

Green Port Initiatives:  
A Review of Best Practices for the Port of Providence (RI)

Presented to the Harbor Management Commission

By

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Figure 1: Aerial Map- Providence (<https://images.fineartamerica.com/images-medium-large-5/1-port-of-providence-providence-dave-cleveland.jpg>)

Contents

INTRODUCTION ..... 1

GREEN INITIATIVES IN PLACE..... 3

DEFINING GREEN PORTS ..... 3

EPA BEST PRACTICES ..... 4

OTHER GREEN PORT INITIATIVES..... 6

    The World Ports Climate Initiative (WPCI) ..... 6

    Association Internationale Villes Ports (AiVP)..... 7

EXAMPLES OF GREEN PORT INITIATIVES FROM 10 CASES STUDIES..... 7

FUNDING OPPORTUNITIES.....19

    Transportation Investment Generating Economic Recovery (TIGER) Grant ..... 19

    Diesel Emissions Reduction Act (DERA) .....19

    Fixing America’s Surface Transportation Act (FAST ACT).....20

RECOMMENDATIONS FOR PROVIDENCE .....21

CONCLUSION .....24

ACKNOWLEDGEMENTS .....25

BIBLIOGRAPHY .....26

## INTRODUCTION

This report was completed at the request of the City of Providence's Harbor Management Commission for the purpose of exploring green port initiatives and determining their applicability for the Port of Providence. The Harbor Management Commission is the port commission for the Port of Providence and has the power and responsibility to develop the port, manage, supervise and control the port district, appoint a director for the port, and adopt the annual budget. This report provides an overview of "green practices" that are recommended by national and international bodies and examples from case studies throughout the U.S. It provides an overview of potential funding sources for new green initiatives and concludes with a set of recommendations that the Harbor Management Commission may consider for the Port of Providence. Research for this project was conducted via web searches, independent reports, and informational interview with stakeholders including Harbor Management Commission members, Waterson Terminals, Economic Development for the City of Providence, and Save the Bay.

The Port of Providence, defined here as the community of businesses located on the Providence Harbor waterfront from the Fox Point Hurricane barrier to Fields Point, is the second largest deep-water port in New England and serves both domestic and international clients. Businesses in the port handle cargos such as cement, salt, sand, chemicals, heavy machinery, petroleum, and scrap metal (Chris Waterson, personal communication, November, 6, 2017). Waterson Terminal Services operates the largest business in the port, ProvPort, Inc, which offers 40' deep draft along 3500 linear feet of berthing and 700 additional feet of non-contiguous berthing. As ProvPort's exclusive Port Operator and Manager, Waterson Terminals is responsible for vessel scheduling, general management, safety and capital improvements at the deep water port (Waterson Terminal Services, n.d.).



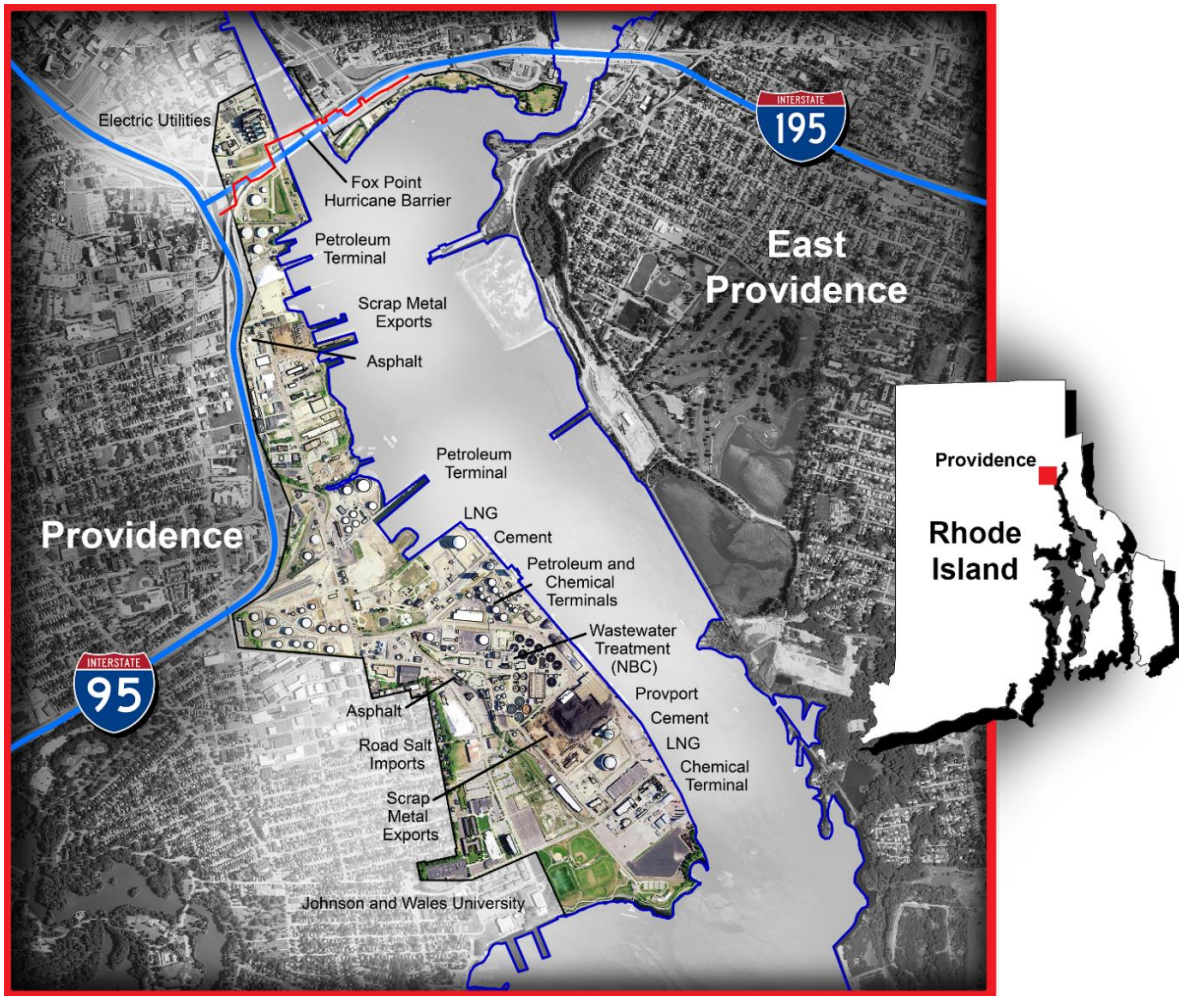


Figure 2: Map- Port of Providence (Stempel, P., 2017)

