



CONTENTS

ABOUT THIS REPORT	3	ENVIRONMENTAL SUSTAINABILITY	23	RESPONSIBLE OPERATIONS	51
ABOUT WESTPORTS	4	POLLUTION PREVENTION AND CONTROL	23	ENHANCING BULK CARGO EFFICIENCY	51
OUR CULTURE	5	MATERIALS MANAGEMENT	23	SAFE PORT	51
A MESSAGE FROM THE EXECUTIVE CHAIRMAN	6	BIODIVERSITY AND MARINE CONSERVATION	23	DIGITAL AND TECHNOLOGY BREAKTHROUGHS FOR POWERING OPERATIONAL SUSTAINABILITY	52
WESTPORTS PURSUITS OF SUSTAINABILITY	7	COMMITMENT TO NET-ZERO CARBON EMISSIONS BY 2050	24	OPTIMISING PORT OPERATIONS THROUGH EFFECTIVE COMMUNICATION AND STREAMLINED OPERATIONS	54
SUSTAINABILITY STRATEGY	7	EFFLUENTS AND WASTE MANAGEMENT	25	ENABLING SEAMLESS PORT OPERATIONS THROUGH IT AND TECHNOLOGY	54
STAKEHOLDER RELATIONS	8	ENERGY AND CLIMATE CHANGE	27	INFORMATION SECURITY MEASURES	54
SHAPING OUR SUSTAINABILITY PRIORITIES	9	CLIMATE CHANGE MANAGEMENT: DRIVING RESILIENCE AND SUSTAINABILITY	29	METRICS AND DATA DISCLOSURE	55
METHODOLOGY	9	WATER MANAGEMENT	35	KEY ENVIRONMENTAL METRICS AND TARGETS	55
APPLYING THE OUTCOMES	11	ENVIRONMENTAL COMPLIANCE	35	KEY SOCIAL METRICS AND TARGETS	57
GOVERNANCE	13	OUR PEOPLE	36	HOW WESTPORTS CALCULATES EMISSION INTENSITY	57
MANAGING RISKS FOR LONG-TERM RESILIENCE	16	COMPETITIVE AND SUPPORTIVE EMPLOYEE OFFERING	36	GROUP SUSTAINABILITY PERFORMANCE DATA	59
STRATEGY	17	DIVERSITY AND INCLUSIVITY	36	ASSURANCE STATEMENT	70
PIONEERING ECONOMIC SUSTAINABILITY IN PORT OPERATIONS	18	HUMAN RIGHTS	38	BURSA MALAYSIA PRESCRIBED TABLE	71
STRONG GROWTH AND POSITIVE OUTLOOK	18	FREEDOM OF ASSOCIATION, UNION REPRESENTATION AND COLLECTIVE BARGAINING	39	APPENDIX	
TRADE GROWTH THROUGH PORT EXPANSION AND INFRASTRUCTURE DEVELOPMENT	18	TRAINING AND DEVELOPMENT	39	PHYSICAL CLIMATE RISK ASSESSMENT, QUANTIFICATION AND CLIMATE DISCLOSURE	
LEADING THE REGION THROUGH STRATEGIC PARTNERSHIP	19	FOSTERING COMMUNICATION, ENGAGEMENT AND DIALOGUE	40		
ETHICAL BUSINESS OPERATIONS	19	BUILDING A SAFER PORT COMMUNITY	41		
ESG INTEGRATION IN THE SUPPLY CHAIN	21	NOTICE PERIOD	47		
		SOCIETY	48		
		CORPORATE RESPONSIBILITY GOVERNANCE	48		



The cover picture shows mangroves growing between the wharf structure and the revetment edge.

ABOUT THIS REPORT

Sustainability is a strategic foundation for Westports Holdings Berhad (“Westports”, the “Company” and together with its subsidiaries, the “Group”). As one of Malaysia’s key port gateways, the Company enables regional and global trade while managing the environmental and social impacts of a high-throughput, energy-intensive operation. Westports integrates ESG considerations into decision-making, risk management and operational planning to support resilient, low-impact and inclusive supply chains.

As the business expands, Westports actively addresses sustainability challenges across its operations, from decarbonising terminal equipment and strengthening marine services to protecting its workforce and supporting surrounding communities. This Sustainability Report outlines how the Company identifies and manages sustainability-related risks and opportunities and how these efforts contribute to long-term economic, social and environmental value.

Reporting Scope and Boundary	All activities of Westports Holdings Berhad and its controlled subsidiary, Westports Malaysia Sdn Bhd, consistent with the Group’s financial reporting boundary	Reporting Guidelines and Framework	This report references the following frameworks and guidelines: <ul style="list-style-type: none"> • Bursa Malaysia Main Market Listing Requirements • Malaysian Code on Corporate Governance (“MCCG”) • Global Reporting Initiative (“GRI”) Standards • Sustainability Accounting Standards Board (“SASB”) and IFRS Sustainability Disclosure Standards • Task Force on Climate-related Financial Disclosures (“TCFD”) • United Nations Sustainable Development Goals (“UNSDGs”) • External ESG rating indices, including FTSE4Good Bursa Malaysia (“F4GBM”) Index and Sustainalytics 	Feedback and comments	Westports welcomes stakeholder feedback at: Mr Chang Kong Meng Head of Investor Relations Email: chang@westports.com.my Encik Shamsul Afif Abdul Waris Special Officer to the Executive Chairman Email: shamsul.afif@westports.com.my Westports Holdings Berhad P.O.Box 266, Pulau Indah 42009 Port Klang Selangor Darul Ehsan Malaysia Website: www.westportsholdings.com
Reporting Period	1 January to 31 December 2025 (“FY2025”); Westports published its previous Sustainability Report in March 2025.	Reliability of information disclosed	The Board Sustainability Committee reviewed the report before its approval by the Group Chairman, the Group Managing Director (“GMD”) and the Chief Executive Officer (“CEO”). Control Union (Malaysia) Sdn. Bhd. has independently verified selected disclosures. Assurance details appear on page 70.		
Information, Data and References	This report integrates requirements from leading sustainability frameworks, stakeholder engagement findings, the Group’s double-materiality assessment and its value-creation priorities. Westports has not restated any data unless stated in the text and includes historical data where useful for context. References to “Westports”, “the Company”, “the Group”, “we”, “us” and “our” refer to Westports Holdings Berhad.				

ABOUT WESTPORTS

Westports manages port operations for container and conventional cargo and provides a wide range of marine, rental and ancillary services. It serves as the main gateway for containerised and conventional cargo for central Peninsular Malaysia.

The Group's container volumes expanded from 20,000 Twenty-foot Equivalent Units ("TEUs") in 1996 to 11.33 million TEUs in 2025, representing approximately 75% of Port Klang's total container market share.

Westports is Malaysia's biggest gateway and one of the region's mega transshipment hubs, driven by its strategic location, deep channel and wharf, linear berth configuration, high productivity levels, a young and committed workforce and connectivity to more than 350 ports worldwide.

The port has 34 berths totalling 10,071 metres, including 20 container berths along a 5,800-metre straight line. Average container handling capacity remained at 13.8 million TEUs, with average berth occupancy of 84% in 2025.

The conventional terminal handled 12.83 million tonnes of bulk cargo in 2025, comprising mixed steel, steel coils, project cargo, animal feed, edible products, fertilisers, building materials, palm oil, petroleum, chemicals and liquefied petroleum gas.

PORT STRENGTHS AND CAPACITY

- 34 berths spanning 10.0 km in aggregate length
- 24 container berths aligned along a 5.8 km straight line for maximum operational efficiency
- Equipped with 52-metre high ship-to-shore cranes at CT8-CT9 wharves
- Supports the largest container vessels with a 17.5m water depth
- Features a 405 ha customs-free zone for seamless commercial and industrial operations

KEY ACHIEVEMENTS

- Making Port Klang the 10th most busy port globally by container TEUs
- Handles 24,000-TEU vessels, the world's largest container ships
- Facilitated the largest RORO vessel (265 m length, 50,335 m² deck area) in 2021
- Record productivity of 801 moves/hour with 12 cranes on CMA CGM Mermoz (2019)
- 11.33 million TEUs handled annually; 62% Intra-Asia trade throughput
- Bulk cargo throughput of 12.83 million metric tonnes
- Generated RM2.55 billion in operational revenue in 2025

AWARDS & ACCOLADES

Recognition & Indexes

- FTSE4Good Bursa Malaysia Index: Member since 2017
- GPR Pure Infrastructure Index Series: Recognised since 2016

Sustainability Rankings

- 'Negligible Risk' by Sustainalytics
- Top-tier FTSE score of 4.5
- 'Prime' with 'C+' rating by ISS ESG

Recent Awards & Accolades

- Gold Award, The Edge Malaysia ESG Awards 2023, 2024 and 2025
- Best of The Best (Gold), The Edge Malaysia ESG Awards 2025
- Highest Return on Equity Over 3 years (The Edge Billion Ringgit Club Awards 2025)
- Highest Growth in Profit After Tax Over 3 years (The Edge Billion Ringgit Club Corporate Awards 2025)
- Highest Return to Shareholders Over 3 years (The Edge Billion Ringgit Club Corporate Awards 2025)
- Asia's Best Islamic Local Currency Deal 2025, Euromoney
- HR Excellence Award 2025, KSI

OUR CULTURE

MISSION

To be the port of choice for our customers, to develop and nurture Malaysian talent, to propel the growth of our community and to drive equitable returns for all stakeholders we engage with whilst ensuring we achieve these goals with integrity, humility and humanity in mind.

VISION

To be the most efficient hub in Southeast Asia and the largest gateway port to Klang Valley in the most sustainable way possible.

Company Objective - G.O.W.E.S.T

Generate Sustainable Revenue	We are determined to generate sustainable revenue through the consistent implementation of our values and corporate philosophy, continuous improvements and innovation, cost management and maintaining high customer satisfaction resulting in excellent returns for employees, shareholders and customers.
Operational Efficiency	We provide operations and services excellence that exceeds global standards through effective training, continuous review of operational achievement and enhancement of SOPs.
World Class Productivity	Our Vision is to be the First Port of Choice for our customers, shareholders and employees. We are determined to go the “Extra Mile” to delight our customers with services that exceed their expectations, which include world-class productivity standards exercised through continuous quality improvement.
Employer of Choice	Westports is determined in providing excellent compensation benefits and training to our employees, job enrichment and developing human capital, as they form an integral component of the Company’s achievements. We are determined to be the Employer of Choice by projecting best work practices.
Service Excellence	We are committed to providing world-class services that surpass our customers’ requirements and expectations. We strive to offer the utmost focus, conduct in-depth study and unvarying improvement to meet our customers’ ever-changing needs.

Technology Driven

We are committed to establishing the aspect of improvement by considering new technologies to expedite and simplify our processes and efforts as a part of the daily work of all departments and sections and ensure the problems are eliminated at the source itself in order to create better opportunities for improvements.

Core Values – T.A.N.S.R.I.G

Teamwork

Westports believes in collective and cooperative teamwork which contributes to the achievement of the Company’s vision and mission.

Accountability and Integrity

Integrity is the bedrock on which trust is built and is the hidden key to success. Employees are embedded with a deep feeling of trust and integrity which provides transparency and positive work environment.

Now Culture

Westportians believe the attitude and process of treating key business as if one’s life depended on it. It is about determination to stay focused and committed in delivering positive results. Westports cultivate a great sense of urgency and priority in every employee.

Safety Awareness

Safety is an integral part of sustaining our business growth success, leading to an increase in productivity.

Responsible

This tenet is embraced by all employees where are all responsible for our actions and conduct.

Innovation

Westportians develop a passion for excellence and success through continuous innovation of new ideas and practices.

Good Family Values

We work together as a family and practice candour, open communications and solve any issues or problems together. Things are done with good thoughts, intentions and deeds. Westports is a big family where everyone is treated with respect.

A MESSAGE FROM THE EXECUTIVE CHAIRMAN

It is my pleasure to present Westports Holdings Berhad's Sustainability Report for FY2025. As Malaysia's leading gateway and transshipment hub, Westports plays a central role in facilitating regional and global trade. With this responsibility, I remain committed to ensuring that our operations are guided by integrity, discipline and foresight so that economic progress remains aligned with environmental stewardship and social responsibility.

Westports has long aspired to be the port of choice. For me, this aspiration is defined not only by scale but by performance and relationships. Strong operational capability, trusted governance and compliance, and meaningful engagement with our customers, employees and the community reflect this commitment. These principles continue to guide our decisions and long-term strategy.

During the year, we demonstrated that growth and sustainability can go hand in hand. The continued development of Westports 2 strengthens Malaysia's long-term port capacity and competitiveness while embedding modern engineering standards into its design and construction. I am also proud that Westports has achieved efficiency gains through digitalisation, which enhance productivity, safety and data-driven decision-making across our terminals. These advancements position Westports at the forefront of operational excellence in the region.

Alongside this growth, we continued advancing our Glide Path to Net Zero 2050. During the year, we expanded renewable energy initiatives and progressed the electrification of terminal equipment. We also subscribed to the Green Electricity Tariff ("GET") and began receiving Malaysian Renewable Energy Certificates ("mREC") from December 2025 onwards. This initiative will reduce our carbon intensity and is expected to bring our Scope 2 emissions intensity close to zero by 2026. At the same time, we strengthened our environmental data management by refining our greenhouse gas inventory, including improvements to the methodology for measuring Scope 3 emissions. In addition, we enhanced our monitoring of non-GHG air pollutants to better understand the broader environmental impacts associated with port activities and our value chain. These improvements support greater transparency and form part of a structured transition strategy to reduce emissions, manage long-term climate risks and strengthen operational resilience as regulatory and market expectations evolve.

Environmental responsibility extends beyond emissions management. As a port operator on the coastal front, I recognise our duty to safeguard the marine and mangrove ecosystems that support biodiversity, shoreline stability, and climate resilience. During the year, we progressed our mangrove restoration commitments by replanting and rehabilitating affected areas in line with regulatory approvals and long-term conservation objectives. Through these efforts, we seek to balance strategic expansion with ecological stewardship, ensuring that port development proceeds responsibly alongside the surrounding natural environment.

Our responsibility also extends to the people of Pulau Indah and the surrounding Port Klang community. I remain committed to supporting local employment, skills development and infrastructure improvements that enhance liveability and economic opportunity. Through community engagement, healthcare support, safety initiatives and collaboration with local authorities, we aim to contribute positively to the well-being and long-term development of the community we call home.

Our people remain at the heart of our progress. I will continue to prioritise workforce development, uphold rigorous safety standards and foster a culture grounded in accountability and integrity. Our zero-tolerance stance on corruption, supported by ISO 37001:2025 re-certification on 11 February 2026 and strong internal controls, reflects the standards we expect across the organisation and throughout our supply chain.

Strong governance remains fundamental to our approach. I ensure that sustainability-related risks and opportunities are embedded within Board oversight and our Enterprise Risk Management ("ERM") framework. This structure enables us to systematically address operational resilience, regulatory compliance, workforce well-being, community impact and climate transition when making strategic and capital planning decisions. Our climate assessment further strengthens our understanding of long-term physical and transition risks through 2080, informing infrastructure design, financial planning and adaptation strategies within a broader sustainability context.

These achievements are made possible through the dedication of our employees and the trust of our customers, regulators, shareholders, suppliers and community partners. On behalf of the Board, I extend my sincere appreciation for your continued support and collaboration.

Looking ahead, I will continue to strengthen operational resilience, accelerate decarbonisation and ensure that sustainability considerations are integrated into every major investment and strategic decision. As global trade evolves and climate challenges intensify, I remain committed to disciplined growth and responsible stewardship so that Westports continues to earn its position as the port of choice for the region.

Thank you for your continued confidence in Westports. I look forward to building a resilient and sustainable future together.

Yours sincerely,

Datuk Ruben Emir Gnanalingam Bin Abdullah
Executive Chairman

WESTPORTS PURSUITS OF SUSTAINABILITY

Westports advances sustainable port operations through focused action in decarbonisation, biodiversity protection, responsible supply chains, people development and community well-being. These efforts strengthen operational resilience and create lasting value for stakeholders.

SUSTAINABILITY STRATEGY

Pathways to Net Zero: Decarbonisation in Action

Westports continues to progress its long-term decarbonisation strategy:

- Completed a detailed assessment of the Glide Path to Net Zero 2050 in 2023, estimating potential electricity needs from replacing diesel-powered equipment with electric alternatives.
- Completed a TCFD-aligned review of the Glide Path in 2024 to forecast emissions and CO₂e intensity per TEU for WP1 and WP2 through 2050.
- Developed an initial transition plan that includes:
 - Purchasing electric terminal trucks and electrified Rubber Tyred Gantry Cranes ("RTGC") within three years.
 - Phasing out ageing diesel-powered equipment.
 - Assessing direct or indirect sourcing of renewable electricity, including solar options.

Preserving Biodiversity on Land, in Air and at Sea

Westports integrates conservation into port development and daily operations:

- Reused 30–40% of suitable degraded dredged materials for future free zone land reclamation, reducing emissions from dredging equipment ("TSHD").
- Secured EIA approval to replant 97 hectares of lost mangroves, with 4 hectares planted in 2025.
- Planted 13,250 mangrove trees since 2015, covering six native species.

Charting Sustainability Across the Supply Chain

Westports embeds ESG principles into procurement and supplier engagement:

Gradually integrating ESG criteria into procurement decisions and supply chain management.

- Key strategies include:
 - ▶ Zero tolerance for human rights violations.
 - ▶ Promoting circularity and waste reduction.
 - ▶ Building a low-carbon supplier base.
 - ▶ Strengthening anti-bribery controls across supplier relationships. Ensuring statutory compliance with EPF, SOCSO and PCB requirements.

By 2030, all vendors must demonstrate clear sustainability commitments, supported by:

- Sustainability roadmaps.
- Forward-looking sustainability plans.
- Transparent disclosures.

Complete alignment with ESG requirements is envisioned by 2050.

People: Catalyst for Progress and Unity

Westports invests in a safe, inclusive and supportive workplace:

- Focus areas include career development, competitive compensation, work-life balance, safety, employee well-being and human rights.
- The Diversity and Equal Opportunity Policy promotes fairness and inclusion:
 - ▶ Achieved 45% female representation on the Board, exceeding the 30% target.
 - ▶ Began deploying female operators in 2024.
- Maintains strong safety performance under OSHA 2022 and EQA 1974, significantly reducing workplace accidents and incidents.

Community: Thriving in Harmony with Society

Westports supports long-term community well-being across Pulau Indah and Port Klang:

- Minimising operational impacts on nearby communities.
- Promoting local employment, skills development and training.
- Upgrading local infrastructure to enhance liveability.
- Supporting logistics-based small businesses.
- Collaborating with local authorities through initiatives such as Klinik Westports, ambulance services and port police.

Westports remains committed to fostering a safe and healthy community while supporting regional economic development.

STAKEHOLDER RELATIONS

Westports recognises that strong, continuous engagement with stakeholders is essential to the success of its operations. The Group maintains open communication with shipping lines, logistics providers, regulators, customers, local communities and other key partners to build trust and ensure expectations are understood and addressed.

Engagement is a strategic function. Westports actively listens, responds and adapts to stakeholder input, enabling stakeholders to shape solutions, improve service quality and contribute to the Group's broader sustainability goals.

IDENTIFYING STAKEHOLDERS

In line with the AA1000SES framework, Westports identifies stakeholders whose interests are directly affected by its activities. The Group systematically prioritises these stakeholders to ensure engagement efforts remain focused, efficient and responsive.

TAILORED ENGAGEMENT APPROACH

Given the diversity of its stakeholders, Westports applies different engagement methods depending on each Group's needs and the nature of the interaction. This targeted approach ensures timely and meaningful participation and allows the Group to address concerns proactively and incorporate feedback into decision-making.

Stakeholder Group	Engagement Method	Key Concerns	Our Response
Port Users	Customer feedback, support centre, market research, events and dialogue sessions, roadshows, social media, materiality survey and sustainability disclosures	Port infrastructure capacity, operational safety, seamless and transparent operations, key sustainability issues, alignment with employee values and workplace priorities	Invest in infrastructure and safety improvements, enhance operational transparency and coordination and address sustainability priorities in line with stakeholder expectations.
Government and Authorities	Formal meetings, performance reports, discussions on government initiatives, safety campaigns, audits and inspections, video conferencing and materiality survey	Regulatory compliance, safety management, environmental protection and support for government initiatives	Ensure strict compliance with regulations, maintain high safety standards, collaborate on environmental and safety campaigns and support national and local government initiatives.
Shareholders and Investors	IR events, annual and sustainability reports, general meetings, shareholder updates, quarterly reports, corporate presentations, signing ceremonies, video conferencing and materiality survey	Governance, corporate transparency, operational updates, ethical operations, regulatory compliance and investment opportunities	Maintain strong governance and transparency, provide timely operational updates, ensure ethical and compliant operations and communicate growth and investment plans clearly.
Community	Website, annual and sustainability reports, community engagement, visits, seminars and joint activities, materiality survey, partnerships with NGOs, infrastructure support and education and health initiatives	Local employment, infrastructure development, community well-being and social investment	Support local hiring and skill development, invest in infrastructure and community projects, promote education and health initiatives and foster partnerships with local organisations.
Employees	Employee surveys, dialogue and engagement, HR Portal, departmental meetings, newsletters, employee engagement programmes, materiality survey, training and development programmes and performance reviews	Employee well-being, workforce engagement, company culture, career development and performance management	Prioritise health and safety, foster an engaged and inclusive culture, provide training and career growth and implement effective performance management systems.
Suppliers	Supplier surveys, supplier training programmes, relationship management, video conferencing, materiality survey, vendor pre-qualification and compliance audits, performance evaluations and ESG collaboration	Supplier quality, ethical sourcing, communication, compliance and sustainability collaboration	Enforce quality and ethical standards, maintain clear communication, conduct regular audits and collaborate on sustainability and ESG goals.
Professional Bodies	Dialogue and engagement, joint activities, consultations and negotiation, certifications, annual and sustainability reports, campaigns and roadshows, materiality survey and participation in industry forums and conferences	Good governance, ethical operations, business investments and socio-environmental impact	Engage in industry discussions, support ethical practices and compliance and collaborate on regulatory and sustainability standards and innovation.
Non-Governmental Organisations ("NGOs")	Dialogue and engagement, collaboration, sponsorships and donations, social media and online channels and materiality survey	Community involvement, societal impact and partnerships	Work closely on community projects, support social and environmental initiatives and maintain transparent, ongoing dialogue.

SHAPING OUR SUSTAINABILITY PRIORITIES

Westports applies the AA1000 AccountAbility Principles to identify and prioritise sustainability issues based on relevance, impact and stakeholder expectations. In line with the IFRS Sustainability Disclosure Standards, the Group adopted a double-materiality approach, recognising that sustainability issues influence both financial performance and Westports' broader impacts on people, the environment and the economy.

METHODOLOGY

Westports' materiality study drew on two core inputs:



The Group evaluated both inputs using a double-materiality lens and plotted the final issues in a Materiality Matrix according to their significance to stakeholders and their impact on Westports' strategy, operations and reputation.

To strengthen the robustness of the assessment, Westports benchmarked its material topics against the criteria applied by its peers and various rating agencies. FTSE4Good, MSCI and Sustainalytics. This additional layer ensured that the final topics aligned with external ESG expectations and reflected issues most relevant to global investors, industry peers and regulatory standards.

STAKEHOLDER INPUT

Key stakeholders were invited to participate in an online materiality survey and rated each sustainability issue on a scale from "Not Important/Not Impactful" to "Extremely Important/Very Significant". The feedback highlighted indicators most relevant to operational performance, service quality and long-term sustainability.

Stakeholders Involved in the Materiality Research

Government Agencies such as Customs	Other Customers such as Warehouse Users
Community such as Schools & Residents at Pulau Indah	Port Users such as Forwarding Companies
Employees of Westports	Suppliers & Contractors of Goods & Services
Shipping Clients such as Liners & NVOCC	Shareholders & Analysts

INTERNAL ASSESSMENT

A parallel survey with the Board of Directors and senior leadership assessed each indicator based on its potential financial, operational and reputational impact and considered:








- How the issue could influence Westports' success
- How Westports' activities affect people, the environment and society

This approach ensured a balanced consideration of outward impacts and internal risks and opportunities.

Each topic is plotted according to its relative importance to stakeholders (vertical axis) and its impact on Westports' operations and long-term value creation (horizontal axis). The colour of each marker reflects the level of external alignment, indicating how strongly the topic aligns with recognised sustainability frameworks and industry expectations (high, medium or low). The size of the markers represents the relative significance of the topic, with larger markers indicating issues assessed as having greater overall importance based on the combined assessment of stakeholder input, leadership evaluation and external benchmarking.

SHAPING OUR
SUSTAINABILITY
PRIORITIES

Sustainability Areas Assessed in the Materiality Study

Materiality Issue	Description	Relevant GRI Standards	Relevant IFRS S1/S2 Areas	Related UNSDGs	Stakeholders Impact	Westports' Impact
Business Development and Value Chain	Nation-building initiatives, business growth, innovation and sustainable supply chain management	GRI 201, GRI 203, GRI 102-9	IFRS S1 – Strategy, Value Chain Risks and Opportunities	 	Port users, government and authorities, suppliers	People and Planet: Supports economic development, job creation and sustainable logistics. Financial: Strengthens market position, resilience and profitability.
Ethics and Compliance	Integrity, legal compliance, transparency and strong governance	GRI 205, GRI 206, GRI 307	IFRS S1 – Governance, Risk Management, Legal Compliance		Shareholders and investors, employees, government and authorities	People and Planet: Builds trust, reduces corruption and promotes ethical practices. Financial: Minimises legal risks and protects reputation and investor confidence.
Energy and Climate Change	Energy efficiency, renewable energy and Greenhouse Gas (“GHG”) emissions reduction	GRI 302, GRI 305	IFRS S2 – Climate-Related Risks and Opportunities	 	Port users, community, employees	People and Planet: Supports climate action and improves air quality. Financial: Reduces energy costs, secures approvals and mitigates climate risks.
Waste, Water, Effluents and Other Pollutants	Waste, water and effluent management and pollution control	GRI 303, GRI 306, GRI 307	IFRS S1 – Resource and Pollution Risks and IFRS S2 – Physical and Transition Risks	 	Community, government and authorities, port users	People and Planet: Protects water quality and community health. Financial: Supports compliance and efficiency and reduces environmental costs.
Labour Practices	Diversity, hiring, engagement, training and human rights	GRI 401, GRI 402, GRI 404, GRI 405	IFRS S1 – Human Capital and Workforce Risks	 	Employees, community, suppliers	People and Planet: Encourages inclusive workplaces and fair opportunities. Financial: Drives productivity, retention and operational stability.

SHAPING OUR
SUSTAINABILITY
PRIORITIES

Materiality Issue	Description	Relevant GRI Standards	Relevant IFRS S1/S2 Areas	Related UNSDGs	Stakeholders Impact	Westports' Impact
Safety, Health and Security	Safety, health initiatives and security measures, including port police	GRI 403	IFRS S1 – Operational Risk and Safety	 	Employees, port users, community	People and Planet: Enhances employee and community safety. Financial: Reduces accidents, disruptions and insurance costs.
Community	Social contributions, engagement and local development	GRI 413, GRI 203	IFRS S1 – Social Risks and Opportunities	  	Community, employees, NGOs	People and Planet: Strengthens community well-being and supports long-term social progress. Financial: Enhances licence to operate and supports workforce availability.
Sustainable Operations	Service quality, cybersecurity, data privacy, operational efficiency and customer satisfaction	GRI 301, GRI 302, GRI 306, GRI 308, GRI 414	IFRS S1 – Business Model, Supply Chain, Performance Metrics	 	Port users, shareholders and investors, employees	People and Planet: Protects information and supports reliable services. Financial: Improves customer satisfaction, reduces risks and supports growth.

APPLYING THE OUTCOMES

The results were reviewed by management and validated by the Board to ensure alignment with strategic priorities and regulatory expectations. These material issues form the basis of Westports' sustainability objectives, targets and action plans.

Westports will continue to refresh the assessment every two years, supported by interim reviews that reflect evolving business conditions, stakeholder expectations and IFRS S1 and S2 requirements.

Westports Materiality Matrix



GOVERNANCE

Effective risk management is crucial for maintaining long-term sustainability and resilience. Westports embeds this approach within its governance framework, applying proactive strategies to address current and emerging challenges across business development, ethics, environmental impacts and the safety and well-being of employees and communities.

The Board, the Sustainability Committee, the Risk Management Committee and the Management Sustainability Committee have their respective Terms of Reference and role descriptions that outline their responsibilities for identifying and managing sustainability-related risks and opportunities. The Group is committed to:

- The transparent reporting of its risk management processes
- Gradually adopting and aligning with the IFRS Sustainability Disclosure Standards
- Keeping stakeholders informed of the Group’s strategies, mitigation measures and progress towards its sustainability goals

OVERSIGHT AND ACCOUNTABILITY

The Board of Directors oversees all risk areas to ensure alignment with corporate and sustainability objectives. It regularly reviews its competencies and receives training, along with expert input, to maintain the skills needed to manage sustainability-related risks and opportunities.

Information on these risks and opportunities is reported to the Board and its Committees quarterly, through management briefings, dashboards and performance reports. Westports integrates sustainability risks and opportunities into strategic planning, investment decisions and risk management policies, including trade-off evaluations. The Board sets sustainability-related targets, monitors progress and ensures that key performance indicators (“KPIs”) are incorporated into management evaluations and remuneration policies, where relevant.

MANAGEMENT’S ROLE AND ORGANISATION

Dedicated management committees, including the Sustainability Committee, Anti-Corruption and Ethics (“ACE”) Committee and the OSH Committee, support oversight responsibilities and report directly to the Board.

Management applies structured controls and procedures, such as audits, risk assessments and compliance reviews, supported by cross-functional coordination among Finance, HR, Operations and Risk Management. These measures provide valuable oversight of sustainability-related risks and opportunities.

SUSTAINABILITY GOVERNANCE

The Board of Directors demonstrates strong leadership in sustainability governance by embedding sustainability as a core principle across all corporate functions and operations. Sustainability remains a standing agenda item at Board meetings and management discussions to maintain ongoing strategic focus.

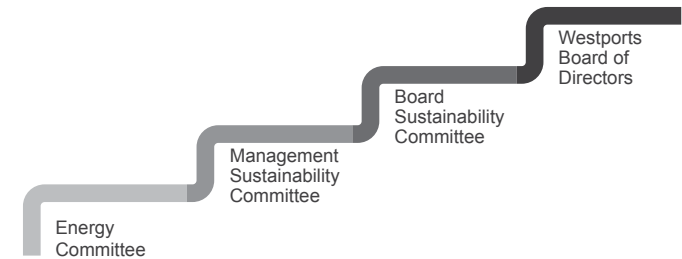
Westports has established a dedicated Sustainability Committee that sets targets, monitors progress and drives the achievement of short-term and long-term sustainability goals. An independent non-executive director chairs the Board Sustainability Committee, which is composed of at least three independent non-executive directors. The Chairperson is independent and distinct from the Chairman of the Board. Meeting quarterly, the Committee provides direction, oversight and guidance on sustainability initiatives across Westports, reinforcing the Group’s commitment to strong governance and sustainable development.

Board Sustainability Committee Structure

Element	Description
Chairperson	Independent non-executive director
Members	Minimum of three independent non-executive directors
Reporting Line	Reports to the Board of Directors
Meeting Frequency	Quarterly
Core Function	Oversight, direction and guidance on sustainability initiatives

Westports also links executive remuneration directly to sustainability targets. This alignment between sustainability performance and compensation embeds sustainable progress at every level of the organisation.

Sustainability Governance Reporting Line



The Management Sustainability Committee (“MSC”) is responsible for developing and proposing sustainability strategies, overseeing their implementation and cascading approved initiatives to the respective departments, while the Board Sustainability Committee provides oversight and review. The Westports Holdings Berhad Board of Directors retains final approval authority.

SUSTAINABILITY AND RISK INTEGRATION

Westports integrates sustainability risks and opportunities into its strategic and risk management frameworks to ensure that ESG factors influence all key decisions. The Group conducts comprehensive risk assessments for current and planned projects to evaluate their implications for sustainability objectives, operational continuity and long-term resilience.

Each risk category is tailored to address critical areas such as:

Climate change	Regulatory developments
Social and community impacts	Resource scarcity
Environmental effects	

The Board of Directors plays a central role in overseeing these activities and conducts quarterly reviews to maintain alignment with the Group’s strategy. Westports has expanded its risk management and internal control systems to include sustainability-related risks, such as climate change, resource scarcity and environmental impacts. The Group’s sustainability risk profile is reported to the Board through the Board Sustainability Committee, ensuring transparent oversight and supporting long-term value creation.

GOVERNANCE

Governance Area	Oversight, Accountability and Management Role	Processes and Controls	Integration with Strategy, Risk Management and Performance
Economic Governance			
Business Development and Value Chain	The Board oversees the governance framework and ensures that business development aligns with sustainability objectives. The Sustainability Committee embeds sustainability principles across operations; the Procurement Committee ensures ESG integration throughout the value chain.	<ul style="list-style-type: none"> • Supplier ESG Compliance Policy • Anti-Greenwashing Policy • Sustainability Policy • Environmental, Social and Governance Compliance Assessments • Capacity-Building Programmes 	Business strategy aligns with sustainable growth. Impacts of business development are evaluated for ethical sourcing and responsible expansion. Quarterly reviews track progress in integrating sustainability throughout the value chain.
Ethics and Compliance	The Anti-Corruption and Ethics Committee oversees ethical governance and anti-corruption policies. The Board ensures alignment with international standards. The Human Resources and Compliance Unit drives employee training and audits.	<ul style="list-style-type: none"> • Anti-Corruption and Bribery Policy • Board Charter • Code of Conduct and Ethics • Conflict of Interest Policy • Whistleblower Policy • ISO 37001 Certification • Compliance Audits • Employee Training • Risk Assessments 	Embedding ethical principles into corporate strategy and integrating sustainability risks into the corporate risk management and compliance frameworks reinforces transparency and integrity.
Environmental Governance			
Environmental Compliance and Impact Management	The Executive Chairman and Board Sustainability Committee provide strategic oversight of environmental policy and performance. On a daily basis, the CEO, General Managers and Heads of Departments implement environmental standards across all departments.	<ul style="list-style-type: none"> • Environmental Policy • Green Port Policy • Environmental Management System (“EMS”) • Management reviews of environmental performance • Benchmarking against established environmental targets • Internal and third-party audits for EMS verification 	The Executive Chairman and Board Sustainability Committee provide strategic oversight of environmental policy and performance. On a daily basis, the CEO, General Managers and Heads of Departments oversee the implementation and execution of environmental standards across all departments.
Energy and Climate Change	The Board provides strategic oversight of climate-related risks through the Risk Management and Sustainability Committee. The Sustainability Working Committee, led by the CEO, coordinates climate strategies across departments. Senior leaders in operations, finance and engineering oversee execution.	<ul style="list-style-type: none"> • Climate risk assessments • Quarterly updates to the Board on climate initiatives • Electrification initiatives • Renewable energy deployment • Independent audits • Westports decarbonisation agenda 	Capital investment decisions incorporate emissions and climate resilience impacts. Key performance indicators track progress towards Net Zero 2050, emissions reductions and renewable energy capacity. Sustainability initiatives are integrated into operational and financial decision-making.

GOVERNANCE

Governance Area	Oversight, Accountability and Management Role	Processes and Controls	Integration with Strategy, Risk Management and Performance
Environmental Governance			
Waste, Water, Effluents and Pollutants	The Board oversees waste, water and effluent management. The Operations Department manages water use, waste minimisation and effluent treatment.	<ul style="list-style-type: none"> • Environmental Policy • Waste Management Policy • Water Management Policy • Cross-department collaboration • Annual audits • Water consumption tracking 	Environmental management supports sustainability goals by improving resource efficiency and reducing waste. Reviews ensure regulatory compliance and track progress on waste, pollution and water management.
Social Governance			
Labour Practices	The Board, the Nomination and Remuneration Committee, the People Matters Committee and the Human Resources Department lead diversity, equity and inclusion through policies and training.	<ul style="list-style-type: none"> • Equal Employment Opportunity Policy • Code of Conduct • Diversity, Equity and Inclusion Training • Annual Employee Surveys • Performance Reviews • Training Completion Tracking • Sexual Harassment at the Workplace Policy 	Labour practices support productivity and long-term talent retention. Engagement and diversity metrics, along with regular alignment reviews, monitor progress.
Safety, Health and Security	The CEO chairs the Safety, Health and Environment (“SHE”) Committee. Port Police and Emergency Response Teams manage daily safety. Environmental Health and Safety Officers lead safety operations.	<ul style="list-style-type: none"> • OSHA compliance • ISO 45001 Certification • Crisis Management Plan • Safety audits • Incident tracking • Employee safety training 	Safety performance links directly to leadership remuneration. Incident tracking and operational resilience reviews monitor progress.
Community	The Board oversees community engagement with a focus on sustainable development in Pulau Indah. The Corporate Social Responsibility Committee manages stakeholder engagement and aligns initiatives with local needs.	<ul style="list-style-type: none"> • Community Safety and Health Policy • Regular stakeholder feedback • Collaboration with local authorities and NGOs • Annual assessments 	Community engagement supports social stability and aligns with the Founder’s commitment to developing Pulau Indah. Investments in infrastructure, education and healthcare support community well-being and contribute to SDG 11.
Responsible Operations	The Board ensures operational excellence and compliance with a focus on quality management, safe operations and sustainable port development. Management fosters sustainable operations through cross-department collaboration and engagement across the value chain.	<ul style="list-style-type: none"> • ISO 27001 for data privacy • ISO 9001 for service quality • ISO 28000 for supply chain security • Audits and IT security measures • Process optimisations • Performance tracking • Customer Safety and Health Policy 	Sustainable operations support business continuity and reliable services. The goal is a safe, digital, efficient and future-ready port.
Information security	Senior management treats cybersecurity as a critical enterprise risk and reports it to the Board. The CEO oversees the ISMS policy and the Information Security Committee meets quarterly. The Security Manager coordinates with technology partners.	<ul style="list-style-type: none"> • ISO 27001:2022 Information Security Management System • Compliance with the Personal Data Protection Act • Restricted employee access to ISMS materials • Quarterly committee reviews 	Cybersecurity is embedded in the ERM framework and aligned with strategic objectives. These controls strengthen resilience and protect critical systems and data. Governance measures ensure accountability and consistent adherence to recognised security standards.

**MANAGING RISKS
FOR LONG-TERM
RESILIENCE**

MANAGING RISKS FOR LONG-TERM RESILIENCE

Westports applies a structured ERM Framework to identify, assess, prioritise and monitor sustainability-related risks and opportunities across its operations. The framework integrates directly into strategic planning and provides stakeholders with a clear view of the Group’s risk profile and its approach to exposures that could materially affect business performance and value.

The Risk Management Committee (“RMC”) leads risk governance, supported by the Enterprise Risk Management Committee (“ERMC”) and departmental Risk Champions. The ERMC meets quarterly to review the consolidated risk register, evaluate emerging risks and assess changes in likelihood and impact. It then escalates outcomes to the RMC for deliberation. This process ensures Westports manages sustainability-related matters, including health and safety, environmental management, climate change, customer relations and regulatory compliance, alongside operational and financial risks.

Westports identifies risks through continuous operational monitoring, regulatory inspections and structured stakeholder engagement. The Group integrates both quantitative data and qualitative insights to ensure early identification of emerging exposures and trends.

Key inputs include:

- Incident and near-miss records
- Yard density levels and throughput performance statistics
- Financial and cost indicators
- Trade policy and regulatory developments
- Sector-wide trends and competitive shifts across global port operators

The Group’s risk register covers all business areas, marine and terminal operations, safety, engineering, finance, human capital and environmental management, ensuring complete organisational visibility.

Westports applies scenario analysis to high-impact exposures such as geopolitical tensions, trade-volume shocks, shipping alliance formations and tariff changes. This process tests assumptions and shapes mitigation strategies.

Each risk is scored using a five-by-five likelihood and magnitude matrix. For example:

- Fatal Accident at Terminal: upgraded from (1, 2) to (3, 5) after three non-staff fatal incidents: i.e. two in August 2025 and one in October 2025
- Yard Density: downgraded from (5, 2) to (3, 2) following improved yard management

As of December 2025, the risk register records 101 active risks: 2 Red, 6 Key, 38 Amber and 55 Green, reflecting an actively managed and balanced risk profile.

Risk owners implement preventive, detective and corrective controls to manage exposures:

In addition, Westports completed the certification for the Business Continuity Management System (“BCMS”) ISO 22301 during the year. This certification demonstrates the Company’s commitment to ensuring the resilience of its operations in the face of potential disruptions. By achieving ISO 22301, Westports has established a robust framework to identify, assess and manage risks that could impact business continuity.

Preventive controls	<ul style="list-style-type: none"> • Hold monthly safety meetings with the CEO • Enforce protective equipment • Run traffic safety campaigns and strengthen traffic controls • Maintain critical equipment • Comply with ISO 45001 and ISO 14001 standards
Detective controls	<ul style="list-style-type: none"> • Conduct audits • Use CCTV surveillance • Perform hydrographic surveys • Review incidents
Corrective actions	<ul style="list-style-type: none"> • Upgrade infrastructure • Retrain employees and contractors • Update procedures

Quarterly reviews assess control effectiveness using indicators such as accident frequency, yard density levels and collection ratios.

Westports continually updates its processes to incorporate lessons learned and respond to changing conditions. In 2025, the Group:

- Introduced stronger traffic controls and installed additional barriers
- Intensified enforcement for hauliers and contractors
- Added succession-planning metrics to strengthen leadership continuity
- Improved financial monitoring with progressive billing and tighter credit controls
- Reduced yard congestion and optimised vessel scheduling to raise operational efficiency

The ERM Framework also identifies sustainability-related opportunities. Digital automation, energy management and efficiency programmes strengthen resilience and support long-term competitiveness.

Westports integrates sustainability risks and opportunities within the same governance structure and reporting cycle used for strategic and financial risks. This alignment ensures sustainability considerations influence board oversight, resource allocation and strategic planning, reinforcing the Group’s commitment to responsible and sustainable growth.

SUSTAINABILITY RISK MANAGEMENT

Westports’ Sustainability Risk Framework identifies and evaluates social and environmental risks linked to business transactions. Company-wide due diligence supports this process by assessing potential impacts, with the framework regularly updated to reflect emerging developments. Westports applies a structured approach to managing operational and supply chain risks, integrating sustainability criteria, including anti-corruption, labour practices, pollution prevention and human rights, into supplier screening and management.

ERM Components and their Purpose

Component	Purpose
Risk Governance (RMC, ERMC, Risk Champions)	Leads and coordinates risk identification, evaluation and reporting
Risk Register	Consolidates risks across marine, terminal, safety, engineering, finance, HR and environmental areas
Scenario Analysis	Tests the impact of severe but plausible events
5x5 Risk Matrix	Scores likelihood and impact to prioritise risks
Preventive Controls	Reduce likelihood of incidents
Detective Controls	Identify weaknesses through audits and monitoring
Corrective Actions	Address incidents and strengthen resilience
Continuous Improvement	Integrates lessons learned into processes, systems and training

STRATEGY

ESG PILLAR	RISK TYPE	RISK DESCRIPTION	POTENTIAL IMPACT	TIMEFRAME	RISK LEVEL	KEY MITIGATION
Environmental	Marine and environmental incidents	Accidental marine or land pollution due to operational activities or vessel incidents	Disruption to operations, regulatory penalties and reputational damage	Short–Medium	Medium–High	Compliance with ISO 14001; regular emergency drills; spill response plans; continuous coordination with DOE and PKA
	Fire, explosions and hazardous spillage	Fire or explosion from hazardous cargo, e-waste, or misdeclared containers	Safety risk, property damage, business interruption	Short–Medium	High	Regular inspections, segregation of DG cargo, firefighting readiness, joint drills with landed clients
	Non-compliance with environmental regulations	Failure to comply with port, environmental or international codes and standards	Suspension of certification, fines and operational restrictions	Ongoing	Medium	Scheduled internal/external audits; staff training; compliance monitoring and reporting
	Climate-related and extreme weather risks	Rising temperatures, severe rainfall or storms disrupting operations or infrastructure	Reduced productivity, increased maintenance and financial loss	Medium–Long	High	Business continuity planning, drainage improvement and climate scenario assessment
Social	Personal workplace injuries and accidents	Workplace accidents involving staff, contractors or hauliers	Injury or fatality, loss of morale, regulatory penalties	Ongoing	High	Enforcement of safety rules and PPE, Health & Safety Committee oversight and ongoing safety campaigns
	Non-compliance with safety rules and regulations	Breach of Occupational Safety and Health requirements or SOPs	Stop-work orders, loss of certification, reputational impact	Ongoing	Medium–High	SHE Committee enforcement, periodic audits, refresher training and monitoring
	Long-lying and e-waste containers	Abandoned or misdeclared containers create congestion and both safety and fire hazards	Storage inefficiencies, financial loss and fire risk	Short–Medium	High	E-waste task force, collaboration with DOE and customs, segregation and progressive billing controls
	Customer dissatisfaction/ service disruption	Vessel delays, high yard density or capacity constraints affecting service quality	Reduced customer confidence, potential volume loss	Short–Medium	Medium	Close engagement with shipping lines, proactive communication and operational efficiency improvements
Governance	Regulatory/legal compliance	Breach of maritime, customs or PDPA laws; failure to meet port authority requirements	Legal liabilities, loss of accreditation, business disruption	Ongoing	Medium–High	Compliance monitoring, continuous legal review and internal audit oversight
	Data protection and cybersecurity	Cyber-attack or data breach affecting port operations or stakeholder information	Financial loss, regulatory fines, reputational impact	Ongoing	Medium	System upgrades, regular penetration testing, staff awareness training and PDPA compliance
	Ethical conduct/ corruption risk	Non-compliance with the Code of Conduct or anti-bribery policies	Reputational damage, legal sanctions	Ongoing	Medium	Enforcement of the Code of Ethics, whistleblowing mechanism and supplier due diligence

STRATEGY

Westports' long-term strategy focuses on operational resilience, economic growth and environmental stewardship while contributing positively to society. This section provides an:

- Overview of how sustainability-related risks and opportunities shape the Group's business planning and financial decisions
- A discussion of detailed initiatives and performance insights

Westports aligns its disclosures with international reporting standards to ensure transparency and accountability.

PIONEERING ECONOMIC SUSTAINABILITY IN PORT OPERATIONS

Westports advances financial and operational sustainability by integrating efficient port operations with innovation, trade growth and responsible resource management. Strategic investments in infrastructure, technology and sustainable practices support operational excellence, long-term economic viability and reduced environmental impact, positioning the Group for resilient growth in a rapidly evolving global market.

STRONG GROWTH AND POSITIVE OUTLOOK

Westports' recent performance reflects a strategy that aligns financial growth with long-term value creation for stakeholders. The government's approval of a phased tariff increase at Port Klang strengthens the Group's financial position and supports continued investment in sustainability. The tariff adjustment enables Westports to enhance earnings, improve operational efficiency and reinvest in ESG initiatives that reinforce its commitment to sustainable port operations.

In 2025, Westports handled 11.33 million TEUs, representing a 3.2% increase from the previous year. This growth demonstrates the Group's ability to meet rising demand while upholding sustainable business practices. It reinforces Westports' standing as a key link in global trade and contributes to Malaysia's broader economic development as a leading regional logistics hub.

As profitability improves through strategic investments and tariff adjustments, Westports remains focused on delivering its sustainability commitments. Key priorities include advancing decarbonisation, improving energy efficiency and fostering an inclusive, safe workplace. These efforts create long-term value for stakeholders, support Malaysia's environmental and social development goals and contribute to global progress towards a sustainable future.

Economic Value Drivers at Westports

Area	Contribution to Sustainable Economic Growth
Tariff adjustments	Strengthen earnings and enable reinvestment into ESG and operational efficiency initiatives
TEU growth	Demonstrates operational capacity, supports Malaysia's competitiveness and drives regional economic activity
Infrastructure investment	Enhances efficiency, reduces congestion and supports long-term competitiveness and resilience
Decarbonisation initiatives	Lower long-term operating costs, reduce emissions and mitigate exposure to future climate regulations

TRADE GROWTH THROUGH PORT EXPANSION AND INFRASTRUCTURE DEVELOPMENT

Westports 2 ("WP2") marks the next phase of Port Klang's long-term expansion and strengthens Malaysia's position as a leading regional transshipment hub. The development extends the port's concession period to 31 August 2070 with CT10–CT13 and to 31 August 2082 upon completion of CT14–CT17.

WP2 adds significant new capacity through a two-phase development plan:

- Phase 1 (CT10–CT13): 2024–2038 with an investment of RM6.3 billion
- Phase 2 (CT14–CT17): 2036–2053 with a similar investment value

Westports' projects combined capital expenditure for WP1 and WP2 at RM39.6 billion through to 2082.

As at 31 December 2025, overall progress for CT10–CT13 stands at 45%, outpacing the scheduled progress of 40%. Reclamation works for CT10 are progressing well and are scheduled for completion by the end of 2026. Construction remains aligned with the long-term development timeline, supported by effective planning and sustained project financing.

WP2 Impacts and Strategic Features

Area	Details
Economic and Industry Impact	<ul style="list-style-type: none"> ■ Expected economic output of RM55 billion through direct, indirect and induced effects ■ Contributes RM19 billion to Malaysia's GDP through value-added trade services, construction supply chains and business linkages ■ Creates ~6,000 full-time jobs for Malaysians, supporting workforce participation and local capability development
Community and Environmental Stewardship	<ul style="list-style-type: none"> ■ Development affects 97 hectares of mangroves ■ Westports will replant 100 hectares of mangroves ■ Over 250,000 mangrove trees planned for replanting over 25 years ■ Terminal designed for operational Net Zero emissions from Day 1 ■ Electrification of quay cranes, RTGs, guided vehicles and terminal trucks reduces carbon emissions and aligns with Westports' decarbonisation pathway
Digitalisation and Innovation	<ul style="list-style-type: none"> ■ WP2 integrates advanced automation and digital architecture ■ Electrified infrastructure enables flexible automation of equipment ■ Supports IoT, AI and blockchain technologies ■ Enhances reliability, safety and energy efficiency ■ Builds high-skilled local talent and strengthens Malaysia's logistics technology ecosystem

LEADING THE REGION THROUGH STRATEGIC PARTNERSHIP

As Malaysia's leading mega transshipment hub for major shipping lines, Westports plays a central role in shaping the port, transportation and maritime sectors. The Group works closely with key industry associations, regulatory bodies such as the Ministry of Transport ("MOT") and UKAS, the Selangor state government and other port operators and business partners. These partnerships strengthen industry standards, drive innovation and support sustainable growth across the national logistics ecosystem.

Industry Organisations, Associations and Partners

Category	Organisations
Port and Logistics Committees	<ul style="list-style-type: none"> ■ Port Consultative Committee ("PCC") ■ National Logistic Taskforce ("NLTF") ■ Technical Working Group on Trading Across Borders ("TWGTAB") ■ Logistics Council of the Malaysian International Chamber of Commerce and Industry ("MICCI") ■ Jawatankuasa Teknikal Fasilitasi Perdagangan ("JKTFP") ■ Industrial Park Management Committee ("IPMC")
Industry Associations	<ul style="list-style-type: none"> ■ Federation of Malaysian Manufacturers ("FMM") ■ Federation of Malaysian Freight Forwarders ("FMFF") ■ Selangor Freight Forwarders and Logistics Association ("SFFLA") ■ Malaysia Freight Forwarders Association ("MAFFA") ■ Association of Malaysian Hauliers ("AMH")
Government Ministries & National Agencies	<ul style="list-style-type: none"> ■ Economic Planning Unit ("EPU") ■ Performance Management and Delivery Unit ("PEMANDU") ■ Ministry of Transport ("MOT") ■ Ministry of Finance ("MOF") ■ Ministry of International Trade and Industry ("MITI") ■ Malaysia Productivity Council ("MPC") ■ Malaysia External Trade Development Corporation ("MATRADE")
Local Government & Enforcement Agencies	<ul style="list-style-type: none"> ■ Port Klang Authority ■ Royal Malaysian Customs Department ■ Department of Safety and Health ■ Department of Environment ■ Royal Malaysia Police ■ Fire and Rescue Department ■ Port Health Authority ■ Klang Municipal Council

ETHICAL BUSINESS OPERATIONS

Westports upholds the highest ethical standards through its Code of Conduct, which sets clear expectations for fair, safe and responsible behaviour. All employees are briefed on these principles and must formally acknowledge them upon joining the organisation. The Company enforces a strict zero-tolerance policy on bribery and corruption and embeds integrity into every aspect of its operations.

Code of Conduct Focus Areas

Category	Focus Areas
Integrity & Fair Practices	<ul style="list-style-type: none"> ■ Fair Dealing and Integrity ■ Anti-Bribery and Anti-Corruption ■ Anti-Money Laundering ■ Anti-Competition
Respectful Workplace	<ul style="list-style-type: none"> ■ Discrimination and Harassment ■ Sexual Harassment ■ Equal Employment Opportunity
Safety & Environment	<ul style="list-style-type: none"> ■ Health and Safety ■ Environment
Information & Accountability	<ul style="list-style-type: none"> ■ Confidential Information ■ Personal Data Protection ■ Whistle Blowing ■ Abuses of Power ■ Conflicts of Interest

ANTI-CORRUPTION AND BRIBERY

Westports upholds a strict zero-tolerance policy against all forms of corruption and bribery, as set out in the Group's comprehensive Anti-Corruption and Bribery Policy. The Policy covers embezzlement, gifts and hospitality, money laundering, conflicts of interest, political contributions, illegal financing, charitable donations and dealings with government officials. It applies to all employees, intermediaries and supply chain partners.

To strengthen integrity across the organisation, Westports has identified approximately 60 high-risk roles and implemented specific mitigation measures to address potential corruption exposures. Due diligence remains a critical component of operations, especially for high-risk activities and intermediaries such as contractors. Westports also submits external audit findings to the Malaysian Anti-Corruption Commission ("MACC") as part of a voluntary self-declaration, reinforcing transparency and demonstrating strong ethical conduct.

The Group takes decisive action against misconduct. Breaches of the Anti-Corruption and Bribery Policy may result in warnings, dismissal or prosecution, depending on the severity of the breach.

Westports' Certified Integrity Officer ("CeIO"), Mr Veeranaidu Ramandu, is accredited by the Integrity Officer Accreditation Board, chaired by the MACC Chief Commissioner. The CeIO plays a pivotal role in mitigating corruption risks, conducting investigations and guiding ethical decision-making across the organisation.

Westports' Anti-Corruption and Integrity Framework

Component	Key Responsibilities and Actions
Policy Scope and Coverage	<ul style="list-style-type: none"> Addresses all forms of corruption and bribery, including embezzlement, gifts and hospitality, money laundering, conflicts of interest, political contributions, illegal financing, charitable donations and dealings with government officials Applies to employees, intermediaries and supply chain partners
ACE Committee Oversight	<ul style="list-style-type: none"> Committee established by Westports Overseen by the Board of Directors Provides strategic direction for anti-corruption controls and governance
Employee Responsibility	<ul style="list-style-type: none"> Employees must actively prevent, detect and report bribery or corruption Reports can be submitted through the whistleblowing channel: integrity@westports.com.my Employees acknowledge the Code of Conduct upon joining
Corruption Risk Assessments	<ul style="list-style-type: none"> Regular comprehensive assessments covering all corruption types, including bribery Integrated into assessments for intermediaries, including contractors
High-Risk Roles	<ul style="list-style-type: none"> Approximately 60 "high-risk" roles identified Specific mitigation measures implemented to address potential corruption issues
Due Diligence	<ul style="list-style-type: none"> Conducted on personnel, business associates, contractors and agents Covers projects, significant business activities and new business partners Targets activities or areas with heightened corruption risks
MACC Transparency & External Audit	<ul style="list-style-type: none"> External audit findings submitted to MACC as voluntary self-declaration Demonstrates Westports' commitment to transparency and ethical conduct
Consequences for Breaches	<ul style="list-style-type: none"> Zero-tolerance policy enforced Penalties include warnings, dismissal or prosecution based on severity
CeIO	<ul style="list-style-type: none"> Mr Veeranaidu Ramandu has served as CeIO since 2023 Accredited by the Integrity Officer Accreditation Board, chaired by the MACC Chief Commissioner Leads investigations, mitigates corruption risks and guides ethical conduct

ANTI-BRIBERY MANAGEMENT SYSTEM ("ABMS")

Westports strengthens its governance framework through ISO 37001:2016, comprehensive training, strict controls and strong oversight across its operations and supply chain:

- Implemented ISO 37001:2016 ABMS across all operations.
- Completed Year 3 Surveillance Audit on 11 February 2026 by SIRIM and re-certified with ISO 37001:2025.
- Conducted ABMS Internal Audit Training for Legal and Internal Audit teams, covering audit planning, methodology, sampling, competency development and review procedures and reporting.

ANTI-CORRUPTION AND BRIBERY TRAINING

- All new personnel received training on the Anti-Corruption and Bribery Policy during induction.
- Executives and managers sign an Anti-Bribery Pledge.
- Westports requires 100% participation in corruption training before surveillance audits.
- 100% completion achieved.

POLITICAL CONTRIBUTIONS

Westports does not make monetary or political contributions to political parties, officials or candidates. The Group prohibits political donations, except those that support nation-building and benefit the public, ensuring it gains no improper business advantage.

ANTI-COMPETITION

Westports complies with competition laws, prohibits anti-competitive behaviour and respects confidential agreements. The Port Klang Authority regulates rates and shipping lines have specific contracts with Westports, subject to third-party audits to address any allegations.

CONFLICT OF INTEREST

Westports upholds the highest standards of integrity and transparency in its recruitment practices, preventing conflicts of interest and safeguarding fairness in candidate selection.

Westports excludes individuals with personal connections to applicants from the hiring panel. The Human Resources Department introduced a conflict-of-interest declaration section into the interview evaluation form, requiring all panel members to disclose any potential conflicts with candidates before interviews. This measure ensures transparency and accountability throughout the recruitment process.

Westports prevents conflicts of interest by excluding individuals with personal connections from the hiring panel. All parties must disclose any potential conflicts during interviews to ensure transparency and integrity in the recruitment process.

WESTPORTS' ANTI-CORRUPTION COMMITMENT ACROSS THE SUPPLY CHAIN

Focus Area	Actions and Requirements
Supplier Integrity Standards	<ul style="list-style-type: none"> Westports enforces comprehensive anti-bribery and corruption requirements for all suppliers.
Quarterly Risk Assessments	<ul style="list-style-type: none"> Conducts quarterly corruption-risk assessments on contractors and intermediaries to ensure ongoing compliance and mitigate potential risks.
Due Diligence	<ul style="list-style-type: none"> Performs due diligence when evaluating all contracts and high-risk activities, including screening business partners and intermediaries.
Vendor Pre-Qualification Requirements	<ul style="list-style-type: none"> Requires suppliers to acknowledge and commit to anti-corruption expectations through the Vendor Pre-Qualification Assessment Form.

WHISTLEBLOWING

Feature	Description
Policy Availability	English and Bahasa Malaysia (Employee Handbook)
Reporting Channels	Confidential reporting, open or anonymous
24/7 Hotline	Managed independently and linked to the Port Police
Legal Protection	Witness Protection Act 2009 and Whistleblower Protection Act 2010
Governance Oversight	The Board holds ultimate responsibility Audit Committee provides oversight Management implements anti-corruption measures

ESG INTEGRATION IN THE SUPPLY CHAIN

Westports integrates ESG principles across its supply chain to ensure all vendors uphold the Group's policies and Code of Conduct. Sustainability and corporate responsibility clauses are embedded into contracts to encourage suppliers to align with Westports' values and adopt responsible practices. During contract renewals, Westports evaluates suppliers' sustainability plans and incentivises progress toward its goals. Strict enforcement of the Supplier Code of Conduct, regular inspections and continuous monitoring ensure consistent compliance.

Westports informed all landed clients of its 2026 sustainability expectations, including planned activities, completed initiatives, anticipated outcomes, comparative benefits and overall impact. Conventional tenants are also encouraged to undertake decarbonisation and sustainability projects.

Vendor Sustainability Expectations and Milestones

Timeline	Requirements and Expectations
By 2030	<p>Expectation: All vendors demonstrate a clear commitment to sustainability.</p> <p>Key Actions:</p> <ul style="list-style-type: none"> Develop a sustainability roadmap. Establish medium- and long-term sustainability plans. Provide detailed disclosures of sustainability efforts.
By 2050	<p>Vision: Complete vendor alignment with ESG requirements.</p> <p>Focus Areas:</p> <ul style="list-style-type: none"> Ensure economic profitability for both purchaser and vendor. Demonstrate social responsibility while generating profits. Exercise responsible management of environmental resources.

Westports also commits to encouraging SME vendors to begin their sustainability reporting journey by providing practical guidance and tools for ESG disclosure.

Westports Malaysia Sdn Bhd participated in the ASEAN-BAC Malaysia x SFIA Interoperability Sandbox 2025, a key initiative under the ASEAN Sustainability Reporting Advocacy Collaborative ("ASRAC"). Our participation focused on supporting SME vendors in starting their sustainability reporting journey.

Through the sandbox, our vendors responded to a comprehensive survey and utilised a practical tool, the Simplified ESG Disclosure Guideline ("SEDG"), developed by Capital Markets Malaysia under the Securities Commission Malaysia. The SEDG provides SMEs with a standardised and accessible approach to ESG disclosure.

By supporting suppliers in adopting this made-in-Malaysia solution, Westports contributed to ASRAC's objective of addressing the "3Cs" of compliance, cost and capacity, enabling smaller enterprises in its value chain to meet emerging reporting expectations through a simplified, practical reporting framework.

**PIONEERING ECONOMIC
SUSTAINABILITY IN PORT
OPERATIONS**

ENVIRONMENTAL SUPPLY CHAIN

Westports integrates environmental responsibility across its procurement activities by enforcing strict compliance requirements, embedding ESG criteria into contracts and holding suppliers accountable through audits, training and performance reviews.

Focus Area	Key Requirements and Actions
Commitment to Compliance	<ul style="list-style-type: none"> Adheres strictly to the Environmental Quality Act (“EQA”) and related regulations. Conducts robust environmental assessments for all new suppliers.
Integration of ESG Criteria	<ul style="list-style-type: none"> Implements progressive ESG integration across the supply chain. Focus areas: <ul style="list-style-type: none"> Energy use and greenhouse gas emissions Water conservation and biodiversity protection Pollution control, waste reduction and resource efficiency
Environmental Clauses in Contracts	<ul style="list-style-type: none"> Approximately 30% of contracts now include environmental clauses. New agreements require suppliers to: <ul style="list-style-type: none"> Assess and minimise environmental impacts Manage resources responsibly Reduce carbon emissions across product life cycles Preference given to suppliers certified with ISO 14001 and ISO 9001. Prohibits hazardous materials, such as asbestos.
Supplier Awareness and Accountability	<ul style="list-style-type: none"> Conducts risk assessments for all suppliers. Procurement teams receive training on environmental standards. Non-compliant suppliers may be required to undergo re-training or re-auditing. Contract termination may occur if compliance is not achieved.
2025 Achievements	<ul style="list-style-type: none"> Recorded zero major incidents of environmental non-compliance.

SOCIAL SUPPLY CHAIN

Westports embeds strong social standards into its procurement processes to ensure suppliers uphold labour rights, ethical conduct and responsible business practices across the value chain.

Focus Area	Key Requirements and Actions
Compliance with Social Standards	<ul style="list-style-type: none"> Requires key supply chain partners to comply with Malaysian Labour Law and International Labour Organisation (“ILO”) guidelines Integrates social considerations into supply chain management through supplier screening, training, questionnaires and risk assessments

Focus Area	Key Requirements and Actions
Social Contractual Clauses	<p>Suppliers are contractually required to:</p> <ul style="list-style-type: none"> Provide equal opportunities for all employees Adhere to industry standards for working hours, living conditions and minimum wages Prohibit harassment, coercion, verbal abuse, cruel or degrading disciplinary practices Eliminate child and forced labour Maintain zero tolerance for corruption Meet health and safety standards Respect freedom of association and the right to collective bargaining Promote non-discrimination
Communication of Expectations	<p>Westports communicates its social and environmental expectations to suppliers through:</p> <ul style="list-style-type: none"> Purchasing policies Supplier contracts Training programmes <p>Supplier obligations are clearly outlined in accessible language</p>
Supplier Risk Assessments	<ul style="list-style-type: none"> Conducts risk assessments for all major suppliers, new and existing, to ensure compliance with social standards Evaluations include formal and informal assessments Conducts on-site inspection audits when required
Ensuring Accountability	<ul style="list-style-type: none"> Emphasises transparency through ongoing monitoring of supplier performance Enforces compliance through audits and follow-up actions
2025 Achievements	<ul style="list-style-type: none"> Recorded zero major incidents of social non-compliance

LOCAL HIRING

Westports prioritises local employment to strengthen the national economy and embed responsible hiring practices across its operations and supply chain. Since October 2020, the Company has included an Encouragement Clause in its Letters of Agreement (“LOA”) to promote local hiring among vendors.

To date, 37% of vendors have achieved an entirely local workforce. Westports continues to work toward its target by conducting regular engagement sessions and guiding vendors to better align with its local employment objectives.

ENVIRONMENTAL SUSTAINABILITY

Westports drives sustainable port operations through a robust EMS that guides compliance, monitoring and continuous improvement. The Group's strategy focuses on reducing emissions, optimising fleet and equipment performance, improving resource efficiency and collaborating with stakeholders to strengthen environmental performance. Investments in automation and digital systems further enhance operational efficiency and minimise environmental impact, reinforcing Westports' goal of operating as a leading green port.

POLLUTION PREVENTION AND CONTROL

Westports recognises the environmental challenges associated with air and water pollution, including vessel emissions such as sulphur oxides ("Sox") and nitrogen oxides ("Nox"), ballast water contamination and potential oil leaks. The Group is committed to reducing these impacts through stringent waste-management practices, targeted mitigation measures and proactive programmes that improve air and water quality across port operations.

Actions, Targets and Programmes to Reduce Port Air Pollution and Improve Air Quality

Action Area	Programmes and Initiatives
Pollution Monitoring and Assessment	<ul style="list-style-type: none"> Pollution control monitoring Pollution risk assessment studies
Training and Capacity Building	<ul style="list-style-type: none"> Pollution training for employees and contractors Awareness programmes on pollution risks and controls
Pollution Prevention Procedures	<ul style="list-style-type: none"> Implementation of pollution risk prevention procedures Adoption of low-nuisance and low-emission equipment
Environmental Rehabilitation	<ul style="list-style-type: none"> Rehabilitating polluted soil and affected areas
Operational Efficiency	<ul style="list-style-type: none"> Improving operational efficiency to reduce emissions and waste
Collaboration and Partnership	<ul style="list-style-type: none"> Participating in local and global initiatives to reduce pollution Collaborating with companies in Pulau Indah to minimise pollution and waste

MATERIALS MANAGEMENT

SCRAP METAL AND WASTE PAPER HANDLING

Regulatory Requirement	Westports' Responsibilities and Actions
Certificate of Approval ("COA") for imported scrap metal and waste paper	<ul style="list-style-type: none"> Every consignment requires a COA issued by MITI under the <i>Customs (Prohibition of Imports) (Amendment) (No. 2) Order 2022</i> SIRIM verifies compliance and conducts audits before COAs are issued
Contamination and Waste Controls	<ul style="list-style-type: none"> Materials must be free from contamination identified as scheduled waste under the <i>Environmental Quality (Scheduled Waste) Regulations 2005</i> Materials must not contain hazardous waste as defined under the Basel Convention These requirements ensure the responsible handling of recyclable imports and support Malaysia's environmental protection framework

BIODIVERSITY AND MARINE CONSERVATION

As a leading gateway port, Westports operates within sensitive coastal and marine environments where biodiversity protection is integral to long-term sustainability. The Group proactively manages ecological impacts from dredging, reclamation, vessel movements and cargo handling to minimise disturbance to marine habitats and preserve water quality.

Focus Area	Key Actions and Outcomes
Mangrove Reforestation	<ul style="list-style-type: none"> Westports strengthened its mangrove reforestation efforts in 2025 as part of its long-term biodiversity and climate resilience strategy. Planted 4 hectares at Kompartmen 14, Hutan Simpan Pulau Klang. Westports plans to plant will be completed planting an additional 16 hectares at Hutan Simpan Kapar in 2026, increasing the total reforested area to 20 hectares (outside Pulau Indah). A total of RM51,513 was spent on mangrove planting in 2025. The mangrove species planted include Bakau Minyak, Bakau Kurap, Bakau Api-api, Bakau Tumu, Bakau Lenggadai and Bakau Pasir.
Conservation in Operations	<ul style="list-style-type: none"> Implements Green Port Policy and practices. Actively reuses degraded materials for reclamation, reducing reliance on transported sand. Applies energy-efficient technologies, water recycling and erosion-control measures.

**ENVIRONMENTAL
SUSTAINABILITY**

Westports also contributes to the UNSDGs by supporting reforestation efforts, with a particular emphasis on biodiversity restoration and carbon sequestration. Through its collaboration with EcoMatcher, Westports actively participates in climate action by planting trees to offset carbon emissions. The Company's commitment extends beyond environmental impact, aiming for long-term sustainability through continuous engagement with climate action strategies. This effort highlights Westports' integration of environmental goals into its broader business operations.

UNSDG	Impact
15	Trees planted: 1,000 Trees
10	Families helped: 5 Families
13	CO ₂ sequestered to date*: 130.6 tonnes CO ₂ sequestered over lifetime*: 250 tonnes

* CO₂ only calculated from trees purchased

COMMITMENT TO NET-ZERO CARBON EMISSIONS BY 2050

Westports continues to strengthen its commitment to achieve operational net-zero carbon emissions by 2050. Following the introduction of Glide Path 2050 in last year's report, the Group has refined its decarbonisation pathway using updated operational data, revised national energy transition projections and the requirements of the expanded terminal development from CT10 to CT17. These refinements improve forecasting accuracy and ensure more substantial alignment with IFRS S2 expectations.

STRENGTHENING GLIDE PATH 2050: EVOLUTION TO VERSION 3

Last year's Glide Path established the primary levers for decarbonisation: improvements in the national grid emission factor, progressive electrification of terminal operating equipment and integration of renewable energy. During 2025, the Group enhanced this pathway to Glide Path version 3, informed by detailed energy consumption data, updated NETR projections and the operational needs of a larger port.

Key Glide Path Enhancements

Enhancement	Description
Updated National Energy Transition Outlook	Malaysia's National Energy Transition Roadmap confirms a phased reduction in fossil fuel dependence, with natural gas serving as a transitional fuel. The projected reduction in the grid emission factor from 0.78 kg CO ₂ e/kWh (2023) to 0.48 kg CO ₂ e/kWh by 2050 supports earlier and deeper planning for electrification.
Integration of Terminal Expansion Requirements	The development of CT10 to CT17 will increase Westports' future handling capacity to 28 million TEUs. Glide Path v3 incorporates updated emissions modelling for this expanded footprint while continuing to target reductions in emissions intensity per TEU.

Enhancement	Description
More Ambitious and Realistic Electrification Roadmap	Operational data collected in 2025 enabled refinements to fleet energy assumptions and accelerated electrification across key equipment categories: <ul style="list-style-type: none"> Terminal trucks: electrification begins in 2026, with 25% electrified by 2030 and 73% by 2040. RTG cranes: 26% electrified by 2030 and 77% by 2040, supported by confirmed deployment at WP1 and WP2. Marine vessels: full electrification retained by 2050 with updated consumption estimates.
Expanded Renewable Energy Integration	Westports builds on past solar installations, projecting more than 29,000 MWh of annual solar generation by 2035. The Group will evaluate opportunities for additional solar capacity at WP2 and adopt Renewable Energy Certificates ("RECs") from 2031 onwards, increasing RECs by 5% annually to reach full coverage by 2050.

UPDATED DECARBONISATION COMMITMENTS

Westports integrates decarbonisation considerations into its long-term capital allocation strategy to ensure future investments remain aligned with its Operational Net Zero 2050 pathway and converges towards the Paris Agreement's 1.5°C objective. In line with this commitment, the Group prioritises capital expenditure towards low-carbon and energy-efficient infrastructure, including solar photovoltaic systems, electrified port equipment, digital optimisation platforms and next-generation terminal technologies, while progressively phasing out diesel-dependent and other carbon-intensive assets in line with its Glide Path 2050 roadmap. Planned investment cycles include the retirement and replacement of diesel-powered rubber-tired gantry cranes, terminal trucks and other legacy equipment with electrified alternatives. To strengthen alignment between capital deployment and decarbonisation goals, Westports applies a structured investment appraisal methodology that considers life-cycle GHG reduction potential, asset replacement timing, operational efficiency gains, technology readiness and long-term internal carbon cost assumptions, ensuring that major capital commitments support the transition to a lower-carbon port ecosystem while also ensuring favourable financial Return On Investment ("ROI").

Westports retains its long-term ambition to achieve net-zero Scope 1 emissions by 2050 and strengthens its Scope 2 pathway through greater integration of renewable energy. Updated intensity targets include:

- 14.4 kg CO₂e/TEU by 2030
- 12.8 kg CO₂e/TEU by 2035
- 30% reduction in CO₂e per TEU by 2035

These targets reflect operational expansion while maintaining a clear trajectory of emissions reduction.

DELIVERING GLIDE PATH 2050: PROGRESS IN 2025

Westports advanced several foundational measures during the year to support long-term decarbonisation:

Name	Initiative
Energy Management System	The Group established an Energy Management Committee in 2025 to oversee energy performance and guide the implementation of a structured energy management system.
Digitalisation to Improve Equipment Efficiency	Digital tools continue to support operational optimisation, reducing fuel consumption and improving the efficiency of terminal operating equipment.
Electrification Aligned with Terminal Commissioning	Equipment electrification is sequenced with the commissioning of new terminal facilities and the renewal of existing fleets to maximise emissions reduction benefits.
Scaling Renewable Energy Use	Westports continues to invest in solar installations and evaluate additional capacity within future terminal phases.
Managing Residual Emissions	The updated pathway retains the use of RECs and future offset mechanisms for unavoidable emissions upon maximising electrification and renewable integration.

A FORWARD-LOOKING AND ADAPTIVE GLIDE PATH

Glide Path version 3 presents a realistic and accountable framework for achieving operational net-zero emissions by 2050. It remains adaptable to advances in equipment technology, grid decarbonisation, renewable energy procurement and the development of the new terminal. Westports will continue to assess and implement the most efficient and commercially viable decarbonisation measures while maintaining safe and reliable port operations.

EFFLUENTS AND WASTE MANAGEMENT

Focus Area	Westports' Commitments and Actions
Policy & Compliance	Manages effluents and waste under the Environmental Quality Act 1974 and Green Port Policy
Resource Efficiency	Reduces resource consumption and improves operational efficiency
Waste Minimisation	Minimises waste generation and maximises recycling or beneficial reuse
Responsible Material Management	Assesses the end destination of all materials brought onto the port premises
Waste Segregation	Separates recyclable and non-recyclable waste to prevent contamination
Effluent Treatment	Channels effluent through oil interceptors and treatment systems to ensure DOE-compliant discharge

SCHEDULED WASTE MANAGEMENT

Westports manages all scheduled waste, including used oil, oil-water emulsions, oil filters, rags, sludge and contaminated containers in full compliance with the Environmental Quality (Scheduled Waste) Regulations 2005.

Waste is properly labelled, stored in designated areas and collected by DOE-licensed contractors, with full traceability recorded through the Electronic Scheduled Waste Information System ("eSWIS").

This system ensures transparent reporting and strict adherence to national environmental standards.

Scheduled Waste Governance and Operations

Area	Key Actions/Requirements
Regulatory Compliance	<ul style="list-style-type: none"> Complete adherence to the Environmental Quality (Scheduled Waste) Regulations 2005 Proper labelling, storage and segregation of all scheduled waste Mandatory use of DOE-licensed contractors for collection and disposal
Tracking & Documentation	<ul style="list-style-type: none"> All movements recorded in eSWIS for complete traceability Ensures transparent reporting and strengthens regulatory compliance
Waste Types Managed	<ul style="list-style-type: none"> Used engine oil and hydraulic oil Oil-water emulsions Oil filters Contaminated rags, sludge and drums Scheduled waste generated from workshops and vessel operations

Enhancing Scheduled Waste Treatment Capacity at Port Klang Port Reception Facility ("PK PRF")

Development Initiative	Key Details
Purpose	<ul style="list-style-type: none"> Enable all scheduled waste generated within Westports to be treated efficiently on-site.
Operational Scope	<ul style="list-style-type: none"> Waste oil collected from vessels. Waste from Maintenance & Repair workshops. Transfer to PK PRF for treatment, recovery or safe disposal.
Status	<ul style="list-style-type: none"> Facility under construction; operator awaiting DOE licence approval.
Expected Commissioning	<ul style="list-style-type: none"> Expected to be fully operational by April 2026.
Impact	<ul style="list-style-type: none"> Stronger environmental compliance. Improved waste handling efficiency. Reduced reliance on external treatment facilities.

Innovation to Reduce Scheduled Waste Generation

Initiative	Description & Expected Benefit
RTG Engine Oil Optimisation	Testing a new oil formulation that may extend maintenance intervals from 670 hours to 1,000 hours, reducing waste oil generation and maintenance downtime.
RTG Fuel Filter Upgrade	Planned trial of an advanced fuel filter that may extend filter life from one month to five months, significantly reducing material consumption and scheduled waste.
Cotton Rags & Gloves Reduction	Targeting a 5% reduction in rag and glove consumption through improved inventory control and reuse practices.
Electric Equipment Transition	Introducing 60 electric terminal tractors under the 2025 CAPEX plan (delivery expected by the 3 rd Quarter 2026), which will reduce oil use, oil changes and associated scheduled waste.

