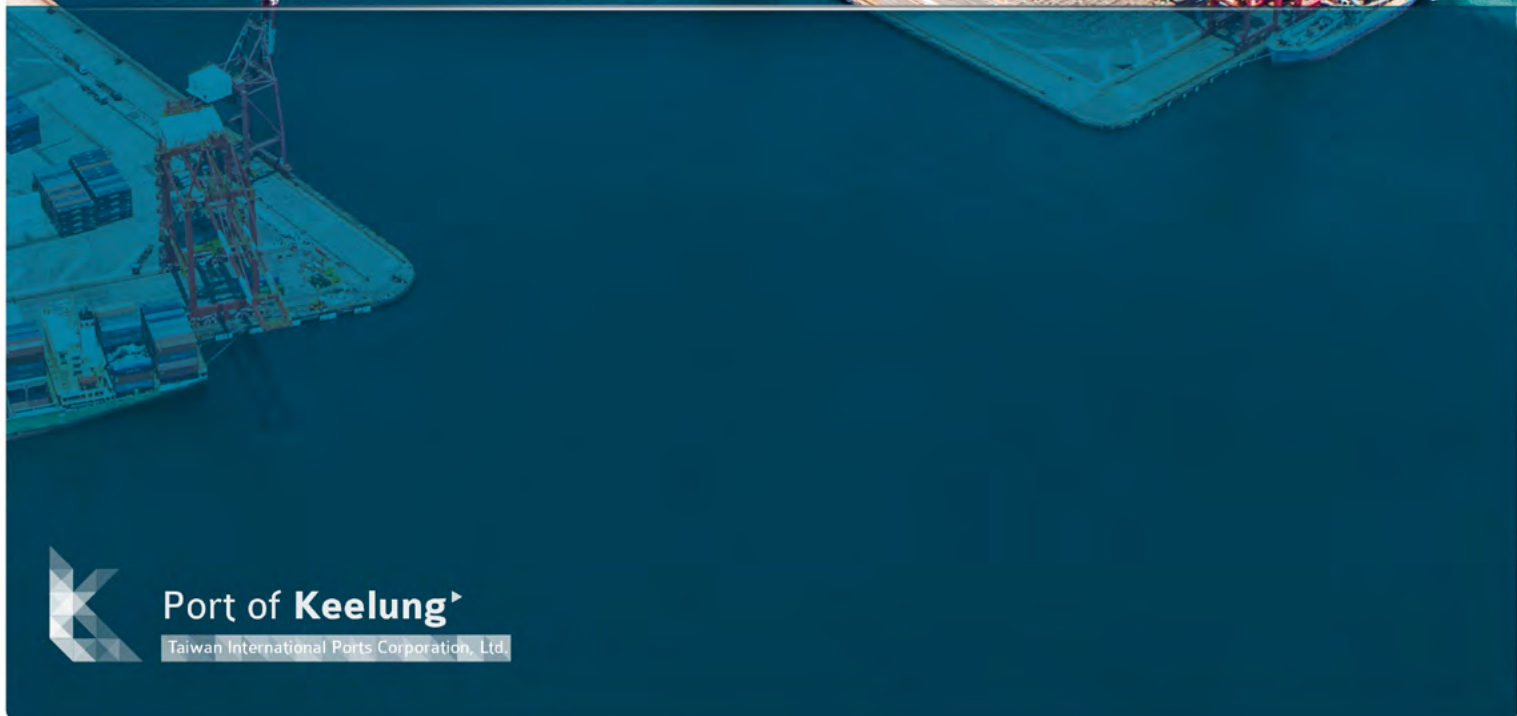


Port of Keelung

# Environmental

# Report

▶ 2015



Port of **Keelung** ▶

Taiwan International Ports Corporation, Ltd.

# Port of Keelung Environmental Report

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This environmental report presents Keelung Port's achievements in environmental protection from 2013 to 2014 as well as the environmental policy, commitments and action plans of the Port of Keelung, Taiwan International Ports Corporation.

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## Taiwan International Ports Corporation Environmental Policy

“Leverage innovation effectively to connect and communicate with global trade flows. Mature into a world-class port management group” is the vision of Taiwan International Ports Corporation (TIPC). TIPC manages and operates commercial ports in Taiwan and is engaged in maritime transport related services, free trade zones, and the development of relevant tourism and recreational projects.

While TIPC pursues business growth, we are well-aware of the importance of our social responsibility, which is to ensure both environmental and economic sustainability. With the goal to establish green and sustainable ports, we will proactively identify environmental risks that may be associated with our activities and manage the risks accordingly to minimize the environmental impacts.

We commit to:

1. Implement and follow through with the Green Port Programme to establish extraordinary world-class ports;
2. Comply with applicable environmental regulations to fulfill corporate environmental responsibility;
3. Execute pollution prevention, monitoring, and control mechanism to enhance environmental quality in and around port areas;
4. Reinforce environmental education to cultivate environmental awareness among employees; and
5. Strengthen the communication with local communities, and pursue sustainable development for both the ports and the cities where we are operating.

Chang, Chih-Ching  
Chairman of TIPC

Date: 10/14/2014

Lee, Tai-Hsin  
President of TIPC

Date: 10/14/2014

## Port of Keelung, Taiwan International Ports Corporation Environmental Policy

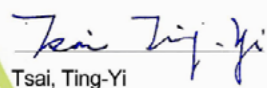
In charge of port operation and developments, Port of Keelung, Taiwan International Ports Corporation (hereinafter referred to as Port of Keelung) recognizes its obligations towards protecting the environment as its corporate social responsibility. Aiming at being an eco-friendly and sustainable port with continuous advancement, we consider environmental protection as a part of port operation and work proactively to prevent the pollution of the environmental impacts.

In order to minimize the potential and actual environmental impacts from port operations, Port of Keelung has identified the scope of its environment protection. With autonomous management, periodic inspection and evaluation, we will keep continuously improving our environmental performance.

We commit to:

- Regularly evaluate port environmental impacts and any pollution generated from port operation.
- Set environmental objectives to continuously lower environmental impacts.
- Comply with all relevant environmental regulations and aim at pollution prevention.
- Provide environmental education to build environmental awareness in all staff to completely implement our environmental policy.

The full understanding and mutual consent to this environmental policy have been reached by all the relevant parties, including employees, suppliers and tenants of Port of Keelung. This policy is open to the public on our website.

  
Tsai, Ting-Yi

President of Port of Keelung, TIPC

Date: Sep. 10, 2014



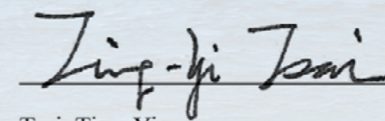
No.1, Chung-Cheng Road, Keelung 20202, Taiwan, R.O.C.  
Tel:(02)24206100 Website: <http://kl.twport.com.tw/>

## Objectives for the Port of Keelung Environment

To fulfill our environmental policy promises, we selected the ten most important environmental issues and set an objective for each of them.

- **Reduce waste**  
Promote the reduction of trash in the Port and implement reuse and recycling.
- **Improve air quality**  
Assist the Environmental Protection Bureau in controlling old trucks and advocating the replacement of fuel and oil to reduce exhaust emissions.
- **Reduce noise**  
Build the access road system and continue to operate the continuous environmental monitoring system in the Port.
- **Reduce river pollution**  
Assist the city government in maintaining riverbank space and provide sites for the establishment of sewage interception stations.
- **Reduce cargo spill**  
Reinforce the management of loading/unloading cargos to avoid overloading or spillage; enhance relevant agencies' communication and coordination mechanisms in emergency responses.
- **Prevent vessels from discharging waste oil and sewage**  
Force vessels to properly handle waste oil and sewage; work with the law enforcement agency to carry out joint inspection.
- **Reinforce the control of ship garbage**  
Enforce the classification of ship garbage, and determine reasonable garbage handling fees.
- **Readjust the use of land area**  
Readjust the type of land use in the Port to achieve comprehensive space distribution.
- **Promote the development of the water area**  
Re-create the water area of the Port; open up more water space to allow public access to the water.
- **Improve water quality of the port basin**  
Gradually complete the connection of sewage systems between the Port and the City; monitor water quality of the Port.

The President, Keelung Branch of TIPC is responsible for the implementation, maintenance and effectiveness of the environmental issues, and also for reviews the environmental issues on an annual basis and adjusts the action plans based on the condition of the Port, so as to live up to the promises and improvements to achieve the environmental objectives.

  
Tsai, Ting-Yi

President of Port of Keelung, TIPC

Date: May 15, 2015

# Message from TIPC 01/

## Message from the Chairman of Taiwan International Ports Corporation, Ltd.

In the past few years, competition has been increasing in the global marine transportation industry, gradually driving the industry from a profit- and efficiency-oriented structure toward a future that creates multiple values. A port's success is typically the result of a considerable amount of support and unseen effort. The ultimate goal is to become an international port with modern infrastructure, high traffic, and friendly work environment.

Taiwan International Ports Corporation (TIPC) strives to become the most efficient port operating company and a more prominent member of the global marine transportation industry. While the core values of the company are innovation, globalization, and international excellence, TIPC continues to innovate and increase its competitiveness in planning, constructing, and operating its international ports. What remains unchanged is the company's commitment to protecting the environment, providing high-quality service, and improving living conditions in Taiwan. These core values, we believe, are essential to excelling in this generation.

TIPC has short-, mid-, and long-term goals of promoting green ports throughout Taiwan from the perspectives of tourism, cargo operation, port environment, and city and community development. In addition to enhancing the quality of tourism and the efficiency of cargo shipping, we aim to improve port environments and infrastructure to contribute to local city development. The company has also established communication channels with local governments and residents. We believe that guidance from the European Sea Ports Organization regarding EcoPorts would facilitate developing a more comprehensive port environmental management system and monitoring the effectiveness of TIPC's environmental management plan.



**Chang, Chih-Ching**

Chairman  
Taiwan International Ports Corporation, Ltd.

## Message from the President of Taiwan International Ports Corporation, Ltd.

To achieve sustainable development, socioeconomic advancement and environmental improvement must be considered. Accordingly, Taiwan International Ports Corporation (TIPC) has implemented environmental protection policies as a principle of port environmental management. While recognizing the environmental risks involved in port services and activities, the company is actively developing an autonomous port environmental management system.

With EcoPort and GreenPort becoming a trend in the global marine transportation industry, TIPC has been working on equipment upgrading, pollution control and green incentive program, as well as actively participating in port environmental management certification system. As a result, the Port of Kaohsiung became the first port in Asia to receive EcoPort certification in 2014, and we expect that the Port of Taichung and Port of Keelung will also obtain EcoPort certification this year.

As a transportation hub in the Pan Pacific area, Taiwan plays a critical role in promoting the development of international trade and marine transportation. By committing to developing green ports, the company has upgraded its equipment to enhance its competitiveness and implemented environmental protection measures to mitigate the environmental impact of port operations. We are committed to developing Taiwan's ports into first-class international ports while fulfilling our corporate social responsibility.

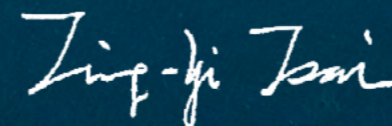


**Lee, Tai-Hsin**  
President  
Taiwan International Ports Corporation, Ltd.

## Message from the President of Port of Keelung, Taiwan International Ports Corporation, Ltd.

With the development of ports and the increase in cargo throughput and factories, ports around the world all face the challenge to strike a balance between economic development and environmental protection. In light of the rise of environmental awareness and sustainable development, the Taiwan International Ports Corporation is set to give consideration to the economic, environmental and social sustainability, and fulfill its corporate social responsibility. Approved by the Ministry of Transportation and Communications, the Taiwan International Ports Corporation started the implementation of the Taiwan Green Ports Promotion Project, in January 2013. With the project, the Taiwan International Ports Corporation has designed short, medium and long-term programs regarding green port development and action plan based on the four aspects of the operation of the Port: tourism, cargo operation, port environment and city/community development.

The Port of Keelung is positioned as a container port, a port for passenger and cargo vessels from both sides of the Taiwan Strait, as well as international mainliners, and a logistic and distribution center in the Asia-Pacific region. In addition to continuing to pursue stable growth of economic benefits and complete the planning of space utilization, the Port of Keelung, TIPC also fulfills its corporate social responsibility by including environmental protection and sustainable management as part of its work. The Port of Keelung, TIPC strives to reduce the environmental impact of the operation of the Port, so as to improve the friendly relationship between the Port and the City. It has passed the procedure of applying for the EcoPorts certification and refined its examination of work that has room for improvement. By taking procedural steps toward the status as a green port, the Port of Keelung expects to become one of the international EcoPorts. By deepening its exchanges with other countries, the Port of Keelung, TIPC adopts the benchmark learning strategy to build a better and friendlier port city.



**Tsai, Ting-Yi**  
President of Port of Keelung  
Taiwan International Ports Corporation, Ltd.

An aerial photograph of a port facility, likely Keelung Port, showing various docks, cranes, and ships. The port is situated in a bay with a city and mountains in the background. The water is a deep blue, and the sky is clear. A white boat is visible in the foreground, leaving a white wake.

# Port Profile 02/



# Port Profile

Keelung Port is located in the Northeastern tip of Taiwan (121°44'22.5" and 25°09'26.5" north latitude) and is the primary shipping hub in Northern Taiwan.



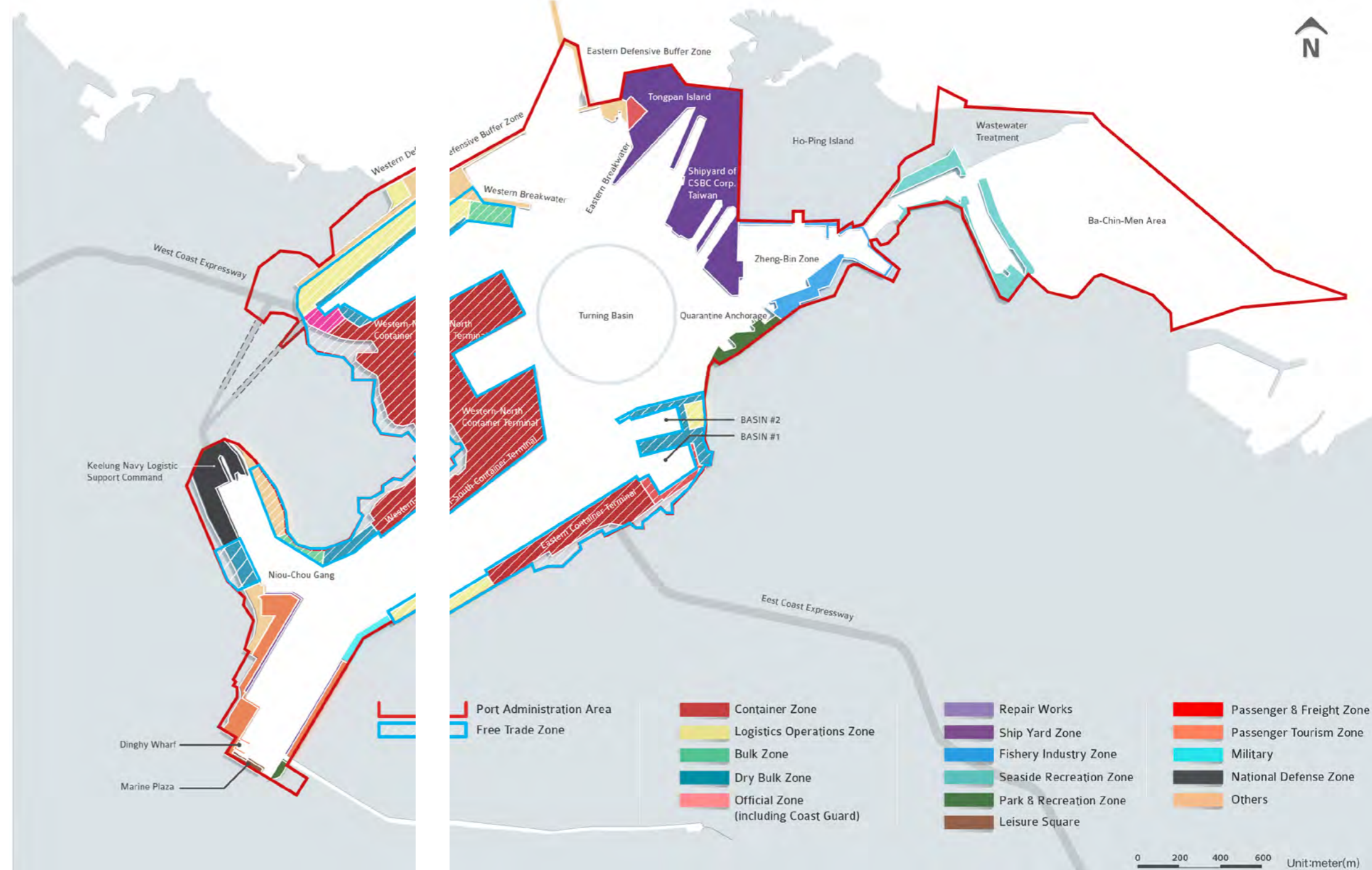
## Port Location and Port Area

The harbor includes a total of area 5,721,657.57 m<sup>3</sup> (572.17hectare). The land area accounts for 196.4 hectare while the marine area accounts for approximately 375.8 hectare. The pier has a design depth between 3.0 to 14.5 meter and has a tidal range of 0.73 meter. The port has only one entrance.

Geographically, Keelung Port's stevedoring advantages were naturally formed, and the port is a natural port. The seashore around Port of Keelung is primarily composed of pebble beaches, rocky shores, and seawall. The port itself is in close proximity to Keelung City, industrial areas (CSBC Keelung shipyard, Hsieh-ho Power Plant), and leisure/recreation areas. The mouth of two rivers, the Hsu-Chuan River and Tien-Liao River are located in the port area.

## Legal Status and Port Operators

To promote modernized commercial port management system reforms, Taiwan amended the Commercial Port Law on December 28, 2011. In March 2012 the maritime system changed to a "separation of government and corporation" method. Previously publicly managed organization was transformed into state enterprise organizations, which combined port operation originally under Keelung Harbor Bureau, Taichung Harbor Bureau, Kaohsiung Harbor Bureau, and Hualien Harbor Bureau into a company managed system (Taiwan International Ports Corporation). This solved previous problem of commercial ports being limited by legal and system restrictions, which caused an inability to respond to market changes and decreased competitive strength. After restructuring of the Keelung Harbor Bureau, stevedore operation business is now the responsibility of the Port of Keelung, TIPC. Maritime administration, operation items, and public authority within the harbor are handled by the North Taiwan Maritime Affairs Center of the Maritime and Port Bureau (MPB).



## Main Commercial Activities and Cargo Handling



Keelung Port's commercial harbor area has 56 piers, 20 on the east shore and 36 on the west shore. Pier types include 15 container piers, 23 bulk cargo piers, 2 passenger piers, and 16 other piers. Transported cargo is mainly containers, followed by bulk cargo, then automobiles, yachts, steel, cement, coal, and petroleum goods. The development of Keelung Port is set as a container port for near-ocean shipping routes, berthing for cross-strait passenger and cargo ships and international cruise ships, and logistics distribution center for the Asia region. Commercial activities within the harbor include ship building and repair, yacht pier, leisure and recreation, and storage and packaging.

### » Main Commercial Activities and Cargo Handling in Port of Keelung

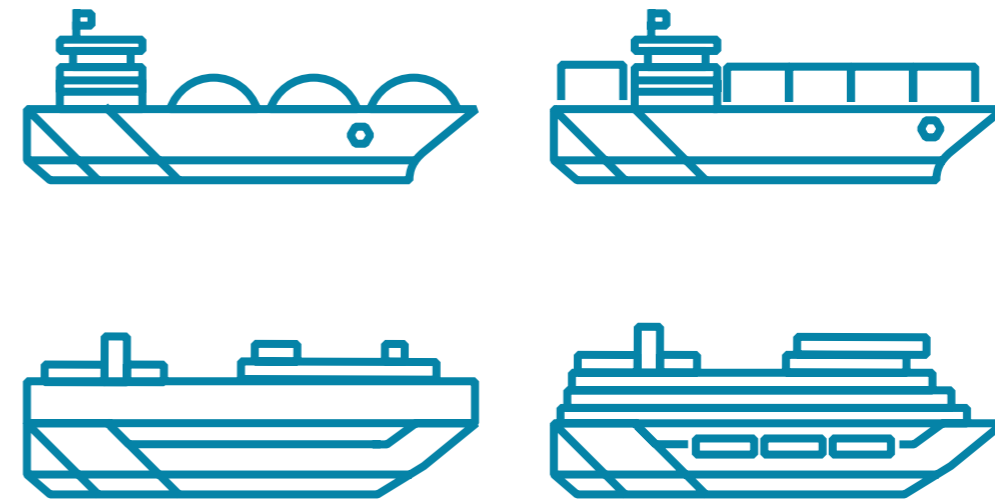
Commercial activities	
Aggregates (sand and gravel)	Ship building and maintenance
Yacht pier/leisure	Storage and packaging
Cargo handling	
Dry bulk cargo	Liquid bulk cargo (non-petroleum )
Automobile	Petroleum
Ro-Ro	General cargo

### » Keelung Port business statistics from 2013 to 2014

Business item	2013	2014	Comparison between 2013 and 2014		
			Actual number	%	
Incoming and outgoing ships	Total number of ships (vessel)	12,410	12,468	58	0.47
	Total tonnage (ton)	193,586,888	195,362,116	1,775,228	0.92
Cargo handling quantity	Container cargo (shipping ton )	58,055,967	60,666,570	2,610,603	4.50
	Bulk cargo (shipping ton )	8,754,904	8,559,101	-195,803	-2.24
	Channel cargo (shipping ton )	2,569,728	3,013,223	443,495	17.26
	Total (shipping ton )	69,380,599	72,238,894	2,858,295	4.12
Container handling quantity	Inbound container (TEU)	847,663.75	888,106.75	40,443	4.77
	Outbound container (TEU)	765,002.00	797,075.75	32,074	4.19
	Total (TEU)	1,612,665.75	1,685,182.50	72,517	4.50
Cargo throughput	Imported cargo (metric ton)	12,794,625	12,449,194	-345,431	-2.70
	Exported cargo (metric ton)	4,710,575	4,566,237	-144,338	-3.06
	Domestic cargo (metric ton)	3,930,919	4,597,109	666,190	16.95
	Total (metric ton)	21,436,119	21,612,540	176,421	0.82
Number of travelers	Number of domestic line travelers (number of people)	95,859	95,137	-722	-0.75
	Number of international line travelers (number of people)	428,749	482,865	54,116	12.62
	Total number of travelers (number of people)	524,608	578,002	53,394	10.18

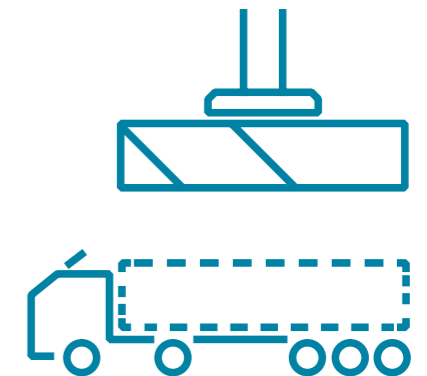
## Main Cargo

The main import cargo at Port of Keelung for 2013 and 2014 was mineral products, followed by chemical or industrial products and base metal products. Main export cargo was plastic and rubber products, chemical and industrial products, and textile products.



