PIANC

The World Association for Waterborne Transport Infrastructure

Presenting PIANC

Presented by

Sam Mazaheri

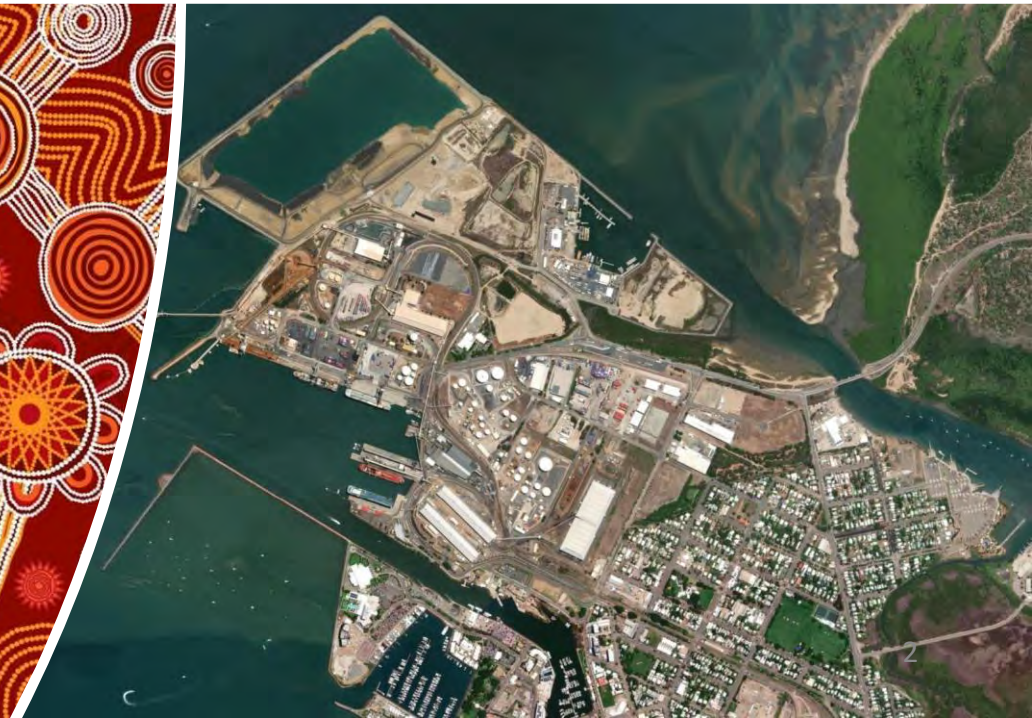
Port of Townsville

Acknowledge of Country

- PIANC ANZ acknowledges the traditional custodians of the country throughout Australia including the land on which we gather and meet today, and recognises their continuing connection to land, water and community.
- We pay our respect to them and their cultures, and to elders past, present and emerging.

PIANC

The World Association for Waterborne Transport Infrastructure



PIANC IS

A worldwide network of professionals,

Providing expert advice
on cost-effective and sustainable
waterborne infrastructure,

And the leading partner
for governments and the private sector
in the design, development and
maintenance of ports,
waterways and coastal areas
...

SINCE 1885!

WHAT PIANC DOES

- Deliver high-quality technical reports within our International Commissions and Working Groups
- Create a worldwide network of the best international experts, both public and private, on technical, economic and environmental issues pertaining to waterborne transport infrastructure
- Support Young Professionals and Countries in Transition
- Keep the network connected through **PIANC's** international/regional/local events

Remains
the leading
international source of
waterborne transport-
related information
in the 21st century

7 REASONS TO JOIN PIANC

1 Get connected to expert guidance and technical advice

2 Gain open access to advanced technological information

3 Address climate change

4 Team up with decision makers

5 Be active in Working Groups, Commissions and National Sections

6 Come aboard the Young Professional Community

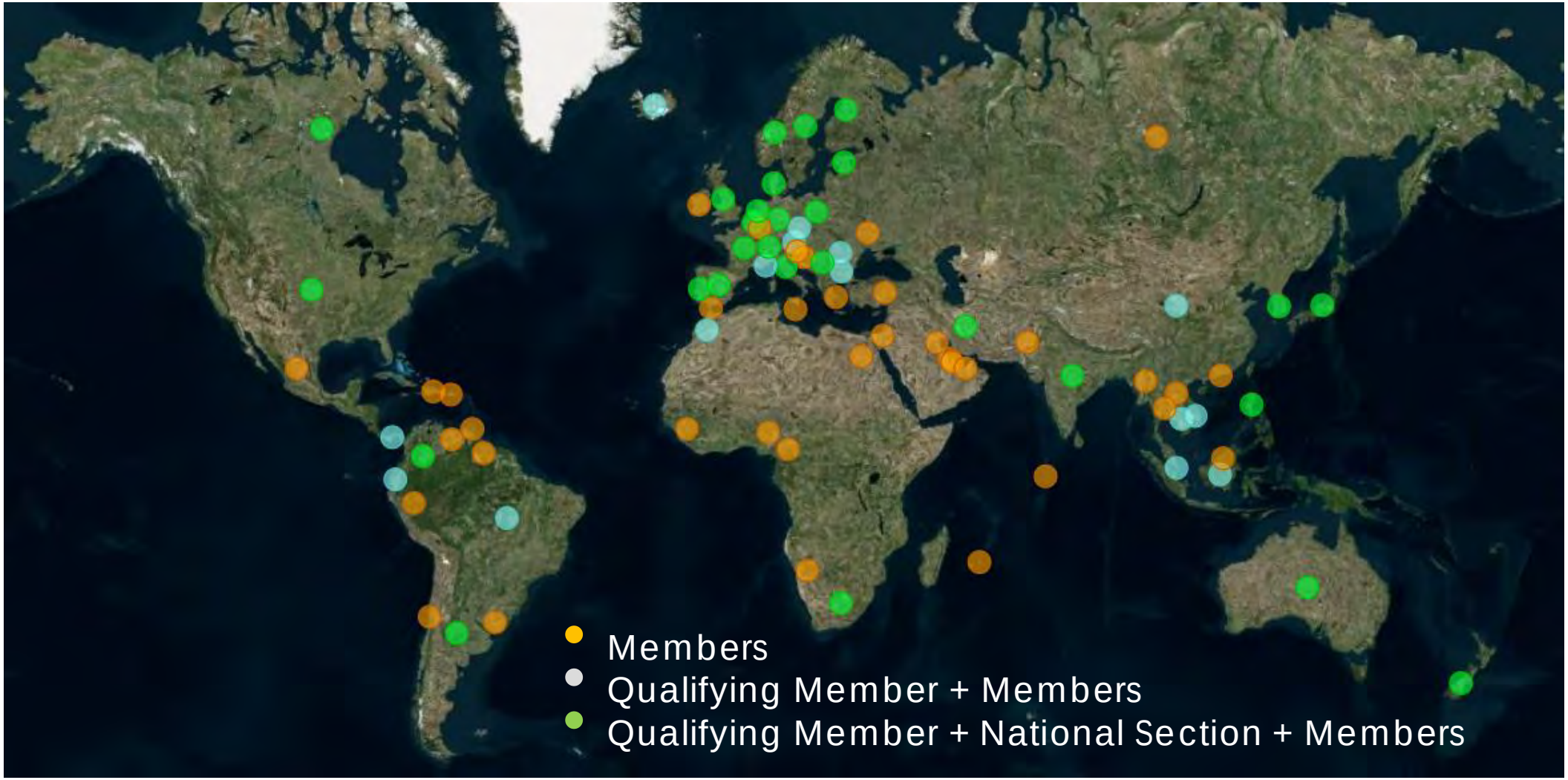
7 Become part of our international network

OUR GLOBAL MEMBERS

THE PIANC MEMBERSHIP CONSISTS OF:

- **43 Qualifying Members (QM) of which 27 have a National Section (NS)**
- **About 1,800 Individual Members**
- **More than 500 Corporate Members**
  - **port authorities**
  - **professional associations**
  - **universities**
  - **public- and private-sector organisations**
  - **…**
- **12 Platinum Partners**

OUR GLOBAL MEMBERSHIP



OUR A&NZ MEMBERS

THE PIANC A&NZ MEMBERSHIP CONSISTS OF:

- **Currently*180 Individual Members**
- **Including 50 Student members**
- **More than 95 Corporate Members**
  - **port authorities**
  - **professional associations**
  - **universities**
  - **public- and private-sector organisations**
  - **consultants & contractors**

**** As at 31 March 2023***

PIANC A&NZ BOARD

PIANC A&NZ IS LED BY A VERY ACTIVE BOARD

CHAIR - LUKE CAMPBELL

Board members participated at recent AGM 2023 in Sydney

PIANC A&NZ CONFERENCES

PIANC A&NZ ORGANISES OR CO-ORGANISES TWO MAJOR BIENNIAL CONFERENCES IN THE REGION AS WELL AS WORKSHOPS AND WEBINARS

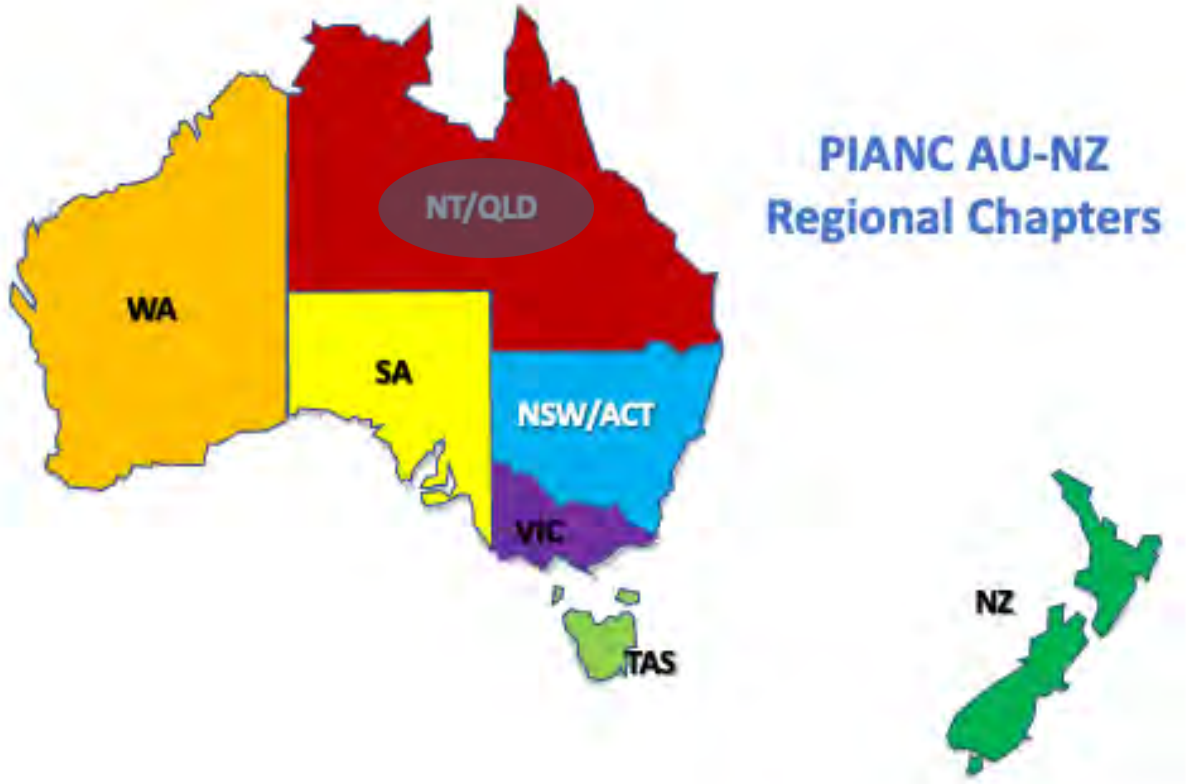
PIANC A&NZ REGIONAL CHAPTERS

PIANC A&NZ HAS SEVEN REGIONAL CHAPTERS

WE HOST CONFERENCES, TECHNICAL SEMINARS AND NETWORKING EVENTS FOR MEMBERS & OUR COMMUNITY

GET INVOLVED IN YOUR REGION!

http://pianc.org.au/about/regional-chapters/



PIANC A&NZ NORTHERN CHAPTER (QLD/NT)

- Governance
  - Leadership Committee (10 + 2 members)
  - Monthly meeting
- Organising and holding local events
- Supporting/Mentoring YP
- Contributing to the body of knowledge and technical reports

PIANC A&NZ NORTHERN CHAPTER (QLD/NT) – 2023 KEY EVENTS

Oct 5 2023

PORT OF TOWNSVILLE TECHNICAL PRESENTATIONS IN-PERSON & WEBINAR PLUS PORT TOUR - THURS OCT 5 2023

Thu Oct 5 2023, 01:00pm UTC+10 to 06:00pm UTC+10

Oct 31 2023

PIANC YOUNG PROFESSIONALS LEADERSHIP BREAKFAST IN BRISBANE!

Tue Oct 31 2023, 07:00am AEST

PIANC End of Year Sundowner in Brisbane, Pig N Whistle riverside, 30 Nov.

- 2024 Outlook
- Hydrogen
- Offshore Renewable Energy
- QGHL
- Coastal Eng (Griffith University)

Apr 18 2023

PIANC QLD/NT CHAPTER: OCEAN ENERGY & OFFSHORE WIND SEMINAR/WEBINAR - 18 APRIL - BRISBANE -

Tue Apr 18 2023, 05:30pm AEST to 08:30pm AEST

May 17 2023

PIANC ANZ QLD/NT CHAPTER: DARWIN FREE NETWORKING SUNDOWNER WED 17 MAY, 5 - 7.30PM

Wed May 17 2023, 05:00pm to 07:30pm

Luke Campbell – Chair PIANC A&NZ, with Shore Power Workshop organisers:
L-R Peter Engelen – PIANC A&NZ Deputy Chair & Workshop Coordinator, Jackie Spiteri – PIANC A&NZ Board Member and Sustainability Lead, Scott Keane – PIANC A&NZ Board Member and Technical Lead MarCom, Ron Cox – PIANC A&NZ Board and member PTGCC, Sam Mazaheri – Chair of PIANC Queensland and Northern Territory Regional Chapter.
Absent: Neil Lawson, PIANC A&NZ Board.

AUSTRALASIAN COASTS & PORTS 2023 Sunshine Coast
15 - 18 August 2023
Novotel Sunshine Coast Resort, QLD
WORKING TOGETHER
50 Years of Coasts and Ports

PIANC A&NZ MENTORING PROGRAM

PIANC A&NZ RUNS AN ANNUAL MENTORING PROGRAM FOR MEMBERS

IN 2022 WE CONNECTED 32 PARTICIPANTS FROM 22 MEMBER ORGANISATIONS

https://pianc.org.au/membership/members-mentoring-program/

AWARDS

- **PIANC DE PAEPE-WILLEMS AWARD (DPWA):**

➢ **special prize established as a recognition of outstanding technical research on waterborne transport infrastructure by young engineers (< age of 40).**

➢ **3 prizes: 4,000.00; 2,000.00 and 1,000.00 EUR**

- **MEDA AWARD (RecCom)**

- **WORKING WITH NATURE AWARD (EnviCom)**

➢ **Visit https://www.pianc.org/awards for more information!**

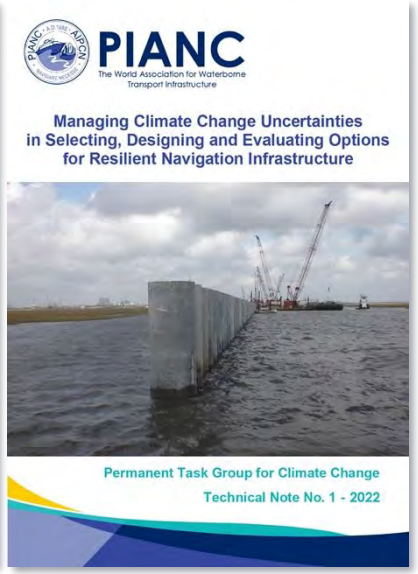
- **YOUNG PROFESSIONAL AWARD**
- **Granted every 4 year at the occasion of the PIANC World Congress to the author of the best paper.**

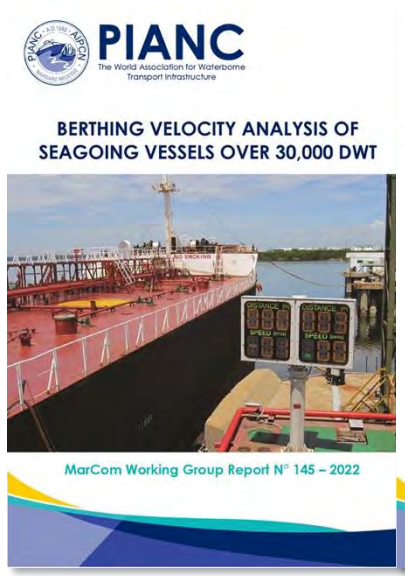
OUR TECHNICAL REPORTS

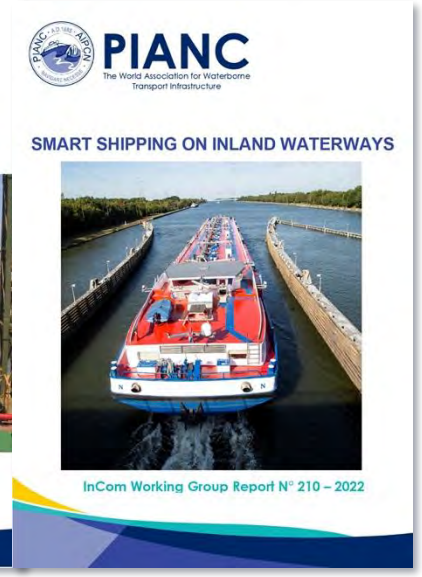
THE CORE BUSINESS OF PIANC

- Provide state-of-the-art guidance on waterborne transport-related topics for professionals
- Drafted by international Working Groups supervised by a Commission
- An average of 50 Working Groups active at any time!

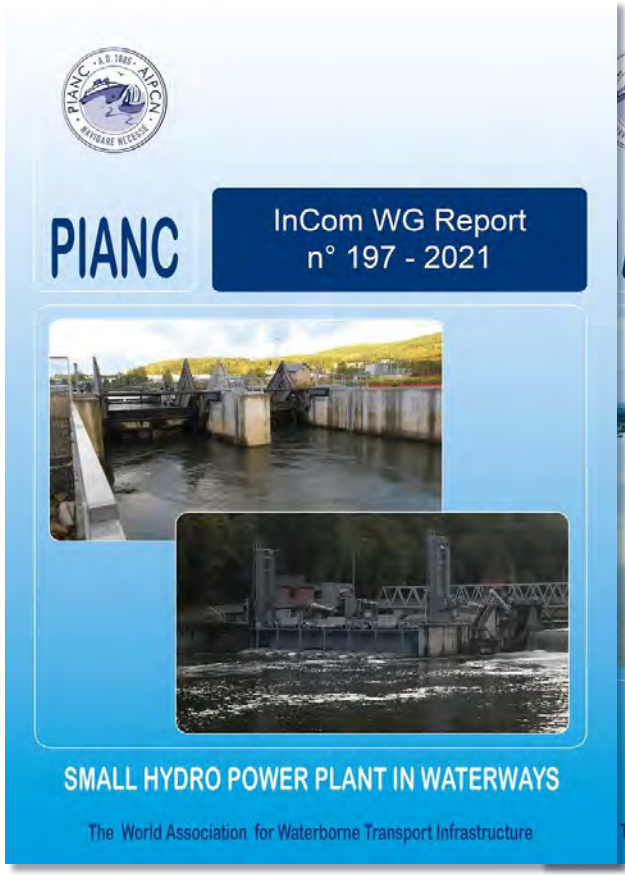
Available FOR FREE for all PIANC members on the Members Only pages!

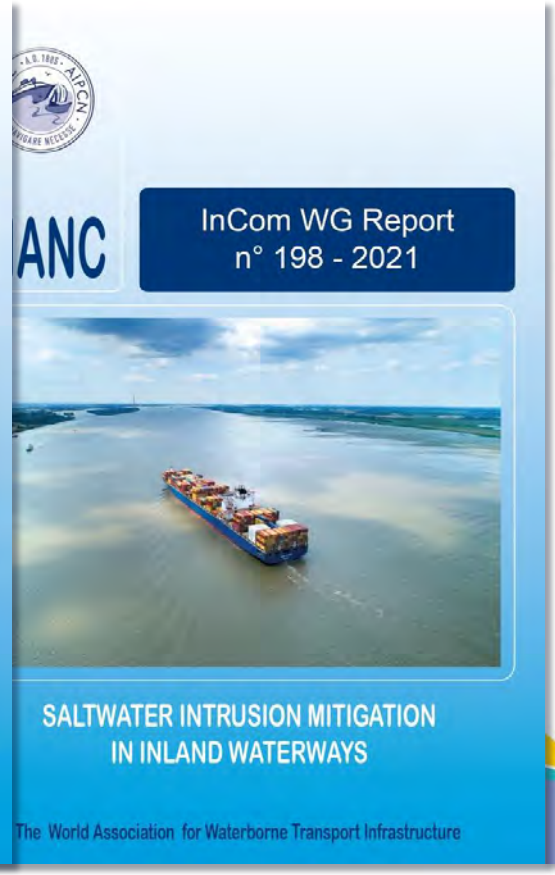


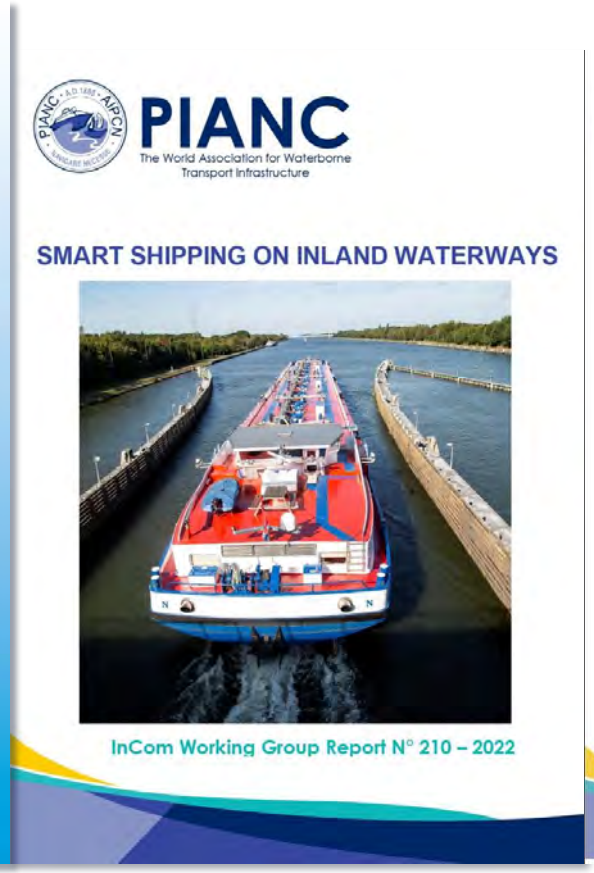


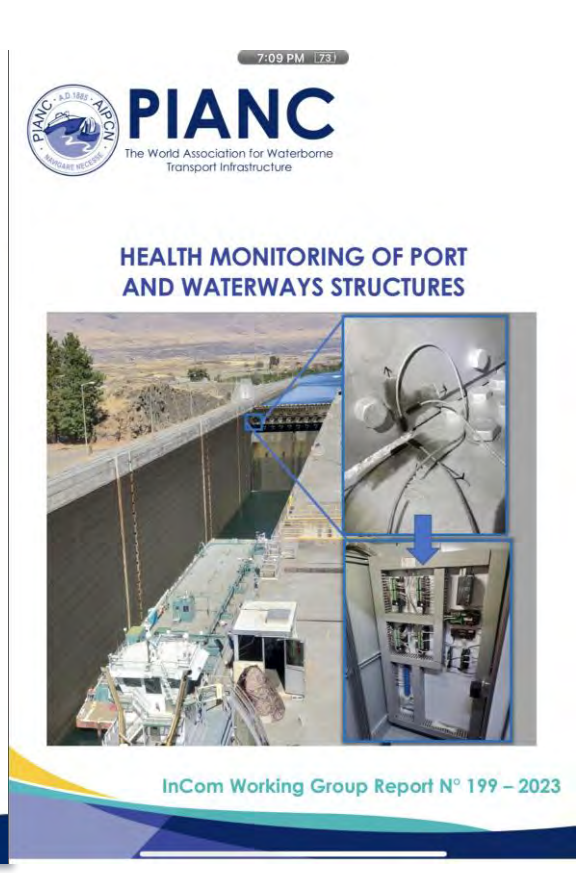


OUR TECHNICAL REPORTS (InCom)









OUR TECHNICAL REPORTS (MarCom

PIANC

MarCom WG Report
n° 208 - 2021

PLANNING FOR AUTOMATION
OF CONTAINER TERMINALS

The World Association for Waterborne Transport Infrastructure

PIANC
The World Association for Waterborne
Transport Infrastructure

BERTHING VELOCITY ANALYSIS OF
SEAGOING VESSELS OVER 30,000 DWT

MarCom Working Group Report N° 145 – 2022

PIANC
The World Association for Waterborne
Transport Infrastructure

A FRAMEWORK FOR
EARLY CONTRACTOR INVOL
IN INFRASTRUCTURE PRO

MarCom Working Group Report N° 19

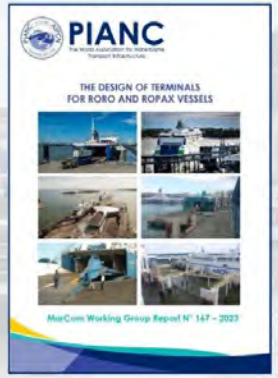
PIANC
The World Association for Waterborne
Transport Infrastructure

NEW PIANC WG REPORT

'The Design of Terminals for
RoRo and RoPax Vessels'

MarCom Working Group 167
€ 199.00 (342 pages)

https://bit.ly/45cZEL3



www.pianc.org

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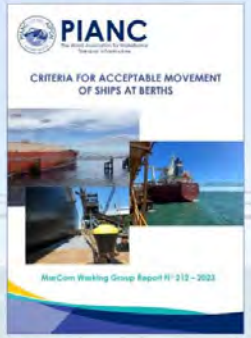
Transport Infrastructure

NEW PIANC WG REPORT

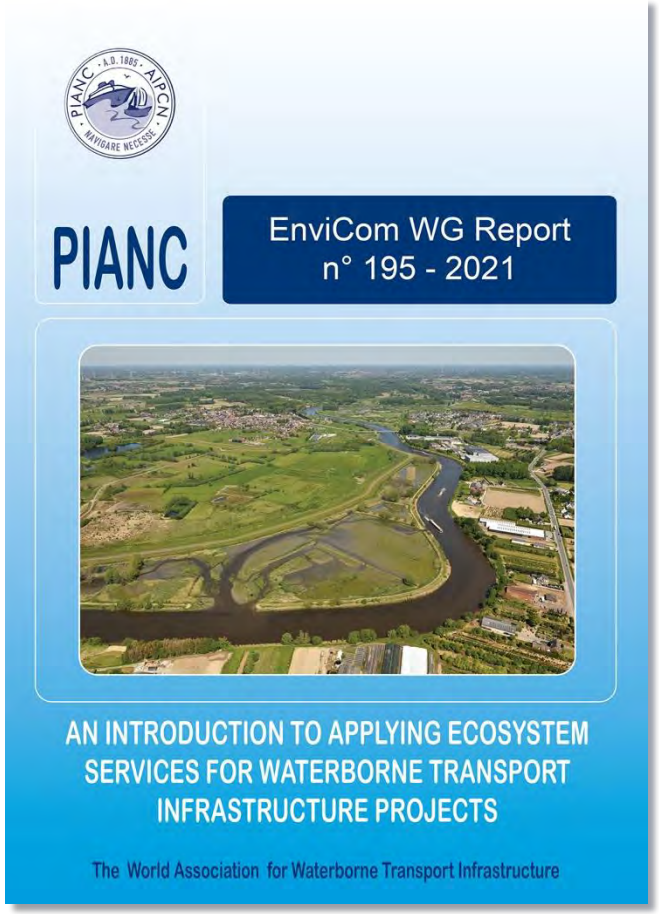
'Criteria for Acceptable
Movement of Ships at Berths'

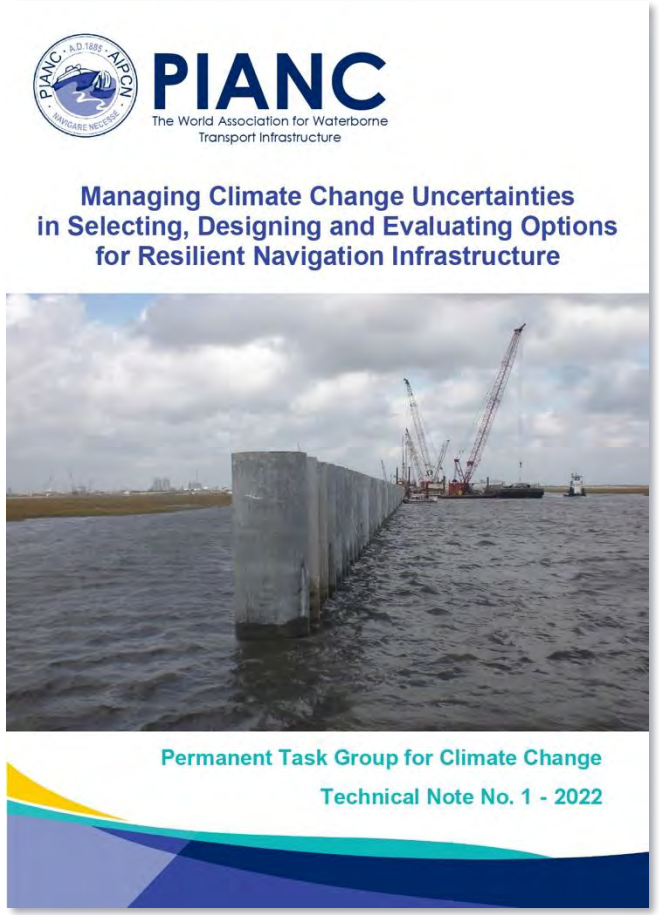
MarCom Working Group 212
€ 88.00 (76 pages)
Free for PIANC Members
https://www.pianc.org/publications/marcom/wg212



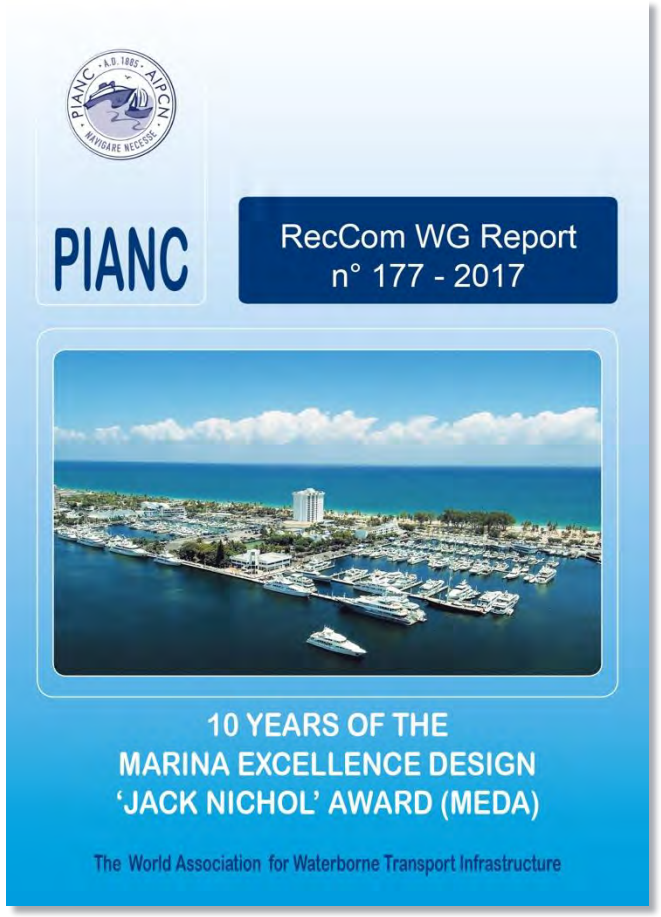
www.pianc.org

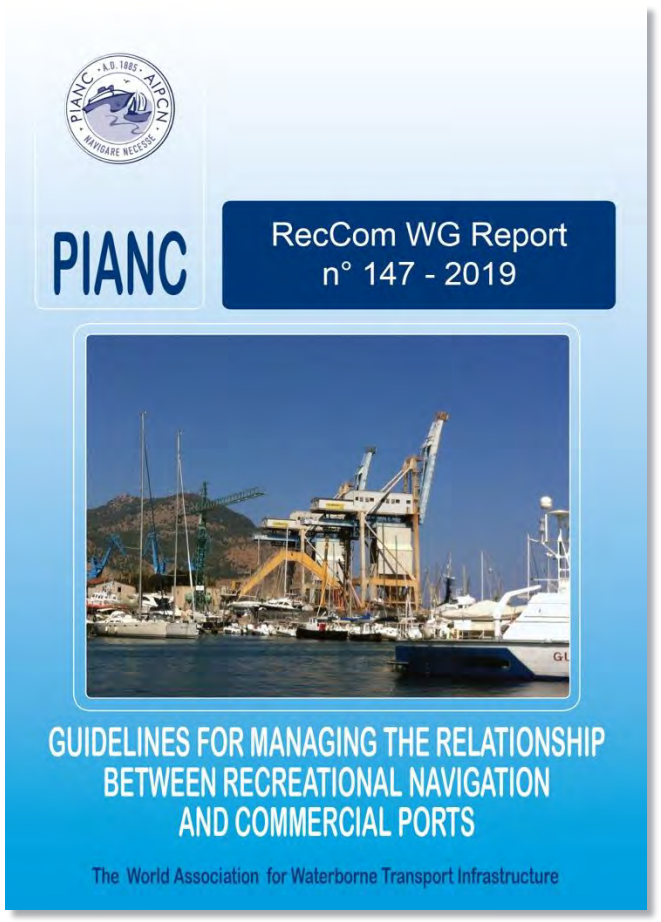
OUR TECHNICAL REPORTS (EnviCom)

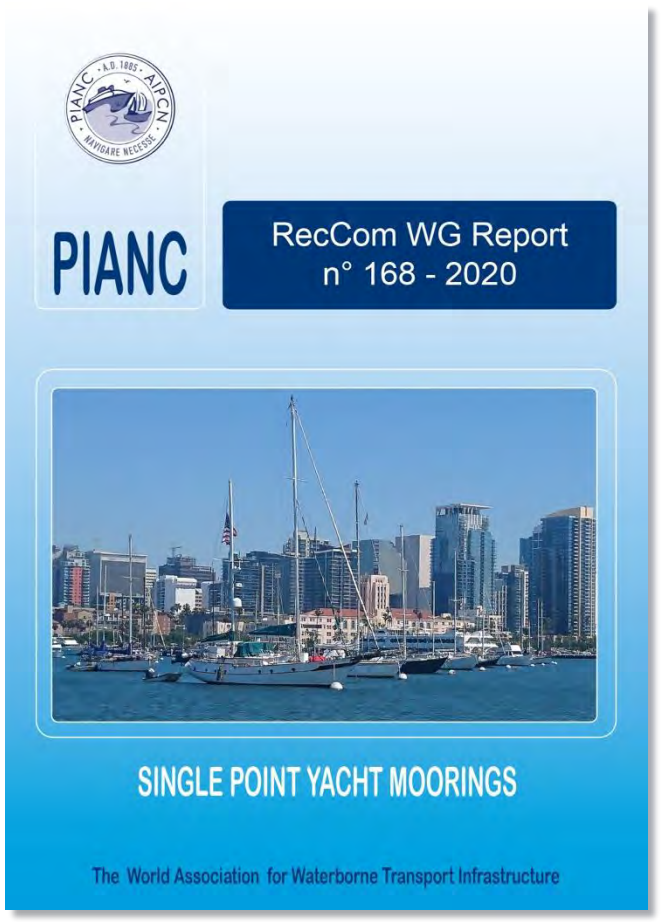




OUR TECHNICAL REPORTS (RecCom)

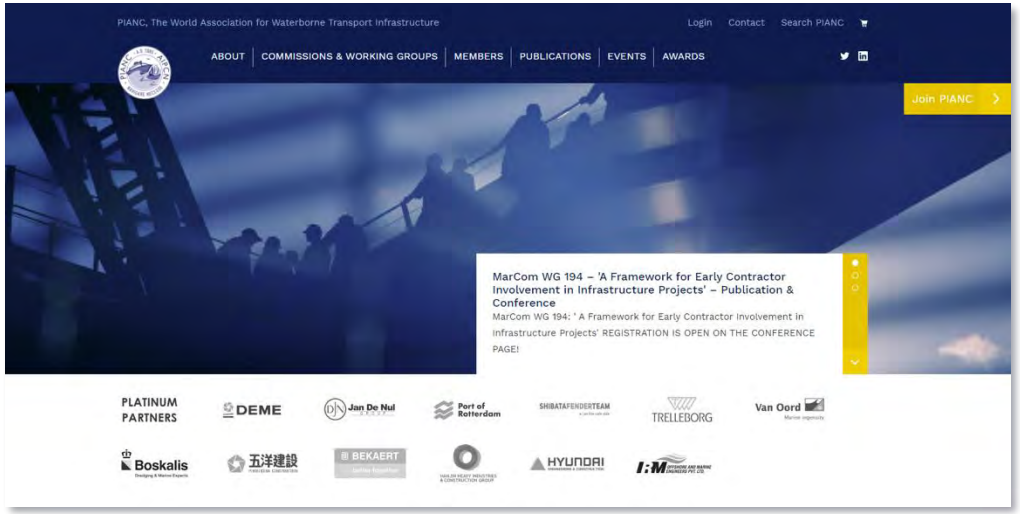






PIANC COMMUNICATION TOOLS

VISIT THE PIANC WEBSITE AT
https://www.pianc.org



JOIN PIANC ON THE SOCIAL MEDIA!

LinkedIn - https://www.linkedin.com/company/pianc-international/

Twitter - https://twitter.com/PIANC1

YouTube - https://www.youtube.com/@piancinternational

CONNECT WITH PIANC A&NZ

PIANC A&NZ MEMBERS RECEIVE REGULAR EMAIL UPDATES ON NEWS & EVENTS

VISIT THE PIANC WEBSITE AT
https://www.pianc.org.au

JOIN PIANC A&NZ ON SOCIAL MEDIA!

LinkedIn https://www.linkedin.com/company/pianc-a-nz/

YouTube - https://www.youtube.com/@pianc_anz

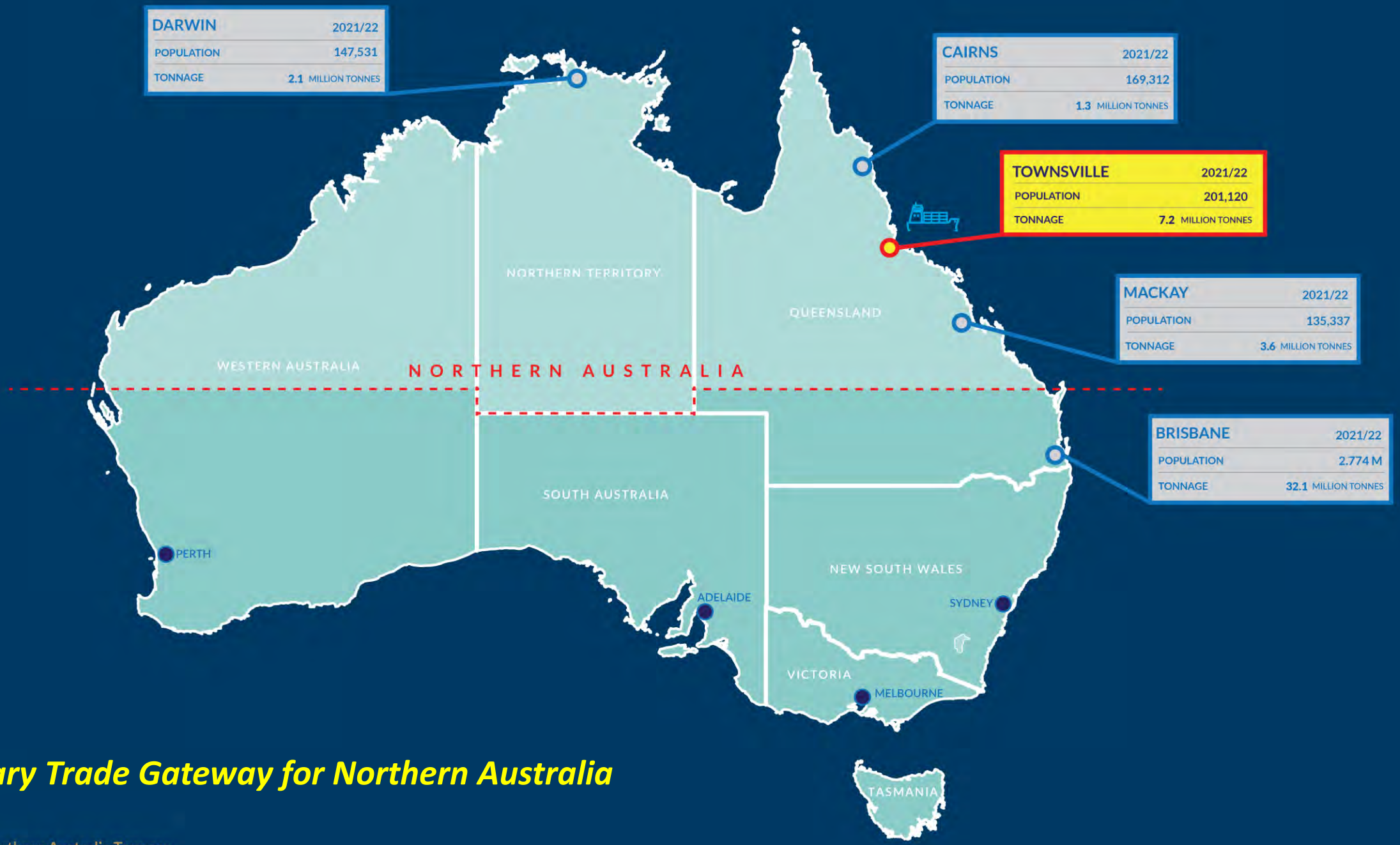
LinkedIn Group for our YPs https://www.linkedin.com/groups/5078998/


PORT OF TOWNSVILLE
delivering sustainable prosperity
Australian Port of the Year Award
2015, 2016, 2021

• ACKNOWLEDGEMENT

The Port of Townsville stands on Gurambilbarra country, traditionally cared for by the Wulgurukaba people.

