



# Karish and Tanin: Current status of activity

(Dr. Steve Moore, Energean Chief Growth Officer (CGO))

**Digitization and Automation in the Oil and Gas Industry – Challenges and Opportunities**  
(Tel Aviv, Israel – June 18<sup>th</sup> 2018)

# Agenda

1. Energean Oil and Gas
2. Karish and Tanin – a brief overview
3. Current status of the project

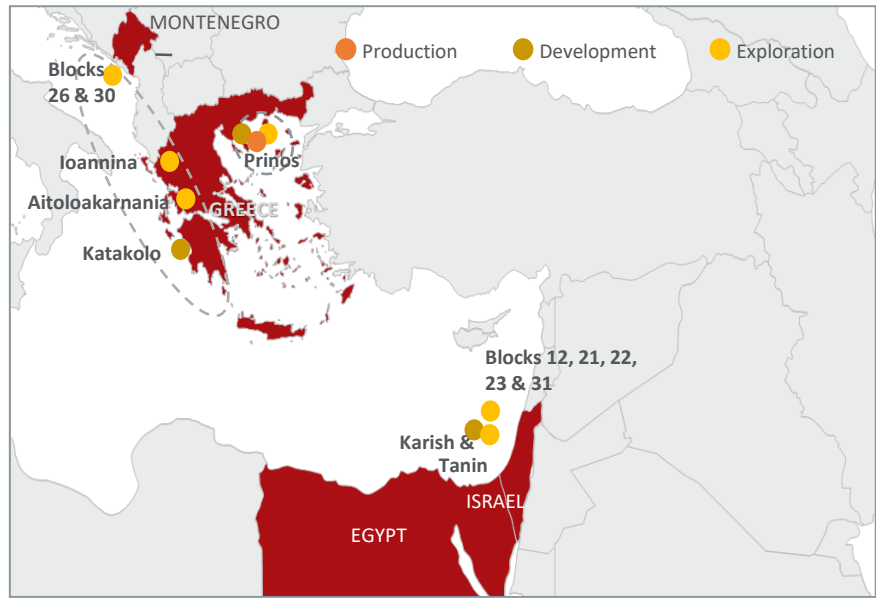
# Energean at a glance

**2.4 Tcf**  
2C gross gas Resources in Israel

**51**  
mmboe 2P Reserves in Greece

**55.8**  
mmbbls of hydrocarbon liquids gross 2C Resources in Greece and Israel

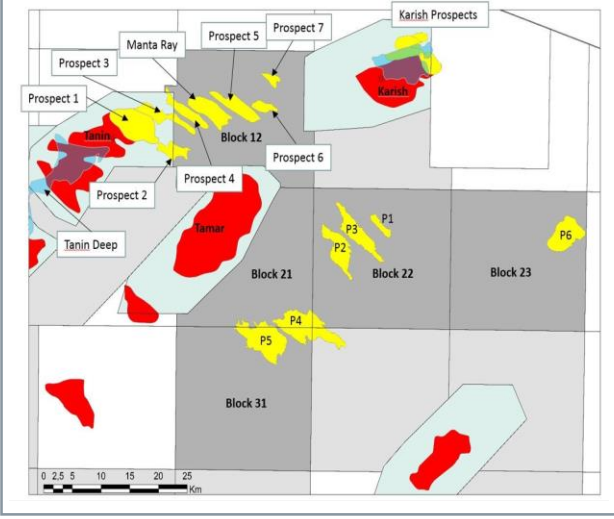
**2,4 Tcf**  
gross unrisks prospective Resources in Israel



