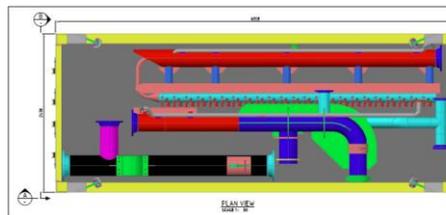
Specification of the OCS Articulated jet sled are as follows:

- Jetting Nozzles - 322 nos
- Jetting Nozzle Dia - 5/16" – 3/8" (7.93 – 25mm)
- Nozzle Pattern - Vertical axis along the front of jetting arms
- Flow Rate - 1550 – 1650m<sup>3</sup> / hr
- Eductors (Rear) - 10" x 2nos
- Trench Depth - Maximum 2.5m based on jetting arms adjustment

No of Units - 1

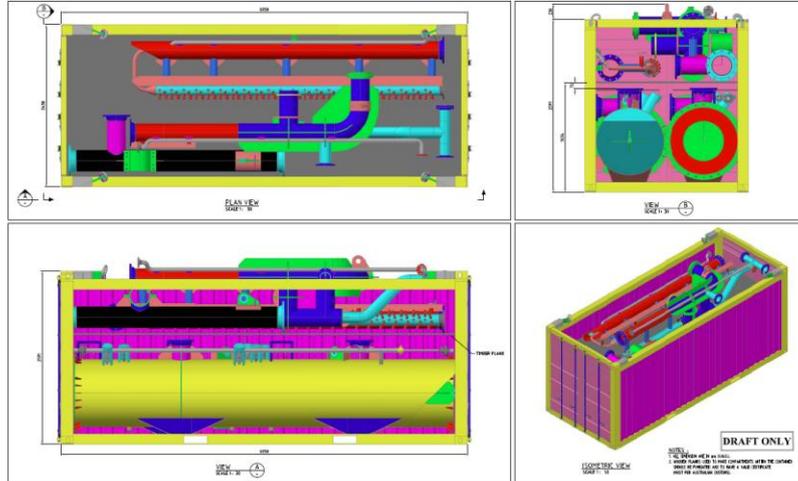
Transportable in 2 x 20' open top containers and 1 x 20' open top Half height container

**Container 1**

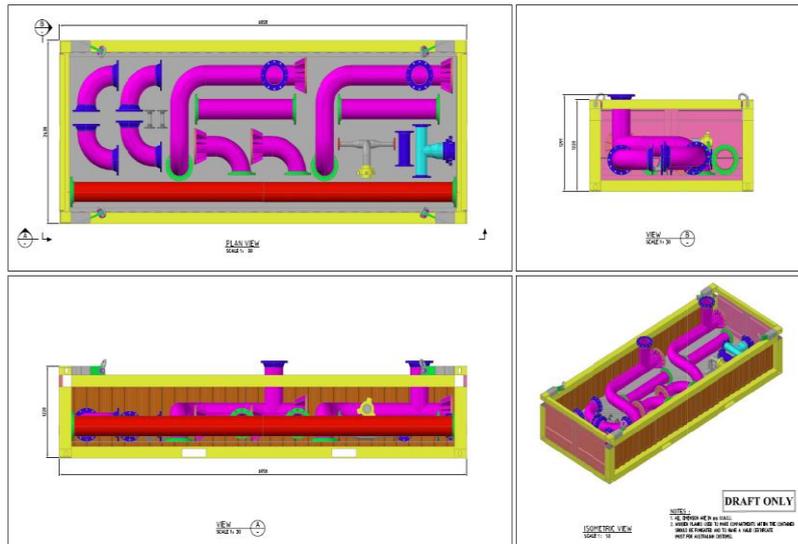


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Container 2



Container 3



**9.11 Pictures – Jetting Operations**



**Figure 9.11.1 Setting SLED onto pipeline**



**Figure 9.11.2 Jetting in operation -1**



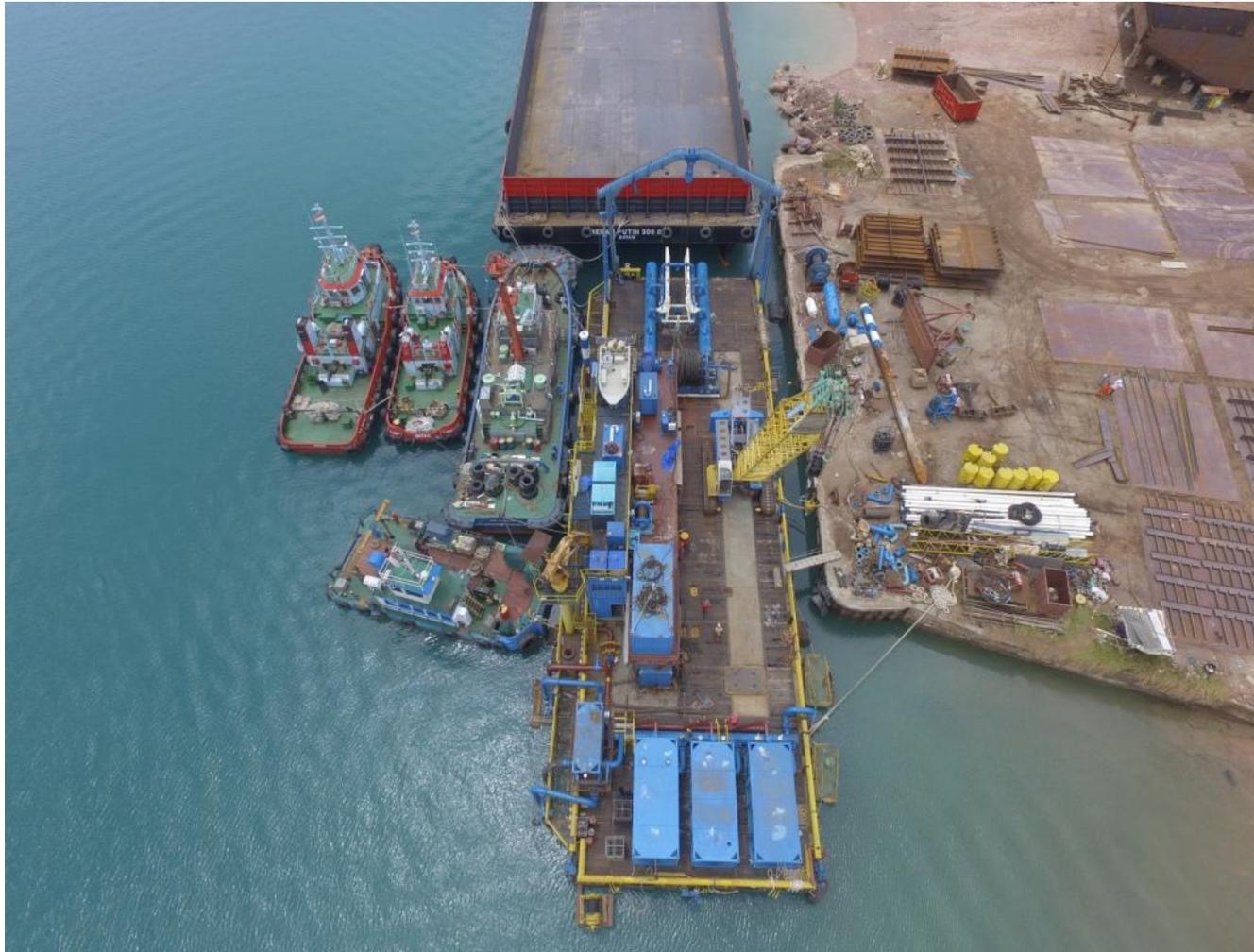
**Figure 9.11.3 Jetting in operation -2**