- We pay our respect to our traditional owners past, present and emerging.



Primary Trade Gateway for Northern Australia

2021/22 - Northern Australia Tonnage

AUSTRALIA'S LARGEST

ZINC, LEAD, COPPER,
SUGAR & FERTILISER PORT

NORTH AUSTRALIA'S LARGEST

CONTAINER & AUTOMOTIVE PORT

GROWING CRUISE PORT

PORT PRECINCTS

300HA
PORT LANDS (EXISTING)

400km²
MARINE LIMITS

PORT OF TOWNSVILLE
delivering sustainable prosperity

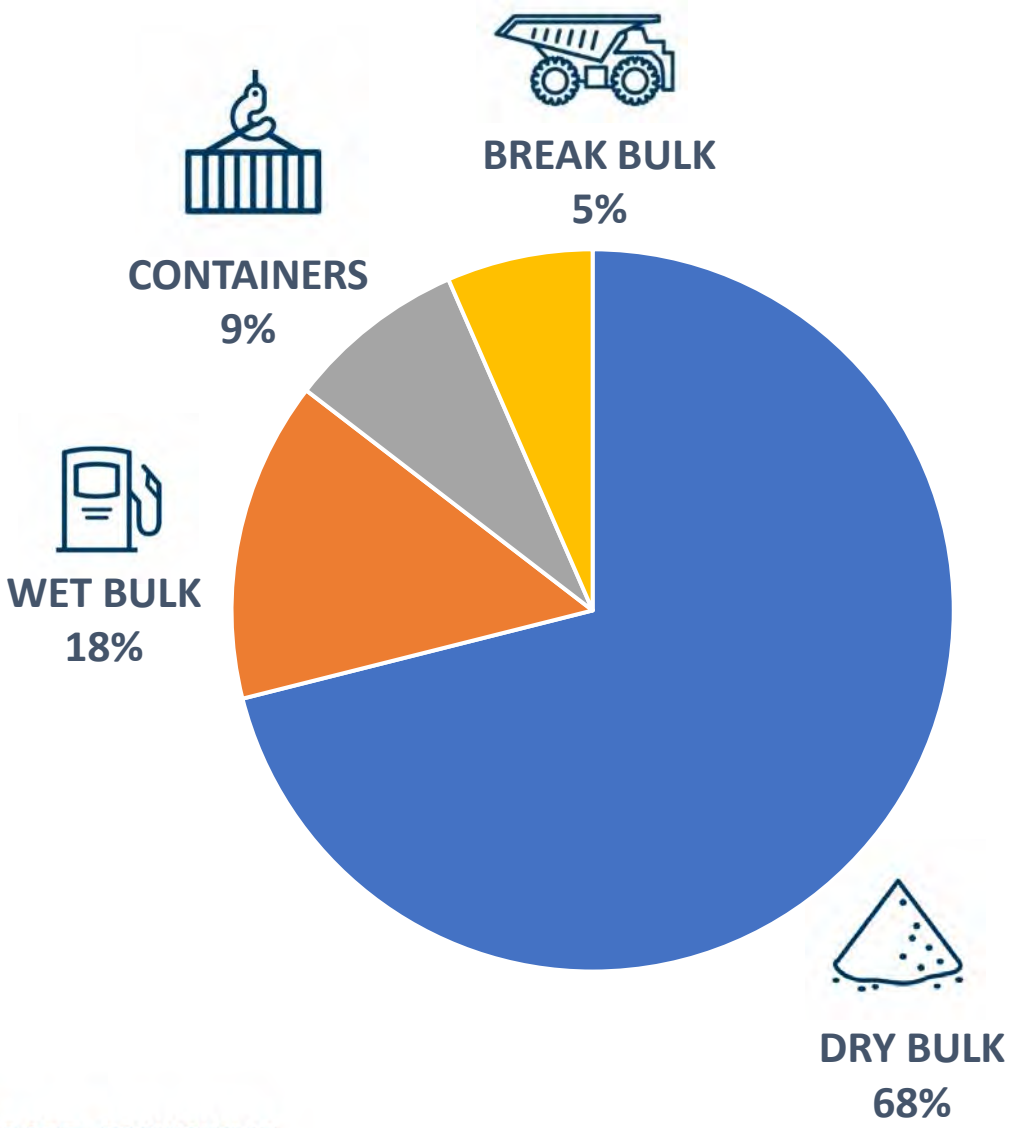
8 BERTHS

8 M TONNES OF TRADE

$10BN WORTH


30+
KEY
COMMODITIES

Key Trades



TONNES 2022-23

Mineral Concentrates	1,440,000
Sugar	1,556,256
Fertiliser	943,767
Petroleums	1,077,051
Refined Metals	5,812

44,731 TEUs

36,862 Motor Vehicles

54,042 Live Cattle

PORT OF TOWNSVILLE

delivering sustainable prosperity

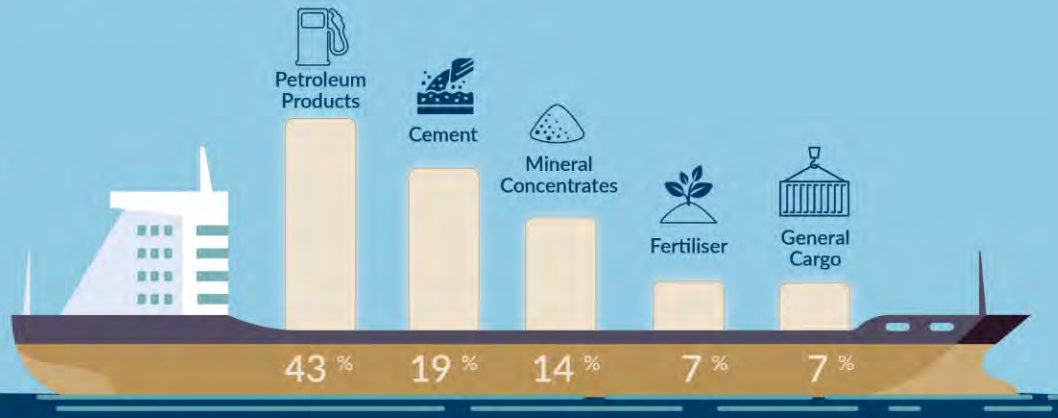
Links to 130 ports in 44 countries

PORT OF TOWNSVILLE

2021/22 - Top 10 Trading Partners

Top 5 Export Commodities

Top 5 Import Commodities



Top 5 Export Destinations

SOUTH KOREA	21 %	
AUSTRALIA	15 %	
CHINA	15 %	
JAPAN	9 %	
USA	6 %	

Top 5 Import Origins

23 %	SOUTH KOREA	
22 %	AUSTRALIA	
7 %	CHINA	
6 %	SINGAPORE	
6 %	CANADA	

PORT OF TOWNSVILLE
delivering sustainable prosperity

2021 - 2022

STRATEGIC LAND
CLOSE TO PORT

4,900HA
STATE INDUSTRIAL ZONE

$28M
MULTI LEVEL GOVERNMENT FUNDING FOR LANSDOWN PRECINCT (2,200HA)

• THE OPPORTUNITIES

POTENTIAL NEW TRADE OPPORTUNITIES

- Battery Chemicals
- Phosphate Rock
- Windfarm
- Biofuel Efuel
- CopperString
- Rare Earths
- Hydrogen

Queensland Pacific Metals

AUSTRALIAN MINES LIMITED

PURE BATTERY TECHNOLOGIES

ÆON METALS

Chatham Rock Phosphate Ltd

PHOSPHATE INTERNATIONAL

GTGF Australia

windlab

Genex Power

IBERDROLA

ZEPHYR ENERGY

tagenergy

QEM

jet zero

HIF

SEFAAS Sustainable Energy From An Agri Source Energy for the Environment

GreenDay ENERGY

ABEL ENERGY

Powerlink QUEENSLAND

MULTICOM RESOURCES

CURRIE ROSE RESOURCES INC

QEM

origin

Edify™

ARK ENERGY CORPORATION

CHANNEL UPGRADE

$251M
CHANNEL WIDENING

62HA
RECLAMATION AREA CREATED

300M LOA VESSELS

JUNE 2024
EST. COMPLETION

• NEW CAR LAYDOWN

Increases total capacity up to 3200 cars

New laydown completed September 2023

PORT OF TOWNSVILLE
delivering sustainable prosperity

$1.6 BILLION

PORT EXPANSION PROJECT

30 YEAR DEVELOPMENT

SMART PORT ENABLED

SAFE & RESILIENT

CRUISING INTO THE FUTURE

The global cruise market size expected to reach USD $15 billion by 2028:
11.0% CAGR

Queensland is Australia's most sought-after destination for the world's cruise ships.

Townsville aims to have the best passenger experience in Australia.

130
cruise ships by 2050
=25% berth occupancy

$50M
economic impact

200,000
passengers

STRATEGIC ANCHOR FOR DEFENCE CAPABILITY

- ARMY WATERCRAFT MASTER PLANNED FACILITY
- FORWARD MOUNTING BASE FOR LHD VESSELS
- STRATEGIC DEFENCE LOCATION
- SECURE CRITICAL INFRASTRUCTURE FOR AUSTRALIA & ITS FRIENDS
- TERMINAL DEVELOPMENT OPTIONS
- CLOSE TO ARMY & RAAF FACILITIES

Q&A

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PO Box 1031, Townsville Q 4810

PORT OF TOWNSVILLE

• Backhoe Dredging – Townsville CUP

• PIANC Northern Chapter

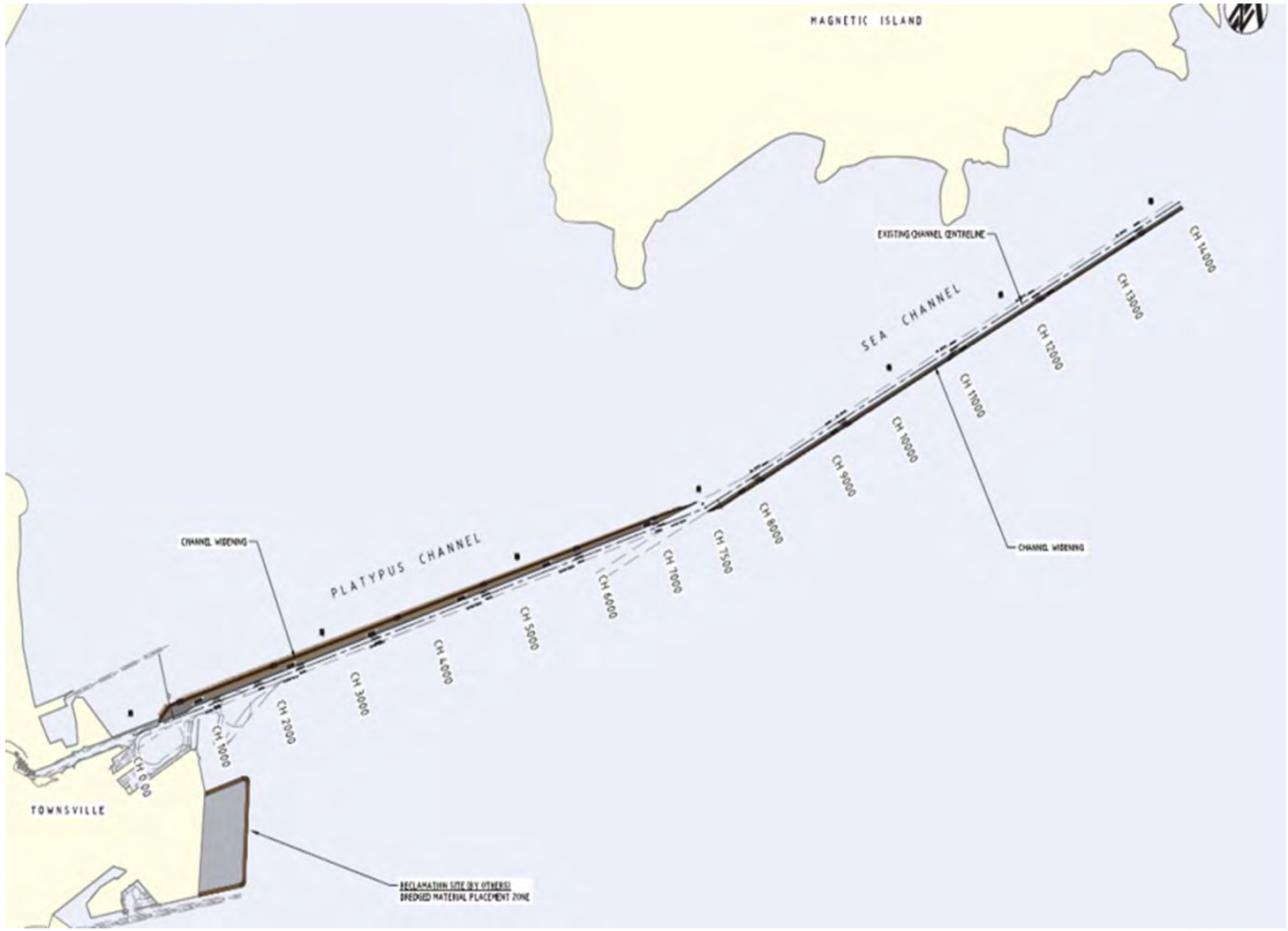
- Jason Mahlberg

- 05 October 2023

• Backhoe Dredging

- Is BHD on a larger scale your friend?

- **1. Project overview**
- **2. Dredging**
- **3. Reclamation**
- **4. Impacts**
- Environmental
- Community
- Optics




CHANNEL UPGRADE
After Channel Widening:
Total Width 180M (Port End) To 120M (At Sea End)
Existing Channel:
Total Width 92M
No capital dredge material will be disposed of at sea
All capital dredge material will be 100% beneficially re-used
550m
1100m
RECLAMATION AREA (62ha)
550m

• Channel Upgrade Project

- Project Overview

• Channel Upgrade Project

• Project Overview

The Channel Upgrade project will deliver a wider 14.9km shipping channel from 92m to 180m at the inshore (Port end), tapering to 120m at the seaward end.

Once complete, ships up to 300m long will be able to safely access the Port of Townsville.

Operations are being conducted by Hall Contracting using the largest Australian-owned backhoe dredge Woomera.

Dredging works commenced on 15 March 2022 and the project is expected to be finalised by late 2024.

Woomera will remove approx. 3.4 million cubic metres of dredge material which will be transported to a Temporary Unloading Facility and deposited within a 62ha area for future Port expansion.

• Channel Upgrade Project

• Project Overview

- Total dredge volume for the project 3,414,131 m3
- Dredging total to end of September

  2,604,768m3
- Percentage completed as at end of September 73%
- Dredging forecasted to be completed around April 2024

- **Dredging**

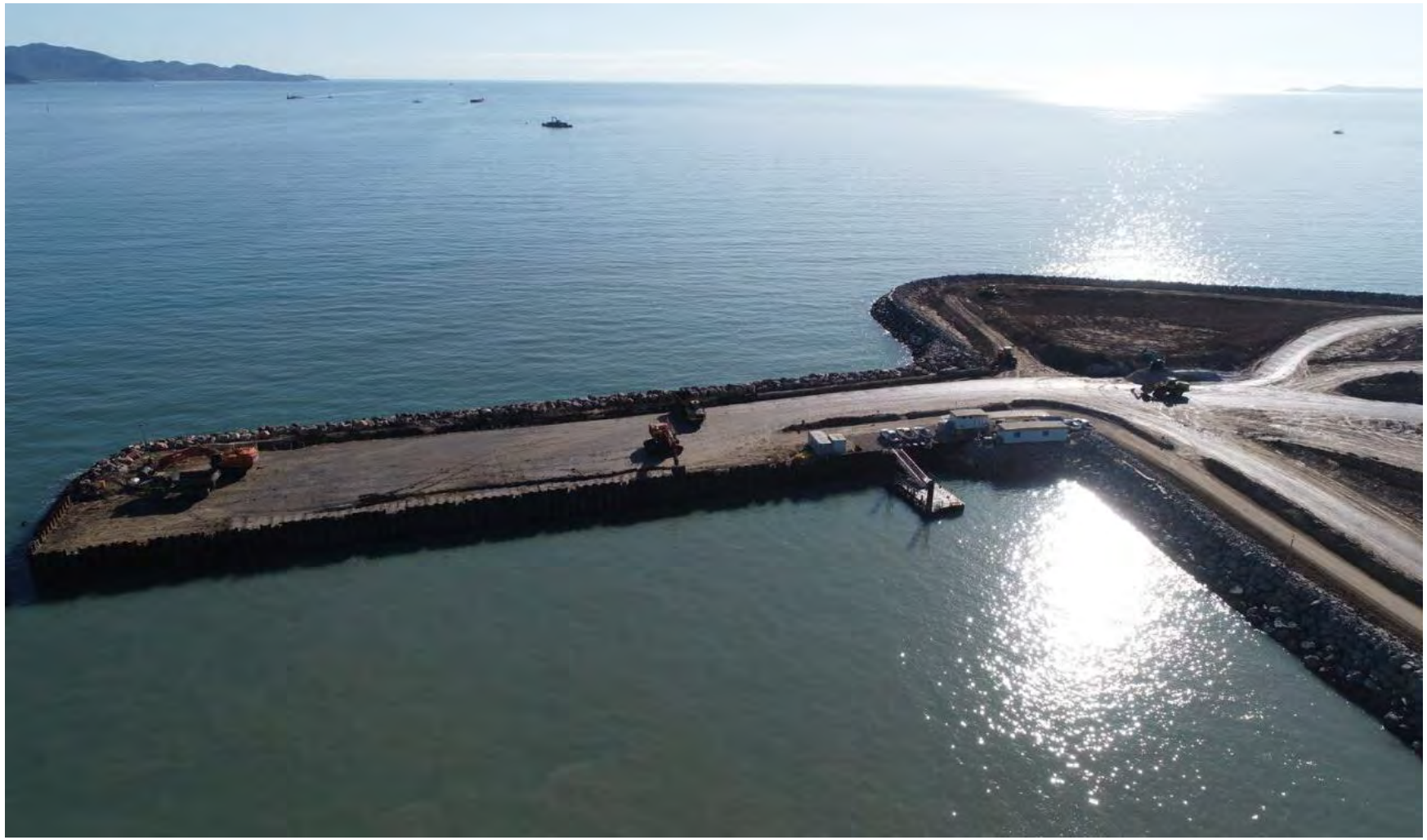
• Channel Upgrade Project

• Dredging

- With the project moving more than 1,989 barges to date and other vessels involved in the project Marine Operational Risk play a major role in the in project.

• Channel Upgrade Project

- Dredging
- TUF



- Reclamation

• Channel Upgrade Project

- Reclamation

Operational Constraints

- All weather access
- Trafficable surface
- Efficiencies at commencement– prior to bund wall sealing

• Channel Upgrade Project

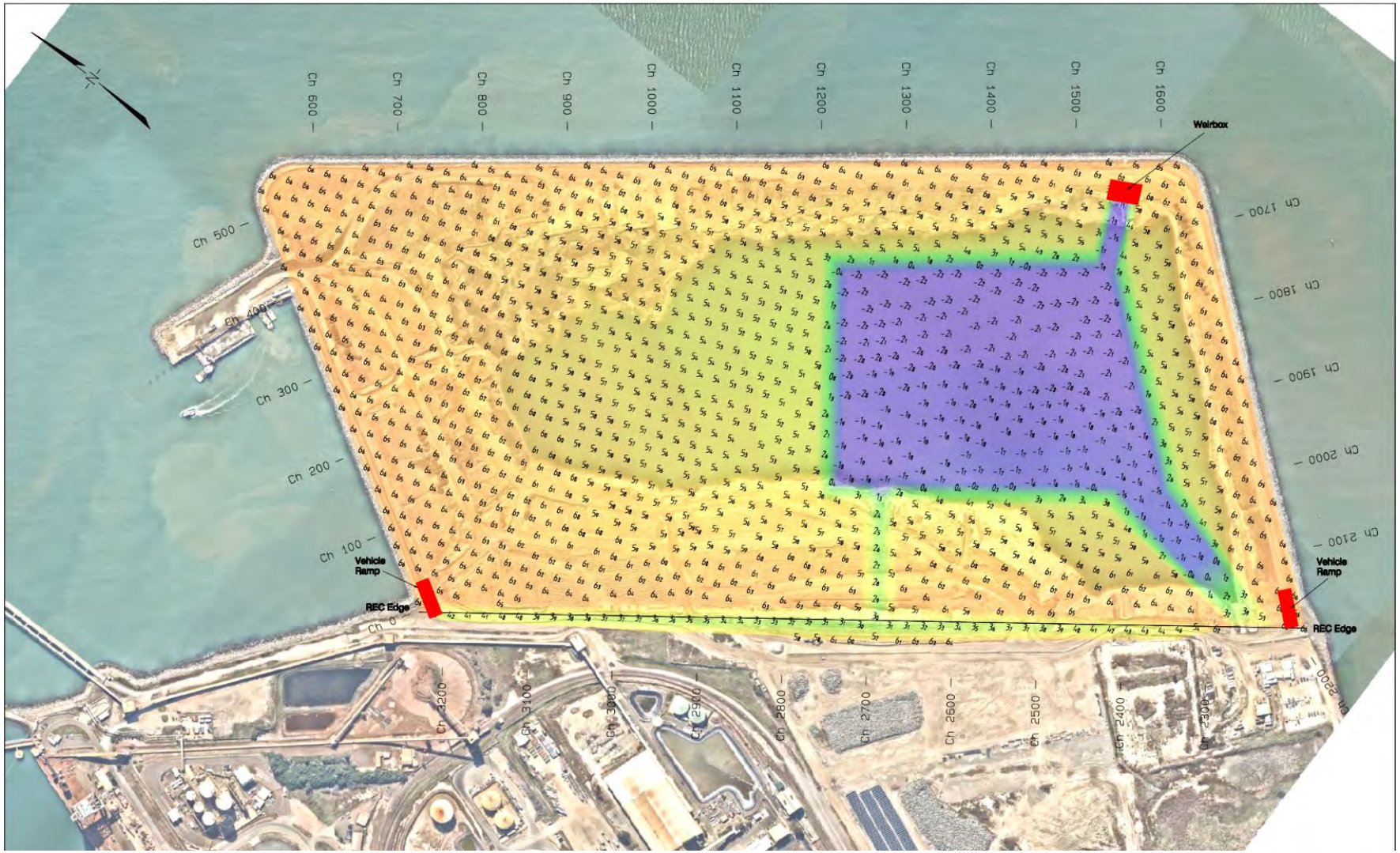
• Reclamation

Operational Opportunities

- Multi tip faces & work areas
- Multi circuits running
- Working in wet weather works
- Drying of materials
- Stockpile
- Dewatering
- Separation of different materials
- Staging of heights /levels
- Sediment controls

• Channel Upgrade Project

- Reclamation



- **Channel Upgrade Project**
- Reclamation

• Impacts

• Channel Upgrade Project

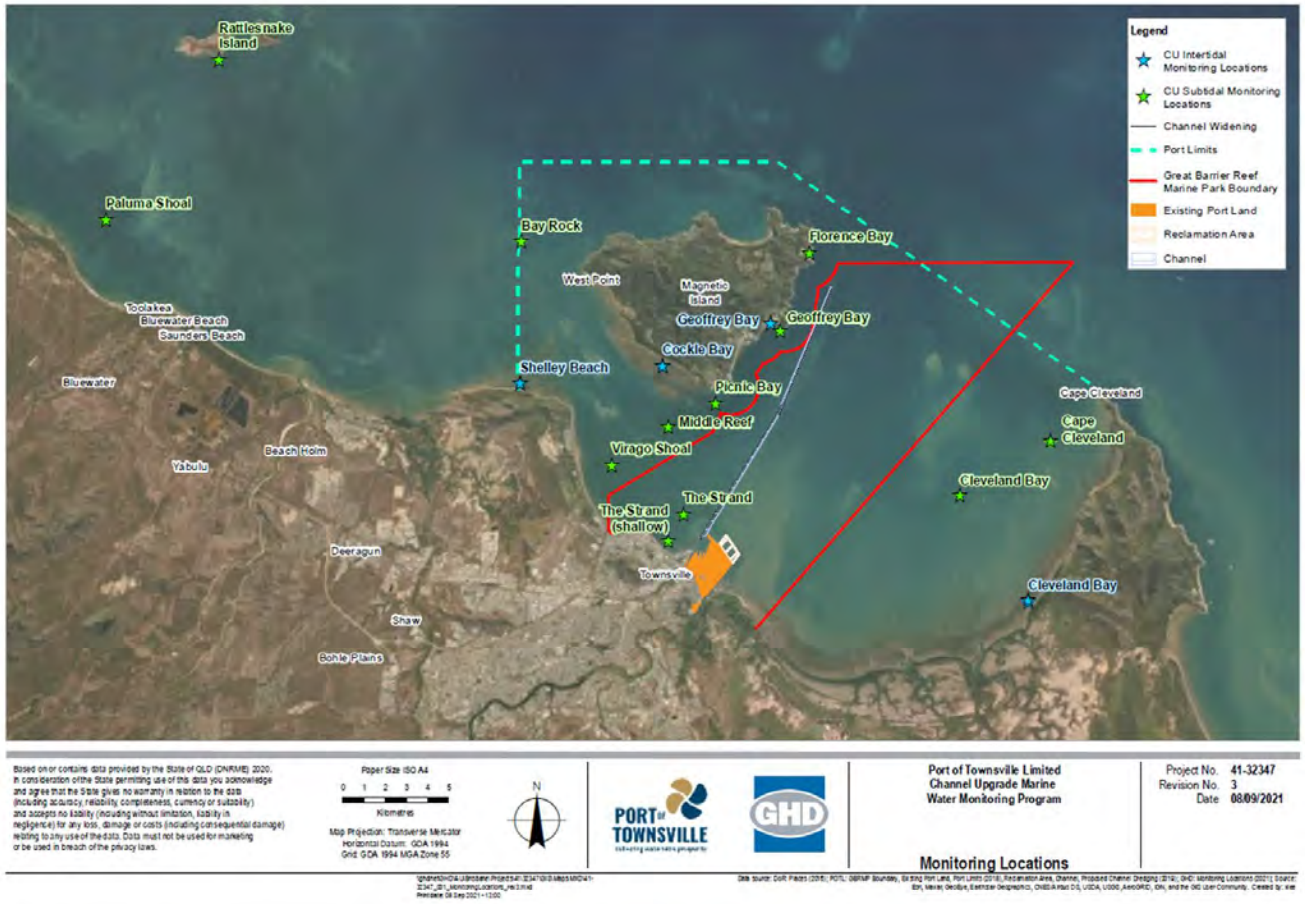
- Environmental Impact

Water Quality Monitoring

13 monitoring sites

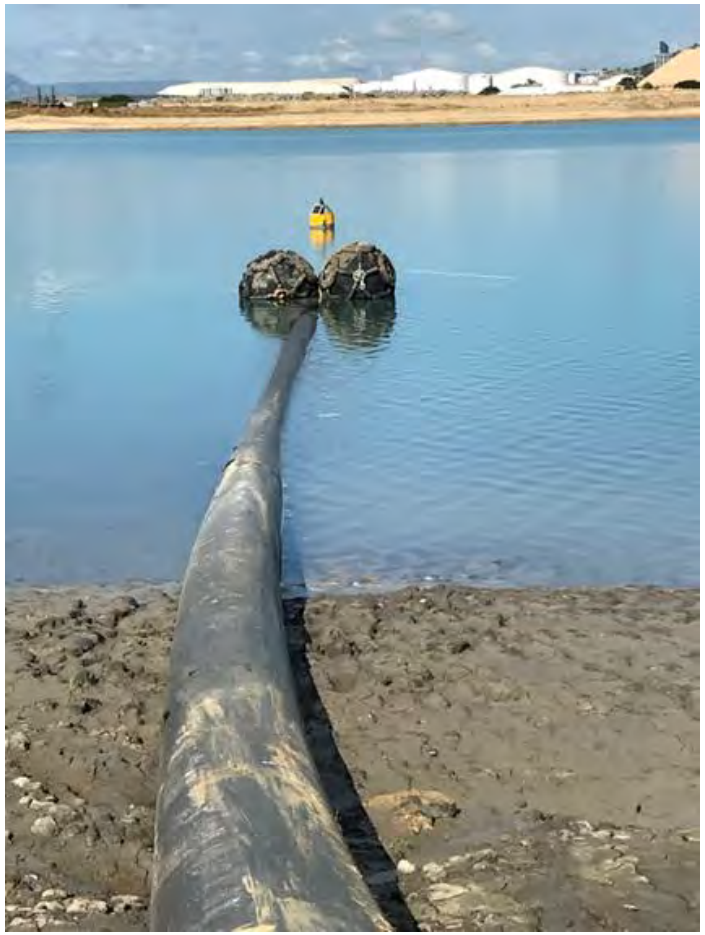
3 compliance sites – Virago Shoals, Middle Reef, Strand Shallow

Trigger levels/limits based on rolling average light levels



• Channel Upgrade Project

- Environmental Impact
  - Real time tailwater monitoring - monitored in the reclaim before discharge for pH, turbidity and dissolved oxygen
  - Receiving environment monitoring at 2 locations – 300m from outlet
  - Tailwater characte meet conditions



• Channel Upgrade Project

- Optics
- MODIS imagery of
- 5th September 20

• Channel Upgrade Project

- Community Impact
- Optics

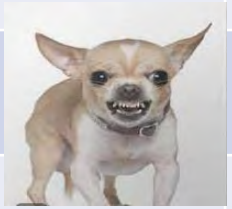
• Channel Upgrade Project

- Community Impact

Interactions between commercial and recreational vessel users on Cleveland Bay

• Channel Upgrade Project

- Yes or No?

BHD	Item	CSD/TSHD
	Schedule	
	Dredging	
	Reclamation	
	Environmental impact	
	Community impact	
	Optics	
	Outcome	

PORT OF TOWNSVILLE

delivering sustainable prosperity

• Thank you

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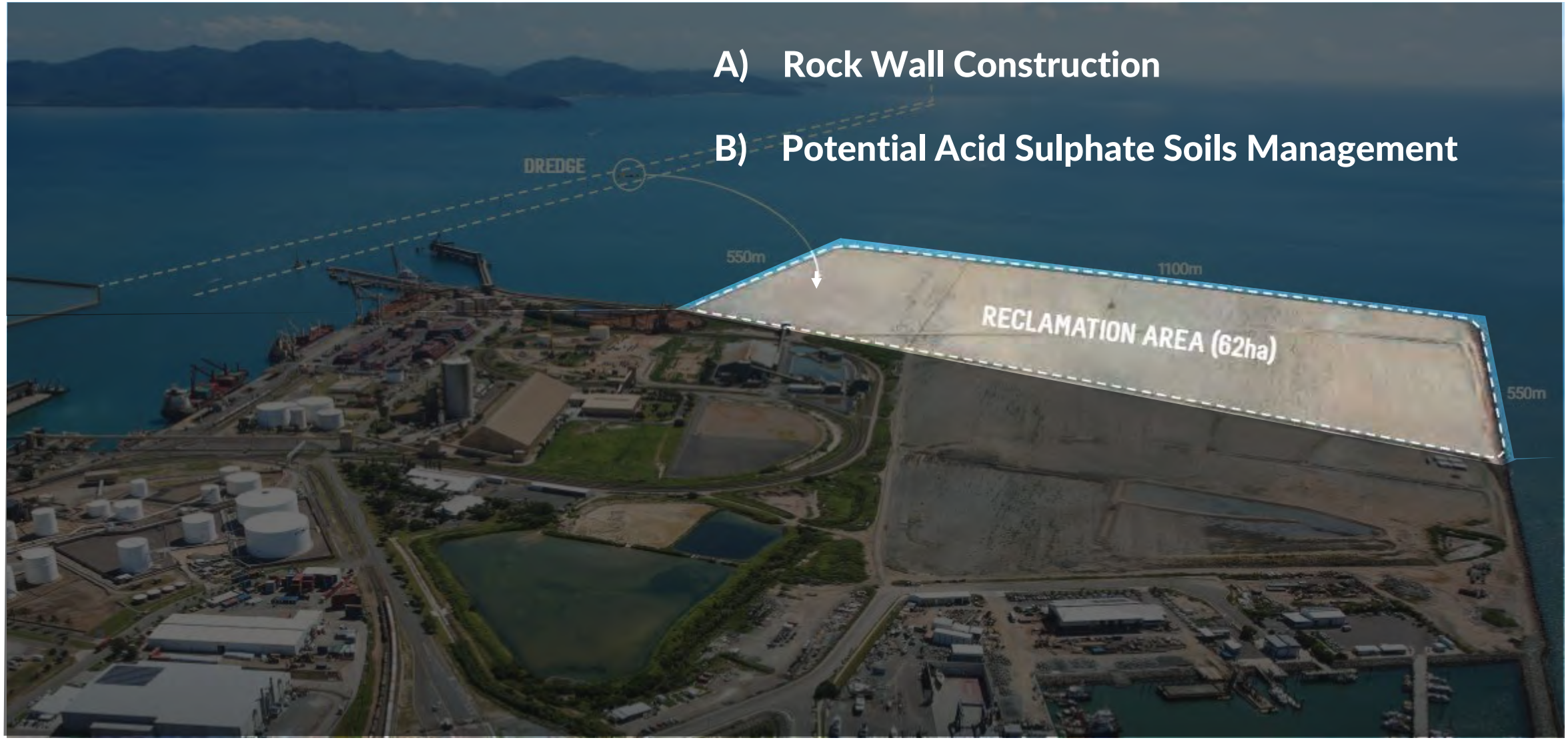
+61 7 4781 1500

Administration Building, Benwell Road
PO Box 1031, Townsville Q 4810

PORT OF TOWNSVILLE

Channel Upgrade Project - Reclamation Works

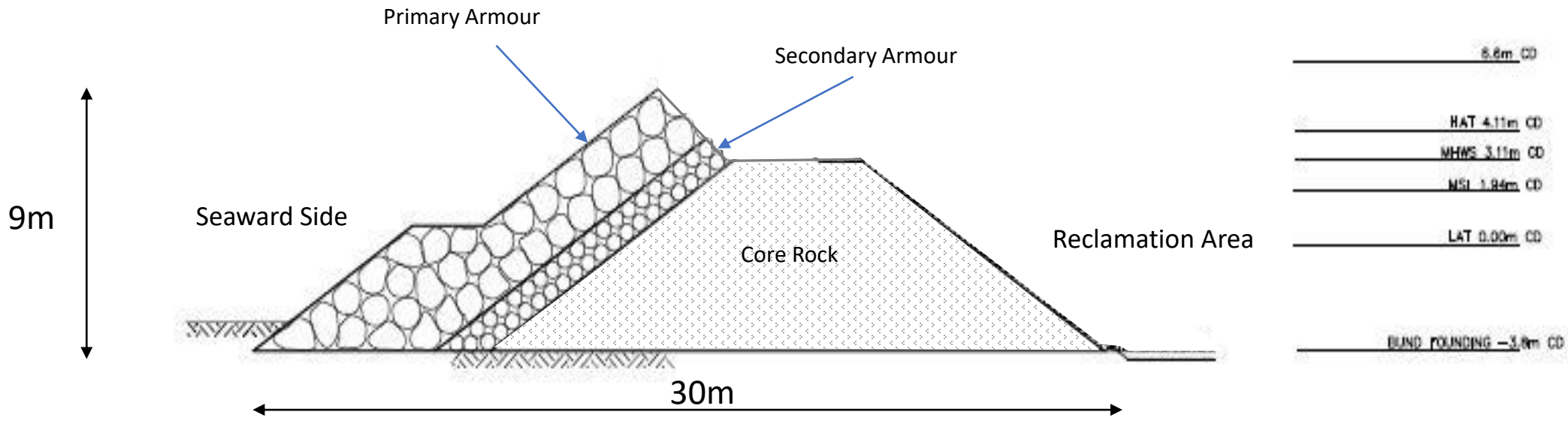


A) Rock Wall Construction

- **Construction Methodology Overview**
- **Difficulties with Differential Tide Pressures**
- **Estimating Tide Differentials for Remainder of Project**

Level 1 Rock Placement

Rock Only



Rock wall section

Level 1 Rock Placement

Level 1 Rock Placement

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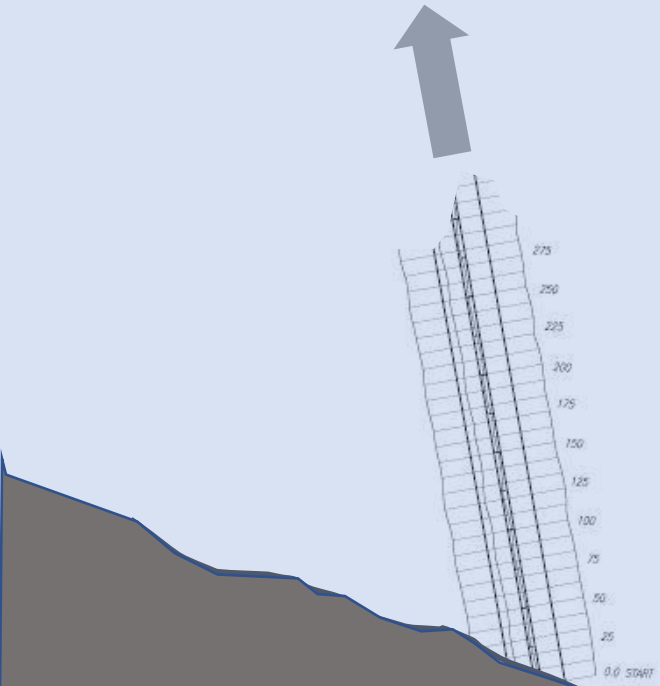
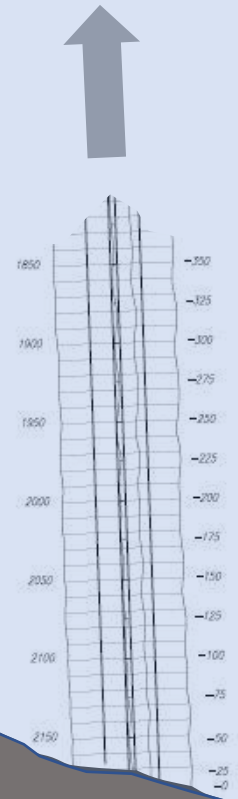
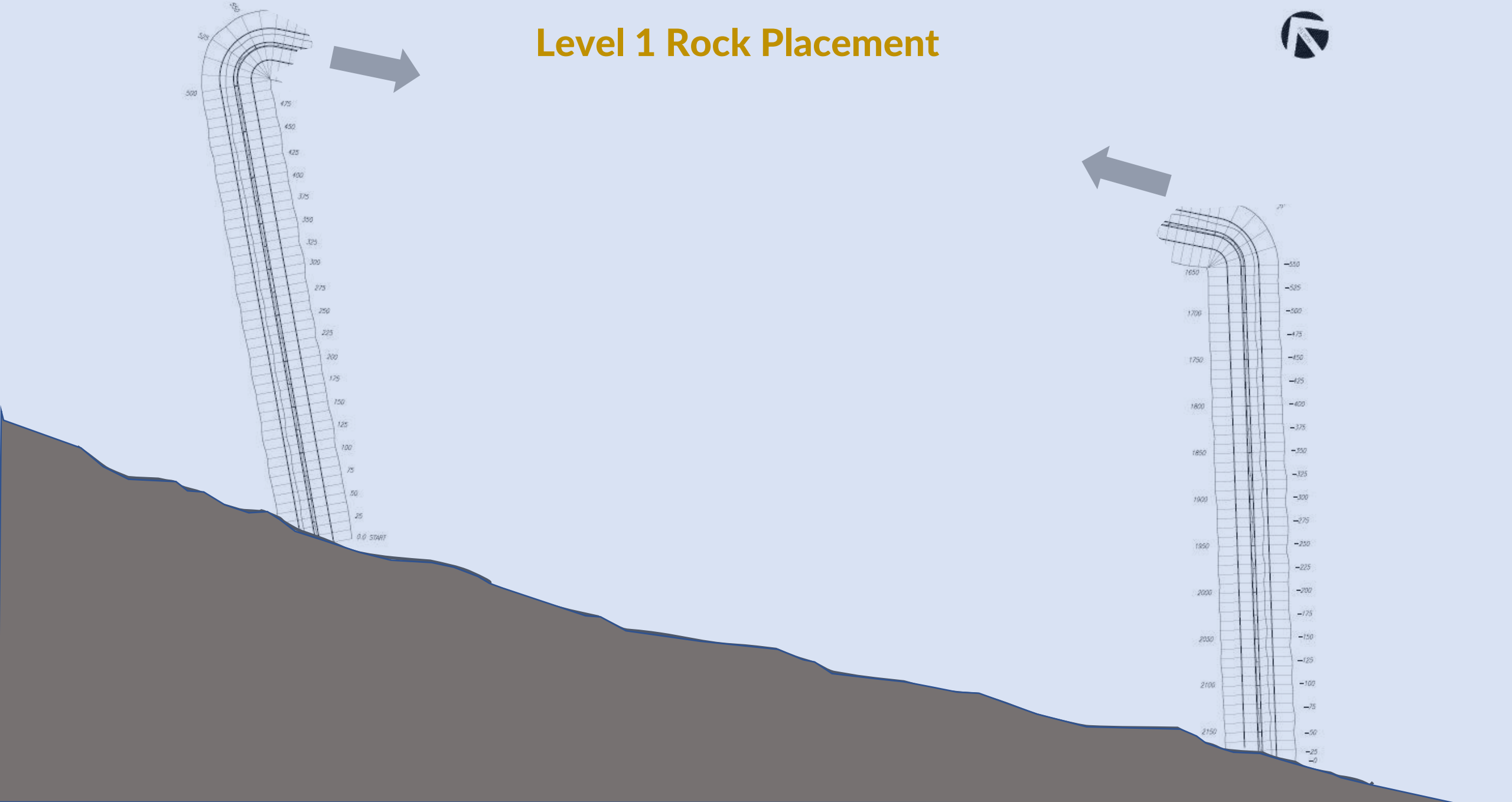
Level 1 Rock Placement



