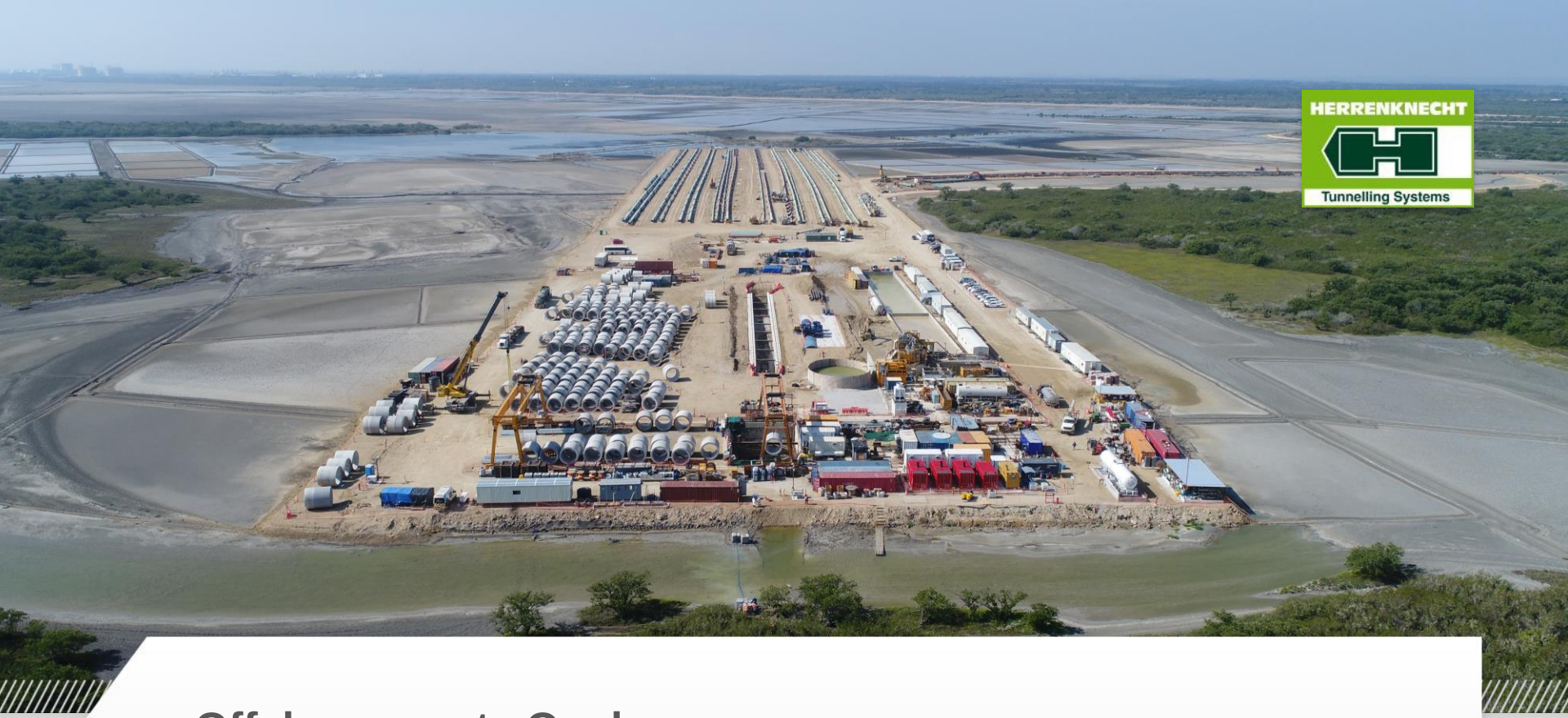


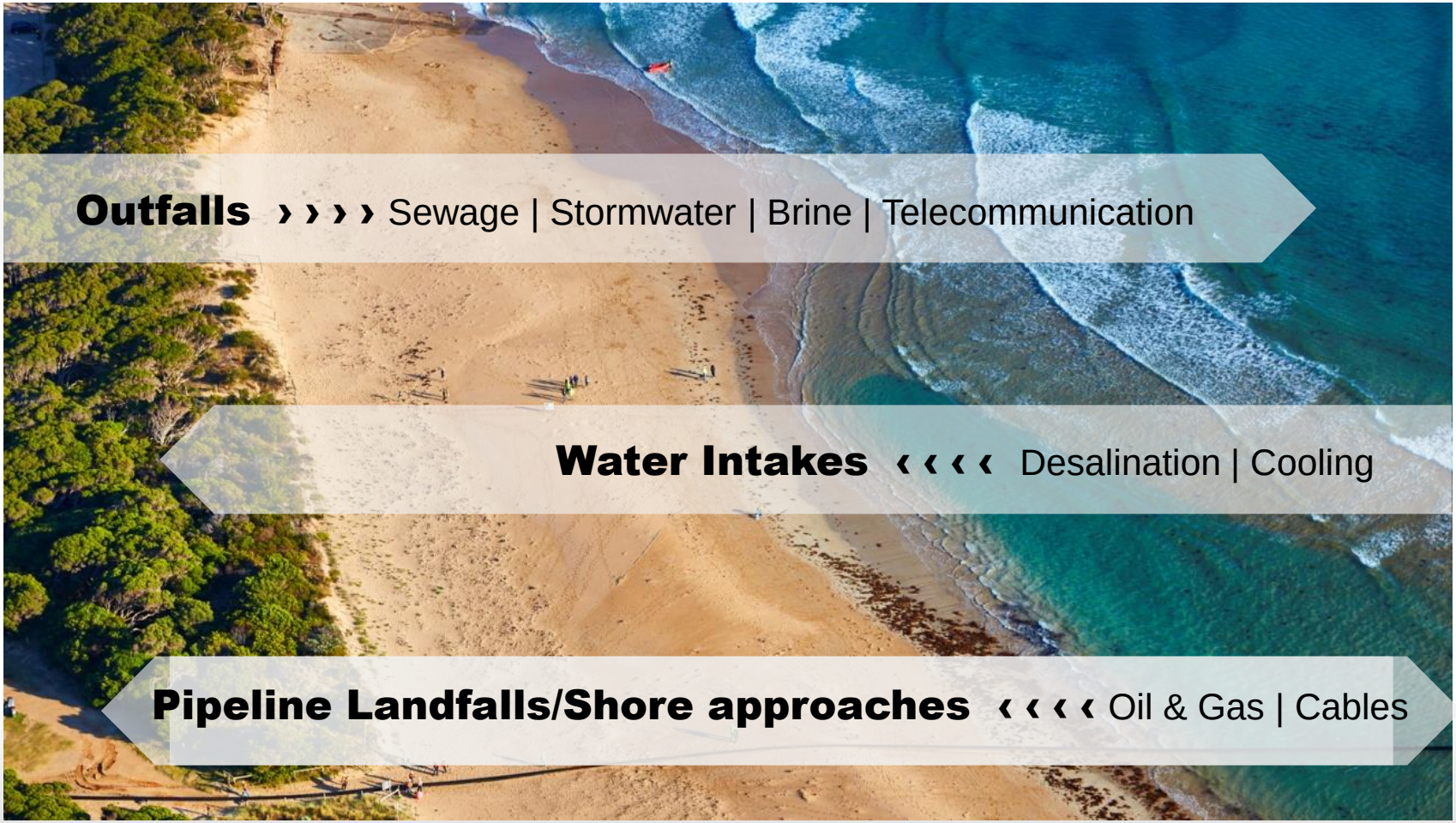
Offshore meets Onshore:
Trenchless solutions for pipeline landfalls.