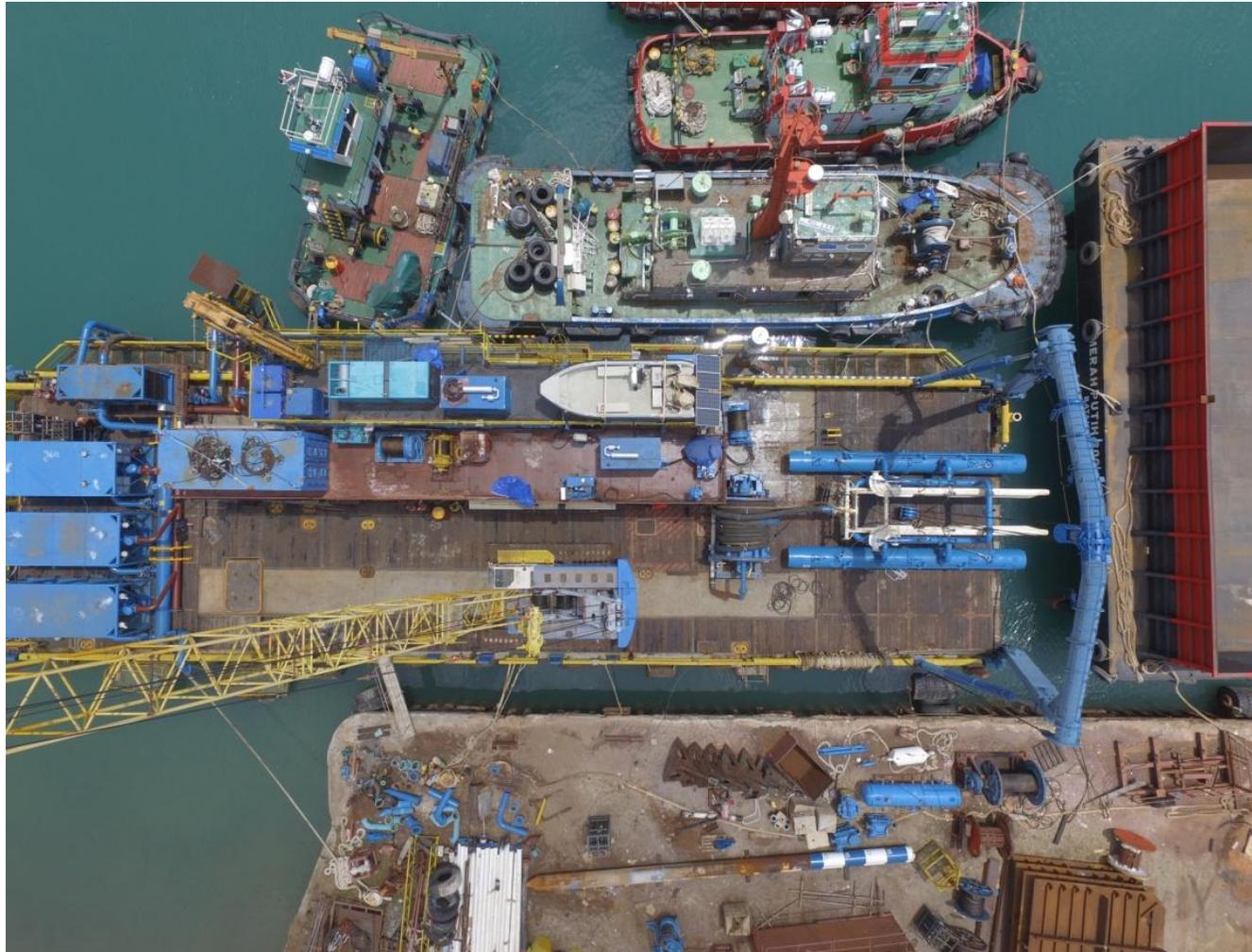
**Figure 9.11.4 Jetting in operation -3**



**Figure 9.11.5 Post Trenching Spread Rigged-Up on Miss Pennie -1**



**Figure 9.11.6 Post Trenching Spread Rigged-Up on Miss Pennie - 2**



**Figure 9.11.7 Post Trenching Spread Rigged-Up on Miss Pennie – 2**



**Figure 9.11.8 Post Trenching Spread Testing on Miss Pennie**





Figure 9.11.10 Deployment of Pontoon Articulated Jet Sled on a 3<sup>rd</sup> Party Barge (Kalinda)



Figure 9.11.11 Deployment of Pipe Riding Sled on 3<sup>rd</sup> party vessel Timas DLB01 (Ketapang)

**9.12 Pictures – Water Jet Distribution System**



**PIPELINE POST-TRENCHING  
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**9.13 Trailer Arm**

Another configuration for post trenching in water depth up to 31m is the use of a Trailing Arm equipped with an articulating jetting arm. OCS has already executed pre-trenching project using this trailing arm in Sriracha Refinery Project for Exxon Thailand and the same arrangement can be adopted for post trenching thus making an additional available configuration option for our UB01 Miss Pennie for clients to consider.