## Leading Oil & Gas Development in the Eastern Mediterranean

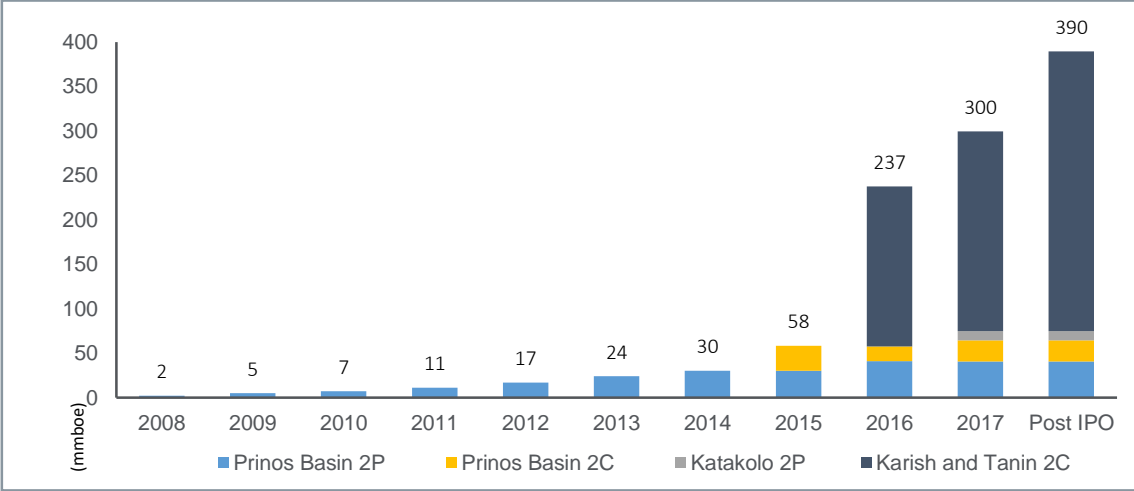


## Significant Israeli asset portfolio



## Industry Partners

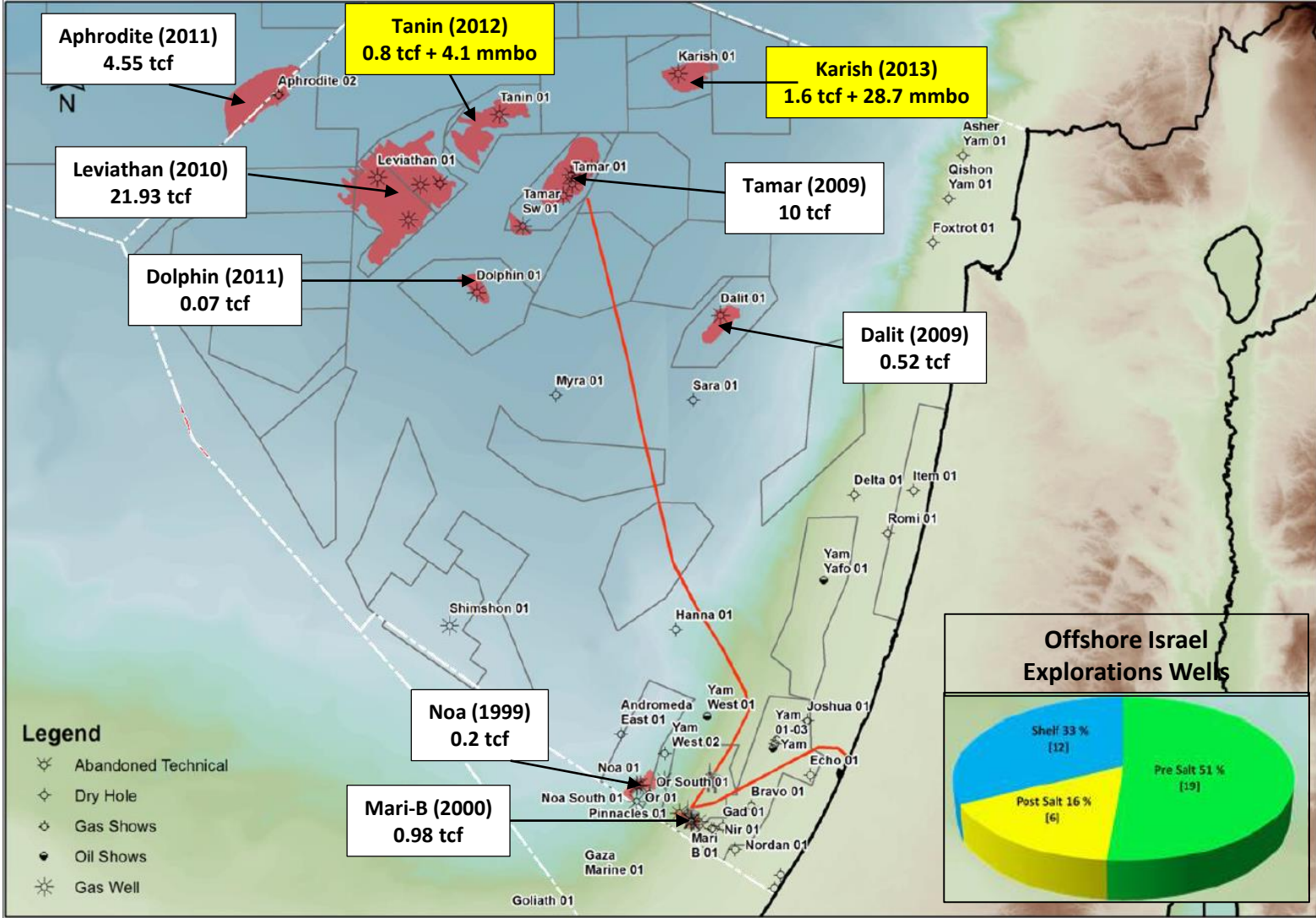
## Reserves Growth History



# Agenda

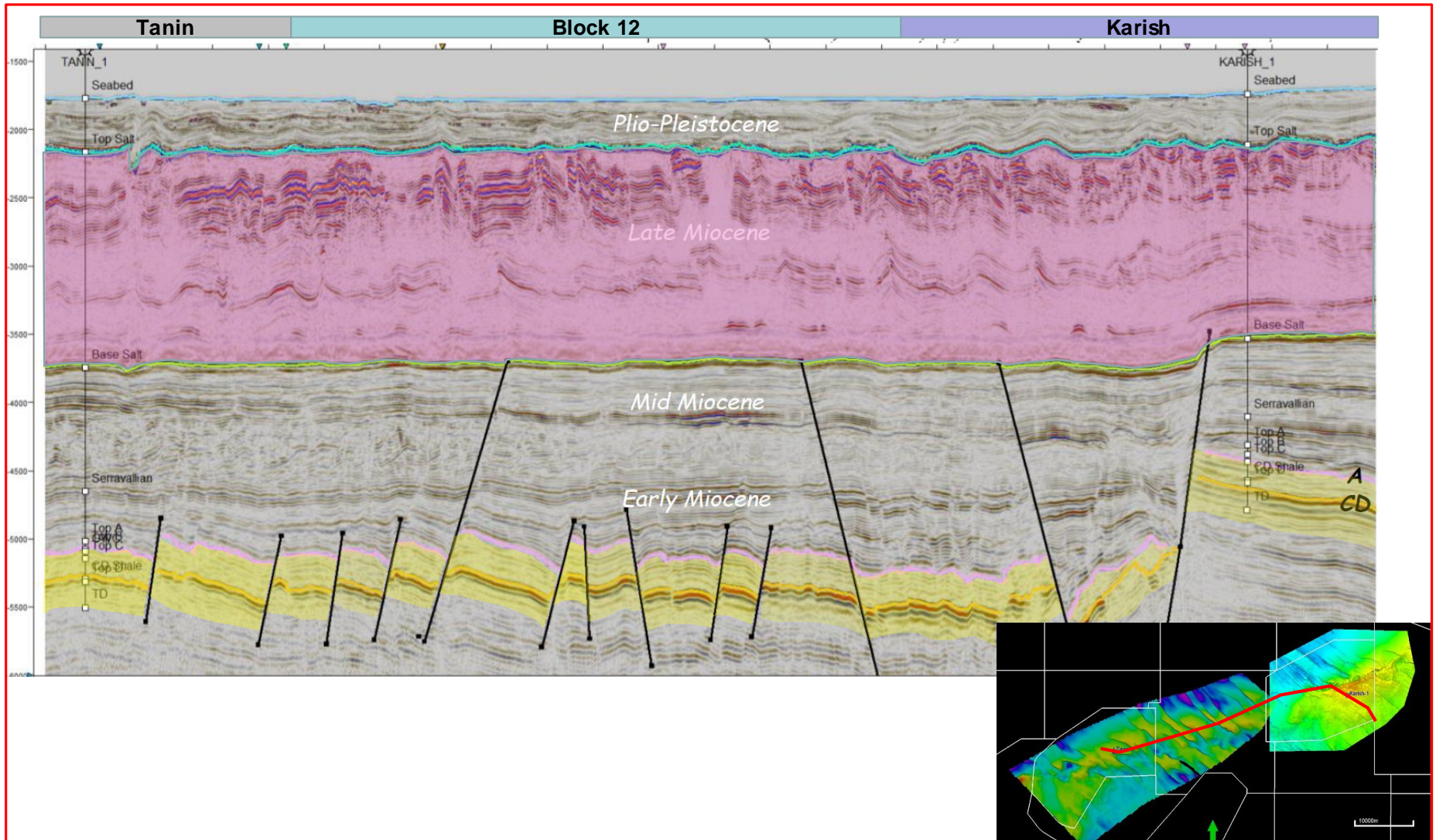
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# Main gas discoveries Offshore Israel since 1999: Over 40Tcf