Michael Lubberger, Herrenknecht AG

Geneva, October 2018

Sea Outfalls, Intakes, Shore approaches and Landfalls.

Application fields.



Why going trenchless in coastal areas?

Sea Outfalls, Intakes and Landfalls.

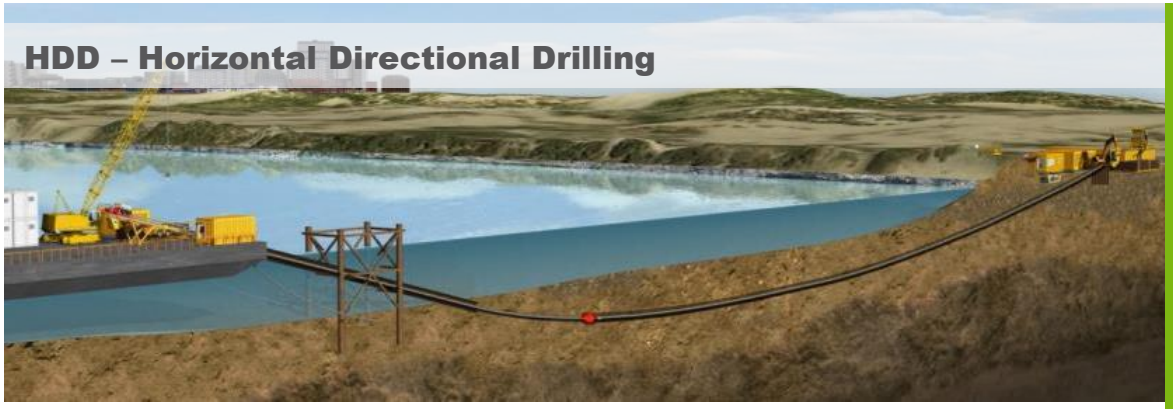
Advantages of trenchless technologies.

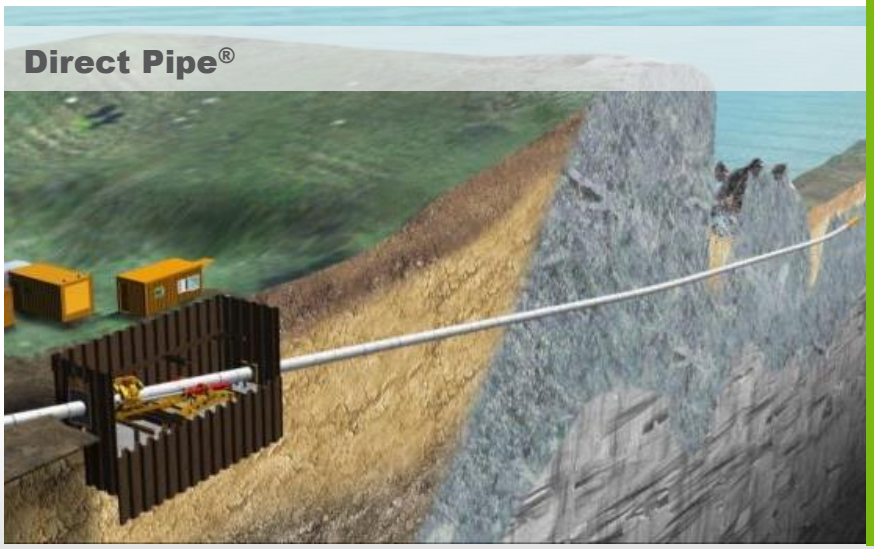
- Minimized impact on **environment**: protection of wildlife and sea water quality
- Minimized impact on **surroundings**
  - Small jobsite footprint
  - Tourism and shipping not affected
  - Independent of rock or soil condition and shape of coastline

Pipeline Landfalls.

Trenchless installation methods.

Tunneled casings





Direct installations

Tunnelling technologies for marine installations.

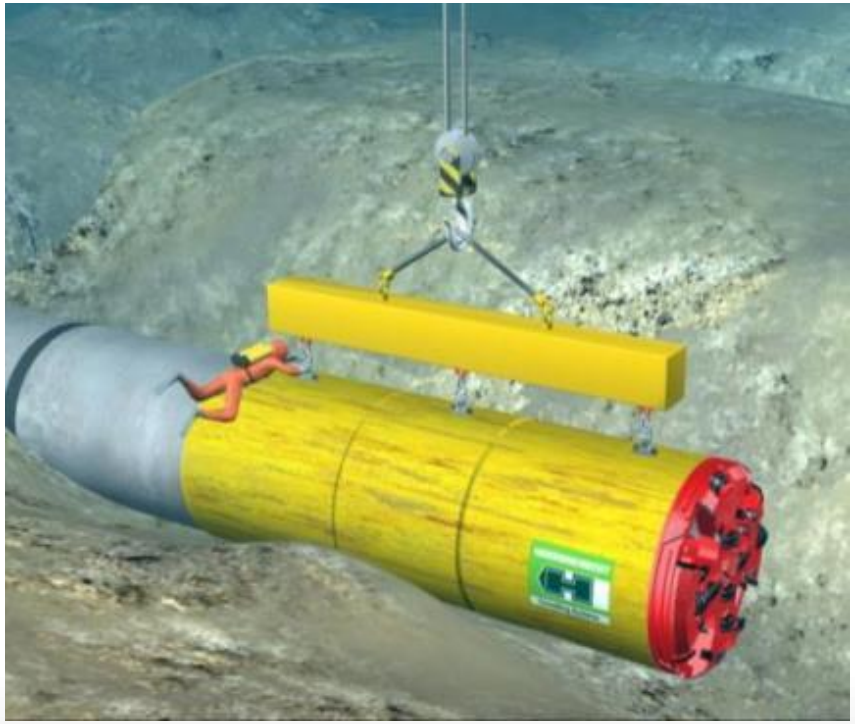
Overview Pipe Jacking versus Segment Lining.

	Segment Lining	Pipe Jacking
Diameter in mm	> ID 2500	up to ID 3500 state-of-the-art
Drive length	up to 10 km depending on diameter and logistics	up to ~1.5 km or longer depending on diameter and geology
Interjacking stations	not needed	necessary for longer drives
Machine recovery	Release of machine with jacking cylinders	Recovery module needed

Tunnelling technologies for marine installations.

Offshore recovery of tunnelling machine.