Figure 9.13.1 Trailing Arm on UB01 Ms Pennie Illustration

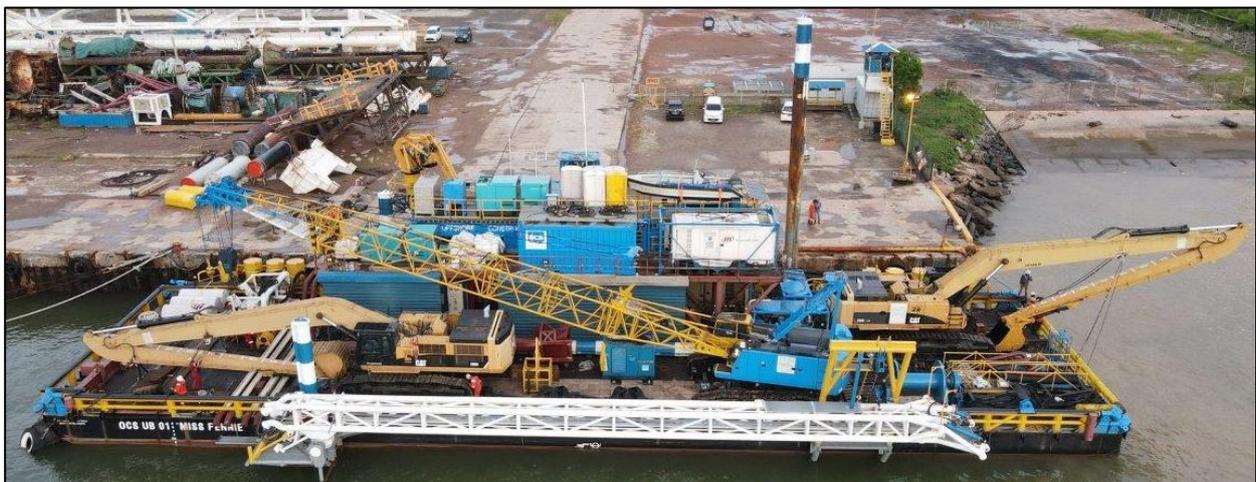


Figure 9.13.2 Trailing Arm on UB01 Ms Pennie Actual load out configuration for Sriracha Project



Figure 9.13.3 Trailing Arm working on UB01 Ms Pennie Illustration

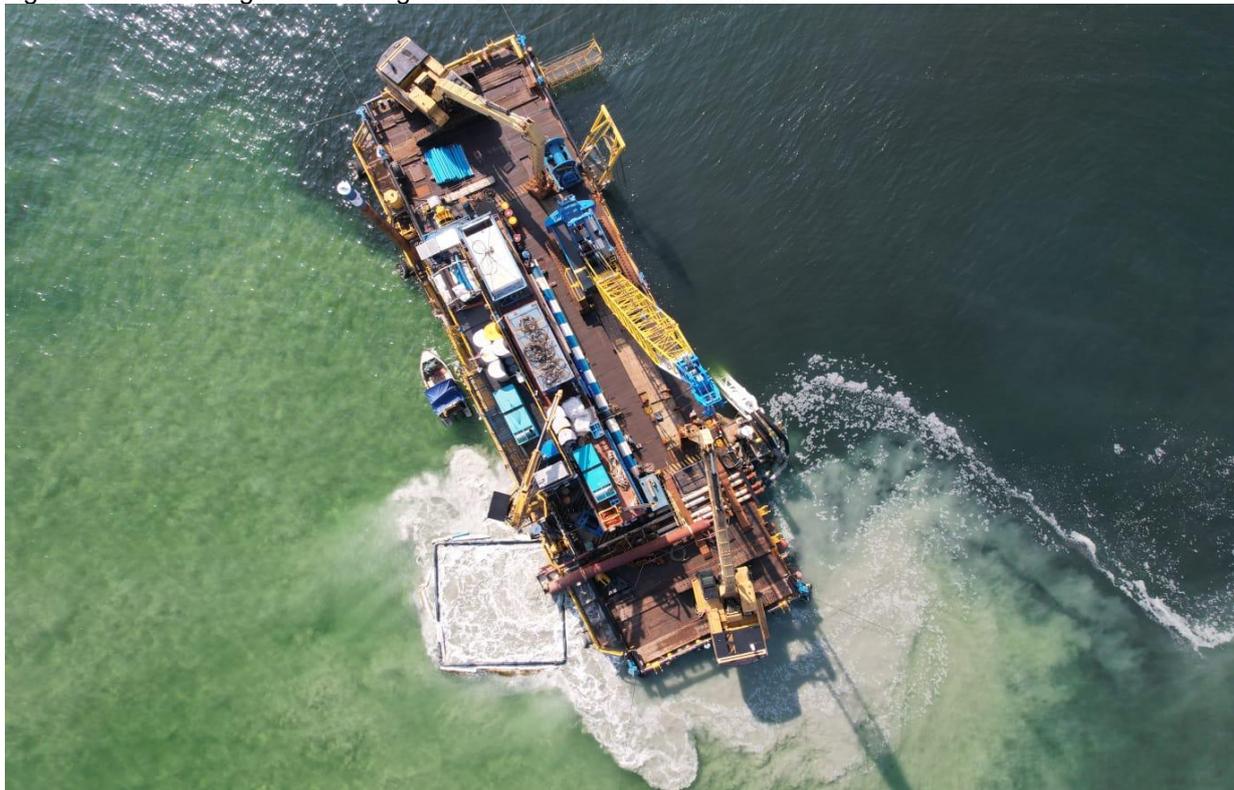


Figure 9.13.4 Pre-Trenching with Trailing Arm in Sriracha Project (can be adopted for post trench) – Aerial view



Figure 9.13.5 Pre-Trenching with Trailing Arm in Sriracha Project (can be adopted for Post Trench)