ProvPort, Inc. was created in 1994 for the dual purpose of holding and managing the asset formerly known as the Port of Providence and previously owned by the City of Providence. ProvPort was created as a 501(c)3 nonprofit organization chartered in Rhode Island and holds the operating rights through 2036 when the land and improvements returns back to the City of Providence. In 2007, ProvPort entered into a Terminal Management Agreement designating Waterson Terminal Services as the general manager of ProvPort and as the exclusive stevedore at the port (Waterson Terminal Services, n.d.).

In November 2016, voters overwhelmingly supported the bond question approving the \$20-million purchase of up to 25 acres of property of Allens Avenue waterfront to expand the city's port. ProvPort, the RI Commerce Corporation and the City of Providence are currently developing an expansion plan (Anderson, P., 2016). As the port considers expansion and different development projects, the city and port are looking toward green initiatives to serve as a basis for economic development. Though shipping is relatively green compared to other modes of transportation, ports are a dirty business. Dirty air due to emissions, dirty water due to dredge material, ballast water, and diesel along with stormwater runoff and hazardous waste are just some of the environmental issues facing ports today (Becker, A., 2015).

## GREEN INITIATIVES IN PLACE

The Port of Providence is already practicing green initiatives including the substitution of rail for trucking and installation of wind turbines to generate renewable energy on the property. Using rail or barge instead trucking increases the volume flow and efficiency of cargo in and out of the port. Rail and barge offer less congestion than trucks and reduces diesel exhaust from unnecessary idling (United States Environmental Protection Agency [EPA], n.d.a). Waterson terminals currently utilizes the rail system for a portion of dry bulk cargo though the major cargos (sand and salt) must be delivered locally by truck.

Wind technology ranges from onshore to offshore turbines with the first offshore windfarm in the United States located nearby off Block Island. Wind energy is non-polluting, renewable as wind turbines create power without the use of fossils fuels and without producing greenhouse gases or radioactive or toxic waste. The majority of the Port of Providence green initiatives are focused around renewable energy specifically wind.

Federal financial incentives are available in the form of tax credits though the 3rd party developer (Narragansett Bay Commission) receives these directly for the 3 wind turbines as they are owner/operator of the wind farm and lease the land from Waterson Terminals. Narragansett Bay Commission is a sewage treatment plant and neighbor of the port (though not affiliated) which uses the power from the wind turbines and still pulls power as the grid as a large energy consumer. Waterson terminal has an agreement to install two additional wind turbines within a year and is exploring options to use that renewable energy as shore-power for vessels alongside (Chris Waterson, personal communication, November, 6, 2017).

## DEFINING GREEN PORTS

Green ports are generally defined by their achievement of long-term environmental, societal and economic benefits through resource conservation, waste reduction, and pollution prevention (Port of San Diego, n.d.b ). While some ports have completed green initiatives in a matter of months, other initiatives have taken years, or even decades, to achieve with the assurance from previously conducted Environment Impact Statements (EIS) that the ultimate benefits of sustainability outweigh the costs. According to Inbound Logistics, the primary goal of green ports is to significantly diminish emissions that are detrimental to the health of the environment, employees, and residents who live nearby. In order to achieve that goal, ports focus mainly on reducing congestion, decreasing nonrenewable fuel consumption, and modernizing fleets (Lewis, C., 2016).

## EPA BEST PRACTICES

In this section, we outline EPA “Port Authority Best Practices” which assist ports in promoting economic development while protecting environmental quality including only the practices which are applicable to the Port of Providence. These come from the EPA’s Ports Initiatives program, which is designed to work in collaboration with port industry, communities, and all levels of government to improve environmental performance and increase economic prosperity. The EPA considers recommendations from the Clean Air Act Advisory Committee and others to guide the development of the program (EPA, n.b.c). As part of the program, “Port Authority Best Practices” are provided on their website in order to assist ports (EPA, n.d.b) The following sections describe relevant best practices, as defined by the EPA, recommendations for implementing these best practices in the Port of Providence, and the current initiatives already underway at ProvPort.

### *Near port community considerations*

The EPA recommends that ports make efforts to learn about near-port community considerations and work with near-port communities to identify needs and issues related to port activities (EPA, n.d.b). ProvPort is located in an industrial zone surrounded by businesses and highways and their immediate local impact may not be as considerable as if they were located in a residential area (i.e., the Port of Boston).

Waterson Terminals worked toward building social equity by donating funds, offering scholarships and providing computer equipment to the local high school, though this has ceased due to administrative issues at the school. Waterson Terminals could work to reinstate the program. However, investing in local environmental organizations such as Save the Bay for educational programs and beach cleanups would be a great way to obtain visible community outreach with an environmental basis.

Out of 13 acres recently developed at ProvPort, 10 acres were used for storage space with the remainder being dedicated to public access way and tree plantings. In addition, ProvPort is currently focused on developing a training program that is related to the potential future workforce at the port such as a technical school. ProvPort is also involved with the Neighborhood Improvement Fund initiated by the City of Providence and currently donates a couple thousand dollars a month which is then placed in a discretionary fund for small projects in the local community (Chris Waterson, personal communication, November, 6, 2017).

Recommendation: Invest in local educational organizations (i.e. Save the Bay) as part of community outreach.

### *Establish anti-idling policies*

The EPA states that establishing anti-idling policies for trucks, locomotives, and cargo handling equipment effectively reduces diesel emissions. Waterson Terminal Services rarely has issues with congestion as their vessel calls are spaced out and there is rarely any wait time. Sprague’s terminals, however, do experience congestion and has trucks lined up on Allens Avenue at various times (Chris Waterson, personal

communication, November, 6, 2017). Turning off engines when not in use is the smartest and easiest way to reduce air pollution and save money (EPA, n.d.b).