### » Main Cargoes at Keelung Port.

Petroleum	Pyrites minerals
Refined products	Cement
Dry bulk	Liquid bulk ( non-oil )
Chemicals	Liquid chemicals
Wood products	
Other	
Cars/Vehicles	



Environmental  
Management  
System

03/



# Environmental Management

## Organization Structure

In addition to the Port of Keelung, TIPC environmental issues within the Keelung Port also involves the Maritime and Port Bureau North Taiwan Maritime Affairs Center (Ministry of Transportation and Communications), the Department of Economic Affairs (Keelung City Government), the Bureau of Environmental Protection (Keelung City), the Environmental Protection Administration (Executive Yuan), the Coastal Patrol Directorate General - Northern Coastal Patrol Office of the Coast Guard Administration (Executive Yuan), the Keelung Harbor Police Department (National Police Agency, Ministry of the Interior), the Keelung Harbor Fire Brigade (National Fire Agency, Ministry of the Interior), the Navy Keelung Logistics Support Command, the Keelung Customs (Customs Administration, Ministry of Finance), and the Centers for Disease Control Taipei Area Control Center - Keelung Office.

the Keelung Harbor Police Department (National Police Agency, Ministry of the Interior), and the Keelung Harbor Fire Brigade (National Fire Agency, Ministry of the Interior) shall assist with the monitoring of harbor area environment, implement bans, gather evidence, and prosecution.

The 13 divisions of the Port of Keelung, Taiwan International Ports Corporation consist of the Secretariat, Construction Management/Engineering Division, Harbor Management Division, Stevedoring and Warehousing Business Division, Port Business Division, Accounting Division, Information Technology Division, Personnel Division, Ship and Machinery Division, Occupational Safety Division, Civil Service Ethics Division, Taipei Port Branch Office of Keelung Port, TIPC, and Suao Port Branch Office of Keelung Port, TIPC.

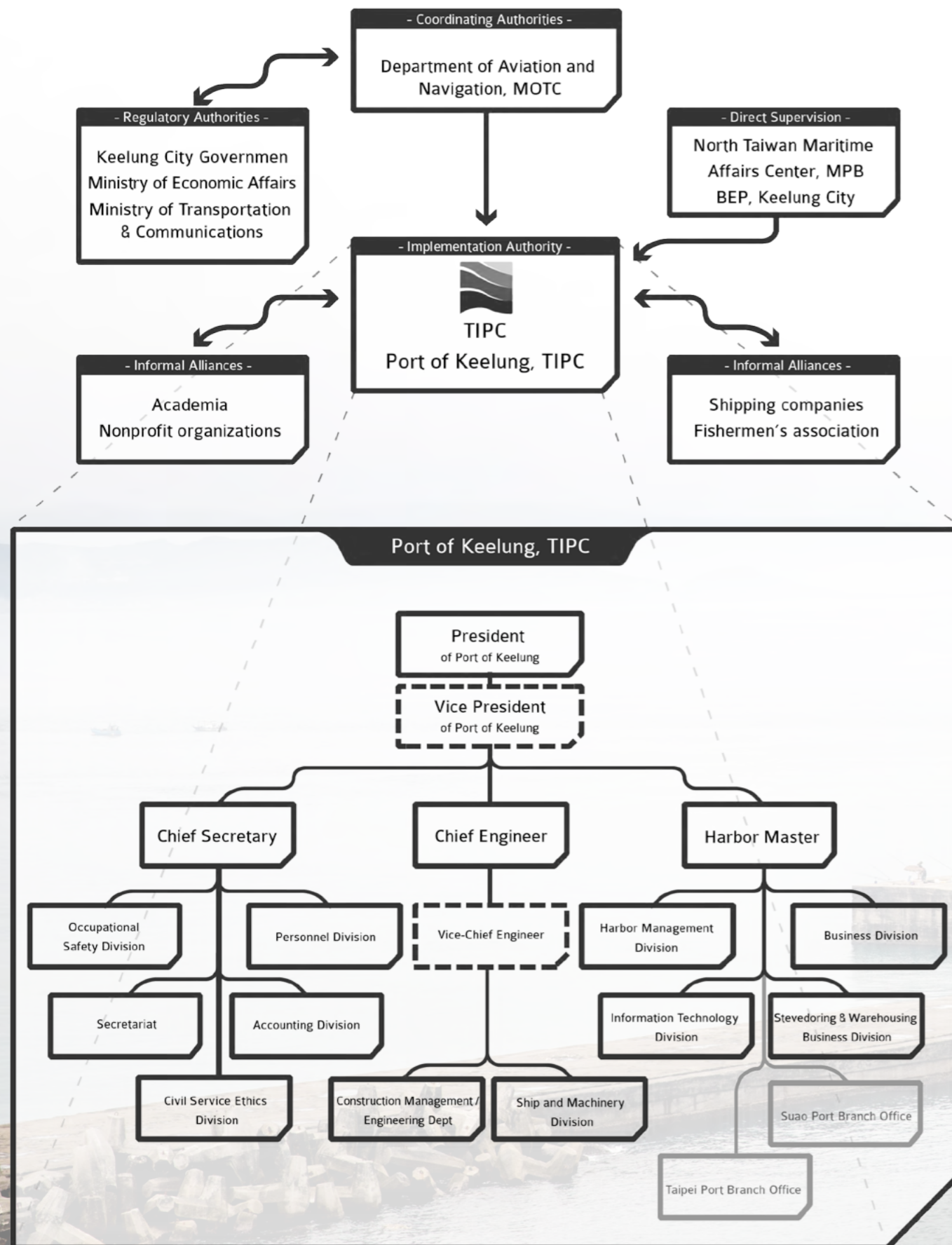


According to Commercial Port Law regulations, the Port of Keelung, TIPC and the North Taiwan Maritime Affairs Center (Maritime and Port Bureau, Ministry of Transportation and Communications) is responsible for environmental management in the Keelung commercial port area. Port of Keelung, TIPC is responsible for environmental issues in management and operations while the North Taiwan Maritime Affairs Center shall handle environmental issues that involve public authority. Environmental Protection Administration (Executive Yuan) and the Bureau of Environmental Protection (Keelung City) shall manage stevedoring and neighboring municipal areas, and monitor and supervise the environment. The Northern Coastal Patrol Office of the Coast Guard Administration (Executive Yuan),

The Occupational Safety Division in various units is mainly responsible for the environment of the harbor area, and the division is further divided into the Occupational Health and safety Section and the Environmental Management Section. The Occupational Health and safety Section handles waste processing, resource recycling, and occupational health and safety relevant business. The Environmental Management Section handles harbor pollution prevention, environmental protection regulations, environmental impact assessment, environmental monitoring, environment cleanup after an oil spill, environmental education, ecological preservation, and planting and conservations. Overall, 17 personnel are involved in environmental protection work.

### » Functions of the divisions of the Port of Keelung, TIPC.

Division	Description
Secretariat	Company Management
Construction Management / Engineering Division	Port planning, design, construction and supervision
Harbor Management Division	Port safety management and port affairs operation
Stevedoring and Warehousing Business Division	Tourist services and private store operation
Port Business Division	Attraction of local investments, implementation of port functions, and creation of benefit
Accounting Division	Budget review and management of income and expenditures
Information Technology Division	Development and maintenance of IT systems and equipment
Personnel Division	Company human resource management
Ship and Machinery Division	Maintenance and management of electrical equipment, ship machinery and tools
Occupational Safety Division	Port environmental protection, pollution prevention and management of occupational health and safety
Civil Service Ethics Division	Enforcement of ethics and investigation
Taipei Port Branch Office of Keelung Port, TIPC	Taipei port operation and management
Suao Port Branch Office of Keelung Port, TIPC	Suao port operation and management



The Taipei Port Branch Office is responsible for the operation and management of Taipei Port. The Suao Port Branch Office is responsible for the operation and management of Suao Port.

» Authorization of environmental management units in the Keelung commercial port area.

## Environmental Regulation

The Port of Keelung, TIPC upholds the Port Environmental Management Procedure with the assistance of the local responsible authorities in accordance with environmental protection laws. Environmental protection laws applicable to ports are listed in the table below:

» Domestic port environment regulations.

Regulations			Central competent authority	Local law enforcement agencies
Transportation regulations	The Commercial Port Law	2011/12/28	Ministry of Transportation and Communications	Maritime and Port Bureau North Taiwan Maritime Affairs Center
	North Taiwan Maritime Affairs Center	2010/12/08		
Agriculture regulations	Wildlife Conservation Act	2013/01/23	Council of Agriculture (Executive Yuan)	Department of Economic Affairs, Keelung City Government
Interior regulations	Fire Services Act	2011/12/21	Ministry of Interior	Keelung Harbor Fire Brigade
Economic regulations	Petroleum Administration Act	2014/06/04	Ministry of Economic Affairs	Keelung City Government Public Works Bureau
	Marine Pollution Control Act	2014/06/04		
Environmental Protection regulations	Air Pollution Control Act	2012/12/19	Environmental Protection Administration (Administrative Yuan)	Bureau of Environmental Protection (Keelung City)
	Basic Environment Act	2002/12/11		
	Toxic Chemical Substances Control Act	2013/12/11		
	Indoor Air Quality Act	2011/11/23		
	Water Pollution Control Act	2015/02/04		
	Waste Disposal Act	2013/05/29		
	Resource Recycling Act	2009/01/21		
	Soil and Groundwater Pollution Remediation Act	2010/02/03		
	Noise Control Act	2008/12/03		
	Environment Impact Assessment Act	2003/01/08		
	Environmental Dispute Resolution Act	2009/06/17		
	Environmental Education Act	2010/06/05		
	Greenhouse Gas Reduction and Management Act	2015/07/01		
Cross-department regulations	Disaster Prevention and Protection Act	2012/11/28	Different central and local competent authorities based on disaster type	

State of  
the  
Environment

04/



# Resource Consumption

The Port of Keelung, Taipei International Ports Corporation (TIPC), has compiled statistical data on the water, electricity, fuel, and paper consumption of its offices and public areas to determine the usage of each department and make improvements.

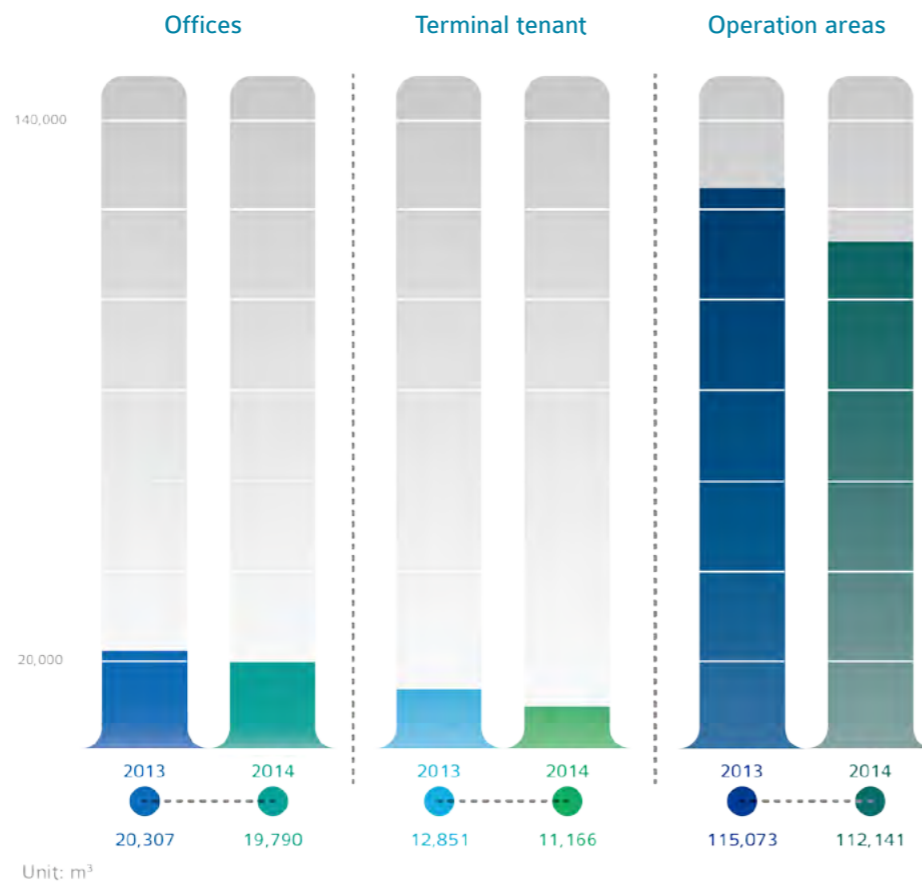
## Water Consumption



Water consumption at Port of Keelung, TIPC offices: In 2013, 20,307 m<sup>3</sup> of water was used, with 19,790 m<sup>3</sup> of water was used in 2014.

Terminal tenant water consumption: 12,851 m<sup>3</sup> of water was used in 2013 and 11,166 m<sup>3</sup> of water was used in 2014.

Operation areas: 115,073 m<sup>3</sup> of water was used in 2013 and 112,141 m<sup>3</sup> of water was used in 2014.



»2013-2014 Total Water Consumption at Port of Keelung, TIPC

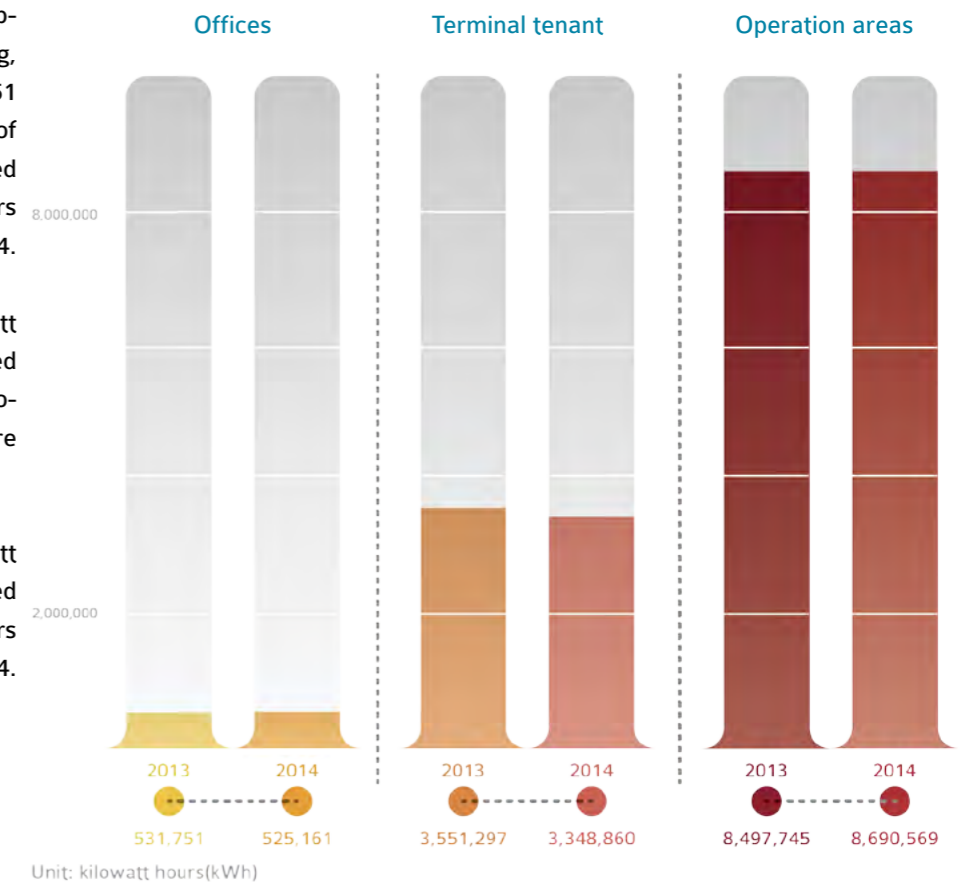
## Electricity Consumption



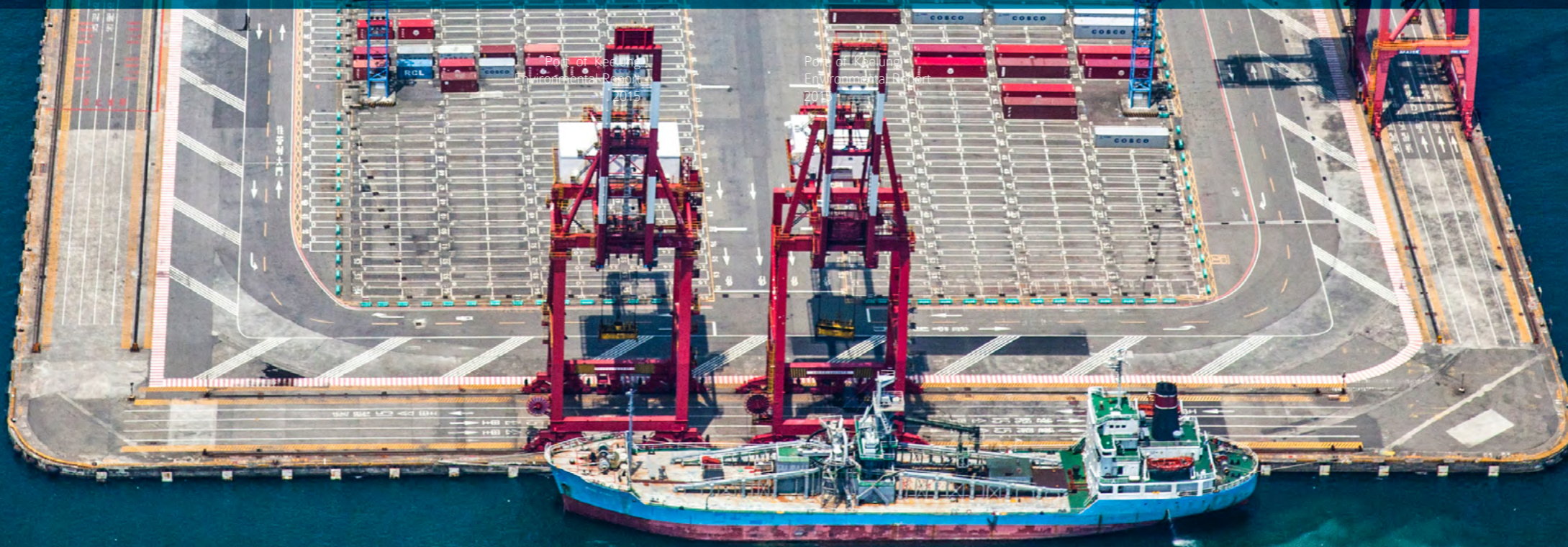
Electricity consumption at Port of Keelung, TIPC offices: 531,751 kilowatt hours (kwh) of electricity were used in 2013 and 525,161 kilowatt hours (kwh) of electricity were used in 2014.

Terminal tenants: 3,551,297 kilowatt hours (kwh) of electricity were used in 2013 and approx. 3,348,860 kilowatt hours (kwh) of electricity were used in 2014.

Operation areas: 8,497,745 kilowatt hours (kwh) of electricity were used in 2013 and 8,690,569 kilowatt hours (kwh) of electricity were used in 2014.



» Electricity Consumption at Port of Keelung, TIPC

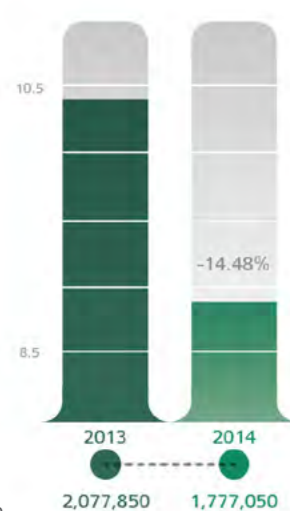


Aerial Photography by Chen, Min-Min

## Paper Consumption



Paper consumption of Port of Keelung, TIPC offices: 2,077,850 sheet of paper (approx. 10.39 metric tons) were used in 2013 and 1,777,050 sheet of paper (approx. 8.89 metric tons) were used in 2014.



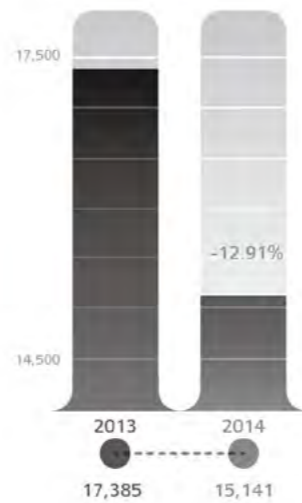
Unit: tonne

»2013-2014 Paper Consumption at Port of Keelung

## Fuel Consumption



Port of Keelung, TIPC office fuel consumption: 17,385 liter of fuel were used in 2013 and 15,141 liter of fuel were used in 2014.



Unit: liter

»2013-2014 Fuel Consumption at Port of Keelung

## Resource Conservation Rate



Because of increasing passenger numbers and expanding operations in the past 2 years, in the Port of Keelung, TIPC, electricity consumption has exhibited a rising trend. Water, fuel, and paper consumption rates have been controlled successfully because of internal announcements and attempts to curb related energy consumption and carbon emissions in order to limit resource consumption in the port area.