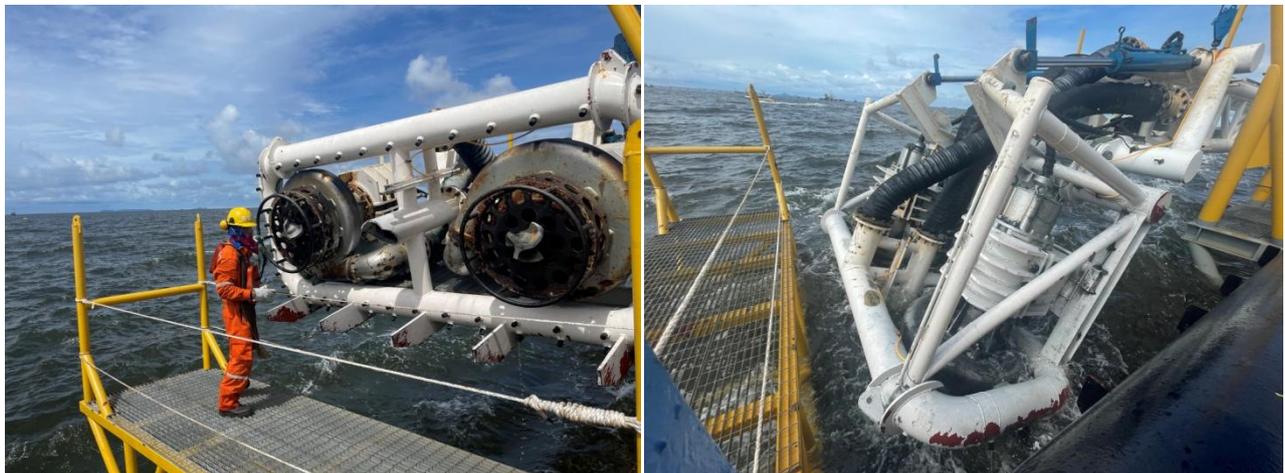


Figure 9.13.6 Pre-trenching Trailing Arm with Submersible Dredge Pump Components (Bottom section)

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Figure 9.13.7 Trailing Arm Components (Arm and top support section)

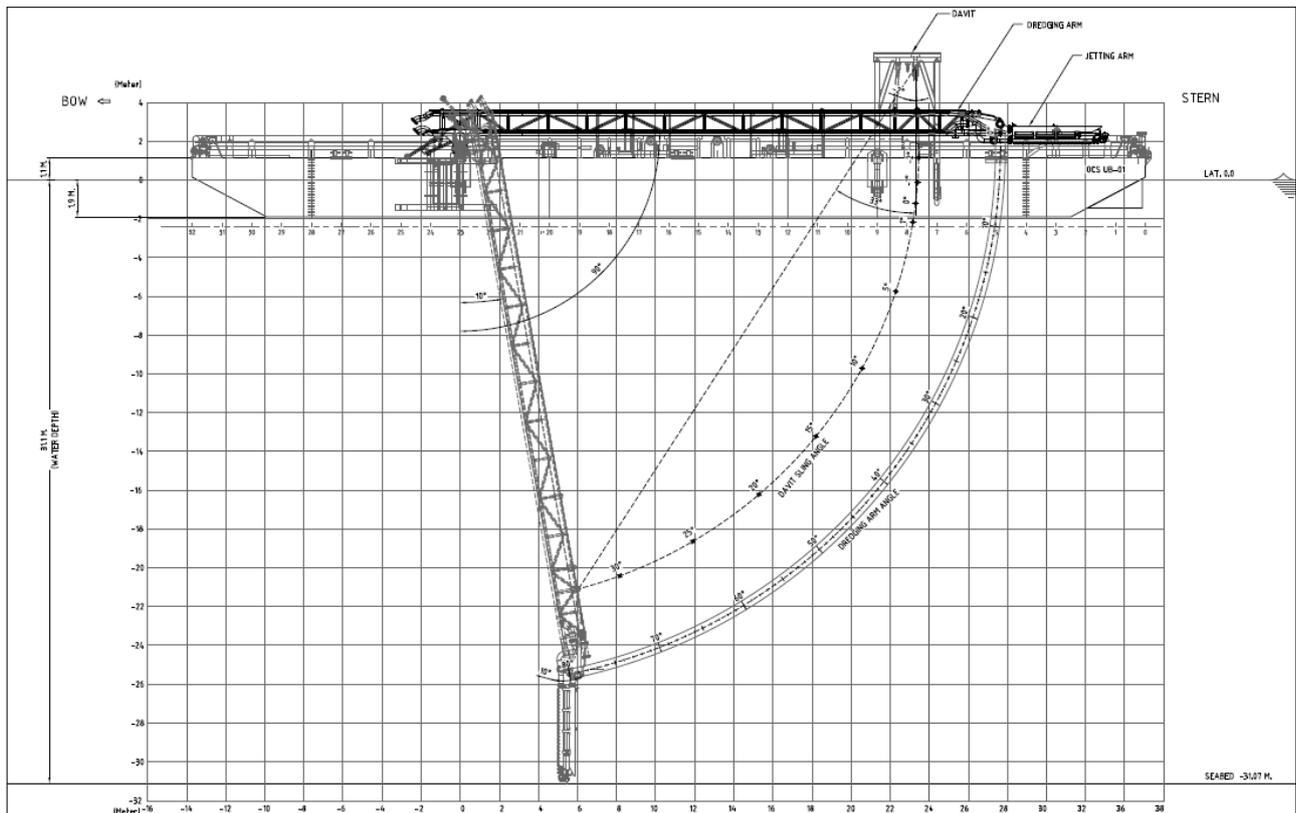


Figure 9.13.8 Trailing Arm with jetting arm configuration for post trenching



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### 10.0 ISO CERTIFICATION



## Certificate of Registration

This certificate has been awarded to

**Offshore Construction Specialists Pte Ltd**  
36 Kian Teck Road, Singapore 628781, Singapore

in recognition of the organization's Quality Management System which complies with

**ISO 9001:2015**

The scope of activities covered by this certificate is defined below

**Provision of Project Management and Consultancy Services for Oil and Gas Construction Facilities**

<b>Certificate Number:</b>	<b>Date of Issue: (Original)</b>	<b>Date of Issue:</b>
41578/B/0001/SA/En	04 November 2016	04 November 2019
<b>Issue No:</b>	<b>Expiry Date:</b>	
2	03 November 2022	

Issued by:  On behalf of the Director



If there is any doubt as to authenticity of this certificate, please do not hesitate to contact the Head Office of the Group on info@ur-certification.com  
URS is a member of United Registrar of Systems (Singapore) Ltd, United House, 111111 Road, Singapore, 041 222 222. Company Registration no. 20068888  
URS Pte Ltd Pte Ltd, 1500A Beach Road #150-022, The Plaza, Singapore 109957

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Certificate Number:

41578/C/0001/UK/En

Date of Issue: (Original)

06 November 2016

Date of Issue:

06 November 2019

Issue No:

3

Expiry Date:

05 November 2022

Issued by:

On behalf of the Schemes Manager



If there is any doubt as to the authenticity of this certificate, please do not hesitate to contact the Head Office of the United Registrar of Systems (URS) at 11 Raffles Quay, Singapore 048503. URS is a member of United Registrar of Systems (Holdings) Ltd, United House, 4 Market Road, Bournemouth, BH1 2BS, UK. Company Registration no. 5050465

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**OFFSHORE CONSTRUCTION SPECIALISTS**

**PIPELINE POST-TRENCHING  
PRE-QUALIFICATION DOCUMENT**



## 11.0 NATA CERTIFICATION

**NATA**

**NATA  
ACCREDITED LABORATORY**

National Association of Testing Authorities, Australia  
(ABN 59 004 379 748)  
has accredited

**Offshore Construction Specialists Pte Ltd  
Singapore**

following demonstration of its technical competence to operate in accordance with  
**ISO/IEC 17025**

This facility is accredited for the tests shown on the *Scope of Accreditation* issued by NATA

  
**Jennifer Evans**  
Chief Executive Officer

Date of issue: 14 May 2020  
Date of accreditation: 15 July 2013  
Accreditation number: 19122  
Site number: 21585

NATA is Australia's government-endorsed accreditor of laboratories, and a leader in accreditation internationally. NATA is a signatory to the international mutual recognition arrangements of the International Laboratory Accreditation Cooperation (ILAC) and the Asia Pacific Accreditation Cooperation (APAC).  
APC-1-9 / Issue 5 / May 2015



**OFFSHORE CONSTRUCTION SPECIALISTS**

**PIPELINE POST-TRENCHING  
PRE-QUALIFICATION DOCUMENT**



**12.0 BCA CERTIFICATION**

Serial No : C2108038

**Building and Construction Authority**

**CERTIFICATE OF LICENCE**

This is to certify that

**OFFSHORE CONSTRUCTION SPECIALISTS  
PTE LTD**

(Unique Entity Number / ACRA Registration Number : 200720801G )

is licensed as a

General Builder Class 1  
(24 Aug 2021 to 24 Aug 2024)

under Part VA of the Building Control Act and Building Control  
(Licensing of Builders) Regulations 2008



Date: 25 Aug 2021

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Commissioner of Building Control  
Singapore

	<p align="center"><b>OFFSHORE CONSTRUCTION SPECIALISTS</b></p>	 
	<p align="center"><b>PIPELINE POST-TRENCHING PRE-QUALIFICATION DOCUMENT</b></p>	

**13.0 EXPERIENCE LIST /TRACK RECORD**

**SUBJECT: KAMBUNA (APD/SERICA) POST TRENCHING**

**Project Details:-**

Asia Petroleum Development (APD) Ltd developed the Glagah Kambuna Field located approximately 70km North East of Medan, North Sumatera. An offshore wellhead platform (WHS-A) will produce gas and condensate, which will transport to the Onshore Receiving Facilities (ORF) by a 14" Pipeline for further processing. The pipeline is 42 km long from the Kambuna platform in the straits of Malacca to the landfall site.

**Pipeline/Trench Information:-**

Pipeline Size:-	14"
Pipeline wt:	11.5mm to 11.9mm
Pipeline Grade	API 5LX65
Total Pipeline length	42 km
Water Depth	35 m Deepest
Beach Pull Length	5km pull
Pre-trench	5km to nearshore
Post trench	8km till 13m water depth
Cover	2m T.O.P

**Project Scope:-**

OCS was contracted by PT TIMAS Suplindo (main contractor to APD) to provide management and technical services to prepare, plan and manage the installation of the 14" pipeline including beach preparation, nearshore preparation, beach pull execution, pipelay, pre and post trenching. The project was completed in 2009.



**SUBJECT: UJUNG PANGKAH (Phase 1) HESS INDONESIA POST TRENCHING**

**Project Details:-**

HESS (INDONESIA-PANGKAH) LTD (HIPL), undertook the development of the Ujung Pangkah oil and gas field. The Ujung Pangkah field lies adjacent to the Solo river delta, which was formed due to the river being diverted in the 1930's. The original seabed surface has been overlain by the deposition of a large amount of soft silt layer up to 30m thick, giving a water depth ranging from 5 to 30m.

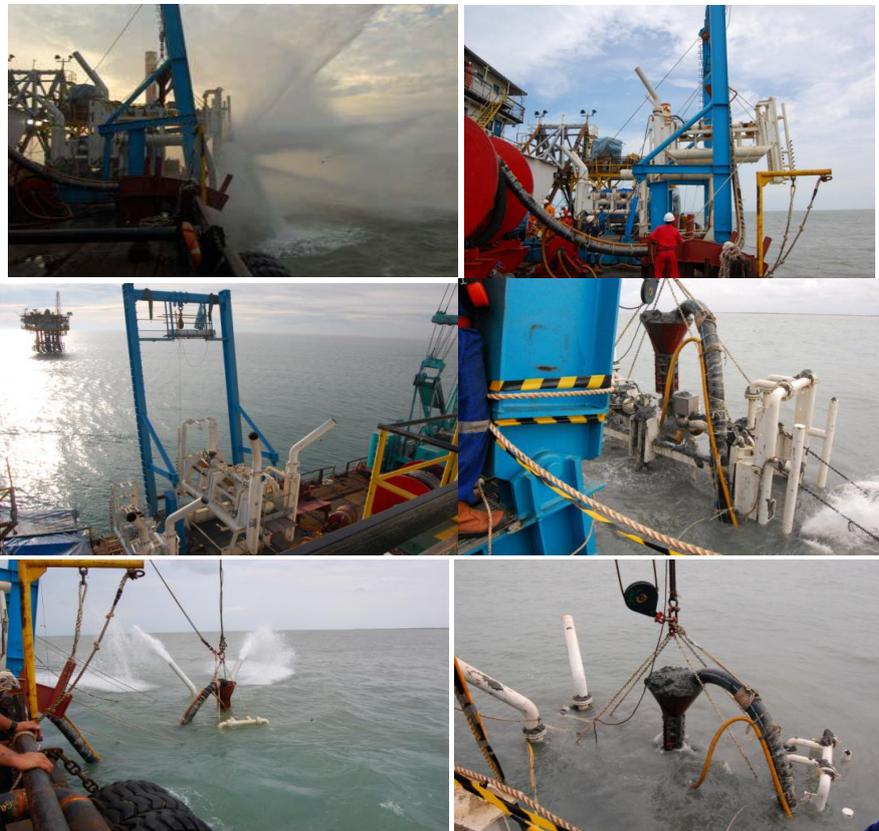
The Ujung Pangkah field is located between 2 and 10km offshore off the north coast of East Java, Indonesia. The existing facilities consist of a wellhead platform (WHP-A) and 1ea x 18" subsea export pipeline from the WHP-A platform to onshore processing facility (OPF) at Gresik. A new wellhead platform, WHP-B, is to be installed approximately 5 km northwest from the existing platform, WHP-A. The 3ea x subsea flowlines, 6.625in OD, 12.75in OD and 16in OD will be installed to connect WHP-B and WHP-A.

