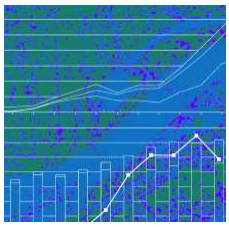

# Washington Coast Marine Spatial Planning Assessment of Shipping Sector

## Final Sector Assessment

PREPARED FOR

**Washington State Department of Natural Resources**

PREPARED BY

**BST Associates**
**PO Box 82388**
**Kenmore, WA 98028-0388**
**(425) 486-7722**
**bstassoc@seanet.com**

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BST Associates
Market Research & Strategic Planning

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## Executive Summary

BST Associates was retained by the Washington State Department of Natural Resources (DNR) to describe current and potential future activities by the navigation sector along the Washington coast, and to assess whether there are potential conflicts with development of offshore energy systems.

### *Study Purpose and Process*

The goal of this study is to:

- Describes the current state of the shipping industry including an assessment of the key issues facing the shipping industry, and
- Projects future shipping activities, including cargo volumes and ship calls.
- Discuss the potential conflicts for the shipping industry from development of offshore energy systems.

The deliverable from this task is a report for review by the expert group. This report presents an assessment of potential growth opportunities in waterborne traffic for Washington and Oregon, as well as estimates of the number of cargo vessels that could transit the Washington Coast.

### *Findings*

Waterborne cargo volumes in the Pacific Northwest (or "PNW", defined to include the states of Washington and Oregon) are projected to continue growing at modest rates during the study period. Across all cargo types, overall growth is projected to average approximately 1.3 percent per year from 2013 through 2035 under the baseline scenario. In contrast, the number of vessel transits is expected to continue to decrease due in part to the use of larger vessels.

There are several new market opportunities, mainly focused on the energy sector. However, none of these projects is currently permitted and under construction. As a result, there were not included in the baseline forecast.

Offshore energy systems are considered viable within approximately 20 miles of the coast but future technology could increase the distance from the coast. Most deep draft vessels and barges carrying liquid bulks (petroleum, petroleum products and chemicals) transit well offshore unless entering/departing a port. The closer off-shore power projects are to the coast, the less likely there will be conflicts with deep draft vessel traffic. Two key exceptions are barges carrying dry cargoes, and barges/vessels accessing the Port of Grays Harbor that must transit the coastal area just below the Area To Be Avoided (ATBA), see Figure 10 at the end of the report for a map of the ATBA.[1] As a result, they could be impacted by development of offshore energy systems, depending upon where they are placed.

[1] Source: NOAA, *Vessel Transits Through Olympic Coast National Marine Sanctuary and Area to Be Avoided (ATBA) - 2013 Estimated Compliance*, April 16, 2013. The International Maritime Organization (IMO) designated an Area to be Avoided (ATBA) off the coast of Washington to reduce the risk of marine casualties including oil spills, and the resulting environmental damage to Olympic Coast National Marine Sanctuary.

## Cargo and Vessel Transit Forecasts

The following report characterizes the PNW Gateway (consisting of the states of Washington and Oregon) and presents an assessment of cargo projections and transits by commodity handling group.

### *Overview of PNW Gateway Trade*[2]

The PNW Gateway is one of the largest in the U.S. for international trade, accounting for $204 billion dollars of goods in 2013. The PNW Gateway includes 11 seaports, airports (SeaTac International and Portland International as well as several regional airports) and two land crossings (Blaine and Sumas). Combined, these three accounted for 4.0% of total U.S. exports and 2.7% of total U.S. imports in 2013.

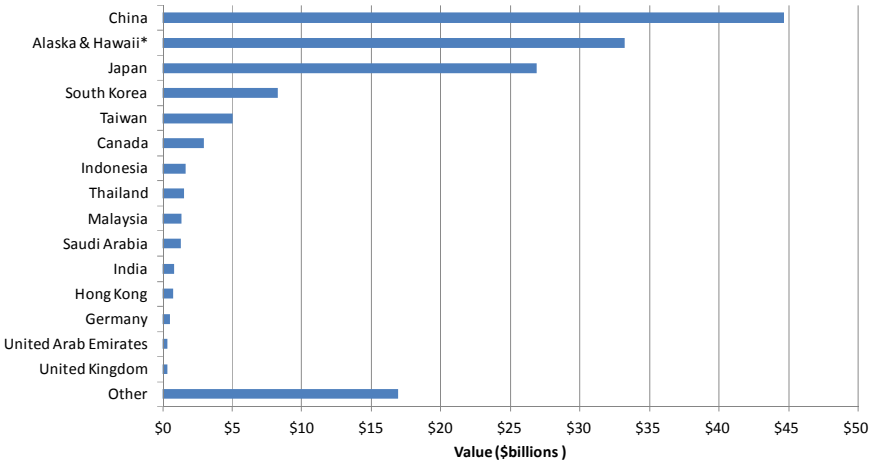
The goods imported through the PNW Gateway supply inputs to U.S. manufacturers and products for North American consumers. Exports of agricultural and manufactured products support farms, businesses and households throughout the Pacific Northwest and the Midwest.

The Pacific Northwest is a key gateway for goods moving between Asia and the United States. Across all modes of transportation, approximately 10% (by value) of U.S. trade with Asia moves through the Pacific Northwest (including 13% of waterborne trade of Asia-U.S. trade). The Pacific Northwest is also one of the top gateways for exports of American products. Based on 2013 export value, the Pacific Northwest was the fifth largest export gateway across all modes of transportation, and the sixth largest for waterborne exports.

The Pacific Northwest is the second largest gateway in the U.S. to Northeast Asia (China, Japan, South Korea, Hong Kong and Taiwan, as well as North Korea and Mongolia) for both total trade and waterborne trade.

China is the largest trading partner through the PNW ports, accounting for 31 percent of waterborne trade, followed by Alaska and Hawaii (23 percent), Japan (18 percent), South Korea (6 percent) and other partners. (See Figure 1).

**Figure 1 – Value of Waterborne Trade Through PNW Ports in 2013 ($billions)**

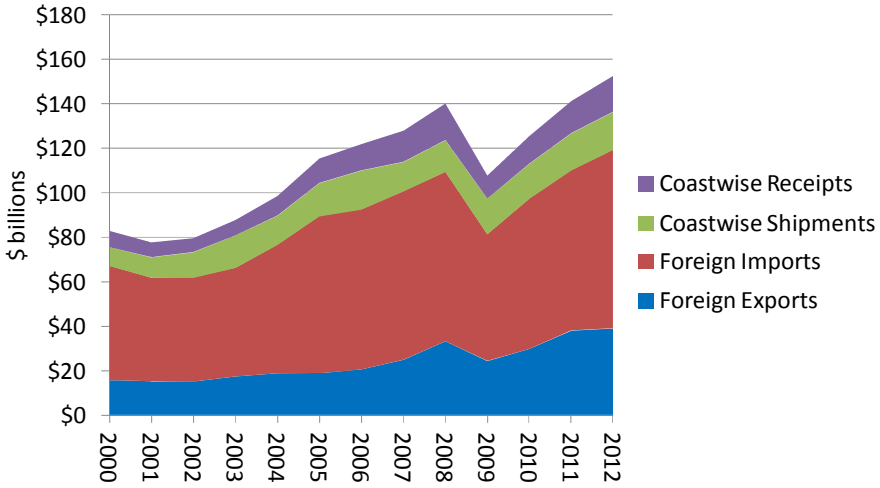



Source: USACE, US Dept. of Commerce

[2] Source: BST Associates, *PNW Gateway White Paper*, prepared for Washington Public Ports Association, May 2014

Including both foreign and domestic cargo movements, the value of waterborne trade moving through ports in the Pacific Northwest grew from an estimated $81 billion in 2000 to more than $152 billion in 2012. Although the recent recession depressed trade values in 2009 and 2010, strong growth resumed in both 2011 and 2012 (see Figure 2).

**Figure 2 – Pacific Northwest Waterborne Trade Value ($billions)**




Source: USACE, US Dept. of Commerce

## Changing Trade Patterns

Changes in world trade patterns may affect trade flows through the PNW, most notably; trade with China is being affected. For thirty years, China experienced rapid growth, with its gross domestic product (GDP) increasing at an average rate of 10 percent. China's GDP is expected to grow annually at approximately 7 percent for the near future.[3]

As its economy has matured, wage rates in China have increased and the exchange rate has appreciated. These trends are causing multinational firms to consider:

- Shifting production from coastal China to less expensive areas such as western China or other Asian countries (notably Vietnam and Malaysia)[4]
- Reshoring (relocating production the US) or
- Nearshoring (relocating manufacturing to Mexico, Canada or Latin/South America).

