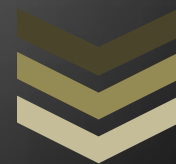


The Port of Port Angeles Log Yard: A Nexus in the Forest Products Industry

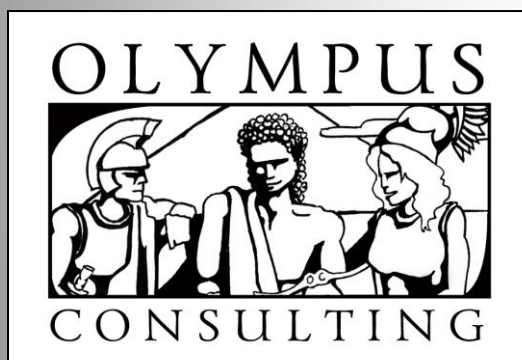


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Abstract

This report explores how the Port of Port Angeles Log Yard integrates a complex flow of wood fiber to support economic development associated with the forest products industry. The economic impacts resulting from that integration are estimated in terms of employment and income. Economic sectors analyzed include forest preparation and management, commercial logging, truck and water transport, wood product manufacturing, and activities at the Port Log Yard and Marine Terminal. How those sectors affect the overall economy of Clallam County is explored. The report concludes with a discussion of strategic issues confronting current and future economic development as affected by the Port of Port Angeles Log Yard.



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A Foreword from the Port Commission President

The Port of Port Angeles commissioned Olympus Consulting in the spring of 2018 to study the economic impacts of the Port's Log Yard because we needed an objective analysis to help guide our capital investments on the industrial waterfront. The economic effects of the Port's Log Yard throughout the economy of the north Olympic Peninsula are significant. The Port is pleased to share this study with fellow agencies and the community. We feel that the information in this study will also be beneficial in informing the policy decisions of other groups.

The Port is a leader in economic development and has at its core the mission of bringing prosperity to the communities of the north Olympic Peninsula. Our mission statement is: *We bring people, resources and industry together to foster economic prosperity and living wage jobs.* Focusing on living wages jobs is significant. As part of raising the overall well-being of a community, it is important for a local organization to take the lead on focusing on higher paying jobs that have a good multiplier effect to create additional jobs. Higher paying jobs accessible to the average citizen are primarily in manufacturing. Therefore, the Port focuses on industrial development and manufacturing. Other organizations focus on other needs in the community.

The Port will use this analysis to make decisions about current and future resource allocations, infrastructure planning, assessing opportunities in forest products, and providing better service to those who depend on the Port's Log Yard. We also hope it will help readers gain a clearer understanding of how far-reaching the Port's Log Yard impacts are felt, and the complexity and interconnectedness of our local forest products industry. Forest products touch our lives on a daily basis, from the homes we live in to the products we use, from the direct jobs in the forests to the supply chain and indirect services, and from the food we eat and drink that uses wood in its preparation, to the forests, meadows and streams that we recreate in. Wood is a wonderful renewable resource that is subject to conscientious regulation to protect the environment it grows in and to ensure that future generations will also reap the benefits of wood.

The Port is grateful to Olympus Consulting for the outstanding work it has produced. The data results are invaluable and will prove extremely useful not only to us, but to all those who have an interest in a healthy forest products industry.

Connie Beauvais, Port Commission President

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Based on Olympus Consulting’s study on the Port’s Log Yard (August 2018), we now have a better understanding of how the flow of logs from forests in the Pacific Northwest and beyond creates jobs in Clallam County. There are complex, integrated relationships throughout the forest products industry, and changes in one part of the industry will impact jobs in another part of the industry. The Port’s log yard and marine terminals are essential to support jobs throughout the entire economy of Clallam County due to their effects on direct, directly dependent, indirect and induced jobs.

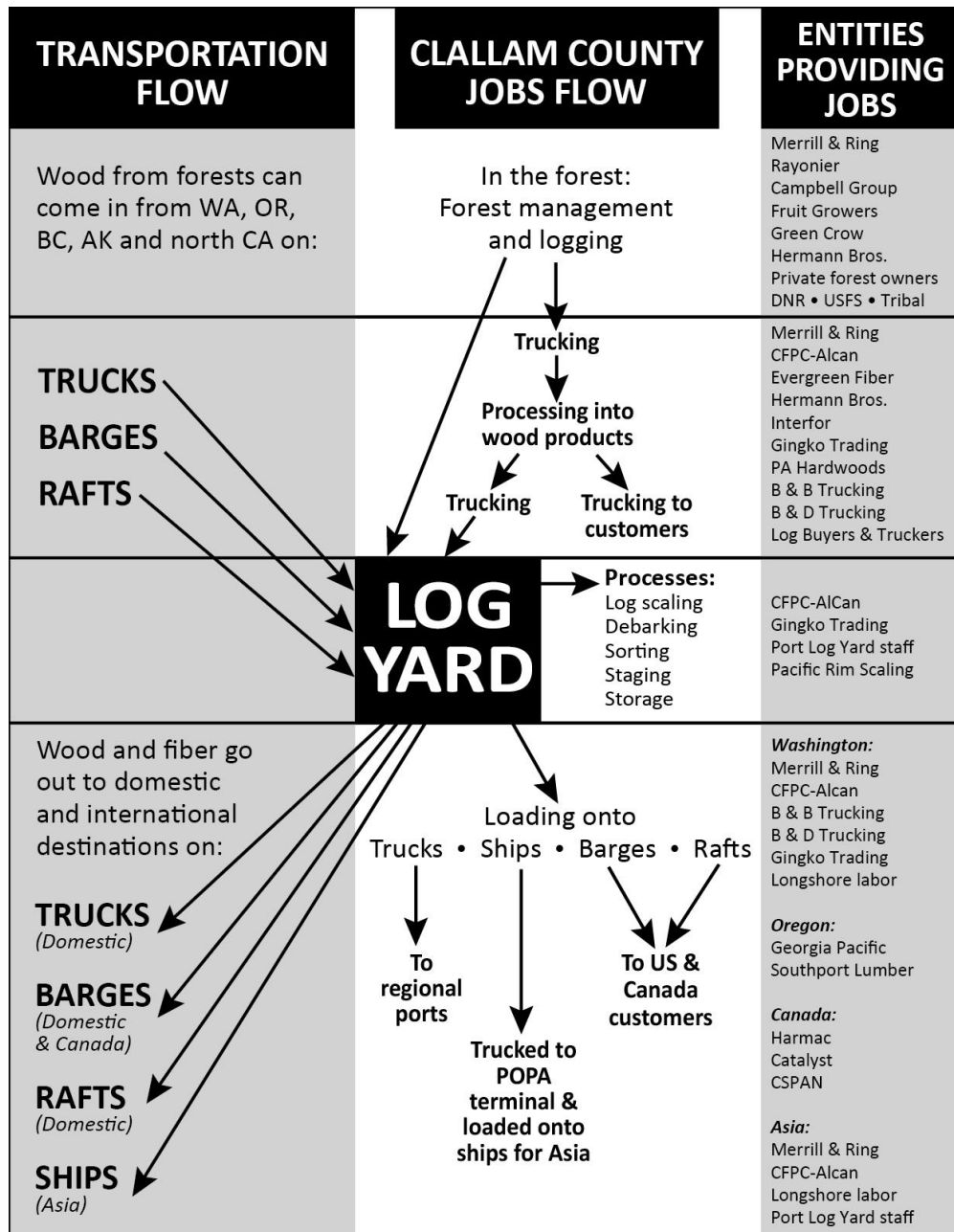


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Executive Summary

The Port of Port Angeles (Port) Log Yard (Port Log Yard) is a nexus integrating a complex flow of wood fiber from forests on the North Olympic Peninsula to final markets. The most obvious user is CFPC-Alcan with exports of 33.8 million board feet (MMBF) of saw logs in 2016.¹

The Port Log Yard integrates a complex flow of wood fiber from forests on the North Olympic Peninsula to final markets.

The flow of wood fiber moving through the Port Log Yard begins in the forest with preparation and management; there is commercial logging and truck transport. Some wood fiber arrives at the Port Log Yard by barge and raft. Wood fiber is scaled, debarked, sorted and stacked for different customers, including Evergreen Forest Industries, Interfor and Port Angeles Hardwood. Wood not exported by water – ship, barge and raft – moves by truck. Wood exported by water also moves by truck. At each stage in these integrated processes expenditures are made by the enterprises involved supporting employment and creating income. These are the economic impacts analyzed in this report.

Table ES1 presents direct economic impacts derived from the flow of wood fiber described above in terms of full time equivalent workers (FTE), the average monthly wage (Average), a living wage premium (LWP), the difference between a monthly wage and that necessary to support a family of 4 with 2 adults, one working, and monthly proprietor gross income (Monthly PI).

Direct jobs from wood flowing into the log yard include forest preparation and management, commercial logging, truck transport, scaling, debarking, sorting and stacking, movement by truck through the Port Log Yard, and loading of ships, barges and rafts.

The direct impact includes forest preparation and management, commercial logging, truck transport, scaling, debarking, sorting and stacking, movement by truck through the Port Log Yard, and loading of ships, barges and rafts. For the study year 2016 the direct economic impacts of the Port Log Yard was 81.4 FTE at an average monthly wage of \$4,990 with LWP = \$1,003; monthly proprietor gross income were \$1,038,913. The indirect economic impacts – those caused by expenditures in the supply chain – were 19.1 FTE at an average monthly wage of \$2,339 with LWP = -\$1,648; monthly proprietor gross income was \$42,785. Those directly

¹ Merrill and Ring does not use the Port Log Yard in its operations, and is not included in the main body of this report. Its economic impacts are included in Appendix B, The Total Economic Impacts of the Forest Products Industry.

and indirectly employed made expenditures in the economy of Clallam County creating induced impacts of 80.2 FTE at an average monthly wage of \$1,833 with LWP = -\$2,154; monthly proprietor gross income was \$34,443. These sum to 180.7 FTE with an average wage of \$3,308 with LWP = -\$679 and monthly proprietor gross income of \$1,116,140. This does not include the direct impacts of local wood product manufacturers.

Impact Type	FTE	Average	LWP	Monthly PI
Direct	81.4	\$4,990	\$1,003	\$1,038,913
Indirect	19.1	\$2,339	-\$1,648	\$42,785
Induced	80.2	\$1,833	-\$2,154	\$34,443
Total	180.7	\$3,308	-\$679	\$1,116,140

Table ES1: The direct economic impacts of the Port Log Yard.

The direct economic impacts of the Port Log Yard extend beyond the flows analyzed above. Primary flows result from imported wood by water to support operations. Local wood product manufacturers obtain some of the wood they process as ancillary flows from water export activities, or as primary flows from water import activities. Ancillary flows consisting of wood fiber not meeting export requirements is sent to different customers and markets, either from the Port Log Yard or in the process of sorting logs in the forest that is trucked to different customers. Thus, *those businesses are directly dependent upon the flow of wood moving through the Port Log Yard.* The primary businesses affected are Evergreen, a subsidiary of Hermann Brothers, Interfor, and Port Angeles Hardwoods, a subsidiary of Cascadia Hardwood Group. The impacts of directly dependent economic effects are summarized in Table ES2. The flow of wood fiber analyzed in this report supports 48 FTE directly associated with Evergreen, 125 FTE at Interfor, and 83 FTE at Port Angeles Hardwoods. The indirect employment impact in the supply chain is 22.4 FTE, 98.1 FTE, and 65.1 FTE respectively. The resulting induced impacts from those directly and indirectly employed are 38.7 FTE, 69 FTE, and 45.8 FTE respectively. The total employment impact for each business – sum of direct, indirect and induced employment – upon the economy of Clallam County is 109.1 FTE, 292.1 FTE, and 193.9 FTE respectively. The grand total employment impacts are 256 direct FTE, 185.6 indirect FTE and 153.5 induced FTE. Thus, the total directly dependent employment effect of the Port Log Yard is 595.1 FTE as accounted for by the operations of Evergreen, Interfor, and Port Angeles Hardwoods, the primary local wood product manufacturers.

Directly Dependent Businesses	Direct	Indirect	Induced	Total
Evergreen	48	22.4	38.7	109.1
Interfor	125	98.1	69	292.1
Port Angeles Hardwoods	83	65.1	45.8	193.9
Grand Total FTE	256	185.6	153.5	595.1

Table ES2: The employment impacts of businesses directly dependent on the Port Log Yard.