**Pipeline/Trench Information:-**

Pipeline Size:-	6"/12" and 16"
Pipeline wt:	varies
Pipeline Grade	API 5LX60
Total Pipeline length	5.5km each
Water Depth	15m max
Beach Pull Length	NA (Pltf – Pltf)
Pre-trench NA	
Post trench	5km till 13m WD for each pipeline
Cover	2m T.O.P

**Project Scope:-**

OCS was contracted by PT TIMAS Suplindo (main contractor to APD) to provide project management and technical services to prepare, plan and manage the installation of the new facilities comprising WHP-B platform and 3x pipelines including start up, pipelay, post trenching and pre-commissioning. The project was completed in 2010/2011



**SUBJECT: DOMGAS (CLOUGH-SAPURA JV) CHEVRON AUSTRALIA POST TRENCHING**

**Project Details:-**

Clough Sapura JV (CSJV) was contracted by Chevron Australia PTY Ltd for the installation of the 20" x 59.4km long offshore Domgas pipeline from Barrow island to mainland Australia for the Gorgon Project. In order to achieve required permanent stability of the Domgas pipeline, it was required to use a combination of pre/post pipelay trenching and stabilization anchors at specific locations. Post trenching operations were carried out between KP18.2 to KP34.3 (using DWLB Java Constructor) and between KP48.414 to KP57.014 (with SWLB Kalinda)

**Pipeline/Trench Information:-**

Pipeline Size:-	20"(508mm)
Pipeline wt:	15.9
Pipeline Grade	DNV HFW 450 DF
Total Pipeline length	59.4km
Water Depth	15m max
Beach Pull Length	NA (Onshore – Pltf)
Pre-trench	NA
Post trench	KP18.2 to KP34.3 and KP48.414 to KP57.014
Post Trench Cover	0.5m to 1m T.O.P

**Project Scope:-**

OCS was contracted by CSJV to provide Post Trenching system and offshore support for the post trenching requirement. The project was completed in 2012.



**SUBJECT: PERTAMINA EP MOL (LEIGHTON) POST TRENCHING**

**Project Details:-**

PT Leighton is laying a 12" pipeline near Cirebon in Central Java, Indonesia for Pertamina EP.

**Project Scope:-**

OCS was contracted by PT TIMAS Suplindo (sub contractor to PT Leighton) to provide equipment and personnel on a day rate basis to support Leighton's project in MOL on board the barge Leighton Faulkner. Project was completed in 2014.

**Pipeline/Trench Information:-**

Pipeline Size:-	12"
Pipeline wt:	varies
Pipeline Grade	NA
Pipeline length	NA
Water Depth	NA
Beach Pull Length	NA
Pre-trench	NA
Post trench	As required
Cover	2m T.O.P