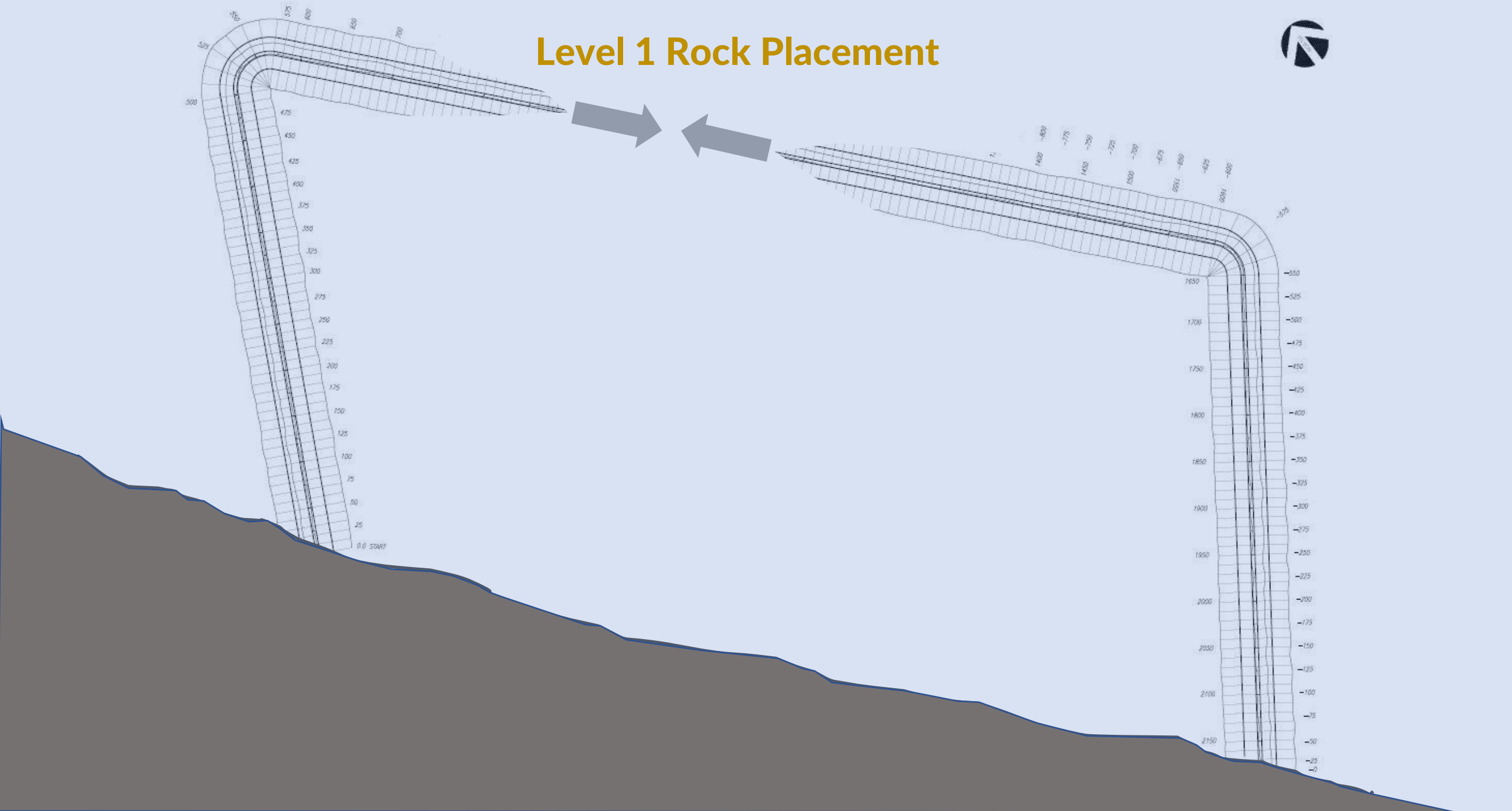
Rock wall construction



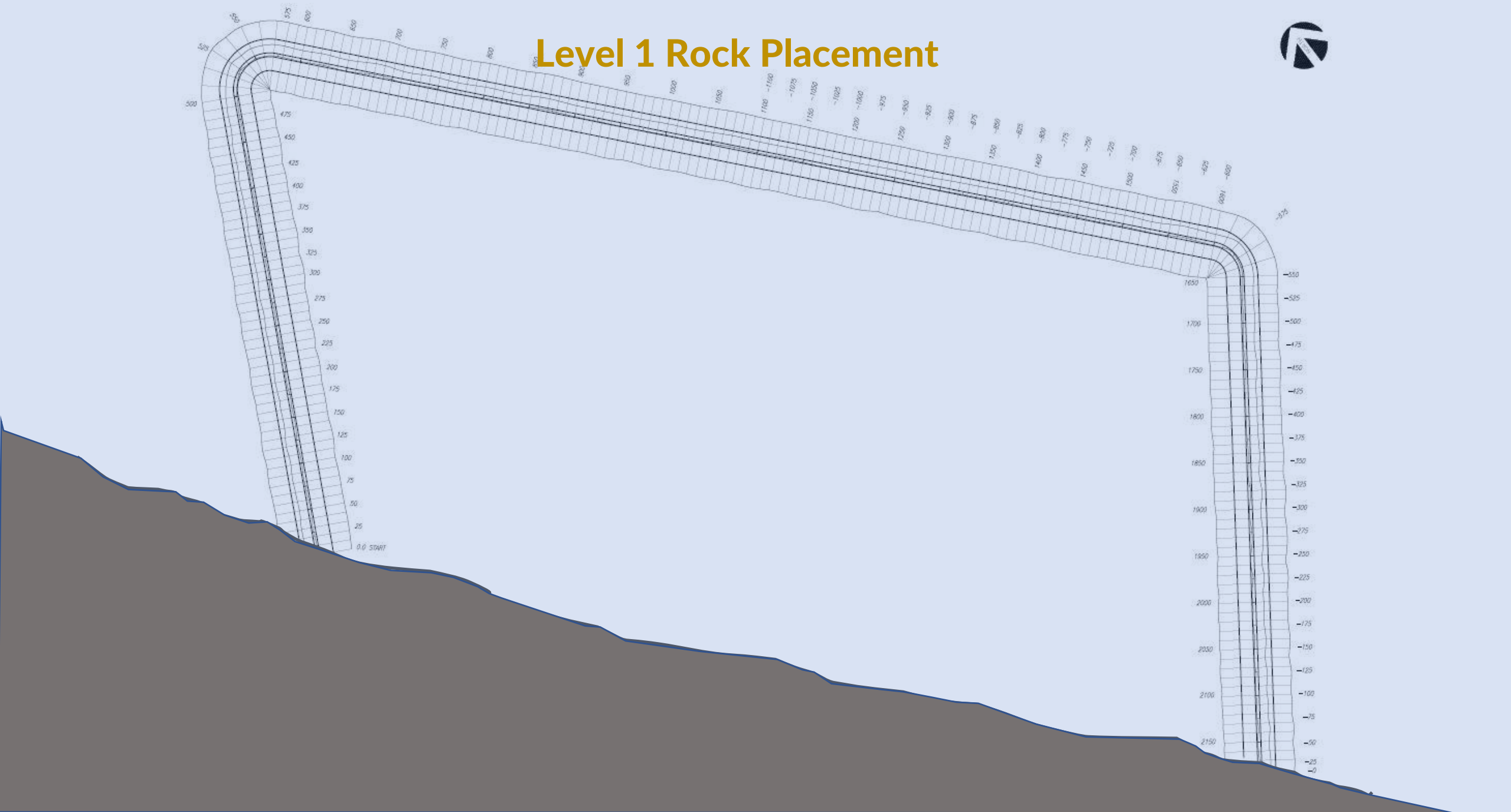
Level 1 Rock Placement



Level 1 Rock Placement

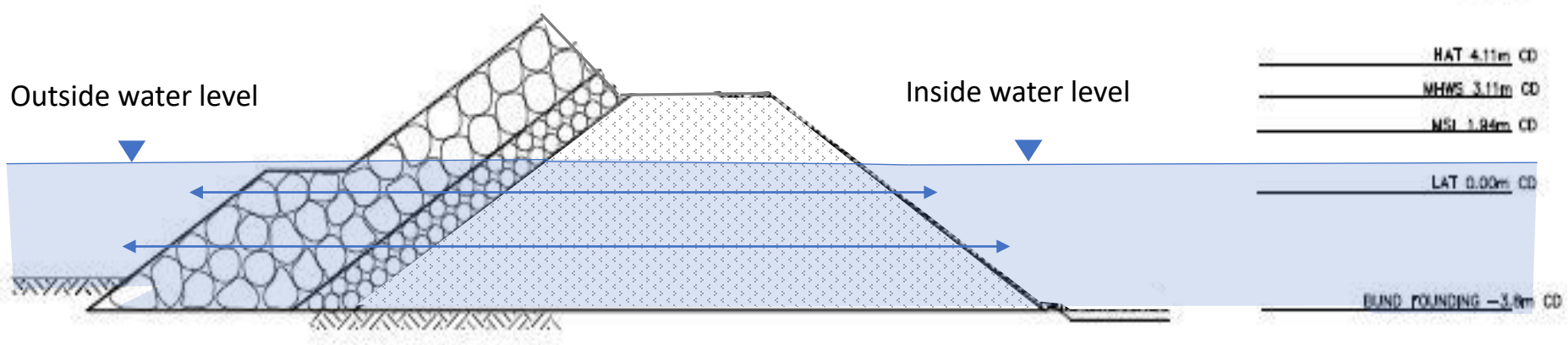


Level 1 Rock Placement



Level 1 Rock Placement

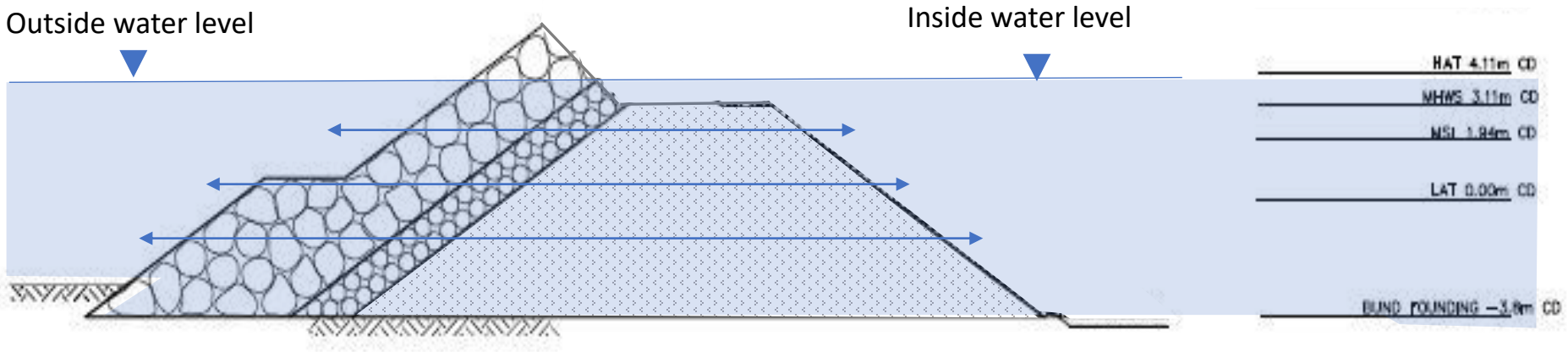
Tidal Flows with Rock Only



Rock wall section

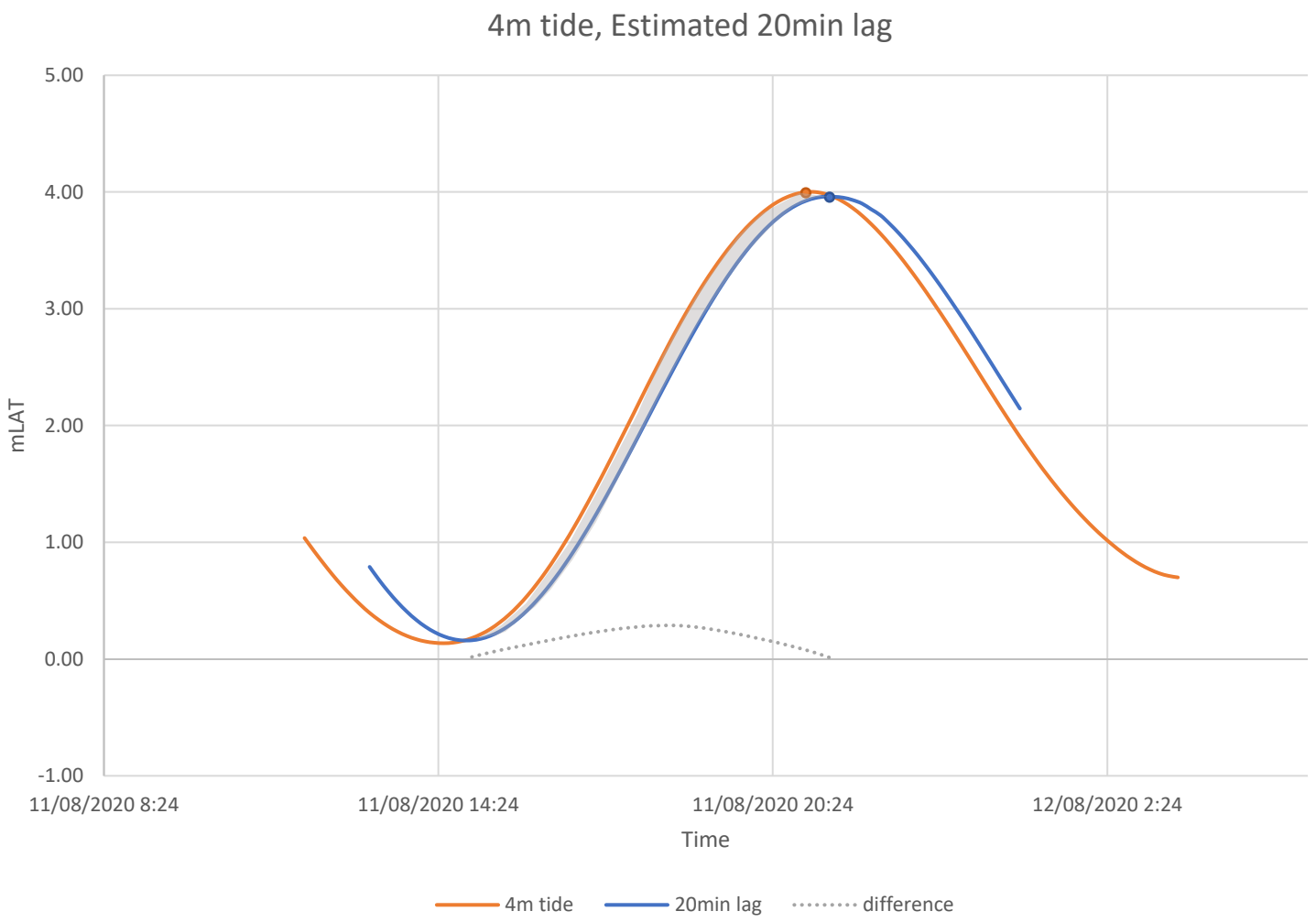
Level 1 Rock Placement

Tidal Flows with Rock Only



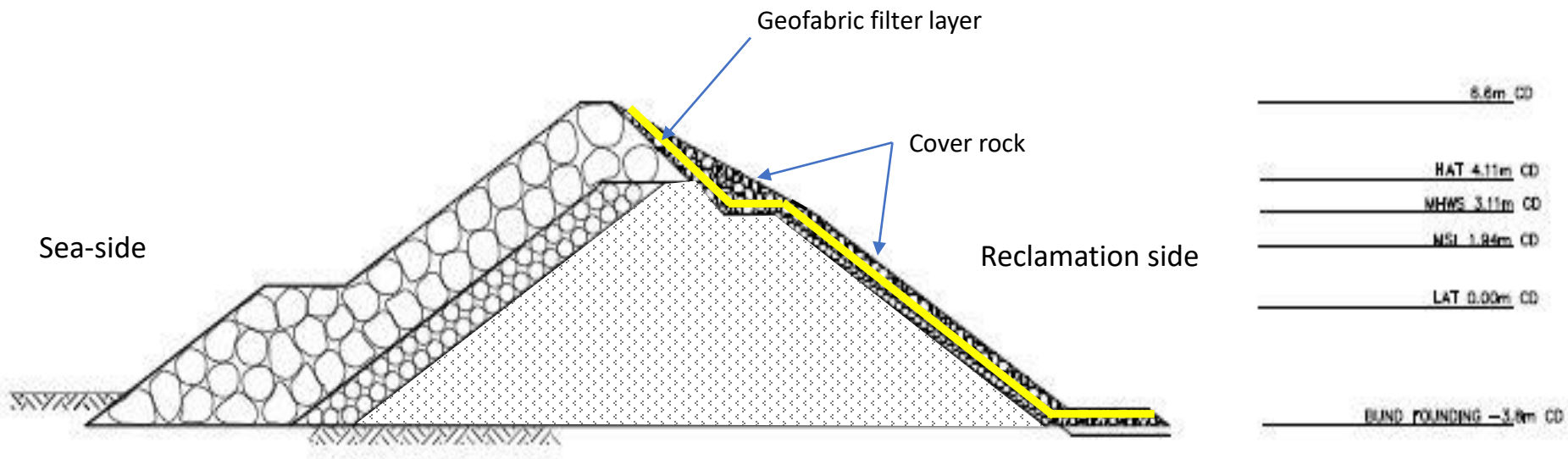
Rock wall section

Level 1 Rock Placement



Level 2 Rock plus Geofabric

Installation of geofabric filter layer

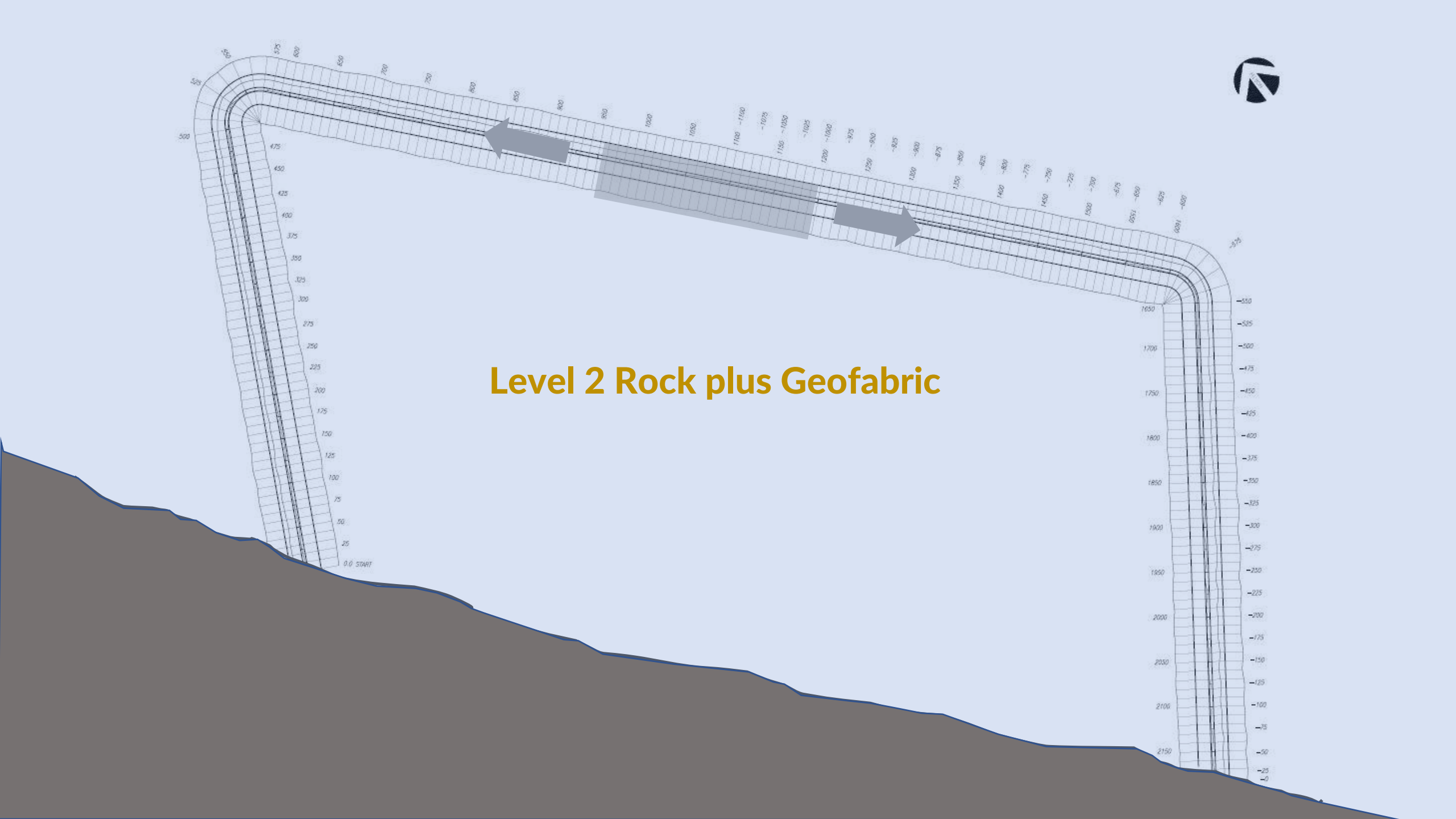


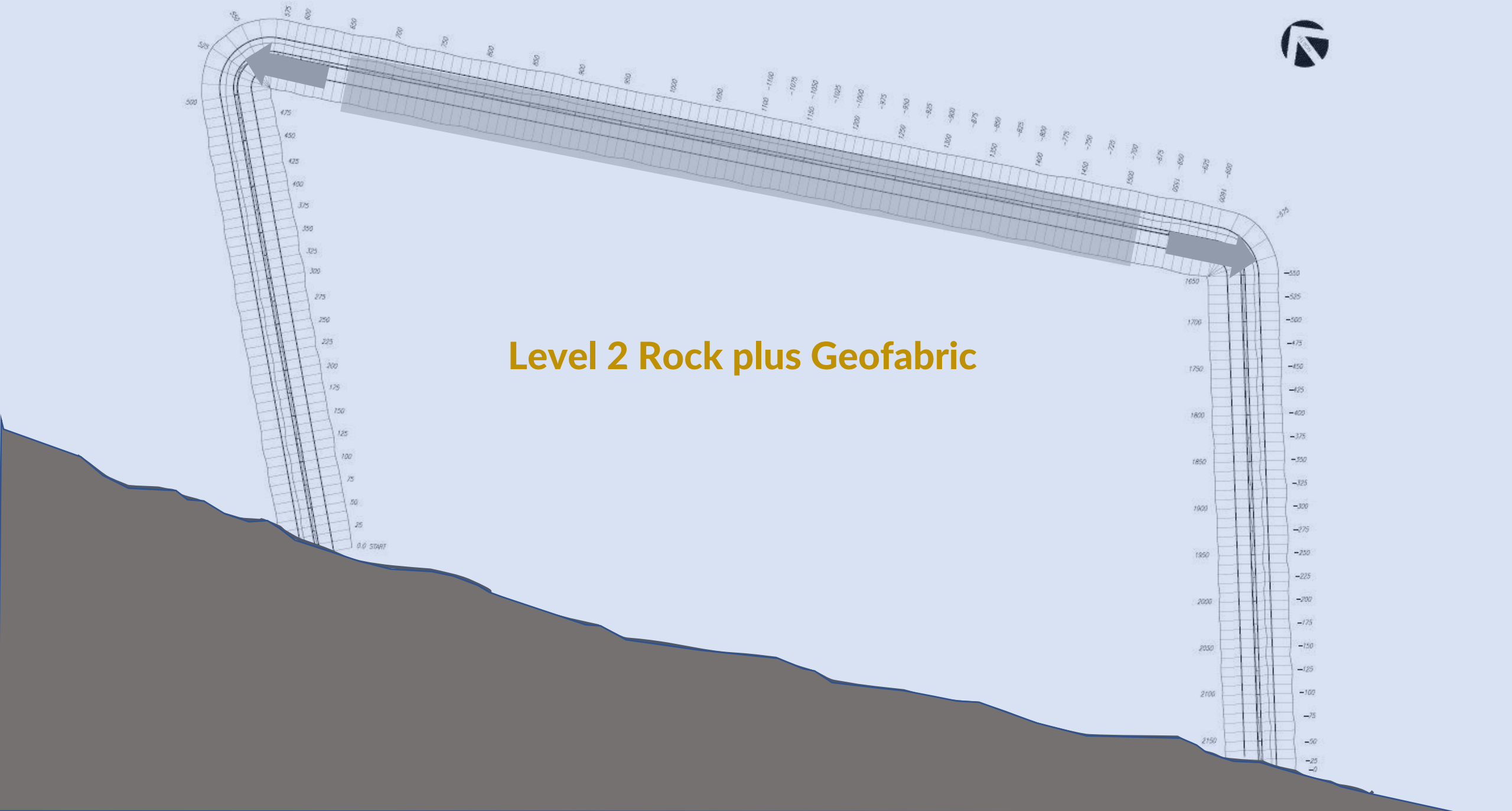
Rock wall section

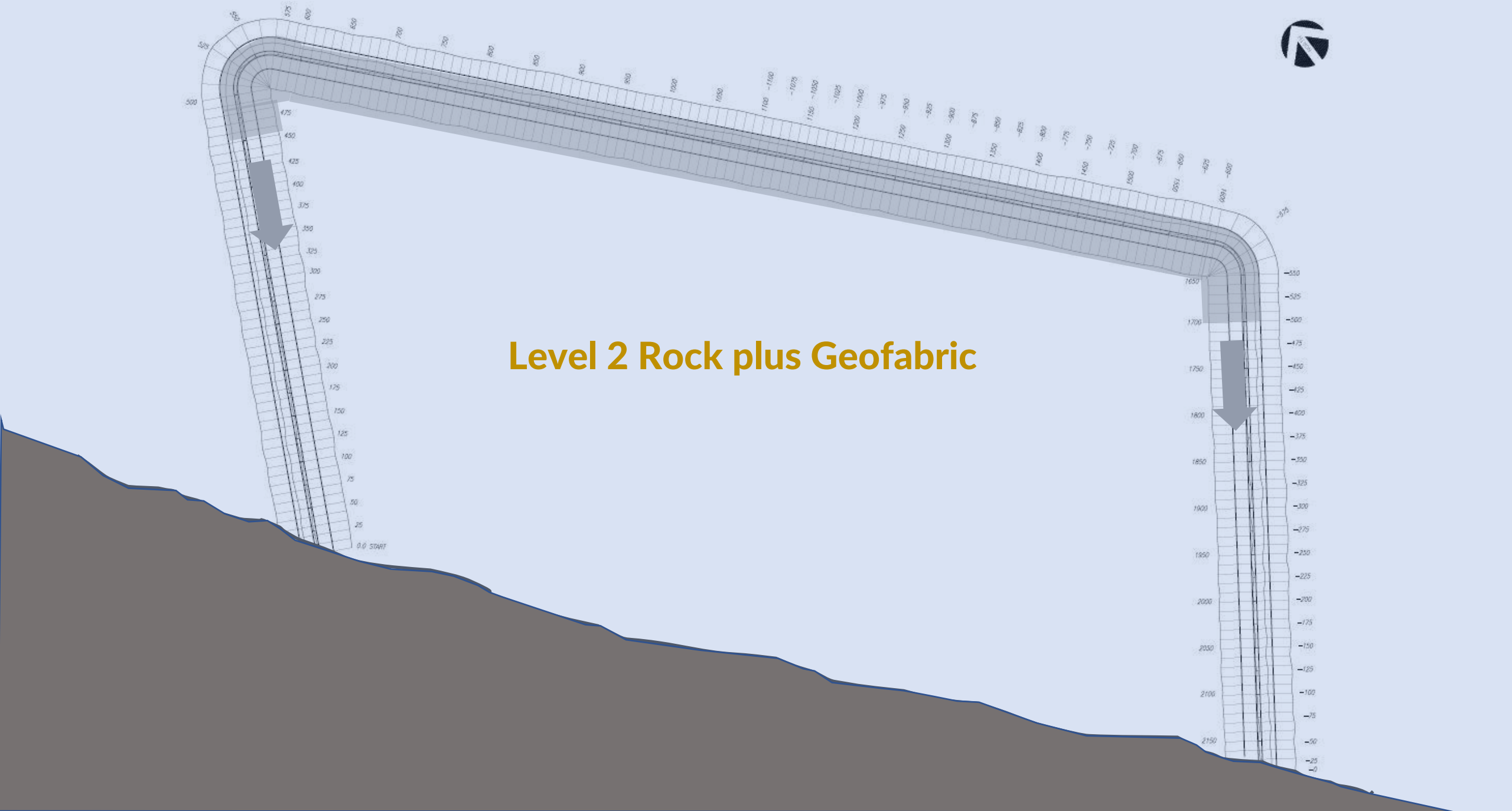
Level 2 Rock plus Geofabric

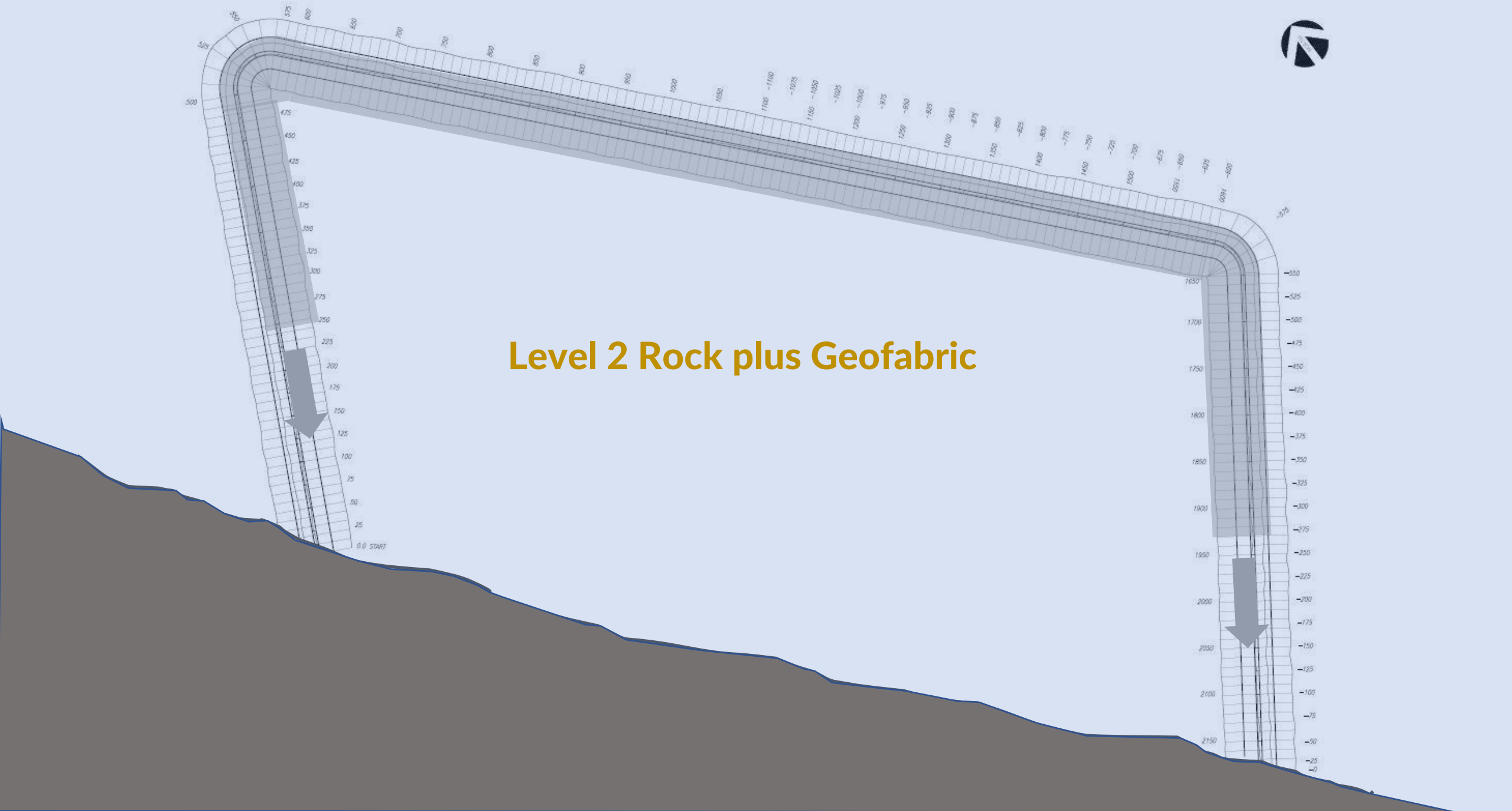

Laydown Cam 2, 15 Feb 2021 15:51:55.294 (UTC+10:00) Brisbane

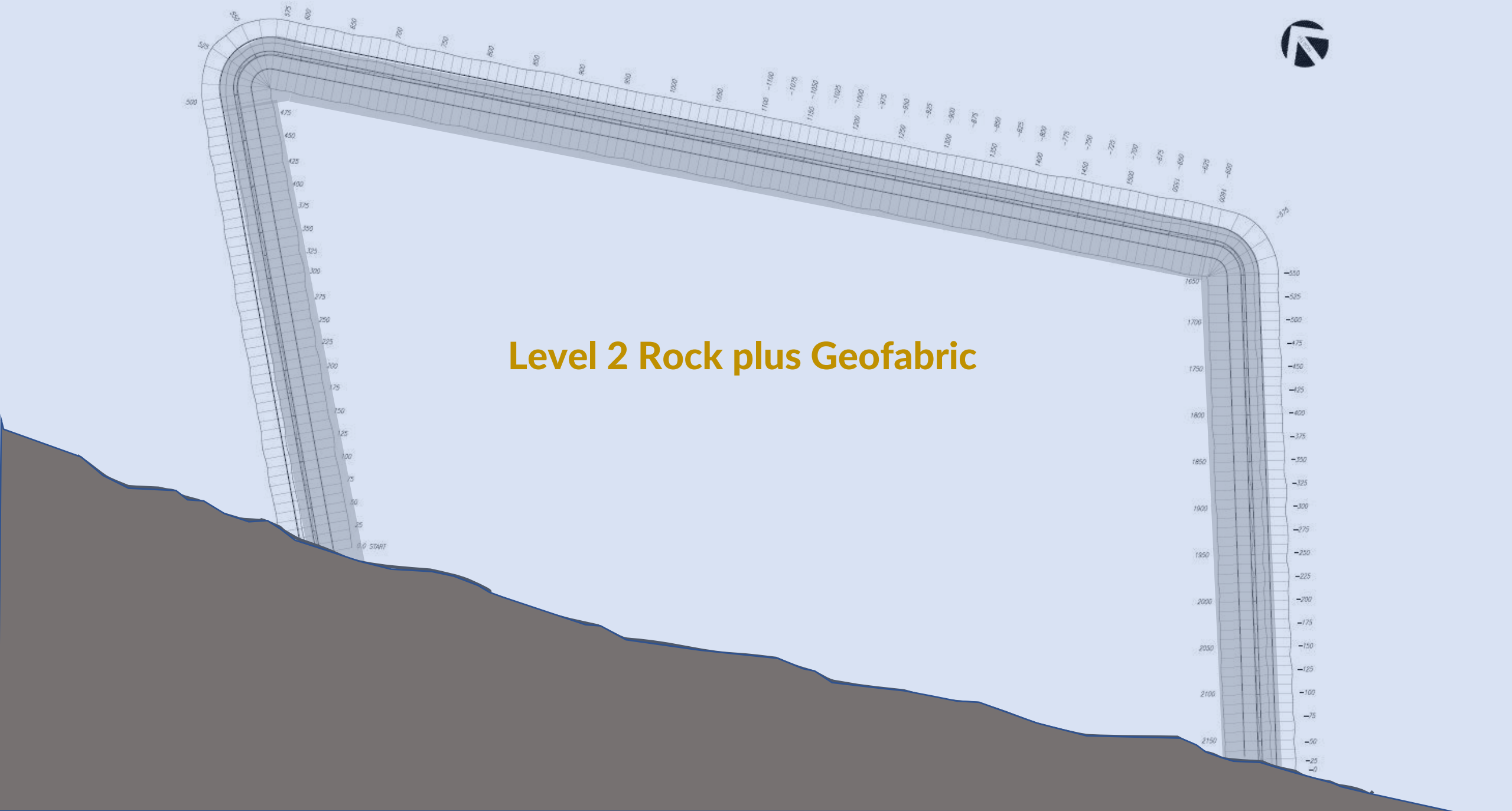
Level 2 Rock plus Geofabric


Level 2 Rock plus Geofabric


Level 2 Rock plus Geofabric

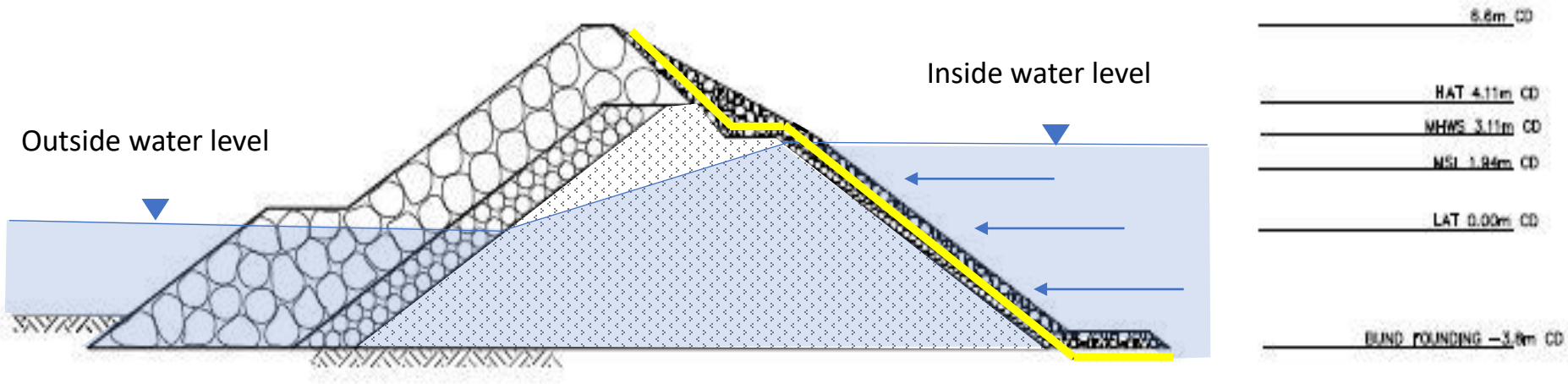

Level 2 Rock plus Geofabric


Level 2 Rock plus Geofabric


Level 2 Rock plus Geofabric

Level 2 Rock plus Geofabric

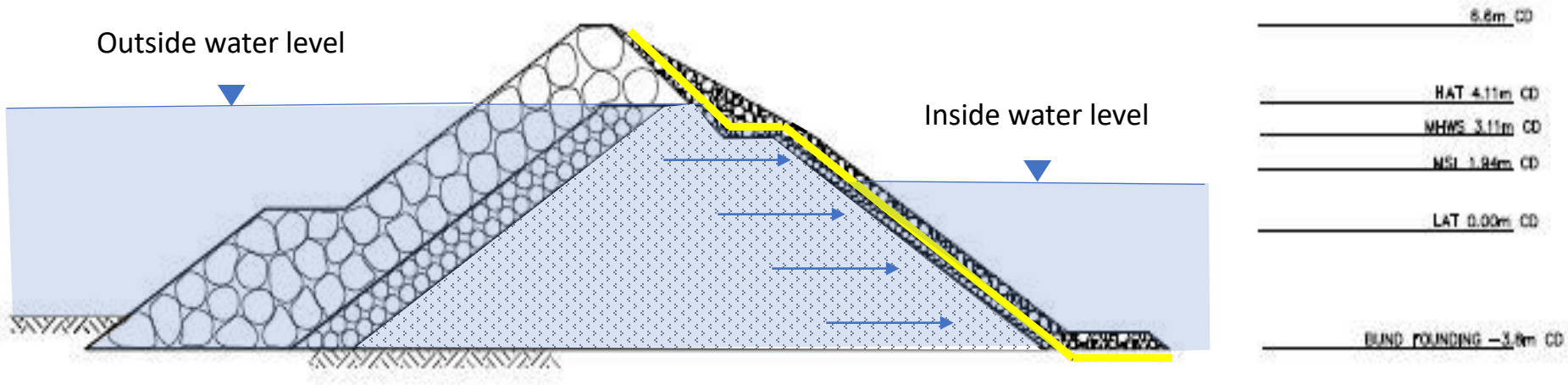
Tidal Flows with Geofabric



Rock wall section

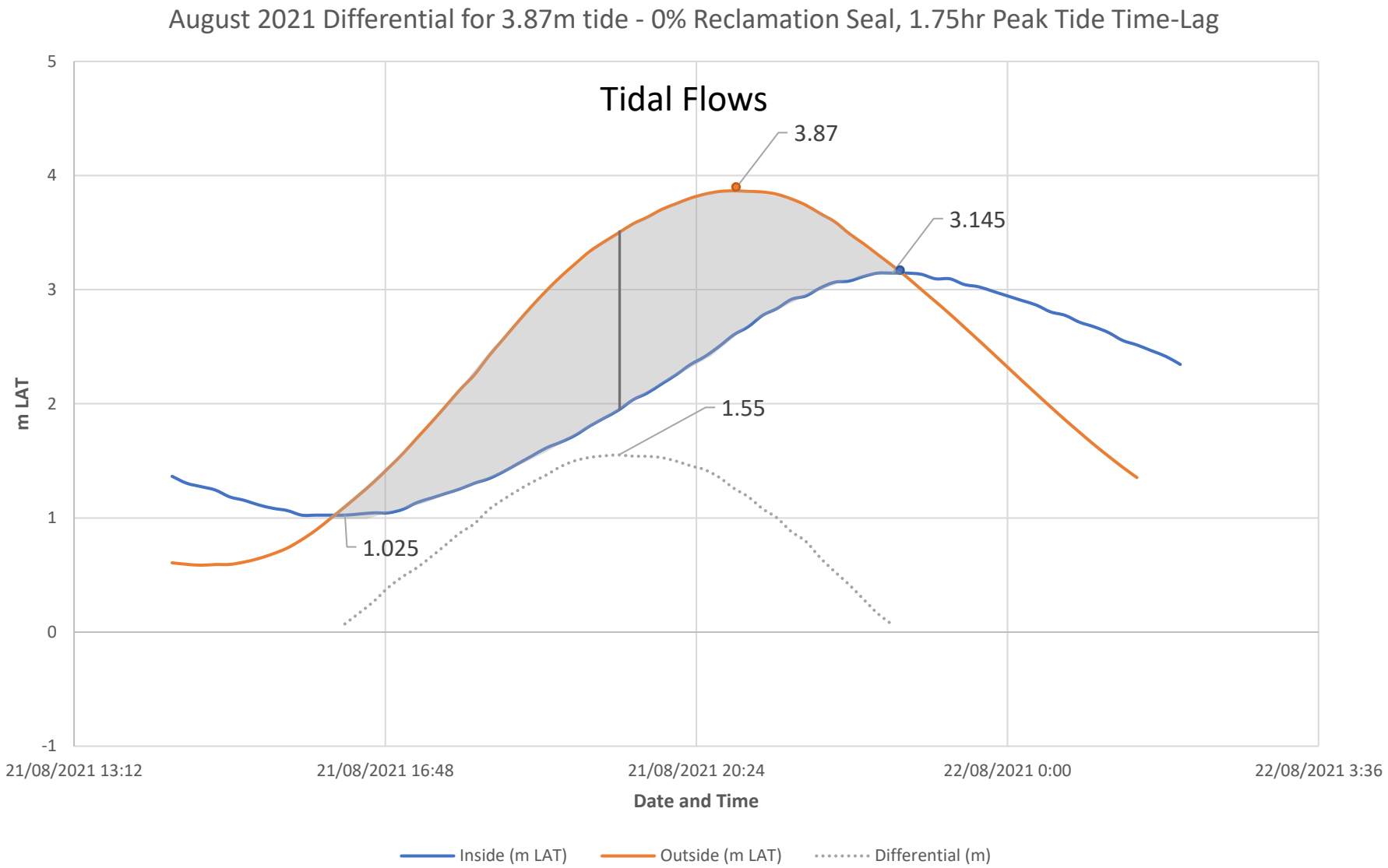
Level 2 Rock plus Geofabric

Tidal Flows with Geofabric

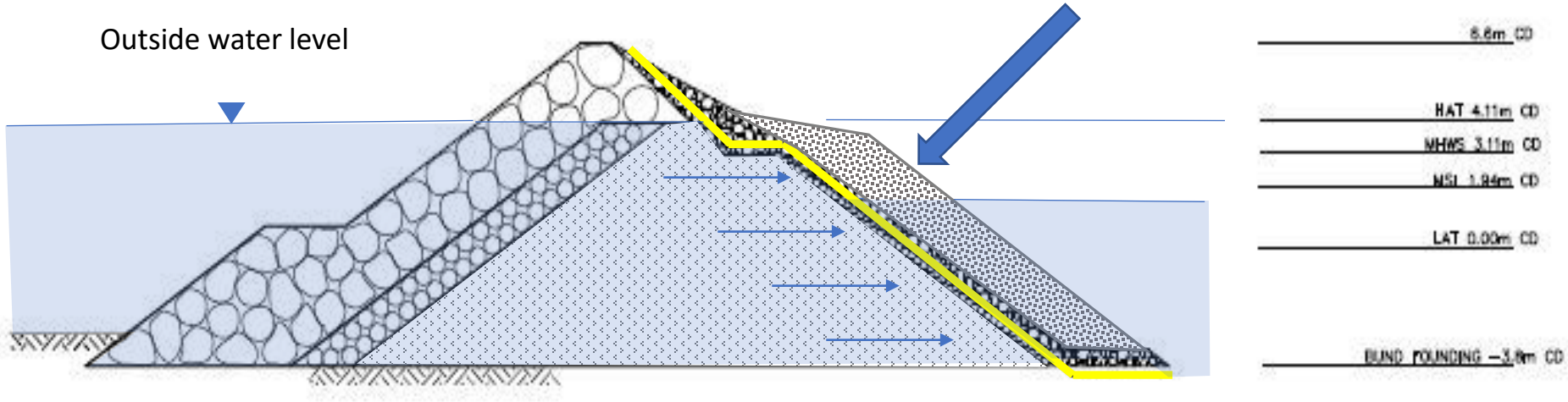


Rock wall section

Level 2 Rock plus Geofabric



Design Solution

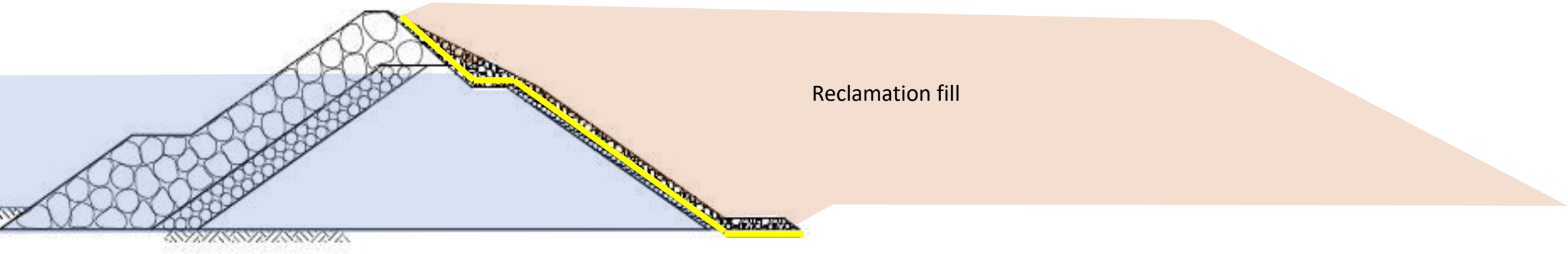


Rock wall section