Total employment is 256 direct FTE, 185.6 indirect and 153.5 induced FTE . . . the total direct employment effect of the Port Log Yard is 595.1 FTE as accounted for by the . . . primary wood product manufacturers in Clallam County.

Not included in Table ES2, are the impacts on Port Townsend Paper Company. Trees harvested from peninsula forests are segmented for different uses. Approximately 45 percent of a tree is for saw logs, 43 percent for wood chips, and 12 percent for hog fuel (tree bark). Every MMBF of logs moving onto the Log Yard is matched by 0.96 million board feet (MMBF) moving to Evergreen for wood chip production, and 0.27 MMBF as hog fuel. That flow of wood fiber is critical to the operations of Port Townsend Paper Company. Approximately 80 percent of the wood chips and hog fuel used by Port Townsend Paper Company come from Evergreen. With 300 FTE at an average monthly wage of \$5,833 with LWP = \$1,846, Port Townsend Paper Company is a major employer on the North Olympic Peninsula that directly depends on the flow of wood fiber moving through the Port Log Yard.

Overview

The Port of Port Angeles (Port) contracted Olympus Consulting (Olympus) to investigate the strategic role of the Port Log Yard in supporting the forest product industry in Clallam County. Towards that general objective four research questions were formulated.

- (1) How much wood fiber moves through the Port's Log Yard?
- (2) What businesses make use of that flow of wood fiber?
- (3) What are the economic impacts of those businesses in term of employment and income?
- (4) How might the Port Log Yard be used to stimulate economic development?

Towards that objective, Olympus conducted numerous interviews with professionals representing land management firms, commercial logging, wood product manufacturing, land and water transport, domestic and international wood fiber imports and exports, and investment capital.² The individuals interviewed and the organizations of which they are a part face competitive conditions. Values used for estimates were obtained from those interviews, Port records, various data bases and previous studies. The information interviewees shared at least partly reflects their strategic position and interests.

Olympus has endeavored to use that information in an objective fashion to analyze the strategic role of the Port Log Yard to create a quantitative approximation of actual physical and economic relationships between various businesses, their interconnections, and resulting economic impacts. While the overarching goals were broad, the analytical scope was tightly focused. Information provided in those interviews, and that available from public data sources was used to construct a regional economic impact model using IMPLAN.³

The estimated economic impacts for Clallam County can facilitate an understanding of the interconnections between industries in the local economy that depend on the forest products industry and support from the Port Log Yard.

The estimated economic impacts for Clallam County as approximations can inform development of a qualitative understanding of the interconnections between industries in the local economy as dependent on the forest products industry and supported by the Port Log Yard. While employment and income estimates are approximations, values are large and any small error will be insignificant to overall economic impacts presented. Thus, decision makers can gauge likely effects of the Port Log Yard on the economy using the results in this study. This report will help interested parties understand how the Port's Log Yard directly supports current

² Bill Hermann and Mike Hermann, Hermann Brothers; Ron Hurn and Michelle Pettit, Port Angeles Hardwoods; Norm Schaff, Merrill and Ring; Heather Buckmaster and Riley Fogarty, Merrill & Ring Timber & Land Trust; Grant Munro, Munro LLC; Travis Bear, B&D Trucking; Rich Runkel, SSA Marine; Roger Redifer, ALCAN-China Forest Products; Paul Bialkowsky, Interfor; Emily Browning and Chris Browning, B&B Trucking; Don Covington, Green Crow; Eric Haller, NW LOG-ISTICS; Bart Hollen, Ginkgo Trading; Tyler Kruzfeldt, Monta Vista Capital. Information was also obtained from Port staff: John Nutter, Mike Nimo, Dan Shae and Debbie Roebuck.

³ Data employed is explained in Appendix C, Data and Methodology.

operations in the forest products industry in terms of employment and income, and how those operations support the broader economic community. This report also explores the potential strategic role of the Port Log Yard in creating future opportunities and synergies to develop sustainable energy and material industries that can provide living wage jobs for local families.

The Port of Port Angeles Log Yard as a Nexus for Forest Products

The Port of Port Angeles (Port) Log Yard integrates a complex flow of wood fiber products through a number of sectors comprising the forest products industry.

The Port of Port Angeles (Port) Log Yard integrates a complex flow of wood fiber products through a number of sectors comprising the forest products industry. The flow of wood fiber between various economic sectors and businesses is illustrated in figure 1 where the Port Log Yard is the nexus of those interrelationships.

Wood fiber moving into the Port Log Yard comes from harvests in Clallam and Jefferson Counties, and wood imported by barge or raft.

Wood fiber moving into the Port Log Yard (indicated by directional arrows) comes from two primary directions: harvests from Clallam and Jefferson Counties and wood imported by barge or raft.^{4,5} Wood imported by water comes primarily from Vancouver Island and Southern Alaska. The economic sectors accounting for the timber harvests include forest preparation and management, commercial logging, and truck transport. It is to be emphasized that the majority of those harvests, including harvests from public lands, move directly to wood product manufacturers: Evergreen, Ginkgo, Interfor and Port Angeles Hardwoods (PA HW). Each of those wood product manufacturers sends their products to final markets primarily by truck. Ginkgo moves wood chips produced at the Eclipse Industrial Park by truck to the Port Log Yard and then onto sea going vessels by conveyor.⁶

Wood from peninsula harvests is scaled and debarked at the Port Log Yard.

Wood transported from peninsula harvests is scaled and debarked at the Port Log Yard. Debarking creates hog fuel, a renewable energy resource – bioenergy – that is trucked to final customers.⁷ The majority of that wood fiber, in the form of saw logs, is exported to international markets (indicated by directional arrow) by way of the Port Marine Terminal. Wood fiber not meeting international export requirements is sold and moved by truck to

⁴ Wood fiber could also be imported by ship, though current market conditions and the structure of the forest products industry are not favorable for this sourcing. However, wood fiber markets are dynamic and international in scope and wood fiber will flow to take advantage of differential prices and opportunities in final wood products.

⁵ The wood coming from Clallam and Jefferson Counties would be from private lands. That said, scenarios do exist under which a log could be harvested from public lands and sent to the Port Log Yard for sorting and transport to a domestic saw mill.

⁶ Port Townsend Paper Company, which is not located in Clallam County, is present in the illustration because it plays a key role in the discussion of strategic issues and as a major destination for Evergreen products.

⁷ Ginkgo is exploring the feasibility of exporting hog fuels and other forest bioenergy to international markets.

Evergreen, Interfor and PAHW. Green Crow acquires and accumulates miscellaneous logs trucked to final customers. Some wood fiber moving through the Port Log Yard is exported by water to domestic markets: Southport Lumber, Sierra Pacific, and Georgia Pacific. Lastly, wood chip exports are an emergent market with a recent sale to Nanaimo.

Some of the wood fiber moving through the Port Log Yard is exported by water to domestic markets. The flow of wood into the Port Log Yard begins in forests.

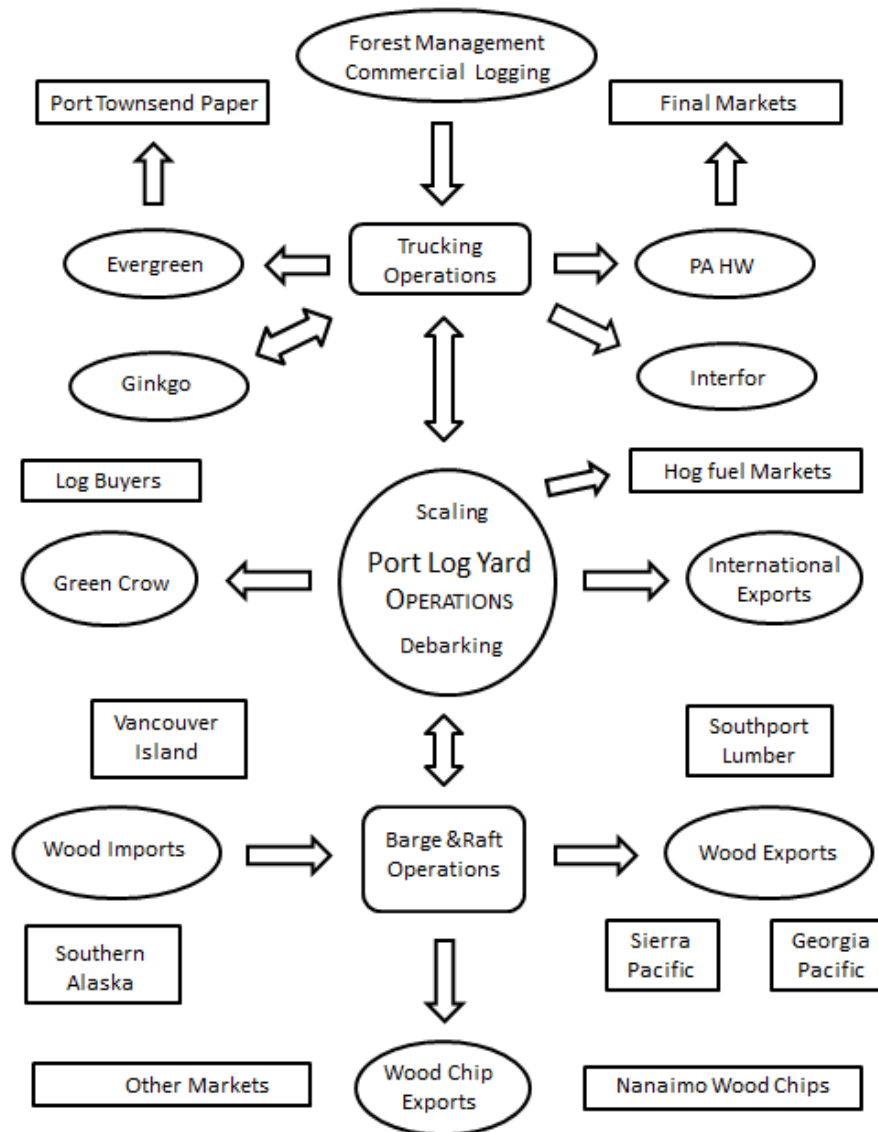


Figure 1: The Port of Port Angeles as a nexus for the forest products industry.

Figure 1 makes clear that the flow of wood fiber through the Port Log Yard begins in the forest, be those forests on the peninsula or elsewhere. Trucks are integral to the flow of that fiber, either directly to wood product manufacturers, indirectly to wood product manufacturers by way of the Port Log Yard, and to final customers.

Wood fiber is sorted for various markets: saw logs, for domestic or international use; chip and saw, and pulp logs used for renewable material resources.

Wood fiber is sorted for various markets: saw logs for domestic or international use; chip and saw, and pulp logs used in markets for renewable material resources. Bark (hog fuel) and harvest slash constitute fourth and fifth products used as bioenergy. Thus, a tree is apportioned to final users who constitute three different yet related markets for sustainable materials; by-products of those materials move to markets for sustainable bioenergy.

The sections that follow explore the *direct effects* of those flows. All wood fiber moving to and from the Port Log Yard constitutes a direct employment effect. The economic impacts of these direct employment effects begin in the forest and include forest preparation and management, commercial logging and truck transport of wood fiber to the Port Log Yard.⁸

All wood fiber moving to and from the Port Log Yard constitutes a direct employment effect.

Direct effects also include activities associated with moving wood through the Port Log Yard facilities, from scaling to sorting and stacking. Lastly, direct effects include movement out of the Port Log Yard for local wood product manufacturing or export, be it by water transport or truck transport. While these are the direct effects associated with the Port Log Yard, there are also *directly dependent employment effects* that are analyzed. Wood fiber imported through the Port Log yard by barge or raft transport is utilized by local wood product manufacturers. Those imports are a source of wood fiber in addition to harvests from private and public lands on the North Olympic Peninsula.

Wood fiber imported through the Port Log yard by barge or raft transport is used by local wood product manufacturers.

Some of that imported wood fiber moves toward domestic or international export after processing. Some of that processing occurs at the Port Log Yard; the remainder of the processing is done off-site by local businesses. In addition, some wood harvested from the peninsula moves through the Port Log Yard for scaling, sorting and stacking until sufficient quantities are accumulated for use by local wood product manufacturers, or transported by water or truck to more distant markets. The economic impacts of those wood product manufacturers are therefore included in this report as *directly dependent employment effects*.⁹

⁸ This assumption, which best captures the linkage between forest activities and the Port Log Yard – the overarching objective of this report – does not affect total FTE estimates. Only their distribution is affected, appearing as direct effects and not in the supply chain as indirect effects. Similarly, the impact on the overall economy through induced effects is not altered.

