# PRACTICAL CLIMATE CHANGE ADAPTATION SOLUTIONS FOR PORTS

PEEL PORTS GROUP

BRITISH PORTS ASSOCIATION

UKMPG

Maritime UK

## Welcome

-Gary Doyle, Group Harbour Master, Peel Ports Clydeport, Scotland
-Robert Courts, Maritime Minister, UK Government

## Climate change challenges and adaptation experience from the Americas

-Jill Lemke, Manager, Strategic Planning & Special Projects, Maryland Port Administration, USA
-Philip Gibbons, Program Manager, Energy & Sustainability, Port of San Diego, USA
-Gerardo Bessone, Manager of Dredging and Navigational Aids, Management Consortium of the Port of Bahía Blanca, Argentina

## Panel discussion

Short break

## Harbour masters and pilots: at the frontline

-Captain Yoss Leclerc, Chief of Marine Operations, Port of Quebec, Canada; President, International Harbour Masters' Association
-Gary Doyle, Group Harbour Master, Peel Ports, UK
-Captain John Pearn, Maritime Pilot, Milford Haven Port Authority, UK and Vice President, International Maritime Pilots' Association
-Captain Naresh Sewnath, Senior Manager Pilotage & VTS, Transnet National Ports Authority, South Africa

## Panel discussion

# Climate change challenges and adaptation experience from the Americas

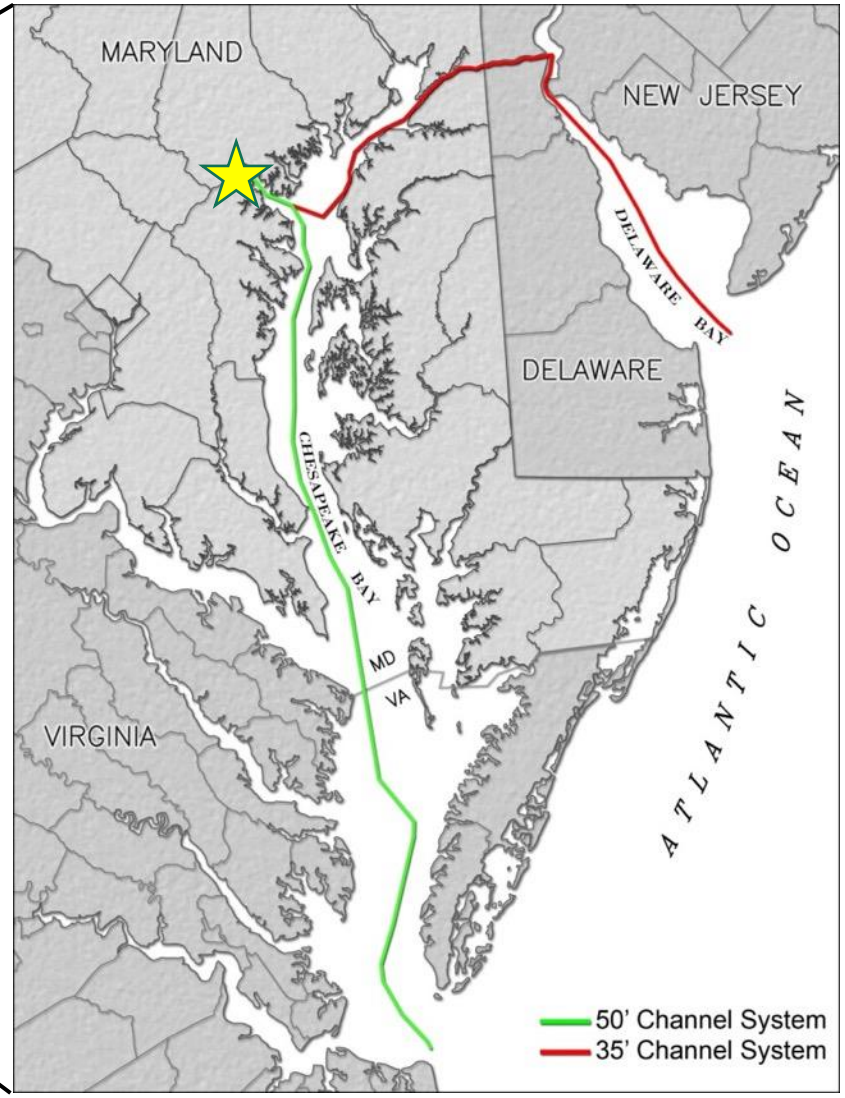
November 2, 2021

Jill Lemke
Maryland Department of Transportation Maryland Port Administration

# Topics to Cover

- MDOT MPA and Port of Baltimore Background
- Climate Change Risks
- Climate Vulnerability Assessment and Resilience Strategy Overview
- Project Implementation Examples'
- Questions

# Baltimore's inland location is part of the Port's success

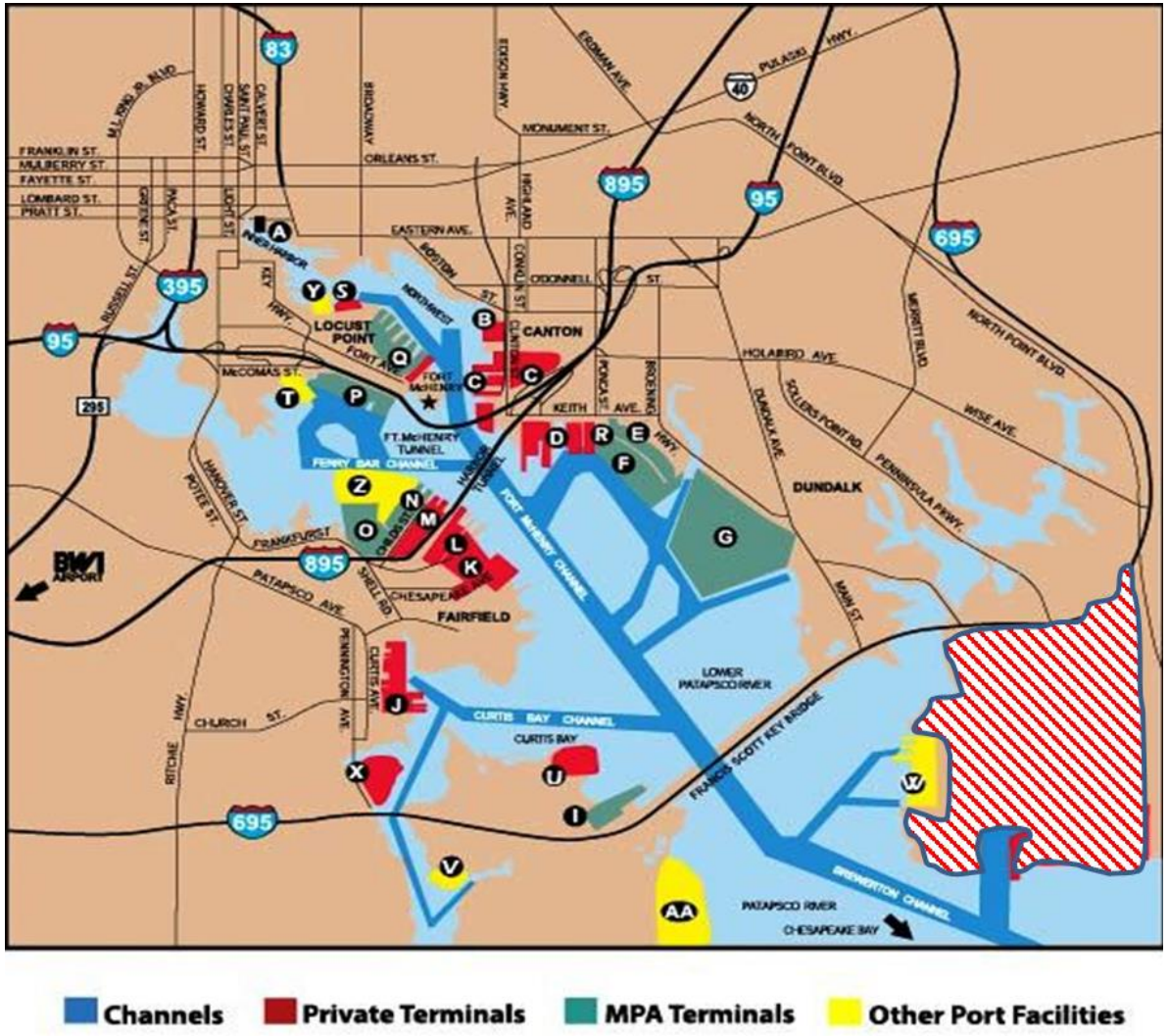



# The Maryland Port Administration's Mission

"To increase the flow of waterborne commerce through the State of Maryland in a manner that provides economic benefit to the citizens of the State."

# The Port of Baltimore is a complex mix of Private and Public terminals

- 45 miles of waterfront facilities and industries
- 23 private facilities handle nearly all bulk commodities
- Six MPA public cargo terminals handle over 90% of the general cargo
- Active relationships by both public & private sector entities on local, regional, state, national and international levels



# The Port of Baltimore handles a diverse range of bulk & general cargoes

**Forest Products**


**Sugar**

**Agriculture, Mining, & Construction Equipment**

**Salt & Fertilizers**

**Containers**

**Coal**


**Autos**

# Marine terminals and other Port assets are vulnerable to a variety of Climate Change risks:

- Sea Level Rise and Storm Surge
- Extreme Rain Events
- Extreme Temperatures
- Increased Sedimentation
- High Winds
- Snow, Ice and Hail Events

# Risk of Flooding from both Sea Level Rise and, Extreme Precipitation Events is our Top Concern

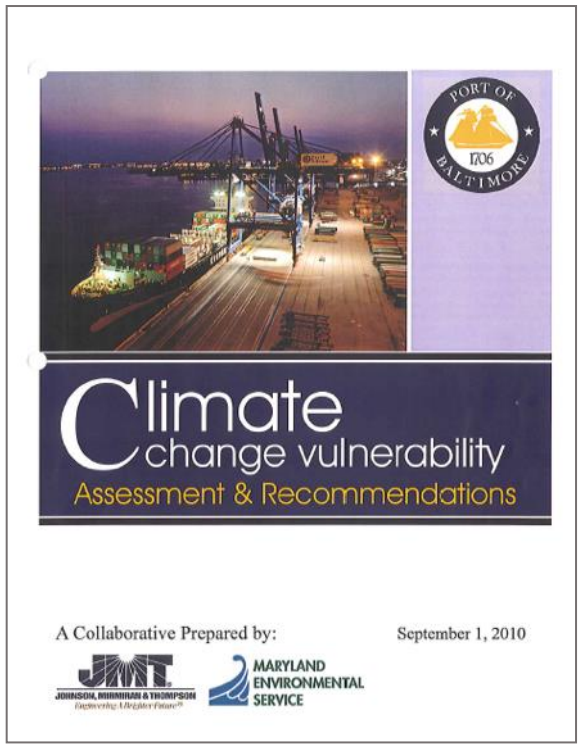
Lessons in Flooding from Hurricane Isabel, Sept. 2003

+7.5’ storm surge with waves - this matched deck heights at many of MPA’s berths.

# Highway and rail access to the terminals are also vulnerable to flooding

**Main road leading to two largest port terminals after a localized extreme rain event.**

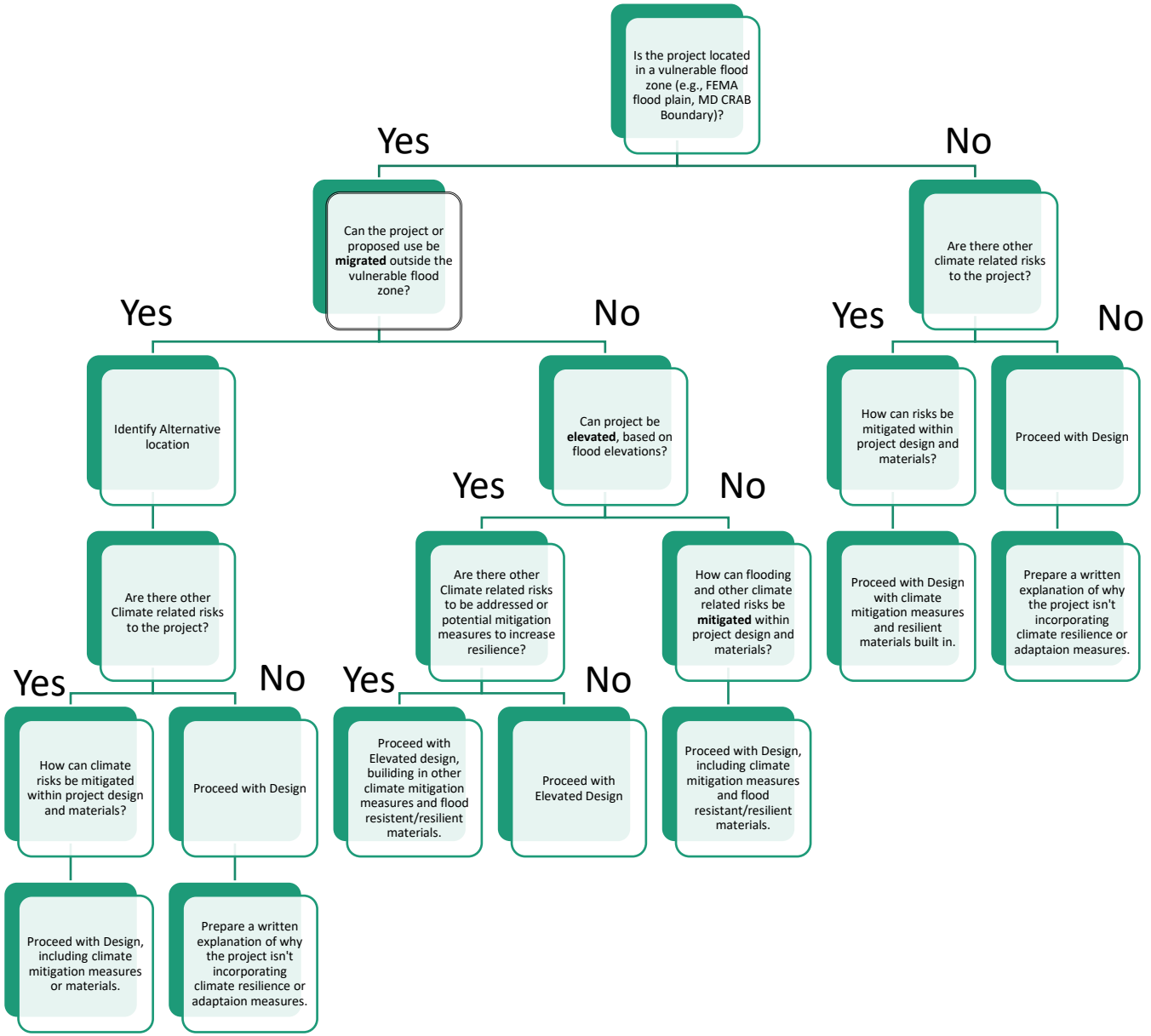
# MDOT MPA Climate Resilience & Adaptation Strategy




Recognizing that port facilities and operations are vulnerable to changing climate conditions, the MPA conducted a vulnerability assessment in 2010, and in 2015 adopted a three-pronged approach to build climate resilience into future capital projects, as follows:

- **MIGRATE:** Move terminal functions out of the flood plain, whenever feasible.
- **ELEVATE:** **D**esign all new MPA facilities or structures that must remain on the terminals to be 2 feet above the 100-year flood elevation, if operationally feasible.
- **MITIGATE:** Reinforce and/or strengthen facilities to limit potential weather damage, whenever significant maintenance or major capital investments are being made.

# MDOT MPA Climate Resilience & Adaptation Strategy




A **Decision Tree** illustrates the strategy and can guide project managers, designers and engineers.

It asks a series of questions about the project, potential climate risks and the feasibility of migrating, elevating and/or mitigating the project and/or its components.

# MDOT MPA Climate Resilience & Adaptation Strategy Implementation Examples

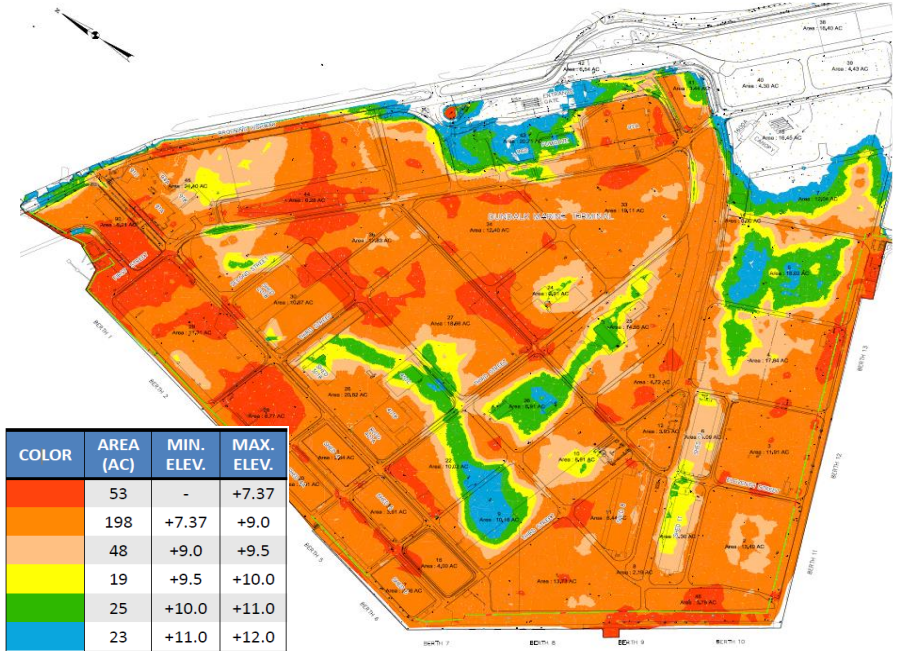
FMT Wet Basin: Large Underground Storm Water Management System,
Jan. 17, 2019, (before being buried).