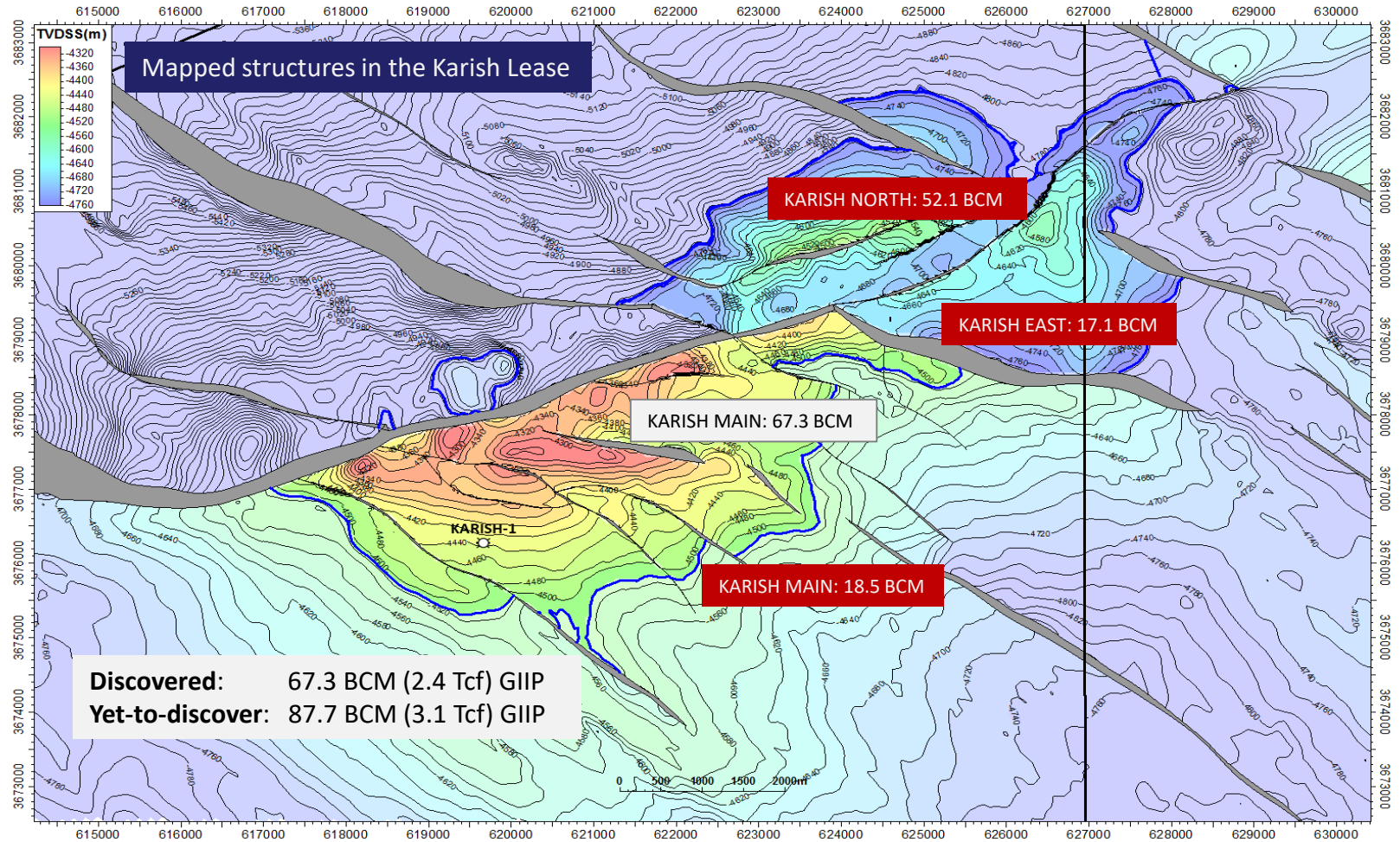


Notes: All volumes are 2C resource estimates prepared by third party (NSAI)

# Regional seismic line between Tanin and Karish



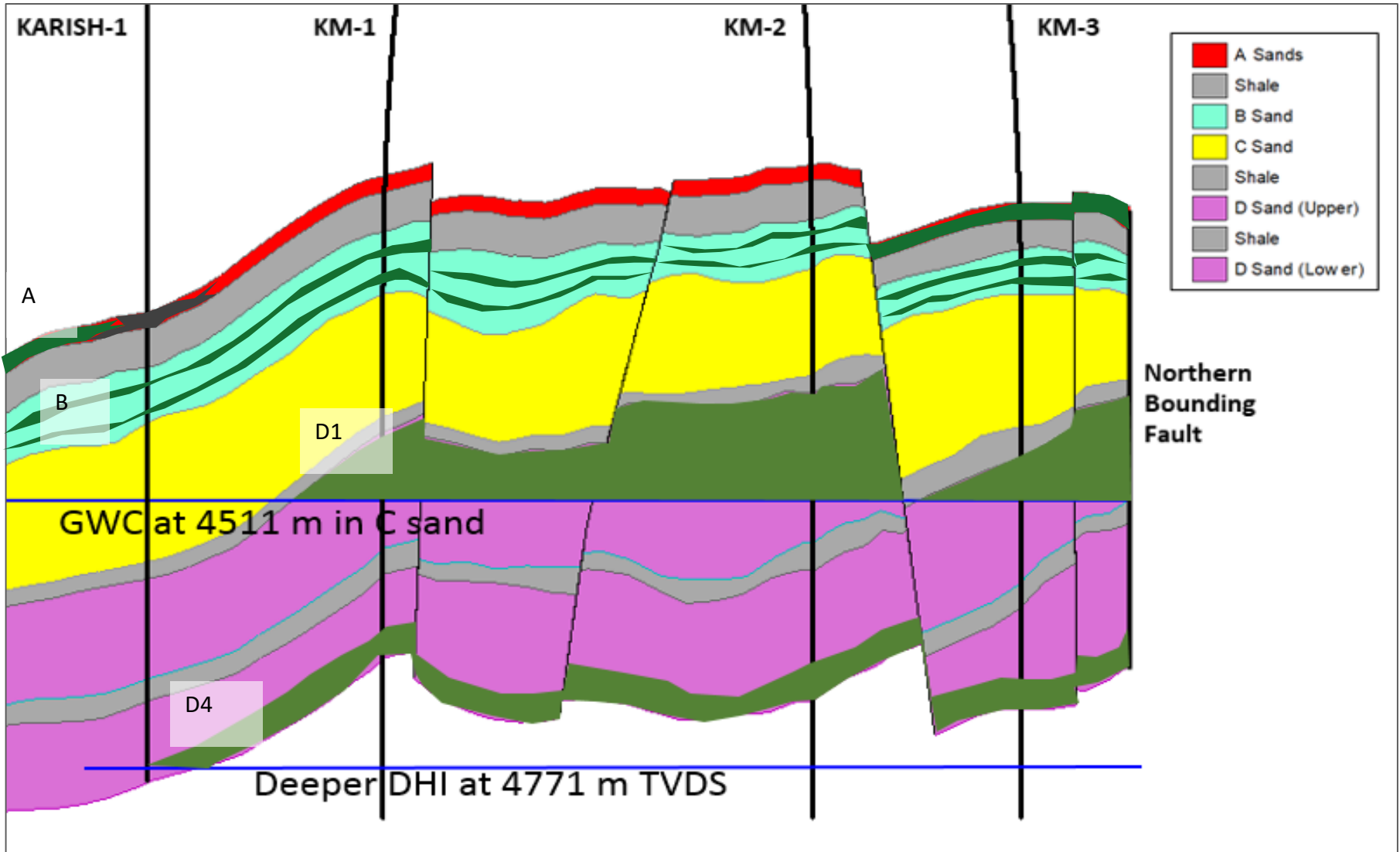
# Karish Field: discovered and undiscovered accumulations