⁹ There is no absolute objective basis from which to determine the extent to which operations of a local wood product manufacturer is directly dependent upon flows of wood fiber moving through the Port Log Yard. If a local mill obtains 10 percent of its wood from barge imports, does that mean only 10 percent of its payroll depends on those imports? The answer is no. It is often the case that the net increment in wood fiber is the difference between profitability and insolvency. The issue of net increments will be explored in the report's conclusion.

Exploration of Direct Employment Effects

THE FLOW OF WOOD FIBER INTO THE PORT LOG YARD

Wood harvested from private lands in Clallam and Jefferson counties, 201.4 MMBF in 2016,¹⁰ moves by truck for scaling at four locations: the Pacific Rim Scale on Highway 101, Interfor, Port Angeles Hardwoods and the Port Log Yard. In 2016, 43.6 MMBF of that private timber was trucked to the Port Log Yard for scaling, debarking, sorting and stacking.¹¹ The employment in forest preparation and commercial logging required to provide that flow of 43.6 MMBF consisted of 4 FTE and 51 FTE respectively.^{12, 13}

In 2016, 43.6 of 201.4 MMBF of private timber was trucked to the Port Log Yard for scaling, debarking, sorting and stacking.

In addition, wood was barged and rafted to the Port Log Yard. In 2016, approximately 3.8 MMBF were imported by CFPC-Alcan for sale to Port Townsend Paper, and another 2.1 MMBF for international export. Port Angeles Hardwood rafted in 3 MMBF for local operations. Another 6 MMBF was imported by raft for various customers. In sum, for the year 2016, approximately 58.5 MMBF of timber moved through the Port Log Yard: 43.6 MMBF by truck and 14.9 MMBF by water creating direct and directly dependent employment effects.¹⁴

Imported wood, as saw logs or pulp logs, comes primarily from Vancouver Island and Southern Alaska by barge or raft.

Imported wood, as saw logs or pulp logs, comes primarily from Vancouver Island and Southern Alaska by barge or raft. The primary destinations for wood imported by barge and

¹⁰Daniel Underwood and Jason Cross, *The Economic Impacts of Private Timber Harvests: An Exploratory Investigation of Harvests, Exports, Employment, Income and Tax Remittances*, December 2017. Published by the Port of Port Angeles.

¹¹ Source, correspondence with Pacific Rim Scaling.

¹²Daniel Underwood and Jason Cross, *The Economic Impacts of Private Timber Harvests: An Exploratory Investigation of Harvests, Exports, Employment, Income and Tax Remittances*, December 2017. Published by the Port of Port Angeles. These FTEs in forest preparation would be employed in Clallam and Jefferson counties, as the 43.6 MMBF of timber was sourced from those destinations.

¹³ Employment is defined as all wage and salaried employees who would be reported to the Washington Employment Security Department. An FTE is, in general, an individual working 2080 hours per year. Not all FTEs in this report meet that requirement. There is some seasonality in economic sectors. Forest preparation is one example. However, with that exception, all other FTEs reported in the forest products industry satisfy that threshold, or come close. Other sectors analyzed, in the supply chain and service economy, tend to exhibit seasonality in employment and part time employment. Thus, the total number of people employed would be greater than the report FTE.

¹⁴ Two interviews were conducted with Port staff to determine volumes of wood fiber moving into the Port Log Yard by barge and raft. Estimating total wood fiber for a calendar year is problematic given there are differences between the accounting processes used and the timing of wood flows. Accordingly, these volumes must be regarded as rough approximations. While the quantitative values are approximations, the qualitative strategic ramifications of those flows will remain the same. Barge and raft are used to import additional wood fiber in a tight local market.

raft are local mills, domestic exports, and international exports. NW LOG-istics provides services for log acquisition, transport and distribution to domestic markets, including Southport Lumber, Georgia Pacific and Sierra Pacific in the USA. At present, CFPC-Alcan is an international customer.¹⁵

THE FLOW OF WOOD FIBER THROUGH THE PORT LOG YARD

The primary buyers of wood fiber moving through the Port Log Yard are CFPC-Alcan, Port Angeles Hardwoods, NW LOG-ISTICS, Interfor and Green Crow. Munro LLC contracts and manages many private timber sales in this flow.¹⁶

The primary buyers of wood fiber moving through the Port Log Yard are CFPC-Alcan, Port Angeles Hardwoods, NW LOG-ISTICS, Interfor and Green Crow.

The scaling facility at the Port Log Yard employs 2 FTE. Wood moving directly to the Port Log Yard is de-barked by a machine owned by CFPC-Alcan, which is managed by B&B Trucking.¹⁷ Debarking operations employ 4 FTE. Logs are then sorted and stacked, activities supported by Port Log Yard personnel, consisting of 7 FTE at the Port Log Yard and 1 FTE in support staff.¹⁸ Logs not meeting export requirements, but of sufficient dimensions for milling, can be sold to Interfor.¹⁹ Green Crow buys miscellaneous logs that are sorted and stacked to meet the needs of various customers, including Interfor and Bussey in Everett.²⁰ Of the 1.5 to 2 MMBF purchased by Green Crow annually, approximately 65 percent come from nonindustrial private forest lands (NIFL) on the peninsula.²¹ While Green Crow's relative acquisitions are small (about 3 percent of the total volume moving through the Port Log Yard), it plays an important functional role integrating NIFL owners and local log buyers by accumulating sufficient volumes to complete a transaction, an activity which helps to increase wood fiber volumes to local wood product manufacturers and to allow small scale NIFL owners to access these markets.²²

¹⁵ NW LOG-ISTICS uses the Port Log Yard for sorting and stacking, and then exporting to customers primarily by water. Some of those logs go to Alcan-China Forest Products. An interview with Eric Haller did not result in isolation of specific numerical values of timber flows to estimate economic impacts. That interview did provide qualitative information used in this report about economic interrelationships between entities as integrated through the Port Log Yard and for strategic issues.

¹⁶ Interview, Grant Munro, Munro LLC.

¹⁷ Chris Browning, B&B Trucking.

¹⁸ John Nutter, Port of Port Angeles. Support staff includes office and grounds security. While formal job assignments, overtime, and necessary shifting of job responsibilities make this FTE estimate problematic, all estimates are within 1 FTE..

¹⁹ Interfor buys and mills logs 19 inches or less in diameter. Interview, Paul Bialkowsky, Interfor.

²⁰ It is interesting to note from multiple independent interviews that all wood fiber removed from the forest is used: milled into lumber, chipped into pulp, debarked to produce energy, and firewood to heat homes. At present, slash piles remain in the forest for incineration could be used for bioenergy.

²¹ Don Covington, Green Grow.

²² NIFL might serve as a source of increased private harvests from the peninsula. Grant Munro, Munro LLC.

INTERNATIONAL EXPORTS

CFPC-Alcan and Merrill and Ring are the two primary international exporters of wood fiber – saw logs – from the Port of Port Angeles. In 2016, combined, they exported 84.1 MMBF of timber by ship through the Port of Port Angeles Marine Terminal: 50.4 MMBF by Merrill and Ring and 33.8 MMBF by CFPC-Alcan. As Merrill and Ring does not use the Port Log Yard, those activities are not analyzed in this report.²³ Merrill and Ring does, however, make use of the Port’s Marine Terminal and the Airport Industrial Park.²⁴

Before logs sorted and stacked at the Port Log Yard can be loaded onto ships for international export by CFPC-Alcan, Port Log Yard staff use Wagners to load log trucks dispatched by B&B Trucking.²⁵ It takes 22 trucks operating 8.5 hours for 8 to 9 days to move sufficient logs to load a shipment of 7 MMBF, or 1,590 driving hours per ship. As CFPC-Alcan exported approximately five 7MMBF ships in 2016, a total of 7,950 driving hours were required. This translated into 3.8 FTE log truck drivers.^{26,27}

Hog fuel (tree bark) is a significant by-product of the process whereby logs transported to the Port Log Yard are processed for export.

Hog fuel (tree bark) is a significant by-product of the process whereby logs transported to the Port Log Yard are processed for export. As discussed above, the de-barking operations managed by B&B Trucking employ 4 FTE. Hog fuel is an energy feedstock used in paper production.²⁸ Port Townsend Paper and Brady in Shelton are the primary customers for CFPC-Alcan’s hog fuel. Under the current form of organization for log movement by truck from peninsula forests, approximately 3 loads of hog fuel per day move from the Port Log Yard, primarily to Port Townsend Paper Company, which supports 1 FTE truck driver.²⁹ Local feedstocks – wood chips and hog fuel – support the local economy from the forest to local users while minimizing travel distance, and have been estimated as direct employment effects. It does not include the number of proprietors.

²³ The total economic impacts associated with international exports through the Port’s Marine Terminal can be found in Daniel Underwood and Jason Cross, *The Economic Impacts of Private Timber Harvests: An Exploratory Investigation of Harvests, Exports, Employment, Income and Tax Remittances*, December 2017. Published by the Port of Port Angeles. 16.4 FTE are supported in ship side operations as longshore men. Those exports supported 106 FTE in forestry and logging and an additional 30.6 FTE in the supply chain. 117.1 FTE are supported in the broader economy.

²⁴ Those economic impacts appear in Appendix B.

²⁵ Emily Browning, B&B Trucking. These FTE estimates correspond to those for B&D Trucking when moving similar volumes. Interview, Travis Bear, B&D Trucking.

²⁶ The log trucks utilized in this process are owned by a variety of companies, including B&D Trucking, Hermann Brothers, and Swanson Trucking.

²⁷ The total number of truck drivers needed to move logs to the Marine Terminal for twelve 7 MMBF ships (84.1 MMBF exported in 2016) is 9.2 FTE. That total is the sum of exports by Alcan-China Forest Products and M&R.

²⁸ It was also used by NIPPON Paper to generate electricity and steam for operations.

²⁹ Chris Browning, B&B Trucking.

SUMMARY OF DIRECT EMPLOYMENT EFFECTS

Table 1 summarizes total direct employment effects resulting from the flow of wood fiber from the forests of the North Olympic Peninsula through the Port Log Yard as illustrated in Figure 1. The corresponding NAICS codes are listed at the 3 digit level.³⁰ Employment effects are presented as FTE, or full time equivalent employees: individuals working 40 hours a week for 52 weeks. Table 1 reveals 2 FTE for scaling and 4 FTE for de-barking. 1 FTE is employed trucking hog fuel. The Port Log Yard Crew consists of 7 FTE plus 1 FTE in support staff, or 8 FTE. Green Crow has 1 FTE working at the Port Log Yard. Ship loading employs 3.8 FTE driving log trucks and 6.6 in shipside operations. Not included is Roger Redifer, CFPC-Alcan ; Grant Munro, Munro LLP; and Eric Haller, NW LOG-ISTICS. Each has a small office staff assisting their operations.³¹

NAICS	Economic Activity	FTEs
115	Forest Preparation	4
113	Commercial Logging	51
113	Log Scaling	2
113	De-barking	4
113	Green Crow Log Buyer	1
113	Port Log Yard Crew	8
113	Trucking of Logs at Log Yard	3.8
4883	Shipside Operations	6.6
113	Trucking of Hog Fuel	1
Total Direct Employment		81.4

Table 1: Total direct employment effects from Port Log Yard operations in 2016.

The direct employment effects discussed above do not include the economic impacts from Ginkgo Trading (Ginkgo), as Ginkgo was not operating in 2016, the study period. However, it is an emergent and potentially growing operation with real economic impacts. At present, Ginkgo is in negotiations with numerous international buyers of wood chips and biomass energy fuels.³² Projected annual sales are for twelve 2,300 ton barges, four ships transporting 45,000 tons of wood chips, and four 45,000 ton shiploads of biomass energy. Table 2 presents the direct employment effect of 10.5 FTE associated with a single 45,000 ton shipload of wood chips exported in January of 2018.³³ As seen in previous export analysis

³⁰ NAICS – North American Industrial Classification System is used to organized economic data into specific sectors. 3 digit NAICS codes are translated into IMPLAN code for impact analysis, explained in Appendix C.