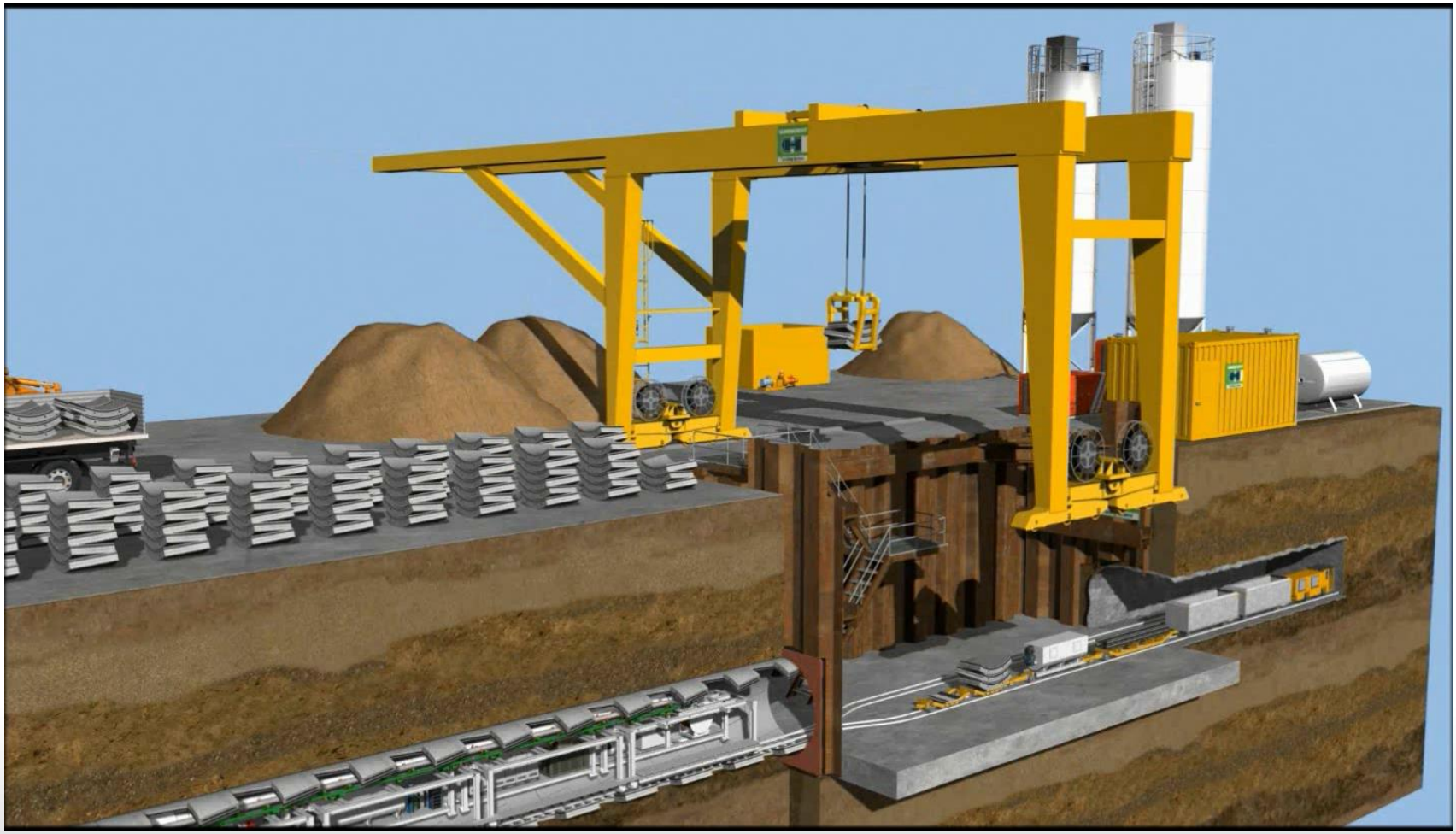
- Preparation of the “wet” machine recovery from the seabed



- Lifting the tunnelling machine to the surface (by crane and/or airbags)

Tunnelling technologies for marine installations.

Segmental Lining.



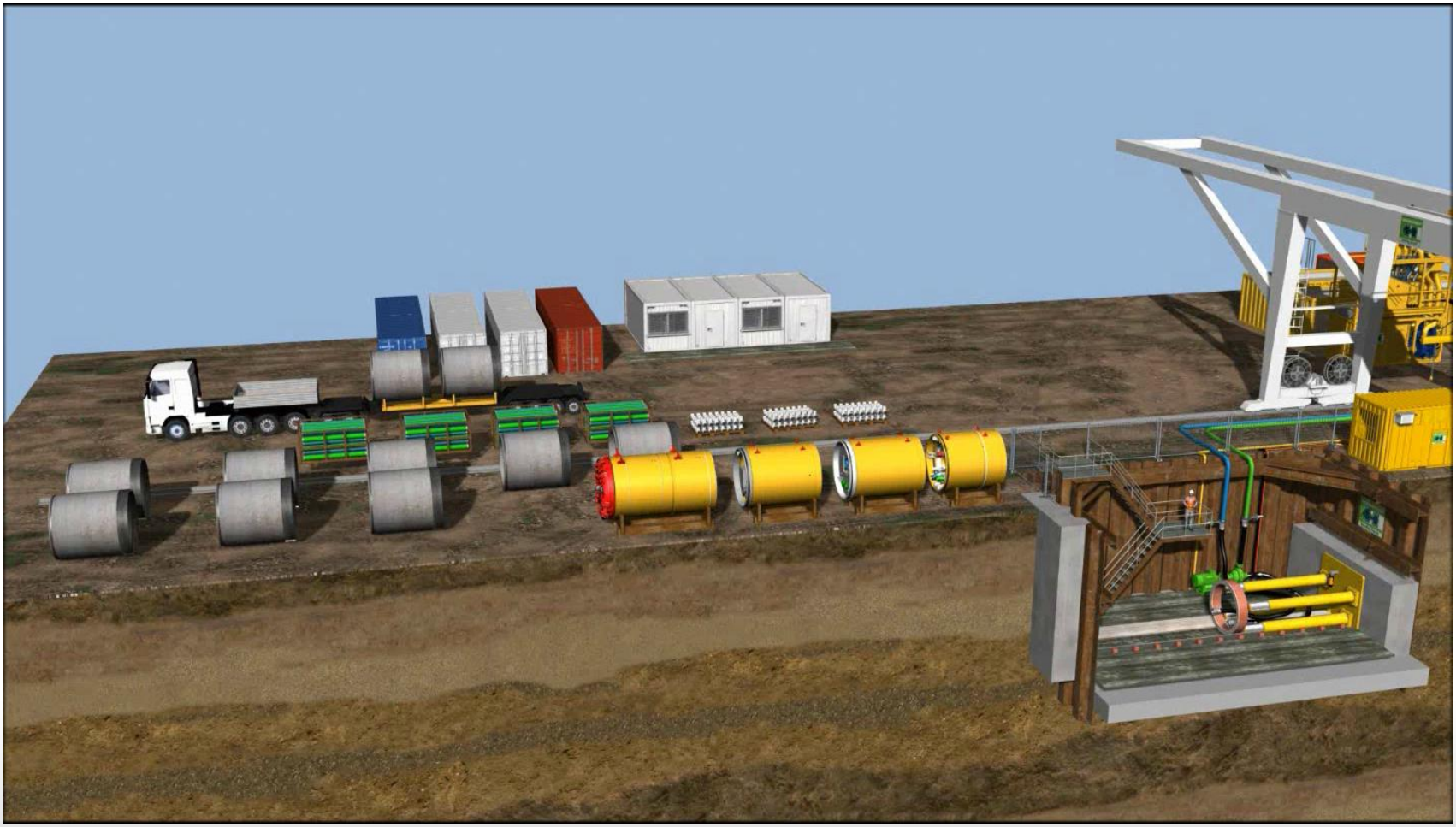
Reference Project: Sydney, Australia.