# MDOT MPA Climate Resilience & Adaptation Strategy Implementation Examples

Elevating portions of the terminal when feasible. This was formerly a Wet Basin at the Fairfield Marine Terminal; during redevelopment, the site was elevated (above stormwater vault/filter infrastructure) for additional resiliency. It has since been leased for auto import/export storage.

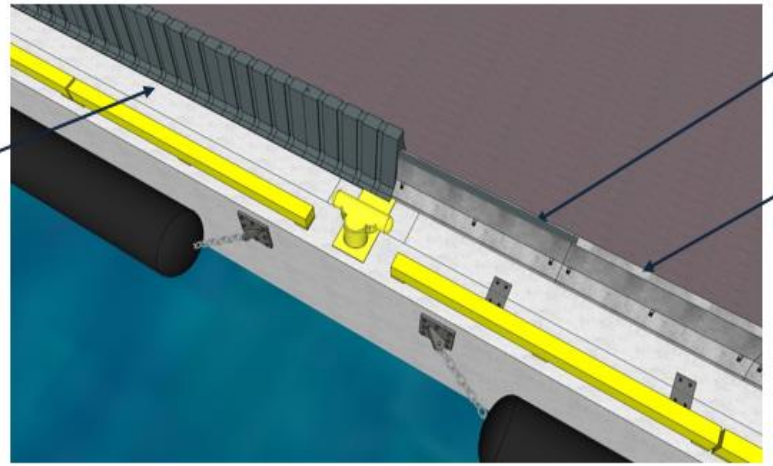
# MDOT MPA Climate Resilience & Adaptation Strategy Implementation Examples

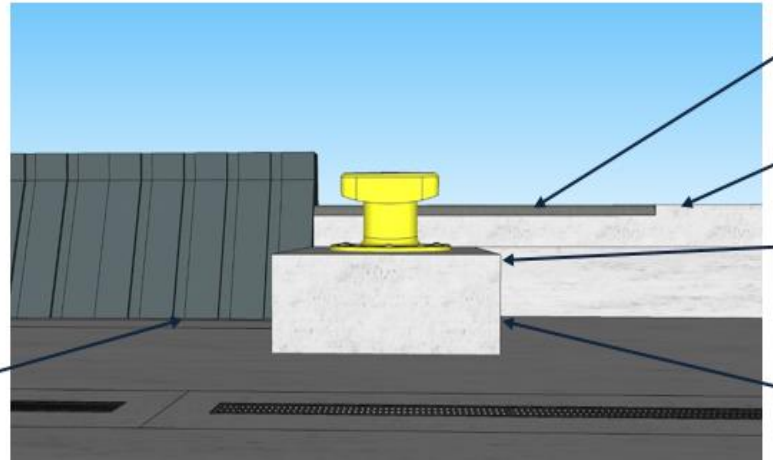
## Proposed Dundalk Marine Terminal Resiliency and Flood Mitigation Improvements



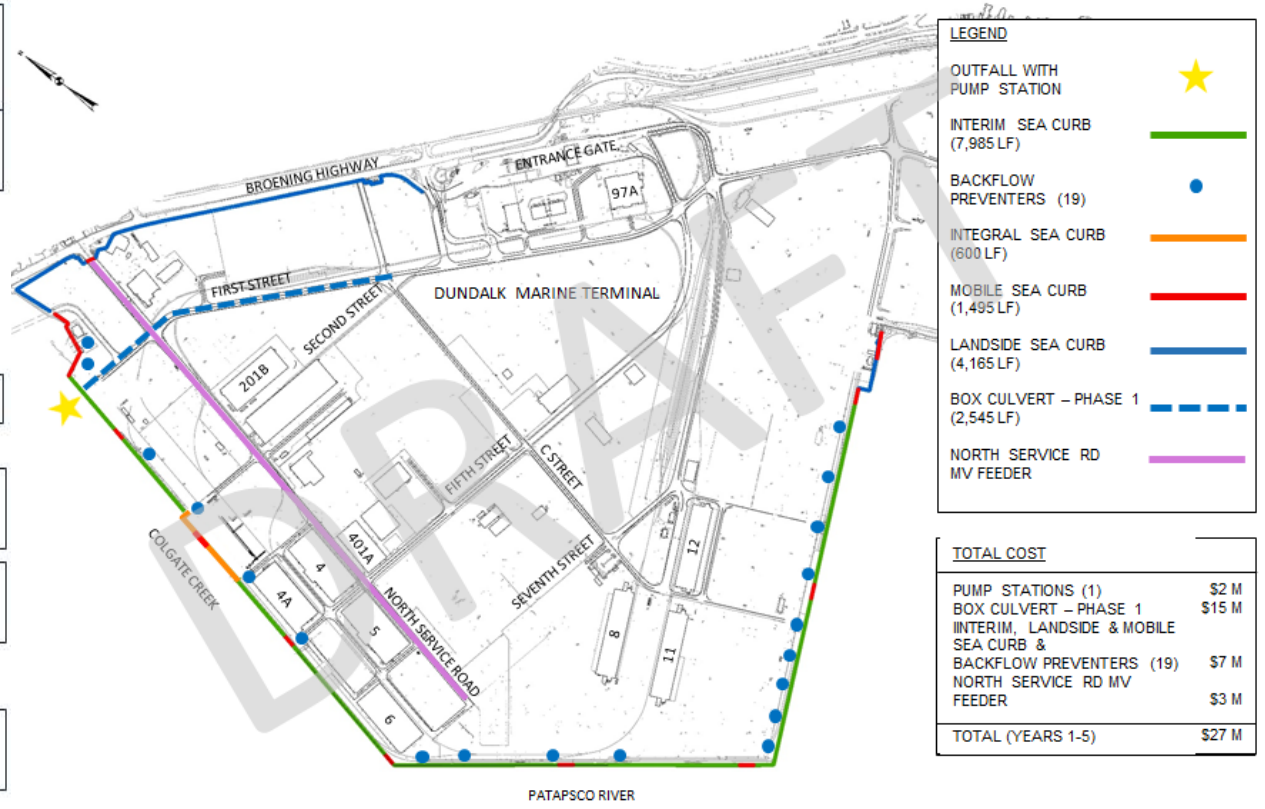
| COLOR | AREA (AC) | MIN. ELEV. | MAX. ELEV. |
|---|---|---|---|
| | 53 | - | +7.37 |
| | 198 | +7.37 | +9.0 |
| | 48 | +9.0 | +9.5 |
| | 19 | +9.5 | +10.0 |
| | 25 | +10.0 | +11.0 |
| | 23 | +11.0 | +12.0 |
| | 95 | +12.0 | - |

# MDOT MPA Climate Resilience & Adaptation Strategy Implementation Examples




## DMT Buildout Years 1-5



# MDOT MPA Climate Resilience & Adaptation Strategy Implementation Examples

Storm Water Vaults (like this one at Dundalk Marine Terminal) are installed when feasible to increase resilience by holding large amounts of storm water to be released back into the harbor, while also filtering nutrients.

# MDOT MPA Climate Resilience & Adaptation Strategy Implementation Examples

**Mitigation Projects also provide Climate adaptation benefits.**

This Shoreline Restoration At the Arlington Echo Outdoor Education Center created 400 feet of new living shoreline with over 5,000 shoreline grasses to help provide habitat and protect from erosion.

# Preparing for Resilience –Policy Considerations and Other Actions

- Prioritizing investments by need, level of risk and potential impact
- Exploring reuse of dredge material for resilience projects (i.e. terminal raising, wetland restoration, shoreline/island restoration)
- Identifying potential resilience partnerships with Federal, State and local partners.  Information sharing partnership through Baltimore-Rotterdam Sister Cities.
- Investigating electric/micro-grid improvements, redundancies, and emergency power generation options to maintain operations and security
- Reducing emissions while growing cargo volumes

# Thank you. Questions?

***Jill Lemke***

***Manager, Strategic Planning & Special Projects***

Certified Port Executive (CPE); Certified Climate Professional (CC-P)

MDOT Maryland Port Administration

e-mail: jlemke@marylandports.com

phone: (410) 385-4445

PORT of SAN DIEGO
Environment

# Adapting to Climate Change at the Port of San Diego

Philip Gibbons, Program Manager—Climate and Resiliency

COP26 International Maritime Hub November 2-3, 2021

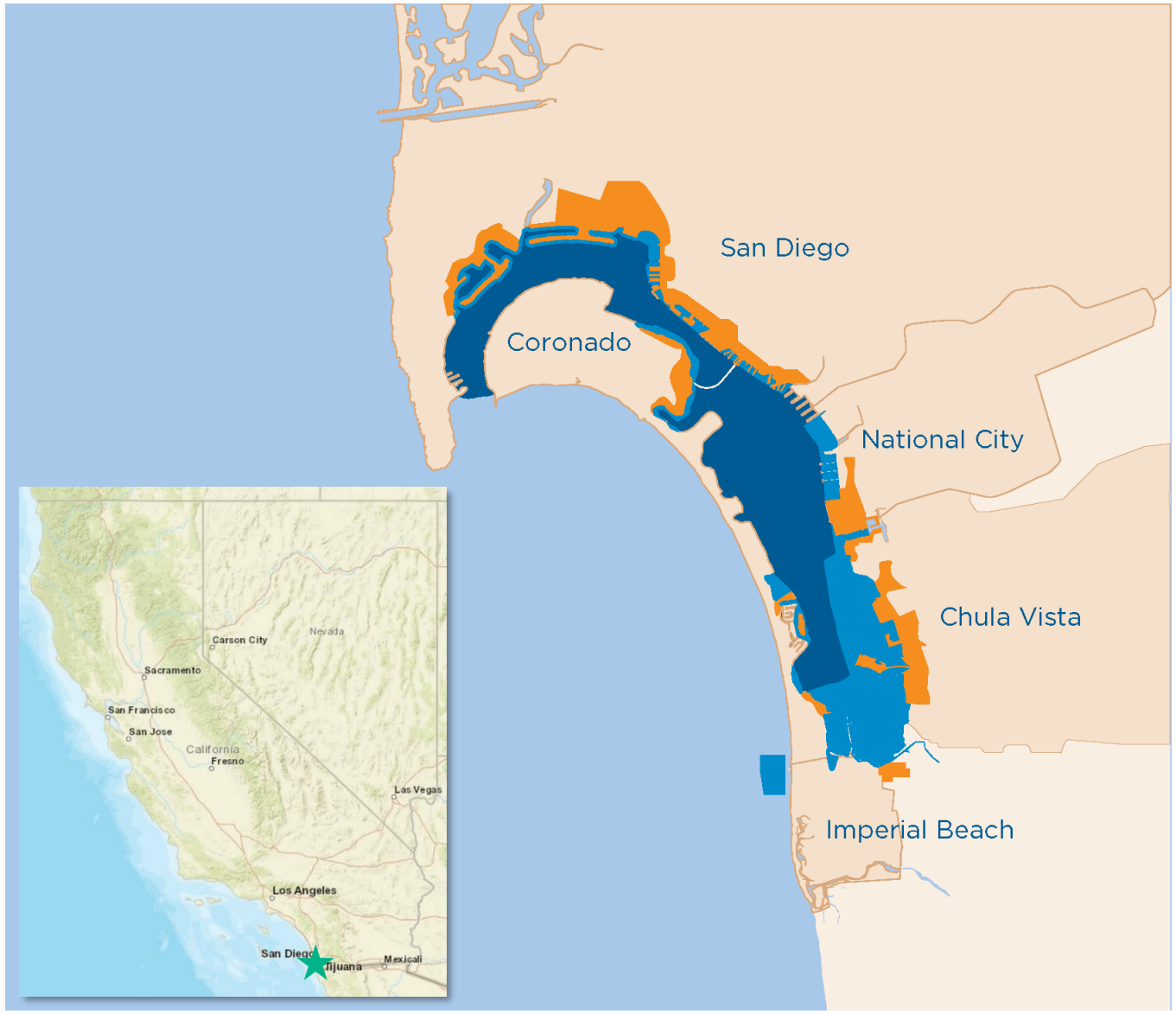
# Port of San Diego

**34**
miles of waterfront

**2,404**
acres of Port Tidelands

**3,677**
acres of submerged Tidelands
prior to January 1, 2020

**3,677**
acres of new submerged Tidelands
after to January 1, 2020



# Administrative Portfolio

Maritime, tourism, recreation, environmental, public safety

**5**
public piers

**4**
terminals


**9**
museums & attractions

**18**
hotels

**74**
restaurants

**22**
parks

**70**
artworks

**80+**
sponsored events

# Climate Change

## Sea Level Rise


## *Physical Risks*

*Risks to physical assets*

## *Transition Risks*

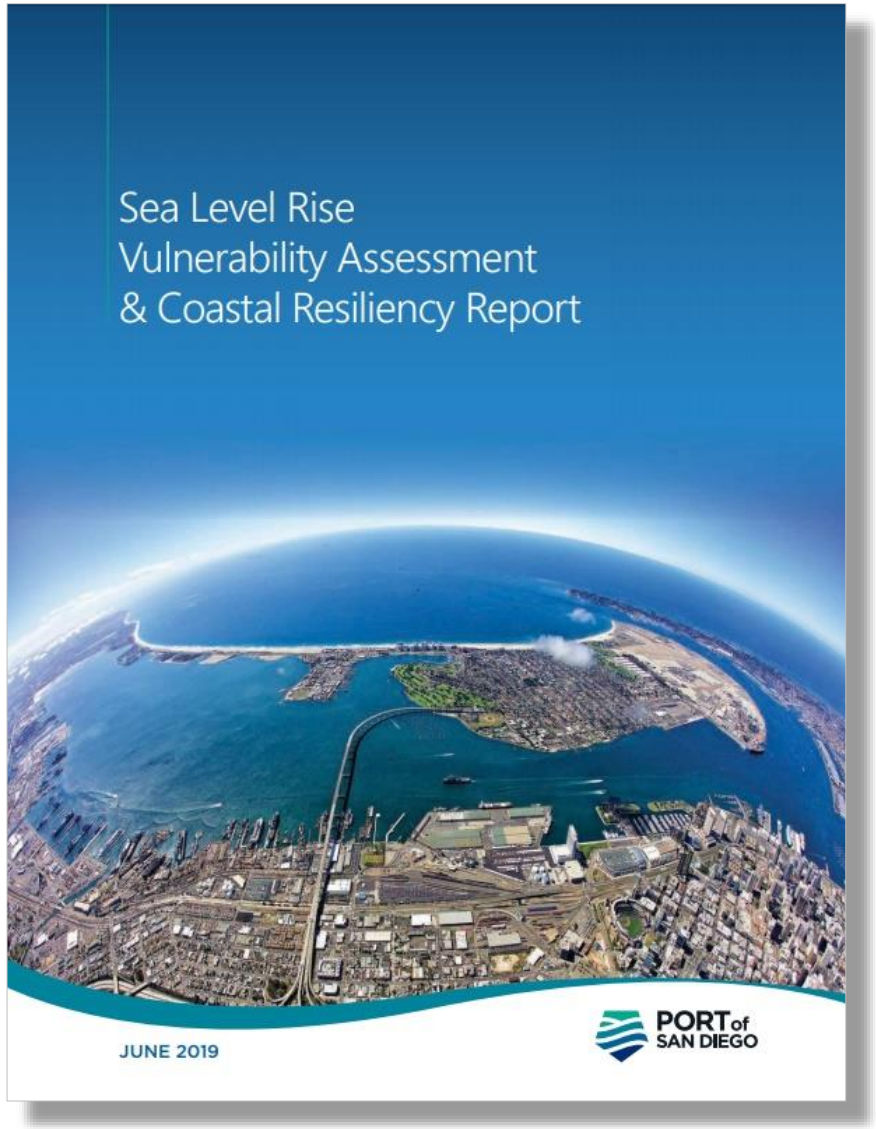
*Risks to a changing regulatory, business, and shoreline environment*

# Vulnerability Assessment

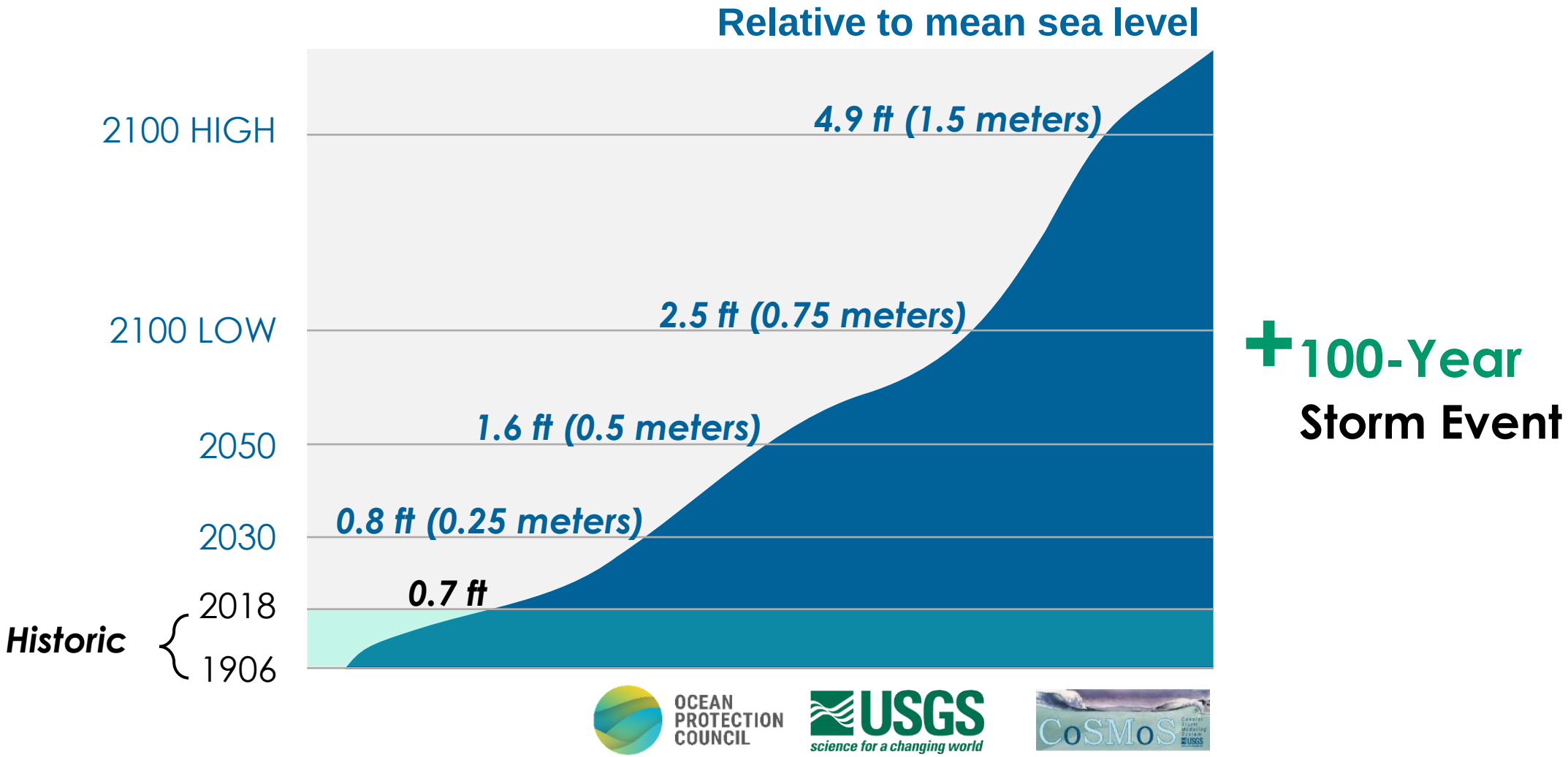
Pursuant to California Assembly Bill 691