³¹ Given the nature of the estimation in IMPLAN, it is likely that some of the economic impacts directly associated with the activities of Redifer, Munro and Haller may appear as proprietor income and FTE as indirect effects.

³² Bart Nollen, Ginkgo Trading.

³³ Insufficient information exists at present to estimate the direct employment effects for biomass energy exports. As those exports will utilize wood waste products, they may not directly contribute to employment in forestry preparation or commercial logging. While not requiring chipping, harvest waste is chopped into fuel form in the

conducted by Olympus, the majority of employment impacts are in the forest, or 8.3 FTEs in forest preparation and commercial logging, to provide enough forest fiber for a single shipload. In addition to the FTE in forest preparation and commercial logging reported in Table 2, 0.1 and 1.1 proprietors are supported in those respective sectors. 2.2 FTEs are directly supported in wood chip manufacture and loading operations. If Ginkgo's projected sales are achieved, the total direct employment effect of chip exports will be 4.6 times greater than the values presented in table 2, or 48.3 FTE.³⁴

It is critical to keep in mind the estimated employment impact of 48.3 FTE assumes an increased in the availability of wood fiber for chip production.

It is critical to keep in mind *the estimated employment impact of 48.3 FTE assumes an increased in the availability of wood fiber for chip production.* The 48.3 FTE can only represent a net increase in employment provided there are no negative impacts with other businesses utilizing the flow of wood fiber as analyzed in this report. Similarly, it assumes the current organizational structure to produce and move wood chips remains constant. If Ginkgo's use of wood fiber decreases fiber used elsewhere, a net reduction in FTE may result. This topic is rejoined in the discussion of strategic issues.

NAICS	Economic Activity	FTEs
115	Forest Preparation	0.7
113	Commercial Logging	7.6
321	Chipping	0.9
113	Chip Transport by Truck	0.7
4883	Shipside Operations	0.5
113	B&D Operations	0.1
Total Direct Employment		10.5

Table 2: Total annualized direct employment effects for a 45,000 ton shipload of wood chips exported by Ginkgo Trading from the Port of Port Angeles.

field before loading onto trucks. However, the employment estimates in Table 2 for other operations – trucking and loading – should be similar.

³⁴ This expansion factor assumes FTEs are allocated on a per ton basis independent of transport mode. While this is not true, ship export accounts for 87 percent of the total tonnage. Thus, this assumption is a close approximation of expected outcomes.

Directly Dependent Employment Effects

In this report *a business is said to be directly dependent on the Port Log Yard if a portion of the wood fiber it buys and/or sells move through the Port Log Yard*. At least three wood product manufacturers receive a portion of the wood fiber they process from the Port Log Yard and meet this definition: Evergreen Forest Industries (Evergreen), Interfor and Port Angeles Hardwoods.³⁵

In this report a business is said to be directly dependent on the Port Log Yard if a portion of the wood fiber it buys and/or sells move through the Port Log Yard.

Figure 1 illustrates this directly dependent relationship with the Port Log Yard. While the majority of the wood fiber manufactured by these enterprises is harvested from private and public forests on the North Olympic Peninsula, a portion is imported by barge and/or raft for wood product manufacturing. In addition, the Port Log Yard serves as the interface for water borne exports for some of their products, with emergent markets in Canada and China for wood chips.³⁶ Lastly is the interface with Evergreen. Trees harvested in the forest are portioned into saw logs, chip and saw, and pulp logs, illustrated in Figure 2. In addition, bark, renewable bioenergy, is the feedstock for hog fuel. By volume, approximately 45 percent of a tree is a saw log, 43 percent chip and saw and pulp log, and 12 percent hog fuel.³⁷ Thus, a log moving through the Port Log Yard for export has a directly dependent component that moves to Evergreen for debarking, chipping, and transport to customers, even if that wood fiber does not physically move through the Port Log Yard.

Wood fiber flow is complex and interconnections between economic entities is not readily apparent.

This discussion emphasizes that the wood fiber flow is complex and interconnections between economic entities is not readily apparent. Trees are apportioned in the forest for different markets (Figure 2). Thus, a log transported to the Port Log Yard for export by CFPC-Alcan is directly associated with the remainder of the tree which is transported to different customers to be processed for different markets. In this case Evergreen debarks and chips the non-export portion of the log and transports it to a final customer, mostly Port Townsend Paper Company, as wood chips and hog fuel.

³⁵ Ginkgo may also receive a portion of the wood fiber they process. However, the economic impacts of Ginkgo's operations are examined under direct employment effects as they are an international export operation that utilizes the Port for transport.

³⁶ In January Ginkgo exported its first barge load of wood chips to Nanaimo, Canada. The feasibility of developing international markets for hog fuel is also under exploration.

³⁷ Bill Hermann, Hermann Brothers.

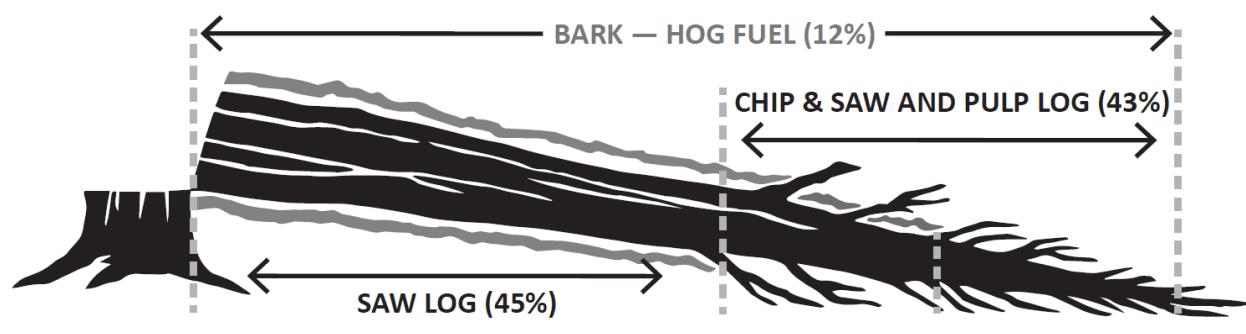


Figure 2: Segmentation of a tree by market.³⁸

THE FLOW OF FIBER TO WOOD PRODUCT MANUFACTURERS

Evergreen is the largest producer of wood chips and hog fuel in Clallam County and provides most of the feedstock used by Port Townsend Paper Company.³⁹ Hermann Brothers, of which Evergreen is a subsidiary, has developed a complex and extensive market system for its trucking fleet, with customers ranging from northern Oregon, to western Montana and Utah. Evergreen receives most of the wood it processes directly from harvesting operations on the peninsula when trees are sorted as saw logs, chip and saw, and pulp logs.

Evergreen is the largest producer of wood chips and hog fuel in Clallam County and provides most of the feedstock used by Port Townsend Paper Company.

Wood imported by CFPC-Alcan is another source of wood fiber for Evergreen. Log sections not meeting CFPC-Alcan export requirements can move to Evergreen as pulp and chip and saw logs. Those materials too are a source of wood chips used by Port Townsend Paper Company. Logs meeting milling dimensions for Interfor are trucked to that destination when acquired on the market. The sources of those logs are both private and public harvests from the peninsula, and wood imported by barge or raft.⁴⁰ At present, Port Townsend Paper Company is the largest buyer for wood chips produced by Evergreen, and receives from 35 to 60 truckloads per day. About 4 loads of hog fuel are shipped daily. Chipping operations at Evergreen employ 6 FTE. However, individuals operating the chipper are a small component of the total operations, as the bulk of employment move wood fiber to Evergreen and then chips to customers by truck. Shipment of wood chips and hog fuel to Port Townsend Paper Company employs approximately 21 FTE annually, 6 operating the chipper and 15 in trucking.⁴¹ It is to be emphasized that the majority of FTE in wood chips are in transport, not direct manufacture.

³⁸Mike Nimmo, Port of Port Angeles; Bill Hermann, Hermann Brothers. Illustration, Laurel Black Designs.

³⁹ It was also a primary supplier of hog fuel and wood chips to Nippon Paper. Evergreen will likely play an important role providing raw materials to McKinley Paper should it commence operations.

⁴⁰ At present, Interfor receives little wood fiber by water import. However, as discussed previously, Interfor has an expressed interest in utilizing this method of transport provided technical issues associated with water contact can be resolved. This topic is rejoined in the discussion of strategic issues.

⁴¹ A value of 40 truckloads of wood chips was used at 3 trips per day, plus 4 loads of hog fuel for approximately 15 FTE in trucking. Actual FTE can be much larger. Analyzing the multifarious ways Evergreen interfaces with the Port Log Yard was exceptionally complex.

These numbers do not contain other related activities at Evergreen (Hermann Brothers) which keep that flow of wood chips and hog fuel moving, and therefore capture but a portion of the directly dependent employment effect, explored in more detail below and in Appendix C.⁴²

Interfor obtains wood fiber primarily from public and private lands in Clallam and Jefferson counties.

Interfor obtains wood fiber primarily from public and private lands in Clallam and Jefferson counties. Interfor uses approximately 100 MMBF annually to support two operational shifts that employ approximately 125 FTE. At present, between one third and one half of the wood volume comes from private lands, the remainder from public lands. Interfor does make use of import/export facilities at the Port Log Yard, as a source of logs, and as an export venue for its wood chips.⁴³ At present, Interfor has markets for increased production. However, insufficient timber supply prevents increasing production to access additional markets; thus employment and income in Clallam County could be greater with increases in harvests from peninsula forests, and especially harvests from public lands. The only other source for increased wood fiber would be imports barged in.⁴⁴ At present, the form of barging operations limits cost effective imports at large scale.⁴⁵ Needed is a cost effective way to bundle loads of logs so that they can be off loaded without contact with sea water. This is an economic constraint – an opportunity – that, if solved, can increase economic development in Clallam County.

Port Angeles Hardwoods is a third major milling operation in Clallam County, employing 83 FTE to process red alder, black cottonwood and big leaf maple.

Port Angeles Hardwoods (PAHW in figure 1) is a third major milling operation in Clallam County, employing 83 FTE to process approximately 27-30 MMBF of red alder, black cottonwood and big leaf maple annually. Of that total, approximately 10-15 percent moves through the Port Log Yard, imported by barge or raft from markets in Southern Alaska and Vancouver Island. Finished lumber from Port Angeles Hardwoods moves by truck to markets throughout the United States, where it is used in the production of furniture.

⁴² It is critical to keep in mind the difference between partial and general analysis. While a part of an operation may not seem important, the financial viability of an entire organization likely depends on it. Furthermore, a shutdown of one business can cause shut downs elsewhere given the highly integrated structure of the forest product industry in Clallam County. Daniel A. Underwood, Dan Friesner and Jason Cross, "Towards an Institutional Legitimation of Sustainability, *Journal of Economic Issues* (December 2015): 112-1123; Daniel A. Underwood and Jason Cross, *Analysis of the Wild Olympic Wilderness and Wild and Scenic Rivers Acts of 2012: Economic Impacts and Opportunities*, published by the Port of Port Angeles, November, 2012.

⁴³ Interfor is experimenting with quality control of the size and shape of wood chips from milling for exports to paper mills. Paul Bialkowsky, Interfor.

⁴⁴ At present, rafting has been an unsuccessful method of importing timber for Interfor as the wood is in contact with salt water which impairs milling operations and contaminates bark as a source for hog fuel.

⁴⁵ Interviews indicated a strong belief that increased harvests from Vancouver Island could provide a cost effective source of imports. Those increased harvests should be the result of second growth forests reaching maturity in the near future. A critical issue is avoidance of wood contact with salt water and/or methods of treating and/or using salt water contaminated wood.