**Notes:**

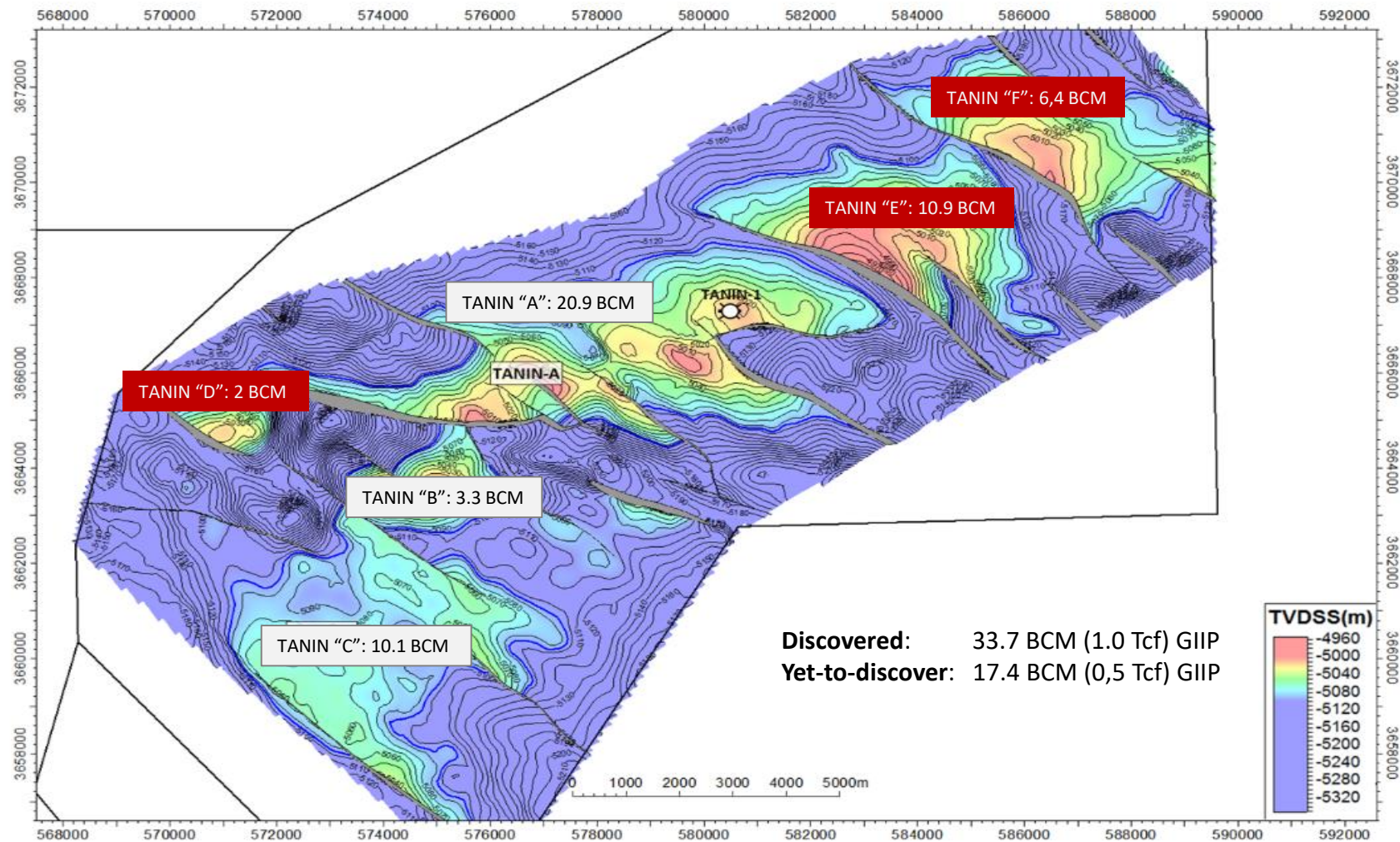
- NSAI 2017 CPR Mid Case Contingent and Prospective Resources
- Volumes exclude deeper upside in lower Miocene/upper Oligocene horizons. These additional Prospective volumes to be included in the 2018 CPR (~26 BCM GIIP)
- Volumes exclude additional upside in Karish Main B sands that will be appraised during planned 3-well drilling campaign.

# Karish Field cross section: Deeper D sand potential





# Tanin Field: Discovered and undiscovered accumulations



# Production system overview by 2021

## Field Schematic – Phase 1

### Infield

- EHXT and Wellheads
- Manifold and Foundation
- Multi-bore Spools
- PLETs
- 10" SCLW Risers
- Subsea Controls
- Umbilical

### Onshore

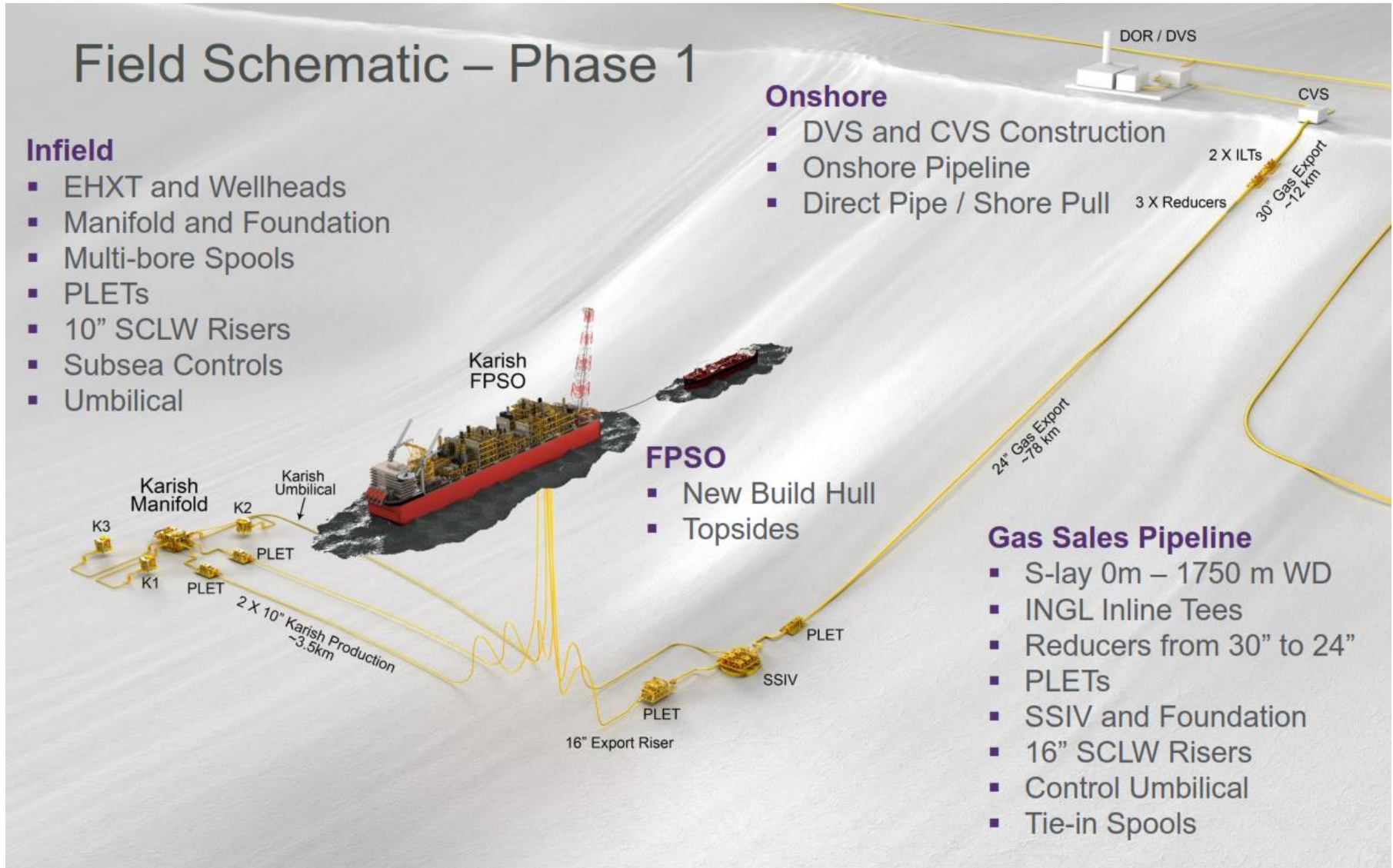
- DVS and CVS Construction
- Onshore Pipeline
- Direct Pipe / Shore Pull