If relocation occurs, it could have two potential impacts on waterborne trade. First, a transfer of manufacturing to Southeast Asian countries could trigger a shift of vessel traffic from the Panama Canal to the Suez Canal. Second, a shift to reshore/nearshore would eliminate a portion of waterborne container trade that was previously sourced overseas. Both of these impacts could result in decreased trade moving via the PNW.

Thus far there has been only a modest net effect on trade routes due to reshoring/nearshoring, and future results are still uncertain. Recent research of trade trends through 2013 indicates that shifts have been minimal:

[3] Source: International Monetary Fund, *World Economic Outlook*, April 2014, page 36.

[4] *Sources: Boston Consulting Group, The Shifting Economics of Global Manufacturing: An Changing Cost Competitiveness of Analysis of the World's Top 25 Export Economies*, April 2014

> "*Notwithstanding some recent business surveys that show increasing interest in the re-shoring theme, there is little evidence that it is happening now, or is poised to occur near-term. Overall, the US-China trade route continues to be dominant, although we note the emergence of other Asian suppliers, but from a low base (for instance, Vietnam). Mexico remains a small player in many segments.*"[5]

Even the Reshoring Initiative, a proponent of reshoring efforts, suggests that the number of jobs that were offshored in 2013 roughly equaled the number of jobs reshored, and reshoring could potentially add 50,000 net new jobs by 2016.[6] Some of these jobs are in call centers and professional services and do not affect manufacturing. In addition, a portion of the manufacturing jobs are in assembly but still rely on products manufactured overseas. As a consequence, potential shifts in trade are uncertain.

In contrast to the potential loss of cargo due to reshoring, rising incomes in China and elsewhere in Asia may lead to increased cargo moving through PNW ports. The growth in income is stimulating increased consumption of U.S. products, including meat, seafood, grains and a variety of other consumer products and manufactured goods. This bodes well for exports of both containerized and non-containerized products from the PNW, which (as noted above) serves as a natural trade gateway for the PNW through the Midwest.

Improvements to the Panama Canal could also negatively impact the volume of containerized trade moving the PNW. To a large extent, however, the cargo that would be vulnerable shifting from PNW ports to ports on the East and Gulf coasts has already done so.

## Energy Development

The dramatic growth in energy production in the Bakken region of North Dakota and Montana, as well as in the Canadian plains provinces, has created market opportunities for the PNW. Crude oil production increased from around 200,000 barrels per day in 2009 to more than one million barrels per day in 2013 and is expected to increase further. According to the U.S. Energy Information Administration (EIA), the "Bakken region now accounts for a little over 10% of total U.S. oil production. The growth of crude oil production in the Bakken region is part of a longer-term trend in drilling efficiency gains that has led North Dakota to rank second in crude oil production in the United States, behind only Texas."[7]

The Williston Basin of the Bakken Formation has an estimated reserve of 3.2 billion barrels of crude oil.[8] The North Dakota State Pipeline Authority estimated that production in the Williston Basin could reach 1.4 million to 1.6 million barrels per day around 2023.[9] However, production has increased much faster than predicted in 2012, and some believe that production could reach 2.0 million or more barrels per day.

This trend is occurring at the same time that Alaska's oil production is declining. Oil production in Alaska peaked at 2.05 million barrels per day in 1988, but has declined steadily since then. Over the past decade Alaska production dropped from around 1.0 million barrels per day in 2004 to 543,000 barrels per day in 2013. The Alaska State Department of Revenue

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[5] Source: Standard Chartered, United States – Trade: 'Re-shoring' not in the data, February 2014.

[6] Source: Reshoring Initiative, Annual Activity and Accomplishments Summary: 2013.

[7] EIA Drilling Productivity Report, November 2013

[8] EIA U.S. Crude Oil and Natural Gas Proved Reserves, 2012, April 2014

[9] Petroleum News, June 8 2014

expects production to continue to decline, falling to 319,000 barrels per day in 2023.[10] To make up for the shortfall, refineries on the U.S. West Coast shifted an increasing share of their crude oil inputs to foreign sources. In the PNW this includes crude moving by pipeline from Canada as well as moving by ship from overseas. With the recent growth of crude oil in Bakken region, however, West Coast refineries have quickly shifted to using that source, shipping it in by rail or by a combination of rail and vessel.

In addition to crude oil, marine terminal projects to handle other energy products from the U.S. and Canada are also being considered, including three coal terminals, three methanol plants and exports of liquefied petroleum gases (LPG, consisting of propane and butane). This is creating opportunities for ports as well as for U.S. manufacturers.

The increase in North American oil and gas production at significantly lower cost than in competing countries is likely to impact several energy-intensive industries that import and export products, including:[11]

- Iron and steel product manufacturing,
- Resins and synthetic material manufacturing,
- Basic organic chemical manufacturing,
- Plastics and rubber products manufacturing,
- Fabricated metal product manufacturing,
- Agricultural chemical manufacturing,
- Nonmetallic mineral product manufacturing,
- Petroleum and coal products manufacturing, and
- Machinery manufacturing, among others.

There are opportunities to attract energy-intensive industries to the PNW. An example of this is the plan by Northwest Innovations to develop three methanol plants (planned at Tacoma, Kalama, and St Helens).

### *Cargo Forecasts*

This section presents cargo forecasts by commodity handling group for the PNW, including:

- Containers,
- Neobulk/Breakbulk,
- Grain,
- Dry Bulks, and
- Liquid Bulks.

#### Containers

The discussion of changing trade trends provides important background information, because approximately 40 percent of the containerized imports moving through PNW ports is consumed in the Pacific Northwest (Washington and Oregon), while the remaining 60 percent is transported beyond (mainly to the Midwest but also to the Mountain Central, Northeast,

[10] Alaska DOR, Revenue Sources Book, Fall 2013.

[11] Source: IHS Group, America's New Energy Future: The Unconventional Oil and Gas Revolution and the US Economy, September 2013.

Southeast and South). Routing decisions are influenced by the total delivered costs for the goods, service reliability and speed, among other factors.

Many retailers have adopted a "four corner" strategy to diversify their supply chains away from reliance on the West Coast, and now move their imports through Southeast and Northeast ports, in addition to the Pacific Northwest and California,. The result has been a loss of market share by PNW container ports (Portland, Seattle and Tacoma) to ports in Southern California (Los Angeles and Long Beach) and to ports on the Gulf and East coasts. In addition, much of the containerized cargo that moved through Portland has been diverted to Seattle and Tacoma.

The competition for container cargo has also expanded to include ports in British Columbia, which have claimed a growing share of the cargo that once moved through Seattle, Tacoma, and Portland. Much of the incentive to shift cargo to B.C. ports is related to price differentials, and the Port of Seattle estimates that it costs $200 to $400 more per TEU to ship a container through the PNW than through B. C. Key factors are the Harbor Maintenance Tax (HMT), charged on cargo moving though U.S. ports, and lower rail rates from Canada to the U.S. Midwest.[12] The PNW container ports are particularly susceptible to shifts between ports because a large share of the container ships that call at PNW ports also call at a port in B.C. or California on the same voyage, often calling at the other port first.

Other trends impacting container ports include:

- Use of much larger vessels. Vessels used in the Transpacific container trade have grown an average of 5,000 TEUs capacity to between to 8,000 TEUs and 10,000 TEUs. The average vessel size is expected to continue to grow.
- Larger and more productive terminals. Larger vessels require much larger container terminals, typically 100 acres or more. Efforts are underway to increase the productivity of existing terminals as much as possible in order to lower operating and capital costs. In addition, significant improvements are being made to terminals in competing ports.
- Rail connections. The major container trade routes require direct access to extensive intermodal rail connections. Cost effective and efficient rail service is a key determinant of success for intermodal ports.
- Transloading. The use of transloading is also increasing, in which the contents of ocean containers are stripped and repacked into domestic containers at or near the container dock in order to reduce overall transport costs. The availability of domestic containers is largely driven by population size, which favors ports with a large population base, as in Southern California.