Completed Rock Wall - 2021

Clay Lining

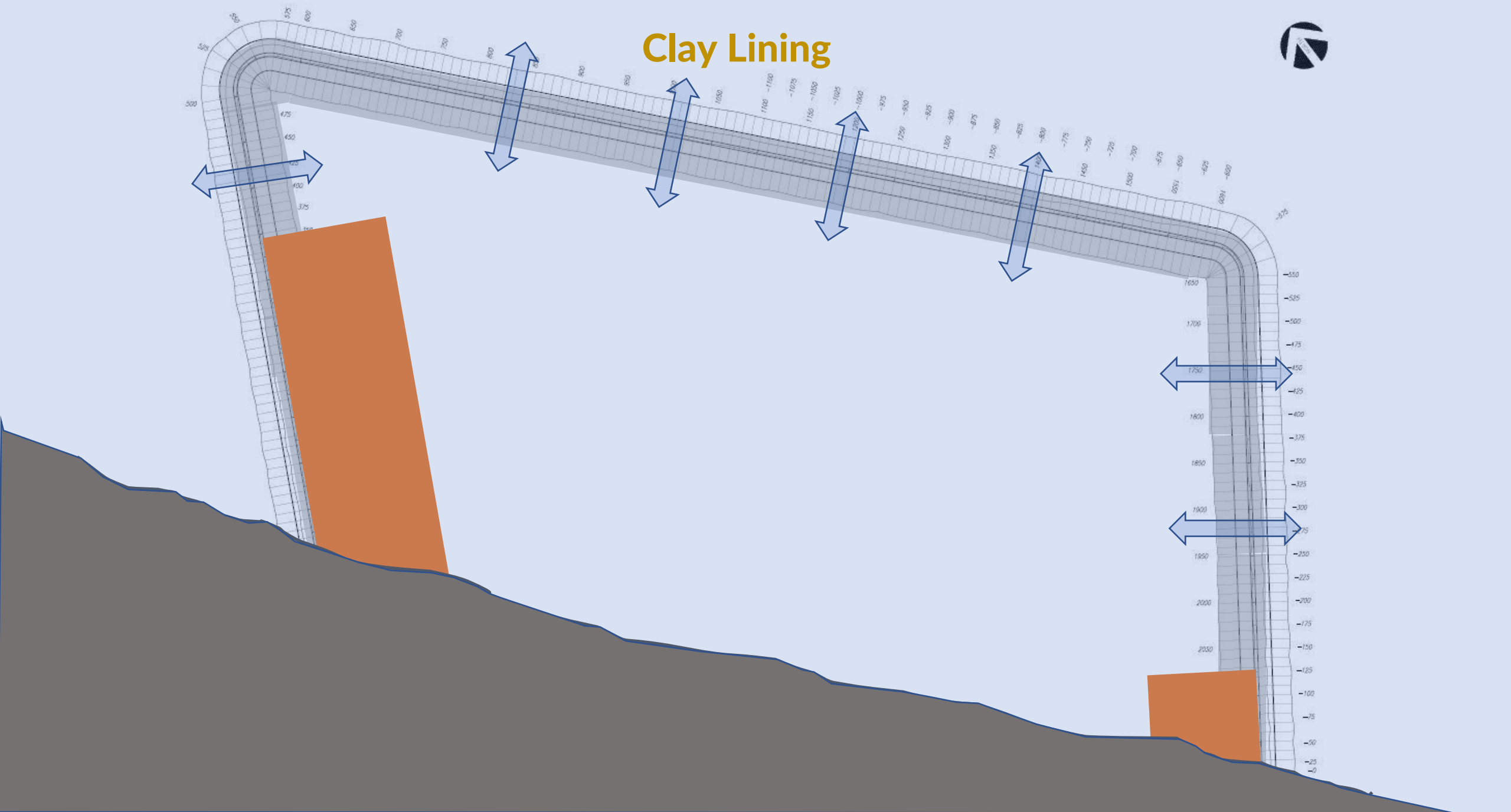
Reclamation - perimeter seal



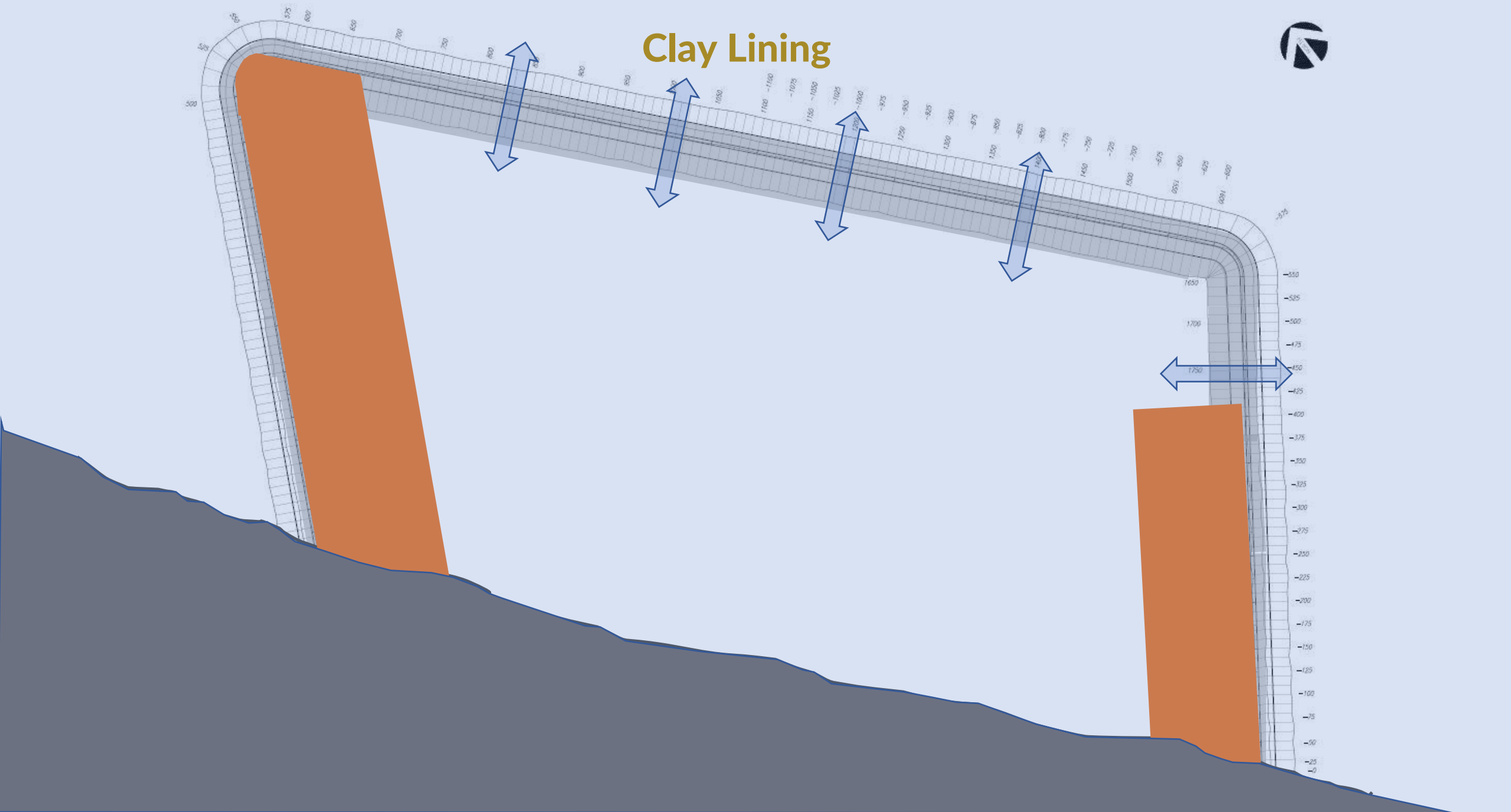
Rock wall and 60m of reclamation

Clay Lining

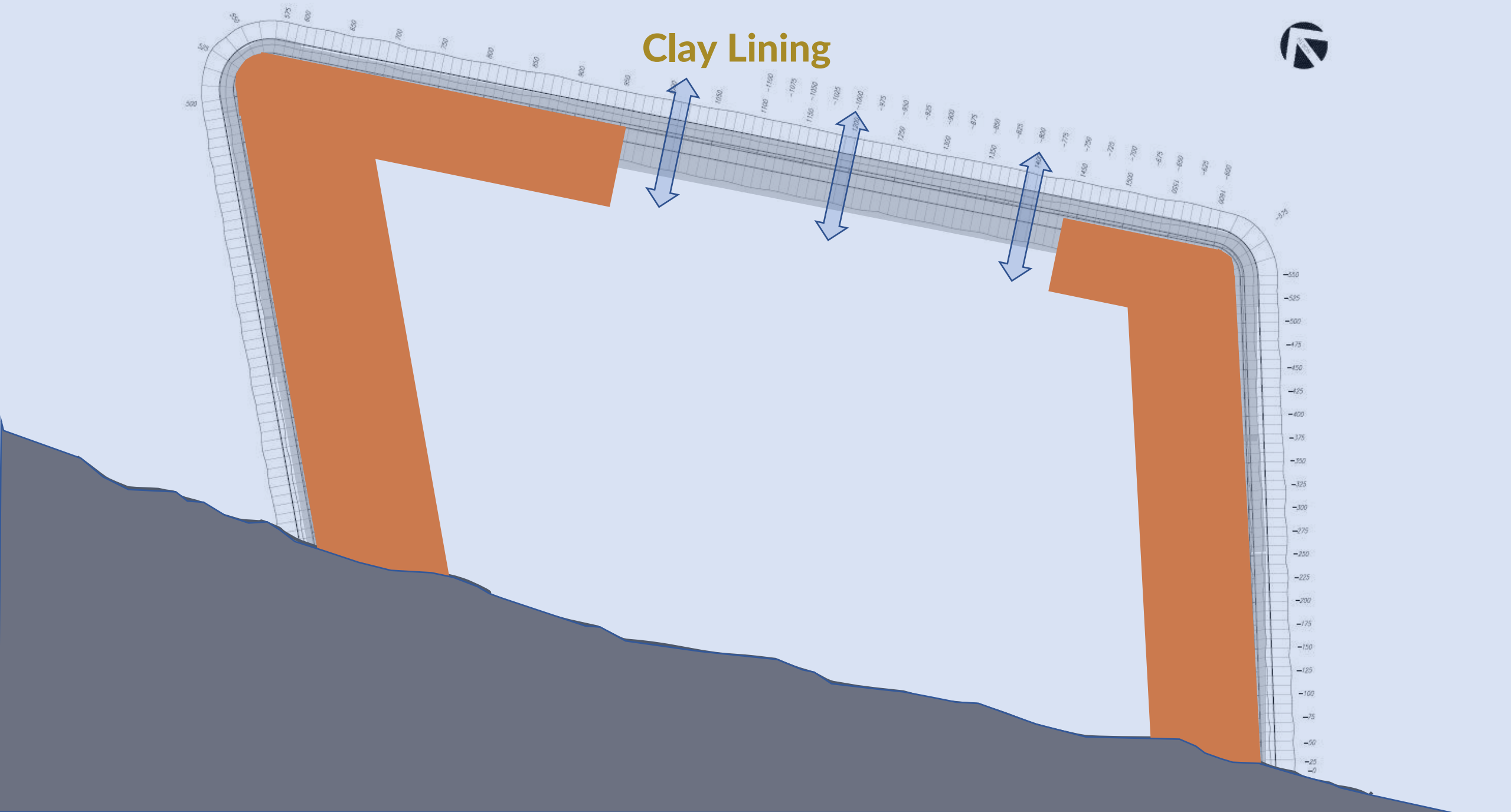
Clay Lining



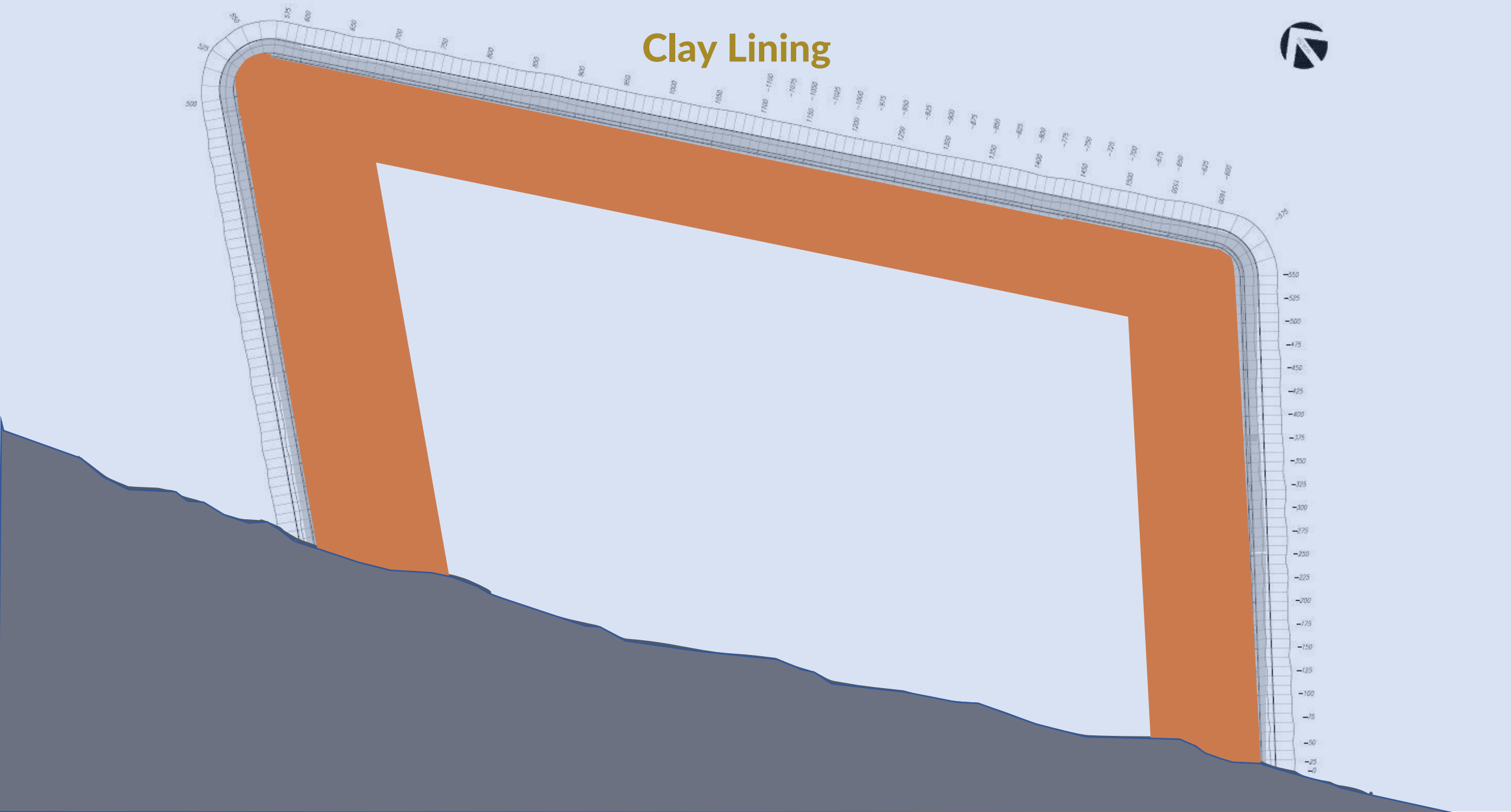
Clay Lining



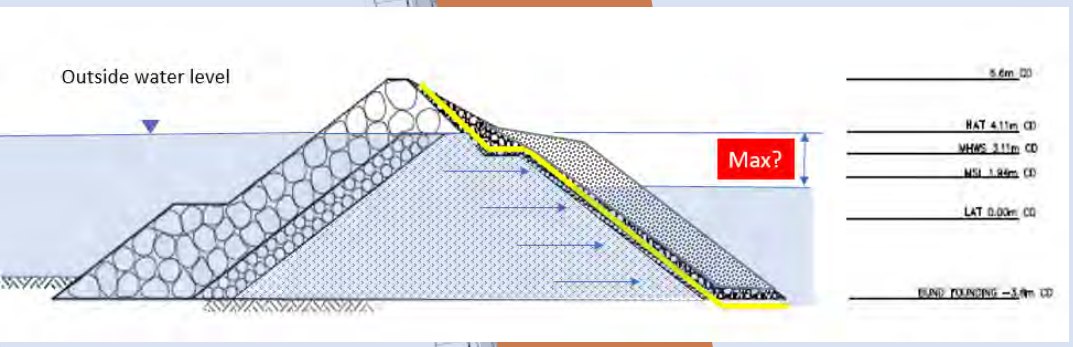
Clay Lining



Clay Lining



Clay Lining



Dynamic conditions that determine the maximum differential

Modelling

Hydraulic Flow Modeling

Mathematical component

- Tried and tested over time
- Can be quite sophisticated
- High level of confidence

Conceptual component

- Assumptions required
  - Flow-rate through rock layers
  - Flow-rate through filter fabric
  - Initial conditions
  - Conditions over changes over time
  - Tides cycles to model

Modelling

Hydraulic Flow Modelling

Assumptions

- Each assumption has a margin for error
- Multiple assumptions may lead to compounding errors
- Uncertainty in the results

Change

- Design
- Construction schedule

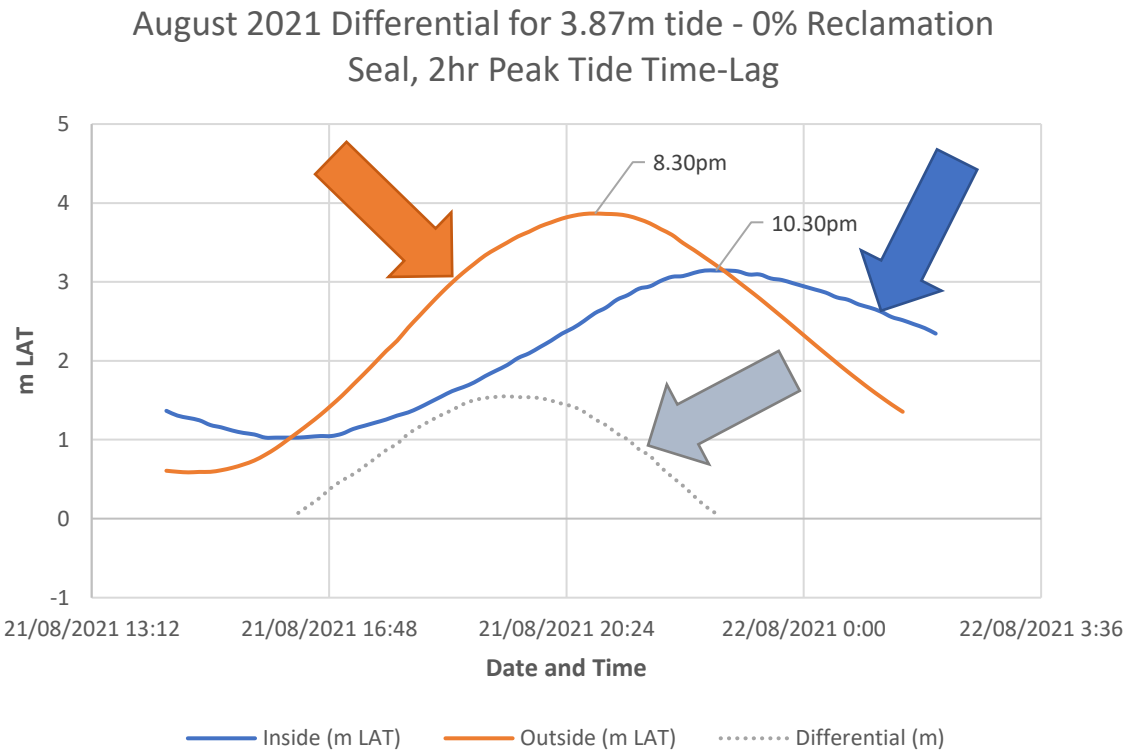
Estimating Tide Differential

Correlation between restricting the flow and tidal lag

Correlation between tide-lag in the height differential

Behaviour can be approximated if:

1) Known external tides
2) Calculate internal water levels
3) Subtract 1) – 2)



Estimating Tide Differential

External Tides (Design Tide):

Use tide prediction data at 10 min intervals or historical tide data

Internal Water Levels (Theoretical Tide):