Sydney Desalination Plant.

- M-1214M + M-1215M, 2x TBM3400, OD4340 Segment Lining
- Outfall length: 2 x 2,579m
- Min. curve radius: 500m
- Geology: sandstone, approx. 70Mpa
- Contractor: John Holland Pty. Ltd.

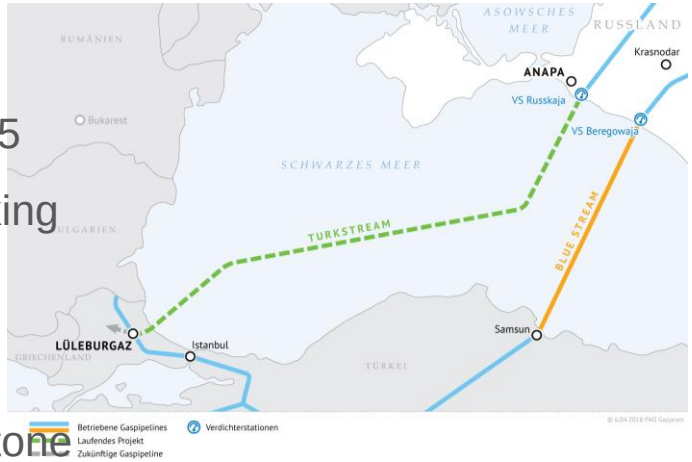
Tunnelling technologies for marine installations.

Pipe Jacking.

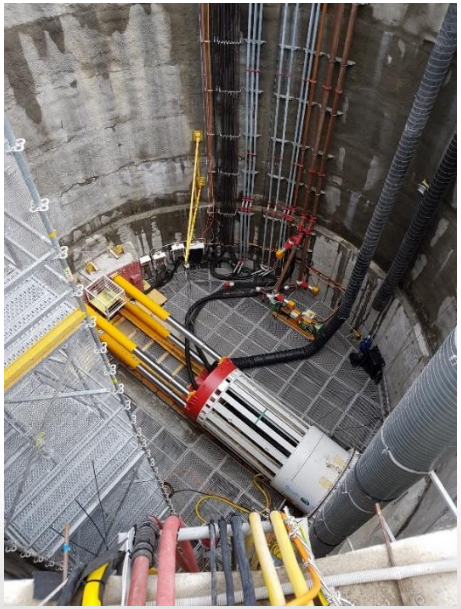


Turkstream Outfalls, Anapa, Russia.

2 x 1.4km into the Black Sea.



- M-1890M + M-1892M, 2 x AVN 2000 AH, OD 2475
- Tunnel length: 2 x 1.430m long distance pipe jacking
- Height difference vom launch to target: 80m
- Max. gradient: -11,5%
- Geology: clay with layers of sandstone and limestone



Turkstream Outfalls, Anapa, Russia.