»2013-2014 Resource Conservation Rate at Port of Keelung, TIPC Offices

Year	Water use (m <sup>3</sup> )	Fuel use (liter)	Electricity use (kwh)	Paper use (sheet)
2013	20,307	17,385	535,075	2,077,850
2014	19,790	15,141	525,161	1,777,050
Conservation Rate	2.55%	12.91%	1.85%	14.48%

»2013-2014 Resource Conservation Rate at Port of Keelung, TIPC Operation

Year	Water Use (m <sup>3</sup> )	Electricity Use (kwh)
2013	115,073	8,497,745
2014	112,141	8,690,569
Conservation Rate	2.55%	-2.27%

»2013-2014 Resource Conservation Rate by Port of Keelung, TIPC Terminal

Year	Water Use (m <sup>3</sup> )	Electricity Use (kwh)
2013	12,851	3,551,297
2014	11,166	3,348,860
Conservation Rate	13.11%	5.70%



## Waste & Oily Wastewater

**The Port of Keelung, TIPC, outsources vendors to dispose of the regular waste produced in public areas including on land, water, and ships in the Keelung port area. For disposing business waste (including oily wastewater), shippers, terminal tenant, and operators individually contact companies qualified in waste management. The Port of Keelung, TIPC, conducts regular inspections of waste collection practices to ensure that they are performed correctly.**

Company qualifications: Disposal companies must provide related certification documents (i.e., a waste disposal permit approved by a competent environmental protection authority, a business plan, an emergency response plan, and permission to enter the site). A shipper (i.e., a shipping agent) submits the disposal application, which is reviewed by the Port of Keelung, TIPC, and provides information such as the scheduled disposal time, pier, ship name, and disposal amount. Subsequently, the hired disposal (transportation) company conducts the disposal tasks in accordance with the submitted application.

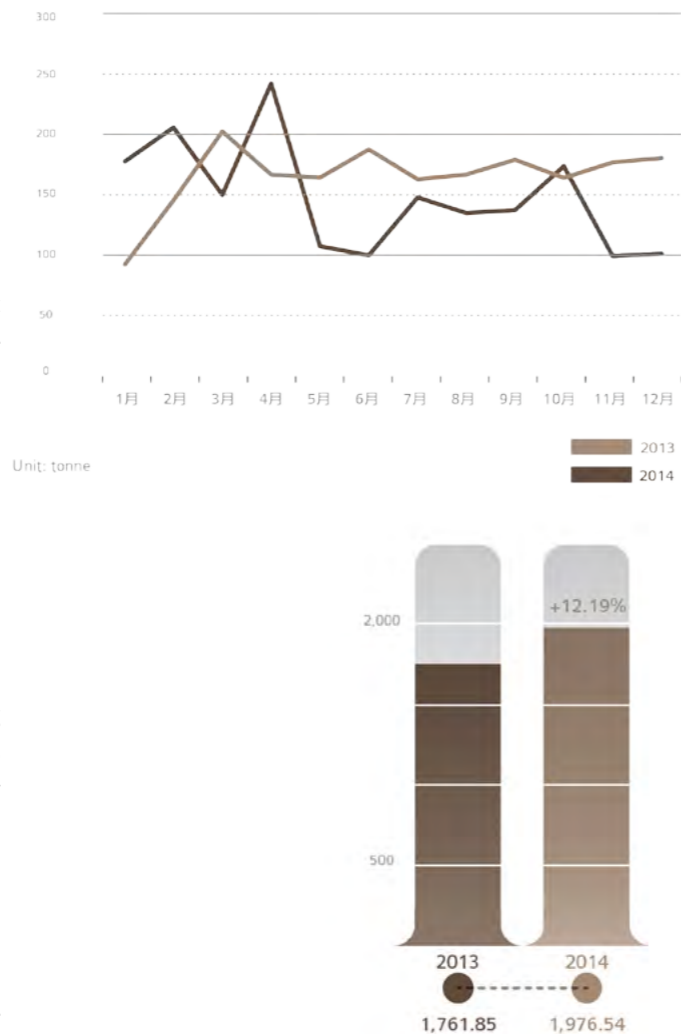
### Waste



The source of waste produced in the port area is primarily from land, waterways, and ships, and ship waste can be classified as produced by the crew and travelers. Regarding the land waste in the port area, the Port of Keelung,

TIPC, has installed temporary storage containers in specific locations, and has contracted sanitation companies to collect the waste at scheduled times. Regarding waste in the water area, a cleaning ship removes the floating waste and oil pollution from the port area, the Xuchuan River mouth, and adjoining zones at regularly scheduled times, and a crane installed at a specific location transports the waste collected by the cleaning ship. Regarding the ship-crew and traveler waste, it is collected shipside by garbage trucks. The Port of Keelung, TIPC, requests that travelers sort the waste for collection. After this waste is collected, it is sorted at specific sites in accordance with regulations before being sent to a legal landfill for disposal. The sanitation records and the handling records of the organization responsible for final disposal are submitted regularly to the Port of Keelung, TIPC, for review.

Port of Keelung, TIPC, waste disposal amounts: In 2013, 1,761.85 metric tons of waste was disposed of, with 1,976.54 metric tons of waste disposed of in 2014, representing a 12.19% increase of total waste disposal.



»2013-2014 Waste Disposal Amounts at the Port of Keelung

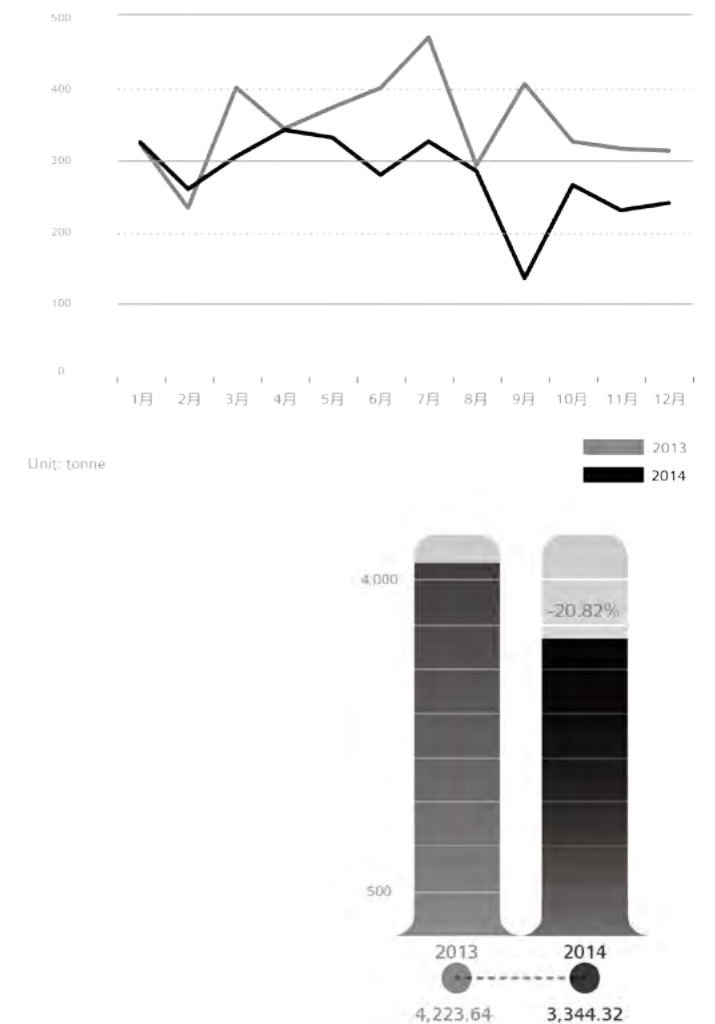
### Oily Wastewater



Oily wastewater produced in the port area is primarily from ships. The carrier (i.e., shipping agency) submits oily wastewater clean-up applications, which are reviewed by the Port of Keelung, TIPC. Information such as the scheduled disposal time, dock, ship name, and disposal amount are noted, and a disposal (transportation) company performs the disposal tasks in accordance with the application.

The Port of Keelung, TIPC, regularly compiles the "Port Ship Oily Wastewater Disposal Table," which is submitted to the Environmental Protection Administration and the Environmental Protection Bureau of Keelung City before being forwarded for review to their counterparts at the local county and city levels.

Port of Keelung, TIPC oily wastewater disposal amounts: A total of 4,223.64 metric tons of oily wastewater were disposed of in 2013 and 3,344.32 metric tons of oily wastewater was disposed of in 2014, representing a 20.82% reduction of oily wastewater disposal amount.



» 2013-2014 Oily wastewater Disposal Amounts at the Port of Keelung

## Resource Recycling



Trash collection for the port area is contracted out to a disposal company, which performs the sorting and handling. The collected waste is sorted at a specific site in accordance with regulations, and the recyclable waste is transferred to the Environmental Protection Bureau for handling. The handling of statutory recyclable materials is contracted to outsourced vendors. Once handling is complete, a list of recycled

material amounts is submitted for review to the Port of Keelung, TIPC. The main recycled substances in the Port of Keelung, TIPC, include scrap iron, glass waste, individual categories of scrap metal (i.e., copper, zinc, aluminum, and tin), and plastic waste.

Total resource recycling at Port of Keelung, TIPC: A total of 2.069 metric tons of resources were recycled in 2013 and a total of 5.754 metric tons of re-

sources were recycled in 2014, representing a 178.11% increase of total resource recycling amount.

### Scrap iron

Scrap iron recycling amounts at the Port of Keelung, TIPC: A total of 0.483 metric tons of scrap iron were recycled in 2013 and a total of 0.931 metric tons of scrap iron were recycled in 2014, representing a 92.75% increase of total scrap iron recycling amount.

### Waste paper

Waste paper recycling amounts at the Port of Keelung, TIPC: A total of 0.968 metric tons of waste paper were recycled in 2013 and 2.810 metric tons of waste paper was recycled in 2014, representing a 190.29% increase of total waste paper recycling amount.

### Waste glass

Waste glass recycling amounts at the Port of Keelung, TIPC: A total of 0.086 metric tons of waste glass were recycled in 2013 and 0.186 metric tons of waste glass were recycled in 2014, representing a 116.28% increase of total waste glass recycling amount.

Waste glass were recycled in 2014, representing a 116.28% increase of total waste glass recycling amount.

### Single metal category

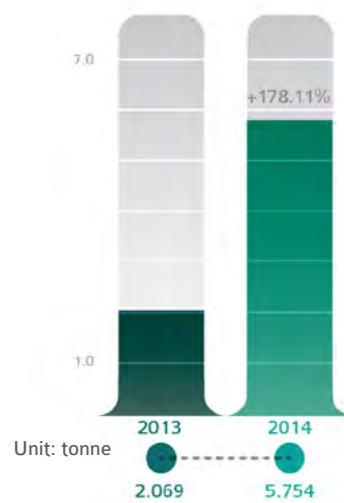
Single metal category recycling amounts at the Port of Keelung, TIPC: A total of 0.229 metric tons of single metal categories were recycled in 2013 and 0.836 metric tons of single metal categories were recycled in 2014, representing a 265.07% increase of total single metal category recycling amounts.

category recycling amounts.

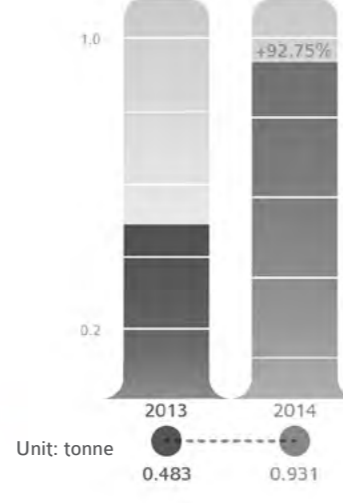
### Waste plastic

Waste plastic recycling amounts at the Port of Keelung, TIPC: A total of 0.303 metric tons of waste plastic were recycled in 2013 and 0.991 metric tons of waste plastic were recycled in 2014, representing a 227.06% increase of total waste plastic recycling amount.

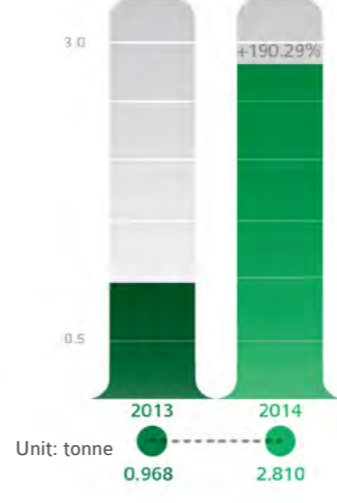
Total resource recycling



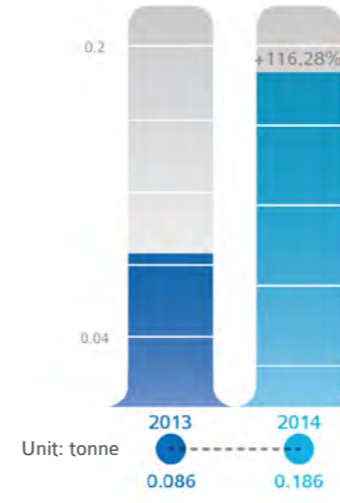
Scrap iron



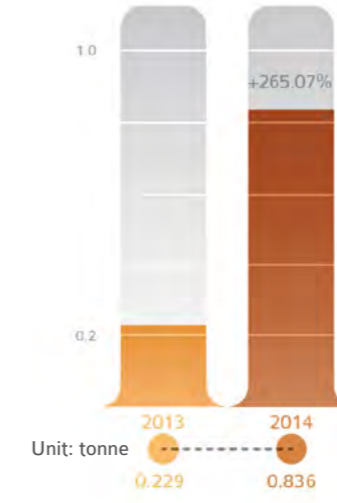
Waste paper



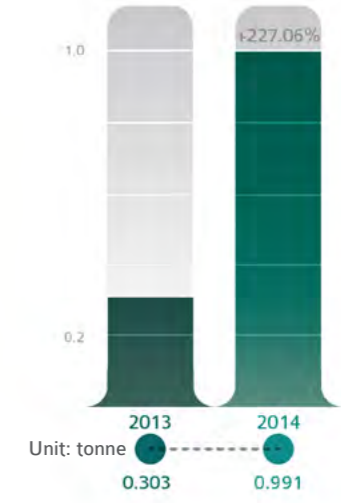
Waste glass



Single metal category



Waste plastic



» Recycling Amounts at the Port of Keelung, TIPC

» Recycling Amounts at the Port of Keelung, TIPC

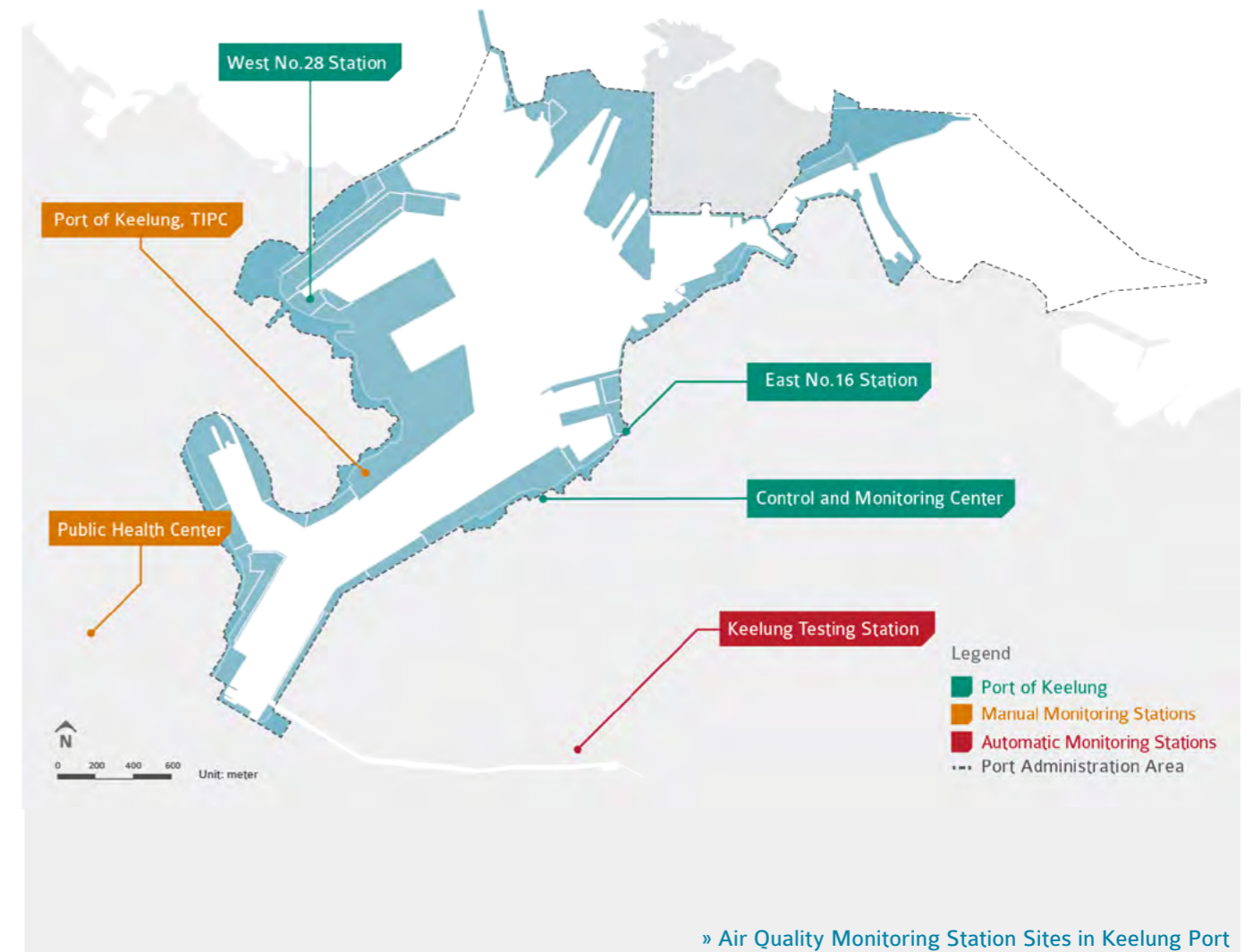
## Air Quality

The major factors of air pollution in the Keelung port area are black smoke emitted by ships, motorcycle and car exhaust around the port, and fugitive dust and smoke-stack emissions from the Hsieh-Ho Power Plant located nearby. Because Keelung has a rainy climate, suspended particulate matter and soot particles in the air are easily carried to the ground, which is one reason buildings in Keelung are grayish.

Port of Keelung, TIPC, has long been aware of these conditions, and has planned a 24-h air-quality monitoring system. The monitored chemicals are sulfur dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter less than or equal to 10 microns (PM<sub>10</sub>), nitrogen oxides (NO<sub>x</sub>), nitrogen oxide (NO), nitrogen dioxide (NO<sub>2</sub>), and fine particulates less than or equal to 2.5 microns (PM<sub>2.5</sub>) for a prompt understanding of the actions required to improve air-pollution conditions. In addition, the Environmental Protection Bureau of Keelung City has established automated monitoring stations and manually operated monitoring stations in the periphery of the port area. The monitoring data show that the air-quality monitoring results in the Keelung port area meet the air-quality standards established in Article 5-3 of the Air Pollution Control Act.

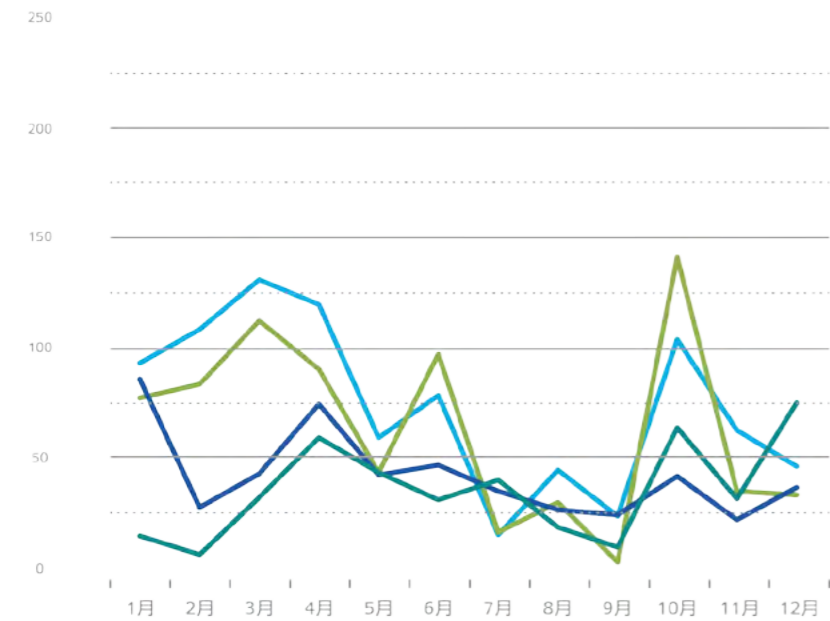
Data recording did not commence until June 2013 because of the incompatibility of the monitoring system programs. The presence of suspended particulate matter (PM<sub>10</sub>) and

fine suspended particulate matter (PM<sub>2.5</sub>) in the Keelung port was higher in the winter and lower in the summer because of the northeast seasonal winds. In addition, all nitrogen dioxide levels were higher than those reported by the Keelung measurement station in the second half of 2013 and in the first half of 2014. During this time, the Yellow Rubber Duck was on display in the port of Keelung, which attracted large crowds and generated substantial traffic, which raised the monitored levels. In the second half of 2014, the levels dropped close to that recorded at the Keelung measurement station. In addition, the monitoring results for sulfur dioxide are continuing to rise. This could be due to vehicle exhaust from roads around the port and emissions from nearby factories. Therefore, the Port of Keelung, TIPC, will cooperate with the Environmental Protection Bureau of Keelung City to strengthen vehicle controls, offer guidance, and conduct sample testing to alleviate air pollution in the Port of Keelung.