Recommendation: Implement mandatory anti-idling policy at Port of Providence for trucks with wait times longer than 5 minutes.

*Retrofit with verified technologies, use cleaner fuels and operate more efficiently*

The EPA recommends ports install or require installation of emission reduction devices, replace engines or equipment, use cleaner fuel, and implement operational efficiencies which have been tested and verified. Technologies yield substantial emissions results and can be cost effective under EPA's Clean Diesel National Grant program (see **Funding Opportunities** section) (EPA, n.d.b). ProvPort's trucks are replaced on an annual basis while considering the ports financial viability. ProvPort is currently retiring early 2000 model trucks and replacing them with current year models (Chris Waterson, personal communication, November, 6, 2017).

Recommendation: An overhaul of the entire ProvPort trucking fleet would be cost effective for the port if a DERA grant could be obtained, though a number of vehicles have already been replaced.

*Develop educational programs on air pollution and emissions reductions for terminal operators and fleet owners*

According to EPA guidance, the barrier to implementing cost-effective emissions reduction strategies is lack of knowledge on the part of terminal operators and fleet owners about various options. Guidance and education on air quality, air pollutants, technologies and ways to implement emissions reduction strategies not only increase awareness but also increase the opportunities to reduce emissions (EPA, n.d.b).

Recommendation: ProvPort could hold an annual 'green initiatives' meetings with relevant stakeholders at the Port of Providence to discuss any upcoming projects with the operations departments and determine if green ports initiatives might apply.

*Substitute electric power for diesel power*

The EPA notes that electric shore side power at the berth would eliminate the need for ships to run their auxiliary diesel engines (EPA, n.d.b). ProvPort is considering shore power, however, it is one of the most expensive environmental initiatives to implement. In addition, not all vessels are equipped to receive shore power as part of their operations. Bulk carriers specifically tend to be older than other types of vessels and many of them are not designed to receive shore power once alongside. Regardless, ProvPort looks to position itself as a port of the future as a means to attract new business and gain recognition as a leader in green port initiatives.

In 2010, ProvPort's TIGER Grant II application included a budget which designated \$2 million for shorepower installation though funding was not awarded for this specific project. The figure was basis an estimate from Waterson's electricians at the time and included trenching and equipment at 5-6 locations along the berth (Chris Waterson, personal communication, November, 6, 2017).

**Recommendation:** The implementation of shorepower is recommended only if a TIGER Grant can be obtained to cover the costs and help ProvPort prepare for the future (see **TIGER Grants section**).

## **OTHER GREEN PORT INITIATIVES**

Although the EPA provides guidance for US ports, there are a number of other initiatives globally that can inform new sustainability initiatives for the Port of Providence. Two groups in particular, the World Port Climate Initiative (WPCI) and the Association Internationale Villes Ports (AiVP), have developed tools and case studies to assist in these efforts.

### **The World Ports Climate Initiative (WPCI)**

The WPCI was formed in 2008 when the “International Association of Ports and Harbors (IAPH) requested its Port Environment Committee, in consultation with regional Port Organizations, to provide a mechanism for assisting ports to combat climate change. The World Ports Climate Initiative (WPCI) is dedicated to fighting against climate change by initiating programs at the ports that reduce greenhouse gas emissions and improve air quality.” (World Ports Climate Initiative [WPCI], 2017b).

The WPCI Carbon Footprinting Work Group released a Guidance Document which serves as a reference for ports to improve their greenhouse gas emissions inventories. Carbon footprinting is a tool used to determine emission sources, track emission trends, and provide information needed to determine where ports can focus efforts to reduce their greenhouse gas emissions. A carbon footprint is the total amount of emissions the port releases over a given time expressed as a carbon dioxide equivalent. Once emissions sources of greenhouse gases are identified, a carbon management strategy can be created and implemented (WPCI, 2017a).

In 2010, WPCI released a separate ‘Onshore Power Supply’ website via their working group Onshore Power Supply (OPS). The website provides information regarding OPS for vessels as a way to reduce emissions by replacing onboard-generated power from diesel engines with electricity generated on onshore. The website is targeted at port authorities, terminal operators, and shipping companies and includes resources on implementation, cost, suppliers, and case studies on installation (WPCI, n.d.b).

Another project within the WPCI is the Environmental Shipping Index (ESI) which identifies vessels that perform better in reducing air emission than required by the current International Maritime Organization emissions standards. An ESI evaluates the amount of nitrogen oxide (NOx) and Sulphur oxide (Sox) emitted by the vessel as an indicator of environmental performance. The ESI is voluntary and meant to be used by ports to reward ships when they participate as a mean of improving their own environmental performance (WPCI, n.d.a)

The International Association of Ports and Harbors ‘Tool Box’ is a feature that allows quick access to the tools needed to start the planning process for addressing port-related air quality and climate change issues. Based on case studies, it describes



strategies to reduce emissions and guidance on how to develop a Clean Air Program and Climate Protection Plan. The toolbox has two main sections including ‘Priority Pollutants’ and ‘Greenhouse Gases’ which help determine the right course of action for ports with a variety of needs and capabilities (International Association of Ports and Harbors [IAHP], n.d.).

### **Association Internationale Villes Ports (AiVP)**

AiVP is a worldwide network which for over 30 years has been bringing together all the public and private development stakeholders of port cities. With AiVP, port cities are jointly imagining urban, economic and port developments which are more sustainable, responsible, and innovative. AiVP accompanies their members in the implementation of new strategies that allow them to more effectively face up to the changes that impact economic, social, and environmental development in port cities: urban-port integration, global reorganization of economic routes, the challenge of social integration, climate change, energy transition, and the development of the cruise industry.

AiVP is nonprofit organization which has over 500 members from 5 continents with a regular programs including conferences and seminars. It serves as an international resource for port city projects and provides up-to-the-minute news from industry experts. Members have access to a directory of 1,800 contacts, a weekly newsletter, the resources of an international network of experts, and a wide range of communication material. AiVP created the ‘Port Center Network’ which provides expertise on port projects and assists you from the moment a project is conceived until implementation (Association Internationale Villes Ports [AiVP], 2014).