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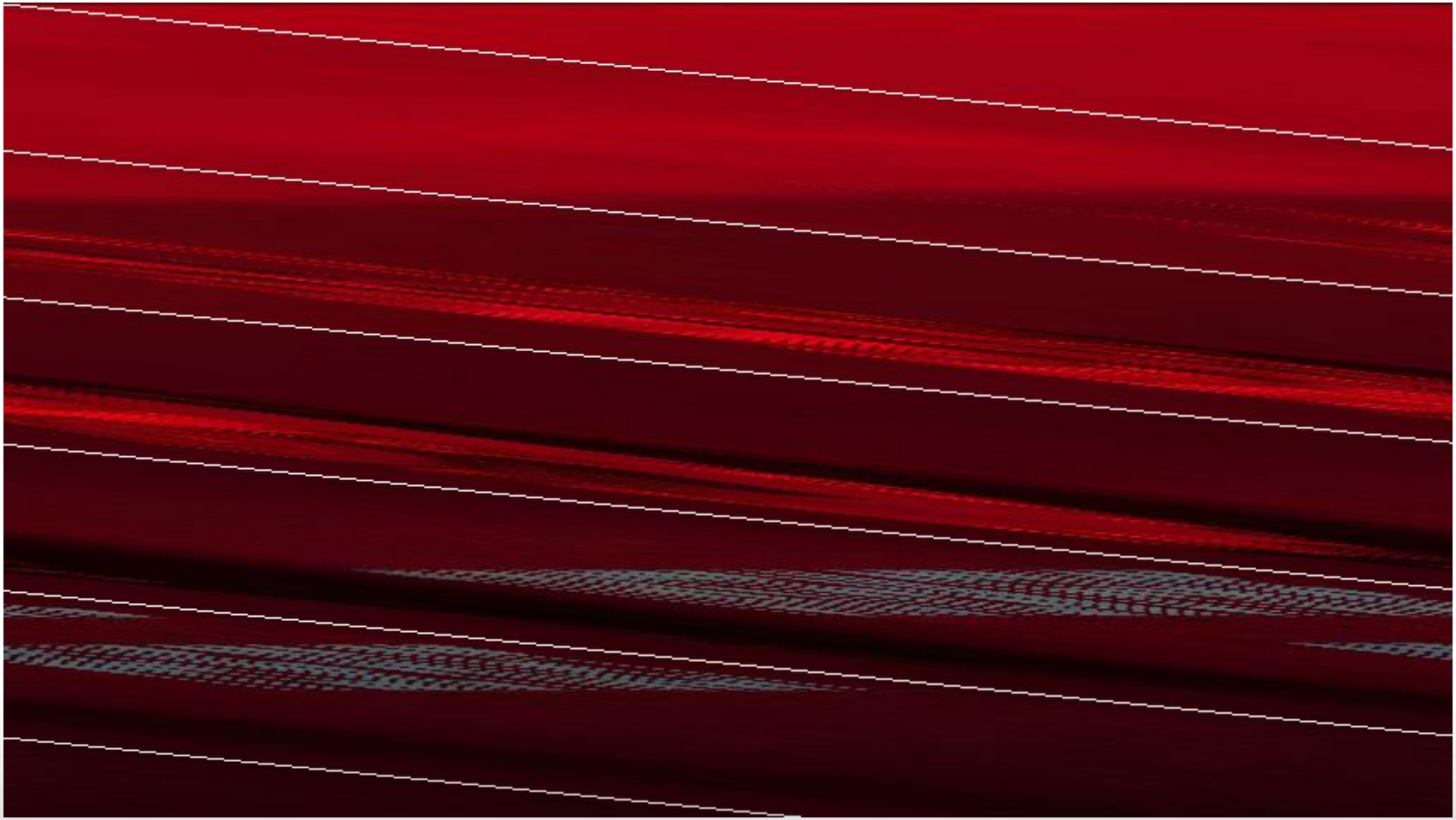
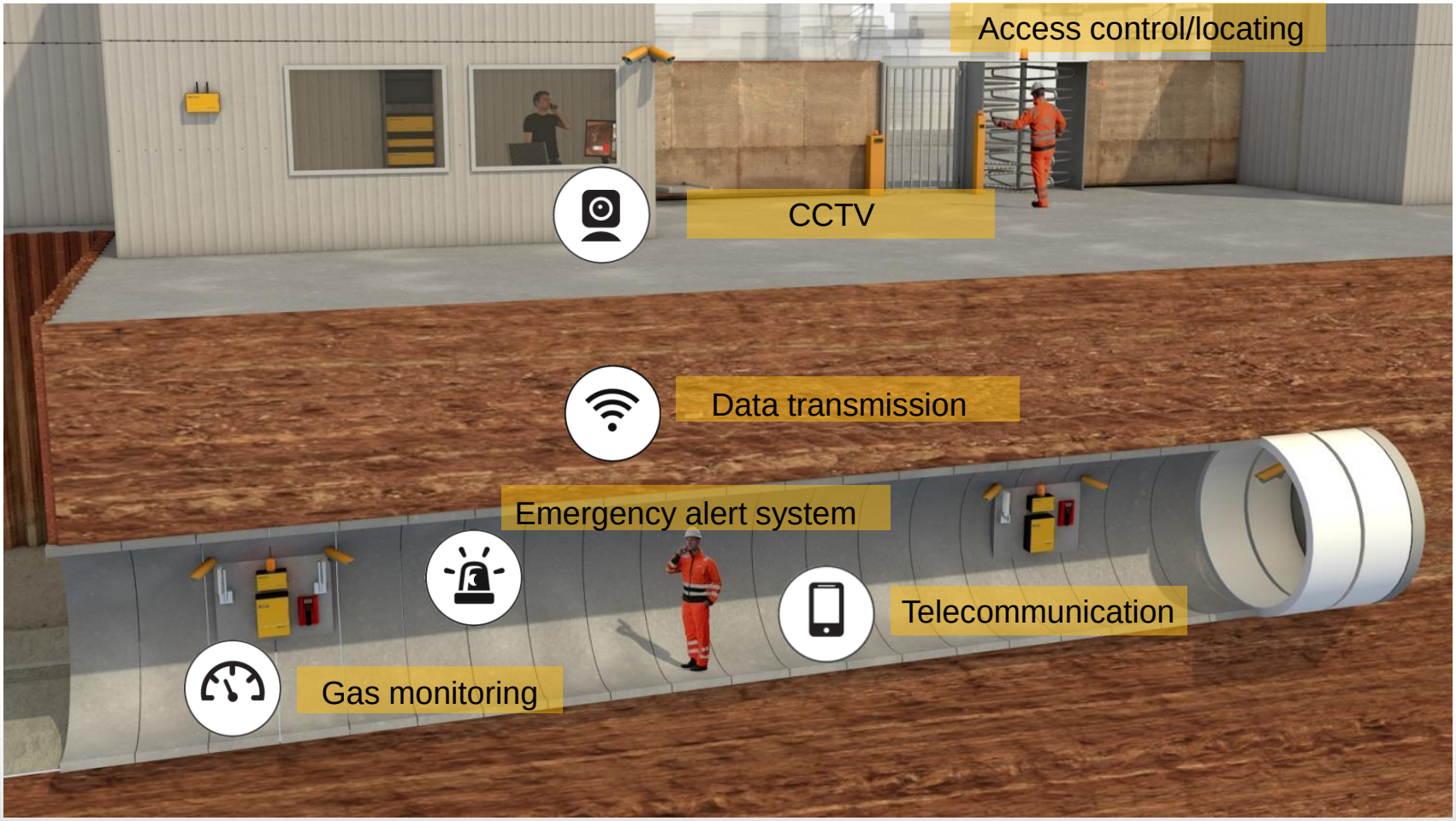


Turkstream Outfalls, Anapa, Russia.

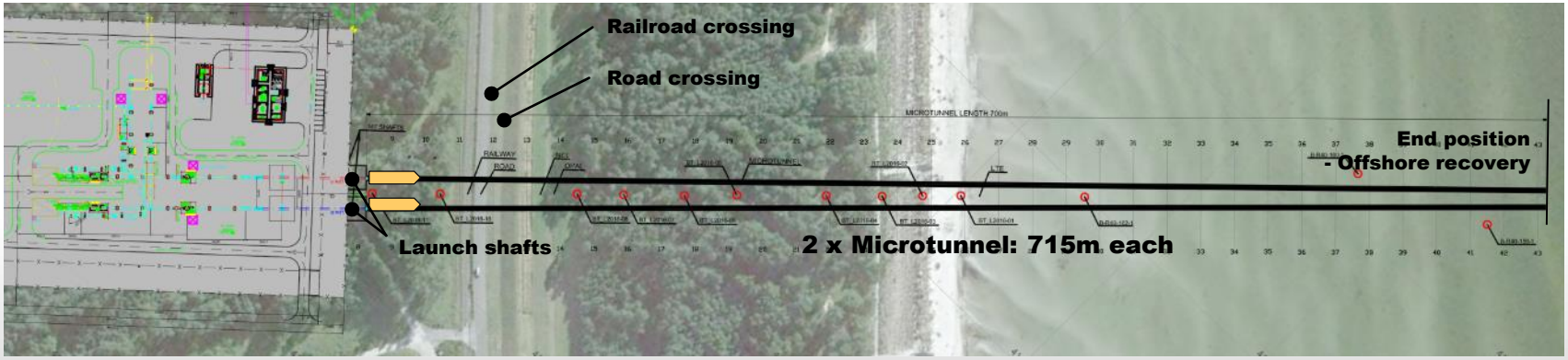
Safety first – The communication system HADES



Nord Stream 2 Landfall Lubmin, Germany.

Trenchless Shore Crossing for 48“ twin gas pipeline.

- M-1890M + M-1892M, 2 x AVN 2000 AH, OD 2475
- Location: Lubmin, Germany
- Tunnel length: 2 x 715m, 5 Interjacking stations installed, but not used
- Geology: sand, marl, boulders
- Max. gradient: -5,2%
- Machines launched: March 30th, 2018 | End position: May 13th, 2018
- Best daily performance: 42.4m



Nord Stream 2 Landfall Lubmin, Germany.

Trenchless Shore Crossing for 48“ twin gas pipeline.

Pipe Jacking and Direct Pipe® methods on one project.