Use $y = a(\sin x)+q$

$a = (max - min)/2$

$q = (max + min)/2$

max = *peak tide time-lag value*

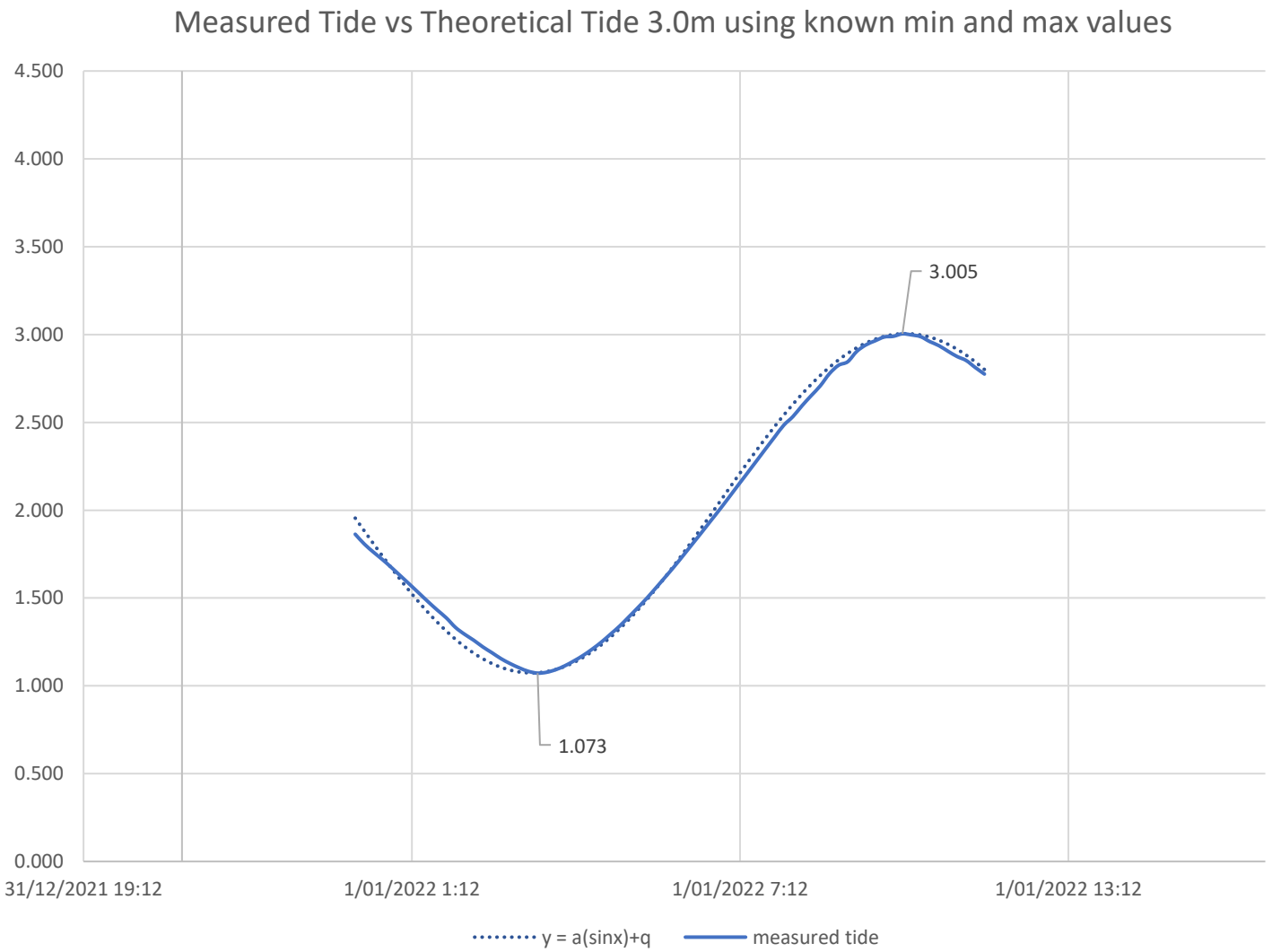
min = α *(ebb tide time-lag value)*

α = *adjustment factor for time difference between inward and outward flows*

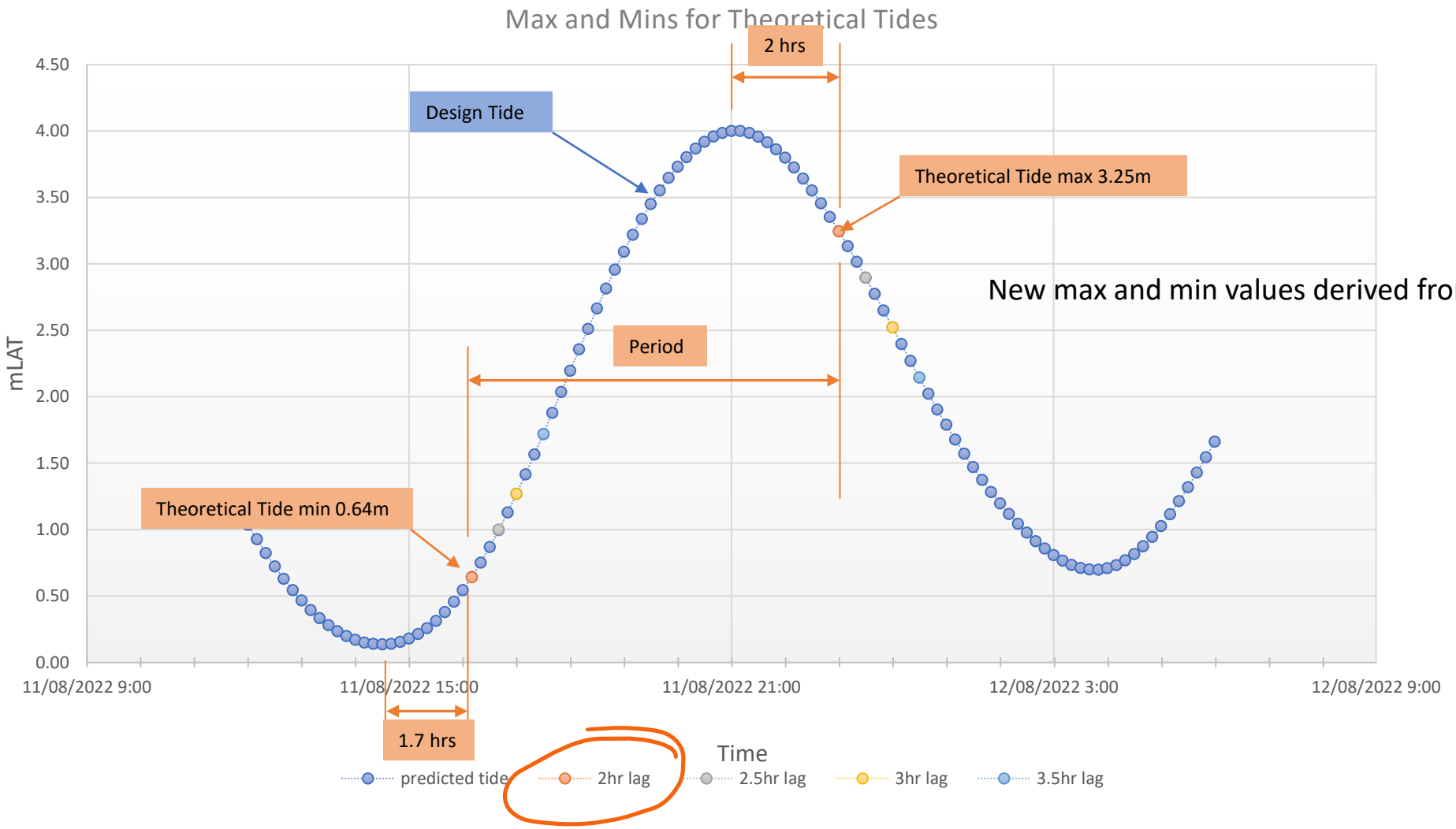
Estimating Tide Differential

Theoretical Tide vs Measured Tide

- check using matching max and min values
- good correlation using sine equation

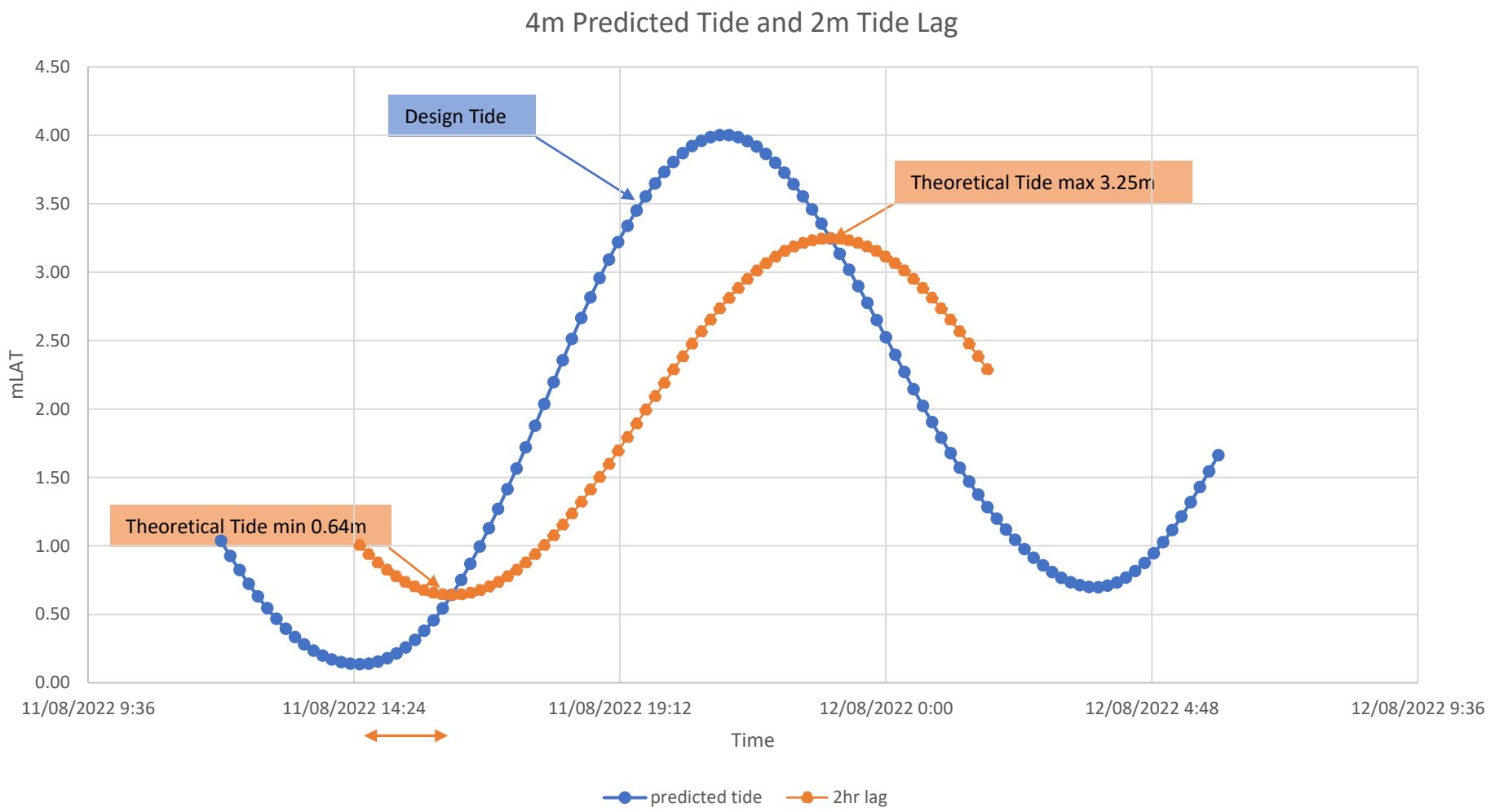


Estimating Maximum Tide Differential

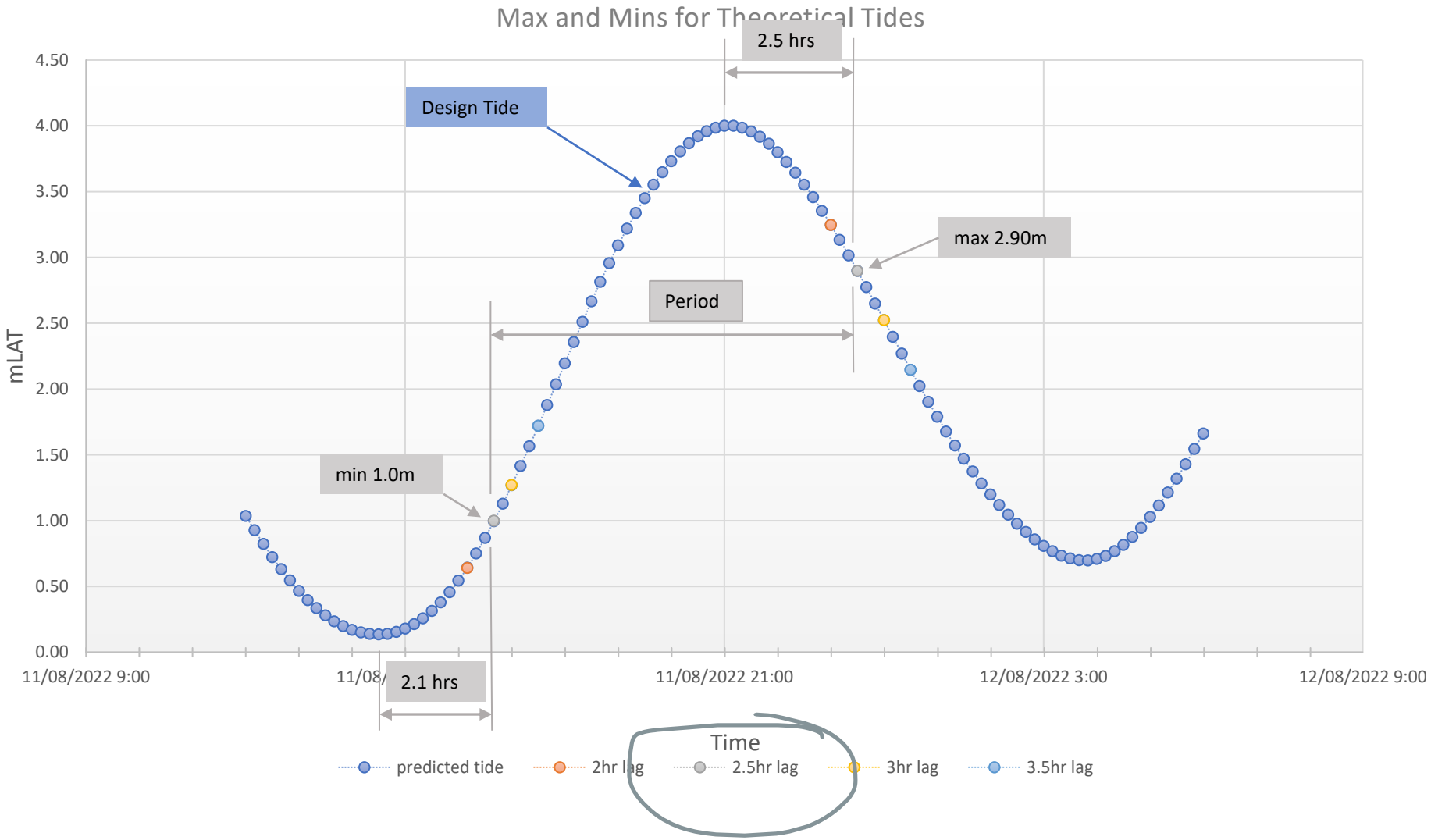


New max and min values derived from Design Tide

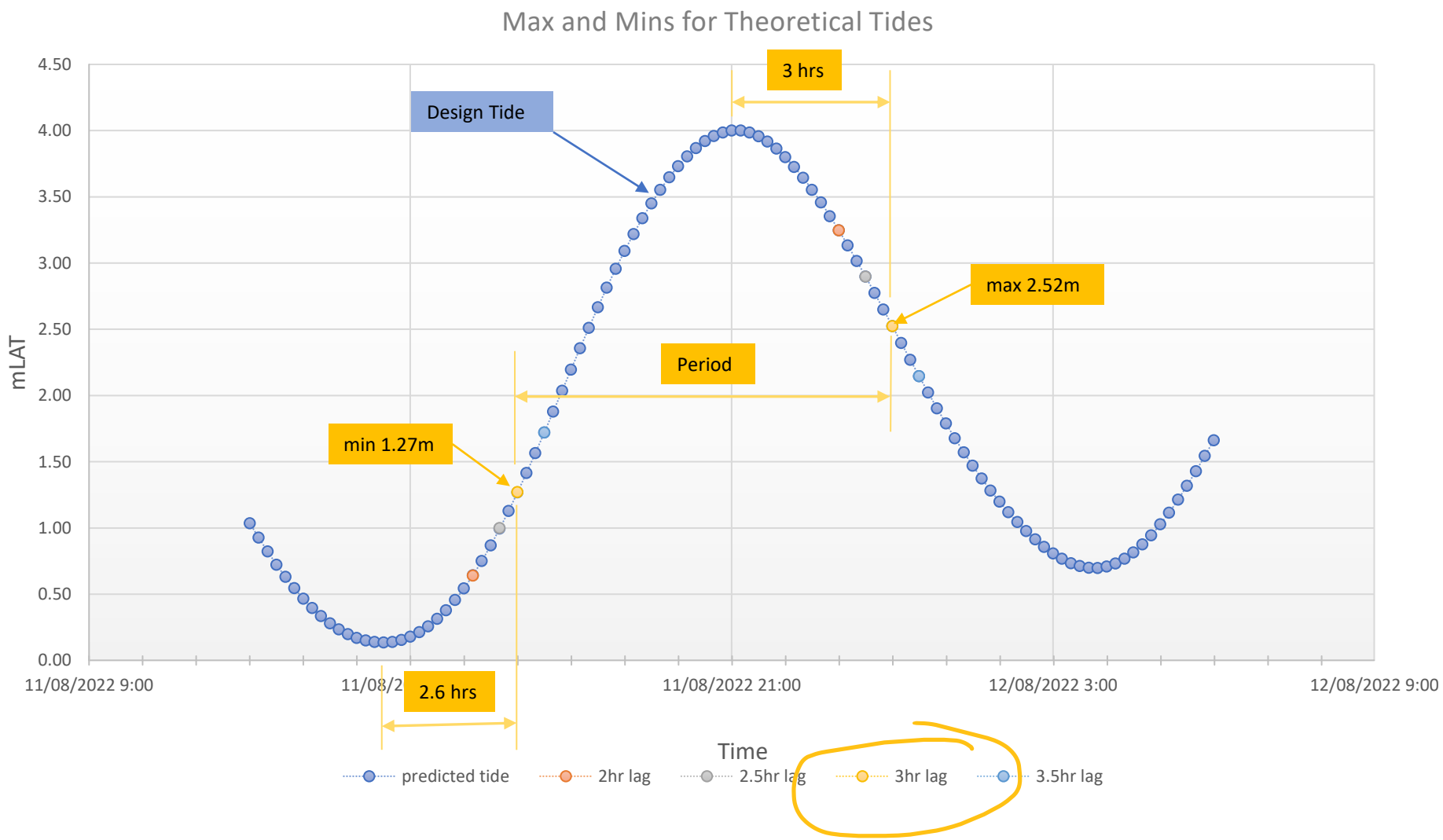
Estimating Maximum Tide Differential



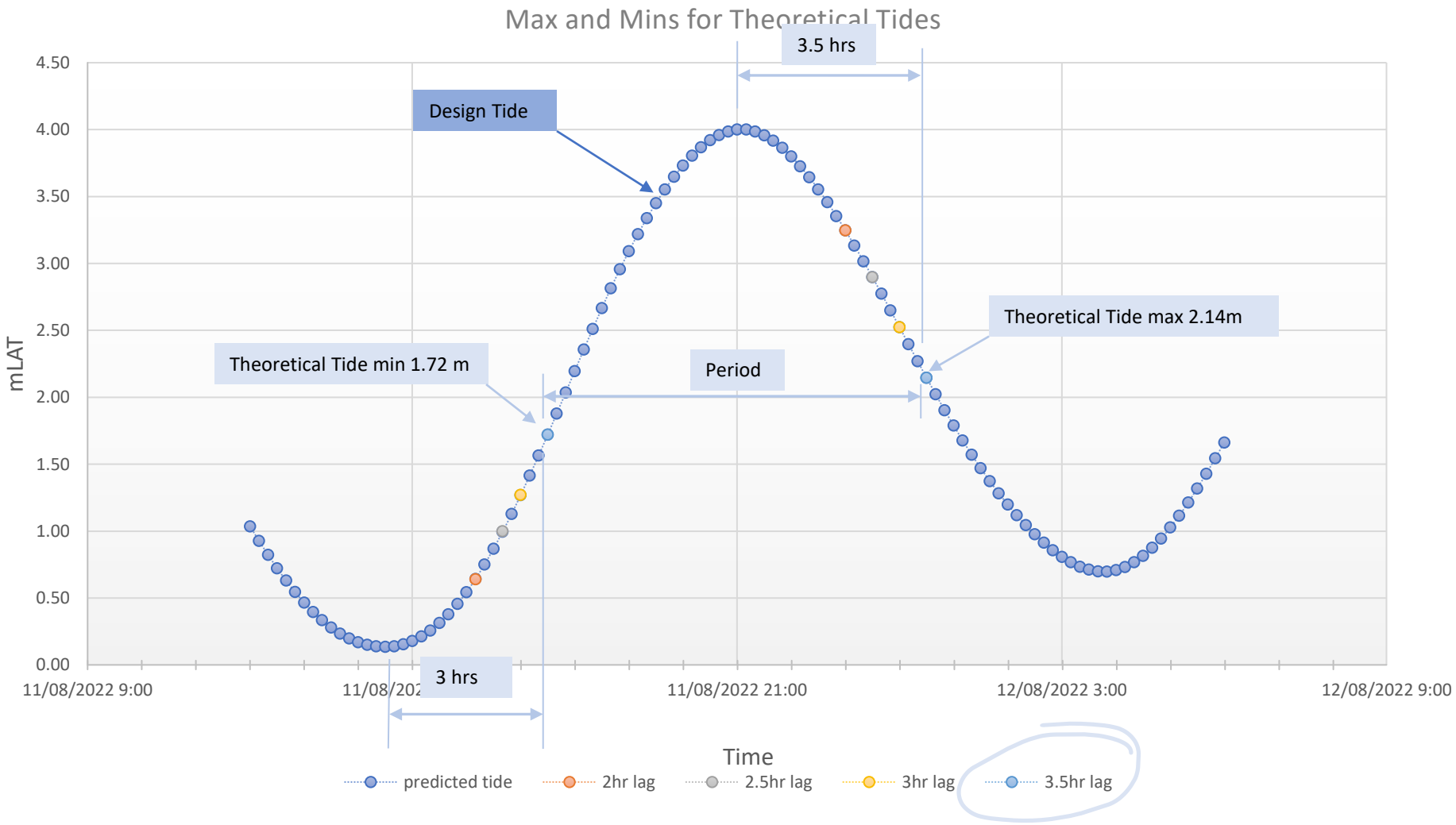
Estimating Maximum Tide Differential



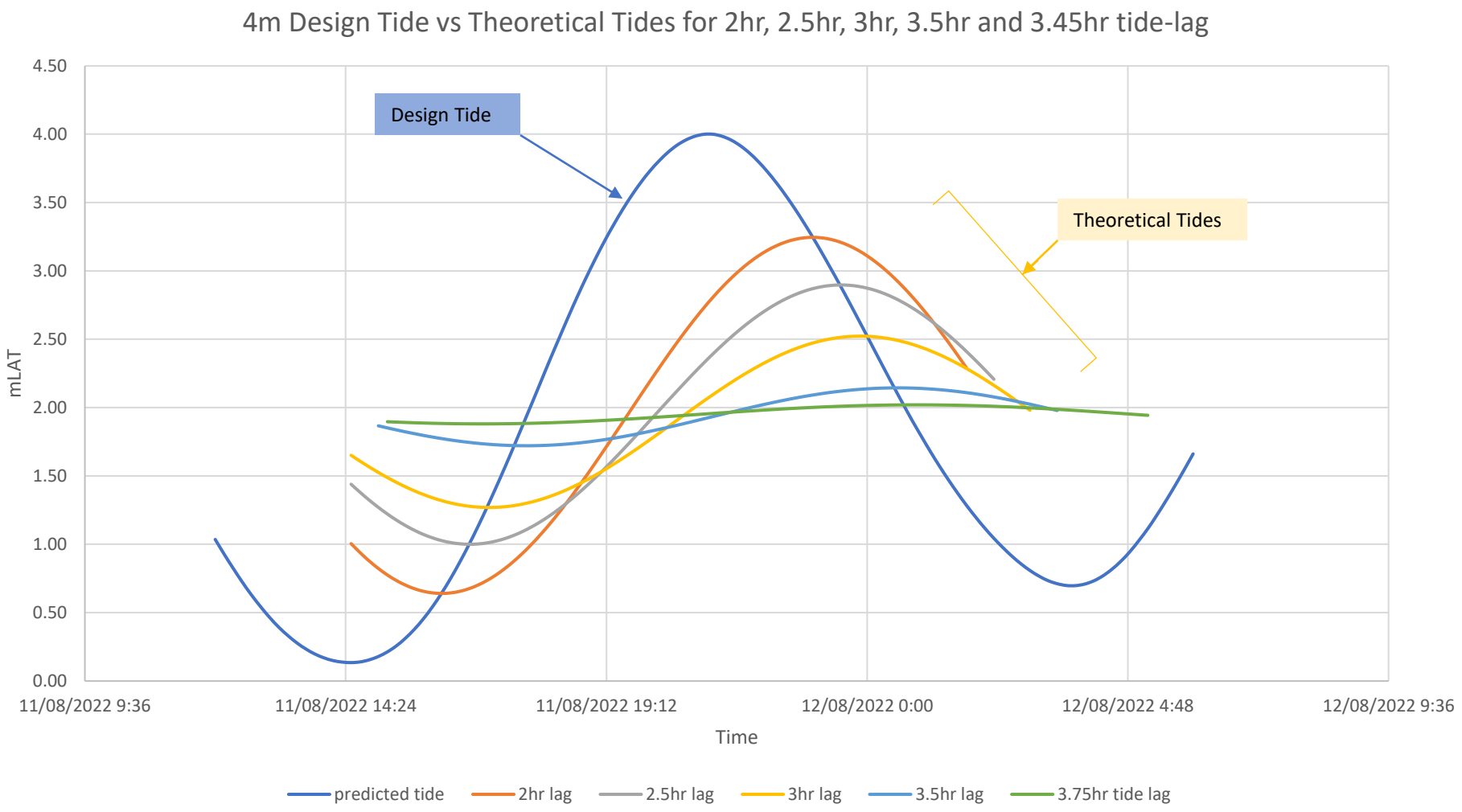
Estimating Maximum Tide Differential



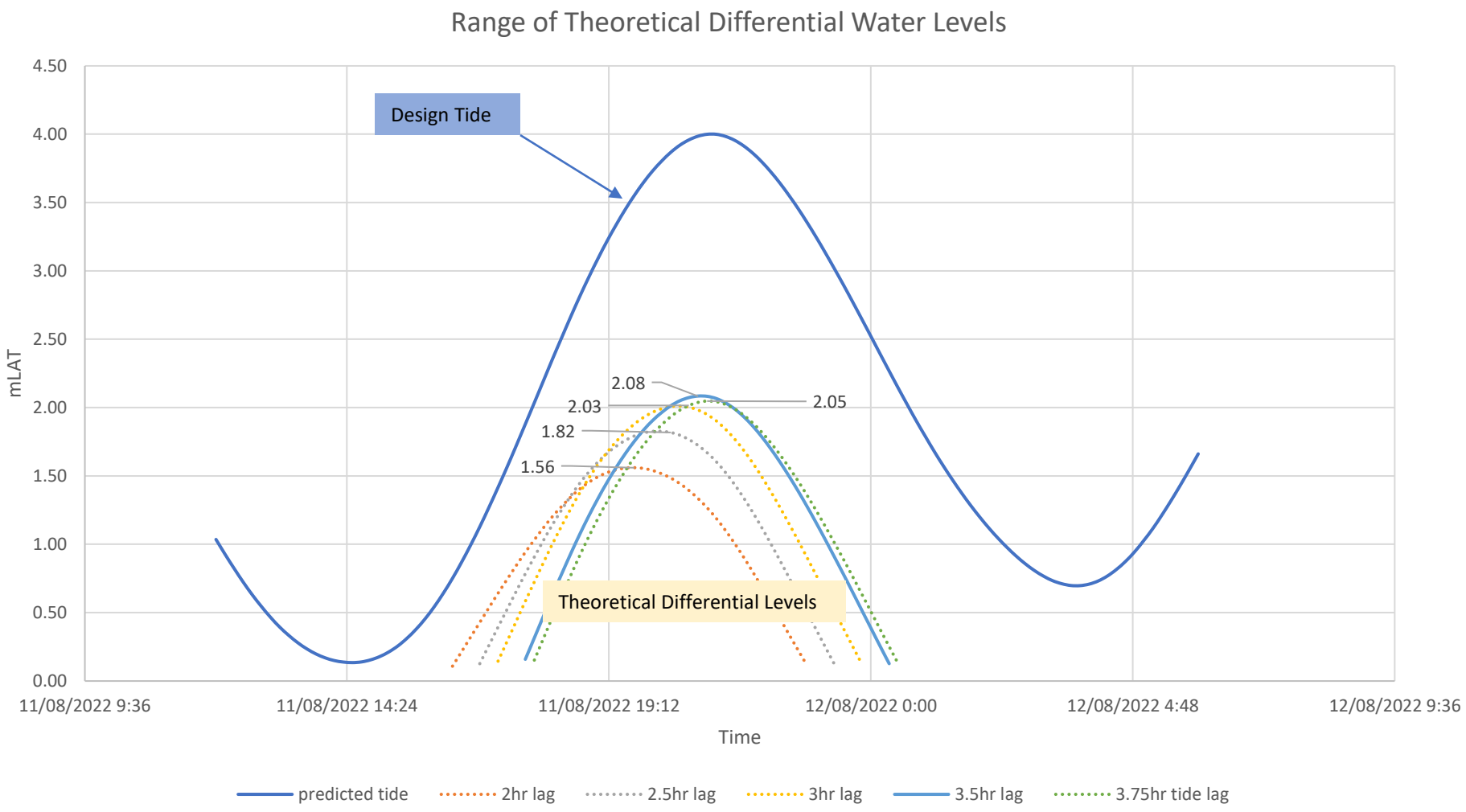
Estimating Maximum Tide Differential



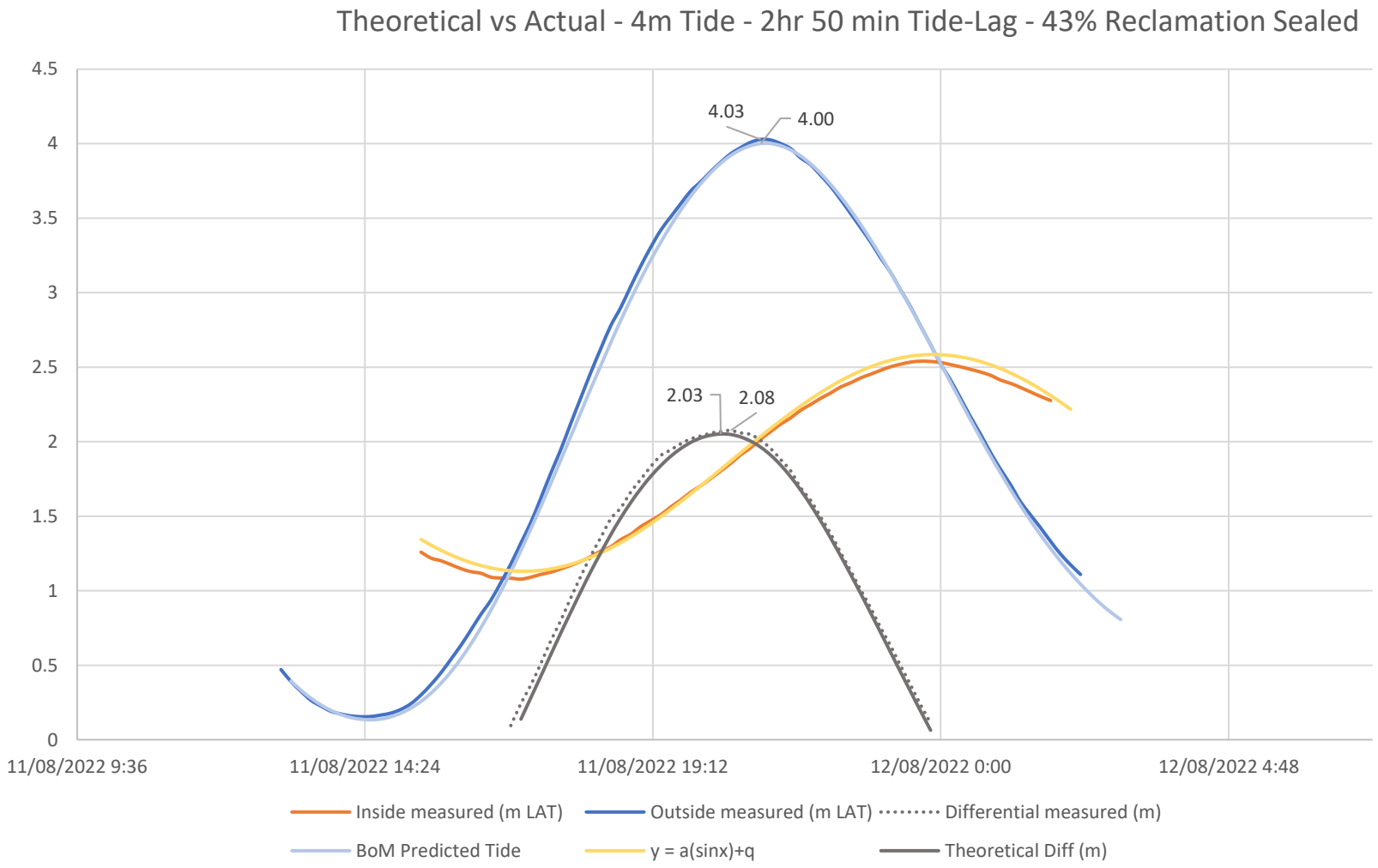
Estimating Maximum Tide Differential



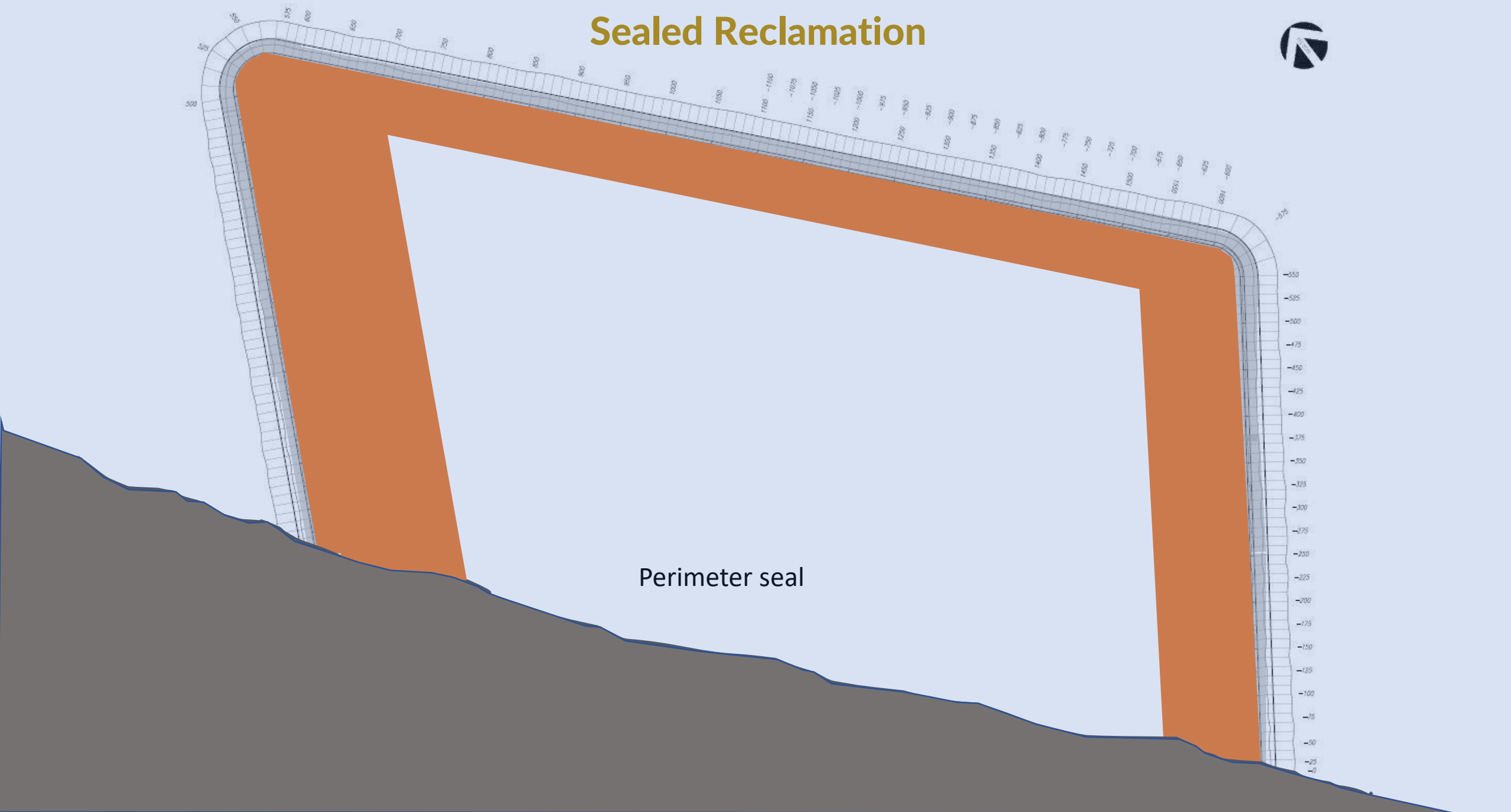
Estimating Maximum Tide Differential



Estimating Maximum Tide Differential



Sealed Reclamation



Reclamation January 2023

Photo provided by Hall Contracting

B) Potential Acid Sulphate Soils

- What are PASS
- Quantifying PASS for the CU Project Dredge Area
- Treating PASS for CU Project
- Testing and Validating Reclamation Area

What is PASS?

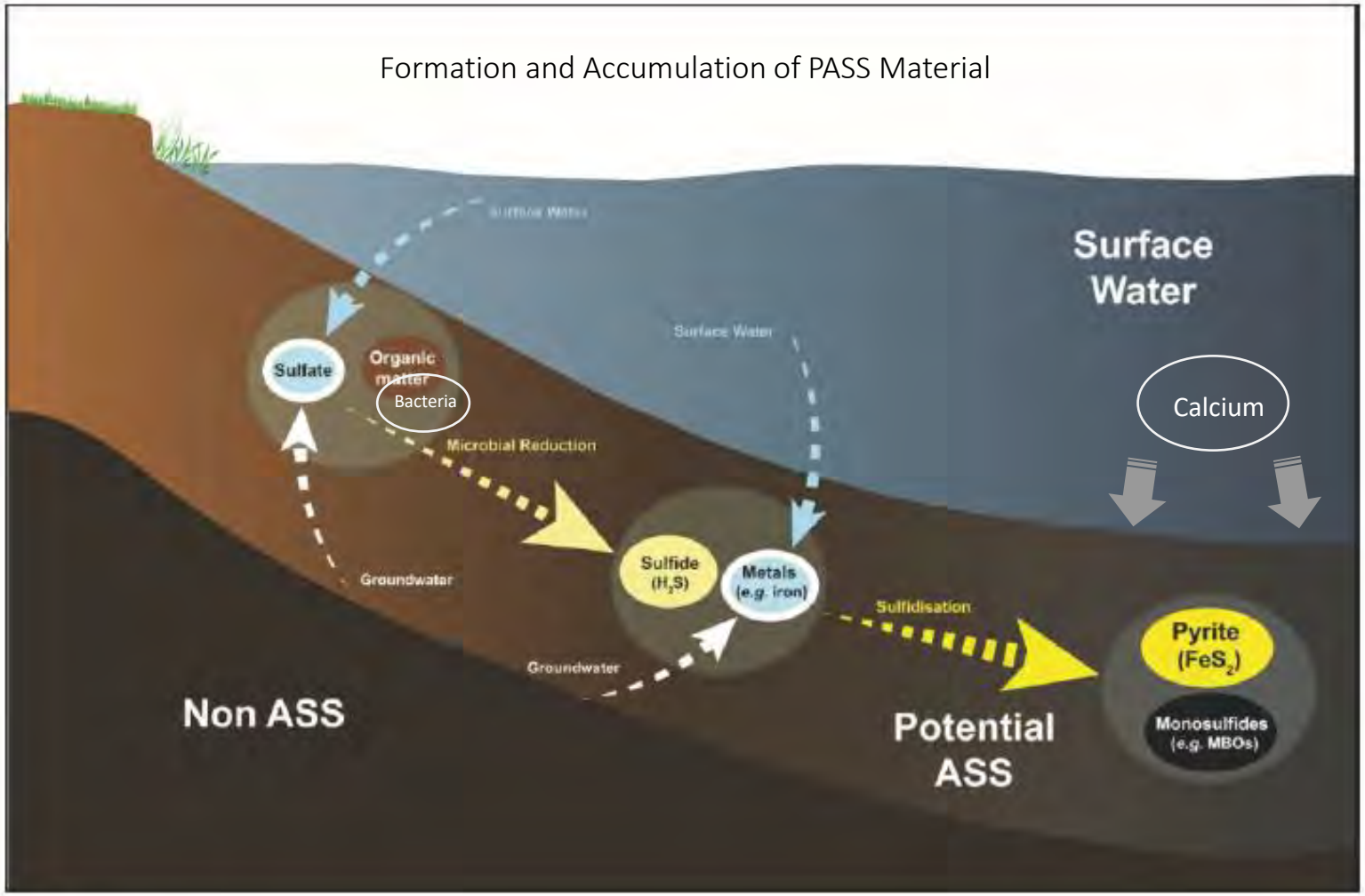
- Soils and Sediments that contain iron sulfides which when drained or disturbed form sulfuric acid.

- "Acid sulfate soils" is a general term that may include both:
  - Potential Acid Sulfate Soils (PASS)
  - or
  - Actual Acid Sulfate Soils (AASS)

- Unconsolidated - can be clays, silts, sands, gravels or peats.

- Not previously exposed to oxygen

What is PASS?



Note: not to scale.

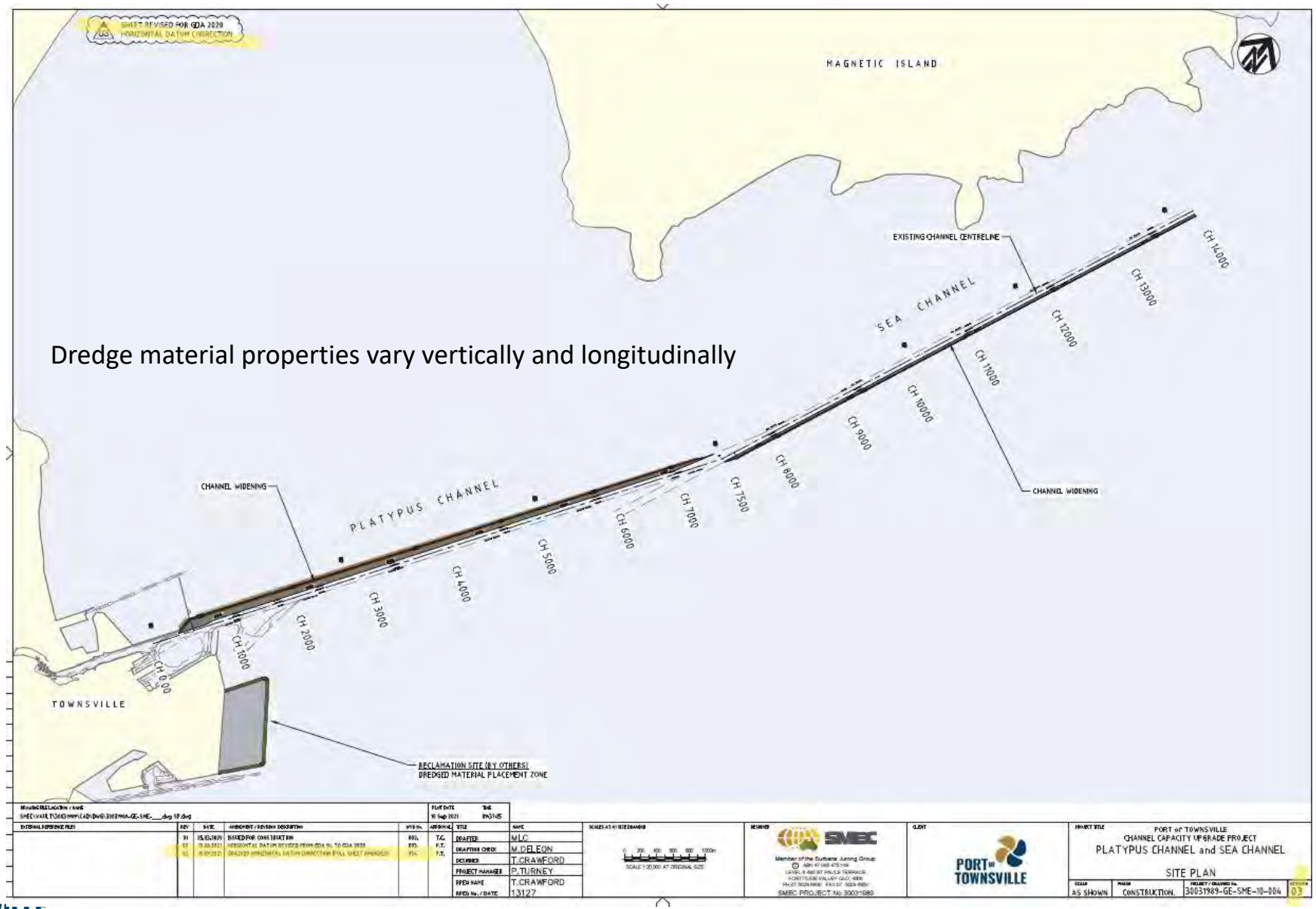
Source: Adapted from EPHC & NRMMC (2011) and Ward et al. (2013).

What is PASS?

Potential for the material to form acid when exposed to oxygen:

- = acid forming capacity – self neutralising capacity
- = **Pyrite Sulfide – Calcium Fine Fraction**
- All material identified as PASS during investigations is required to be treated to prevent harm to the environment.
- Treatment involves addition of an acid neutralising agent.
- Treated PASS:
- = acid forming capacity – self neutralising capacity – neutralising agent
- = **Pyrite Sulfide – Calcium Fine Fraction – Ag Lime**

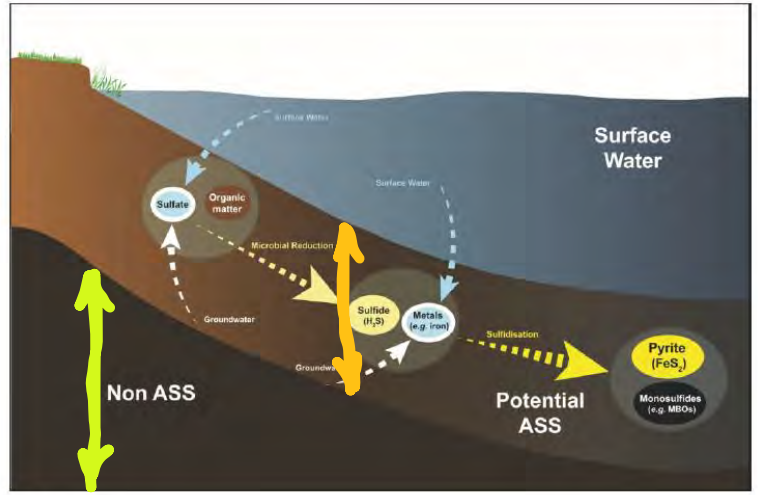
Quantifying PASS?



Dredge material properties vary vertically and longitudinally

Quantifying PASS?

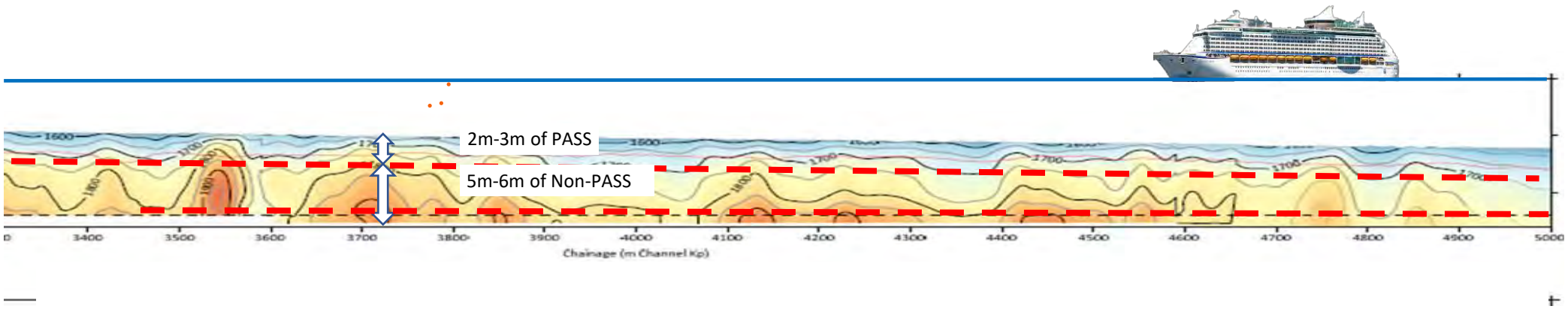
Seismic Readings



Note: not to scale.
Source: Adapted from EPHC & NRMMC (2011) and Ward et al. (2013).

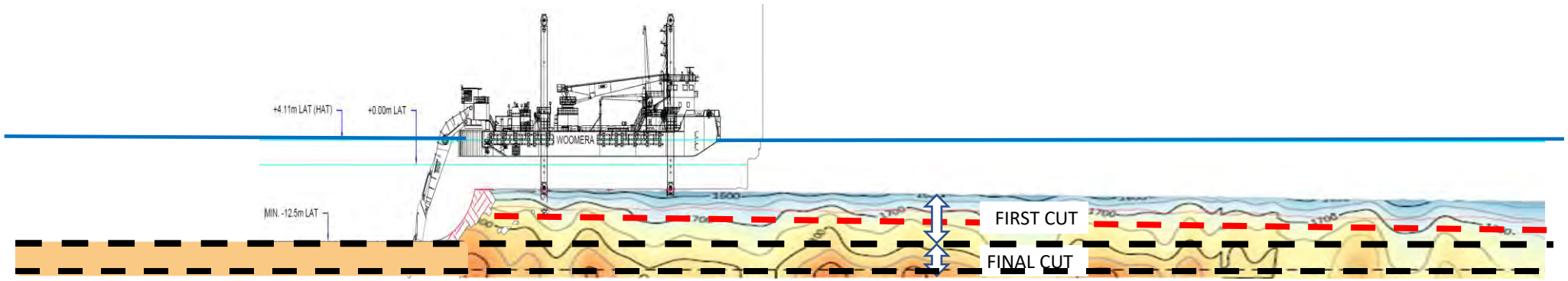
Quantifying PASS?

Insitu Estimated PASS volume



Quantifying PASS?