World conferences address the development of practices and know-how, through experience exchanges between the economic decision-makers and stakeholders for the projects and achievement of port cities. The conference takes place every two years for a duration of 3 to 5 days with an attendance of 400-500 delegates and 50 countries represented. The next conference ‘16<sup>th</sup> World Conference Cities and Ports’ will be held June 11-14<sup>th</sup>, 2018 in Quebec, Canada (AiVP, 2015).

### **EXAMPLES OF GREEN PORT INITIATIVES FROM 10 CASES STUDIES**

In the next section, we describe the green initiatives in place at 10 ports. We selected these specific ports based on their wide-ranging approaches to reducing emissions such as greenhouse gases (mainly from diesel emissions), carbon monoxide, and fine particulate matter. The most current green initiatives gained from news sources have been added for each port in addition to those outlined by Inbound Logistics. While not all ports or initiatives may be applicable to the Port of Providence, we find it important to outline the popular green port initiatives in order to gain an understanding of all available opportunities.

## GEORGIA PORTS AUTHORITY

The Georgia Port Authority was founded in 1945 and currently oversees the deepwater ports of Brunswick and Savannah, supplemented by inland barge operations in Bainbridge and Columbus. The Port of Savannah is the home to the largest single-terminal container facility in North America and is comprised of two modern, deepwater terminals (Georgia Ports Authority, n.d.). Georgia Port Authority enacted a variety of initiatives with the central purpose of emissions reduction.



Figure 3: GPA- Refrigerated Containers (<https://image.slidesharecdn.com/allslideshowpage-140220083112-phpapp01/95/georgia-ports-sustainability-slides-8-638.jpg?cb=1392885477>)

### GREEN INITIATIVES:

- In 2015, the port transitioned rubber-tired gantry cranes (RTGs) from diesel power to electric. Cranes operate on electric power more than 90 percent of time since they only use diesel to move between rows.
- Installed 104 electrified refrigerated container racks which do not require the use of diesel generators and currently save 5.6 million gallons of fuel a year.
- Installed new computer-controlled, photosensitive lights at the 1,200-acre Garden City Terminal and 200-acre Ocean Terminal, reducing over 3,569 metric tons of CO<sub>2</sub> emissions annually.
- Launched a truck rebate and finance program that assists owners and operators as they replace their diesel trucks with container hauling trucks equipped with 2010 (or newer) engines (Lewis, C., 2016).
- Under a new partnership, KMMG will move car parts via rail from the Port of Savannah to the inland terminal in Cordele saving 6 million truck miles per year while moving 30,000 TEU containers (GreenPort, 2016b).

- Preserved 312 acres of wetlands to protect and improve water quality, provide fish and wildlife habitats, store floodwaters and maintain surface water flow during dry periods.

**At what cost:** To date, the RTG retrofitting project alone has cost \$20.6 million (Lewis, C., 2016).

## HELEN DELICH BENTLEY PORT OF BALTIMORE

Helen Delich Bentley Port of Baltimore is closer to the Midwest than any other East Coast port and within an overnight drive of one-third of the nation’s population. Simply referred to as the “Port of Baltimore”, it is considered to be one of only four Eastern U.S. deepwater ports with a draft of 50ft and specializes in a variety of cargo including coal, wastepaper, automobiles, and light trucks (Maryland.gov, 2017).



Figure 4: Port of Baltimore- Mr. Trash Wheel (<https://cbsbaltimore.files.wordpress.com/2016/09/trash-wheel.jpg?w=1280> )

### GREEN INITIATIVES:

- Offers a Dray Truck Replacement Program which allows truck owners and operators to trade in their older model trucks (over 170) for newer models that reduce air emissions.
- Retrofitted, replaced, and repowered more than 100 pieces of equipment that service terminals.
- Installed a variety of underground wet vaults (meant to trap heavy particles) that treat stormwater, upgraded its lighting, and mounted solar panels on cruise terminal and transit shed.
- Planted 35 acres of trees.

- Installed the Inner Harbor Water Wheel (Mr. Trash Wheel), a solar- and water-powered device that removes trash from Baltimore's waterfront (Lewis, C., 2016).
- The Port of Baltimore will play host to the GreenPort Congress in 2018 which welcomes environmental leaders from around the world. It is the first port in North America to host the conference (GreenPort, 2017a).

**At what cost:** Mr. Trash Wheel cost \$550,000 to construct and was funded through numerous donations (Mulvihill, A., 2016).

## PORT OF LONG BEACH (CA)

The Port of Long Beach is located in California and with trade valued at \$180 billion is the second largest seaport in the United States (behind The Port of Los Angeles) and 20<sup>th</sup> busiest container port in the world. The port imports and exports a variety of cargo mainly via containers which include everything from clothing and shoes to toys, furniture, and consumer electronics. Specialized terminals also move petroleum, automobiles, cement, lumber, steel and other products.

In 2005, the Long Beach Board of Harbor Commissioners ratified the Green Port Policy which is an investment in cleaner air, soil, and harbor water with the goal of decreasing the ecological footprint in the long term. The port seeks to improve air quality through various initiatives of the San Pedro Bay Ports Clean Air Action Plan which was updated in 2006, as the port seeks new strategies to reduce emissions. The ports of Los Angeles and Long Beach have approved the 2017 Clean Air Action Plan (CAAP) Update ushering in a new era of aggressive clean air strategies. This update to the Clean Air Action Plan is an important step toward the ambitious goal of zero emissions landside goods movement by 2035 (Port of Long Beach, n.d.).



*Figure 5: Port of Long Beach- Solar Photovoltaic (PV) System*  
(<https://mms.businesswire.com/media/20161129005487/en/557318/5/2016-11-PFMG-LB-310-edited.jpg>)

#### GREEN INITIATIVES:

- In 2015, the port constructed four new buildings on a recently redeveloped marine terminal which conserve energy and water and have received a gold level certification from the Leadership in Energy and Environmental Design (LEED).
- Cranes and cargo-handling equipment at the terminal are run on electricity, resulting in nearly zero emissions.
- Introduced the Clean Trucks Program—since 2008, all trucks entering terminals must be equipped with engines that were manufactured in 2007 or later.
- Began a transition to renewable power sources and self-generation systems including a 904.75kW Mitsubishi Electric solar photovoltaic (PV) system.
- Increased use of shore-power for ships. (Lewis, C., 2016) At least one berth at every container terminal has shore power. By 2020 all containers berths will have shore power (Port of Long Beach, n.d.).
- The first phase of the zero-emissions Long Beach Container Terminal opened on Pier E in 2016.