Sur de Texas – Tuxpan Pipeline, USA-Mexico.

OUTFALLS FOR SUR DE TEXAS-TUXPAN PIPELINE

1. **Direct Pipe® Sea Outfall**
   - Port Isabel, Brownsville, Texas, USA
   - M-1491M, AVN1000DP (48") + HK750PT
   - 1,495 m, 42" pipeline
   - End position: December 02, 2017
2. **AVN Sea Outfall**
   - Altamira, Mexico
   - M-1275M, AVND2000, OD3200
   - 2,246 m Pipe Jacking, tunneled casing
   - End position: July 27, 2018
3. **Direct Pipe® Sea Outfall**
   - Tamiahua (Tuxpan), Mexico
   - M-2250M, AVN1200DP (56") + HK750PT
   - 698 m, 56" casing
   - End position: July 18, 2018

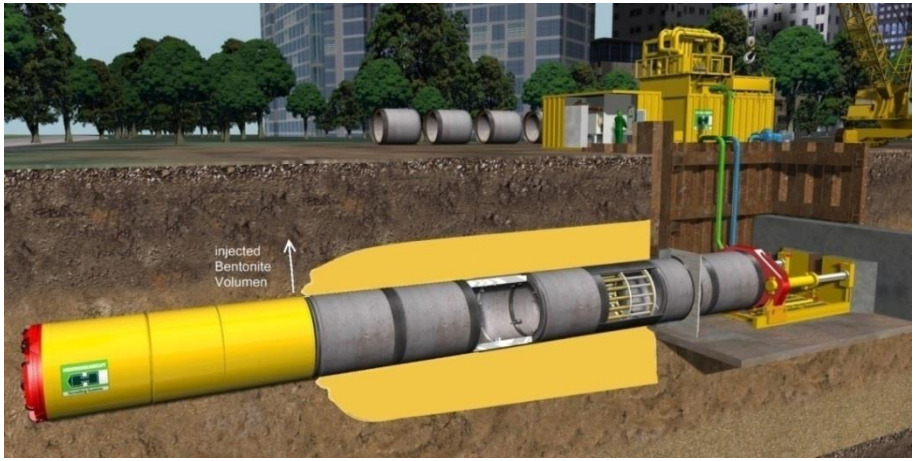
Record Pipe Jacking Outfall.

Altamira Landfall, Sur de Texas – Tuxpan Pipeline.

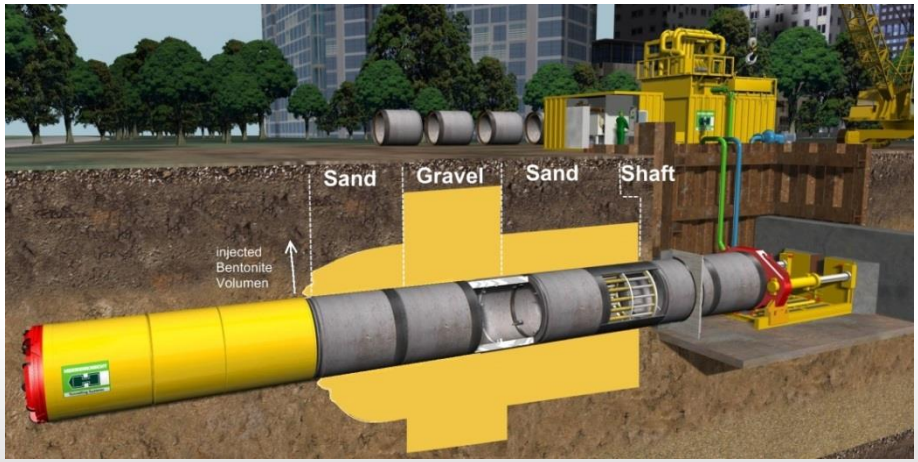
- M-1275M, AVND2000, OD3200
- Tunnel length: **2.246m Sea Outfall, World Record for „wet“ recovery**
- Geology: sand, silt, clay
- Groundwater pressure: up to 3 bar
- Contractor: Eurohinca
- End position reached: July 27th, 2018
- Best daily performance: 25,5m
- Best weekly performance: 111,2m

Record Pipe Jacking Outfall.

Key to success – advanced lubrication



- Without Volume control: constant lubrication along the alighnment.



- With advanced Volume control: Adjusted Lubrication amounts in changing geological formations.

Pipe Jacking and Direct Pipe® methods on one project.

Sur de Texas – Tuxpan Pipeline, USA-Mexico.

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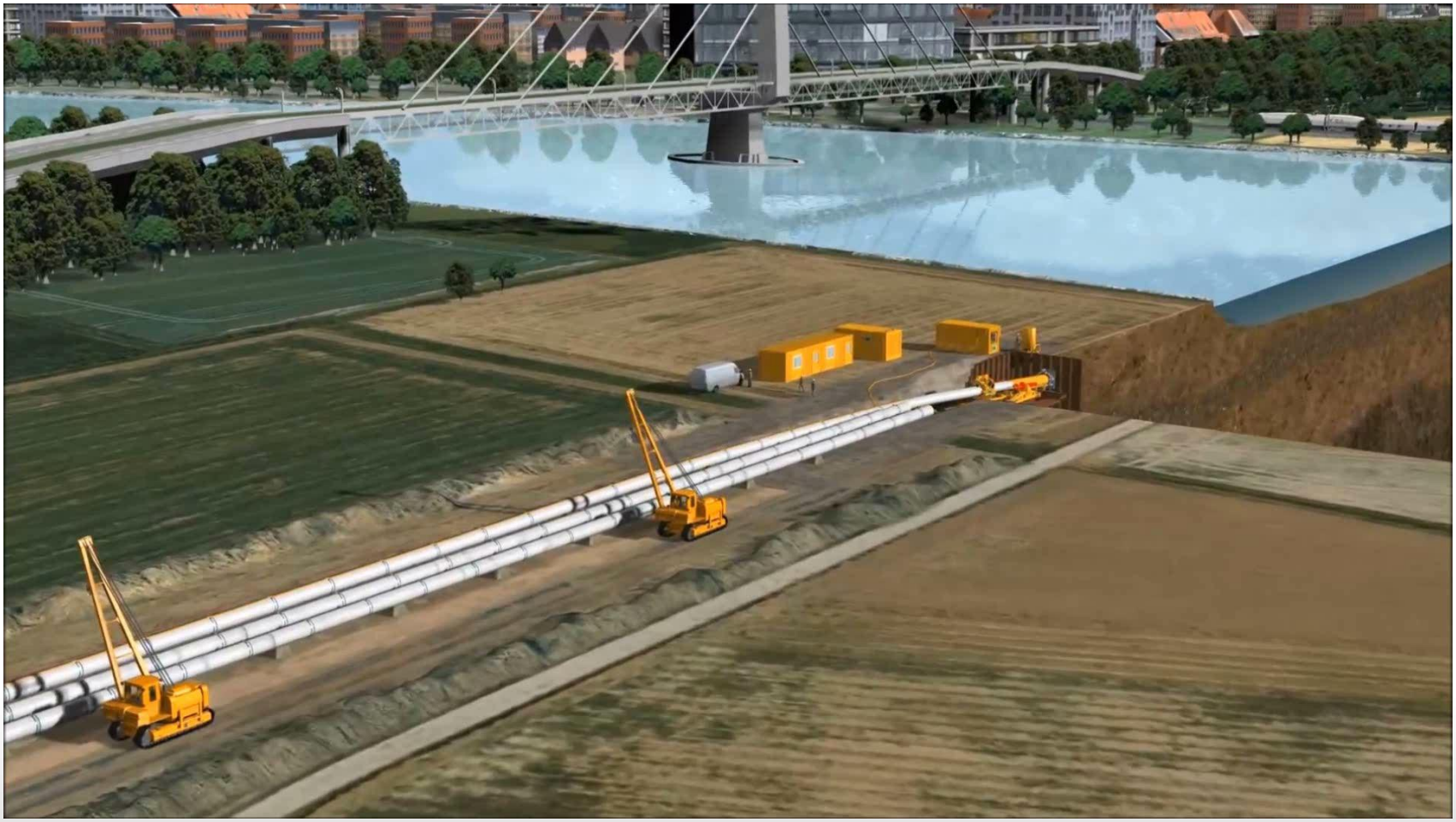
Tunnelling technologies for marine installations.