**SUBJECT: KETAPANG BUKIT TUA (PETRONAS INDONESIA) POST TRENCHING**

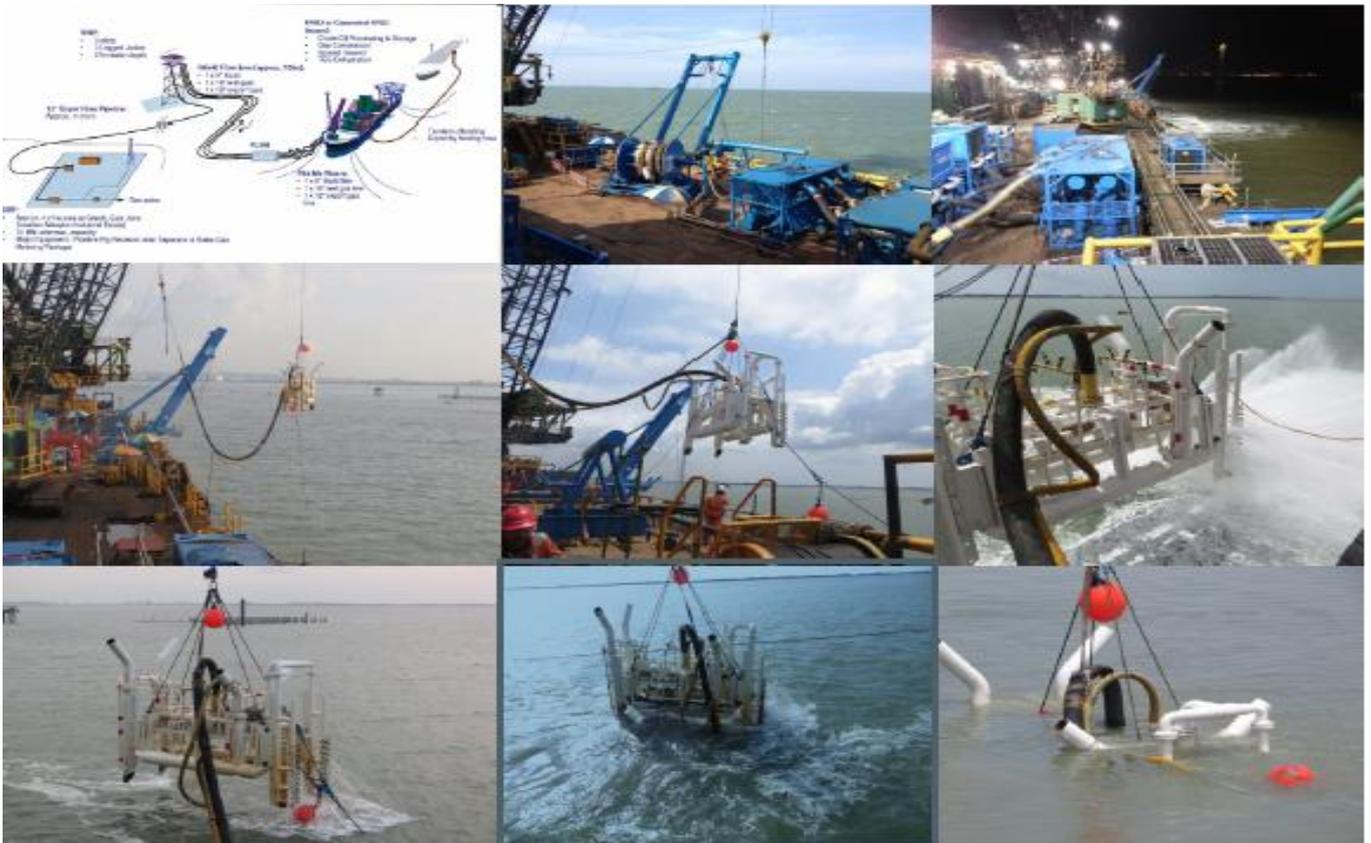
**Project Details:-**

PC Ketapang II Ltd (PCK2L) is developing the Bukit Tua Field, in Ketapang Block, East Java. Bukit Tua, is located 35 km north of Madura Island and 110 km northeast of Gresik at a water depth of approximately 57m. The development consist of unmanned Well Head Platform (WHP) which is tied back to a spread-moored Floating Production, Storage and Offloading (FPSO), anchored approximately 900 m from the WHP. The Full Well Stream (FWS) from the wells are separated into gas and liquid streams in the production separator on WHP. The gas and liquid are evacuated to the FPSO via two separator single phase 16" and 8" liquid infield flowlines. Associated gas is compressed and conditioned on the FPSO and exported via a 12" gas pipeline to WHP and there onwards via a 12" gas export pipeline to the Onshore Receiving Facilities (ORF) in Gresik.

**Pipeline/Trench Information:-**

Pipeline Size:-	12"
Pipeline wt:	varies
Pipeline Grade	API 5LX60
Pipeline length	110km
Water Depth	57m @ Pltf
Beach Pull Length	3km
Pre-trench	3km
Post trench	25km
Cover	1-2m T.O.P

**Project Scope:** OCS was contracted by PT TIMAS Suplindo (main contractor to PCK2L) to provide project management and engineering services to prepare, plan and manage the installation of the new facilities comprising WHP platform, 1x12"x110km pipeline and 3x infield pipelines (8", 12" and 16") incl. Pre-trenching, Beach pull, pipelay, post trenching and pre-commissioning. Project was completed in 2014.



**SUBJECT: THAI BINH (PVGAS) POST TRENCHING**

**Project Details:-**

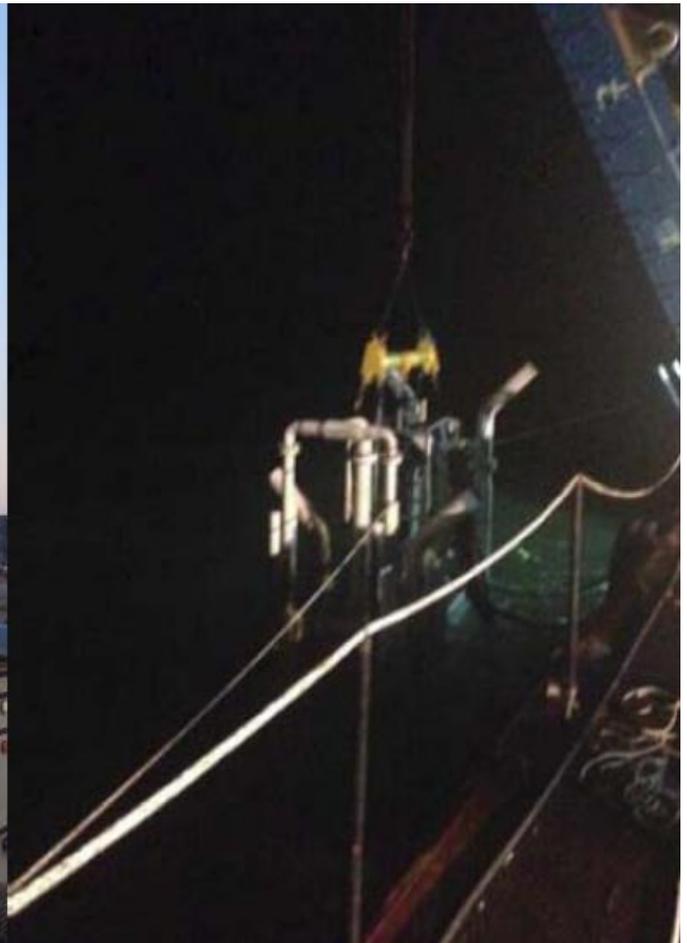
Petro Vietnam Gas Joint Stock Corporation (PVGas) is developing the Thai Binh-Ham Rong Gas Distributino and Gathering Project to transport gas from Ham Rong field (Block 106, Thai Binh field (Block 102) and other fields (Hong Long, Sapa Nam, Hong Ha Block 103 and 107) to industrial zones in Thai Binh and neighbouring provinces in the north of Vietnam. Phase 1 of the project include facilities on Thai Binh Platform, Gas distribution centre (GDC) and gas transport pipeline connecting Thai Binh field to GDC

**Pipeline/Trench Information:-**

Pipeline Size:-	12"
Pipeline wt:	25.4mm
Pipeline Grade	NA
Pipeline length	NA
Water Depth	3.5m to 25m
Beach Pull Length	NA
Pre-trench	NA
Post trench	10.2km
Cover	1m B.O.P

**Project Scope:-**

OCS was contracted by Sapura Offshore (main contractor to PVGas) to provide post trenching services with procedure preparation, equipment and personnel to perform pipeline burial using post trenching of about 11km of 12" pipeline in water depths varying from 3.5m to 25m. Project was completed in 2015



**SUBJECT: JANGKRIK (ENI) POST TRENCHING**

**Project Details:-**

ENI Muara Bakau (Operator) in joint venture with GDF Suez (45%) is developing the Jangkrik Complex Project (JKK) inclusive of Jangkrik Main (JKK Main) and Jangkrik North East (JKNE Fields). The JKK Complex is located in the Muara Bakau PSC permit area, approximately 70km off the coast of Makassar Strait, Offshore Borneo of Indonesia. Water depths in Jangkrik Complex are ranging from 200 to 500m. The subsea development consists of seven (7) wells at JKK Main field and four (4) wells at JKNE field tied back to a spread moored FPU with full treatment facilities. Seven (7) subsea wells of JKK Main field will be drilled from three (3) drilling centres named Drill Centre Cluster 1, Drill Centre Cluster 2 and Drill Centre Cluster 3. Production of these drilling centres will be gathered by 3 manifolds named Manifold 1, Manifold 2 and Manifold 3. Two (2) of JKNE field wells will be satellite wells, connected to an intermediate manifold named Manifold NE2. The remaining two (2) wells will be drilled from a drilling centre named Drill Centre Cluster NE1, where a manifold named Manifold NE1 will gather the production of these two wells.