MOVING FORWARD: FUTURE WASTE REDUCTION INITIATIVES

Westports is committed to advancing sustainability through several key initiatives to reduce waste and enhance operational efficiency across its fleet and equipment.

Extending Engine Oil Lifecycle by 40%

Westports is testing new oils to extend engine oil lifecycles from 700 to 1,000 hours. This initiative will reduce the frequency of oil changes, conserve resources and minimise waste in the long-term.

5x Longer Lasting Fuel Filters

The Company is installing new RTG fuel filters that last five times longer, extending their lifespan from 1 month to 5 months. This upgrade will significantly reduce the need for frequent filter replacements, thereby lowering waste and improving the sustainability of fuel management systems.

Investing in Electric Vehicles

As part of its commitment to reducing emissions and improving environmental performance, Westports is investing in 60 new Electric Vehicle Terminal Tractors for deployment by 2026. This transition to electric vehicles will help eliminate the need for future oil changes, significantly reducing both waste and carbon emissions.

PAPER WASTE REDUCTION

Westports is advancing towards its Zero Paper Target by 2030 through the large-scale digitalisation of operational and administrative processes. These initiatives reduce paper dependency, enhance data accuracy and strengthen efficiency across container terminal operations.

Digital Transformation Measures and Outcomes

Digital Transformation Measures	Performance Outcomes
<ul style="list-style-type: none"> Process Automation: Traditional paper-based procedures such as crane sequences, bay plans and damage reports have been replaced with digital systems and tablets, eliminating manual documentation. Electronic Container Damage Report ("E-CDR"): A fully digital reporting tool enabling real-time communication, faster documentation and reduced paper use. Digital Lashing Systems: Electronic documentation for lashing operations streamlines processes and removes the need for printed records. 	<ul style="list-style-type: none"> Reduced paper consumption: Significant decline in paper use across operational and administrative workflows. Improved accuracy and productivity: Real-time digital reporting reduces errors, shortens turnaround time and enhances reliability. Environmental and economic gains: Lower paper waste supports sustainability goals, reduces storage needs and decreases printing costs.

ENERGY AND CLIMATE CHANGE

ENERGY AND CLIMATE CHANGE GOVERNANCE

Westports recognises that strong climate governance is essential to achieving Net Zero by 2050 and to maintaining long-term operational resilience. Climate action is treated not only as a compliance matter but as a strategic driver that supports efficiency, competitiveness and future growth.

The highest level of governance oversees climate-related risks and opportunities. The Board of Directors retains ultimate accountability, as defined in its Terms of Reference and sets the overall direction for climate strategy and performance.

The Board delegates oversight to the Risk Management Committee and the Board Sustainability Committee, which integrate climate considerations into the Group's broader ERM framework. The RMC and SC assess climate-related risks, transition exposures and decarbonisation initiatives alongside other principal business risks.

The MSC supports the RMC and SC in effective implementation. Chaired by the Executive Chairman and comprising senior leaders from operations, finance, engineering and corporate services, it links Board-level oversight to operational execution and cross-functional delivery.

A dedicated Energy Committee, comprising executive members, monitors greenhouse gas reduction targets, oversees decarbonisation initiatives and reports its findings to the MSC for escalation to the SC and the Board. This layered governance model strengthens transparency, accountability and timely decision-making.

At the strategic level, Datuk Ruben Emir Gnanalingam Bin Abdullah, Group Executive Chairman, oversees the Group's greenhouse gas emissions strategy and ensures alignment with its long-term decarbonisation commitments. The Board sets and monitors climate-related targets, including key performance indicators on emissions reduction, renewable energy capacity and supply chain ESG integration. The RMC and SC further ensure that climate performance outcomes are reflected in management remuneration, including that of the Chief Executive Officer, reinforcing alignment between climate objectives and executive accountability.

Westports Board of Directors strengthens its oversight capabilities through:

- Regular training and external briefings
- Updates on regulatory changes and climate-related trends
- Exposure to developments in low-carbon technologies

Structured reporting keeps the Board informed of key developments. The Board of Directors receives quarterly updates covering:

- Progress against the Glide Path to Net Zero 2050
- Emissions performance and GHG trends
- Electrification initiatives and renewable-energy deployment

These controls embed climate risk considerations within Westports' wider governance and risk management systems. Internal control mechanisms, including independent data verification, audit integration and structured cross-functional coordination, strengthen oversight, accuracy and accountability.

Climate Governance Structure

Governance Level	Role and Responsibilities
Board of Directors	Provides strategic oversight of climate risks and opportunities; approves the climate strategy, targets and significant climate-related investments
Executive Chairman	Provides strategic oversight of the Group's GHG emissions strategy and ensures alignment with long-term decarbonisation commitments
RMC and SC	Integrates climate considerations into the Group's risk framework; reviews climate reports and escalates key issues to the Board
MSC	Chaired by the Executive Chairman, coordinates operational implementation of climate strategies across business functions and reports to the RMC and SC
Energy Committee	Tracks GHG-reduction targets, monitors progress of decarbonisation initiatives and reports findings to the MSC

ENERGY MANAGEMENT POLICY

The policy aims to establish an Energy Management System that integrates energy efficiency and sustainability into business decisions and operational activities.

Key commitments	Objectives
<ul style="list-style-type: none"> Continual improvement of energy performance. Reducing carbon footprint and carbon intensity. Encouraging innovation through green technology. Promoting energy-efficient procurement practices. 	<ul style="list-style-type: none"> Maintaining an effective EnMS. Providing training to foster an energy conservation culture. Promoting energy efficiency and reducing energy intensity. Incorporating renewable energy sources. Complying with laws and regulations. Integrating green procurement practices and working with energy-efficient vendors.

An Energy Management Committee will oversee the policy, meeting at least four times annually to meet its objectives. Periodically, Westports will review the policy in line with business strategies, international standards and regulations based on evolving best practices.

ENERGY TRANSITION MEASURES, MILESTONES AND IMPACT

Westports continues to invest in measures that reduce energy intensity and emissions, including:

- Variable-speed RTG cranes
- High-efficiency LED lighting
- Paperless and digitalised operations
- Progressive fleet and equipment electrification

These initiatives reduce potential carbon cost exposure while strengthening competitiveness in an increasingly carbon-conscious maritime sector.

At the same time, the Group evaluates opportunities arising from:

- Electrifying port equipment
- Expanding renewable energy
- Investing in automation and artificial intelligence
- Using digital platforms such as SWIM to enhance logistics efficiency

Westports' pathway to net zero by 2050 presents opportunities for efficiency, innovation and cost savings. Key opportunities include:

- Renewable-energy expansion
- Electrification of port equipment
- Digital optimisation and real-time meteocean forecasting
- IoT-based monitoring of environmental conditions

Category	Milestones and Impact
Lighting Efficiency	Achieved 100% LED conversion for all street and building lighting. High-mast lighting achieved 35% LED conversion, with ongoing replacement. Sustainable lighting systems at the Tower Block reduced power demand and maintenance frequency.
Energy Monitoring and Control	Installed sub-metering or power meters across cranes, warehouses, chillers and reefers for real-time tracking and better load balancing. An integrated energy dashboard and occupancy sensors are in development to reduce idle consumption and optimise performance.
Cleaner Fuel Transition	Replaced Euro 2M diesel with Euro 5-grade fuel for terminal tractors, RTGs, tugboats and pilot boats, reducing SOx and particulate emissions and improving local air quality.
Equipment Modernisation	Progressively replacing older diesel-powered units with more efficient machinery to lower fuel intensity and operational emissions.
Renewable Energy Integration	Implementing on-site solar generation and purchasing Renewable Energy Certificates ("RECs") to offset grid electricity and support long-term decarbonisation goals.
Renewable Energy Expansion	Installed a 6,334 kWp (4,550 kWac) solar system at the Seahawk Warehouse, generating 8,312,170 kWh annually. Westports completed the RM10,997,800 project in December 2025 and secured licensing from the Sustainable Energy Development Authority.
Biodiesel Programme	All terminal tractors, the latest RTG models and all yard equipment now operate on B7 biodiesel (7% methyl ester, 93% petroleum diesel), reducing GHG emissions and particulate matter and improving engine performance.

Category	Milestones and Impact
Empowering Efficiency Through Fleet and Equipment Upgrades	Replaced seven outdated Impsa Quay Cranes with six advanced Mitsui Quay Cranes. The new cranes maximise moves per kWh, significantly reduce electricity consumption and enhance operational performance.
Key Achievements	<ul style="list-style-type: none"> Maximised moves per kWh through Mitsui Quay Cranes. Renewable energy use increased from 0.2% in 2023 to 8.1% in 2025. Energy intensity remained stable as efficiency gains offset operational growth.

GREEN ELECTRICITY TARIFF (“GET”) SUBSCRIPTION AND IMPACT

In alignment with the Government of Malaysia’s goals for carbon neutrality by 2050, Westports has subscribed to the GET provided by Tenaga Nasional Berhad (“TNB”). This initiative allows Westports to procure zero-emission electricity from renewable facilities, such as solar power plants and hydropower stations, without installing its own renewable systems. This approach aligns with our commitment to reducing our carbon footprint and enhancing our sustainability performance, contributing positively to Malaysia’s climate action targets.

GET Tariff Subscription

Westports has committed to a GET subscription of 130 million kWh annually, representing 130% of our average monthly consumption. The subscription period runs for 2.5 years, ending on December 31, 2027. With the introduction of a new electricity tariff structure from July 2025, the Group has benefited from significantly reduced GET premium rates, resulting in some savings over the subscription period.

Westports will be exempt from the Automatic Fuel Adjustment (“AFA”) and the 1.6% Renewable Energy Fund charges, further enhancing the financial benefit of the GET subscription.

Carbon Tax Savings

With Malaysia’s planned carbon tax phased implementation starting in 2026, Westports stands to benefit further from GET by potentially saving on carbon tax costs, depending on the carbon tax rates. Given our current Scope 1 and 2 emissions of 171,385 metric tonnes annually, the savings from the carbon tax under various scenarios could range from approximately RM2.6 million to RM24 million per year, based on projected carbon tax rates of RM15 to RM139 per tonne of CO₂.

Conclusion

The GET subscription is a component of Westports’ strategy to enhance its sustainability performance, reduce emissions and contribute to Malaysia’s climate goals. Through the GET, Westports not only achieves financial benefits but also supports its decarbonisation efforts, aligning with IFRS sustainability disclosure standards. As part of our ongoing commitment to sustainability, we will continue to integrate renewable energy initiatives and transparently disclose emissions and the financial impact of these actions in our Sustainability Report.

CLIMATE CHANGE MANAGEMENT: DRIVING RESILIENCE AND SUSTAINABILITY

Climate change presents a significant risk to Westports and the broader shipping, port and maritime industries. Recognising this challenge, Westports has made mitigating the effects of climate change a strategic priority, with a proactive, holistic approach that involves employees, contractors and industry stakeholders.

Westports aligns its climate risk management with the recommendations of the Task Force on Climate-related Financial Disclosures (“TCFD”) and became an official TCFD supporter in November 2022. The framework guides the Group’s approach to governance, strategy, risk management, metrics and targets.

The Group conducts detailed analyses to identify and assess both physical and transition risks affecting port infrastructure, logistics operations and supply chains. These findings support resilience planning, capital investment decisions and operational continuity.

Summary of Climate-Related Governance, Strategy, Risk Management and Metrics

Pillar	Key Findings/Insights	Response/Actions
Governance	<ul style="list-style-type: none"> Oversight of climate-related risks and opportunities resides with the Board of Directors through the Risk Management Committee (“RMC”) and the Sustainability Committee (“SC”). The Management Sustainability (“MSC”), chaired by the Executive Chairman, manages implementation across divisions. Westports commissioned a Climate Change Assessment from DHI Water & Environment (M) Sdn. Bhd., following PIANC (2020) guidelines. Following the extension of Westports’ concession to 2082, Environmental Resources Management (M) Sdn Bhd (“ERM”) was appointed in July 2025 to undertake a thorough climate risk assessment. Westports will update ERM’s findings in the next Sustainability Report 2026. Nevertheless, ERM’s full report is attached in the Appendix of this report. 	<ul style="list-style-type: none"> Integrate climate topics into Board and management deliberations on risk, strategy and capital projects Use assessment findings to guide investment priorities and operational planning

Pillar	Key Findings/Insights	Response/Actions
Strategy	<ul style="list-style-type: none"> DHI's assessment covers 2020–2080 across short-, medium- and long-term horizons. Key physical risks: <ul style="list-style-type: none"> Sea-level rise of 0.47–0.65 m by 2080. Temperature increase of 1.6–2.7°C, including longer heatwaves. More intense rainfall and longer dry periods. Minor wind and wave changes with uncertainty during squall seasons. High-risk assets: container, dry-bulk and liquid-bulk berths. Moderate-risk assets: drainage, revetments and electrical substations. 	<ul style="list-style-type: none"> Integrate scenario findings into master-planning and southern expansion design beyond CT9 Apply adaptive engineering standards (raised deck levels, reinforced revetments, improved drainage) Incorporate projections into business continuity and insurance planning
Risk Management	<ul style="list-style-type: none"> Risks identified using PIANC's structured method: identification → vulnerability → likelihood → consequence → mitigation. High-risk assets require long-term adaptation. Moderate-risk systems require targeted engineering upgrades. 	<ul style="list-style-type: none"> Integrate climate-related risk assessment into the ERM framework Maintain on-site monitoring (weather stations, tide gauges, wave recorders) Reassess every five years in line with updated IPCC data
Metrics & Targets	<ul style="list-style-type: none"> Indicators monitored include: <ul style="list-style-type: none"> Sea-level rise (0.47–0.65 m). Temperature rise (°C above 2020 baseline). Rainfall intensity (mm/day). Heatwave duration (days/year). Overtopping events affecting quay decks. 	<ul style="list-style-type: none"> Integrate findings into a climate-risk dashboard for infrastructure design and drainage planning Link metrics with long-term emission-reduction and adaptation targets

Westports commissioned a study to assess how climate change could affect the risk profile of its facilities over the short-, medium- and long-term. The study examined both physical and transition risks, including those arising from adaptation measures, such as the port's 2°C operations strategy, and from mitigation technologies, investments, policies and behavioural shifts. Its findings support the formulation of a medium- and long-term climate strategy. Westports also commits to aligning all future capital investments with its long-term GHG reduction targets and the Paris Agreement goal of limiting global warming to 1.5°C.

ADDRESSING CLIMATE CHANGE AND GHG EMISSIONS

Westports' efforts to combat climate change focus on key initiatives:

- Innovation and Adaptation:
 - Researching and implementing solutions to reduce the impact of climate change
- Renewable Energy:
 - Exploring renewable energy technologies to transition away from fossil fuels
- Risk Assessments:
 - Conducting complete climate change risk evaluations to understand and mitigate vulnerabilities
- Technology Integration:
 - Adopting advanced technologies to achieve efficiency gains while reducing costs and emissions
- Cleaner Fuels:
 - Transitioning to low-carbon and cleaner fuel alternatives
- Fuel Efficiency:
 - Implementing technical and operational measures that improve fuel efficiency across operations

COLLABORATION AND ADVOCACY

- Westports collaborates with the Port Klang Authority and the International Maritime Organisation ("IMO") to address environmental challenges, regulatory compliance, climate-related risk and operational efficiency in the maritime sector.
- Senior management leverages their expertise to shape public policy and industry regulations.
- Through memberships in trade associations, Westports ensures alignment between its climate change policies and the industry positions it supports. Westports identifies and addresses conflicting viewpoints, ensuring alignment with emerging best practices.

COMMITMENT TO CARBON INTENSITY REDUCTION

- Westports is dedicated to reducing long-term carbon emission intensity by:
 - Adopting energy-efficient terminal operating equipment when financially and environmentally feasible.
 - Driving improvements in climate change, water and waste management across its supply chains.

STRATEGIC OVERVIEW

Climate change presents material operational and strategic challenges for a coastal port operator such as Westports. Rising sea levels, heavy monsoon rainfall and extreme weather events can disrupt operations, damage infrastructure and increase maintenance costs, while the transition to a low-carbon economy creates both regulatory risk and commercial opportunities.

A detailed Climate Change Assessment by DHI Water & Environment (M) Sdn. Bhd. applied the PIANC (2020) Climate Change Adaptation Planning for Ports and Inland Waterways methodology. The study evaluated future implications for existing facilities and expansion areas across short-, medium- and long-term horizons. It modelled wind, sea levels, wave conditions, ocean currents, rainfall and temperature over a 60-year horizon to 2080, aligned with international IPCC scenarios and relevant national climate baselines.

These findings inform long-term engineering design, drainage capacity and asset resilience planning.

High-risk areas:	Moderate-risk areas:	Low-risk areas:
<ul style="list-style-type: none"> • Container, dry-bulk and liquid-bulk berths • Exposure: deck overtopping, sea-level-related structural load 	<ul style="list-style-type: none"> • Drainage systems • Revetments • Electrical substations 	<ul style="list-style-type: none"> • Cargo-handling and yard zones

The Group identifies and evaluates physical and transition risks. Physical risks include tidal surges, river flooding and heat stress on equipment. DHI modelling indicates that while temperature, winds and waves pose moderate impacts, sea-level rise under the Highest Astronomical Tide (“HAT”) may affect operations toward the end of the 60-year outlook.

Transition risks arise from potential carbon pricing, tightening fuel standards and changing customer expectations for lower-carbon logistics. The corresponding opportunities involve expanding renewable energy use, electrifying equipment and securing efficiency gains through automation.

Malaysia has not yet implemented a national carbon pricing mechanism. However, if the Malaysian Government were to introduce a carbon tax at a level comparable to Singapore’s SGD 45 per tCO₂e (or about RM139), Westports’ current emissions footprint of 171,385 tCO₂e could result in an estimated annual cost of approximately RM24 million, directly affecting operating margins.

In parallel, transition pressures are increasing as major shipping lines incorporate decarbonisation criteria into port selection decisions. Preference for lower-carbon logistics hubs is accelerating the need for operational upgrades.

IMPACTS ON BUSINESS MODEL AND STRATEGIC RESPONSE

Climate factors are embedded in the business model and investment planning, influencing asset design, equipment selection and throughput strategy. For example, major projects undergo climate-risk screening before approval to ensure resilience and cost-effectiveness across their operational lifespan.

The 3rd Supplemental Privatisation Agreement between Westports with the Government and the Port Klang Authority to facilitate WP2 container terminal development has extended the concession period to 31 August 2070, when CT10-CT13 is developed, and will be further extended to 31 August 2082 with the development of CT14-CT17.

How Westports defines short-, medium- and long-term time horizons

Due to the duration of the concession period involved, Westports has adopted the following time horizon definition on climate-related risks and opportunities with the following strategic decision-making purposes:

Time Horizon	Definition	Rationale/Key Considerations
Short-term	Within 5 years to 2030	This period supports evaluation and purchasing decisions for electrified terminal operating equipment.
Medium-term	Between 2030 and 2050	This period is sufficiently long to allow the deployment and replacement of many, if not most, diesel-powered terminal operating equipment with electrified alternatives such as terminal trucks and RTG cranes.
Long-term	Beyond 2050 or more than 25 years from 2025	This extended period reflects the potential for more material climate-related risks and opportunities, as well as the mitigating or adaptation measures required or to be implemented. It also aligns with the concession horizon, with at least a 20-year operating period remaining beyond 2050. Terminal operating equipment with lifespans of up to 30 years would need to be replaced within this timeframe, if not earlier, due to decarbonisation imperatives.

Westports' core business, including container handling, marine services and terminal operations, is inherently energy-intensive. Climate change affects equipment reliability, berth availability and vessel turnaround times. The greatest exposure lies within container yards, quay cranes, RTGs, substations and coastal utilities, all located at low elevation along the Straits of Malacca.

To strengthen resilience, Westports executes an integrated climate-action framework:

- Resource allocation: continued investment in resilient and efficient infrastructure. In 2024, the Group invested RM16.1 million in solar panels for Petikemas and drainage enhancements to mitigate flood risk.
- Direct mitigation: replacement of diesel RTGs with hybrid and variable-speed units; deployment of Euro 5 terminal tractors; and expansion of the 7,864 kWp solar fleet. These initiatives reduced electricity intensity to 184 MJ per TEU.
- Indirect mitigation: collaboration with shipping lines and logistics partners through joint decarbonisation projects, data sharing and green-corridor participation.
- Transition plan: adoption of the Glide Path 2050 decarbonisation plan, targeting 45 per cent Scope 1 and 2 intensity reduction by 2030 (14.4 kg CO₂e per TEU) and 55 per cent by 2035 (12.8 kg CO₂e per TEU). Key dependencies include the national grid's decarbonisation and the availability of renewable energy.
- Target achievement: electrification of 607 terminal tractors and 218 RTGs by 2040; pilot testing of autonomous Q-Trucks and evaluation of electric tugboats for operation before 2050.

Funding for these activities is provided through internal capital, green finance facilities and reinvested efficiency savings.

FINANCIAL EFFECTS AND PLANNING

Westports integrates climate and broader sustainability considerations into capital allocation and operational planning. Investment decisions are assessed not only against immediate operational requirements but also against long-term transition and physical risk exposure, ensuring resilience and value preservation over time.

In evaluating capital projects and operational initiatives, the Group considers:

- Financial viability and long-term return profile
- Climate resilience of infrastructure and assets
- Impact on greenhouse gas emissions and energy efficiency
- Alignment with the Group's long-term sustainability and decarbonisation objectives

Climate change affects Westports' financial performance through maintenance costs, insurance exposure and capital requirements. Adaptation investments, such as drainage upgrades and quay-wall strengthening, safeguard revenue continuity, while hybrid RTGs and solar systems reduce fuel and electricity costs.

Westports embedded climate factors into long-term budgeting, asset management and investment decisions. Near-term actions focus on operational efficiency and emission control; medium-term priorities include equipment electrification and grid integration; long-term plans centre on resilient port expansion and full-fleet electrification.

An internal carbon price of RM83.33 per tonne CO₂e in 2025 guides scenario testing and capital appraisals, ensuring investment decisions incorporate future carbon costs. Westports reviews asset values and depreciation rates annually to reflect climate-related adjustments in line with IAS 36 impairment requirements. Westports identified no material impairments to date.

Expected financial outcomes include lower operating costs from reduced fuel use, higher upfront capital expenditure for electrification and renewable integration and improved access to sustainability-linked financing.

CAPITAL INVESTMENTS IN CLIMATE RESILIENCE

Climate change drives up capital expenditure ("CAPEX") in the port industry by requiring investments in resilient infrastructure to withstand extreme weather, rising sea levels and regulatory demands. Westports continues to allocate capital to:

- Upgrade facilities to improve environmental performance.
- Ensure adequate water discharge to protect infrastructure.
- Adopt energy-efficient technologies to mitigate environmental impacts and enhance long-term operational stability.

CLIMATE-RELATED CAPITAL DEPLOYMENT

In 2025, Westports invested over RM19.04 million in low-carbon technologies and digital systems to support the transition to net zero. Key initiatives completed during the year include the deployment of IoT-based environmental monitoring across terminal operations, expansion of hybrid-equipment upgrades and additional solar-energy installations.

The fleet-electrification programme progressed substantially, with autonomous electric Q-Trucks already deployed into the fleet. In 2025, the SC and the Board already approved the purchase of 60 electric terminal trucks for deployment in 2026. Upgrading the site infrastructure supports the electrification of 217 RTG cranes, with implementation incorporated into the next capital expenditure cycle. These investments demonstrate the Group's continued integration of climate considerations into capital allocation and long-term asset planning.

During the year, Westports also invested RM10.99 million in a 6,334 kWp solar installation at the Seahawk Warehouse, which generates 8.31 million kWh annually and saves about RM75,000 per month in standby electricity charges. Beyond cost efficiency, the project enhances climate resilience by reducing exposure to fossil-fuel volatility, stabilising energy supply during grid disruptions and lowering carbon dependency. This long-term investment strengthens operational continuity and supports Westports' transition toward a low-carbon, climate-resilient port infrastructure.

WESTPORTS CLIMATE FOOTPRINT ASSESSMENT

Consolidation method in calculating the carbon footprint	Operational.
Organisational boundary for calculating the carbon footprint	Accounts for 100% of GHG emissions, where Westports has the authority to implement operational policies.
Independent review of environmental data	Control Union (Malaysia) Sdn Bhd reviewed environmental performance in energy, water, waste and emissions management.

Please refer to the data performance table at the end of this report for Westports' comprehensive carbon disclosure.

CLIMATE SCENARIO LIFE-CYCLE ANALYSIS: CLIMATE CHANGE IMPACTS ON SEAPORTS

Westports commissioned an independent life-cycle climate risk and scenario analysis to test the resilience of its strategy, operations and assets under multiple global warming pathways. The initial study was undertaken by DHI Water & Environment in collaboration with the Marine Ecosystems Research Centre ("EKOMAR") of Universiti Kebangsaan Malaysia ("UKM"), assessing both transition and physical risks across three reference scenarios:

- Orderly Transition (Net Zero 2050): early and coordinated policy alignment with the Paris Agreement.
- Disorderly Transition (Delayed Action): delayed regulatory response resulting in a delayed regulatory response that results in sharper mid-term carbon price escalation.
- Hot House World: limited mitigation leading to greater exposure to chronic and acute physical climate impacts.

This scenario framework provides a balanced perspective on regulatory, market and operational uncertainties, including a pathway aligned with limiting warming to 1.5°C.

Following the extension of Westports' concession to 2082, the Company commissioned Environmental Resources Management (M) Sdn Bhd ("ERM") in July 2025 to undertake an updated climate risk assessment covering its terminal operations at Pulau Indah. Using IPCC AR6 climate projections, ERM evaluated eight climate-related hazards under the SSP5-8.5 scenario for 2050 and 2085, covering critical infrastructure including operational facilities, utilities, equipment, warehouses and nearshore assets.

The full ERM study is included in the Appendix of this Sustainability Report and is also available on the Company's website. Westports will highlight key findings from this assessment in greater detail in the Sustainability Report 2026.

Key Assumptions

- Introduction of national carbon pricing and international shipping-fuel standards.
- Higher logistics costs moderate sustained trade growth.
- Regional changes in rainfall intensity, tidal range and ambient temperature.
- Progressive grid decarbonisation with renewable-energy integration toward 2050.
- Technological advancement in port electrification and battery performance.

The DHI-EKOMAR-UKM study's time horizons extend to 2030 and 2050, covering all current terminals and expansion areas at Port Klang. The analysis concluded that Westports' elevation of +7.23 m above mean sea level provides sufficient protection against the HAT of +5.82 m, indicating that projected sea-level rise for Peninsular Malaysia is unlikely to affect port operations during the concession period. Nonetheless, Westports continues to monitor mean and extreme sea-level trends and may commission further studies to assess potential near-term changes relative to IPCC projections by 2100.

Wave and Ocean Dynamics

A warming climate may alter ocean-wave patterns along over 50% of global coastlines. Surge motion directly affects safe berthing and cargo-handling efficiency, as excessive vessel movement can hinder crane alignment. A DHI marine and coastal engineering assessment found that projected wave conditions at Westports' future berths are comparable to existing ones and pose no operational constraint. A breakwater is therefore not required. However, wave-height effects will continue to be monitored to ensure uninterrupted operations and crew safety.

ADAPTIVE CAPACITY AND RESILIENCE

Current adaptation works—drainage upgrades, quay-wall fortification and hybrid RTG deployment—already mitigate most near-term physical risks. Long-term resilience depends on sustained investment in equipment electrification, renewable energy capacity and digital monitoring systems. Scenario testing confirmed Westports' capacity to repurpose existing assets, adjust operational schedules during extreme events and reallocate financial resources through flexible CAPEX planning.

Westports will integrate scenario analysis into its risk management and strategic decision-making processes in the near future. The Group will conduct regular reviews to assess whether significant climatic, regulatory, or technological developments have occurred. Cross-industry and sector-specific metrics, such as GHG intensity per TEU, renewable energy share and climate-related CAPEX, are used to monitor performance and inform strategic decisions.

EMISSIONS MANAGEMENT

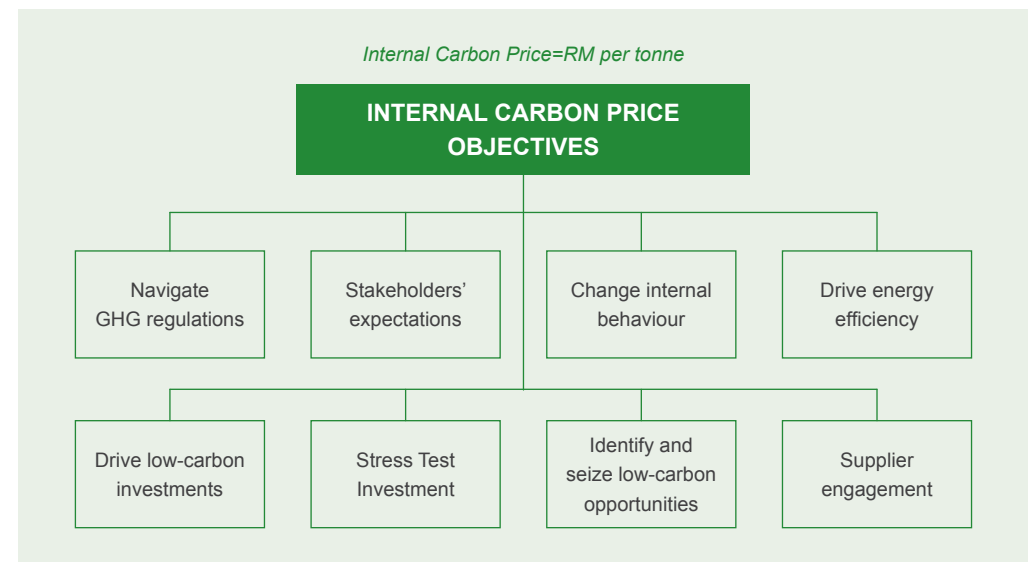
Westports manages emissions from port equipment, vehicles and marine assets to comply with environmental regulations and advance its decarbonisation goals. The Group reduces fuel consumption, improves equipment efficiency and deploys cleaner technologies as part of its strategy to lower its carbon footprint.

Category	Key Actions	Outcomes/Benefits
RTG Performance: Variable Speed RTGs	<ul style="list-style-type: none"> Adjust engine speed based on load demand Save fuel during idling Improve operational efficiency with precise engine control 	<ul style="list-style-type: none"> Lower fuel consumption Reduced emissions during low-load conditions Limited benefits at 100% utilisation
RTG Performance: Hybrid RTGs	<ul style="list-style-type: none"> Use stored battery power to reduce diesel usage Operate efficiently at only 8 litres/hour Deploy in high-idling areas for maximum benefit 	<ul style="list-style-type: none"> Up to 30% fuel savings Lower emissions Batteries last for six years and require regular replacement costs
RTG Fleet Composition	<ul style="list-style-type: none"> 52% RTGCs Remainder includes Hybrid and Variable-Speed RTGs 	<ul style="list-style-type: none"> Balanced fleet that supports staged decarbonisation
RTG Fleet Transition	<ul style="list-style-type: none"> 2026: Replace 15 ageing RTGs with Variable-Speed RTGs Begin transitioning the entire fleet to electric RTGs 	<ul style="list-style-type: none"> Significant long-term emission reduction Major step in sustainable port operations
RTG Emission Control	<ul style="list-style-type: none"> Maintain RTGs within 20%–40% emission levels Conduct precise preventive maintenance Perform in-house injector servicing 	<ul style="list-style-type: none"> 10% reduction in heavy black/white smoke Improved performance and cleaner operations
Terminal Tractors ("TTs")	<ul style="list-style-type: none"> Procure only Euro 5-compliant units 	<ul style="list-style-type: none"> Cleaner fleet with lower particulate emissions

Category	Key Actions	Outcomes/Benefits
Hybrid RTG Deployment Strategy	<ul style="list-style-type: none"> Place Hybrid RTGs where idling is most frequent Coordinate deployment with Planning and M&R 	<ul style="list-style-type: none"> Maximised carbon savings without operational impact
Marine Emissions: Tugboats & Pilot Boats	<ul style="list-style-type: none"> Explore interim methods to reduce diesel consumption Evaluate future adoption of electric tugboat technologies 	<ul style="list-style-type: none"> Target to operate electric tugboats by 2050

INTERNAL CARBON PRICE

Westports has applied an initial internal price for CO₂ emissions to consider climate challenges in its long-term economic decisions. The Group will regularly evaluate and increase this amount when necessary.



WATER MANAGEMENT

Category	Details
Water Target	<ul style="list-style-type: none"> 60,000 m³ per month for Westports' own operational use
Water Monitoring & Efficiency	<ul style="list-style-type: none"> Water meters installed across operations for accurate monitoring Automated water-flow systems in toilets at five port locations to improve efficiency Supports long-term sustainable consumption and optimisation
Water Supply System Upgrade	<ul style="list-style-type: none"> Fire-safety upgrade project for hydrant and foam-pipe systems Phase 1 completed in August 2025, with systems tested and commissioned Phase 2 is ongoing, targeting enhanced firefighting water infrastructure Completion expected by March 2026
Rainwater Harvesting Expansion	<ul style="list-style-type: none"> Original capacity: 24 m³ across four tanks Added 2 m³ at the Petikemas Warehouse Added 2 m³ at the Infinity Warehouse Planned expansion: another 2 m³ at Alfred Talke and Seahawk Warehouses Strengthens sustainable water-use practices and reduces reliance on treated water

ENVIRONMENTAL COMPLIANCE

Westports maintains full compliance with all applicable environmental laws and regulations, embedding these requirements into its environmental policies, management systems and operational controls. The Group actively monitors compliance, conducts regular reviews and implements programmes that not only meet legal obligations but position the organisation to exceed regulatory expectations.

Throughout the reporting period, Westports recorded no significant incidents of non-compliance and received no fines related to environmental impact, demonstrating the effectiveness of its governance and continuous-improvement approach.

OUR PEOPLE

Westports operates under a structured governance framework that sets mandatory standards for ethical conduct and fair labour practices across its operations and supply chain. Key policies supporting this framework cover:

- Governance & Ethical Conduct: Board Charter, Code of Conduct, Code of Ethics for Directors and Directors' Fit and Proper Policy
- Fair Labour & Workforce Protection: Equal Employment Opportunity Policy and Child and Forced Labour Policy

These policies establish precise requirements on integrity, workplace behaviour, recruitment standards and the protection of workers' rights. The Labour Standards Policy, embedded within the Code of Conduct, is communicated globally in English, with translations planned to ensure accessibility for Westports' diverse workforce.

COMPETITIVE AND SUPPORTIVE EMPLOYEE OFFERING

Westports provides a strong employee value proposition built on fair remuneration, comprehensive benefits and practical support for work-life balance across its workforce.

Area	Key Benefits
Fair & Competitive Pay	<ul style="list-style-type: none"> ▪ Exceeds national minimum wage and living wage standards ▪ Upholds equal pay for equal work ▪ Benchmarked 33 port-related roles ▪ Implemented structured salary schemes for all grades to ensure consistent and transparent compensation
Medical & Insurance Benefits	<ul style="list-style-type: none"> ▪ Provides extensive medical coverage at a highly subsidised rate ▪ Employees contribute less than 10% of total insurance premiums
Work-Life Balance	<ul style="list-style-type: none"> ▪ Supports flexible scheduling during commuting disruptions to and from Pulau Indah caused by weather, accidents or port congestion
Family Support	<ul style="list-style-type: none"> ▪ Offers job-protected parental leave for employees who are becoming parents ▪ Operates an on-site daycare centre established in 2019, run by an experienced external provider ▪ The centre provides safe childcare, structured early-learning programmes and balanced meals

DIVERSITY AND INCLUSIVITY

Westports promotes fairness, inclusivity and equal opportunity across its workforce. The Group's Diversity and Equal Opportunity Policy prohibits discrimination of any kind and is supported by strong governance, targeted training and inclusive employment practices.

Area	Key Actions	Outcomes/Commitments
Non-Discrimination	<ul style="list-style-type: none"> ▪ Prohibits discrimination based on race, religion, gender, age, sexual orientation, HIV status, disability, nationality, social background or political opinion 	<ul style="list-style-type: none"> ▪ Ensures a fair, respectful and inclusive workplace for all employees
Governance & Training	<ul style="list-style-type: none"> ▪ Diversity governance led by the Executive Chairman, Group Managing Director and the CEO ▪ HR supports onboarding training and guidance via the Employee Handbook ▪ Provides sexual-harassment training, diversity awareness sessions (English & Bahasa Malaysia), research on gender and age inclusivity and training on inclusive communication (email & WhatsApp) 	<ul style="list-style-type: none"> ▪ Strengthens DEI awareness ▪ Reduces bias and supports long-term culture development
Equal Employment Opportunity Practices	<ul style="list-style-type: none"> ▪ Applies equal opportunity across recruitment, remuneration, training, development and promotions ▪ Removed gender, race and religion requirements from recruitment since 1 October 2023 ▪ Upholds equal pay for similar roles with transparent justification for any differences ▪ Encourages partners, vendors and contractors to adopt similar EEO practices 	<ul style="list-style-type: none"> ▪ Ensures fairness across all employment processes ▪ Reinforces transparent and merit-based workforce decisions

Area	Key Actions	Outcomes/Commitments
Championing Female Representation	<ul style="list-style-type: none"> Maintains a 6% representation target across the workforce and more than 30% at the Board level Senior leadership promotes female representation in the transport sector Provides enhanced graveyard-shift security measures Offers dedicated female toilets and plans a female-exclusive rest area 	<ul style="list-style-type: none"> Target continues to be met Improved safety, comfort and inclusion for female employees
Supporting Disadvantaged Individuals	<ul style="list-style-type: none"> Provides opportunities for individuals from disadvantaged backgrounds, particularly from Pulau Indah Maintains non-discriminatory hiring regardless of age, sexual orientation or nationality 	<ul style="list-style-type: none"> Expands access to employment for vulnerable groups
Veterans & Reserve Service Inclusivity	<ul style="list-style-type: none"> Maintains a neutral stance on reserve service and veteran status — does not actively recruit from these groups but does not discriminate 	<ul style="list-style-type: none"> Aims to increase representation over time
Inclusion of Persons with Disabilities	<ul style="list-style-type: none"> Provides accessible facilities for employees and visitors with mobility limitations Employs three persons with disabilities 	<ul style="list-style-type: none"> Demonstrates commitment to inclusive hiring and accessibility

ENHANCED RECRUITMENT INTEGRITY

Beginning this year, Westports has strengthened its recruitment process by introducing comprehensive criminal background checks for all candidates and requiring completion of a Criminal Record Declaration Form. For high-risk positions, the Company conducts additional screenings through the Malaysian Anti-Corruption Commission (“MACC”) Corruption Offenders Database.

Westports prevents the hiring of individuals with prior corruption offences or adverse integrity records, reinforcing its commitment to a workforce built on trust, professionalism and ethical conduct.

CEO ACTION FOR DIVERSITY AND INCLUSION

Westports strengthens its commitment to diversity and inclusion through its active participation in the CEO Action Network (“CAN”), of which Executive Chairman Datuk Ruben Emir Gnanalingam is a member. He drives the Company’s contribution to the platform and ensures Westports’ priorities are reflected in national and sector-wide initiatives.

Datuk Ruben supports policy advocacy, collaboration and knowledge-sharing that embed diversity, inclusion and sustainability into organisational strategies in Malaysia and globally. His leadership promotes equitable opportunities, ethical conduct and responsible business practices across the industry.

SAFE REPORTING AND HARASSMENT PREVENTION

Westports maintains a safe, respectful and inclusive workplace by providing confidential reporting channels, clear procedures and proactive prevention programmes. Employees and managers receive training to recognise, handle and escalate misconduct appropriately, to address concerns promptly and sensitively.

Pillar	Key Measures	Outcome/Impact
Confidential Reporting Channels	<ul style="list-style-type: none"> Dedicated whistleblowing channel for reporting harassment, discrimination and bullying CeIO exclusively manages the whistleblowing policy to ensure confidentiality and oversight 	Protects employee identity and strengthens trust in reporting processes
Alternative Escalation Pathway	<ul style="list-style-type: none"> Employees may raise concerns through the Penghulu Me platform Employees can escalate issues directly to the committee or senior management 	Provides multiple safe avenues to report misconduct
Employee & Manager Training	<ul style="list-style-type: none"> Training on identifying, handling and escalating harassment and/or bullying reports appropriately 	Ensures consistent, informed responses and strengthens organisational capability
Sexual Harassment Hotline	<ul style="list-style-type: none"> Zero-tolerance policy enforced Dedicated hotline managed by trained HR personnel for confidential reporting 	Enables safe, immediate access to support and intervention

Pillar	Key Measures	Outcome/Impact
Sexual Harassment Survey (2025)	<ul style="list-style-type: none"> 62% female participation 74% feel safe from harassment at all times 77% know the reporting channels 78% feel comfortable reporting with confidence that action will follow 	Provides data-driven insights to strengthen safety measures and trust
Awareness Programme (Jun–Sep 2025)	<ul style="list-style-type: none"> Covered definitions and types of sexual harassment Guided victims and step-by-step reporting procedures 	Builds awareness and removes barriers to reporting

HUMAN RIGHTS

Westports anchors its human rights commitments in internationally recognised standards, including the Universal Declaration of Human Rights, the International Bill of Human Rights, the Voluntary Principles on Security and Human Rights, the ILO 1998 Declaration on Fundamental Principles and Rights at Work and the UN Guiding Principles on Business and Human Rights.

The Company actively participates in workshops and industry collaborations to strengthen Malaysia’s labour standards and ensure alignment with global expectations.

There were no non-compliance cases involving labour standards during the financial year and no incidents or risks of child labour, forced or compulsory labour or violations of indigenous rights in the Company’s history.

Despite zero cases, Westports continues to implement mitigation and remediation measures through training, consultation and strengthened grievance mechanisms.

Westports’ Human Rights Commitments	Actions Taken in Addressing Labour & Human Rights Issues	Local & International Laws and Standards Guiding Westports
<ul style="list-style-type: none"> Recognise human rights as a critical management issue when conducting business Respect the human rights of all stakeholders, including employees and supply chain partners Raise awareness of human rights through employee programmes Promote the use of grievance mechanisms, including formal whistleblowing channels, to address concerns such as bullying and harassment Conduct human rights impact assessments, especially for the port expansion project Maintain regular consultation with local communities and residents’ representatives Provide public grievance channels for external stakeholders 	<ul style="list-style-type: none"> Provide a safe and healthy workplace for associates Implement processes to avoid slavery and human trafficking Do not use child, forced or involuntary labour Conduct regular salary benchmarking to sustain a decent living wage Prohibit discrimination in hiring and employment (gender, race, religion, age, sexual orientation, disability, nationality) Enforce equal pay for equal work Prohibit physical abuse, harassment and threats Support freedom of association and collective bargaining Provide mechanisms for employee representatives to engage with management Ensure work–life balance; prohibit excessive working hours; pay above the local minimum wage Formalised policies, including the Child Labour Policy and Forced Labour Policy Plan work hours with a 10% buffer to manage demand surges; overtime follows minimum required thresholds 	<ul style="list-style-type: none"> Children and Young Persons (Employment) Act 1966 Employment Act 1955 Occupational Safety and Health Act 2022 Minimum Wages Order 2020 Minimum Retirement Age Act 2012 Workman’s Compensation Act 1952 UN Guiding Principles on Business and Human Rights OECD Guidelines for Multinational Enterprises

HUMAN RIGHTS IN THE SUPPLY CHAIN

Human Rights Focus Areas	Actions Taken Across the Supply Chain	Enforcement, Support & Capacity Building
<ul style="list-style-type: none"> Assess human rights risks across operations and the supply chain Review labour standards for existing and potential partners Cover key issues including discrimination, equal remuneration and child and forced labour Prioritise vulnerable groups such as employees, women, children and local communities 	<ul style="list-style-type: none"> Integrate human rights expectations into supplier selection and ongoing assessments Conduct regular inspections of supply chain partners Apply strict action, including contract termination, for non-compliance Work with specialised organisations to strengthen human rights practices across the value chain 	<ul style="list-style-type: none"> Invite suppliers to participate in human rights training and awareness programmes Strengthen consistent human rights standards across the supply chain Provide executive-level industrial relations training to equip leaders to manage human rights matters with clarity and accountability

FREEDOM OF ASSOCIATION, UNION REPRESENTATION AND COLLECTIVE BARGAINING

Westports upholds the rights to freedom of association and collective bargaining, embedding these commitments in its formal policies, Code of Conduct and Business Ethics. These commitments exceed local legal requirements and reinforce the Company’s approach to fair and ethical labour practices. Direct communication channels between employees and management further strengthen constructive employee relations.

A strong union presence underpins this framework. Westports supports employee participation in the registered trade union, Kesatuan Sekerja Pekerja Westports. A total of 3,567 non-executive employees (62%) are union members. Non-executive employees who handle confidential matters are not unionised but remain covered under the same collective bargaining terms, ensuring equal protections and benefits.

Collective Bargaining Overview

Area	Details
Freedom of Association Commitment	Embedded in Westports’ policy framework and Code of Conduct, exceeding local legal requirements.
Union Representation	3,925 non-executive employees (77%) are members of the recognised union, Kesatuan Sekerja Pekerja Westports.
Coverage for Non-Union Roles	Non-unionised non-executive employees handling confidential matters receive identical collective bargaining protections and benefits.
Employee–Management Engagement	Direct communication channels foster transparent, constructive employee relations.
Scope of Collective Agreements	Agreements negotiated with the union cover: <ul style="list-style-type: none"> Health and safety Corporate social responsibility Remuneration Working hours and flexibility Training, career development and lifelong learning Stress management and employability Equal opportunities Benefits

TRAINING AND DEVELOPMENT

Westports delivered extensive training to the operations team throughout the year, covering New Terminal Operator Training, Defensive Driving, Operator Cabin Maintenance & Systems, Diesel Engine Cooling Systems, Electrical Technology, Container Damage and Inspection and Oil Spill Training. Alongside technical programmes, the Company strengthened soft skills and personal development through targeted training in communication, leadership and personal effectiveness.

To build future leaders, Westports leveraged its assessment centre to identify talent from the Assistant Manager level and above. Comprehensive leadership programmes enhanced strategic thinking, decision-making and management capabilities. Employees also attended Harvard Business School programmes in Malaysia and a KAIZEN programme, reinforcing operational excellence and advanced business acumen.

In support of digitalisation, Westports prioritised digital literacy training, especially Power BI, enabling employees to develop essential data analytics capability for better decision-making and operational efficiency.

Area	Details
Technical Training	New Terminal Operator Training, Defensive Driving, Operator Cabin Maintenance & Systems, Engine Diesel Cooling Systems, Electrical Technology, Container Damage and Inspection and Oil Spill Training
Soft Skills & Personal Development	Communication, leadership and personal effectiveness
Leadership Pipeline Development	Assessment centre used to identify talent from Assistant Manager level and above; comprehensive leadership programmes
Advanced Leadership Exposure	Participation in Harvard Business School programmes (Malaysia) and the KAIZEN programme
Digital Capability Building	Digital literacy training with emphasis on Power BI

SUCCESSION PLANNING

Westports advanced its strategic succession planning by introducing structured metrics categorised as Ready Now, Ready Soon, Ready Later, and No Successor, along with a scoring system. This approach improves talent visibility, supports targeted development and strengthens leadership continuity.

Succession Planning Framework

Component	Description
Scoring Categories	Ready Now, Ready Soon, Ready Later, No Successor
Purpose	Improve visibility of leadership readiness; support targeted development
Outcome	Stronger succession pool and proactive continuity planning

YOUTH UNEMPLOYMENT

Westports' paid internship programme helps address youth unemployment and supports underprivileged groups, including those from deprived backgrounds, low social status and without formal qualifications. In 2025, Westports provided temporary internships to five candidates.

The Management plans to prioritise internship opportunities for employees' children by identifying suitable assignments and candidates before opening opportunities to external applicants.

Internship Programme at a Glance

Area	Details
Purpose	Address youth unemployment and support underprivileged groups
2025 Internships Offered	Five candidates
Future Approach	Prioritise children of employees; match assignments and candidates before offering externally

FOSTERING COMMUNICATION, ENGAGEMENT AND DIALOGUE

Westports cultivates a culture of open communication, collaboration and mutual respect through multiple formal engagement platforms that strengthen dialogue between employees and management. These channels support trust, transparency and shared problem-solving across the organisation.

Engagement Platform	Purpose & Activities	Details & Outcomes
Westports Joint Consultative Council ("WJCC") <i>Established in 2011</i>	<ul style="list-style-type: none"> Serves as a formal platform for two-way dialogue between employees and company representatives. Provides a consistent avenue for updates, feedback and shared problem-solving. 	<ul style="list-style-type: none"> Meets monthly Management updates employees on business performance and direction Employees share feedback, ideas and concerns on daily work matters Strengthens communication, engagement and alignment Bridges leadership-workforce gap and supports a cohesive, inclusive culture
Industrial Counsellors <i>Penghulu Programme, introduced in 2011</i>	<ul style="list-style-type: none"> Provides informal yet structured feedback and support channels for non-executive employees. Enables early escalation of workplace or personal issues. 	<ul style="list-style-type: none"> Penghulus are executives and managers assigned to all non-executive employees Mentors appointed by senior management guide Penghulus in managing complex people dynamics Issues raised may include: health and safety, CSR matters, remuneration, working hours, training, career development, flexibility, employability, stress and equal opportunities

Engagement Platform	Purpose & Activities	Details & Outcomes
Westports Family Day	<ul style="list-style-type: none"> Strengthens community and a sense of belonging by bringing employees and their families together. 	<ul style="list-style-type: none"> Held at Sunway Lagoon over four days: 7 & 22 December 2024, 21 & 26 January 2025 Activities included telematches, games, breakfast and lunch sessions Reinforces a supportive, inclusive workplace culture and strengthens family-company ties
Other Engagement Activities	<ul style="list-style-type: none"> Additional touchpoints to maintain consistent communication and address employee needs. 	<ul style="list-style-type: none"> Communications Day Workshops and townhalls Monthly meetings with the registered trade union (Kesatuan Sekerja Westports) on welfare and safety matters Luncheon with staff or members of the Pulau Indah community during festive periods Westports Annual Dinner over five sessions in December 2025 and January 2026 for all staff members

BUILDING A SAFER PORT COMMUNITY

Given the inherent risks associated with heavy machinery and large-scale port operations, a comprehensive safety governance framework is essential to mitigate risks and maintain operational integrity. Westports prioritises safety and security through a structured framework led by the OSH Committee, chaired by the Chief Executive Officer. Compliance with OSHA 2022 and ISO 45001 certification supports high safety standards, while the Port Police and emergency response teams manage operational risks. A robust Crisis Management Plan strengthens preparedness for environmental challenges and supports operational resilience.

Safety is more than a policy at Westports. It is a core value that shapes operations and corporate culture. The Safety, Health and Environment (“SHE”) Committee, chaired by Group Managing Director Datuk Eddie Lee, drives collaboration between management and employee representatives. The Committee evaluates performance, addresses concerns raised by employees and stakeholders and implements proactive safety strategies to minimise risks. In 2025, the SHE Committee held four meetings in line with OSHA requirements and resolved all concerns raised, reflecting Westports’ open and responsive approach to safety governance.

Safety officers perform a central role in daily safety operations. Their responsibilities include:

- Coordinating and overseeing the implementation of EHS programmes
- Ensuring compliance with OSHA 2022 and internal safety standards
- Extending Westports’ safety commitment to contractors and port users to foster a safety culture across all stakeholders

Safety is embedded in leadership accountability. The Group Executive Chairman, Datuk Ruben Emir Gnanalingam Bin Abdullah, the Group Managing Director, Datuk Eddie Lee, and CEO, Vijaya Kumar, have remuneration and bonuses directly linked to the Company’s fatality record. This approach reinforces a zero-tolerance culture for safety lapses and elevates safety performance as a top leadership priority.

Westports strengthened its safety governance in line with the OSHA (Amendment 2022) by:

- Appointing Safety Officers, Site Safety Supervisors and OSH Coordinators across its operations
- Partnering with landed clients to streamline Safety Officer appointments
- Collaborating with vendors to train and support OSH Coordinators and equip them with the skills to maintain and elevate safety standards

Safety Governance Structure

Role	Responsibilities
SHE Committee	Oversees safety strategy, resolves employee concerns and reviews safety performance
Port Police and Emergency Response Teams	Manage operational security, emergency response and incident control
Safety Officers	Implement safety programmes, enforce compliance and support contractors and port users
SHO, SSS and OSH Coordinators	Reinforce safety practices across operations in line with OSHA amendments
Executive Leadership	Accountable through safety-linked remuneration and oversight responsibilities

Westports is certified under ISO 45001:2018 and ISO 14001:2015, reflecting a strong commitment to workplace safety and environmental stewardship. Westports treats safety as a critical operational priority, supported by robust systems, continuous training and full compliance with all relevant legislation, including OSHA 2022 and EQA 1974.

The Company successfully recertified ISO 45001 during the year through a comprehensive audit. Westports' safety duties extend beyond its workforce to contractors and suppliers, ensuring consistent protection across the entire ecosystem.

Pillar	Key Features/Activities	Impact/Outcomes
Safety Systems & Certification	<ul style="list-style-type: none"> ISO 45001:2018 certified since 2021 and recertified in 2025 Fully aligned with ISO 14001:2015 environmental requirements 	<ul style="list-style-type: none"> Maintains internationally recognised management standards Reinforces compliance and continuous improvement
Incident Reporting & Monitoring	<ul style="list-style-type: none"> Accident Tracking System ("ATS") "You See You Act" ("UCUX") mobile reporting tool 	<ul style="list-style-type: none"> Proactive identification and mitigation of safety risks Faster response to near-misses and violations
Training & Capability Building	<ul style="list-style-type: none"> 100% of operational employees trained annually Safety awareness embedded across operations 	<ul style="list-style-type: none"> Strengthens a safety-first culture Ensures consistent safe work practices
Performance Management	<ul style="list-style-type: none"> Monitoring of Lost-Time Incidents SHE measurement and monitoring matrix 	<ul style="list-style-type: none"> Clear accountability for performance Continual improvement in safety metrics
2025 Outcomes	<ul style="list-style-type: none"> Target: 25% reduction in accidents/incidents Actual: 26% reduction achieved 	<ul style="list-style-type: none"> Demonstrates compliance and behavioural improvements
Emergency & Crisis Preparedness	<ul style="list-style-type: none"> Led by Head of Security, Dato' K. Manoharan Crisis Management Plan for haze and other emergencies Involvement of CMC, Port Police, Fire & Rescue, paramedics and clinic 	<ul style="list-style-type: none"> Strengthened response capability Coordinated multi-team crisis handling
Risk Assessment & Compliance	<ul style="list-style-type: none"> SHE risk assessments for all operations and new projects Biannual internal and external audits Collaboration with Jabatan Kerja Raya 	<ul style="list-style-type: none"> Ensures safe operations and continual compliance Improvements in road safety and SHE systems
Benchmarking & Continuous Learning	<ul style="list-style-type: none"> Safety performance benchmarking across ports 	<ul style="list-style-type: none"> Identifies best practices and improvement areas

COMMITMENT TO CONTINUOUS IMPROVEMENT

Westports views health and safety as a dynamic priority requiring ongoing investment and adaptation. Embedding strong systems, empowering employees and continually benchmarking performance enable the Group to protect its workforce, contractors and community while supporting sustainable operations.

CLEAN HABITS, SAFE PORT

No Smoking or Vaping	Drug, Substance and Alcohol Abuse Policy
<p>Smoking is restricted to designated areas only. Smoking and vaping are strictly prohibited at the Liquid Bulk Terminal and inside crane or truck cabins.</p> <p>Enforcement prevents ignition risks in high-hazard zones.</p>	<p>Westports maintains a zero-tolerance policy on drugs, substances and alcohol to uphold a safe and productive workplaqqce.</p>

PEDESTRIAN SAFETY

Westports prioritises road safety within the port by:

- Conducting regular awareness campaigns
- Installing clearer pedestrian signage
- Implementing a Summon and Demerit Procedure to enforce safe driving behaviour
- Conducting periodic reviews of all road and safety signage

These initiatives enhance discipline, awareness and hazard prevention across the port.

HAZE MONITORING

Westports installed air-monitoring sensors to track PM2.5, PM10 and carbon monoxide.

The system monitors air quality within a 10 km radius and issues early warnings when pollution levels rise. HR activates the Crisis Management Plan to safeguard employee health during haze events.

NOISE RISK ASSESSMENT

Westports conducted a comprehensive Noise Risk Assessment every quarter in 2025, which fulfilled the requirement of the OSH (Noise Exposure) Regulations 2019. Actions included:

- Identifying high-risk areas and implementing job-specific PPE requirements
- Conducting annual audiometric tests to monitor employee hearing health

These measures reinforce compliance and strengthen workplace safety.

PEST CONTROL AND FOGGING

Westports conducts regular fogging and pest control across its operational areas to maintain a safe and hygienic environment for employees, visitors and the wider community. A trained and certified service team carries out systematic treatments to minimise health risks.

These measures are essential for preventing mosquito-borne diseases such as dengue, which pose significant risks in Malaysia’s tropical climate. Regular monitoring and scheduled interventions help reduce mosquito breeding sites and support a healthier, safer port environment.

EXTENDING SAFETY AND HEALTH BEYOND THE GATES

PORT POLICE (SECURITY)

Safety and security at Westports meet international standards befitting a world-class port. Established under the Police Act 1990 and the Privatisation Agreement 1994, the revamped Security Department in 2024 oversees Westports Police and Fire & Rescue operations. Currently, the Safety Department’s main role is to ensure the safety, health and environmental-related matters of Westports. Together, the Security Department and Safety Department play a central role in keeping the port and Pulau Indah safe and free from crime.

Through continuous surveillance, coordinated emergency response and proactive enforcement, the Port Police protect both land and water boundaries, ensuring operational integrity and public safety. Their close collaboration with internal departments, the Marine Department and national enforcement agencies underscores Westports’ commitment to maintaining international-standard safety, security and environmental protection across all port operations.

Port Police Roles and Responsibilities

Function	Key Responsibilities
Maritime Patrols	<ul style="list-style-type: none"> ▪ Conduct regular seaside patrols ▪ Respond to marine emergencies as directed by the Vessel Traffic Management System (“VTMS”) under PKA
Safety and Enforcement	<ul style="list-style-type: none"> ▪ Prevent illegal or unsafe activities, including unauthorised fishing ▪ Support piloting and navigation safety with the Marine Department
Crime Prevention	<ul style="list-style-type: none"> ▪ Established under the Police Act 1990, with full policing powers for Pulau Indah since 2009 ▪ Maintain order and enforce laws across the island
Emergency Response	<ul style="list-style-type: none"> ▪ Assist in search and rescue ▪ Support fire and oil spill operations to safeguard marine and operational safety
Land Security	<ul style="list-style-type: none"> ▪ Safeguard vessels, cargo, buildings and port facilities ▪ Provide traffic control and security patrols throughout the port, industrial and residential areas
Law Enforcement Collaboration	<ul style="list-style-type: none"> ▪ Coordinate with external enforcement agencies to ensure smooth, secure port operations
Fire and Safety Services	<ul style="list-style-type: none"> ▪ Oversee industrial fire prevention ▪ Conduct safety audits ▪ Provide ambulance services and land/underwater rescue operations
Training and Administration	<ul style="list-style-type: none"> ▪ Manage access systems ▪ Process port passes ▪ Provide security escorts ▪ Deliver safety, fire and rescue training for staff and port users

Performance Highlights

Year	CSR Patrolling	Traffic Control	Highway Assistance
2024	1,432	496	1,812
2025	1,106	698	1,960

Year	Container or Cargo Theft	Other Property Theft	Intrusion/Security Breach (Physical)
2024	0	0	2
2025	0	0	1

ACTIONS TO MINIMISE CRIME AND ACCIDENT RATES

Crime Prevention

Westports Port Police reinforce crime prevention and detection through:

- Intelligence sharing with Klang Selatan Police, Pandamaran Police and PDRM
- Joint patrols with local law enforcement to increase visibility and deterrence

Pulau Indah Crime Statistics

2024	66
2025	83

Accident Prevention

The Port Police take a proactive approach to reducing accident risks by:

- Road Hazard Reporting: Roadcare team reports potholes, debris and hazards to JKR Klang for immediate action
- Route Inspections: Conducted during the 1st and 3rd shifts to identify and mitigate risks
- Incident Reporting: Port police report all haulier and transporter-related accidents to SFFLA and AMH
- Speed Monitoring: Conducting regular speed trap operations with PDRM enforces compliance
- Awareness Campaigns: Developing billboard and communication messages promotes safe driving and accident prevention

Pulau Indah Highway Accident Statistics

Year	Fatality	Major Injury	Minor Injury	Accident Damage Only	Total Accidents	Accident Per Km (20Km)
2024	15	5	0	1,165	1,185	53.8
2025	9	0	0	1,059	1,068	48.5

KLINIK WESTPORTS

Westports demonstrates its dedication to employee and community well-being through two Klinik Westports facilities. The first clinic, established in 2009 on Pulau Indah, offers free consultations and treatments for employees and their families. The initiative is fully funded and managed by an in-house medical team.

Building on this success, Westports opened a second 24-hour Klinik Westports on 17 April 2023, providing the same benefits to employees and their dependents while extending affordable healthcare services to the public. Conveniently located near the KESAS Highway, the facility offers quick, accessible medical care for all.

Westports has partnered with private and government hospitals in Klang to provide access to specialised medical care at preferential rates. This holistic approach reinforces Westports' role as a responsible employer and valued community partner.

AMBULANCE SERVICES

Westports strengthens its community support through dedicated ambulance services that serve as a vital lifeline during medical emergencies. Operating two ambulances, the fully funded service ensures rapid and reliable response, providing timely medical assistance to employees and the surrounding community.

Ambulance Services 2025 (Employees)

Total cases	Total hours	Total man-hours (two personnel)
113	500	100

FIRE ENGINE SERVICES

Westports' fire engine services support both the port and the surrounding community in emergency and rescue operations. Staffed by trained and experienced personnel, the team ensures readiness and professionalism in every response. Over the past year, the unit responded to three incidents, contributing eight man-hours to provide swift, effective action.

EXTENDING SAFETY STANDARDS ACROSS THE SUPPLY CHAIN

Westports enforces strict health, safety and environmental requirements across its supply chain, with all contractors subject to a rigorous pre-qualification and ESH-led prescreening process that evaluates safety performance and operational risks. Clear expectations deliver consistently high safety standards throughout port operations, particularly for the lashing gang.

Contractor safety measures include:

- Mandatory participation in Port Police safety training.
- Valid certifications for all machinery operators, including forklifts and stackers.
- Continuous risk assessments and provision of appropriate tools and PPE.
- Strict enforcement of safety guidelines, with penalties such as charges, suspension of port passes and restricted terminal access for non-compliance.

CARING FOR MENTAL HEALTH

Westports promotes mental well-being through clear guidance on recognising depression, anxiety and related symptoms. Employees can seek support through the clinic, their department, the Penghulu, the WJCC or Human Resources.

Support measures include work-from-home options, onsite childcare, enhanced parental leave and mental health training.

WORKING HOURS POLICY

Westports has aligned its Working Hours Policy with the Malaysian Employment Act 1955, as outlined in the Employee Handbook and employment contracts. As the port operates 24/7 and cannot afford any downtime, the nature of the work, particularly in the yard, can be demanding and physically exhausting.

Westports accommodates this flexibly by announcing the roster and shift patterns at least one year in advance and monitoring atypical working hours. Employees receive overtime compensation but cannot work more than a double shift to prioritise health and safety. This limit is in place to prevent excessive working hours. Westports also upholds employees' right to rest days and off days.

OVERTIME HOURS MANAGEMENT INITIATIVE

In 2025, Westports introduced the Overtime Hours Management Policy to:

- Strengthen compliance with Section 60A of the Malaysian Employment Act 1955.
- Promote employee well-being by effectively managing work hours.

Under this initiative:

- Overtime Limit per Employee: Overtime is capped at 60 hours per month (equivalent to 15 hours per week) to ensure fair workload distribution and prevent excessive working hours.
- Approval Requirement: Any overtime exceeding the monthly limit requires Head of Department approval, supported by a valid justification.

Westports also implemented an Overtime Control Initiative to monitor and manage overtime hours by department, ensuring fair workload distribution and improved operational efficiency.

CONTRACT OF SERVICE COMMITMENT

Westports complies with the terms of the Contract of Service, ensuring that employees are not required to work beyond the limits stipulated under labour regulations. These commitments safeguard fair working hours and prevent excessive workloads.

Contract of Service Requirement	Description
Rest Break Requirement	Employees must not work more than five consecutive hours without a minimum 30-minute break.
Daily Working Hour Limit	Employees must not work more than eight hours in one day.
Daily Spread Limit	Working hours must not exceed a 10-hour spread in any one day.
Weekly Working Hour Limit	Employees must not work more than 48 hours in one week.

* Excludes certain times, such as emergencies or if work is essential to the life of the community

SAFETY AWARENESS INITIATIVES

In FY2025, Westports conducted a comprehensive series of safety campaigns and engagements to strengthen workplace safety, health awareness and employee participation. Key activities included the Health Passport, Toolbox Talks, Working at Heights Workshop, Mental Health Talk, Family Visit to the M&R Workshop, Pop Quiz Competition, First Aid Safety Campaign and the TTS Townhall Session, supported by audits, drills, vendor discussions, SW workshops and regular walkabouts.

A **Safety Carnival** was held on 1 and 8 October 2025, featuring exhibitions, games, vehicle inspections and safe riding demonstrations. The JPJ Mobile Van offered on-site licence renewal and summons discounts. Participating agencies included DOSH, PERKESO, JPJ, PDRM, MIROS, MOTOWAZI and MJKR, promoting stronger cross-agency collaboration and safety awareness.

Westports continues to promote worker consultation and participation at all levels through frequent safety and health activities.

Programme	Date(s)	Objectives	Activities	Impact
Commuting Safety Programme	20 & 25 February, 17 March & 16 April	Increase safety awareness during travel	Safe driving talk, exhibition and quiz	<ul style="list-style-type: none"> Target: reduce travel-related accidents by 25% Collaboration with PERKESO, PDRM, MOTOWAZI, IMTIYAZ and JPJ
Health Screening Programme	25 February & 12 March	Increase awareness of health care and early detection of non-communicable diseases	Health talk, exhibition and health screening	<ul style="list-style-type: none"> Achievement: 100% participation of employees aged 40+ Collaboration with PERKESO & National Cancer Society of Malaysia (“NCSM”)
Town Hall with DOSH Selangor	13 March	Reinforce continuous compliance with DOSH requirements and implement methods to minimise workplace accidents	Townhall talk on the theme: Compliance is Everyone’s Responsibility	<ul style="list-style-type: none"> Strengthened employee understanding of DOSH requirements, improving compliance awareness across all departments Reinforced a safety-first mindset through direct engagement with regulators
World Day for Safety and Health at Work	21 May	Celebrate global safety and health awareness	DOSH pledge recital, montage screening, launch gimmick & exhibition	<ul style="list-style-type: none"> Officiated by the Director of DOSH; attended by over 800 guests
Cooking Gas Safety Campaign	26 May	Increase safety awareness on using cooking gas at home	Safety briefing, tips & fire extinguishing demonstration	<ul style="list-style-type: none"> Collaboration with PETRON, BHP & Fire and Rescue Department of Pulau Indah
Mental Health Talk & “Say No to Sugar” Campaign	25 February, 12 March, 11 April & 21 May	Promote mental health awareness and healthy lifestyle choices	Briefing on self-care, self-control & sugar-free lifestyle	<ul style="list-style-type: none"> Strengthened employee awareness of mental well-being and healthy lifestyle habits through practical guidance on self-care and stress management Encouraged behaviour change by highlighting the effects of sugar intake on long-term health and promoting healthier daily routines
Workplace Wellness Programme	5 May	Increase health awareness among selected staff (Red Health Pass holders)	Workshop with health briefing, physical exercise & healthy menu demonstration	<ul style="list-style-type: none"> Supported at-risk employees (Red Health Pass holders) through targeted interventions that promote early prevention and healthier habits Improved overall wellness literacy and motivated participants to adopt sustainable lifestyle changes
Safety Carnival	1 & 8 October	Promote workplace and commuting safety	Exhibitions (DOSH, PERKESO, JPJ, PDRM, MIROS), games, vehicle inspections & safe riding demo	<ul style="list-style-type: none"> Boosted workforce engagement in safety practices through interactive demonstrations, exhibitions and real-world learning experiences Strengthened collaboration with key enforcement agencies, reinforcing Westports’ safety culture and shared responsibility across the port community

UNITING AGAINST GLOBAL DISEASE

Westports supports global disease prevention through comprehensive lab screenings for Tuberculosis (“TB”), malaria and HIV. Employees flagged for health concerns undergo testing every three or six months. Monthly educational talks strengthen awareness and prevention. Where a disease is detected, particularly HIV/AIDS, Westports provides complimentary specialised care and refers individuals to recognised centres for complete assessment and follow-up treatment.

SAFETY AND HEALTH IMPROVEMENT ACTIVITIES

Westports advanced its safety performance through targeted improvement initiatives informed by stakeholder feedback and on-site risk observations. These actions strengthen preventive controls, enhance collaboration and reinforce a proactive safety culture across the port. Improvements ranged from upgraded physical safety measures to enhanced committee oversight, accelerated traffic-safety innovations and structured inspection programmes that drive continuous improvement.

Safety and Health Improvement Measures

Focus Area	Key Activities	Impact/Outcomes
Collaboration & Joint Learning	<ul style="list-style-type: none"> Strengthened engagement with landed clients’ safety teams Shared safety data, insights and practices 	<ul style="list-style-type: none"> Improved cross-partner alignment on risk controls Enhanced joint learning and collaborative safety culture
Physical Safety Enhancements	<ul style="list-style-type: none"> Installed new safety signage across the port Added clearly marked pedestrian crossings 	<ul style="list-style-type: none"> Increased visibility and hazard awareness Reduced risk of pedestrian–vehicle incidents
Gate Drive-Through System	<ul style="list-style-type: none"> Accelerated implementation from December to September Enabled drivers to complete transactions without exiting vehicles 	<ul style="list-style-type: none"> Eliminated driver exposure to moving trucks Improved traffic flow and overall safety
Strengthened OHS Governance	<ul style="list-style-type: none"> SHC enhanced its role in identifying hazards and mitigation measures Benchmarking against industry best practices 	<ul style="list-style-type: none"> More structured oversight of workplace risks Stronger compliance with legal and internal requirements

Focus Area	Key Activities	Impact/Outcomes
Team-Based Inspections	<ul style="list-style-type: none"> Six SHC groups conducted inspections of high-risk zones and unsafe acts Findings reviewed in SHC meetings with corrective/preventive measures tracked 	<ul style="list-style-type: none"> Faster identification of risks Continuous performance improvement and accountability
Ongoing Compliance & Improvements	<ul style="list-style-type: none"> Regular meetings to review findings and implement corrective actions Continuous refinement of safety procedures 	<ul style="list-style-type: none"> Sustained operational safety standards Better visibility of risk trends and improvement priorities

NOTICE PERIOD

Westports complies with all Malaysian labour laws and collective agreements governing minimum notice periods for significant operational changes. When proposing such changes, Westports:

- Initiates early communication with affected employees
- Provides the maximum possible advance notice, beyond minimum legal requirements, where feasible
- Consults the WJCC and union representatives to assess and manage potential impacts on employees

This approach ensures transparency, protects employee rights and supports fair workforce transitions during organisational change.

SOCIETY

As a leading port operator, Westports plays a significant role in Malaysia’s trade, industrial development and supply chain strength. Its operations support national growth and reinforce Malaysia’s position as a regional maritime hub. From its earliest days, Westports has recognised that the people of Pulau Indah, its closest neighbours, are an integral part of its journey.

This commitment was instilled by the late founder, Tan Sri Datuk G. Gnanalingam, who believed in uplifting the surrounding community and prioritised efforts to reduce poverty in Pulau Indah. His values remain embedded in Westports’ culture and continue to guide how the organisation contributes to social well-being today.

Established in 2019, the Westports Foundation carries this legacy forward. Its programmes focus on eight priority areas, shaped by the needs of Pulau Indah, including education, healthcare access, household resilience, youth development and environmental protection. Each initiative aims to deliver practical improvements and long-term benefits for the community.

In 2025, Westports invested a total of RM4,559,025 in its community support initiatives, contributed 8,215 volunteer hours and supported around 19,348 beneficiaries, with Pulau Indah as the primary focus. Activities strengthened local schools, supported vulnerable families, enhanced community facilities and improved overall well-being. The emphasis remains on sustained, measurable impact rather than one-off activities.

Year	Cost Spent	Social Impact
2024	RM4,753,704	RM11,918,079
2025	RM4,559,025	RM12,592,735

The Social Return on Investment (“SROI”) analysis reveals that for every RM1 spent on Corporate Social Responsibility initiatives, a social impact of 2.7 times the initial expenditure is generated.

Westports shares this responsibility across the organisation. Employees from operations, engineering, marine services, EHS, finance, corporate functions, security and frontline teams actively participate in Foundation programmes, reflecting a culture grounded in service, responsibility and shared progress.

Looking ahead, Westports will continue deepening its engagement with Pulau Indah and the wider stakeholder community by expanding strategic partnerships and scaling programmes that build resilience and opportunity.

CORPORATE RESPONSIBILITY GOVERNANCE

Westports embeds strong governance to manage its community engagement and social programmes. Senior managers oversee all initiatives to ensure alignment with corporate objectives and values. Each department and employee plays an active role in CSR activities to promote shared responsibility.

Key Elements

Community Engagement Policy

Westports maintains continuous communication with local communities to understand operational impacts. Community programmes are shaped through active dialogue to address real needs and priorities.

Formal Grievance Mechanisms

Westports operates systems to manage incidents, complaints and grievances, supported by routine stakeholder meetings to ensure timely resolution.

These measures strengthen transparency, accountability and trust in Westports’ role as a responsible community partner.

STRUCTURES TO FACILITATE EMPLOYEE ENGAGEMENT

Westports values employee volunteerism and recognises the critical role its workforce plays in supporting Pulau Indah. The Company allows volunteering during work hours and treats CSR participation as part of employees’ professional responsibilities while ensuring that rest days are not disrupted.

Key Engagement Strengthening Efforts

Framework for Employee Involvement

Westports has established the Penghulu system and CSR Committees to coordinate and encourage employee participation. The Company also works closely with philanthropic partners to deliver programmes with meaningful impact. Embedding CSR into daily workplace culture helps inspire consistent and active involvement.

Department Ownership of CSR Activities

Each department is responsible for its own CSR initiatives. This approach promotes shared responsibility across the organisation and reinforces a collective commitment to community impact.

8 Pillars of CSR

1. Community Investment Areas	5. Community Safety
2. Community Development	6. Poverty Eradication
3. Climate Change	7. Entrepreneurial
4. Employability	8. Health

Westports' community investment aligns with its business strategy to foster long-term growth and social impact.

CSR Focus Pillars	Programmes
Community Development	<ul style="list-style-type: none"> Programme <i>Ramah Mesra</i> with Kg Sungai Pinang community, involving clean-up, grass cutting, drainage clearing and repainting works at local facilities Programme <i>Ramah Mesra</i> with Kg Teluk Nipah residents, involving repainting and clean-up works at village facilities Programme <i>Ramah Mesra</i> with Kg Perigi Nenas community, involving cleaning, landscaping, minor repairs and engagement activities Back-to-school programme, providing essential school attire and school supplies to underprivileged students from three targeted schools in Pulau Indah Repair, refurbishment and cleaning works at Surau Al Mubarak, Pulau Indah Cleaning, repainting and upgrading facilities at SK Pulau Indah, including new tables, chairs and teaching and learning equipment. Cleaning and painting of SK Pulau Indah 2 Repair and upgrade works at Balai Raya Kg Teluk Nipah, including installation and servicing of air conditioners, electrical wiring, lighting installation and plumbing repairs Major repair works at Sekolah Rendah Agama Pulau Lumut (Pulau Indah), including roof, electrical, piping and waiting bay upgrades Maintenance and repair works at Tadika Baitul Ilmi, covering electrical, piping, civil and painting works Repair and upgrading works at Masjid Sultan Abdul Aziz, Pulau Indah, including gazebo refurbishment, plumbing repairs, repainting, electrical works and aircond servicing Community clean-up and mural painting programme in collaboration with the Port Klang Authority

CSR Focus Pillars	Programmes
Employability	<ul style="list-style-type: none"> A half-day attachment for SMK Pulau Indah students with the Westports Port Police Department to provide exposure to careers in uniformed services IT workshops for students of SMK Pulau Indah covering theoretical knowledge and practical experience Career Talk and Port Visit for students of SMK Pulau Indah to expose them to the Port working environment and career pathways Career talk for students of SK Pulau Indah to introduce them to various career options, future pathways and education routes Introduction of Artificial Intelligence to secondary students of SMK Pulau Indah Soft skills training programme for SMK Pulau Indah students focusing on community, teamwork and self-awareness
Health	<ul style="list-style-type: none"> Dengue Prevention Programme at Pangsapuri Seri Bahtera, Pulau Indah <i>Gotong-royong</i> as part of the Dengue Prevention Programme at Pulau Indah Industrial Park 1 <i>Gotong-royong</i> as part of the Dengue Prevention Programme at Taman Sentosa Klang Basic medical check-ups for community members Health talk for students of SMK Pulau Indah covering topics such as bullying, sexual misconduct, sexual health, personal boundaries and emotional well-being Mental and Emotional Well-being Workshop for secondary students at SMK Pulau Indah to promote self-awareness, stress management and healthy coping skills. <i>Program Ramah Mesra dan Sukan Rakyat</i> with the Telok Gong community, with activities such as dengue awareness talk, fun tele matches and upgrading works of facilities
Poverty Eradication	<ul style="list-style-type: none"> Collection and distribution of school items for underprivileged students at SMK Pulau Indah
Climate Change	<ul style="list-style-type: none"> Plogging programme at Kg Sungai Pinang. 500kg of waste was collected

CSR Focus Pillars	Programmes
Community Safety	<ul style="list-style-type: none"> ■ Jetty clean-up, tree planting and distribution of safety kits to local fishermen at Jetty Kg Teluk Nipah ■ Fire-fighting system inspection and hands-on fire safety training for teachers of Sekolah Rendah Agama Pulau Indah ■ Fire safety inspection, drill and extinguisher use training for students and teachers of SMK Pulau Indah ■ Fire-fighting systems inspection at SK Pulau Indah ■ E-waste collection drive and road safety seminar for villagers of Kg Sg Pinang ■ Road traffic accident awareness talk for SMK Pulau Indah students, in collaboration with IPD Klang Selatan ■ Road safety programme for students and teachers of Sekolah Integrasi Kafa Kampung Perigi Nenas ■ Flood and fire safety awareness for Flat Samudera residents, Pulau Indah
Entrepreneurial Development	<ul style="list-style-type: none"> ■ <i>Seminar Pengenalan Keusahawanan 2025</i> for the Pulau Indah community to promote entrepreneurship and small business development ■ Financial training seminar focusing on entrepreneurship and basic financial management ■ Entrepreneurship Carnival 2.0, which brought together local entrepreneurs through this networking event

FLOOD RELIEF MANAGEMENT ACTION PLAN

Westports strengthened its disaster preparedness in 2025 by launching its Flood Relief Management Action Plan on 27 October 2025. Introduced ahead of the year-end monsoon season, the plan enhances the Company's ability to support employees and nearby communities during flood events, especially as the number and duration of evacuations at temporary evacuation centres (Pusat Pemindahan Sementara, PPS) continue to rise.