» Air Quality Monitoring Station Sites in Keelung Port

# TSP

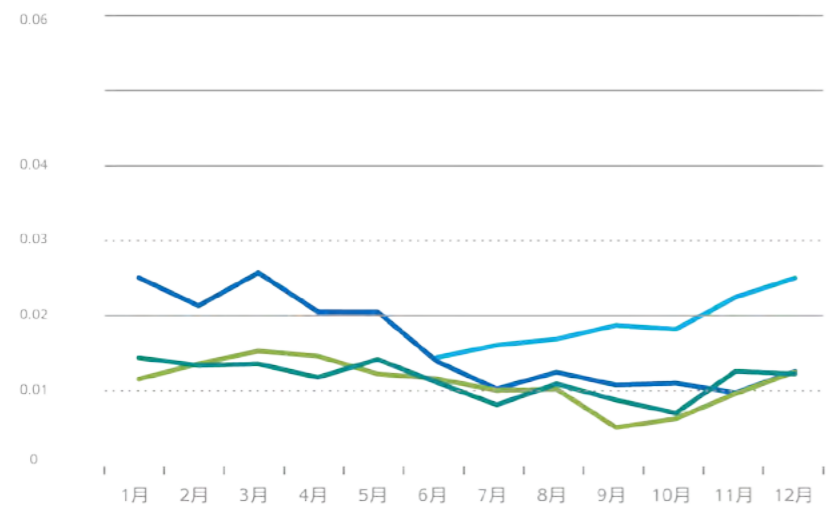


Unit:  $\mu\text{g}/\text{m}^3$   
 » 2013-2014 Monthly Total Suspended Particulate Matter Monitoring Levels

» 2013-2014 Monthly Total Suspended Particulate Matter Monitoring Levels

TSP annual mean $\mu\text{g}/\text{m}^3$	Public Health Center		Port of Keelung, TIPC	
	2013	2014	2013	2014
Measurement value	85.42	57.37	76.29	51.42
Regulation standard	250.00	250.00	250.00	250.00

# NO<sub>2</sub>



Unit: ppm  
 » 2013-2014 Monthly Nitrogen Dioxide Monitoring Levels

» 2013-2014 Nitrogen Dioxide Monitoring Levels

NO <sub>2</sub> annual mean ppm	Monitoring Center		Keelung Testing Station	
	2013(Jun. to Dec.)	2014	2013	2014
Measurement value	0.01931	0.01670	0.01166	0.01211
Regulation standard	0.05000	0.05000	0.05000	0.05000

# SO<sub>2</sub>



Unit: ppm  
 » 2013-2014 Monthly Sulfur Dioxide Monitoring Levels

» 2013-2014 Sulfur Dioxide Monitoring Levels

SO <sub>2</sub> annual mean ppm	Monitoring Center		Keelung Testing Station	
	2013(Jun. to Dec.)	2014	2013	2014
Measurement value	0.01276	0.01444	0.00235	0.00248
Regulation standard	0.03000	0.03000	0.03000	0.03000

# PM<sub>10</sub>



Unit:  $\mu\text{g}/\text{m}^3$   
 » 2013-2014 Monthly PM<sub>10</sub> Monitoring Levels

» 2013-2014 PM<sub>10</sub> Monitoring Levels

PM <sub>10</sub> annual mean $\mu\text{g}/\text{m}^3$	East No.16		Keelung Testing Station	
	2013(Jun. to Dec.)	2014	2013	2014
Measurement value	41.41	37.00	29.58	30.42
Regulation standard	65.00	65.00	65.00	65.00

# PM<sub>2.5</sub>



Unit:  $\mu\text{g}/\text{m}^3$   
 » 2013-2014 Monthly PM<sub>2.5</sub> Monitoring Levels

» 2013-2014 PM<sub>2.5</sub> Monitoring Levels

PM <sub>2.5</sub> annual mean $\mu\text{g}/\text{m}^3$	West No.28		Keelung Testing Station	
	2013(Jun. to Dec.)	2014	2013	2014
Measurement value	41.17	23.40	18.78	17.97
Regulation standard	15.00	15.00	15.00	15.00

# Greenhouse Gas Emissions

Increases in greenhouse gas concentrations easily induce dramatic changes in climate conditions and lead to compound disasters, which result in significant human, property, and environmental losses. Therefore, greenhouse gases including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrogen dioxide (NO<sub>2</sub>), and manmade hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>) are controlled under the 2005 Kyoto Protocol. These six items have been listed as reduction control targets, and each industry emission is listed to be quantified for inventory, verification, and carbon-trading units. For greenhouse gas controls in the

port area, Keelung port operations contribute a substantial amount of emissions, the sources of which include inbound and outbound ships and factories as well as transportation vehicles. Large-scale resource consumption generates a substantial amount of carbon emissions. Therefore, city and county governments have been actively promoting total carbon emission controls for port areas, and estimating the emission or sequestration amounts for each mode of operation. Companies are required to submit reduction plans for reducing the overall emission level of greenhouse gases in the port area.

## Carbon Emissions from Resource Consumption

Estimates of carbon emissions produced from resource consumption by the Port of Keelung, TIPC, offices, operation areas, and terminal tenant were calculated using the carbon emission factors established by the Taiwan Water Corporation, Bureau of Energy MOEA, and Chung Hwa Pulp Corporation. The carbon emission amount calculated for the Port of Keelung, TIPC, was 6,696,563 kg in 2013 and 6,643,013 kg in 2014, which represents a 0.27% decrease in total carbon emissions.

»2013-2014 Carbon Emissions of Resource Consumption by Port of Keelung, TIPC (unit: KgCO<sub>2</sub>e)

Resource	2013		2014	
	Amount of Resource Consumption	Carbon Emissions	Amount of Resource Consumption	Carbon Emissions
Water	148,231(m <sup>3</sup> )	23,124	143,097(m <sup>3</sup> )	22,323
Fuel	17,385(L)	39,344	15,141(L)	34,266
Electricity	12,584,117(kWh)	6,568,909	12,564,590(kWh)	6,558,716
Paper	2,077,850(sheets)	11,636	1,777,050(sheets)	9,951
Total		6,643,013		6,625,256

Note: CO<sub>2</sub> factor-Water: 0.156 KgCO<sub>2</sub>e /CMD (2013); Power: 0.522 KgCO<sub>2</sub>e /kwh(2013); Fuel: 2.2631 KgCO<sub>2</sub>e /liter; Paper: 2.8 KgCO<sub>2</sub>e / 500 sheets (A4,70 pounds)

## Carbon Emissions from Ships



The Taiwan air pollution emission [TEDS 8.1] line source manual-calculation formula was adopted to estimate carbon emissions by ocean-going vessels:

Note: Fuel consumption amount (L) = Cargo throughput (L)× Energy density (L/ton kilometer)× Harbor travel distance (km)×1000 (kg/metric ton)  
A ship entering the harbor may switch to marine diesel oil, the properties of which are similar to those of regular diesel fuel. Therefore, the 2013 diesel fuel carbon emission factor in the EPA carbon factor database is used as a reference for the emission factor.

**Ocean-going ship carbon emissions(KgCO<sub>2</sub>e) =**

**Fuel consumption amount (L)× Emission factor(KgCO<sub>2</sub>e/L)× Control factor**

» 2013-2014 Ocean-Going Ship Carbon Emissions in Keelung Port (Unit: KgCO<sub>2</sub>e)

Year	Total Cargo Throughput (metric ton)	Energy Density (liter / metric ton km)	Harbor Travel Distance(km)	Unit	Fuel Consumption(L)	Emission Factor (KgCO <sub>2</sub> e/Liter)	Carbon Emissions
2013	21,436,119	0.003	1	Liter	64,308,357	3.45	221,863,832
2014	21,612,540				64,837,620		223,689,789

## Carbon Emissions of Port Vehicles



The Taiwan air pollution emission [TEDS 8.1] line source manual-calculation formula was adopted to estimate carbon emissions by inbound and outbound container trucks:

Note:

Total number of vehicles per year=(Total cargo throughput (TEU) - Container transshipment throughput (TEU))÷2  
Automotive Research & Testing Center data were reviewed to determine the average fuel consumption rate in the port area. The monthly fuel consumption rate was 2.47 km/L. The research findings of Harbor and Marine Technology Center, MOTC, were also reviewed. The average travel distance to Keelung port is 1.03 km, and the round-trip distance is 2.06 km. Thus, Keelung port fuel consumption was estimated to be 1 L.

**Container truck carbon emissions(KgCO<sub>2</sub>e)=**

**Total number of vehicles per year × Average fuel consumption(L) in the port area× Emission factor(KgCO<sub>2</sub>e/L)× Control factor**

» 2013- 2014 Carbon Emissions of Container Truck in Keelung Port (Unit: KgCO<sub>2</sub>e).

Year	Inward / Outward Container Throughput (TEU)	Heavy Goods Vehicle Carrying Limit (TEU)	Unit	Total Trips per Year	Fuel Consumption (liter)	Emission Factor (KgCO <sub>2</sub> e/liter)	Carbon Emissions
2013	1,551,278.0	2	No of vehicles	775,639.00	1	3.45	2,675,955
2014	1,590,250.5			795,125.25			2,743,182

An analysis of these results revealed that ships were the major source of carbon emissions in the port. The Port of Keelung, TIPC, is highly concerned about this problem, and has begun introducing carbon reduction measures such as by installing shore power equipment at piers and using solar panel equipment to reduce the use of energy sources that generate high levels of pollution.

» Shore Power Installations at Keelung Port pier

Item	Pier No.	Use	Shore Power Specification
1	West No. 1(jetty boat dock)	Cleaning ships	AC 110/220V
2	West No.1	Northern Coastal Patrol Office patrol vessels	AC 220/440V
3	West No.1B	Navy warships	DC 110/220V&AC 440V
4	West No.2	Taiwan-Matsu Ferry (dedicated use)	AC 440V
5	West No.5	Ho Fu Ferry (dedicated use)	AC 440V
6	West No.12B	Port service vessels	AC 110/220V
7	West No.12	Cement ship (dedicated use)	AC 440V
8	East No.1	Small commercial ferries	AC 110/220V
9	East No.2B(boat dock)	Harbor tour vessels	AC 110/220V
10	East No.5	Navy dock	DC 110/220V&AC 440V
11	East No.15	Coast Guard patrol vessels	AC 110/220V

Note:

1.AC alternating current, DC direct current, V volt.  
2.The above shore power usage rate is virtually 100% so usage conditions are excellent.  
3.The funds and expenditures for shore power installation, maintenance and power use are provided by the user.

# Noise

The Keelung port is adjacent to Keelung City. The port area is too small to establish buffer zones. The noise generated by handling, transportation activities, and traffic surrounding the port easily affects the quality of life of local residents. According to the Noise Control Zone Designation Guidelines in Article 6 of the Noise Control Act, the noise-level standards for regular areas are determined based on each control zone and period. The current Keelung City noise-level control zone map devised by the Environmental Protection Bureau of Keelung City has designated the entire Keelung port area as a Class 4 control zone for industrial noise-level controls. The full-range equivalent noise-level standards (20 Hz to 20 KHz) are divided by time, with 80 dB in the day (7:00 AM to 7:00 PM), 70 dB in the evening (7:00 PM to 11:00 PM), and 65 dB at night (11:00 PM to 7:00 AM). When es-

tablishing their 24-h air-quality monitoring system, the Port of Keelung, TIPC, also planned an ongoing noise-monitoring system for prompt response to noise conditions. Because the noise-monitoring stations established by the Environmental Protection Bureau of Keelung City are situated relatively far from the port, the monitoring data were included in the present analysis. Although the monitoring results from most of the monitoring stations meet the statutory requirements, the analytical results revealed that the data from the East No. 9 and the East No. 4 monitoring stations remain high, indicating heavy traffic flow on Zhongzheng Road (adjacent to the port) and on the entrance and exit ramps to connecting roads on the east coast. The Port of Keelung, TIPC, has submitted a development proposal to address this concern.

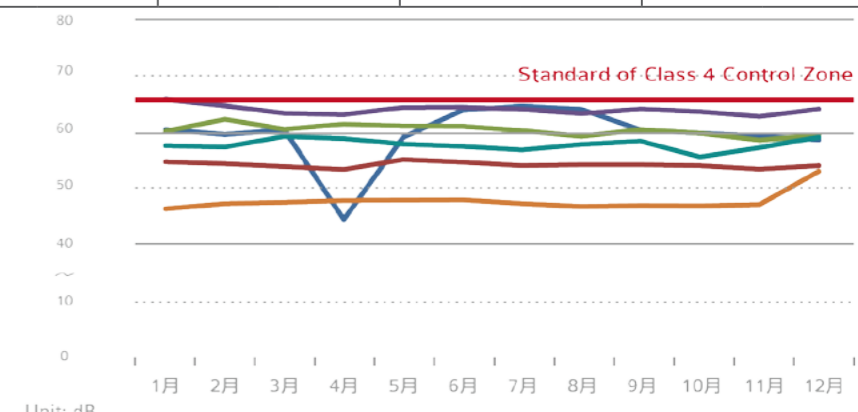
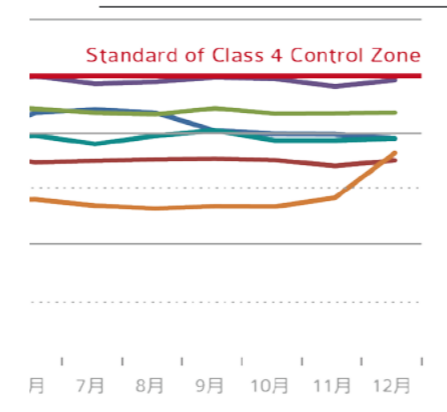
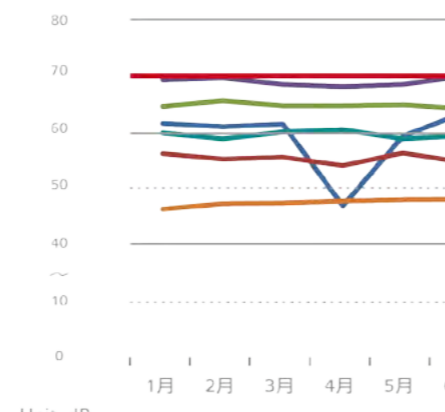
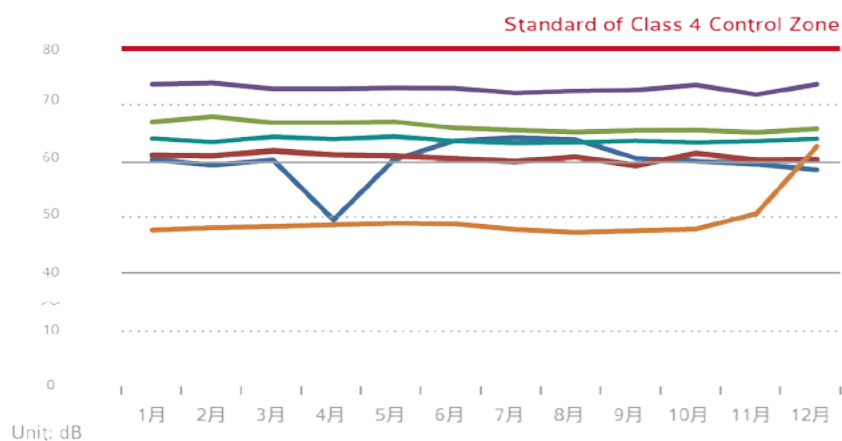
To alleviate traffic noise pollution, the Port of Keelung, TIPC,

has strengthened controls for handling as well as traffic, and has planted trees on the East No. 16 and East No. 20 piers to isolate the noise from handling. The Port of Keelung, TIPC, is currently planning to transfer the port area's east coast container yard to the west coast to shift the noise generated

from major traffic routes as well as handling activities away from city areas to reduce noise disturbances affecting neighboring communities.

» 2013-2014 Leq Noise Level in Keelung Port (only calculated from Jun. to Dec. in 2013)

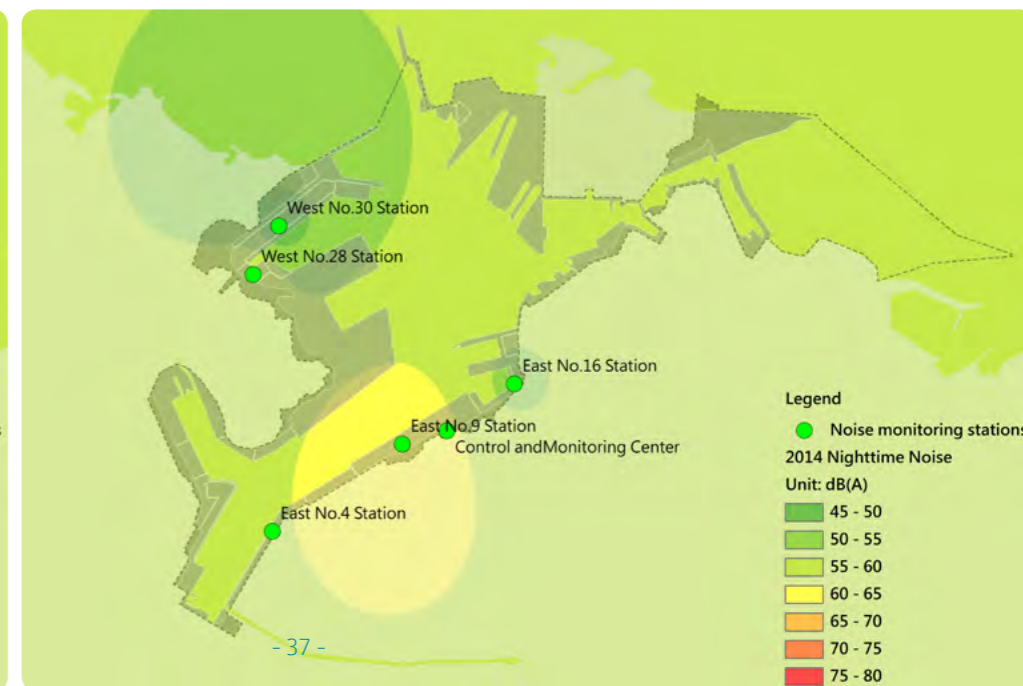
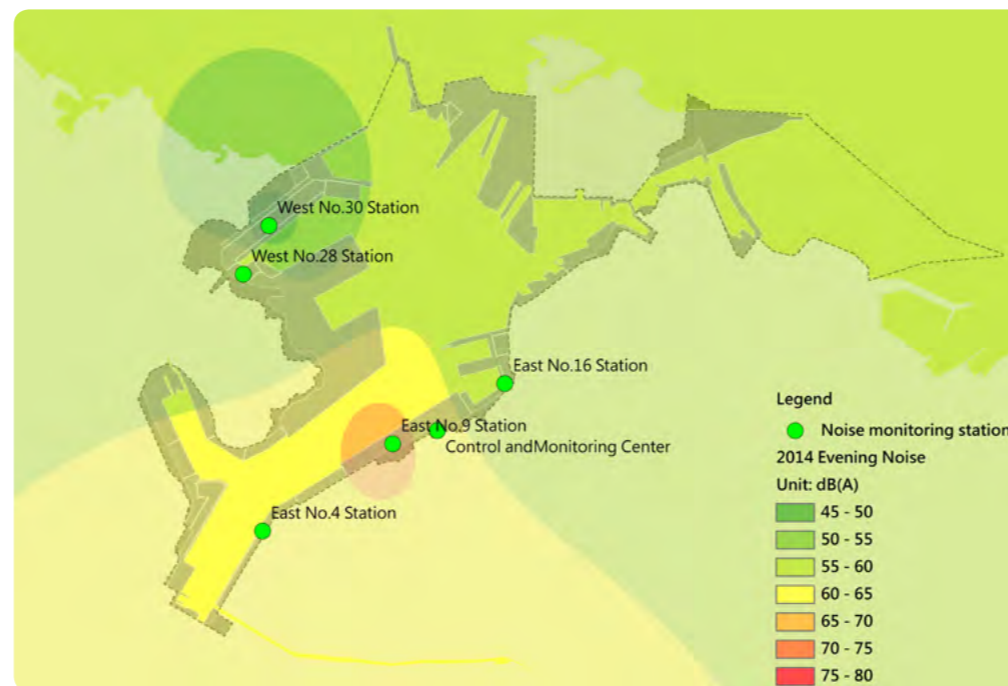
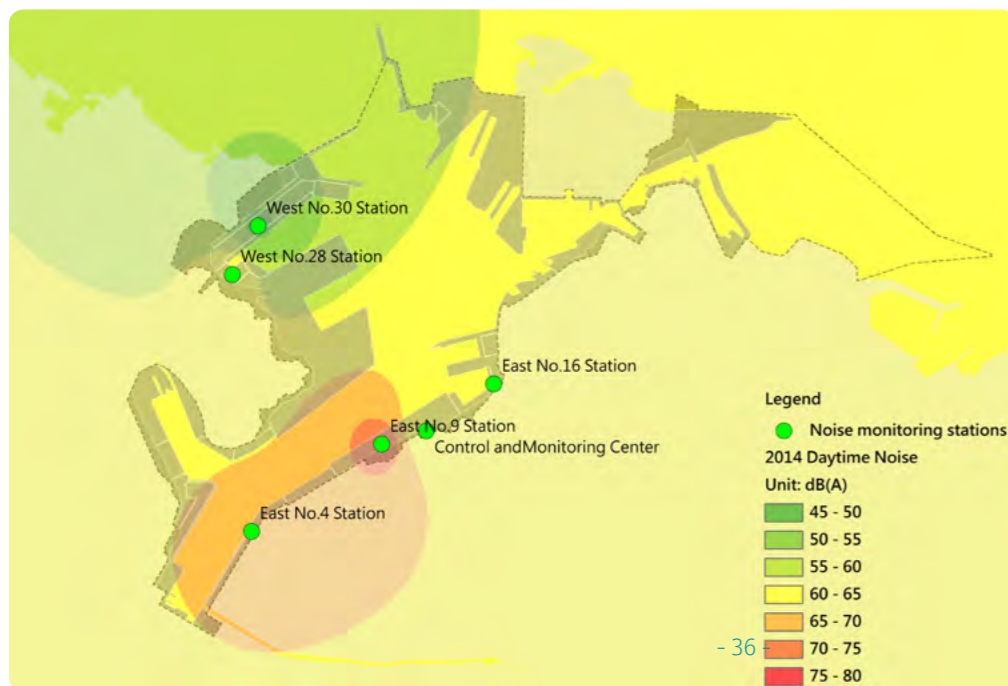
Station	Daytime Leq		Evening Leq		Nighttime Leq		Full Range Leq	
	2013	2014	2013	2014	2013	2014	2013	2014
Monitoring Center	63	60	62	60	62	60	63	60
East No.16 Monitoring Station	62	60	57	55	56	54	61	58
East No.4 Monitoring Station	68	66	65	64	62	61	66	64
East No.9 Monitoring Station	74	73	70	69	65	65	72	70
West No.28 Monitoring Station	62	64	58	60	57	58	61	61
West No.30 Monitoring Station	60	49	54	48	51	48	58	49
Control Area IV Standard	80		70		65		-	



»2014 Spatial Analysis of Monthly Daytime Leq Noise Level in Keelung Port Area

»2014 Spatial Analysis of Monthly Evening Leq Noise Level in Keelung Port

»2014 Spatial Analysis of Monthly Nighttime Leq Noise Level in Keelung Port



# Water Quality

Several canals from Keelung City flow into the Keelung port. Over 140 discharge outlets exist, including for domestic and wastewater from the city area, contributing to high seawater nutrient and salt levels in the port. In addition, pollution caused by oily ship water, trash, and other floating objects has led to the gradual loss of water-friendly practices in the Keelung port area and its drainage canals. The Port of

Keelung, TIPC, commenced planning long-term water-quality monitoring for the Keelung port area in 2014, and also added monitored sediment in 2015 to gain a clear understanding of the causes of water pollution in the port, and to use the monitoring results as a reference for future strategies aiming to improve the water environment.

flowing into the port area. The Port of Keelung, TIPC, has contributed the land, the Environmental Protection Administration has provided funds to subsidize construction costs, and the Keelung City government is responsible for the construction and operations following completion. Construction lasted more than 4 years. Following its completion on June 30, 2013, Keelung residents and visitors had access to cleaner rivers. Moreover, the Port of Keelung, TIPC, will collaborate with

the Keelung City government on the East Coast Wastewater Sewer Line Construction Plan to connect the Keelung port sewage line and prevent domestic wastewater from draining into the port area, and communicate with the Environmental Protection Bureau of Keelung City to monitor city wastewater discharge into the port and alleviate potential factors contributing to water pollution.