**At what cost:** Since 2005, the port has spent approximately \$500 million to implement the Green Port Policy; it spent about 40 percent of this total on shore power. A major grant will fund the demonstration project for zero-emissions cargo-handling equipment. (Lewis, C., 2016)

#### THE PORT OF LOS ANGELES (CA)

The Port of Los Angeles (CA), “America’s premier port”, is a port complex that occupies 7,500 acres of land and water along 43 miles of waterfront and adjoins the separate Port of Long Beach. Los Angeles is the nation’s leading seaport in terms of container volume and cargo value facilitating \$270 billion dollars in trade in 2015 (LA The Port of Los Angeles, n.d.). The Port of Los Angeles pioneered the process of ships plugging into shore power while at berth in order to capture emissions. The State of California requires container and refrigerated ships to plug into shore-side power as 2014 (Lewis, C., 2016).





Figure 6: The Port of Los Angeles- Shore Power

(<https://www.portoflosangeles.org/environment/progress/initiatives/alternative-maritime-power/>)

#### GREEN INITIATIVES:

- Currently has more shore power capable berths than anywhere in the world.
- Established a new system that uses a bonnet to capture emissions as they emerge from a ship's stacks. The system was developed at a Port of Los Angeles terminal and approved by the State of California as an alternative to compliance with the shore power rule. This bonnet system is the first of its kind anywhere.
- Focused on the Pasha Terminal, which may become the world's first terminal to generate power onsite via a renewable energy source that, with a 2.6-MW battery storage system, could potentially allow it to operate off the local energy grid while using zero emissions yard equipment and drayage trucks (Lewis, C., 2016).
- A zero-emissions truck prototype will serve the ports of Los Angeles and Long Beach haulage routes to surrounding rails yards and warehouses to test the capabilities of its hydrogen fuel cell system (GreenPort, 2017b).

**At what cost:** From 2006 to 2016, the port has spent more than \$350 million on environmental initiatives (Lewis, C., 2016). The port has invested more than \$185 million (The Port of Los Angeles, n.d.) in shore power since 2006 which includes shore power capable berths at the port's eight marine container terminals, as well as its cruise passenger and ferry terminals (Lewis, C., 2016).



## PORT OF OAKLAND

The Port of Oakland is a major container ship facility located in Oakland, California, which inhabits nearly 19 miles of waterfront on the San Francisco Bay. It was the first major port on the Pacific Coast of the United States to build terminals for container ships. All shipping channels and 90% of berths at the port are dredged to 50 feet and can accommodate vessels up to 18,000 TEU capacity (Port of Oakland Seaport, n.d.).



*Figure 7: Trucks wait to enter the Port of Oakland  
([https://www.joc.com/sites/default/files/field\\_feature\\_image/oakland%20truck.jpg](https://www.joc.com/sites/default/files/field_feature_image/oakland%20truck.jpg) )*

### GREEN INITIATIVES:

- Created a Maritime Air Quality Improvement Plan whose key objective is to reduce diesel particular matter emissions by 85 percent by 2020.
- Sought funding for zero-emission container handling and truck technology.
- Introduced two smartphone applications so truckers can calculate their turn times, optimize their arrival, and decrease their idling time—and, in turn, fuel and emissions.
- Offers shore-power for ships which can plug into electric grids when docked.

**At what cost:** The port has spent about \$60 million on its shore power project. (Lewis, C., 2016) A Port of Oakland freight-hauler is planning to spend \$1 million USD on cleaner cargo-handling equipment to tackle diesel emissions (GreenPort, 2017d).

## PORT OF PORTLAND (OR)

The Port of Portland in Oregon owns four marine terminals, including Oregon's only deep-draft container port, and three airports. The Portland Harbor exports the largest amount of wheat from the United States and the Columbia River system, including Portland, and is third largest wheat export gateway in the world. The Port is the third largest auto import gateway in the country, and the largest mineral bulk port on the U.S. west coast (Inchcape Shipping Services, n.d.).



Figure 6: Porous Pavement (<https://www.prestogeo.com/wp-content/uploads/2016/10/Geopave-Aggregate-320-x-180.jpg>)

### GREEN INITIATIVES:

- In 2013, the port replaced the Oregon's (a dredge that it owns and operates) 1960's engine with a modern more efficient one.
- Purchased certified Renewable Energy Credits for 10 percent of electricity consumption and invested in new energy efficient LED lighting; it will complete the project in 2017.
- Implemented 35 acres of porous pavement at one its terminals which infiltrates 100 percent of stormwater into the site's subsurface to naturally break down pollutants.
- Installed shore power at Terminal 6 for all tugs that are moored, so that they can plug into an electric grid.
- Installed meters to track energy cost savings.
- Monitored aquatic invasive species, such as zebra mussels, in the Columbia River, through a partnership with state agencies and the Oregon Invasive Species Council.

**At what cost:** The port has invested \$3.5 million toward energy efficiency improvements port-wide; it has also spent \$5.1 million on the Oregon's engine replacement (a new tug can cost up to \$10 million) (Lewis, C., 2016).

## PORT OF SAN DIEGO (CA)

The Port of San Diego is the 4<sup>th</sup> largest of 11 ports in California. The port overseas two maritime cargo terminals, two cruise ship terminals, 20 public parks, the Harbor Police Department and the leases of hundreds of tenant and sub tenant businesses around San Diego Bay. In terms of cargo, the port is ranked one of America's top 30 containership ports, is a primary point of entry for autos, and imports the majority of the countries banana as it holds a 24 1/2 year lease with Dole Foods (Port of San Diego, n.d.a).