Westports identified four key villages on Pulau Indah as priority relocation and relief zones: Kampung Sungai Pinang, Kampung Sungai Kembang, Kampung Teluk Nipah and Kampung Perigi Nenas.

The Flood Relief Committee, chaired by the Chief Executive Officer and supported by the Head of Safety with representatives from all departments, oversees implementation. Westports designated two PPS locations on its premises: Dewan Tan Sri Gnanalingam (Dewan TSG) and the Port Police Dormitory.

The Action Plan defines clear procedures before, during and after flood events, detailing preparedness, emergency response and recovery measures. A dedicated 24/7 helpline and operations room (Bilik Gerakan) also help coordinate communication, staff mobilisation and assistance during emergencies.

RESPONSIBLE OPERATIONS

Westports operates one of Malaysia's busiest gateway ports, where safety, security and operational excellence are essential to uninterrupted performance. The Company embeds strong governance, disciplined risk management and digital innovation across all operations to ensure reliable, efficient and responsible service delivery.

ENHANCING BULK CARGO EFFICIENCY

Westports is upgrading its dry bulk handling capabilities by adopting a Siwertell screw unloader, reflecting its commitment to efficient, safer and more sustainable port operations. This technology delivers higher productivity, improved environmental performance and enhanced operational reliability compared with conventional grab cranes.

The Siwertell system optimises dry bulk unloading, achieving:

- A discharge rate of up to 850 metric tonnes per hour and
- An estimated 50% improvement in productivity for commodities such as soya bean meal

Its enclosed screw conveyor design reduces mechanical wear, minimises downtime and prevents dust and spillage, resulting in significantly cleaner operations.

A hybrid control system that enables both remote and cabin operation strengthens safety and visibility. IoT-enabled predictive maintenance provides real-time condition monitoring and early fault detection, extending equipment lifespan and ensuring consistent performance.

Benefit Area	Improvements/Outcomes
Productivity	<ul style="list-style-type: none"> ▪ Discharge rate up to 850 MT/hour ▪ ~50% faster than existing grab unloaders
Environmental Performance	<ul style="list-style-type: none"> ▪ Enclosed screw conveyor reduces dust and spillage ▪ Cleaner, lower-impact bulk operations
Safety & Control	<ul style="list-style-type: none"> ▪ Hybrid control system (remote + cabin) enhances visibility and operator safety
Reliability & Maintenance	<ul style="list-style-type: none"> ▪ Predictive maintenance allows real-time monitoring and early detection of issues ▪ Lower mechanical wear and reduced downtime
Energy Efficiency	<ul style="list-style-type: none"> ▪ Expected significant electricity-efficiency improvement vs. grab unloaders, supporting Westports' decarbonisation goals

The unloader will enter operation by June 2027, supported by an estimated RM50 million investment under Westports' broader decarbonisation strategy. Once commissioned, Westports will phase out the existing grab unloaders within three to five years, aligning the transition with scheduled structural repairs and the shift toward cleaner, energy-efficient cargo-handling technology.

This initiative strengthens Westports' modernisation agenda, elevates operational performance and advances long-term sustainability across port operations.

SAFE PORT

Westports is committed to maintaining a safe, secure and well-regulated operating environment for employees, contractors, visitors and all port users. The Company enforces comprehensive safety guidelines across every stage of port activity, supported by strict equipment-handling protocols, clear emergency response procedures, systematic hazard identification and focused management of high-risk areas.

Continuous training and awareness programmes ensure that everyone working within the port remains informed, competent and accountable. This proactive approach demonstrates Westports' commitment to protecting its workforce and safeguarding port operations.

Measures for A Secure Port Environment

Risk Category	Identified Issues	Mitigation Efforts
Unauthorised vehicles	Unauthorised vehicle operations within the port	Enforcing strict access controls ensures only authorised vehicles operate in the port, supported by the signing of the Aku Janji declaration.
Oil spill studies	Potential for oil spills and ocean leakage	Conducting a comprehensive oil spill study enables the identification of critical areas and sources, supporting significant reductions in spillage.
Reduced speed limit	High vehicle speeds in operational areas	Reducing the speed limit from 40 km/h to 35 km/h improves safety for all port users.
Defensive driving course	Accident risks involving port vehicles	Delivering mandatory defensive driving training strengthens the capability of TTO, ambulance and firefighting equipment drivers.
Buzz off	Risk of dengue and mosquito-borne diseases	Implementing a joint dengue-prevention programme ensures coordinated action with Majlis Bandaraya Diraja Klang and the Port Klang Health Department, supported by expert panels and community participation.
Safety campaign	Limited awareness of safety protocols	Running regular safety campaigns increases awareness of safety protocols, featuring agencies such as DOSH, the Ministry of Health and the Fire Department.

Risk Category	Identified Issues	Mitigation Efforts
Pre-operational check	Equipment failure or human error leading to incidents	Requiring mandatory pre-shift safety checks ensures that all employees and contractors verify equipment safety before operations begin.
Alcohol-free Port	Safety risks linked to alcohol consumption	Conducting random alcohol breath tests upholds the Alcohol-Free Port policy within terminal areas.
Urine Screening	Influence of drugs or alcohol in accidents	Administering mandatory urine tests ensures proper investigation and compliance following incidents.
Telemetry	Limited real-time operational safety visibility	Using a telemetry system provides continuous real-time monitoring of critical equipment and safety parameters.
Crime-free Port	<ul style="list-style-type: none"> ■ Container or cargo theft ■ Other property theft ■ Intrusion ■ Security breaches 	Strengthening security through robust controls enhances protection against theft, intrusion and security breaches, supported by collaboration with relevant authorities.

During the year, Westports introduced a Substance Abuse Policy, which management endorsed in August 2025. It establishes clear expectations regarding the use of drugs and alcohol within the organisation and provides a structured approach to preventing substance abuse.

The policy outlines procedures for identifying and managing substance abuse issues, providing support to employees affected and ensuring strict compliance with relevant laws and regulations. It establishes guidelines for testing procedures, outlines the consequences of policy violations and identifies support mechanisms for employees seeking assistance, such as counselling or rehabilitation programmes.

STRENGTHENED SECURITY

Westports strengthened its security framework by achieving ISO 28000:2022 certification for its Security Management System in February 2024. The certification covers the provision and management of port operations for both containerised and conventional cargo, as well as all critical supporting activities that ensure seamless operations. Issued by QSA International (United Kingdom), the certification requires regular audits to maintain compliance. Westports completed the external audit and two internal audits in the first quarter of 2025, reaffirming its adherence to stringent global security standards.

To further enhance operational security, Westports:

- Upgraded its surveillance room and reinforced monitoring capacity in high-risk zones, with a particular focus on gate surveillance.
- Deployed additional personnel to ensure vigilant monitoring across operational hotspots.
- Integrated authorised drone patrols, approved by the Civil Aviation Authority of Malaysia (“CAAM”), to expand surveillance reach and strengthen rapid-response capability.

These enhancements demonstrate Westports’ proactive approach to secure cargo handling, continuous improvement and alignment with international best practices.

DIGITAL AND TECHNOLOGY BREAKTHROUGHS FOR POWERING OPERATIONAL SUSTAINABILITY

In 2025, Westports strengthened its technological foundation and digital resilience through a series of high-impact IT initiatives. These programmes enhanced operational reliability, cybersecurity readiness and process efficiency across critical business functions.

DIGITAL TWIN – AI-DRIVEN YARD ALLOCATION

Westports deployed its Digital Twin Yard Allocation AI Service to optimise yard planning and elevate container-handling performance. The AI model achieved a 100% success rate in generating accurate yard recommendations, significantly reducing unproductive shifting and speeding up turnaround times.

By integrating and simulating multiple data streams from existing terminal systems, the solution:

- Improves resource utilisation
- Reduces unnecessary container shifting
- Optimises container grounding
- Minimises manual monitoring

The AI model is currently in the Proof-of-Concept (“POC”) phase until 3Q 2026, after which it will be scaled to additional yard blocks with continuous KPI monitoring throughout 2026.

ITAP BILLING AUTOMATION

The iTAP project successfully digitalised billing processes for liquid bulk, dry bulk, breakbulk and RORO operations. Developed in collaboration with Privaports, the system enables real-time digital cargo tallying, automates gate transactions and provides real-time warehouse and cargo storage reporting. It also improves traceability of cargo handling, service vouchers and contractor payments.

The platform enhances operational transparency and integrates fully with Cargomove, Westports' cargo booking system.

Further enhancements planned for 2026 include:

- Digitalised document submission
- Automated billing modules
- Analytics dashboards

These upgrades will streamline operational workflows and strengthen financial performance reporting.

AGS2 GATE AUTOMATION

The AGS2 initiative fully automated gate operations by integrating CCTV, OCR and visual analytics technology. This modernisation significantly reduced container-truck transaction time, improved data accuracy and enhanced gate security, while eliminating manual monitoring errors.

Westports ensures uninterrupted operations by deploying a secondary gate application that activates during system downtime. The system will continue to evolve as Westports rolls out an enhanced auto-gate concept and automated traffic-data analytics in 2026.

SMART TELEMATICS AND SAFETY SYSTEM

Westports successfully rolled out its Smart Telematics Programme across nearly 600 terminal trucks, deploying an AI-enabled system that delivers real-time GPS tracking, engine performance monitoring, maintenance alerts and driver behaviour recording. This programme enhances vehicle maintenance, improves safety and strengthens operational visibility.

The system's robustness comes from custom-built console boxes, brackets and camera designs. Developed through multiple prototypes, they ensure tamper-proof installation and uninterrupted data streaming to central servers. These upgrades have improved fleet safety, strengthened accountability and reduced fuel inefficiency.

Westports will further enhance the system by integrating predictive analytics for proactive maintenance scheduling, advanced driver-behaviour detection and real-time alerts and obstacle-identification features to prevent accidents.

DIGITAL METERING AND RESOURCE MANAGEMENT

Westports strengthened resource efficiency through its Meter Digitalisation Programme, which introduced smart monitoring for water, sub-station electricity and fuel meters. Real-time dashboards now track consumption and efficiency trends, while automated data capture improves accuracy and supports energy reporting. These upgrades enhance energy utilisation, reinforce environmental management and help identify new efficiency opportunities.

In the next phase, Westports will integrate advanced analytics to benchmark energy intensity per TEU handled.

SECURING LARGEST EV PORT TERMINAL TRUCK ORDER IN MALAYSIA

In a significant move toward sustainability, Westports placed a groundbreaking order for 60 Terberg electric port terminal trucks, marking one of the largest EV terminal truck orders in Malaysia to date. This new acquisition surpasses last year's order from Port of Tanjung Pelepas, which secured 52 units.

The collaboration with Westwell, a leader in intelligent and connected new-energy solutions, highlights Westports' commitment to advancing green technologies in port operations. Westports will deploy the 60 E-Trucks, equipped with PowerOnair battery-swapping stations, to enhance operational efficiency and significantly reduce carbon emissions at Malaysia's largest container terminal.

This development is part of Westports' ongoing efforts to electrify its terminal truck fleet, a key component in the port's ambitious decarbonisation plan. With an operating range of 150 kilometres per charge and zero tailpipe emissions, the new E-Trucks will help the port transition to a low-carbon ecosystem. This initiative aligns with Westports' strategic goals of improving sustainability and operational efficiency, solidifying its position as a leading green logistics hub in Southeast Asia.

INFORMATION SECURITY AND ISO/IEC 27001:2022 CERTIFICATION

Westports maintained its ISO/IEC 27001:2022 Information Security Management System certification with zero major non-conformities. The IT Division has scheduled to complete the penetration test by 2Q 2026. Resolving all audit findings within the reporting period demonstrated Westports' commitment to international standards in data governance, access control and network security.

The next audit cycle will focus on strengthening vulnerability management and enhancing continuous monitoring through advanced SIEM tools.

ENTERPRISE SYSTEMS AND ERP RELIABILITY

Westports' SAP S/4HANA platform achieved 100% uptime during the year, exceeding its 99.95% target. Enhancements to core modules, including Maintenance, Payroll, Human Capital and Engineering, strengthened data accuracy and reporting efficiency. The IT team completed system patches, kernel updates and database upgrades with zero downtime, ensuring uninterrupted operations.

Future improvements will expand automation across the SAP ecosystem and introduce enhanced user dashboards for real-time analytics.

AI AND DIGITAL INNOVATION

Westports accelerated its Smart Port ambitions through several AI and IoT deployments. The Company launched DolphinGPT, an internal AI assistant that enables employees to quickly and accurately retrieve procedural and operational information. Westports also introduced IoT dashcams and digital safety solutions to strengthen operator well-being, enhance visibility and improve incident reporting.

These technologies reinforce Westports' digital leadership and reflect its ongoing commitment to operational excellence and continuous innovation.

OPTIMISING PORT OPERATIONS THROUGH EFFECTIVE COMMUNICATION AND STREAMLINED OPERATIONS

Westports maintains smooth operations and prevents delays by ensuring continuous two-way communication with customers and complete transparency in its workflows. Advanced operational information, such as vessel arrival times, the number of moves, container discharge and loading, crane splits and expected ship duration, enables precise berth planning. This information also supports the four-hour target, optimises port performance, keeps customers well-informed and minimises potential delays.

To further enhance efficiency, Westports uses the Smart Pickup System to track and reduce unnecessary container movements, lowering waiting times and improving container shifting performance. Westports also collaborates with the Malaysia Maritime Single Window ("MMSW") to streamline vessel berthing and ship management declaration and operations. This initiative enables immediate berthing upon arrival, maximises operational readiness and transforms vessel management efficiency through advanced data integration.

ENABLING SEAMLESS PORT OPERATIONS THROUGH IT AND TECHNOLOGY

Westports strengthened its IT and OT environment over the past year, delivering clear improvements across core port operations:

- Cybersecurity controls are significantly stronger through full-system encryption, more secure access management and advanced identity risk detection. These measures ensured there were no data breaches or regulatory issues.
- System reliability improved as the upgraded data centre now supports higher uptime for the Terminal Operating System, marine planning tools, gate processing and billing platforms, reducing the risk of operational disruption.
- OCR technology now delivers higher accuracy in identification and registration work, reducing manual errors and supporting a steadier flow of containers across the terminal.
- Automation in tugboat planning increased fuel efficiency and improved coordination of vessel movements, lowering marine operating costs and strengthening marine-support capabilities.

Together, these enhancements have created a more secure, stable and efficient operating environment and continue to strengthen Westports' ability to deliver smooth, safe and uninterrupted port services.

INFORMATION SECURITY MEASURES

Westports applies a structured set of controls to safeguard operational and customer data. Conducted quarterly, Westports ensures that all employees eventually undergo cybersecurity training and that new staff complete ISMS awareness training during induction. Biannual security assessments test and strengthen controls across hardware, software, system access, backups, operational technology and cloud environments. Technical safeguards prevent unauthorised access and protect sensitive information from misuse or external threats.

These measures have supported a strong compliance record with zero customer-related lawsuits and zero regulatory violations, reflecting the effectiveness of Westports' cybersecurity practices.

METRICS AND DATA DISCLOSURE

Westports discloses key sustainability and climate performance indicators to demonstrate how it measures, monitors and reports progress against its strategic goals and long-term decarbonisation commitments. These metrics provide transparency into operational efficiency, resource use and social performance, supporting compliance with IFRS S1 and S2 disclosure requirements, as well as Malaysia's Net Zero 2050 and IMO 2050 pathways.

KEY ENVIRONMENTAL METRICS AND TARGETS

Coverage	Definition & Source	Measure type	Method & Assumption	Target Metric	Target Value	Base Year	Performance to Date
Scope 1 & 2 GHG emissions	Based on the GHG Protocol, adjusted with IPCC emission factors for diesel, petrol, LPG and electricity	Absolute (tCO ₂ e) + Intensity (tCO ₂ e/TEU)	Data from energy bills and fuel purchase records; assumptions: grid factor 0.774 kgCO ₂ /kWh (Peninsular Malaysia). Scopes 1 and 2 cover entities under operational control. There are no material emissions from associates/joint ventures outside the consolidated group. Scope 2 is location-based using the Peninsular Malaysia grid factor. No contractual instruments or PPAs applied in FY2024	tCO ₂ e	30% emission intensity reduction by 2035	2021	4% reduction in 2025 and 15% reduction base year of 2021
Scope 3 emissions	Estimated in accordance with the GHG Protocol Scope 3 Standard using DEFRA, GHG Protocol tools, Energy Commission grid factors, and Open CEDA emission factors adjusted through OECD ICIO MRIO trade modelling	Absolute (tCO ₂ e)	Current categories include fuel- and energy-related activities, business travel, employee commuting, downstream leased assets and investments, purchased goods and services, capital goods, upstream transportation, waste and upstream leased assets. Supply chain and capital-goods categories are calculated using Open CEDA emission factors, adjusted for deflation, foreign exchange and OECD ICIO trade flows to capture embodied emissions from imported materials. FY2023 and FY2024 were restated to reflect improved emission factors and internal monitoring systems	Data coverage	≥80% of relevant categories by 2026	2024	Coverage expanded to energy, logistics, downstream assets, supply chain and capital goods, with prior years restated for improved factor accuracy
Renewable energy capacity	Internal KPI, based on installed solar PV systems across terminal rooftops and yards	Absolute (MWp)	Installed system capacity, aggregated by project phase	MWp installed	14 MWp by 2025	2022	Petikemas with 7.7 MWp installed in 2024. Seahawk with 6.3 MWp started in January 2026
RTG electrification	Internal KPI aligned with NETR and Net Zero 2050 pathway	Absolute (No. of units electrified)	Based on the number of RTGs converted to full-electric from diesel-hybrid	No. of units electrified	217 RTGs fully electrified	2024	Electric RTG cranes to be deployed at Westports 2 CT10 by 2028
Lost-Time Injury Frequency Rate ("LTIFR")	GRI 403 methodology, consistent with DOSH reporting	Absolute (per 1 million hours worked)	Based on total reportable LTIs ÷ total hours worked × 1,000,000	LTIFR	Maintain < 2.0	2022	3.12
Suppliers with ESG clauses in contracts	Internal KPI based on procurement policy and supplier declarations	Percentage (%) of key suppliers	Based on the proportion of active key suppliers with signed ESG clauses in contracts	% of suppliers	100% by 2026	2023	More than 60% achieved
Internal carbon price	Internal tool to evaluate investment and scenario impacts, aligned with IFRS S2	RM/tCO ₂ e	Shadow price applied to CAPEX appraisals and scenario tests	Review frequency	Annual review	2024	RM83.33 /tCO ₂ e applied to FY2025 investments

Coverage	Definition & Source	Measure type	Method & Assumption	Target Metric	Target Value	Base Year	Performance to Date
Executive remuneration linkage	Internal KPI under Sustainability Governance Framework	Percentage (%) of variable pay	Portion of executive KPIs tied to ESG and carbon-intensity reduction	% of remuneration linked	≥10% of total variable pay	2024	10% implemented; expansion to mid-management by 2026
Water use intensity	Internal KPI aligned with GRI 303 (Water)	Intensity (m ³ /TEU)	Based on meter readings divided by annual throughput	% reduction	5% reduction by 2025	2022	14% reduction water usage intensity in 2025 when compared to the base year 2022
Paper consumption	Paper consumption across all office operations	Data compiled from internal procurement records and monthly supply inventories	Annual paper purchase volumes compared against the base year	% reduction	15% reduction by 2025	2020	Achieved a 67% reduction in 2025 when compared to 2020 levels
Capital deployed	Internal CAPEX tracking for solar PV, drainage, hybrid/ electric equipment	Currency (RM)	Sum of climate-tagged CAPEX in the year	Annual climate CAPEX	-	2024	RM19.1 million (2025)
Energy consumption and intensity	GRI 302: Electricity and fuel use	GH and MJ/ TEU	Bills and fuel logs converted to GJ; intensity	Energy intensity reduction	-10% vs 2022 by 2026	2022	181 MJ/TEU in 2025, a reduction by 2% from 2024's intensity

* All data compiled under the operational control boundary. Sources include fuel, power, fleet and HR systems. Environmental data reviewed by Control Union (Malaysia) Sdn Bhd as part of Westports annual verification. Rounding variances <2%. Future improvements will incorporate IoT-based monitoring and digital data assurance. No revisions made.

* "Scope 2 is location-based; no PPAs/RECs used in FY2024."

"Scope 1–2 covers operational control entities; no material emissions from non-consolidated investees."

"Scope 3 categories covered: Business travel (Cat. 6), Employee commuting (Cat. 7); expansion planned to Cat. 1 and Cat. 3."

* GHG targets cover CO₂, CH₂, N₂O in Scopes 1 & 2; gross intensity targets; sector pathway used; external validation by 2026; no carbon credits used.

The Sustainability Committee and the Board review targets annually, and no revisions were made in FY2025. Westports will obtain external validation of the 2030 and 2035 targets by 2026.

The Group will also subject its decarbonisation targets to independent third-party validation by 2026 to confirm consistency with science-based pathways. Westports currently uses renewable energy credits ("RECs") and expects Scope 3 emissions to be neutral from 2026.

Overall performance trends show continued improvement across key indicators:

- Over RM19.04 million was spent in 2025 on low-carbon technologies and digital systems supporting the transition to net zero
- GHG intensity reduced by 9% since 2022
- Renewable energy capacity more than doubled
- Waste recycling rates increased
- LTIFR remained below target at 1.6

These achievements demonstrate steady progress towards the Glide Path 2050 decarbonisation plan and Westports' long-term resilience objectives.

KEY SOCIAL METRICS AND TARGETS

Target	Key Activities/Milestones	Timeline/Target
Strengthen Safety Management System through Qavach	Qavach implemented in January 2025. Enhancement phase underway with improvements to dashboards and reporting workflows. Ongoing assessment of AI functions to improve hazard detection trend analysis and response planning.	Full system enhancement by February 2026. AI capabilities operational by January 2027.
	Implementation of AI capabilities in Safety Management	January 2027.
Develop OSH Capability through Supervisor Certification	Equip supervisors across all business units with OSH coordinator knowledge and practical skills. An annual training plan to certify fifty employees per year to build a competent safety leadership layer.	Fifty employees certified per year from 2025 to 2027.
Reduction of accidents and incidents	Implement targeted interventions data driven monitoring and continuous safety engagement to reduce total cases by twenty five per cent each year.	Annual reduction target met.

HOW WESTPORTS CALCULATES EMISSION INTENSITY (BOX ARTICLE)

Westports discloses absolute Scope 1, 2 and 3 emissions in accordance with the GHG Protocol. However, the Company has chosen energy intensity as its key emissions target, as outlined in its Glide Path 2050. Westports develops its energy intensity measurement internally, rather than deriving it from the IFRS Sustainability Disclosure Standards. This approach better reflects the business's energy usage, which is primarily driven by the container segment. Given that approximately 85% of the Company's revenue comes from this segment and its expected growth, the energy intensity approach focuses on the most significant and growing aspect of Westports' energy consumption.

ENERGY INTENSITY MEASUREMENT FORMULA

This section clarifies that the energy intensity measurement Westports uses is not derived from or sourced from the IFRS Sustainability Disclosure Standards, but has been developed by the Company to better reflect energy intensity usage, given the Company's business nature. More than 80% of the Company's revenue is derived from the container segment, and the segment's contribution is expected to grow in the coming years. Hence, this is the reason why Westports has chosen this particular measurement approach. The intensity measurement will reflect the most critical and, by far, the most significant and growing proportion of the Company's energy consumption.

Westports calculates the Energy Intensity Measurement (“EIM”) using the following formula:

Definition and Inputs

$$EIM = \frac{\sum_{\{i=1\}}^{\{4\}} (A_i \times TEU_i \times E_i \times EF_a) + \sum_{\{j=1\}}^{\{2\}} (TEU_j \times E_j \times EF_a) + \sum_{\{k=1\}}^{\{3\}} (TEU_k \times E_k \times EF_b)}{TEU}$$

EIM	= Energy Intensity Measurement
TEU	= Total and overall container TEU measured by units handled or carried by TOEs at the wharf side
TEU _i	= Container TEU measured by units handled at the wharf side by equipment type i
TEU _j	= Container TEU measured by units carried at the wharf side, requiring boats type j
TEU _k	= Container TEU measured by units handled at the wharf side by electrified equipment type k
A _i	= Units of diesel-powered Terminal Operating Equipment, associated with equipment type i
E _i	= Energy intensity associated with equipment type i, measured by diesel litre per TEU
EF _a	= Diesel emission factor for conversion to CO ₂ e as per IPCC adjusted for biodiesel of 7% in Malaysia
E _j	= Energy intensity associated with diesel-powered boats type j, measured by diesel litre per TEU
E _k	= Energy intensity associated with electrified equipment type k, measured by kWh per TEU
EF _b	= Electricity consumption kWh emission factor for conversion to CO ₂ e

The EIM is not an absolute measure of emission intensity but an intensity measurement in which the CO₂e emissions of all terminal operating equipment are measured relative to the total containers handled at the wharves, the latter measured in TEUs. Hence, we define EIM as a broad measure of emission intensity that reflects the key operating activities at the shipping port.

The EIM quantifies CO₂e emissions relative to the total containers handled, measured in TEUs. A TEU refers to a 20-foot equivalent unit shipping container.

ASSUMPTIONS AND LIMITATIONS

The historical EIM for 2024 is 16.2 kg CO₂e per TEU, based on actual data. Westports has set a target to reduce this by 30% by 2035 to reach 12.8 kg CO₂e/TEU, with assumptions including:

- An annual growth of 440,000 TEUs, reaching 22.3 million TEUs by 2050.
- 100% electrification of terminal truck fleets, rubber-tyred gantry cranes, boats and vehicles by 2050.
- The use of carbon offsets from 2031.

REVIEW AND UPDATES

The EIM and the Glide Path 2050 will be reviewed at least annually, based on actual data (namely, actual litres of diesel, kWh of electricity consumed and container TEUs handled) from the preceding year, to fine-tune projections and ensure the Company is on track to meet its projected emission intensity reduction. This review process also ensures that the projection always takes into consideration the actual emission intensity experienced by the Company.

If, for any reason whatsoever, there are material and known changes that may require the forecast kg CO₂e per TEU to be amended, the Company will then amend the projections.

GROSS VS. NET GHG EMISSIONS INTENSITY

Westports considers the EIM a net emissions intensity target, as it accounts for deductions from:

- Solar panel installations on-site
- Renewable Energy Certificates (“RECs”) earned through the Corporate Green Power Programme (“CGPP”) by 2050

This structured approach to energy intensity calculation, using a well-defined formula and assumptions, will aid in answering IFRS-related queries and clarifying the method used to calculate emission intensity for Westports.

GROUP SUSTAINABILITY PERFORMANCE DATA

Indicator	Unit	FY2025	FY2024	FY2023
FINANCIAL*				
Financials				
Revenue	RM'000	3,124,961	2,344,145	2,151,918
Profit before tax	RM'000	1,292,276	1,138,651	1,006,214
Profit after tax	RM'000	998,311	897,982	779,432
Shareholders' equity	RM'000	4,168,763	3,817,602	3,520,121
Total assets	RM'000	8,891,645	7,777,999	5,339,238
Per Share and Ratios				
Earnings per share	sen	29.3	26.3	22.9
Dividend per share	sen	20.8	17.6	15.7
Dividend payout ratio	%	75.0%	75.0%	74.0%
Return on equity	%	23.9%	23.5%	22.1%
Return on total assets	%	11.2%	11.5%	14.6%
Operations				
Container throughput	million TEUs	11.3	11.0	10.9
Container handling capacity	million TEUs	13.8	13.8	13.7
Westports market share of Port Klang	%	75.0%	75.0%	77.0%
Conventional throughput	million MT	12.8	12.2	11.6
Vessels accommodated	No.	8,280	8,363	9,356

* Financial data audited by Ernst & Young Malaysia.

Indicator	Unit	FY2025	FY2024	FY2023
ECONOMIC				
Economic Value Generated and Distributed				
To employees	RM'000	371,756	340,693	337,546
To government (income tax)	RM'000	293,965	240,669	226,782
To capital providers	RM'000	749,367	656,299	575,399
Retained for future reinvestment and growth	RM'000	638,082	552,098	504,635
Total economic value generated and distributed	RM'000	2,053,170	1,789,759	1,644,362
Supply Chain				
Proportion of spending on local suppliers	%	49.59%	83.51%	91.86%
Corruption				
Reported breaches of Code of Conduct	No.	0	0	0
Anti-corruption related fines and settlements	RM	0	0	0
Anti-corruption related fines and settlements	% of revenue	0.0%	0.0%	0.0%
Total substantiated corruption and bribery cases	No.	0	0	0
Total staff disciplined or dismissed due to non-compliance with anti-corruption policy	No.	1	0	0
Total Employees Receiving Training on Anti-Corruption: Grade: Top management	No. (%)	34 (100.00%)	31 (100.00%)	27 (96.43%)
Total Employees Receiving Training on Anti-Corruption: Grade: Middle management *	No. (%)	148 (94.87%)	148 (100.00%)	142 (157.78%)

Indicator	Unit	FY2025	FY2024	FY2023
ECONOMIC (CONT'D.)				
Corruption (cont'd.)				
Total Employees Receiving Training on Anti-Corruption: Grade: Executive *	No. (%)	341 (102.40%)	336 (100.00%)	321 (84.47%)
Total Employees Receiving Training on Anti-Corruption: Grade: Operations	No. (%)	5,184 (99.42%)	5,072 (100.00%)	5,056 (97.47%)
Total Employees Receiving Training on Anti-Corruption	No. (%)	5,707 (99.48%)	5,587 (100.00%)	5,546 (97.55%)
Operations assessed for corruption-related risks	%	100%	100%	100%
Money laundering related lawsuits or offences investigated by a judicial/regulatory process	No.	0	0	0
* Percentages exceeding 100% is due to trained employee resignations.				
Political Contributions				
Lobbying, interest representation or something similar	RM	0	0	0
Local, regional or national political party contribution	RM	0	0	0
Political campaigns or candidates	RM	0	0	0
Trade associations or tax-exempt groups (e.g. think-tanks)	RM	0	0	0
Others (spending related to ballot measures, referendums, etc.)	RM	0	0	0
Total politically-related contributions and other spendings	RM	0	0	0
Direct or indirect political contributions	RM	0	0	0
Anti-competition				
Fines and settlements	No. of cases	0	0	0
Fines and settlements total amount	RM	0	0	0

Indicator	Unit	FY2025	FY2024	FY2023
ECONOMIC (CONT'D.)				
Anti-competition (cont'd.)				
Total fines and settlements	% of total annual revenue	0%	0%	0%
Anti-competitive behaviour-related lawsuits or offences investigated by a judicial/regulatory process	No.	0	0	0
Environmental Management				
Capital investments	RM	16,131,238	65,000	NA
Operating expenses	RM	NA	2,223,000	NA
Sites covered by recognised by ISO14001	%	100%	100%	100%
Total costs of all energy consumption	RM	188,369,836	209,595,653	255,445,729
Environmental Violations				
Number of violations of legal obligations or regulations	No.	0	0	NA
Total cost of environmental fines and penalties	RM	0	0	0
Environmental liability accrued at the year-end	RM	0	0	NA
Taxation				
Tax related lawsuits or offenses investigated by a judicial/regulatory process	No.	0	0	0
EC-to-Employee Compensation Ratio				
Average Salary	(RM'000 per/ annum)	47	61	59
Executive Chairman Remuneration	(RM'000 per/ annum)	4,182	5,546	5,012
EC Salary To Average Staff Salary/Cost	(multiples)	88	91	84

Indicator	Unit	FY2025	FY2024	FY2023
ENVIRONMENT				
Energy (100% of Operations)				
<i>Direct Energy</i>				
Diesel consumption	Litres	52,713,941	51,981,197	51,686,903
Petrol consumption	Litres	157,022	174,345	179,586
Total direct energy consumption	MWh	509,469	502,487	499,762
Total direct energy consumption *	TJ	1,834	1,809	1,799
<i>Electricity (Physical Energy)</i>				
Grid electricity purchased	MWh	106,424	108,853	107,412
Total grid electricity purchased	TJ	383	392	387
Grid electricity consumed	MWh	50,600	54,468	55,491
Grid electricity consumed	TJ	182	196	200
<i>Renewable Energy & Certificates (Contractual Instruments)</i>				
On-site renewable electricity generated – solar	MWh	9,358	3,881	233
On-site renewable electricity generated – solar	TJ	34	14	1
REC type – solar	MWh	4,684	NA	NA
REC type – hydroelectric	MWh	827	NA	NA
Total electricity consumption	MWh	59,958	58,349	55,724
Total electricity consumption	TJ	216	210	201
<i>Renewable Energy Ratios</i>				
Renewable electricity (physical only)	%	15.6%	6.7%	0.4%
Renewable electricity (market-based, including RECs)	%	24.8%	6.7%	0.4%
Renewable energy as percentage of total operational energy	%	2.6%	0.7%	0.0%
Total Operational Energy	MWh	569,427	560,836	555,486

Indicator	Unit	FY2025	FY2024	FY2023
ENVIRONMENT (CONT'D.)				
Energy (100% of Operations) (cont'd.)				
<i>Renewable Energy Ratios (cont'd.)</i>				
Total Operational Energy	TJ	2,050	2,019	2,000
Energy Intensity				
Energy Intensity (fuel)	GJ/TEU	0.1623	0.1648	0.1654
Energy Intensity (electricity)	GJ/TEU	0.0191	0.0191	0.0184
Energy intensity (all)	GJ/TEU	0.1814	0.1839	0.1839
Electricity Supplied to Third Parties †				
Electricity supplied to tenants/clients **	MWh	55,824	54,385	51,921
Electricity supplied to tenants/clients **	TJ	201	196	187
* Conversion coefficients for diesel and petrol to joules are derived using the stationary combustion emission factors from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (FY2022 and FY2023 restated due to amended emission factor and country-level data).				
** Restated due to improve internal data monitoring.				
† This data comprises electricity used to power clients' reefers and clients that have leased land on Westports' site. Previously, Westports reported aggregate data. From 2022, Westports separates this data as it has no operational control of this energy consumption.				
Water and Effluent				
Total water withdrawal from municipal supplies consumed by Westports	m ³	797,040	724,604	738,244
Total water withdrawal from fresh groundwater	m ³	0	0	0
Fresh groundwater used	m ³	0	0	0
Total rainwater	m ³	253	0	0
Total water consumption by Westports	m ³	797,293	724,604	738,244
Total water withdrawn	m ³	1,654,376	1,596,690	1,515,556
Freshwater withdrawal (Westports)/ million USD sales *	m ³ /mil USD sales	1,034	1,382	1,577

Indicator	Unit	FY2025	FY2024	FY2023
ENVIRONMENT (CONT'D.)				
Water and Effluent (cont'd.)				
Total water withdrawal from municipal supplies: others/sale	m ³	857,083	872,086	777,312
Total water withdrawal from municipal supplies (for internal and external use)	m ³	1,654,123	1,596,690	1,515,556
Water storage capacity	m ³	7,557	0	0
External water supply response time	Hours	24	0	0
Water consumption per employee	m ³ /employee	139	130	130
Volume of treated effluent	m ³	461,580	NA	NA

* FY2022 and FY2023 restated as Westports internal processes now separate internal and external water use.

Effluent Analysis				
BOD* 5 days @ 20c	mg/l	ND (<5) - 13	ND (<5) - 40	ND (<1) - 49
Total Suspended solids	mg/l	8-12	8-78	8-30
COD	mg/l	9-47	9-121	3-173
Oil and Grease	mg/l	ND (<1) - 1	ND (<1) - 1	ND (<1)
Ammoniacal Nitrogen	mg/l	0.12-15	0.12-15	2.41-19.2
Nirate	mg/l	2.4-26.6	0.9-28.4	0.3-15.2
Phosphorus	mg/l	0.36-1.18	0.41-50	NA

GHG Emissions				
Scope 1 † ‡				
CO ₂	tCO ₂ e	135,673	133,809	133,084
CH ₄	tCO ₂ e	512	505	502
N ₂ O	tCO ₂ e	300	296	295
Total Scope 1 (fuel)	tCO ₂ e	136,485	134,610	133,881
Total Scope 1	tCO ₂ e	136,485	134,610	133,881

Indicator	Unit	FY2025	FY2024	FY2023
ENVIRONMENT (CONT'D.)				
GHG Emissions (cont'd.)				
<u>Scope 2 † ‡</u>	tCO ₂ e	34,899	42,158	42,950
Total carbon sequestered	tCO ₂ e	160	32	32
Total operational emissions ‡	tCO ₂ e	171,224	176,736	176,799
Total operational emissions reduction	%	3.22%	0.04%	NA
<u>Emissions intensity</u>				
Scope1 Intensity kgCO ₂ e/TEU				
RTGC	kgCO ₂ e/TEU	4.48	4.57	4.50
Trucks	kgCO ₂ e/TEU	4.28	4.38	4.42
Marine	kgCO ₂ e/TEU	2.95	2.92	2.99
Fuel	Litre/TEU	4.66	4.73	4.75
Scope 2 Intensity (Quay cranes)	kgCO ₂ e/TEU	3.06	3.07	2.96
Total GHG Intensity	CO ₂ ekg/TEU Volume	15.15	16.10	16.26
GHG intensity reduction	%	5.87%	0.97%	NA
<u>Scope 3 † † †</u>				
1. Purchased goods and services				
CO ₂	tCO ₂ e	35,569	35,756	42,564
CH ₂	tCO ₂ e	704	610	531
N ₂ O	tCO ₂ e	807	819	774
HFC	tCO ₂ e	4,746	4,943	4,343
PFC	tCO ₂ e	473	368	136
SF ₂	tCO ₂ e	151	123	73
Other F-gases (unspecified)	tCO ₂ e	4,383	4,574	4,039
Total CO ₂ e	tCO ₂ e	46,833	47,192	52,460

Indicator	Unit	FY2025	FY2024	FY2023
ENVIRONMENT (CONT'D.)				
GHG Emissions (cont'd.)				
<u>Scope 3 + (cont'd.)</u>				
2. Capital goods				
CO ₂	tCO ₂ e	123,740	32,192	22,120
CH ₂	tCO ₂ e	6,203	1,112	1,051
N ₂ O	tCO ₂ e	513	104	104
HFC	tCO ₂ e	9,213	2,839	1,881
PFC	tCO ₂ e	7	8	3
SF ₂	tCO ₂ e	29	8	6
Other F-gases (unspecified)	tCO ₂ e	8,613	2,653	1,757
Total CO ₂ e	tCO ₂ e	148,318	38,916	26,921
3. Fuel-and energy-related activities	tCO ₂ e	34,458	34,034	33,784
4. Upstream Transportation and Distribution				
CO ₂	tCO ₂ e	778	1,201	1,758
CH ₂	tCO ₂ e	4	11	20
N ₂ O	tCO ₂ e	2	7	16
HFC	tCO ₂ e	14	45	86
PFC	tCO ₂ e	0	0	0
SF ₂	tCO ₂ e	0	0	0
Other F-gases (unspecified)	tCO ₂ e	13	42	80
Total CO ₂ e	tCO ₂ e	811	1,306	1,960
5. Waste Generated in Operations				
CO ₂	tCO ₂ e	79	94	101
CH ₂	tCO ₂ e	394	480	546
N ₂ O	tCO ₂ e	7	9	10
HFC	tCO ₂ e	4	6	6

Indicator	Unit	FY2025	FY2024	FY2023
ENVIRONMENT (CONT'D.)				
GHG Emissions (cont'd.)				
<u>Scope 3 + (cont'd.)</u>				
5. Waste Generated in Operations (cont'd.)				
PFC	tCO ₂ e	0	0	0
SF ₂	tCO ₂ e	0	0	0
Other F-gases (unspecified)	tCO ₂ e	4	5	6
Total CO ₂ e	tCO ₂ e	489	593	668
6. Business travel (air)				
CO ₂	tCO ₂ e	1,684	501	NA
CH ₄	tCO ₂ e	6	0	NA
N ₂ O	tCO ₂ e	21	4	NA
HFC	tCO ₂ e	104	0	NA
PFC	tCO ₂ e	0	0	NA
SF ₂	tCO ₂ e	0	0	NA
Other F-gases (unspecified)	tCO ₂ e	98	0	NA
Total CO ₂ e	tCO ₂ e	1,914	505	603
7. Employees Commuting				
CO ₂	tCO ₂ e	5,546	5,828	NA
CH ₄	tCO ₂ e	62	64	NA
N ₂ O	tCO ₂ e	21	22	NA
CO ₂ e	tCO ₂ e	5,628	5,914	8,567
8. Upstream Leased Assets				
CO ₂	tCO ₂ e	274	145	99
CH ₂	tCO ₂ e	9	5	3
N ₂ O	tCO ₂ e	11	6	4
HFC	tCO ₂ e	15	8	5
PFC	tCO ₂ e	0	0	0
SF ₂	tCO ₂ e	0	0	0
Other F-gases (unspecified)	tCO ₂ e	14	8	5
Total CO ₂ e	tCO ₂ e	324	172	116

Indicator	Unit	FY2025	FY2024	FY2023
ENVIRONMENT (CONT'D.)				
GHG Emissions (cont'd.)				
<u>Scope 3 ††† (cont'd.)</u>				
9. Downstream transportation and distribution	tCO ₂ e	0	0	0
10. Processing of sold products ***	tCO ₂ e	0	0	0
11. Use of sold products ***	tCO ₂ e	0	0	0
12. End-of-life treatment of sold products ***	tCO ₂ e	0	0	0
13. Downstream leased assets *	tCO ₂ e	43,208	42,094	40,187
14. Franchises	tCO ₂ e	0	0	0
15. Investments	tCO ₂ e	673	704	371
Internal Carbon Price for Scopes 1&2	RM	83.33	66.67	50.00
Internal Carbon Price (total)	RM	14,268,136	11,783,021	8,839,941

Reporting Boundaries and Methodology

Boundary: Westports measures Scope 1 and Scope 2 for the consolidated accounting group using the operational control approach. The boundary for Scopes 1, 2, and 3 represents 100% of operations unless stated otherwise. Associates, joint ventures, and unconsolidated subsidiaries are excluded from Scopes 1 and 2 and are reported under Scope 3 Category 15 (Investments). Consequently, the "other investees" line in Scope 1 and 2 disaggregation is nil.

Internal Carbon Price: The internal carbon price (RM per tCO₂e) applies to Scopes 1, 2, and 3 for planning and appraisal purposes. This is informational and is not deducted from reported emissions.

Emission Factor ("EF") Framework:

† Scope 1: Derived using the IPCC 2006 Guidelines for National Greenhouse Gas Inventories.

†† Scope 2: Derived from the Energy Commission Grid Emission Factor for Peninsular Malaysia 2022. Reported on a location-based basis. Market-based information is disclosed separately for transparency where available and is not added to totals.

*††† Scope 3 (Energy & Logistics): * Fuel- and energy-related activities: UK Government GHG reporting conversion factors. Business Travel: Online tools derived from the WRI GHG Protocol.*

Employee Commuting: Mobile Combustion GHG Emissions Calculation Tool (GHG Protocol Initiative).

Downstream Leased Assets & Investments: Energy Commission Grid Emission Factor for Peninsular Malaysia 2022.

‡ Scope 3 (Supply Chain & Capital Goods): For FY2023–FY2025, emissions for Purchased Goods and Services, Capital Goods (Construction), Upstream Transportation, Waste, and Upstream Leased Assets are calculated using Open CEDA emission factors.

Trade Adjustment: To ensure accuracy against country benchmarks and reflect the embodied carbon of global supply chains (particularly for significant construction works), these factors are adjusted for deflation, Forex, and integrated with OECD Inter-Country Input-Output ("ICIO") tables. This MRIO (Multi-Regional Input-Output) approach ensures that trade-embodied emissions from imported materials are fully captured.

Category-Specific Notes:

** Scope 3 (Downstream Assets): Comprises emissions from Westports Reefer Operations.*

*** Scope 3 (Downstream Assets): Comprises emissions resulting from 50% ownership of Port Klang Cruise Terminal Sdn Bhd.*

**** Note: Westports does not sell products and has no franchises; therefore, no emissions are recorded for these categories.*

Restatements: FY2023 and FY2024 figures have been amended to reflect new emission factors and improved internal monitoring systems.

Indicator	Unit	FY2025	FY2024	FY2023
ENVIRONMENT (CONT'D.)				
Non-GHG Pollution *				
<u>Criteria Air Pollutants</u>				
NOx	kg	373,267	347,530	290,140
SO ₂	kg	272,313	362,857	279,849
CO	kg	173,013	134,742	310,364
PM2.5	kg	36,391	27,711	50,527
PM10	kg	82,613	15,520	10,871
VOC (aggregate)	kg	25,438	23,764	37,984
NH ₂	kg	1,803	2,312	7,214
Total Criteria Air Pollutants	kg	964,838	914,436	986,949
<u>Ozone-Depleting Substances ("ODS")</u>				
1,1,1-trichloroethane	kg	12	16	10
halon 1001	kg	3	5	4
carbon tetrachloride	kg	0	0	0
methyl bromide	kg	0	0	0
Total Operational ODS	kg	16	21	14
halon 1001	kg CFC-11 eq	10	14	12

Indicator	Unit	FY2025	FY2024	FY2023
ENVIRONMENT (CONT'D.)				
Non-GHG Pollution *				
<u>Ozone-Depleting Substances ("ODS") (cont'd.)</u>				
1,1,1-trichloroethane	kg CFC-11 eq	1	2	1
carbon tetrachloride	kg CFC-11 eq	0	0	0
methyl bromide	kg CFC-11 eq	0	0	0
Total ODP-weighted	kg CFC-11 eq	11	16	13
<u>Other non-GHG Pollution</u>				
Acid & Reactive Gases	kg	3,793	5,635	5,384
Heavy Metals	kg	126	139	112
Hazardous Organic Pollutants	kg	3,921	3,279	4,955
Other Air Pollutants	kg	1,931	2,614	2,285

* Non-GHG air pollutant emissions were estimated using the USEEIO model developed by the U.S. Environmental Protection Agency.

Extreme Weather				
QC operations stopped by weather conditions	%	0.23%	0.03%	0.03%

Waste				
<u>Scheduled waste</u>				
Used Battery (SW102)	tonnes	36.31	26.27	44.52
Electronic Waste (SW110)	tonnes	3.04	7.94	2.60
Used oil (SW305)	tonnes	306.98	341.48	215.63
Spent mineral oil-water emulsion (SW307)	tonnes	150.26	122.56	175.00
Spent oil-water mixture (SW309)	tonnes	0.00	5.94	1.40
Sludge (SW312)	tonnes	20.02	45.52	65.56
Clinical waste (SW404)	tonnes	0.27	1.07	0.15
Used sawdust (SW408)	tonnes	5.40	14.92	54.81

Indicator	Unit	FY2025	FY2024	FY2023
ENVIRONMENT (CONT'D.)				
Waste (cont'd.)				
<u>Scheduled waste (cont'd.)</u>				
Empty drums (SW409)	tonnes	43.82	54.50	44.76
Waste rag, gloves and oil filters (SW410)	tonnes	93.52	91.10	85.28
Total Scheduled Waste (Unrecycled)	tonnes	659.62	711.30	689.71
Total scheduled waste recycled (Hydraulic Oil)	tonnes	4.59	3.42	3.40
Total Scheduled Waste	tonnes	659.62	714.72	693.11
<u>Solid waste</u>				
Total internal solid waste	tonnes	2,210.33	2,428.26	NA
Total solid waste processed for external parties	tonnes	7,258.86	7,376.82	NA
Total non-recycled solid waste	tonnes	2,210 (100.00%)	2,428 (100.00%)	0 (NA)
	(% of total)			
Total recycled solid waste	tonnes	0 (0.00%)	0 (0.00%)	0 (NA)
	(% of total)			
Total waste directed to disposal	tonnes	2,865 (99.84%)	3,140 (99.89%)	690 (0.00%)
	(% of total)			
Total waste diverted from disposal	tonnes	5 (0.16%)	3 (0.11%)	3 (0.00%)
	(% of total)			
Total waste generated	tonnes	2,870	3,143	693
Waste intensity	kg/TEU	0.25	0.29	0.06
Materials				
Wire ropes	tonnes	371.80	436.39	520.60
Engine oil	tonnes	78.30	99.00	94.50
Lubricants	tonnes	113.58	157.56	156.82
Degreasers	tonnes	24.28	88.35	84.35
Cotton rags	tonnes	48.18	50.50	44.78
Gloves	tonnes	8.47	8.53	7.56
Tyres	tonnes	0.04	0.08	0.35
Total	tonnes	0.00	840.41	908.96

Indicator	Unit	FY2025	FY2024	FY2023
SOCIAL				
Cybersecurity				
Total information security breaches or other cybersecurity incidents *	No.	0	0	0
Total data breaches	No.	0	0	0
Total customers and employees affected by the company's data breach	No.	0	0	0
Total fines/penalties paid concerning information security breaches or other cybersecurity incidents	RM	0	0	0
Cybersecurity breaches prevented	No.	0	NA	NA
Customer Privacy: Complaints	No.	0	0	0
Substantiated complaints received from outside parties	No.	0	0	0
Complaints from regulatory bodies	No.	0	0	0
Board members' membership in the committee overseeing cybersecurity strategy	No.	3	3	3
Number of substantiated complaints concerning breaches of customer privacy and losses of customer data	No.	0	0	0
IP-related lawsuits or offenses investigated by a judicial/regulatory process	No.	0	0	0
Audit compliance rate	%	100%	NA	NA
Cybersecurity training participation rate	%	100%	NA	NA
Phishing drill participation	%	100%	NA	NA
Operational uptime	%	100%	NA	NA
Customer access downtime	Hours	1	NA	NA
Average resolution time	Minutes	30	NA	NA

Indicator	Unit	FY2025	FY2024	FY2023
SOCIAL (CONT'D.)				
CSR				
CSR donations (Charitable contributions and sponsorships)	RM	3,819,504	3,088,577	1,594,099
Total community investments made to registered not-for-profit organisations	RM	3,180,496	1,890,903	1,594,099
Total beneficiaries of investment in communities	No.	19,348	21,868	12,394
Staff visits to Westports' clinics	No.	28,205	23,145	22,374
Community projects completed	No.	48	NA	NA
Volunteer hours	Hours	8,215	NA	NA
Number of Volunteers	No.	1,626	NA	NA
Staff dependents and community Visits to Westports' Clinics	No.	23,020	18,917	5,485
Pulau Indah Non-Staff Non-Community	No.	792	NA	1,565
Physiotherapist Visits	No.	2,117	2,318	2,257
Total visits to clinics	No.	54,134	44,380	31,681
Klinik Westports Cost	RM	932,495	868,839	1,024,638
Klinik Masyarakat Cost	RM	490,513	473,718	555,291
Total cost of clinics	RM	2,393,634	1,624,551	1,579,929
Diversity, Equity & Inclusion				
Total employees	No.	5,737	5,587	5,685
Gender				
Male	No. (%)	5,352 (93.29%)	5,274 (94.40%)	5,402 (95.02%)
Female	No. (%)	385 (6.71%)	313 (5.60%)	283 (4.98%)
Age				
<30	No. (%)	2,631 (45.86%)	2,614 (46.79%)	2,859 (50.29%)
30-50	No. (%)	2,760 (48.11%)	2,638 (47.22%)	2,537 (44.63%)
>50	No. (%)	346 (6.03%)	335 (6.00%)	289 (5.08%)

Indicator	Unit	FY2025	FY2024	FY2023
SOCIAL (CONT'D.)				
Diversity, Equity & Inclusion (cont'd.)				
<u>Employee category</u>				
Top management	No. (%)	34 (0.59%)	31 (0.55%)	28 (0.49%)
Middle management	No. (%)	156 (2.72%)	148 (2.65%)	90 (1.58%)
Executive	No. (%)	333 (5.80%)	336 (6.01%)	380 (6.68%)
Operations	No. (%)	5,214 (90.88%)	5,072 (90.78%)	5,187 (91.24%)
<u>Employee category and gender</u>				
Men: Top management	No. (%)	27 (79.41%)	25 (80.65%)	24 (85.71%)
Women: Top management	No. (%)	7 (20.59%)	6 (19.35%)	4 (14.29%)
Men: Middle management	No. (%)	127 (81.41%)	126 (85.14%)	78 (86.67%)
Women: Middle management	No. (%)	29 (18.59%)	22 (14.86%)	12 (13.33%)
Men: Executive	No. (%)	257 (77.18%)	278 (82.74%)	318 (83.68%)
Women: Executive	No. (%)	76 (22.82%)	58 (17.26%)	62 (16.32%)
Men: Operations	No. (%)	4,941 (94.76%)	4,845 (95.52%)	4,982 (96.05%)
Women: Operations	No. (%)	273 (5.24%)	227 (4.48%)	205 (3.95%)
<u>Employee category and age</u>				
Age <30: Top management	No. (%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Age 31 - 50: Top management	No. (%)	19 (55.88%)	18 (58.06%)	16 (57.14%)
Age >51: Top management	No. (%)	15 (44.12%)	13 (41.94%)	12 (42.86%)
Age <30: Middle management	No. (%)	3 (1.92%)	6 (4.05%)	4 (4.44%)
Age 31 - 50: Middle management	No. (%)	129 (82.69%)	119 (80.41%)	76 (84.44%)
Age >51: Middle management	No. (%)	24 (15.38%)	23 (15.54%)	10 (11.11%)
Age <30: Executive	No. (%)	133 (39.94%)	146 (43.45%)	168 (44.21%)
Age 31 - 50: Executive	No. (%)	190 (57.06%)	185 (55.06%)	198 (52.11%)
Age >51: Executive	No. (%)	10 (3.00%)	5 (1.49%)	14 (3.68%)
Age <30: Operations	No. (%)	2,495 (47.85%)	2,462 (48.54%)	2,687 (51.80%)
Age 31 - 50: Operations	No. (%)	2,421 (46.43%)	2,316 (45.66%)	2,247 (43.32%)
Age >51: Operations	No. (%)	298 (5.72%)	294 (5.80%)	253 (4.88%)

Indicator	Unit	FY2025	FY2024	FY2023
SOCIAL (CONT'D.)				
Diversity, Equity & Inclusion (cont'd.)				
<u>Ethnicity</u>				
Malay	No. (%)	4,942 (86.14%)	4,781 (85.57%)	4,851 (85.33%)
Chinese	No. (%)	37 (0.64%)	34 (0.61%)	36 (0.63%)
Indian	No. (%)	495 (8.63%)	521 (9.33%)	520 (9.15%)
Other Malaysians	No. (%)	263 (4.58%)	250 (4.47%)	276 (4.85%)
Foreigners	No. (%)	0 (0.00%)	1 (0.02%)	2 (0.04%)
<u>Employment type</u>				
Permanent	No. (%)	5,737 (100.00%)	5,587 (100.00%)	5,681 (99.93%)
Temporary	No. (%)	0 (0.00%)	0 (0.00%)	4 (0.07%)
Women in Management				
Women in all management positions (middle and top management)	No. (%)	29 (15.26%)	28 (15.64%)	24 (20.34%)
Women in top management positions	No. (%)	7 (20.59%)	6 (19.35%)	4 (14.29%)
Women in management positions in revenue-generating functions	No. (%)	NA (0.00%)	NA (0.00%)	NA (0.00%)
<u>Other</u>				
People with disabilities ‡	No. (%)	2 (0.03%)	2 (0.04%)	2 (0.04%)
‡ FY2022 and FY2023 restated.				
Recruitment/hiring				
Total	No.	788	536	548
Gender: Male	No. (%)	679 (12.69%)	463 (8.78%)	393 (7.28%)
Gender: Female	No. (%)	109 (28.31%)	73 (23.32%)	155 (54.77%)
Age: <30	No. (%)	683 (25.96%)	455 (17.41%)	454 (15.88%)
Age: 31 - 50	No. (%)	100 (3.62%)	78 (2.96%)	90 (3.55%)
Age: >51	No. (%)	5 (1.45%)	3 (0.90%)	4 (1.38%)

Indicator	Unit	FY2025	FY2024	FY2023
SOCIAL (CONT'D.)				
Recruitment/hiring (cont'd.)				
Top management	No. (%)	4 (11.76%)	6 (19.35%)	3 (10.71%)
Middle management	No. (%)	15 (9.62%)	13 (8.78%)	6 (6.67%)
Executive	No. (%)	36 (10.81%)	61 (18.15%)	66 (17.37%)
Operations	No. (%)	733 (14.06%)	456 (8.99%)	473 (9.12%)
Malay	No. (%)	692 (14.00%)	464 (9.71%)	451 (9.30%)
Chinese	No. (%)	4 (10.81%)	6 (17.65%)	5 (13.89%)
Indian	No. (%)	43 (8.69%)	45 (8.64%)	58 (11.15%)
Others	No. (%)	49 (18.63%)	21 (8.40%)	34 (12.32%)
Foreigner	No. (%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Average hiring cost - Operations	RM	39	33	1,772
Average hiring cost - Executives	RM	3,228	903	4,213

Training				
Employees Receiving Training	No. (%)	5,749 (100.21%)	2,348 (42.03%)	2,523 (44.38%)
Gender: Male	No. (%)	5,376 (100.45%)	2,180 (41.33%)	2,305 (42.67%)
Gender: Female	No. (%)	373 (96.88%)	168 (53.67%)	218 (77.03%)
Age: <30	No. (%)	2,791 (106.08%)	1,111 (42.50%)	1,202 (42.04%)
Age: 31 - 50	No. (%)	2,635 (95.47%)	1,110 (42.08%)	1,174 (46.28%)
Age: >51	No. (%)	323 (93.35%)	127 (37.91%)	147 (50.87%)
Grade: Top management	No. (%)	31 (91.18%)	21 (67.74%)	20 (71.43%)
Grade: Middle management	No. (%)	149 (95.51%)	96 (64.86%)	117 (130.00%)
Grade: Executive	No. (%)	312 (93.69%)	200 (59.52%)	210 (55.26%)
Grade: Operations	No. (%)	5,257 (100.82%)	2,031 (40.04%)	2,176 (41.95%)
Ethnicity: Malay	No. (%)	4,959 (100.34%)	2,000 (41.83%)	2,174 (44.82%)
Ethnicity: Chinese	No. (%)	473 (1278.38%)	17 (50.00%)	26 (72.22%)
Ethnicity: Indian	No. (%)	33 (6.67%)	231 (44.34%)	282 (54.23%)
Ethnicity: Others	No. (%)	284 (107.98%)	100 (40.00%)	41 (14.86%)
Ethnicity: Foreigner	No. (%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

Indicator	Unit	FY2025	FY2024	FY2023
SOCIAL (CONT'D.)				
Training				
<u>Training hours</u>				
Top management	Hours	1,850	753	620
Middle management	Hours	9,828	3,618	5,321
Executives	Hours	14,607	8,651	23,746
Operations	Hours	318,950	127,724	109,150
Total time spent on employee development training	Hours	345,235	140,746	138,837
Average hours of training per employee	Hours	60	25	24
Average days of training per employee	Days	7	3	3

Turnover				
Total employee turnover	No. (%)	598 (10.42%)	664 (11.88%)	608 (10.69%)
Gender: Male	No. (%)	561 (10.48%)	616 (11.68%)	568 (10.51%)
Gender: Female	No. (%)	37 (9.61%)	48 (15.34%)	40 (14.13%)
Age: <30	No. (%)	413 (15.70%)	471 (18.02%)	438 (15.32%)
Age: 31 - 50	No. (%)	155 (5.62%)	165 (6.25%)	137 (5.40%)
Age: >51	No. (%)	30 (8.67%)	28 (8.36%)	33 (11.42%)
Grade: Top management	No. (%)	1 (2.94%)	3 (9.68%)	4 (14.29%)
Grade: Middle management	No. (%)	13 (8.33%)	12 (8.11%)	10 (11.11%)
Grade: Executive	No. (%)	38 (11.41%)	53 (15.77%)	54 (14.21%)
Grade: Operations	No. (%)	546 (10.47%)	596 (11.75%)	540 (10.41%)
Ethnicity: Malay	No. (%)	498 (10.08%)	556 (11.63%)	510 (10.51%)
Ethnicity: Chinese	No. (%)	2 (5.41%)	8 (23.53%)	7 (19.44%)
Ethnicity: Indian	No. (%)	63 (12.73%)	55 (10.56%)	62 (11.92%)
Ethnicity: Others	No. (%)	35 (13.31%)	45 (18.00%)	29 (10.51%)
Ethnicity: Foreigner	No. (%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Voluntary employee turnover	No. (%)	497 (83.11%)	586 (88.25%)	NA
Involuntary employee turnover	No. (%)	101 (16.89%)	78 (11.75%)	NA

Indicator	Unit	FY2025	FY2024	FY2023
SOCIAL (CONT'D.)				
Health And Safety Performance				
Sites with ISO 45001 certification (previously OHSAS 18001)	%	100%	100%	100%
Incidents and accidents (total)	No.	518	697	791
Accident frequency rate (employees)	Accidents per million hours worked	3.12	0.01	2.21
Accident severity rate (employees)	Severe accidents per million hours worked	65.17	1.65	122.78
Average number of cases per 100,000 TEU's (container operation)	No.	4.57	6.93	7.27
Average number of cases per 100,000 tonnage (conventional operation)	No.	0	0	0
Fatalities (employees)	No.	0	1	0
Fatalities (third-party contractors)	No.	3	0	0
Lost-Time Injury Frequency Rate ("LTIFR") (per million hours worked) (employees)	Rate	3.12	0.01	2.21
Lost-Time Incident rate (per million hours worked) (employees) *	Rate	3.12	0.01	6.46
Lost Workday Rate or Days Away (employees)	Days away per 200,000 hours worked	7.13	0.33	NA
Total employee workplace fatalities (exclusions)	No.	2	1	0
* This increase is due to improved reporting accuracy.				
Occupational HSE Training				
Number of staff trained on health and safety standards	No.	30 (ISO45001)	138 (SHE Committee & Crisis Committee trained on ISO45001)	138 (SHE Committee & Crisis Committee trained on ISO 45001)

Indicator	Unit	FY2025	FY2024	FY2023
SOCIAL (CONT'D.)				
Occupational HSE Training (cont'd.)				
Staff trained on safety only	No.	305 (WAH, Forklift, MEWP, HIRARC, OSHC)	Chemical Handling Training	Training on - ISO45001 (Introduction) - Evacuation drill at Business Centre
Employee Engagement				
% of actively engaged employees (PENGHULU, COMMS DAY)	%	5,318%	3,032%	NA
Proportion of total employees actively engaged	%	92.70%	57.80%	NA
Employees belonging to a union	No. (%)	3,567 (62%)	3,925 (70%)	3,483 (61.27%)
Number of working days disrupted due to strike action or disputes	Days	0	0	0
Human Rights				
Number of substantiated complaints concerning human rights violations	No.	0	0	0
Governance				
Number of Directors	No.	11	11	10
Number of independent Directors	No.	6	6	6
Men	No. (%)	6 (54.55%)	6 (54.55%)	5 (50.00%)
Women	No. (%)	5 (45.45%)	5 (45.45%)	5 (50.00%)
Age: <30	No. (%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Age: 31 - 50	No. (%)	2 (18.18%)	2 (18.18%)	2 (20.00%)
Age: >51	No. (%)	9 (81.82%)	9 (81.82%)	8 (80.00%)

ASSURANCE STATEMENT



INDEPENDENT ASSURANCE STATEMENT

Control Union (Malaysia) Sdn Bhd (hereinafter referred to as “Control Union”) was commissioned by Westports Holdings Berhad (hereinafter referred to as “Westports”) to undertake an independent assurance of Sustainability Statement for year 2026.

Westports is responsible for the collection, analysis, and preparation of the information in the Sustainability Statement. Control Union was not involved in the preparation of any material included in the statement, except for issuing this Independent Assurance Statement.

Control Union’s responsibility is to verify and provide assurance concerning the information included in the Sustainability Statement within the assurance scope mentioned below, with the purpose of informing all Interested Parties. Control Union’s assurance engagement is based on the assumption that all data and information provided is reliable and in good faith.

Scope of Assurance

The assurance was planned and performed for the applicable sustainability performance disclosures in line with Bursa Malaysia’s Sustainability Reporting Guide 3rd Edition, specifically focusing on the Common [C] Indicators as presented by Westports in the Sustainability Statement.

The Common [C] Indicators are defined as the prescribed indicators associated with the common sustainability matters that are deemed to be material for all Main Market listed issuers, as outlined in Annexure PN9-A, and ACE Market listed corporations, in Annexure GN11-A, regardless of size or sector. Sector-specific [S] Indicators, which pertain to sustainability matters material to specific sectors, were not included in this assurance scope.

Control Union multi-disciplinary verification team performed the assurance process that involves verification of the following indicators following the key sustainability focus areas include: **Anti-Corruption (C1), Community/Society (C2), Diversity (C3), Energy Management (C4), Health and Safety (C5), Labour Practices and Standards (C6), Supply Chain Management (C7), Data Privacy and Security (C8), Water (C9), Waste Management (C10), and Emission Management (C11).**

The additional disclosures outlined in the Bursa Malaysia Sustainability Reporting Guide including sustainability governance, scope of the sustainability statement, materiality assessment, management approach, performance targets, and performance data have been reviewed and verified for completeness and consistency with the stated reporting framework.

Methodology

Based on our verification process, the assurance methodology for Westports’s Sustainability Statement included reviewing the text of the statement (pre-assurance research), examining internal and external documentary evidence (including third-party consultants), and collecting data at the company, subsidiary, and corporate office levels. This also involved reviewing sample data and selecting internal performance documents, with a specific focus on the Common [C] Indicators in accordance with the provisions of the Bursa Sustainability Reporting Guide 3rd Edition.

Our methodology was conducted in accordance with the requirements of ISAE 3000. A limited assurance engagement involves performing procedures to obtain sufficient appropriate evidence to support a conclusion expressed in negative form. The procedures performed vary in nature and timing and are less in extent than for a reasonable assurance engagement.



This Sustainability Statement discloses Westports’s strategies, performance and forward-looking targets in managing material environmental and social matters, enhancing employee well-being, strengthening ethical governance and supporting long-term sustainable value creation for stakeholders.

Reporting Criteria and Level of Assurance

The level of Assurance is used to determine the extent of procedures that an assurance provider uses to identify if there are material errors, omissions or misstatements. The independent verification process is designed and conducted in line with the requirements of the International Standard on Assurance Engagements (ISAE) 3000 (Revised) for Limited Assurance engagements. The qualified verifiers have also evaluated the adequacy of the report against the Bursa Securities Main Market Listing Requirements (“MMLR”) and Bursa Sustainability Reporting Guide (3rd edition).

Independence and Quality Control

Control Union is an accredited Certifications and Assurance body operating in more than 80 countries. These accreditations and recognitions include the need to maintain a comprehensive system of quality control including documented policies and procedures on compliance to ethical and legal requirements as well as objectivity throughout our operations. The verifiers performing the data check were selected appropriately based on our internal qualifications’ requirements, training and experience. It is also reviewed by management to ensure that the applied approach and assurance are strictly followed and operated transparently.

Conclusion

Based on our moderate assurance process, nothing has come to our attention that causes us to believe that the scope (subject matter) as detailed above and presented in the Sustainability Statement is not presented fairly in accordance with the criteria. Hence, our work confirms that the information included in the Sustainability Statement is reliable, objective and is presented clearly.

For and on behalf of Control Union (Malaysia) Sdn Bhd,

Signed: Ebnun Holdoon Shawal

Date : 16th March 2026
Lead Verifier

BURSA MALAYSIA PRESCRIBED TABLE

WESTPORTS HOLDINGS BERHAD
IFRS S1

Date & Time: 2026-04-07 17:58:58

FYE 31/12/2025

Sustainability Matter	Metric	Measurement Unit	2025	Target	Assurance
Environment - Energy Intensity Measurement	Kg of GHG	CO2e/TEU	1515	1610	External (Limited)
Environment - Water and Effluent	Water for the Group's own consumption	Cubic meter	797,293	-	External (Limited)
Social - CSR	CSR donations and community investments	Amount, RM	7,000,000	-	External (Limited)
Social - Health & Safety Performance, Key Indicator	Fatalities (employees and 3rd party contractors)	Number	3	0	External (Limited)
Social - Diversity, Equity and Inclusion	Female employees in the Group	Percentage	6.7%	6.0%	External (Limited)
Economic - Sustainable Supply Chain	Supply chain, spending on local suppliers	Percentage	49.6%	-	External (Limited)
Economic - Ethical Governance	Total employees receiving training on anti-corruption	Percentage	99.5%	-	External (Limited)

This report was generated on the Bursa Malaysia CSI Platform on 2026-04-07 17:58:58

Page 1 of 2

WESTPORTS HOLDINGS BERHAD

IFRS S2

Date & Time: 2026-04-07 17:58:58

FYE 31/12/2025

Sustainability Matter	Metric	Measurement Unit	2025	Target	Assurance
GHG emissions	Scope 1	Metric tonnes of carbon dioxide equivalents (tCO2e)	136,485	-	External (Limited)
GHG emissions	Scope 2 Location-based	Metric tonnes of carbon dioxide equivalents (tCO2e)	34,899	-	External (Limited)

CONTENTS

ABOUT THIS REPORT	3	ENVIRONMENTAL SUSTAINABILITY	23	RESPONSIBLE OPERATIONS	51
ABOUT WESTPORTS	4	POLLUTION PREVENTION AND CONTROL	23	ENHANCING BULK CARGO EFFICIENCY	51
OUR CULTURE	5	MATERIALS MANAGEMENT	23	SAFE PORT	51
A MESSAGE FROM THE EXECUTIVE CHAIRMAN	6	BIODIVERSITY AND MARINE CONSERVATION	23	DIGITAL AND TECHNOLOGY BREAKTHROUGHS FOR POWERING OPERATIONAL SUSTAINABILITY	52
WESTPORTS PURSUITS OF SUSTAINABILITY	7	COMMITMENT TO NET-ZERO CARBON EMISSIONS BY 2050	24	OPTIMISING PORT OPERATIONS THROUGH EFFECTIVE COMMUNICATION AND STREAMLINED OPERATIONS	54
SUSTAINABILITY STRATEGY	7	EFFLUENTS AND WASTE MANAGEMENT	25	ENABLING SEAMLESS PORT OPERATIONS THROUGH IT AND TECHNOLOGY	54
STAKEHOLDER RELATIONS	8	ENERGY AND CLIMATE CHANGE	27	INFORMATION SECURITY MEASURES	54
SHAPING OUR SUSTAINABILITY PRIORITIES	9	CLIMATE CHANGE MANAGEMENT: DRIVING RESILIENCE AND SUSTAINABILITY	29	METRICS AND DATA DISCLOSURE	55
METHODOLOGY	9	WATER MANAGEMENT	35	KEY ENVIRONMENTAL METRICS AND TARGETS	55
APPLYING THE OUTCOMES	11	ENVIRONMENTAL COMPLIANCE	35	KEY SOCIAL METRICS AND TARGETS	57
GOVERNANCE	13	OUR PEOPLE	36	HOW WESTPORTS CALCULATES EMISSION INTENSITY	57
MANAGING RISKS FOR LONG-TERM RESILIENCE	16	COMPETITIVE AND SUPPORTIVE EMPLOYEE OFFERING	36	GROUP SUSTAINABILITY PERFORMANCE DATA	59
STRATEGY	17	DIVERSITY AND INCLUSIVITY	36	ASSURANCE STATEMENT	70
PIONEERING ECONOMIC SUSTAINABILITY IN PORT OPERATIONS	18	HUMAN RIGHTS	38	BURSA MALAYSIA PRESCRIBED TABLE	71
STRONG GROWTH AND POSITIVE OUTLOOK	18	FREEDOM OF ASSOCIATION, UNION REPRESENTATION AND COLLECTIVE BARGAINING	39	APPENDIX	
TRADE GROWTH THROUGH PORT EXPANSION AND INFRASTRUCTURE DEVELOPMENT	18	TRAINING AND DEVELOPMENT	39	PHYSICAL CLIMATE RISK ASSESSMENT, QUANTIFICATION AND CLIMATE DISCLOSURE	
LEADING THE REGION THROUGH STRATEGIC PARTNERSHIP	19	FOSTERING COMMUNICATION, ENGAGEMENT AND DIALOGUE	40		
ETHICAL BUSINESS OPERATIONS	19	BUILDING A SAFER PORT COMMUNITY	41		
ESG INTEGRATION IN THE SUPPLY CHAIN	21	NOTICE PERIOD	47		
		SOCIETY	48		
		CORPORATE RESPONSIBILITY GOVERNANCE	48		



FINAL REPORT

Physical Climate Risk Assessment, Quantification and Climate Disclosure

REFERENCE: 0802982

PREPARED FOR: WESTPORTS MALAYSIA SDN BHD

PREPARED BY: ENVIRONMENTAL RESOURCES MANAGEMENT (M) SDN BHD

DATE: 25 MARCH 2026

Sustainability is our business

© Copyright 2025 by The ERM International Group Limited and/or its affiliates ("ERM"). All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, without prior written permission of ERM.





Document details	
Document title	Physical Climate Risk Assessment, Quantification and Climate Disclosure
Document subtitle	Final Report
Project No.	0802982
Date	25 March 2026
Version	1.0
Author/s	Senthil Gurusamy, Sharifah Nurul Akmal, Xiao Feng Gan, Hoffman Cheung, Pramon Karnchanapimonkul
Client	WESTPORTS MALAYSIA SDN BHD

Document history							
Version	Revision	Phases	Author/s	Reviewed by	ERM approval to issue		Comments
					Name	Date	
1.0	0.0	1	Senthil Gurusamy, Sharifah Nurul Akmal	Venkat Kolluru	Jye Yng Voon	13 February 2026	Submitted as Draft Report
		2	Xiao Feng Gan, Hoffman Cheung, Senthil Gurusamy	Venkat Kolluru		13 February 2026	
		3	Xiao Feng Gan, Pramon Karnchanapimonkul	Yulia Dobrolyubova		30 December 2025	
	1.0	1	Senthil Gurusamy	Edmund Ang, Venkat Kolluru	Jye Yng Voon	25 March 2026	Submitted as Final Report
		2	Hoffman Cheung, Senthil Gurusamy	Edmund Ang, Venkat Kolluru		25 March 2026	
		3	Xiao Feng Gan, Pramon Karnchanapimonkul	Edmund Ang, Yulia Dobrolyubova		04 March 2026	



SIGNATURE PAGE

Physical Climate Risk Assessment, Quantification and Climate Disclosure

Final Report

0802982



Voon Jye Yng
Partner In Charge

Environmental Resources Management (M) Sdn Bhd
Suite 8-5, Level 8, Menara Milenium,
No. 8, Jalan Damanlela,
Damansara Heights,
50490, Kuala Lumpur,
Malaysia.

T: +603 2706 0010

© Copyright 2026 by The ERM International Group Limited and/or its affiliates ('ERM'). All Rights Reserved. No part of this work may be reproduced or transmitted in any form or by any means without the prior written permission of ERM.