Direct Pipe®.



Direct Pipe® 48“ Shore approach.

Port Isabel Landfall, Sur de Texas - Tuxpan Pipeline, USA.

- M-1491M, AVN1000DP + HK750PT
- Location: Port Isabel, TX, USA
- **Length: 1,495m | 4,900ft**
  - **Record North America**
- Use of Pipeline: 42“ Gas Pipeline
- Client: Enbridge-Spectra Energy
- Contractor: Laney Directional Drilling Inc.
- Best Performance: 120m in 12 hours
- Push Forces: 90 tons
- Breakthrough: December 2nd, 2017

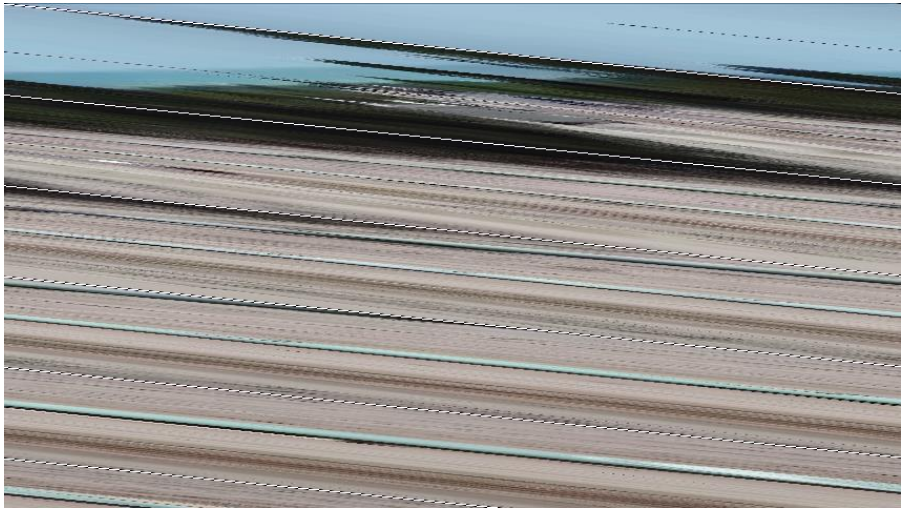
Direct Pipe® 48“ Shore approach.

Port Isabel Landfall, Sur de Texas - Tuxpan Pipeline, USA.

- World´s first “dry” recovery

Direct Pipe® 56“ casing Shore approach.

Tamiahua Landfall, Sur de Texas - Tuxpan Pipeline, Mexico.



- M-2250M, AVN 1200DP + HK750PT
- Location: Tamiahua, Mexico
- Use of Pipeline: 42“ Gas Pipeline
- Drilling length: 698m (2,290 ft)
- Max. section length: 650m (2,130 ft)
- Client: TransCanada
- Contractor: HDI Latam (J.V. GDI - HDI)
- Best Daily Performance: 82m
- Push Forces: 190 - 440 tons

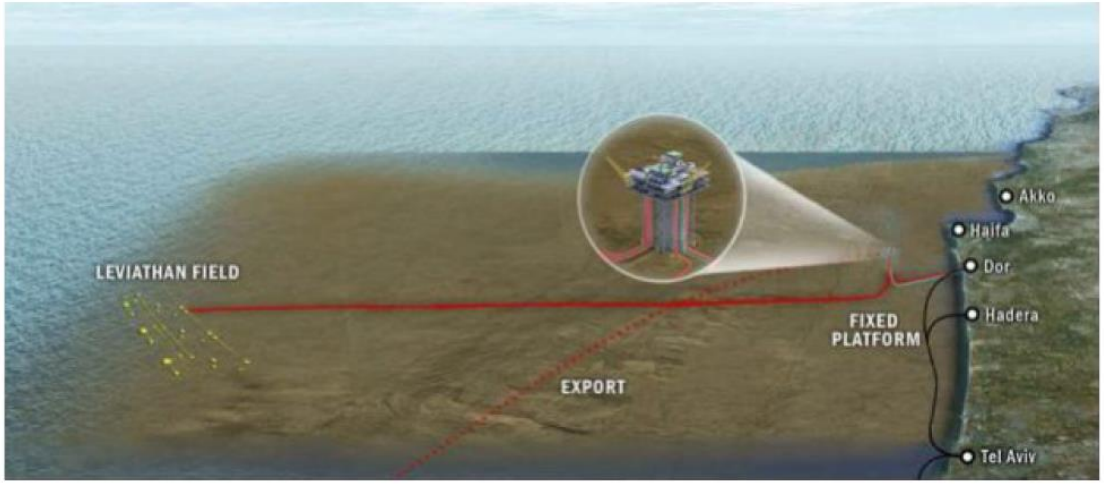
Direct Pipe® Shore approach. Leviathan Gas Field, Israel.

32“ Gas Pipeline with 56” Direct Pipe®.

- M-2246M, AVN1200DP + 2 x HK750PT Pipe Thruster (one standby)
- Location: Dor, Israel
- Drilling length: 1,123m | 3,690ft
- Pipe section length: 60m
- Geology: sands, clays, Kurkar
- Client: Noble Energy
- Contractor: A. Hak Drillcon B.V.
- Best daily performance: 61,8m

Direct Pipe® Shore approach. Leviathan Gas Field, Israel.

32“ Gas Pipeline with 56” Direct Pipe®.



Remote-controlled subsea recovery

World Record Direct Pipe® Project.

48“ Shore Approach with wet recovery.