**Pipeline/Trench Information:-**

Pipeline Size:-	24"/4" Piggyback
Pipeline wt:	15.88mm
Pipeline Grade	API 5L X65
Pipeline length	72km
Water Depth at post trench location	3m to 33m (LAT)
Beach Pull Length	NA
Pre-trench	NA
Post trench	KP70.915 to KP38.99 ~32km
Cover	0.5m – 2m T.O.P

**Project Scope:-**

OCS was subcontracted by PT TIMAS to perform post trenching work on the ENI JANGKRIK 24"/4" (Piggyback) Subsea Pipelines which extends 72.3km from the JANGKRIK FPU to the LTE. PT TIMAS is a subcontractor to the main contractor PT TECHNIP INDONESIA. The shallow water portion was post trenched using the articulated pontoon jet sled.



**SUBJECT: BD PROJECT**

**Project Details:-**

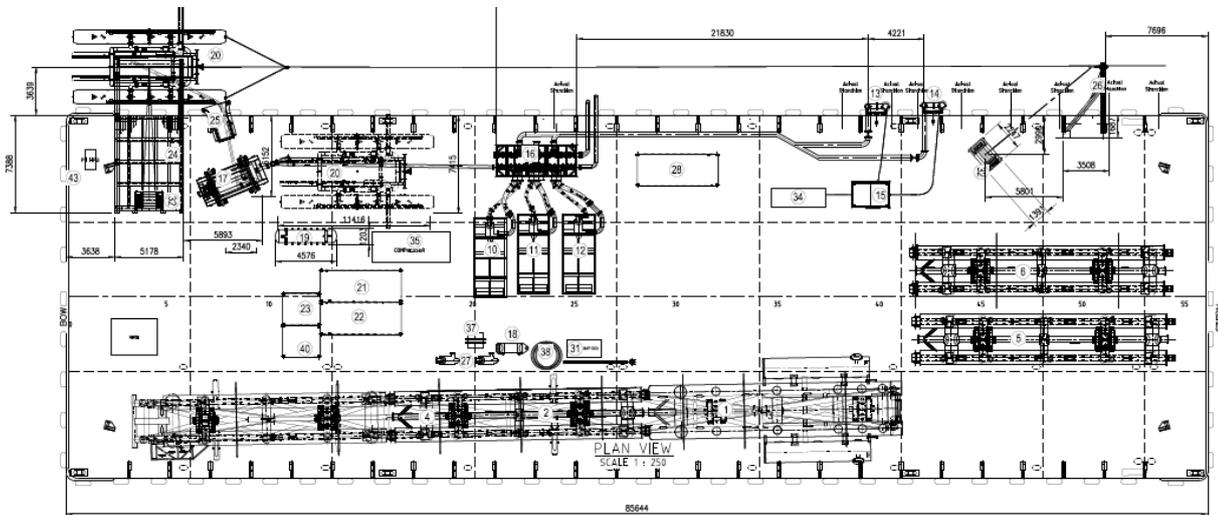
Husky-CNOOC Madura Ltd. (HCML), hereafter referred as COMPANY is developing the Madura Strait Block BD gas reserves for sales gas to buyers in Java Island. This BD field is located offshore in the Madura Strait East Java, about 65 km east of Surabaya and about 16km south of Madura Island. The project envisages development of a wellhead platform; an offshore spread moored Floating, Production, Storage and Offloading (FPSO) with gas processing facilities; Gas metering Station (GMS); flexible risers from wellhead platform to FPSO; and a 16" x 52.924km export gas pipeline from WHP to GMS.

**Pipeline/Trench Information:-**

Pipeline Size:-	16" (406mm)
Pipeline wt:	11.1mm
Pipeline Grade	API 5L X65
Pipeline length	52.924km
Water Depth at post trench location	8m to 13m (LAT)
Beach Pull Length	NA
Pre-trench	NA
Post trench	KP46.118 to KP45.47 ~650m
Cover	2m T.O.P

**Project Scope:-**

OCS was contracted by PT Timas for the provision of 650m Post Trenching scope with 2m cover from T.O.P. at near shore location between KP46.118 to KP45.47 at Pasuran City Surabaya, Indonesia. The Post Trench equipment was set up on a Cargo Asset Barge and towed using the DLB01.



Port Trench equipment set up



**SUBJECT: JAWA-1 COMBINED CYCLE GAS TURBINE POWER PLANT (1760MW) PROJECT**

**Project Details:-**

PT Pertamina (Persero) have formed a Consortium with Marubeni Corporation and Sojitz, named JAWA SATU POWER (“Sponsor”) for the development of LNG Floating Storage and Regasification Facilities including mooring system and gas transmission line i.e. offshore & onshore gas pipeline and Onshore Receiving Facility (ORF) facilities at the receiving point at Cilamaya site in North Java “Facilities”.

The FSRU facility will provide a reliable/alternative source of gas supply to fulfil gas requirement for Power Plants called IPP (Independent Power Producer) SPONSOR with 1760 MW capacity. Facilities is planned to be able for re-gasifying LNG and delivering gas with maximum peak rating of 300 MMSCFD and expandable up to 400 MMSCFD.

The Gas Supply Facilities comprise of:

1. Floating Storage and Regasification Facility (FSRU)
2. 2. Mooring System and Gas Offloading Platform
3. 3. Offshore and Onshore Pipeline (20” x 14km)
4. 4. Onshore Receiving Facility (ORF)

**Pipeline/Trench Information:-**

Pipeline Size:-	20” (508mm)
Pipeline wt:	12.7mm
Pipeline Grade	API 5LX65
Pipeline length	14.05km
Water Depth at post trench location	0.5m to 16m
Beach Pull Length	NA
Pre-trench	NA
Post trench	KP 0.175 to KP 10.75 ~10.6km
Cover	2m T.O.P

**Project Scope:-**

OCS was contracted by PT Meindo for the provision of post trenching scope for the 20” pipeline from KP0.175 to KP 10.75 approximately 10.6km distance with 2.0m TOP at around 0.5 - 16m water depth (LAT).