Figure 8: Electric vehicle charging stations ([https://financialtribune.com/sites/default/files/field/image/new/13\\_Brief\\_2.jpg](https://financialtribune.com/sites/default/files/field/image/new/13_Brief_2.jpg) )

#### GREEN INITIATIVES:

- In 2013, the Port of San Diego's Board of Port Commissions created a 7 year and 22 year Climate Action guide which outlined six emission reduction strategies, including water and energy conservation with the goals of reducing greenhouse gases.
- The port has reduced water usage by 47 percent since 2008
- Installation of 10 public electric vehicle charging stations around port tidelands so that vessels can receive shore power.
- Replaced 296 street, parking, and walkway lights with LEDs, leading to an annual decline of 270,000 kilowatt hours—enough energy to power 17 homes for one year.
- Removed 29 tons of trash and invasive vegetation during recent port-sponsored cleanup events.

**At what cost:** Within the past 10 years, the port's environmental fund committed \$8.5 million to support 75 projects (Lewis, C., 2016).



## SOUTH CAROLINA PORT AUTHORITY (SC)

The South Carolina Port Authority (SCPA), established in 1942, operates terminals in Charlestown and Georgetown, as well as South Carolina's Inland Port in Greer. An economic development engine for the State, the South Carolina Ports Authority handles international commerce valued at more than \$63 billion annually while receiving no direct taxpayer subsidy. The largest facilities are located in Charleston, the Southeast's deepest port, where the SCPA operates five major ocean terminals capable of handling breakbulk and container shipments in addition to passenger vessels (South Carolina Ports, 2017).



Figure 9: Port of Charleston (<https://livability.com/sites/default/files/7840712THB0498.jpg>)

### GREEN INITIATIVES:

- Replaced traditional diesel conveyors with electrified ones and upgraded its terminal equipment, including fully electrified ship-to-shore power and rubber-tired gantry cranes.
- In March 2016, the port publicized plans to install solar panels on warehouse rooftops of two of its terminals
- Dedicated \$5 million to the conversation of the Cooper River Corridor's Francis Marion National Forest, in Huger, S.C.
- Introduced the Clean Truck Program. Since January 2014, all trucks serving the SCPA's container terminals must have engines that were manufactured in 1994 or later; to date, more than 80 trucks have been replaced.

**At what cost:** The SCPA, along with its local, state, and federal partners, has spent more than \$20 million on environmental protection and emission reduction efforts (Lewis, C., 2016).

## THE NORTHWEST SEAPORT ALLIANCE

The Northwest Seaport Alliance is a port authority based in the Puget Sound region of the United States, comprising the seaports of Seattle and Tacoma in Washington State. The combined port authority is the third largest cargo port in the United States and fourth largest by container volume (The Northwest Seaport Alliance, n.d.).

### GREEN INITIATIVES:

- The ports of Seattle and Tacoma formed a partnership known as The Northwest Seaport alliance to unify the management of their marine cargo terminals with the goals of reducing emissions more efficiently.
- Installed bio-filtration stormwater treatment systems at Seattle's and Tacoma's log and container terminals, as well as Tacoma's rail yards.
- Introduced a Clean Truck Program that requires drayage trucks to have model-year 2007 or newer engines by Jan. 1, 2018.

**At what cost:** Although expenditures have not yet been measured, the alliance's budget allocated \$1.7 million for its air quality and sustainable practices program in 2016 (Lewis, C., 2016).



Figure 10: The Northwest Seaport Alliance  
([http://www.cargobusinessnews.com/featured\\_stories/images/NW-Seaport-Alliance-Up-to-the-Task.jpg](http://www.cargobusinessnews.com/featured_stories/images/NW-Seaport-Alliance-Up-to-the-Task.jpg))

## PORT AUTHORITY OF NEW YORK AND NEW JERSEY

The Port Authority of New York and New Jersey (PANYNJ) is a joint venture between the states of New York and New Jersey which oversees much of the regional transportation infrastructure including bridges, tunnels, airports, and seaports. PANYNJ is the third-largest port in the nation and largest on the East Coast capturing 30 percent of the market share in the region (The Port Authority of NY & NJ, n.d.).



Figure 11: Brooklyn Cruise Terminal (<https://www.nycruise.com/content/uploads/2012/06/1A.jpg>)

#### GREEN INITIATIVES:

- Introduced a Clean Air Strategy, a set of voluntary actions that will reduce emissions through initiatives such as installing shore power capability, modernizing cargo handling equipment, and replacing old trucks.
- Acquired nearly 400 acres of property within the Hudson-Raritan Estuary to preserve open space for conservation and ecological development.
- Restored several Jamaica Bay marsh islands, using the clean dredge material it acquired by deepening its harbor to 50 feet.
- Implemented a cargo handling fleet modernization program, which reduces emissions by replacing old equipment with new units.
- Introduced a Truck Replacement Program that awards truck owners a financial incentive if they replace older trucks with newer vehicles (Louis, C, 2016).
- The Brooklyn Cruise Terminal in New York has installed shore power (GreenPort, 2016a).
- Two container terminal facilities in New York will be retrofitted with auto stop-start hybrid technology at a cost of up to US\$144,000 (GreenPort, 2017c).

**At what cost:** Since 2006, the Port Authority spent approximately \$42 million on air emission reduction initiatives. (Louis, C, 2016)



## FUNDING OPPORTUNITIES

### **Transportation Investment Generating Economic Recovery (TIGER) Grant**

The Transportation Investment Generating Economic Recovery, or TIGER Grant program allows the DOT to invest in road, rail, transit and port projects that promise to achieve national objectives by investing in our Nation's infrastructure. Eligibility requirements for TIGER allow project sponsors at State and local levels to obtain funding for multi-modal jurisdictional projects that are more difficult to support through traditional DOT programs.

TIGER can provide capital funding directly to any public entity to support projects that typically have limited sources of federal funding. Eligible projects include but are not limited to: port infrastructure investments (including inland port infrastructure and land point of entry) and intermodal projects. In each round of Tiger, DOT receives hundreds of applications and examines the projects on their merits to help ensure taxpayers are receiving the highest value for every dollar invested.

The latest round of TIGER grants known as TIGER IX was appropriated \$500 million in funding on September 17, 2017 which is available through September 2022. The deadline to submit an application for the FY 2017 Tiger grant program was October 16, 2017. TIGER grants have historically achieved co-investment of 3.6 dollars (including other Federal, State, local, private and philanthropic funds) for every Tiger dollar invested. The maximum award for all projects is \$25 million and not more than \$50 million can be award to a single state (US Department of Transportation, 2017).