Trustees of granted public trust lands

- Submit a description of how trustee proposes to address sea level rise
- Evaluate the impacts of sea level rise: 2030, 2050, and 2100
- Estimate financial impacts
- Collaborate with stakeholders

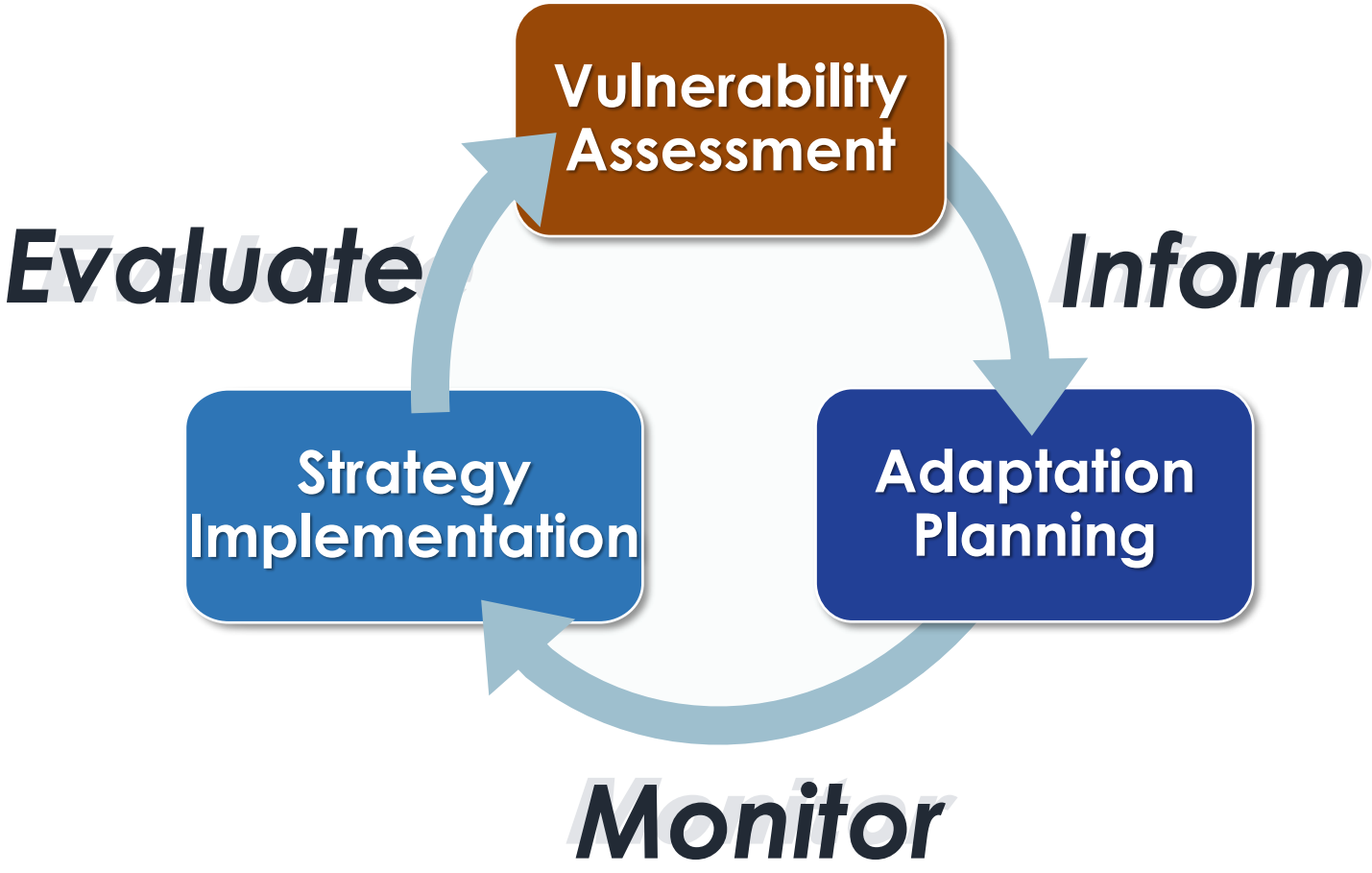


# Sea Level Rise Projections



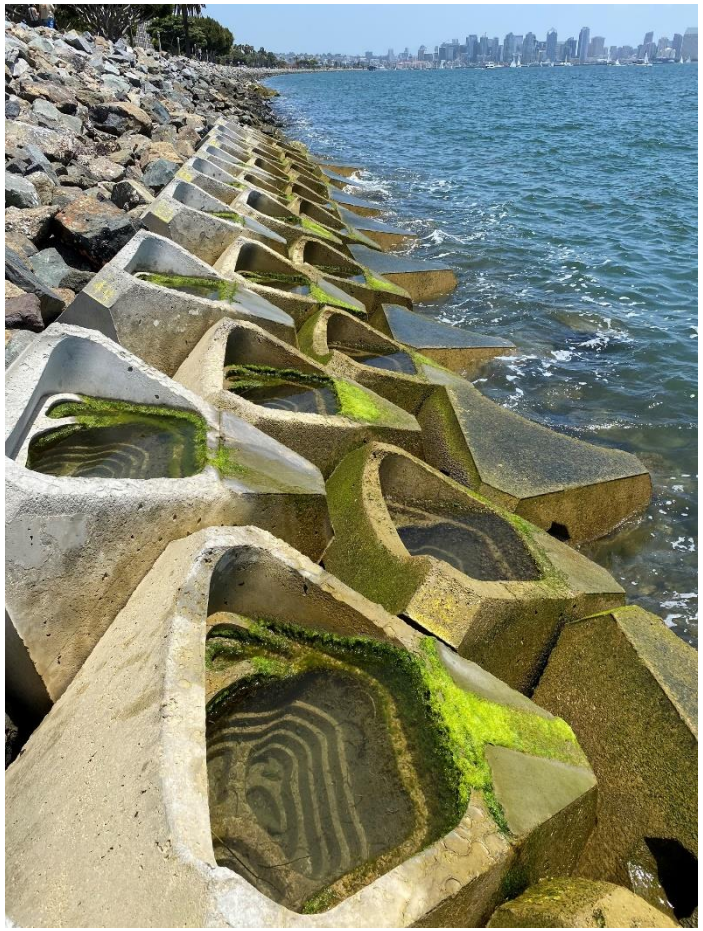
# 2100:
## 1.5-Meter Sea Level Rise

# Adaptive Management Framework



# Nature-Based Shoreline Solutions

## ECOncrete®



# Nature-Based Shoreline Solutions

## Living Shoreline

# Maritime and Waterfront Development

Fender Replacement at the B Street Cruise Ship Terminal


Harbor Park Rendering in Chula Vista

# Lessons Learned

- Stakeholder engagement and partnerships are important
- “Whole-of-Government-Approach” is necessary
- Multiple solutions will be needed
- Utilize existing business practices but recognize that climate adaptation may require a paradigm shift
- Don’t let uncertainty distract you

# Thank you!

Philip Gibbons
Program Manager—Climate and Resiliency
pgibbons@portofsandiego.org

PORT of SAN DIEGO
Waterfront of Opportunity

# Consequences of extreme low waters on the Paraguay-Paraná Waterway on Ports in Argentina

Gerado Bessone

PUERTO BAHÍA BLANCA

COP26 INTERNATIONAL MARITIME HUB

CITY OF GLASGOW COLLEGE · Maritime UK · Decarbonised Maritime

# Paraguay Paraná waterway

One of the world´s longest inland waterway transport network connecting 5 countries: Bolivia, Brazil, Paraguay, Argentina and Uruguay.



>120 millions tons throughput (expo, impo, cabotage) in 2018
(Min. Transporte, BCR)

2.180 km
7´/ 10’ draft
132 km
25´ draft
680 km
34´ draft

PUERTO BAHÍA BLANCA

COP26 INTERNATIONAL MARITIME HUB

# The Waterway in numbers

## Waterway network in the Río de la Plata Basin

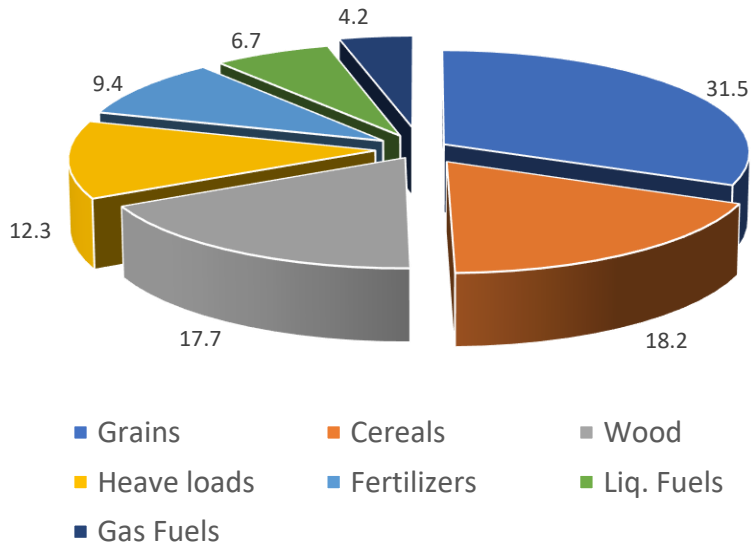
- **Hidrovía Paraguay-Paraná**
  3442 Km
- **Alto Paraná**
  630 Km (shared Ar-Py)
- **Hidrovía Paraná-Tieté**
  1354 Km (Br)
- **Hidrovía Uruguay up to Salto Grande**
  320 Km (shared Ar-Uy)
- **Río de la Plata**
  aprox. 300 Km

# The Waterway in numbers

- Downstream traffic is 4 times greater than upstream
- Over 70 Bn U$D Transported in 2017 (60% of Argentina's export value and almost 80% in volume)
- 82% of solid and 95% of liquids Agri bulk are transported in the PP Waterway
- In 2019 more than 2600 sea going transport vessels used the waterway, in all more than 500 vessels per month.

Source: Ministry of Agriculture and Production, Argentina

Main products transported in the Paraguay-Paraná Waterway



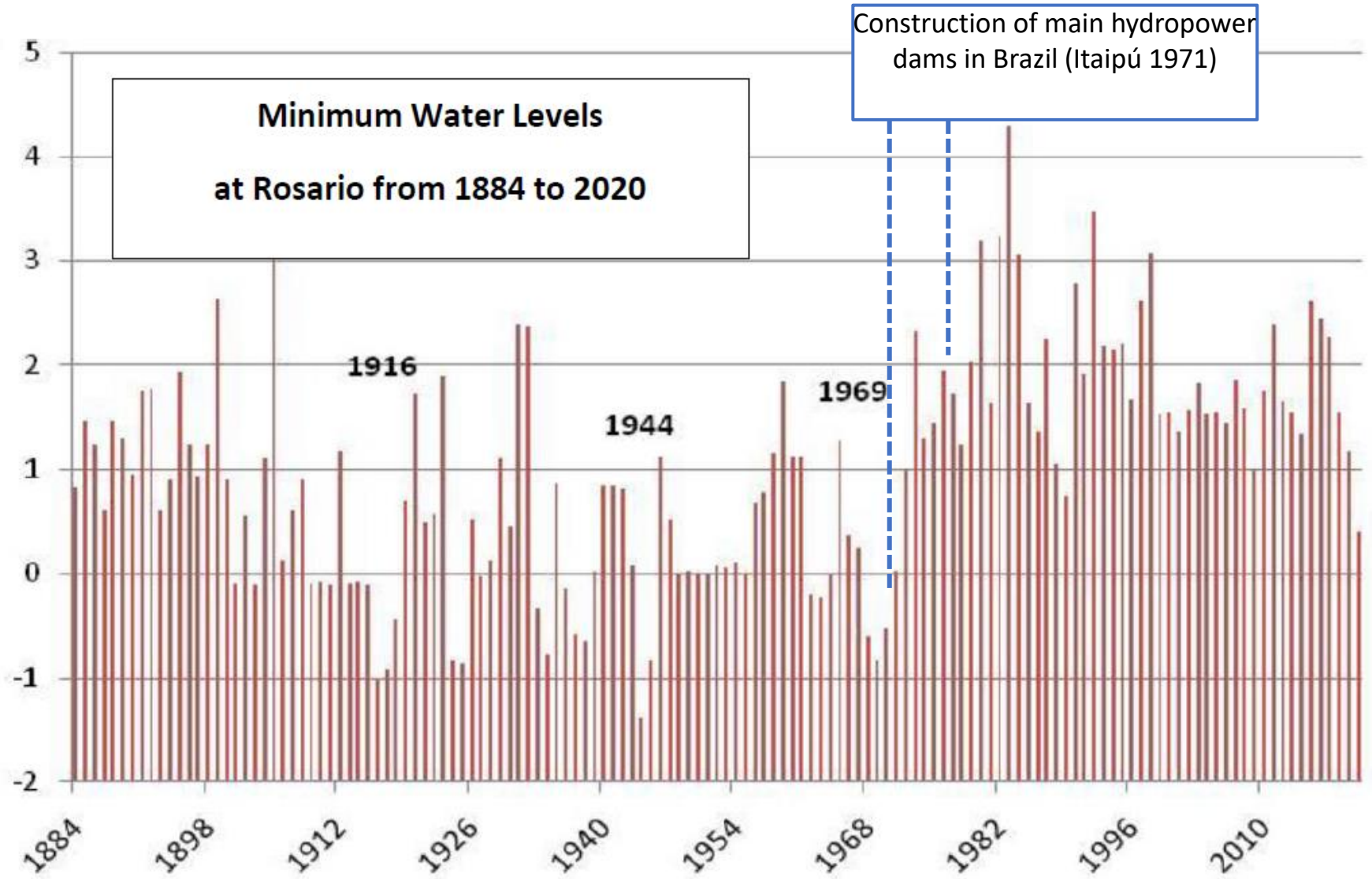
# 2020-2021 Low Waters


**Satellite imagery comparing changes in the waterway**


PUERTO BAHÍA BLANCA

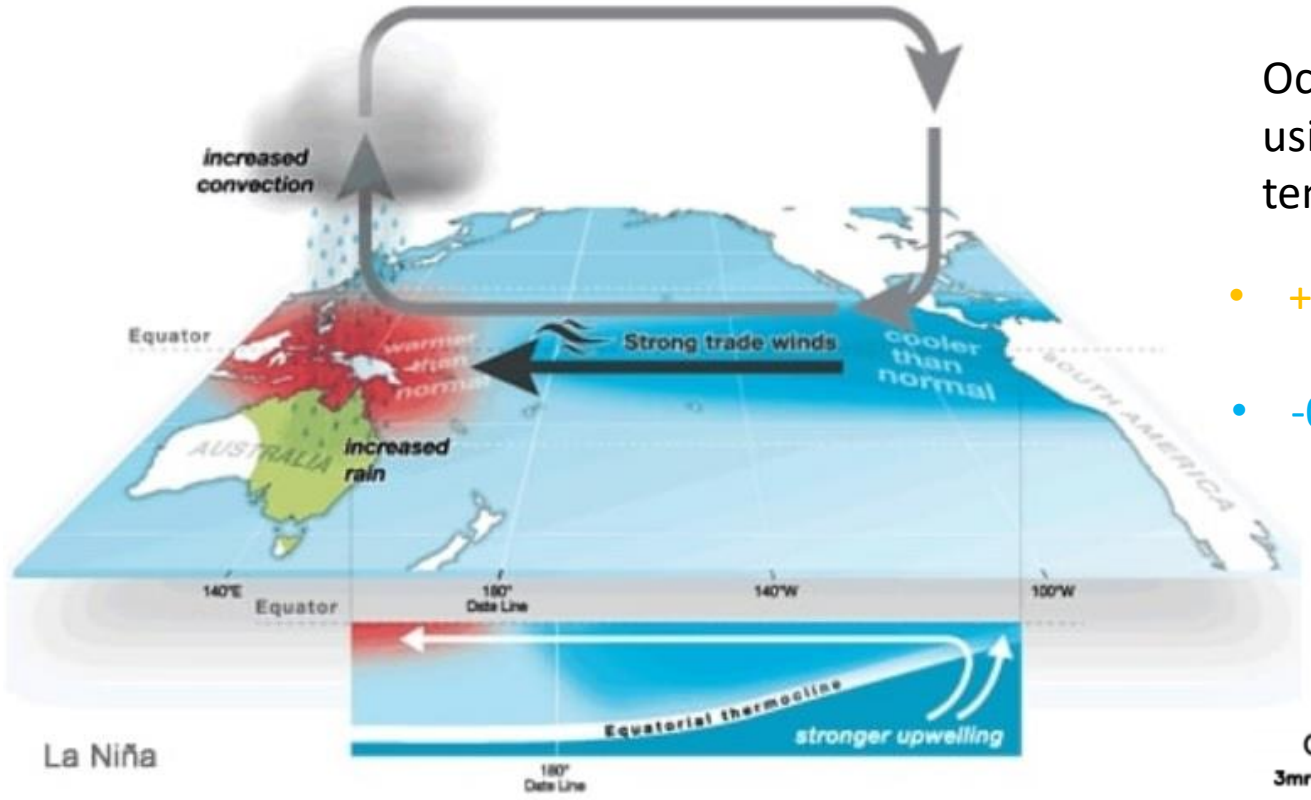
COP26 INTERNATIONAL MARITIME HUB

# Paraná's Water levels in Rosario




Source: INA

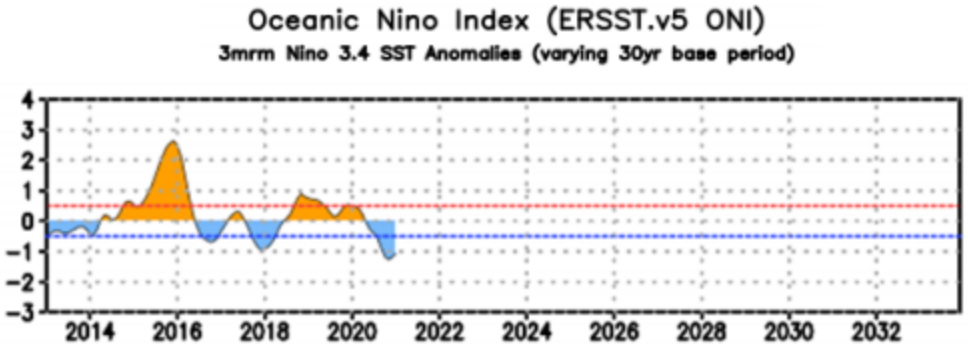
# ENSO – El Niño and La Niña Southern Oscillation