Dredge volume requiring treatment > Insitu PASS volume



Alternative project specific method developed

- Based on good SNC in most areas
- Detailed ASSMP
    - Daily testing
    - GIS tracking of material placement
    - Daily QA data sheet
    - Corrective Actions if required
    - Validation testing at completion of works

PASS Treatment

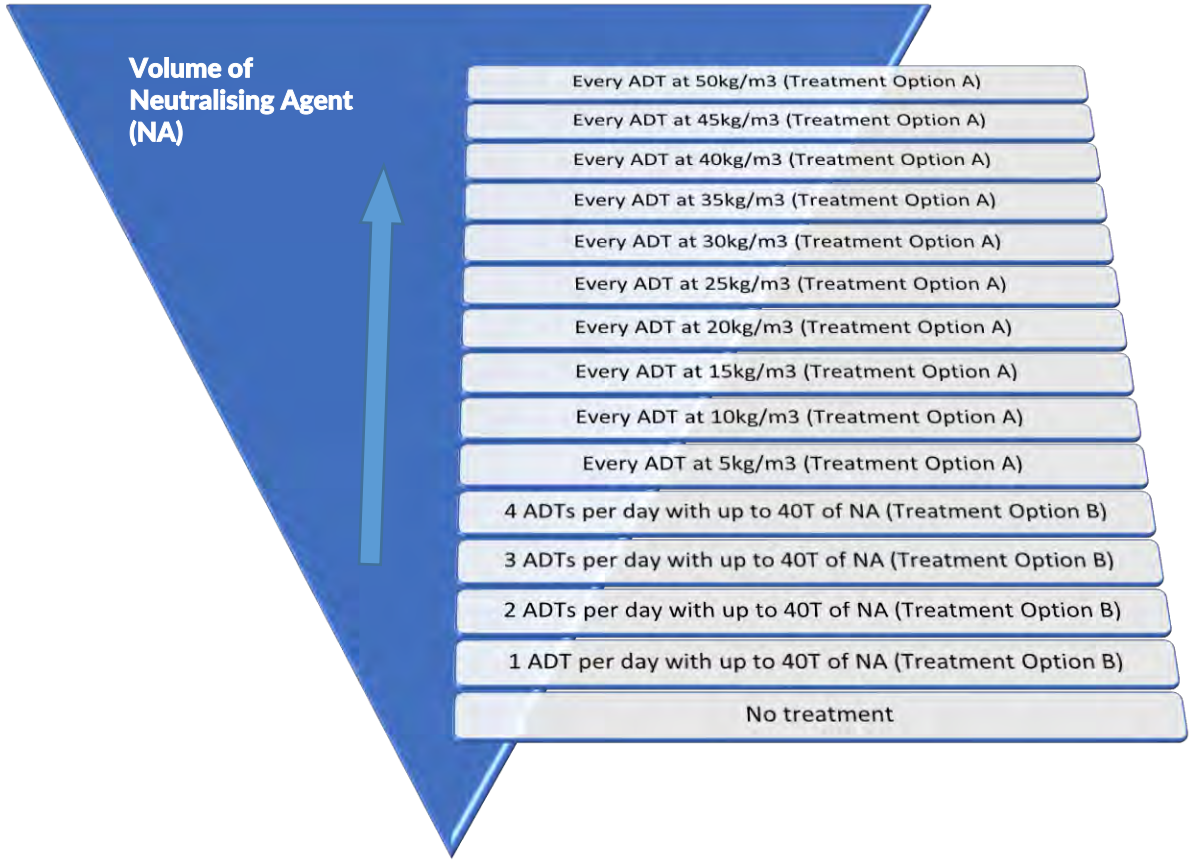
PASS Treatment


PASS Treatment

LOCATION	CHAINAGE	PROPOSED TREATMENT OPTION	PROPSED TREATEMENT RATE	NEUTRALISING AGENT WITH ENV OF >95% TONNES
TUF	Not applicable	B	2kg/m3	133
CHANNEL	0-1000	B	2kg/m3	764
	1000-2000	B	2kg/m3	727
	2000-3000	Nil		
	3000-4000	B	2kg/m3	723
	4000-5000	B	2kg/m3	552
	5000-6000	A	10kg/m3	2,029
	6000-7000	A	10kg/m3	1,428
	7000-7400	A	10kg/m3	56
	7400-8000	A	10kg/m3	449
	8000-9000	A	10kg/m3	949
	9000-10000	A	10kg/m3	739
	10000-11000	A	20kg/m3	851
	11000-12000	A	20kg/m3	474
	12000-13000	A	20kg/m3	381
	13000-14000	A	20kg/m3	282

PASS Treatment

Escalating lime dosing rates



Testing and Validation

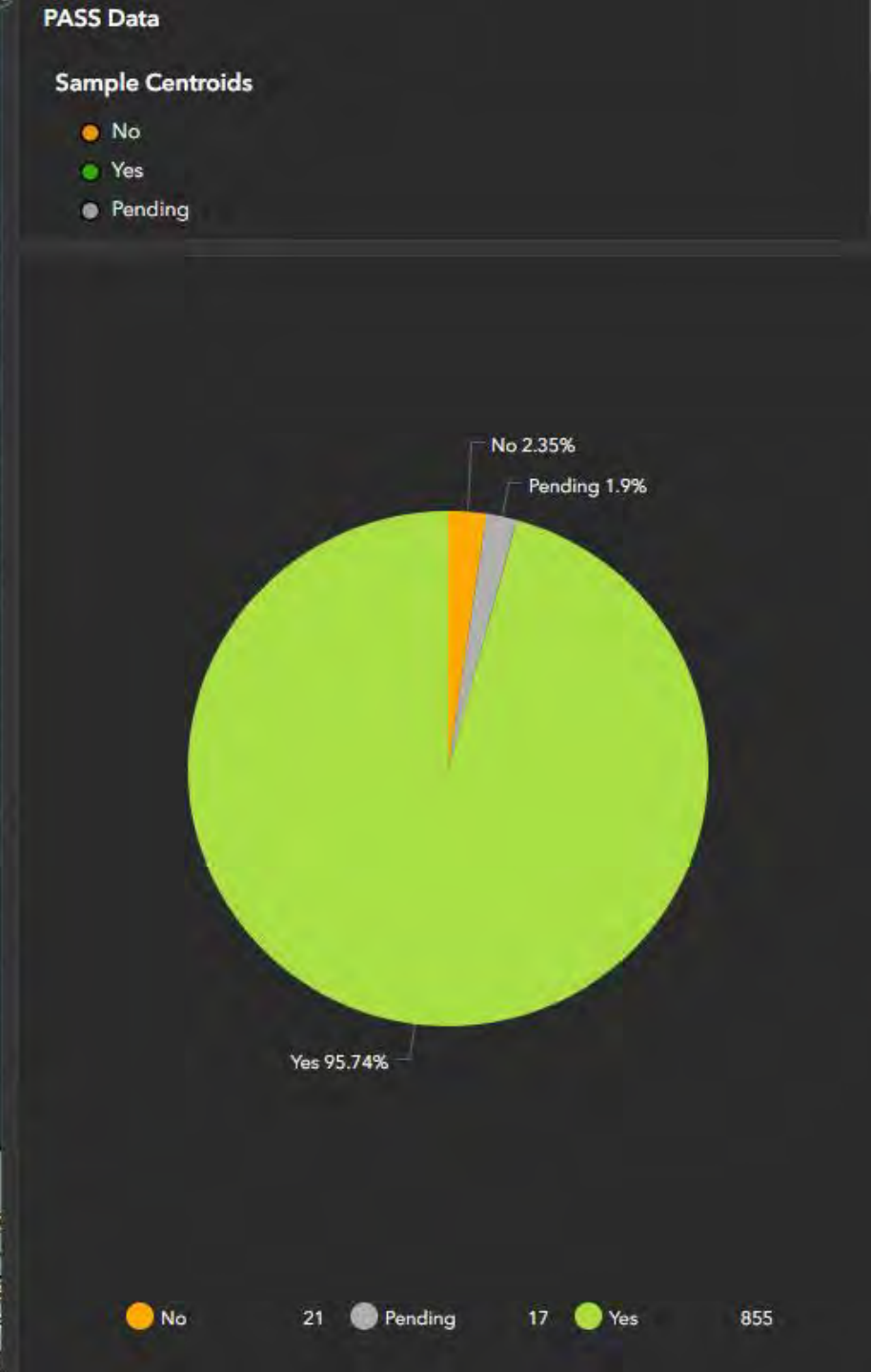
Testing and Validation

CU Project 2022

Summary of PASS Treatment Test Results

Dredge and Reclamation Date	Treatment Type	Dose Rate kg/m3	Sample ID	Chromium Reducible Sulfur (SCR) %S	Acid Neutralising Capacity %CaCO3 (selved ANC)	Sufficient Neutralising Capacity Y/N	Lab Test Conforming Y/N	Non Conformance Item	NCR Closed/ Comment
5-Feb-22	B	2	2202051A	0.068	3.0	Y	Y	-	-
5-Feb-22	B	2	2202051B	0.047	2.3	Y	Y	-	-
5-Feb-22	B	2	2202052A	0.048	3.5	Y	Y	-	-
5-Feb-22	B	2	2202052B	0.046	3.2	Y	Y	-	-
6-Feb-22	B	2	2202061A	0.059	3.8	Y	Y	-	-
6-Feb-22	B	2	2202061B	0.04	3.0	Y	Y	-	-
6-Feb-22	B	2	2202062A	0.054	3.5	Y	Y	-	-
6-Feb-22	B	2	2202062B	0.046	2.9	Y	Y	-	-
7-Feb-22	B	2	2202071	0.032	0.7	Y	Y	-	-
7-Feb-22	B	2	2202072	0.041	1.3	Y	Y	-	-
8-Feb-22	B	2	2202081	0.073	2.2	Y	Y	-	-
8-Feb-22	B	2	2202082	0.077	2.4	Y	Y	-	-
9-Feb-22	B	2	2202091	0.15	2.8	Y	Y	-	-
9-Feb-22	B	2	2202092	0.12	2.5	Y	Y	-	-
10-Feb-22	B	2	2202101	0.085	2.8	Y	Y	-	-
10-Feb-22	B	2	2202102	0.086	3.5	Y	Y	-	-
11-Feb-22	B	2	2202111	0.39	2.9	N	Y	Y	
11-Feb-22	B	2	2202112	0.41	3.0	N	Y	Y	
12-Feb-22	B	2	2202121	0.16	1.8	Y	Y	-	-
12-Feb-22	B	2	2202122	0.1	1.8	Y	Y	-	-
13-Feb-22	B	2	2202131	0.14	2.3	Y	Y	-	-
13-Feb-22	B	2	2202132	0.048	1.6	Y	Y	-	-
14-Feb-22	B	2	2202141	0.1	5.5	Y	Y	-	-
14-Feb-22	B	2	2202142	0.1	2.6	Y	Y	-	-
15-Feb-22	B	2	2202151	0.13	3.4	Y	Y	-	-
15-Feb-22	B	2	2202152	0.11	3.1	Y	Y	-	-
16-Feb-22	B	2	2202161	0.11	750.0	Y	Y	-	-
16-Feb-22	B	2	2202162	0.11	940.0	Y	Y	-	-

Testing and Validation



Reclamation August 2023

Rockfield
Reimagine. Transform.

PORT OF TOWNSVILLE

PIANC ANZ Technical Presentations & Networking Event
5th October 2023 - Port of Townsville , Townsville QLD , 4810

Berth 1 Structural Health Monitoring

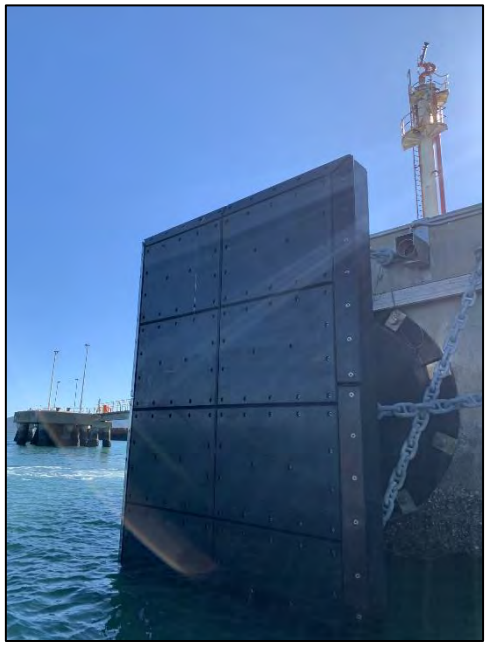
Mohamed Jaditager – Asset Engineer, POTL
Daniel Whipp – Software Engineer, Rockfield

Presentation Overview

- About the project
- Instrumentation design
- Monitoring approach
- Data analysis and results
- Into the future

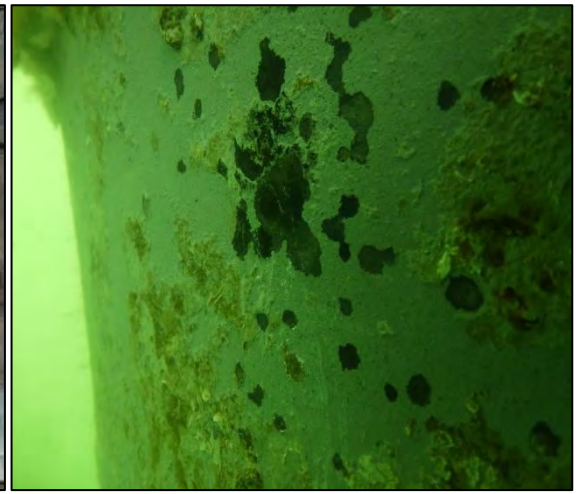
Project Overview

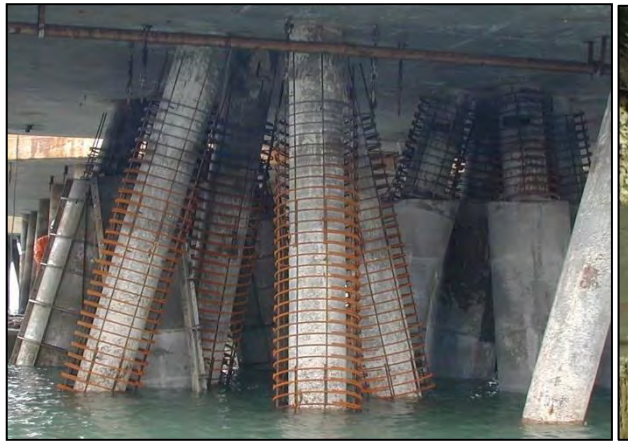
- Berth 1 Characteristics:
  - Bulk chemical handlining wharf that constructed mid 1960s, for design life of 50 years.
  - Concrete wharf deck structure is supported by concrete piles with discrete SCN1800 E2.4 fender systems attached to 2 berthing dolphins.
  - Condition of the wharf structure is deteriorating due to asset age, harsh environment, Alkali –Silica Reaction , and Chloride Ingress.
- Goal:
  - Install a monitoring system to understand loading profile and behavior of the asset during real-time ship berthing events.
  - Analyze the relationship between fender loads and structure performance.
  - Trial system on 1x fender
  - Assess the actual structural capacity of the ageing wharf structure against its theoretical capacity.



Berth 1 Wharf Structure Asset Management

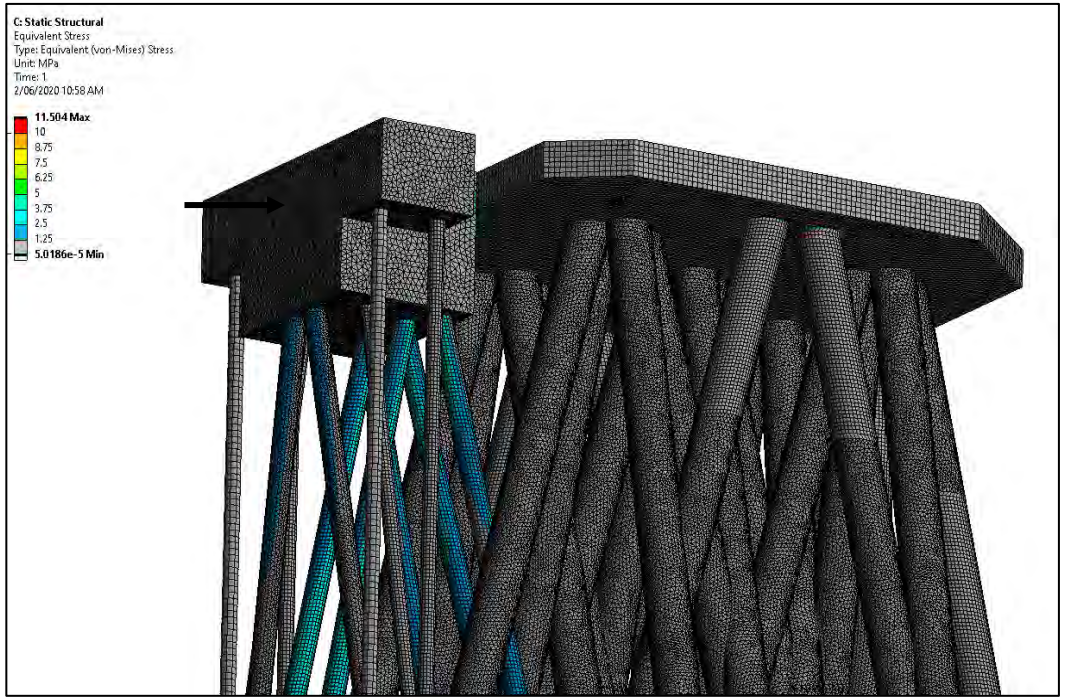
- Berth 1 is a critical asset for the Port of Townsville, with no backup berth to handle petroleum products & bulk chemicals
- Managed on risk-based approach to always keep the asset available.
- Cathodic protection system (sacrificial & sprayed zinc anodes)
- Regular asset inspections including underwater piles inspections
- Major pile encapsulation works in 2003
- Ongoing concrete repairs program
- Access bridge load restrictions





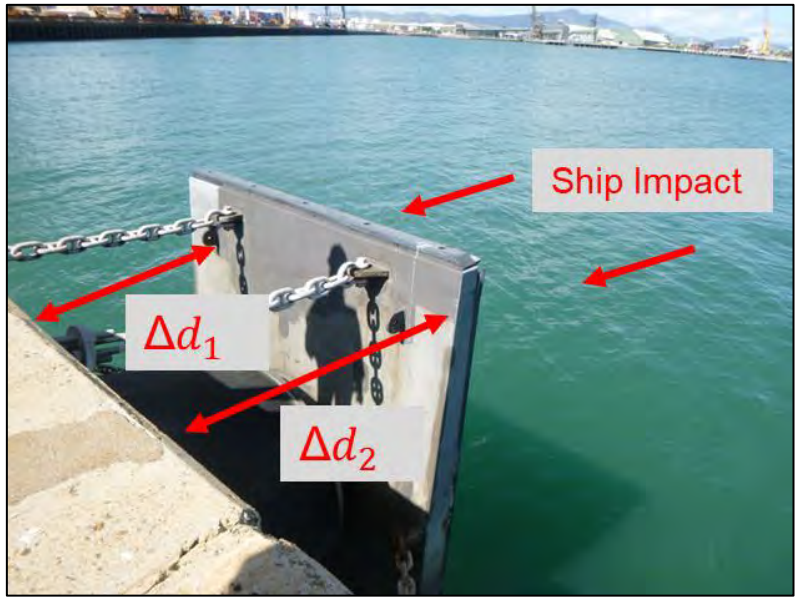
Monitoring Outcomes

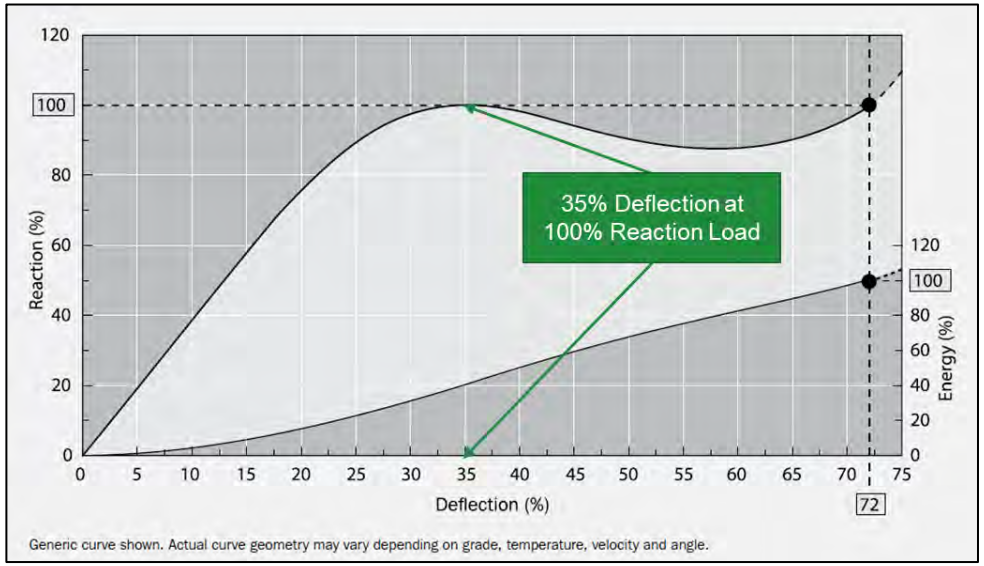
- Monitor behavior of the fender and stress in piles during berthing
- Analyze factors that cause higher stresses to wharf.
  - E.g. ship type, pilot, weather conditions.
- Estimate the actual structural capacity of wharf structure degradation with time
- Develop a proof of concept for long term degradation monitoring of wharf structures and wharf structure asset management plan.



Fender Monitoring Theory

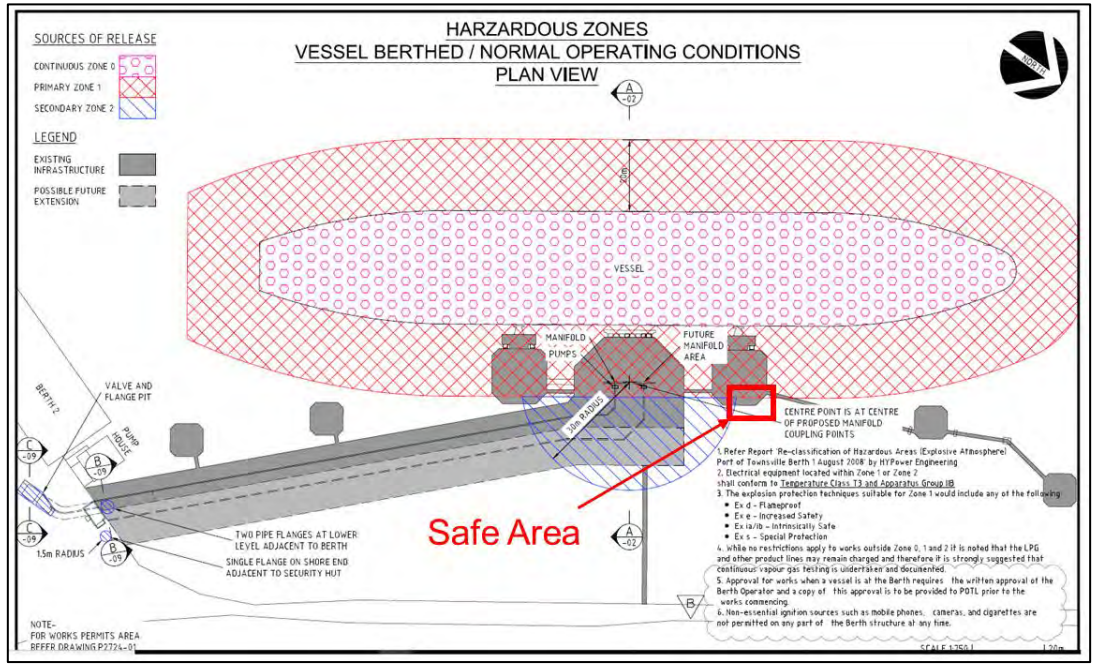
- Fender compression during impact induces stress in piles supporting wharf structure.
- Energy absorbed by the fender is determined by compression amount, impact time, temperature, impact angle, and fender age.
- Pile forces can be predicted based on the compression profile of the fender.
- Likelihood and magnitude of damage to wharf structure can be derived from pile stresses.

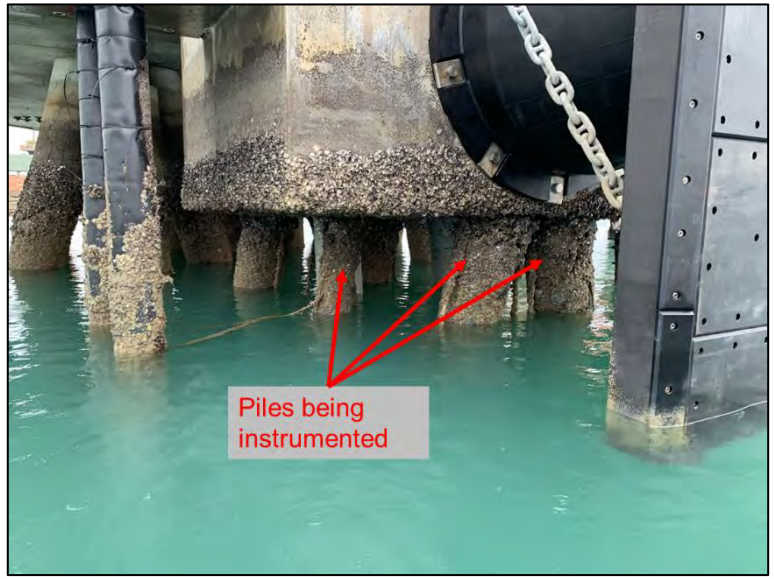




Challenges

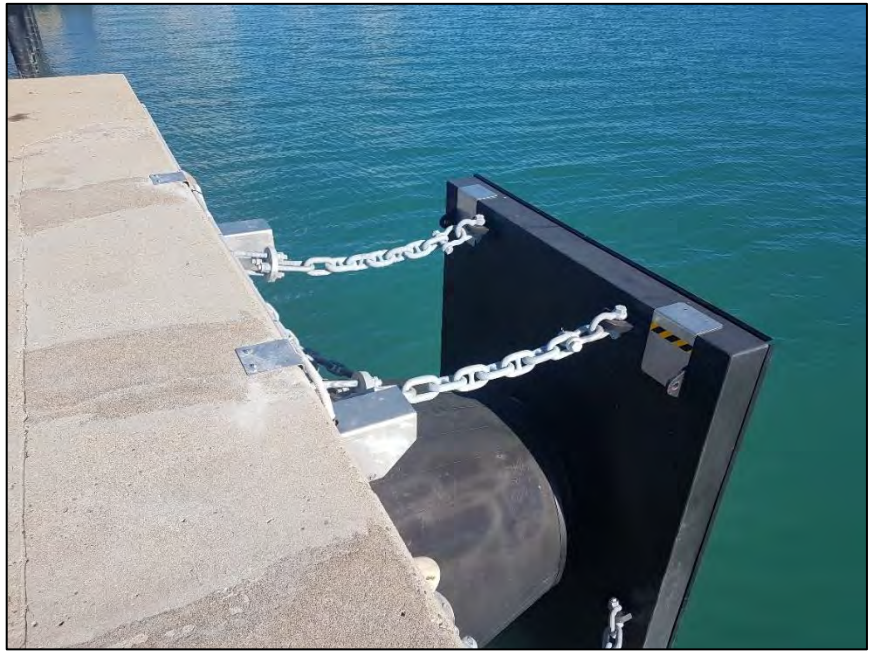
- Hazardous area
- Salt water tidal environment
  - Fouling, corrosion
- Cannot impede ship berthing
  - Rigging, chemical transfer pipes, dock workers
- Fender deflection profile will change as fender ages/rubber degrades.
- Project management & organisational change challenges

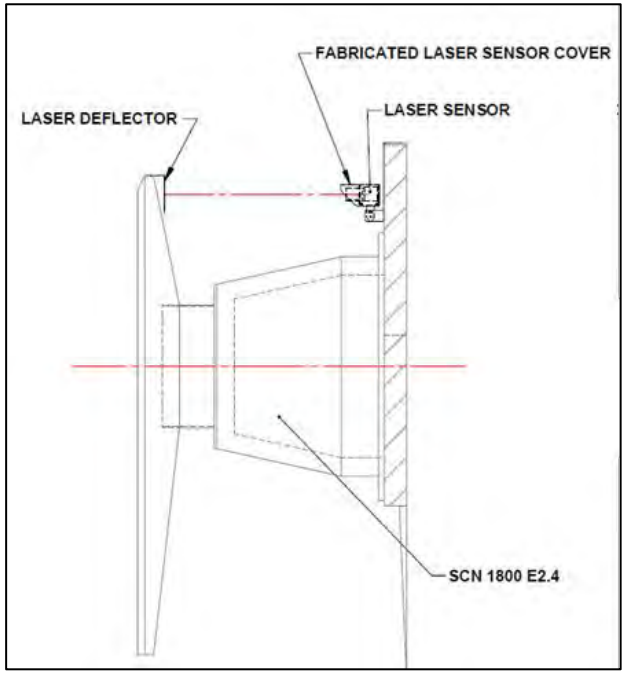


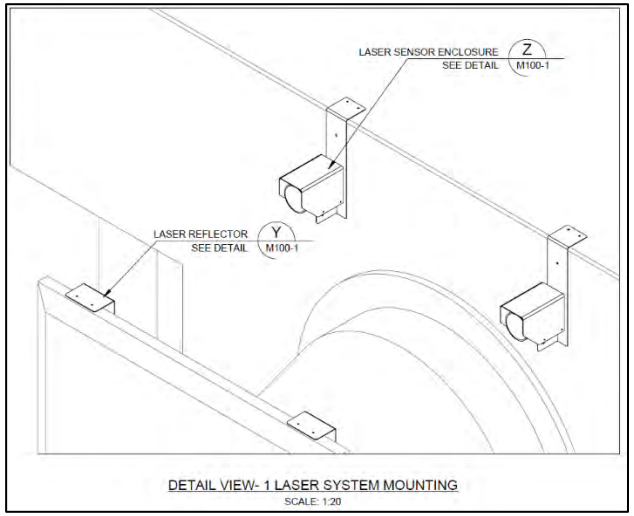


Monitoring System

- 2x Laser sensors on fender to record deflection profile during ship berthing
  - Ex. rated housing
  - Cover to protect from animals, debris, and rigging.

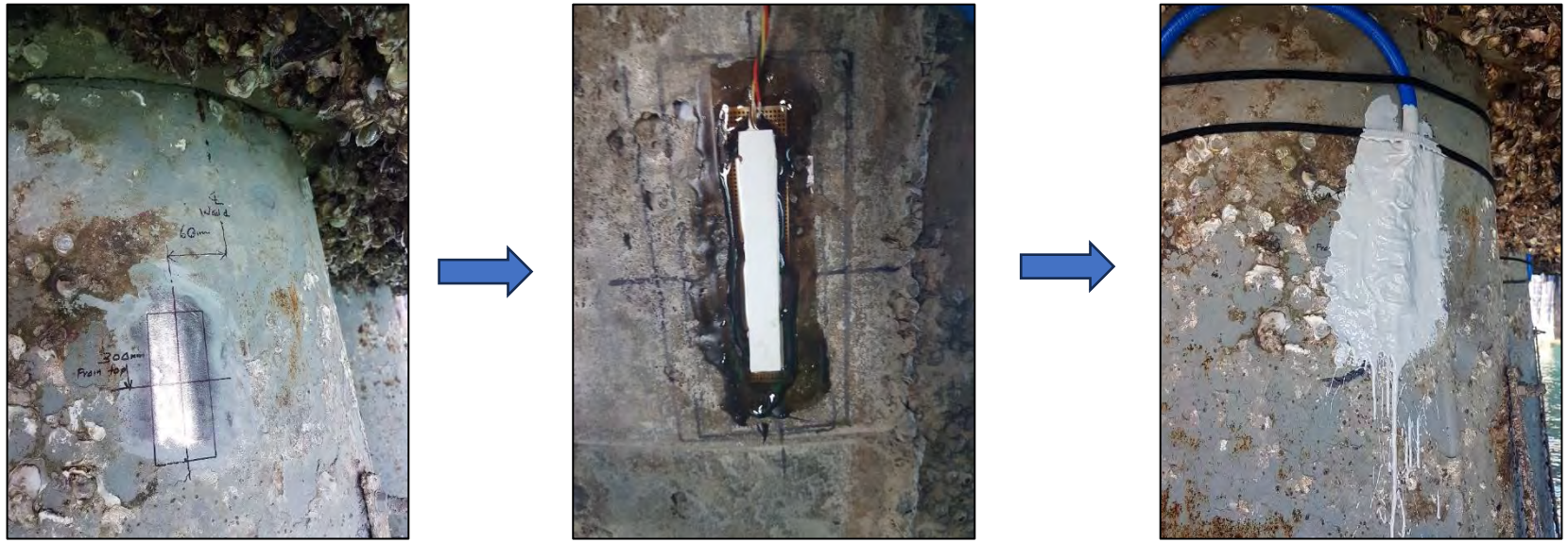






Monitoring System

- 8x Strain gauges on wharf piles to validate readings and confirm theory for trial
  - Waterproof, long-life gauges
  - Bonded using high-strength epoxy with antifouling coating.
  - Intrinsically safe, hazardous area safe.

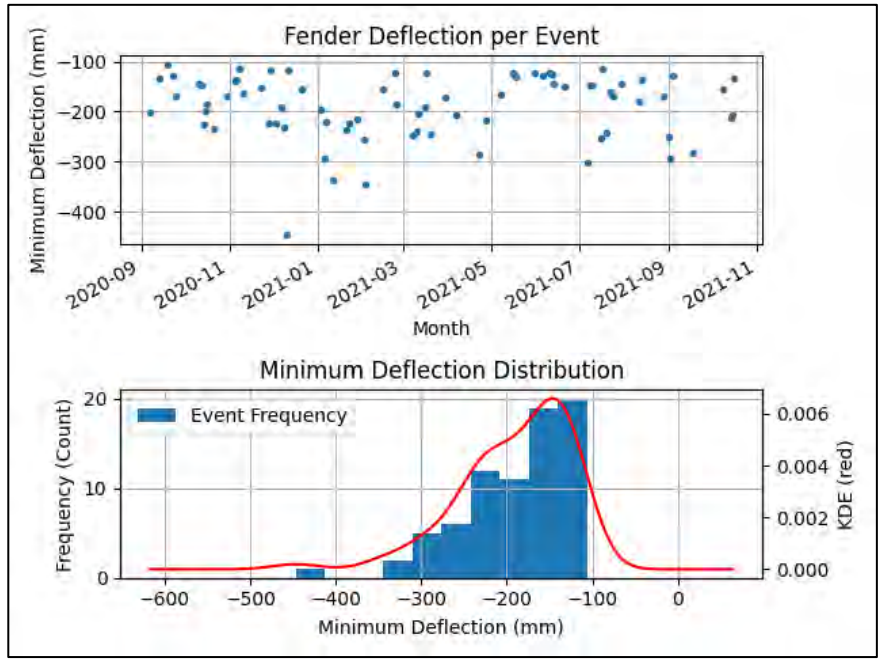


Monitoring System

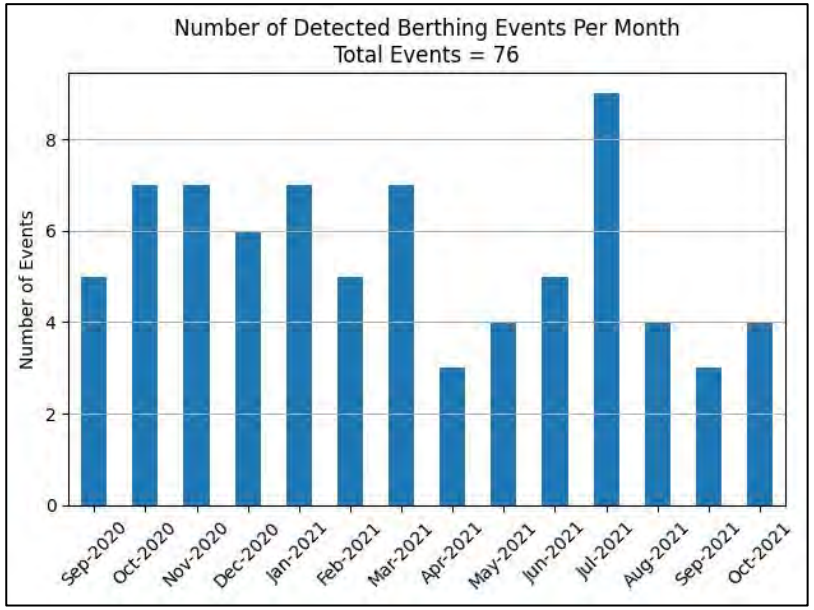
- Datalogging station in safe area (not hazardous)
  - 4g router for remote monitoring and data collection
  - Event based monitoring during berthing only
  - 10Hz scan rate to capture dynamic behavior.

Long Term Monitoring

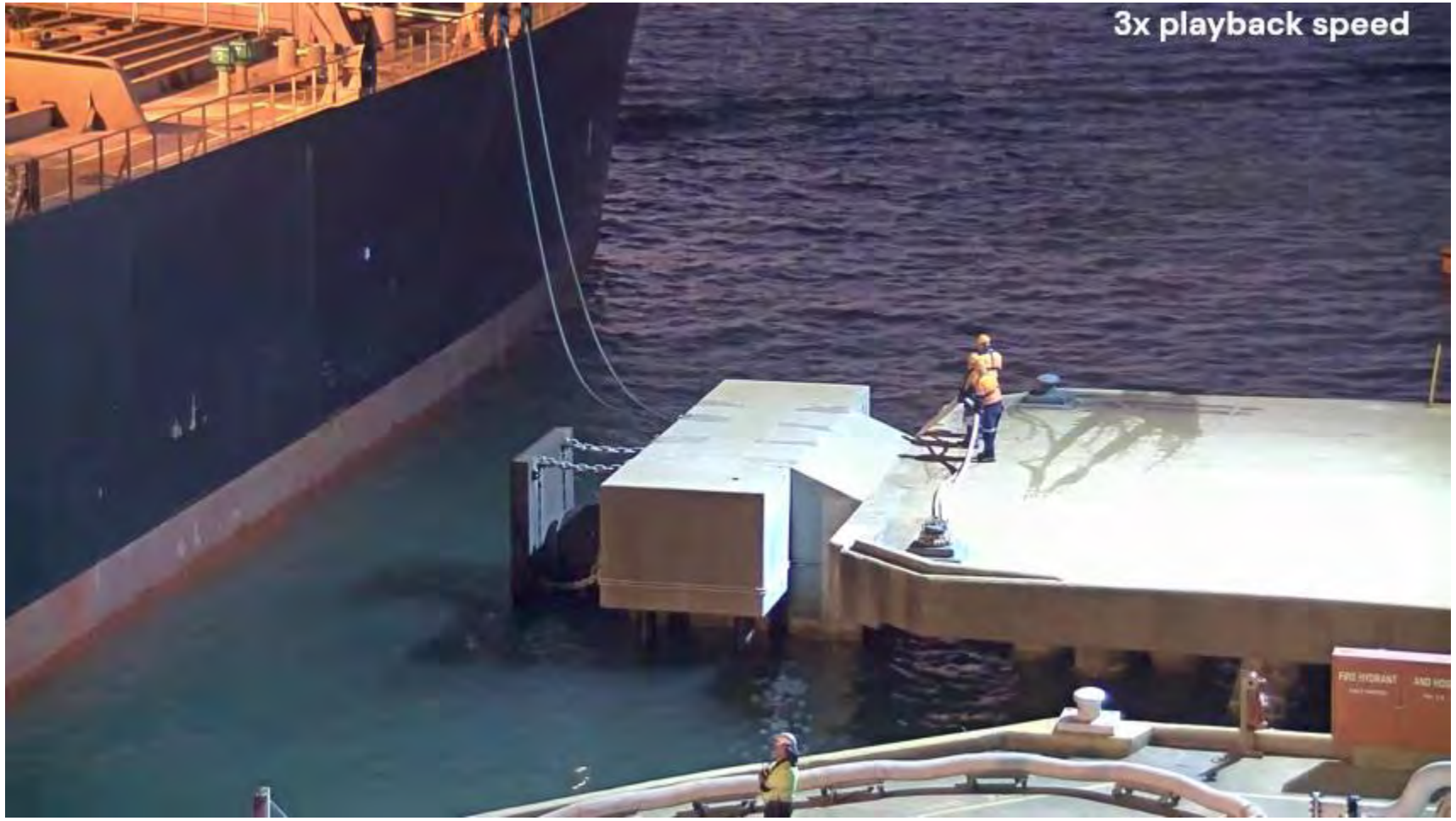
- 12-months of monitoring
  - Sept 2020 to Oct 2021
- 76 ship berthing events
- Data correlated with vessel information and BOM weather data



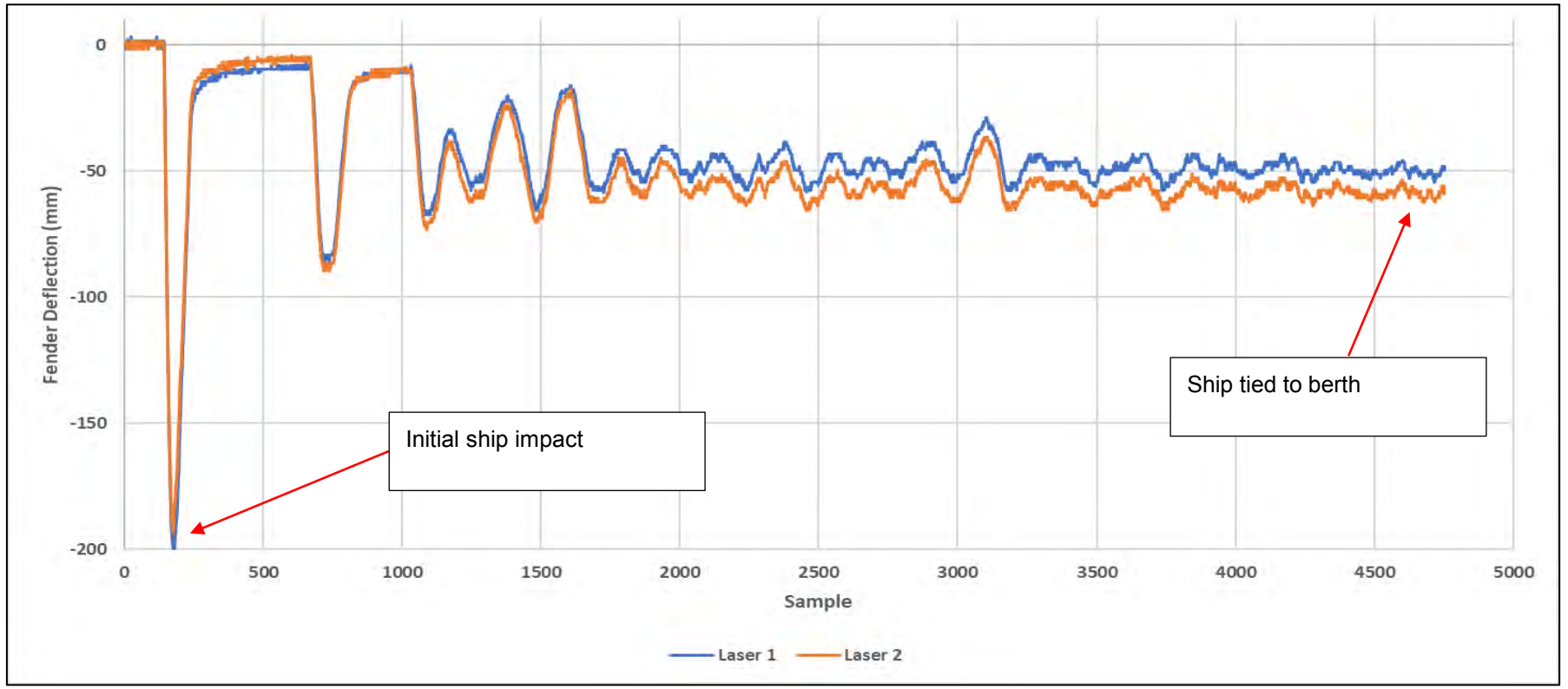
Commodity	
Category	Count
Diesel oil (DO)	35
Unleaded (91)	16
Bitumen (petroleum bitumen or asphalt)	5
Jet fuel (jet a1)	4
Other	13



Typical Berthing Event



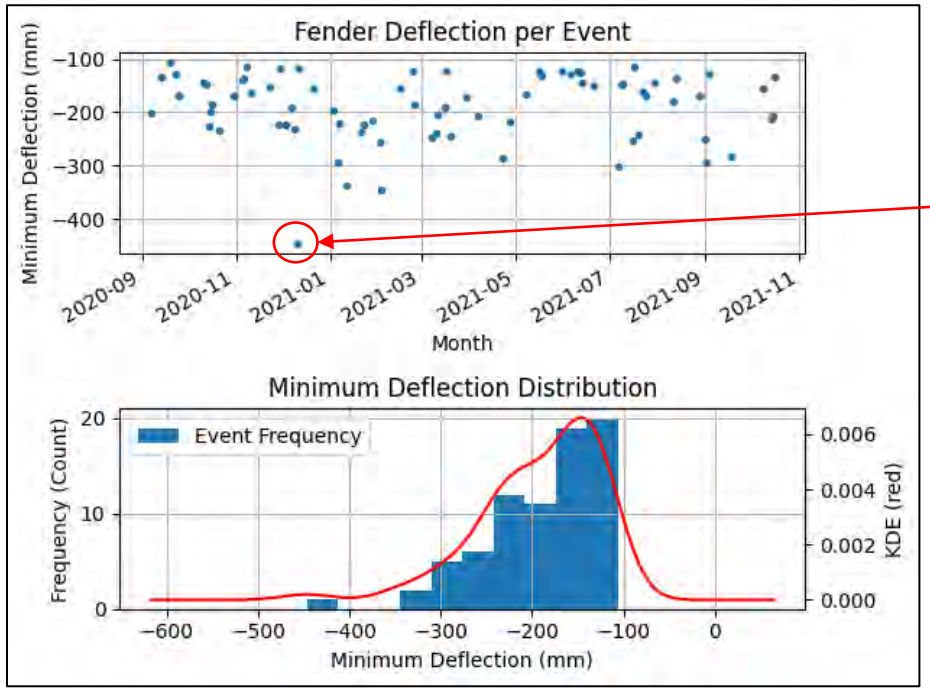
Typical Berthing Event



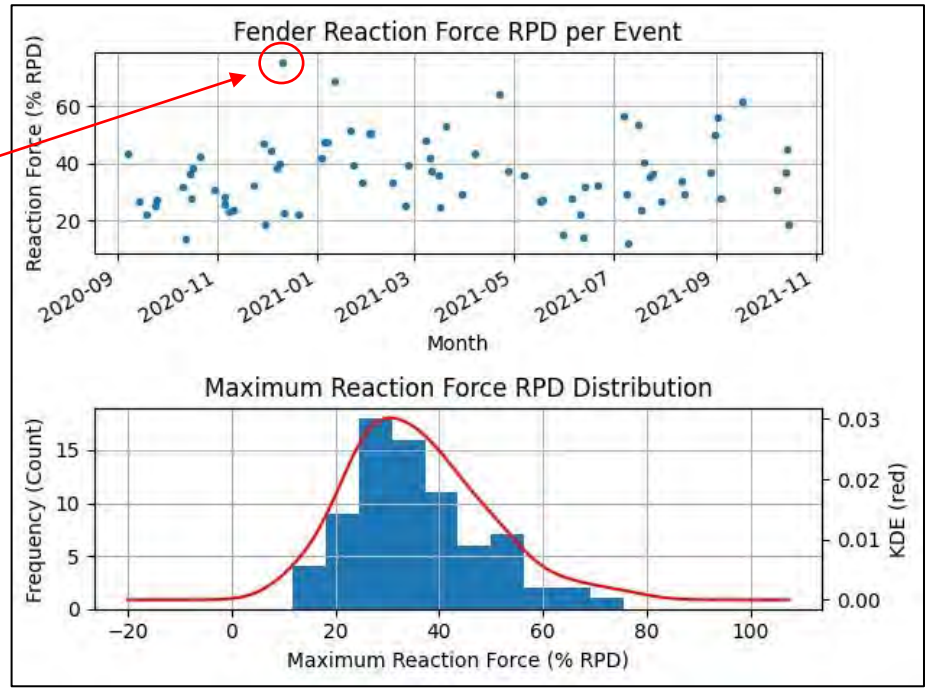
- Fender reaction forces and energy calculated from compression time, impact angle, and temperature

Fender Forces

- Reaction force close to normally distributed.
- Majority of berthing events between 20-60% of rated fender reaction force (100mm to 300mm deflection).