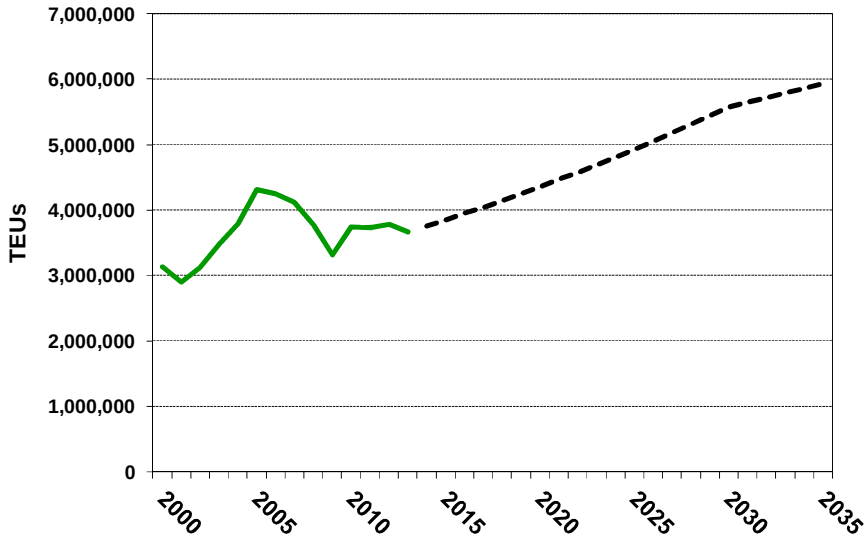
Container ports in the PNW also handle container traffic moving to and from domestic locations, primary Alaska and Hawaii. Growth in these trades is driven by the economies of those states. In addition, efforts are underway to stimulate short sea shipping, especially in coastal trade between ports in the PNW and California. A shortage of long-haul truckers is a primary impetus for this, in addition to other factors. This effort is considered an emergent trend that could increase domestic container and breakbulk trade.

[12] Source: Mike Moore et al, Freight Trends presented to the Freight Mobility Strategic Investment Board in May 2013, accessed June 27, 2014 www.fmsib.wa.gov/fac/FAC%20May%2013.../Freight%20TRENDS.pptx

***Trends & Forecasts***

Container traffic in the region saw strong growth through 2005. After 2005, a combination of the economic recession and competition from other ports, most notably ports in British Columbia, caused a decline in container traffic. Traffic levels began to recover in 2011, but remained essentially flat in both 2012 and 2013. Container volumes are projected to grow, but at a slower rate than that seen in the early 2000's.

**Figure 3 – Container Forecast**




Source: data on historical trends (individual ports, USACE, US Dept. of Commerce), forecasts (BST Associates update of Pacific Northwest Marine Cargo Forecast Update and Rail Capacity Assessment, 2011)

Ocean Shipping Consultants projects growth[13] for the Pacific Northwest (the region from Prince Rupert to Portland) as growing at the following average annual growth rates between 2011 and 2035:

- Low Case – growth at 2.3 percent per year on average
- Base Case – growth at 3.2 percent per year
- High growth at 4.0 percent per year.

The container forecast is based upon 2.2 percent annual growth rate from 2013 to 2035, which is at the low end of the forecast range for PNW ports.

## Grain

In the Pacific Northwest, nearly all exports of wheat and barley are handled through Columbia River ports. Competition from other exporting countries is intense in the wheat and barley trade, primarily from Canada and Australia. In addition, some former importers, including India and Pakistan, are now beginning to export to the same markets served by PNW ports. Much of the wheat exported through the PNW is grown in the Upper Midwest, but the

[13] Source: Port Metro Vancouver Container Forecasts prepared by Ocean Shipping Consultants for Port Metro Vancouver August 2012, page 73.

ports also handle substantial volumes of wheat grown in Eastern Washington, Oregon, Idaho, Montana, and Utah.

Coarse grains, including corn and sorghum, are primarily used as animal feed. Soybeans are used for animal feed and for human consumption. World competition in the coarse grain market is intense, and Washington exporters vie for sales against Brazil, Argentina, and others. Washington ports also face competition from other U.S. port regions, specifically ports on the Gulf of Mexico.

Ocean freight rate and rail freight rate differentials can cause major shifts of exports between PNW and Gulf Coast ports. Washington state ports saw rapid growth in corn exports due to favorable, including relatively lower freight rates). However, several factors may impede continued growth in corn exports. In particular, an increasing share of U.S. corn production has shifted to use in ethanol production (approximately 40 percent), reducing the volume of corn available for export. In addition, international competition from Argentina and Ukraine is expected to increase in the near-term for export sales. China is expected to expand as a net importer, which could expand the export market size substantially.

Soybean exports through the PNW have also increased significantly in the recent past. There continues to be a strong demand for vegetable oils for food consumption and for protein meals used in livestock production and biodiesel. The export markets are large and growing, particularly in China. As with other crops, there is international competition (mainly from Brazil and Argentina).

Significant investments to upgrade PNW grain elevator capacity have recently been undertaken:[14]

- Longview: $230 million export grain terminal, the first new grain facility built in North American in 25 years,
- Kalama: $100 million Port of Kalama/CHS, Inc. grain terminal improvements and $36 million improvements at Kalama Export's grain terminal,
- Vancouver: $450 million in new investment, including $150 million rail freight access and $300+ million in private investment for new exports at the grain elevators and at Terminal 5,
- Portland: $3.2 million berth deepening at T-5, $120.5 million investment in T-6.

A key factor in the decision to improve the grain terminals on the Columbia River was the deepening of the navigation channel from 40 feet to 43 feet below mean lower low water (MLLW). Each foot of additional draft allows approximately 2,000 tons of additional products to be shipped, which reduces the average shipping cost per ton. In addition, improvements have been undertaken in Grays Harbor, including terminal upgrades and plans for navigation improvements.

## Trends & Forecasts

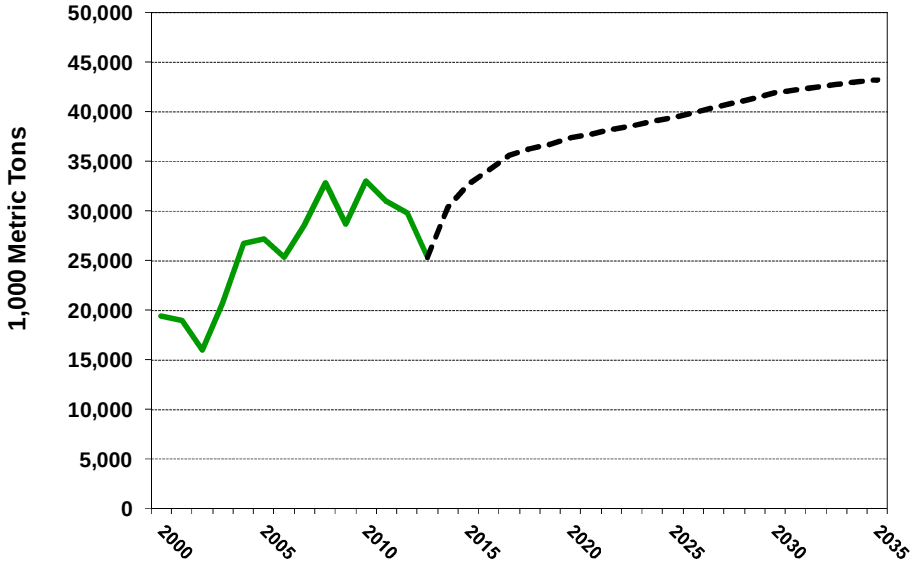
Annual exports of grain and oilseeds through PNW ports doubled between 2002 and 2010, growing from less than 16 million metric tons to nearly 33 million metric tons. Although volumes were down recently, they are projected to recover and to continue growing through 2035.

[14] Source: Pacific Northwest Waterways Association

A number of factors have contributed to the increase in exports of grain and oilseeds, including growth in demand from Asia (especially China), deepening of the Columbia River navigation channel, higher production in the hinterlands for Pacific Northwest ports, and ocean freight rate differentials.

Growth in the PNW is projected at 2.2 percent per year from 2013 to 2035.

**Figure 4 – Grain and Oilseeds Forecast**




Source: data on historical trends (individual ports, USACE, US Dept. of Commerce), forecasts (BST Associates update of Pacific Northwest Marine Cargo Forecast Update and Rail Capacity Assessment, 2011)

## Dry Bulks

Key commodities at Puget Sound/Coast ports include scrap metal , wood chips, sand and gravel, cement, and gypsum, which are used as an input to manufacturing (cement, steel, paper/pulp etc) or construction (aggregates and cement). Non-grain dry bulk exports on the Lower Columbia include: minerals, ores, chemicals and fertilizers, and petroleum by-products (i.e., petroleum coke). There are large volumes of soda ash and potash that move through Columbia River ports (mainly Portland but a large export terminal is being considered in Vancouver). Copper concentrates from Montana are exported via the Port of Vancouver. Petroleum coke is produced at the refineries on Puget Sound then shipped by rail to Longview for export. There are also limited volumes of aggregates and cement moved on the river system as well as shipments of wood chips from chip terminals to forest products manufacturers.