Acronyms and Abbreviations	Description
AR5	Fifth Assessment Report
AR6	Sixth Assessment Report
BBT	Break Bulk Terminal
CT	Container Terminal
DBT	Dry Bulk Terminal
ENSO	El Niño–Southern Oscillation
ETWL	Extreme Total Water Level (ETWL) (metres)
GCD	ERM's Global Climate Database
HVAC	Heating, Ventilation and Air Conditioning
IFRS	International Financial Reporting Standards
IFRS S2	International Financial Reporting Standards: Climate-Related Disclosures
IOD	Indian Ocean Dipole
IPCC	Intergovernmental Panel on Climate Change
LBT	Liquid Bulk Terminal
NSRF	National Sustainability Reporting Framework
PIANC	Permanent International Association of Navigation Congresses-The World Association for Waterborne Transport Infrastructure
QC	Quay Cranes
RTG	Rubber-Tyred Gantry Crane
SLR	Sea Level Rise (metres)
SSP	Shared Socioeconomic Pathway
TCFD	Tasked Force on Climate-Related Financial Disclosures
TEUs	Twenty-foot Equivalent Unit
WSDI	Warm Spell Duration Index (days)

Content

1	Executive Summary	6
2	Project Background and Objectives	16
3	Chapter 1: Comprehensive Physical Risks Assessment using IPCC AR6	19
4	Chapter 2: Financial Impact Assessment – Quantification Approach	72



Executive Summary



ERM conducted a 2-day site visit on 6th and 7th August 2025 to look at how climate hazards may impact the processes, infrastructure, and/or equipment within the asset. The site visit highlighted several operational, environmental, and infrastructure-related factors that directly influence the materiality of physical climate risks for the port. These observations were essential in validating the assumptions, exposure ratings, and vulnerability pathways used in the physical risk assessment for the eight hazards.

Operational Sensitivities Confirm Exposure to Climate-Driven Interruptions

- ❖ **Swell >3 m** → Pilot boarding delays (8–12 hrs).
 - ❖ **Winds >30m/s** → Quayside operations halted (cranes, container handling).
 - ❖ **Reduced visibility (haze)** → Safety concerns, slower operations.
- Related hazards: **Winds & Storms, Waves, Currents, and Extreme Total Water Level (ETWL)**



Infrastructure Dependence Highlights Materiality of Flooding & Sea-Level-Related Risks

- ❖ **Drainage system performance** is critical during intense rainfall events.
 - ❖ **Site elevation (~8.0 m)** provides baseline protection but requires assessment against future SLR.
 - ❖ **Low-lying electrical substations** increase vulnerability to coastal flooding and ETWL.
- Related hazards: **Coastal Flooding, ETWL, and Rainfall Flooding**



Equipment & Crane Operations Reinforce Sensitivity to Wind and Heat Hazards

- ❖ **QCs (quay cranes) auto-shutdown at wind >30 m/s**, confirming vulnerability to high-wind conditions.
 - ❖ **RTGs (dependent on operator skill)** under adverse weather.
 - ❖ **Enclosed cabins reduce heat exposure**, but heat still drives:
- Related hazards: **Extreme Heat**



Maintenance Practices Indicate Long-Term Vulnerability of Marine Assets

- ❖ **Dredging cycles** reflect ongoing influence of sedimentation and currents.
 - ❖ **Corrosion control intervals** highlight exposure to humidity and salt spray.
 - ❖ **Drainage maintenance** underscores vulnerability during heavy rainfall events.
- Related hazards: **Currents and Waves**

Electrical Power Systems Identified as Critical Nodes with Cascading Risk Potential

- ❖ **Dual power feeds and backup generators** improve resilience.
 - ❖ **Substations near the waterfront** remain exposed to flood pathways.
- Related hazards: **Flooding, ETWL and Winds & Storms**

High Vessel Throughput Increases Consequence of Disruptions

- With ~50 vessel movements daily, operational delays rapidly create congestion and financial impacts.
- Related hazards: **Winds & Storms, Waves, Rainfall Flooding and Extreme Heat**

This assessment evaluated **36 Asset Group Types (199 assets)** for baseline and projected risk scores for **eight climate-related hazards** under **SSP5-8.5 scenarios for 2050 and 2085**. The analysis covered critical infrastructure categories including buildings, operational facilities, equipment, utilities, warehouses, and nearshore assets.

Key Findings by Hazard

- ❖ **Extreme Heat**
 - ❖ **Trend:** A pronounced upward trend.
 - ❖ **High-Risk Assets:** Data centers, chemical manufacturing, and fuel warehouses
- ❖ **Extreme Winds & Storms**
 - ❖ **Trend:** Minimal increase.
 - ❖ **High-Risk Assets:** All assets remain in the **Minimal to Low-risk range**.
- ❖ **Rainfall Flooding**
 - ❖ **Trend:** Negligible change.
 - ❖ **High-Risk Assets:** All assets remain in **the minimal risk range**.
- ❖ **Riverine Flooding**
 - ❖ **Trend:** No measurable change
 - ❖ **High-Risk Assets:** All assets remain in **the minimal risk range**.
- ❖ **Coastal Flooding**
 - ❖ **Trend:** Minimal increase.
 - ❖ **High-Risk Assets:** Sewerage systems, nearshore operational buildings, uncovered warehouses and maintenance buildings.
- ❖ **Extreme Total Water Level**
 - ❖ **Trend:** A clear upward trend
 - ❖ **High-Risk Assets:** Berths, nearshore equipment, operational buildings, and power substations.
- ❖ **Waves**
 - ❖ **Trend:** **No projected increase.**
 - ❖ **High-Risk Assets:** **Revetment onshore, Buildings (data centers, operational nearshore), power substations Nearshore, warehouses (covered nearshore) and telecommunication services nearshore.**
- ❖ **Currents**
 - ❖ **Trend:** **Slight decline**
 - ❖ **High-Risk Assets:** **Openwater nearshore and transport waterways.**

Heat Map of Westports Assets**

Physical Hazard*	Baseline	SSP5-8.5: 2050	SSP5-8.5: 2085
Extreme Heat	1.56	5.54	6.41
Extreme Winds & Storms	0.81	0.95	1.03
Rainfall Flooding	0.01	0.01	0.01
Riverine Flooding	0.00	0.00	0.00
Coastal Flooding	0.24	0.34	0.66
Extreme Total Water level	3.48	4.51	5.12
Waves	2.32	2.32	2.32
Currents	1.92	1.95	1.85

Risk level	Minimal	Low	Moderate	High	Very High
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10

* Definitions of physical hazards are included on slides in Appendix A.

** Risk level in each cell refers to the aggregated risk score (arithmetic mean) across all 199 assets.

Overall Risk Outlook

- ❖ **Potential Hazards:** Extreme Heat and Extreme Total Water Level show the highest escalation and pose severe risks to nearshore and operational assets.
- ❖ Waves and Currents remain largely unchanged, while Riverine, Rainfall and Coastal Flooding pose minimal risk.
- ❖ **Strategic Priority:** Prioritise investment in **heat adaptation strategies, coastal flood defenses, and water-level resilience measures** to safeguard critical infrastructure.
- ❖ The heat-map assessment (detailed risk register table is shown in the following slide) shows a clear and progressive escalation of physical climate hazards across the port's asset group types from the baseline to 2050 and further to 2085 under the SSP5-8.5 scenario, with the most significant increases occurring in Extreme Heat, Extreme Total Water Level (ETWL), Waves, Currents and Coastal Flooding.

Executive Summary – Climate Hazard Heatmaps for Asset Group Types Across Time Horizons

Heat maps of physical climate hazards for asset group types– baseline period as well as 2050 and 2085 timeframes under SSP5-8.5 scenarios

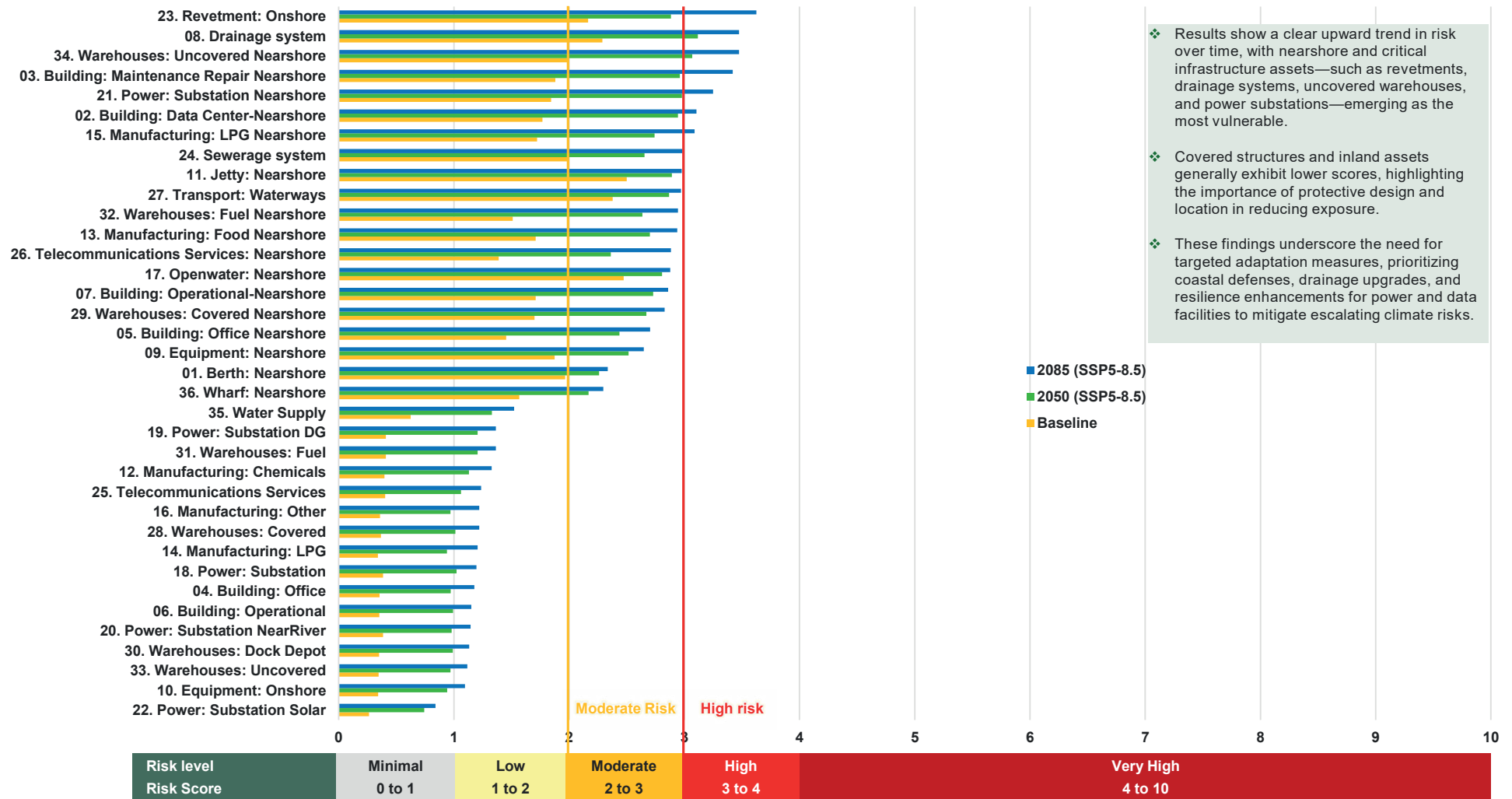
Asset Group Types	Extreme Heat			Extreme Winds & Storms			Rainfall Flooding			Riverine Flooding			Coastal Flooding			Extreme Total Water level			Waves			Currents		
	Baseline	2050	2085	Baseline	2050	2085	Baseline	2050	2085	Baseline	2050	2085	Baseline	2050	2085	Baseline	2050	2085	Baseline	2050	2085	Baseline	2050	2085
01. Berth: Nearshore	0.95	3.36	3.88	0.66	0.78	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	8.00	8.00	1.20	1.20	1.20	4.92	4.74	4.76
02. Building: Data Center-Nearshore	2.40	8.60	9.80	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.96	8.00	8.00	5.92	5.92	5.92	0.00	0.00	0.00
03. Building: Maintenance Repair Nearshore	1.84	6.40	7.60	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	1.45	2.33	4.73	4.96	8.00	8.00	5.92	5.92	5.92	0.00	0.00	0.00
04. Building: Office	1.86	6.52	7.66	0.88	1.04	1.12	0.01	0.02	0.02	0.00	0.00	0.00	0.08	0.20	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05. Building: Office Nearshore	1.84	6.40	7.60	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.96	4.96	8.00	8.00	3.94	3.94	3.94	0.00	0.00	0.00
06. Building: Operational	1.92	6.88	7.84	0.88	1.04	1.12	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.01	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07. Building: Operational-Nearshore	1.92	6.88	7.84	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.96	8.00	8.00	5.92	5.92	5.92	0.00	0.00	0.00
08. Drainage system	1.44	5.16	5.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	8.00	8.00	2.96	5.86	8.00	5.92	5.92	5.92	0.00	0.00	0.00
09. Equipment: Nearshore	1.92	6.88	7.84	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	8.00	8.00	1.20	1.20	1.20	3.00	3.02	3.03
10. Equipment: Onshore	1.86	6.50	7.65	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11. Jetty: Nearshore	0.92	3.20	3.80	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.69	8.00	8.00	1.50	1.50	1.50	10.00	9.40	9.39
12. Manufacturing: Chemicals	2.30	8.00	9.50	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13. Manufacturing: Food Nearshore	1.84	6.40	7.60	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.24	0.87	4.96	8.00	8.00	5.92	5.92	5.92	0.00	0.00	0.00
14. Manufacturing: LPG	1.84	6.40	7.60	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15. Manufacturing: LPG Nearshore	1.84	6.40	7.60	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.58	2.07	4.96	8.00	8.00	5.92	5.92	5.92	0.00	0.00	0.00
16. Manufacturing: Other	1.84	6.40	7.60	0.88	1.04	1.12	0.07	0.08	0.08	0.00	0.00	0.00	0.07	0.24	0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17. Openwater: Nearshore	0.96	3.44	3.92	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	8.00	8.00	1.20	1.20	1.20	8.75	8.77	8.79
18. Power: Substation	1.90	6.73	7.77	0.88	1.04	1.12	0.01	0.01	0.01	0.00	0.00	0.00	0.30	0.40	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19. Power: Substation DG	2.40	8.60	9.80	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20. Power: Substation NearRiver	1.84	6.40	7.60	0.88	1.04	1.12	0.36	0.41	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21. Power: Substation Nearshore	1.90	6.76	7.78	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.43	1.18	5.83	9.68	10.00	5.92	5.92	5.92	0.00	0.00	0.00
22. Power: Substation Solar	1.44	5.16	5.88	0.66	0.78	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23. Revetment: Onshore	1.42	5.06	5.83	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.45	1.19	2.30	4.35	8.65	9.86	9.86	9.86	2.63	2.32	2.36
24. Sewerage system	0.96	3.44	3.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	8.00	8.00	2.96	5.86	8.00	3.94	3.94	3.94	0.00	0.00	0.00
25. Telecommunications Services	1.91	6.84	7.82	0.88	1.04	1.12	0.01	0.01	0.01	0.00	0.00	0.00	0.43	0.61	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26. Telecommunications Services: Nearshore	1.92	6.88	7.84	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.20	2.39	5.04	8.00	5.92	5.92	5.92	0.00	0.00	0.00
27. Transport: Waterways	1.44	5.16	5.88	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	8.00	8.00	1.20	1.20	1.20	7.50	7.54	7.58
28. Warehouses: Covered	1.90	6.74	7.77	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.32	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29. Warehouses: Covered Nearshore	1.84	6.40	7.60	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.96	8.00	8.00	5.92	5.92	5.92	0.00	0.00	0.00
30. Warehouses: Dock Depot	1.92	6.88	7.84	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31. Warehouses: Fuel	2.40	8.60	9.80	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32. Warehouses: Fuel Nearshore	2.30	8.00	9.50	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	1.00	4.96	8.00	8.00	3.94	3.94	3.94	0.00	0.00	0.00
33. Warehouses: Uncovered	1.89	6.72	7.76	0.88	1.04	1.12	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34. Warehouses: Uncovered Nearshore	1.84	6.40	7.60	0.88	1.04	1.12	0.09	0.10	0.10	0.00	0.00	0.00	2.16	3.08	5.05	4.96	8.00	8.00	5.92	5.92	5.92	0.00	0.00	0.00
35. Water Supply	1.86	6.52	7.66	0.88	1.04	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.10	0.42	1.24	2.00	2.00	0.99	0.99	0.99	0.00	0.00	0.00
36. Wharf: Nearshore	0.95	3.38	3.89	0.66	0.78	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.83	7.27	7.71	1.20	1.20	1.20	4.89	4.72	4.74
Asset Averaged Risk Score	1.56	5.54	6.41	0.81	0.95	1.03	0.01	0.01	0.01	0.00	0.00	0.00	0.24	0.34	0.66	3.53	4.59	5.12	2.32	2.32	2.32	1.92	1.84	1.85



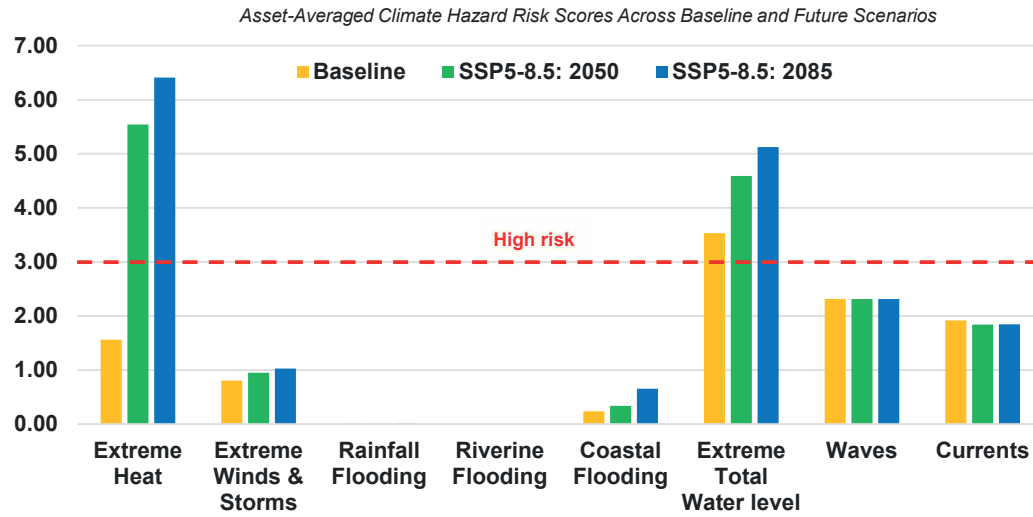
Risk level	Minimal	Low	Moderate	High	Very High
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10

Executive Summary – Asset Aggregated Risk Score for Asset Group Types

The chart illustrates aggregated climate risk scores for various asset group types under baseline conditions and future scenarios (SSP5-8.5-2050 & 2085).



Summary of High-Risk Assets by Key Physical Hazard Categories



Number of assets at high risk (risk score ≥ 3) *

High Risk	Baseline	SSP5-8.5	
		2050s	2085s
Extreme Heat	0	36	36
Extreme Winds & Storms	0	0	0
Rainfall Flooding	0	0	0
Riverine Flooding	0	0	0
Coastal Flooding	2	3	4
Extreme Total Water level	16	20	20
Waves	14	14	14
Currents	6	6	6

*Numbers with more than 18 (50% of assets) are shaded.

Risk level	Minimal	Low	Moderate	High	Very High
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10

Key Findings

- ❖ **Extreme Heat** is projected to become the most critical hazard, with high-risk assets increasing from **0 at baseline** to **36 assets (100%)** by both **2050s and 2085s** under SSP5-8.5 scenario. This indicates that all assessed assets will face severe heat-related risks in future timeframes.
- ❖ **Extreme Total Water Level** remains a major concern, starting with **16 assets (44%)** at high risk in the baseline period and increasing to **20 assets (56%)** by 2050, maintaining the same level through 2085. This highlights persistent vulnerability to elevated water levels.
- ❖ **Coastal Flooding** shows a gradual rise in high-risk exposure, from **2 assets (6%)** at baseline to **3 assets (8%)** by 2050 and **4 assets (11%)** by 2085, indicating incremental but notable risk growth.
- ❖ **Waves** maintain consistent high-risk exposure across all timeframes, with **14 assets (39%)** identified as high risk from baseline through 2085. Similarly, **Currents** remain unchanged at **6 assets (17%)**, reflecting stable but significant operational challenges.
- ❖ Other hazards, including **Extreme Winds & Storms**, **Rainfall Flooding**, and **Riverine Flooding**, show **0 assets** at high risk across all timeframes, suggesting comparatively lower exposure under SSP5-8.5 scenario.



Executive Summary – Physical impacts and High-Level Recommendations (1/2)

The overall physical risk level is projected to increase from baseline to 2050s and 2085s with higher increase under the high emissions scenario (SSP5-8.5). Five major climate hazards are identified from this assessment across different timeframes:

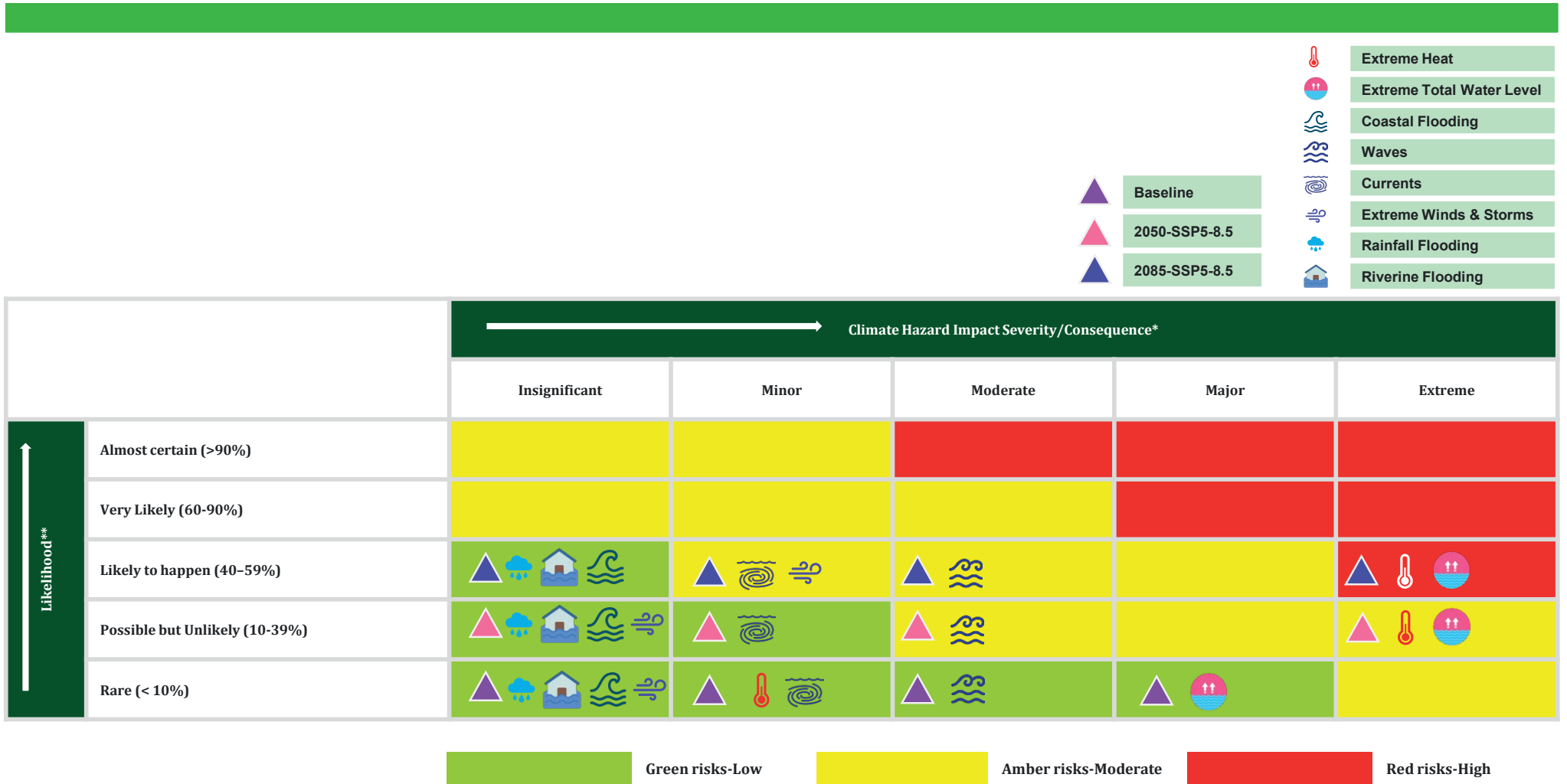
Hazard	Affected Assets	Potential Physical and Financial Impacts	High-level Recommendations
Extreme heat	<p>Extreme heat risk shows a pronounced upward trend.</p> <p>02. Building: Data Center-Nearshore, 19. Power: Substation DG, 31. Warehouses: Fuel, 32.</p> <p>Warehouses: Fuel Nearshore, 12. Manufacturing: Chemicals, 26. Telecommunications Services: Nearshore, 09. Equipment: Nearshore, 30.</p> <p>Warehouses: Dock Depot, 06. Building: Operational, 07. Building: Operational-Nearshore, 25. Telecommunications Services, 21. Power: Substation Nearshore, 28. Warehouses: Covered, 18. Power: Substation, 33. Warehouses: Uncovered</p>	<p>Physical Impacts:</p> <ul style="list-style-type: none"> ❖ Increased cooling demand for indoor areas, leading to higher energy consumption. ❖ Accelerated wear and tear on building materials and equipment. ❖ Elevated risk of equipment failure in data centers, telecom systems and sensitive electronics due to overheating. ❖ Greater likelihood of electricity shortages, fires, and explosions, causing operational disruptions. ❖ Health and safety risks for site personnel (e.g., heat stroke), reducing workforce efficiency. <p>Financial Impacts:</p> <ul style="list-style-type: none"> ❖ Operating Costs: Higher energy bills for cooling and increased maintenance expenses. ❖ Capital Expenditure: Investment in advanced cooling systems and heat-resistant materials. ❖ Business Interruption: Revenue loss from downtime and reduced productivity. ❖ Insurance Premiums: Increased coverage costs due to elevated fire and equipment failure risks. 	<ul style="list-style-type: none"> ❖ Implement advanced cooling systems for data centers and critical indoor areas. ❖ Upgrade building materials to heat-resistant specifications. ❖ Enhance energy efficiency through insulation and smart cooling technologies. ❖ Develop workforce safety protocols (heat stress management, shaded rest areas). ❖ Install backup power systems to prevent outages during peak demand.
Extreme Total Water level	<p>Extreme Total Water Level risk shows a clear upward trend under the SSP5-8.5 scenario.</p> <p>21. Power: Substation Nearshore, 23. Revetment: Onshore, 08. Drainage system, 01. Berth: Nearshore, 32. Warehouses: Fuel Nearshore, 11. Jetty: Nearshore, 29. Warehouses: Covered Nearshore, 27. Transport: Waterways, 26. Telecommunications Services: Nearshore, 09. Equipment: Nearshore, 34. Warehouses: Uncovered Nearshore, 05. Building: Office Nearshore, 03. Building: Maintenance Repair Nearshore, 13. Manufacturing: Food Nearshore, 07. Building: Operational-Nearshore</p>	<p>Physical Impacts:</p> <ul style="list-style-type: none"> ❖ Inundation of nearshore assets such as berths, wharves, warehouses, and operational buildings. ❖ Structural instability and accelerated deterioration of foundations due to prolonged water exposure. ❖ Corrosion of metal components and electrical systems, reducing asset lifespan. ❖ Increased risk of damage to power substations and telecommunication infrastructure. ❖ Disruption of cargo handling and vessel operations, leading to operational delays. <p>Financial Impacts:</p> <ul style="list-style-type: none"> ❖ Operating Costs: Higher maintenance expenses for corrosion control and structural repairs. ❖ Capital Expenditure: Significant investment in flood barriers, elevation works, and reinforcement of critical infrastructure. ❖ Business Interruption: Revenue loss from downtime during extreme water-level events and recovery periods. ❖ Insurance Premiums: Increased coverage costs due to elevated flood and structural failure risks. 	<ul style="list-style-type: none"> ❖ Construct robust flood barriers and storm surge protection systems. ❖ Elevate critical infrastructure (power substations, control rooms, warehouses). ❖ Reinforce foundations and structural components to withstand prolonged water exposure. ❖ Develop emergency response and continuity plans for operational downtime. ❖ Integrate real-time water-level monitoring systems for early warning.



Executive Summary – Physical impacts and High-Level Recommendations (2/2)

Hazard	Affected Assets	Potential Physical and Financial Impacts	High-level Recommendations
Waves	<p>Wave risk remains stable across all timeframes, showing no projected change under the SSP5-8.5 scenario.</p> <p>23. Revetment: Onshore, 15. Manufacturing: LPG Nearshore, 13. Manufacturing: Food Nearshore, 34. Warehouses: Uncovered Nearshore, 03. Building: Maintenance Repair Nearshore, 07. Building: Operational-Nearshore, 29. Warehouses: Covered Nearshore, 02. Building: Data Center-Nearshore, 08. Drainage system, 26. Telecommunications Services: Nearshore</p>	<p>Physical Impacts:</p> <ul style="list-style-type: none"> ❖ Continuous wave action causing erosion of revetments and nearshore structures. ❖ Structural stress on berths, wharves, and mooring systems. ❖ Damage to protective barriers and coastal infrastructure over time. ❖ Increased risk of operational delays during high wave conditions. <p>Financial Impacts:</p> <ul style="list-style-type: none"> ❖ Operating Costs: Ongoing maintenance for revetments and breakwaters. ❖ Capital Expenditure: Periodic reinforcement or replacement of coastal defenses. ❖ Business Interruption: Potential delays in vessel berthing and cargo handling during severe wave events. 	<ul style="list-style-type: none"> ❖ Maintain and reinforce revetments and breakwaters to reduce erosion. ❖ Design berths and mooring systems to withstand wave-induced stress. ❖ Schedule vessel operations based on wave forecasts to minimize delays. ❖ Periodic inspection and maintenance of coastal structures.
Currents	<p>Currents risk remains unchanged across all timeframes under the SSP5-8.5 scenario.</p> <p>11. Jetty: Nearshore, 17. Openwater: Nearshore, 27. Transport: Waterways, 01. Berth: Nearshore, 36. Wharf: Nearshore, 09. Equipment: Nearshore, 23. Revetment: Onshore</p>	<p>Physical Impacts:</p> <ul style="list-style-type: none"> ❖ Strong currents affecting navigation safety and vessel maneuverability. ❖ Increased strain on mooring systems and berthing infrastructure. ❖ Higher risk of vessel collisions and operational accidents. ❖ Potential damage to underwater structures and pipelines. <p>Financial Impacts:</p> <ul style="list-style-type: none"> ❖ Operating Costs: Investment in current monitoring systems and enhanced mooring equipment. ❖ Capital Expenditure: Reinforcement of berthing and mooring infrastructure. ❖ Business Interruption: Losses from shipping delays and potential accidents. ❖ Insurance Premiums: Increased coverage costs for navigation-related risks. 	<ul style="list-style-type: none"> ❖ Install current monitoring and alert systems for navigation safety. ❖ Upgrade mooring and berthing infrastructure to handle strong currents. ❖ Develop operational protocols for vessel movement during high-current conditions. ❖ Train personnel on emergency maneuvers and contingency planning.
Coastal Flooding	<p>Coastal flooding risk shows a slight upward trend under the SSP5-8.5 scenario.</p> <p>08. Drainage system, 24. Sewerage system, 34. Warehouses: Uncovered Nearshore, 03. Building: Maintenance Repair Nearshore, 15. Manufacturing: LPG Nearshore, 23. Revetment: Onshore, 21. Power: Substation Nearshore</p>	<p>Physical Impacts:</p> <ul style="list-style-type: none"> ❖ Inundation of nearshore operational buildings, warehouses, and sewerage systems. ❖ Corrosion and structural degradation of exposed metal and concrete components. ❖ Damage to electrical systems and utilities located at or below ground level. ❖ Increased vulnerability of uncovered storage areas and maintenance facilities. ❖ Disruption of port operations and cargo handling during flood events. <p>Financial Impacts:</p> <ul style="list-style-type: none"> ❖ Operating Costs: Higher maintenance and repair expenses for flood-damaged assets. ❖ Capital Expenditure: Significant investment in coastal defenses, elevation works, and waterproofing measures. ❖ Business Interruption: Revenue loss from operational downtime and recovery delays. ❖ Insurance Premiums: Increased coverage costs due to elevated flood risk and structural failure exposure. 	<ul style="list-style-type: none"> ❖ Implement coastal defense structures (revetments, seawalls, breakwaters). ❖ Relocate or elevate vulnerable nearshore assets where feasible. ❖ Waterproof electrical systems and install submersible pumps for rapid drainage. ❖ Plan for temporary relocation of operations during severe flood events.





*Climate Hazard Impact Severity / Consequence, indicates the extent of material impact likely to happen under 8 hazard conditions. This is adapted from Westports Enterprise Risk Register Map.

**Indicates the probability of occurrence at any given year (e.g., 1-in-100 year = 1%). It will be assumed the during the indicated time periods, each separate return period events represent a discrete event that happen at least once. Using this basis, cumulative probability (or likelihood) of 100-year return period over the time periods (or time horizons) can be estimated.

The following two physical risks have been quantified based on Phase 1 results:

- ❖ **Impact of Extreme Heat on Electricity Cooling Cost (OPEX).**
- ❖ **Impact of Extreme Total Water Level on Revenue.**

Comparatively, the **anticipated financial impact*** of extreme total water level is significantly larger than that of extreme heat. This is related to the potential of business interruption caused by higher projected water level.

Anticipated Financial Impacts due to Extreme Heat and Extreme Total Water Level (RM)*

Time Horizon	Extreme Heat	Extreme Total Water Level
2050	RM 1,710,000	RM 29,240,000 to 34,750,000 (1.50 to 1.78% of FY2024 revenue)
2085	RM 4,201,000	RM 87,280,000 to 96,790,000 (4.48 to 4.96% of FY2024 revenue)

Hence, it is crucial to enhance the climate resilience against future projected extreme water levels.

**All financial data provided by Westports were from FY2024. Therefore, the anticipated financial impacts represent additional financial impacts compared to FY2024 figures. Note that business growth and inflation are not considered in the quantification. In other words, the results here reflect the financial impacts on the current operation under future climate conditions.*

Project Background and Objectives

Preparing a science-based context for climate disclosure through four key steps, with stakeholder (ranging from operations/facilities managers to management functions in risk, finance, and management) validation at each stage.

1	2	3
<p>Comprehensive Physical Risks Assessment using IPCC AR6</p> <ul style="list-style-type: none"> ✓ Site visit and asset exposure validation 🌐 Detailed assessment of physical risks using IPCC AR6 projections 📊 Scenario analysis across relevant climate futures 	<p>Quantify Financial Impact of Physical Risks</p> <ul style="list-style-type: none"> 💰 Financial quantification of potential climate impacts 🔧 Identification of relevant adaptation and resilience measures 📋 Evaluation of adaptation measures/ planning 	<p>Develop Climate Disclosure Reporting</p> <ul style="list-style-type: none"> 📄 Preparation of climate disclosure, covering report aligned with stakeholder expectations and global frameworks
Phase 1 Task	Phase 2 Task	Phase 3 Task
<ul style="list-style-type: none"> ✓ Site visit ✓ Reassessment of Physical Risk with AR6 ✓ Scenario analysis of physical risks 	<ul style="list-style-type: none"> ✓ Financial Quantification of Physical Climate Risks ✓ Identification of Relevant Adaptation and Resilience Measures ✓ Evaluation of adaptation measures/ planning 	<ul style="list-style-type: none"> ✓ Climate disclosure report development

- ❖ To better understand how climate hazards may impact the processes within Westports' asset, ERM conducted a site visit to look at how climate hazards may impact the processes, infrastructure, and/or equipment within the asset.
- ❖ ERM reviewed past climate risk assessments, which include Environmental Impact Assessments (EIAs), latest CCRA reports, risk matrix defining materiality, and any TCFD/NSRF/IFRS S2-aligned reports.
- ❖ Physical risk reassessment with IPCC AR6 have been undertaken to assess the physical risks and hazard types that are relevant to the assets/infrastructures, which include extreme heat, extreme rainfall and flooding, extreme winds (including wind direction and speed), ocean waves (including wave height and wind current), sea level rise, thunderstorms, and visibility.
- ❖ Key processes, infrastructure, and/or equipment that will be impacted by agreed-upon key climate hazards will also be identified. These are chosen based on their importance towards Westports' underlying financial performance and their exposure to the agreed-upon key climate hazards.
- ❖ ERM has developed two financial models focusing on extreme heat and extreme total water levels to quantify the potential impacts of the climate hazards shortlisted in Phase 1 on Westports' critical processes, infrastructure, and equipment. The financial models assess impacts across two future time horizons (2050 and 2085) under the IPCC SSP5-8.5 scenario.
- ❖ Based on the results of the site-specific physical risks assessment, ERM assessed and identified pertinent and effective response measures specific to Westports' assets.
- ❖ ERM conducted a desktop review to develop a long list of up to three adaptation options per prioritized climate hazard. The provisional longlist of adaptation options will be reviewed by Westport, and a final list of items will be agreed upon to carry through to appraisal.
- ❖ ERM has compiled the site-specific physical risk assessment results, identified adaptation measures, and overall recommendations for Westports' management in a PPT slide deck.
- ❖ ERM has provided high-level cost estimates on the adaptation measures.
- ❖ ERM developed the key KPIs to be tracked for identified adaptation and mitigation plans to provide the Company with the ability to measure the effectiveness of the actions proposed.
- ❖ ERM drafted climate disclosure in line with TCFD/NSRF/IFRS S2 requirements to be included in the Company's Sustainability / Integrated Report or to be published as a standalone climate disclosure.



Westports Climate Change Assessment – Review and Future Recommendations

- ❖ The 2022 DHI's Climate Change Assessment evaluated how projected climatic and metocean changes may affect Westports' existing and planned infrastructure and operations over a **60-year horizon (to ~2080)**.
- ❖ The study followed PIANC (2020) Climate Change Adaptation Planning Guidelines and focused on **winds, waves, water levels/sea-level rise, currents, rainfall, and temperature**, followed by an initial vulnerability and risk screening.

Key Findings by Hazard

- ❖ **Sea Level Rise (SLR): Primary Long-Term Risk**
 - ❖ Projected SLR of **~0.47–0.65 m by 2080** (central (median) to 83% confidence).
 - ❖ 100-year extreme water levels increase to **~6.48–6.66 mCD**, significantly reducing berth freeboard over time.
 - ❖ SLR is the **dominant driver of long-term structural and operational risk** for quay structures.
- ❖ **Winds & Waves: Generally Minor Changes with Uncertainty in Extremes**
 - ❖ Mean wind and wave changes are **small under low–medium scenarios**.
 - ❖ Under high-emission scenarios, **seasonal increases in peak wind and wave heights** (especially during the NE monsoon) are possible.
 - ❖ **Squall-related extremes remain highly uncertain** due to modelling limitations but cannot be dismissed operationally.
- ❖ **Rainfall: Higher Extremes, Longer Dry Spells**
 - ❖ No clear trend in annual rainfall totals.
 - ❖ **Intensity of extreme rainfall increases** (higher 1-day maxima; higher contribution from very wet days).
 - ❖ **Longer dry spells** increase operational stress on drainage, utilities, and maintenance regimes.
- ❖ **Temperature: Clear and Consistent Increase**
 - ❖ Mean temperature increase of **~1.6–2.6°C by 2080**, depending on scenario.
 - ❖ **Heatwaves are more frequent, longer, and more intense**, with potential compounding from urban heat effects.
 - ❖ Implications for **workforce safety, equipment reliability, and energy demand**.
- ❖ **Currents: Negligible Change**
 - ❖ Future changes in tidal and residual currents are **minor** and not expected to materially affect port operations.

Forward-Looking Recommendations

1. Move from Screening to Asset-Level Adaptation Planning

2. Climate-Proof New Developments

- ❖ Design all new berths and coastal structures for **future water levels (≥2080 conditions)**, potentially requiring **higher deck levels and enhanced wave protection**.

3. Strengthen Drainage and Flood Resilience

- ❖ Implement targeted upgrades to **low-lying drainage nodes and critical electrical infrastructure**.

4. Establish a Permanent Metocean Monitoring Program

- ❖ Use data for **early warning, operational decision-making, and periodic risk reassessment**.

5. Update the Climate Risk Assessment Regularly

- ❖ Refresh the assessment **every 5 years**, or earlier when **high-resolution AR6 downscaled data for Malaysia becomes available**.
- ❖ Align future updates with **ESG reporting, capital investment planning, and insurance risk reviews**.

Source: * [Westports Climate Change Assessment Report 2022.pdf](#)
Climate Change Adaptation Planning for Ports and Inland Waterways – PIANC (2020)

A **Climate Change Physical Risk Re-assessment** has been undertaken following the recommendations of the previous assessment and subsequent site visit findings. The study utilises **IPCC AR6 high-resolution downscaled climate data for Malaysia** to robustly evaluate future physical climate risks relevant to Westports' assets and infrastructure.

Key Climate Hazards

- ❑ The assessment covers a comprehensive range of **key climate hazards** that potentially affect Westports assets, including:
 - ❖ **Extreme Heat**
 - ❖ **Extreme Winds & Storms**
 - ❖ **Rainfall Flooding**
 - ❖ **Riverine Flooding**
 - ❖ **Coastal Flooding**
 - ❖ **Extreme Total Water Level**
 - ❖ **Waves**
 - ❖ **Currents**
- ❑ **Detailed studies** have been carried out to address additional hazards and operational stressors that are critical to port performance and asset resilience, including:
 - ❖ **Swells and wave amplification**
 - ❖ **TEU (Twenty-foot Equivalent Unit)- related operational disruptions**
 - ❖ **Sedimentation and maintenance dredging implications**
 - ❖ **Localised flooding within operational and hinterland areas**
 - ❖ **Squall events and short-duration high-intensity wind systems**
 - ❖ **Other site-specific hazards with the potential to affect the port's structural integrity and operational continuity**
- ❑ **Financial impact models** have been developed for each of the key climate hazards to quantify potential impacts on **Westports' core processes, infrastructure assets, and critical equipment**, supporting risk-informed decision-making and long-term investment planning.
- ❑ A **comprehensive climate-related disclosure package**, aligned with **IFRS S2 and the Malaysian National Sustainability Reporting Framework (NSRF)**, has been prepared, capturing:
 - ❖ **Identified climate hazards and physical risks**
 - ❖ **Asset-level and operational exposure**
 - ❖ **Financial implications and risk pathways**
 - ❖ **Alignment with regulatory and best-practice disclosure expectations**



Chapter 1

COMPREHENSIVE PHYSICAL RISKS ASSESSMENT USING IPCC AR6





Site Visit – Asset Condition and Vulnerability Assessment

PORT ASSETS AND OPERATIONS



ERM conducted a 2-day site visit on 6th and 7th August 2025 to look at how climate hazards may impact the operations, infrastructure, and/or equipment within the asset.

Key Assets and Operational Processes

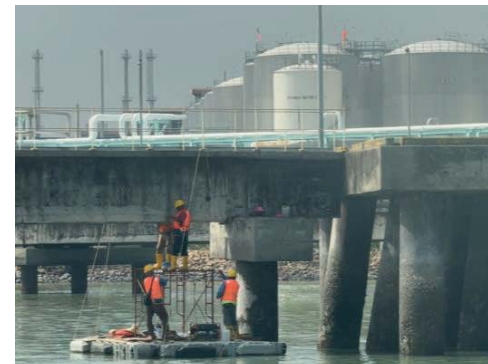
- ❖ **Berthing & Unberthing:** Main operations involve berthing/unberthing cargo ships.
- ❖ **Berths:** 24 total (4 conventional cargo, 20 container).
- ❖ **Support Assets:**
 - ❖ 9 tugboats (45–70 tons pulling capacity).
 - ❖ 5 pilot boats for pilot transfer.
- ❖ **Mooring:** Manual mooring gangs secure vessels during loading/unloading.

Operational Challenges

- ❖ **Berthing Requirements:**
 - ❖ Tugboat needs vary by vessel size (1–4 tugs per guidelines).
 - ❖ Additional support during adverse weather or technical issues.
- ❖ **Weather-Related Disruptions:**
 - ❖ Swell events (>3m) cause pilot boarding delays (8–12 hrs).
 - ❖ High winds (>15 knots) or poor visibility halt operations; past incidents linked to container instability.
- ❖ **Climate Factors:**
 - ❖ Haze historically caused rare disruptions; minimal recent impact.

Facility Management & Maintenance

- ❖ **Dredging:** Every 18 months to maintain depth.
- ❖ **Sedimentation Surveys:** Monthly; quarterly reports to authorities.
- ❖ **Crane Operations:** Halted at wind >15 knots or poor visibility; incidents of empty containers falling in strong winds.
- ❖ **Corrosion Control:** Special coatings applied; repainting every ~10 years.



Operational & Personnel Risks

- ❖ **Traffic:** ~50 vessel movements/day (~8,000 ships/year).
- ❖ **Heat:** No stoppages due to extreme heat; operators have air-conditioned cabins.
- ❖ **Flooding:** Highest tide (5.6m) has never flooded deck.
- ❖ **Environmental Risks:** Oil spills, waste dumping, tsunami/earthquake risks minimal but monitored.

Equipment & Maintenance

- ❖ **Cranes:**
 - ❖ Quay Cranes (QCs) auto-shutdown at wind >30 m/s; Rubber-Tyred Gantry Crane (RTGs) more stable.
 - ❖ RTGs equipped with anti-sway systems; QCs rely on operator skill.
- ❖ **Maintenance:** Weatherproof coatings; repaint every 10 years.

Drainage System

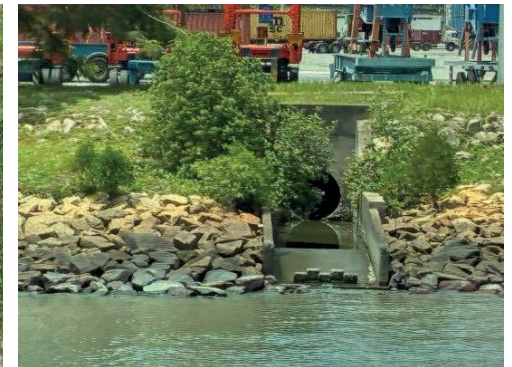
- ❖ **Liquid Bulk Terminal:** ~1-1.5m deep drainage.
- ❖ **Container Yard:** Slotted drainage integrated into pavement; flooding usually due to blockages.

Electrical Operations & Power Supply

- ❖ **Redundancy:** Dual power feeds; substations critical for cranes and reefers.
- ❖ **Backup:** Mobile generators (3-4 hrs); some reefers last up to 12 hrs.
- ❖ **Solar Panels:** On warehouse roofs; supply ~5% of total power.

Climate & Flood Resilience

- ❖ **Site Levels:** Current and future reclamation aim for ~8.2m elevation.
- ❖ **Drainage Capacity:** Designed for rainwater and treated wastewater; historical reliability high.
- ❖ **Critical Assets:** Substations near sea require flood protection assessment.



Take-Away Message: Materiality of Risks

Although day-to-day operations at the port are generally stable and resilient, the materiality of risks lies in their potential to cause high-impact operational, financial, or safety disruptions, even if such events are infrequent. Several risk categories remain operationally significant due to their system-critical nature and the compounding effects of climate and operational stressors:

Critical Infrastructure = High Consequence

Assets such as **substations, quay cranes, RTGs, power feeds, and tugboats** form the backbone of port operations. Even a single point of failure—particularly in power supply or marine assets—can halt ship movements or container handling, triggering:

- ❖ Large vessel delays
- ❖ Berth congestion
- ❖ Revenue loss and penalty exposure
- ❖ Safety risks for workers and marine operations

Thus, risks related to these assets remain **material** even if incidents are rare.

Weather-Driven Operational Thresholds Are Increasingly Tested

Wind, swell, and visibility thresholds directly govern safe operating conditions. While shutdowns are not frequent, the consequences of exceeding limits (e.g., 15-knot wind thresholds for crane operations, >3m swell for pilot transfer) can result in:

- ❖ Multi-hour to multi-day operational losses
- ❖ Safety incidents such as container sway or equipment instability
- ❖ Increased insurance claims and vessel diversion risks

Swell-driven pilot delays and past crane damage highlight that **climate-sensitive risks are real and potentially escalating**.

Compounding Hazards Can Overwhelm Historically Sufficient Systems

Flooding has not historically disrupted port operations, but the combination of:

- ❖ Higher rainfall intensities
- ❖ Blocked or capacity-limited drainage
- ❖ Higher tide levels
- ❖ More climate volatility may expose vulnerabilities not previously observed.

This does not indicate current failure but demonstrates **material future exposure** that requires anticipatory planning.

Operational Dependencies Increase Risk Amplification

Many systems are interdependent:

- ❖ If **power** is lost, cranes stop.
- ❖ If cranes stop, **RTG and yard movements** are disrupted.
- ❖ If pilots cannot board, **vessels cannot enter**, regardless of berth availability.

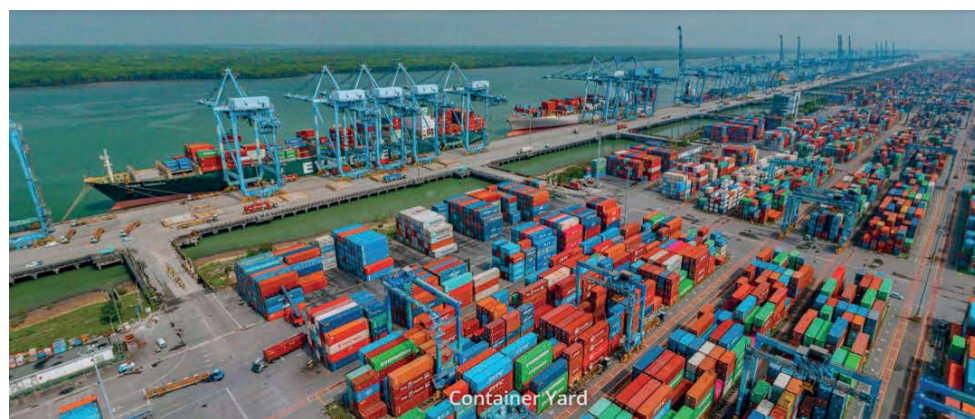
These interdependencies make even unlikely events **material** because their cascading impacts can be large.

Financial Exposure Is Driven by Low-Likelihood but High-Impact Events

Historical incidents—e.g., the 2019 vessel collision damaging cranes—show that:

- ❖ Financial losses can involve major repair costs
- ❖ Business interruption claims can be significant
- ❖ Downtime carries high opportunity cost

While probabilities remain low, the **cost severity** elevates the materiality of operational and climate risks.



- ❖ The **199 individual assets** were consolidated into **36 asset group types** based on a combination of **asset location** (e.g., nearshore, onshore, offshore) and **functional role in day-to-day port operations** (e.g., berthing, power supply, drainage, warehouses, telecommunications).
- ❖ Assets performing **similar operational functions** and experiencing **comparable physical climate exposure** were grouped together to ensure consistency in climate-risk screening and to reflect how risks are experienced in practice rather than at an individual-asset level.
- ❖ This grouping approach enables a **manageable, exposure-based assessment framework**, allowing climate hazards to be evaluated efficiently across asset types while preserving operational relevance for port activities.

No.	Asset Group Types	Total Assets
1	Berth: Nearshore	39
2	Building: Data Center-Nearshore	1
3	Building: Maintenance Repair Nearshore	2
4	Building: Office	4
5	Building: Office Nearshore	1
6	Building: Operational	3
7	Building: Operational-Nearshore	1
8	Drainage system	1
9	Equipment: Nearshore	5
10	Equipment: Onshore	10
11	Jetty: Nearshore	2
12	Manufacturing: Chemicals	1
13	Manufacturing: Food Nearshore	4
14	Manufacturing: LPG	1
15	Manufacturing: LPG Nearshore	1
16	Manufacturing: Other	2
17	Openwater: Nearshore	2
18	Power: Substation	13
19	Power: Substation DG	1
20	Power: Substation NearRiver	1
21	Power: Substation Nearshore	12
22	Power: Substation Solar	1
23	Revetment: Onshore	14
24	Sewerage system	1
25	Telecommunications Services	11
26	Telecommunications Services: Nearshore	10
27	Transport: Waterways	1
28	Warehouses: Covered	14
29	Warehouses: Covered Nearshore	1
30	Warehouses: Dock Depot	6
31	Warehouses: Fuel	1
32	Warehouses: Fuel Nearshore	1
33	Warehouses: Uncovered	3
34	Warehouses: Uncovered Nearshore	5
35	Water Supply	4
36	Wharf: Nearshore	19
Total		199

ERM has undertaken a high-level physical risk screening of **36 Asset Group Types (199 assets)** across the Westports area using ERM’s proprietary Global Climate Database (GCD). The assessment covers:

One (1) shared socioeconomic (SSP) scenarios* from the sixth assessment report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) to account for the uncertainty of future climate change:

SSP5-8.5# – a high emissions (business-as-usual / stress-test) scenario;

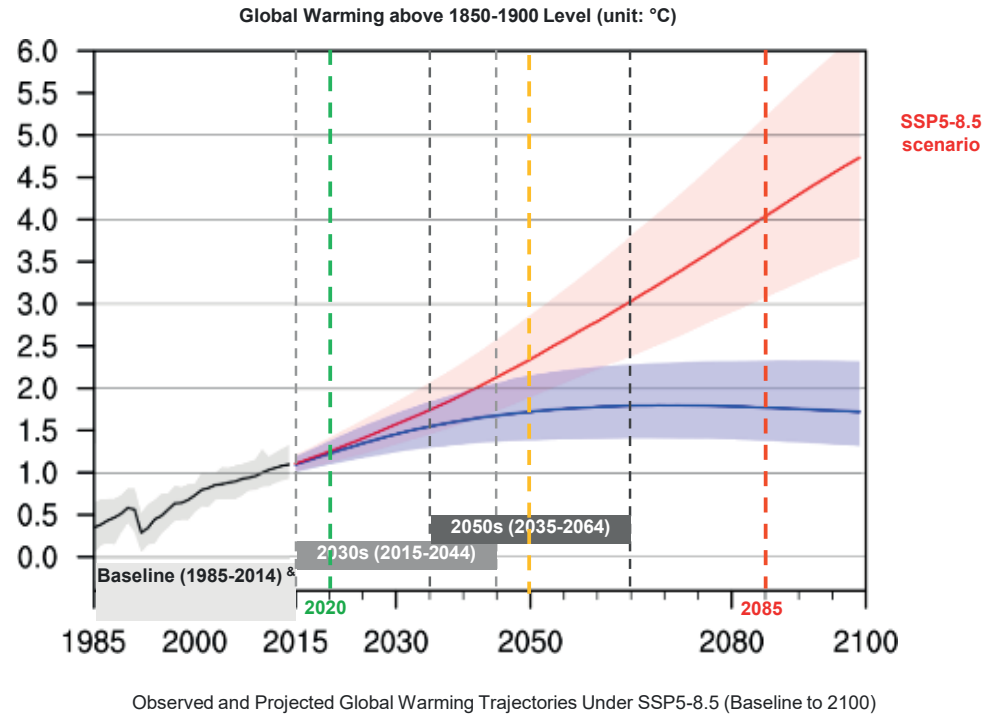
Three (3) timeframes representing 30-year climatic conditions from present-day to different periods in the 21st century:

Baseline*** present-day climatic condition and a reference period of future climate.

2050s and 2085s – short-to-medium term and medium-to-long-term climate change.

Eight (8) physical hazard types that potentially affect Westports assets:

- ❖ Extreme Heat
- ❖ Extreme Winds & Storms
- ❖ Rainfall Flooding
- ❖ Riverine Flooding
- ❖ Coastal Flooding
- ❖ Extreme Total Water Level
- ❖ Waves
- ❖ Currents



Time series of global surface air temperature above 1850-1900 level under IPCC SSP5-8.5 scenarios. The solid line and shading indicate the median and the 5% to 95% likelihood based on IPCC AR6 climate models. The three (3) time horizons considered in this assessment are labeled at bottom.

*The high-emissions scenario (SSP5-8.5), representing a business-as-usual trajectory, was selected for the assessment based on guidance from Westports’ management.

*The climate scenarios in IPCC AR6 report are shared socioeconomic pathways (SSPs) in IPCC AR6 report incorporate socioeconomic conditions and greenhouse gas emissions.

**Redrawn from Figure SPM. 8 in IPCC AR6 Summary for Policymakers (https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf), where the data are available at Centre for Environmental Data Analysis Archive (https://data.ceda.ac.uk/badc/ar6_wg1/data/spm/spm_08/v20210809/panel_a)

***1985-2014 is the standard baseline period that refers to the last 30 years of the historical run in IPCC AR6 models, but the baseline period is different for some of the climate indicators.

Asset-level **risk scores** will be used to determine the risk level of individual **physical hazard types** as well as the overall risk level of **an asset** across different timeframes and climate scenarios. The risk scores are calculated through the following four stages*:



- 1. Collection of asset coordinates/addresses and asset type;**
- 2. Extraction of physical hazard data** for each of **8 hazard types** during **baseline period** and **2050** and **2085;** timeframes from ERM's Global Climate Database (GCD) or publicly available datasets based on asset coordinates (location dependent); then the data are **normalized** to a 0 to 1 range;
- 3. Determination of unmitigated exposure rating multiplier** (0 to 10 range) for each hazard type based on asset type (location independent)
- 4. Calculation of hazard type risk scores** by combining normalised data and exposure rating multiplier (0 to 10 range).

The **hazard type risk scores** will be used to identify key physical risks at individual assets. The risk scores of 8 climate hazard types will also be **aggregated** to deduce the assets with higher overall physical climate risk. Five (5) risk levels categorise all risk scores – minimal (0 to 1), low (1 to 2), moderate (2 to 3), high (3 to 4), and very high (4 to 10).

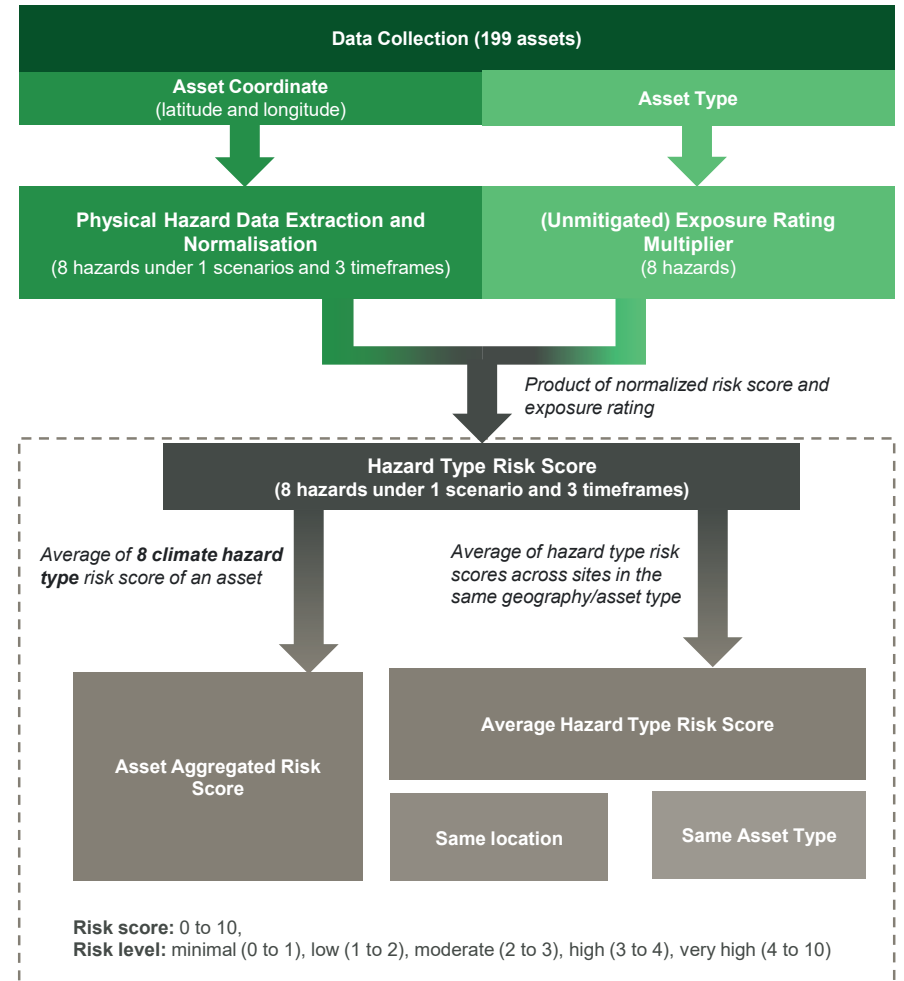
Risk level	Minimal	Low	Moderate	High	Very High
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10

The procedures of risk score calculation are illustrated by a schematic diagram on the right.

Note that this approach assumes no mitigation measures are in place.

*Details of methodology are presented in Appendix A, and the rationale of exposure ratings is provided in Appendix B.

Schematic Diagram of Risk Score Calculation



For each asset, risk scores are calculated for **eight (8) hazards (Hazard Type Risk Score)** for the **baseline period, 2050 and 2085** timeframe under **SSP5-8.5** scenarios. The hazard type risk score is aggregated to a risk score representing the overall physical hazard experienced by the asset (Asset Aggregated Risk Score).


Hazard Type Risk Score at an asset = **Normalized Indicator** at asset location × **Exposure Rating Multiplier** of asset type for specific hazard

$$\text{Asset Aggregated Risk Score} = \frac{\text{Sum of Hazard type Risk Score}}{\text{Number of Hazards}}$$

Similarly, the hazard type risk scores would be aggregated over all assets.

$$\text{Hazard Aggregated Risk Score for all assets} = \frac{\text{Sum of Hazard type Risk Score}}{\text{Number of Assets}}$$

Risk scores are categorized into five categories (minimal/low/moderate/high/very high) for a **qualitative assessment of physical hazard level**:

Categorization	Normalized Risk Score	Mid-Point of Exposure Rating Multiplier	Hazard Type/Aggregated Risk Score
Minimal	0 to 0.2		0 to 1
Low	0.2 to 0.4		1 to 2
Moderate	0.4 to 0.6		2 to 3
High	0.6 to 0.8		3 to 4
Very High	0.8 to 1		4 to 10*

*Threshold of 'very high' risk score is determined by the multiplication of normalized indicator x mid-point of exposure rating (4 = 0.8 x 5), and the upper-limit is determined by multiplication of maximum normalized risk score and maximum exposure rating (10 = 1 x 10).

To analyse how much hazard type/asset aggregated risk score changes from the baseline period to a future timeframe, a difference is calculated between the future timeframes (2050 and 2085) and the baseline period, which is categorized into seven (7) categories representing the direction and magnitude of change.

Categorization	Hazard Type Risk Score	Asset Aggregated Risk Score
Significant Decrease	-10 to -2	-10 to -1
Moderate Decrease	-2 to -1	-1 to -0.5
Minimal Decrease	-1 to -0.25	-0.5 to -0.125
No/Limited Change	-0.25 to +0.25	-0.125 to +0.125
Minimal Increase	+0.25 to +1	+0.125 to +0.5
Moderate Increase	+1 to +2	+0.5 to +1
Significant Increase	+2 to +10	+1 to +10

Major Climate Hazards on Asset Group Types

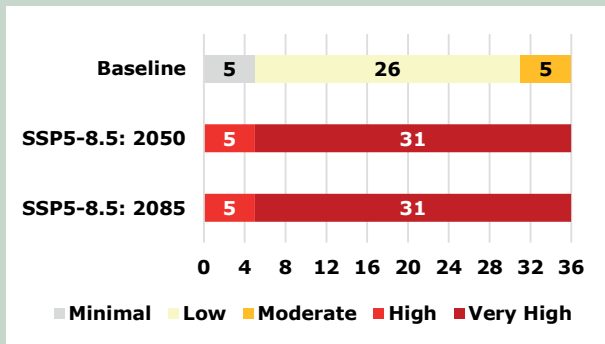
FIVE KEY HAZARDS



Understand the trend and potential impact of major hazards

Trends

- ❖ Extreme heat risk shows a pronounced upward trend. During the baseline period, all 36 asset group types were classified under minimal, low, or moderate risk. However, projections indicate a substantial escalation, with all 36 assets by 2050 and 2085 under the SSP5-8.5 scenario.



Warm Spell Duration Index

- ❖ The risk of extreme heat is measured by the warm spell duration index. Under climate change, temperature is projected to increase and corresponds to increase in unusually warm days as well as increased severity of extreme heat conditions.

The assets most vulnerable to extreme heat in 2050 and 2085 timeframes under SSP5-8.5 scenario, ranked in descending order of risk score are:

Rank	Asset Group Type
1	02. Building: Data Center-Nearshore
2	19. Power: Substation DG
3	31. Warehouses: Fuel
4	32. Warehouses: Fuel Nearshore
5	12. Manufacturing: Chemicals
6	26. Telecommunications Services: Nearshore
7	09. Equipment: Nearshore
8	30. Warehouses: Dock Depot
9	06. Building: Operational
10	07. Building: Operational-Nearshore
11	25. Telecommunications Services
12	21. Power: Substation Nearshore
13	28. Warehouses: Covered
14	18. Power: Substation
15	33. Warehouses: Uncovered
16	04. Building: Office
17	35. Water Supply
18	10. Equipment: Onshore
19	20. Power: Substation NearRiver
20	16. Manufacturing: Other
21	29. Warehouses: Covered Nearshore
22	15. Manufacturing: LPG Nearshore
23	34. Warehouses: Uncovered Nearshore
24	14. Manufacturing: LPG
25	05. Building: Office Nearshore
26	13. Manufacturing: Food Nearshore
27	03. Building: Maintenance Repair Nearshore
28	27. Transport: Waterways
29	08. Drainage system
30	22. Power: Substation Solar
31	23. Revetment: Onshore
32	24. Sewerage system
33	17. Openwater: Nearshore
34	36. Wharf: Nearshore
35	01. Berth: Nearshore
36	11. Jetty: Nearshore

Potential Physical and Financial Impacts

Physical Impacts:

- ❖ Increased cooling demand for indoor areas, leading to higher energy consumption.
- ❖ Accelerated wear and tear on building materials and equipment.
- ❖ Elevated risk of equipment failure in data centers, telecom systems and sensitive electronics due to overheating.
- ❖ Greater likelihood of electricity shortages, fires, and explosions, causing operational disruptions.
- ❖ Health and safety risks for site personnel (e.g., heat stroke), reducing workforce efficiency.

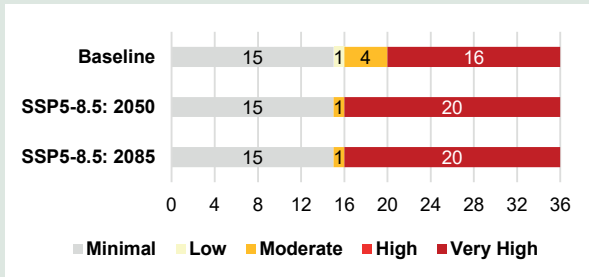
Financial Impacts:

- ❖ **Operating Costs:** Higher energy bills for cooling and increased maintenance expenses.
- ❖ **Capital Expenditure:** Investment in advanced cooling systems and heat-resistant materials.
- ❖ **Business Interruption:** Revenue loss from downtime and reduced productivity.
- ❖ **Insurance Premiums:** Increased coverage costs due to elevated fire and equipment failure risks.

Extreme Total Water Level- Combined Ocean Forcing

Trends

- ❖ Extreme Total Water Level risk shows a clear upward trend under the SSP5-8.5 scenario. At baseline, 15 assets (42%) are classified as minimal risk, 1 asset (3%) as low risk, 4 assets (11%) as moderate risk, and 16 assets (44%) as very high risk. By 2050 and 2085, the number of assets at very high risk increases to 20 (56%), while moderate risk decreases to 1 asset (3%) and low risk is eliminated. This indicates a significant escalation in exposure for assets currently at higher risk levels.



The assets most vulnerable to extreme total water level in 2050 and 2085 timeframes under SSP5-8.5 scenario, ranked in descending order of risk score are:

Rank	Asset Group Type
1	21. Power: Substation Nearshore
2	23. Revetment: Onshore
3	08. Drainage system
4	01. Berth: Nearshore
5	32. Warehouses: Fuel Nearshore
6	11. Jetty: Nearshore
7	29. Warehouses: Covered Nearshore
8	27. Transport: Waterways
9	26. Telecommunications Services: Nearshore
10	09. Equipment: Nearshore
11	34. Warehouses: Uncovered Nearshore
12	05. Building: Office Nearshore
13	03. Building: Maintenance Repair Nearshore
14	13. Manufacturing: Food Nearshore
15	07. Building: Operational-Nearshore
16	15. Manufacturing: LPG Nearshore
17	02. Building: Data Center-Nearshore
18	24. Sewerage system
19	17. Openwater: Nearshore
20	36. Wharf: Nearshore

Potential Physical and Financial Impacts

Physical Impacts:

- ❖ Inundation of nearshore assets such as berths, wharves, warehouses, and operational buildings.
- ❖ Structural instability and accelerated deterioration of foundations due to prolonged water exposure.
- ❖ Corrosion of metal components and electrical systems, reducing asset lifespan.
- ❖ Increased risk of damage to power substations and telecommunication infrastructure.
- ❖ Disruption of cargo handling and vessel operations, leading to operational delays.

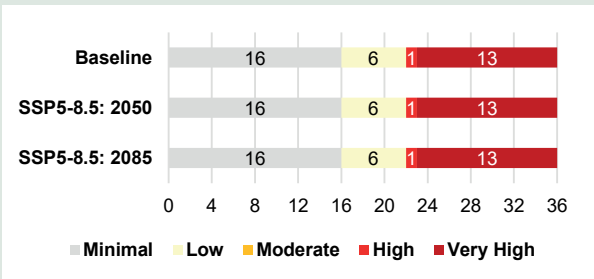
Financial Impacts:

- ❖ **Operating Costs:** Higher maintenance expenses for corrosion control and structural repairs.
- ❖ **Capital Expenditure:** Significant investment in flood barriers, elevation works, and reinforcement of critical infrastructure.
- ❖ **Business Interruption:** Revenue loss from downtime during extreme water-level events and recovery periods.
- ❖ **Insurance Premiums:** Increased coverage costs due to elevated flood and structural failure risks.

Waves

Trends

- Wave risk remains stable across all timeframes, showing no projected change under the SSP5-8.5 scenario. During the baseline period, 16 assets (44%) are classified as minimal risk, 6 assets (17%) as low risk, 1 asset (3%) as high risk, and 13 assets (36%) as very high risk. These proportions remain unchanged through 2050 and 2085, indicating persistent exposure for assets currently at high and very high-risk levels.



Waves

- Waves are assessed using significant wave height projections. Under SSP5-8.5, stronger storms and changing wind patterns increase wave heights, posing risks to marine operations and coastal defenses.

The assets most vulnerable to waves in 2050 and 2085 timeframes under SSP5-8.5 scenario, ranked in descending order of risk score are:

Rank	Asset Group Type
1	23. Revetment: Onshore
2	15. Manufacturing: LPG Nearshore
3	13. Manufacturing: Food Nearshore
4	34. Warehouses: Uncovered Nearshore
5	03. Building: Maintenance Repair Nearshore
6	07. Building: Operational-Nearshore
7	29. Warehouses: Covered Nearshore
8	02. Building: Data Center-Nearshore
9	08. Drainage system
10	26. Telecommunications Services: Nearshore
11	21. Power: Substation Nearshore
12	32. Warehouses: Fuel Nearshore
13	24. Sewerage system
14	05. Building: Office Nearshore

Potential Physical and Financial Impacts

Physical Impacts:

- Continuous wave action causing erosion of revetments and nearshore structures.
- Structural stress on berths, wharves, and mooring systems.
- Damage to protective barriers and coastal infrastructure over time.
- Increased risk of operational delays during high wave conditions.

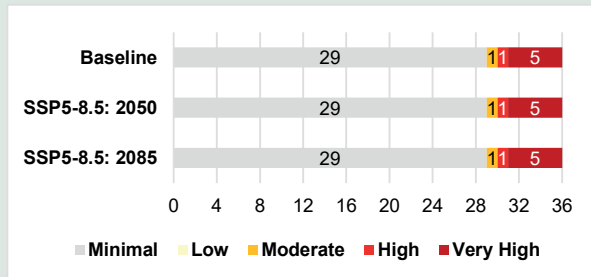
Financial Impacts:

- Operating Costs:** Ongoing maintenance for revetments and breakwaters.
- Capital Expenditure:** Periodic reinforcement or replacement of coastal defenses.
- Business Interruption:** Potential delays in vessel berthing and cargo handling during severe wave events.

Currents

Trends

- ❖ Currents risk remains unchanged across all timeframes under the SSP5-8.5 scenario. At baseline, 29 assets (81%) are classified as minimal risk, 1 asset (3%) as moderate risk, 1 asset (3%) as high risk, and 5 assets (14%) as very high risk. These proportions remain consistent through 2050 and 2085, indicating stable exposure with no projected escalation in risk levels.



Currents

- ❖ Ocean current risk relates to changes in nearshore current speeds, which can affect navigation and port operations. Under SSP5-8.5, altered wind and wave dynamics may strengthen currents, increasing operational challenges.

The assets most vulnerable to currents in 2050 and 2085 timeframes under SSP5-8.5 scenario, ranked in descending order of risk score are:

Rank	Asset Group Type
1	11. Jetty: Nearshore
2	17. Openwater: Nearshore
3	27. Transport: Waterways
4	01. Berth: Nearshore
5	36. Wharf: Nearshore
6	09. Equipment: Nearshore
7	23. Revetment: Onshore

Potential Physical and Financial Impacts

Physical Impacts:

- ❖ Strong currents affecting navigation safety and vessel maneuverability.
- ❖ Increased strain on mooring systems and berthing infrastructure.
- ❖ Higher risk of vessel collisions and operational accidents.
- ❖ Potential damage to underwater structures and pipelines.

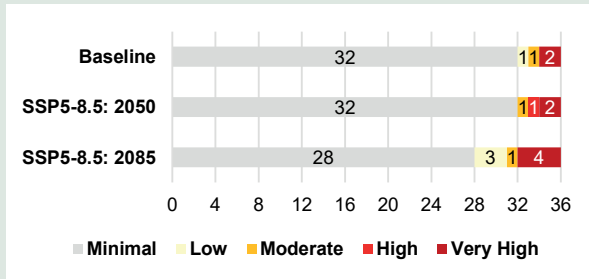
Financial Impacts:

- ❖ **Operating Costs:** Investment in current monitoring systems and enhanced mooring equipment.
- ❖ **Capital Expenditure:** Reinforcement of berthing and mooring infrastructure.
- ❖ **Business Interruption:** Losses from shipping delays and potential accidents.
- ❖ **Insurance Premiums:** Increased coverage costs for navigation-related risks.

Coastal Flooding

Trends

- ❖ Coastal flooding risk shows a slight upward trend under the SSP5-8.5 scenario. At baseline, 32 assets (89%) are classified as minimal risk, 1 asset (3%) as low risk, 1 asset (3%) as moderate risk, and 2 assets (6%) as very high risk. By 2050, the distribution remains largely unchanged, with only a minor shift—low risk is eliminated, and 1 asset moves to high risk. By 2085, minimal risk decreases to 28 assets (78%), low risk increases to 3 assets (8%), and very high-risk doubles to 4 assets (11%). This indicates a gradual increase in exposure for



Coastal Flooding

- ❖ Coastal flooding risk is driven by rising mean sea level combined with storm surge and tidal effects. Under SSP5-8.5, accelerated ice melt and thermal expansion cause significant sea level rise, increasing inundation risk for ports and coastal infrastructure.

The assets most vulnerable to coastal flooding in 2050 and 2085 timeframes under SSP5-8.5 scenario, ranked in descending order of risk score are:

Rank	Asset Group Type
1	08. Drainage system
2	24. Sewerage system
3	34. Warehouses: Uncovered Nearshore
4	03. Building: Maintenance Repair Nearshore
5	15. Manufacturing: LPG Nearshore
6	23. Revetment: Onshore
7	21. Power: Substation Nearshore

Potential Physical and Financial Impacts

Physical Impacts:

- ❖ Inundation of nearshore operational buildings, warehouses, and sewerage systems.
- ❖ Corrosion and structural degradation of exposed metal and concrete components.
- ❖ Damage to electrical systems and utilities located at or below ground level.
- ❖ Increased vulnerability of uncovered storage areas and maintenance facilities.
- ❖ Disruption of port operations and cargo handling during flood events.