## Water Quality Monitoring

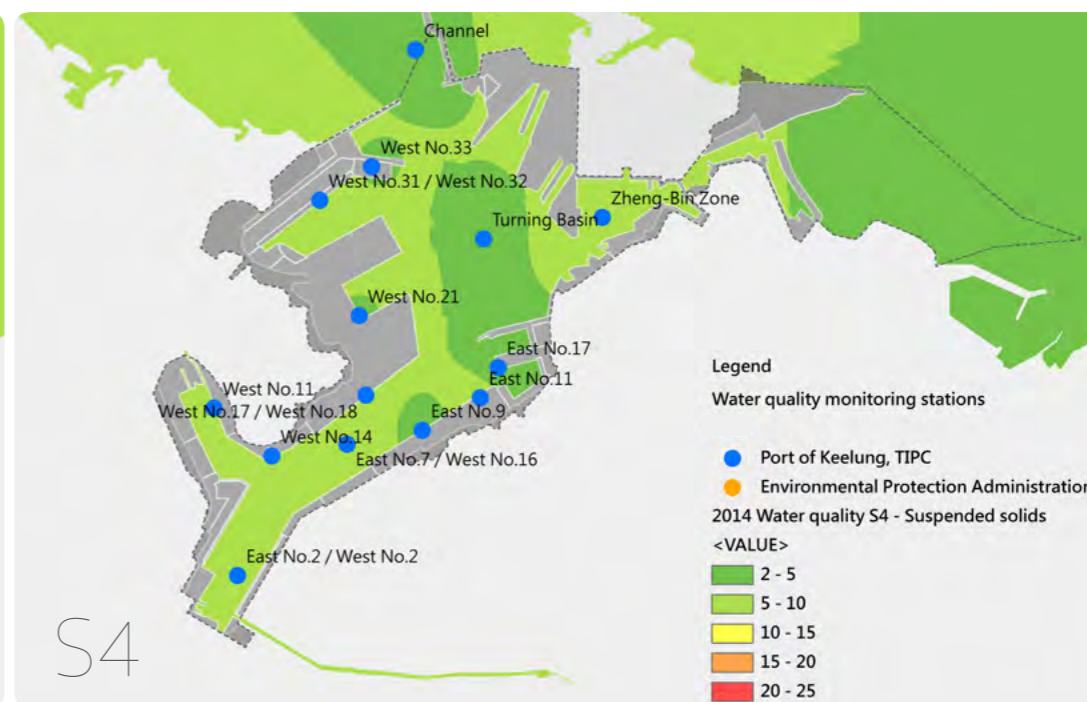
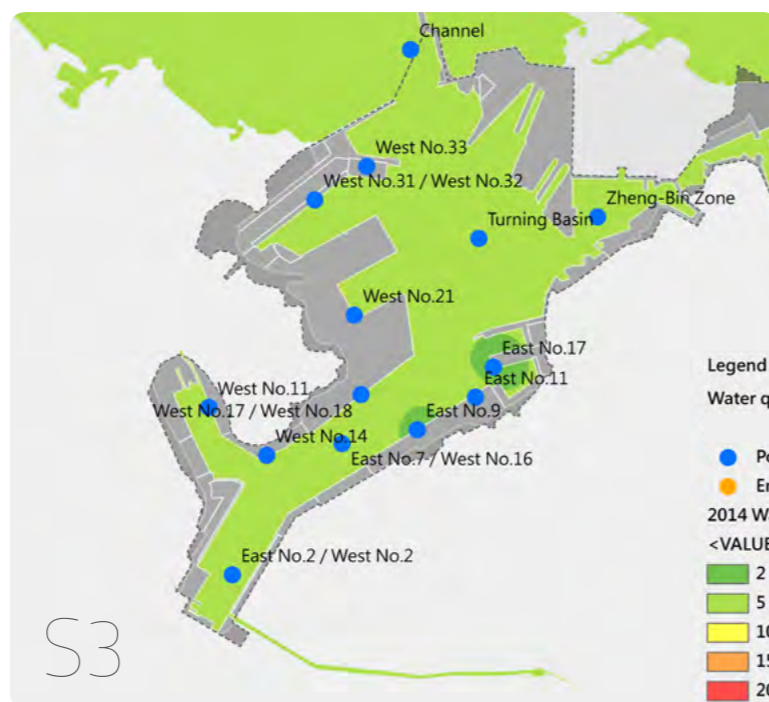
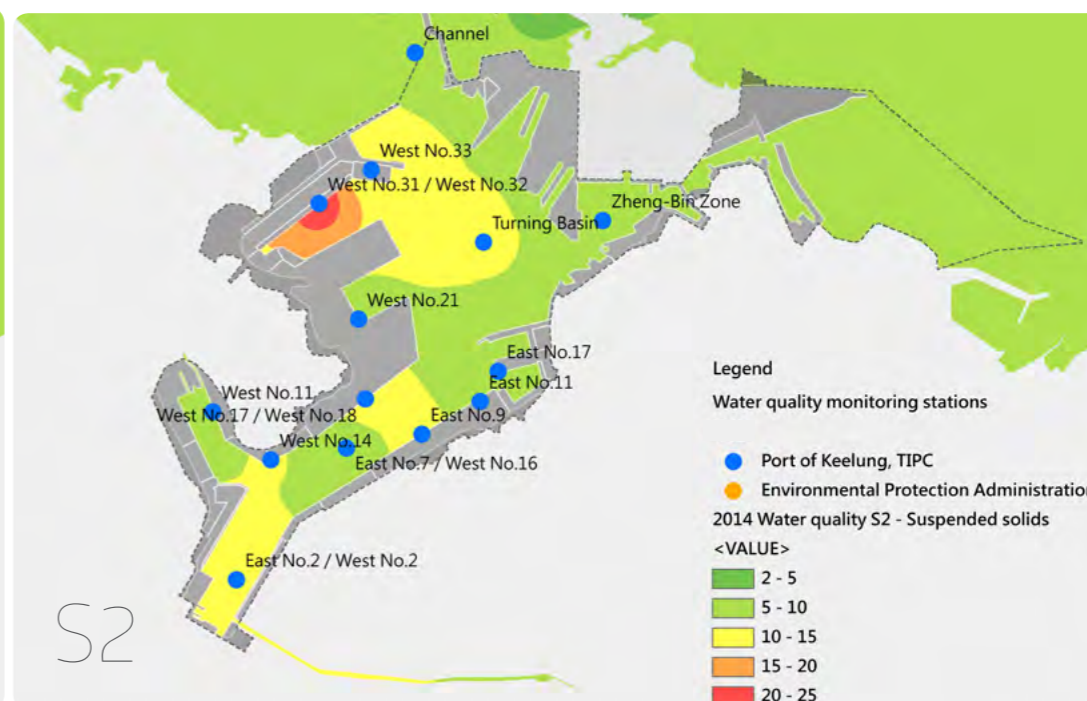
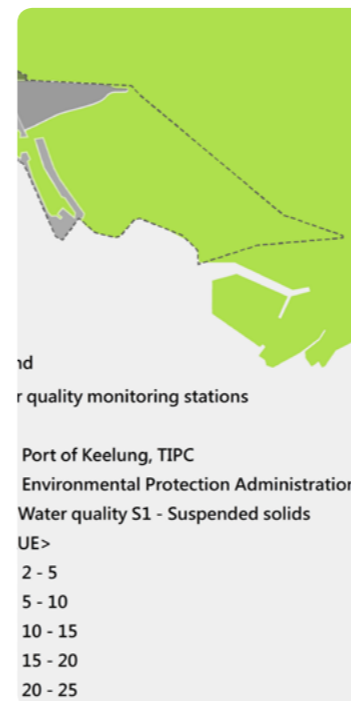
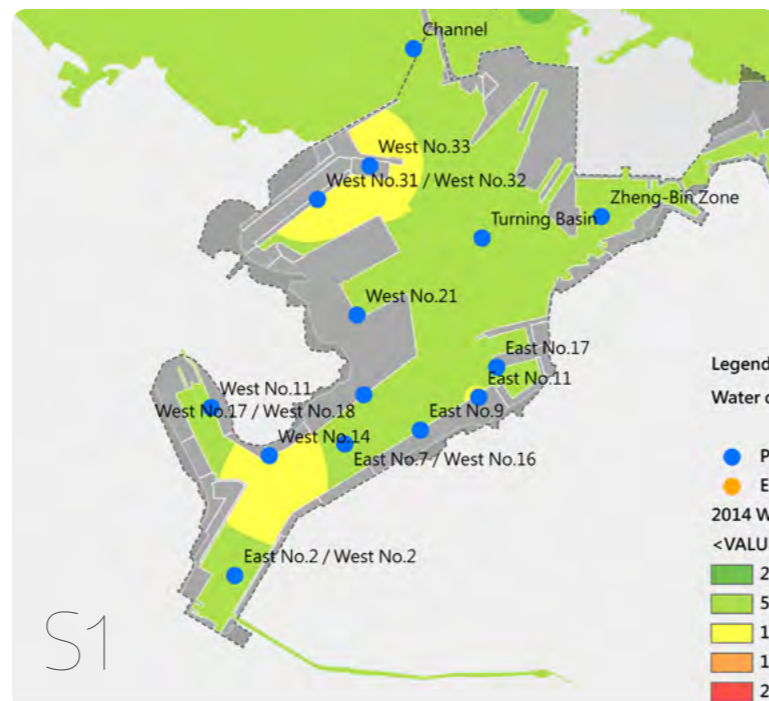


Two water-quality monitoring organizations exist: The Port of Keelung, TIPC, and the Environmental Protection Administration. The Port of Keelung, TIPC, began the long-term monitoring of the water quality in 2014. Fourteen monitoring stations were established, nine of which monitor the effluent water quality, and the remaining five stations monitor the seawater quality. Three monitoring stations of the Environmental Protection Administration are located in the waters outside the port area. The main target of their monitoring efforts is the port gateway. The water-quality items monitored by these two organizations are not identical, but include hydrogen ion concentration, chemical oxygen demand, mineral oil, suspended solids, biochemical oxygen demand, coliform groups, cyanide, total phosphorus, dissolved oxygen, phenols and ammonia.

According to the Marine Environment Classification and Marine Environment Quality Standards established under Article 8-1 of the Marine Pollution Control Law, the marine environment is divided into classes A, B, and C. The Class B marine environment quality standards are applied to the waters offshore of Keelung. However, waters within a 2 km radius of a discharge outlet are considered subordinate-level waters. Comparing the monitoring results against the statutory standards revealed that monitored areas met the standard, which shows that the Port of Keelung, TIPC, has effectively improved the long-term water quality.

The analytical results of the monitoring data revealed that suspended particulate matter levels are relatively high in the Keelung port waters during the summer. Substantial precipitation from the plum rain season and typhoons washes suspended particulate matter from the bulk cargo pier and the gravel pier into the seas, causing relatively high levels of suspended particulate matter for the West No. 27 and West No. 30-32 piers. The Port of Keelung, TIPC, has planned to install interception facilities for wastewater runoffs from the piers, set for completion in 2016, to improve the water quality in the Keelung port area.

In addition, the Port of Keelung, TIPC, the Environmental Protection Administration, and the Keelung City government have collaborated to address the problem of wastewater



» Spatial Analysis of 2014 Water Quality Monitoring in Keelung Port – Suspended Solids

## Sediment

Sediment testing has been conducted several times in Keelung port. In 2015, long-term sediment monitoring was formally contracted out, and three representative monitoring sites were established. The monitored items include heavy metals such as copper, zinc, lead, cadmium, nickel, total chromium, arsenic, and mercury, in addition to total organic matter.

According to the Marine Discarded Substance Classifications established under Article 22-1 of the Marine Pollution Control Act, marine discarded substances are categorized under Classes A, B, and C. Ocean disposal of Class A substances is forbidden. When the 2011 and 2012 monitoring results were compared against Class B substance standards, the copper and zinc levels were found to exceed statutory standards. The copper levels were over twice the standardized limits.

The presence of these two metals may have been caused by copper corrosion from ships, dispersion during cargo handling, or wastewater discharged from factories located upstream. Its long-term accumulation may affect the sediment quality in the Keelung port.

In addition, if the soil in Keelung City becomes contaminated with heavy metals, precipitation would wash the heavy metal contamination into rivers, which could be carried into the port area. The Environmental Protection Bureau of Keelung City is planning to conduct sediment-quality analysis for rivers in late 2015 to determine river sediment conditions in Keelung City. These monitoring results may aid the Port of Keelung, TIPC, in identifying the source of the heavy metals in the sediment.

### » 2011-2012 Sediment Monitoring in Keelung Port (Unit: mg/kg)

item	Temporarily placement between west breaker and west breakwater			Sediment Quality Index		Marine Disposed Material Classification	US NOAA Sediment Biohazard Standard July 22, 2011	
	July 22, 2011	Nov. 16, 2011	Aug. 29, 2012	Min	Max		Min	Max
Arsenic	7.930	7.970	12.800	11	33	20	8.2	70
Cadmium	<0.090	<0.090	<0.33	0.65	2.49	-	1.2	9.6
Chromium	22.800	18.700	35.100	76	233	60	81	370
Copper	116.000	50.700	134.000	50	157	65	34	270
Mercury	0.442	0.098	0.468	0.23	0.87	-	0.15	0.71
Nickel	N.D.	N.D.	23.700	24	80	70	-	-
Lead	30.700	19.300	37.000	48	161	50	46.7	218
Zinc	N.D.	N.D.	226.000	140	384	200	-	-
Cyanide	<0.128	<0.132	N.D.	-	-	1	-	-
Fluorides	N.D.	N.D.	N.D.	-	-	1,000	-	-
Silver	<3.330	<3.330	N.D.	-	-	1	1.0	3.7

## Dredging Management



There are four possible sources of the port sediments: Sediments carried into the port basin from rivers and discharge outlets; sand blown in from the waters outside the port area; and solid particulate matter deposited through port construction and the atmosphere. Because of the slow exchange flow in the Keelung port waters and seas outside the port, the Keelung port sediment could be from upstream rivers including Xuchuan River, Nanrong River, Xiding River, Tianliao River, and Niuchougang Stream. To maintain the free flow of the navigation channels and pier berths of the port, the Port of Keelung, TIPC, dredges the port waters annually.

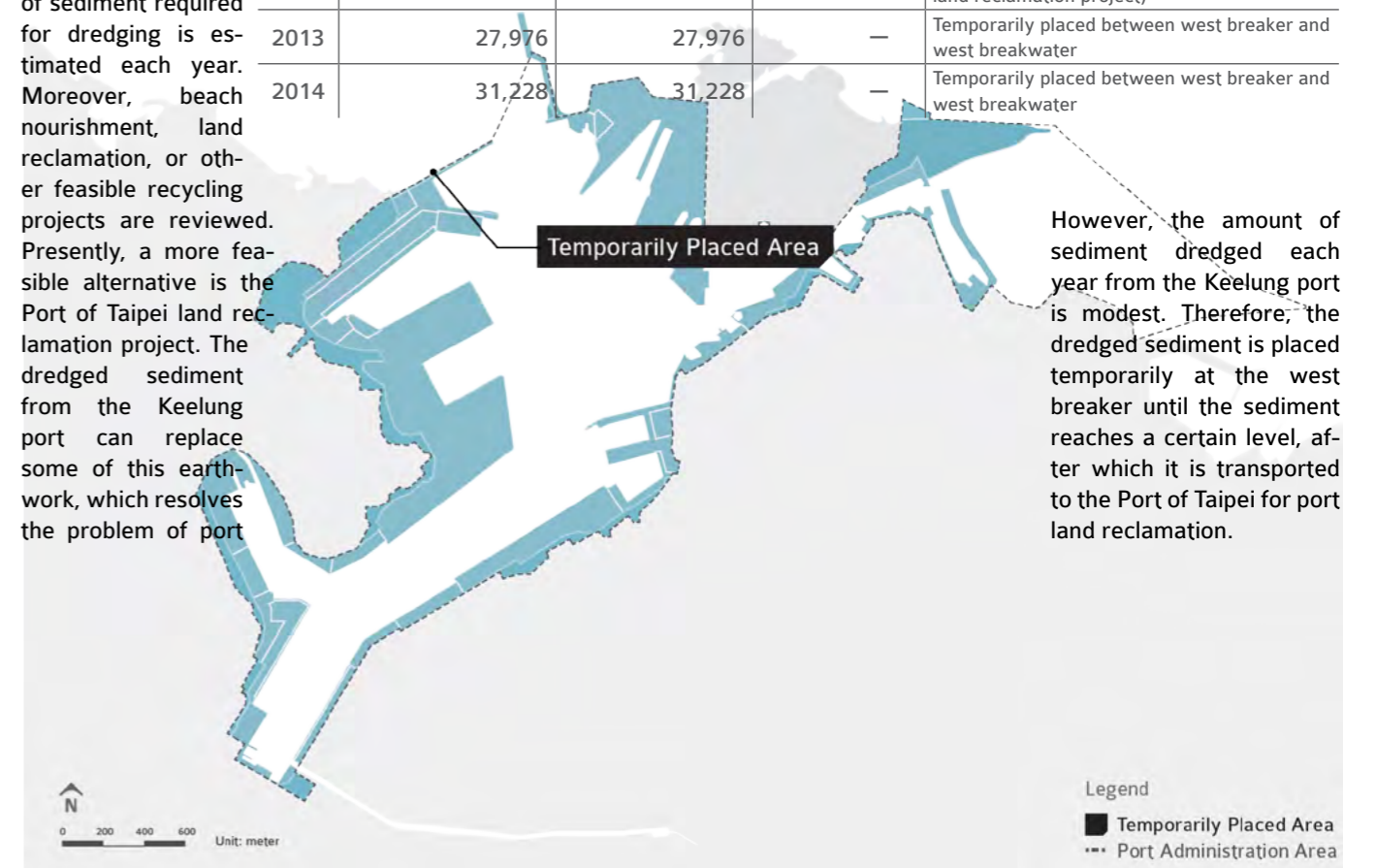
sediment disposal and releases the funds designated for purchasing the earthwork. This is currently the best alternative for the dredged sediment from the Keelung port.

The different usage purposes of the dredged sediment should follow their respective environmental management standards. At present, the testing results of Keelung port sediment meet the Categories and Usage Restrictions for Sediment Quality Indicator standards, and can be used for beach nourishment along the port area. In addition, because they meet the commonly used NOAA sediment biohazard standards, they can be used for land reclamation in the port.

The Port of Keelung, TIPC, measures the port water depth regularly. For navigation channels with sediment levels that are higher than the designed water depth, the amount of sediment required for dredging is estimated each year. Moreover, beach nourishment, land reclamation, or other feasible recycling projects are reviewed. Presently, a more feasible alternative is the Port of Taipei land reclamation project. The dredged sediment from the Keelung port can replace some of this earthwork, which resolves the problem of port

### » Keelung Port Navigation Channel, Turning Basin and Berth Dredging Statistics (unit: m<sup>3</sup>)

Year	Estimated Dredging Amount	Actual Dredging Amount	Actual Landfill Amount	Remark
2009	4,273	5,072	5,072	Done by landfill method (filled at legal landfill)
2010	8,612	8,080	—	Temporarily placed between west breaker and west breakwater
2011	22,719	15,124	—	Temporarily placed between west breaker and west breakwater
2012	16,228	9,420	11,606	Done by landfill method (filled at Port of Taipei land reclamation project)
2013	27,976	27,976	—	Temporarily placed between west breaker and west breakwater
2014	31,228	31,228	—	Temporarily placed between west breaker and west breakwater



However, the amount of sediment dredged each year from the Keelung port is modest. Therefore, the dredged sediment is placed temporarily at the west breaker until the sediment reaches a certain level, after which it is transported to the Port of Taipei for port land reclamation.



# Development of Land & Water Areas at the Port

The proposal Future Development and Construction of International Ports in Taiwan, TIPC (2012 – 2016) assigns Keelung Port the dual functions of "local tourism and international cargo shipping." Local Tourism will take the form of collaboration with local cities and towns in the development of a commercial tourism area and cooperation with the government to urbanize West No. 2 and 3 piers and revitalize port lands. In addition, East No. 2-4 piers and West No. 2-4 piers will be fully developed for local tourism. As for "international cargo shipping," the focus will be on improving the current infrastructure for container and cargo shipping and promoting free trade and transshipment.

The most recent development plan for the Port of Keelung, TIPC (2012 – 2016) chiefly targets local tourism. The southern shore of the port was opened to the public in 2013; currently known as the "Marine Plaza," it is a new landmark of Keelung Port and has aquatic-oriented facilities. As for east and west shores of the port, the Port of Keelung, TIPC will

continue to work on the projects "Construction of a Port Affairs Building for Passengers on the West Coast of Keelung Port" and "Construction of the Tourist Information Center and Public Facilities in the Tourist and Commercial Area at East No. 2-4 Piers," which will correct the problem of old and scattered offices at the Port of Keelung, TIPC. The two projects will help handle the major increase in tourists due to direct cross-Strait transport and make Keelung Port an international cruise ship port. In addition, the recent "International Cargo Shipping" development project focuses on reconstruction of the container storage area on the west side of Keelung Port. In this project, a new high-density container storage system will resolve the problem of insufficient land for container storage. Replacing old operating machinery and equipment will increase working efficiency and eliminate pollution. The ultimate goal of this project is to make the west side of the port a trial operations area paving the way for a full-scale high-density container storage system in the future.



» Proposed recent development locations at Keelung Port (2012-2016)

# Port Green Landscaping



In addition to port development, the Port of Keelung, TIPC is also expanding the port's green area and building recreational facilities in Keelung Port to make it more appealing to local residents.