In 2010, the Port of Davisville in Quonset received a \$22.3 million TIGER grant award to make structural improvements to piers, terminals, roadways, and railroad tracks (Quonset Development Corp, n.d.). That same year the Port of Providence received a TIGER grant for \$10.5 million which went towards the purchase and installation of harbor cranes to replace the 2 antiquated diesel burning cranes (U.S. Senator Sheldon Whitehouse of Rhode Island, 2010). The port had originally applied for a \$40 million dollar grant for port infrastructure with a package that included mobile cranes, solar, wind, and shore power (Chris Waterson, personal communication, November, 6, 2017).

### **Diesel Emissions Reduction Act (DERA)**

The program is aimed at projects that achieve significant reductions in diesel emissions in terms of pollution produced and exposure, particularly from fleets operating in areas designated by the administrator as poor air quality areas.

Eligible diesel vehicles, engines, and equipment include

- School buses
- Class 5 – Class 8 heavy-duty highway vehicles
- Locomotive engines
- Marine engines
- Non-road engines, equipment or vehicles used in construction, handling of cargo (including at ports or airports)

Grants awarded tend to fall into two major categories including drayage truck replacement and marine vessel power which replaces old, higher emitting engine with new EPA-certified cleaner engines (EPA, n.d.a).

The EPA awarded \$34 million in grant funding for the Diesel Emissions Reductions Act (DERA) Clean Diesel Funding in 2017. The 2017 Request for Proposals is closed. Under DERA funding for state efforts to reduce diesel emissions Rhode Island was awarded \$222,982. Under the DERA national grant program the EPA awarded CLF Ventures, Inc. \$386,105 to install three EPA-certified Tier 3 marine propulsion engines in the Block Island ferry, M/V Carol Jean. The EPA anticipates the release of the 2018 Clean Diesel Funding Assistance Program in February 2018 (EPA, 2017).

### **Fixing America's Surface Transportation Act (FAST ACT)**

On December 4, 2015, President Obama signed into law the Fixing America's Surface Transportation Act (FAST Act). The act funds surface transportation programs including but not limited to Federal-aid highways. The goal is to provide flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act.

Funding is available to reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter (nonattainment areas) and for former nonattainment areas that are now in compliance (maintenance areas). The FAST Act authorizes \$226.3 billion in Federal funding for FY 2016 through 2020 for road, bridge, bicycling, and walking improvements. In addition, the FAST Act includes a number of provisions designed to improve freight movement in support of national goals (U.S. Department of Transportation Federal Highway Administration [FHWA], 2016).

Rhode Island is authorized to receive nearly \$222 million in highway funding with annual authorization for the state now project to reach over \$242 million by 2020. According to the Federal Highway Administration, Rhode Island has 6,480 miles of roadway and 1,745 miles of that roadway are eligible for federal aid (Congressman David Cicilline, 2015). If the port's roadways are eligible for federal aid it should be considered for paving the roadways at ProvPort which are currently in serious disrepair.

## RECOMMENDATIONS FOR PROVIDENCE

Based on the examples provided, the information from the EPA, WPCI, and AIVP, and the funding opportunities outlined there are a number of best practices that the Harbor Commission could consider initiating.

### **Trash Skimmer**

Like most commercial harbors, Providence harbor is littered with marine debris which is one of the most widespread problems facing the ocean and our waterways. As the city plans to install private mooring in the area, marine debris becomes an increasing concern. In addition, marine debris tends to accumulate on coastlines which can have deadly consequences for seabirds, fish, and marine animals.

Baltimore developed the Inner Harbor Water Wheel, or “Mr. Trash Wheel” as it’s known to locals, to clean up their inner harbor. Mr. Trash Wheel combines old and new technology to harness the power of water and sunlight to collect litter and debris flowing down the river. The river’s current provides power to the turn the water wheel, which lifts trash and debris from the water and deposits it into a dumpster barge. When there isn’t enough current, a solar panel array provides additional power to keep the machine running. Since May of 2014, over 700 tons of trash has been collected and incinerated to generate electricity for local homes (Waterfront Partnership of Baltimore, n.d.).

The Rhode Island version of Baltimore’s Mr. Trash Wheel is known as the “Trash Skimmer” developed with the goal of reducing the amount of marine debris in local waters. Essentially they operate as a large, industrial sized pool filter, filtering water through twenty four hours a day capturing floating debris and absorbing surface oil and other contaminants. As the Marina Trash Skimmers need to be emptied regularly, contents collected can be analyzed to better understand what debris is most prevalent in each location and potential sources of that pollution.

A Trash Skimmer is shaped like a dumpster measuring 4’x6’x5’ and is attached to a floating dock. A ¾ horsepower water circulation unit on the bottom of the unit forces water out of the skimmer; this results in a current on the surface that collects trash, soaking up oil, and trapping floating debris. Over 300 gallons of water are cleaned per minute. Marina maintenance crews remove the collected debris from within the unit. Marina Trash Skimmers are highly effective, require very little maintenance, work 24 hours a day, 7 days a week, and use approximately 25Kwh/day resulting in minimal operating expenses.

New England Boatworks (NEB), located in Portsmouth, Rhode Island, installed the third Trash Skimmer in Rhode Island at their marina last year. The other two trash skimmers were installed in Newport Harbor and collected over 6,000 pounds of debris during the first four months of operations. In May of last year, Rhode Island Governor Gina Raimondo presented NEB with a Certificate of Special Recognition for becoming Rhode Island’s largest and most diverse Clean Marina (New England Boatworks, 2017).

Clean Ocean Access is a nonprofit located in Middletown, Rhode Island whose goals are to eliminate marine debris, improve coastal water quality, and protect and preserve shoreline access. In April 2017, it was announced that Clean Ocean Access received an additional grant of \$66,000 from 11<sup>th</sup> Hour Racing to implement two additional Trash Skimmers in Newport Harbor and to create a strategic plan for four different locations around Rhode Island.

ProvPort should petition Clean Ocean Access to install a Trash Skimmer on a floating dock in the harbor as one of the four proposed locations. The Trash Skimmer Project would reduce the amount of marine debris entering from stormwater runoff, increase the recreational and commercial value of the waterfront, bring awareness to the types of re-accumulating debris via education and outreach, and promote environmental stewardship. Its implementation could also be considered a community outreach and educational initiative if the port helped sponsor its implementation via Clean Ocean Access and 11<sup>th</sup> Hour Racing (11<sup>th</sup> Hour Racing, n.d.).