Financial Impacts:

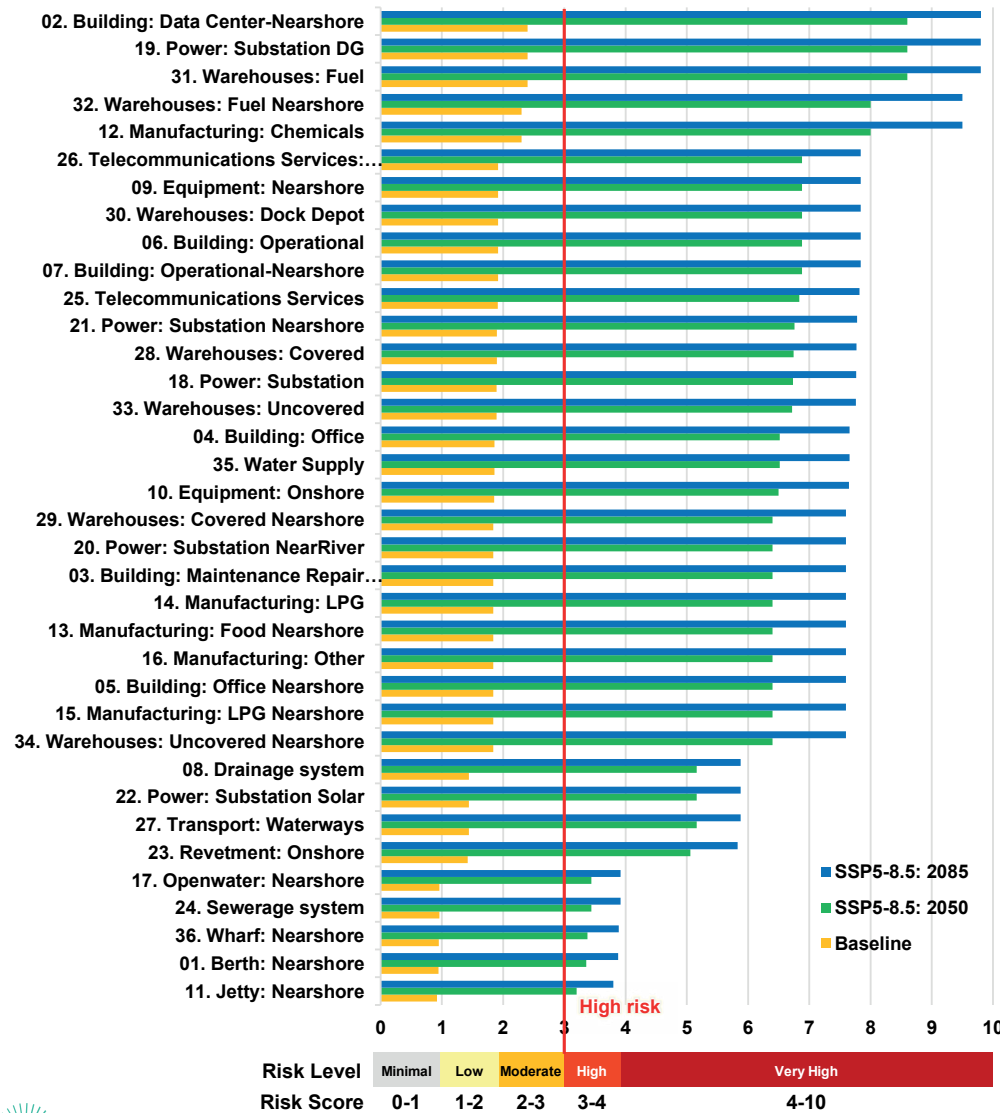
- ❖ **Operating Costs:** Higher maintenance and repair expenses for flood-damaged assets.
- ❖ **Capital Expenditure:** Significant investment in coastal defenses, elevation works, and waterproofing measures.
- ❖ **Business Interruption:** Revenue loss from operational downtime and recovery delays.
- ❖ **Insurance Premiums:** Increased coverage costs due to elevated flood risk and structural failure exposure.

Hazard Risk Score

BASELINE AND PROJECTED RISK SCORES BY ASSET GROUP TYPES- FIVE KEY HAZARDS

Extreme Heat: Baseline and Projected Risk Scores by Asset Group Types

Risk Profile of 36 Asset Group Types



Key Trends & Risks

The table presents the progression of asset-averaged risk scores for **Extreme Heat** across multiple asset types under **baseline** conditions and projected climate scenarios (**SSP5-8.5** for **2050** and **2085**).

Overall Trend

The average risk score increases sharply from **1.56** at baseline to **5.54** in 2050 and **6.41** in 2085, representing a **72% rise by 2050** and **76% by 2085**. This indicates a significant escalation in heat-related risks over time, moving most assets into the **High** or **Very High** risk categories.

High-Risk Assets

Assets with the greatest projected vulnerability include:

- **Data Centers (Nearshore)** – Risk score surges from **2.40** to **9.80** by 2085.
- **Chemical Manufacturing Facilities** – Increase from **2.30** to **9.50**.
- **Fuel Warehouses** – Jump from **2.30** to **9.80**.

These assets exhibit **Very High** risk levels by 2085, reflecting extreme sensitivity to prolonged heat exposure and operational disruptions.

Other Vulnerable Assets

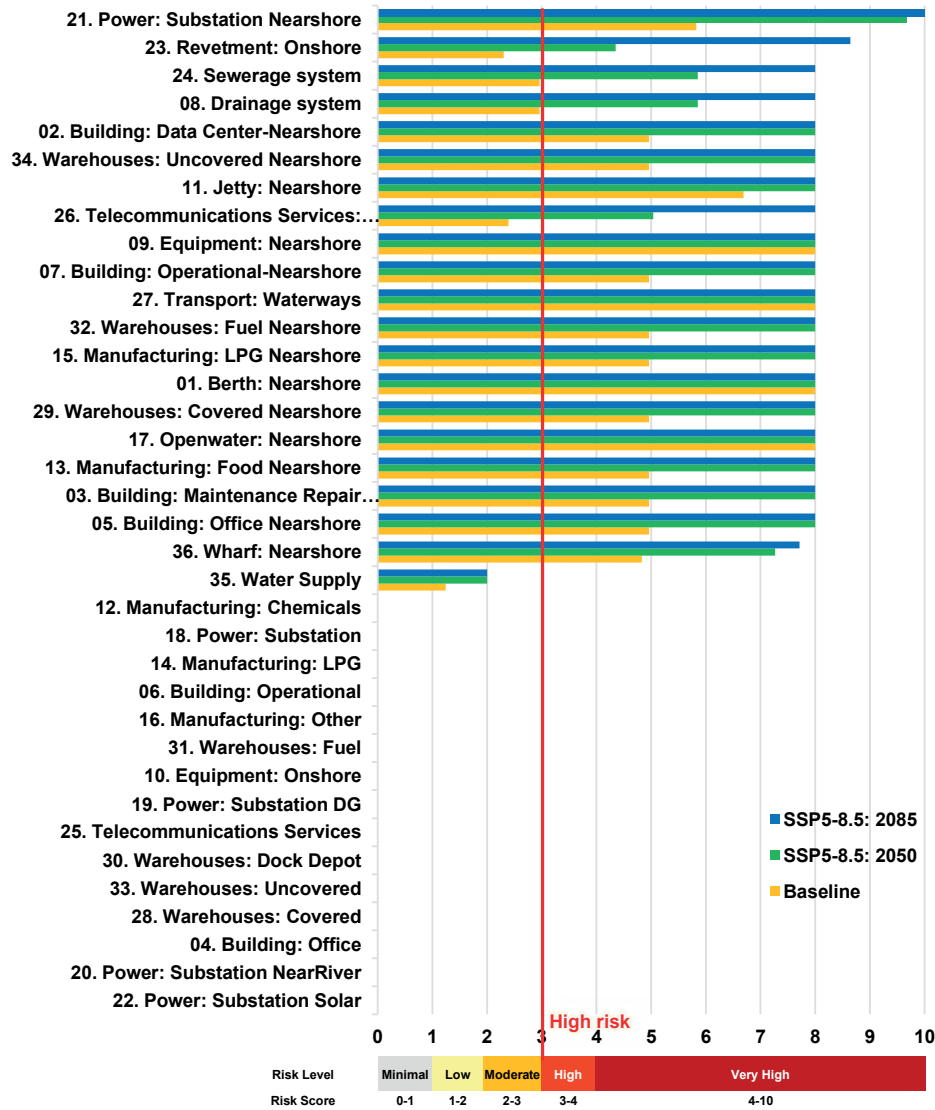
- **Nearshore Buildings, Power Substations, and Operational Facilities** show substantial increases, reaching scores between **7.0–8.0** by 2085.
- **Telecommunication Services** and **Drainage Systems** also trend upward, signaling potential infrastructure stress.
- Conversely, **Sewerage Systems** and **Open Water Areas** remain relatively lower risk, with scores below **4.0**, though still higher than baseline.

Asset Type	Baseline	2050	2085
Asset Averaged Risk Score	1.56	5.54	6.41
% Change from Baseline		72%	76%



Extreme Total Water Level : Baseline and Projected Risk Scores by Asset Group Types

Risk Profile of 36 Asset Group Types



Key Trends & Risks

The table shows the aggregated risk scores for **Extreme Total Water Level** across various asset types under **baseline** conditions and projected climate scenarios (**SSP5-8.5 for 2050 and 2085**).

Overall Trend

The average risk score increases from **3.53** at baseline to **4.59** in 2050 and **5.12** in 2085, representing a **23% rise by 2050** and **31% by 2085**. This indicates a significant escalation in water-level-related hazards, pushing many assets into the **Very High risk category (≥4)**.

High-Risk Assets

- **Nearshore Berths and Equipment** remain at **8.00** across all periods, indicating persistent **Very High risk**.
- **Operational and Nearshore Buildings** surge from **4.96** to **8.00**, reflecting extreme vulnerability.
- **Warehouses (Fuel Nearshore and Uncovered Nearshore)** also climb to **8.00**, signaling severe exposure.
- **Power Substations Nearshore** increase sharply from **5.83** to **10.00**, becoming one of the most critical assets at risk.

Other Vulnerable Assets

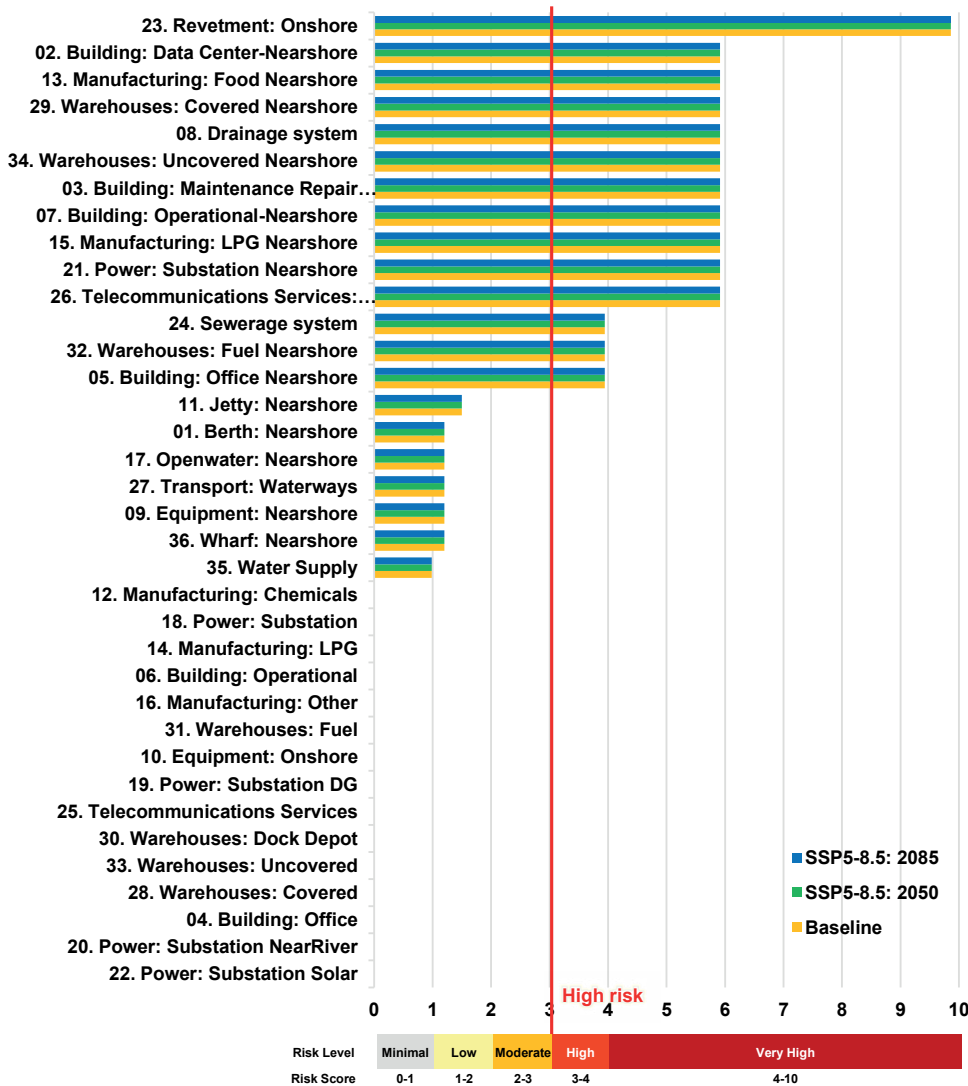
- **Telecommunication Services Nearshore** rise from **2.39** to **8.00**, moving from **Moderate** to **Very High risk**.
- **Water Supply** shows a slight increase from **1.24** to **2.00**, remaining in the **Moderate risk range**.
- **Manufacturing Facilities (Chemicals, LPG, Food Nearshore)** also reach **8.00**, indicating severe exposure.

Asset Type	Baseline	2050	2085
Asset Averaged Risk Score	3.53	4.59	5.12
% Change from Baseline		23%	31%



Waves : Baseline and Projected Risk Scores by Asset Group Types

Risk Profile of 36 Asset Group Types



Key Trends & Risks

The table presents the aggregated risk scores for **Waves** across various asset types under baseline conditions and projected climate scenarios (SSP5-8.5 for 2050 and 2085).

Overall Trend

The average risk score remains unchanged at 2.32 across all timeframes, indicating **no measurable increase** in wave-related risk for the assessed assets under the projected scenarios. This suggests that wave hazards are **static and not expected to intensify significantly** for these asset types.

Risk Level

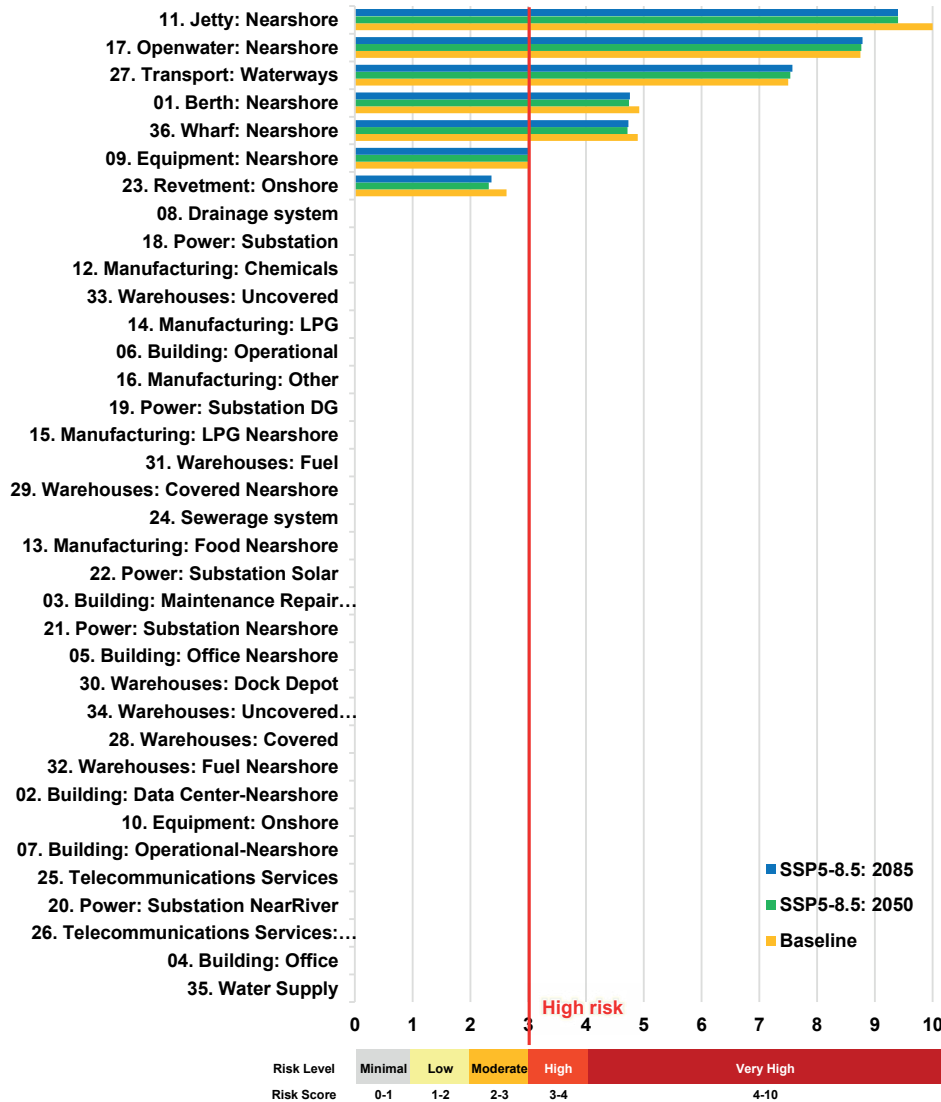
- Several assets already fall within the **Very High risk category (≥4)** at baseline and remain unchanged through 2085:
 - Buildings (Data Centers, Operational Nearshore)** – consistently at **5.92**.
 - Power Substations Nearshore** – **5.92**.
 - Warehouses (Covered Nearshore)** – **5.92**.
 - Telecommunication Services Nearshore** – **5.92**.
- Revetment Onshore** remains at **9.86**, indicating extreme vulnerability.
- Other assets, such as **Berths Nearshore** and **Equipment Nearshore**, stay within **Low to Moderate risk ranges (1.20–1.50)**.

Asset Type	Baseline	2050	2085
Asset Averaged Risk Score	2.32	2.32	2.32
% Change from Baseline		0%	0%



Currents : Baseline and Projected Risk Scores by Asset Group Types

Risk Profile of 36 Asset Group Types



Key Trends & Risks

The table presents the aggregated risk scores for **Currents** across various asset types under **baseline** conditions and projected climate scenarios (**SSP5-8.5 for 2050 and 2085**).

Overall Trend
The average risk score decreases slightly from **1.92** at baseline to **1.84** in 2050 and **1.85** in 2085, representing a **4% decline by 2050 and 2085** respectively. This indicates that current-related hazards are expected to remain stable or slightly reduce over time.

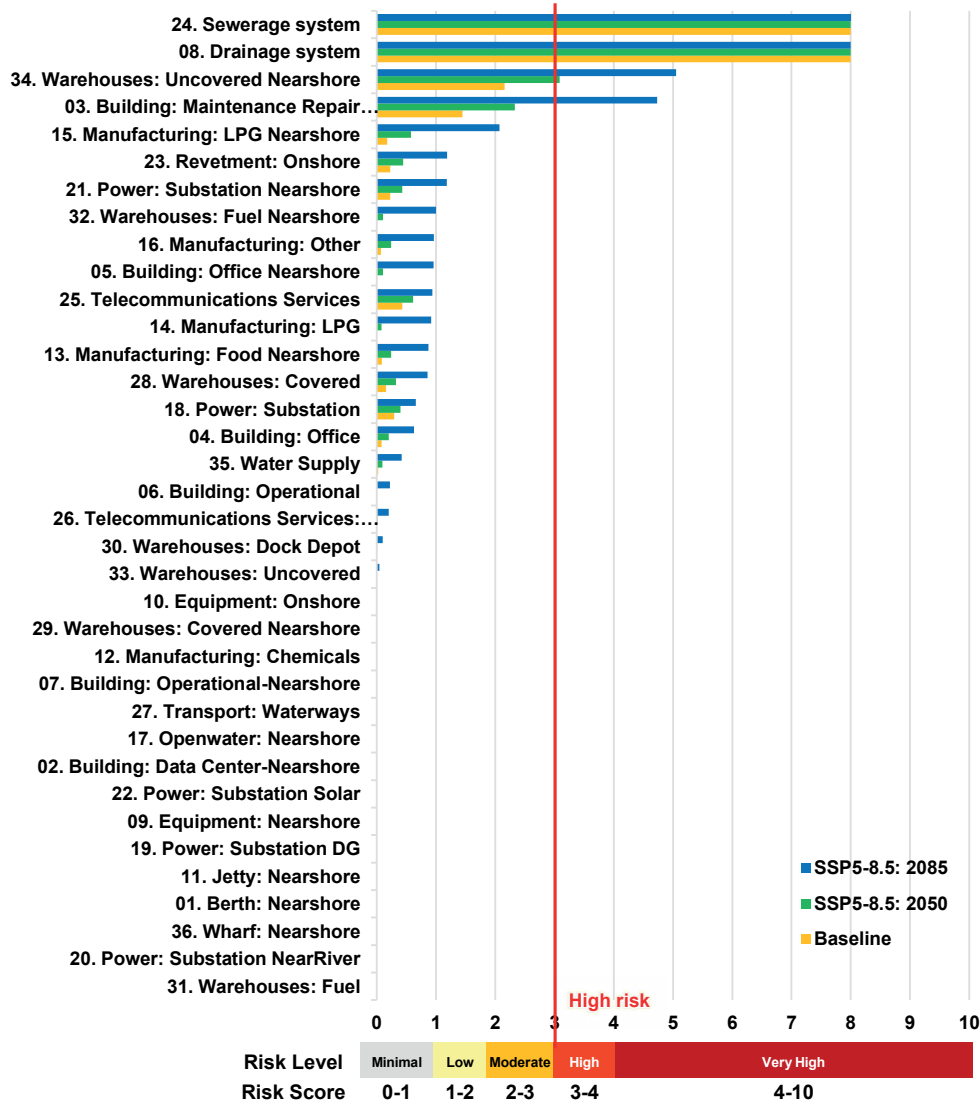
- Risk Level**
- **Openwater Nearshore** remains the highest-risk asset, with scores around **8.75–8.79**, indicating persistent **Very High risk**.
 - **Transport Waterways** also stays elevated at **7.50–7.58**, reflecting strong exposure to current-related hazards.
 - **Berths Nearshore** and **Wharfs Nearshore** slightly decreases from **4.92** to **4.76**, within the **Very High risk** category.
 - **Equipment Nearshore** remains moderate at **3.00–3.03**, while **Revetment Onshore** slightly decreases from **2.63** to **2.36**.

Asset Type	Baseline	2050	2085
Asset Averaged Risk Score	1.92	1.84	1.85
% Change from Baseline		-4%	-4%



Coastal Flooding : Baseline and Projected Risk Scores by Asset Group Types

Risk Profile of 36 Asset Group Types



Key Trends & Risks

The table illustrates the change in asset averaged risk scores for **Coastal Flooding** across various asset types under **baseline** conditions and projected climate scenarios (**SSP5-8.5 for 2050 and 2085**).

Overall Trend

The average risk score rises from **0.24** at baseline to **0.34** in 2050 and **0.66** in 2085, representing a **30% increase by 2050** and a substantial **64% increase by 2085**. This indicates a growing vulnerability to coastal flooding over time, particularly for assets located nearshore.

High-Risk Assets

- **Drainage and Sewerage Systems** remain at **8.00** across all periods, indicating persistent **Very High** risk.

Other Vulnerable Assets

- **Maintenance Repair Buildings Nearshore** increase from **1.45** to **4.73** by 2085, moving from **Moderate** to **Very High** risk.
- **Warehouses (Uncovered Nearshore)** rise sharply from **3.08** to **5.05**, indicating growing susceptibility.
- **Manufacturing LPG Nearshore** climbs from **0.58** to **2.07**, shifting from **Minimal** to **Moderate** risk.
- **Power Substations Nearshore** and **Telecommunication Services Nearshore** show incremental increases, though remaining below **2.0**.

Asset Type	Baseline	2050	2085
Asset Averaged Risk Score	0.00	0.34	0.66
% Change from Baseline		30%	64%

Details regarding the others hazards are given in Appendix C



Hazard Risk Score

CHANGE FROM BASELINE RISK SCORE- FIVE KEY HAZARDS



Extreme Heat: Change from Baseline Risk Score

Risk Profile of 36 Asset Group Types

Asset Group Type	Baseline	2050	2085
01. Berth: Nearshore	0.95	2.41	2.93
02. Building: Data Center-Nearshore	2.40	6.20	7.40
03. Building: Maintenance Repair Nearshore	1.84	4.56	5.76
04. Building: Office	1.86	4.66	5.80
05. Building: Office Nearshore	1.84	4.56	5.76
06. Building: Operational	1.92	4.96	5.92
07. Building: Operational-Nearshore	1.92	4.96	5.92
08. Drainage system	1.44	3.72	4.44
09. Equipment: Nearshore	1.92	4.96	5.92
10. Equipment: Onshore	1.86	4.64	5.79
11. Jetty: Nearshore	0.92	2.28	2.88
12. Manufacturing: Chemicals	2.30	5.70	7.20
13. Manufacturing: Food Nearshore	1.84	4.56	5.76
14. Manufacturing: LPG	1.84	4.56	5.76
15. Manufacturing: LPG Nearshore	1.84	4.56	5.76
16. Manufacturing: Other	1.84	4.56	5.76
17. Openwater: Nearshore	0.96	2.48	2.96
18. Power: Substation	1.90	4.84	5.87
19. Power: Substation DG	2.40	6.20	7.40
20. Power: Substation NearRiver	1.84	4.56	5.76
21. Power: Substation Nearshore	1.90	4.86	5.88
22. Power: Substation Solar	1.44	3.72	4.44
23. Revetment: Onshore	1.42	3.63	4.41
24. Sewerage system	0.96	2.48	2.96
25. Telecommunications Services	1.91	4.92	5.91
26. Telecommunications Services: Nearshore	1.92	4.96	5.92
27. Transport: Waterways	1.44	3.72	4.44
28. Warehouses: Covered	1.90	4.85	5.87
29. Warehouses: Covered Nearshore	1.84	4.56	5.76
30. Warehouses: Dock Depot	1.92	4.96	5.92
31. Warehouses: Fuel	2.40	6.20	7.40
32. Warehouses: Fuel Nearshore	2.30	5.70	7.20
33. Warehouses: Uncovered	1.89	4.83	5.87
34. Warehouses: Uncovered Nearshore	1.84	4.56	5.76
35. Water Supply	1.86	4.66	5.80
36. Wharf: Nearshore	0.95	2.43	2.94
Asset Averaged Risk Score	1.56	3.98	4.85

Key Trends & Risks

The table illustrates the change in asset averaged risk scores for **Extreme Heat** across various asset types from the baseline to future climate scenarios (**SSP5-8.5 for 2050 and 2085**).

Overall Trend:

The average risk score **increases significantly** from the baseline to 3.98 in 2050 and 4.85 in 2085, indicating a substantial escalation in heat-related risks over time.

High-Risk Assets:

Critical assets such as data centers, chemical manufacturing facilities, and fuel warehouses exhibit the highest projected increases, with scores exceeding 7.0 by 2085, reflecting their high sensitivity to temperature extremes.

Other Vulnerable Assets:

Nearshore buildings, power substations, and operational facilities also show marked vulnerability, while assets such as sewerage systems and open water remain relatively lower risk.

These trends underscore the urgent need for proactive heat adaptation strategies, including advanced cooling systems, material upgrades, and operational resilience planning for high-risk assets.

Projected Risk Change and Potential Operational Impacts

Extreme Heat – projected to **increase significantly** from baseline to **‘very high’ risk level** by 2050 and 2085 under SSP5-8.5 scenario. This escalation leads to potential risks including:

Operational Costs:

- Substantial increase in cooling demand for indoor areas, driving up energy consumption and operating expenses.

System Reliability:

- Greater likelihood of electricity shortages, equipment failures, fires, and explosions, resulting in business interruption, revenue loss, and higher capital expenditure, repair costs, and insurance premiums.

Health & Safety:

- Elevated health risks for site personnel, with potential reductions in working hours or downtime during extreme heat events, leading to productivity loss and decreased revenue.

Risk level	Minimal	Low	Moderate	High	Very High	
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10	
Change from Baseline Risk Score						
Significant Decrease	Moderate Decrease	Minimal Decrease	No Change	Minimal Increase	Moderate Increase	Significant Increase
-10 to -2	-2 to -1	-1 to -0.25	-0.25 to 0.25	+0.25 to +1	+1 to +2	+2 to 10



Extreme Total Water Level: Change from Baseline Risk Score

Risk Profile of 36 Asset Group Types				Key Trends & Risks																																						
Asset Group Type	Baseline	2050	2085																																							
01. Berth: Nearshore	8.00	0.00	0.00	<p>Key Trends & Risks</p> <p>The table illustrates the change in asset averaged risk scores for Extreme Total Water Level across various asset types from the baseline to future climate scenarios (SSP5-8.5 for 2050 and 2085).</p> <p>Overall Trend: The average risk score rises sharply from baseline to 1.06 in 2050 and 1.59 by 2085, indicating a significant increase in risk associated with extreme water levels over time.</p> <p>Asset-Level Observations: High-Risk Assets: Multiple nearshore assets—including data centers, maintenance repair buildings, operational buildings, LPG manufacturing facilities, and warehouses—reach 3.04 by 2050, remaining high through 2085. Power Substation Nearshore increases from 3.85 (2050) to 4.18 (2085), representing one of the highest risk scores. Telecommunications Services Nearshore rises from 2.65 (2050) to 5.61 (2085), indicating severe vulnerability. Drainage and Sewerage Systems escalate from 2.90 (2050) to 5.04 (2085), highlighting critical exposure.</p> <p>Moderate Risk: Wharf Nearshore climbs to 2.44 (2050) and 2.89 (2085), impacting port operations. Water Supply reaches 0.76, suggesting moderate exposure.</p> <p>Minimal Risk: Inland assets remain near 0.00, reflecting negligible exposure. These findings indicate that Extreme Total Water Level poses a major threat to port facilities and nearshore infrastructure, requiring urgent adaptation measures.</p> <p>Projected Risk Escalation and Potential Operational Impacts</p> <p>Extreme Total Water Level – projected to increase significantly from baseline to 'very high' risk level by 2050 and 2085 under SSP5-8.5 scenario. As extreme water levels intensify, potential impacts on port facilities and operations include:</p> <p>Severe Flooding and Inundation: High exposure of nearshore warehouses, power substations, and telecommunications systems to storm surge and tidal extremes.</p> <p>Operational Disruptions: Prolonged downtime for cargo handling, vessel berthing, and critical services during extreme water level events.</p> <p>Asset Integrity and Safety: Structural damage to wharves, drainage systems, and electrical infrastructure, leading to costly repairs and increased insurance premiums.</p> <table border="1"> <thead> <tr> <th>Risk level</th> <th>Minimal</th> <th>Low</th> <th>Moderate</th> <th>High</th> <th>Very High</th> </tr> <tr> <th>Risk Score</th> <td>0 to 1</td> <td>1 to 2</td> <td>2 to 3</td> <td>3 to 4</td> <td>4 to 10</td> </tr> <tr> <th colspan="6">Change from Baseline Risk Score</th> </tr> <tr> <th>Significant Decrease</th> <th>Moderate Decrease</th> <th>Minimal Decrease</th> <th>No Change</th> <th>Minimal Increase</th> <th>Moderate Increase</th> <th>Significant Increase</th> </tr> <tr> <td>-10 to -2</td> <td>-2 to -1</td> <td>-1 to -0.25</td> <td>-0.25 to 0.25</td> <td>+0.25 to +1</td> <td>+1 to +2</td> <td>+2 to 10</td> </tr> </thead></table>							Risk level	Minimal	Low	Moderate	High	Very High	Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10	Change from Baseline Risk Score						Significant Decrease	Moderate Decrease	Minimal Decrease	No Change	Minimal Increase	Moderate Increase	Significant Increase	-10 to -2	-2 to -1	-1 to -0.25	-0.25 to 0.25	+0.25 to +1	+1 to +2	+2 to 10
Risk level	Minimal	Low	Moderate								High	Very High																														
Risk Score	0 to 1	1 to 2	2 to 3								3 to 4	4 to 10																														
Change from Baseline Risk Score																																										
Significant Decrease	Moderate Decrease	Minimal Decrease	No Change								Minimal Increase	Moderate Increase	Significant Increase																													
-10 to -2	-2 to -1	-1 to -0.25	-0.25 to 0.25								+0.25 to +1	+1 to +2	+2 to 10																													
02. Building: Data Center-Nearshore	4.96	3.04	3.04																																							
03. Building: Maintenance Repair Nearshore	4.96	3.04	3.04																																							
04. Building: Office	0.00	0.00	0.00																																							
05. Building: Office Nearshore	4.96	3.04	3.04																																							
06. Building: Operational	0.00	0.00	0.00																																							
07. Building: Operational-Nearshore	4.96	3.04	3.04																																							
08. Drainage system	2.96	2.90	5.04																																							
09. Equipment: Nearshore	8.00	0.00	0.00																																							
10. Equipment: Onshore	0.00	0.00	0.00																																							
11. Jetty: Nearshore	6.69	1.31	1.31																																							
12. Manufacturing: Chemicals	0.00	0.00	0.00																																							
13. Manufacturing: Food Nearshore	4.96	3.04	3.04																																							
14. Manufacturing: LPG	0.00	0.00	0.00																																							
15. Manufacturing: LPG Nearshore	4.96	3.04	3.04																																							
16. Manufacturing: Other	0.00	0.00	0.00																																							
17. Openwater: Nearshore	8.00	0.00	0.00																																							
18. Power: Substation	0.00	0.00	0.00																																							
19. Power: Substation DG	0.00	0.00	0.00																																							
20. Power: Substation NearRiver	0.00	0.00	0.00																																							
21. Power: Substation Nearshore	5.83	3.85	4.18																																							
22. Power: Substation Solar	0.00	0.00	0.00																																							
23. Revetment: Onshore	2.30	2.05	6.34																																							
24. Sewerage system	2.96	2.90	5.04																																							
25. Telecommunications Services	0.00	0.00	0.00																																							
26. Telecommunications Services: Nearshore	2.39	2.65	5.61																																							
27. Transport: Waterways	8.00	0.00	0.00																																							
28. Warehouses: Covered	0.00	0.00	0.00																																							
29. Warehouses: Covered Nearshore	4.96	3.04	3.04																																							
30. Warehouses: Dock Depot	0.00	0.00	0.00																																							
31. Warehouses: Fuel	0.00	0.00	0.00																																							
32. Warehouses: Fuel Nearshore	4.96	3.04	3.04																																							
33. Warehouses: Uncovered	0.00	0.00	0.00																																							
34. Warehouses: Uncovered Nearshore	4.96	3.04	3.04																																							
35. Water Supply	1.24	0.76	0.76																																							
36. Wharf: Nearshore	4.83	2.44	2.89																																							
Asset Averaged Risk Score	3.53	1.06	1.59																																							



Waves: Change from Baseline Risk Score

Risk Profile of 36 Asset Group Types

Asset Group Type	Baseline	2050	2085
01. Berth: Nearshore	1.20	0.00	0.00
02. Building: Data Center-Nearshore	5.92	0.00	0.00
03. Building: Maintenance Repair Nearshore	5.92	0.00	0.00
04. Building: Office	0.00	0.00	0.00
05. Building: Office Nearshore	3.94	0.00	0.00
06. Building: Operational	0.00	0.00	0.00
07. Building: Operational-Nearshore	5.92	0.00	0.00
08. Drainage system	5.92	0.00	0.00
09. Equipment: Nearshore	1.20	0.00	0.00
10. Equipment: Onshore	0.00	0.00	0.00
11. Jetty: Nearshore	1.50	0.00	0.00
12. Manufacturing: Chemicals	0.00	0.00	0.00
13. Manufacturing: Food Nearshore	5.92	0.00	0.00
14. Manufacturing: LPG	0.00	0.00	0.00
15. Manufacturing: LPG Nearshore	5.92	0.00	0.00
16. Manufacturing: Other	0.00	0.00	0.00
17. Openwater: Nearshore	1.20	0.00	0.00
18. Power: Substation	0.00	0.00	0.00
19. Power: Substation DG	0.00	0.00	0.00
20. Power: Substation NearRiver	0.00	0.00	0.00
21. Power: Substation Nearshore	5.92	0.00	0.00
22. Power: Substation Solar	0.00	0.00	0.00
23. Revetment: Onshore	9.86	0.00	0.00
24. Sewerage system	3.94	0.00	0.00
25. Telecommunications Services	0.00	0.00	0.00
26. Telecommunications Services: Nearshore	5.92	0.00	0.00
27. Transport: Waterways	1.20	0.00	0.00
28. Warehouses: Covered	0.00	0.00	0.00
29. Warehouses: Covered Nearshore	5.92	0.00	0.00
30. Warehouses: Dock Depot	0.00	0.00	0.00
31. Warehouses: Fuel	0.00	0.00	0.00
32. Warehouses: Fuel Nearshore	3.94	0.00	0.00
33. Warehouses: Uncovered	0.00	0.00	0.00
34. Warehouses: Uncovered Nearshore	5.92	0.00	0.00
35. Water Supply	0.99	0.00	0.00
36. Wharf: Nearshore	1.20	0.00	0.00
Asset Averaged Risk Score	2.32	0.00	0.00

Key Trends & Risks

The table illustrates the change in asset averaged risk scores for **Waves** across various asset types from the **baseline** to future climate scenarios (**SSP5-8.5 for 2050 and 2085**).

Overall Trend:
The average risk score remains 0.00 across all timeframes (baseline, 2050, and 2085), indicating **no significant change in wave-related risk** under the assessed climate scenario.

All assets—including **buildings(data centers, operational nearshore), power substations nearshore, warehouses (covered nearshore), telecommunication services nearshore, revetment Onshore**—remain at a high-risk, though no measurable increase projected for 2050 or 2085 under the SSP5-8.5 scenario.

Drainage systems and sewerage systems remain at a high-risk level because the baseline assessment already indicated a high risk. Although the risk score does not change by 2050 or 2085 under the SSP5-8.5 scenario, the overall risk remains elevated.

Berths, wharves, nearshore warehouses, and manufacturing facilities—remain at a low-risk, though no measurable increase projected for 2050 or 2085 under the SSP5-8.5 scenario.

These findings confirm that Waves pose no material risk to the assessed infrastructure under SSP5-8.5, though ongoing monitoring is recommended to address potential changes in wave dynamics due to sea-level rise or extreme storm events.

Projected Risk Escalation and Potential Operational Impacts

Waves—projected to **increase minimally** from baseline by **2050 and 2085** under **SSP5-8.5** scenario. Given the negligible risk scores, wave activity is not expected to cause significant operational or structural impacts. However, potential considerations include:

Localized Splash and Spray:
Minor effects on nearshore structures during extreme storm conditions.

Operational Delays:
Temporary restrictions on cargo handling or vessel berthing during high-energy wave events.

Risk level	Minimal	Low	Moderate	High	Very High	
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10	
Change from Baseline Risk Score						
Significant Decrease	Moderate Decrease	Minimal Decrease	No Change	Minimal Increase	Moderate Increase	Significant Increase
-10 to -2	-2 to -1	-1 to -0.25	-0.25 to 0.25	+0.25 to +1	+1 to +2	+2 to 10



Currents: Change from Baseline Risk Score

Risk Profile of 36 Asset Group Types

Asset Group Type	Baseline	2050	2085
01. Berth: Nearshore	4.92	-0.18	-0.16
02. Building: Data Center-Nearshore	0.00	0.00	0.00
03. Building: Maintenance Repair Nearshore	0.00	0.00	0.00
04. Building: Office	0.00	0.00	0.00
05. Building: Office Nearshore	0.00	0.00	0.00
06. Building: Operational	0.00	0.00	0.00
07. Building: Operational-Nearshore	0.00	0.00	0.00
08. Drainage system	0.00	0.00	0.00
09. Equipment: Nearshore	3.00	0.02	0.03
10. Equipment: Onshore	0.00	0.00	0.00
11. Jetty: Nearshore	10.00	-0.60	-0.61
12. Manufacturing: Chemicals	0.00	0.00	0.00
13. Manufacturing: Food Nearshore	0.00	0.00	0.00
14. Manufacturing: LPG	0.00	0.00	0.00
15. Manufacturing: LPG Nearshore	0.00	0.00	0.00
16. Manufacturing: Other	0.00	0.00	0.00
17. Openwater: Nearshore	8.75	0.02	0.04
18. Power: Substation	0.00	0.00	0.00
19. Power: Substation DG	0.00	0.00	0.00
20. Power: Substation NearRiver	0.00	0.00	0.00
21. Power: Substation Nearshore	0.00	0.00	0.00
22. Power: Substation Solar	0.00	0.00	0.00
23. Revetment: Onshore	2.63	-0.31	-0.26
24. Sewerage system	0.00	0.00	0.00
25. Telecommunications Services	0.00	0.00	0.00
26. Telecommunications Services: Nearshore	0.00	0.00	0.00
27. Transport: Waterways	7.50	0.04	0.08
28. Warehouses: Covered	0.00	0.00	0.00
29. Warehouses: Covered Nearshore	0.00	0.00	0.00
30. Warehouses: Dock Depot	0.00	0.00	0.00
31. Warehouses: Fuel	0.00	0.00	0.00
32. Warehouses: Fuel Nearshore	0.00	0.00	0.00
33. Warehouses: Uncovered	0.00	0.00	0.00
34. Warehouses: Uncovered Nearshore	0.00	0.00	0.00
35. Water Supply	0.00	0.00	0.00
36. Wharf: Nearshore	4.89	-0.17	-0.16
Asset Averaged Risk Score	1.92	-0.08	-0.07

Key Trends & Risks

The table illustrates the change in asset averaged risk scores for **Currents** across various asset types from the **baseline** to future climate scenarios (**SSP5-8.5 for 2050 and 2085**).

Overall Trend:

The average risk score shifts slightly from baseline to **-0.08 in 2050** and **-0.07 by 2085**, indicating a **minimal decrease** in current-related risk over time. This suggests that currents are not expected to pose significant hazards under the assessed scenario.

Asset-Level Observations:

Minor Negative Changes:

- **Jetty Nearshore, Transport: Waterways, Berth Nearshore** and **Wharf Nearshore** remain at a very high-risk level because the baseline assessment already indicated a very high risk, though the risk score does have a minimal decrease by 2050 or 2085 under the SSP5-8.5 scenario.
- **Equipment Nearshore** remain at a high-risk level.
- **Revetment Onshore** remain at a moderate-risk level though there is a minimal decreases to **-0.31 (2050)** and **-0.26 (2085)**.

Minimal Positive Changes:

Some inland assets (e.g., **Manufacturing Other**) show negligible increases (up to 0.04), but these remain insignificant.

These findings indicate that **Currents** pose **no material risk** to port facilities and operations under SSP5-8.5, with slight reductions in exposure for nearshore structures.

Projected Risk Escalation and Potential Operational Impacts

Currents—projected to have **no significant change** by 2050 and 2085 under **SSP5-8.5** scenario. Given the negligible and slightly decreasing risk scores, currents are unlikely to cause significant operational or structural impacts. However, potential considerations include:

Localized Flow Variations:

Minor changes in current patterns could affect berthing maneuvers or mooring stability during extreme conditions.

Operational Adjustments:

Occasional need for tug assistance or revised docking protocols in areas with altered current flow.

Risk level	Minimal	Low	Moderate	High	Very High	
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10	
Change from Baseline Risk Score						
Significant Decrease	Moderate Decrease	Minimal Decrease	No Change	Minimal Increase	Moderate Increase	Significant Increase
-10 to -2	-2 to -1	-1 to -0.25	-0.25 to 0.25	+0.25 to +1	+1 to +2	+2 to 10



Coastal Flooding: Change from Baseline Risk Score

Risk Profile of 36 Asset Group Types

Asset Group Type	Baseline	2050	2085
01. Berth: Nearshore	0.00	0.00	0.00
02. Building: Data Center-Nearshore	0.00	0.00	0.00
03. Building: Maintenance Repair Nearshore	1.45	0.88	3.28
04. Building: Office	0.08	0.12	0.55
05. Building: Office Nearshore	0.00	0.10	0.96
06. Building: Operational	0.00	0.01	0.22
07. Building: Operational-Nearshore	0.00	0.00	0.00
08. Drainage system	8.00	0.00	0.00
09. Equipment: Nearshore	0.00	0.00	0.00
10. Equipment: Onshore	0.00	0.00	0.00
11. Jetty: Nearshore	0.00	0.00	0.00
12. Manufacturing: Chemicals	0.00	0.00	0.00
13. Manufacturing: Food Nearshore	0.08	0.16	0.79
14. Manufacturing: LPG	0.00	0.08	0.92
15. Manufacturing: LPG Nearshore	0.18	0.40	1.90
16. Manufacturing: Other	0.07	0.17	0.89
17. Openwater: Nearshore	0.00	0.00	0.00
18. Power: Substation	0.30	0.10	0.36
19. Power: Substation DG	0.00	0.00	0.00
20. Power: Substation NearRiver	0.00	0.00	0.00
21. Power: Substation Nearshore	0.23	0.20	0.95
22. Power: Substation Solar	0.00	0.00	0.00
23. Revetment: Onshore	0.23	0.22	0.96
24. Sewerage system	8.00	0.00	0.00
25. Telecommunications Services	0.43	0.18	0.51
26. Telecommunications Services: Nearshore	0.00	0.01	0.20
27. Transport: Waterways	0.00	0.00	0.00
28. Warehouses: Covered	0.16	0.17	0.70
29. Warehouses: Covered Nearshore	0.00	0.00	0.00
30. Warehouses: Dock Depot	0.00	0.00	0.10
31. Warehouses: Fuel	0.00	0.00	0.00
32. Warehouses: Fuel Nearshore	0.00	0.10	1.00
33. Warehouses: Uncovered	0.00	0.00	0.04
34. Warehouses: Uncovered Nearshore	2.16	0.92	2.89
35. Water Supply	0.03	0.07	0.39
36. Wharf: Nearshore	0.00	0.00	0.00
Asset Averaged Risk Score	0.24	0.10	0.42

Key Trends & Risks

The table illustrates the change in asset averaged risk scores for Coastal Flooding across various asset types from the baseline to future climate scenarios (SSP5-8.5 for 2050 and 2085).

Overall Trend:
The average risk score increases from **baseline to 0.10 in 2050 and 0.42 by 2085**, indicating a **progressive escalation** in coastal flooding risk over time, particularly for nearshore and exposed assets.

Asset-Level Observations:
High-Risk Assets by 2085:
Building: Maintenance Repair Nearshore rises sharply from baseline to **3.28 (2085)**.
Warehouses: Uncovered Nearshore increases from baseline to **2.89 (2085)**.
Warehouses: Fuel Nearshore reaches **1.00 by 2085**.
Drainage systems and sewerage systems remain at a very high-risk level because the baseline assessment already indicated a very high risk. Although the risk score does not change by 2050 or 2085 under the SSP5-8.5 scenario, the overall risk remains elevated.
Moderate Risk Growth:
Nearshore manufacturing facilities (LPG, food) and power substations show incremental increases, reaching **0.79–1.90 by 2085**.
Minimal Risk: Inland assets remain near 0.00, reflecting negligible exposure.

These findings indicate that **Coastal Flooding** poses a growing threat to **nearshore operational facilities, warehouses, drainage systems and sewerage systems and maintenance buildings**, requiring targeted adaptation measures.

Projected Risk Escalation and Potential Operational Impacts

Coastal Flooding – projected to **increase minimally by 2085** under **SSP5-8.5** scenario. As coastal flooding risk intensifies, potential impacts on port facilities and operations include:

Structural Damage:
Increased exposure of nearshore warehouses and maintenance facilities to inundation and saltwater corrosion.

Operational Disruptions:
Delays in cargo handling and vessel berthing during high tide or storm surge events.

Asset Integrity:
Accelerated deterioration of critical infrastructure, leading to higher maintenance and repair costs.

Risk level	Minimal	Low	Moderate	High	Very High	
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10	
Change from Baseline Risk Score						
Significant Decrease	Moderate Decrease	Minimal Decrease	No Change	Minimal Increase	Moderate Increase	Significant Increase
-10 to -2	-2 to -1	-1 to -0.25	-0.25 to 0.25	+0.25 to +1	+1 to +2	+2 to 10

Details regarding the others hazards are given in Appendix D



Key Climate Hazard Insights and Operational Implications

This report presents a comprehensive physical risk assessment of **eight (8)** climate hazard types across **199 assets** located in Westports, utilizing **ERM's Global Climate Database** for the baseline period, as well as projections for **2050** and **2085** under the **SSP5-8.5 (high emissions) scenario**. The assessment encompasses:

- ❖ Identification of major hazards affecting all **36 asset group types**; and
- ❖ A detailed analysis of the most at-risk assets, baseline and projected risk scores and change from the baseline risk score

From the asset group evaluations, **five (5) key climate hazards** were identified as **critical to infrastructure resilience**. These hazards impact essential categories including **buildings, operational facilities, equipment, utilities, warehouses, and nearshore assets**.

Major Hazard	Number of 'High' or 'Very High' Risk Assets (risk score ≥ 3)		Affected Asset Group Type	Potential Physical and Financial Impacts
	Baseline	2085s under SSP5-8.5		
Extreme heat	0 (0%)	36 (100%)	02. Building: Data Center-Nearshore, 19. Power: Substation DG, 31. Warehouses: Fuel, 32. Warehouses: Fuel Nearshore, 12. Manufacturing: Chemicals, 26. Telecommunications Services: Nearshore, 09. Equipment: Nearshore, 30. Warehouses: Dock Depot, 06. Building: Operational, 07. Building: Operational-Nearshore, 25. Telecommunications Services, 21. Power: Substation Nearshore, 28. Warehouses: Covered, 18. Power: Substation, 33. Warehouses: Uncovered	
Extreme Total Water level	16 (44%)	20 (56%)	21. Power: Substation Nearshore, 23. Revetment: Onshore, 08. Drainage system, 01. Berth: Nearshore, 32. Warehouses: Fuel Nearshore, 11. Jetty: Nearshore, 29. Warehouses: Covered Nearshore, 27. Transport: Waterways, 26. Telecommunications Services: Nearshore, 09. Equipment: Nearshore, 34. Warehouses: Uncovered Nearshore, 05. Building: Office Nearshore, 03. Building: Maintenance Repair Nearshore, 13. Manufacturing: Food Nearshore, 07. Building: Operational-Nearshore	<ul style="list-style-type: none"> ❖ Power outage (extreme heat, flooding, extreme winds & storms) ❖ Increase in operating cost (extreme heat) ❖ Increase in capital expenditure, repairing cost and insurance premium (extreme heat, flooding, extreme winds & storms, extreme total water level)
Waves	14 (39%)	14 (39%)	23. Revetment: Onshore, 15. Manufacturing: LPG Nearshore, 13. Manufacturing: Food Nearshore, 34. Warehouses: Uncovered Nearshore, 03. Building: Maintenance Repair Nearshore, 07. Building: Operational-Nearshore, 29. Warehouses: Covered Nearshore, 02. Building: Data Center-Nearshore, 08. Drainage system, 26. Telecommunications Services: Nearshore	<ul style="list-style-type: none"> ❖ Decrease in revenue (all eight hazards)
Currents	6 (17%)	6 (17%)	11. Jetty: Nearshore, 17. Openwater: Nearshore, 27. Transport: Waterways, 01. Berth: Nearshore, 36. Wharf: Nearshore, 09. Equipment: Nearshore, 23. Revetment: Onshore	<ul style="list-style-type: none"> ❖ Health and safety risk to site personnel (all eight hazards)
Coastal Flooding	2 (6%)	4 (11%)	08. Drainage system, 24. Sewerage system, 34. Warehouses: Uncovered Nearshore, 03. Building: Maintenance Repair Nearshore, 15. Manufacturing: LPG Nearshore, 23. Revetment: Onshore, 21. Power: Substation Nearshore	

- ❖ **Extreme Heat** → Most critical hazard by 2050 & 2085; impacts indoor assets, electronics, cooling demand, and workforce safety.
- ❖ **Extreme Total Water Level (ETWL)** → Continues to escalate; drives inundation, corrosion, structural weakening, and berthing/cargo disruptions.
- ❖ **Coastal Flooding** → Minimal in current dataset but understated due to missing sea-level-rise inputs; ETWL is the more realistic indicator of future coastal risk.
- ❖ **Waves & Currents** → No projected change, but swell remains operationally material (vessel delays, TEUs/meter lost).
- ❖ **Sedimentation** → Recurring monsoon-linked issue; increases dredging needs, reduces depth, affects deeper-draft vessel operations.
- ❖ **Other Hazards (Extreme Winds & Storms, Rainfall Flooding, Riverine Flooding)** → Remain comparatively low-risk across all scenarios.





Extreme Water Level Analysis



Wharf Ground Elevation (mCD) Represents the wharf structural ground elevation, measured in meters, Chart Datum (mCD).

Revetment (mCD) Indicates the crest height of the revetment or coastal protection structure, showing how high the revetment stands relative to chart datum.

All Yard Ground Level (mCD) Shows the general ground elevation across the port yard. Used to assess flooding or overtopping risk to operational areas.

Highest Astronomical Tide (HAT) (mCD) represents the highest tidal level predicted to occur under average meteorological conditions (new/full moon + lunar perigee + sun declination). **(5.82 mCD)**

Tide (mCD) Represents the predicted tide level relative to the chart datum. This is the total High-Water level for a 100-year RP without sea-level rise or storm effects. This is the normal water level without sea-level rise or storm effects.

Sea Level Rise (m) The assessment relies on actual observed sea-level records collected from Permanent Service for Mean Sea Level (PSMSL)/Department of Survey and Mapping Malaysia (JUPEM)/ tide-gauge station (1993–2018) and satellite altimetry datasets from AVISO/DUACS. These real measurements of sea-surface height form the basis of the historical trend analysis, which shows an average rise of **3.8 mm/yr** from tide gauges and **4.4 mm/yr** from satellite altimetry over the same period. In the Westports assessment, sea-level rise was estimated and projected using NAHRIM's Sea Level Rise Projection and Adaptations for Malaysia Based on IPCC AR6 (2023). This dataset is considered more reliable for Malaysia because it provides location-specific projections grounded in the latest IPCC assessment. In contrast, Seeger and Minderhoud (2026), "Sea level much higher than assumed in most coastal hazard assessments," focuses primarily on the global challenge of incorrect or inconsistent use of vertical datums. While their work highlights an important methodological issue, it is less suited for site-specific projection needs in Malaysia compared to NAHRIM's locally calibrated analysis.

Tide + Sea Level Rise (mCD) Shows the future elevated tide level after accounting for projected sea-level rise. Indicates long-term baseline water height.

Tide + Sea Level Rise + Storm Surge (mCD) Represents extreme water levels during severe storm conditions, combining tide, sea-level rise, and 100-year storm surge

Tide + Sea Level Rise + Storm Surge + Wave Height (mCD)

Shows the total extreme water level, adding the 100-year extreme wave height to the storm surge on top of sea-level rise. This line represents the maximum potential water elevation impacting port structures such as revetments and wharves. At Westports, a semidiurnal tide produces 5.5–6.5-hour intervals between successive high and low tides, meaning any tide-driven overtopping typically aligns with this **~6-hour** high-water window. During storm conditions, peak surge and wave forcing—the period when overtopping is most likely—usually lasts **3–12 hours**, but can extend to **12–24 hours** for slow-moving systems, or shorten to **1–3 hours** for fast-moving storms.

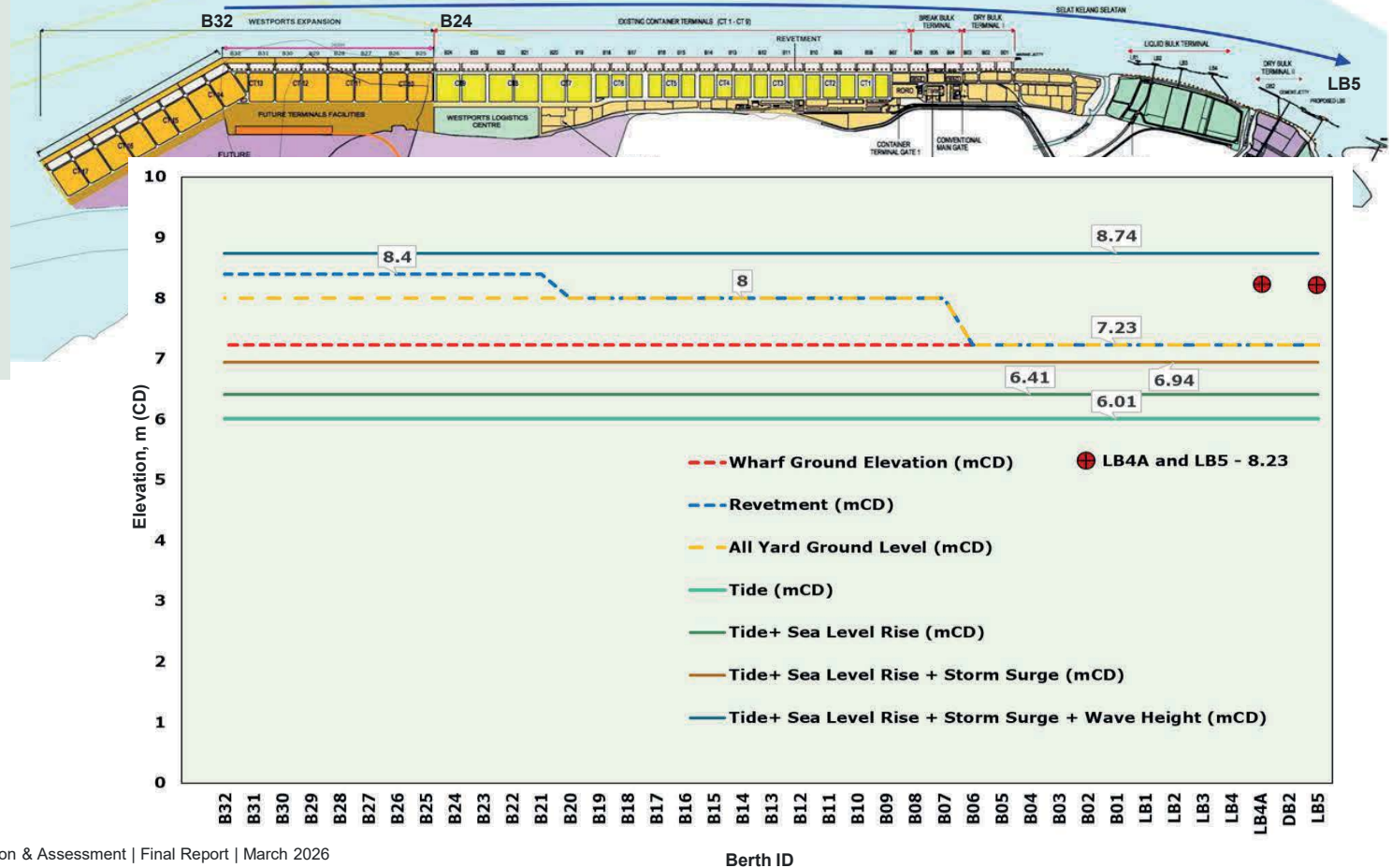
SSP5-8.5 represents the highest emissions pathway under CMIP6, reflecting a fossil-fuel-intensive global development trajectory with limited climate mitigation. Under this scenario, greenhouse gas concentrations continue to rise substantially throughout the century, driving the system toward a radiative forcing level of 8.5 W/m² by 2100. It is widely used as a "worst-case" or high-end stress-test scenario in climate impact studies. Global mean temperature increase in **2085** under **SSP5-8.5** is projected to be approximately **4.4°C above pre-industrial levels**.

The '**100-year event**' is a modelled projection (forecast), not an observed past event, so there is no actual record of when it last occurred.

The section compares port ground and coastal protection elevations against progressively more extreme water-level conditions. Under normal conditions, existing **wharf, yard, and revetment levels** remain well above the **present 100-year tide level**. When **sea-level rise** is included, baseline water levels rise closer to yard and wharf elevations, reducing freeboard. During **100-year storm surge conditions**, water levels does not approach the revetment crest, indicating lowered risk of overtopping. Under the combined **tide + sea-level rise + storm surge + extreme wave height**, the total water level reaches or exceeds **revetment and wharf ground elevations** (notably around LB4A–LB5 at ~8.23 mCD), highlighting a **high risk of overtopping and wave impact on wharves and behind-wharf yards by 2050**, unless adaptation measures (crest raising, wave walls, or drainage upgrades) are implemented.

*Joint probability of all events occurring together

Scenario: SSP5-8.5 Time frame: 2050	High-Water Level 100-year Return Period	Sea Level Rise	Storm Surge 100-year Return Period	Wave Height	Total Water Level
Projected/estimated /observed value	6.01 mCD	0.4 m	0.53 m	1.8 m	8.74 mCD
% Probability	26%	26%	26%	26%	0.5%*
Likelihood					Rare
Impact Severity/Consequence					Extreme

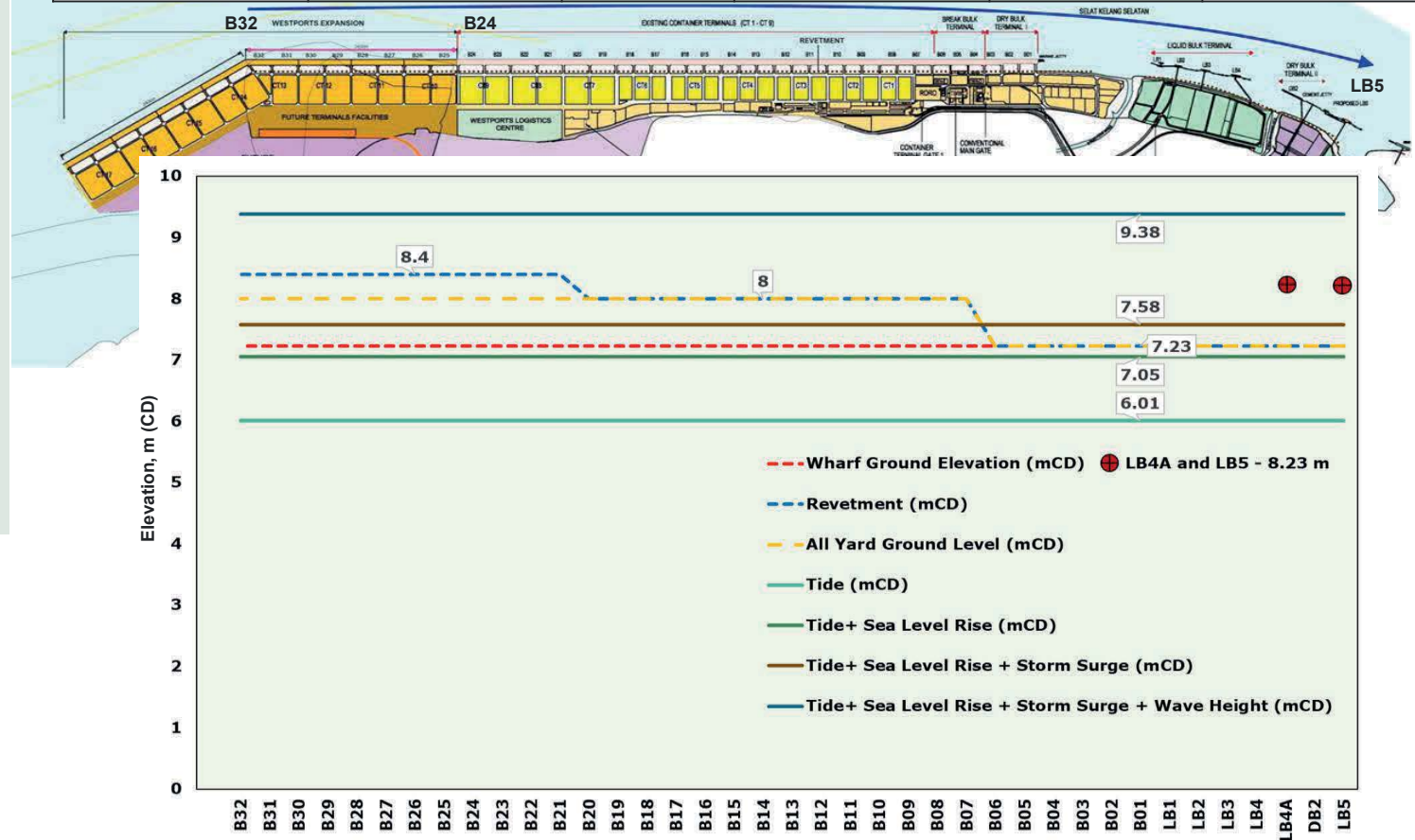


Global mean temperature increase in 2085 under SSP5-8.5 is projected to be approximately 4.4°C above pre-industrial levels.

The section compares port ground and coastal protection elevations against progressively more extreme water-level conditions. Under normal conditions, existing wharf, yard, and revetment levels remain well above the present 100-year tide level. When sea-level rise is included, baseline water levels rise closer to yard and wharf elevations, reducing freeboard. During 100-year storm surge conditions, water levels approach the revetment crest at several locations, indicating increased risk of overtopping. Under the combined tide + sea-level rise + storm surge + extreme wave height, the total water level reaches or exceeds revetment and wharf ground elevations (notably around LB4A–LB5 at ~8.23 mCD), highlighting a high risk of overtopping and wave impact on wharves and behind-wharf yards by 2085, unless adaptation measures (crest raising, wave walls, or drainage upgrades) are implemented.

*Joint probability of all events occurring together

Scenario: SSP5-8.5 Time frame: 2085	High-Water Level 100-year Return Period	Sea Level Rise	Storm Surge 100-year Return Period	Wave Height	Total Water Level
Projected/estimated /observed value	6.01 mCD	1.04 m	0.53 m	1.8 m	9.38 mCD
% Probability	48%	48%	48%	48%	5.3%*
Likelihood					Rare
Impact Severity/Consequence					Extreme





Swells and TEUs Analysis



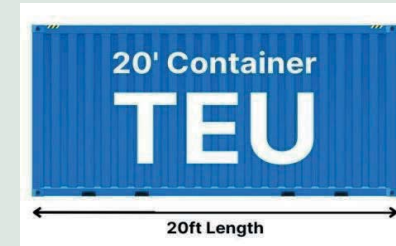
Swells and TEUs Analysis

- ❖ An **ocean swell** is a series of long, rolling surface waves that travel across the ocean, often generated by distant storms or strong winds.
- ❖ Unlike local wind waves, which are short and choppy and caused by winds blowing directly over the water, swells:
 - ❖ **Originate far away** from where they are observed.
 - ❖ **Travel long distances** across the ocean with little loss of energy.
 - ❖ Have **longer wavelengths** (the distance between wave crests) and **smoother, more uniform shapes**.
- ❖ Can arrive at coastlines even when the local weather is calm, since the energy that formed them may have come from a storm thousands of kilometers away.
- ❖ Swell waves are important in **navigation, coastal erosion, surfing, and wave energy studies**, since they carry large amounts of energy and can strongly impact shorelines.
- ❖ Swells in ports can be a **serious problem** because they bring ocean wave energy into areas that are supposed to be relatively calm for safe mooring, loading, and unloading of ships.
- ❖ **Effects of swells in ports**

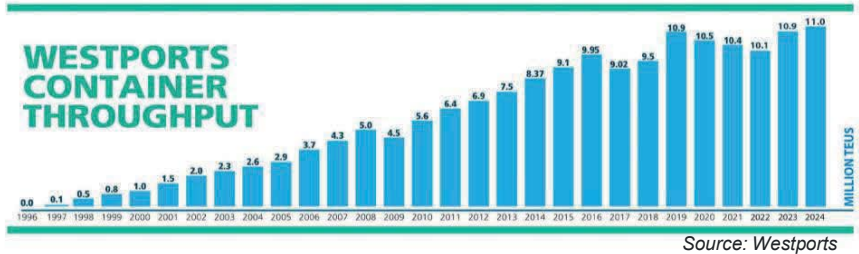


- ❖ **Ship movement at berth** → moored vessels move excessively (surging, swaying, yawing), making cargo handling dangerous or impossible.
- ❖ **Mooring line stress** → ropes and fenders can break under constant tension.
- ❖ **Damage risk** → to ships, piers, and port infrastructure.
- ❖ **Delays** → loading/unloading operations may stop, and ships may have to wait offshore, increasing costs.

- ❖ A TEU, short for **Twenty-foot Equivalent Unit**, is a standard unit of measurement derived from the size of a standard 20' shipping container, which is 20 feet in length.

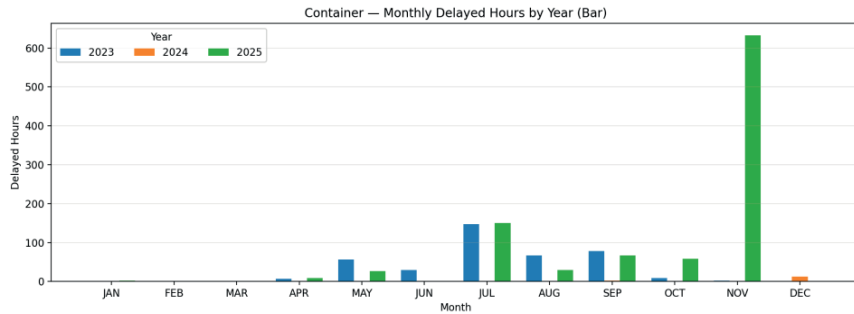


- ❖ The TEU became the standard unit to help calculate the capacity of container vessels and the volume of cargo they can carry. This standardization has allowed for greater efficiency in the loading and unloading of ships, as well as the stacking and transportation of containers via multi-modal transport.

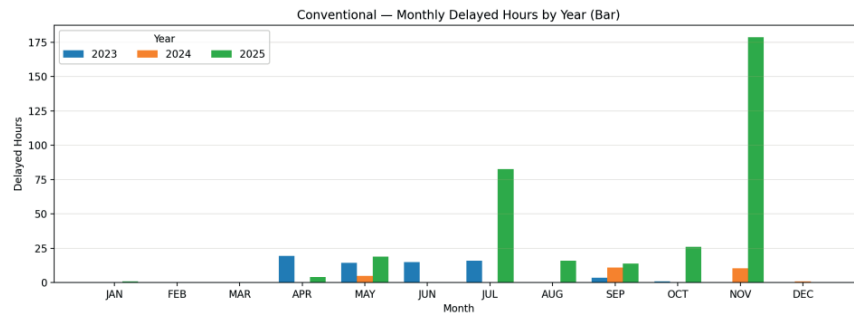


Climate Change Projections

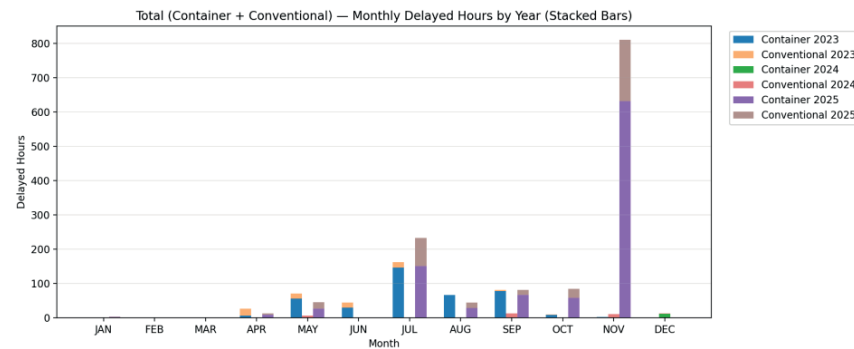
- ❖ In summary, even under a high-emissions future (SSP5-8.5, year ~2085), the Malacca Strait's wave climate is projected to remain very much like today's: calm on average with small monsoonal waves and occasional squall waves up to ~1 m, but no emerging trend toward larger waves.
- ❖ The consensus of high-resolution modeling and multi-model ensembles is that seasonal mean SWH (Significant wave heights) and extreme wave events will not significantly change in this region, making sea-level rise (and associated coastal flooding) a far greater concern than wave height increases.



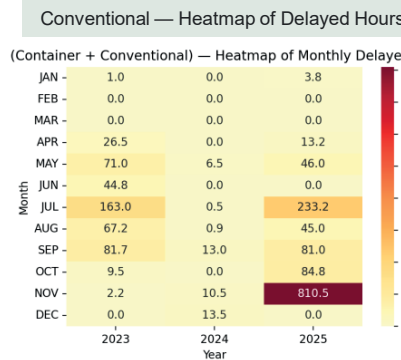
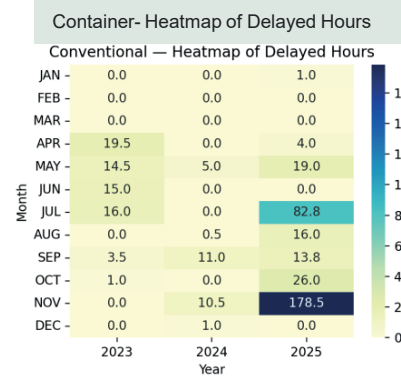
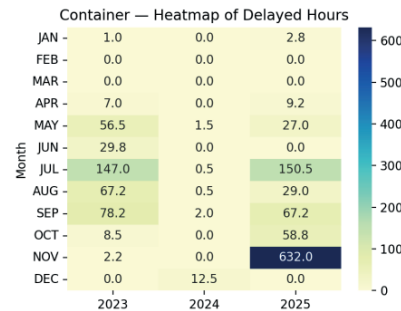
The plot shows container monthly delayed hours for all the years,



The plot shows conventional monthly delayed hours for all the years,



The plot shows both container and conventional monthly delayed hours for all the years,



Heatmap- Container and Conventional combined

Key Trends

❖ Containers — Monthly Delayed Hours by Year:

Peak in **Nov-2025** (~632 hr) with a clear secondary ridge in **Jul-2025**; **2024** remains low across months.

❖ Conventional — Monthly Delayed Hours by Year:

Sharp spike in **Nov-2025** (~178.5 hr) and elevated **Jul-2025**; other months are comparatively modest.

❖ Containers — Heatmap:

Hot cells cluster at **Jul-2023**, **Sep-2023**, **Jul-2025**, and especially **Nov-2025**.

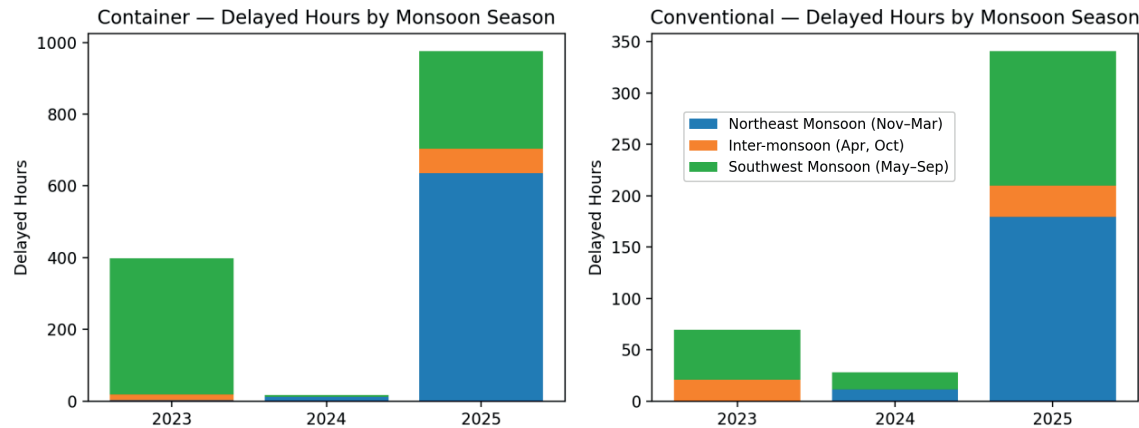
❖ Conventional — Heatmap:

Intensity concentrates in **Nov-2025** and **Jul-2025**; moderate activity in **Apr/Jun-2023** and **Sep/Nov-2024**.

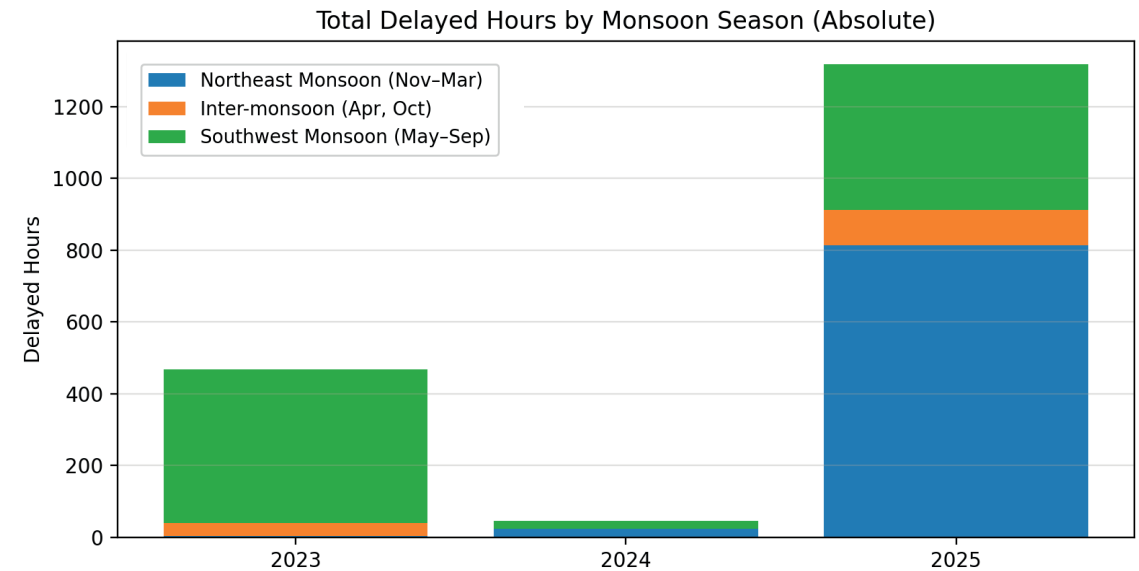
Key points

- ❖ **2025** shows a sharp resurgence in weather-related schedule impacts across both segments, dominated by the **Container** trade. In 2025, containers account for ~74.1% of all delayed hours (976.5 of 1,317.5 hours).
- ❖ **November 2025** stands out as the largest spike across both trades (Containers >> Conventional). Secondary hotspot appears in **July 2025** (Southwest Monsoon), visible in both the plots and heatmaps.
- ❖ Secondary hotspot appears in **July 2025** (Southwest Monsoon), visible in both the lines and heatmaps.