Emergent from this discussion is that the Port Log Yard is the nexus for a complex set of interrelationships between a multitude of economic entities from a wide range of economic sectors. The Port manages that nexus, employing 7 FTE at the Log Yard and 1 additional FTE in support staff.⁴⁶ These individuals work in a variety of occupations, ranging from operating log handling equipment to managing barge and ship operations. Wood flows to and from Clallam County through this nexus of operations. While most of the private wood harvested from the peninsula is milled locally, 42 percent is exported.⁴⁷ Exports increase total wood demand, putting upward pressure on price. While higher prices can squeeze margins for local firms, those higher prices increase the total tax revenues going to local governments, both as tax remittances from timber sales from Trust Lands and from excise taxes imposed on all harvests. Excise taxes from private lands in 2016 totaled \$1.4 million, approximately \$150,000 of which was due to increased price of timber associated with log exports.⁴⁸

Economic Impact Analysis

The conceptual model developed in the previous section and illustrated in figure 1 presents the Port Log Yard as a nexus integrating a variety of economic sectors. A regional model was created using IMPLAN to analyze two related forms of impacts: direct employment effects and directly dependent employment effect as explained above. The *direct effects* are the focal point of this study and analyze wood fiber moving into the Port Log Yard where they are processed and then exit as final products.⁴⁹ Accordingly, the regional model begins in the forest with forest preparation, and moves forward as commercial logging, scaling, debarking, sorting and stacking at the Port Log Yard, and then handling for export, and appear as direct impacts. Thus, those direct effects include employment and income from activities in the forest, activities that would generally appear in the supply chain for a wood product manufacturer.⁵⁰ Other economic impacts in the supply chain – from wholesaling to management of companies – are estimated as *indirect impacts*. Those directly and indirectly employed make expenditures in the economy of Clallam County, supporting a wide array of business sectors. Those expenditures create *induced impacts*.⁵¹

⁴⁶ The number of FTE working at the Port Log Yard has increased to 8.

⁴⁷ Daniel A. Underwood and Jason Cross, *The Economic Impacts of Private Timber Harvests: An Exploratory Investigation of Harvests, Exports, Employment, Income and Tax Remittances*. Published by the Port of Port Angeles, November, 2017. This study determined a small quantity of the 84.1 MMBF exported was harvested on Vancouver Island and imported by barge and raft.

⁴⁸ Ibid.

⁴⁹ A debarked log for international export is a final product. The direct employment effect includes all activities including loading it onto the ship. Similarly, the bark (hog fuel) moves by truck to a final customer and thus too is a final product, and the process thus constitutes part of the direct employment effect.

⁵⁰ This methodology was critical to capture the linkages between the Port Log Yard and the forest. While IMPLAN did not capture this linkage, its modeling flexibility makes it possible.

⁵¹ Appendix C: Data and Methodology elaborate on the relationship between these economic impacts.

Direct employment effects are concentrated in wood product manufacturing. The economic impacts from forest preparation and management and commercial logging are indirect impacts.

Also analyzed were those sectors of the forest product industry *directly dependent* on the flow of wood fiber to and from the Port Log Yard. In terms of magnitude those effects are concentrated in wood product manufacturing. Accordingly, the economic impacts from forest preparation and management and commercial logging are indirect impacts in the supply chain. This assumption is reasonable as wood product manufacturers acquire wood fiber from a multitude of sources, including wood fiber moving through the Port Log Yard.⁵²

In this section the economic impacts are estimated in terms of employment (FTE), average monthly wages (Average), and monthly proprietor gross income (Monthly PI) for the study year 2016. To provide a comparative reference point for wages, a Living Wage Premium (LWP) for a family of four with two adults, one working, which equals the difference between an average monthly wage and \$3,987. This section proceeds as follows. First, the economic impacts of direct employment effects are presented and summarized. Second, the economic impacts of directly dependent employment effects are presented and summarized.⁵³

THE ECONOMIC IMPACTS OF DIRECT EMPLOYMENT EFFECTS

The direct employment effects presented in table 1 begin in the forest with preparation and management (4 FTE and 0.5 proprietors), and commercial logging 51 FTE and 7.1 proprietors), which includes transport to the Port Log Yard. The process continues with log scaling and de-barking (6 FTE and 0.8 proprietors), Green Crow operations (1 FTE), Port Log Yard employees (8 FTE), trucking of logs at the Port Log Yard (4.8 FTE and 0.7 proprietors), shipside operations (6.6 FTE), and trucking of hog fuel (included with truck hauling). Each of these activities is part of the process of moving logs from the forest onto the Port Log Yard, and moving out as forest products. Table 3 presents employment as FTE, average monthly wage (Average), LWP, proprietors and monthly proprietor gross income (Monthly PI).⁵⁴

⁵² The section “The Economic Impacts of the Wood Product Manufacturing,” which can be found in Appendix A, explores how changes in one sector impact other parts of the economy in Clallam County. It also explains how changes in the employment of one sector affect other sectors throughout the economy, including the monetary compensation gained or lost.

⁵³ The methodology employed in this section is explained in the Appendix C: Data and Methodology.

⁵⁴ As explained in Appendix C: Data and Methodology, employment multipliers for proprietors are only available for NAICS 113 and 115, the two sectors with large levels of proprietor income. As proprietor income is a gross revenue value and average monthly wage is not presented. Rather, the monthly proprietor gross income is presented.

Sector by NAICS	FTE	Average	LWP	Proprietors	Monthly PI
115 Forestry, and timber tract production	4	\$3,052	-\$935	0.5	\$34,208
113 Commercial logging	51	\$4,377	\$390	7.1	\$697,638
113 Scaling and De-barking	6	\$4,377	\$390	0.8	\$82,075
423 Green Crow	1	\$4,377	\$390		\$13,679
113 Port Log Crew	8	\$4,824	\$837	1.1	\$123,113
113 Truck Hauling	4.8	\$4,377	\$390	0.7	\$65,660
4483 Shiplside Operations	6.6	\$8,479	\$4,492		\$22,539
Total	81.4	\$4,688	\$701	10.2	\$1,038,912

Table 3: The direct economic impacts by sector from operations moving wood fiber through the Port of Port Angeles Log Yard in 2016.⁵⁵

The total direct employment effects of the Port Log Yard is 81.4 FTE at an average monthly wage of \$4,688 and LWP = \$701. The average monthly wage is pulled upward by the average wages of Shiplside Operations that include significant benefits.⁵⁶ That direct economic activity supports an additional 10.2 proprietors with a combined average monthly gross income of \$1,038,912.⁵⁷ On a sector by sector basis, all sectors except timber tract preparation pay a living wage, with LWP ranging from \$390 to \$4,492 in shiplside operations.⁵⁸

Total direct employment effects of the Port Log Yard are 81.4 FTE at an average monthly wage of \$4,688 and LWP = \$701.

The economic impacts in table 3 create expenditures in the supply chain (indirect impacts) and elsewhere in the economy (induced impacts) of Clallam County. The sum of direct, indirect and induced effects is presented in table 4. The 81.4 FTE employed from activities ranging from forest preparation through shiplside operations earn an average monthly wage of \$4,688 and LWP = \$701 with a monthly proprietor gross income of \$1,038,913.⁵⁹ That direct employment supports an additional 19.1 FTE in the supply chain (indirect impacts) at an average monthly wage of \$2,339 and LWP = -\$1,648 with a monthly proprietor gross income of \$42,785. The expenditures of those directly and indirectly employed support an additional 80.2 FTE in the economy of Clallam County at an average annual wage of \$1,833 and LWP = -\$2,154 with a monthly proprietor gross income of \$34,667. The total 180.7 FTE earn an average wage of \$3,308 with LWP = -\$679 with monthly proprietor gross income of \$1,116,140.

⁵⁵ IMPLAN estimates wages for forestry and timber tract production differently than the wage aggregation in QCEW data for NAICS 115. The implications for wage estimates are explained in Appendix C.

⁵⁶ Benefits were not included under wages for all other sectors.

⁵⁷ IMPLAN's estimates for proprietor income are "operating income" which, from an accounting standpoint, would be regarded as revenues. It is not net income, or revenues minus operating expenses. Proprietor income has a significant impact on indirect impacts as it covers expenses for operations, which creates employment and income in related sectors.

⁵⁸ The average monthly wage of \$4,377 is associated with NAICS 113 in the QCEW data for 2016, the code applied to several activities that all fall into commercial logging.

⁵⁹ Rounding accounts for the discrepancy of \$1 between tables 3 and 4.

Impact Type	FTE	Average	LWP	Monthly PI
Direct	81.4	\$4,990	\$1,003	\$1,038,913
Indirect	19.1	\$2,339	-\$1,648	\$42,785
Induced	80.2	\$1,833	-\$2,154	\$34,443
Total	180.7	\$3,308	-\$679	\$1,116,140

Table 4: Total annual direct economic impacts from operations moving wood fiber through the Port of Port Angeles Log Yard in 2016.

THE ECONOMIC IMPACTS OF DIRECTLY DEPENDENT EMPLOYMENT EFFECTS

As mentioned earlier, in this report *a business is said to be directly dependent on the Port Log Yard if a portion of the wood fiber it buys/sells move through the Port Log Yard*. While that volume may be a small proportion of its total, it can be the difference between profitability and insolvency. The directly dependent employment effects consist of 21 at Evergreen (chipping and transport) plus 27 in commercial logging for 48 FTE,⁶⁰ 125 at Interfor, and 83 at Port Angeles Hardwoods. The 21 FTE at Evergreen are a portion of the total operations of Hermann Brothers, whereas the 125 at Interfor and 83 at Port Angeles Hardwoods constitute their entire payroll in Clallam County.

A business is said to be directly dependent on the Port Log Yard if a portion of the wood fiber it buys and/or sells move through the Port Log Yard.

The indirect effects begin with forest preparation and commercial logging and extend to trucking of final products to market.⁶¹ Those trucking operations include movement of hog fuel and wood chips. The values presented in this section are for each firm analyzed independently of the others. Thus, the values in the tables that follow cannot directly be combined with tables summarized in the section *The Economic Impacts of Direct Employment Effects*, as there are spillover effects. To do so can result in counting an economic impact twice.^{62,63} With this

⁶⁰ As emphasized in Appendix C, modeling Evergreen's economic impacts is complex. To avoid a substantial downward bias in estimates, operations in the woods had to be included as direct FTE to more accurately capture the economic impacts of Evergreen.

⁶¹ The reader is reminded to keep in mind footnote 58. The connection between jobs in the woods for Interfor and Port Angeles is strong, so that those impacts can be treated as indirect.

⁶² As an example in the analysis of Evergreen some of its wood fiber supply comes from Alcan-China Forest Products. The expenditures for that supply will appear as indirect impacts in this section. However, in the section direct employment effects, when modeling the flow of wood fiber through the Port Log Yard, some of the labor used to move that wood fiber was analyzed as a direct impact.

⁶³ An additive methodology could have been developed for this study. However, as with any study, tradeoffs are necessary. It was determined that for the purposes of making maximum potential use of the results herein contained, analyzing each wood product manufacturer separately could inform decision makers of how these employers contribute to the economy of Clallam County.

caveat in mind, the aggregation of direct and directly dependent employment effects does create an approximation of total impacts.

Economic Impacts of Evergreen

Evergreen (EFI) wood chip production is a subsidiary operation of Hermann Brothers, a local company with a long term standing in the forest products industry in Clallam County. In addition to operating the Eclipse Industrial Park, which includes the physical location of Port Angeles Hardwood, Hermann Brothers employs 95 FTE driving 70 trucks. Hermann Brothers also maintains numerous ancillary operations, from mechanics to specialized hog fuel processing machines used in the forest.⁶⁴

Hermann Brothers employs 95 FTE driving 70 trucks.

Hermann Brothers is the primary exporter of the wood chips and hog fuel used at Port Townsend Paper Company, the largest private sector employer in Jefferson County, with 300 FTE at an average monthly wage of \$5,833 and LWP = of \$1,846. On a daily basis, Evergreen transports 35-60 truckloads of wood chips and 3-4 truckloads of hog fuel to Port Townsend Paper. While the direct linkage in this report between Evergreen and the Port Log Yard is export logs sold by CFPC-Alcan, Hermann Brothers also produces and transports wood chips and hog fuel to Port Townsend Paper Company provided by other suppliers of these feedstocks (see Figure 2). In total Hermann Brothers provides upward of 80 percent of the total feedstocks used by Port Townsend Paper Company.⁶⁵ Evergreen's products also include beauty bark, top soil and saw timber exported to markets as distant as Ogden, Utah, and Boise, Idaho.⁶⁶ Thus, Evergreen's directly dependent employment in this study is a subset all of these economic activities, from wood product manufacture to transport by truck.

Evergreen is directly dependent upon the Port Log Yard as CFPC-Alcan is a customer. When Munro LLC contracts for and executes a timber sale, logs are sorted and directed to specific customers. The export log section goes to CFPC-Alcan. Chip and saw and pulp wood can be sent to Evergreen for processing into wood chips and trucking to Port Townsend Paper. The directly dependent employment impacts associated with Evergreen were estimated by using a daily wood chip transport of 40 loads, plus 4 loads of hog fuel transported to Port

⁶⁴ Bill Hermann, Hermann Brothers.