Figure 12: Trash Skimmer- Newport, RI

### **Replace Current Warehouse at ProvPort with LEED Certified Building**

LEED (leadership in Energy and Environmental Design) is an internally recognized green building certification system providing third-party verification that a building was designed and built using green strategies that improve performance across environmental metrics. LEED provides a point system to score green building design and construction. The system is categorized in five basic areas: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality. Buildings are awarded points based on the extent various sustainable strategies are achieved. The more points awarded the higher the level of certification achieved from Certified, Silver, Gold, to Platinum (inc Sustainability, n.d.).

The 120,000 square foot warehouse located at ProvPort is in need of replacement in the near future. The EPA does not currently provide funding for green building projects (EPA, 2016). No applicable state funding is currently available but there are tax incentives and tax incentive assistance projects provided by the federal government.

### **Install Solar Panels at ProvPort**

Commerce Rhode Island provides financial grants for small scale solar photovoltaic systems and domestic solar water heating systems to help reduce energy costs and increase renewable energy adoption. The program is funded by the Rhode Island Renewable Energy Fund (REF) and alternative compliance payments (ACPs) from the state's renewable portfolios standard (RPS). The program currently offer small scale solar grants with varying incentives depending on direct or third-party ownership (DSIRE, 2017).

Purchasing a solar system generally requires upfront installation and equipment costs but there are significant benefits realized over time including avoiding electricity costs and net metering. Upfront costs can be offset by a 30% federal solar tax credit for qualified residential and commercial projects in addition to the REF Grant Program which provides a 25-30% subsidy (Rhode Island Commerce Corporation, n.d.).

National Grid offers the Renewable Energy Growth program which pays residential or non-residential customers for solar generation. Non-resident customers: Payments are available for 20 years and depending on the term, project, size and other factors National Grid will pay between 29.8 cents and 41.35 cents per kilowatt. The host customer may receive a bill credit for energy consumed during a month, with the remainder paid to the system owner or the entire PerformanceBased Incentive (PBI) can be paid directly to the system owner (National Grid, n.d.).

ProvPort currently leases a building to a cement terminal next door as cement is a high percentage of imports for the port. The terminal recently rehabilitated a 120,000 square foot warehouse for cement storage which they plan to add a dome to for extra capacity. The plan is then to add solar panels to the dome of the existing warehouse though it is not yet clear if they will offer a roof lease to a 3<sup>rd</sup> party (like the wind turbines) or install solar panels themselves as the first party owner. As mentioned, the existing older warehouse at Waterson Terminals is in need of replacement soon and therefore it would not be economical to consider solar panels for the roof until the building is replaced.

### **Develop Stormwater-Treatment (Porous Pavement)**

Porous paving (also known as pervious paving or permeable pavement), is a term used to describe paving methods for roads, parking lots and walkways. Porous asphalt, concrete, paving stones or bricks allow precipitation to infiltrate through to the soil below. Gravel pavers range in price from around \$1.50 and up to \$5.75, per square foot of installed pavement. Porous concrete, however, can cost anything from \$2.00 up to \$6.50, per square foot on average. Though costs may be higher in the initial stage of installation, porous pavement can eliminate the need for stormwater drains and save on related construction costs. Funding may be available through the EPA via infrastructure grants (Paver Search, n.d.).

ProvPort is currently working with DEM to reach the current standards for stormwater treatment, however, the facility was built in the 1930's for sheet flow. Stormwater management was addressed in a new development via an expansion project several years ago which added 10 acres of storage to the port. The installation includes a stormwater mitigation system (the only one at the port) but does not, however, utilize porous pavement. The port paved 10 acres and technically by the standards would be required to have roughly 12 acres of treatment area which is not feasible in the footprint the port is working with. Instead a sediment boom barrier is set up along the entire edge of the dock meant to catch any solids that come through it. The water then overtops it and goes into the river. Waterson also has a regular sweeping program done throughout the port whenever a cargo discharge is completed which is performed by 3 loaders with broom attachments and a street sweeper. The terminals is currently consulting with environmental experts to see how they can better utilize any free space along the roads or other areas for stormwater management and other sustainable projects. Planting trees would not be feasible as there is limited space and

the impact would be minimal unless roof plantings were considered (Chris Waterson, personal communication, November, 6, 2017).

## CONCLUSION

As ProvPort considers an expansion plan and various development projects, it is paramount to mitigate environmental concerns through the continued application of green initiatives. Green ports provide long-term environmental, societal and economic benefits by focusing on reducing congestion, decreasing non-renewable fuel consumption, and modernizing fleets. ProvPort employs several green practices, notably the generation of renewable energy via wind turbines.

EPA best practices are important when considering funding from the agency for different projects. The EPA recommends learning about near-port community consideration which can be achieved through investing in local educational organizations. In addition, establishing anti-idling policies at the port for trucks with a wait time over 10 minutes would help reduce pollution generated from congestion at Sprague terminal. Retrofitting with verified technologies can be achieved by an overhaul of the ProvPort trucking fleet which could be funded through a DERA grant. Developing education programs on air pollution and emissions reduction for terminal operators and fleet owners can be addressed by arranging an annual meeting where relevant stakeholders consider upcoming projects to determine if green initiatives can apply throughout. Substituting electric for diesel power refers to the application of shore side power at the berth which would be the most expensive project to consider but could be funded via a TIGER grant.

Working with agencies such as the WPCI and AIVP would provide a worldwide network of support when considering sustainability and the implementation of the green port initiatives. Tools and case studies are made available by the organizations in addition to world conferences which help to inform and support. Examples of green initiatives are provided from 10 relevant ports across the United States the main ones including the switch from diesel to electric, replacing outdated engines, shorepower, and habitat preservation. Relevant recommendations for Providence include the introduction of the trash skimmer, solar panels, LEED buildings, and stormwater treatment achieved through porous pavement. Funding for the projects can be provided through TIGER grants, DERA grants, and the Fast Act along with state and federal tax incentives.



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