### *Trends & Forecasts*

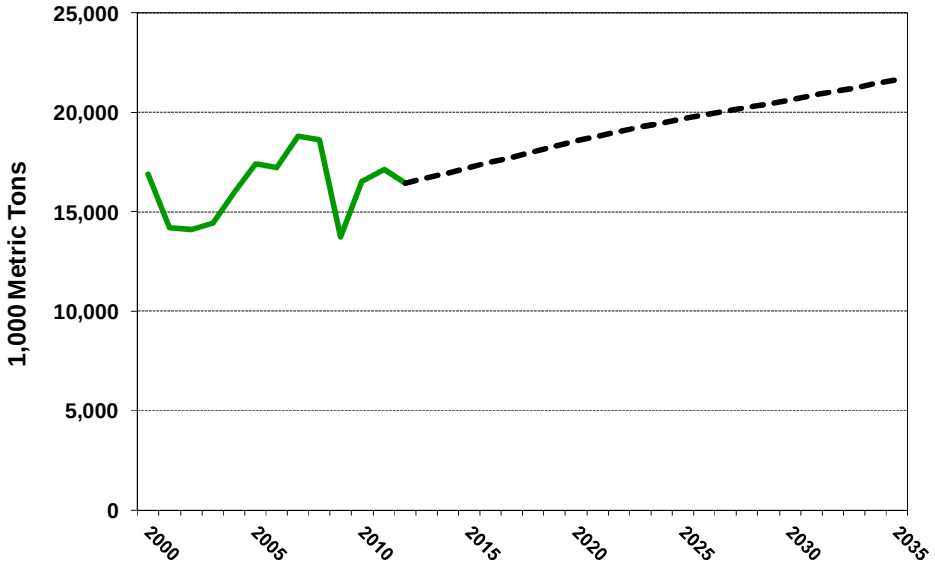
Since 2000 the trend in the volume of dry bulks moved by water is generally one of slow growth, although volumes were impacted by the recession. Over the long term the slow, steady growth is projected to resume, with total volume increasing from approximately 17 million metric tons in 2013 to 22 million metric tons in 2035.

There are a number of projects currently in the planning or permitting stages that could substantially increase the volume of dry bulk shipments. Because of the uncertainty surrounding these projects they are not included in the forecast. These include coal export terminals at Cherry Point on northern Puget Sound, and at Longview and Saint Helens on the Columbia

River. The total volume of these coal terminals could exceed 100 million metric tons if developed as planned. In addition, a potential new terminal in Vancouver (WA) could export up 16 million metric tons of potash, and the Gateway Pacific Terminal at Cherry Point could handle six million metric tons of dry bulks in addition to coal.

Under baseline conditions, dry bulks are projected to grow at 1.3 percent per year from 2013 to 2035 under baseline conditions.

**Figure 5 – Dry Bulk Forecast (Excluding Grain and Oilseeds)**




Source: data on historical trends (individual ports, USACE, US Dept. of Commerce), forecasts (BST Associates update of Pacific Northwest Marine Cargo Forecast Update and Rail Capacity Assessment, 2011)

## Liquid Bulks

The liquid bulk trade in the Pacific Northwest is dominated by petroleum, including crude oil and refined products. A variety of other liquid commodities are also handled, but in much smaller volumes (primarily chemicals and fertilizers).

In Puget Sound, crude oil accounts for most of the liquid bulk cargo, including receipts of domestic oil from Alaska and foreign oil from overseas sources. However, as noted previously, there has been a recent shift from waterborne receipts to receipts of crude oil by rail. All refineries in Puget Sound have or plan to build facilities to receive crude by rail.[15] In addition to crude oil, refined products are both shipped and received by Puget Sound ports in large volumes. Most of the remaining liquid bulk tonnage is comprised of chemicals and animal fats, which move in significantly smaller volumes than petroleum products.

The Port of Grays Harbor handles liquid bulks at its terminals (ethanol and methanol, among other products). Ports in the Columbia River (Portland, Vancouver, Kalama and St Helens) handle petroleum products and chemical products for regional consumption.

There are a number of projects currently in the planning or permitting stages that could substantially increase the volume of liquid bulk shipments. These include:

[15] Source: EIA, Washington State Energy Profile: Washington Quick Facts, last updated March 27, 2014.

- Crude oil rail-to-vessel transfer facilities in Portland, Vancouver (WA), and Grays Harbor,
- Methanol production and export facilities at Kalama and Port Westward in the Columbia River, and at Tacoma, and
- LPG export facilities (butane and propane) at Ferndale (existing facilities) and a new terminal being considered at Longview.

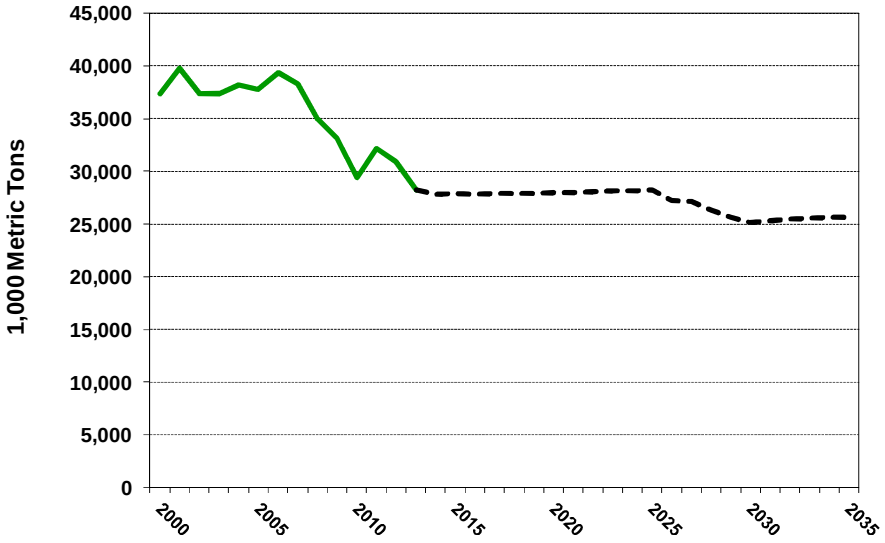
In addition, LNG terminal proposals are still in process for sites in Coos Bay (on the Oregon Coast) and Warrenton (at the mouth of the Columbia River). At full build-out, the Coos Bay terminal would export approximately 5 million tons per year, requiring around 100 vessel calls per year.

***Trends & Forecasts***

The volume of liquid bulks transported by water has decreased over the past decade, due mainly to a decline in receipts of crude oil. Alaska has historically been the primary source of crude oil for refineries on Puget Sound, but as production in Alaska has declined an increasing share has come from other sources. These other sources have included foreign crude imported via water, but also Canadian crude moved by pipeline. In addition, the past several years have seen major growth in the volume of crude oil moving to the PNW by rail from North Dakota, which has offset declines in waterborne receipts.

Waterborne movements of petroleum products are projected to decline over the forecast period. These moves mainly involve shipment of refined products from the refineries at Anacortes and Ferndale to the Columbia River, but also include moves to Vancouver, BC, Alaska, points on Puget Sound, and elsewhere. The volume of liquid bulks is projected to continue to decline for several years, and then to remain relatively flat through the end of the forecast period (i.e. average annual growth of -0.4 percent from 2013 to 2035). The potential future projects discussed above are not included in the forecasts.

**Figure 6 – Liquid Bulk Forecast**




Source: data on historical trends (individual ports, USACE, US Dept. of Commerce), forecasts (BST Associates update of Pacific Northwest Marine Cargo Forecast Update and Rail Capacity Assessment, 2011)

## Neobulk/Breakbulk Cargo

Neobulk cargo includes autos and logs, among other products. Breakbulk cargo includes general cargo that is unitized or palletized. In the Pacific Northwest, most breakbulk commodities include metal products (steel and aluminum products), forest products (lumber, pulp, paper, plywood et al), and project cargoes (wind turbines, cranes, heavy equipment and other similar products). Cargoes that can be transported in either containers or in breakbulk form are referred to as swing cargoes (examples include lumber, paper, pulp and other like products).