Because Keelung Port is geographically restricted by its small land area, greening of the port area involves building add-ons to existing facilities. These include:

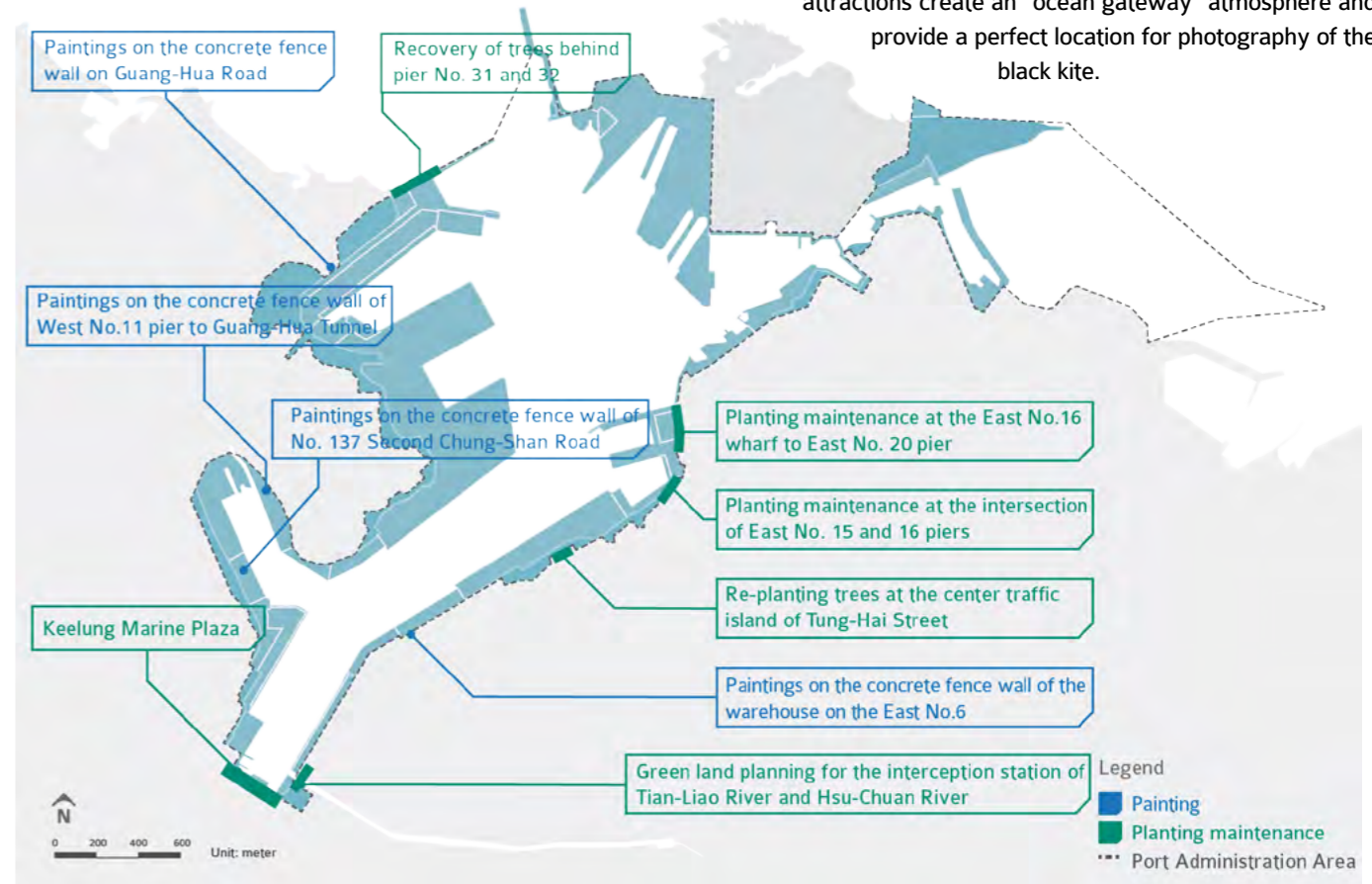
1. Paintings on the concrete wall that runs from the warehouse on the sea side of East Provincial Highway 6 near West No. 11 pier to the entrance of the Chung-Shan Tunnel, on the concrete wall along No. 137 Second Chung-Shan Road, and on the concrete wall along the outside of Guang-Hua Road.
2. In order to prevent noise and beautify the port environment, two rectangular gardens have been constructed to the right of the pedestrian path that runs from East No. 16 pier to East No. 20 pier and at the intersection of East No. 15 and 16 piers. A total of 48 palmettos, 46 garcinias, and 94 Tashiro Indian hawthorns have been planted in order to minimize noises caused by cargo handling, and thereby reducing annoyance to

local residents.

3. Recovery of trees behind piers No. 31 and 32, and planting of 336 Ficus microcaps on the center traffic island of Tung-Hai Street.

4. Use of East No. 1 pier as an interception point for the Tian-Liao River and Hsu-Chuan River in cooperation with the Environmental Protection Administration, Executive Yuan and Keelung City Government. The interception station intercepts domestic sewage from upstream so as to improve the water quality of Keelung Port and eliminate odor from the Tian-Liao River. In addition, the area to the north of the sewage interception station on the East Shore Pier is reserved for landscaping, and will serve as a garden for the East No. 1 pier.

5. The Port of Keelung, TIPC has cooperated Keelung City Government to build a Marine Plaza within the port area. The Marine Plaza is surrounded by East No. 1 pier, West No. 1 pier, and Chung-Yi Road, which form a belt-shaped area of tourist interest linking the West Shore Piers of Keelung Port, the Customs Building, Marine Plaza, and East Shore Piers. These attractions create an "ocean gateway" atmosphere and provide a perfect location for photography of the black kite.



» Green Locations of Keelung Port

# Soil Pollution



Land pollution testing and site improvements have not been necessary for land use in the Keelung port for the past 10 years, with the soil exception of the Keelung forge operated by the CSBC Corporation, Keelung Yard (originally named "China Shipbuilding Corporation Keelung Yard").

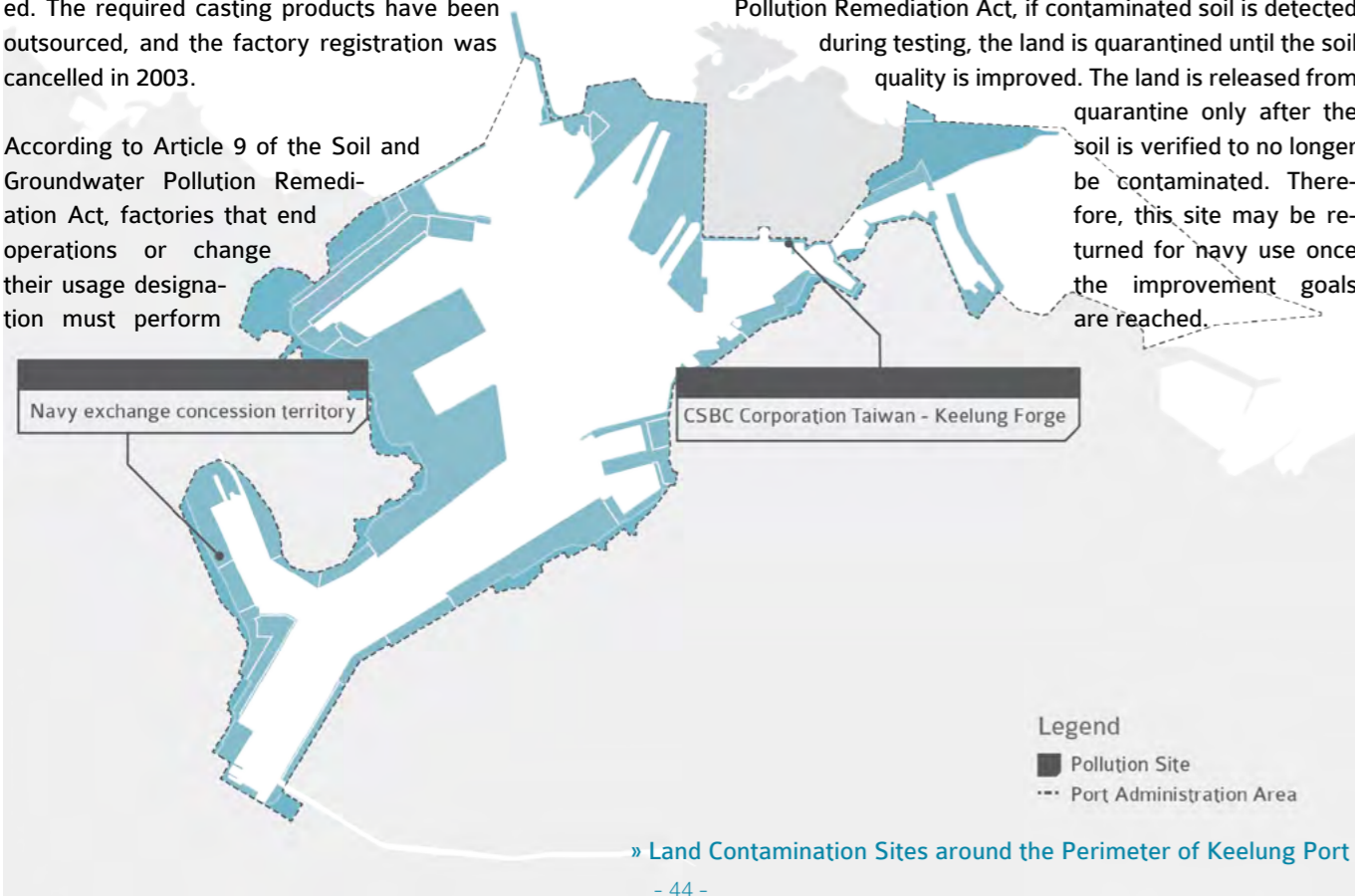
The CSBC Corporation, Keelung Yard commenced operations in 1975. The plant is located at No. 42 Heyi Road, Zhongzheng District, Keelung City. The land is owned by Naval Third Military Region Command Headquarters, Ministry of Defense. The parties have exchanged leases for their respective sites since 1972. The CSBC Corporation, leases the factory site at No. 62 Zhongshan 2 Road, Zhongshan District, Keelung City to the navy. (The West No. 9 pier is owned by the Port of Taiwan, TIPC.) This exchange did not accompany any changes to the property rights. The factory occupies a space of 12,000 m<sup>2</sup> and is a basic foundry that uses arc furnace methods to refine and manufacture steel and also produce cast steel and cast iron products. In 2001 the CSBC Corporation, Taiwan, underwent restructuring and changed its operating model. Forge employees were laid off, and operations were terminated. The required casting products have been outsourced, and the factory registration was cancelled in 2003.

According to Article 9 of the Soil and Groundwater Pollution Remediation Act, factories that end operations or change their usage designation must perform

soil pollution surveys and testing. The Environmental Protection Bureau of Keelung City conducted sample testing of the groundwater and soil at the CSBC Corporation, Keelung Yard. Of the 6 samples tested, 6 contained heavy metal or total petroleum hydrocarbon (TPH) concentrations that exceeded control standards. The groundwater did not exceed groundwater control standards. According to Article 8 of the Soil and Groundwater Pollution Remediation Act Enforcement Rules announced on December 5, 2006, the CSBC Corporation, must improve the soil quality.

CSBC Corporation, estimates medium to heavy levels of contamination in approximately 3,000 m<sup>3</sup> of the soil in the forge area, low levels of heavy metal contamination in 9,000 m<sup>3</sup> of soil, 900 m<sup>3</sup> of earthwork with TPH contamination, and 2,000 m<sup>3</sup> of construction waste and waste foundry sand. On June 12, 2008, the Environmental Protection Bureau of Keelung City approved the soil improvement project, which included the digging of oil-contaminated soil, construction waste, and waste foundry sand, and the processing of TPH-contaminated soil. The improvement project was completed on July 18, 2009. According to Article 26 of the Soil and Groundwater

Pollution Remediation Act, if contaminated soil is detected during testing, the land is quarantined until the soil quality is improved. The land is released from quarantine only after the soil is verified to no longer be contaminated. Therefore, this site may be returned for navy use once the improvement goals are reached.



» Environmental Performance Indicators of Keelung Port

Significant environmental issues of the Keelung Port	Index item	Calculation method	Index target	Description of calculation		Correspondence
				2013	2014	
Port and harbor waste	General waste removed and recycling rate in the harbor land area	<ul style="list-style-type: none"> <li>General waste removed from the harbor land area</li> <li>General waste recycling rate in the harbor land area</li> </ul>	1% general waste recycling rate in the harbor land area based on general waste removed	<ul style="list-style-type: none"> <li>General waste removed from the harbor land area: 1761.85 ton</li> <li>General waste recycling rate in the harbor land area: <math>2.069 / 1761.85 = 0.12\%</math></li> </ul>	<ul style="list-style-type: none"> <li>General waste removed from the harbor land area: 1976.54 ton</li> <li>General waste recycling rate in the harbor land area: <math>5.754 / 1976.54 = 0.29\%</math></li> </ul>	Waste and Oily wastewater P.26
	Ratio of service vessels using low-emission fuels or biodiesels and the volume of low-emission fuels used by service vessels	<ul style="list-style-type: none"> <li>Number of service vessels using low-emission fuels (marine diesel oil or super diesel) ÷ total number of service vessels × 100%</li> <li>Volume of low-emission fuels used by service vessels</li> </ul>	100% of service vessels using low-emission fuels or biodiesels	<ul style="list-style-type: none"> <li><math>6 \div 17 \times 100\% = 35.2\%</math></li> <li>Service vessels owned by the Port of Keelung, TIPC: 17</li> <li>Service vessels using low-emission fuels (super diesel): 6 Low-emission fuels used by service vessels: 7,749 KL of super diesel and 1,197,383 KL of marine diesel oil</li> </ul>	<ul style="list-style-type: none"> <li><math>6 \div 13 \times 100\% = 46.1\%</math></li> <li>Port of Keelung, TIPC owns 7 tugs, 1 crane ship, 1 shuttle vessel, 1 mooring vessel, and 13 cleaning vessels (total: 13 vessels)</li> <li>Number of vessels using low-emission fuels (super diesel): 6 Low-emission fuels used by service vessels: 13,521 KL of super diesel and 1,371,160 KL of marine diesel</li> </ul>	Air Quality P.30
Vessel speed restriction policy	<ul style="list-style-type: none"> <li>Number of inbound vessel speed restriction guidance activities held (communication records/work logs)</li> <li>Number of meetings (through written) invitations for addressing vessel speed restrictions</li> <li>Number of berth meetings addressing vessel speed restriction policies</li> </ul>	At least maintain 100 meeting or through written invitation per year	<ul style="list-style-type: none"> <li>0 inbound vessel speed restriction guidance activities (communication records/work logs)</li> <li>0 meetings (through written invitation) related to compliance with vessel speed restriction policies</li> <li>0 berth meetings addressing compliance with vessel speed restriction policies (Continued sending guidance notices requesting shipping companies to reduce vessel speeds below 12 kn within 20 M of the harbor)</li> </ul>	<ul style="list-style-type: none"> <li>0 inbound vessel speed restriction guidance activities (communication records/work logs)</li> <li>0 meetings (through written invitation) related to compliance with vessel speed restriction policies</li> <li>0 berth meetings addressing compliance with vessel speed restriction policies (to be implemented by the Port of Keelung, TIPC, in the future to further address vessel speed restriction policies)</li> </ul>		
Completely automated gate control system for all transport operators	<ul style="list-style-type: none"> <li>Ratio of vehicle traffic lanes with automated gate controls</li> <li>Number of trucks and drivers with approved access cards</li> </ul>	Number of lanes equipped with automated gate control: 6 entry lanes and 9 exits lanes Minimum number of personnel access cards: 700 each year	<ul style="list-style-type: none"> <li>Ratio of entry lanes with automated gate controls: <math>2 \div 6 \times 100\% = 33.3\%</math></li> <li>Ratio of exit lanes with automated gate controls: <math>5 \div 9 \times 100\% = 55.5\%</math> 2 entry lanes and 5 exit lanes are equipped with automatic access controls 6 entry lanes and 9 exits lanes in total</li> <li>Number of approved personnel radio-frequency identification (RFID) access cards for the automated gate control system: 748 (vehicle RFIDs have not yet been issued)</li> </ul>	<ul style="list-style-type: none"> <li>Ratio of entry lanes equipped with automated gate controls: <math>2 \div 6 \times 100\% = 33.3\%</math></li> <li>Ratio of exit lanes equipped with automated gate controls: <math>5 \div 9 \times 100\% = 55.5\%</math> 2 entry lanes and 5 exit lanes are equipped with automatic access controls 6 entry lanes and 9 exits lanes in total</li> <li>Approved personnel RFID access cards for the automated gate control system: 910 (vehicle RFIDs have not yet been issued)</li> </ul>		
Ratio of service vessels using shore power	Number of service vessels using shore power ÷ total number of service vessels × 100%	All service vessels using shore power	$17 \div 17 \times 100\% = 100\%$ Number of service vessels: 17; number of service vessels using shore power: 17	$13 \div 13 \times 100\% = 100\%$ Number of service vessels: 13; number of service vessels using shore power (7 tugs, 1 crane ship, 1 shuttle vessel, 1 mooring vessel, and 3 cleaning vessels)		
Pollution from river influx	Ratio of river channels or canals installed with trash racks at interception stations	Number of rivers channels or canals installed with trash racks ÷ total number of river channels or canals in the harbor area × 100%	50% of river channels or canals with trash racks installed	<ul style="list-style-type: none"> <li><math>1 \div 4 \times 100\% = 25\%</math></li> <li>Number of river channels with trash racks installed: 1 (Hsuehuan River)</li> <li>Total number of river channels or canals in the harbor area: 4 (Xiangfeng Street channel, Niouchougang River, Hsuehuan River, and Tienliao River)</li> </ul>	<ul style="list-style-type: none"> <li><math>1 \div 4 \times 100\% = 25\%</math></li> <li>Number of river channels with trash racks installed: 1 (Hsuehuan River)</li> <li>Total number of river channels or canals in the harbor area: 4 (Xiangfeng Street channel, Niouchougang River, Hsuehuan River, and Tienliao River)</li> </ul>	Water Quality P.38
Cargo spillage	Number of harbor inspections, cargo spillage emergency response drills, and jointly supervised harbor safety drills	Number of harbor inspections, cargo spillage emergency response drills, and jointly supervised harbor safety drills	100 harbor inspections At least one cargo spillage emergency response drill per year At least one jointly supervised harbor safety drill per year	<ul style="list-style-type: none"> <li>Number of harbor inspections: 87 (75 environmental management inspections and 12 harbor safety inspections)</li> <li>Cargo spillage emergency response drills: 0 Jointly supervised harbor safety drills: 1</li> </ul>	<ul style="list-style-type: none"> <li>Number of harbor inspections: 310 (298 environmental management inspections and 12 harbor safety inspections)</li> <li>Cargo spillage emergency response drills: 0 Jointly supervised harbor safety drills: 1</li> </ul>	Emergency Response P.48
Vessel sewage discharge	Performance of commissioned qualified operators on cleaning oily wastewater	Number of cleanups conducted by relevant vessels ÷ number of vessels that collected oily wastewater × 100%	100% oily wastewater water cleanup	$311 \div 311 \times 100\% = 100\%$ Cleanups conducted by relevant vessels (oily wastewater water): 311 Total oily wastewater water collected: 4223.64 t	$281 \div 281 \times 100\% = 100\%$ Cleanups conducted by relevant vessels: 281 Total oily wastewater water collected: 3344.32 t	Water Quality P.38
Vessel solid waste	Performance of commissioned qualified operators on cleaning general waste	Number of cleanups conducted by relevant vessels (general waste) ÷ number of vessel operators that collected general waste × 100%	100% general waste cleanup	Independently implemented by the Port of Keelung, TIPC, in 2013; the source of waste was not tracked	<ul style="list-style-type: none"> <li>Percentage of general waste cleanups executed by commissioned qualified operators: 100%</li> <li>Vessel waste transport capacity: 129 t Total recycled materials: 31 t (July–December, 2014)</li> </ul>	Waste and Oily wastewater P.26
Port and harbor land area development	Maintain green belt areas in the harbor	Maintain green belt areas in the harbor	Minimum green belt area maintained: 0.2 ha	Harbor green belt areas maintained: 0.042 ha (0.015 ha in East Pier 1 and 0.0279 ha in East Pier no.16)	Harbor green belt areas maintained: 0.2 ha (added 0.16 ha in West Pier no.9)	Port Green Landscaping P.43
	Area related to recreational facilities such as harbor waterfront areas and pedestrian-friendly spaces	Area related to recreational facilities	Maintain a minimum of 2.71 ha of land for relevant recreational facilities	Relevant recreational facilities: 2.55 ha (including 0.165 ha of public open space in the New Keelung Port Service Building, 0.1976 ha of public space at West Pier no.2, 0.3814 ha at the Marine Plaza, and 1.806 ha of open fishing areas in 2013)	Relevant recreational facilities: 2.71 ha (added 0.16 ha in West Pier no.9)	
Harbor development in the water area	Number of times tour activities in the water area were held and number of participants	Number of times tour activities in the water area were held and number of participants	13 water tours 700 participants	In preparation	13 water tours 700 participants	
Harbor water quality	Ratio of certified operators requiring monitoring or operators that own wastewater (sewage) treatment equipment permitted for use in a harbor under the Water Pollution Control Act	<ul style="list-style-type: none"> <li>Number of certified operators requiring monitoring or operators that own wastewater (sewage) treatment equipment permitted for use in a harbor under the Water Pollution Control Act ÷ total number of operators requiring monitoring for generating wastewater (sewage) in the harbor × 100%</li> </ul>	Ratio of certified operators requiring monitoring or operators that own wastewater (sewage) treatment equipment permitted for use under the Water Pollution Control Act: 100%	<ul style="list-style-type: none"> <li><math>12 \div 13 \times 100\% = 92.3\%</math></li> <li>Number of certified operators requiring monitoring: 0</li> <li>Number of operators that own wastewater (sewage) treatment equipment: 12 Number of operators within the harbor that generate wastewater (sewage): 13</li> </ul>	<ul style="list-style-type: none"> <li><math>12 \div 12 \times 100\% = 100\%</math></li> <li>Number of certified operators requiring monitoring: 0</li> <li>Number of operators that own wastewater (sewage) treatment equipment: 12 Number of operators within the harbor that generate wastewater (sewage): 12</li> </ul>	Water Quality P.38