### FPSO

- New Build Hull
- Topsides

### Gas Sales Pipeline

- S-lay 0m – 1750 m WD
- INGL Inline Tees
- Reducers from 30" to 24"
- PLETs
- SSIV and Foundation
- 16" SCLW Risers
- Control Umbilical
- Tie-in Spools



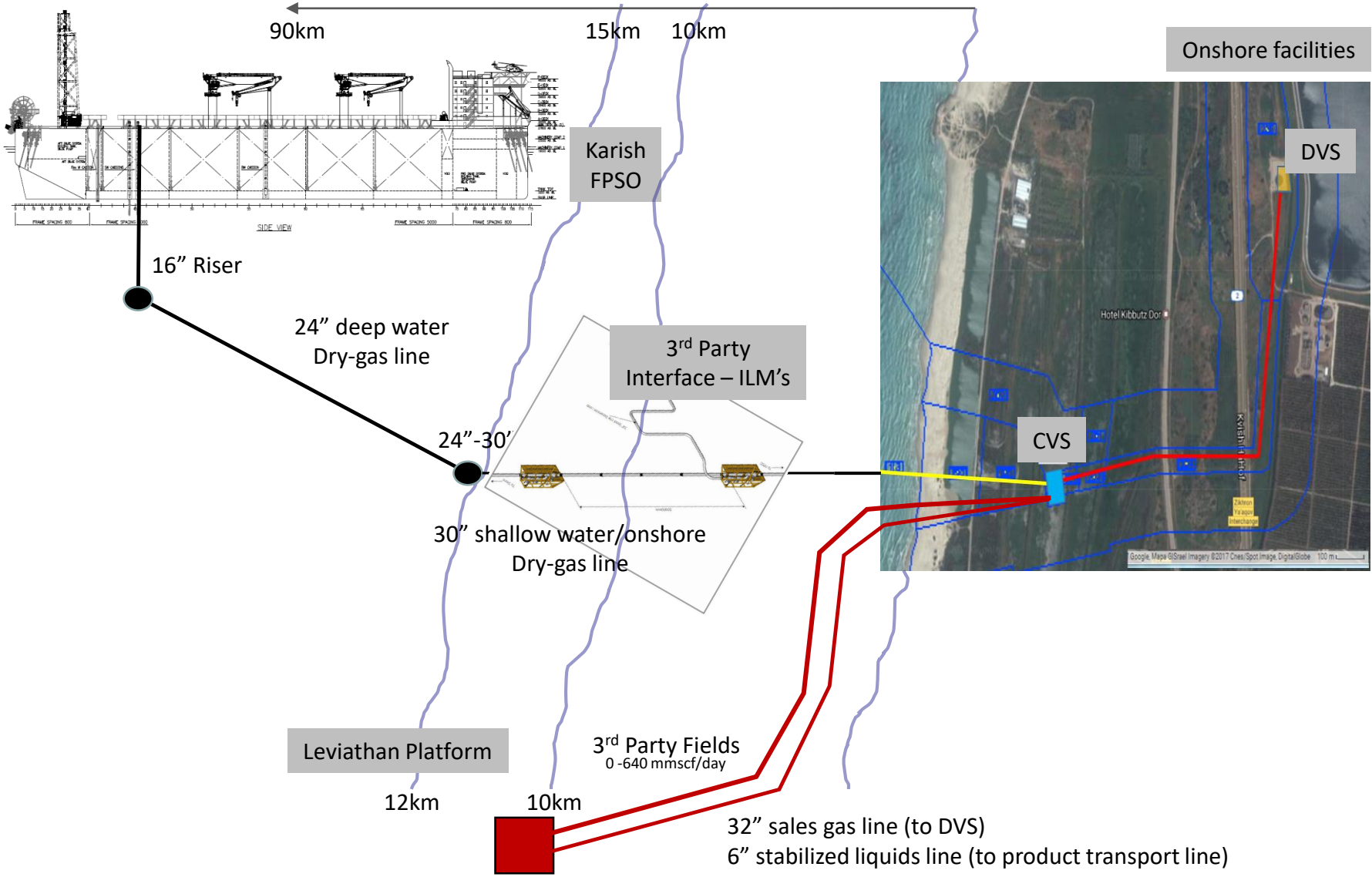
# Karish FPSO – view from North



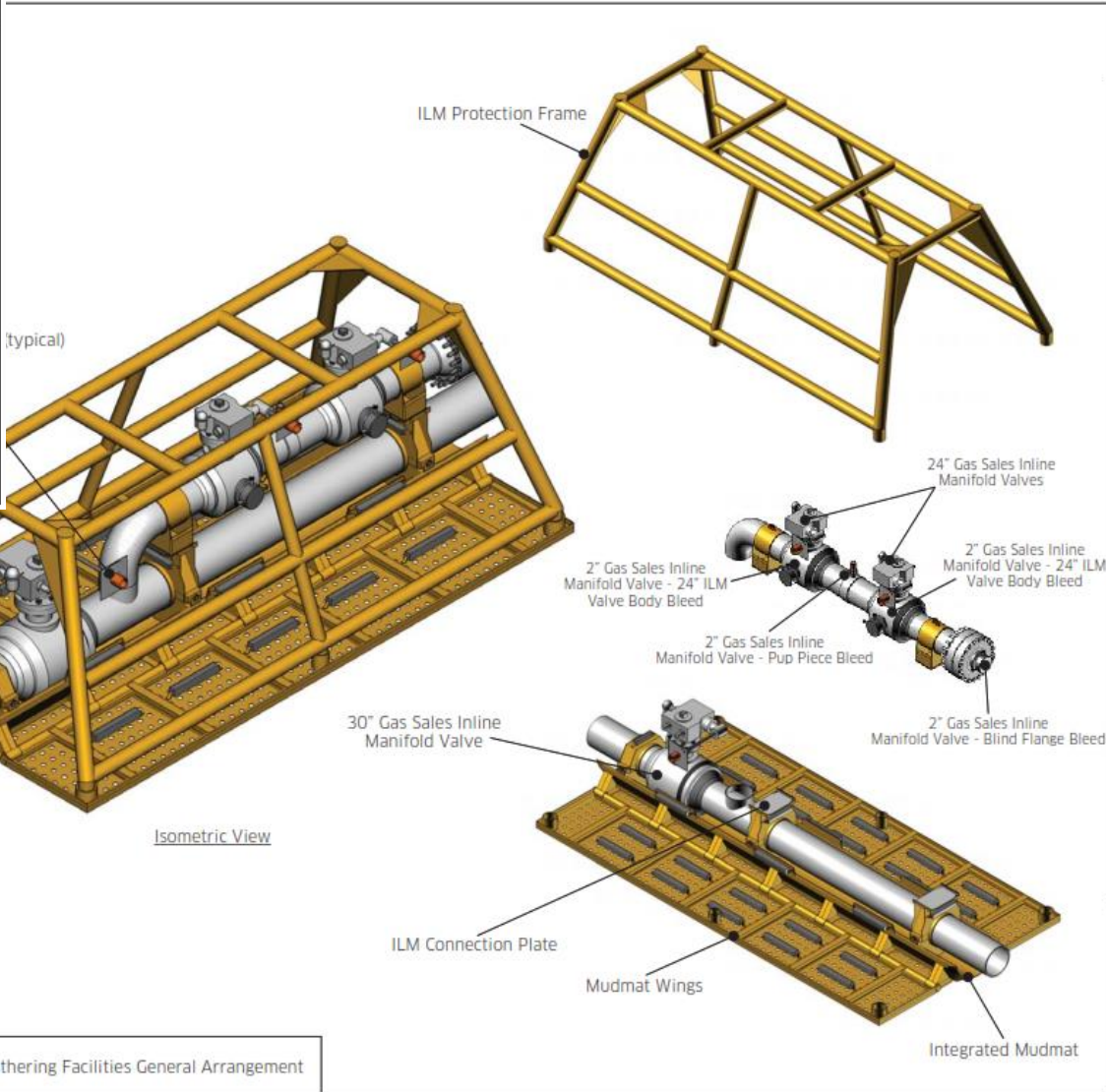
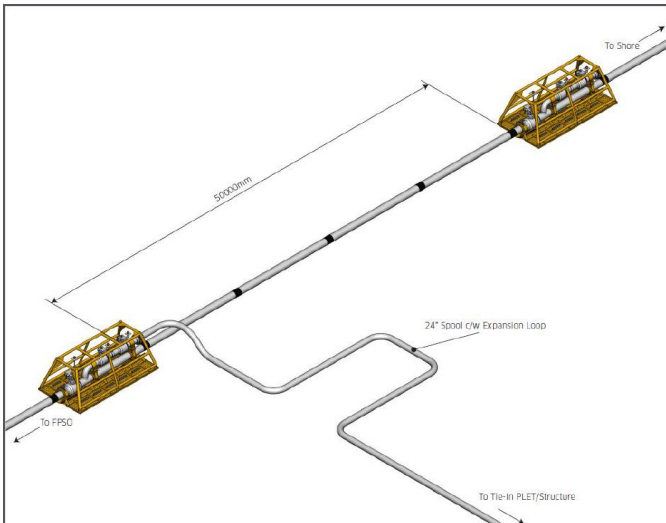
# Karish FPSO – view from South east