Imports of cars and trucks via U.S. PNW ports reached a peak of approximately 650,000 units in 2006/7 but the effects of the recession significantly impacted auto imports. The majority of U.S. PNW auto imports are handled at Columbia River ports, including Portland and Vancouver, with a smaller share moving through Tacoma. Recently, the Port of Grays Harbor has entered the auto trade, handling exports of Chrysler vehicles. Approximately 70 percent to 75 percent of imported vehicles are transported by rail from the PNW to inland U.S. destinations, while the rest are transported by truck to Pacific Northwest markets.

Log exports have been relatively strong during the past three to four years, due mainly to growing demand in China, but also in Japan and Korea. The portion of logs exported by tramp vessel has increased from 75 percent in 2008 to 93 percent in 2012.[16] Several variables may impact log exports. Most notably, as the housing construction market improves, the increasing demand for lumber could reduce log exports. In addition, a significant decline in the Chinese economy could impact construction. Since a large share of the imported logs is used in forming concrete, a decline in construction could reduce PNW log exports. However, most analysts expect that the Chinese government will prime the pump if growth falls, which would likely create additional infrastructure construction.

Breakbulk exports of forest products (lumber, pulp and paper) have declined significantly in recent years. However, in 2013 there was an uptick. According to the U.S. Forest Service, West coast lumber exports increased 2 percent over 2012 levels (first nine months). A significant volume of forest products moves via container. In 2012, approximately 64 percent of forest products (lumber, pulp and paper) moved by container but this was down from 71 percent in 2008. Domestic shipments to Hawaii and California have also experienced an increase.

Most steel is moved in a breakbulk form (coils, plates, sheets etc). A majority of the steel imports in the PNW terminate at a plant located on or near a port, such as steel imports to Oregon Steel Company (transits through the Port of Portland to the adjacent mill site) and steel coils bound for Steelscape (a steel mill located in the Port of Kalama). In addition, a relatively large share of the imported steel products and forest products are bound for regional construction markets. With the downturn in residential and commercial construction markets in the U.S., these volumes declined significantly. They are beginning to rebuild but it will take several years for the markets to return to their previous levels. Construction cargoes also seek to minimize transportation costs. As a result, they tend to locate in urbanized areas, closer to the dense population bases along the I-5 corridor.

Imports and exports of cranes and heavy equipment are mainly handled by terminals in Seattle and Tacoma. However, ports on the Columbia River (mainly Portland), as well as Everett and Grays Harbor, have seen growth in these cargoes.

Wind turbine equipment has been a major source of breakbulk imports for PNW ports. Imports are sourced primarily from Denmark, Spain, Japan, India, and Germany as well as an

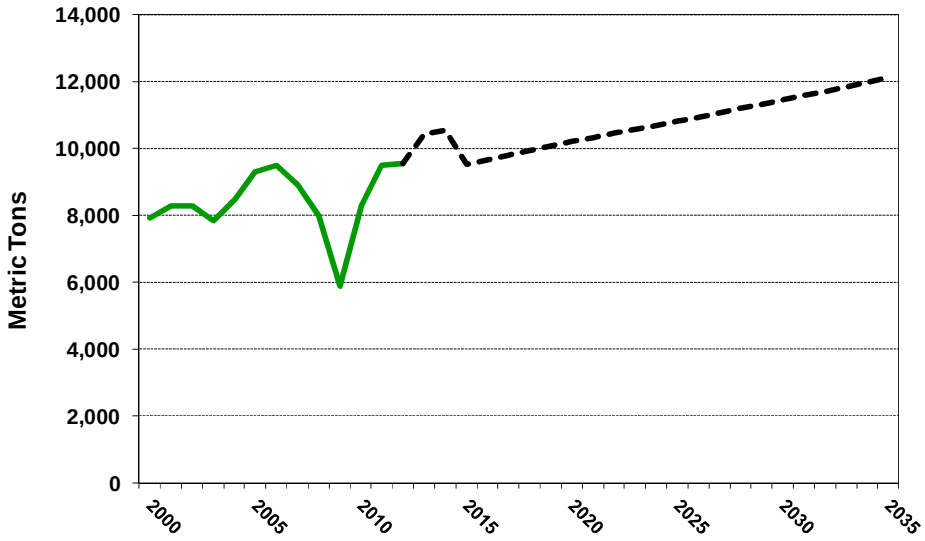
[16] Source: Wiser Trade Waterborne Trade Statistics

increase in imports of towers and lattice masts from Canada and Mexico. The U.S. West Coast has accounted for approximately 35 percent of U.S. imports. Most of the U.S. West Coast imports were transported through Columbia River ports (Vancouver and Longview), which averaged 35,000 tons of imports per year between 2005 and 2010 (approximately 59 percent of the U.S. West Coast market).

***Trends & Forecasts***

The recent economic recession had a major impact on breakbulk and neobulk trade, with vehicle imports hit especially hard. Since bottoming out in 2008, however, breakbulk and neobulk volumes have bounced back, to well above the pre-recession level. Volumes are projected to grow slowly through 2035 (average annual growth of 0.7 percent).

**Figure 7 – Breakbulk and Neobulk Forecast**




Source: data on historical trends (individual ports, USACE, US Dept. of Commerce), forecasts (BST Associates update of Pacific Northwest Marine Cargo Forecast Update and Rail Capacity Assessment, 2011)

## Vessel Transit Forecasts

Trends and forecasts of vessel trends are presented in this section.

### *Vessel Trends by Handling Group*

Using average deadweight tons per call as a proxy for average load, the average size of vessels calling in PNW ports increased at 2 percent to 3 percent on average annual basis for most vessel types.

**Table 1 – Average Deadweight Tonnage per Call**

| Year | Container | Bulkers | Tankers | Other | Total |
|---|---|---|---|---|---|
| ***Columbia River*** | | | | | |
| 2002 | 40,158 | 37,560 | 42,900 | 23,369 | 35,696 |
| 2011 | 52,632 | 49,764 | 38,113 | 27,325 | 45,974 |
| CAGR 2002-11 | 3.1% | 3.2% | -1.3% | 1.8% | 2.9% |
| | | | | | |
| ***Puget Sound*** | | | | | |
| 2002 | 49,991 | 46,473 | 85,599 | 5,061 | 41,259 |
| 2011 | 59,778 | 57,150 | 102,314 | 6,753 | 49,331 |
| CAGR 2002-11 | 2.0% | 2.3% | 2.0% | 3.3% | 2.0% |

Source: Maritime Administration, Vessel Calls at U.S. Ports, 2002-2011

The sole exception was for tankers in the Columbia River, which is explained by changing distribution of product types. In 2002, there were 17 inbound tankers of crude oil (serving an asphalt plant) but these deliveries have declined, which caused the average tonnage to increase. The average size of product tankers has remained at 36,000 to 37,000 deadweight tons. The increasing vessel sizes in the Columbia River reflect the completion of the deepening project from 40 feet to 43 feet in 2010.

The average size of deep-draft vessels calling at the Port of Grays Harbor has also increased from an average deadweight tonnage of 28,300 tons in 2005 to 35,300 tons in 2012, an average annual increase of 3.2 percent.[17]

The following sections review trends and expectations for vessel size by commodity handling type.

#### *Container Vessels*

The container fleet calling at PNW ports ranges from 1,000 to 5,000 TEU ships serving domestic routes (Alaska and Hawaii) and smaller international trade routes (Europe, Oceania etc). In addition, a portion of the containers shipped to Alaska and Hawaii are transported by barge.

The average container vessel in the Transpacific services (between the U.S. West Coast and Asia) has increased in size, and this trend is expected to continue. Shipping lines have increased ship sizes from 5,000 TEU vessels to 8,000 TEU vessels and are currently deploying 10,000 TEU vessels. Ocean Shipping Consultants describes the likely trend as follows:

- *"The shift to larger vessels has been the most significant feature for deepsea containerisation. The search for scale economies is at the heart of this drive. On a*

[17] Source: Grays Harbor, Washington Navigation Improvement Project General Investigation Feasibility Study DRAFT Limited Reevaluation Report, Appendix C: DRAFT Supplemental dated January 2014, Page 4.1-12

*tonnage-mile basis, the savings from larger vessels are significant and also one of the few factors that are directly controlled by ship operators. Furthermore, as soon as one major operator advances to the next size echelon, the competitive nature of the shipping industry may force other operators to follow suit. The net effect is a rise in both average vessel size and the size of the largest vessels deployed.*

- *The largest vessels that are planned will have a length (LOA) of 400m, a beam of 59m and a design draught of around 15.5m – although full draught will seldom be used. Berthing of these vessels should be possible with careful management at Vancouver and at Prince Rupert* [and at Seattle and Tacoma].
- *The 18,000-20,000TEU vessels now on-order are likely to represent the largest container vessels that will be constructed. The ULCS fleet (i.e. vessels of over 10,000TEU capacity) will account for 16.6 per cent of the total fleet in terms of TEU capacity by the end of 2015. There will be very great pressure to deploy much larger vessels at PNW ports. This represents a transformation of terminal requirements for the Asia-North America trades."*[18]

As a result, the number of container ship calls has decreased over time, and a leveling or reduction of calls is expected to continue in the future.