The heatmap shows container and conventional delayed hours during monsoon seasons for all the years,



The heatmap shows total delayed hours during monsoon seasons for all the years,

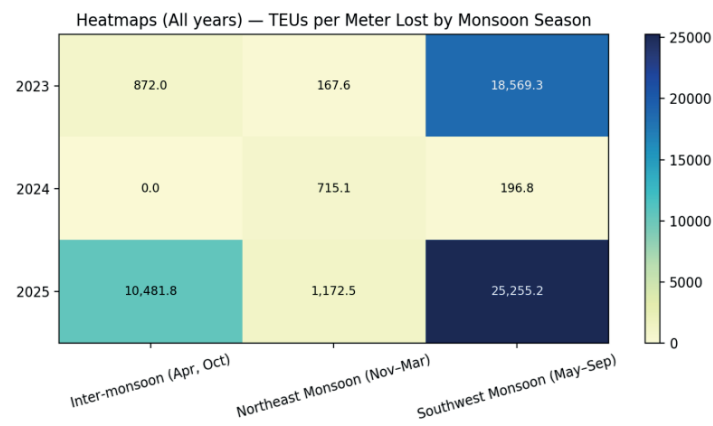
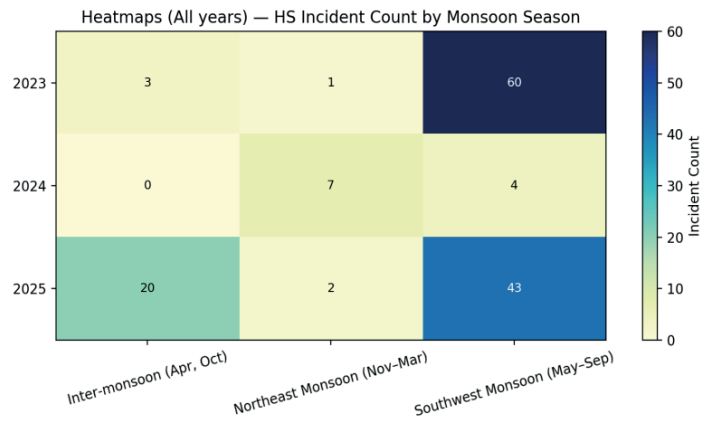
- ❖ **Northeast Monsoon-NEM (Nov-Mar)**
- ❖ **Inter-monsoon (Apr & Oct)**
- ❖ **Southwest Monsoon-SWM (May-Sep)**

- ❖ **2023:** Seasonality is **strongly SWM-centric** (>90% of total delays).
- ❖ **2024:** Low activity overall; **NEM ≈ SWM** split (no Inter-monsoon signal).
- ❖ **2025:** **NEM becomes the dominant driver** (≈62% of total), with **SWM** still material (~31%). Containers account for ~74% of all 2025 delayed hours.

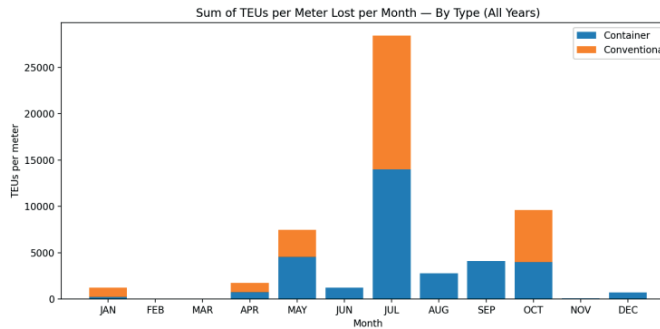
Operational implications

- 1. Plan around July- November risk**
 - ❖ Pre-position pilots/tugs and allocate buffer windows in **Jul-Nov**; build contingency berth plans for “swell-exposed” berths to reduce cascading delays in peak weeks.
- 2. Container-centric mitigations**
 - ❖ Because containers yield ~74% of 2025 delay hours, prioritize container services for dynamic berth reassignment to more sheltered berths when forecast thresholds are exceeded.
- 3. Seasonal rostering & cut-off policies**
 - ❖ Implement stricter cut-off/ETA control and proactive rescheduling in **Northeast Monsoon** months; escalate pilotage/weather hold criteria in **July** as a secondary hotspot.
- 4. KPIs to track going forward**
 - ❖ (i) **Delay hours per call** by service string,
 - ❖ (ii) **% of calls affected** by month/monsoon,
 - ❖ (iii) **Mean delay vs forecasted swell/wind categories** to improve trigger thresholds for holds and berth swaps.

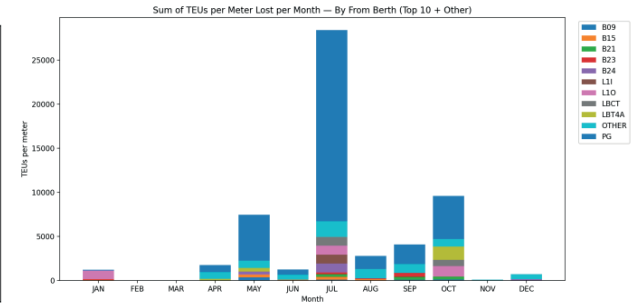




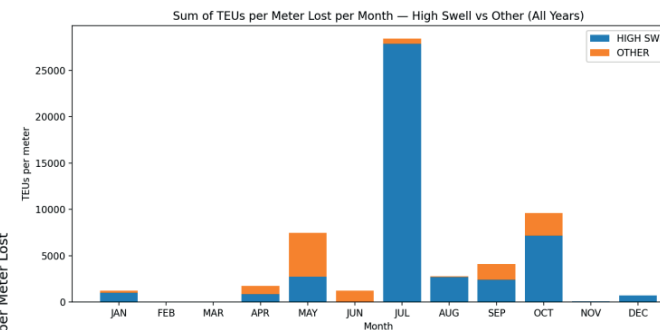
The heatmap shows High Swell incident counts during monsoon seasons, while TEUs/m lost heatmap illustrates the severity of operational impact attributed to each re-defined monsoon season.



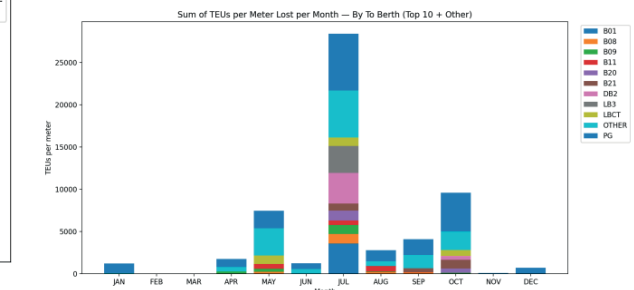
This visualisation compares TEUs per meter lost by vessel type.



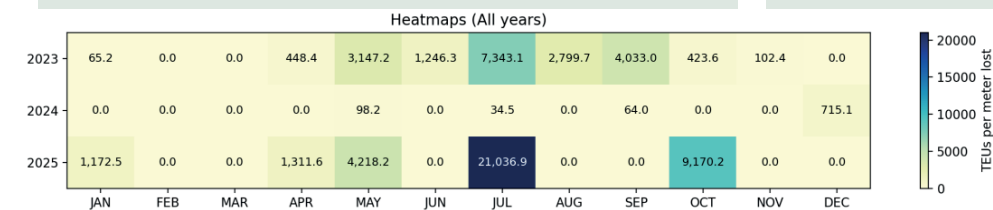
This plot shows "from berth" cumulative TEUs per meter lost across years, stacked per month.



This plot shows sum of TEUs per meter lost due to High Swell and all other delayed reasons for all years.



This plot shows "to berth" cumulative TEUs/m lost across years, stacked per month.



The heatmap shows monthly TEUs per meter lost across 2023, 2024, and 2025 (upto Oct).

In summary, there is no change in the baseline trend in future years due to climate projections.

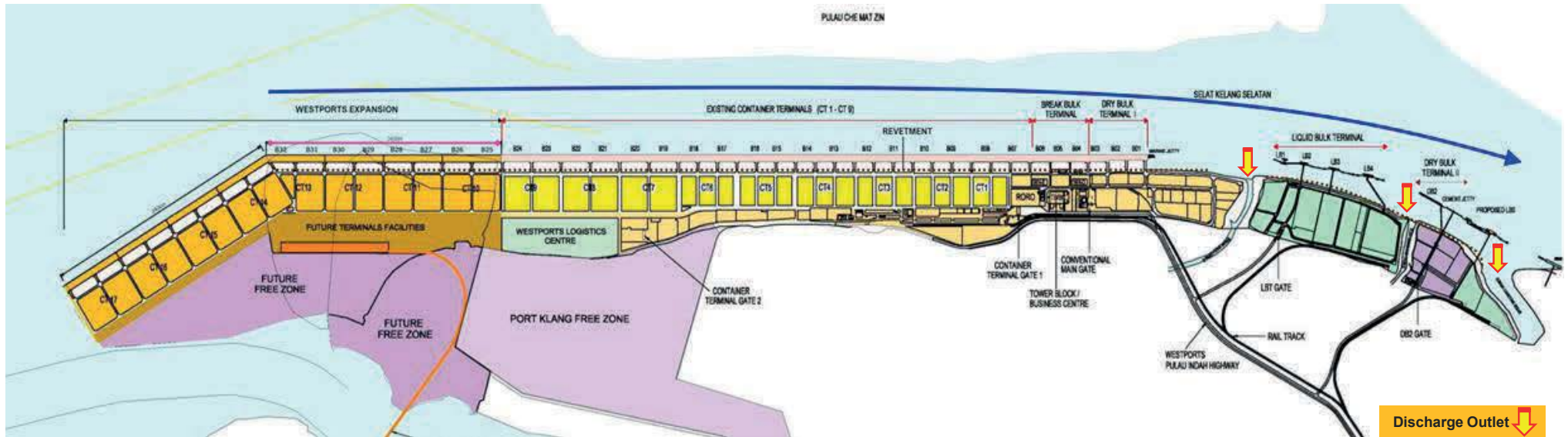




Sedimentation in Port Klang Channel

Westports Layout

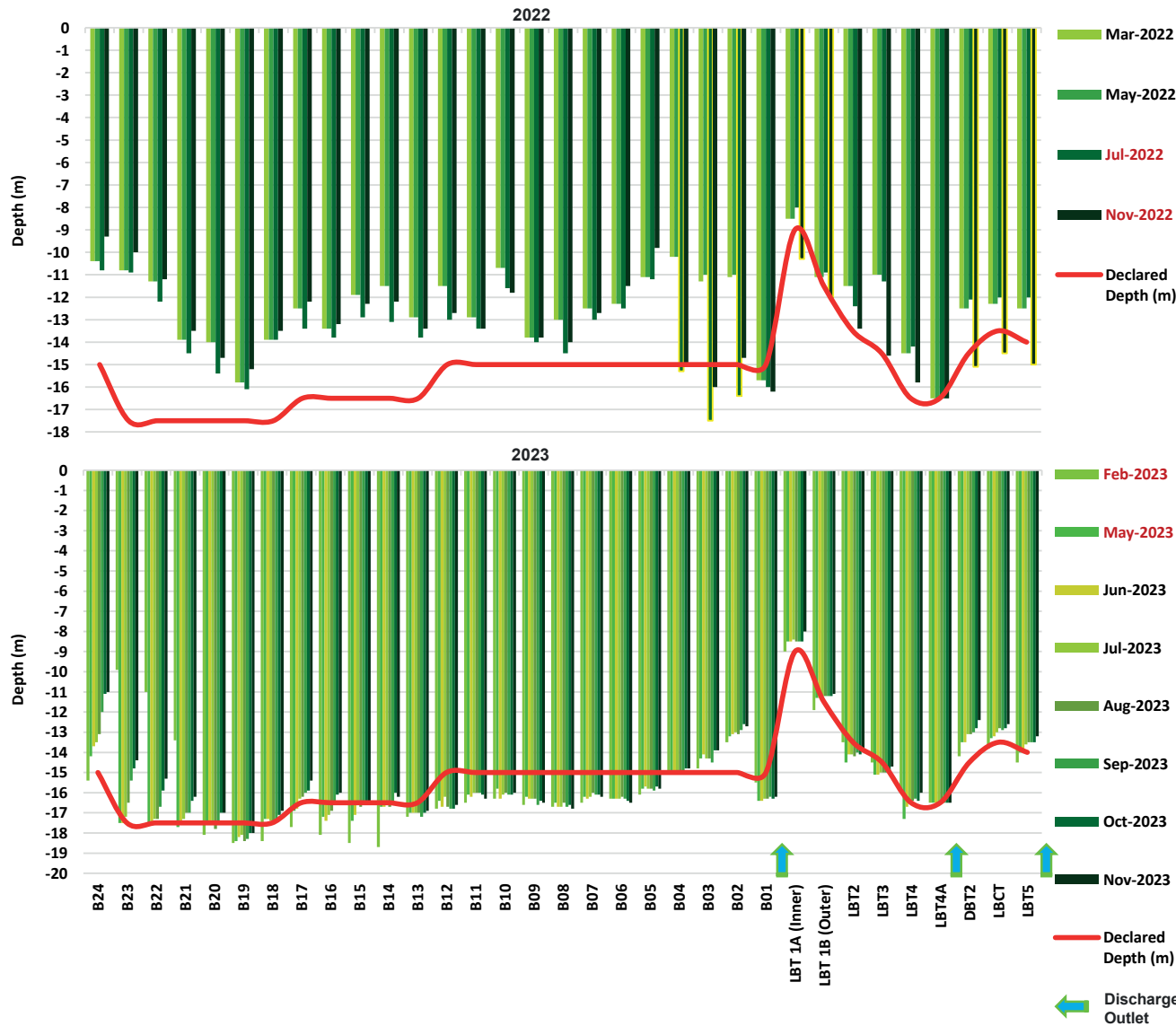
- ❖ The figure shows the overall layout of Westports' full development, including existing container terminals (CT1 to CT9), planned expansion berths to the southwest, logistics and future free zone areas inland, and specialised terminals (break bulk, dry bulk, liquid bulk) on the eastern side, all connected through multiple gates, highways, and rail access.



Sedimentation in Ports

- ❖ Sedimentation in ports is the process where natural and human-induced factors cause suspended sediment to settle and accumulate in navigation channels, berthing areas, and other port infrastructure, reducing water depth and hindering port operations.
- ❖ This process is driven by factors like **river discharge**, tidal currents, wind, waves, and ship movements, which transport and deposit sediments, requiring regular **dredging** for maintenance and posing significant economic challenges.

Bathymetry along the Berths



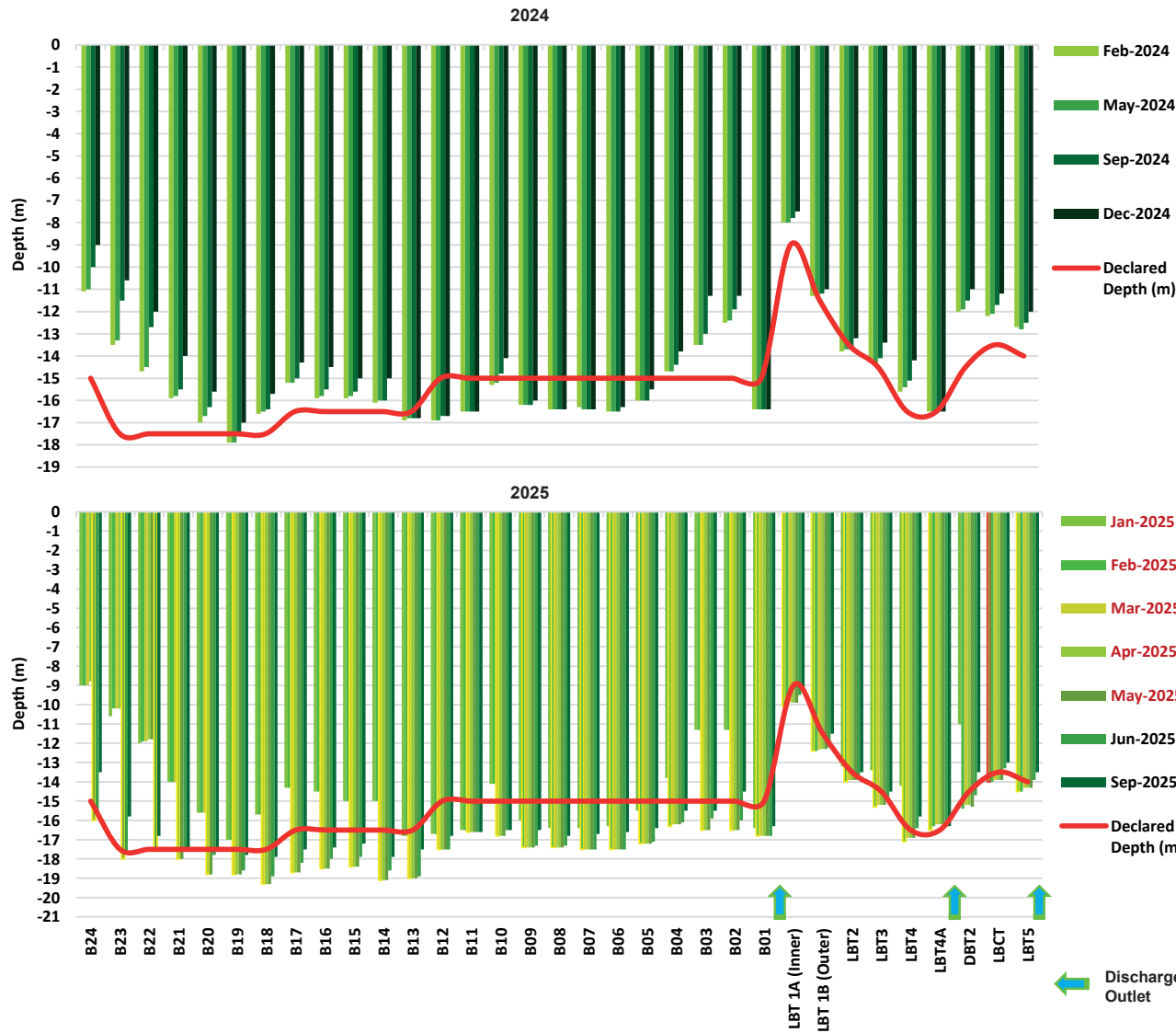
The plot shows measured seabed depths along a continuous sequence of berths (B24 → B01 → LBT berths → OBT berths → LCT berths) for four different survey periods in 2022 (Mar, May, Jul, Nov), compared against the Declared Depth (red line).

Location	Main Drivers	Effect	Influence of Dredging
B24–B17	Reclamation sediment, sand fill	Very high deposition	No dredging → depth loss is natural
B16–B09	Transport from reclamation	Medium	No dredging
B08–B01	River discharge	Medium–Low	Jul dredging at B02–B04
LBT1A–LBT5, DBT2, LBCT	Multiple river outlets + hydrodynamics	High & variable	Nov dredging resets depths to deeper values

The plot shows measured seabed depths along a continuous sequence of berths (B24 → B01 → LBT berths → OBT berths → LCT berths) for eight different survey periods in 2023 (Feb to Nov), compared against the Declared Depth (red line).

Segment	Dredged	Shoaling Level	Main Drivers
B24	Feb 2023	Very High	Reclamation sand movement
B05–B20	Feb 2023	High (esp. B13–B17)	Reclamation + seasonal currents
B21–B23	May 2023	Medium	Transition zone between construction & river influence
B01	May 2023	Medium–High	River discharge at B01–LBT1A
LBT2–LBT4	May 2023	High	River plumes + hydrodynamics
LBT5, LBCT, DBT2	No	High variability	River discharge + vessel-induced turbulence





2024

The plot shows measured seabed depths along a continuous sequence of berths (B24 → B01 → LBT berths → OBT berths → LCT berths) for four different survey periods in 2024 (Feb, May, Sep, Dec), compared against the Declared Depth (red line).

2024 represents a pure natural-sedimentation year (no maintenance dredging), providing a clear view of intrinsic sediment dynamics across the port. Depth variations from Feb → May → Sep → Dec 2024 reflect the combined influence of:

- ❖ Reclamation-driven sediment supply near B24–B17
- ❖ River discharge sedimentation affecting B01–B04 and all LBT berths
- ❖ Hydrodynamic trapping zones near jetty structures
- ❖ Seasonal monsoon effects (increased suspended load and weaker flushing)

Overall, the port-wide trend in 2024 is progressive shoaling, with hotspots aligning with both reclamation influence and river inflow zones. 2024 provides a reliable baseline for **annual sedimentation rate estimation and long-term dredging optimisation**.

2025

The plot shows measured seabed depths along a continuous sequence of berths (B24 → B01 → LBT berths → OBT berths → LCT berths) for seven different survey periods in 2025 (Jan to Sep), compared against the Declared Depth (red line).

- ❖ **Reclamation Legacy (B24–B17):** Continued basin infill from residual sand mobility and altered flow paths near the new terminal footprint.
- ❖ **River Discharge Inputs:** Three river outlets (B01–LBT1A, LBT4–DBT2, near LBT5) deliver continuous fine sediments, especially during wet months (Feb–May and Sep).
- ❖ **Jetty & Hydrodynamic Effects at LBT:** Structural turbulence and thruster-induced resuspension accelerate localised deposition at tanker berths.
- ❖ **Seasonal Monsoon Influence:** Southwest monsoon pulses increase suspended sediment load, raising background infill rates across the central and lower basins.

Bathymetry Heatmap

Overall port- Terminal wise depth variation

The bathymetry heatmap tracks depth deviations from declared berth depths across multiple berths and dry / liquid bulk terminals (LBT) over a 3.5-year period. Color coding indicates sedimentation severity and dredging status:

BERTH	B24	B23	B22	B21	B20	B19	B18	B17	B16	B15	B14	B13	B12	B11	B10	B09	B08	B07	B06	B05	B04	B03	B02	B01	LBT 1A (Inner)	LBT 1B (Outer)	LBT2	LBT3	LBT4	LBT4A	DBT2	LBCT	LBT5
DECLARED DEPTH (m)	-15.0	-17.5	-17.5	-17.5	-17.5	-17.5	-17.5	-16.5	-16.5	-16.5	-16.5	-16.5	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-11.5	-9.0	-13.5	-14.5	-16.5	-16.5	-14.5	-13.5	-14.0
Mar-22	4.6	6.7	6.2	3.6	3.5	1.7	3.6	4.0	3.1	4.6	5.0	3.6	3.5	2.1	4.3	1.2	2.0	2.5	2.7	3.9	4.8	3.7	3.9	-0.7	0.4	0.5	2.0	3.5	2.0	0.0	2.0	1.2	1.5
May-22	4.6	6.7	6.2	3.6	3.5	1.7	3.6	4.0	3.1	4.6	5.0	3.6	3.5	2.1	4.3	1.2	2.0	2.5	2.7	3.9	4.8	4.0	4.0	-0.7	0.4	0.5	2.0	3.5	2.0	0.0	2.0	1.2	1.5
Jul-22	4.2	6.6	5.3	3.0	2.1	1.4	3.6	3.1	2.7	3.6	3.4	2.7	2.0	1.6	3.4	1.0	0.5	2.0	2.5	3.8	-0.3	-2.5	-1.4	-1.0	0.6	1.0	1.1	3.2	2.3	0.0	2.4	1.5	2.0
Nov-22	5.7	7.5	6.3	4.0	2.8	2.3	4.0	4.3	3.3	4.2	4.3	3.1	2.3	1.6	3.2	1.2	1.0	2.3	3.5	5.2	0.0	-1.0	0.3	-1.2	-0.5	-1.3	0.1	-0.1	0.7	0.0	-0.6	-1.0	-1.0
Feb-23	-0.4	7.6	6.5	4.1	-0.6	-1.0	-0.9	-1.2	-1.6	-2.0	-2.2	-0.7	-1.8	-1.5	-1.3	-1.6	-1.7	-1.5	-1.3	-1.1	0.0	0.2	1.5	-0.5	-0.4	0.0	0.0	0.7	0.0	0.3	-0.3	-0.5	
May-23	0.8	0.0	0.0	-0.2	0.0	-0.9	0.2	-0.4	-0.7	-0.9	-0.2	-0.5	-1.4	-1.1	-0.8	-1.2	-1.5	-1.2	-1.3	-0.8	0.0	0.7	1.8	-1.4	0.2	0.5	-1.0	-0.6	-0.8	0.0	1.0	0.2	0.0
Jun-23	1.3	0.0	0.0	0.0	-0.1	-0.7	0.2	-0.3	-0.9	-0.6	-0.2	-0.5	-1.7	-1.2	-1.3	-1.3	-1.7	-1.3	-1.3	-0.7	0.0	0.9	1.9	-1.4	0.2	0.5	-0.6	-0.6	-0.2	0.0	1.0	0.3	0.1
Jul-23	1.5	0.3	0.2	0.2	0.0	-0.6	0.1	0.2	-0.6	0.0	0.0	-0.5	-1.2	-1.0	-1.1	-1.3	-1.7	-1.2	-1.3	-0.8	0.0	0.7	2.0	-1.3	0.3	0.6	-0.6	-0.5	0.1	0.0	1.4	0.5	0.4
Aug-23	1.9	1.0	0.2	0.5	-0.3	-0.9	0.0	0.3	-0.4	-0.2	-0.2	-0.5	-1.7	-1.0	-1.0	-1.3	-1.5	-1.0	-1.2	-0.8	0.0	0.7	1.9	-1.3	0.3	0.5	-0.7	-0.5	0.1	0.0	1.4	0.7	0.5
Sep-23	3.0	2.1	0.8	0.5	0.0	-0.8	0.1	0.5	0.0	-0.1	0.1	-0.7	-1.8	-1.0	-1.1	-1.6	-1.7	-1.1	-1.3	-0.9	0.0	0.5	2.1	-1.2	0.3	0.5	-0.5	-0.5	0.2	0.0	1.5	0.6	0.5
Oct-23	3.9	2.7	1.6	1.1	0.5	-0.5	0.4	0.6	0.4	0.0	0.5	-0.5	-1.8	-1.1	-1.1	-1.4	-1.6	-1.1	-1.4	-0.7	0.2	1.1	2.4	-1.3	0.3	0.5	-0.6	-0.5	0.1	0.0	1.7	0.7	0.5
Nov-23	4.0	3.1	2.2	1.3	0.5	-0.5	0.6	1.1	0.5	0.1	0.3	-0.4	-1.6	-1.3	-1.0	-1.5	-1.8	-1.2	-1.5	-0.8	0.2	1.1	2.3	-1.2	0.4	1.0	-0.4	-0.2	0.5	0.0	2.1	0.9	0.8
Feb-24	3.9	4.0	2.8	1.6	0.5	-0.4	0.9	1.3	0.6	0.6	0.4	-0.4	-1.9	-1.5	-0.3	-1.2	-1.4	-1.3	-1.5	-1.0	0.3	1.5	2.5	-1.4	0.2	1.0	-0.3	0.2	0.9	0.0	2.5	1.3	1.3
May-24	4.0	4.2	3.0	1.7	0.8	-0.4	1.0	1.3	0.7	0.7	0.5	-0.3	-1.9	-1.5	-0.2	-1.2	-1.4	-1.4	-1.5	-1.0	0.3	1.5	2.6	-1.4	0.2	1.0	-0.2	0.2	1.1	0.0	2.6	1.4	1.2
Sep-24	5.0	6.0	4.8	2.0	1.2	0.1	1.1	1.5	1.0	0.9	0.5	-0.3	-1.7	-1.5	0.2	-1.2	-1.4	-1.4	-1.5	-1.0	0.6	2.0	3.1	-1.4	0.3	1.2	-0.2	0.4	1.4	0.0	3	1.8	1.5
Dec-24	6.0	6.9	5.5	3.5	1.9	0.5	1.8	2.2	2.0	1.5	1.5	-0.3	-1.7	-1.5	0.9	-1.0	-1.4	-1.4	-1.3	-0.5	1.2	3.7	3.7	-1.4	0.5	1.5	0.3	1.1	2.3	0.0	3.5	2.3	2.0
Jan-25	6.0	6.9	5.5	3.5	1.9	0.5	1.8	2.2	2.0	1.5	1.5	-0.3	-1.7	-1.5	0.9	-1.0	-1.4	-1.4	-1.3	-0.5	1.2	3.7	3.7	-1.4	-0.9	-1.1	0.3	1.1	2.3	0.0	3.5	-0.5	-0.5
Feb-25	6.0	7.3	5.6	3.5	1.9	0.5	1.8	2.2	2.0	1.5	1.5	-0.3	-1.7	-1.5	0.9	-2.4	-2.4	-2.5	-2.5	-2.2	-1.3	3.7	3.7	-1.8	-0.9	-1.1	-0.5	-0.8	-0.6	0.2	-0.9	-0.5	-0.5
Mar-25	6.0	7.3	5.6	3.5	1.9	-1.3	-1.8	-2.2	-2.0	-1.9	-2.6	-2.5	-2.5	-1.6	-1.8	-2.4	-2.4	-2.5	-2.5	-2.2	-1.2	-1.5	-1.5	-1.8	-0.8	-0.9	-0.4	-0.7	-0.4	0.3	-0.7	-0.4	-0.3
Apr-25	6.2	7.3	5.7	-0.5	-1.3	-1.3	-1.8	-2.2	-2.0	-1.9	-2.6	-2.5	-2.5	-1.6	-1.8	-2.4	-2.4	-2.5	-2.5	-2.2	-1.2	-1.5	-1.5	-1.8	-0.8	-0.9	-0.4	-0.7	-0.4	0.3	-0.7	-0.4	-0.3
May-25	-1.0	-0.5	5.7	-0.5	-1.3	-1.3	-1.8	-2.2	-2.0	-1.9	-2.6	-2.5	-2.5	-1.6	-1.8	-2.4	-2.4	-2.5	-2.5	-2.2	-1.2	-1.5	-1.5	-1.8	-0.8	-0.9	-0.4	-0.7	-0.4	0.3	-0.8	-0.4	-0.3
Jun-25	-0.7	-0.1	-0.1	-0.1	-0.3	-1.1	-1.4	-1.7	-1.5	-1.4	-2.1	-2.4	-2.5	-1.6	-1.5	-2.3	-2.3	-2.5	-2.5	-2.1	-1.1	-0.9	-1.0	-1.8	-0.7	-0.5	-0.3	-0.4	0.1	0.5	-0.2	0.2	0.1
Sep-25	1.5	1.7	0.7	-0.1	-0.1	-0.3	-0.4	-1.0	-0.9	-0.7	-1.4	-1.0	-1.8	-1.6	-1.5	-1.5	-1.8	-1.7	-1.6	-1.4	-0.5	-0.5	0.5	-1.3	0.0	-0.2	0.0	0.0	0.7	0.2	1.0	0.5	0.5

Outer Berths (B24–B21/B20)

- ❖ Highest siltation rates: Frequent orange/yellow/red zones indicate depth loss >2 m within months post-dredging.
- ❖ Requires short dredging cycles (6–9 months) to maintain operational clearance.

Mid Berths (B19–B12/B11)

- ❖ Moderate sedimentation: Mostly green/brown, occasional orange.
- ❖ Condition-based dredging recommended every 9–18 months

Inner Berths (B10–B06)

- ❖ Stable depths: Mostly green/light green.
- ❖ Minimal dredging; monitor semi-annually.

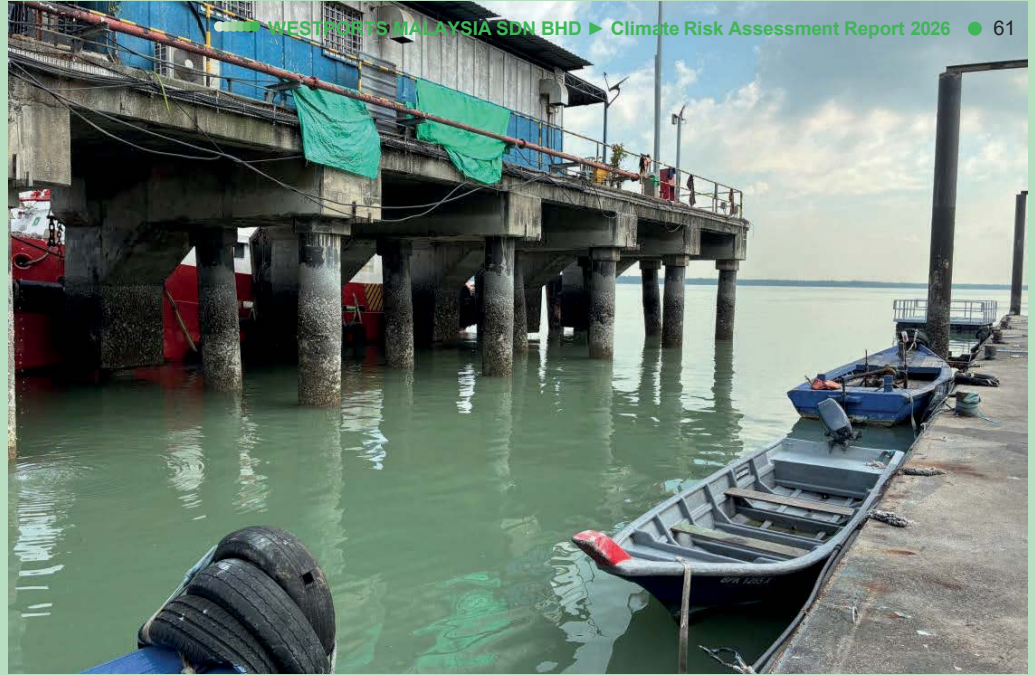
Post-Dredged
Above Declared Depth
Below Declared Depth (Less than 1.0m)
Depth Deviation (1.0m - 2.0m)
Depth Deviation (2.0m - 3.0m)
Depth Deviation (3.0m - 4.0m)
Depth Deviation (>4.0m)

← Discharge Outlet

Liquid Bulk Terminals (LBT)

- ❖ Depths remain near declared values (light green).
- ❖ Monitoring only; dredging rarely required.



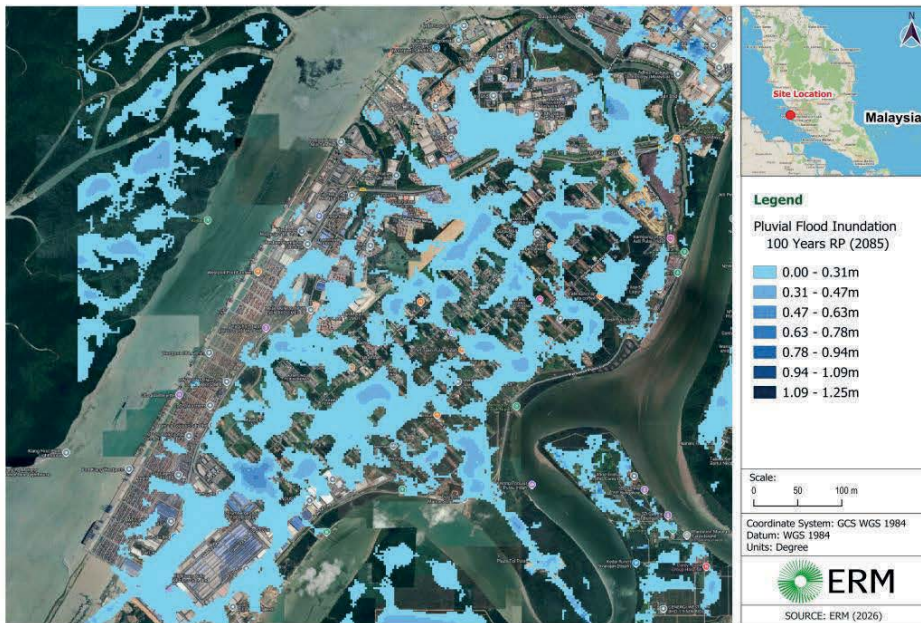


Flood Inundation Analysis

RAINFALL, RIVER AND COASTAL



Rainfall Flood Inundation



Key findings

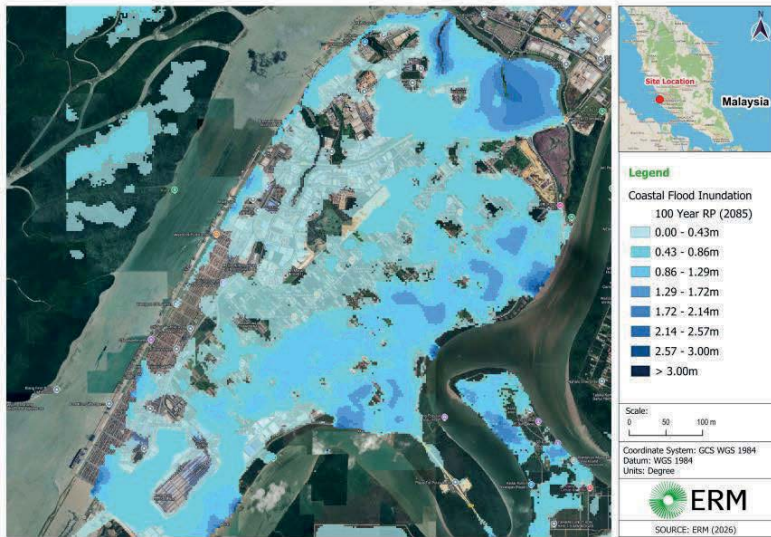
The map shows widespread **surface-runoff (pluvial) flooding** across Westports and adjacent industrial areas in 2085 under a 1-in-100-year storm. The table below shows the Westports assets and respective flood depths.

- ❖ No extreme (>0.5 m) pluvial flooding is detected inside core operational platforms by 2085.
- ❖ Flooding is predominantly shallow (0.10–0.33 m) across most affected assets.
- ❖ Flooding concentrates in: Low-lying back-of-yard areas behind container yards.
- ❖ Road corridors between terminals and support facilities.
- ❖ Older asset zones (CT1–CT3) with relatively lower platform elevations.
- ❖ Marine berths and quayline remain largely unaffected, consistent with elevated platform levels.
- ❖ The Main PMU 132kV is the single most high-risk vulnerability, with potential port-wide cascading impact.
- ❖ Critical supporting systems (power, telecom, substations) face frequent shallow flooding that can cause operational shutdowns without structural failure.
- ❖ Flooding is more operational than structural, but the repeatability and criticality make it highly material.

No.	Asset Location	Rainfall flood depth 2085 (m)
1	Main Power Supply Station-PMU PIDH 132KV	0.33
2	DBT-I-Yard 4 Zone 1, 5A & 5B, 11	0.29
3	BBT-Yard 4 Zone 2	0.21
4	DBTII-Cement Factory	0.20
5	CT1-2-Telecom Data Exchange	0.14
6	CT1-Yard-Sub Station No.8	0.14
7	CT1-Container GATE IN	0.14
8	CT1-KASTAM	0.14
9	CT1-Yard-Container Freight Station (CFS) 1	0.10
10	CT9-2-Telecom Data Exchange	0.10
11	CT1-Westports Distripark	0.09
12	CT1-Rail Freight Terminal	0.09
13	CT1-Yard-Sub Station No.7	0.08
14	CT1-Yard-Sub Station No.6	0.08
15	CT9-Yard-Sub Station No.23	0.08
16	CT2-Yard-Container Freight Station (CFS) 2	0.07
17	CT3-1-Telecom Data Exchange	0.07
18	CT3-Yard-Sub Station No.14	0.06
19	CT9-3-Telecom Data Exchange	0.06

Rank	Asset	Flood Depth (m)	Risk Interpretation
1	Main Power Supply Station – PMU PIDH 132kV	0.33	<i>Highest criticality:</i> Even 0.3 m can damage switchgear, threaten continuity, and cause port-wide operational shutdown.
2	DBT-I Yard 4 Zone 1, 5A & 5B, 11	0.29	Yard-level flooding disrupts container movement, ground slots & rubber-tyred equipment.
3	BBT-Yard 4 Zone 2	0.21	Localised ponding affecting yard operation efficiency.
4	DBTII-Cement Factory	0.20	Flooding impacts conveyor motors, electrical rooms & hygiene requirements.
5–7	CT1-2 & CT1-Yard Sub Station No.8, CT1-Container Gate In	0.14	Electrical rooms & gate operations vulnerable to water ingress.

Coastal Flood Inundation



Coastal Flooding

The map shows widespread coastal flooding across Westports and adjacent industrial areas in 2085 under a 1-in-100-year storm. The table (right) shows the Westports assets and respective flood depths.

- ❖ Coastal flooding in 2085 is significantly deeper than rainfall-driven flooding, with depths ranging 0.4 m to >3.6 m across Westports' low-lying zones.
- ❖ Large parts of the port platform, especially older areas (CT1–CT3, BBT, DBT), fall within moderate to deep flood zones (>1 m).

No.	Asset Location	Coastal flood depth(2085)-m
1	Drainage Network	3.62
2	Sewerage Network	3.62
3	CT9-3-Telecom Data Exchange	1.62
4	DBT-I-Yard 4 Zone 1, 5A & 5B, 11	1.56
5	CT9-Yard-Sub Station No.23	1.48
6	BBT-Yard 4 Zone 2	1.43
7	BBT-Yard 11A	1.3
8	BBT-M&R Recond Store	1.24
9	DBT-I-Sub Station No.4	1.19
10	Revetment for Liquid Bulk terminal (LBT1- LBT5)	1.18
11	BBT-Warehouse D	1.04
12	BBT-M&R Conventional	0.91
13	BBT-Warehouse E	0.91
14	Revetment for Dry Bulk terminal I	0.81
15	Revetment for Dry Bulk terminal II	0.79
16	DBT-I-Sugar Refinery	0.79
17	BBT-Port Police Building	0.78
18	BBT-Yard 13AW	0.77
19	CT9-Logistic Company	0.76
20	LBT-Sub Station No.3	0.72
21	LBT-Stolthaven-Westports	0.72
22	LBT-Water Tank/ Pump House	0.7
23	DBTI-II-Cement Factory	0.69
24	BBT-Sub Station No.02	0.67
25	CT9-Logistic Company	0.66
26	Revetment for Break Bulk terminal	0.64
27	CT1-Yard-Sub Station No. 5	0.52
28	CT1-1-Telecom Data Exchange	0.52
29	CT9-2-Telecom Data Exchange	0.52
30	BBT-Fuel Bay No.01	0.5
31	DBT-I-Warehouse FGH	0.5
32	BBT-M&R Admin Centre	0.49
33	DBTI-II-LPG Terminal	0.48
34	CT2-Yard-Sub Station No.10	0.43
35	Revetment for CT2	0.42
36	CT6-Yard-On Dock Depot (ODD)	0.39
37	CT6-2-Telecom Data Exchange	0.39
38	CT9-Yard-Westports-PKFZ Gate	0.38
39	CT2-1-Telecom Data Exchange	0.36
40	CT7-2-Telecom Data Exchange	0.28
41	Revetment for CT3	0.27
42	BBT-Sub Station No.01	0.27
43	CT4-1-Telecom Data Exchange	0.26
44	BBT-Water Tank/ Pump House	0.26
45	BBT-Telecom Data Exchange	0.26
46	CT9-Logistic Company	0.22
47	CT3-2-Telecom Data Exchange	0.19
48	BBT-Yard 12AW & 12AS	0.19
49	CT7-Yard-Sub Station No.20	0.15
50	BBT-Car Terminal-open	0.15

Critical Lifeline Infrastructure at High Risk

- ❖ Drainage Network and Sewerage Network experience the deepest flooding (up to 3.62 m)—indicating full system failure, backflow, and overtopping risk.
- ❖ Multiple substations (CT9-23, CT1-4, CT6-ODD, CT1-5) face 0.39–1.43 m inundation—high probability of electrical failure and extended outages.
- ❖ Telecom Data Exchanges across CT1, CT2, CT3, CT9 experience 0.26–1.62 m flooding, risking widespread ICT and terminal system downtime.

High-Risk Operational Assets

- ❖ DBT-I Yard 4 (Zones 1, 5A, 5B, 11) and BBT Yard 4 record 1.4–1.6 m water depth—severe disruption to ground equipment, storage, and container movement.
- ❖ Bulk terminal revetments (Liquid Bulk, Dry Bulk I/II, Break Bulk) show 0.9–1.2 m inundation, indicating future overtopping along the waterfront.
- ❖ Warehouses (D, E, FGH) face 0.48–0.97 m flooding, threatening stored cargo, electrical panels, and internal facilities.

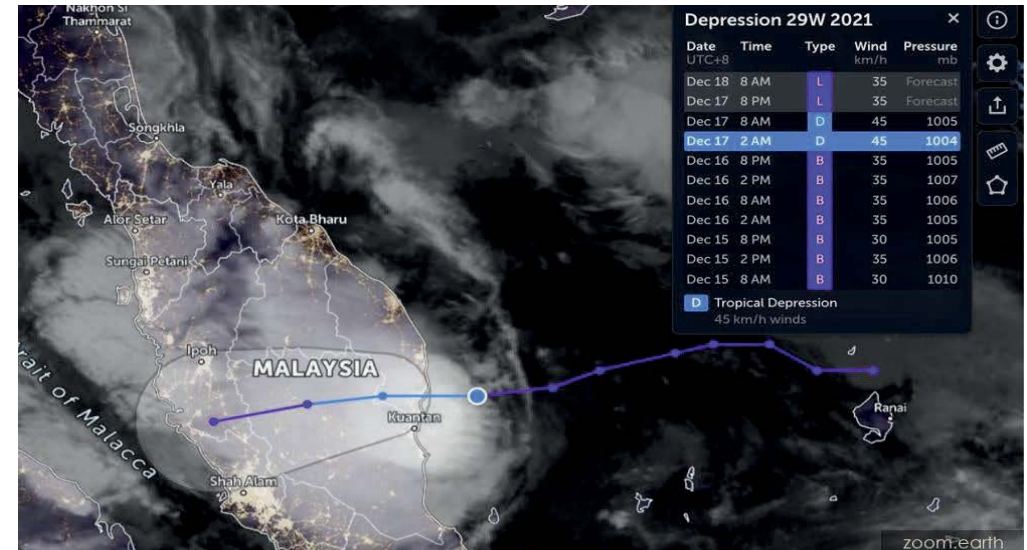
Nature of Risk (Structural + Operational)

- ❖ Coastal flooding poses both structural and operational impacts, unlike the mostly operational impacts from pluvial flooding.
- ❖ Deep and saline floodwaters significantly increase corrosion, equipment degradation, and pavement damage.
- ❖ Critical utilities (power, ICT, sewerage, drainage) face high failure probability and could trigger cascading port-wide outages.

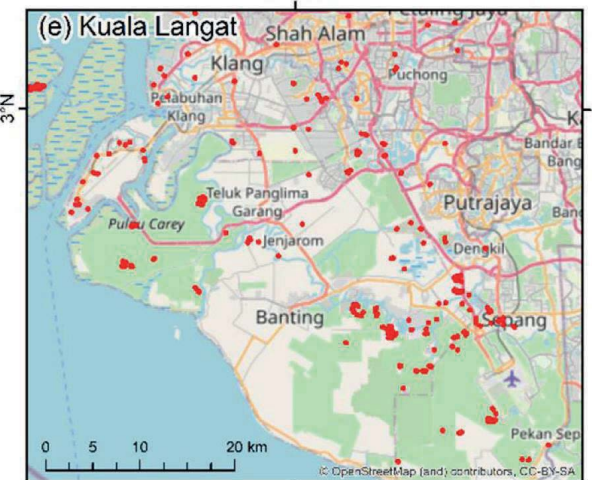
Strategic Implications for Westports

- ❖ Future waterfront protections (revetments, seawalls) need height upgrades to withstand 2085 water levels.
- ❖ Substations and telecom rooms require elevation, floodproofing or bunding to prevent service disruptions.
- ❖ Drainage outfalls need non-return valves and backflow prevention, given the >3 m flooding at drainage/ sewerage networks.
- ❖ Low-lying yards need platform raising, improved runoff management and critical equipment relocation.

- ❖ On 17 December 2021, MetMalaysia issued an amber alert, which then swiftly rose to a red alert (the highest level) for the Klang Valley, Selangor and neighbouring states. It rained continuously for four days, a deluge equivalent to a month's worth of rainfall in the area.
- ❖ Most of Peninsular Malaysia experienced moderate to heavy rain with thunderstorms on 17-18 December, causing severe flooding. According to the Department of Irrigation and Drainage, 316.5mm of rain fell in Klang on Saturday, 18 December, compared to the average monthly national rainfall of 202mm.
- ❖ The floods left almost 50 people dead, the evacuation of about 400,000 people, and resulted in an overall estimate of RM6.1 billion in financial losses.
- ❖ Unprecedented volumes of rainfall left areas on the west coast of Peninsular Malaysia under almost four meters of water and turned roads into rivers.
- ❖ Four rivers around Kuala Lumpur breached their banks.
- ❖ **Kapar in the Klang district of Selangor recorded 316 mm of rain in 24 hours on 18 December 2021.**
- ❖ Three water pumps were deployed to remove the floodwaters at the scene, while 134 floodgates were closed to prevent overflows from high tides.
- ❖ Residents of Kajang and Salak Tinggi were advised to evacuate.
- ❖ The main electrical substation at Glenmarie exploded during the night, causing a blackout across some parts of Shah Alam.
- ❖ Two water treatment plants were shut down due to the floods, leading to water cuts in 472 areas across Klang Valley.
- ❖ Water supply trucks could not reach the affected regions as most roads were closed down or cut off from the floods.



Source: Zoom Earth



Flood inundation hot spots of Selangor during the 2021–2022 Malaysia flood

A view of buildings and vehicles submerged in flood waters in Shah Alam, Selangor state, Malaysia, December 19, 2021. Picture taken with a drone. Source: REUTERS/Ebrahim Harris

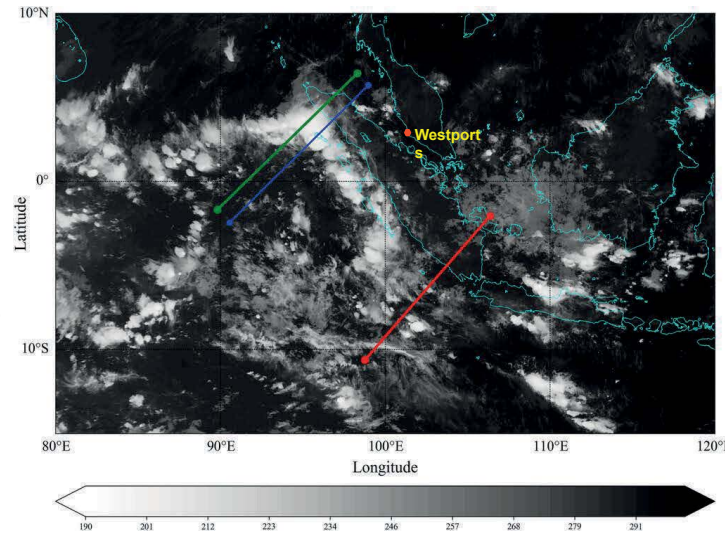
Source: Rapid Extreme Tropical Precipitation and Flood Inundation Mapping Framework (RETRACE): Initial Testing for the 2021–2022 Malaysia Flood



Extreme Wind-Squall Analysis

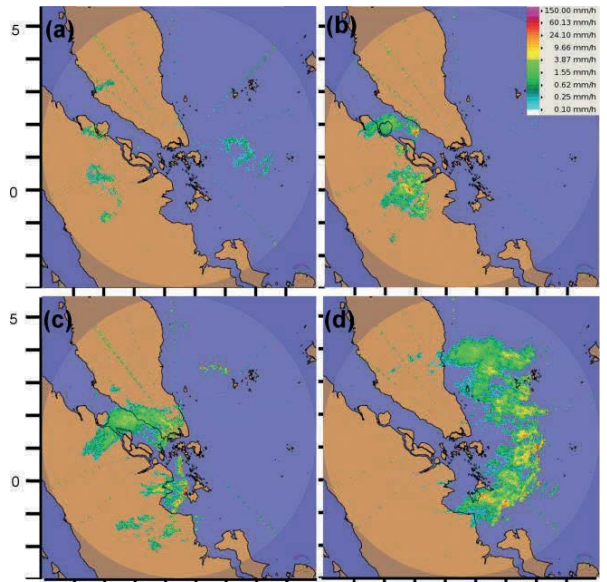


- Adverse Weather Caused by Sumatra Squall Lines (SSL)
 - Sumatra squalls are narrow bands of thunderstorms, often associated with intense precipitation and strong wind gusts. In addition, squalls usually have rapid increases in wind speed and an intense period of precipitation. They affect areas across the Malacca Strait: Indonesia, Malaysia, and Singapore. SSL-induced extreme weather is categorized as dangerous weather conditions.
- Duration & Coverage
 - SSL events can last 6–8 hours.
 - They affect areas across the Malacca Strait: Indonesia, Malaysia, and Singapore.
- Rainfall
 - Rainfall intensity can reach 90.4 mm/hour.
 - This has led to flash floods in Malaysia and Singapore.
- Winds
 - Strong winds during SSL cause:
 - Tree collapses, roof damage to buildings.
 - Maximum recorded wind speed: 144 km/hour.
- Warning Systems
 - SSL can only be detected about 3 hours before occurrence.
 - Detection depends on real-time Doppler radar data analysis.



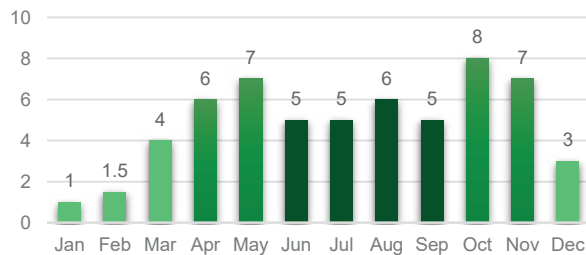
Himawari-8 AHI brightness temperature (K) of band 13 (10.4- μ m spectral band) during the squall-line propagation offshore Sumatra at 0700 LST 11 Jan 2016. Lines for the sections perpendicular to the west coast of Sumatra are indicated, the northern sections are indicated with the green and blue lines, and the southern section is indicated with the red line.

Source: 1. Lopez-Bravo C, Vincent CL, Huang Y, Lane TP. A Case Study of a West Sumatra Squall Line Using Satellite Observations. *Mon. Wea. Rev.*. 2023;151(2):523-543. doi:10.1175/MWR-D-21-0194.1
 2. Hanh Nguyen, Muhammad E Hassim, Jia Yan Huan et al. Large-scale to local factors influencing Sumatra squalls affecting Singapore, 01 April 2025, Research Square [https://doi.org/10.21203/rs.3.rs-5607311/v1]

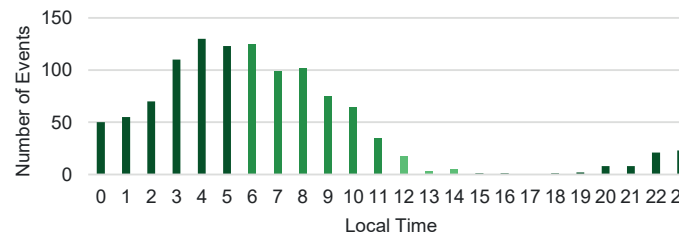


A typical squall from formation, through propagation to dissipation. This squall occurred overnight on the 31 July 2013 to 1 August 2013. Formation (a) occurs in the late evening (2017 LT) over Sumatra and on the coast of the Malacca Strait. Growth (b) occurs as the squall extends from a single cell thunderstorm to multi-cellular (2302 LT). A bow echo forms (c) (0302 LT) as the squall line becomes more prominent and propagates over Singapore and the islands to the south. Dissipation begins over the South China Sea (d) as the squall becomes disorganised and widespread (0902 LT).

a) Monthly distribution



b) Diurnal cycle of the Sumatra squalls



Distribution of the Sumatra squalls (SS) identified from 33 years of radar images. (a) Monthly distribution and (b) Diurnal cycle of the Sumatra .

Climate Change Projection

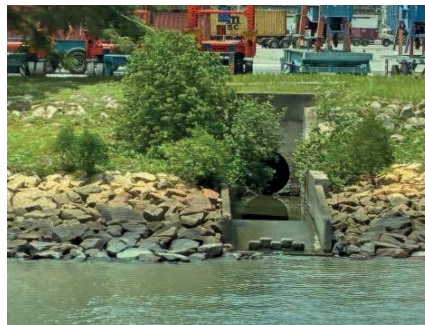
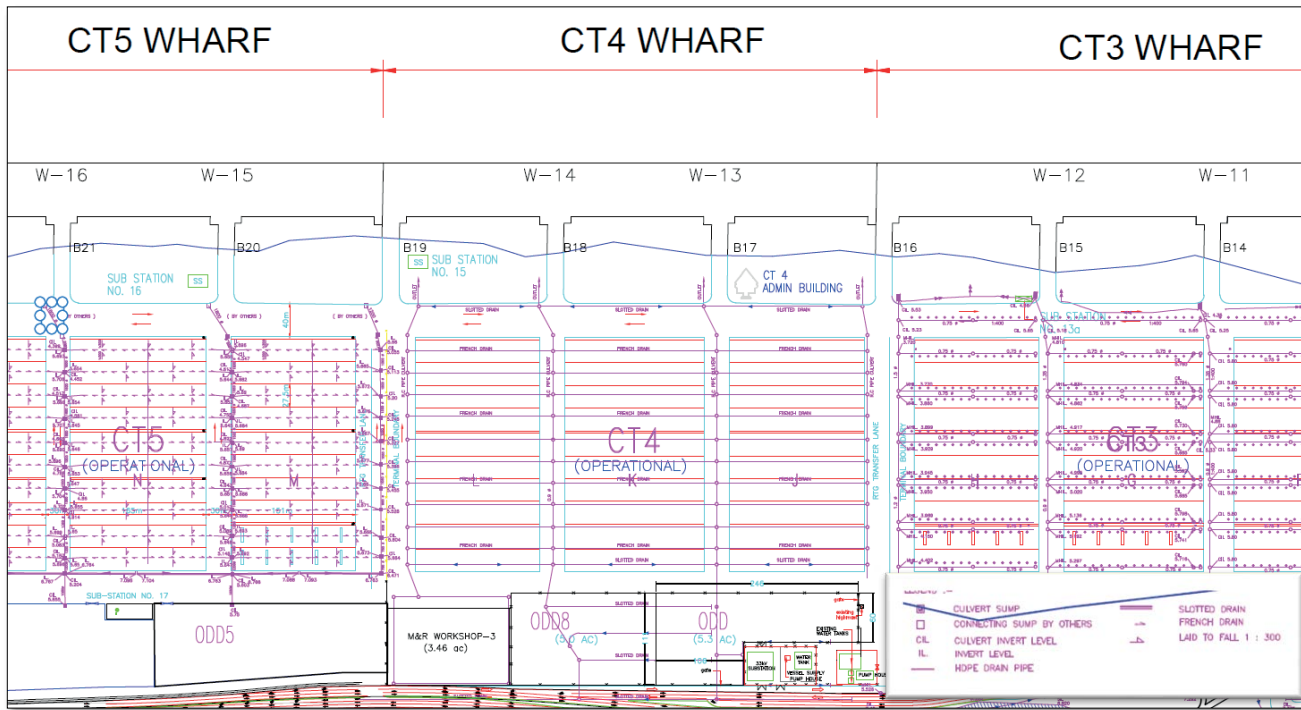
Future climate projections from Singapore's Third National Climate Change Study (V3) study indicate that **Sumatra squalls are likely to become more intense**, with stronger wind gusts and heavier rainfall. A warmer atmosphere will enhance convective activity, providing more energy for severe squall lines. However, changes in squall frequency remain uncertain, as these events are strongly influenced by complex regional climate drivers such as El Niño–Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD).

Source: CLIMATE CHANGE PROJECTIONS FOR SINGAPORE.pdf



Storm Water Drain System Analysis





Overview

The Port drainage design integrates surface and subsurface drainage, discharging through a network of sumps, RC pipe culverts, slotted drains, French drains, and outfalls leading to the sea. It covers container yards, RTG lanes, wharf areas, access roads, and ancillary facilities.

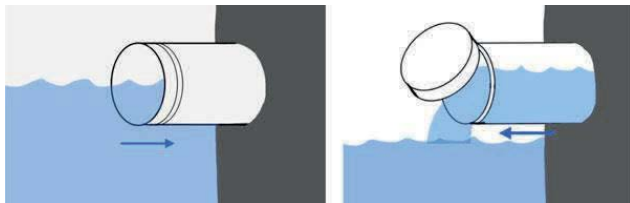
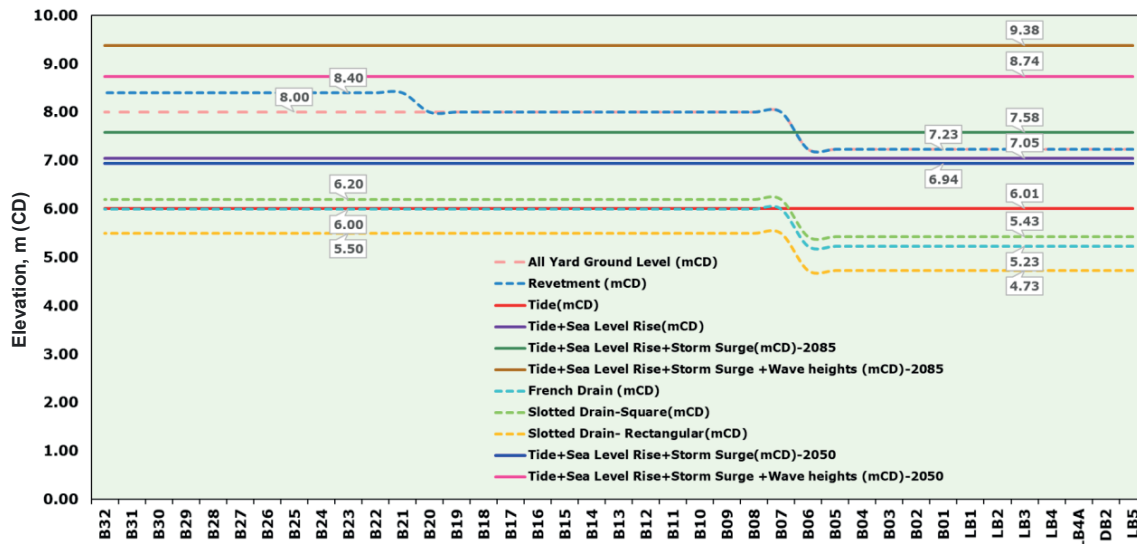
The figure on the left shows the drainage network for container terminals CT3-5. The image on the left bottom shows the open drain and outfall point.

Key Components

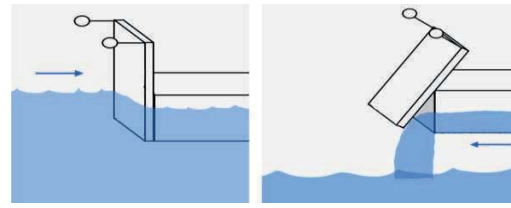
- ❖ **French Drains (450 mm perforated HDPE + geotextile)** under yards for subsurface drainage; laid in gravel beds with 1:30 pipe slope. The sump connected to the drain has depth of around 2.0m.
- ❖ **Slotted Drains with heavy-duty GI gratings** for yard and wharf surface runoff; HB-loading compliant.
- ❖ **RC Sumps & Manholes** with ladders, gratings, reinforced base/walls for collection and maintenance access. The depth of slotted square and rectangular drains are around 1.8m and 2.5m respectively.
- ❖ **RC Pipe Culverts (900–2100 mm)** conveying flow from sumps to outfalls; typical gradient 1:350.
- ❖ **Outfalls with wingwalls, geotextile & rip-rap protection** to safely discharge flow to sea/harbour.

Water movement

- ❖ French drains → Sumps → Large RC culverts → Outfalls
- ❖ Network spans CT1–CT9 with complete level control (IL/SIL/CIL shown at each sump & pipe run).
- ❖ Culvert discharges sized up to $\approx 3.10 \text{ m}^3/\text{s}$, ensuring capacity during monsoon events.



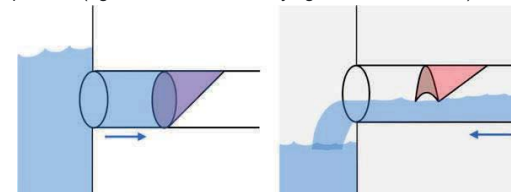
A **round flap gate** at the end of a pipe in closed position (left, at high tide) and open position (right, at low tide, conveying stormwater runoff).



A **rectangular flap gate** at the end of a channel (for example, ditch) in closed position (left, at high tide) and angled in open position (right, at low tide, conveying stormwater runoff).



A **duckbill check valve** at the end of a pipe outfall in closed position (left, at high tide) and open position (right, at low tide, conveying stormwater runoff).



An **inline check valve** inside of a pipe in closed position (left, at high tide) and open position (right, at low tide, conveying stormwater runoff).

Overall Drainage Vulnerability Pattern

The figure shows three drain types and their elevations relative to progressively higher water levels (Tide → Tide + SLR → Storm Surge → Waves).

French Drain Level (~5.23–6.0 mCD)

❖ The **100-year tide level (~6.01 mCD)** is consistently above the French drain level, which means:

- ❖ **Backflow risk is present even under normal tide.**
- ❖ Drain outflow can become **submerged**, reducing hydraulic gradient.
- ❖ During high tides or spring tides, **drains operate under submerged conditions**, slowing discharge from yards toward the shoreline.

Slotted Drain – Square (~5.43–6.2 mCD)

Slotted Drain – Rectangular (~4.73–5.5 mCD)

❖ Both slotted drain types sit **well below the tide line in some parts of the berth area**,

resulting in:

- ❖ **Permanent or near-permanent drowning** of the outlet.
- ❖ Reliance on internal storage, trunk lines, or pump assistance (if provided).
- ❖ **Rapid loss of discharge efficiency** during elevated tide conditions.

Details regarding probability, likelihood and consequence are provided in **Slides 49 & 50**.

Recommended Protection Strategy

Primary:

- ❖ Flap gates / duckbill valves at all outfalls.
- ❖ NRVs (non-return valve) at pump discharge lines.
- ❖ Raised outfall where possible.

Secondary:

- ❖ Pumping stations for low-lying zones.
- ❖ Surge-triggered outfall gates.

Tertiary:

- ❖ Deployable barriers during extreme storm forecasts.



Flap gates



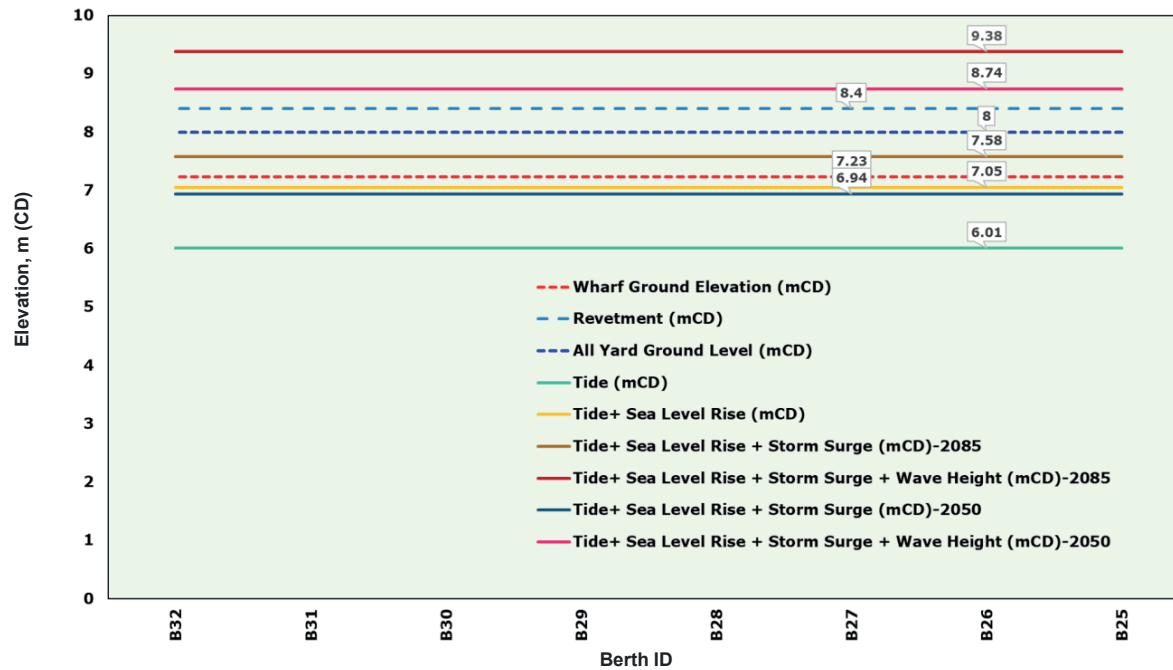
Duckbill valves

Source: <https://content.ces.ncsu.edu/devices-for-retrofitting-stormwater-management-systems-to-reduce-tidal-flood-impacts>



Westports Expansion Analysis





Heat Map of Westports Assets (New Terminal)

Physical Hazard*	Baseline	SSP5-8.5: 2050	SSP5-8.5: 2085
Extreme Heat	0.96	3.44	3.92
Extreme Winds & Storms	0.66	0.78	0.84
Rainfall Flooding	0.00	0.00	0.00
Riverine Flooding	0.00	0.00	0.00
Coastal Flooding	0.00	0.00	0.00
Extreme Total Water level	7.128	8.00	8.00
Waves	1.20	1.20	1.20
Currents	3.00	2.677	2.727

Risk level	Minimal	Low	Moderate	High	Very High
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10

Overall Risk Outlook

- ❖ A physical climate risk assessment was undertaken for the **new reclaimed-land terminal** to quantify baseline and future climate-driven hazard risks under the SSP5-8.5 high-emissions scenario for 2050 and 2085.
- ❖ Results indicate that **Extreme Total Water Level (ETWL)** is the dominant and persistent hazard, with an already High–Very High baseline risk (7.128) increasing to the maximum score of 8.0 by 2050 and remaining elevated in 2085, reflecting continued sea-level rise and storm surge amplification.
- ❖ **Extreme Heat** shows a significant escalation from Low (0.96) today to High (3.44) by 2050 and Very High (3.92) by 2085, signaling strong operational and structural heat-stress implications for exposed assets.
- ❖ **Currents** remain in the Moderate range, decreasing slightly by 2050 (2.677) before rising again by 2085 (2.727).
- ❖ **Extreme Winds & Storms** show only marginal increases but remain in the Low category across all timeframes.
- ❖ **Waves, Rainfall Flooding, Riverine Flooding, and Coastal Flooding** remain Minimal to Low, indicating that hydrological flooding pathways are not currently material for the reclaimed platform.
- ❖ Overall, the new terminal's long-term exposure is primarily governed by **Extreme Total Water Level** and escalating **Extreme Heat**, which will drive the need for forward-looking design allowances, operational thresholds, and phased adaptation planning.

The section compares port ground and coastal protection elevations against progressively more extreme water-level conditions. Under normal conditions, existing **wharf, yard, and revetment levels** remain well above the **present 100-year tide level**. When **sea-level rise** is included, baseline water levels rise closer to yard and wharf elevations, reducing freeboard. During **100-year storm surge conditions**, water levels overtops the wharf and approach closer to the yard and revetment.

- ❖ Under the combined Tide + SLR + Storm Surge + Wave Height scenario, all structures (wharf, yard, revetment) are overtopped.
- ❖ The critical exceedances are between 0.98–2.15 m, which is high.

Implication: These berths are highly vulnerable to coastal flooding and overtopping under extreme future conditions. Details regarding probability, likelihood and consequence are provided in **Slides 49 & 50**.



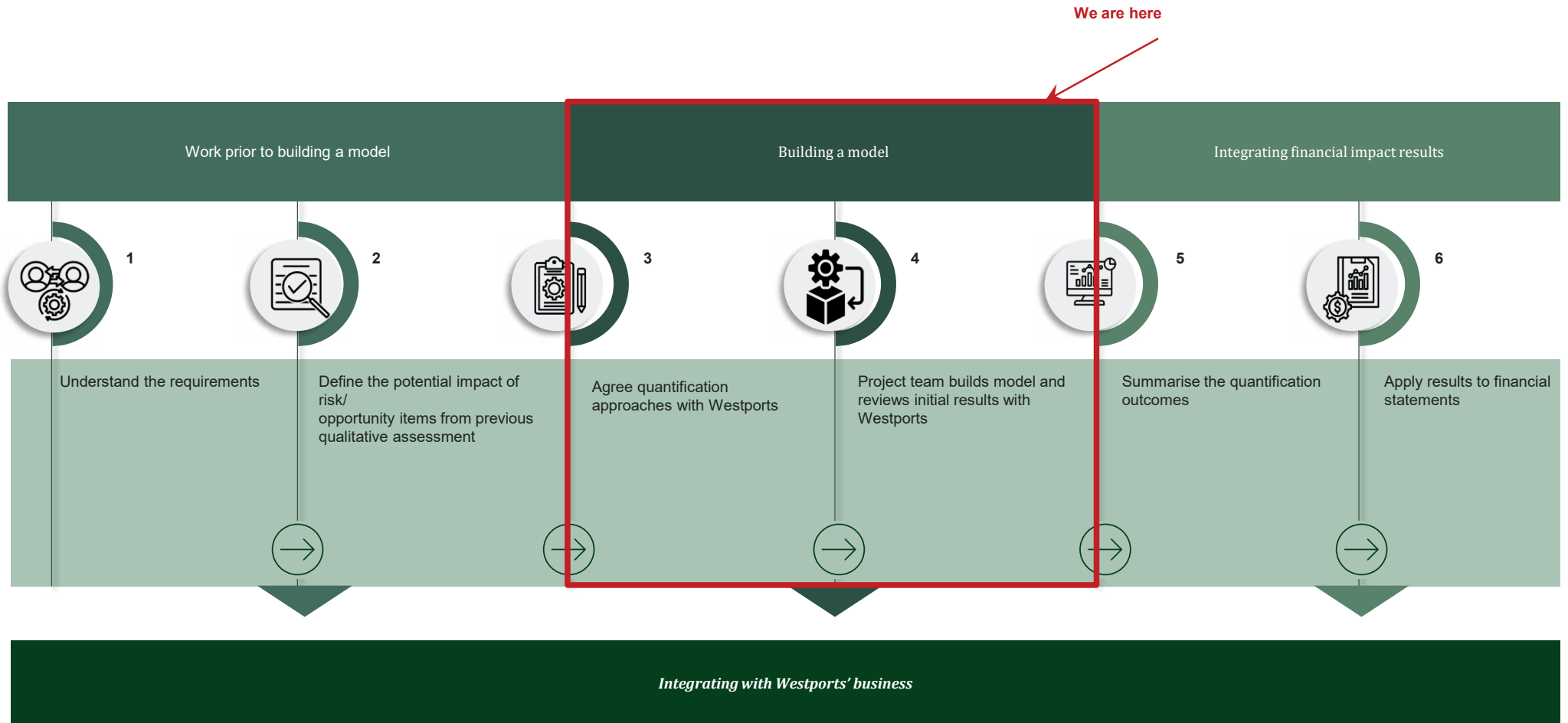


Chapter 2

FINANCIAL IMPACT ASSESSMENT-QUANTIFICATION APPROACH



Our approach follows six steps towards quantification aligned with IFRS requirements



Quantification Boundary – Climate Scenarios and Timeframes

Similarly to Physical Risk Qualitative Assessment in Task 1, in the financial quantification exercise:

Scenario Selected

We are using the latest Sixth Assessment Report (AR6) from the Intergovernmental Panel on Climate Change (IPCC). In this assessment SSP5-8.5 is used for scenario analysis.

- **SSP5-8.5:** a high emissions scenario, which follows a “business as usual” trajectory, assuming no additional climate policy and seeing CO₂ emissions triple by 2100. The selection of this scenario follows Tasked Force on Climate-Related Financial Disclosures (TCFD) guidance to assess **stressed exposure** to physical climate change risks.



Scenario	Best estimate temperature by 2100 (5%-95% likelihood)*
SSP1-1.9	1.4°C (1.0°-1.8°C)
SSP1-2.6	1.8°C (1.3°-2.4°C)
SSP2-4.5	2.7°C (2.1°-3.5°C)
SSP3-7.0	3.6°C (2.8°-4.6°C)
SSP5-8.5	4.4°C (3.3°-5.7°C)



Time Horizon

Depending on the type of the hazard, our assessment horizon may extend up to the year 2100:

Hazard	Baseline	2050s	2085s
Extreme heat			
Extreme total water level	1985 – 2014	2035 - 2064	2065 - 2094
Current			

Hazard and Impacts

We have shortlisted the top two (2) hazards identified in Phase 1 to quantify the financial impacts of these hazards to Westports’ assets.

Climate Hazard	Justification and Potential Impacts
Extreme Heat 	Under global warming, Westports’ assets are exposed to elevated extreme heat risk. Affected assets include the container yards, office tower, and data center, all of which rely on cooling systems. Prolonged periods of extreme heat increase cooling demand and subsequently raise operational costs for these facilities.
Total Water Level 	The combined effects of sea-level rise, storm surge, tides, and waves can generate extreme coastal water levels. Under global warming, sea levels are projected to rise progressively, increasing the potential severity of this hazard. As Westports’ operations are located along the coast, its assets are expected to experience stronger impacts over time. Flooding of these assets may cause operational disruption, leading to business interruption and reduced revenue.

Quantification Boundary

For extreme heat, only Westports’ assets that require cooling systems will be included in the quantification. For total water level, due to potential financial impact arising from operational disruptions, all 36 asset group types will be assessed.



Extreme Heat

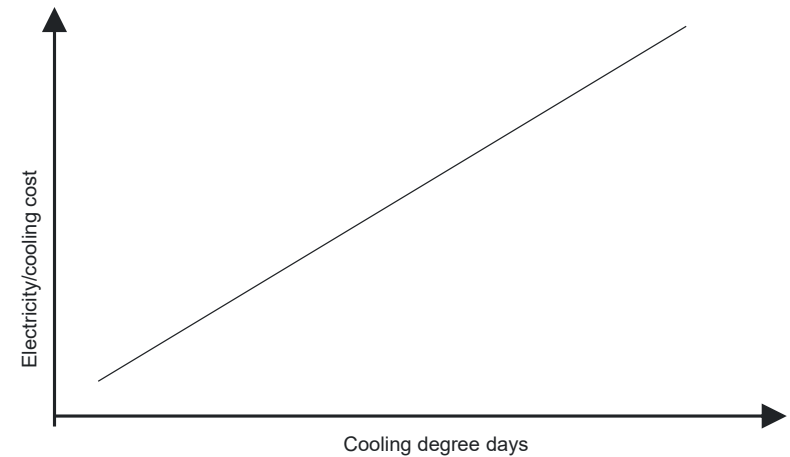
The **impact of increasing temperature** on the operation of an asset is determined by the electricity/cooling cost that is **proportional to the cooling degree days*** (the sum of daily-mean temperature over all calendar days with daily-mean temperature above 18.3°C [65°F] or cooling threshold).