# Interface with INGL and onshore scope



# Interface with future 3<sup>rd</sup> parties: In Line Manifolds

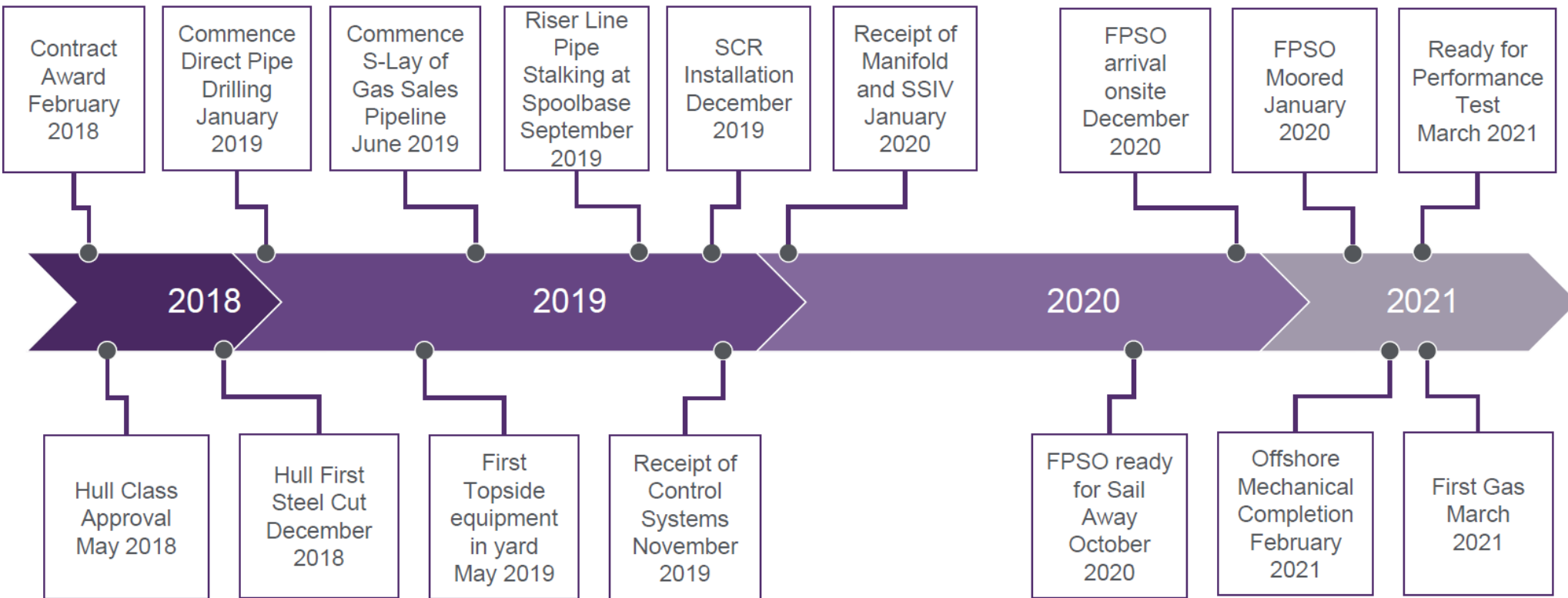


Title: INGL Subsea Gas Gathering Facilities General Arrangement



# High Level Project Timeline: TFMC iEPCIC scope of work

## High Level Project Timeline



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# Subsurface and Exploration