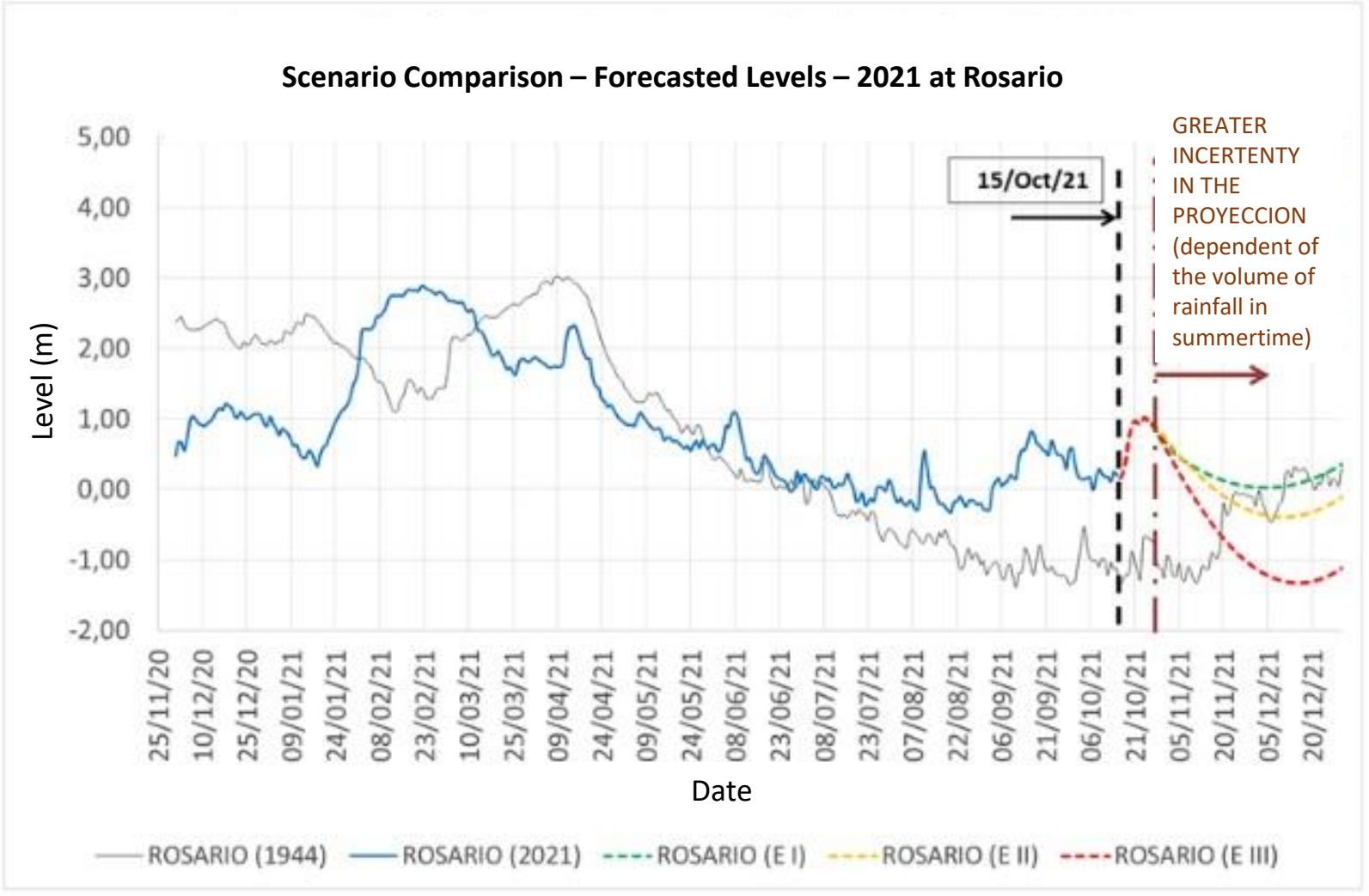

Schematic of a La Niña event. Source: Australian Government BOM.

Oceanic Niño Index (ONI) determined using the three monthly mean temperature in the central region

- +0.5ºC Niño, warmer and humid in SA
- -0.5ºC Niña, colder and dryer in SA



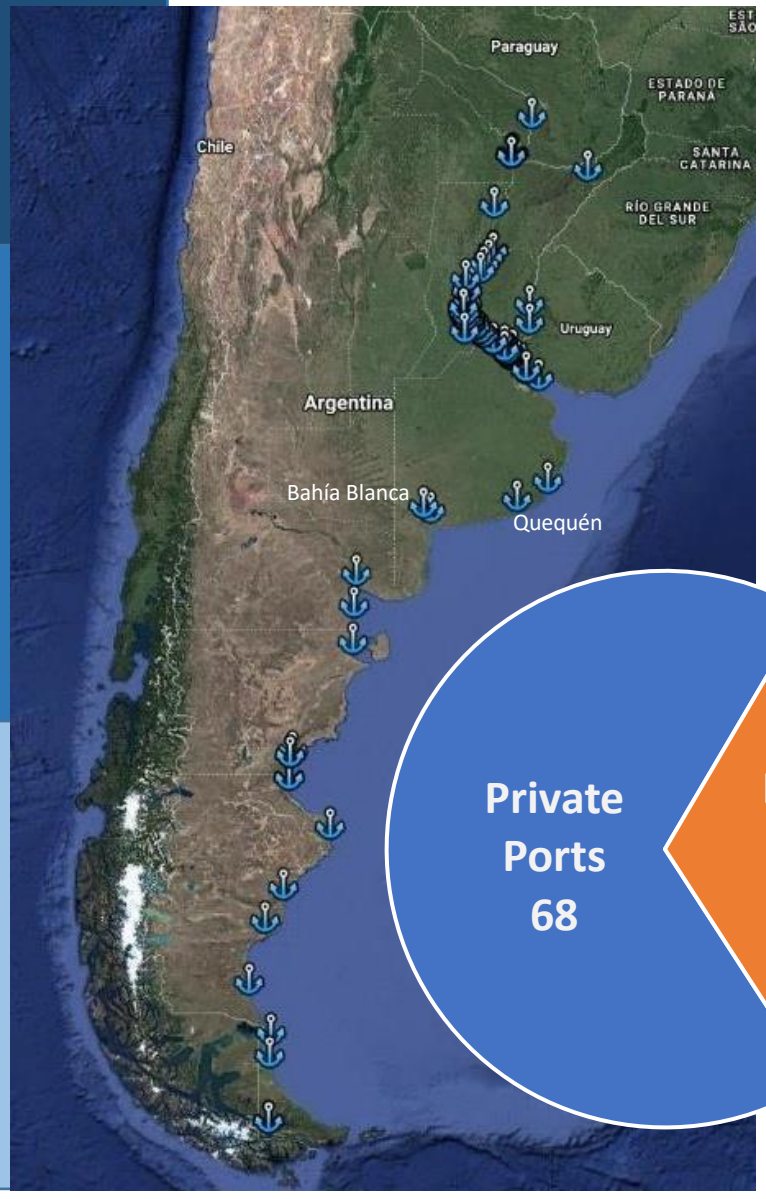
# Levels at Rosario




| Forecasted levels at Rosario | | | | |
|---|---|---|---|---|
| Week | Date | Scenario I | Scenario II | Scenario III |
| 42 | 2021-10-19 | 0.74 | 0.74 | 0.74 |
| 43 | 2021-10-26 | 0.95 | 0.94 | 0.92 |
| 44 | 2021-11-02 | 0.59 | 0.64 | 0.47 |
| 45 | 2021-11-09 | 0.34 | 0.31 | -0.04 |
| 46 | 2021-11-16 | 0.19 | 0.04 | -0.48 |
| 47 | 2021-11-23 | 0.09 | -0.18 | -0.84 |
| 48 | 2021-11-30 | 0.03 | 0.32 | -1.09 |
| 49 | 2021-12-07 | 0.03 | -0.39 | -1.26 |
| 50 | 2021-12-14 | 0.07 | -0.39 | -1.32 |
| 51 | 2021-12-21 | 0.17 | -0.31 | -1.29 |
| 52 | 2021-12-28 | 0.31 | -0.17 | -1.17 |

*Source: INA*

# Argentine Port System



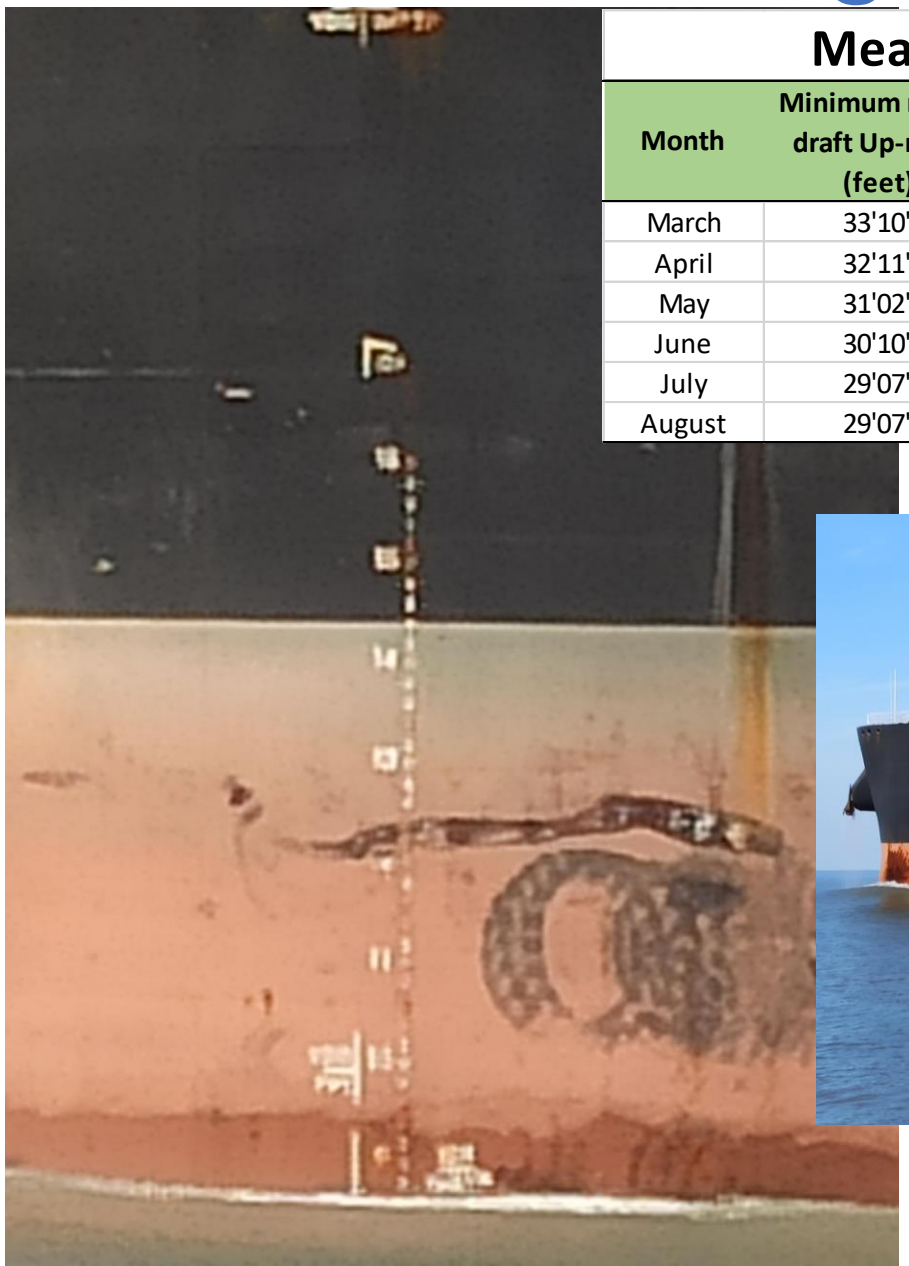

- 101 Registered Ports
- +4.500Km from Iguazu (North) to Ushuaia (South)




- Under normal conditions (34 feet draft) Cereal Bulk Carriers (Panamax) Top Off at Atlantic Ports (Quequén and Bahía Blanca) to 45 feet draft or go to Brazilian Ports

Source: https://www.argentina.gob.ar/puertos-vias-navegables-y-marina-mercante/informacion-portuaria

# Cargo and drafts Upriver



## Mean minimum draft and loss of cargo 2021 at Rosario

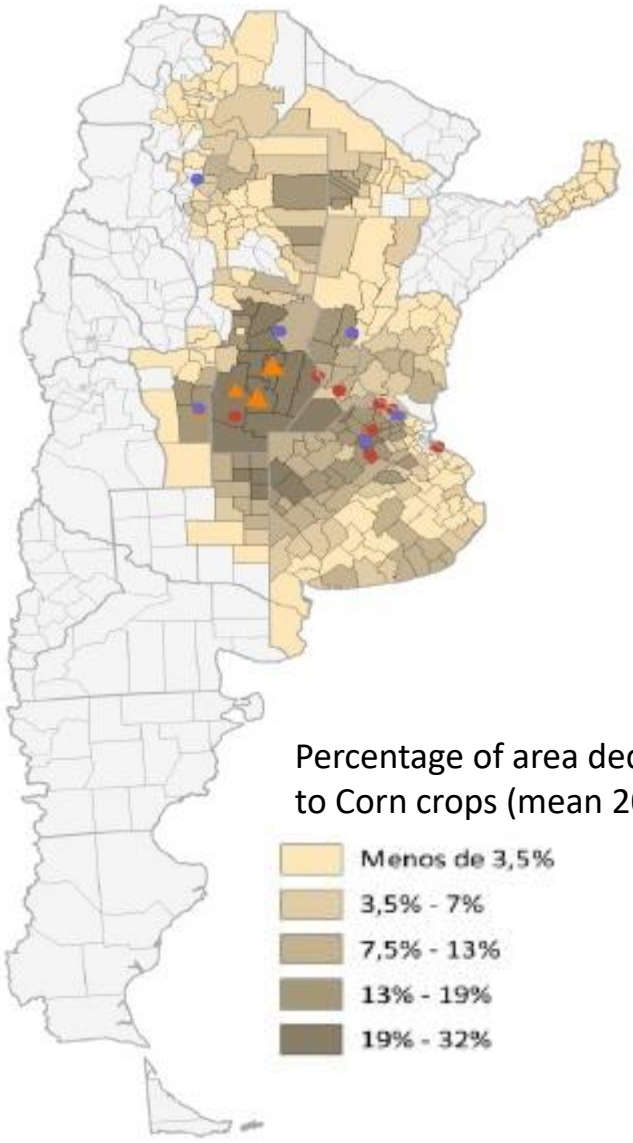
| Month | Minimum mean draft Up-river (feet) | Minimum mean draft Up-river (m) | Draft difference to 34' (10.36m) | Estimaterd loss of cargo according to vessel type (Tn) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Handy 33 K | Small Tanker | Big Tanker | Supramax 56 K | Panamax 75 K |
| March | 33'10" | 10.33 | 0.03 | 200 | 200 | 200 | 200 | 200 |
| April | 32'11" | 10.04 | 0.32 | 1600 | 1600 | 1900 | 1900 | 2200 |
| May | 31'02" | 9.5 | 0.86 | 4200 | 4200 | 4900 | 5100 | 5900 |
| June | 30'10" | 9.41 | 0.95 | 4700 | 4700 | 5500 | 5600 | 6500 |
| July | 29'07" | 9.02 | 1.34 | 6600 | 6600 | 7700 | 7900 | 9200 |
| August | 29'07" | 9.02 | 1.34 | 6600 | 6600 | 7700 | 7900 | 9200 |