***Dry Bulk Trends***

Most of the grain exported via PNW ports currently moves in Handymax and Panamax vessels.[19] However, there is a possibility that future volumes will move in larger vessels such as small Capesize vessels, as larger importers seek to reduce per unit transportation costs.[20]

There is a large range of vessels involved in bulk trades, ranging from barges (woodchips, limestone, scrap and other products) to Handysize vessels and Panamax vessels (potash, soda ash, and other products).

Vessels are defined by their carrying capacity or deadweight tonnage (dwt), which is the number of metric tons that a vessel can transport of cargo, stores and bunker fuel. Most vessels serving in the bulk trades in the PNW are classified as Handysize, Handymax, Panamax or Capesize.

- Handysize - 10,000 to 34,000dwt.
- Handymax - 35,000 to 49,000dwt.
- Panamax (the largest size vessel that can traverse the existing Panama Canal with maximum dimensions of: length 965 feet; width 106 feet and draft of 39.5 feet in tropical fresh water) - 50,000 to 70,000dwt.
- Capesize vessel (vessels above 80,000dwt or whose beam precludes passage via the Panama Canal and thus forces them to pass around Cape Horn or the Cape of Good Hope).

If the planned projects come to fruition, the products would likely be carried by Panamax and Capesize vessels.

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[18] Source: Port Metro Vancouver Container Forecasts prepared by Ocean Shipping Consultants for Port Metro Vancouver August 2012, page 13.

[19] Sources: U.S. Maritime Administration, Glossary of Shipping Terms and Starcrest Consulting Group LLC, Puget Sound Maritime Air Emissions Inventory, May 2013 Update.

[20] Source: Informa Economics in Panama Canal Expansion: Impact on U.S. Agriculture, September 2011.

### *Tankers*

Tankers calling in the PNW range from approximately 12,000 to over 190,000 DWT and fall into one of the following size categories depending on their DWT:

- Handysize–up to 50,000 dwt
- Panamax - 50,000 to 80,000 dwt
- Aframax - 80,000 to 120,000 dwt
- Suezmax - 120,000 to 200,000 dwt

However, it should be noted that laden tankers carrying crude oil and products are limited in Puget Sound to 125,000 deadweight tons.[21] Integrated tug-barges (ITB) and articulated tug-barges (ATB) also handle crude oil and products. Petroleum product and chemical tankers calling at PNW ports are typically Handysize vessels or ITBs/ATBs with a deadweight tonnage up to 50,000 tons. These types of vessels are expected to continue to handle liquid products at the PNW ports for the existing product base as well as for proposed products.

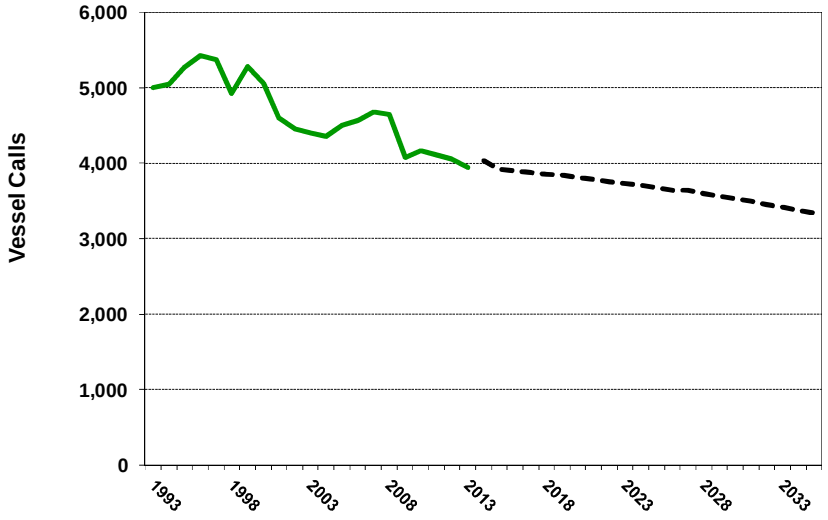
### *NB/BB Vessels*

Vessels in this category include auto carriers, Ro-ro vessels, general cargo ships and dry bulk vessels. Vessels in this group have generally increased during the past ten years. Modest growth is expected in the future.

## *Vessel Forecast*

Figure 8 presents a summary trend and forecast of vessel calls through PNW ports based upon data provided in the Washington State Department of Ecology VEAT report for the Columbia River and by the Marine Exchange of Puget Sound for Puget Sound and Grays Harbor.

**Figure 8 – PNW Vessel Calls (Entrances)**




Source: data for historical trends (Washington State Department of Ecology Vessel Entries And Transits [1993 to 2013], Marine Exchange of Puget Sound internal database); forecasts (BST Associates based upon commodity group forecasts and expected vessel sizes).

[21] Source: Puget Sound Harbor Safety Committee, Puget Sound Harbor Safety Plan, April 2013, page 42

The number of vessel calls (entrances) peaked at 5,431 in 1996 and fell to 3,947 in 2013. This represents a decline of 1,484 vessel calls (average annual trend of minus 1.9 percent per year). As noted above, the decline was due in part to increased vessel size.

The forecast indicates a continued decline in the number of calls, reaching 3,336 vessel entrances in 2035. This represents a decline of 611 vessel calls (average annual trend of minus 0.8 percent per year).

### *Potential Impacts from Offshore Development*

This study is tasked with assessing whether development off offshore energy systems would pose a conflict for marine shipping. This depends on where the energy systems are placed. A recent report provides the likely area of development as follows: "*Results suggest that there is a wider range of sites with higher suitability scores off the southern half of the Washington coast than the northern coast, although results differ based on device type. Fixed foundation wind energy models and nearshore wave device models closely followed this pattern, though it is less distinct in the mid- and deepwater wave model results. Most areas with high suitability occur within 25 miles or less of the coast. Results also suggest that the Washington coast has limited areas suitable for tidal energy development*."[22]

The authors of this report indicate that offshore energy systems will likely be located within 25 miles within a seven year window as constrained by existing technology: "*The scope includes projects that would commence a planning or feasibility phase within the next five to seven years. This time horizon serves to narrow the focus to existing, tested technologies deployed within a few miles of shore, with the exception of offshore wind floating platform technology which would most likely be deployed within 20 miles of shore*."[23]

An offshore development located near Coos Bay is expected to be 15 to 18 miles from shore. An awardee of the US Department of Energy's Offshore Wind: Advanced Technology Demonstration program, Principle Power and its partners have proposed a 30 MW floating offshore wind project approximately 15 miles off the coast of Coos Bay, Oregon. The project will consist of five of Principle Power's WindFloat floating foundations featuring Siemens 6 MW direct drive offshore wind turbines. Located in deep water, the project will be the first offshore wind farm off the West Coast of the United States. The project will have the following capabilities:[24]

- Project Capacity - Five 6MW WindFloat systems, or 30 MW. This is roughly equivalent to the power required for 10–12,000 homes.
- Distance from Shore - 15 – 18 miles. At this distance, the project will be barely, if at all, visible from shore.
- Water Depth - Approximately 350 meters, or 1,200 feet. It will be located outside of major commercial activities, including fishing and navigation.
- Cable Crossing and Interconnection Point - The cable will be drilled under the beach and interconnect at a location in the North Spit of Coos Bay.

[22] Pacific Northwest National Laboratory and Parametrix, *Geospatial Analysis of Technical and Economic Suitability for Renewable Ocean Energy Development on Washington's Outer Coast*, prepared for the U.S. Department of Energy, June 2013, page ii.

[23] Source: ibid.

[24] Source: Principal Power at http://windfloatpacific.com/the-project/

- Power Purchaser - WindFloat Pacific is in negotiations for the purchase of the full output of the WindFloat Pacific project.
- Final Assembly Location - Oregon International Port of Coos Bay.