## 3D Seismic reprocessing:

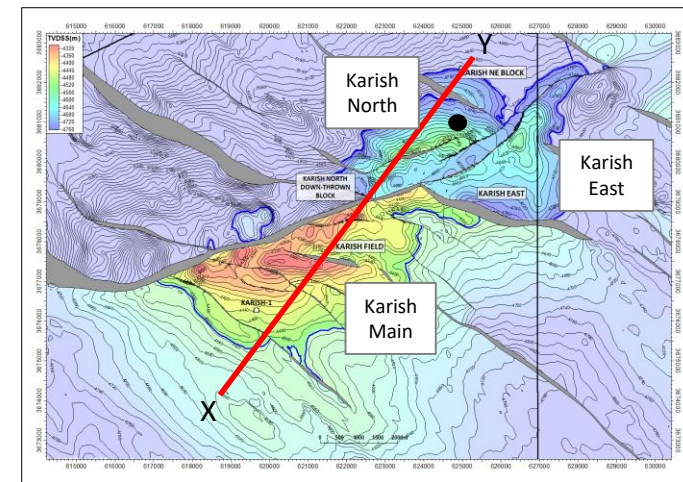
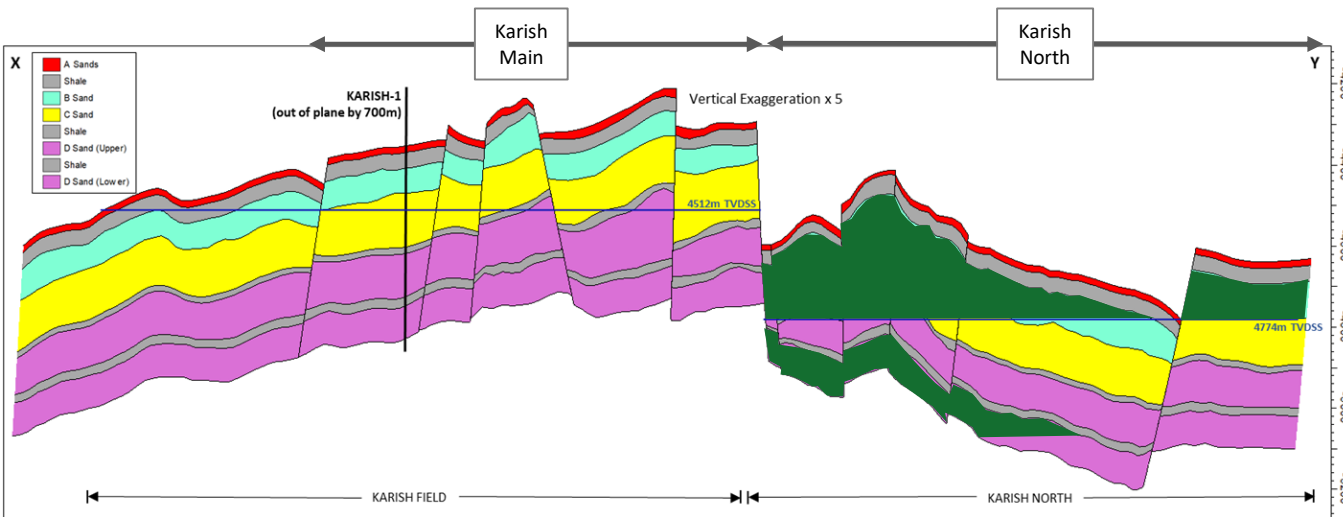
- Seismic re-processed from original tapes,
- Significant improvement in quality,
- Re-interpretation ongoing.

## Exploration:

- Two exploration options agreed with Stena at a competitive day rate,
- Possible that one exploration well could be drilled prior to the Karish Main campaign

## Growth area:

- Evaluation of Block 12 complete – CPR in preparation (NSAI),
- Work ongoing on Blocks 21,22, 23,31 – CPR by mid year,
- 3D surveys to be acquired over blocks 23 and 31 end 2018,
- Facility development studies commenced:
  - Sub sea tie backs to FPSO or mini-floaters?



# Drilling and Logistics

## Drilling Rig:

- Stena Forth – 6<sup>th</sup> gen drill ship,
- Mobilisation March 2019,
- 3 firm wells, 2+5 options

## Drilling Services Contract:

- Halliburton – Integrated Services,
- Managed out of Haifa,
- Supported from Halliburton base in Cyprus.

## Well Detailed Design:

- Lloyd Register team managed by Energean,
- Tree and wellheads – TechnipFMC,
- OCTG and Conductor – award in progress
- Well clean up – tender in preparation
- Formation evaluation programme,
  - B-sand – chase additional 15 Bcm GIIP,
- Explore D1 and D4 plays – deepen 2 wells,
  - Target additional 23 Bcm GIIP.

## Logistics:

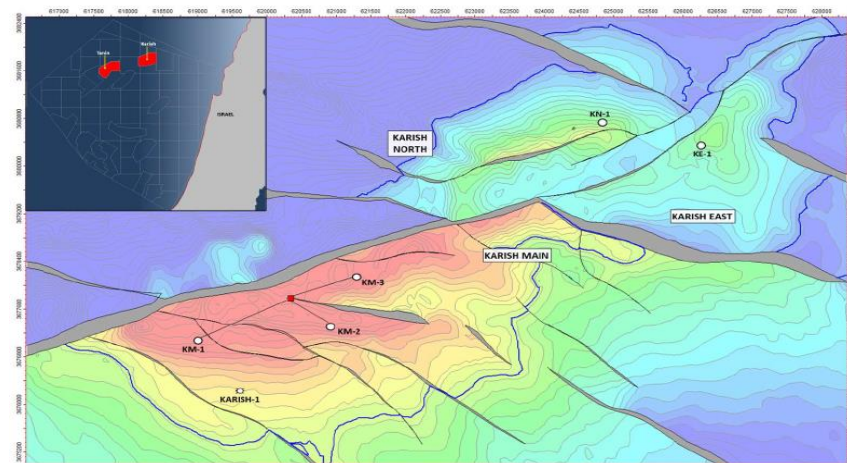
- Tenders planned for Q3 2018,
- Logistics manager recruited.