*Source: BCRmercado with data provided by NABSA*


**Draft of incoming ships from Upriver to top off at Bahia Blanca, september 2021**

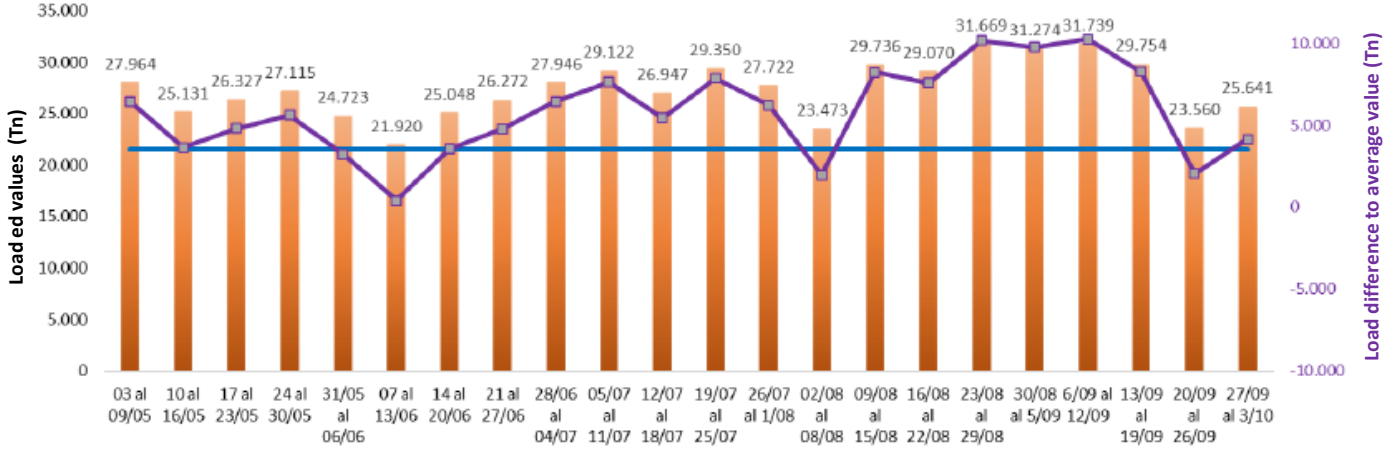
# Cargo shift to Atlantic Ports

## Cereals: Corn




Percentage of area dedicated to Corn crops (mean 2013-2017)

Corn exported from Bahía Blanca Weekly mean Top Off (Tn)




- Mean Top Off volumes increased in 29%
- Record breaking volume for Corn embarked in Bahía Blanca over 5.4 Mill Tn in 9 months (superior to all 2020)

Source: Operations CGPBB

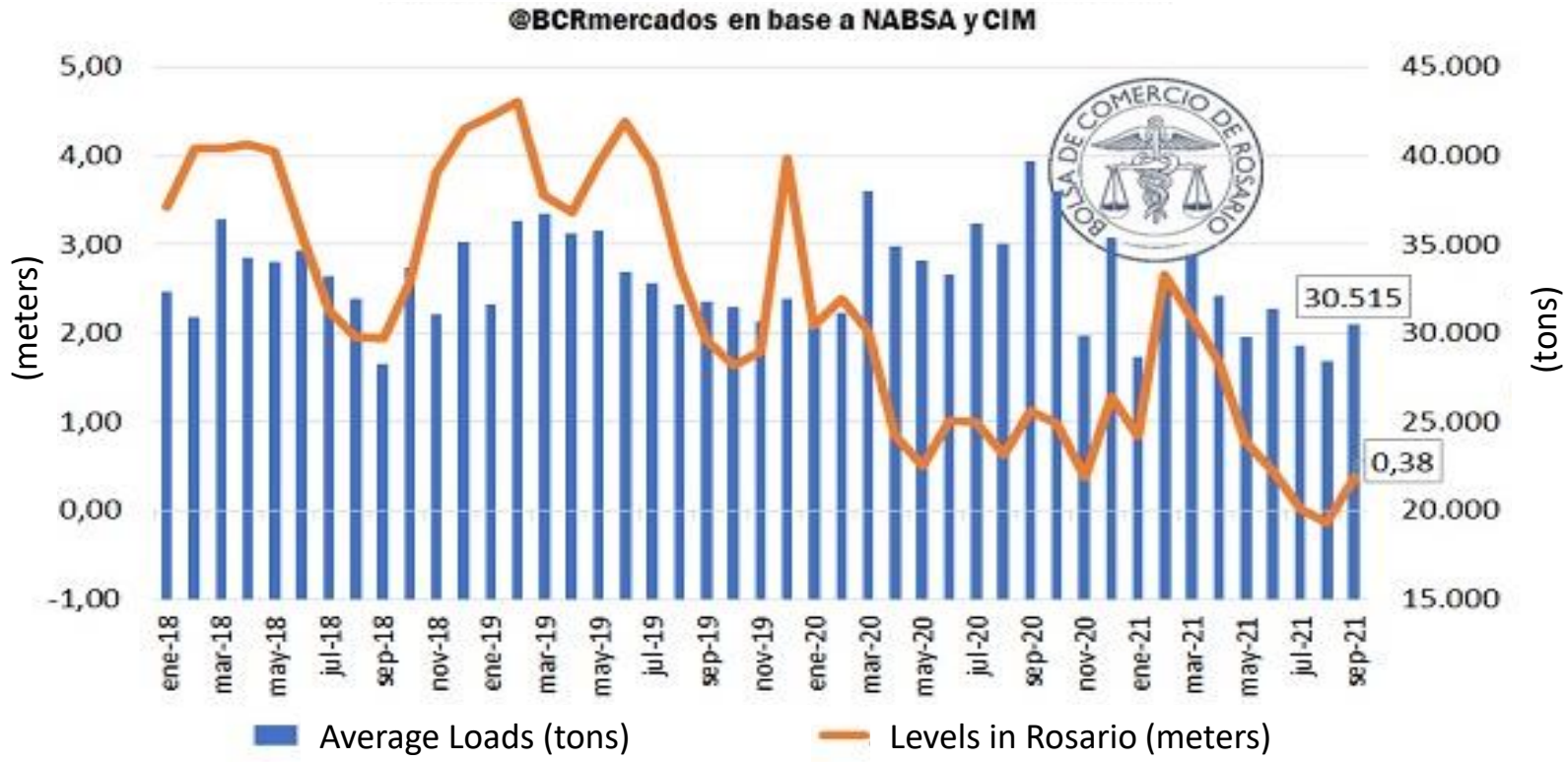
In 2017 the Volumes exported were:

- Rosario Area 19.742.475 Tn (83.2% of the total)
- Bahía Blanca 2.496.598 Tn (10.5% of the total)

Source:SS Agricultura Argentine Government

# Cargo shifts to Atlantic Ports

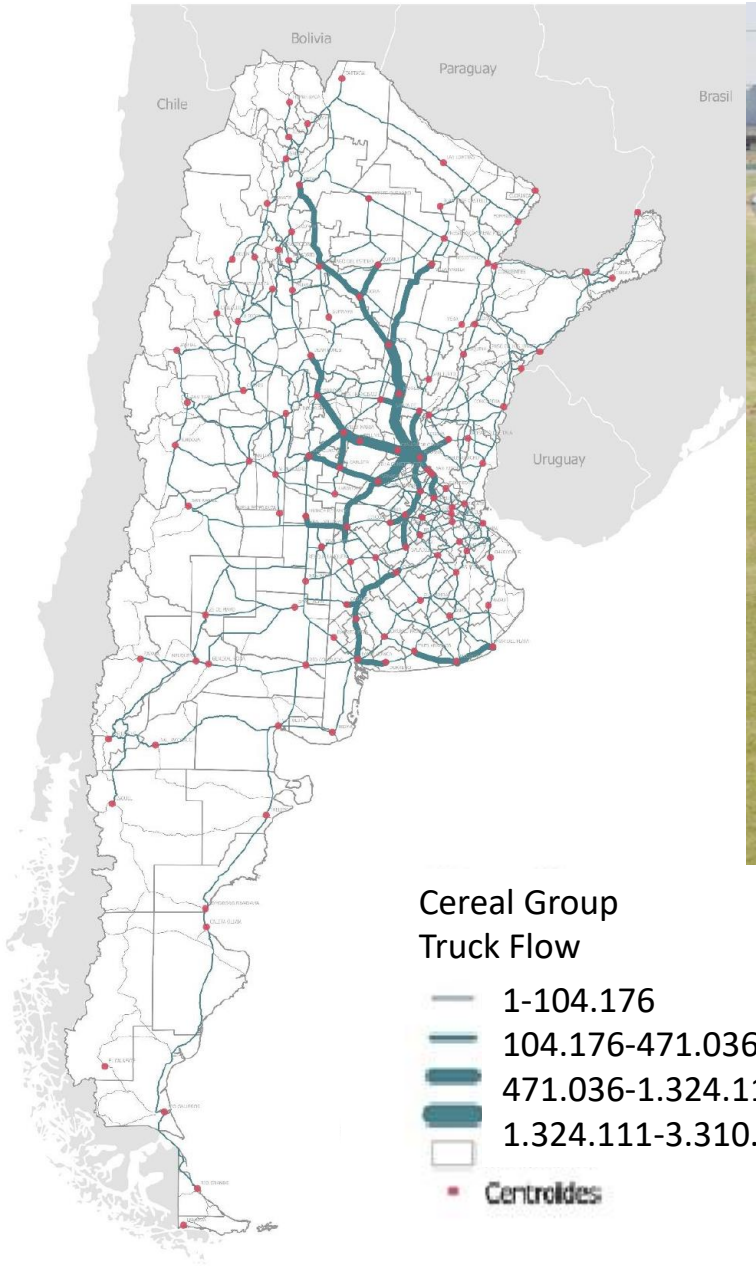
Mean monthly levels and average volumes loaded
in the Waterway for Corn




## In the period August-September 2021

- **Great Rosario saw a three year minimum in average corn loading volume in August**
- **Bahía Blanca and Quequén in the Atlantic coast saw it's historic record with 2.5 M Tn and 2.23 M Tn in each month**

# Intermodal deficiencies




## Deficiencies in land accesses to Ports

- Great Rosario area 2.000.000 trucks/year (up to 14.000 trucks/day)
- Bahía Blanca area 400.000 trucks/year (up to 4.000 trucks/day)

In 2019 93% of all transportation was done by roads

## Railroad accesses to Ports

- Almost all Terminals in the Rosario area have Rail connections, but it only amounts to 15% of the cargo received in 2020.
- Bahía Blanca has outdated infrastructure , but has the highest percentage of cargo received by rail (30 %)

PUERTO BAHÍA BLANCA

COP26 INTERNATIONAL MARITIME HUB

# Intermodal deficiencies

Congestion of trucks near the port accesses causes disruption and tension in neighbouring urban centres. This includes an increase in fatal accidents.
To somewhat improve the situation the Ministry of Transportation has devised (in 2021) a quota system, where only trucks with prior reserve of a slot to unload are allowed to transit to the Ports. It still isn't enough, collapse being common during post harvest periods.

Many roads used to transport cargo to the ports are in a state of great decay.
Overloaded trucks and scarce control contribute to deterioration.
Maintenance and repairs are insufficient to improve the general situation.

## In the period March-July 2021 compared to 2020

- Great Rosario area decreased by 20% in trucks arriving with corn
- Bahía Blanca saw it's arrivals increase by 46%

PUERTO BAHÍA BLANCA

COP26 INTERNATIONAL MARITIME HUB

# Price of corn at different destinations

| Corn price at different destinations. Monthly average | | | |
|---|---|---|---|
| Month | Price at Rosario (Us$ /Tn) | Price at Bahía Blanca (Us$ /Tn) | Average Spread (Us$ /Tn) |
| March | 196.5 | 214 | 17.5 |
| April | 209.2 | 219 | 9.8 |
| May | 227.6 | 235.1 | 7.5 |
| June | 198.8 | 213.7 | 14.9 |
| | | Average spread (Us$/Tn) | 12.4 |
| | Source: BCR with data from C.A.C in Rosario and B.B. | | |

The spread between prices in Rosario and Bahía Blanca is partly due to the availability of the product, and also because of higher transport costs to reach the port.

During greater part of August and September this spread grew until reaching a maximum 38 Us$/Tn (highest value since 2012). By the end of the month it had settled at 18 Us$/Tn.

According to studies carried out by the BCR (Cereal Stock Exchange of Rosario) losses attributed to higher prices due to the low water crisis amounted already to over 350 M Us$, with some stating that until the event ends that value could double.

This represents not only higher cost for export traders, but also that part of the cargo was lost against Brazilian producers, which means a loss for the country.

Studies show* that up to 300 km transport by road is preferable, form 300-800 Km by railroad, and over that distance water bourne.

* (Ministry of agriculture and production, Argentina)

# CONCLUSIONS

Although there is not a unanimous consensus yet as to its relation to Climate Change, Extreme events related to ENOS have resulted in frequent high waters, and since 2020 an unforeseen (in the last +70 years) low water levels in the Paraguay-Parana waterway.

The Paraguay-Parana Waterway is vital to the Argentine economy, a disruption to it has grave consequences to foreign trade. This is partly resolved by moving cargo to the Atlantic ports.

Displacing cargo hundreds of kilometres stresses an already deficient intermodal system. Rail has a minority participation, and road transportation causes grave consequences on infrastructure, albeit higher economic cost and environmental damage through augmented emissions compared to other means of transportation.

# Thank You


COP26
INTERNATIONAL
MARITIME HUB

CITY OF GLASGOW COLLEGE · Maritime UK · Cockspeed Motors

gbessone@puertobahiablanca.com

# PANEL DISCUSSION

# Blue Carbon and Biosecurity

## The HM's Perspective!

**Gary Doyle**
**Group Harbour Master**

# HM's Role – Adaptation planning

**Key areas of consideration:**

- We have always done it that way!
- Navigational safety
  - Navaids
  - Pilotage
  - Berthing
- Impact on Marine infrastructure
  - Berths
  - Storage
  - Run off
- Dredging
  - Dredging material
- Regulatory requirements – environmental protection
- In the UK, major ports are invited to report to Government on the status of their climate change adaptation planning
- Peel Ports Marine Department is in the process of completing Adaptation Reports

*Picture: Callum McFadden PPG*

# Adaptation - Risk assessment

- Mid - and long-term UK projections/scenarios used for sea level, air/water temperature, precipitation, surge, wind, waves, fog, extreme weather
- Risks and vulnerabilities assessed for marine assets, activities, operations
- Amongst the main potential risks identified:
  - Changes in waves, high water levels, etc. affecting operations and maintenance activities (e.g. docks, lock gates, bollards, other infrastructure)
  - Monitoring and communications systems impacted by overtopping, extreme waves
  - Pollution risks from bunkering, waste management
  - Indirect implications for bathymetry (dredging) and biology (marine biosecurity)
- **Presentation will focus on dredging and sediment management and the implications of increased water temperatures for marine biosecurity**

*Picture: Niall Mason PPG*

# Dredging and sediment management

- The challenges/opportunities?
  - Changes in sea level, waves, currents, ‘storminess’
  - Disposal/use of dredged material
- Peel Ports is committed to understanding and implementing ‘beneficial use’ options
  - Mersey Estuary salt marshes – dredged sediment retained in system for distribution by natural processes – salt marshes keep up with sea level rise
  - Project awarded PIANC’s Working with Nature Certificate for sediment management

*Picture: PPG*

# Dredging and sediment management

- Clydeport exploring beneficial use options
  - Protecting and enhancing ecosystems and the services they provide:
    - Resilient intertidal habitats play an important natural flood protection role
    - Blue carbon stocks (sediments and their associated aquatic habitats) play a vital role in sequestering and storing carbon
    - Land support – building usage (infill)
- Peel Ports Marine Team is committed to the support and enhancement of the critical and interrelated natural processes.
  - Benefit for not only climate and nature, but also society and economy
- We have therefore endorsed the SedNet ‘Climate change and sediment management’ pledge being launched here at COP26 next week **https://sednet.org/**

*Picture: Callum McFadden PPG*

# Invasive non-native species (INNS)

- Over the last 50 years INNS have cost global economies over $1trillion
- **Globalisation** coupled with a **changing climate** is facilitating a **shift in tolerance** of non native species.
- Pathways for introduction of INNS:
  - Unregulated ballast water transfer
  - Biofouling (commercial and recreational)
  - Plant equipment
- Risks
  - Navigation
  - Fouling
  - Smothering
  - Reef building
  - Burrowing - structural integrity of embankments
  - Displacement of native species and ecosystem impacts
- **Prevention is better than cure! Appropriate management measures for invasive non-native species are critical**

*Picture: Callum McFadden PPG*

# Biosecurity management

- Education
  - Collaborative approach
    - Work with local groups to inform them of locally present invasive non-native species
    - Steps to reduce the transfer and spread of these species to new regions
- Good practice techniques
  - Regulation and compliance
  - Discipline (simple things – check-clean-dry of clothing and equipment)

*Picture: Callum McFadden PPG*

# Biosecurity - practical management

- Some ideas
  - Peel Ports Group Marine have developed:
    - Vessel hull cleaning guidance
    - Biosecurity risk assessments for small activities and large scale projects
    - Regional workshops to discuss possible management techniques
    - Mapping out known invasive non-native species across the UK and Europe to assess pathways for transfer
- Development of port biosecurity plan
- Removal of debris/unused paraphernalia from water around berths that may act as a stepping stone for INNS
- Challenges – making management practicable in a operating port

*Picture: Callum McFadden PPG*

# What adaptation measures are we taking?

- **The issue**
  - In-water cleaning
  - Cleaning of equipment and plant machinery
- **The answer??**
  - Collect debris and wash water for appropriate disposal (Dry Dock) - practical?
  - Bunded area - wash water collected for appropriate treatment prior to discharge
  - Ballast water management
  - Signage/education
  - Good berth housekeeping

*Picture: Callum McFadden PPG*

# Question for us all – so what?

- Still many uncertainties so new and enhanced **monitoring** is needed to improve understanding of nature and rates of change
- **Maintenance** of assets, equipment, infrastructure is vital to resilience
- **Sediment management**: continue to explore opportunities to protect ecosystems and their services; pledge reflects actions we are already taking
- **Marine biosecurity**: finalisation of biosecurity plans for all our ports: climate change emphasises the importance of implementing these plans
- Other measures:
  - Strengthen **preparedness** for extreme weather: develop flexibility and adaptive capacity; **digitalisation** will help

*Picture: Callum McFadden PPG*

# Thank you!

**Gary Doyle**
**Group Harbour Master**
**Gary.Doyle@PeelPorts.com**

# POTENTIAL IMPACTS OF CLIMATE CHANGE ON PORT OPERATIONS

*INTERNATIONAL MARITIME HUB - COP 26*

*NOVEMBER 02SD, 2021*

*YOSS LECLERC*

# INTERNATIONAL HARBOUR MASTERS ASSOCIATION

- The International Harbour Masters' Association is the professional body for those with responsibility for the safe, secure, efficient and environmentally sound conduct of marine operations in port waters.
- With members in more than 50 countries, the Association brings together Harbour Masters and all those who hold a managerial position in aspects of the control of marine operations within a port.