Emergency  
Response

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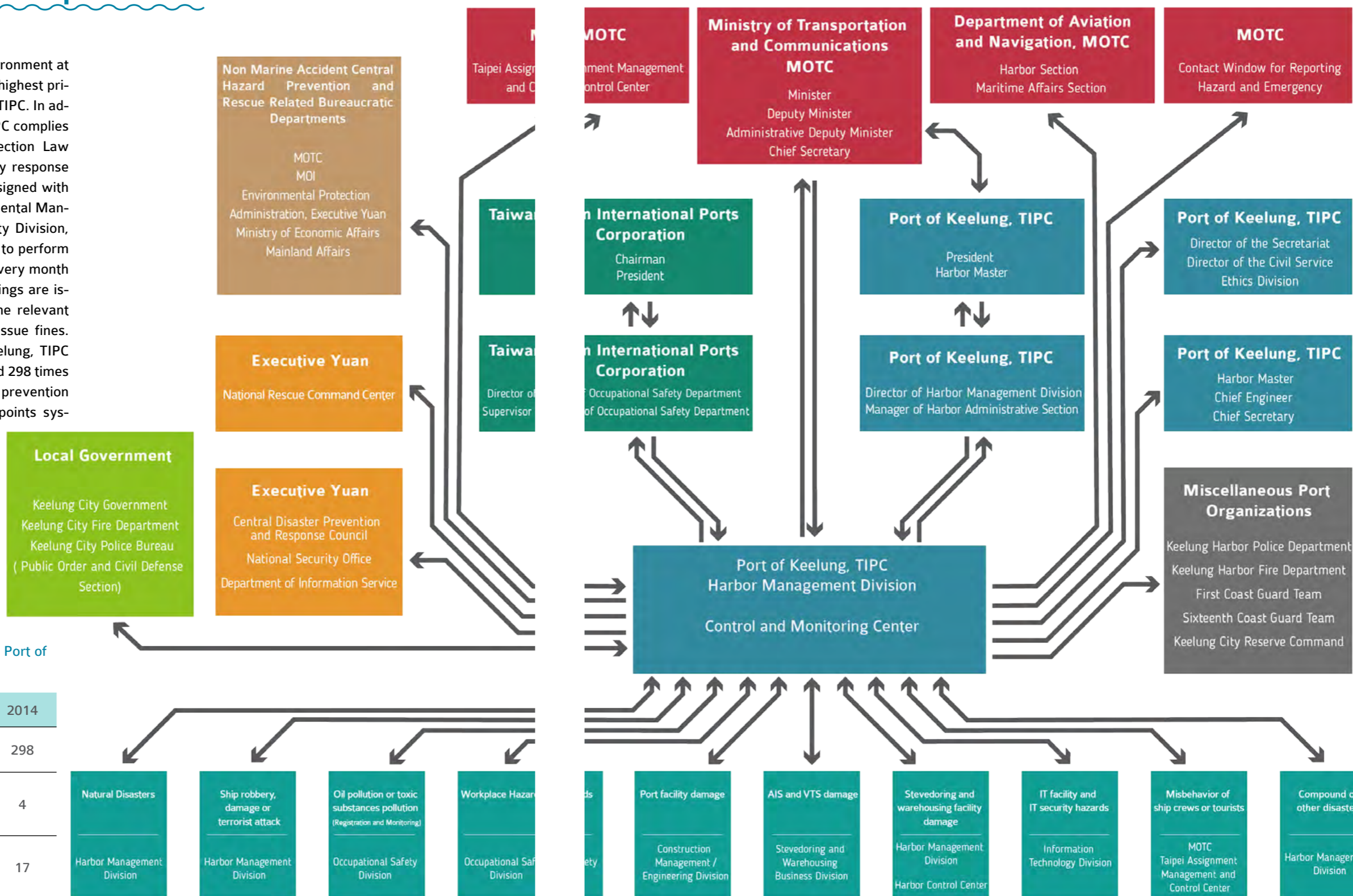
# Environmental Inspection



Maintaining the operating environment at the Keelung Port is one of the highest priorities for the Port of Keelung, TIPC. In addition, the Port of Keelung, TIPC complies with the Environmental Protection Law and has established appropriate emergency response measures in accordance with the contract signed with port companies. Furthermore, the Environmental Management Section of the Occupational Safety Division, Port of Keelung, TIPC also sends personnel to perform environmental inspection of the port area every month on the regular basis. Notification and warnings are issued if pollution sources are found, and the relevant law enforcement unit may be notified to issue fines. According to the statistics, the Port of Keelung, TIPC inspected the port environment 75 times and 298 times in 2013 and 2014, and performed pollution prevention inspections (employing an environmental points system) 68 and 17 times in 2013 and 2014.

» Environmental inspection statistics for the Port of Keelung, TIPC, 2013-2014

Task/Year	2013	2014
Environmental management Patrol	75	298
Fines based on the Commercial Port Law (by Maritime and Port Bureau)	0	4
Pollution prevention and inspections (Environmental Points System)	68	17



» Procedure for reporting major disasters and emergencies at the Port of Keelung, TIPC

## Emergency Notification and Drills



Most of the accidents occurring in the marine area of Keelung Port in 2013 and 2014 consisted miscellaneous events (fishing boats posing threats to navigation safety). Other accidents included small-scale oil spills, trash dumping, fires, ship collisions, and chemical leaks, as well as minor ship malfunctions and listing. According to Northern Maritime Affairs Center, Maritime and Port Bureau, environmental pollution fines in 2013 and 2014 were chiefly due to dust generated by cargo handling,

air pollution caused by ships, and sewage discharged by ships. With regard to port pollution and hazards, the Port of Keelung, TIPC and Environmental Protection Bureau of Keelung City have set up a communication channel to facilitate reporting by residents, transportation companies, and other units.

In addition to managing environmental issues using methods for handling reported events and emergency response measures, the Port of Keelung, TIPC strives to reduce the incidence hazardous events via occupational safety campaigns, environmental education, and skills training. Furthermore, joint drills are held every year with other relevant port management units. The Port of Keelung, TIPC held three joint drills in 2013 and 2014 focusing on marine hazards, International Ship and Port Facility security (ISPS), drills for International ship and port facility security, and prevention of biological attack. The main participating units included the Port of Keelung, TIPC, Keelung Harbor Police Department of the

### » Number of Occurrence of the Accident at Keelung Port in 2013-2014

Accident Type / Year	2013	2014
Vessel collision, foundering, capsizing, fire, oil pollution, and other chemical leaks	17	3
Vessel malfunctions, faulty operation, vessel listing and grounding	7	1
Fire and explosion of major warehouses or storage tanks	0	0
Small-scale pollution in the port, fire, chemical leaks	2	1
Drowning, accidents, drifting objects on the sea and other	14	2



National Police Agency of the Ministry of the Interior, Keelung Harbor Fire Brigade of the National Fire Agency of the Ministry of the Interior, the Central Area Coast Guard Bureau of the Coast Guard Administration and the North Maritime Affairs Center of the Maritime and Port Bureau. As a consequence, port safety and order are maintained through interagency cooperation.

### » Joint drill records by the Port of Keelung, TIPC in 2013 and 2014

Year	Name of Drill	Drills	Date
2013	2013 National Marine Hazard Rescue class and drill	Marine rescue and fire extinguishing, response to marine oil spills, containment and collection of oil spills	May 24, 2014
2013	Response procedure for "2013 ISPS Military Exercise at Keelung Port"	Motor boat intrusion into the port area and explosives found in the container center	Dec 11, 2013
2014	2014 drills for International Ship and Port Facility security and prevention of biological attack	Random killing at customs and biological attack in the port	Oct 31, 2014





# Innovation & Cooperation

## 06/

The Port of Keelung, TIPC has established best practices for issues concerning the port environment, and the proposal demonstrates the port's ability to successfully promote port environmental management. In 2013 and 2014, best practices included: (1) facilities for Intercepting Pier wastewater and runoff, (2) a port wastewater treatment project, and (3) a 24-h automated and continuous environmental surveillance system. These three best practices at Keelung Port can be added to the ECO Sustainable Logistic Chain database and provide guidance for other EcoPorts partners.



## Facilities for Intercepting Pier Wastewater and Runoff

Environmental Management Strategies: Enforcing, Enabling, and Encouraging

### Concern/Motivation

Keelung Port is a commercial port in operation. In review of the port's pollution prevention policies for improving the management and treatment of wastewater, the Port of Keelung, TIPC introduced the Port Pollution Prevention and Mitigation Measures Plan. The plan divides the pier and secondary areas of the port into sections and focuses on periodically and gradually treating the surface runoff and wastewater at the piers and operation areas, thereby reducing the discharge of wastewater into ocean and gradually achieving the objective of becoming a green port. A specific piers and

secondary areas are self-managed by the Port of Keelung, TIPC while other areas are leased to and managed by various tenants, including container distributors; cement storage; and oil storage, transportation, and logistics. The Port of Keelung, TIPC mandates the collection and treatment of runoff in the self-managed piers and secondary areas based on the Overall Plan for the Discharge of Wastewater and Runoff in the Piers and Secondary Area Managed by the Port of Keelung, TIPC.

### Solution

The short-term plan involves the design and construction of wastewater and runoff intercepting facilities in the port's gravel-pier operation zones. These zones include the East No.19 to East No.22 piers, West No.27 pier and the back-end of the port, and West No.30 to West No.32 piers. Interception and storage facilities will be designed and established in the construction sites to effectively process wastewater

and runoff, where a reduction over 60% is estimated. Relevant maintenance and management operations following the completion of the wastewater and runoff intercepting facilities will be assigned to on-site warehouses within the jurisdiction, where warehouse staff will be responsible for the cleaning and maintenance of the equipment.

### Environmental Issues

Water quality, rainwater treatment, ocean sediment contamination

### Effects/Benefits

The design of the newly constructed ditches and stagnation ponds to intercept wastewater and runoff is based on the Outline for Best Management Practices for Rainwater Runoff Nonpoint Source Pollution announced by the Environmental Protection Administration. The dry stagnation pond design proposed by the EPA can reduce up to 60% of suspended solids.

### Participants

Port of Keelung, TIPC.; stevedores

### Stakeholders

Port operation departments

### Investment

Approximately NT\$ 8 million



» Pier Locations for the Placement of Wastewater and Runoff Intercepting Facilities

### Implementation/Timeline

Construction will begin in October 2015, and completed before 2016. The construction schedules for each pier section are as follows:

1. **East No. 19 to East No. 22 piers:** Construction will be initiated concurrently in three areas in six terms
2. **West No. 27 and the back-end of the port:** Construction will be initiated in one area in seven terms.
3. **West No. 30 to West No. 32 piers:** Construction will be initiated concurrently in three areas in eight terms.

If the three construction areas are initiated simultaneously, seven construction sites will concurrently be in operation. In this instance, eight terms will be required to complete the entire construction project. Based on the aforementioned schedule, each term comprises 30 days. Therefore, eight terms translate to 240 days. With the addition of a 30-day preparation period, the estimated overall construction period will be 270 days.

#### Contact Information

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## Port Wastewater Treatment Project

(Port Sewage Pipe Connection/Keelung City & Keelung Port Water Quality Improvement and Intercepting Plan)

Environmental Management Strategies: Exemplifying, Enforcing, and Enabling

### Concern/Motivation

Keelung Port is a busy and long-standing urbanized port. The wastewater and sewage of Keelung City, which is discharged into the River, are redirected to the port, consequently elevating the nutrients in the waters. This discharge, along with drifting pollution, such as oil pollution from ships and litter, has caused the waters and domestic draining channels to gradually lose their original clarity.

### Solution

Researchers have estimated that the overall water pollution in Keelung City will reach 131,160m<sup>3</sup> by 2026. Of this figure, Keelung Port will constitute 48.8% (62,459 m<sup>3</sup>) because the port bears a portion of the city's sewage and wastewater. The project endeavors to implement an interception method to treat and improve the wastewater discharged into the port and rivers on clear days before the penetration rate of the city's wastewater pipelines achieve 80%, thereby reducing pollution concentrations in the port area.

Moreover, the Port of Keelung, TIPC and the Keelung City Government collaboratively establish sewage systems on the open space located on East No.1 pier and on the east shore of the port. The domestic wastewater generated on the east



shore of the Keelung Port will be directed to its sewage system, thereby preventing the wastewater from contaminating waters.

### Environmental Issues

Water quality, ocean sediment contamination, influence on local communities, river pollution

### Effects/Benefits

Improving the waterways and water quality of Keelung City; enhancing international reputation; facilitating the tourism of Keelung City; and increasing quality of life.

### Participants

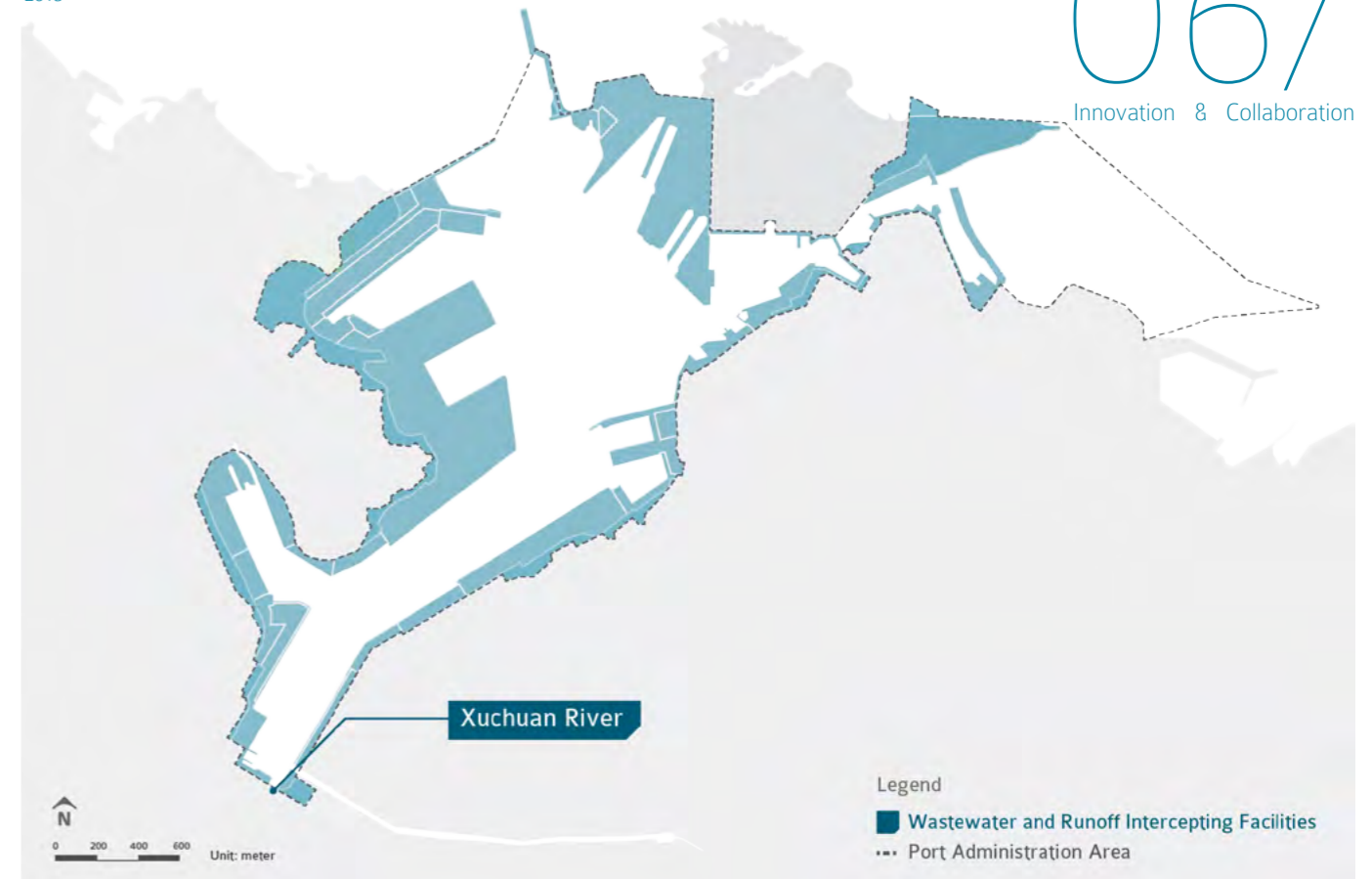
Port of Keelung, TIPC.; Keelung City Government

### Stakeholders

Residents of Keelung City; Port operating departments

### Investment

Approximately NT\$ 478,303,341



» Xuchuan River

### Implementation/Timeline

- 1. Interceptor Station Body Construction:** From 1 August 2009 to 6 February 2013.
- 2. Interceptor Pipe Construction:** From 3 August 2009 to 17 December 2012.
- 3. Keelung Port Domestic Wastewater Sewage Pipe Connection:** Estimated budgeting and initiation between 2015 and 2017.

#### Contact Information

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## 24-Hour Automated and Continuous Environment Surveillance System

Environmental Management Strategies: Exemplifying, Enabling

### Concern/Motivation

Due to the unique environment of the Keelung Port and the close to Keelung city, pollution from the port's handling operations is the center of attention for nearby residents, whom often require the port authority to implement measures, to mitigate environmental pollution and reduce noise disturbance at night. In response, the Port of Keelung, TIPC planned and established an automated port-environment-quality surveillance system.

### Solution

To mitigate environmental pollution, reduce noise disturbance at night, and promptly acquire the environment quality status of the port area, the Port of Keelung, TIPC established a 24-h automated and continuous environment-quality surveillance system. The system was completed and formally instated on 6 August 2003. Since then, the system has undergone two updates. The system monitors the sources of port pollution, and transmits these data via the port's optical network to the control and monitoring center. Operators can then observe the noise and pollution levels and climate conditions at each station, identify anomalies, and report these anomalies to on-site stevedores, thereby targeting the anomalies early and reducing environmental impact. To elevate the availability of the system to over 80%, the port has outsourced the maintenance of the system to an external professional vendor, ensuring the smooth operation of the system. Furthermore, the data collected from the system can serve as a reference for analysis and improvement.

### Effects/Benefits

The Port of Keelung, TIPC established a comprehensive optical network to promptly transmit environment-quality monitoring data to the control and monitoring center. Operators can then observe the noise and pollution levels and climate conditions at each station, identify anomalies, and report these anomalies to on-site stevedores, thereby targeting the anomalies early. In addition, the environmental monitoring data of the previous day are then announced on the port's information website, allowing the public to check whether the air and noise quality of the port conform to regulatory standards. By combining citizen monitoring and information transparency, the port's environmental quality can be effectively improved.

### Participants

Port of Keelung, TIPC

### Stakeholders

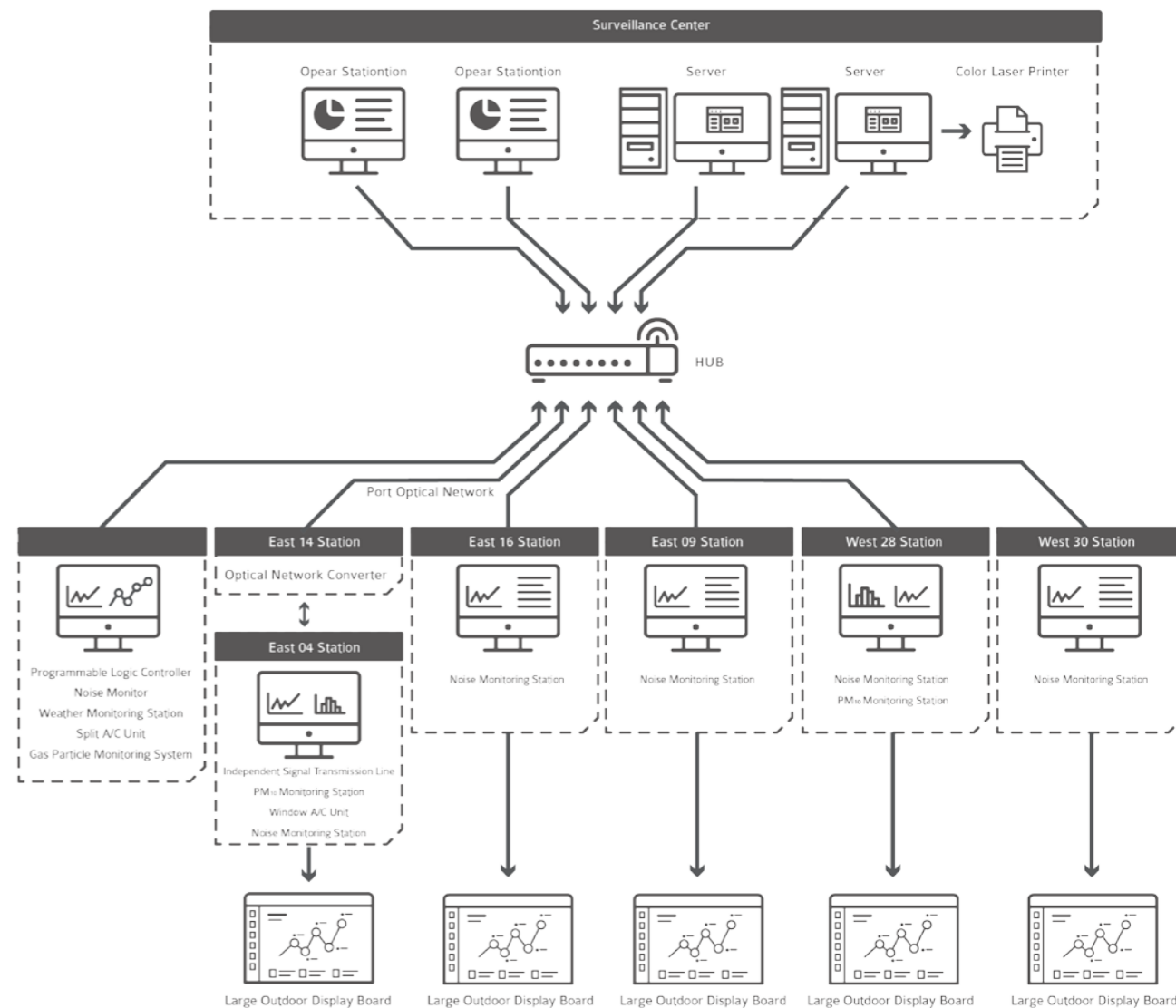
Port forwarders; stevedores, and tenants; Keelung City Bureau of Environmental Protection; Environmental Protection Administration

### Investment

Approximately NT\$20 million in 2003  
Approximately NT\$2.8 million in 2010  
Approximately NT\$2.5 million in 2011

### Environmental Issues

Air quality; noise; fugitive dust prevention; influence on local communities; river pollution



» A System Framework and Location Diagram of Air Quality and Noise Equipment in the Keelung Port

### Implementation/Timeline

August 2003: Completed the testing of and formally instated the 24-h automated and continuous environment-quality surveillance system

2011: Replaced the air pollution prevention and surveillance equipment of three stations and surveillance software

2010: Replaced the surveillance equipment of five stations and the graphics control software of the control and monitoring center.