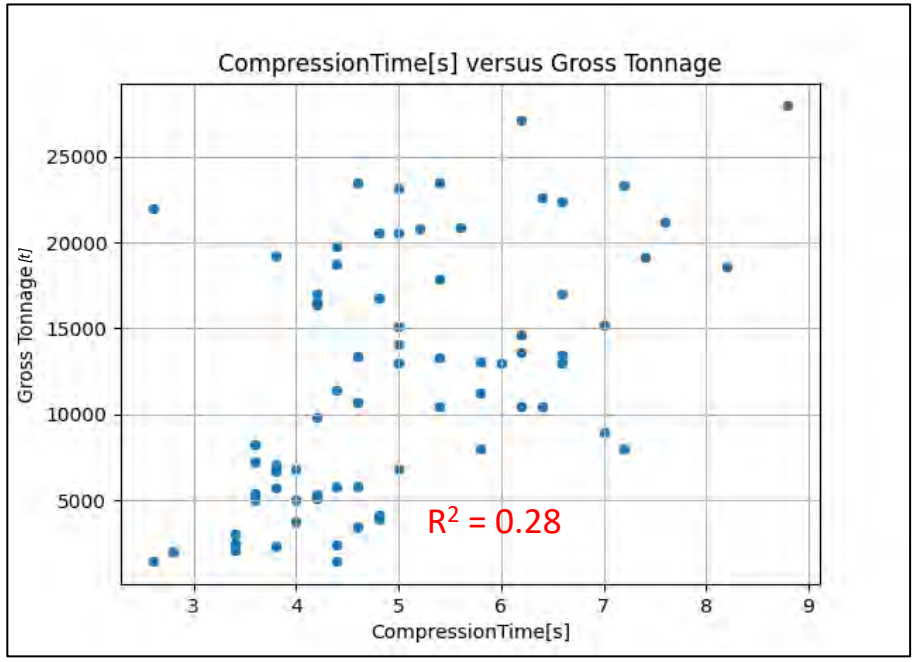


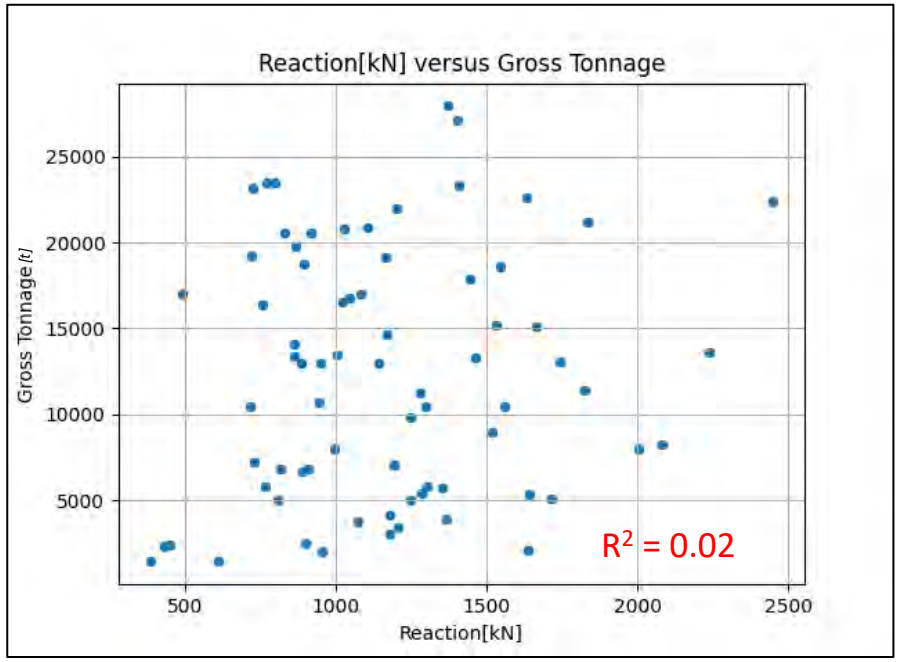
Largest Impact



Ship Size

- Larger ships berth slower (increased compression time). Does not necessarily lead to increased forces in fender.
  - Larger ships (based on draft and tonnage) do not necessarily cause higher reaction forces



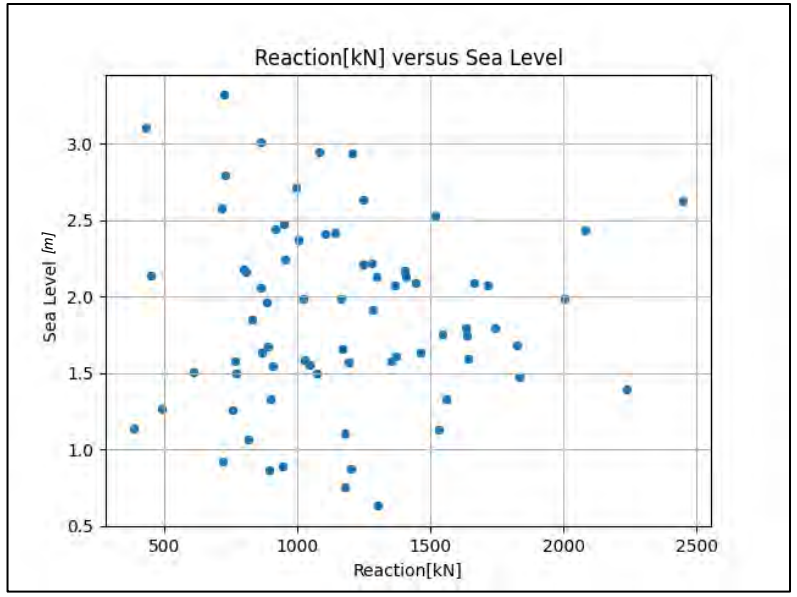


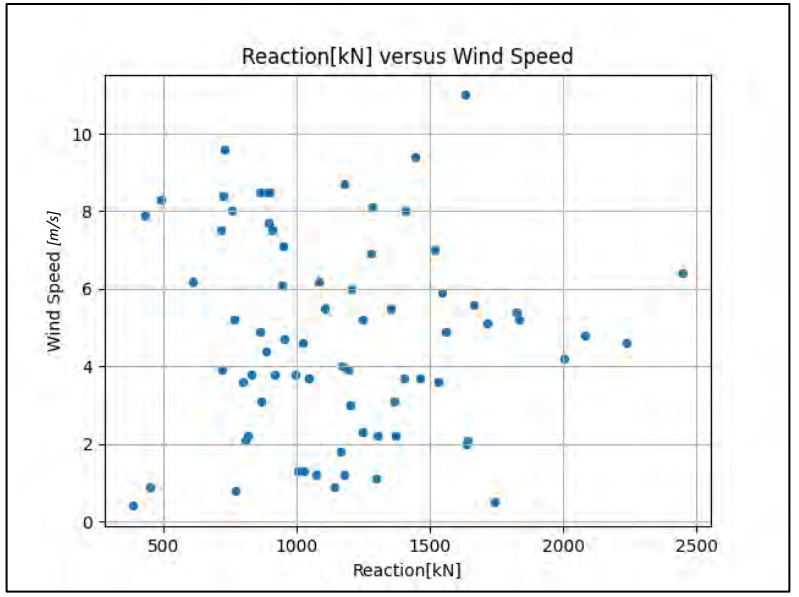
Weather

- Weather station at Cape Cleveland.
- No obvious correlations between climate variables and fender behaviour.
  - Sea level, wind speed, wind gust

Correlation Coefficient (R^2)

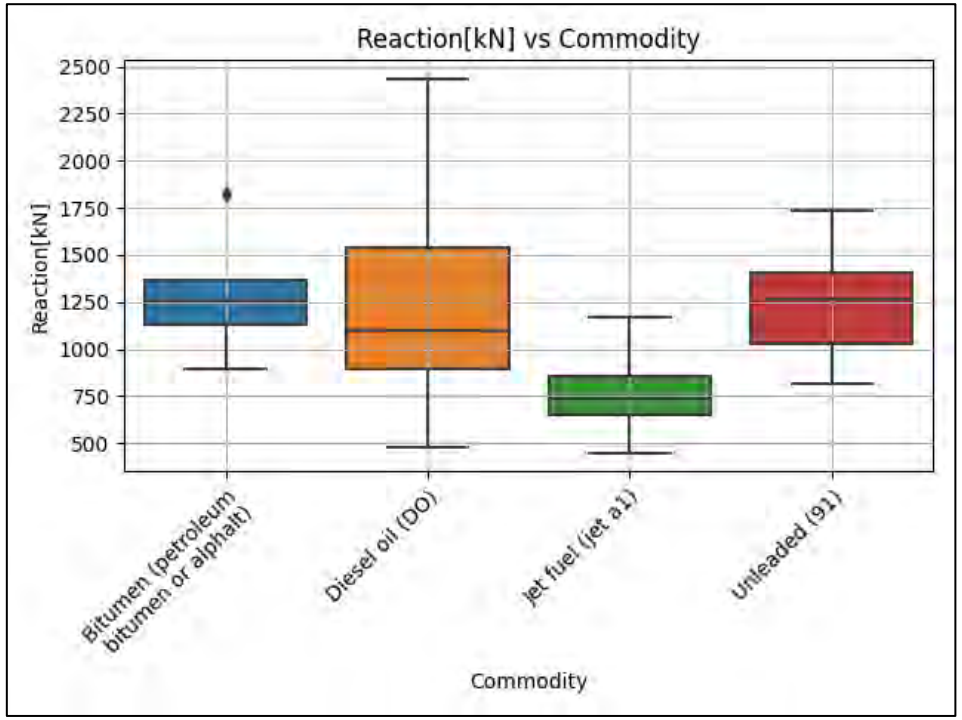
	Compression Time (s)	Reaction (kN)	Energy (kJ)
Sea Level (m)	0.001	0.001	0.002
Wind Speed (m/s)	0.000	0.000	0.000
Wind Gust (m/s)	0.000	0.000	0.000





Commodity

- Tankers carrying Diesel oil cause the largest range of reaction forces (biggest swing from max to min).
  - Jet fuel lowest mean reaction force.
- Asphalt/Bitumen Tankers have highest average reaction force

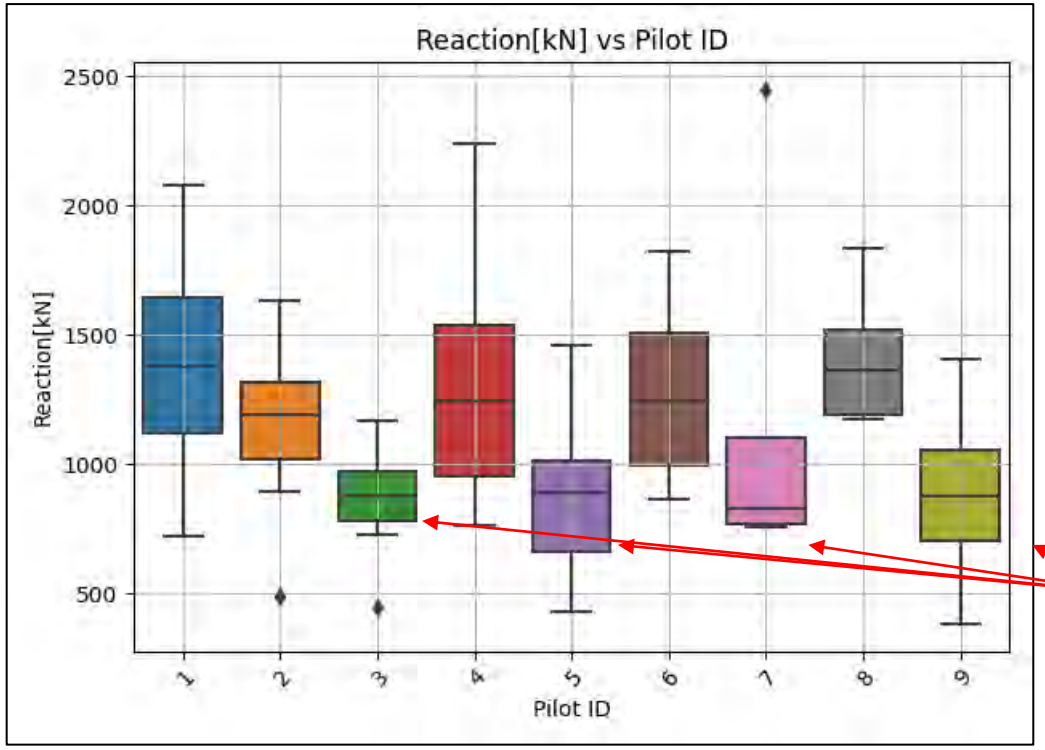


Fender Reaction Force (% of Rated)

	Mean	Min	Max
Diesel oil (DO)	39%	15%	76%
Unleaded (91)	39%	25%	54%
Bitumen (petroleum bitumen or asphalt)	40%	28%	56%
Jet fuel (jet a1)	24%	14%	36%
Other	29%	12%	43%

Pilot Behaviour

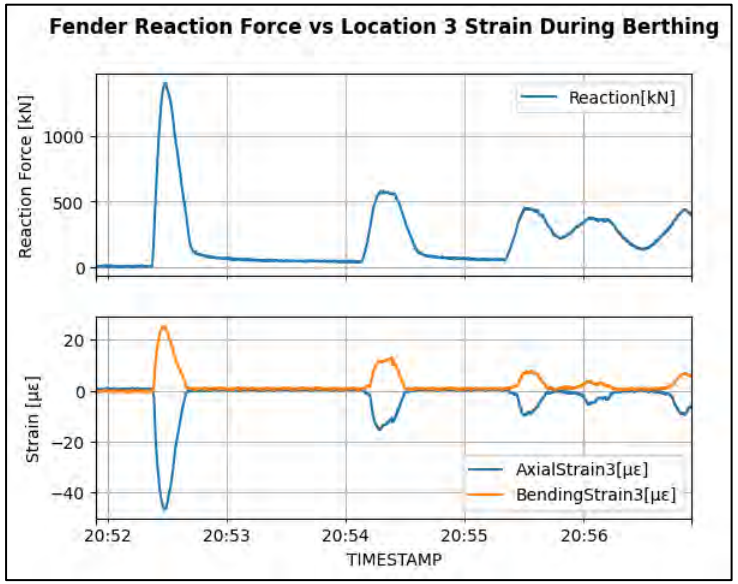
- Majority of pilots within 1 standard deviation of mean reaction force.
- Typically, faster berthing speeds tend towards higher reaction forces.



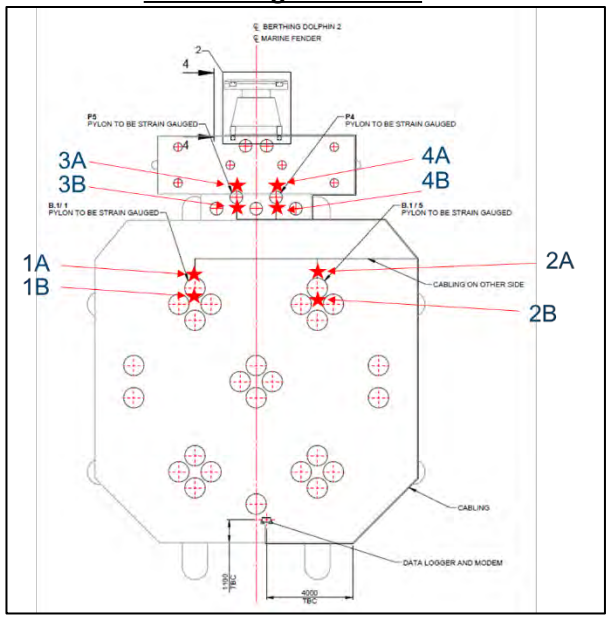
Pilot's causing lower-than-average forces on the berth.

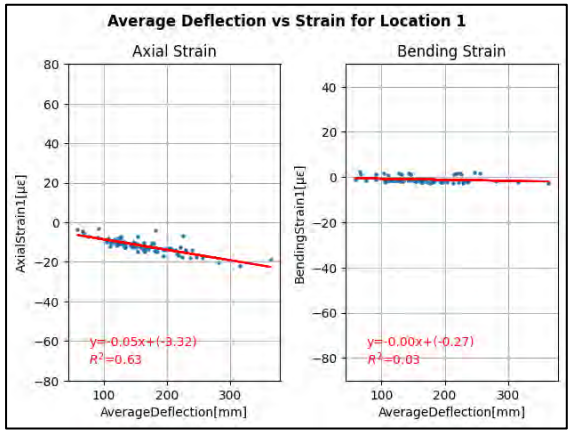
Strain Data

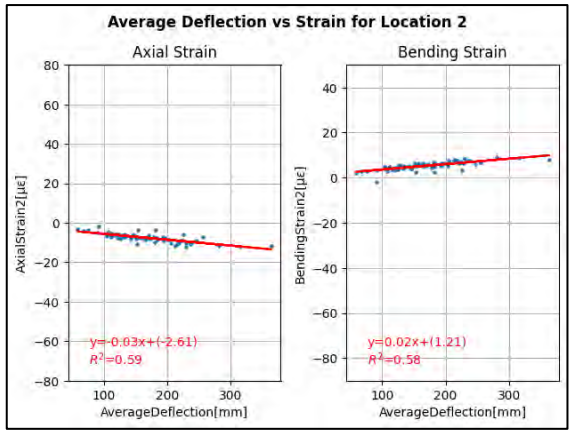
- Strong correlation between fender deflection and strains
- Possibility of predicting strain in structure based on fender deflection profile.
- Structural modelling required to analyse data in detail and determine acceptable strain ranges.

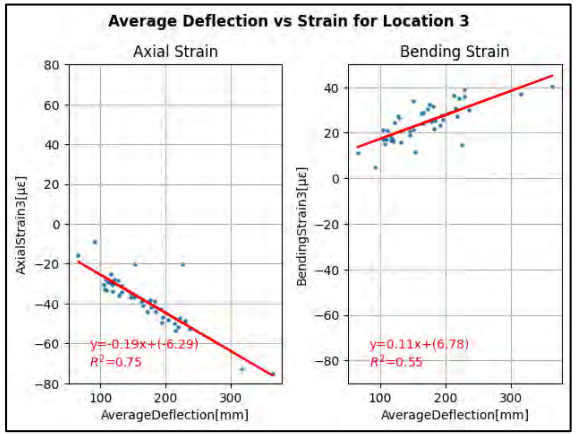


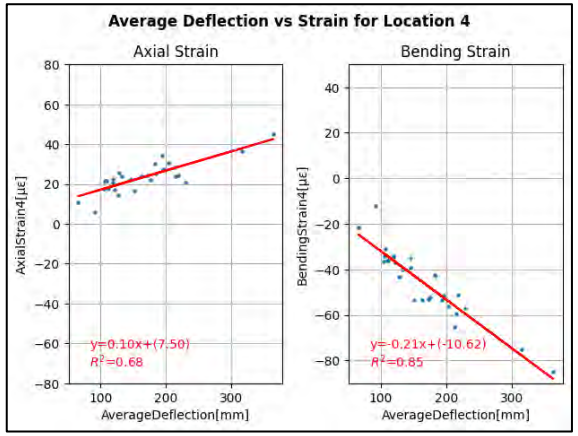
Strain Gauge Locations









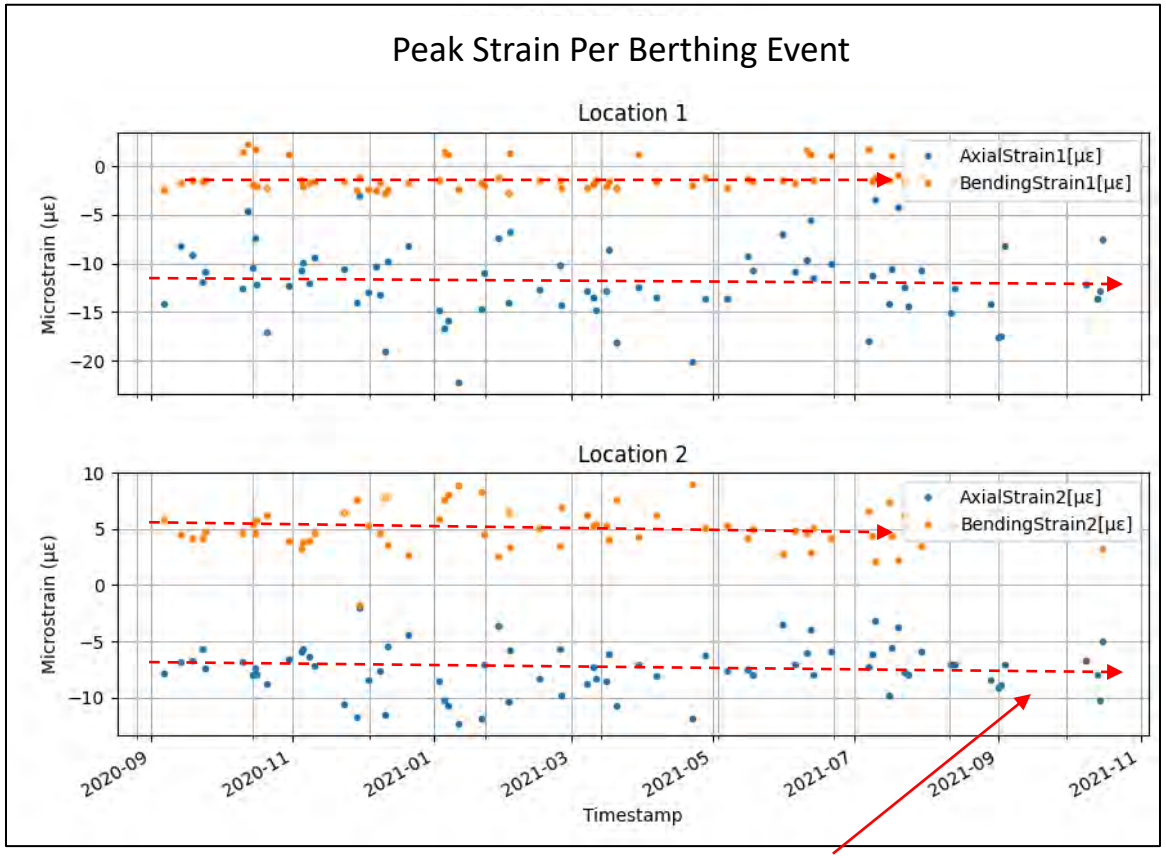


Outcomes

- No overloaded ship impacts were detected within the 1-year of monitoring.
- Weather has minimal to no impact on fender impact characteristics.
- Larger ships do not necessarily lead to larger reaction forces.
- Chemical tankers (Diesel oil) causing largest impact forces on wharf.
- Pile strains strongly correlated with fender deflection. With appropriate modelling strains may not need to be monitored in the future, fender deflection alone should be suitable.

Into the Future

- Current analysis based on theoretical (manufacturer provided) fender design curves. Does not factor in age & deterioration of fender.
  - Controlled berthing tests to calibrate fender curves recommended.
- Structural modelling required to interrogate strain data, relate strains to forces acting on the structure.
- Continued, long term monitoring to track fender and wharf degradation over time. 12-months not a long enough period to see significant degradation.



• ACKNOWLEDGEMENT

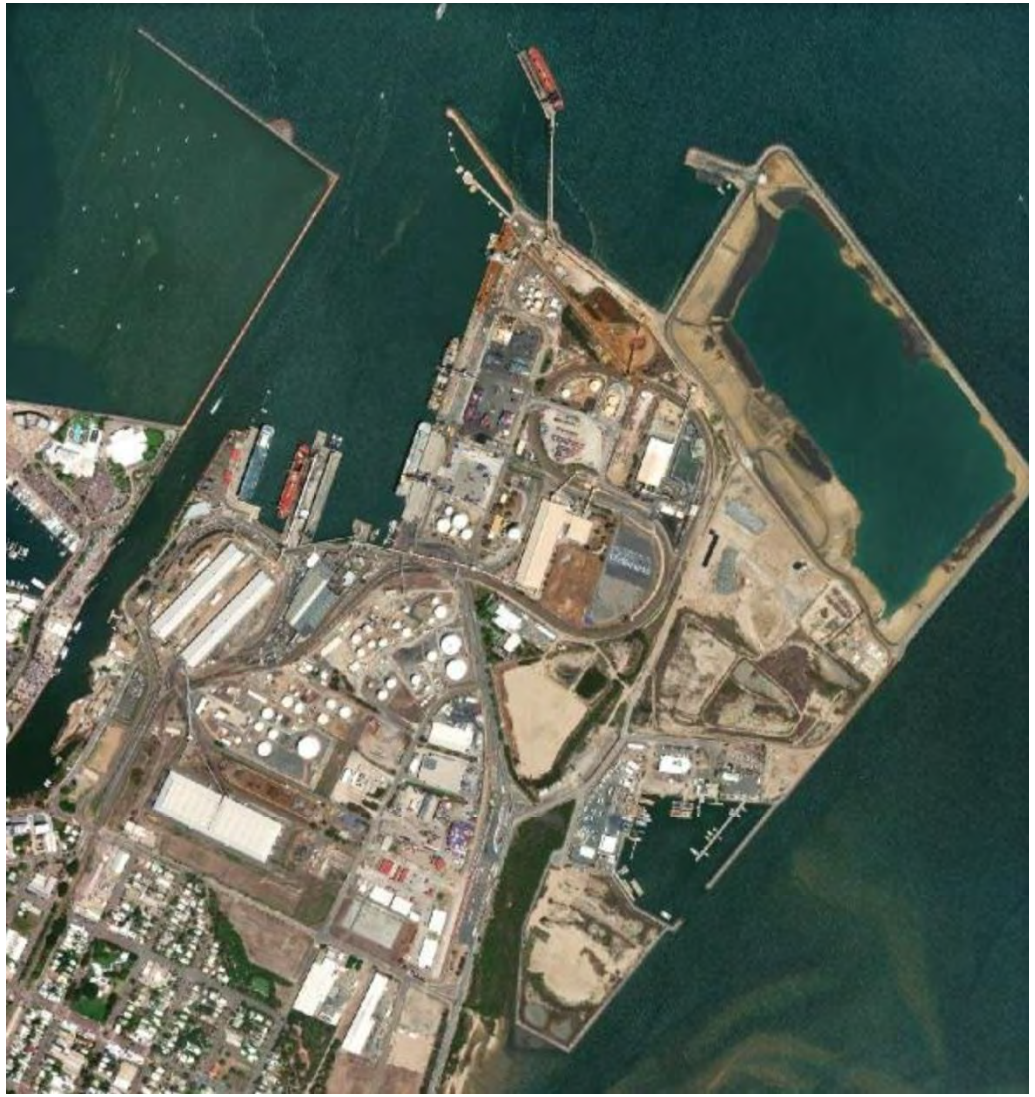
The Port of Townsville stands on Gurambilbarra country, traditionally cared for by the Wulgurukaba people.

- We pay our respect to our traditional owners past, present and emerging.

Port Development Planning and GIS

- David Edelman
- A/Manager Asset management and Planning

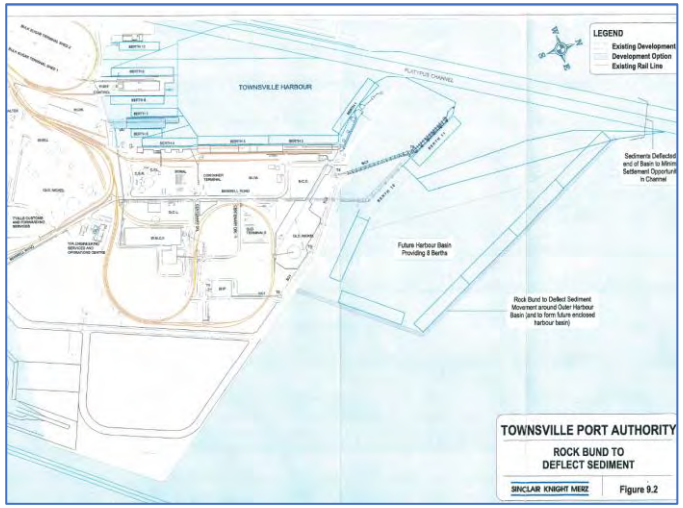
• The port has been steadily growing since 1864



• 1941

2023

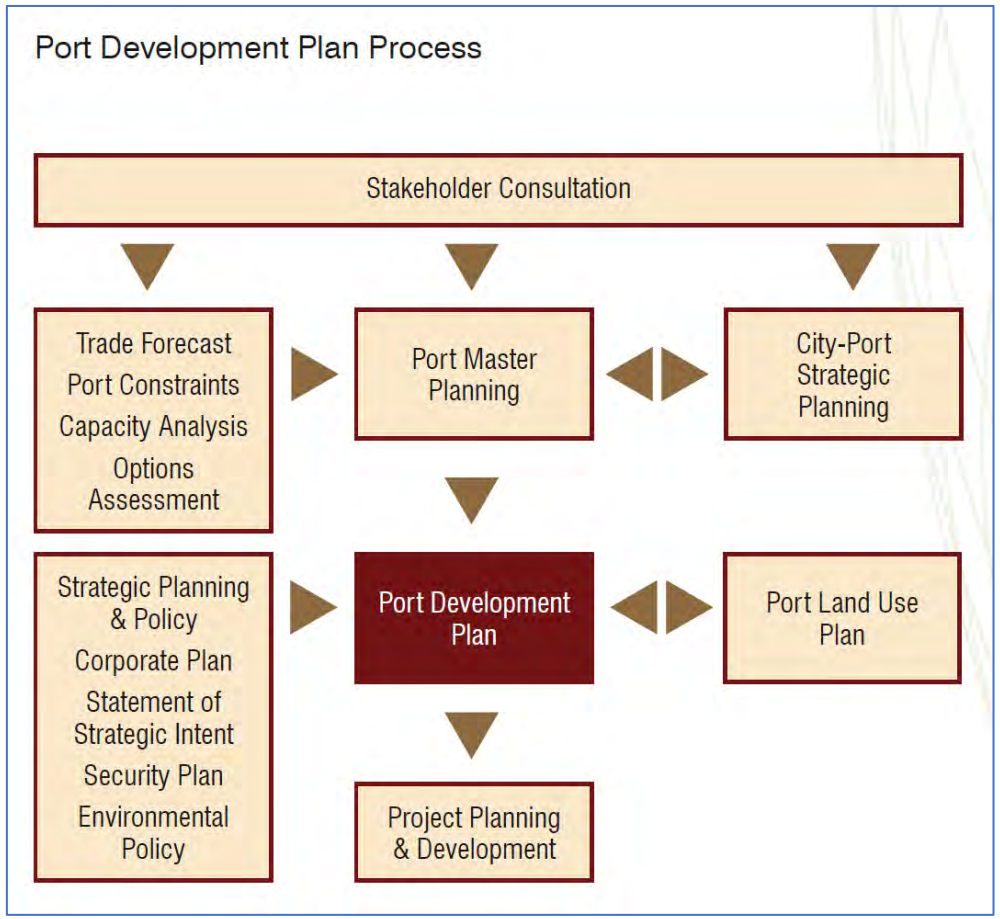
- **We spend a lot of time planning!**



PORT OF TOWNSVILLE

delivering sustainable prosperity

• The port planning process

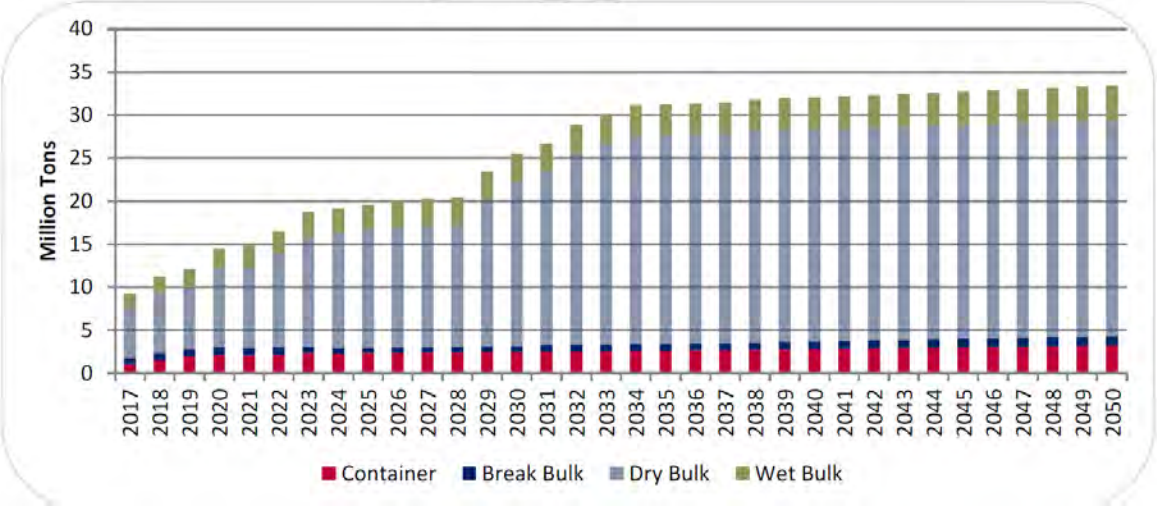


From 2009 Port Development Plan

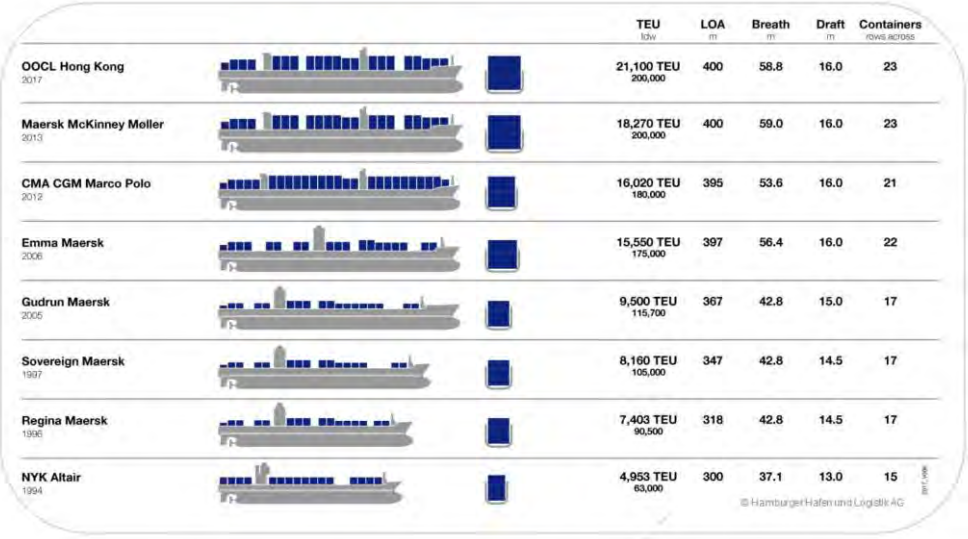
- Many inputs, requirements and stakeholders
- High level of analysis and optimisation required
- High levels of uncertainty on future trades/customers and timing -> plans date rapidly
- **Heavily data driven**

• Trade inputs and forecasts

Forecasts and capacity modelling,



Industry trends,



New trades and customers,

And some that never eventuate.