As offshore technology advances, systems could presumably be developed at greater distance from the coast. In this event, additional conflicts between offshore energy systems and the shipping sector could occur.

Most deep draft vessels and barges (carrying liquid bulks) transit well offshore unless entering/departing a port. For example, off the northern coast of Washington State there is an Area To Be Avoided (ATBA) that extends up to 25 miles off the coast and tapers down near the opening to the Strait of Juan de Fuca. Nearly all deep draft vessels comply with the area to be avoided (ATBA). Those that don't are quickly notified. The closer off-shore power projects are to the coast, the less likely there will be conflicts with deep draft vessel traffic.

Two key exceptions are barges carrying dry cargoes, and barges/vessels accessing the Port of Grays Harbor that must transit the coastal area just below the ATBA. As a result, they could be impacted by development of offshore energy systems, depending upon where they are placed.

**Table 2 presents a summary of transits off the Washington Coast, including transits through the Olympic Coast National Marine Sanctuary (which extends from Cape Flattery in the north, to the mouth of the Copalis River, a distance of about 162.5 miles and extending 25 to 40 miles from the shore)[25] and through the area to be avoided. Table 2 – Transits through the OCNMS and ATBA Compliance in 2013 [26]**

| Vessel Type | Outer Washington Coast Transits[3] | Transits passing through the Sanctuary[4] | Transits passing through the ATBA within the Sanctuary[5] | Estimated ATBA Compliance Rate[6] |
|---|---|---|---|---|
| Bulk Carrier | 4620 | 1306 | 11 | 99.20% |
| Cargo Ship | 418 | 137 | 2 | 98.50% |
| Chemical Carrier | 252 | 110 | 1 | 99.10% |
| Container Ship | 2192 | 849 | 3 | 99.60% |
| Liquefied Gas Carrier | 19 | 7 | 0 | 100.00% |
| Oil Tanker | 973 | 553 | 3 | 99.50% |
| Passenger Ship | 389 | 180 | 4 | 97.80% |
| Refrigerated Cargo | 25 | 8 | 0 | 100.00% |
| RoRo Cargo Ship | 302 | 102 | 0 | 100.00% |
| Tug | 661 | 375 | 17 | 95.50% |
| Vehicle Carriers | 815 | 360 | 0 | 100.00% |
| **TOTAL** | **10,666** | **3,987** | **41** | **98.97%** |

Source: NOAA, Olympic Coast National Marine Sanctuary, Vessel Transits Through Olympic Coast National Marine Sanctuary and Area to Be Avoided (ATBA) - 2013 Estimated Compliance

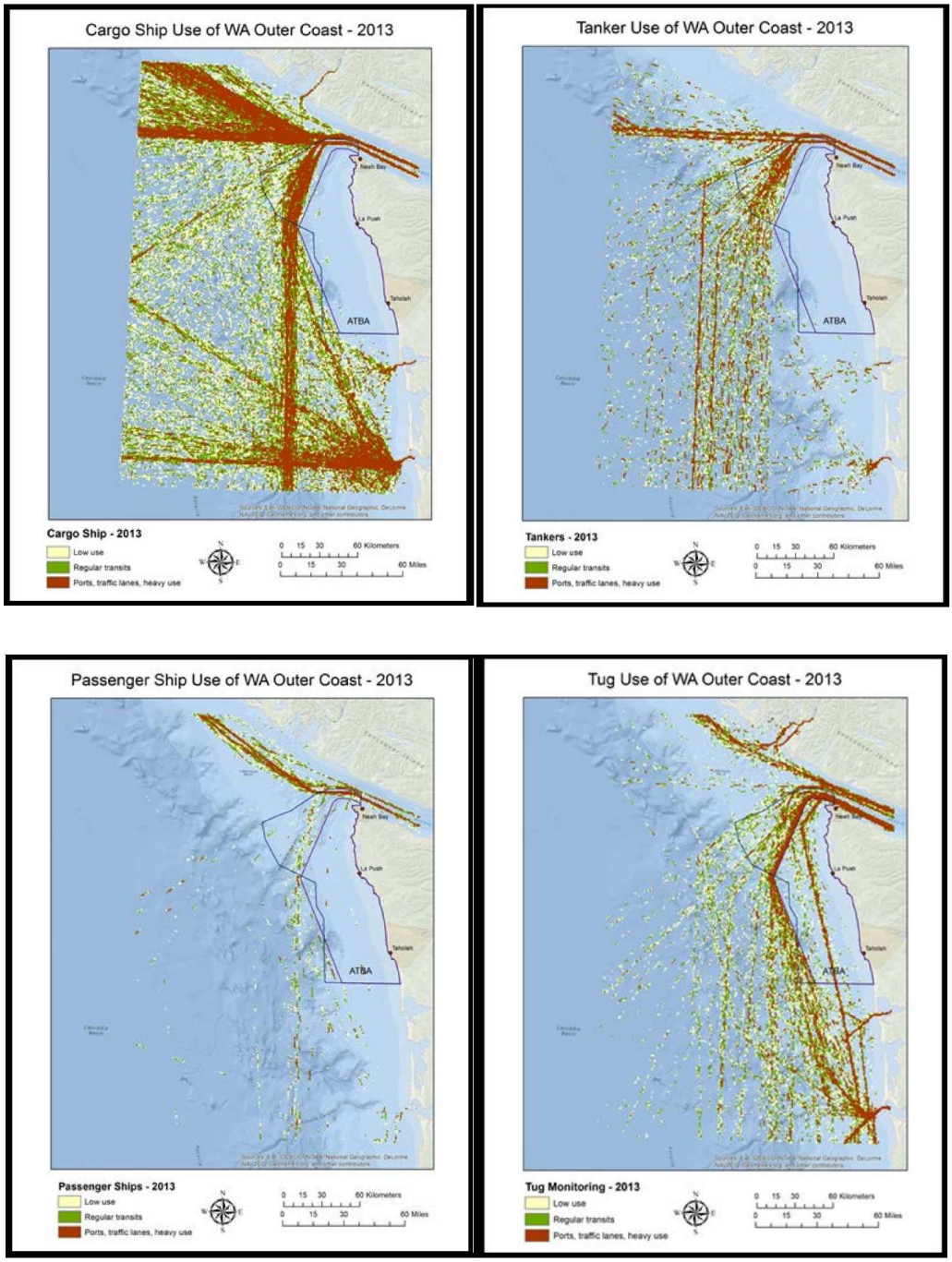
As can be seen, there were 3,987 transits through the sanctuary, but only 41 deep draft vessel and tug/barge transits passed through the ATBA. The estimated ATBA compliance rate is very high (nearly 99 percent), which indicates that most traffic is complying with the ATBA.

[25] Source: http://olympiccoast.noaa.gov/visitor/visitormaps/visitormaps.html

[26] NOAA, *Vessel Transits Through Olympic Coast National Marine Sanctuary and Area to Be Avoided (ATBA) - 2013 Estimated Compliance*, April 16, 2013.