⁶⁵ IMPLAN does not directly capture the structure of Evergreen's operation. A model that does capture those operations was used for the estimate below. The methodology is explained in Appendix C.

⁶⁶ Evergreen processes logs harvested on the peninsula for Alcan-China Forest Products as well. Those economic impacts are captured in the analysis of direct employment effects. Similarly, Evergreen processes logs imported by Alcan-China Forest Products using barge and raft. The movement of those materials is captured in this section.

Townsend Paper Company.⁶⁷ Employment (FTE), average monthly wage (Average), Living Wage Premium (LWP) and monthly proprietor gross income (Monthly PI) are presented in table 5.⁶⁸ While the values presented capture most of Evergreen’s economic impacts, those impacts are only a small part of the total economic impacts of Hermann Brothers on the economy of Clallam County.

Impact Type	FTE	Average	LWP	Monthly PI
Direct	48	\$4,688	\$701	\$363,094
Indirect	22.4	\$2,942	-\$1,045	\$91,526
Induced	38.7	\$1,838	-\$2,149	\$16,647
Total	109.1	\$3,319	-\$668	\$441,846

Table 5: The estimated directly dependent economic impacts of Evergreen in 2016.

The 21 FTE employed by Evergreen and Hermann Brothers to transport and produce wood chips directly derived from the 43.6 MMBF of wood fiber harvested from private lands on the peninsula moving through the Port Log Yard in 2016 also directly employed 27 FTE in the woods, in forest preparation and management and commercial logging. Thus, total direct FTE is 48, the sum of 21 and 27.⁶⁹ The average monthly wage was \$4,688 with LWP = \$701. The monthly proprietor gross income of \$363,094 supported nearly 4 proprietors in forest preparation and management and commercial logging. Indirect employment was 22.4 FTE at an average monthly wage of \$2,942 with LWP -\$1,045 and monthly proprietor gross income of \$91,526.⁷⁰ Induced employment is 38.7 FTE at an average monthly wage of \$1,838 with LWP = -\$2,149 and average monthly gross proprietor income of \$16,647. There are 109.1 FTE impacted by this component of Evergreen’s operations at an average monthly wage of \$3,319 with LWP = -\$668 and monthly proprietor gross income of \$441,846.

⁶⁷ Actual transports can be as high as 60 truckloads per day. Thus, the values in table 5 are conservative, and actual impacts can be far greater.

⁶⁸ The direct dependent employment effects of Evergreen were estimated using a mix of trucking and wood chip manufacturing. An aggregate of values is presented, where FTE is the sum of values shared by Hermann Brothers and average monthly wage estimated using IMPLAN modeling. The goal is to protect proprietary information while estimating reasonably accurate approximations.

⁶⁹ The complex and large scale structure of Hermann Brothers makes modeling problematic. Evergreen processes all of the chip and saw and pulp logs harvested on the North Olympic Peninsula. Only a portion of those operations are captured in the estimates appearing in this report. See Appendix C.

⁷⁰ Given the analytical assumptions necessary to capture Evergreen’s economic impacts, explained in Appendix C, most of the “jobs in the woods” are captured as direct effects; hence, average indirect wages are biased downward in this section.

Economic impacts of Interfor

Interfor employs approximately 125 FTE over 2 shifts to process an average of 100 MMBF of timber annually. Capital equipment is routinely updated to maintain an efficient production facility.

Interfor employs approximately 125 FTE over 2 shifts to process an average of 100 MMBF of timber annually.

Its milling capabilities utilize logs of 19 inches in diameter or less. At present, Interfor cannot fully utilize potential markets for its products due to limited availability of saw logs. Given the current level of public harvest, and tight competition for private harvests which are at their maximum sustainable threshold, imports by water are seen as the remaining potential to increase operational capabilities.

The 125 FTE was used along with Quarterly Census of Employment and Wages (QCEW) data and proprietor income created by IMPLAN. The results are presented in table 6 in terms of direct, indirect and induced impacts. Impacts are presented in terms of employment (FTE), average monthly wage (Average), Living Wage Premium (LWP) and monthly proprietor gross income (Monthly PI). Employment at Interfor provides an average monthly wage of \$4,420 with a LWP = \$433. Indirect impacts are 98.1 FTE at an average monthly wage of \$3,214 with a LWP = -\$773. Monthly proprietor gross income is \$459,239 with 88 percent in commercial logging. The indirect 98.1 FTE include proprietors. 25.3 of those indirect FTE are employed in commercial logging at an average monthly wage of \$4,377 with a LWP = \$777.

The 125 FTE at Interfor support an additional 167.1 FTE at an average monthly wage of \$2,648 in the economy of Clallam County.

The estimated 4.1 proprietors receive a monthly gross income of \$404,806 from forest preparation and commercial logging. Induced impacts consist of 69 FTE at an average monthly wage of \$1,842 with a LWP = -\$2,145; monthly proprietor gross income is \$29,642. The 125 FTE at Interfor support an additional 167.1 FTE at an average monthly wage of \$2,648 in the economy of Clallam County.

Impact Type	FTE	Monthly Wage	LWP	Monthly PI
Direct	125	\$4,420	\$433	\$23,661
Indirect	98.1	\$3,214	-\$773	\$459,239
Induced	69	\$1,842	-\$2,145	\$29,642
Total	292.1	\$3,406	-\$581	\$512,542

Table 6: Estimated directly dependent economic impacts of Interfor in 2016.

Economic impacts of Port Angeles Hardwoods

Port Angeles Hardwoods (PA Hardwoods) is a subsidiary of Cascadia Hardwood Group. Capital equipment is routinely updated to maintain an efficient production facility. At present 83 FTE are employed to process an average of 28.8 MMBF of Alder, Maple and Cottonwood annually. Approximately 85% were harvested from the peninsula while approximately 15% was barged into the Port's Log Yard. Those imports are necessary to compensate for insufficient peninsula harvest to maintain a single shift operating at slightly above 100% production capacity.⁷¹

At present 83 FTE are employed to process an average of 28.8 MMBF of alder, maple and cottonwood annually. Approximately 85% were harvested from the peninsula while approximately 15% was barged into the Port's Log Yard. Those imports are necessary to compensate for insufficient peninsula harvest.

In addition, it makes possible sourcing wood fiber at markets with lower prices thereby increasing profit margins. Were PA Hardwoods to run a second shift that wood fiber would likely need to be imported via barge and/or raft.

The current 83 FTE was used along with QCEW wage data and proprietor gross income created by IMPLAN. The results are presented in table 7 in terms of direct, indirect and induced effects. Impacts are presented in terms of employment (FTE), average monthly wage (Average), Living Wage Premium (LWP) and monthly proprietor gross income (Monthly PI). Employment at Port Angeles Hardwoods provides an average monthly wage of \$4,420 with a LWP = \$433. Indirect impacts are 65.1 FTE at an average monthly wage of \$3,216 with a LWP = -\$771. Monthly proprietor gross income is \$304,935 with 88 percent in commercial logging. The indirect 65.4 FTE include proprietors. 16.8 of those FTE are employed in commercial logging at an average monthly wage of \$4,377 with a LWP = \$777; that estimate corresponds to 2.6 proprietors and a monthly gross income of \$267,119. Induced impacts consist of 45.8 FTE at an average monthly wage of \$1,843 with a LWP = -\$2,144; monthly proprietor gross income is \$19,682. The 83 FTE at Port Angeles Hardwoods support an additional 114.1 FTE in the economy of Clallam County.⁷²

⁷¹ The shift operates at 40 hours a week for about half the year, and 50 hours a week the other half. Michelle Petitt, Port Angeles Hardwoods. Payroll data was provided; however, values contained in this report were generated using IMPLAN to protect the proprietary nature of that payroll data. As the payroll data exceeds

⁷² Port Angeles Hardwood pays a wage plus benefits in excess of that reported here, which uses QCEW data. Thus, the methodology employed results in a downward bias in the estimates presented. Stated differently, Port Angeles Hardwood contributes more to the economy of Clallam County in terms of employment and income.

The 83 FTE at Port Angeles Hardwoods support an additional 114.1 FTE in the economy of Clallam County.

Impact Type	FTE	Monthly Wage	LWP	Monthly PI
Direct	83	\$4,420	\$433	\$15,711
Indirect	65.1	\$3,216	-\$771	\$304,935
Induced	45.8	\$1,843	-\$2,144	\$19,682
Total	197.1	\$3,352	-\$635	\$340,328

Table 7: Estimated directly dependent economic impacts of Port Angeles Hardwoods in 2016.

The Port of Port Angeles Log Yard and a Strategic Future

The forest products industry— forest preparation and management, commercial logging, wood product manufacturing and exports – provides direct employment of 662 FTE at an average wage of \$4,550 with a LWP = \$603.⁷³

The forest products industry provides direct employment of 663 FTE in Clallam County at an average monthly wage of \$4,550.

In addition, that direct impact supports 54 proprietors with a combined average monthly gross income of \$5,643,545. Those direct impacts support indirect employment of 296 FTE in the supply chain and another 555 FTE as induced employment in the overall economy. This report has detailed the role of the Port Log Yard as a nexus for those interconnected impacts.

The specific ways in which the Port Log Yard supports the forest product industry have changed over time in response to changing market conditions. It continues to provide an interface between water transport and the movement of wood fiber that is open to all potential customers. The presence of a long term infrastructure that meets changing economic needs can continue to support the industry that is the largest single source of export earnings in Clallam County, \$193,735,806 in 2015.⁷⁴ At present, the Port Log Yard serves as a nexus whereby wood harvest on the peninsula is exported, by truck, barge, raft or ship, to domestic and international markets.⁷⁵ Those exports take the form of saw logs and, recently, wood chips. Imported logs arrive by barge and raft. The Port Log Yard also provides the space for log

⁷³ This analysis is presented in Appendix B, The Total Economic Impacts of the Forest Products Industry.

⁷⁴ This constitutes 19 percent of total exports. With paper production, the value was \$351,925,758, or 35 percent of total export income. Exports represent an infusion of income and employment to the economy that would not exist otherwise. In the forest products industry, export sales create multiple stages of value added and, as a result, significant employment multipliers.

⁷⁵ Sales to Port Townsend Paper Company are a source of export income.

processing, from scaling to debarking, and sorting and stacking in preparation for sales. Some of those sales are to local mills, where wood fiber is transported by truck. Some logs processed at the Port Log Yard are exported to domestic markets by truck. At each stage of expenditures employment, generally at a living wage, is created for local families. These activities occur in a dynamic market, the uncertainties of which pose a number of strategic challenges.

At present, harvests from private lands are at or near upper sustainable thresholds. Harvests from public lands have been uncertain, and future harvest levels from State Trust Lands remain unknown as the sustainable harvest guidelines for 2015 have yet to be established by the Board of Natural Resources.

Harvests from private lands are at or near upper sustainable thresholds. Harvests from public lands have been uncertain, and future harvest levels from State Trust Lands remain unknown.

Harvests from Olympic National Forest are, at present, a by-product of forest restoration activities. As harvests from public lands cannot be exported internationally prior to value added manufacturing, they represent a source of wood fiber, including bioenergy, which can be captured with some certainty by local manufacturing firms, thus increasing stages of processing and expenditures with impacts on corresponding employment and income.

Saw log demand is high, and softwood demand is forecast to grow at an annual rate of 2.3 percent through 2030, reaching an all-time high.⁷⁶ Thus, price competition is and will continue to be significant.

Saw log demand is high, and softwood demand is forecast to grow at an annual rate of 2.3 percent through 2030, reaching an all-time high.

Demand comes from local mills, the international export market, and off peninsula markets for saw logs. Interfor could expand production with more wood input, as markets for their product exist. Port Angeles Hardwoods has insufficient supply for one shift, and imports 10-15% of its raw material by water. It is to be stressed profitability at these mills is wood fiber supply dependent: reductions in those flows can make the difference between economic viability and insolvency. At the same time, the demand for wood chips is high. Market conditions for wood chips changed rapidly over the past 12 months. At present there is insufficient supply for users in the Pacific Northwest. Demand is increasing from China as new investments in chemical cellulose manufacturing are made that require an increased supply of wood chips produced

⁷⁶ Industry News, *Forestry Source*, April 2018, p. 11.

from hemlock.⁷⁷ At present, Port Townsend Paper Company is the primary consumer of wood chips on the peninsula. There is reason to believe that competition for pulp logs and chip and saw logs will be intense. If that demand results in buying saw logs for chipping, there will be constraints on the capability of local saw mills to operate.⁷⁸

While the shutdown thresholds caused by wood shortages-price increases are unknown, they do exist. In 2015 we experienced two such events with Green Creek and Interfor shutdowns.