HALLIBURTON

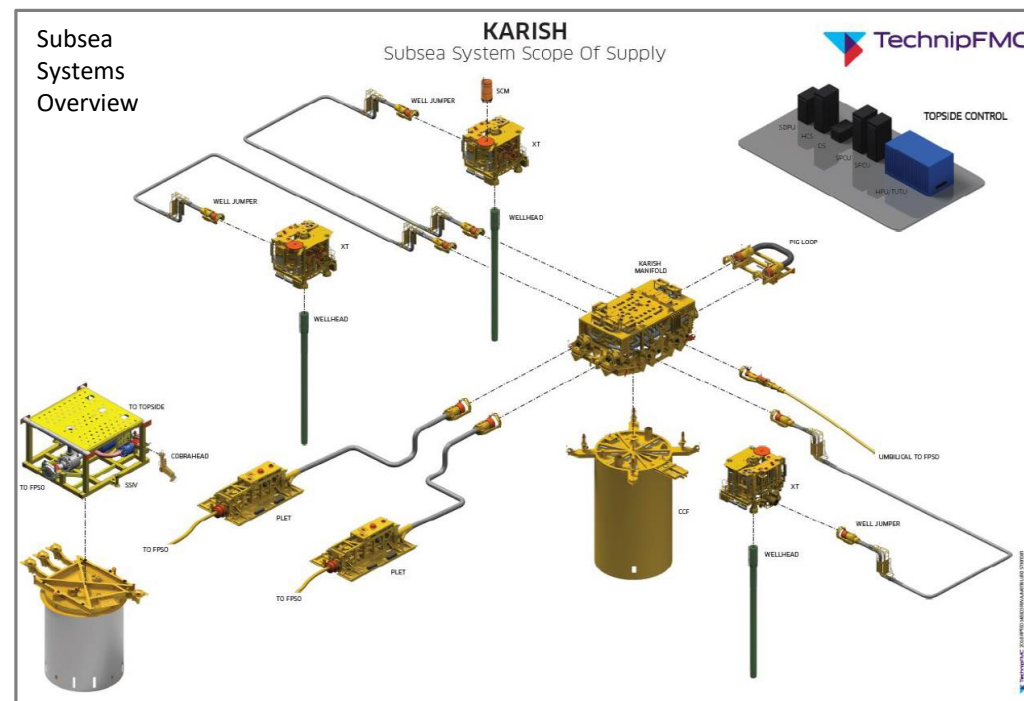


| Karish Main 1 (KM-1) Well Conceptual Schematic |             |             |                 |   |                   |               |            |                      |                      |                      |
|--|-------------|-------------|-----------------|---|-------------------|---------------|------------|----------------------|----------------------|----------------------|
| Rig  | Stena Forth | Stena Forth | Water Depth (m) | Casing / Liner Details                              |                   | Connection    | Drift (in) | Convent Wt Type      | Mud Weight / Type    | FIT / LOT            |
| 36"  | 552.7       | 8.80        | Leopard SD EF   | 33.000  | Class G / Seabed  | Leopard SD EF | 34.000     | Seawater and sweeps  | NA                   | NA                   |
| 21" Ext. joint x 20"                           | 217.263.9   | 3.65        | Swk DW2 HTAR    | 18.500  | Class G / Seabed  | Swk DW2 HTAR  | 18.572     | Seawater and sweeps  | 12.75 FIT            | 12.75 FIT            |
| 13 5/8"  | 88.2        | P-110       | VAM 21          | 12.250  | Class G / 2,400 m | VAM 21        | 12.250     | 11.5 / Salt Sol. WBM | 11.5 / Salt Sol. WBM | 11.5 / Salt Sol. WBM |
| 10 3/4"  | 66.7        | P-110       | VAM 21          | 8.500   | Class G / 3,830m  | VAM 21        | 8.500      | 11.7 / Salt Sol. WBM | 11.7 / Salt Sol. WBM | 11.7 / Salt Sol. WBM |
| 8 5/8"   | 63.6        | P-110       | VAM 21          | 8.500   | Class G / 3,830m  | VAM 21        | 8.500      | 11.7 / Salt Sol. WBM | 11.7 / Salt Sol. WBM | 11.7 / Salt Sol. WBM |
| Formation                                      | TVDSS (m)   | MDERT (m)   | Inc             | Description   | MDERT (m)         | TVDSS (m)     |            |                      |                      |                      |
| Seabed   | 1738        | 1770        |                 | 0" 36" Shoe   | 1854              | 1822          |            |                      |                      |                      |
| Top Evaporite/Salt                             | 2051        | 2083        |                 | 20" Tail TOC  | 2610              | 2578          |            |                      |                      |                      |
| MESO   | 2243        | 2275        |                 | 13.5/8" Lead TOC (150 m above shoe)                 | 2610              | 2578          |            |                      |                      |                      |
|  |             |             |                 | 6.1/2" TRS/CSBV                                     |                   |               |            |                      |                      |                      |
|  |             |             |                 | 10" 20" Shoe  | 2766              | 2724          |            |                      |                      |                      |
|  |             |             |                 | 20" Rathole   | 2766              | 2724          |            |                      |                      |                      |
|  |             |             |                 | 10.3/4" x 9.5/8" crossover                          |                   |               |            |                      |                      |                      |
|  |             |             |                 | 7" 32pp P110 Tubing                                 |                   |               |            |                      |                      |                      |
|  |             |             |                 | 13.5/8" Tail TOC                                    | 3763              | 3474          |            |                      |                      |                      |
|  |             |             |                 | 13.5/8" Lead TOC (150 m above shoe)                 | 3763              | 3474          |            |                      |                      |                      |
| Base Salt                                      | 3593        | 4052        |                 | 6 1/2" 13.5/8" Shoe                                 | 3913              | 3543          |            |                      |                      |                      |
|  |             |             |                 | 17.1/2" Rathole                                     | 3913              | 3543          |            |                      |                      |                      |
| Tortonian Sands                                | 3887        | 4439        |                 |   |                   |               |            |                      |                      |                      |
| Mid Miocene UC                                 | 4089        | 4676        |                 |   |                   |               |            |                      |                      |                      |
| A Sand   | 4193        | 4834        |                 | 9.5/8" Tail TOC (100 m above shoe)                  | 4802              | 4163          |            |                      |                      |                      |
| B Sand   | 4293        | 4996        |                 | Production Packer                                   |                   |               |            |                      |                      |                      |
| C Sand   | 4311        | 4952        |                 | Liner Hanger Packer                                 |                   |               |            |                      |                      |                      |
| Sidetrack TD                                   | 4350        | 5005        |                 | 3.5/8" Shoe   | 4921              | 4313          |            |                      |                      |                      |
| CD Shale                                       | 4429        | 5.071       |                 | 4.1/2" x 12.1/4" Open Hole (CHOP) x premium screens | 4956              | 4.350         |            |                      |                      |                      |
| D Sand   | 4444        | 5095        |                 | 12.1/4" PWD Hole - TD                               | 5380              | 4.820         |            |                      |                      |                      |



# Facilities Project and Operations Readiness

- **EPCIC Contract → TechnipFMC:**
  - SPS/SURF, Pipeline and Onshore scope – Aberdeen (UK):
    - Wellheads and X-mas Trees: Dunfermline (UK),
    - Umbilicals: Newcastle (UK),
    - Manifolds and structures: Kongsberg (Norway),
    - Risers and Pipeline: Houston and Mobile (USA),
    - Onshore: Rome (Italy).
  - FPSO – Paris (France):
    - Process module design: Oslo (Norway),
    - Other topsides and integration design: Paris (France),
    - Hull and LQ design (SCM): Singapore,
    - Hull Fabrication (SCM): Bei-Hai (China),
    - Topsides fabrication and Integration (SCM): Singapore.
- **Operations Readiness and Assurance → Wood:**
  - Managed from Wood office (Aberdeen),
  - Joint Energean/Wood integrated team:
    - Operations Management System,
    - Maintenance Strategy,
    - HSE Management System components,
  - Staffing contract in preparation.
- **Operator Dynamic Training Simulator → TBC,**
  - Tender in preparation



## Key Facilities Milestones

**1<sup>st</sup> Gas target date:**

**15<sup>th</sup> February 2021**

**1<sup>st</sup> steel cut (FPSO hull):**

**Q4 2018**

**Pipeline installation:**

**Q3 2019**

**Risers and structures installation:**

**Q2 2020**

**FPSO arrives Israel:**

**Q4 2020**

# Health, Safety and Environment

## HSE in design:

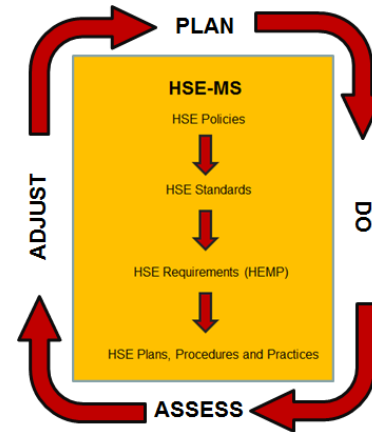
- Fire, explosion etc. design studies completed,
- QRA and ALARP completed,
- ROMH to be complete August 2018.

## HSE Management:

- HSE-MS submitted to Ministry of Energy,
- Detailed Procedures in preparation – Energean/Wood,
  - Oil Spill response, Emergency Response and Evacuation,
  - Incident Investigation.

## Environment:

- Development option with lowest Environmental footprint selected:
  - 5 - 10% greater cost than near-shore solution,
  - FPSO located “over horizon”,
  - Nearshore facilities on sea-bed,
  - Liquids exported,
  - No liquids pipeline over Dor beach,
  - No liquids connection to Haifa.
- Environmental Design Basis approved,
- Environmental Base Line Survey complete,
- Lease Environmental Document submitted end May,
- ESIA, ESMP and EPAP delivered to lending banks.



Questions?



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