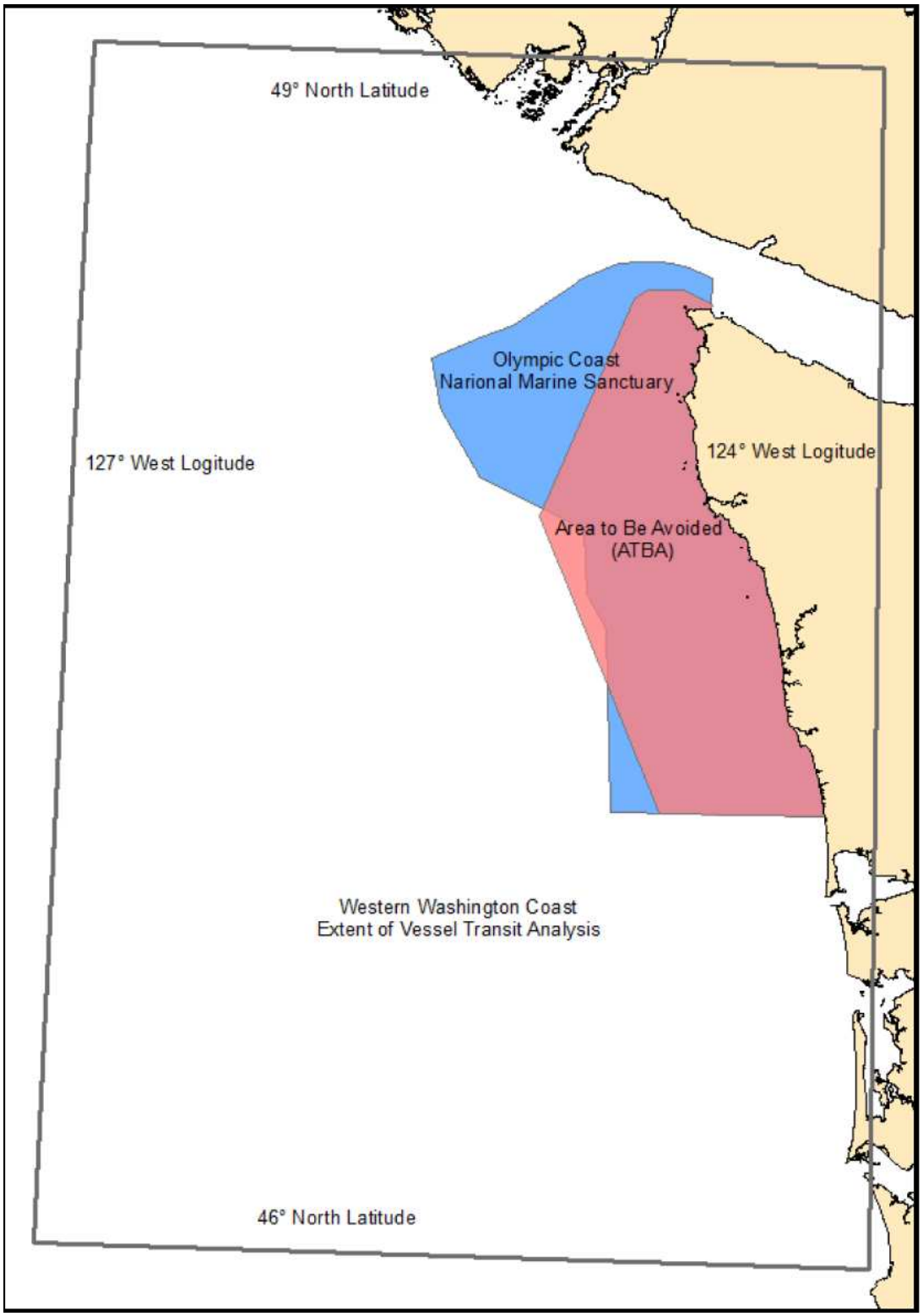
NOAA also maps transit patterns of deep draft vessels engaged in marine transportation (cargo ships, tankers and passenger vessels) as well tug/barge operations. These maps (see Figure 9) further illustrate most traffic avoids the ATBA, with exceptions noted above (barges carrying dry cargoes and barges/vessels accessing the Port of Grays Harbor do transit the ATBA). In addition, vessels/barges entering the Columbia River currently appear to transit within 20 miles of the Washington coast in the area south of the ATBA.

**Figure 9 – Vessel Use of Washington Coast**




Source: NOAA, Olympic Coast National Marine Sanctuary, Vessel Transits Through Olympic Coast National Marine Sanctuary and Area to Be Avoided (ATBA) - 2013 Estimated Compliance

**Figure 10 – Map of the Area To Be Avoided (ATBA) and the boundaries of the Olympic Coast Marine sanctuary (OCNMS)**




Source: NOAA, Olympic Coast National Marine Sanctuary, Vessel Transits Through Olympic Coast National Marine Sanctuary and Area to Be Avoided (ATBA) - 2013 Estimated Compliance

## Review of Existing Data Sources, Data Gaps and Key Economic Questions

This section provides a summary of the key sources of information that are currently available to support development of an economic analysis of the shipping sector.

Data on shipping activity (tons and value) is provided for most shipping activity. The number of vessel transits is available for marine vessels and barges loaded with petroleum products and for barges on international trade routes (i.e., British Columbia to Puget Sound ports). However, data on the tonnage and transits carrying non-petroleum products on domestic routes (mainly consisting of minerals and forest products) is not well documented.

A summary of relevant economic impact studies is presented in Figure 11. Most of the port (and marine terminal) impact studies provide an estimate of the economic contribution of the port and its tenants to the local and regional economies. A few of the reports also estimate the impacts in Washington State or the United States. The statewide reports typically report the importance of trade to Washington State's economy.

These reports do not provide an estimate of economic losses if shipping lanes were constrained or eliminated as a result of future activities. The key questions to consider are:

- What are the constraints being considered regarding the location of off-shore energy systems? Reports for the State have considered location of wind farms within 24 miles of the coast but there are examples of systems reaching out 100 miles.
- How would shipping interests (beneficial cargo owners, navigation firms et al) respond to potential limits- would this cause a reduction or elimination of shipping activity? Surveys of selected firms and estimation of increased costs would assist in determining potential responses.
- Given potential to changed conditions, what would the loss of economic impacts be? Could it be mitigated? The impacts of lost market opportunities should be considered at the local/regional coast levels as well as at the state and national level.

## Figure 11 – Summary of Shipping Sector Economic Impact Studies

| Report Title | Author | Description | Available from: |
|---|---|---|---|
| ***The Local and Regional Impacts of the Port of Longview, 2013*** | Martin Associates | Estimates the economic impacts of port operations at the Port of Longview | http://www.portoflongview.com/Portals/0/Documents/Document-Library/Miscellaneous/_6.2013%20Port%20of%20Longview%20Economic%20Impact%20Analysis.pdf |
| ***The Local and Regional Impacts of the Port of Portland, 2011*** | Martin Associates | Estimates the economic impacts of port operations in the Portland Metro area | http://www.portofportland.com/PDFPOP/Trade_Trans_Studies_Ecnmc_Impact_2011.pdf |
| ***Port of Astoria Economic Impact Report, 2009*** | BST Associates | Estimates the economic impacts of port operations in Clatsop County | http://www.portofastoria.com/media/PDFFiles/POAEconomicImpactStudyDraft4-15-2011.pdf |
| ***Port of Port Angeles Economic Impact Report, 2006*** | BST Associates | Estimates the economic impacts of port operations in Clallam County | https://wa-portofportangeles.civicplus.com/DocumentCenter/View/65 |

| Report Title | Author | Description | Available from: |
|---|---|---|---|
| ***Economic Impact Analysis for the Port of Grays Harbor, to be published in 2014*** | Martin Associates | Estimates the economic impacts of port operations by the Port of Grays Harbor. | not yet available but will be in 2014 |
| ***Economic and Fiscal Impacts of Millenium Bulk Terminals Longview, 2012*** | Berk: Seattle Strategic Planning & Business Consulting Firm | Estimates the economic impacts of construction and operation of a coal terminal in Cowlitz County | http://millenniumbulk.com/wp-content/uploads/2012/06/Economic_Study-Full_Report.pdf |
| ***The Projected Economic Impacts for the Development of a Bulk Terminal at Cherry Point, 2011*** | Martin Associates | Estimates the economic impacts of construction and operation of a coal terminal in Whatcom County | http://gatewaypacificterminal.com/wp-content/uploads/2011/11/MartinReport102711ForPrint.pdf |
| ***Economic Impact Analysis of Bulk Liquid Storage Facilities at the Port of Grays Harbor, 2013*** | ECONorthwest | Estimates the economic impacts of construction and operation of a liquid bulk terminal in Grays Harbor County | http://www.imperiumrenewables.com/docs/news/20130905_econw-westway_and_imperium.pdf |

| Report Title | Author | Description | Available from: |
|---|---|---|---|
| ***Washington State Maritime Cluster, 2013*** | Community Attributes, Inc. | Estimates economic impacts of maritime sectors, including marine terminals. | http://www.psrc.org/assets/10304/Maritime-Impact.pdf |
| ***Trade Creates Jobs for Washington, 2010*** | Business Roundtable | Estimates the number of jobs created in Washington State from trade. | http://businessroundtable.org/resources/trade-creates-jobs-for-washington |
| ***An International Competitiveness Strategy for Washington State*** | Washington Council on International Trade & the Trade Development Alliance of Greater Sea | Identifies trade as the key driver for Washington's economy and discusses means to enhance trade opportunities. | http://www.seattletradealliance.com/discover/publications/intlcompstrat/comp-strat.pdf |
| ***International Maritime Trade Benefits the Nation's Economy, 2013*** | Institute for Trade and Transportation Studies | Estimates Washington State's maritime economy accounted for 13 percent of state GDP. | http://www.ittsresearch.org/adobe/ITTS%20-%20wp%201%20-%20ports%20in%20us%20economy.pdf |