Example

If the cooling cost of an asset in 2023 is \$1 million, and the cooling degree days are projected to increase from 200°C day in the baseline period to 250°C day in 2050 time horizon under SSP5-8.5 scenario, the additional cooling cost of the asset is

$$\$1 \text{ million} \times \frac{250-200^\circ\text{C day}}{200^\circ\text{C day}} = \$0.25 \text{ million (25\% increase)}$$

*Assuming that the electricity/cooling cost increases linearly with the increase in cooling degree days



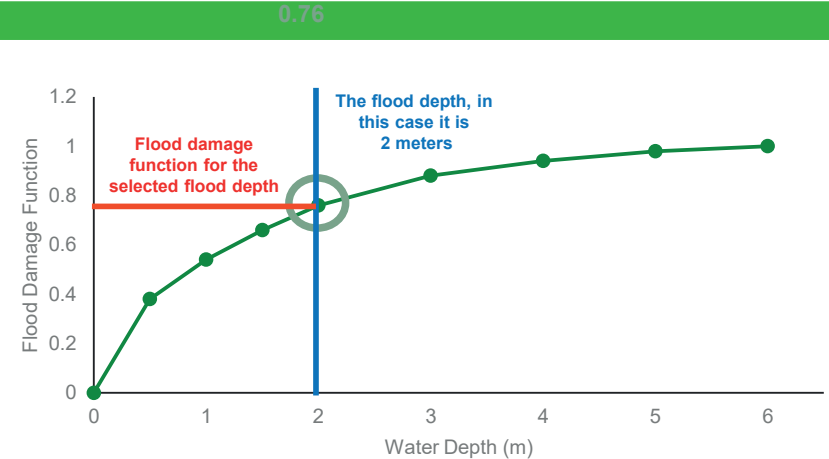
Extreme Total Water Level

Total water level may result in flooding, which can damage Westports' physical assets and affect on the business operation. The severity of damage depends on how deep the flood is. **The deeper the flood, the more impact it causes.**

To estimate this impact, we utilize a **flood damage curve from Huzinga et al. (2017)***, where it will show the **flood damage function** or the proportion of an asset's damage resulted from flood impact at different flood depths. A value of 0 means no impact and a value of 1 means the asset is completely damaged. An example of this curve can be seen on the right.

The flood damage function will then be multiplied by number of days to completely recover the damage (Verschuur et al. 2022)** to estimate on the potential **revenue loss**. In other words, the graph will be used to quantify **revenue loss** arising from business disruption due to flood-related damage.

However, ERM notes that there has been no historical asset damage resulting from flooding. Therefore, for this assessment, ERM will focus on the additional (anticipated) financial impacts caused by the projected increase in the total water level.



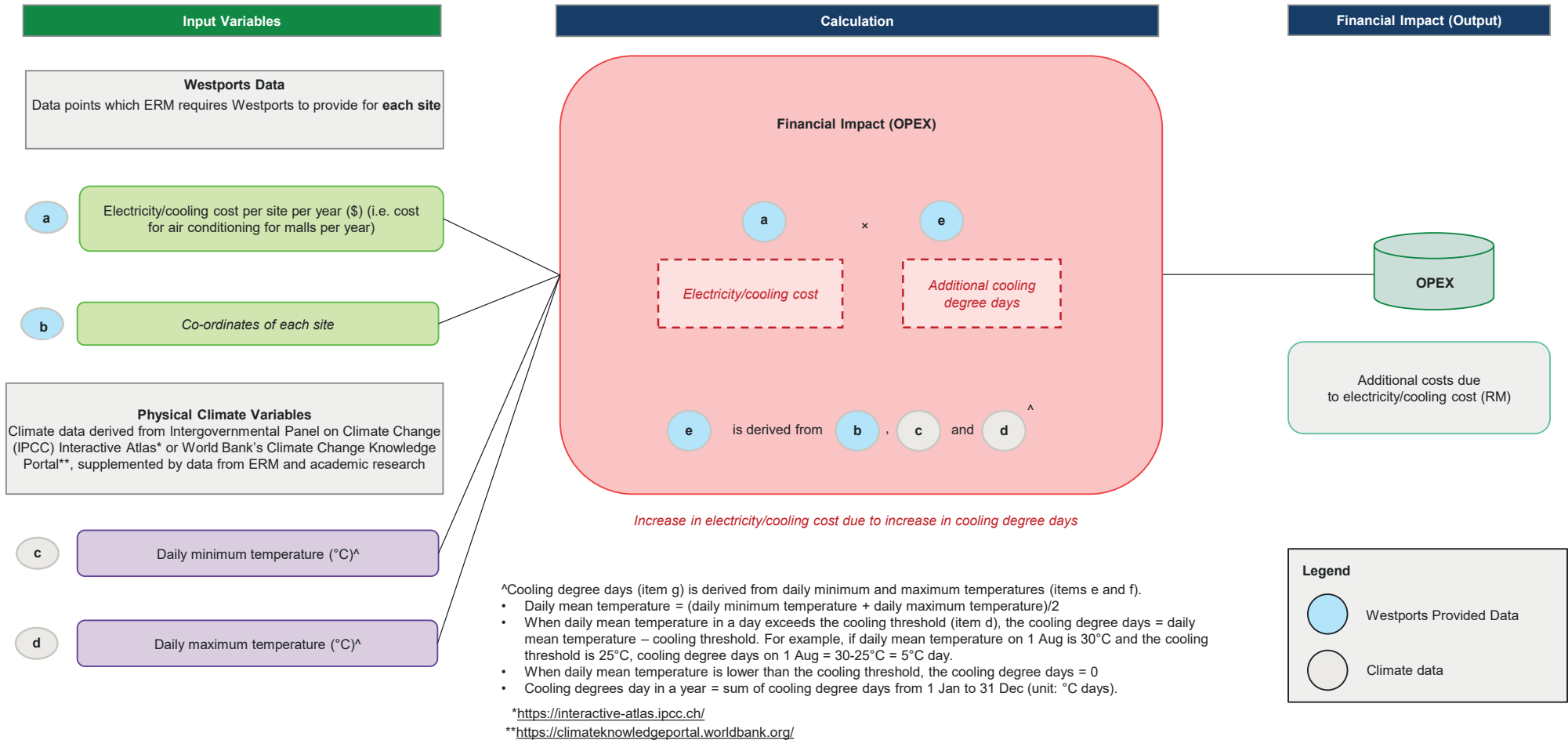
Flood damage curve for commercial buildings in Asia, from the European Commission (EU) Joint Research Centre (JRC) (Huzinga et al. 2017)*. **ERM will use the most relevant damage function(s) from this source in the quantification, along with the maximum downtime due to flooding for ports/power assets** (Verschuur et al. 2022**).

*Huzinga et al. (2017) – JRC Publications Repository - Global flood depth-damage functions: Methodology and the database with guidelines

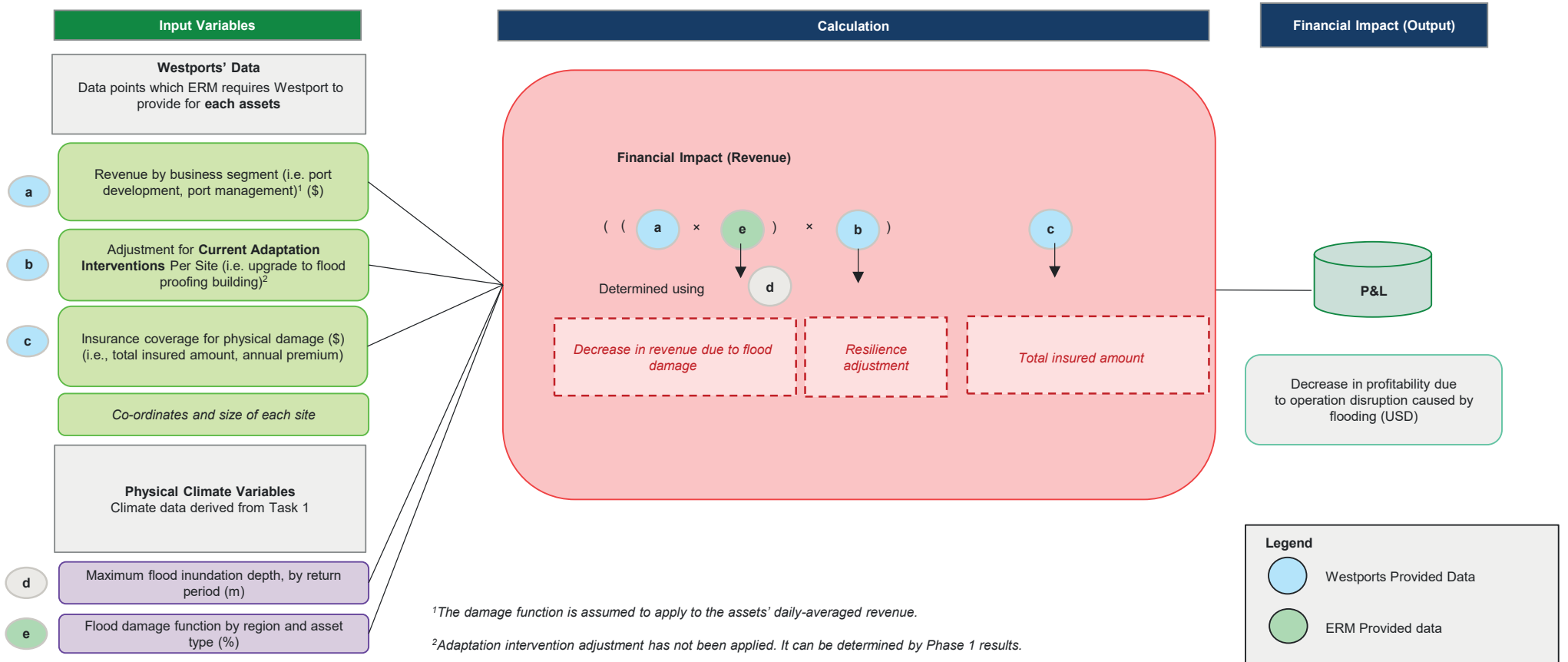
**Verschuur et al. (2022) – Multi-hazard risk to global port infrastructure and resulting trade and logistics losses | Communications Earth & Environment



Methodology for Quantifying the Impact of Extreme Heat on OPEX



Methodology for Quantifying the Impact of Extreme Total Water Level on Profit and Loss (P&L)



Key Findings for Physical Risk Quantifications



Summary of Key Findings

- ❖ The following two physical risks have been quantified based on Phase 1 results:
- ❖ **Impact of Extreme Heat on Electricity Cooling Cost (OPEX).**
- ❖ **Impact of Extreme Total Water Level on Revenue.**
- ❖ Comparatively, the **anticipated financial impact*** of extreme total water level is significantly larger than that of extreme heat. This is related to the potential of business interruption caused by higher projected water level.

Anticipated Financial Impacts due to Extreme Heat and Extreme Total Water Level (RM)*

Time Horizon	Extreme Heat	Extreme Total Water Level
2050	RM 1,710,000	RM 29,240,000 to 34,750,000 (1.50 to 1.78% of FY2024 revenue)
2085	RM 4,201,000	RM 87,280,000 to 96,790,000 (4.48 to 4.96% of FY2024 revenue)

Hence, it is crucial to enhance the climate resilience against future projected extreme water levels.

The following key assumptions were formulated as part of the model development.

Hazard	Assumptions
Extreme Heat	Business growth and inflation are assumed to be excluded from this model.
	As it is assumed that cooling systems are expected to be a major driver of electricity consumption; therefore, the total electricity bill has been considered in estimating the projected increase in electricity costs.
	The total electricity cost for 2024 is used as the baseline to estimate the expected increase in electricity costs over the assessment period.
	It is assumed that extreme heat will not cause operational disruptions or result in any direct/indirect damage to the asset during model development, as there is no historical record of such damage.
Water Level	Business growth and inflation are assumed to be excluded from this model.
	It is assumed that the flood inundation depth will have directly impact the business operations.
	It is assumed that total water level will not result in any direct/indirect damage to the asset during model development, as there is no historical record of such damage.

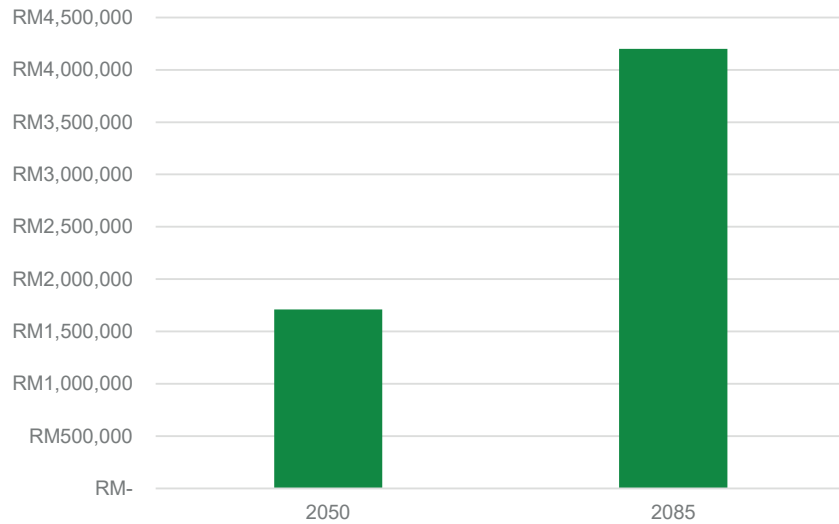
*All financial data provided by Westports were from FY2024. Therefore, the anticipated financial impacts represent additional financial impacts compared to FY2024 figures. **Note that business growth and inflation are not considered in the quantification. In other words, the results here reflect the financial impacts on the current operation under future climate conditions.**





Additional financial impact of extreme heat is projected to increase over time

Projected Change in Electricity Cost due to Increasing Temperature (RM)*



- Higher temperature → Higher cooling demand under warmer climate → Higher electricity cost for cooling.
- Three buildings with electricity expenditure for cooling systems are affected – “Container – Westport building”, “Building – TowerBlock WMSB” and “Building – BiZCentre WMSB”.

Key assumptions:

- Electricity cost for each building is derived from the total electricity cost for Westports and the total electricity consumption for each building.
- Projected change in electricity cost is directly proportional to projected change in cooling degree days.
- No change in electricity grid price.

Additional Financial Impact of Extreme Heat across All Building with Cooling Systems (RM)



Current Electricity Cost (FY2024; RM)



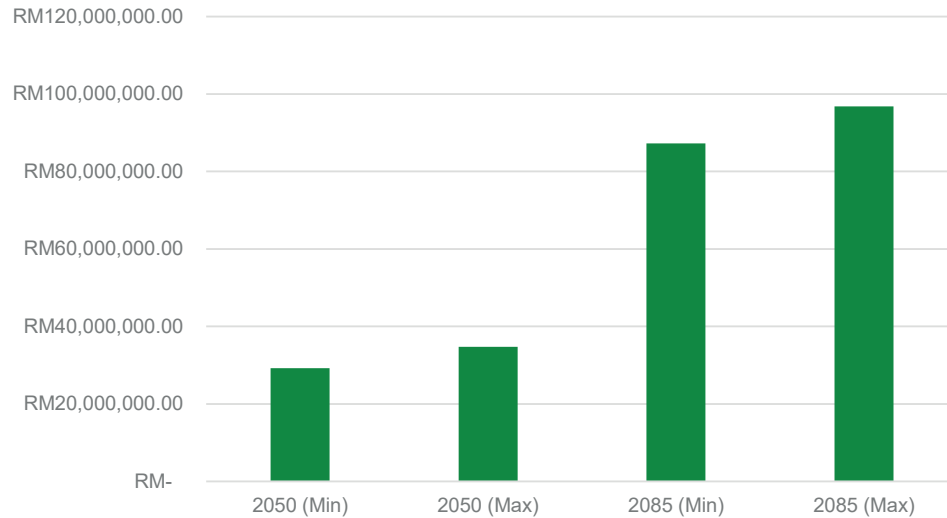
Projected Change in Cooling Degree Days (°C)

*All financial data provided by Westports were from FY2024. Therefore, the anticipated financial impacts represent additional financial impacts compared to FY2024 figures.



Additional financial impact of extreme water level is projected to increase with time

Projected Change in Revenue Loss due to Extreme Total Water Level (RM)*



- ❖ Extreme water levels → business interruption → reduction in revenue.
- ❖ Extreme total water level: +3.3 to +4.2 m (baseline) → +3.65 to +4.57 m (2050) → +4.29 to +5.21 m (2085).
- ❖ Additional financial impacts due to revenue loss:
 - ❖ 2050: RM 29,240,000 to 34,750,000 (1.50 to 1.78% of FY2024 revenue)
 - ❖ 2085: RM 87,280,000 to 96,790,000 (4.48 to 4.96% of FY2024 revenue)

- ❖ *Key assumptions:*
 - ❖ Water level for each asset group takes the minimum (min) and maximum (max) value within the asset group.
 - ❖ Business interruption day for each asset group is derived from (1) X% of damage due to water level of N meters, and (2) restoration of operations due to X% of damage.
 - ❖ Min and max impact is derived from the largest business interruption days across all asset groups.
 - ❖ No change in revenue.

Revenue Loss due to Extreme Total Water Level (RM) = Daily Revenue in FY2024 (RM/day) \times Maximum Business Interruption Days due to Extreme Total Water Level (day)

*All financial data provided by Westports were from FY2024. Therefore, the anticipated financial impacts represent additional financial impacts compared to FY2024 figures.

Adaptation Measures

No.	Asset Group Types	Total Assets
1	Berth: Nearshore	39
2	Building: Data Center-Nearshore	1
3	Building: Maintenance Repair Nearshore	2
4	Building: Office	4
5	Building: Office Nearshore	1
6	Building: Operational	3
7	Building: Operational-Nearshore	1
8	Drainage system	1
9	Equipment: Nearshore	5
10	Equipment: Onshore	10
11	Jetty: Nearshore	2
12	Manufacturing: Chemicals	1
13	Manufacturing: Food Nearshore	4
14	Manufacturing: LPG	1
15	Manufacturing: LPG Nearshore	1
16	Manufacturing: Other	2
17	Openwater: Nearshore	2
18	Power: Substation	13
19	Power: Substation DG	1
20	Power: Substation NearRiver	1
21	Power: Substation Nearshore	12
22	Power: Substation Solar	1
23	Revetment: Onshore	14
24	Sewerage system	1
25	Telecommunications Services	11
26	Telecommunications Services: Nearshore	10
27	Transport: Waterways	1
28	Warehouses: Covered	14
29	Warehouses: Covered Nearshore	1
30	Warehouses: Dock Depot	6
31	Warehouses: Fuel	1
32	Warehouses: Fuel Nearshore	1
33	Warehouses: Uncovered	3
34	Warehouses: Uncovered Nearshore	5
35	Water Supply	4
36	Wharf: Nearshore	19
Total		199

Hazard	Asset Group Types Cluster	Group specific adaptation measures	Cost Benchmarks
Extreme Heat	Critical IT & Control	Critical IT & Control	
	02 Data Center-Nearshore 25 Telecommunications Services 26 Telecommunications Services: Nearshore	<p>Engineering Measures</p> <ul style="list-style-type: none"> ❖ Upgrade cooling systems to N+1 or N+2 redundancy; adopt high-efficiency chillers or liquid cooling for dense racks. ❖ Cold/hot aisle containment, server-room pressure control, and thermal zoning. ❖ Install thermal insulation, cool roofs, reflective paint, and external shading on building envelope. ❖ Indoor temperature/HVAC automatic load balancing during peak heat. ❖ Move critical servers to edge sites with lower thermal exposure where possible. ❖ Replace VRLA UPS batteries with LFP lithium-ion with higher heat tolerance. ❖ Implement real-time thermal monitoring (rack, room, cooling loop). <p>Operational Measures</p> <ul style="list-style-type: none"> ❖ Heat-based IT failover protocols to backup systems. ❖ Restrict maintenance windows during peak heat periods. 	<p>Engineering (CAPEX)</p> <ul style="list-style-type: none"> ❖ Air-cooled chiller: RM 1,780–5,930 per ton; Water-cooled: RM 1,185–1,580 per ton. <i>N+1/N+2 premium</i>: +30–50% on baseline cooling CAPEX. Liquid cooling (direct-to-chip/immersion): RM 3,950–7,900 per kW of IT load. Aisle containment retrofit: RM 1,580–5,930 per rack; Sliding aisle doors: RM 9,085–10,665 per door; ❖ Building envelope (control rooms): <ul style="list-style-type: none"> ❖ Roof/wall insulation: RM 15.8–23.7/m² ❖ Cool roof/reflective coating: RM 3.95–11.85/m² (materials), ❖ External shading: RM 197–593/m² ❖ HVAC automation (BAS): RM 9.9–29.6/ft² (≈RM 106–319/m²); smart zone controllers/thermostats: RM 790–3,950 per unit. ❖ Thermal monitoring: Sensors RM 198–790 each; platform RM 2,963–19,750 (one-time) or low monthly. <p>Operational (OPEX)</p> <ul style="list-style-type: none"> ❖ Colocation rack: ~RM 3,160/month (≈RM 37,525/yr). ❖ Cloud-hosted critical workloads: RM 395–1,185 per server/month. ❖ Heat-triggered failover / planned maintenance windows: minimal CAPEX; possible overtime premiums only.
	Power & Energy Systems	Power & Energy Systems	
	18 Power: Substation 19 Power: Substation DG 20 Power: Substation Near River 21 Power: Substation Nearshore 22 Power: Substation Solar	<p>Engineering Measures</p> <ul style="list-style-type: none"> ❖ Transformer uprating for >50–55°C ambient temperatures. ❖ Shading roofs or solar canopies over transformer yards, switchgear enclosures, and inverters. ❖ Install forced-air cooling, larger radiators, or improved oil circulation systems. ❖ Oversize critical feeders to reduce thermal ampacity limits. ❖ Upgrade cabling to XLPE-rated high-temperature insulation. ❖ Improve PV system ventilation; allow greater row spacing for cooling airflow. <p>Operational Measures</p> <ul style="list-style-type: none"> ❖ Heat-triggered load shedding and demand management. ❖ Protective relays adjusted for warm-day settings. ❖ Conduct summer preventative inspections (IR scanning, transformer oil checks). 	<p>Engineering (CAPEX)</p> <ul style="list-style-type: none"> ❖ Transformer uprating for >50–55 °C ambient (new spec): +15–35% vs baseline transformer CAPEX. ❖ Distribution transformer replacement (~5–20 MVA): RM 0.59–3.16 million per unit. ❖ Steel shade canopy (transformers/switchgear yards): RM 593–1,975 per m². ❖ Solar canopy (PV + structure): RM 13.8–23.7 per W installed. ❖ Forced-air cooling retrofit (existing transformers): RM 79k–316k per transformer. ❖ New forced-cooled transformer (ONAF/OFWF, etc.): +20–30% CAPEX vs natural-cooled baseline. ❖ Feeder upsizing (capacity & temperature margin): RM 0.59–3.16 million per feeder. ❖ XLPE MV/LV cable (materials): RM 39.5–237 per m. ❖ Installed cable incl. civil works: RM 593–3,950+ per m. ❖ PV layout/ventilation: Row spacing change 1–5% CAPEX impact; inverter ventilation upgrades: RM 39.5k–395k per station. <p>Operational (OPEX)</p> <ul style="list-style-type: none"> ❖ Heat-triggered load-shedding & EMS logic: RM 395k–1.58 million. ❖ Warm-day relay settings & protection coordination: RM 197.5k–790k. ❖ IR thermography inspections: RM 7.9k–39.5k per visit. ❖ Transformer oil testing (DGA, furan, etc.): RM 1,185–5,925 per unit.

Hazard	Asset Group Types Cluster	Group specific adaptation measures	Cost Benchmarks
Extreme Heat	Fuels, LPG & Chemicals (Process & Storage)	Fuels, LPG & Chemicals (Process & Storage)	
	12 Manufacturing: Chemicals	<p>Engineering Measures</p> <ul style="list-style-type: none"> ❖ Apply high-reflectivity/insulative coatings on tanks, spheres, and piping. ❖ Install or expand water-spray cooling rings for LPG and fuel storage. ❖ Shade fuel loading/unloading manifolds and hose stations. ❖ Upgrade gaskets/hoses/seals to heat-resistant elastomers. ❖ Activate Vapor Recovery Units (VRUs) to reduce VOC emissions in hot conditions. ❖ Overpressure protection: PRVs rated for higher peak temperatures. <p>Operational Measures</p> <ul style="list-style-type: none"> ❖ Avoid loading/unloading during peak heat hours. ❖ Increase thermal surveillance: tank temperature, vapor pressure, PRV activity. 	<p>Engineering (CAPEX)</p> <ul style="list-style-type: none"> ❖ High-reflectivity coatings (tanks/spheres/piping): RM 79–237/m²; insulative coatings: RM 158–474/m²; conventional repaint: RM 316–593/m². ❖ Water-spray cooling rings (per tank): Retrofit RM 592.5k–1.975m; new system (incl. pumps/controls) RM 1.185–4.74m. ❖ Shading (manifolds, loading bays, hose racks): Steel canopy RM 593–1,975/m²; localized covers RM 39.5k–197.5k per station. ❖ Heat-resistant gaskets/hoses/seals: +10–30% vs standard; replacement program RM 79k–790k per system. ❖ Vapor Recovery Units (VRUs): New unit RM 3.95–19.75m each; capacity upgrade RM 1.975–7.90m. ❖ Overpressure protection (PRVs): RM 39.5k–395k per valve; system-wide relief review/upgrade RM 395k–1.975m. <p>Operational (OPEX)</p> <ul style="list-style-type: none"> ❖ Heat-avoidance loading practices (procedures & training): RM 98.8k–296.3k; scheduling changes = minimal CAPEX. ❖ Thermal & pressure surveillance: Tank temp/vapor sensors RM 19.75k–118.5k per tank; PRV monitoring RM 79k–395k per system; SCADA integration RM 197.5k–987.5k. <p>Portfolio-level envelope (indicative)</p> <ul style="list-style-type: none"> ❖ Engineering measures: RM 39.5–237 million (program of coatings, spray systems, VRUs, relief upgrades). ❖ Operational measures: RM 790k–3.16 million per year.
	Warehousing & Logistics (Cargo & Yard)	Warehousing & Logistics (Cargo & Yard)	
	28 Warehouses: Covered	Engineering Measures	Engineering (CAPEX)
	29 Warehouses: Covered Nearshore	<ul style="list-style-type: none"> ❖ Apply cool roofs, roof insulation, radiant barriers, and solar-reflective coatings. ❖ Install HVLS fans, ridge vents, and mechanical ventilation for heat dissipation. ❖ Build shaded staging areas for cargo, forklifts, and staff. ❖ Use reflective pavement, light-coloured yard surfacing, or permeable pavement where possible. ❖ Indoor temperature monitoring linked to work-rest cycles. <p>Operational Measures</p> <ul style="list-style-type: none"> ❖ Increase reefer plug capacity and reefer cooling efficiency. ❖ Set temperature stability SOPs for heat-sensitive cargo. ❖ Summer fire-prevention protocols (heat-driven spontaneous ignition risks). 	<ul style="list-style-type: none"> ❖ Cool roofs / reflective paint: RM 3.95–11.85/m² (materials); . ❖ Roof insulation retrofit: RM 15.8–39.5/m². ❖ Radiant barrier (foil systems): RM 11.85–31.6/m². ❖ HVLS fans (large-diameter): RM 39.5k–118.5k per fan. ❖ Ridge vents / roof ventilators: RM 395–1,580 per linear meter. ❖ Mechanical ventilation upgrades (per building): RM 197.5k–1.185 million. ❖ Shaded staging: Steel canopies RM 593–1,975/m²; fabric tensile RM 316–988/m²; modular shade tents RM 19.75k–98.8k per unit. ❖ Yard surfacing: Reflective coating RM 39.5–118.5/m²; light-coloured concrete RM 316–593/m²; permeable systems RM 395–988/m². ❖ Indoor temperature monitoring: Sensors RM 198–790 each; platform & alerts RM 19.75k–197.5k (site-scale). <p>Operational (OPEX)</p> <ul style="list-style-type: none"> ❖ Reefer capacity: Additional plugs RM 19.75k–59.25k per plug; electrical upgrades RM 1.975–7.90 million per yard section; efficiency tuning = low CAPEX. ❖ Temperature-sensitive cargo SOPs: RM 98.8k–296.3k for SOP development & training; monitoring embedded in operations. ❖ Summer fire-prevention: Fire-risk assessment RM 98.8k–395k; enhanced patrols = OPEX; temperature-triggered restrictions = minimal CAPEX. <p>Portfolio-level envelope (indicative)</p> <ul style="list-style-type: none"> ❖ Engineering measures: RM 39.5–197.5 million. ❖ Operational measures: RM 1.185–3.95 million per year.
	30 Warehouses: Dock Depot		
	33 Warehouses: Uncovered		
	34 Warehouses: Uncovered Nearshore		
	31/32 Fuel Warehouses		

List of assets and group types are detailed in Appendix A

Hazard	Asset Group Types Cluster	Group specific adaptation measures	Cost Benchmarks
Extreme Heat	Buildings & Workforce (Operations & Offices)	<p>Buildings & Workforce (Operations & Offices)</p> <p>Engineering Measures</p> <ul style="list-style-type: none"> ❖ Upgrade to high-efficiency, variable-speed HVAC with humidity control. ❖ Improve building envelope: <ul style="list-style-type: none"> ❖ Low-SHGC glazing ❖ External louvers ❖ Green roofs or cool roofs ❖ Thermal insulation ❖ Provide cool rooms, air-conditioned shelters, hydration stations, and shaded walkways. ❖ Install smart building controls to reduce internal heat gain. <p>Operational Measures</p> <ul style="list-style-type: none"> ❖ Implement WBGT-index work-rest cycles. ❖ Emergency response for heat exhaustion/heat stroke. ❖ Schedule high-exertion tasks outside peak heat hours. 	<p>Engineering (CAPEX)</p> <ul style="list-style-type: none"> ❖ High-efficiency VSD HVAC (retrofit): RM 79–197.5 per ft² of conditioned area (≈RM 850–2,125 per m²). ❖ Dehumidification modules (per zone): RM 19.75k–118.5k. ❖ Precision cooling for control/dispatch rooms: RM 197.5k–1.185 million per room. ❖ Building envelope <ul style="list-style-type: none"> ❖ Low-SHGC glazing retrofit: RM 1,185–2,765 per m²; solar-control film: RM 197.5–593 per m². ❖ External louvers/shading: Fixed RM 593–1,580 per m²; adjustable RM 1,185–3,160 per m². ❖ Cool roof coating: RM 3.95–11.85 per m² (materials); ; extensive green roof: RM 593–1,185 per m². ❖ Thermal insulation (roof/wall): RM 15.8–39.5 per m². ❖ Workforce cooling & welfare <ul style="list-style-type: none"> ❖ Air-conditioned cool rooms/rest shelters: RM 197.5k–987.5k per facility. ❖ Shaded walkways/canopies: RM 593–1,975 per m². ❖ Hydration stations (plumbed/mobile): RM 7.9k–39.5k per station. ❖ Smart building controls <ul style="list-style-type: none"> ❖ BMS: RM 9.9–29.6 per ft² (≈RM 106–319 per m²). ❖ Smart sensors (temp/RH/occupancy): RM 197.5–1,185 each. ❖ Lighting & equipment load optimization: RM 39.5k–395k per building. <p>Operational (OPEX)</p> <ul style="list-style-type: none"> ❖ WBGT-based work–rest: Policy & assessment RM 98.8k–296.3k; WBGT monitors RM 3.95k–19.75k per unit; training embedded in H&S. ❖ Heat-illness emergency response: Plans RM 79k–237k; first-aid/cooling supplies RM 19.75k–98.8k per site; drills = OPEX. ❖ Scheduling high-exertion tasks: Minimal CAPEX; supervision/productivity management = operational trade-off. <p>Portfolio-level envelope (indicative)</p> <ul style="list-style-type: none"> ❖ Engineering measures: RM 39.5–158 million (HVAC, envelope, welfare infrastructure). ❖ Operational measures: RM 1.185–3.95 million per year.
	Equipment & Mobile Assets	<p>Equipment & Mobile Assets</p> <p>Engineering Measures</p> <ul style="list-style-type: none"> ❖ Install larger radiators, upgraded hydraulic oil coolers, and heat shields on exposed parts. ❖ Use heat-rated tires, hoses, and cables. ❖ Improve ventilation on control cabinets and electronics housings. ❖ Provide shading for parking, maintenance areas, and charging stations. ❖ Retrofit machines with predictive thermal monitoring (coolant temp, hydraulic oil temp, inverter temp). <p>Operational Measures</p> <ul style="list-style-type: none"> ❖ Adjust duty cycles or reduce load during peak heat. ❖ Implement summer-specific PM schedules (oil changes, coolant checks). ❖ Limit idle time for engines under direct sun. 	<p>Engineering (CAPEX)</p> <ul style="list-style-type: none"> ❖ Cooling upgrades (per machine): Larger radiator RM 39.5k–197.5k; hydraulic-oil cooler RM 19.75k–98.8k; heat shields RM 7.9k–39.5k. ❖ Heat-rated components: Tires +10–25% vs standard; high-temp hoses RM 790–5,925 per hose; heat-resistant cables RM 39.5–197.5/m. ❖ Electronics cabinet cooling (per cabinet): Fans/filters RM 1,975–11,850; air-to-air exchanger RM 7,900–31,600; small industrial AC RM 11,850–39,500. ❖ Shading for parking/maintenance/charging: Steel canopy RM 593–1,975/m²; fabric tensile RM 316–988/m²; solar canopy RM 13.8–23.7/W. ❖ Predictive thermal monitoring: Temp sensors RM 395–1,975 each; onboard telemetry RM 3,950–19,750 per machine; fleet platform RM 39.5k–395k. <p>Operational (OPEX)</p> <ul style="list-style-type: none"> ❖ Heat-aware duty limits & procedures: Minimal CAPEX (planning/training). ❖ Summer PM (per year, per machine): Extra oil/coolant changes RM 1,975–11,850; seasonal inspections/diagnostics RM 3,950–19,750. ❖ Idle-time management: Policies/training = minimal; auto-shutdown timers RM 1,975–7,900 per machine.

Hazard	Asset Group Types Cluster	Group specific adaptation measures	Cost Benchmarks
Extreme Heat	Marine Interfaces & Waterfront Structures	Marine Interfaces & Waterfront Structures	
	01 Berth: Nearshore 11 Jetty: Nearshore 36 Wharf: Nearshore 27 Transport: Waterways 23 Revetment: Onshore 17 Open water: Nearshore	<p>Engineering Measures</p> <ul style="list-style-type: none"> ❖ Use high-temperature elastomers for fenders and seals. ❖ Ensure rail neutral temperature resets for RTG/RMG and crane rails. ❖ Add shading to sensitive elastomeric components and mooring systems. ❖ Improve expansion joints for decks, rails, and wharf surfaces. ❖ Use heat-resistant coatings on steel structures to reduce thermal cycling fatigue. ❖ Improve drainage to avoid drying+cracking cycles. <p>Operational Measures</p> <ul style="list-style-type: none"> ❖ Heat-day berthing SOPs (mooring line condition checks, fender hardness checks). ❖ Restricted crane operations during maximum heat if thermal tolerance is exceeded. 	<p>Engineering (CAPEX)</p> <ul style="list-style-type: none"> ❖ High-temperature elastomers (fenders, seals, bearings): +10–30% vs standard components. ❖ Elastomeric seals/bearings (unit cost): RM 7.9k–59.25k per unit. ❖ Rail Neutral Temperature (RNT) study & reset (crane/yard rails): RM 0.593–1.975 million per rail system. ❖ Rail stress adjustment / destressing works: RM 197.5k–790k per intervention. ❖ Shading of elastomeric components & mooring points: Localized shade structures RM 593–1,975/m²; protective covers RM 19.75k–98.75k per berth section. ❖ Expansion joints: Heavy-duty joint replacement RM 7.9k–39.5k per linear meter; rail expansion devices/sliding joints RM 197.5k–987.5k per location. ❖ Steel protection (heat-resistant/reflective coatings): RM 98.8–316/m²; full marine-grade repaint RM 316–593/m². ❖ Deck drainage & crack management: Drainage improvements RM 790k–3.95 million per berth section; joint sealing & crack repairs RM 197.5k–1.185 million per intervention. <p>Operational (OPEX)</p> <ul style="list-style-type: none"> ❖ Heat-day berthing SOPs: RM 98.75k–296.25k (development & training); fender hardness and mooring-line checks embedded in routine inspections. ❖ Restricted crane operations under extreme heat: Thermal tolerance assessment & operating limits RM 197.5k–593k; implementation (procedures/alerts/training) = minimal CAPEX.
	Water, Sewer & Drainage Utilities	Water, Sewer & Drainage Utilities	
	35 Water Supply 24 Sewerage system 08 Drainage system	<p>Engineering Measures</p> <ul style="list-style-type: none"> ❖ Add storage buffering to water supply systems for peak heat demand. ❖ Upgrade pump motors with higher-temperature ratings or improve pump room ventilation. ❖ Install odor control at sewerage hotspots (biofilters, activated carbon). ❖ Use more heat-resistant gaskets and seals on pipelines and valves. ❖ Protect open channels or critical nodes with shading or reflective lining. <p>Operational Measures</p> <ul style="list-style-type: none"> ❖ Proactive water leakage repair during heat waves (pressure drops more common). ❖ Adjust chemical dosing for biological process stability in high temperatures. ❖ Inspect drainage for cracking, joint failures, and low-flow sections. 	<p>Engineering (CAPEX)</p> <ul style="list-style-type: none"> ❖ Storage buffering for peak-heat demand: RM 3,160–9,875 per m³ (steel/concrete tanks); modular/packaged: RM 5,925–13,825 per m³. ❖ Pump stations: High-temperature motor upgrade: +10–25% vs standard; motor replacement: RM 79k–395k per unit; pump-room ventilation: RM 98.75k–592.5k per station. ❖ Odor control at sewer hotspots: Biofilters: RM 395k–1.975 million per installation; activated-carbon units: RM 197.5k–1.185 million per unit. ❖ Heat-resistant gaskets, seals & valve components: +10–30% vs standard; valve-seal replacement program: RM 19.75k–197.5k per intervention. ❖ Shading/reflective lining (open channels & chambers): Shade structures: RM 593–1,975/m²; reflective/low-absorption lining: RM 118.5–395/m². <p>Operational (OPEX)</p> <ul style="list-style-type: none"> ❖ Targeted leak-detection surveys: RM 39.5k–197.5k per campaign; emergency repair allowance = OPEX contingency. ❖ Chemical dosing adjustments for high-temperature stability: Process review/recalibration: RM 79k–296.25k; incremental chemicals: typically <10% seasonal increase. ❖ Drainage inspections for heat-related degradation: CCTV/visual: RM 19.75k–118.5k per area; minor joint/crack repairs: RM 79k–790k per intervention.

List of assets and group types are detailed in Appendix A

Hazard	Asset Group Types Cluster	Group specific adaptation measures	Cost Benchmarks
Extreme Total Water level (ETWL)	Marine Berthing & Loading Structures	Marine Berthing & Loading Structures	
	01 Berth: Nearshore 11 Jetty: Nearshore 36 Wharf: Nearshore	<p>Structural</p> <ul style="list-style-type: none"> Raise/upgrade deck levels or provide localized crest height increases at low points (berth edge, access transitions) to reduce inundation frequency. Upgrade fenders, bollards, mooring fittings for higher storm loads and wave action; use corrosion-resistant materials (marine-grade). Add wave-overtopping reduction features (parapets/edge beams) where safe for operations. Improve scour protection around foundations and berth toes (ETWL + waves increases seabed mobility). <p>Operational</p> <ul style="list-style-type: none"> Define ETWL operating thresholds (water level + wave conditions) for: berthing, crane ops, bunkering, personnel access. Pre-storm securing: standardized mooring plans, equipment tie-downs, shut-off sequences. <p>Institutional</p> <ul style="list-style-type: none"> Embed ETWL criteria into design standards and renewal cycles (capex triggers when residual life is low), consistent with PIANC's emphasis on planning and life-cycle decisions. 	<p>Engineering (structural) – CAPEX</p> <ul style="list-style-type: none"> RM 78.4 – 235.2 million (selective, phased upgrades across berths/quay assets). <p>Representative structural unit rates (typical ranges)</p> <ul style="list-style-type: none"> Localized deck raising (per linear meter): RM 11,762 – RM 31,366. Parapet / edge beam for overtopping control (per lm): RM 5,881 – RM 15,683. Fender panel system (per berth face): RM 1,568,316 – RM 4,704,948. Heavy-duty bollard / mooring hook (per unit): RM 156,832 – RM 470,495. Scour armoring (per m²): RM 7,842 – RM 19,604. <p>Operational – OPEX</p> <ul style="list-style-type: none"> RM 1.18 – 3.14 million (ETWL thresholds, manuals, training, pre-storm securing). <p>Representative operational line items</p> <ul style="list-style-type: none"> ETWL analysis & thresholds: RM 588,118 – RM 1,568,316. Operating manuals & decision matrices: RM 196,040 – RM 588,118. Training & drills (initial setup): RM 117,624 – RM 392,079. Standardized mooring & securing plans: RM 294,059 – RM 784,158. Equipment tie-down & shut-off procedures: RM 98,020 – RM 294,059. Annual drills & refreshers (per year): RM 78,416 – RM 196,040.
	Shoreline Protection & Coastal Interface	Shoreline Protection & Coastal Interface	
	23 Revetment: Onshore 17 Openwater: Nearshore	<p>Structural</p> <ul style="list-style-type: none"> Revetment upgrades: crest elevation, armor sizing, toe protection, and overtopping control based on future ETWL. Consider hybrid / Working with Nature buffers (where feasible) to reduce wave energy and provide adaptable protection pathways. <p>Operational</p> <ul style="list-style-type: none"> Routine post-event inspections (displacement, settlement, toe scour) + rapid repair contracts. <p>Institutional</p> <ul style="list-style-type: none"> Establish an adaptive pathway: interim upgrades now, scalable options later as SLR and extremes evolve. 	<p>Engineering (structural) – CAPEX</p> <ul style="list-style-type: none"> RM 117.6 – 470.5 million (revetment crest raising, armor upsizing, toe protection, overtopping control; phased across vulnerable reaches). <p>Representative structural unit rates (typical ranges)</p> <ul style="list-style-type: none"> Revetment crest elevation increase (per lm): RM 11,762 – RM 31,366. Armor layer upsizing / replacement (per lm): RM 15,683 – RM 47,049. Toe protection enhancement (per lm): RM 7,842 – RM 23,525. Overtopping reduction elements (per lm): RM 5,881 – RM 19,604. Hybrid / Working with Nature (WwN) buffers Nearshore rock/gravel berms (per lm): RM 5,881 – RM 15,683. Modular reef / eco-armoring units (per unit): RM 3,921 – RM 11,762. Mangrove / vegetated buffer establishment (per ha): RM 196,040 – RM 784,158. <p>Operational – OPEX</p> <ul style="list-style-type: none"> RM 0.392 – 1.176 million per year (post-storm inspections, rapid-repair retainer). <p>Representative operational line items</p> <ul style="list-style-type: none"> Post-storm inspection program (per year): RM 196,040 – RM 588,118. Standing rapid-repair contracts (retainer): RM 392,079 – RM 1,176,237.

Hazard	Asset Group Types Cluster	Group specific adaptation measures	Cost Benchmarks
Extreme Total Water Level (ETWL)	Water, Wastewater & Drainage (Flood Pathway Controllers)	Water, Wastewater & Drainage (Flood Pathway Controllers)	
	08 Drainage system 24 Sewerage system 35 Water Supply	<p>Structural</p> <ul style="list-style-type: none"> ❖ Increase drainage conveyance + storage, add pump stations where gravity drainage is insufficient during high tide/ETWL. ❖ Install tidal flap gates / backflow preventers on outfalls to prevent seawater intrusion during ETWL. ❖ Harden pump/electrical components: elevate MCCs, waterproof enclosures. <p>Operational</p> <ul style="list-style-type: none"> ❖ ETWL-triggered pre-emptive drawdown of retention basins (when feasible) and pump readiness checks. ❖ Rapid debris clearance teams (ETWL events often block drains; recovery speed depends on maintenance). <p>Institutional</p> <ul style="list-style-type: none"> ❖ Formalize an ETWL drainage performance standard (target time-to-drain, maximum ponding depth) and align it with asset renewal budgets—consistent with PIANC's emphasis on systematic risk management and adaptation planning 	<p>Engineering (structural) – CAPEX</p> <ul style="list-style-type: none"> ❖ RM 58.8 – 274.5 million (storage, pumps, culvert/drain upsizing, gates, electrical hardening; phased across tide-locked/low-lying basins). <p>Representative structural unit rates (typical ranges)</p> <ul style="list-style-type: none"> ❖ Drain upsizing / culvert enlargement (per lm): RM 5,881 – RM 23,525. ❖ New detention/retention storage (per m³): RM 3,137 – RM 9,802. ❖ Stormwater pump station, 5–20 m³/s (per station): RM 7,841,580 – RM 39,207,900. ❖ Mobile/emergency pump deployment points (per site): RM 196,040 – RM 1,176,237. ❖ Outfall backflow prevention (tidal interface) ❖ Tidal flap gate retrofit (per outfall): RM 196,040 – RM 980,198. ❖ Automated tide gate / sluice (per outfall): RM 588,118 – RM 2,352,474. ❖ Backflow preventers for sewer/storm connections (per location): RM 78,416 – RM 588,118. ❖ Pump station hardening (electrical & resilience) ❖ Elevate MCCs & critical controls (per station): RM 392,079 – RM 1,960,395. ❖ Waterproof enclosures/doors (per station): RM 196,040 – RM 980,198. ❖ Backup power (genset/ATS integration) (per station): RM 784,158 – RM 3,920,790. <p>Operational – OPEX</p> <ul style="list-style-type: none"> ❖ RM 0.392 – 1.568 million per year (ETWL-triggered drawdown, readiness, debris clearance teams). <p>Representative operational line items</p> <ul style="list-style-type: none"> ❖ Drawdown protocols & control logic: RM 98,020 – RM 294,059. ❖ Pre-event pump inspections/testing (per event): RM 39,208 – RM 117,624. ❖ Debris clearance teams/contracts (per year): RM 196,040 – RM 588,118. ❖ Emergency access improvements (per location): RM 98,020 – RM 392,079.
	Critical Lifelines (Power + Digital/Control)	Critical Lifelines (Power + Digital/Control)	
	21 Power: Substation Nearshore 26 Telecommunications Services: Nearshore 02 Building: Data Center-Nearshore	<p>Structural</p> <ul style="list-style-type: none"> ❖ Floodproof/elevate substations, switchgear rooms, telecom nodes, and data center critical equipment above design flood + freeboard; seal cable trenches and penetrations. ❖ Add perimeter flood barriers (demountable or permanent) and backflow prevention for conduits. ❖ Provide redundant routing (dual feeds, diverse fiber routes) to avoid single-point failure. <p>Operational</p> <ul style="list-style-type: none"> ❖ ETWL pre-event shutdown/transfer protocols (safe isolation of electrical equipment) + rapid restart checklist. ❖ Deploy real-time monitoring (water level sensors at low points; alarms to control room). <p>Institutional</p> <ul style="list-style-type: none"> ❖ Update business continuity plans: prioritized load restoration (reefer yards, safety systems, comms) and mutual aid agreements. 	<p>Engineering (structural) – portfolio envelope</p> <ul style="list-style-type: none"> ❖ RM 58.8 – 235.2 million (elevation/dry-proofing of substations/switchgear/telecom, perimeter barriers, and route redundancy; phased by consequence and outage risk). <p>Representative structural unit rates (typical ranges)</p> <ul style="list-style-type: none"> ❖ Elevate switchgear/MCCs (per room): RM 784,158 – RM 3,920,790. ❖ Floodproof substation buildings (per facility): RM 1,960,395 – RM 11,762,370. ❖ Raised plinths/platforms (per asset cluster): RM 196,040 – RM 1,176,237. ❖ Cable trench sealing & penetration protection (per area): RM 78,416 – RM 588,118. ❖ Perimeter flood barriers & backflow prevention ❖ Demountable flood barriers (per lm): RM 5,881 – RM 15,683. ❖ Permanent flood walls/bunds (per lm): RM 9,802 – RM 23,525. ❖ Backflow preventers for conduits/drains (per penetration): RM 39,208 – RM 392,079. ❖ Redundancy & diversity (power/fiber) ❖ Dual electrical feeds / tie-in works (per critical zone): RM 1,960,395 – RM 7,841,580. ❖ Diverse fiber route installation (per segment): RM 196,040 – RM 1,176,237. <p>Operational – portfolio envelope</p> <ul style="list-style-type: none"> ❖ RM 0.784 – 2.352 million (protocols, training, monitoring & SCADA/BMS integration). <p>Representative operational line items</p> <ul style="list-style-type: none"> ❖ Protocol development & risk assessment: RM 196,040 – RM 588,118. ❖ Training, drills & documentation: RM 98,020 – RM 294,059. ❖ Water level sensors (per sensor): RM 7,842 – RM 39,208. ❖ SCADA/BMS integration & alarms: RM 78,416 – RM 392,079.

List of assets and group types are detailed in Appendix A

Hazard	Asset Group Types Cluster	Group specific adaptation measures	Cost Benchmarks
Extreme Total Water level (ETWL)	Nearshore Operations, Logistics & Hazardous/Industrial Nodes	Nearshore Operations, Logistics & Hazardous/Industrial Nodes	
	32 Warehouses: Fuel Nearshore	Structural	Engineering (structural) – CAPEX
	29 Warehouses: Covered Nearshore		
	34 Warehouses: Uncovered Nearshore	❖ Elevate/floodproof: warehouse door thresholds, critical control panels, LPG/fuel pump skids, emergency shutdown systems.	❖ RM 19.6 – 98.0 million (elevation/dry-proofing of near-water warehouses, control panels/ESD cabinets, pump skids, raised pads; phased by consequence and HSE risk).
	09 Equipment: Nearshore		
	15 Manufacturing: LPG Nearshore		
	13 Manufacturing: Food Nearshore	❖ Install bunding/containment and water-tight isolation valves to prevent pollutant release during flooding (especially fuel/LPG).	Representative structural unit rates (typical ranges)
	07 Building: Operational-Nearshore		❖ Raise warehouse door thresholds / flood sills (per doorway): RM 19,604 – RM 196,040.
	05 Building: Office Nearshore	❖ Use corrosion-resistant materials and coatings; design for washdown and rapid drying post-flood.	❖ Elevate control panels / ESD cabinets (per unit): RM 39,208 – RM 392,079.
	03 Building: Maintenance Repair Nearshore		❖ Floodproof LPG/fuel pump skids (per skid): RM 196,040 – RM 1,176,237.
	Operational	❖ Local equipment plinths / raised pads (per cluster): RM 78,416 – RM 588,118.	
	❖ ETWL cargo and hazardous material shutdown SOPs: stop transfer at thresholds; secure tanks; isolate utilities.	❖ Bunding, containment & isolation	
	❖ Staging strategy: relocate high-value / hazardous inventory above flood levels ahead of forecast ETWL events.	❖ Secondary containment bunds (per lm): RM 3,921 – RM 19,604.	
	❖ Post-event return-to-service inspections for equipment, forklifts, electricals.	❖ Water-tight isolation valves (per valve): RM 78,416 – RM 392,079.	
		❖ Automated isolation tied to water-level alarms (per system): RM 196,040 – RM 784,158.	
	Institutional	❖ Corrosion-resistant materials & rapid recovery design	
	❖ Integrate ETWL into HSE/HAZOP updates and emergency drills; update insurance/business interruption assumptions using scenario-based planning	❖ Marine-grade coatings (per m ²): RM 118 – RM 392.	
		❖ Equipment upgrades to corrosion-resistant alloys: +10% – +30% vs standard.	
		❖ Washdown & drainage improvements (per area): RM 196,040 – RM 1,176,237.	
		Operational – OPEX	
		❖ RM 0.784 – 2.352 million (shutdown SOPs/HAZOP alignment, training, staging/relocation planning, post-event inspections).	
		Representative operational line items	
		❖ SOP development & HAZOP alignment: RM 196,040 – RM 588,118.	
		❖ Training & drills: RM 98,020 – RM 294,059.	
		❖ Staging plans & trigger definition: RM 98,020 – RM 294,059.	
		❖ Electrical & control inspections (per event): RM 78,416 – RM 392,079.	
		❖ Mechanical inspections (per event): RM 39,208 – RM 196,040.	
		❖ Temporary relocation logistics: OPEX; event-dependent.	

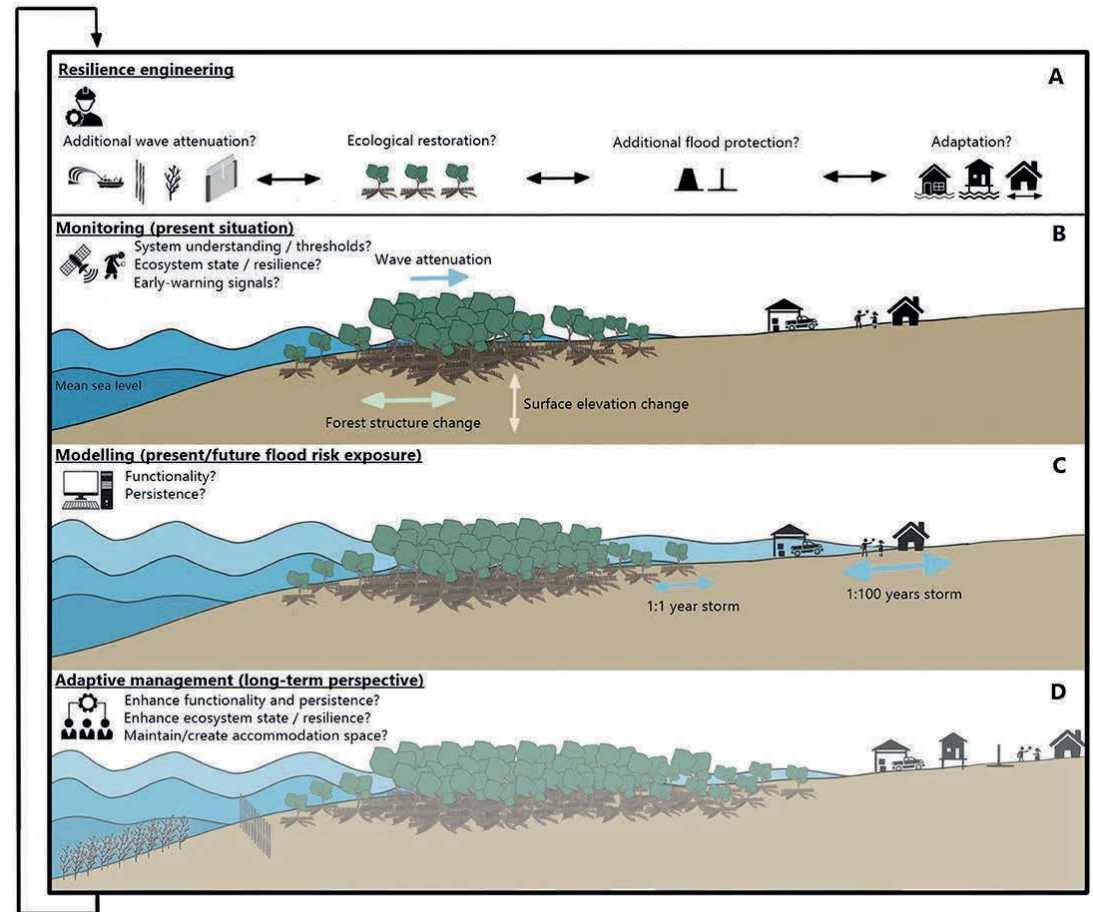
Hazard	Asset Group Types Cluster	Group specific adaptation measures	Cost Benchmarks
Extreme Total Water level (ETWL)	Water, Wastewater & Drainage (Flood Pathway Controllers)	Water, Wastewater & Drainage (Flood Pathway Controllers)	
	08 Drainage system 24 Sewerage system 35 Water Supply	<p>Structural</p> <ul style="list-style-type: none"> ❖ Increase drainage conveyance + storage, add pump stations where gravity drainage is insufficient during high tide/ETWL. ❖ Install tidal flap gates / backflow preventers on outfalls to prevent seawater intrusion during ETWL. ❖ Harden pump/electrical components: elevate MCCs, waterproof enclosures. <p>Operational</p> <ul style="list-style-type: none"> ❖ ETWL-triggered pre-emptive drawdown of retention basins (when feasible) and pump readiness checks. ❖ Rapid debris clearance teams (ETWL events often block drains; recovery speed depends on maintenance). <p>Institutional</p> <ul style="list-style-type: none"> ❖ Formalize an ETWL drainage performance standard (target time-to-drain, maximum ponding depth) and align it with asset renewal budgets—consistent with PIANC’s emphasis on systematic risk management and adaptation planning 	<p>Engineering (structural) – CAPEX</p> <ul style="list-style-type: none"> ❖ RM 58.8 – 274.5 million (storage, pumps, culvert/drain upsizing, gates, electrical hardening; phased across tide-locked/low-lying basins). <p>Representative structural unit rates (typical ranges)</p> <ul style="list-style-type: none"> ❖ Drain upsizing / culvert enlargement (per lm): RM 5,881 – RM 23,525. ❖ New detention/retention storage (per m³): RM 3,137 – RM 9,802. ❖ Stormwater pump station, 5–20 m³/s (per station): RM 7,841,580 – RM 39,207,900. ❖ Mobile/emergency pump deployment points (per site): RM 196,040 – RM 1,176,237. ❖ Outfall backflow prevention (tidal interface) ❖ Tidal flap gate retrofit (per outfall): RM 196,040 – RM 980,198. ❖ Automated tide gate / sluice (per outfall): RM 588,118 – RM 2,352,474. ❖ Backflow preventers (sewer/storm connections) (per location): RM 78,416 – RM 588,118. ❖ Pump station hardening (electrical & resilience) ❖ Elevate MCCs & critical controls (per station): RM 392,079 – RM 1,960,395. ❖ Waterproof enclosures/doors (per station): RM 196,040 – RM 980,198. ❖ Backup power (genset/ATS integration) (per station): RM 784,158 – RM 3,920,790. <p>Operational – OPEX</p> <ul style="list-style-type: none"> • RM 0.392 – 1.568 million per year (ETWL-triggered drawdown protocols, readiness checks, debris-clearance teams). <p>Representative operational line items</p> <ul style="list-style-type: none"> ❖ Drawdown protocols & control logic: RM 98,020 – RM 294,059. ❖ Pre-event pump inspections/testing (per event): RM 39,208 – RM 117,624. ❖ Debris-clearance teams/contracts (per year): RM 196,040 – RM 588,118. ❖ Emergency access improvements (per location): RM 98,020 – RM 392,079.

Mangroves for Flood, Wave and Sea Level Rise Mitigation

Mangrove forests play a significant role in coastal protection by reducing the energy of wind-driven and swell waves, as well as attenuating storm surges. While mangroves do not act as solid barriers to water flow, their dense root and canopy structures help lessen flooding impacts—particularly in areas without levees or seawalls—by diminishing direct wave forces and lowering surge water levels before they reach inland areas. In addition, mangroves contribute to long-term shoreline stability by trapping sediments, reducing erosion, and promoting natural land accretion.

Key Aspects of Mangroves for Flood Mitigation

- ❖ **Wave Attenuation:**
Mangrove trunks, branches, and prop roots create significant drag forces that dissipate incoming wave energy, helping reduce both wave heights and storm surge levels before they reach inland areas.
- ❖ **Sediment Stabilisation:**
The dense root systems trap sediments and organic matter, gradually building soil elevation and reducing shoreline erosion during storms, high tides, or long-term sea-level rise.
- ❖ **Economic Value:**
Mangrove restoration is a highly cost-effective, nature-based solution that provides substantial protection benefits. It reduces the financial impact of coastal flooding on vulnerable communities and lowers long-term maintenance costs compared with hard-engineered structures.
- ❖ **Structural Protection:**
While mangroves do not fully block floodwater, they significantly reduce the force of waves and surge flow, thereby decreasing flood damage to infrastructure, utilities, and coastal settlements.
- ❖ **Optimal Width:**
For effective flood mitigation, a mangrove green belt of **50–200 metres** is commonly recommended, depending on species, site conditions, and local hydrodynamic characteristics.



Schematic overview of an adaptive management approach with (A) (temporary) engineering interventions, in which humans enhance and adapt to the functionality and persistence of the mangroves. The mangroves are (B) monitored, (C) their functionality and persistence are assessed and predicted to determine the necessity of (temporary) engineering interventions within (D) a long-term perspective to reduce coastal flood risk with mangroves. The uncertainty of flooding events due to the variability in mangrove functionality and the uncertainty of monitoring and modelling tools is indicated with the blue arrows in (C). *Adopted from* [Frontiers | Nature-Based Engineering: A Review on Reducing Coastal Flood Risk With Mangroves](#)

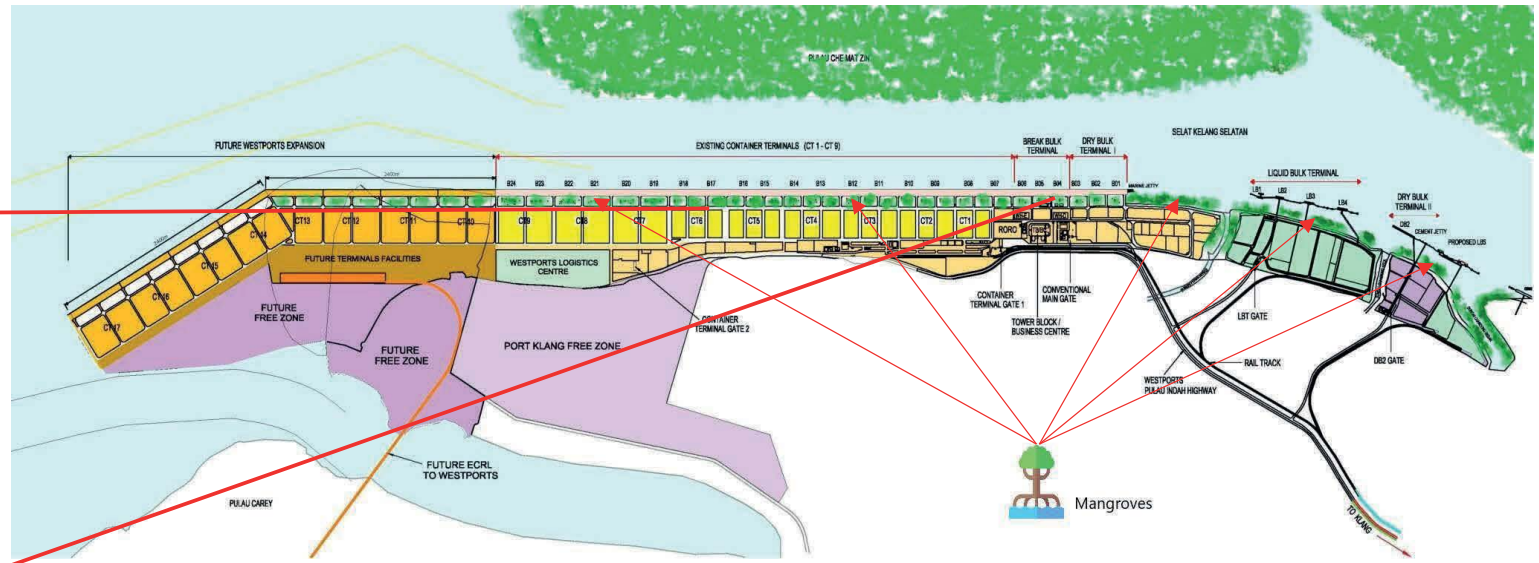
Mangroves for Flood, Wave and Sea Level Rise Mitigation

Plantation of Mangroves along the revetment

Current condition near B16 @CT



Current condition near Breakbulk Terminal



The pictorial (above) representation illustrates how **mangroves can be strategically integrated within the port waterfront**, specifically:

❖ Between the Wharf Structure and the Revetment

- ❖ Mangroves can be planted in the tidal zone located between the vertical wharf face and the sloped rock revetment (Images on the left).
- ❖ This zone typically has sufficient water depth and tidal exposure for species such as Bakau Minyak (*Rhizophora*) and Lenggadai (*Bruguiera*), allowing root systems to develop without obstructing port operations.

❖ Along the Revetment Edge

- ❖ Mangroves can be established at the toe or lower slope of the rock revetment.
- ❖ Their root systems help stabilise sediments, reduce wave energy, and create a natural buffer without compromising the structural integrity of the revetment.

❖ Overall Concept

- ❖ The illustration (right) shows mangrove trees emerging from the intertidal waterline, with clear spacing to avoid interference with vessel berthing.
- ❖ The revetment is shown as a stone-armoured slope, while the wharf is depicted as a vertical concrete structure, with mangroves positioned naturally between and in front of these elements.



Appendix A: List of Westports Assets

List of Westports Assets

Port	Asset Group Type	Asset ID	Name of Assets/Structures/others	Port	Asset Group Type	Asset ID	Name of Assets/Structures/others	
WP1	Berth: Nearshore	WPA10	CT3- B11	WP1	Building: Office	WPA121	CT1-KASTAM	
		WPA11	CT3- B12			WPA168	BBT-Port Police Building	
		WPA13	CT4- B13			WPA169	Business Centre Building	
		WPA14	CT4- B14		WPA170	Tower Block Data Center-TBDC		
		WPA16	CT5- B15		Building: Office Nearshore	WPA154	BBT-M&R Admin Centre	
		WPA17	CT5- B16			Building: Operational	WPA119	CT9-Yard-Westports-PKFZ Gate
		WPA19	CT6- B17				WPA120	CT1-Container GATE IN
		WPA20	CT6- B18		WPA85	CT7-Yard-Admin Marshalling -W/S		
		WPA22	CT7- B19		Building: Operational-Nearshore	WPA83	CT1-Yard-Admin Marshalling	
		WPA23	CT7- B20			Drainage system	WPA197	Drainage Network
		WPA25	CT8- B21		Equipment: Nearshore	WPA64	Marker buoys navigation aids	
		WPA26	CT8- B22			WPA65	Dredging / disposal	
		WPA28	CT9- B23		WPA66	Maintenance of infrastructure		
		WPA29	CT9- B24		WPA67	Cargo handling /Crane usage		
		WPA4	CT1- B07		WPA68	Gangways		
		WPA43	Break Bulk terminal-BBT-B04		Equipment: Onshore	WPA149	CT1-CT9-Cargo handling equipment	
		WPA44	Break Bulk terminal-BBT-B05			WPA150	CT1-CT9-Cranes	
		WPA45	Break Bulk terminal-BBT-B06			WPA171	BBT-Cargo handling equipment	
		WPA49	Dry Bulk terminal(DBT) I-B01		WPA172	BBT-Cranes		
		WPA5	CT1- B08		WPA181	DBT-I-Cargo handling equipment		
		WPA50	Dry Bulk terminal(DBT) I-B02		WPA182	DBT-I-Cranes		
		WPA51	Dry Bulk terminal(DBT) I-B03		WPA186	LBT-Cargo handling equipment		
		WPA53	Liquid Bulk terminal-LB1		WPA187	LBT-Cranes		
		WPA54	Liquid Bulk terminal-LB2		WPA194	DBTI-II-Cargo handling equipment		
		WPA55	Liquid Bulk terminal-LB3		WPA195	DBTI-II-Cranes		
		WPA56	Liquid Bulk terminal-LB4		Jetty: Nearshore	WPA46	Dry Bulk terminal(DBT) I Upper Jetty	
		WPA58	Liquid Bulk terminal-LB4A			WPA47	Dry Bulk terminal(DBT) I Lower Jetty	
		WPA60	Liquid Bulk terminal-LB5		Manufacturing: Chemicals	WPA192	DBTI-II-LPG Terminal	
		WPA62	Dry Bulk terminal(DBT) - DB2			Manufacturing: Food Nearshore	WPA176	DBT-I-Westport Grains Terminal
		WPA7	CT2- B09		WPA177		DBT-I-Warehouse FGH	
		WPA8	CT3- B10		WPA178	DBT-I-Sugar Refinery		
		Building: Data Center-Nearshore	WPA84		CT4-Yard-Admin Marshalling -Data Center	WPA179	DBT-I-Flour Mills	
					Building: Maintenance Repair Nearshore	WPA157	DBTI-II-LPG Terminal	
WPA158	BBT-M&R Conventional	WPA185	LBT-Stolthaven-Westports					
		WPA158	BBT-M&R Recond Store	WPA189	DBTI-II-Cement Factory			
				WPA190	DBTI-II-Cement Factory			



List of Westports Assets

Port	Asset Group Type	Asset ID	Name of Assets/Structures/others
WP1	Warehouses: Covered	WPA128	CT9-Logistic Company
		WPA161	BBT-Warehouse D
		WPA162	BBT-Warehouse E
		WPA163	BBT-Car Terminal
		WPA193	DBTI-II-Logistic Company
		WPA86	CT2-Yard-Container Freight Station (CFS) 2
		WPA87	CT2-Yard-Container Freight Station (CFS) 2
		WPA88	CT1-Yard-Container Freight Station (CFS) 1
		WPA89	CT7-Yard-Container Freight Station (CFS) 4
	Warehouses: Covered Nearshore	WPA180	DBT-I-Logistic Company
	Warehouses: Dock Depot	WPA91	CT5-Yard-On Dock Depot (ODD) 5
		WPA92	CT4-Yard-On Dock Depot (ODD) 8
		WPA93	CT5-Yard-On Dock Depot (ODD) 9
		WPA94	CT2-Yard-On Dock Depot (ODD) 10
		WPA95	CT4-Yard-On Dock Depot (ODD) 11
		WPA96	CT6-Yard-On Dock Depot (ODD) 99
		WPA90	CT3-Fuel Bay
	Warehouses: Fuel	WPA151	BBT-Fuel Bay No.01
	Warehouses: Fuel Nearshore	WPA122	CT1-Westports Distripark
Warehouses: Uncovered	WPA125	CT8-Logistic Company	
	WPA160	BBT-Car Terminal-open	
Warehouses: Uncovered Nearshore	WPA152	BBT-Yard 11A	
	WPA153	BBT-Yard 13AW	
	WPA156	BBT-Yard 12AW &12AS	
	WPA159	BBT-Yard 4 Zone 2	
	WPA175	DBT-I-Yard 4 Zone 1, 5A & 5B, 11	
Water Supply	WPA118	CT4-Yard- Water Tank/ Pump House	
	WPA166	BBT-Water Tank/ Pump House	
	WPA184	LBT-Water Tank/ Pump House	
	WPA196	DBTI-II-Water Tank/ Pump House	

Port	Asset Group Type	Asset ID	Name of Assets/Structures/others
WP1	Wharf: Nearshore	WPA12	CT4- Wharf
		WPA15	CT5- Wharf
		WPA18	CT6- Wharf
		WPA21	CT7- Wharf
		WPA24	CT8- Wharf
		WPA27	CT9- Wharf
		WPA3	CT1- Wharf
		WPA42	Break Bulk terminal-BBT Wharf
		WPA48	Dry Bulk terminal(DBT) I Wharf
		WPA52	Liquid Bulk terminal-LBT I Wharf
		WPA57	Liquid Bulk terminal-LBT II Wharf
		WPA59	Liquid Bulk terminal-LBT III Wharf
		WPA6	CT2- Wharf
WPA61	Dry Bulk terminal(DBT) II Wharf		
WPA9	CT3- Wharf		

Port	Asset Group Type	Asset ID	Name of Assets/Structures/others
WP2	Berth: Nearshore	WPA31	CT10- B25
		WPA32	CT10- B26
		WPA34	CT11- B27
		WPA35	CT11- B28
		WPA37	CT12- B29
		WPA38	CT12- B30
		WPA40	CT13- B31
		WPA41	CT13- B32
		WPA78	Revetment for CT10-CT13
		WPA30	CT10- Wharf
		WPA33	CT11- Wharf
WPA36	CT12- Wharf		
WPA39	CT13 Wharf		






Outside	Asset Group Type	Asset ID	Name of Assets/Structures/others
Outside	Power: Substation NearRiver	WPA199	Main Power Supply Station-PMU PIDH 132KV



Appendix B






METHODOLOGY



Hazard		Scenario Indicator (Unit)	Definition	Resolution	Data source
	Extreme Heat	Warm Spell Duration Index (WSDI) (days)	Annual number of days with at least 6 consecutive days when daily maximum temperature is above 90th percentile of the daily climatic condition.	55 km × 55 km	ISIMIP3b: https://www.isimip.org/
	Extreme Winds and Storms	Maximum Tropical Cyclone Windspeed (knots)	Maximum sustained wind speed within 200km of a tropical cyclone	25 km × 25 km	IBTrACs: https://www.ncei.noaa.gov/products/international-best-track-archive AMS: https://doi.org/10.1175/BAMS-D-18-0194.1
	Extreme Rainfall Flooding	Pluvial Flooding Inundation Depth (metres)	Maximum inundation depth experienced within a 270m×270m area that is associated with a 1-in-100-year [#] pluvial (extreme-rainfall-induced) flooding event.	30 m × 30 m	Fathom-Global 3.0: https://www.fathom.global ISIMIP3b: https://www.isimip.org/
	River Flooding	River Flooding Inundation Depth (metres)	Maximum inundation depth experienced within a 270m×270m area that is associated with a 1-in-100-year [#] undefended river flooding event.		
	Coastal and Offshore	Coastal Flooding Inundation Depth (metres)	Maximum inundation depth associated with a 1-in-100-year [#] coastal flooding event as a result of sea level rise, land subsidence, storm surges and/or high tide events.		
		Extreme Total Water Level (ETWL) (metres)	Factors contributing to extreme sea levels (ETWL) are sea level rise, storm surge (e.g., associated with tropical cyclones and extratropical cyclones), tide, and extreme waves (resulting in high-wave setup at the shoreline). 1-in-100-year return period level.		https://doi.org/10.5194/gmd-9-1937-2016 Port Klang (Pelabuhan Kelang) Station, Malaysia's Survey and Mapping Department(JUPEM) https://psmsl.org/data/obtaining/stations/1591.php
		Waves (metres)	Ocean waves are oscillations of the water surface, primarily generated by wind transferring energy through friction at the air-sea interface.		https://doi.org/10.5194/gmd-9-1937-2016 Port Klang (Pelabuhan Kelang). Malaysia's Survey and Mapping Department(JUPEM) https://psmsl.org/data/obtaining/stations/1591.php
		Ocean currents (metres/seconds)	Ocean currents are continuous, predictable, directional movements of seawater on both the surface and in deep water, driven by a combination of wind, water density differences (temperature and salinity), gravity, and Earth's rotation		https://doi.org/10.5194/gmd-9-1937-2016

[#] 1-in-100 year return period represents 1% annual probability.

The Global Climate Database (GCD) by ERM covers eight (8) physical scenario indicators, including acute risks (Extreme Heat, Extreme Winds & Storms, Rainfall Flooding, River Flooding, Coastal Flooding, Extreme Total Water Level, Waves and Currents) to give a “headline” view of the most material climate-related physical risks for GCD.

TCFD Category (Acute, etc.)		Hazard	Scenario Indicator (Unit)	Baseline Period	2030s	2050s	2085s
Physical - Acute		Extreme Heat	Warm Spell Duration Index (WSDI) (days)	1985–2014	2015–2044	2035–2064	2065–2094
		Extreme Winds & Storms	Maximum Tropical Cyclone Windspeed (knots)	1980–2022			
		River Flooding	River Flooding Inundation Depth (metres)	2020 [#]			
		Rainfall Flooding	Pluvial Flooding Inundation Depth (metres)	2020 [#]			
		Coastal and Offshore	Coastal Flooding Inundation Depth (metres)	2020 [#]			
			Extreme Total Water Level (ETWL) (metres)	1995–2014			
			Waves Height (metres)	1995–2014			
			Ocean Current (metre/seconds)	1995–2014			

The projections in this assessment are based on five CMIP6 global climate models used within the Inter-Sectoral Impact Model Intercomparison Project[^] (ISIMIP3b) framework—GFDL-ESM4, MPI-ESM1-2-HR, MRI-ESM2-0, IPSL-CM6A-LR and UKESM1-0-LL—selected because together they span the full CMIP6 uncertainty range by combining both low- and high-climate-sensitivity models. These models are downscaled and bias-corrected (using WFDE5/ERA5) and then averaged into a multi-model ensemble to provide more robust, representative climate signals. Assumptions include the use of 30-year climate normals for each horizon, non-stationary extreme value analysis for rainfall extremes, and, for some hazards such as coastal flooding and water stress, reliance on WRI CMIP5-based datasets with interpolation/extrapolation where future time horizons are unavailable.

^{*}Future projection of annual surface wind speed from IPCC WG1 Interactive Atlas (<https://interactive-atlas.ipcc.ch/>).

[#] Flooding indicators are flooding inundation depths with 1-in-100 year return period (1% annual probability).

[^]<https://www.isimip.org/>

Physical climate scenarios used in the assessment: IPCC Assessment Report 6 (AR6)

The Intergovernmental Panel on Climate Change (IPCC) released a key review of climate change science, referred to as AR6 (sixth assessment report), in 2021.