While the shutdown thresholds caused by wood shortages-price increases are unknown, they do exist. In 2015 we experienced two such events: Green Creek and Interfor shutdowns.^{79,80}

The emergence of Ginkgo Trading increases the problematics discussed above. The planned annual export of four 45,000 ton ships is equivalent to 11 weeks of total wood chip volume used by Port Townsend Paper Company.⁸¹ On a per ton basis, wood chips going to Port Townsend Paper Company support more FTEs than will international exports for two primary reasons. The first are the 300 FTE employed at the mill.

Wood chips going to Port Townsend Paper Company support more FTEs than international exports for two reasons. The first are the 300 FTE employed at the mill. The second are the 15 drivers employed moving chips to the mill.

The second are the 15 drivers employed moving chips to the mill. *Ginkgo only represents increased employment if additional fiber is available.* If their operations mean shifting that fiber from one place to another, there may be losses in terms of local economic development.⁸² Specifically, the employment and income effects of Ginkgo's chip exporting operations are less than those corresponding to Evergreen's processing and distribution to Port Townsend Paper Company. Should a reduction of hog fuel and wood chips reduce Port Townsend Paper Company's margin precipitously and force closure, the adverse economic consequences for the North Olympic Peninsula could be catastrophic, especially for Jefferson County.

⁷⁷ Interview, Bill Hermann, Hermann Brothers.

⁷⁸ Pulp markets were so tight the winter of 2017-2018 that some paper mills were forced to buy chip and saw logs as a substitute for lower cost pulp wood. Mike Hermann, Hermann Brothers.

⁷⁹ NIPPON Paper ceased operations in 2016. Among the economic factors involved in the shutdown decision, one was a tight fiber supply. Interview, Harold Nordland, NIPPON

⁸⁰ Two of these three shut downs were predicted, and estimates of the economic impacts, in Daniel A. Underwood and Jason Cross, *Analysis of the Wild Olympics Wilderness and Wild and Scenic Rivers Act of 2012: economic impacts and opportunities*, published by the Port of Port Angeles, November, 2012.

⁸¹ Bill Hermann, Hermann Brothers.

⁸² If Ginkgo locates at the Port Log Yard, truck hauling will be reduced with corresponding reductions in driver FTE.

The discussion above leads to the issue of increasing the supply of wood fiber from off-peninsula regions. The Port Log Yard provides the facilities to import wood. There are established markets on Vancouver Island. However, institutional barriers make those potential imports problematic: “rights of refusal” by Canadian mills and export taxes. Wood can also be imported from Southern Alaska, and other northwest regions. However, northwest fiber markets are “tight,” and price competition can be significant.

The Port Log Yard provides the facilities to import wood in order to increase supply.

Modification and or development of facilities at the Port Log Yard to improve the feasibility and efficiency of water imports could increase the availability of wood fiber to local markets by off-setting price competition as wood fiber “follows the money.”⁸³ Similarly, the marine terminal makes possible imports by ship. Given the international nature of wood markets and unknowns of what species might be optimal for advanced wood manufacturing, the future feasibility of using those facilities should not be underestimated.⁸⁴

There are at least two potential emergent markets: tree bark and advanced wood manufacturing.

There are at least two potential emergent markets related to this investigation. The first is that at present there is one form of forest fiber in surplus, partly due to the closure of NIPPON – tree bark that can be used as beauty bark and hog fuel. At present, there is a market for surplus beauty bark in Anacortes, which can be economically accessed using existing barge facilities at the Port water front.⁸⁵ Approximately two barges bring in wood for Port Angeles Hardwoods and return empty. They could be loaded with beauty bark. The same export process might be applied to export hog fuels to markets in the Northwest. Related is export of hog fuel to emergent international markets. At present there is surplus hog fuel. Thus, it is an export market that can be pursued without adverse impacts on the local economy as long as a surplus exists. However, consideration should be given to hog fuel needs should McKinley Paper begin operating as support of those operations would increase local employment and income.

The second potential emergent market would involve creating at least one additional stage of value added. It could take the form of advanced wood manufacturing. It might make use of saw logs currently exported. If so, local FTE will likely increase. If it makes use of

⁸³ Mike Hermann, as conveyed by Bill Hermann, Hermann Brothers.

⁸⁴ Tyler Kruzfeldt., Monta Vista Capital.

⁸⁵ Mike Hermann, Hermann Brothers.

materials currently utilized elsewhere in the local economy, the net change in FTE could be positive or negative. If it makes use of imported wood, local FTE will increase. Development of such an new and emergent sector will require addressing several economic challenges. First is identification of a product, ideally one that fills an open niche. Integration of wood fiber with recycled composite carbon fiber may provide that opportunity. Second will be completion of a carbon life cycle study which explores the potential carbon capture of that product. This is important because, and especially on a global scale, growth in demand for carbon sequestering building materials is expected.⁸⁶ Third will be identifying and securing a reliable supply of wood fiber. Public harvests from the North Olympic Peninsula are one possibility. However, the use of water borne imports through Port facilities should not be discounted. Fourth will be the organizational structure of this emergent sector. Ideally that form of organization can minimize handling and transport costs from harvest through completion of the final product for export. A sequential organizational process may be ideal, one that brings in wood from the forest for processing, from one stage to the next in the absence of necessary loading and unloading onto trucks. This could be literally “seamless,” from debarking, to dimensional sawing, to cross lamination, to the addition of recycled composite carbon with a final product emerging and ready for export, by truck or water.

⁸⁶ Tyler Kruzfeldt, Monta Vista.

Appendix A: The Economic Impacts of Wood Product Manufacturing

Figure 1 illustrates the complex economic network interconnecting multiple sectors of the forest products industry: forestry and logging, transport, wood product manufacturing, and exports. Those direct economic activities are in turn supported by a wide range of businesses in the supply chain, the indirect impacts. All those employed and earning income through direct and indirect impacts in turn make expenditures in the local economy, the induced impacts. The interconnections between these effects and all of the business sectors involved can be analyzed by following the flow of expenditures, illustrated in Figure A-3. The results are captured by IMPLAN and explained below. The discussion that follows is intended to help the reader better understand how a change in the forest products industry impacts other sectors of the economy in Clallam County.

Economic Impacts: Follow the Flow of Expenditures

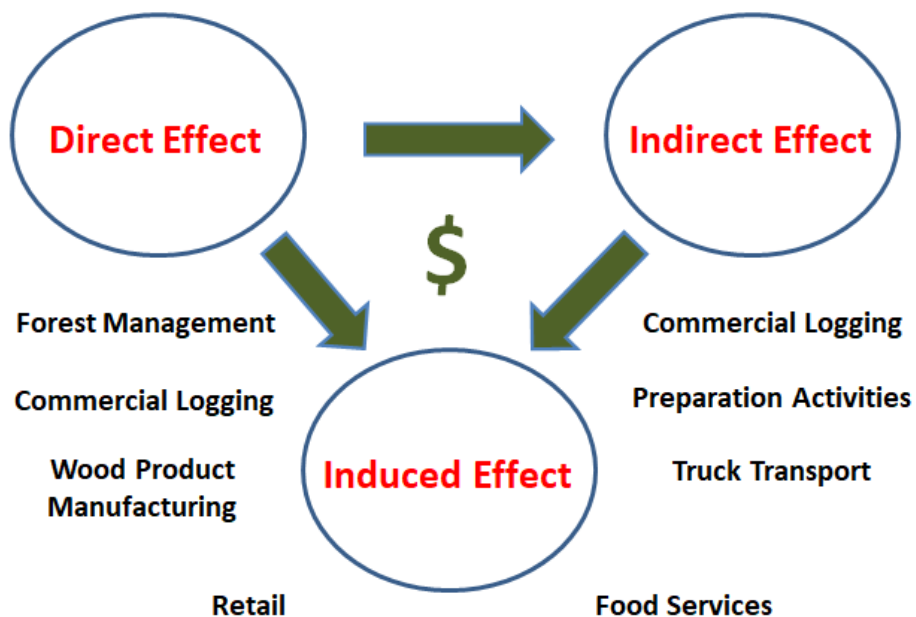


Figure A3: Expenditure flows and direct, indirect and induced economic impacts.

A simple model was used to present the linkages between wood product manufacturing and the economy of Clallam County. The model assumed an imaginary mill was created that employs 100 people in 2016 earning an average wage in wood manufacturing of \$4,420. The use of 100 makes interpretation and application of corresponding employment impacts

straightforward. That will constitute the direct impact. Indirect impacts in the supply chain are then estimated along with resulting induced impact. Employment in the indirect and induced impacts includes proprietors. Income for indirect and induced impacts can be analyzed as a total for payroll employees and proprietors, or independently estimated. That is, for any total level of FTEs, IMPLAN can be used to separately estimate total value added, payroll income, and proprietor gross income. Table A-1 presents direct, indirect and induced impacts in terms of FTE, average monthly wage, Living Wage Premium (LWP), and monthly proprietor gross income (Monthly PI). While direct FTE does not include the number of proprietors, proprietor employment is included at FTE for indirect and induced impacts.⁸⁷ The table illustrates every FTE in wood product manufacturing supports 0.784 FTE in the supply chain (indirect impacts) and 0.552 FTE as induced impacts. Thus, *every wood product manufacturing FTE supports an additional 1.337 FTE in the economy of Clallam County.*⁸⁸

Impact Type	FTE	Income	Average	LWP	Monthly PI
Direct	100	\$5,303,913	\$4,420	\$433	\$18,929
Indirect	78.4	\$3,026,876	\$3,217	\$2,820	\$367,391
Induced	55.2	\$1,220,271	\$1,842	\$1,445	\$23,714
Total	233.7	\$9,551,060	\$3,406	\$3,009	\$410,034

Table A1: Direct, indirect and induced impacts from a mill employing 100 FTE in 2016.

The aggregate employment impacts in table A-1 can be analyzed over 536 individual economic sectors. The indirect employment impacts cover 112 sectors, ranging from commercial logging (20.2 FTE) to vegetable farming (0.1 FTE). Induced impacts cover 131 sectors, ranging from real estate (4.1 FTE) to veterinary services (0.1 FTE). Table A-2 illustrates those employment FTEs for the top ten industries for indirect impacts. Those top ten industries contain 51.6 of the 78.4 indirect FTE (66%). The average monthly income in the top ten industries is \$4,672 with LWP \$685. When reviewing the indirect and induced impacts by top ten sectors, it is important to emphasize that FTEs in all sectors presented except IMPLAN 16, commercial logging, *include* proprietors. With the exception of commercial logging and sawmilling, reported average wages were estimated by IMPLAN and include proprietor income, wages and benefits. The average wage data for commercial logging and sawmills used QCEW data to retain consistency with previous sections. Those sectors too often pay benefits, and we

⁸⁷ IMPLAN automatically estimates proprietors as FTE for indirect and induced impacts. It does not estimate the number of proprietors under direct impacts. Given the existence of little monthly proprietor gross income for wood product manufacturing, there would be only a small proprietor employment impact. This issue has been addressed elsewhere in this report, including estimating the direct FTE for forest preparation and management and commercial logging. Also see Appendix C.