# HARBOUR MASTER

## ROLE

The position of Harbour Master normally carries statutory requirements and duties as part of the role.

The Harbour Master has a key role to play ensuring that people living and working in or close to the port, the port's staff, customers or visitors to the port environment can go about their business safely.

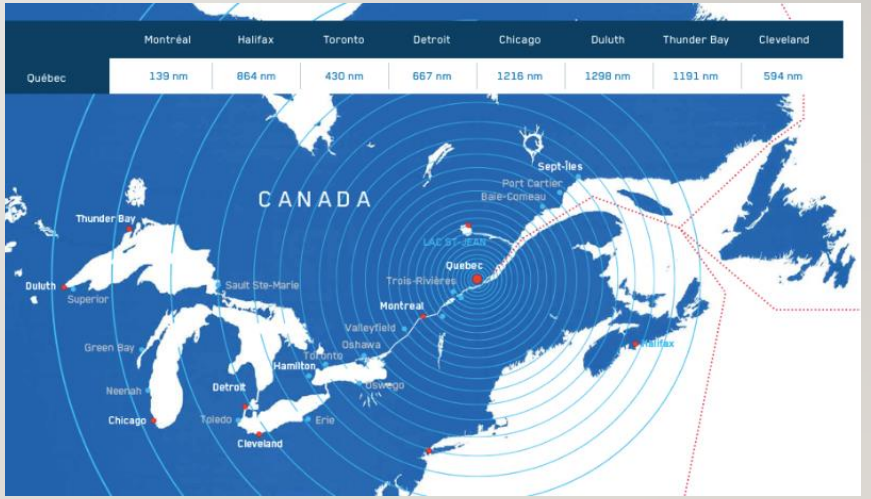
Harbour Masters must be familiar with all relevant safety, environmental and health laws at the international, national and local level.

## KEY AREAS OF RESPONSIBILITY

- Regulation of marine traffic within the Port
- Management of all vessel movements
- Emergency Planning
- Port Security
- Quayside and Terminal management
- Strategic Port Planning
- Safety management
- Business development and support

# CASE STUDY: QUEBEC PORT AUTHORITY

- One of the top 5 Canadian ports
- Largest cruise port along the St-Lawrence River
- The shortest route by sea between Europe and the Great Lakes.
- 27 Million tonnes/ $20 Billion of cargo each year going to or coming from the heart of North America.
- Deep water port (15M at low tide).
- Year-round navigation and all marine services available,
- All terminals are rail connected with CN (One of North America's largest railroad)
- 2nd largest oil refinery in Canada located within the Port's water territory

# CASE STUDY: CONTEXT AND GOALS

- Top 5 Port Authorities in Canada.
- Port sustainability policy.
- Port environmental program (Green marine, etc.)
- Climate changes (Transport Canada 2003 climate modelisation).
- **Identify the climatic and geophysical parameters which affect maritime operations and navigation at the port of Quebec.**
- **Obtain a qualitative assessment of climate change which could cause vulnerabilities for maritime transport and port operations at the port of Quebec.**
- **Propose a direction of interventions consistent with the issues identified during the impact assessment.**

Greenhouse emission reduction directive

ENVIRONMENTAL POLICY

**SUSTAINABLE DEVELOPMENT**

The sustainable development plan that the Port has undertaken transcends borders. This is why we've committed ourselves to a course of action that aligns with the objectives established by the United Nations (via the International Maritime Organization (IMO)), the Worldwide Network of Port Cities, the federal and provincial governments, the Ville de Québec and the Ville de Lévis.

# OPERATIONAL ENVIRONMENT

- The Port and its terminals operate 24/7/365.
- Tides of 4 to 6 meters
- Over 1100 commercial vessels calling every year bridging with 300 ports over 60 countries.
- Deep water port (15M at low tide).
- Summer / Winter water conditions (from +30 to -30 Celsius weather conditions)

https://globalnews.ca › news › quebec-long-harsh-winter

Long, harsh winter with below-normal temperatures in store ...

Sep. 16, 2019 — **Snow** covers the streets of **Montreal** after a **winter** storm, ... road **conditions** deteriorate as southern **Quebec** hit with more **winter** weather.

https://www.ctvnews.ca › canada › extreme-winter-weathe...

'Extreme' winter weather hits Canada | CTV News

Jan. 17, 2019 — As **Quebec** and the **Maritime** provinces brace for an 'intense **winter** storm' this weekend, other regions across the country are facing extreme ...

https://www.theweathernetwork.com › news › article

WINTER 2020-21: A season of extremes across Canada - The ...

Feb. 24, 2021 — While we have already seen historic early **winter weather**, very warm **weather** ... The focus of the **severe** cold will be across Western Canada, ...

# METHODOLOGY

- The review of the literature makes it possible to sketch the climatic and geophysical parameters with regard to their influence on maritime and port operations.
- Identification of the main port components likely to be affected by climate change (Delphi Methodology).
- Analysis of observed and projected climate changes that could have an impact on port activities.
- Quantification of the risks associated with each interaction between the main port components and climatic variables, according to various performance criteria.
- Recommendations.

# SOME RESULTS

- Operational adaptation:
  - Review of operational practices and procedures safety, security, environmental protection).
  - Port planning (infrastructure, snow removal storage capacity, etc.).
  - Extreme weather condition (H&S).
- HR adaptation:
  - Extreme weather conditions ( equipment and resources).
  - Working schedule (events frequency) + administrative (overtime, etc.).
  - Training and exercises.

# LESSONS LEARNED

- Raising awareness and understanding.
- Data availability (KPI utilization) and reliability (qualitative versus quantitative).
- Goals and expectations.
- Experts, professionals and works shops.
- Program Management.

# LESSONS LEARNED

- Study in line with other reports:
  - Situational awareness. CC matters need to be part of port strategic planning.
  - The potential impacts on water levels on the St. Lawrence and the impacts and constraints that this represents on the dredging of navigation channels.
  - The relative contribution of marine transportation on GES and trend towards new energies (fuels).

# END

Contact: Mme Sabrina Delelis

T +44 (0)1737 201482
E secretary.ihma@harbourmaster.org
W www.harbourmaster.org

International Harbour Masters Association

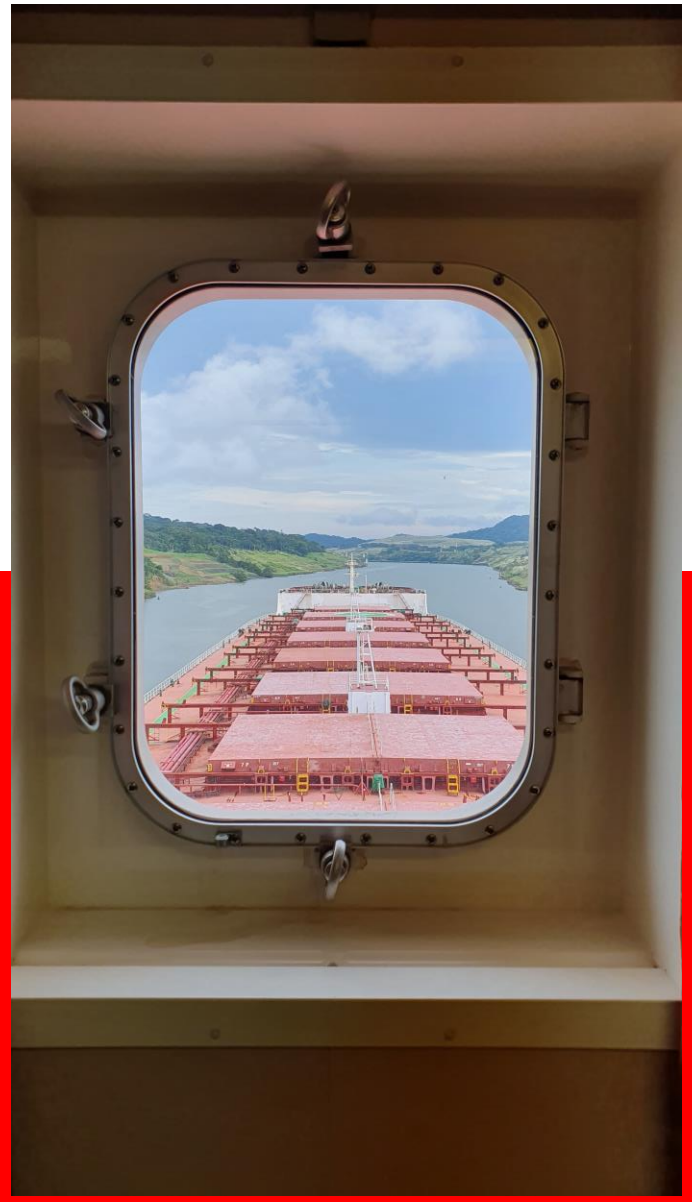
# Concerns about Climate Change
# A Pilotage Perspective

# Areas of Concern

- Increased Frequency of Poor Weather
- Drought
- Rising Sea Levels
- Rising Temperatures
- New Propulsion Systems

# Increased Frequency of Poor Weather

# Drought

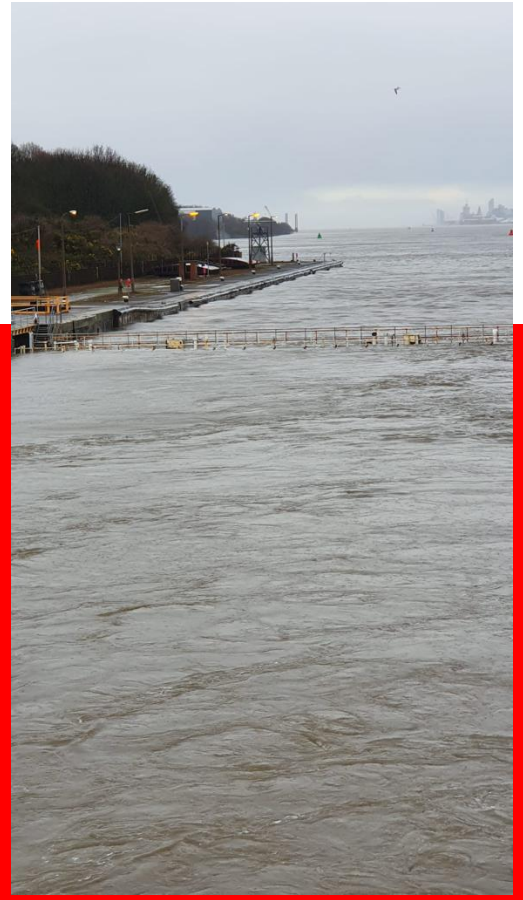


12th May 2011 China’s Yangtze river closed to ships by severe drought

8th August 2015 Panama Canal: Ships asked to carry less cargo after drought depletes water levels

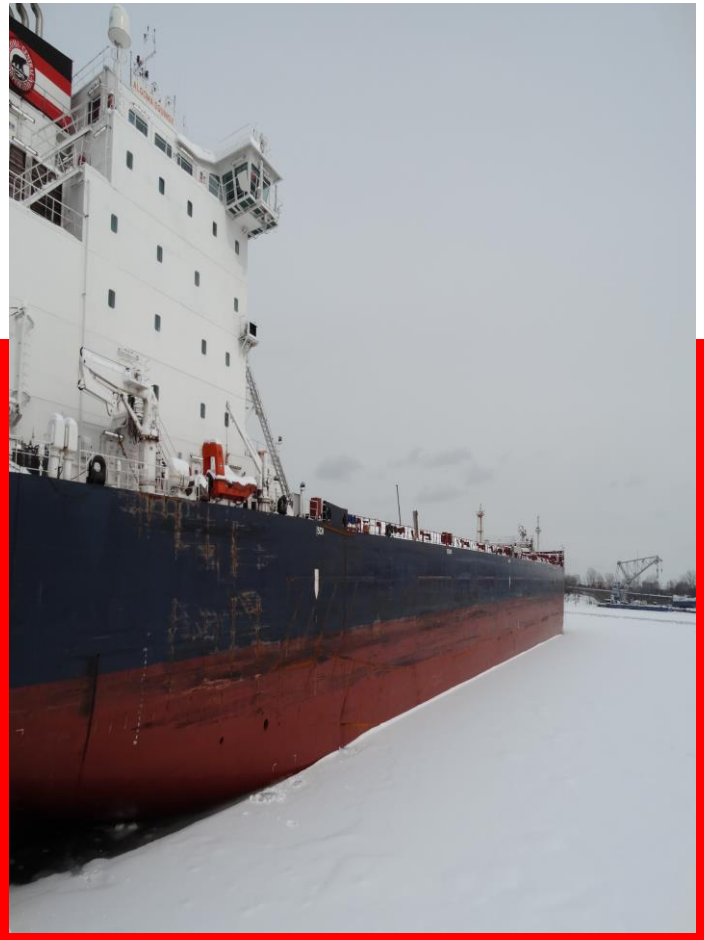
1st September 2021 South America's drought-hit Paraná river at 77-year low

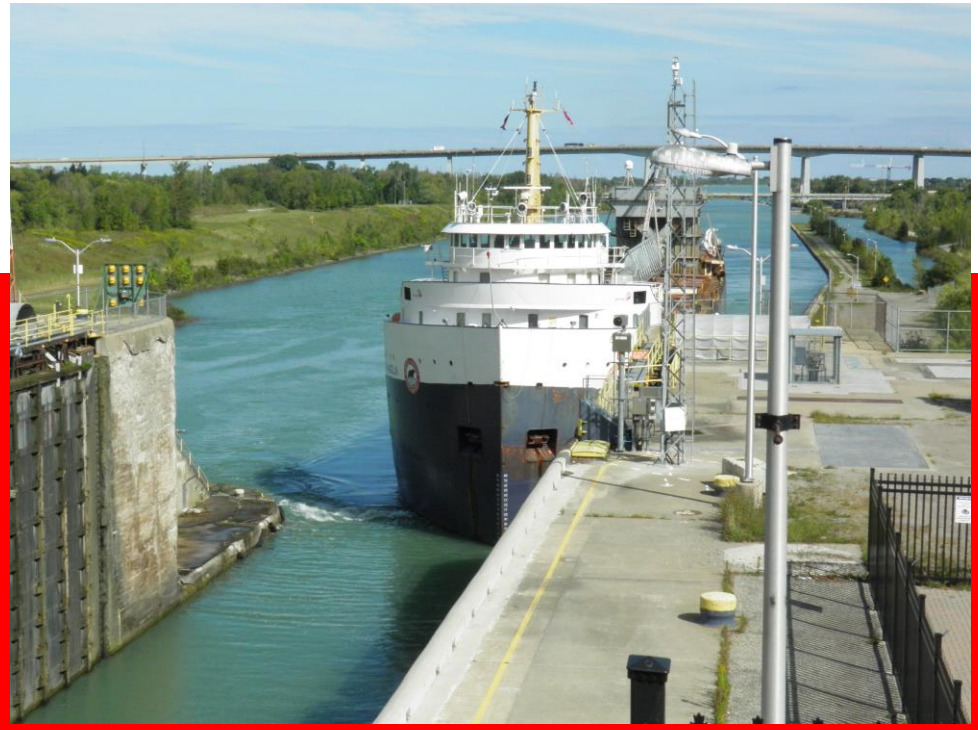
# Rising Sea Levels




shitty cruise
but great buffet

# Rising Temperatures





# New Propulsion Systems

- Eco Friendly Fuels




- Sail assisted vessels


# Planning For Climate Change

## Sustainable Development


# Thank You


# CLIMATE CHANGE EFFECTS: ADVERSE WEATHER MITIGATIONS & ADAPTATIONS

Presentation to:

COP 26

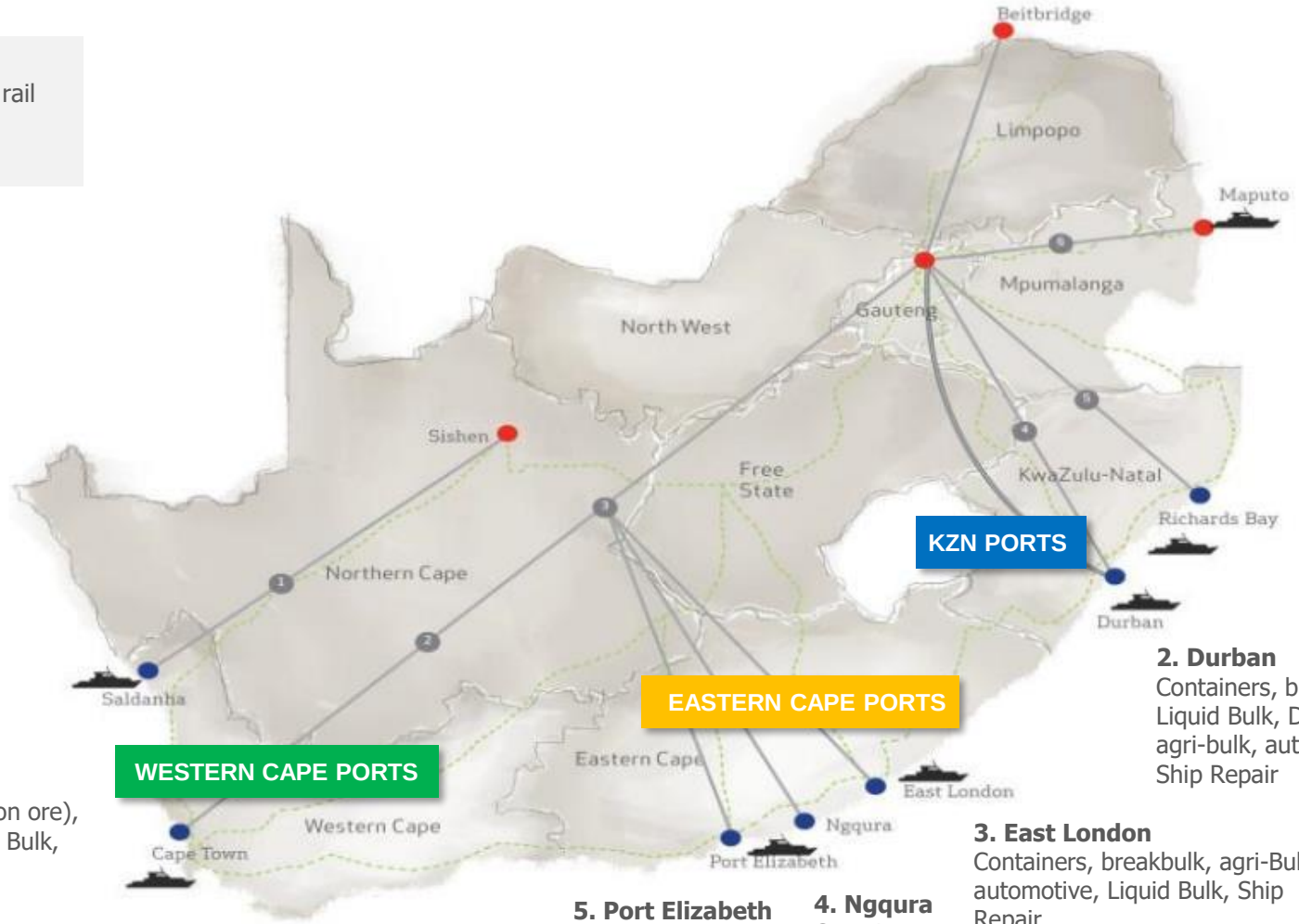
2021/11/02

# CONTENTS


1. Ports of South Africa
2. COP 26 Goals
3. Ports
4. Sea Level Rise – Safety of Navigation
5. Global Growth of Container Vessels
6. Largest Container Vessels – 2021
7. Climate Change Effects Within Africa
8. Enterprise Risk Management
9. SA Ports Weather-Related Shipping Delays
10. Total Ports Dredged Volumes
11. Pilots Tools of the Trade
12. Weather-Related Incidents at SA Ports
13. Maritime Disasters
14. Rough Seas
15. High Level Mitigations
16. MARPOL 78/78 – Annex. VI
17. Climate Change Adaptation
18. Climate Cluster Group
19. Climate Change Initiatives
20. Conclusion


# 1. PORTS OF SOUTH AFRICA

- 20,500 Km rail network
- >200 Million tons of cargo p.a. on rail
- >4.3 Million TEUs p.a.
- >18 Billion litres of fuel, oil




**1. Richards Bay**
Bulk (export coal, magnetite, chrome), breakbulk, Liquid Bulk

**2. Durban**
Containers, breakbulk, Liquid Bulk, Dry Bulk agri-bulk, automotive, Ship Repair

**3. East London**
Containers, breakbulk, agri-Bulk, automotive, Liquid Bulk, Ship Repair

**4. Ngqura**
Containers, manganese

**5. Port Elizabeth**
Automotive, Containers, Breakbulk, Dry bulk, fruit

**6. Mossel Bay**
Liquid Bulk, Fish, Offshore Supply

**7. Cape Town**
Containers, Breakbulk, Liquid Bulk, Dry Bulk, Fruits, Ship Repair

**8. Saldanha**
Bulk (export iron ore), Breakbulk, Dry Bulk, liquid Bulk

# 2. COP 26 GOALS

- **Secure global net zero by mid-century and keep 1.5 degrees within reach**
  - Countries are being asked to come forward with ambitious 2030 emissions reductions targets that align with reaching net zero by the middle of the century.

- **To deliver on these stretching targets, countries will need to:**
  - accelerate the phase-out of coal
  - curtail deforestation
  - speed up the switch to electric vehicles
  - encourage investment in renewables.

- **Adapt to protect communities and natural habitats**
  - The climate is already changing and it will continue to change even as we reduce emissions, with devastating effects.
  - At COP26 we need to work together to enable and encourage countries affected by climate change to:
  - protect and restore ecosystems
  - build defences, warning systems and resilient infrastructure and agriculture to avoid loss of homes, livelihoods and even lives.

- **Mobilise finance**

- **Work together to deliver**

# 3. PORTS

- Ports are important infrastructures that serve as a catalyst for economic growth and development. They have strategic importance to a nation, acting as gateways to trade.

- Harbour Masters are vital role players in any port – with their knowledge of ports ships and other related maritime activities they have the skills to overcome emergency situations in ports and approaches to ports.

- Been at sea provides the added advantage of experiencing nature in her full force without any shelter.  Most Ports are sheltered – however to enter the confines of a port vessels need to approach the port from an open sea which becomes a challenge in stormy weather conditions and high swells.

- Pilots and tug boat masters skills are tested during these adverse conditions.

- The impact of sea-level storm surges and increased storms could affect the port's supporting infrastructure.

    - Evacuation of vessels from port
    - Delays to shipping due to higher swells & stronger winds
    - Damage to Port infrastructure including breakwaters with more frequent severe storms
    - Damage to Aids to Navigation
    - Damage to cargo handling equipment'
    - Damage to evacuations routes, road & rail transport networks
    - Damage to electrical substations thereby affecting power supply to the terminals

# 4. SEA LEVEL RISE – SAFETY OF NAVIGATION

- **Taking into account that maritime transport handles over 90% of international trade**

- Sea-level rise could increase the risk of flooding and overtopping. Ingress of water into sensitive Vessel Traffic Services (VTS) equipment with consequent power loss has been identified as an event that could impact safety of navigation. Loss of navigation support could lead to closure of ports, which would have a effect on the function of the port as a vital node in the logistic supply chain and negatively impact the economy of the region or country.

    - Breakwater lights
    - Channel buoys
    - Pilot Station buoys
    - Radars on breakwaters
    - Weather stations – wind anemometers
    - Tidal gauges
    - Wave Monitors

- Risk Assessments required of all Ports to determine location and risk of Navigational Aids susceptible to extreme weather conditions

# 5. GLOBAL GROWTH OF CONTAINER VESSELS

## Large surface area susceptible to strong winds and wave action

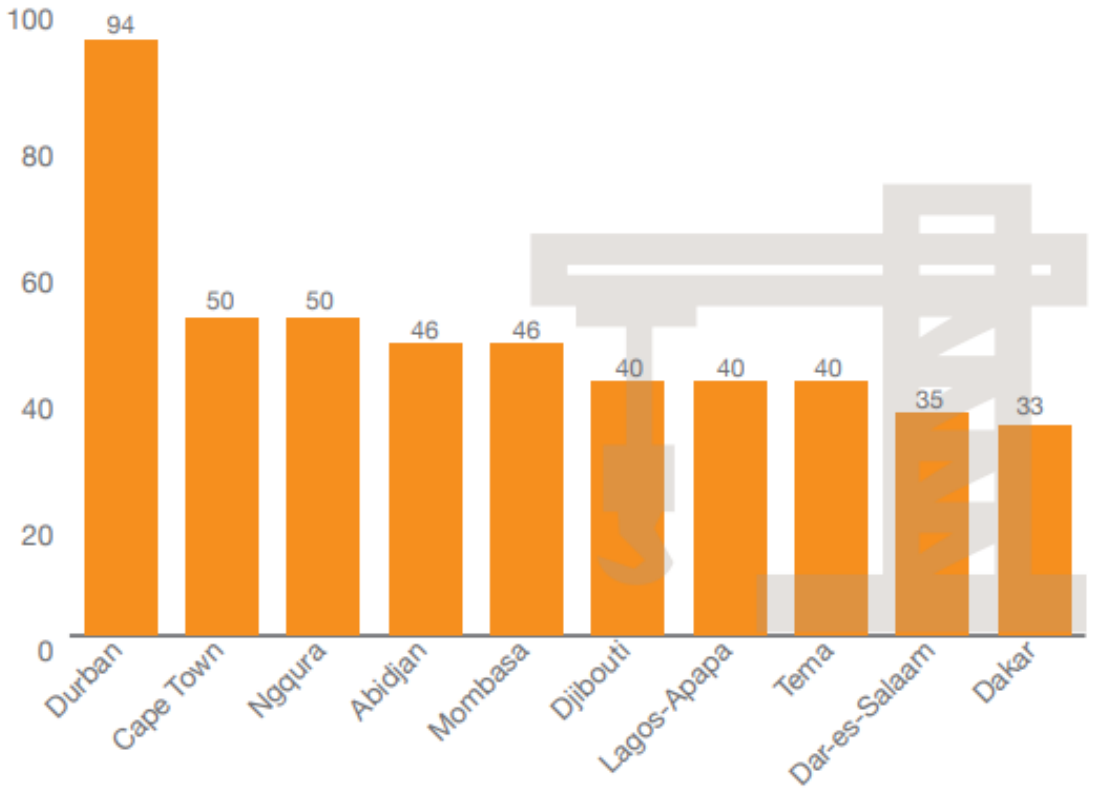
# 6. LARGEST CONTAINER VESSELS - 2021

| | Built | Name | Length overall | | Beam | | Maximum TEU | GT | Operator |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2021 | Ever Ace | 399.9 | 1,312 | 61.5 | 202 | 23,992 | 235,579 | Evergreen (Taiwan) |
| 1 | 2021 | Ever Act | 399.9 | 1,312 | 61.5 | 202 | 23,992 | 235,579 | Evergreen (Taiwan) |
| 2 | 2020 | HMM Algeciras | 399.9 | 1,312 | 61.0 | 200.1 | 23,964 | 228,283 | HMM (South Korea) |
| 2 | 2020 | HMM Copenhagen | 399.9 | 1,312 | 61.0 | 200.1 | 23,964 | 228,283 | HMM (South Korea) |
| 2 | 2020 | HMM Dublin | 399.9 | 1,312 | 61.0 | 200.1 | 23,964 | 228,283 | HMM (South Korea) |
| 2 | 2020 | HMM Gdansk | 399.9 | 1,312 | 61.0 | 200.1 | 23,964 | 228,283 | HMM (South Korea) |
| 2 | 2020 | HMM Hamburg | 399.9 | 1,312 | 61.0 | 200.1 | 23,964 | 228,283 | HMM (South Korea) |
| 2 | 2020 | HMM Helsinki | 399.9 | 1,312 | 61.0 | 200.1 | 23,964 | 228,283 | HMM (South Korea) |
| 2 | 2020 | HMM Le Havre | 399.9 | 1,312 | 61.0 | 200.1 | 23,964 | 228,283 | HMM (South Korea) |
| 3 | 2020 | HMM Oslo | 399.9 | 1,312 | 61.5 | 202 | 23,820 | 232,311 | HMM (South Korea) |
| 3 | 2020 | HMM Rotterdam | 399.9 | 1,312 | 61.5 | 202 | 23,820 | 232,311 | HMM (South Korea) |
| 3 | 2020 | HMM Southampton | 399.9 | 1,312 | 61.5 | 202 | 23,820 | 232,311 | HMM (South Korea) |
| 3 | 2020 | HMM Stockholm | 399.9 | 1,312 | 61.5 | 202 | 23,820 | 232,311 | HMM (South Korea) |
| 3 | 2020 | HMM St Petersburg | 399.9 | 1,312 | 61.5 | 202 | 23,820 | 232,311 | HMM (South Korea) |
| 4 | 2019 | MSC Gülsün | 399.9 | 1,312 | 61.5 | 202 | 23,756 | 232,618 | MSC (Switzerland) |

# 7. CLIMATE CHANGE EFFECTS WITHIN AFRICA

Figure 2.2 showcases the top ten hub ports within Africa, indicating the top three ports being located within South Africa, namely Durban, Cape Town and Ngqura. South Africa provides a primary chokepoint (Cape of Good Hope) within these complicated international shipping routes, therefore highlighting the unparalleled strategic economic importance of the South African port system within the Southern and Eastern African trade region. Due to an integrated supply chain and intraregional dependence, risks affecting the South African port system will have both a direct and severe economic impact on the Eastern and Southern African regions. A key aim of this research was to assess the impacts and effective management of these climate-related risks within the South African ports system, in an attempt to address the secondary effects of these risks on the broader Southern African Development Community (SADC) hinterland trading routes. Therefore the risks associated with climate change and the subsequent mitigation and adaption mechanisms employed by the South African ports will be crucial to the effectiveness, resilience, and preservation of this interlinked supply chain.

*Source: PwC*



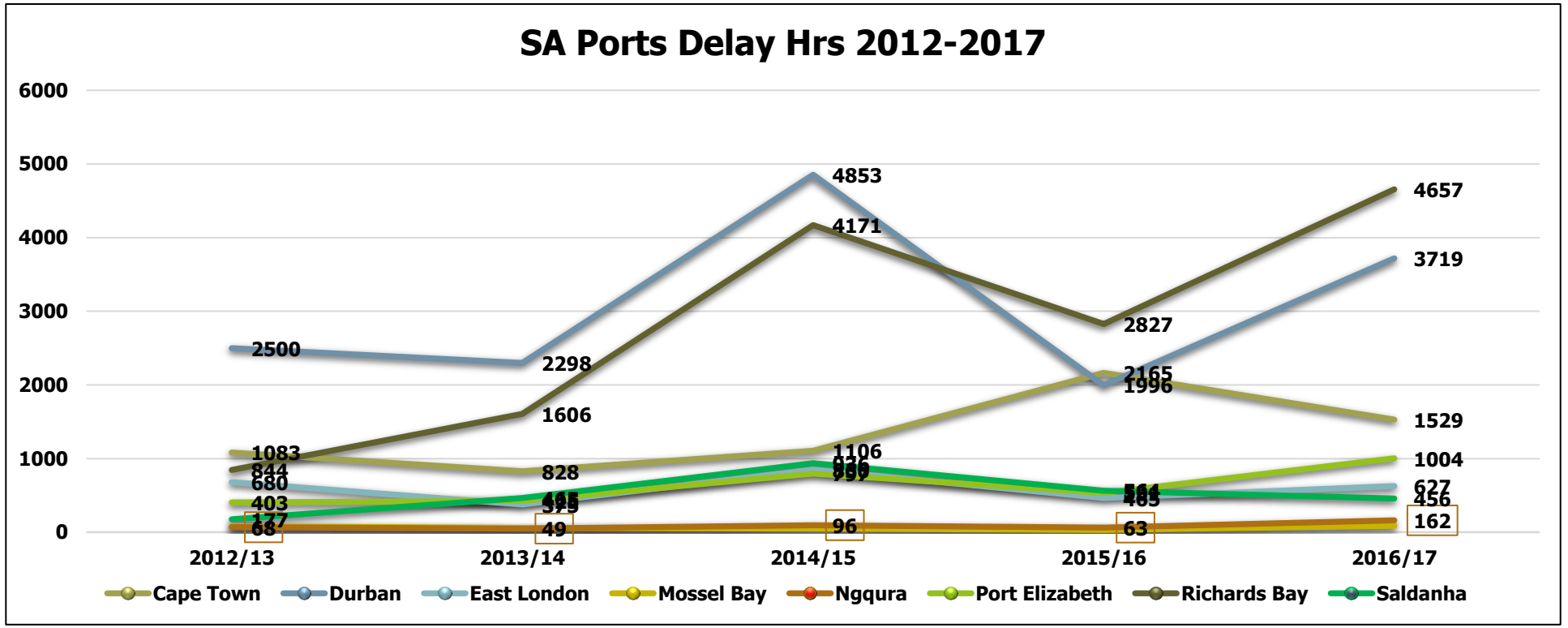

By comparison, the Port of Rotterdam achieves a hub attractiveness score of 421

# 8. ENTERPRISE RISK MANAGEMENT

- A contemporary port enterprise risk management (ERM) framework should aim to address both short- and long-term climate-related vulnerabilities, as the impacts of such risks are both detrimental and extensive (Scott *et al.*, 2013). Developed countries such as the United Kingdom, Australia, Canada, and Denmark have invested both research and financial efforts into addressing the projected impacts of climate-related risks, with the aim of reducing vulnerability of their port systems (Scott *et al.*, 2013; Flegg, 2018; Hallegatte, *et al.*, 2011; UNCTAD, 2020). These countries are at an advanced stage of climate adaption