#### Contact Information

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## Involvement & Collaborating Organizations



The Port of Keelung, TIPC actively cooperates with domestic and foreign companies, governments, and academic institutions in addressing port environmental issues. In addition to gaining an understanding of global development trends, the goal of realizing a green sustainable port is being achieved through collaboration, mutual investment, co-audits, lectures, and internships.

### The International Association of Ports and Harbors – World Ports Conference

The International Association of Ports and Harbors is currently the most influential port and harbor organization in the world, and is a non-governmental organization that provides consulting to various primary UN organizations (ECOSOC, IMO, UNCTAD, UNEP, ILO, WCO, etc.). The Port of Keelung, TIPC participates in the World Ports Conference, which is held once every two years, so as to gain a better understanding of global port development trends.

### Port of Dover

In 2011, the Port of Keelung, TIPC signed a memorandum of cooperation with the Port of Dover, which established a long-term relationship between the two parties in the areas of port risk management system deployment, risk management equipment development, safety management system development and audits, technical training, support, and environmental management systems.

### Association of Pacific Ports(APP)

Association of Pacific Ports hosts conference with the industries, government and educational institutes on a regular basis for port management bureau of port management committees and other parties and thus provides ports in the pacific region with a platform for exchanging professional skills, management knowledge and practical experiences. The port of Keelung, TIPC participates in annual conference on an irregular basis and exchange operation experiences with other member countries so as to gain a better understanding of modern port operation and current development trend at pacific ports.

### Port of Hakata

The port of Hakata has been actively improving port affairs, IT systems, and relevant environmental protection measures in partnership with TIPC since 2014. For example, the ports have exchanged information on electrical RTG cranes, sunshades for mobile refrigerated containers, and hybrid straddle carriers.

### Dafeng Harbor

In 2010, the Port of Keelung, TIPC signed a memorandum of cooperation with Dafeng Harbor Holdings to investigate development and trends among relevant port industries and sea transportation between the two ports. Under this agreement, the most suitable industries have been selected for development at the two ports, and the planning of navigation routes and study of marine transportation market development measures have sought to promote industrial and logistics development at

the ports. As for environmental protection, Shenzhen's Dafeng Harbor has also focused on ecological preservation. Keelung Port and Dafeng Harbor have parallel geographic importance, and can play mutually beneficial roles in terms of industrial development. Both ports also seek to fulfill their corporate social responsibilities in the area of environmental protection. Cooperation between the two ports can yield a synergistic effect in which "1+1 is greater than 2."

### Shanghai International Port Co., Ltd.

TIPC began working with Shanghai International Port Co. in 2014 to boost technical standards at the two ports. The focus of this collaboration is on the exchange of information concerning equipment maintenance, green energy, environmental protection, and new technical applications.

### National Taiwan Ocean University

The Port of Keelung, TIPC signed a memorandum of cooperation with the National Taiwan Ocean University in 1999 concerning the subjects of port operation and management, port development and planning, port tourism and resource planning, port information system planning, staff training, organizational planning, information exchange, promotion and implementation, and tracking.

### National Taiwan Ocean University National Sun Yat-Sen University Institute of Transportation, MOTC

In order to enhance the international competitiveness and the transportation quality, create a good education and academic research environment, and allow the international ports and the educational institutions to prosper together, Taiwan International Ports Corporation has signed memorandum of cooperation with three government-run Taiwan universities in 2012. In the future, with equal rights and if mutually-beneficial, both signing parties of the memorandum of cooperation will be involved in academic exchange, research and development, cooperation between industries and educational institutions, education and training, student internship and port operation seminars. In addition to enhancing training quality, the educational institutions involved can also provide intelligence to port affairs companies, and thus play an active role in assisting practical port management and operations, which will achieve a win-win outcome.

The Institute of Transportation has conducted research projects on such subjects as "Congestion Relief," "Capacity Increase," "Expansion and Use of Current Transportation Facilities," and "Establishing a Long Term Transportation Development Plan." In the past, the Port of Keelung, TIPC worked with the Institute of Transportation on many projects such as "Information System for Obtaining Immediate Water Depth at Keelung Port, Suao Port and Taipei Port" and "Application of Innovation Management to Container Terminal Operation at Keelung Port," etc.

### Northern Maritime Affairs Center, Maritime and Port Bureau

The Port of Keelung, TIPC cooperates with the Northern Maritime Affairs Center of the Maritime and Port Bureau in the implementation of regular audits and drills, and in promotion of international ship and port facility security.

### Zhen-Zhou Logistics and Stevedoring Co., Ltd. and Keelung Container Terminal of Asia Cement Co., Ltd.

In order to enlarge the green area in the port and extend its collaborative relationship with companies in the port, in 2012, the Port of Keelung, TIPC invited the Zhen-Zhou Logistics and Handling Co. and Asia Cement Co. to sponsor paintings on the walls which run from West No. 11 pier to the Chung-Shan Tunnel. These paintings increase the port's green area and raise the quality of life of the residents of Keelung.

### National Cheng Kung University

In order to enhance international competitiveness and transportation quality, create a sound educational and academic research environment, and allow the port and educational institutions to prosper together, Taiwan International Ports Corporation signed a memorandum of cooperation with three public universities in 2012. In the future, the parties to the memorandum will be involved in academic exchanges, research and development, cooperative undertakings between companies and educational institutions, education and training, student internships, and port operation seminars. In addition to enhancing training quality, the educational institutions involved can also provide intelligence to port affairs companies, and thus play an active role in assisting practical port management and operations, which will achieve a win-win outcome.

### Environmental Protection Administration, Executive Yuan

The Environmental Protection Administration, Executive Yuan collaborates with the US Environmental Protection Agency in accordance with the "Agreement between the American Institute in Taiwan and the Taipei Economic and Cultural Representative Office in the United States for Technical Cooperation in the Field of Environmental Protection (1993)," and this partnership has led to development of a series of strategies relating to port environmental issues. Experts from the US have been invited to attend relevant conferences in Taiwan (such as conferences on a regional partnership in promoting cleaner port air quality and sustainable Taiwan-US collaboration, etc.) on a regular basis in order to share technical information.

### Bureau of Environmental Protection, Keelung City

The Port of Keelung, TIPC and the Bureau of Environmental Protection of Keelung City collaborate in regular joint audits and drills in the port areas, and together assist the Environmental Protection Administration in organizing relevant meetings and drafting proposals concerning such topics as the audit and control of fugitive pollution sources and port pollution prevention and reduction, etc.

### Wild Bird Society of Keelung

The Port of Keelung, TIPC has allowed the Wild Bird Society of Keelung to conduct an observation plan in the port's aquatic areas as part of a project to reconstruct black kite ecology at Keelung port.



Training  
07

## Training

The Port of Keelung, TIPC shall provide environment and education trainings based on the company's environmental policies. In addition to increasing employees' awareness in environment, the goal is to enhance their environmental knowledge, thereby increasing the competitiveness of Keelung Port.

According to the "Environmental Education Act," which was implemented in 2011, all government-run organizations shall establish an environmental education plan, and all employees must attend at least four hours of environmental education classes per year. In 2013 and 2014, the company arranged 8 and 14 environmental education and training

programs for general personnel. These classes included environmental protection videos and discussion aimed at enhancing employees' environmental knowledge.

The Port of Keelung, TIPC arranges internal and external training programs every year. In 2013 and 2014, the company arranged 11 and 6 internal and external training programs concerning such environmental issues as occupational health and safety, energy conservation and CO2 emission reduction, risk management, greenhouse gas monitoring, port facility security, energy management systems (ISO 50001), and environmental impact evaluation.





# Communication & Publication

# 08/

The Port of Keelung, TIPC communicates relevant information concerning the Port of Keelung to the public via events, workshops, publications, webpages, and exhibitions, which ensures that the general public, terminal operators, academic institutions, and departments of the Port of Keelung, TIPC can have better understanding of the Port.

## Activities

### Keelung Maritime Festival

The Port of Keelung, TIPC organized the following events between May and July in 2014 to celebrate the 60<sup>th</sup> anniversary of the Keelung Maritime Festival: Keelung Port Cruise Boat Beauty Photography Contest, Golden Steering Wheel Award – Preliminary Round of an English Speech Contest, Inauguration of the “Innovative Customs and Smart Logistics” Campaign involving the Port of Keelung, TIPC and Customs Administration, Conducted a “Grateful Heart” campaign and a reward event, organized the 60<sup>th</sup> Keelung Maritime Festival Ceremony and the Golden Steering Wheel Award Ceremony.

### 2014 College Green Port Program Contest

Taiwan International Ports Corporation and National Taiwan Ocean University co-organized the “2014 College Green Port Program Contest,” expecting to, via the contest, to create linkage among educational institutions, industries, and the general public, and also draw attention to innovative green port ideas. This activity not only allowed the student to understand the current achievements of the green port program, but also enabled enterprises and the general public to gain a better grasp of green environmental issue and promoted green port innovations, thereby inspiring progress in the areas of energy conservation, CO<sub>2</sub> emission reduction and environment ecology.

### 2014 College Green Port Program Contest and Presentation of Excellent Projects

This activity has been conducted in order to discuss views concerning green port issues with college students, and included both theoretical and practical aspects. The goal of this activity is to develop innovative and feasible port development plans, enhance the green concept of the Port of Keelung, TIPC, and collect interesting and useful green port ideas. The Port of Keelung, TIPC hopes that industrial-academic interaction will inspire new ideas at the port, including innovations connected with tourism, cargo transportation, and sustainable operation.

### Hawk Flying over Keelung Port in Delight

In order to promote tourism at Keelung Port, the Port of Keelung, TIPC worked with local travel agencies to conduct a port tour activity with the theme of “Hawk flying over Keelung Port in Delight” in September and October of 2014.

A total of 13 tourist groups consisting of approximately 700 tourists participated in this event.

### Yellow Duckling and Happy Keelung

The Port of Keelung, TIPC cooperated with the Keelung City Government in the “Yellow Duckling and Happy Keelung” event by providing the water in front of the Marine Plaza for an exhibition.

### Launch of Green Port Program

This event marked the official launch of the Green Port Program at seven major ports run by Taiwan International Ports Corporation, as well as future plans and current achievements of the green port program.

### Fish Leaping through the Dragon Gate

In order to promote the beauty of Keelung Port and encourage residents to participate in water-based recreation activities, the Port of Keelung, TIPC cooperated with the Trans Van Links Shipping in 2015 to conduct a port touring event with the theme of “Fish Leaping through the Dragon Gate.” In addition to taking the cruise boats to view the sights on the east and west shores of Keelung Port, tourists can also visit the exhibition hall of the harbor control center and have a boat ride on the primary navigation route through Keelung Port.

## Seminar / Workshop

### 2014 Green Port Development Conference

At this conference, Taiwan International Ports Corporation discussed green port development issues from different perspectives, and investigated changes and development trends that green ports must address together with companies, the government, and academic institutions.

### Taiwan Green Ports Seminar

The Taiwan Green Ports Seminar exhibited the actual achievements of the green port program at each port, and underscored the company’s determination to realize the green port concept.

## Publications / Campaign

### Statistical Summary (Report) of Keelung Port

The Port of Keelung, TIPC regularly publishes annual statistical information on Keelung Port, Suao Port, and Taipei Port. The content of this report includes port affairs, handling and warehousing, financial status, and organizational and personnel information.

### TIPC Health and Safety Service Manual

The TIPC Health and Safety Service Manual serves as a guidebook for new employees and interns, and provides port occupational safety and health information in order to enhance employee safety awareness.

### Keelung Harbor Fire Prevention

Keelung Harbor Fire Prevention is an annual publication published by the Keelung Harbor Fire Brigade, and contains articles on the Keelung Harbor Fire Brigade’s annual drills, potential hazards, training courses, and interviews.

### Introduction to Keelung Port – Pioneer’s Home Town

The “Introduction to Keelung Port– Pioneer’s Home Town” video describes Keelung Port’s facilities and operations.

### Keelung Port Summary Brochure

Keelung Port Summary Brochure introduces Keelung port and other auxiliary ports, including the background of Taipei Port and Suao Port, and provides an overview of these ports’ geographic locations, development purposes, and business operations, etc.

### Manual of TIPC Port Construction Occupational Safety and Health Audit Practice

The Manual of TIPC Port Construction Occupational Safety and Health Audit Practice serves as a guidebook for employees concerning port construction occupational health and safety audit requirements and management.

### Time Travel – Exploring the Harbor Service Building

In Feb 2002, Keelung Cultural Center designated Harbor Service Building a historic building in Keelung City; “Time Travel – Exploring the Harbor Service Building” displays the appearance of the building from 1934 to the present, and explains its history and significance.

## Website

### Promotion of Taiwan Green Ports (bilingual websites)

Taiwan International Ports Corporation publicizes its green port promotion achievements on this bilingual website, which serves as a channel of communication with the world.

### The Global Website of the Port of Keelung, TIPC - Comments

A contact email is provided on the global website of the Port of Keelung, TIPC to allow the general public and consumers to express their opinions.

## Exhibition

### Historic and Cultural Exhibition having the theme of “Chicken Cage, Peace Island and Three-Thousand History”

In order to encourage participation in the port tour “Hawk Flying over Keelung Port in Delight,” the Port of Keelung, TIPC organized a historic and cultural exhibition entitled “Chicken Cage, Peace Island and a Three-Thousand-Year History” (developed by National Taiwan University Professor Hsiao-Ou Bao) at the Harbor Control Center on the Peace Island. This exhibition sought to give people a better understanding of port’s history and strengthen the link between residents and the port.

### Keelung Port History Exhibition Museum – Ocean, Do not Cry for Me

In order to encourage participation in the port tour, which is entitled “Fish Leaping through the Dragon gate,” the Port of Keelung, TIPC is holding the “Ocean, Do not Cry for Me: Exhibition of Innovative Creations of Recycled Sea Waste.”. The purpose of this exhibition is to make people aware of the importance of environmental protection. In addition, the “Keelung Port Historic and Cultural Exhibition” introduces the past growth and future prospects of Keelung Port, as well as sister harbor relationship with other international ports, and seeks to enhance people’s knowledge of and affinity with Keelung Port.



Green  
Accounting  
09/



# Green Accounting

## Environmental Investment and Cost



Regarding environmental issues, the Port of Keelung, TIPC has provided funds for environmental maintenance and management, environmental monitoring, publications, emergency response, and communications with the aim of enhancing employees' environmental awareness and environmental maintenance work, improving environmental quality and emergency response capabilities, and increasing the public's understanding of the port. Funds have been provided for the following items:

-Employees: Personnel expenses for environmental control and environmental education and training.

-Environmental maintenance and management: Port green landscaping, waste disposal and dredging.

-Environmental Monitoring: Monitoring air, noise, water, sediment, and dredging; environmental patrols.

-Emergency Response: Accident response expenses, laboratory test fees for materials, and handling of dangerous goods that pollute the port, etc.

-Communication and Publications: Website maintenance, promotional activities and environmental publications.

The total expenditures of the Port of Keelung, TIPC on environmental matters in 2013 and 2014 were NT\$ 86,097,000 and NT\$ 101,954,000, which are approximately equivalent to € 2,560,886 and € 3,032,540.

» Total expenditures on environmental issues made by the Port of Keelung, TIPC in 2013 and 2014 (Unit: Thousand in NT\$ ).

Cost items	2013	2014
Personnel	28,738	26,260
Environmental maintenance and management	52,685	67,901
Environmental monitoring	2,523	3,848
Emergency response	1,709	1,956
Communication and Publication	442	1,989
Total	86,097	101,954

## Environmental Assets



In order to transform Keelung Port into a hub for cross-strait cargo ships and international cruises, a Pan-Pacific center of logistics and distribution, and an environmentally-friendly green port, the Port of Keelung, TIPC has proposed a series of port development projects (which can be further classified as follow-up projects and new projects) and a general construction and equipment purchasing project. In particular, some projects involving environmental issues, such as

construction of new green buildings, will increase opportunities for port activities involving the general public, modernize dock electrical systems, replace old equipment with new items to increase efficiency, and reduce pollution. The total amounts of environmentally-related fixed asset expenditures made by the Port of Keelung, TIPC in 2013 and 2014 were NT\$ 2,778,990,000 and NT\$ 1,662,792,000 respectively, which are approximately equivalent to € 81,114,711 and € 48,534,500.

» Environmentally-related fixed asset expenditures in 2013 (Unit: Thousand in NT\$)

Items	Fixed Assets	Land	Houses and	Machinery and	Transportation	Other	Total
		Improvements	Buildings	Equipment	Equipment	Equipment	
Development projects	Follow-up Projects		597,883		1,967		599,850
	New Projects		3,082				3,082
General Construction and Equipment Purchase Project		2,108,815		38,022	8,832	20,389	2,176,058
Total		2,108,815	600,965	38,022	10,799	20,389	2,778,990

2013

» Environmentally-related fixed asset expenditures in 2014 (Unit: Thousand in NT\$)

Items	Fixed Assets	Land	Houses and	Machinery and	Transportation	Other	Total
		Improvements	Buildings	Equipment	Equipment	Equipment	
Development projects	Follow-up Projects	1,022,354	427,174				1,449,528
	New Projects						
General Construction and Equipment Purchase Project		118,131	5,324	68,911	10,434	10,464	213,264
Total		1,140,485	432,498	68,911	10,434	10,464	1,662,792

2014

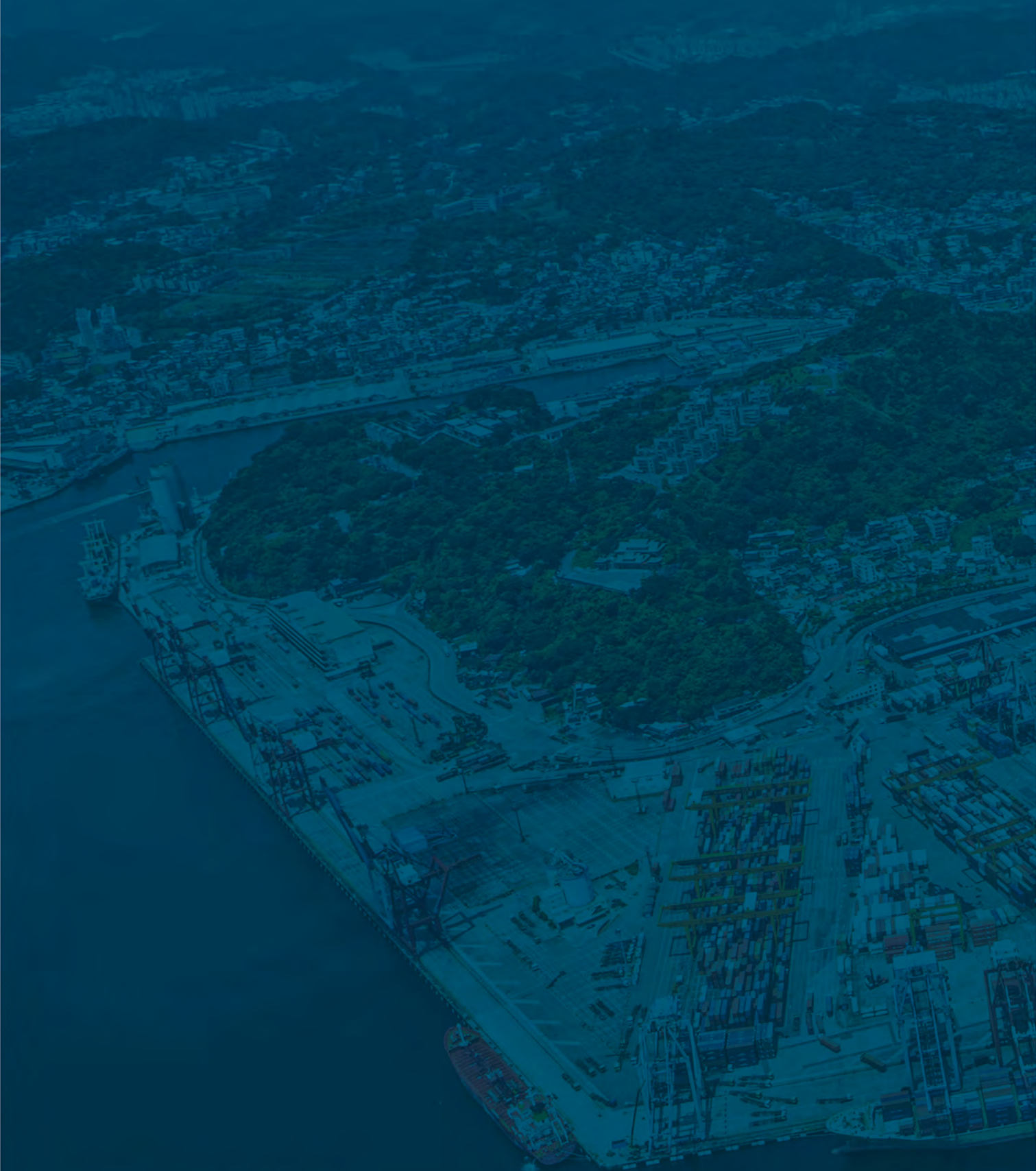
# Improvement Recommendations

## 10/

Since its establishment in the 12th year (1886) of Emperor Guangxu's rule in the Qing Dynasty, the Keelung Port has prospered and grown along with Taiwan's economy. As an international port, the Keelung Port bears a great responsibility in facilitating international trade and aiding the shipping industry. Despite natural limitations, such as limited space and insufficient depth, the Keelung Port is closely connected with Keelung City. Through the cooperation with the City and the friendly connection with its residents, the Port's competitiveness has been upgraded.

As a management authority, the Port of Keelung, TIPC focuses on existing core services. In addition to following the international trend of port management and seeking to diversify its management, the Port of Keelung, TIPC also works on economic and environmental sustainability, and fulfills its corporate social responsibility. By working with the City, the Port of Keelung, TIPC aims to improve its overall image and head towards building a green port step by step, so as to attain the status of an international Eco-Port. With opportunities to deepen exchanges with other countries, the Port of Keelung, TIPC adopts a benchmark learning strategy to build a better and friendlier port city.

Aerial Photography by Chen, Min-Min



**TIPC**  
臺灣港務股份有限公司  
TAIWAN INTERNATIONAL PORTS CORP., LTD  
基隆港務分公司 PORT OF KEELUNG



國立中山大學 海洋環境及工程學系  
海洋環境規劃與管理 研究室  
Lab. Marine Environmental Planning  
& Management Lab.