The report considers climate change trends provided by ~100 leading climate models. Projections trends are grouped into five **Shared Socioeconomic Pathways (SSPs)**. These reflect potential changes in net CO₂ emissions, by combining qualitative storylines of societal features and quantified measures of development alongside climate data to create plausible scenarios for how quickly humans can curb emissions.

In this assessment **SSP5-8.5** is used.

- **SSP5-8.5**: a high emissions scenario, which follows a “**business as usual**” trajectory, assuming no additional climate policy and seeing CO₂ emissions triple by 2100. The selection of this scenario follows Tasked Force on Climate-Related Financial Disclosures (TCFD) guidance to assess **stressed exposure** to physical climate change risks.



Scenario	Best estimate temperature by 2100 (5%-95% likelihood)*
SSP1-1.9	1.4°C (1.0°-1.8°C)
SSP1-2.6	1.8°C (1.3°-2.4°C)
SSP2-4.5	2.7°C (2.1°-3.5°C)
SSP3-7.0	3.6°C (2.8°-4.6°C)
SSP5-8.5	4.4°C (3.3°-5.7°C)

* From Cross-Section Box TS. 1, Table 1 of IPCC AR6 WG1 Technical summary (p. 63). The warming level is relative to the period 1850-1900. Link: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_TS.pdf

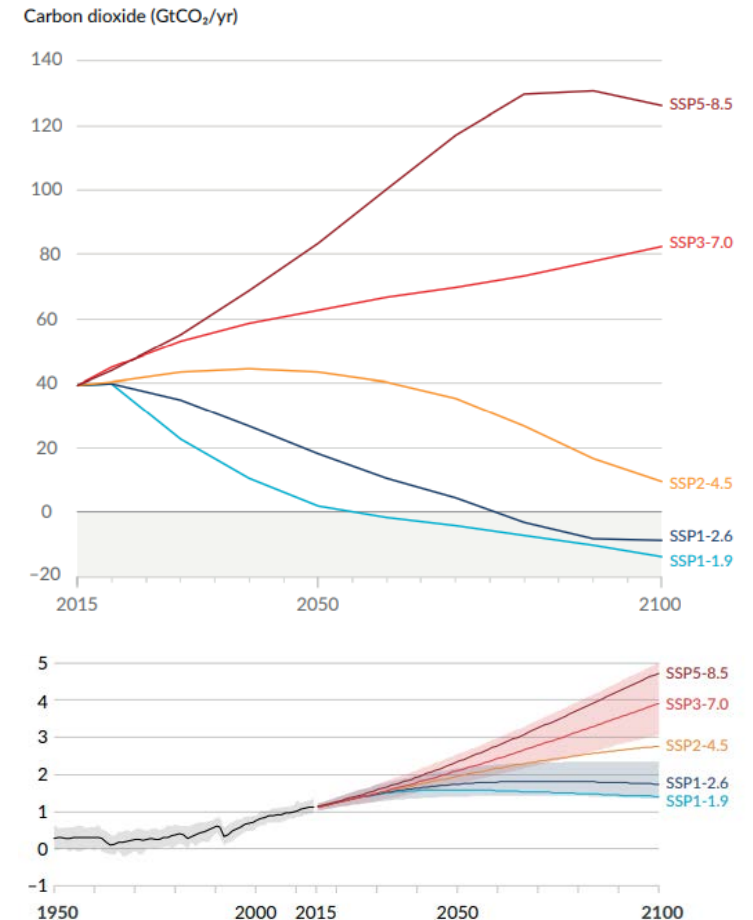


Figure: Projections of CO₂ emissions (top) and global surface temperature change (bottom) under the five SSPs.



Normalization of Physical Indicators

- ❖ For “apples to apples” comparisons of physical risks across different hazards and assets, all physical indicators are normalized to the same scale (0 to 1) prior to risk score calculations as the raw scenario indicators are on different scales (e.g. warm spell duration days in days, flood inundation depths in metres, wind speed in knots), where 0 represents a minimal risk of a physical hazard and 1 represents a maximum risk of that hazard.
- ❖ Climate indicators measured by frequency of occurrence (Extreme Heat) are normalized according to classification by climate zones. Each climate zone is associated with distinct weather patterns and is therefore vulnerable to unique thresholds of physical hazards.
- ❖ Climate indicators measured by magnitude/intensity (Extreme Winds & Storms, Rainfall Flooding, River Flooding, Coastal Flooding, Extreme Total Water Level, Waves and Currents) are normalized based on severity of hazards.

Hazard	Scenario Indicator	Normalization
Extreme Heat	Warm Spell Duration Index (WSDI) (days)	Climate zones
Extreme Winds & Storms	Maximum Tropical Cyclone Windspeed (knots)	Severity
River Flooding	River Flooding Inundation Depth (metres)	Severity
Extreme Rainfall Flooding	Pluvial Flooding Inundation Depth (metres)	Severity
Coastal & Offshore	Coastal Flooding Inundation Depth (metres)	Severity
Coastal & Offshore	Extreme Total Water Level (ETWL) (metres)	Severity
Coastal & Offshore	Waves (metres)	Severity
Coastal & Offshore	Ocean current (metre/second)	Severity



Köppen-Geiger climate classification map (1991-2020)

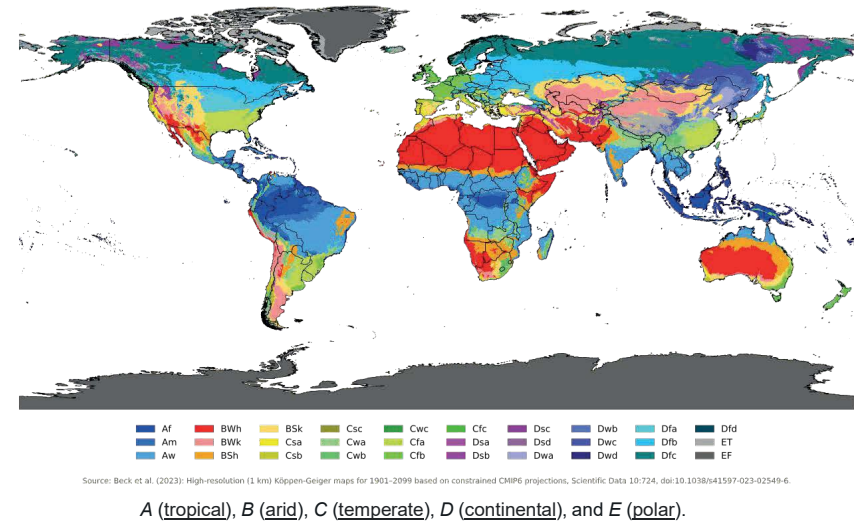


Figure illustrating the different areas dominated by a specific climate zone.



Exposure ratings are allocated to each asset type to incorporate predisposed exposure to physical risk



What is an Exposure Rating?

Considers the significance of each climate hazard on a business' operations

Developed based on **qualitative research** and supplemented by ERM's existing knowledge base of **climate-related exposures**

Combined with climate data in the Global Climate Database to produce **risk scores** for each hazard

*Note: The rating **DOES NOT** consider the **likelihood of the event** occurring and only looks to assess how exposed an asset could be if the event type occurred. The rating **DOES NOT** take into account mitigation measures.*

Exposure Rating	Exposure Rating Multiplier	Definition
Very High	10	Exposure to the Climate/Natural Hazard is very high. Potential impacts may: <ul style="list-style-type: none"> • Be long term (possibly permanent), severe and financially significant. • Have extensive social and health implications with national or international reputational impacts. • Affect large areas of the environment over a period of months, impacting high biodiversity areas. It is likely that the entirety of the overall asset would be impacted.
High	8	Exposure to the Climate/Natural Hazard is high. Potential impacts may: <ul style="list-style-type: none"> • Be long term (months) and financially significant to operations. • Have extensive social and health implications with national or international reputational impacts. • Affect large areas of the environment over a period of months impacting high biodiversity areas. It is likely that a large proportion of the overall asset would be impacted.
Moderate	6	Exposure to the Climate/Natural Hazard is moderate. Potential impacts may: <ul style="list-style-type: none"> • Be medium term (weeks) and moderately financially significant to operations. • Have minor/medium social and health implications with local reputational impacts. • Affect moderate areas of the environment over a period of weeks, impacting low biodiversity areas. It is likely that a moderate proportion of the overall asset would be impacted.
Low	4	Exposure to the Climate/Natural Hazard is low. Potential impacts may: <ul style="list-style-type: none"> • Be short term (days) and not financially significant to operations. • Have minimal social and health implications with limited reputational impacts. • Affect small areas of the environment over a short period. It is likely that a small proportion of the overall asset would be impacted.
Minimal	2	Exposure to the Climate/Natural Hazard is minimal with limited potential effects to assets.
N/A	0	Exposure to the Climate/Natural Hazard is not relevant with no potential effects to assets.



Exposure Ratings

Below are default exposure ratings for individual physical hazards of 39 asset group type covered in this physical risk assessment.



Hazard	Indicator (Unit)
Extreme Heat	Warm Spell Duration Index (WSDI) (days)
Extreme Winds & Storms	Maximum Tropical Cyclone Windspeed (knots)
River Flooding	River Flooding Inundation Depth (metres)
Rainfall Flooding	Pluvial Flooding Inundation Depth (metres)
Coastal & Offshore	Coastal Flooding Inundation Depth (metres)
Coastal & Offshore	Extreme Total Water Level (ETWL) (metres)
Coastal & Offshore	Waves Height (metres)
Coastal & Offshore	Ocean Current (metre/seconds)

Exposure Ratings

The corresponding exposure rating multipliers (the table at bottom right-next slide) are used jointly with the normalized scenario indicators to derive hazard type risk scores.

Asset Group Types	Extreme Heat	Extreme Winds & Storms	Rainfall flooding	Riverine flooding	Coastal Flooding	Extreme Total Water level	Waves	Currents
Berth: Nearshore	Low	Moderate	Low	Low	High	High	High	Moderate
Building: Data Center-Nearshore	Very High	High	Moderate	Moderate	High	High	Moderate	N/A
Building: Maintenance Repair Nearshore	High	High	Moderate	Moderate	High	High	Moderate	N/A
Building: Office	High	High	Moderate	Moderate	High	High	Low	N/A
Building: Office Nearshore	High	High	Moderate	Moderate	High	High	Low	N/A
Building: Operational	High	High	Moderate	Moderate	High	High	Low	N/A
Building: Operational-Nearshore	High	High	Moderate	Moderate	High	High	Moderate	N/A
Drainage System	Moderate	N/A	High	Low	High	High	Moderate	N/A
Equipment: Nearshore	High	High	Low	Moderate	High	High	High	Low
Equipment: Onshore	High	High	Moderate	Moderate	High	High	Low	N/A
Jetty: Nearshore	Low	High	Low	Moderate	Moderate	High	Very High	Very High
Manufacturing: Chemicals	Very High	High	High	High	High	High	Low	N/A
Manufacturing: Food Nearshore	High	High	High	Moderate	High	High	Moderate	N/A
Manufacturing: LPG	High	High	High	High	High	High	Low	N/A
Manufacturing: LPG Nearshore	High	High	High	High	High	High	Moderate	N/A
Manufacturing: Other	High	High	High	Moderate	High	High	Low	N/A
Openwater: Nearshore	Low	High	Low	Moderate	Moderate	High	High	Very High
Power: Substation	High	High	High	High	High	High	Low	N/A
Power: Substation DG	Very High	High	High	High	High	High	Low	N/A
Power: Substation NearRiver	High	High	High	Very High	Very High	Very High	Moderate	N/A
Power: Substation Nearshore	High	High	High	High	Very High	Very High	Moderate	N/A
Power: Substation Solar	Moderate	Moderate	Low	Low	Low	Low	N/A	N/A
Revetment: Onshore	Moderate	High	Low	Low	Very High	Very High	Very High	Moderate
Sewerage System	Low	N/A	High	Low	High	High	Low	N/A
Telecommunications Services	High	High	Moderate	Moderate	High	High	Low	N/A
Telecommunications Services: Nearshore	High	High	Moderate	Moderate	High	High	Moderate	N/A
Transport: Waterways	Moderate	High	High	High	High	High	High	Very High
Warehouses: Covered	High	High	Moderate	Moderate	High	High	Low	N/A
Warehouses: Covered Nearshore	High	High	Moderate	Moderate	High	High	Moderate	N/A
Warehouses: Dock Depot	High	High	High	Moderate	High	High	Low	N/A
Warehouses: Fuel	Very High	High	High	High	High	High	Low	N/A
Warehouses: Fuel Nearshore	Very High	High	High	High	High	High	Low	N/A
Warehouses: Uncovered	High	High	High	Moderate	High	High	Low	N/A
Warehouses: Uncovered Nearshore	High	High	High	Moderate	High	High	Moderate	N/A
Water Supply	High	High	High	High	Moderate	High	Low	N/A
Wharf: Nearshore	Low	Moderate	Low	Moderate	High	High	High	Moderate

Exposure Rating Multiplier					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Detailed exposure rating of each asset groups types are given in Appendix E

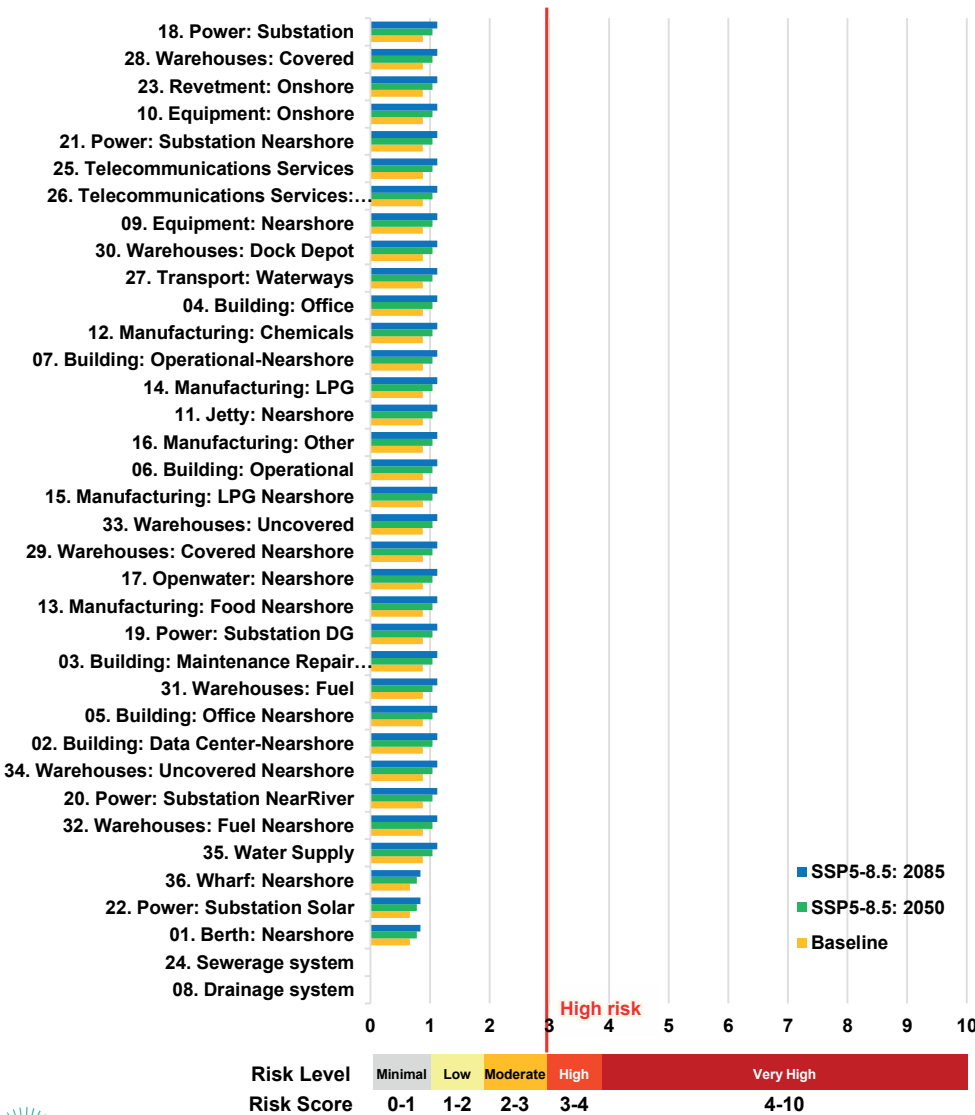


Appendix C: Hazard Risk Score

BASELINE AND PROJECTED RISK SCORES BY ASSET GROUP TYPES- FIVE KEY HAZARDS

Extreme Winds & Storms: Baseline and Projected Risk Scores by Asset Group Types

Risk Profile of 36 Asset Group Types



Key Trends & Risks

The table shows the evolution of asset averaged risk scores for **Extreme Winds & Storms** across various asset types under baseline conditions and projected climate scenarios (**SSP5-8.5** for **2050** and **2085**).

Overall Trend

The average risk score increases modestly from **0.81** at baseline to **0.95** in 2050 and **1.03** in 2085, representing a **15% rise by 2050** and **21% by 2085**. While the escalation is less pronounced compared to other hazards, it signals a gradual increase in wind-related risks over time.

Risk Level

Most assets remain within the **Minimal to Low risk range (0–2)** throughout the projection period. However, the consistent upward trend suggests that even low-risk assets may require attention to maintain resilience.

Assets with Noticeable Change

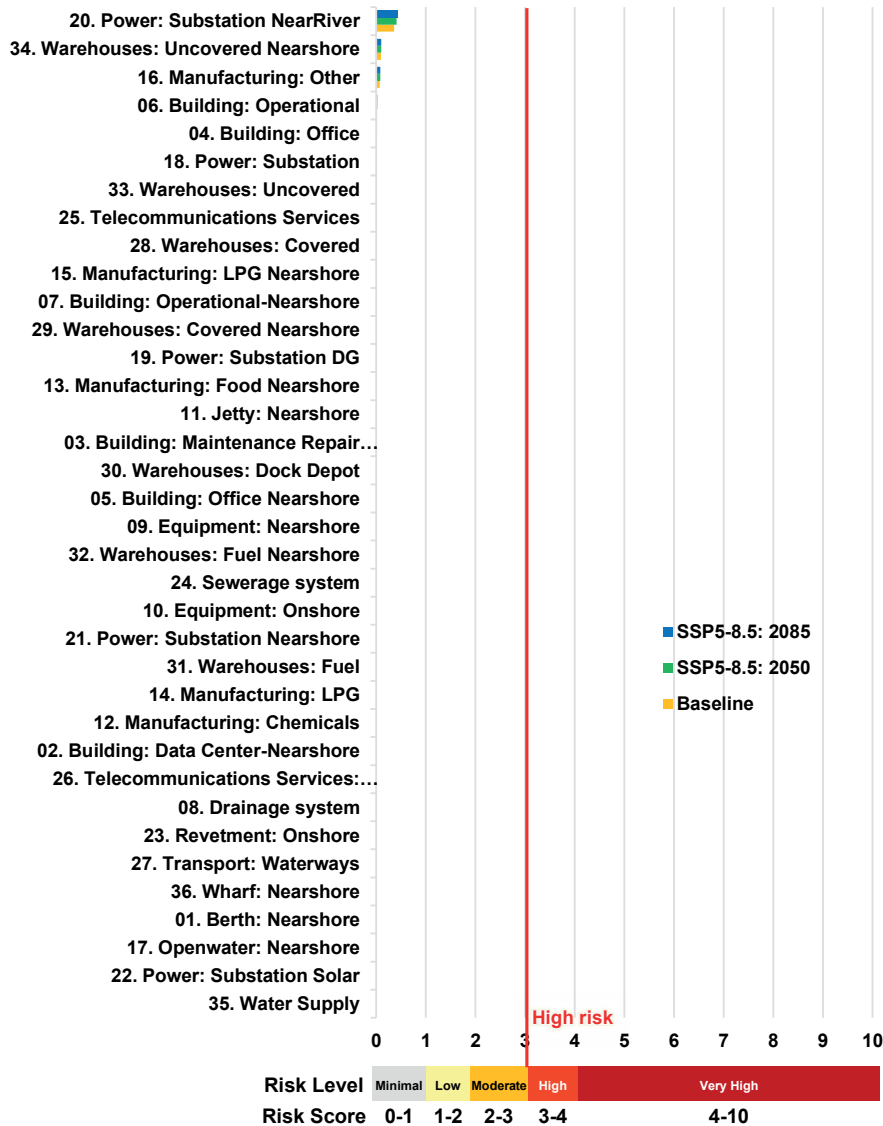
- **Nearshore Berths and Wharves** show slight increases from **0.66** to **0.84** by 2085.
- **Buildings (Data Centers, Offices, Operational)** and **Manufacturing Facilities** rise from **0.88** to **1.12**, moving closer to the upper bound of the **Low risk category**.
- **Power Substations** and **Telecommunication Services** follow similar patterns, reaching **1.12** by 2085.

Asset Type	Baseline	2050	2085
Asset Averaged Risk Score	0.81	0.95	1.03
% Change from Baseline		15%	21%



Rainfall Flooding: Baseline and Projected Risk Scores by Asset Group Types

Risk Profile of 36 Asset Group Types



Key Trends & Risks

The table illustrates the change in asset-averaged risk scores for Rainfall Flooding across various asset types under baseline conditions and projected climate scenarios (SSP5-8.5 for 2050 and 2085).

Overall Trend

The average risk score remains very low, increasing only slightly from **0.01** at baseline to **0.01** in 2050 and **0.01** in 2085. This indicates that rainfall-induced flooding poses **minimal risk** to most assets under the projected scenarios.

Risk Level

All assets remain within the **Minimal risk category (0–1)** throughout the projection period. The changes are negligible compared to other hazards, suggesting that rainfall flooding is not a major driver of vulnerability for these asset types.

Assets with Slight Change

- **Power Substation Near River** shows the highest relative increase, from **0.36** to **0.43** by 2085, though still within minimal risk.
- **Manufacturing (Other)** and **Warehouses (Uncovered)** exhibit minor changes, moving from **0.07–0.10** range.
- Most other assets, including **Buildings**, **Telecommunication Services**, and **Drainage Systems**, remain at **0.00**, indicating no significant projected impact.

Asset Type	Baseline	2050	2085
Asset Averaged Risk Score	0.01	0.01	0.01
% Change from Baseline		0%	0%



Riverine Flooding: Baseline and Projected Risk Scores by Asset Group Types

Risk Profile of 36 Asset Group Types



Key Trends & Risks

The table presents the asset averaged risk scores for **Riverine Flooding** across various asset types under **baseline** conditions and projected climate scenarios (**SSP5-8.5** for **2050** and **2085**).

Overall Trend

The average risk score remains **almost nil** across all timeframes, indicating **no measurable increase** in riverine flooding risk for the assessed assets under the projected scenarios. This suggests that riverine flooding is not a significant hazard for these asset types within the study area.

Risk Level

All assets consistently fall within the **Minimal risk category (0–1)**, with no observed changes from baseline to 2050 or 2085. This stability contrasts sharply with hazards such as **Extreme Heat**, which show substantial escalation.

Asset Type	Baseline	2050	2085
Asset Averaged Risk Score	0.00	0.00	0.00
% Change from Baseline		0%	0%



Appendix D: Hazard Risk Score

CHANGE FROM BASELINE RISK SCORE

Extreme Winds & Storms: Change from Baseline Risk Score

Risk Profile of 36 Asset Group Types

Asset Group Type	Baseline	2050	2085
01. Berth: Nearshore	0.66	0.12	0.18
02. Building: Data Center-Nearshore	0.88	0.16	0.24
03. Building: Maintenance Repair Nearshore	0.88	0.16	0.24
04. Building: Office	0.88	0.16	0.24
05. Building: Office Nearshore	0.88	0.16	0.24
06. Building: Operational	0.88	0.16	0.24
07. Building: Operational-Nearshore	0.88	0.16	0.24
08. Drainage system	0.00	0.00	0.00
09. Equipment: Nearshore	0.88	0.16	0.24
10. Equipment: Onshore	0.88	0.16	0.24
11. Jetty: Nearshore	0.88	0.16	0.24
12. Manufacturing: Chemicals	0.88	0.16	0.24
13. Manufacturing: Food Nearshore	0.88	0.16	0.24
14. Manufacturing: LPG	0.88	0.16	0.24
15. Manufacturing: LPG Nearshore	0.88	0.16	0.24
16. Manufacturing: Other	0.88	0.16	0.24
17. Openwater: Nearshore	0.88	0.16	0.24
18. Power: Substation	0.88	0.16	0.24
19. Power: Substation DG	0.88	0.16	0.24
20. Power: Substation NearRiver	0.88	0.16	0.24
21. Power: Substation Nearshore	0.88	0.16	0.24
22. Power: Substation Solar	0.66	0.12	0.18
23. Revetment: Onshore	0.88	0.16	0.24
24. Sewerage system	0.00	0.00	0.00
25. Telecommunications Services	0.88	0.16	0.24
26. Telecommunications Services: Nearshore	0.88	0.16	0.24
27. Transport: Waterways	0.88	0.16	0.24
28. Warehouses: Covered	0.88	0.16	0.24
29. Warehouses: Covered Nearshore	0.88	0.16	0.24
30. Warehouses: Dock Depot	0.88	0.16	0.24
31. Warehouses: Fuel	0.88	0.16	0.24
32. Warehouses: Fuel Nearshore	0.88	0.16	0.24
33. Warehouses: Uncovered	0.88	0.16	0.24
34. Warehouses: Uncovered Nearshore	0.88	0.16	0.24
35. Water Supply	0.88	0.16	0.24
36. Wharf: Nearshore	0.66	0.12	0.18
Asset Averaged Risk Score	0.81	0.15	0.22

Key Trends & Risks

The table presents the change in asset averaged risk scores for **Extreme Winds & Storms** across various asset types from the **baseline** to future climate scenarios (**SSP5-8.5 for 2050 and 2085**).

Overall Trend:

The average risk score **increases slightly to 0.15 in 2050** and reaches **0.22 by 2085**. This indicates that wind-related risks remain **very low overall**, with only minimal increases projected over time.

Asset-Level Observations:

Most assets, including **buildings, power substations, warehouses, and manufacturing facilities**, show a consistent pattern of low risk, with scores remaining below **0.25** even under future scenarios.

Drainage systems and sewerage systems maintain negligible risk throughout the assessment.

These findings suggest that **Extreme Winds & Storms** pose limited threat to the assessed infrastructure under SSP5-8.5, though localized vulnerabilities may still require monitoring.

Projected Risk Escalation and Potential Operational Impacts

Extreme Winds & Storms – projected to have a ‘minimal’ risk level by **2050 and 2085** under **SSP5-8.5** scenario. While overall risk remains low, potential impacts under extreme wind and storm conditions include:

- **Structural Stress:** Minor increases in wind intensity could lead to localized damage to exposed components such as roofing, cladding, and nearshore structures.
- **Operational Disruptions:** Temporary interruptions in transport and logistics during storm events, particularly for nearshore berths and wharves.
- **Safety Considerations:** Isolated risks to personnel during severe storm occurrences, requiring adherence to emergency protocols.

Risk level	Minimal	Low	Moderate	High	Very High	
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10	
Change from Baseline Risk Score						
Significant Decrease	Moderate Decrease	Minimal Decrease	No Change	Minimal Increase	Moderate Increase	Significant Increase
-10 to -2	-2 to -1	-1 to -0.25	-0.25 to 0.25	+0.25 to +1	+1 to +2	+2 to 10



Rainfall Flooding: Change from Baseline Risk Score

Risk Profile of 36 Asset Group Types

Asset Group Type	Baseline	2050	2085
01. Berth: Nearshore	0.00	0.00	0.00
02. Building: Data Center-Nearshore	0.00	0.00	0.00
03. Building: Maintenance Repair Nearshore	0.00	0.00	0.00
04. Building: Office	0.01	0.00	0.00
05. Building: Office Nearshore	0.00	0.00	0.00
06. Building: Operational	0.02	0.00	0.00
07. Building: Operational-Nearshore	0.00	0.00	0.00
08. Drainage system	0.00	0.00	0.00
09. Equipment: Nearshore	0.00	0.00	0.00
10. Equipment: Onshore	0.00	0.00	0.00
11. Jetty: Nearshore	0.00	0.00	0.00
12. Manufacturing: Chemicals	0.00	0.00	0.00
13. Manufacturing: Food Nearshore	0.00	0.00	0.00
14. Manufacturing: LPG	0.00	0.00	0.00
15. Manufacturing: LPG Nearshore	0.00	0.00	0.00
16. Manufacturing: Other	0.07	0.01	0.01
17. Openwater: Nearshore	0.00	0.00	0.00
18. Power: Substation	0.01	0.00	0.00
19. Power: Substation DG	0.00	0.00	0.00
20. Power: Substation NearRiver	0.36	0.05	0.07
21. Power: Substation Nearshore	0.00	0.00	0.00
22. Power: Substation Solar	0.00	0.00	0.00
23. Revetment: Onshore	0.00	0.00	0.00
24. Sewerage system	0.00	0.00	0.00
25. Telecommunications Services	0.01	0.00	0.00
26. Telecommunications Services: Nearshore	0.00	0.00	0.00
27. Transport: Waterways	0.00	0.00	0.00
28. Warehouses: Covered	0.00	0.00	0.00
29. Warehouses: Covered Nearshore	0.00	0.00	0.00
30. Warehouses: Dock Depot	0.00	0.00	0.00
31. Warehouses: Fuel	0.00	0.00	0.00
32. Warehouses: Fuel Nearshore	0.00	0.00	0.00
33. Warehouses: Uncovered	0.01	0.00	0.01
34. Warehouses: Uncovered Nearshore	0.09	0.01	0.01
35. Water Supply	0.00	0.00	0.00
36. Wharf: Nearshore	0.00	0.00	0.00
Asset Averaged Risk Score	0.01	0.00	0.00

Key Trends & Risks

The table illustrates the change in aggregated risk scores for **Rainfall Flooding** across various asset types from the **baseline** to future climate scenarios (**SSP5-8.5 for 2050 and 2085**).

Overall Trend:
The average risk score shows a across all timeframes (baseline, 2050, and 2085), indicating **no significant change** in rainfall flooding risk under the assessed climate scenario.

Asset-Level Observations:
Nearly all assets—including **buildings, power substations, warehouses, and manufacturing facilities**—maintain a risk score of **0.00-0.01**, with only negligible increases (up to **0.07**) for a near river power substations by 2085.

Drainage and sewerage systems remain unaffected, reflecting minimal exposure to rainfall-induced flooding in this context.

These findings suggest that **Rainfall Flooding** poses **no material risk** to the assessed infrastructure under SSP5-8.5, though localized vulnerabilities should still be monitored as part of broader flood resilience planning.

Projected Risk Escalation and Potential Operational Impacts

Rainfall Flooding – projected to have a ‘**minimal**’ risk level by **2050 and 2085** under **SSP5-8.5** scenario. Given the negligible risk scores, rainfall flooding is not expected to cause significant operational or structural impacts. However, potential considerations include:

Localized Drainage Issues:
Minor water accumulation in low-lying areas during extreme rainfall events.

Operational Disruptions:
Temporary delays in transport or site access during heavy precipitation.

Risk level	Minimal	Low	Moderate	High	Very High	
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10	
Change from Baseline Risk Score						
Significant Decrease	Moderate Decrease	Minimal Decrease	No Change	Minimal Increase	Moderate Increase	Significant Increase
-10 to -2	-2 to -1	-1 to -0.25	-0.25 to 0.25	+0.25 to +1	+1 to +2	+2 to 10



Riverine Flooding: Change from Baseline Risk Score

Risk Profile of 36 Asset Group Types

Asset Group Type	Baseline	2050	2085
01. Berth: Nearshore	0.00	0.00	0.00
02. Building: Data Center-Nearshore	0.00	0.00	0.00
03. Building: Maintenance Repair Nearshore	0.00	0.00	0.00
04. Building: Office	0.00	0.00	0.00
05. Building: Office Nearshore	0.00	0.00	0.00
06. Building: Operational	0.00	0.00	0.00
07. Building: Operational-Nearshore	0.00	0.00	0.00
08. Drainage system	0.00	0.00	0.00
09. Equipment: Nearshore	0.00	0.00	0.00
10. Equipment: Onshore	0.00	0.00	0.00
11. Jetty: Nearshore	0.00	0.00	0.00
12. Manufacturing: Chemicals	0.00	0.00	0.00
13. Manufacturing: Food Nearshore	0.00	0.00	0.00
14. Manufacturing: LPG	0.00	0.00	0.00
15. Manufacturing: LPG Nearshore	0.00	0.00	0.00
16. Manufacturing: Other	0.00	0.00	0.00
17. Openwater: Nearshore	0.00	0.00	0.00
18. Power: Substation	0.00	0.00	0.00
19. Power: Substation DG	0.00	0.00	0.00
20. Power: Substation NearRiver	0.00	0.00	0.00
21. Power: Substation Nearshore	0.00	0.00	0.00
22. Power: Substation Solar	0.00	0.00	0.00
23. Revetment: Onshore	0.00	0.00	0.00
24. Sewerage system	0.00	0.00	0.00
25. Telecommunications Services	0.00	0.00	0.00
26. Telecommunications Services: Nearshore	0.00	0.00	0.00
27. Transport: Waterways	0.00	0.00	0.00
28. Warehouses: Covered	0.00	0.00	0.00
29. Warehouses: Covered Nearshore	0.00	0.00	0.00
30. Warehouses: Dock Depot	0.00	0.00	0.00
31. Warehouses: Fuel	0.00	0.00	0.00
32. Warehouses: Fuel Nearshore	0.00	0.00	0.00
33. Warehouses: Uncovered	0.00	0.00	0.00
34. Warehouses: Uncovered Nearshore	0.00	0.00	0.00
35. Water Supply	0.00	0.00	0.00
36. Wharf: Nearshore	0.00	0.00	0.00
Asset Averaged Risk Score	0.00	0.00	0.00

Key Trends & Risks

The table illustrates the change in asset averaged risk scores for **Riverine Flooding** across various asset types from the **baseline** to future climate scenarios (**SSP5-8.5 for 2050 and 2085**).

Overall Trend:

The average risk score remains **0.00** across all timeframes (baseline, 2050, and 2085), indicating **no significant change** in riverine flooding risk under the assessed climate scenario.

Asset-Level Observations:

All assets—including **berths, wharves, nearshore warehouses, operational buildings, power substations, and manufacturing facilities**—maintain a risk score of **0.00**, with no measurable increase projected for 2050 or 2085.

Drainage and sewerage systems also remain unaffected, suggesting minimal exposure to riverine flooding in the current design and location context.

These findings confirm that **Riverine Flooding** poses **no material risk** to the assessed infrastructure under SSP5-8.5, though ongoing monitoring is recommended to address potential changes in river discharge patterns or upstream developments.

Projected Risk Escalation and Potential Operational Impacts

Riverine Flooding – projected to have a ‘**minimal**’ risk level by **2050 and 2085** under **SSP5-8.5** scenario. Given the negligible risk scores, rainfall flooding is not expected to cause significant operational or structural impacts. However, potential considerations include:

Localized Overflow Risks:

Minor water level fluctuations near river-adjacent assets during extreme rainfall or upstream discharge events.

Operational Delays:

Temporary restrictions on cargo movement or vessel berthing if river conditions change unexpectedly.

Risk level	Minimal	Low	Moderate	High	Very High	
Risk Score	0 to 1	1 to 2	2 to 3	3 to 4	4 to 10	
Change from Baseline Risk Score						
Significant Decrease	Moderate Decrease	Minimal Decrease	No Change	Minimal Increase	Moderate Increase	Significant Increase
-10 to -2	-2 to -1	-1 to -0.25	-0.25 to 0.25	+0.25 to +1	+1 to +2	+2 to 10



Appendix E: Exposure Rating

EXPOSURE FOR ALL ASSET GROUP TYPES



Physical Exposure Ratings

Berth: Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Low	Open-water exposure and continuous sea ventilation reduce local heat accumulation along berth decks. Structural and operational components are not highly heat-sensitive.
Extreme Winds & Storms	Moderate	Berths are directly exposed to southwest monsoon winds and thunderstorm gust fronts. Cranes and vessels at berth face moderate wind-related operational constraints but structural tolerance is generally adequate.
Rainfall Flooding	Low	Berth surface is fully open and graded towards drains/sea, limiting water ponding. Minimal equipment at ground level reduces flood vulnerability.
Riverine Flooding	Low	Berths sit on reclaimed coastal frontage with no direct river catchment influence. River discharge points nearby have limited effect on quay platform levels.
Coastal Flooding	High	Directly fronting the Malacca Strait with low freeboard areas near quay edge. Berths are exposed to tidal surges and elevated water levels during monsoon-driven high tides.
Extreme Total Water Level (SLR + tides + surge + waves)	High	Sea-level rise combined with storm surge and wave setup can exceed quay levels during extreme events, especially during King Tide periods. Overtopping risk increases with long-term SLR.
Waves	High	Nearshore berths face open fetch towards southwest monsoon. Long-period swells and wind waves disrupt mooring stability, berthing operations, and crane productivity.
Currents	Moderate	Tidal currents in the Strait influence vessel manoeuvring and berthing alignment. Moderate hydrodynamic forces act on moored vessels, affecting operational safety.

Building: Data Center-Nearshore

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Very High	Data centers are highly sensitive to heat due to cooling demands. Rising temperatures and urban heat island effects significantly increase operational risks and energy costs.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage infrastructure and disrupt power supply, affecting uptime and equipment safety.
Rainfall Flooding	Moderate	Heavy rainfall can cause localized flooding, especially in low-lying nearshore zones, impacting access and electrical systems.
River Flooding	Moderate	Data centers near river mouths (e.g., Klang) may be affected by overflow events and sedimentation.
Coastal Flooding	High	Sea level rise and storm surges pose serious risks to nearshore data centers, especially in areas like Port Klang.
Extreme Total Water Level	High	Combined tidal and surge events can inundate facilities, threatening continuity and data integrity.
Waves	Moderate	While direct wave impact is limited, strong wave action during storms can affect structural integrity and access.
Currents	N/A	Currents have minimal direct impact on fixed nearshore buildings, though they may influence adjacent waterborne systems.



Physical Exposure Ratings

Building: Maintenance Repair Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Nearshore maintenance buildings are exposed to elevated temperatures due to urban heat island effects and proximity to industrial zones. Heat stress affects workers, equipment, and indoor conditions.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms pose risks to structural integrity and operational continuity, especially in exposed coastal zones.
Rainfall Flooding	Moderate	Heavy rainfall can cause localized flooding, particularly in poorly drained nearshore areas, affecting access and equipment.
River Flooding	Moderate	Facilities near river mouths (e.g., Klang, Perak) may be impacted by overflow events and sedimentation.
Coastal Flooding	High	Sea level rise and storm surges threaten low-lying maintenance buildings near ports and coastal zones.
Extreme Total Water Level	High	Combined tidal and surge events can inundate nearshore facilities, affecting operations and safety.
Waves	Moderate	Strong wave action during storms can affect building foundations and access, especially for facilities close to the shoreline.
Currents	N/A	Currents have minimal direct impact on fixed nearshore buildings unless affecting adjacent marine systems.

Building: Office

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Office buildings in urban areas are highly exposed to heat stress due to rising temperatures and the urban heat island effect. This affects energy demand, indoor comfort, and building materials.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage roofs, windows, and external structures, especially in coastal zones.
Rainfall Flooding	Moderate	Heavy rainfall can cause localized flooding, especially in poorly drained urban areas. Office buildings with inadequate stormwater management are at risk.
River Flooding	Moderate	Offices near rivers (e.g., Klang River) may be affected by overflow events, impacting access and infrastructure.
Coastal Flooding	High	Sea level rise and storm surges pose risks to low-lying office buildings near the coast, especially in Selangor.
Extreme Total Water Level	High	Combined effects of tides, surges, and rainfall can inundate office zones, particularly in reclaimed or low-lying areas.
Waves	Low	Direct wave impact is minimal unless the building is extremely close to the shoreline.
Currents	N/A	Currents do not directly affect onshore office buildings.



Physical Exposure Ratings

Building: Office Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Office buildings have indoor workspaces, HVAC systems, and electronic equipment sensitive to prolonged heat. Higher cooling loads and indoor comfort issues drive a high rating.
Extreme Winds & Storms	High	Nearshore locations experience strong monsoon winds; façade, roofing, windows, and external utilities are exposed to uplift and pressure loads. Wind-driven rain can affect building envelopes.
Rainfall Flooding	Moderate	Although elevated above ground, office buildings rely on local drainage. Intense rainfall can cause entrance-level inundation, waterlogging around access areas, and minor disruptions.
Riverine Flooding	Moderate	Proximity to tidal rivers increases exposure during river-water rise and backflow events. Lower ground levels, basements, and access roads face potential inundation.
Coastal Flooding	High	Nearshore office structures are within the coastal influence zone. Elevated high-tide events and storm surges can reach building surrounds, affecting critical access points and utilities.
Extreme Total Water Level (ETWL)	High	ETWL combining tide + surge + wave setup poses intrusion risks at ground floors, electrical rooms, and building entrances. Increased vulnerability due to low coastal buffer.
Waves	Low	Buildings are typically set back from the quay and protected by port structures; wave action rarely reaches the building itself.
Currents	N/A	Not applicable as currents do not physically impact inland structures such as offices.

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Building: Operational

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Operational buildings (e.g., power stations, control centers) are vulnerable to heat stress, which affects equipment, energy demand, and indoor working conditions. Urban heat island effects intensify this risk.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage structural components, disrupt operations, and require costly repairs.
Rainfall Flooding	Moderate	Heavy rainfall can cause localised flooding, especially in poorly drained or low-lying operational zones.
River Flooding	Moderate	Facilities near rivers (e.g., Klang, Perak) may be affected by overflow events, sedimentation, and access issues.
Coastal Flooding	High	Sea level rise and storm surges pose significant risks to coastal operational buildings, especially in Selangor.
Extreme Total Water Level	High	Combined tidal and surge events can inundate operational zones, affecting continuity and safety.
Waves	Low	Direct wave impact is minimal unless the building is located extremely close to the shoreline.
Currents	N/A	Currents do not directly affect onshore operational buildings.



Physical Exposure Ratings

Building: Operational-Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Nearshore operational buildings (e.g., power stations, control centers) are highly exposed to heat stress due to urban heat island effects and proximity to industrial zones. Heat affects equipment, energy demand, and indoor working conditions.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms pose structural risks and operational disruptions, especially in exposed coastal zones.
Rainfall Flooding	Moderate	Heavy rainfall can cause localized flooding, particularly in low-lying or poorly drained nearshore areas.
River Flooding	Moderate	Buildings near river mouths (e.g., Klang, Perak) may be affected by overflow events and sedimentation.
Coastal Flooding	High	Sea level rise and storm surges threaten infrastructure and continuity of operations in nearshore zones.
Extreme Total Water Level	High	Combined tidal and surge events can inundate operational buildings, affecting safety and functionality.
Waves	Moderate	While direct wave impact is less than offshore structures, strong wave action during storms can affect building foundations and access.
Currents	N/A	Currents have limited direct impact on fixed nearshore buildings, though they may influence adjacent waterborne systems.

Drainage System

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Moderate	Prolonged heat accelerates drying, cracking, and shrinkage of concrete drains; can also harden sediments and reduce hydraulic efficiency. Impacts are present but not severe.
Extreme Winds & Storms	High	Strong winds and storms increase debris loading (leaves, branches, litter) into drains, causing blockages and reduced flow capacity. Storm-driven inflows also exceed system limits.
Rainfall Flooding	High	Drainage networks are directly exposed to intense rainfall. High rainfall overwhelms design capacity, causing surcharging, backflow, and localized flooding around critical assets.
Riverine Flooding	High	When river levels rise, backflow enters the drainage system through outfalls, reducing discharge capacity and causing internal flooding. Tidal/river interfaces are particularly vulnerable.
Coastal Flooding	High	Coastal storm tides elevate downstream water levels, preventing drains from outflowing and causing seawater intrusion into the network. High likelihood of backflow and system overload.
Extreme Total Water Level (ETWL)	High	ETWL (tide + surge + setup) frequently exceeds drain outfall elevations, resulting in backflow, pressurization of pipes, and widespread drainage failure during extreme events.
Waves	Moderate	Wave action near outfalls can push water back into the drainage pipes and damage exposed sections. Risk is moderate where drains discharge close to shoreline.
Currents	Moderate	Strong tidal currents at outfalls hinder discharge efficiency and increase backflow potential, particularly during spring tides. Effects moderate but operationally relevant.



Physical Exposure Ratings

Equipment: Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Nearshore equipment (e.g., cranes, pumps, sensors) may suffer from heat-induced wear, reduced efficiency, and increased cooling demands. Urban heat island effects near ports intensify this risk.
Extreme Winds & Storms	High	Equipment is vulnerable to damage from strong winds and storm surges, especially during monsoon seasons.
Rainfall Flooding	Low	Direct impact is limited unless equipment is located in low-lying or poorly drained areas.
River Flooding	Moderate	Equipment near river mouths (e.g., Klang, Perak) may be affected by sedimentation, corrosion, and access issues during floods.
Coastal Flooding	High	Sea level rise and storm surges pose risks to fixed and mobile equipment near the shoreline.
Extreme Total Water Level	High	Combined tidal and surge events can submerge or damage sensitive equipment, especially in shallow nearshore zones.
Waves	High	Wave action can cause mechanical stress, corrosion, and operational disruption to exposed equipment.
Currents	Low	Strong currents affect moored or floating equipment, influence sediment transport, and increase maintenance needs.

Equipment: Onshore

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Onshore equipment in urban and industrial zones is highly vulnerable to heat stress, especially due to the urban heat island effect. Heat can degrade materials, reduce efficiency, and increase cooling demands.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage exposed equipment, disrupt operations, and increase maintenance costs.
Rainfall Flooding	Moderate	Heavy rainfall can cause localized flooding, affecting equipment in low-lying or poorly drained areas.
River Flooding	Moderate	Equipment near riverbanks (e.g., Klang River) may be impacted by sedimentation, corrosion, and access issues during floods.
Coastal Flooding	High	Sea level rise and storm surges pose significant risks to onshore infrastructure and equipment in coastal zones.
Extreme Total Water Level	High	Combined tidal and surge events can inundate equipment, especially in low-lying industrial areas.
Waves	Low	Direct wave impact is minimal for inland onshore equipment, unless located very close to the shoreline.
Currents	N/A	Currents have limited direct impact on fixed onshore equipment, unless affecting adjacent waterborne systems.



Physical Exposure Ratings

Jetty: Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Low	Open marine structure with full airflow; jetty components (steel, concrete, ladders, fenders) have low sensitivity to heat and do not trap thermal loads.
Extreme Winds & Storms	High	Jetty platforms are directly exposed to monsoon winds and storm conditions. Wind-driven waves and vessel movement increase structural and operational stresses, especially during berthing.
Rainfall Flooding	Low	Rain drains freely off the jetty deck into the sea. No dependence on land-based drainage systems; no ponding risk on the structure.
Riverine Flooding	Moderate	Elevated river levels during heavy upstream discharge can affect jetties located near river mouths. Increased flow velocity and water levels can challenge vessel approach and jetty access.
Coastal Flooding	High	Jetties have low deck levels relative to sea elevation, making them highly exposed to storm tides, overtopping, and splash-inundation during monsoon surge events.
Extreme Total Water Level (ETWL)	High	Combined tide + surge + wave setup reduces freeboard and increases overtopping frequency. ETWL events cause mooring strain, fender submergence, and temporary shutdown of jetty operations.
Waves	Moderate	Jetties face more direct wave action than inland structures. While partial harbour sheltering exists, wave heights rise significantly during monsoon winds, affecting berthing safety.
Currents	Moderate	Tidal currents influence vessel positioning, berthing alignment, and mooring line loads. Stronger currents during spring tides can affect jetty accessibility and operational windows.

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Manufacturing: Chemicals

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Very High	Chemical manufacturing is highly sensitive to heat due to risks of thermal expansion, pressure buildup, and volatility of stored chemicals. Heat stress also affects worker safety and equipment reliability.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage chemical tanks, pipelines, and safety systems, increasing the risk of leaks or explosions.
Rainfall Flooding	High	Heavy rainfall can flood chemical plants, compromise containment systems, and contaminate nearby water sources.
River Flooding	High	Facilities near rivers (e.g., Klang, Perak) are vulnerable to overflow events that can damage infrastructure and lead to environmental hazards.
Coastal Flooding	High	Sea level rise and storm surges pose serious risks to coastal chemical manufacturing zones, especially in industrial hubs like Port Klang.
Extreme Total Water Level	High	Combined tidal and surge events can inundate chemical facilities, increasing risks of leakage, contamination, and fire.
Waves	Low	Direct wave impact is limited but can affect infrastructure near the shoreline during storm events.
Currents	N/A	Currents have minimal direct impact unless affecting adjacent marine transport systems or intake structures.



Physical Exposure Ratings

Manufacturing: Food Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Food manufacturing is highly sensitive to heat due to cooling requirements, spoilage risks, and worker health. Nearshore facilities face intensified heat stress from urban heat island effects and humidity.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage infrastructure, disrupt supply chains, and halt production.
Rainfall Flooding	High	Heavy rainfall can flood nearshore manufacturing zones, affecting raw material storage, machinery, and access routes.
River Flooding	Moderate	Facilities near river mouths (e.g., Klang, Perak) may be impacted by overflow events and sedimentation.
Coastal Flooding	High	Sea level rise and storm surges pose serious risks to low-lying food manufacturing plants near ports and coastal zones.
Extreme Total Water Level	High	Combined tidal and surge events can inundate facilities, affecting operations, food safety, and logistics.
Waves	Moderate	Strong wave action during storms can affect access and structural integrity of nearshore facilities.
Currents	N/A	Currents have minimal direct impact unless affecting adjacent marine transport systems.

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Manufacturing: LPG

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	LPG manufacturing and storage are highly sensitive to heat due to pressure buildup risks, increased evaporation, and fire hazards. Rising temperatures and urban heat intensify these risks.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage tanks, pipelines, and safety systems, increasing the risk of leaks or explosions.
Rainfall Flooding	High	Heavy rainfall can flood LPG facilities, compromise containment systems, and disrupt operations.
River Flooding	High	Facilities near rivers (e.g., Klang, Perak) are vulnerable to overflow events that can damage infrastructure and lead to environmental hazards.
Coastal Flooding	High	Sea level rise and storm surges pose serious risks to coastal LPG manufacturing zones, especially in industrial hubs like Port Klang [cidb.gov.my].
Extreme Total Water Level	High	Combined tidal and surge events can inundate LPG facilities, increasing risks of leakage, contamination, and fire.
Waves	Low	Direct wave impact is limited but can affect infrastructure near the shoreline during storm events.
Currents	N/A	Currents have minimal direct impact unless affecting adjacent marine transport systems.



Physical Exposure Ratings

Manufacturing: LPG Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	LPG handling systems, compressors, pumps, and storage cylinders are sensitive to heat. Elevated temperatures increase tank pressure, equipment fatigue, and safety-control loading.
Extreme Winds & Storms	High	Nearshore exposure increases wind loading on piping racks, elevated platforms, and outdoor equipment. Storms raise risk of mechanical damage, leaks, and ignition if protective barriers are compromised.
Rainfall Flooding	High	Heavy rainfall can inundate low-lying processing areas, affecting electrical cabinets, control panels, and pumps. Floodwater increases corrosion and heightens risk around hazardous materials.
Riverine Flooding	High	Nearshore LPG facilities close to river influence zones face backflow and elevated water levels that can reach process areas, impacting equipment integrity and emergency access routes.
Coastal Flooding	Very High	LPG facilities are highly sensitive to seawater intrusion. Coastal flooding can submerge critical valves, electrical systems, and tank foundations, significantly increasing fire and explosion risk.
Extreme Total Water Level (ETWL)	High	ETWL events (tide + surge + wave setup) can exceed platform grades, exposing LPG systems to dangerous flooding conditions. This increases operational shutdowns and emergency hazards.
Waves	Moderate	Wave action near the shoreline can impact exposed pipelines or jetty-connected LPG transfer systems. Facilities set back from the waterfront experience reduced but still relevant exposure.
Currents	Moderate	Strong tidal currents affect marine LPG transfer lines and berthing operations. While onshore equipment is not directly affected, jetty-linked systems face operational risks during transfer.

Manufacturing: Other

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Moderate	General manufacturing areas contain machinery, electrical panels, and workers affected by prolonged heat, but less thermally sensitive than LPG/chemical facilities. Higher cooling demand and worker fatigue are the primary concerns.
Extreme Winds & Storms	High	Many manufacturing structures are lightweight steel buildings with large wall/roof surfaces exposed to uplift forces. Storm winds also affect external equipment yards, loading zones, and utilities.
Rainfall Flooding	High	Typically located on low/flat industrial platforms that depend on site drainage. Intense rainfall can cause floor-level flooding, affecting equipment, production lines, and finished goods storage.
Riverine Flooding	Moderate	Nearshore manufacturing areas close to tidal rivers may experience water-level rise and backflow at drainage outlets. While not as sensitive as hazardous-material facilities, operations and access may still be disrupted.
Coastal Flooding	High	High-tide events and storm surges can inundate surrounding yards and building entrances. Floodwater may affect electrical systems, conveyor areas, and ground-level machinery.
Extreme Total Water Level (ETWL)	High	ETWL can exceed platform elevation, causing seawater intrusion into production floors, damaging equipment and interrupting operations. Vulnerability increases with limited coastal buffer.
Waves	Low	Manufacturing buildings are typically set back from the shoreline and shielded by port structures; wave energy rarely reaches the facility itself.
Currents	N/A	Currents have no direct impact on land-based manufacturing operations or equipment.



Physical Exposure Ratings

Openwater: Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Low	Rising sea surface temperatures have led to coral bleaching and harmful algal blooms, especially near Penang and Port Dickson.
Extreme Winds & Storms	High	Monsoonal winds and occasional tropical storms impact wave dynamics and coastal mixing.
Rainfall Flooding	Low	Direct impact on open waters is limited, though nutrient runoff from heavy rains can trigger algal blooms.
River Flooding	Moderate	Rivers like the Klang and Perak influence salinity and nutrient levels in adjacent nearshore zones.
Coastal Flooding	Moderate	Sea level rise and storm surges affect infrastructure and ecosystems along the west coast.
Extreme Total Water Level	High	Combined effects of tides, storm surges, and sea level rise are significant in shallow shelf areas like the Straits of Malacca.
Waves	High	Monsoonal and storm-driven waves affect sediment transport and coastal morphology.
Currents	Very High	Currents in the Straits of Malacca are vital for nutrient cycling, larval transport, and ecosystem connectivity.

Power: Substation

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Substations are sensitive to heat stress, which affects transformer efficiency, cooling systems, and increases risk of equipment failure. Urban heat island effects intensify this risk.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage substation structures, overhead lines, and control systems, leading to outages.
Rainfall Flooding	High	Heavy rainfall can flood substations, especially in low-lying or poorly drained areas, affecting electrical safety and continuity.
River Flooding	High	Substations near rivers (e.g., Klang, Perak) are vulnerable to overflow events that can damage infrastructure and disrupt power supply.
Coastal Flooding	High	Sea level rise and storm surges pose serious risks to coastal substations, especially in industrial zones like Port Klang.
Extreme Total Water Level	High	Combined tidal and surge events can inundate substations, affecting operations and safety.
Waves	Low	Direct wave impact is limited but can affect substations located very close to the shoreline during storm events.
Currents	N/A	Currents have minimal direct impact unless affecting adjacent marine infrastructure or intake systems.



Physical Exposure Ratings

Power: Substation DG

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Very High	DG substations are highly sensitive to heat due to reliance on electronics, inverters, and cooling systems. Rising temperatures and urban heat island effects increase failure risks and reduce efficiency.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage rooftop solar arrays, wind turbines, and associated DG infrastructure, disrupting supply and safety.
Rainfall Flooding	High	Heavy rainfall can flood DG substations, especially in low-lying or poorly drained areas, affecting electrical safety and continuity.
River Flooding	High	DG systems near rivers (e.g., Klang) are vulnerable to overflow events and sedimentation, which can damage infrastructure and cause outages.
Coastal Flooding	High	Sea level rise and storm surges pose serious risks to DG substations located near coastal zones or ports.
Extreme Total Water Level	High	Combined tidal, surge, and rainfall events can inundate DG infrastructure, leading to outages and long-term damage.
Waves	Low	Direct wave impact is limited but can affect DG systems located very close to the shoreline during storm events.
Currents	N/A	Currents have minimal direct impact unless affecting adjacent marine infrastructure or intake systems.

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Power: Substation NearRiver

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Transformers, switchgear, and control panels are heat-sensitive. High temperatures reduce cooling efficiency, increase internal temperatures, and accelerate insulation ageing.
Extreme Winds & Storms	High	Substations contain outdoor transformers, busbars, towers, and cables exposed to strong winds. Storms can topple auxiliary structures, cause conductor oscillation, and damage overhead lines.
Rainfall Flooding	High	Heavy rainfall can inundate substation yards, affecting transformers, RMUs, protection systems, and cable trenches. Water ingress risks short circuits and extended outages.
Riverine Flooding	Very High	Being near the river significantly increases the risk of overflow and backwater flooding reaching electrical equipment. Even shallow flooding can cause catastrophic failures and long shutdowns.
Coastal Flooding	Very High	If the river is tidally influenced, storm surges propagate upstream and raise water levels around the substation. Critical components sit close to ground level, increasing exposure.
Extreme Total Water Level (ETWL)	Very High	ETWL pushes tidal/river levels well above normal, creating severe inundation risk. Submersion of transformers and switchgear results in total electrical failure and long-term rehabilitation needs.
Waves	Moderate	Substations are inland from the shoreline; wave action does not typically reach the asset. Only minimal risk at riverbank edges where minor wave agitation may occur.
Currents	N/A	Strong river currents increase bank erosion, potentially undermining foundations, cable routes, or access roads. Does not directly affect electrical equipment but contributes to site instability.



Physical Exposure Ratings

Power: Substation Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Nearshore substations are exposed to elevated temperatures, which affect transformer efficiency, increase cooling demands, and raise fire risk. Urban heat island effects intensify this exposure.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage substation structures, disrupt power supply, and increase maintenance needs.
Rainfall Flooding	High	Heavy rainfall can flood low-lying nearshore substations, compromising electrical safety and continuity of operations.
River Flooding	High	Substations near river mouths (e.g., Klang, Perak) are vulnerable to overflow events and sedimentation, which can damage infrastructure.
Coastal Flooding	Very High	Sea level rise and storm surges pose severe risks to nearshore substations, especially in industrial zones like Port Klang.
Extreme Total Water Level	Very High	Combined tidal and surge events can inundate substations, leading to outages and long-term damage.
Waves	Moderate	Strong wave action during storms can affect access and structural integrity of substations located close to the shoreline.
Currents	N/A	Currents have minimal direct impact unless affecting adjacent marine infrastructure or intake systems.

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Power: Substation Solar

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Low	Solar substations typically have minimal indoor heat-sensitive equipment. Heat may reduce inverter efficiency slightly, but overall systems are designed for high-temperature outdoor operation.
Extreme Winds & Storms	Moderate	Solar substations include lightweight structures, cable trays, and inverter units that can be affected by strong winds. Equipment is outdoors, but risks remain lower than grid substations with tall structures.
Rainfall Flooding	Low	Solar substations are usually sited on elevated, graded platforms with good drainage. Rainwater rarely affects electrical components mounted above ground.
Riverine Flooding	Low	Not typically located near riverbanks; platforms are chosen to avoid fluvial flood zones. Minimal exposure unless adjacent access roads are affected.
Coastal Flooding	Low	Solar farms/substations are generally inland with buffers from the coastline. Limited exposure to storm tides or saltwater inundation.
Extreme Total Water Level (ETWL)	Low	ETWL impacts are minimal unless site elevation is very low. Most solar substations are positioned well above high-water levels.
Waves	N/A	As an inland electrical installation, wave action has no direct physical impact.
Currents	N/A	Not applicable; no interaction with marine or river currents.



Physical Exposure Ratings

Revetment: Onshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Moderate	Revetments are generally resilient to heat, but prolonged exposure may affect material integrity (e.g., concrete, geotextiles) over time.
Extreme Winds & Storms	High	Strong winds and storm surges can increase wave energy and overtopping, stressing revetment structures.
Rainfall Flooding	Low	Revetments are not directly affected by inland rainfall unless combined with poor drainage or runoff from adjacent land.
River Flooding	Low	Exposure depends on proximity to river mouths; generally low unless near estuarine zones.
Coastal Flooding	Very High	Revetments are frontline defenses against coastal flooding. Rising sea levels and storm surges increase overtopping and erosion risks.
Extreme Total Water Level	Very High	Combined effects of tides, surges, and sea level rise challenge the design limits of existing revetments, requiring elevation or reinforcement.
Waves	Very High	Revetments are directly exposed to wave action, especially during monsoons and storms. Wave energy influences erosion and structural wear.
Currents	Moderate	Coastal currents can influence sediment transport and scouring around revetment bases, affecting long-term stability.

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Sewerage System

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Low	Sewerage networks are predominantly underground and not heat-sensitive. Minor impacts include accelerated pipe material ageing and odour generation during prolonged heat.
Extreme Winds & Storms	High	Storm events increase debris and sediment inflow into manholes and pump stations. Power loss and storm surges can disrupt pumping operations and overload treatment units.
Rainfall Flooding	High	Heavy rainfall rapidly overloads sewer lines, causing surcharge, manhole overflow, and infiltration. Mixed stormwater inflow increases treatment volume and risk of system failure.
Riverine Flooding	Low	Sewer systems are usually below-ground and protected, but prolonged river flooding can infiltrate through manholes and joints, increasing hydraulic load on pipes and pump stations.
Coastal Flooding	High	Coastal floodwaters enter manholes, lift stations, and treatment plant inlets. Saltwater intrusion damages biological processes, pumps, electrical units, and pipe integrity.
Extreme Total Water Level (ETWL)	High	ETWL pushes water above manhole covers and outfall elevations, causing significant backflow, infiltration, and system surcharging across multiple network segments.
Waves	Low	Minimal direct impact because assets are underground. Only exposed outfalls near the coast may experience wave splash or structural scouring.
Currents	N/A	Not applicable. Currents do not directly affect buried sewerage infrastructure except at marine outfalls, where the impact remains negligible.



Physical Exposure Ratings

Telecommunications Services

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Heat stress increases cooling demands for base stations, data centers, and network equipment. Urban heat island effects intensify risks in built-up areas.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage towers, disrupt service, and affect power supply.
Rainfall Flooding	Moderate	Heavy rainfall can flood access roads and low-lying infrastructure, affecting maintenance and service continuity.
River Flooding	Moderate	Infrastructure near rivers (e.g., Klang, Perak) may be impacted by overflow events and sedimentation.
Coastal Flooding	High	Sea level rise and storm surges pose risks to coastal telecom infrastructure, especially in Selangor and Penang.
Extreme Total Water Level	High	Combined tidal and surge events can inundate telecom facilities, affecting uptime and safety.
Waves	Low	Direct wave impact is minimal unless infrastructure is located extremely close to the shoreline.
Currents	N/A	Currents do not directly affect terrestrial telecom infrastructure.

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Telecommunications Services – Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Very High	Nearshore telecom infrastructure (e.g., base stations, relay towers, data hubs) is highly vulnerable to heat stress, especially in urban coastal zones. Heat increases cooling demands and risks equipment failure.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage towers, disrupt service, and affect power supply. Coastal exposure amplifies these risks.
Rainfall Flooding	Moderate	Heavy rainfall can flood access roads and low-lying infrastructure, affecting maintenance and service continuity.
River Flooding	Moderate	Infrastructure near river mouths (e.g., Klang, Perak) may be impacted by overflow events and sedimentation.
Coastal Flooding	High	Sea level rise and storm surges pose serious risks to coastal telecom infrastructure, especially in Selangor.
Extreme Total Water Level	High	Combined tidal and surge events can inundate telecom facilities, affecting uptime and safety.
Waves	Moderate	While direct wave impact is limited, strong wave action during storms can affect structural integrity and access.
Currents	N/A	Currents have minimal direct impact on fixed nearshore telecom infrastructure, though they may influence adjacent waterborne systems.



Physical Exposure Ratings

Transport: Waterways

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Moderate	Prolonged heat increases evaporation, reduces water depth marginally, and affects operator comfort for small craft. Infrastructure (jetties, pontoons) remains largely unaffected.
Extreme Winds & Storms	High	Southwest and inter-monsoon winds generate choppy conditions, reducing navigability for small craft and causing service disruption. Wind-driven waves and currents also affect maneuvering safety.
Rainfall Flooding	High	Heavy rainfall increases river discharge and turbidity, reduces visibility, and creates floating debris. Waterway transport slows or stops during intense rainfall episodes.
Riverine Flooding	High	Westports' adjacent rivers can rise rapidly during monsoon and high-flow events, increasing flow velocities and overtopping risk. Strong river influence reduces safe navigation windows.
Coastal Flooding	High	Tide-driven water-level rise and storm surges elevate water depths in navigation channels, affecting docking/embarkation points and increasing the risk of wash-over on low-lying pontoons.
Extreme Total Water Level (ETWL)	High	ETWL significantly alters current strength and water levels, causing hazardous navigation conditions, reduced control of small vessels, and operational shutdowns during extreme events.
Waves	High	During monsoons, wind-driven waves propagate into estuarine and nearshore waterways. Even within partially sheltered areas, wave heights increase vessel roll/pitch and reduce transit safety.
Currents	Very High	Spring-tide and monsoon-enhanced currents greatly affect vessel maneuvering, increase collision/grounding risk, and limit navigation time windows. Small craft navigation becomes unsafe under strong tidal flows.

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Warehouses: Covered

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Covered warehouses are vulnerable to heat buildup, especially in urban and industrial zones. Rising temperatures increase cooling demands, affect stored goods, and reduce worker productivity.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage roofing, walls, and loading infrastructure, especially in coastal areas.
Rainfall Flooding	Moderate	Heavy rainfall can cause localized flooding, especially in poorly drained warehouse zones, affecting access and inventory.
River Flooding	Moderate	Warehouses near rivers (e.g., Klang, Perak) may be impacted by overflow events and sedimentation.
Coastal Flooding	High	Sea level rise and storm surges pose risks to low-lying warehouse facilities near ports and coastal zones.
Extreme Total Water Level	High	Combined tidal and surge events can inundate warehouse zones, affecting operations and stored goods.
Waves	Low	Direct wave impact is minimal unless the warehouse is located extremely close to the shoreline.
Currents	N/A	Currents do not directly affect onshore warehouse structures.



Physical Exposure Ratings

Warehouses: Covered Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Moderate	Large roofed structures trap heat, increasing indoor temperatures and affecting stored goods and workers. Heat can also degrade packaging and reduce ventilation performance.
Extreme Winds & Storms	High	Lightweight steel structures and wide roof spans are vulnerable to uplift, cladding damage, and wind-driven rain ingress. Nearshore winds intensify exposure to structural and operational disruption.
Rainfall Flooding	High	Warehouses rely on yard drainage; intense rainfall can cause water accumulation around loading bays and entrances. Floodwater can damage stored goods, forklifts, and electrical systems.
Riverine Flooding	Moderate	Nearshore sites influenced by river systems face backflow and elevated water levels that may reach warehouse perimeters. Potential for ingress at shutter doors and service ducts.
Coastal Flooding	High	Storm tides and surge can inundate the warehouse surroundings, compromising access, loading operations, and ground-level goods. Saltwater exposure poses corrosion risk to structures and equipment.
Extreme Total Water Level (ETWL)	High	ETWL events exceed yard/platform elevations, allowing seawater to reach loading docks and internal floors. High likelihood of operational shutdown and goods damage during extreme events.
Waves	Low	Warehouses are typically set back from the shoreline and buffered by port infrastructure. Direct wave impact is minimal except for occasional splash in extreme scenarios.
Currents	N/A	No direct interaction between tidal currents and the warehouse structure. Impacts limited to marine areas only.

Warehouses: Dock Depot

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Open-yard dock depots store containers, equipment, and cargo directly exposed to solar heating. Heat accelerates material degradation, affects equipment operators, and increases risk to heat-sensitive goods.
Extreme Winds & Storms	High	Near-coastal depots face strong monsoon winds. High stacks and temporary structures are vulnerable to wind overturning, while storm gusts can displace empty containers and disrupt operations.
Rainfall Flooding	High	Heavy rainfall frequently causes surface flooding and ponding in large open yards. Poor drainage slows water removal, affecting container handling, ground stability, and equipment movement.
Riverine Flooding	Moderate	Dock depots located near tidal river influence zones may experience elevated water levels or backflow into yard drains. Moderate risk due to large ground-contact areas and dependence on drainage outlets.
Coastal Flooding	High	Storm tides and surge can reach dock depot surfaces, particularly low-lying yard zones near wharves. Saltwater intrusion can affect cargo, corrode equipment, and restrict depot operations.
Extreme Total Water Level (ETWL)	High	ETWL (tide + surge + setup) increases yard inundation risk, especially during spring tides. Seawater entry disrupts lifting operations, affects container foundations, and forces temporary shutdowns.
Waves	Low	Depots are inland from the quay line and shielded by port structures; direct wave action does not reach the yard. Only minor spray may occur in extreme monsoon events.
Currents	N/A	Currents do not affect inland dock depot yards. Operational relevance applies only to berths and marine transfer points, not land-based depots.



Physical Exposure Ratings

Warehouses: Fuel

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Very High	Fuel storage is highly sensitive to heat due to risks of evaporation, pressure buildup, and fire hazards. Rising temperatures and urban heat intensify these risks.
Extreme Winds & Storms	High	Strong winds and storms can damage fuel tanks, pipelines, and safety systems, increasing the risk of spills or fires.
Rainfall Flooding	High	Heavy rainfall can flood fuel storage areas, compromise containment systems, and contaminate nearby water sources.
River Flooding	High	Warehouses near rivers (e.g., Klang, Perak) are vulnerable to overflow events that can damage fuel infrastructure and lead to environmental hazards.
Coastal Flooding	High	Sea level rise and storm surges pose serious risks to coastal fuel storage facilities, especially in low-lying industrial zones like Port Klang.
Extreme Total Water Level	High	Combined tidal and surge events can inundate fuel warehouses, increasing risks of leakage, contamination, and fire.
Waves	Low	Direct wave impact is limited but can affect infrastructure near the shoreline during storm events.
Currents	N/A	Currents have minimal direct impact on fixed fuel storage infrastructure unless affecting adjacent marine transport systems.

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Warehouses: Fuel Nearshore

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Very High	Fuel products and associated storage systems are heat-sensitive. High temperatures increase vapour pressure, heighten fire/explosion risk, accelerate material degradation, and stress ventilation/containment systems.
Extreme Winds & Storms	High	Strong monsoon winds expose fuel warehouses to uplift forces, cladding damage, and potential roof failures. Wind-driven rain can infiltrate indoor areas and compromise electrical and fire-safety systems.
Rainfall Flooding	High	Heavy rainfall can inundate loading bays, bunded areas, and transfer points. Water intrusion increases contamination risk, disrupts operations, and may compromise fire-suppression and electrical controls.
Riverine Flooding	High	If located near a river-influenced shoreline, rising river levels can reach the warehouse perimeter and bunded zones. Floodwater can reduce containment effectiveness but full inundation is less frequent.
Coastal Flooding	High	Fuel warehouses are highly sensitive to seawater intrusion. Storm tides and surge can overtop bunds, flood fuel handling areas, and create severe fire and contamination hazards.
Extreme Total Water Level (ETWL)	High	ETWL (tide + surge + setup) raises water levels beyond platform elevation, increasing the likelihood of seawater entering bunds, electrical rooms, and fuel transfer zones, leading to shutdowns.
Waves	Low	Facilities are generally set back from the waterfront and shielded by port structures; direct wave impact on the warehouse is minimal except at exposed transfer lines near jetties.
Currents	N/A	Currents do not directly affect land-based fuel warehouses. Operational relevance is limited to jetty-side marine transfer systems, not the warehouse itself.



Physical Exposure Ratings

Warehouses: Uncovered

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Very High	Uncovered warehouses are highly exposed to direct solar radiation and ambient heat. Without insulation or cooling systems, they pose serious risks to goods, equipment, and worker health.
Extreme Winds & Storms	High	Structural elements like fencing, temporary roofing, and stored materials are vulnerable to damage or displacement during monsoonal winds and tropical storms.
Rainfall Flooding	High	Lack of roofing and drainage systems makes uncovered warehouses highly susceptible to water damage and operational disruption during heavy rainfall.
River Flooding	Moderate	Warehouses near rivers (e.g., Klang, Perak) may be affected by overflow events, sedimentation, and access issues.
Coastal Flooding	High	Sea level rise and storm surges pose significant risks to uncovered storage areas near ports and coastal zones.
Extreme Total Water Level	High	Combined tidal and surge events can inundate uncovered facilities, damaging goods and infrastructure.
Waves	Low	Direct wave impact is minimal unless the warehouse is located extremely close to the shoreline.
Currents	N/A	Currents do not directly affect onshore uncovered warehouse structures.

Warehouses: Uncovered Nearshore

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Very High	Uncovered nearshore warehouses are highly exposed to direct solar radiation and ambient heat. Rising temperatures and urban heat island effects significantly increase risks to stored goods, equipment, and worker health.
Extreme Winds & Storms	High	Monsoonal winds and tropical storms can damage temporary structures, displace stored materials, and disrupt operations.
Rainfall Flooding	High	Lack of roofing and drainage systems makes these warehouses highly vulnerable to water damage during heavy rainfall.
River Flooding	Moderate	Warehouses near river mouths (e.g., Klang, Perak) may be affected by overflow events and sedimentation.
Coastal Flooding	High	Sea level rise and storm surges pose serious risks to low-lying uncovered storage areas near ports and coastal zones.
Extreme Total Water Level	High	Combined tidal and surge events can inundate uncovered facilities, damaging goods and infrastructure.
Waves	Moderate	Strong wave action during storms can affect access and structural integrity of nearshore facilities.
Currents	N/A	Currents have minimal direct impact unless affecting adjacent marine transport systems.



Physical Exposure Ratings

Water Supply

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	High	Rising temperatures increase evaporation rates, reduce reservoir levels, and stress treatment systems. Heat also exacerbates water quality issues due to reduced dilution capacity.
Extreme Winds & Storms	High	Storms can damage water treatment plants, disrupt supply lines, and contaminate sources through overland runoff.
Rainfall Flooding	High	Intense rainfall events cause downstream flooding, damaging dams and treatment facilities, and leading to service interruptions.
River Flooding	High	Riverine floods can overwhelm intake systems, contaminate raw water sources, and damage infrastructure.
Coastal Flooding	Moderate	Coastal water supply systems are vulnerable to saltwater intrusion and infrastructure damage during storm surges.
Extreme Total Water Level	High	Combined effects of tides, surges, and rainfall can inundate water infrastructure, especially in low-lying areas.
Waves	Low	Direct wave impact is minimal unless infrastructure is located very close to the shoreline.
Currents	N/A	Currents have limited direct impact on water supply systems, though they may affect intake structures in coastal zones.

Wharf: Nearshore

Exposure Rating Key					
Very High	High	Moderate	Low	Minimal	N/A
10	8	6	4	2	0

Climatic Indicator	Exposure Rating	Rationale for Rating
Extreme Heat	Low	Open waterfront structure with natural ventilation; concrete deck and steel fixtures have low thermal sensitivity. Minor impacts limited to expansion joints, elastomers, and worker comfort.
Extreme Winds & Storms	Moderate	Monsoon winds influence operations (mooring, cargo handling), but the wharf itself is a robust, low-profile structure designed for lateral loads; primary risk is operational downtime rather than structural damage.
Rainfall Flooding	Low	Wharf deck drains directly to the sea via scuppers/edge discharge; minimal ponding and limited dependence on land drainage networks.
Riverine Flooding	Moderate	Nearshore wharves are primarily marine-exposed; tidal action limits persistent river backflow impacts on the deck. Structural elevations typically exceed river flood stages.
Coastal Flooding	High	Low deck freeboard relative to high tides and storm surges leads to overtopping/splash and temporary access/operational disruption (e.g., wet deck, electrical isolation).
Extreme Total Water Level (ETWL)	High	Combined tide + surge + wave setup reduces freeboard, increases fender submergence and mooring loads, and raises frequency of deck wetting and operational shutdowns.
Waves	High	Usually within sheltered basins protected by breakwaters and harbour geometry; direct wave energy at the quay face is limited except during peak monsoon episodes.
Currents	Moderate	Spring-tide currents affect berth approach, tug assistance, and mooring line tensions; operationally relevant but generally within design allowances.





Thank you

Voon Jye Yng

Partner & Project-in Charge,
ERM Malaysia
Jyeyng.Voon@erm.com

Steve Duckworth

Country Managing Partner,
ERM Malaysia & Brunei
Steve.Duckworth@erm.com

Yulia Dobrolyubova

Partner, Lead for Corporate
Sustainability & Climate Change,
Asia ERM Thailand
Yulia.Dobrolyubova@erm.com

Dr. Venkat Kolluru

Technical Consulting Director,
Technical Lead for Climate Change and Water Resources,
ERM North America
Venkat.Kolluru@erm.com

Edmund Ang

Project Manager,
ERM Malaysia
Edmund.Ang@erm.com

Dr. Senthil Gurusamy

Managing Consultant
Climate Physical Risk and
Water Resources,
ERM Malaysia
Senthil.Gurusamy@erm.com

Dr. Hoffman Cheung

Managing Technical Consultant
(Climate Change),
ERM Hongkong
Hoffman.Cheung@erm.com



Westports Holdings Berhad
Registration No. 199301008024 (262761-A)
www.westportsholdings.com