PORT OF TOWNSVILLE

delivering sustainable prosperity

• Inputs cont'd

- Environmental modelling and data
- Ship navigation simulations
- Wave modelling
- Flood modelling
- Community requirements
- Corporate goals and ambitions
- Etc…

• Importance of having a good Port development plan

- Allows us to progress environmental approval activities (which can take up to 10 years)
- Supports investment and government funding to Townsville and the region
- Allows us to make decisions on long term business agreements (eg 50-year leases)
- Ensures we build the right infrastructure to meet current and future needs
- Allows us to respond to new opportunities rapidly
- Is an integral part of our Port Vision – demonstrating benefits for our communities

• Example: Wind turbine laydown area

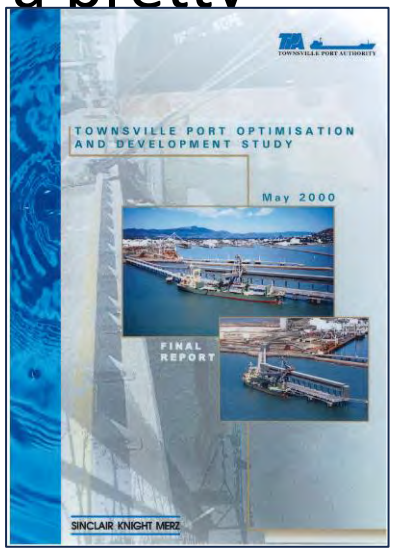
- 18 months to plan and build a 10Ha sealed wind turbine laydown area and access roads with a further 10Ha 12 months later
- 10+ year life
- We want to make sure what we build is useful for future operations and doesn't hamper future development
- Need to consider future roads, services, drainage, rail and other developments

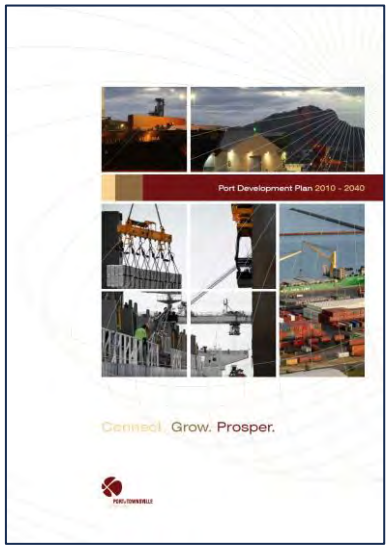
- Traditionally

Analysis and Data driven process that needs to meet complex requirements

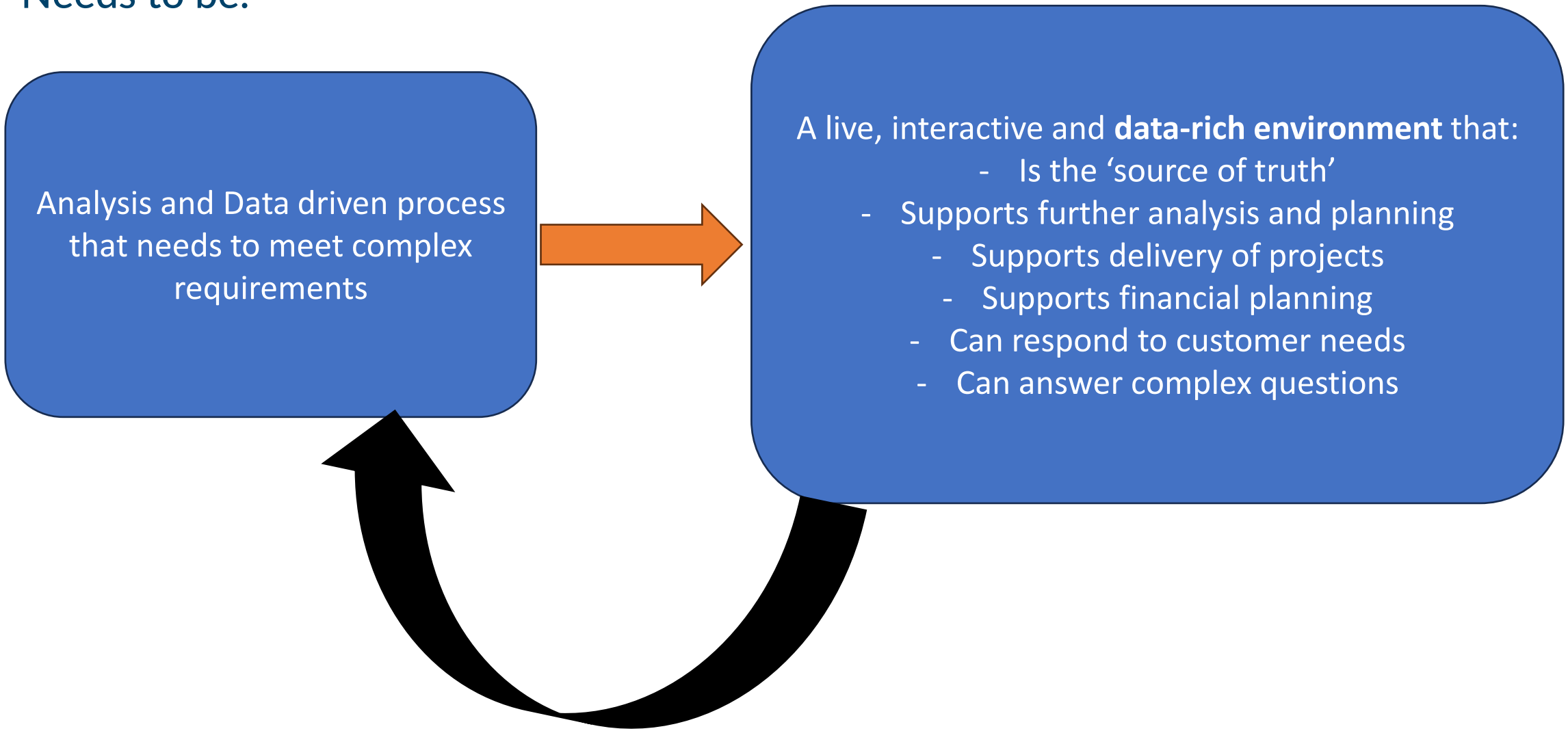
- **High quality, but…**
- **Out of date within 12 months**
- **Expensive and not easily updated**
- **Doesn't provide the level of detail required (where does the stormwater go?)**

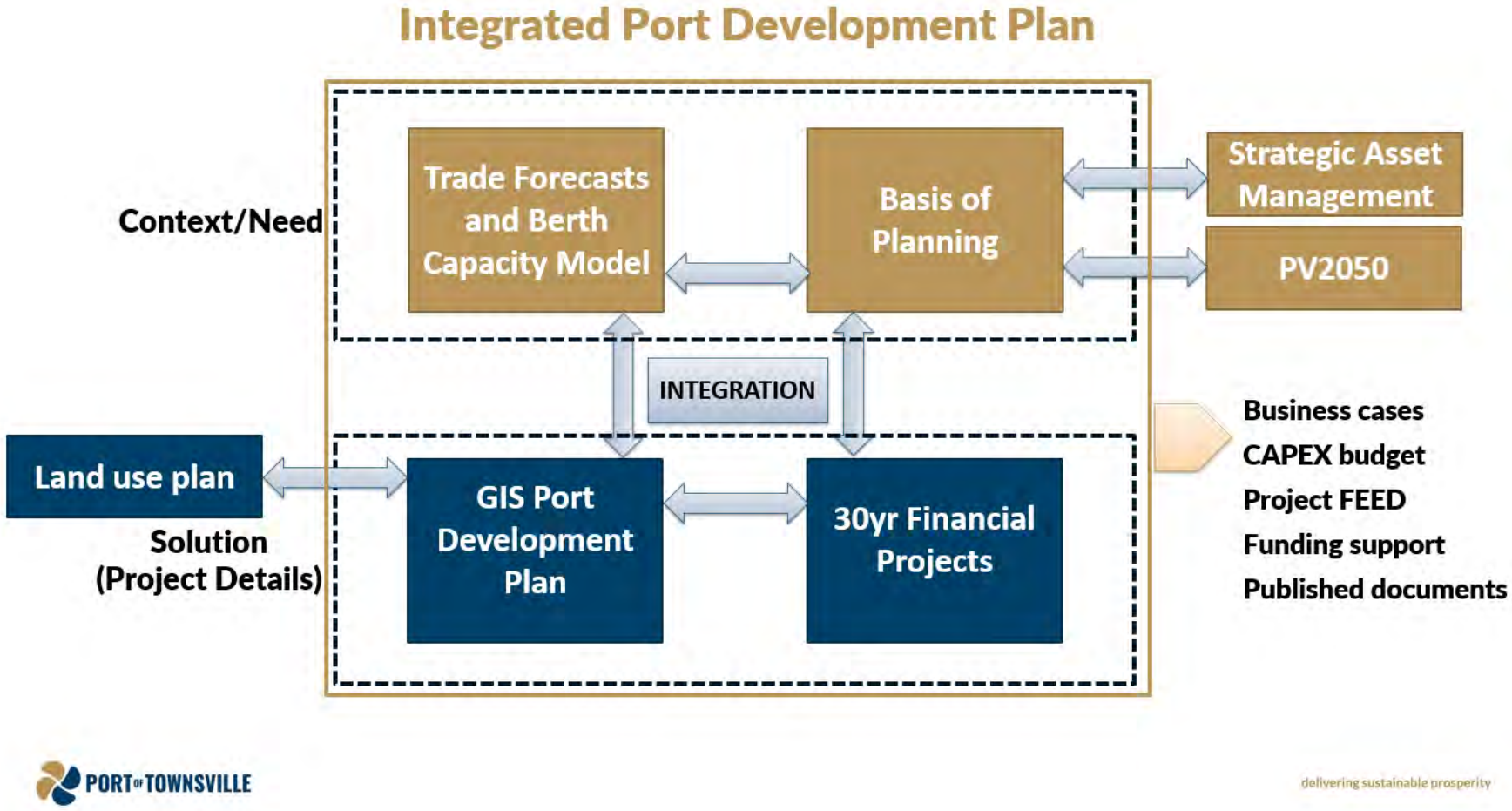
A dense report and a pretty im





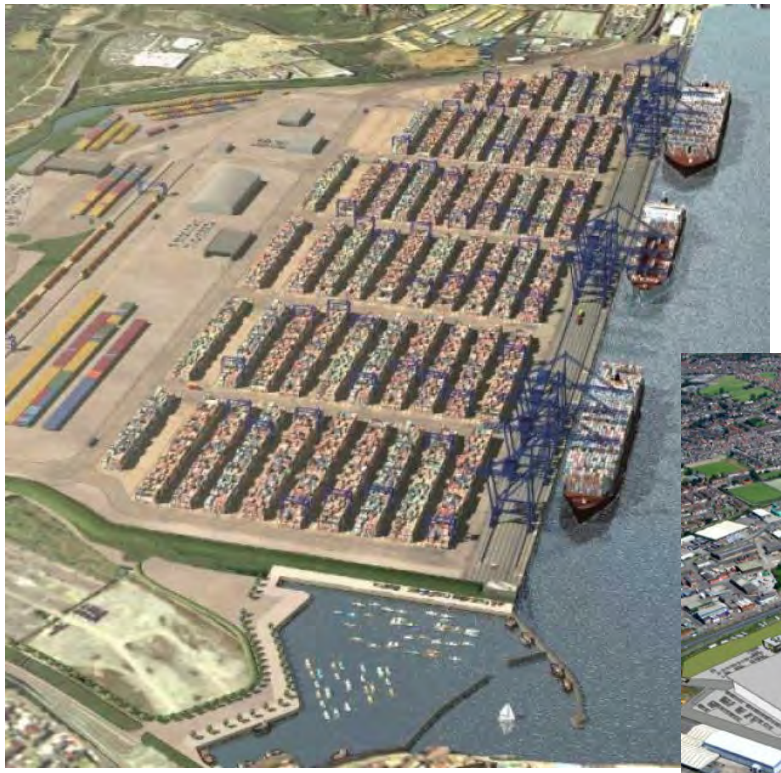
- Needs to be:

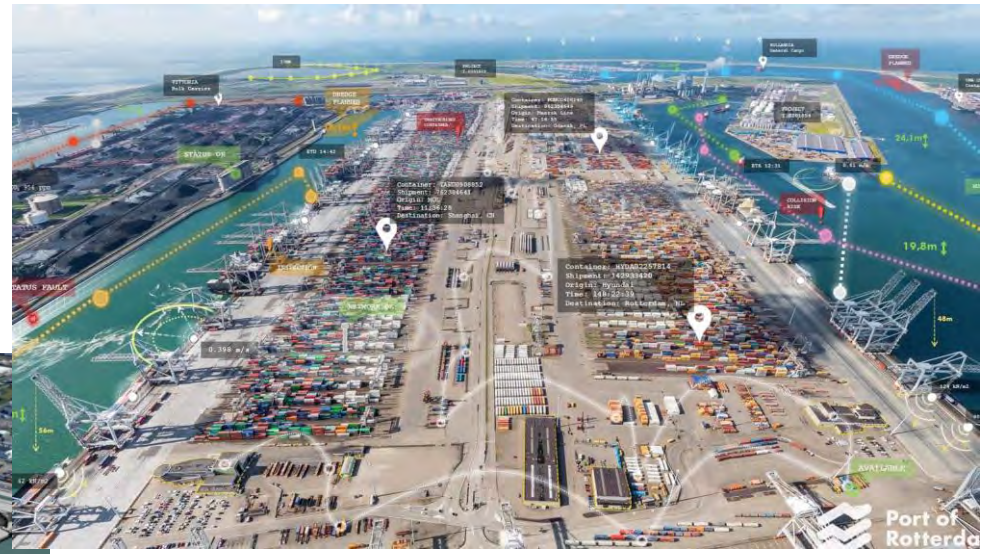

Analysis and Data driven process that needs to meet complex requirements
A live, interactive and **data-rich environment** that:
- Is the 'source of truth'
- Supports further analysis and planning
- Supports delivery of projects
- Supports financial planning
- Can respond to customer needs
- Can answer complex questions



- [POINT2 - Port Development Plans (arcgis.com)]

- Next steps/initiatives
- 3D models of developments and existing assets (underway)
- Data to support modelling in the GIS – eg berth capacity, rail capacity etc
- Digital Twin (asset management and live operational data) is a longer term goal





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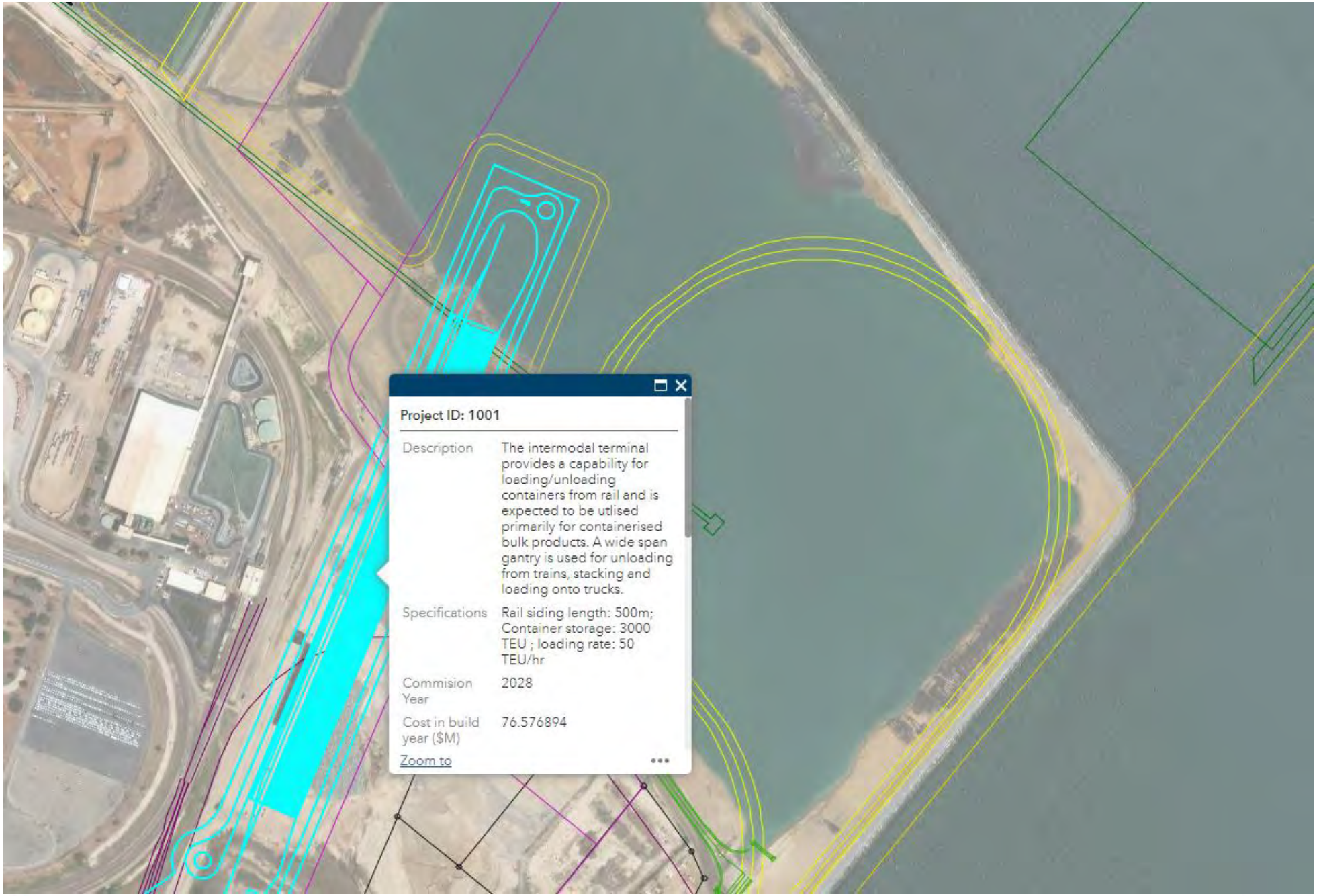
delivering sustainable prosperity


Project ID: 1001
Description
The intermodal terminal provides a capability for loading/unloading containers from rail and is expected to be utlised primarily for containerised bulk products. A wide span gantry is used for unloading from trains, stacking and loading onto trucks.
Specifications
Rail siding length: 500m; Container storage: 3000 TEU ; loading rate: 50 TEU/hr
Commision Year
2028
Cost in build year ($M)
76.576894
Zoom to

• ACKNOWLEDGEMENT

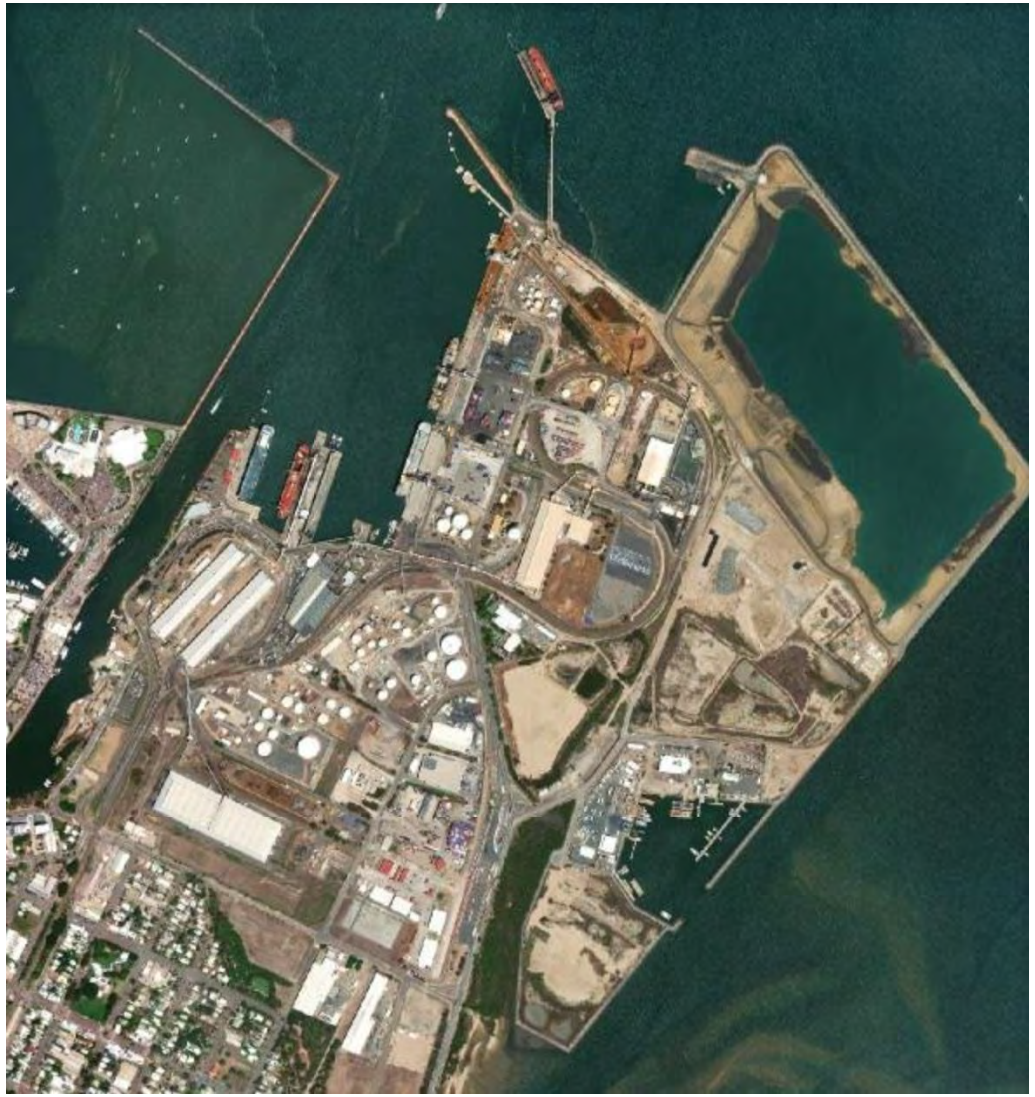
The Port of Townsville stands on Gurambilbarra country, traditionally cared for by the Wulgurukaba people.

- We pay our respect to our traditional owners past, present and emerging.

Port Development Planning and GIS

- David Edelman
- A/Manager Asset management and Planning

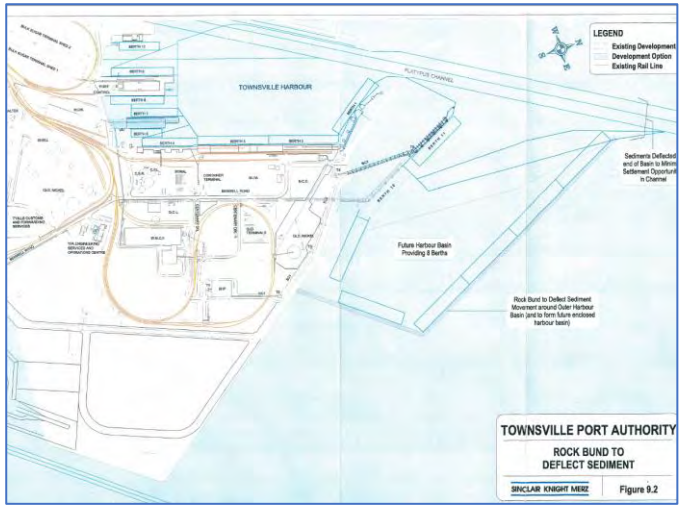
• The port has been steadily growing since 1864



• 1941

2023

- **We spend a lot of time planning!**



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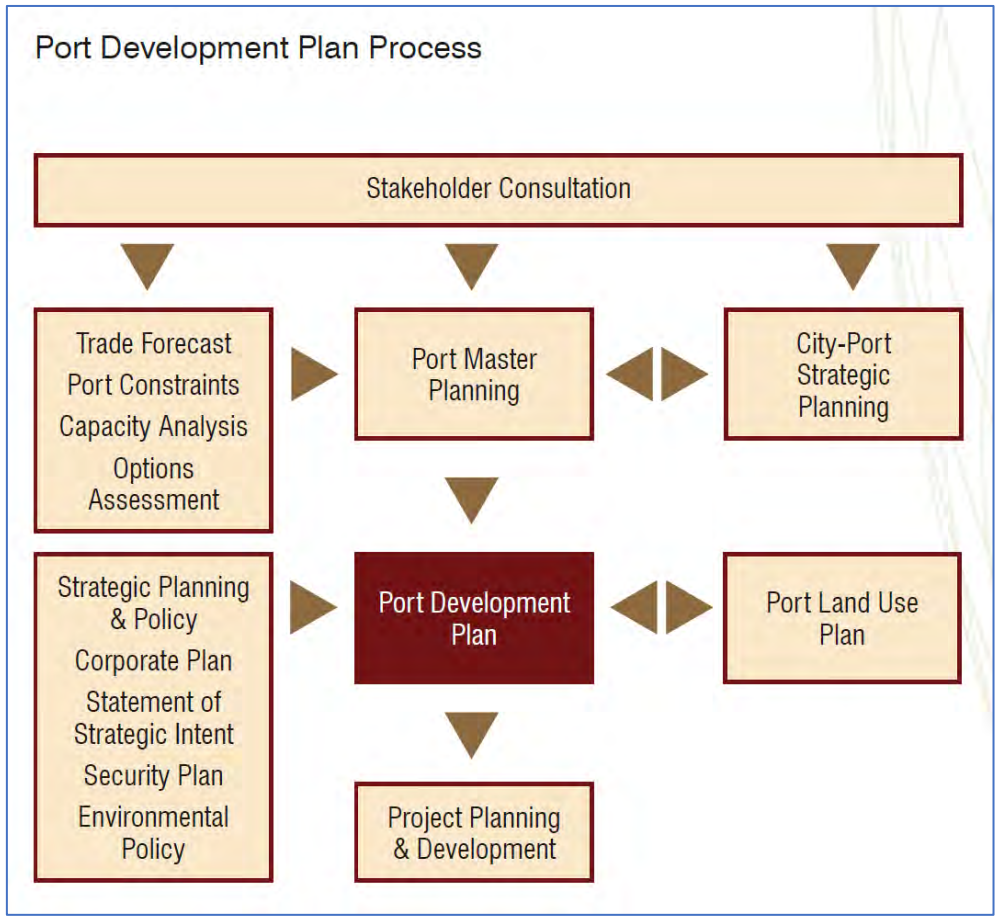
• The port planning process

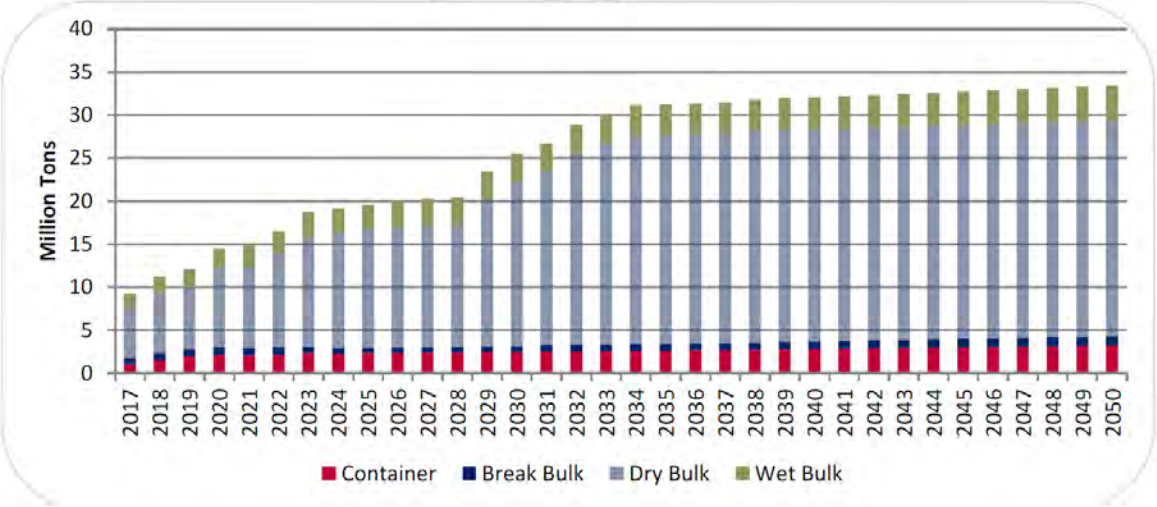


From 2009 Port Development Plan

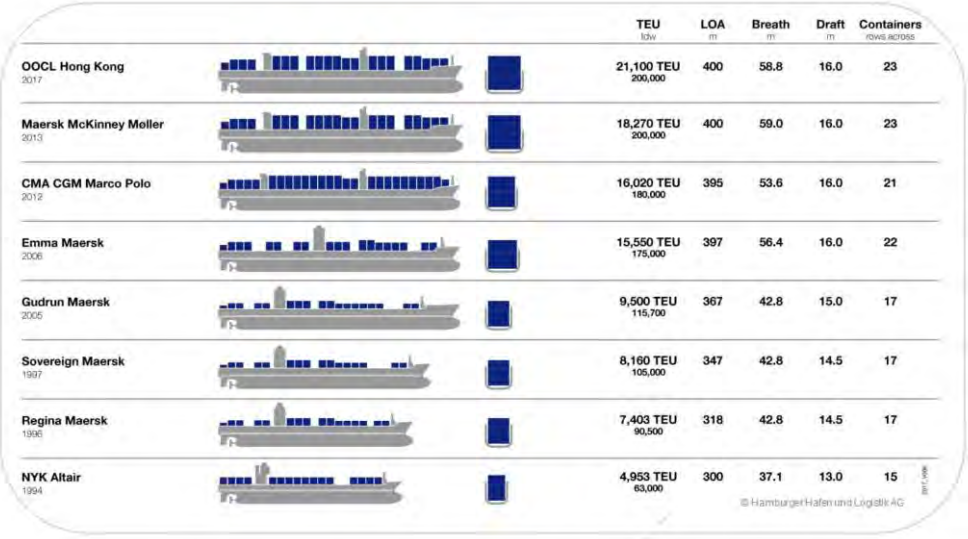
- Many inputs, requirements and stakeholders
- High level of analysis and optimisation required
- High levels of uncertainty on future trades/customers and timing -> plans date rapidly
- **Heavily data driven**

• Trade inputs and forecasts

Forecasts and capacity modelling,



Industry trends,



New trades and customers,

And some that never eventuate.

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• Inputs cont'd

- Environmental modelling and data
- Ship navigation simulations
- Wave modelling
- Flood modelling
- Community requirements
- Corporate goals and ambitions
- Etc…

• Importance of having a good Port development plan

- Allows us to progress environmental approval activities (which can take up to 10 years)
- Supports investment and government funding to Townsville and the region
- Allows us to make decisions on long term business agreements (eg 50-year leases)
- Ensures we build the right infrastructure to meet current and future needs
- Allows us to respond to new opportunities rapidly
- Is an integral part of our Port Vision – demonstrating benefits for our communities

• Example: Wind turbine laydown area

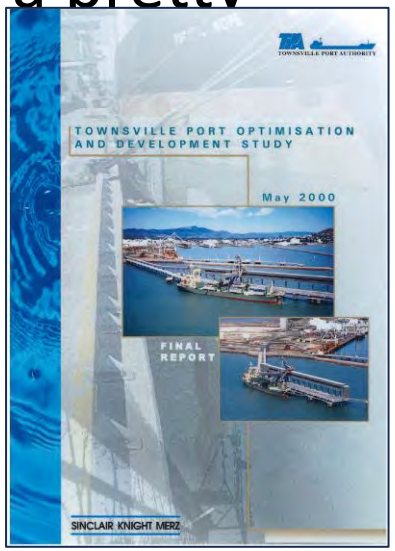
- 18 months to plan and build a 10Ha sealed wind turbine laydown area and access roads with a further 10Ha 12 months later
- 10+ year life
- We want to make sure what we build is useful for future operations and doesn't hamper future development
- Need to consider future roads, services, drainage, rail and other developments

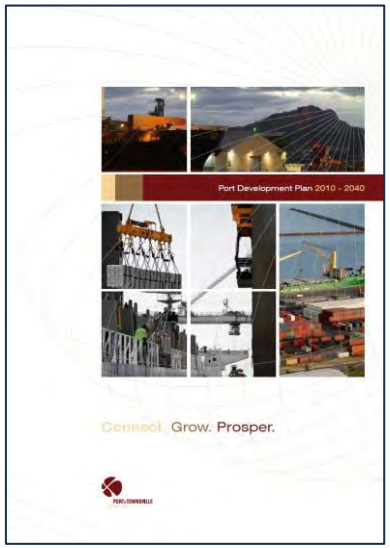
- Traditionally

Analysis and Data driven process that needs to meet complex requirements

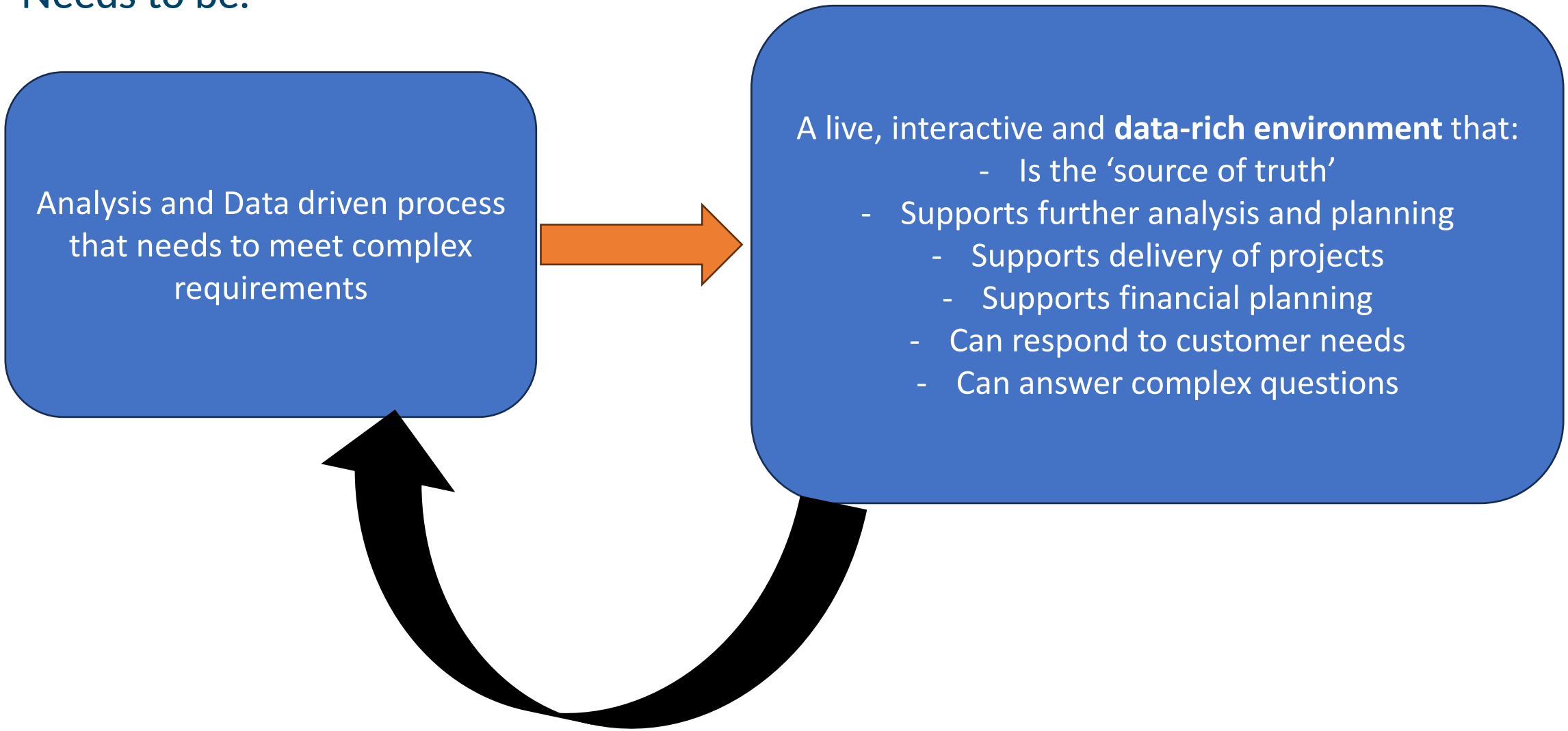
- **High quality, but…**
- **Out of date within 12 months**
- **Expensive and not easily updated**
- **Doesn't provide the level of detail required (where does the stormwater go?)**

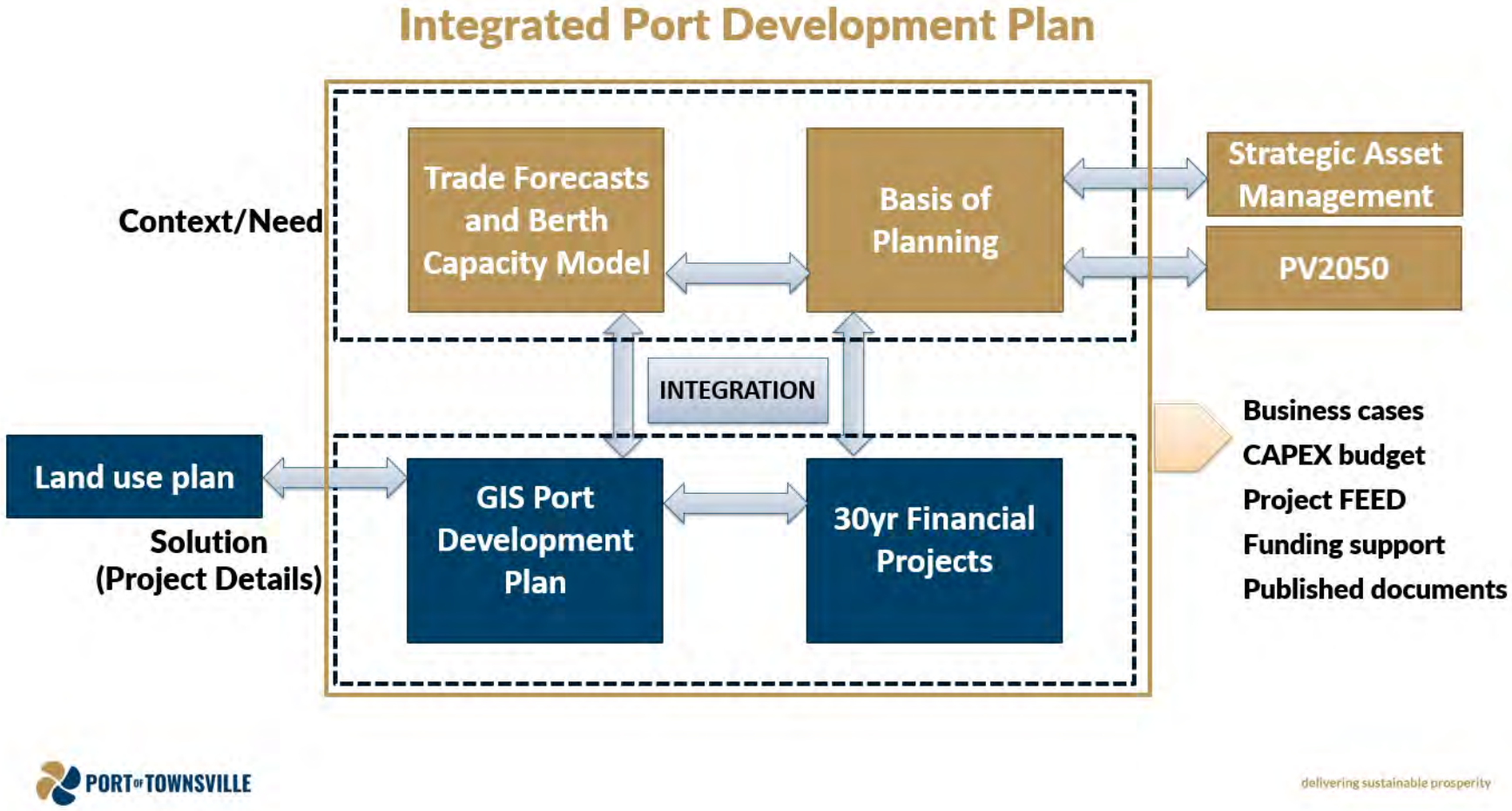
A dense report and a pretty im





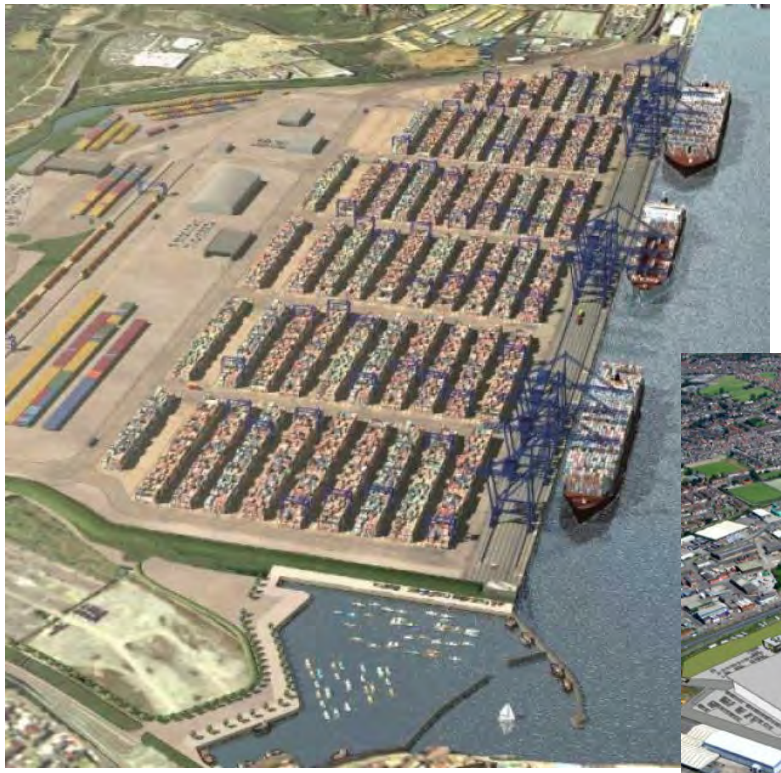
- Needs to be:

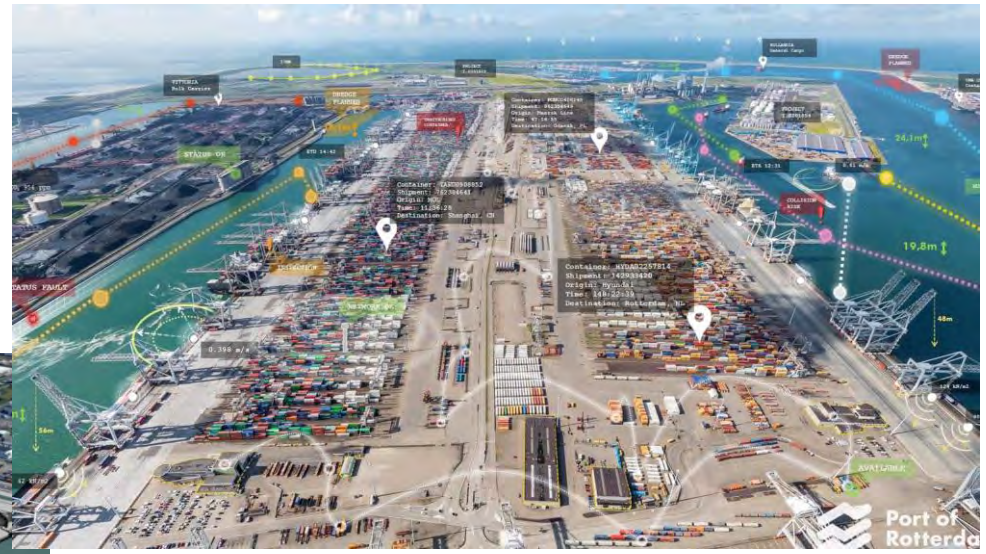

Analysis and Data driven process that needs to meet complex requirements
A live, interactive and **data-rich environment** that:
- Is the 'source of truth'
- Supports further analysis and planning
- Supports delivery of projects
- Supports financial planning
- Can respond to customer needs
- Can answer complex questions



- [POINT2 - Port Development Plans (arcgis.com)]

- Next steps/initiatives
- 3D models of developments and existing assets (underway)
- Data to support modelling in the GIS – eg berth capacity, rail capacity etc
- Digital Twin (asset management and live operational data) is a longer term goal





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