- M-2170M, AVN1000DP + 1 x HK500PT & 1x HK750PT Pipe Thruster
- Use of Pipeline: Army Bay Wastewater Treatment Plant Outfall Replacement
- Location: Auckland, New Zealand
- **Drilling length: 1,930m World Record**
- Geology: sandstone, mudstone
- End position reached: August 02, 2018
- Client: Water Care
- Contractor: McConnell Dowell

Performance:

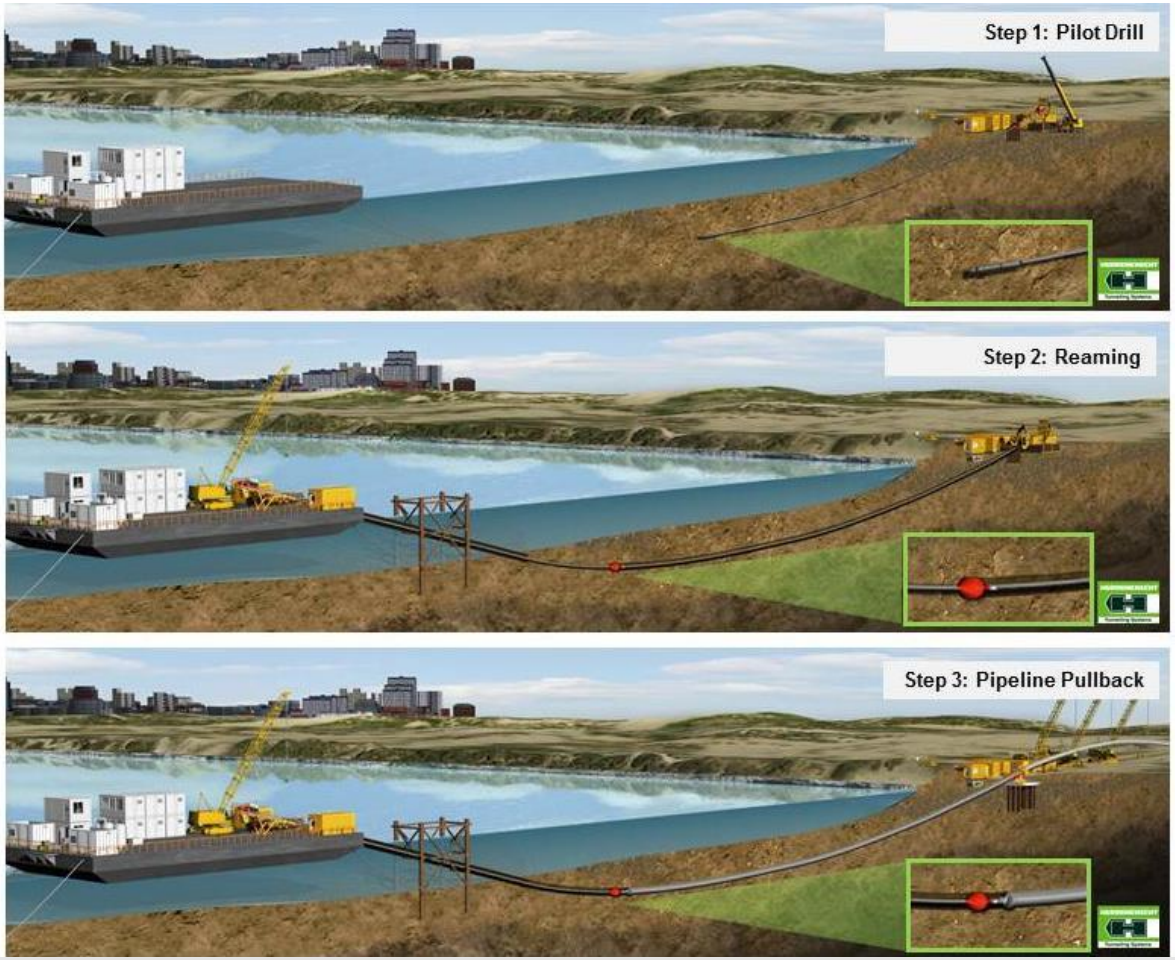
- Best daily performance: 42.5m
- Best monthly performance: 210.7m

World Record Direct Pipe® Project.

48“ Shore Approach with wet recovery.

Marine pipeline and landfall installation with HDD.

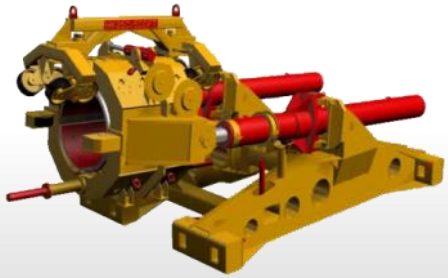
Horizontal Directional Drilling.



- HK400M

- HK250T

- HDD Assist: HK750PT



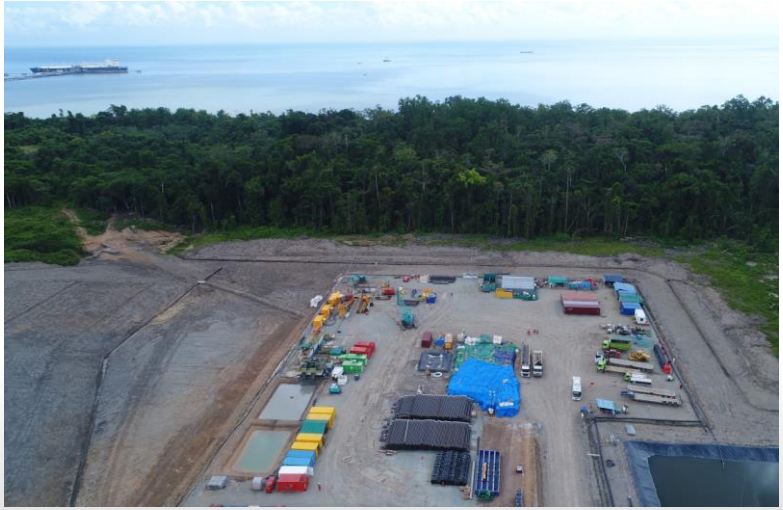
HDD Shore approach: Barrow Island, Australia.

Gorgon gas fields.

- 2 HDD Rigs: HK400CM, HK250T | HK500PT Pipe Thruster
- Pipeline Ø: 2x8”, 2x10”, 3x18”, 2x34”
- Pipeline length: 9x between 450-520m
- Geology: Limestone, Calcarenite (fractured) 60-70 MPa
- Contractor: AJ Lucas
- Client: Chevron

HDD Shore approach: Tangguh LNG Expansion Project.

- H-123; HK400M
- Location: Bintuni Bay, Papua Barat, Indonesia
- Pipeline Ø: 24”
- Pipeline length: **3 x 2,065m**
- Contractor: Lucas



Sea Outfalls, Intakes and Landfalls.

Project references with Herrenknecht technology.

- **~100 tunneled** outfall projects
  - **2,6 km Pipe Jacking**: Longest Outfall in 1994 | still world record
  - Up to **6 bar groundwater** pressure handled successfully
- **6 Direct Pipe®** outfall projects
- **~100 HDD** outfall projects

Thank you !

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- www.herrenknecht.com