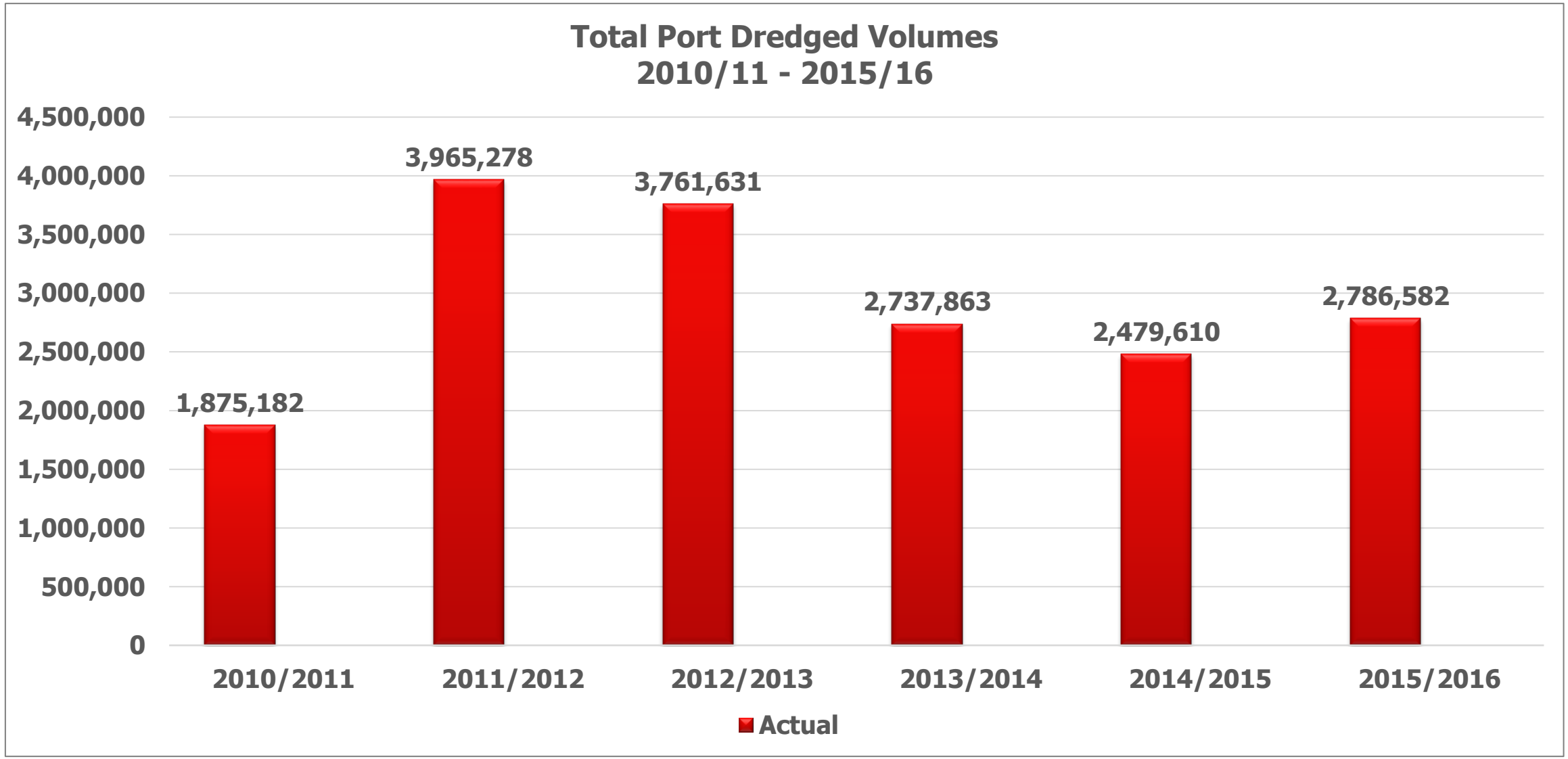
- **Effects of Climate Change on Ports** Port infrastructure is critical to the global economy and is particularly vulnerable to climate risk. Various studies indicate significant climate variables that would hinder long-term port operations and infrastructure; some of these variables include temperature, sea-level rise, precipitation levels, wave, wind, storm surge and salinity (Mutombo, 2017 & Flegg, 2018). Climate change alterations such as the variations in occurrence, frequency and impact of extreme weather events are likely to be more serve and exceed historical predictions (Flegg, 2018). The vital climate change variables that affect ports are:

# 9. SA PORTS WEATHER-RELATED SHIPPING DELAYS (HRS) 2012-2017




| | Cape Town | Durban | East London | Mossel Bay | Ngqura | Port Elizabeth | Richards Bay | Saldanha |
|---|---|---|---|---|---|---|---|---|
| 2012/13 | 1083 | 2500 | 680 | 80 | 68 | 403 | 844 | 177 |
| 2013/14 | 828 | 2298 | 375 | 60 | 49 | 425 | 1606 | 465 |
| 2014/15 | 1106 | 4853 | 850 | 50 | 96 | 797 | 4171 | 936 |
| 2015/16 | 2165 | 1996 | 465 | 30 | 63 | 531 | 2827 | 564 |
| 2016/17 | 1529 | 3719 | 627 | 89 | 162 | 1004 | 4657 | 456 |

# 10. SA PORTS ANNUAL DREDGING VOLUMES



# 11. PILOTS TOOLS OF THE TRADE


Harbour Tug

Marine Pilot Service Helicopters

Pilot Boat

# 12. WEATHER-RELEATED INCIDENTS IN SA PORTS

- 2006: Container vessel left port, lost engines and ran aground on the breakwater in East London
- 2012: CT - Sea Elegance – Strong wind vessel dragged anchor & ran aground
- 2013: NGQ - MSC Luciana – 364m – 3 Jan. 2013 –Winds of 50kts blown off quay Collided with the port Pilot boat.
- 2013: RCB – bulk vessel – deep draft ran aground - took a sheer in channel Swell 4-7m
- 2014: NGQ – Container vessel – evacuated from port due to adverse wx– 25 containers fell off vessel in anchorage area
- 2017: As the premier container port along the east coast of South Africa, the Port of Durban is a major hub linking the hinterland trading routes within the region. During October 2017, operations were ceased due to massive damage resulting from a significant storm(>70kts). Significant damage due to gale-force winds, storm surge, and flooding was noted, including vessels running aground, infrastructure damage, and massive spillages due to toppled containers from vessels.
- 2018: During October 2018, the Port of Port Elizabeth in South Africa experienced gusting winds (above 50 knots per hour) which resulted in the collapse of a container terminal crane. The equipment was blown into the water, blocking the port entrance channel and disrupting operations

# 13. MARITIME DISASTERS

# 14. ROUGH SEAS

# 15. HIGH LEVEL MITIGATIONS

- Port of Ngqura – Mooring Systems – to hold vessels alongside – tugs are used to assist vessel movements – could have 7 vessels in port at one time(3 tugs) – does it mean port requires more resources?
- Also investigating other solutions to mitigate Wind and Long Wave Motion – Mooring System
- UKC – Under Keel Clearance measuring tools
- VTS Risk Assessment – Liaising with IALA to conduct training & provided risk assessment tool.
- CSIR – Wind, Wave, Long Wave, Current & Tide monitoring
- Oil Pollution Contingency Plans
- SAMSA – Salvage vessel for coastal response
- OCIMS – Oceans & Coastal Integrated Management System – Vessel tracking
- Weather monitoring & forecasting _ Alerts and warnings.
- Research & Development can lead to innovative ideas on future infrastructure planning & development to ensure adaption to environmental conditions
- MARPOL 73/78 – Annexure – VI Air Emissions from Vessels
- GloMeep – Global Maritime Energy Efficiency Partnerships – formed to monitor & control emissions from ships

# 16. MARPOL 73/78 – ANNEX. VI

- **Prevention of Air Pollution from Ships**
- Increased size of vessels – old infrastructure
- Increase tug bollard pull – increased consumption – emissions
- Effects of Climate Change – frequency of Storms
- Lifespan of breakwaters – 50 years
- Control of emissions from vessels – Marpol Annex. VI – control of air emission
- **Mandatory Requirements**
  - Energy Efficient Design Index – EEDI
  - Ship Energy Efficiency Management Plan – SEEMP
  - Emission Control Areas –ECA – 2010 Sulphur content in fuel reduced from 1.5% to 1%
- Reduction of Nox emissions – Nitrogen Oxide control
- Reduction of Sox emissions– Sulphur Oxide Control
- Reduction of ODS – Ozone Depleting Substances

# 17. CLIMATE CHANGE ADAPTATION

**Climate Change Adaptation**

**Physical risks**

Acute:
- Risk and Vulnerability of infrastructure, operations and value chain suppliers and customers

Chronic:
- Water scarcity impacting business continuity
- Sea level rise impacting on integrity of port infrastructure

**Business continuity: Actions to mitigate the effects of port disruptions**

| PREPAREDNESS | RESPONSIVENESS | RECOVERY |
|---|---|---|
| Prior actions geared to avoiding or limiting a disruption's impacts | Actions geared to dealing with the immediate impacts of the disruption | Actions geared to getting the port back up and running again as soon as possible |

# 17. CLIMATE CHANGE ADAPTATION

**Business continuity: Actions to mitigate the effects of port disruptions**

**PREPAREDNESS** | RESPONSIVENESS | RECOVERY

- Preparedness will address the long term planning through the integration of climate change parameters into port planning, design of infrastructure and operating parameters by adapting infrastructure and operating procedures.
- PREPAREDNESS can only be achieved effectively when there is a high level of confidence and certainty regarding future climate predictions; hence this approach necessitate the development of port specific climate prediction models. The CSIR, as a specialised unit, has been contracted to work closely with TNPA for the development of the required models.

| Phase 1 | Phase 2 | Phase 3 | Phase 4 |
|---|---|---|---|
| **Needs Analysis** | **Data analytics** | **Risk and Vulnerability Assessment** | **Business cases** |
| ▪Identification of subject matter experts.<br>▪Scoping of requirements and outcomes.<br>▪Procurement activities. | ▪Identify climate variables relevant and specific to each port.<br>▪Develop model architecture<br>▪Model tuning and calibration.<br>▪Model iterations and tuning on climate | ▪Port specific assessments<br>▪Assessment on all identified climate variables<br>▪Assess risk and vulnerability under different scenarios<br>▪Develop climate response solutions | ▪Development of port specific business cases.<br>▪Prioritsation plan for sustaining capital and capital investment<br>▪Alignment of business cases to capital investment portfolio.<br>▪Funding strategy to access climate funds where possible |
| **Appointment of CSIR** | **Climate prediction models for port system** | **Risk and Vulnerability Assessment Report for port system** | **Business case for port system** |

**3 Year delivery programme**

# 17. CLIMATE CHANGE ADAPTATION

**Business continuity: Actions to mitigate the effects of port disruptions**

PREPAREDNESS | **RESPONSIVENESS** | RECOVERY

- Responsiveness addresses the **immediate** impacts of the disruptions to port operations. It aims to increase the flexibility in the port system through increasing awareness and predictive capabilities to mitigate disruptions to port activities. Examples of responsiveness actions are as follows:
  - Normal operating practices and working hours may need to be changed in the interim.
  - When a rail line that serves the port is impacted, road could be used as a suitable alternative.
  - Similarly, rerouting cargo to a back-up port could also be considered as a suitable alternative if it does not significantly affect the entire logistic chain configuration.

| Initiatives | Target | Status |
|---|---|---|
| Weather monitoring to provide real time wind, wave current and tide information. | In place | CSIR Contract in place |
| Early warning system to increase responsiveness in Ports, Terminals and Vessels | Oct 2019 | Procurement Process - budget |
| Larger bollard pull tugs in response to:<br>▪ ensuring safety during strong winds; and<br>▪ assist to hold vessel alongside in crosswind berths (as per fleet plan) | 9 tugs 2019;<br>12 tugs 2022 | 8 Tugs Delivered bet. 2006 & 2018 |
| Helicopters: To facilitate marine Pilot transfer | 2 Helicopters 2019;<br>3 Helicopters 2022 | 2 New Helicopters delivered in May 2019 |
| Climate change is in the top ten risks of the TNPA national risk register for engagement | In place | In Place |
| Establishment of Climate change cluster at each Port | In place | In Place |
| Standing agenda item at Harbour Masters forum | In place | In Place |

# 17. CLIMATE CHANGE ADAPTATION

## Business continuity: Actions to mitigate the effects of port disruptions

PREPAREDNESS | RESPONSIVENESS | **RECOVERY**

- Recovery addresses actions geared to getting the port back to business continuity as soon as possible. In addition to preparedness and responsiveness, the ability to recover from climate induced damages is essential in order to maintain port logistic services.

- Climate induced impacts are opportunities for ports to increase resilience thereby enabling faster recovery after future impacts. Disruptions in ports can have a wide range of potentially negative impacts on their transportation networks, while occasionally benefiting other ports in close proximity. Example: Contingency rerouting of cargo via back-up ports.

| Recovery Plan Reviews | Target | Status |
|---|---|---|
| Business Continuity Plan (BCP) Review: Procedures during and after storms to protect vessels and infrastructure | By end of Oct.2019 | Draft |
| Port closure guidelines during adverse weather conditions - | By end of Sept.2019 | Completed |
| Review berthing of large vessels at high risk berths during adverse conditions | By end of Oct.2019 | Completed |
| Develop communication template for reporting weather conditions to terminals and vessels at berths and at anchorage. | By end of Oct.2019 | Completed |
| Work in progress:<br>▪ Assessment of Port assets: Infrastructure and marine<br>▪ Assessment of human resources to respond<br>▪ Prioritisation of response to vessels under various scenarios<br>▪ Prioritisation of key commodity types after recovery and communicate to stakeholders | | In Progress |

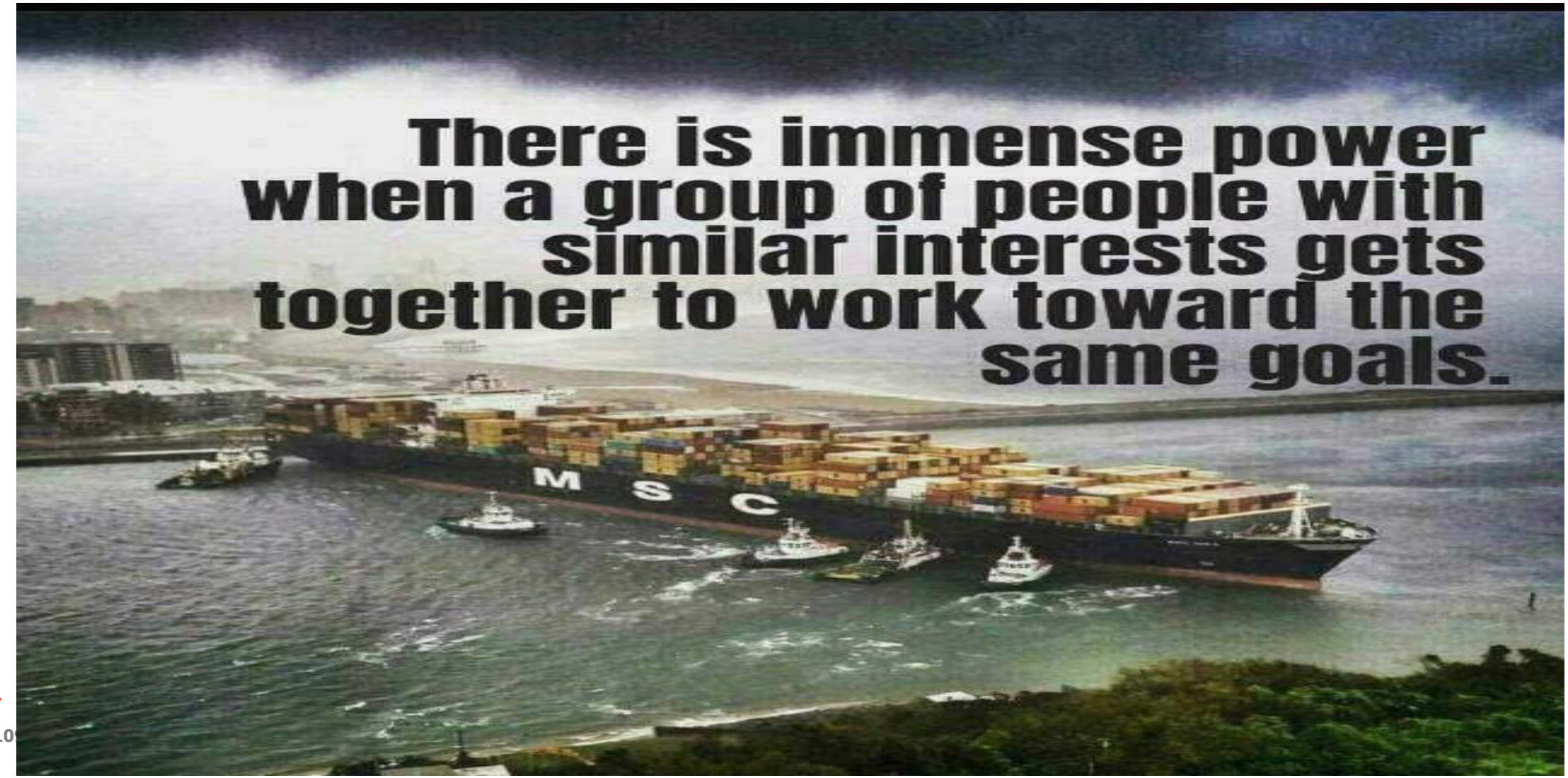
# 18. CLIMATE CLUSTER GROUP

- Until recently, most climate issues have been discussed in existing structures such as Safety and BCP meetings.
- However, owing to the priority that Transnet has now placed on climate change, climate clusters are being established at each port and national office. (Terms of reference developed by project lead.)
- Implementation of climate clusters (with terms of reference) are being finalised. Minutes of meetings to be shared with Climate National office which will consolidate and share newsletters monthly.
- Although each port is affected differently by climate change, significant commonalities across port operations suggest that lessons learned from each disruptive event provide value to other ports that may face future disruptions to services.
- Through the climate cluster group formed at each port, the value of lessons learnt is reflected in the constant updates to port emergency preparations and recovery plans (BCP), as ports aim to decrease recovery time from disruptive events.
- Climate cluster group at port are encouraged to meet at least once a month, or as circumstances dictate. Information from discussions are shared with all other ports through the TNPA National Climate research office.

# 19. CLIMATE CHANGE INITIATIVES

- Weather Monitoring to provide real time wind, wave current & tide information – 3-year contract in place
- Early Warning system from Weather Services to assist Port, Terminals & Vessels
- Larger Bollard pull tugs – ensure safety during strong winds – also assist to hold vessel alongside in crosswind berths – Part of fleet plan
- Helicopters – Marine Pilot Transfer – Part of fleet Plan – higher restrictions than Pilot boat.
- Climate Change Forum in Ports & Agenda Item in HM Forum for discussion
- Risk Management – Climate change one of top ten risks features in TNPA National Risk Meeting
- The South African Weather Services indicates that weather modeling used in the past are no longer accurate for forecasting purposes – requires dynamic modelling studies
- Alternative Mooring system to counter strong winds and long wave action
- Incorporation of Climate effects on Port Planning
- Climate Assessment Studies to determine Mitigation & Adaptation measures
- Collaboration with other State, Public and private entities to ensure concerted effort towards a common goal

# 20. CONCLUSION



International Harbour Masters Association

TRANSNET

delivering freight reliably

# THANK YOU


## Captain Naresh Sewnath

Senior Manager, Pilotage & VTS – Transnet National Ports Authority

Vice President, International Harbour Masters Association


# PANEL DISCUSSION

# THANK YOU