⁸⁸ The total employment and income multiplier impacts depends on the number of times income is spent locally. For comparison, when people shop outside of the county, that income leaves the local economy and has no employment and income impact.

have seen that proprietor income can be significant. Keeping this caveat in mind, the averages reported in Table A2 understate total compensation in commercial logging and sawmilling.⁸⁹

To help decision makers better assess average income, wages plus proprietor income was used to compute the averages in Table A2 except for commercial logging and sawmilling, where QCEW values are used to retain consistency with analysis in previous sections. Thus, those averages should not be compared with average wages in commercial logging and sawmilling because those averages used QCEW data and do not include benefits and proprietor income. The number of proprietors and their income has been analyzed in previous sections

IMPLAN	Description	FTE	Average	LWP
16	Commercial Logging	20.21	\$4,377	\$390
395	Wholesale Trade	6.9	\$8,469	\$4,482
134	Sawmills	5.4	\$4,667	\$680
411	Truck Transportation	5.3	\$5,528	\$1,541
448	Accounting and Payroll	3.6	\$2,377	-\$1,610
461	Management of Companies	2.7	\$6,920	\$2,933
468	Services to Buildings	2.4	\$1,245	-\$2,742
502	Full Service Restaurants	1.8	\$1,766	-\$2,221
19	Agr Support Activities	1.7	\$2,006	-\$1,981
460	Professional Services	1.6	\$1,817	-\$2,170
Total Indirect Effects for Top-10 Sectors		51.6	\$4,672	\$685

Table A2: The economic impacts on the top ten indirect sectors as affected by a mill employing 100 FTE in 2016.

Similar analysis for induced impacts is presented in table A-3. The total induced employment impacts in the top-10 sectors is 23.8, less than one-half the indirect employment effects. Average induced wages range from \$3,082 in General Merchandise Retail to \$234 in Non-store Retail. The average wage of \$1,683 is well below that of \$4,672 for top-10 indirect effects. The value of \$1,683 is weighted downward by Real Estate and Non-store Retail.⁹⁰

⁸⁹ The estimated FTE for commercial logging was adjusted for the total number of proprietors, which is 0.14 proprietors for each 1 FTE, or $(0.14 \times 20.21) = 2.83$ proprietors. Total FTE is thus $20.21 + 2.83 = 23.04$. Inclusion of the high average monthly gross proprietor income would have significantly increase the average wage causing difficulty of interpretation.

⁹⁰ IMPLAN estimates for total income in real estate are poor. Detailed testing of the IMPLAN model by Olympus reveals the total value added by those 4.1 FTE was \$168,159, for an average of \$3,418. That value added covers wages, proprietor income and, likely, commissions. Thus, the average monthly income in Real Estate is probably near but below the average value of \$3,418.

IMPLAN	Description	FTE	Average	LWP
440	Real Estate	4.1	\$416	-\$3,571
501	Full Service Restaurants	3.5	\$1,779	-\$2,208
485	Individual and Family Services	2.6	\$1,572	-\$2,415
502	Limited Service Restaurants	2.5	\$1,558	-\$2,429
400	Retail: Food and Beverage	2.2	\$2,942	-\$1,045
405	Retail: General Merchandise	2.1	\$3,082	-\$905
407	Retail: Nonstore	1.8	\$234	-\$3,753
483	Nursing and Community Care	1.8	\$2,956	-\$1,031
503	Other Food and Drinking	1.8	\$2,202	-\$1,785
406	Retail: Miscellaneous	1.4	\$1,062	-\$2,925
Total Indirect Effects for Top-10 Sectors		23.8	\$1,683	-\$2,304

Table A3: The economic impacts on the top ten induced sectors as effected by a mill employing 100 FTE in 2016.

For illustrative purposes, imagine entry of a new wood product firm with 10 FTEs. While precise economic impacts will depend upon the structure of that firm's expenditure flows to trace out expected impacts on the County's economy, the estimates provided in this section can be applied directly to any changes in wood product manufacturing. Those 10 direct FTE would support 2.6 indirect FTE in commercial logging earning \$4,377 with LWP = \$390. In addition, 0.36 proprietors would be supported with an average monthly proprietor gross income of \$12,873. We would expect to see 0.69 FTE in the wholesale trade, 0.53 in trucking, and 0.36 in accounting as indirect employment effects. In terms of induced effects, we would expect 0.41 FTE in real estate, 0.35 FTE at full service restaurants, and 0.26 in individual and family services.

Appendix B: The Total Economic Impacts of the Forest Products Industry

The total direct economic impacts associated with the forest products industry begin with forest preparation, forestry and logging. Logs are sorted for distribution to customers: local wood product manufacturers, and domestic and international export markets. Some of that sorting by customer is done at the Merrill and Ring (MR) operation at the Port Airport Industrial site and at the Port Log Yard by businesses described in this report.⁹¹ Wood fiber harvested from Clallam and Jefferson counties (approximately 200 MMBF from private lands and 29 MMBF from State Trust Lands in 2016) moves by truck to scales operated by Pacific Rim. Scales are physically located on Highway 101, Interfor, Port Angeles Hardwoods, and the Port Log Yard. Total FTE moving that flow of wood fiber was 383 in 2016, with 24 in forest preparation and 359 in forestry and logging, which includes truck transport. Wood product manufacturing employed 255 FTE. Export operations employed 24 FTE, 16 as maritime workers and 9 as employees of the Port of Port Angeles. This flow of is illustrated in Figure B1.

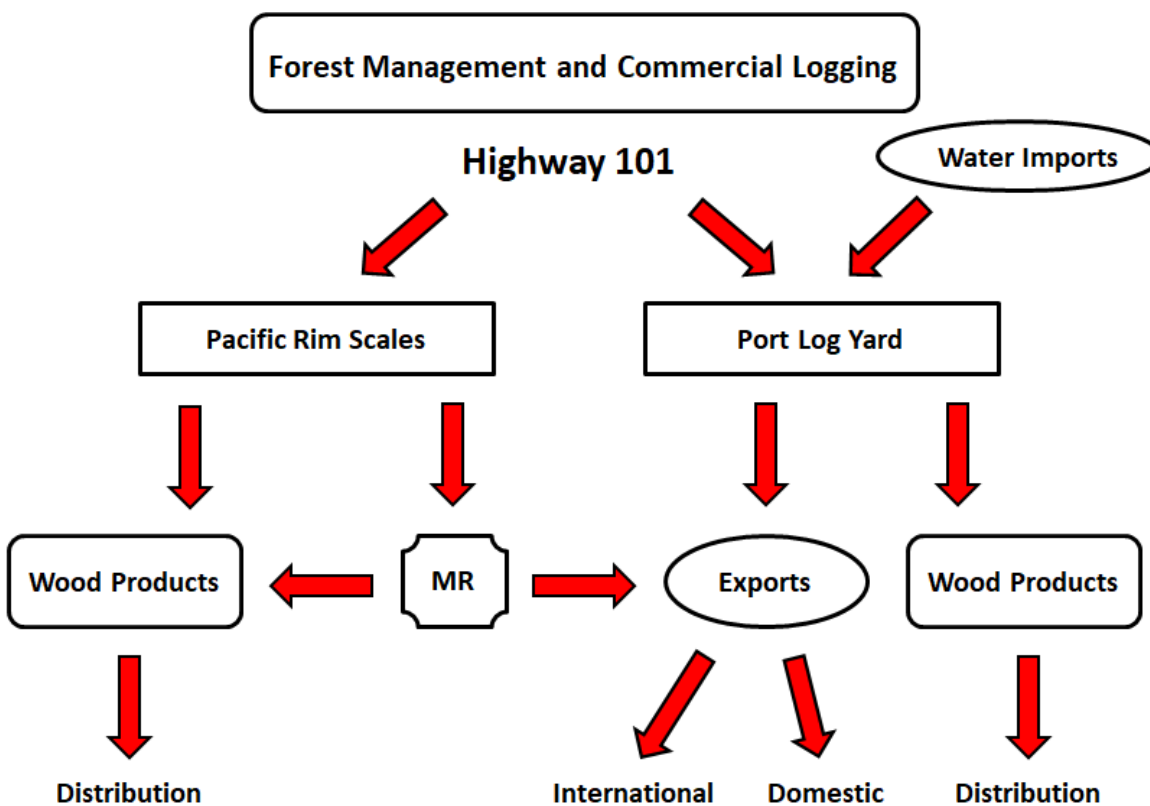


Figure B1: The flow of wood fiber through the forest product industry.

⁹¹ For analysis of the log export industry, see Daniel Underwood and Jason Cross, *The Economic Impacts of Private Timber Harvests: An Exploratory Investigation of Harvests, Exports, Employment, Income and Tax Remittances*, December 2017. Published by the Port of Port Angeles.

Table B1 presents FTE by North American Industrial Classification System (NAICS) and economic activity using QCEW data for NAICS 115, 113 and 321; data for the Port Log Yard and shipside operations came from cited interviews and studies previously cited. Also contained is average monthly wage (Average), living wage premium for a family of four (LWP), the number of proprietors estimated using IMPLAN, and monthly proprietor gross income (Monthly PI). The table reveals the average monthly wages range from \$3,052 in forestry preparation, a sector with seasonality in employment, to \$8,691 in shipside operations. Employment in forestry and logging, wood product manufacturing and at the Port approximates \$4,500 per month. Each of those activities provides a family living wage. A total of 54 proprietors are supported in all economic activities using NAICS 113 and 115.⁹² Monthly proprietor gross income ranges from \$48,269 in wood product manufacturing to \$5,211,770 in forestry and logging. That income is a gross before expenses. Coverage of those expenses results in support of employment in the supply chain, or indirect impacts.

NAICS	Economic Activity	FTE	Average	LWP	Proprietors	Monthly PI
115	Forestry preparation	24	\$3,052	-\$935	3	\$204,387
113	Forestry and logging	359	\$4,377	\$390	50	\$5,211,770
321	Wood product manufacturing	255	\$4,667	\$680		\$48,269
113	Port Log Yard staff	8	\$4,824	\$837	1	\$56,007
4883	Shipside operations	16	\$8,691	\$4,704	0	\$123,113
Total Direct Economic Impacts		662	\$4,550	\$563	54	\$5,643,545

Table B1: Total direct economic impacts associated with the forest products industry.⁹³

Direct employment in the forest products industry, as illustrated above in table B1, results in expenditures in the supply chain creating indirect impacts. Those directly and indirectly employed, when making expenditures in the economy of Clallam County create induced impacts, supporting employment and income in a wide range of economic sectors. The precise linkage between direct, indirect, and induced impacts was explored in Appendix A. Table B2 presents the total direct, indirect, and induced economic impacts caused by the forest product industry in 2016.⁹⁴ Direct employment of 662 FTE earning an average wage of \$4,550 with LWP = \$563 in the forest products industry supports 296 FTE in the supply chain as indirect impacts with an average monthly wage of \$2,908 with LWP = -\$1,079. These impacts are

⁹² The Port Log Yard plays the economic function of commercial logging – it is a log yard operation – and thus supports proprietors off site.

⁹³ Discrepancies in sums are due to rounding.

⁹⁴ Earned income values used in these estimates was taken from QCEW data for 2016; values for Port Log Yard employees were provided by the Port of Port Angeles and do not include benefits. Income values for shipside operations come from Daniel Underwood and Jason Cross, *The Economic Impacts of Private Timber Harvests: An Exploratory Investigation of Harvests, Exports, Employment, Income and Tax Remittances*, December 2017. Published by the Port of Port Angeles.

summarized in Table B2. The direct and indirect employment and income supports 555 FTE in the general economy at an average monthly wage of \$1,839 with LWP = -2,148. Monthly proprietor gross income is \$5,643,545 from direct impacts, \$1,164,309 from indirect impacts, and \$238,963 from induced impacts. The total economic impact of the forest product industry – direct, indirect and induced impacts – is 1,515 FTE at an average monthly wage of \$3,231 with LWP = -\$756 and monthly proprietor gross income of \$7,046,817.

Impact Type	FTE	Average	LWP	Monthly PI
Direct Effect	662	\$4,550	\$563	\$5,643,545
Indirect Effect	296	\$2,908	-\$1,079	\$1,164,309
Induced Effect	555	\$1,839	-\$2,148	\$238,963
Total Effect	1515	\$3,231	-\$756	\$7,046,817

Table B2: Total direct, indirect and induced economic impacts of the forest products industry.

Appendix C: Data and Methodology

AN OVERVIEW OF ECONOMIC IMPACT ANALYSIS

The primary objective of this technical report is to capture the direct economic impact of the Port Log Yard on the local economy. However, as the flow of wood fiber through the Port Log Yard affects other businesses in the forest product industry, directly dependent economic impacts were also investigated and analyzed. While the methodologies were commensurate, some modeling complexities created estimates between effects which are not additive. In other words, some impacts in the directly dependent effects also appear in the direct effects. Adding those tables together would result in double counting. In appendix B, all sectors were integrated into a single model so that the limitations described above are not a problem. However, in so doing the interactive dynamics of the Port Log Yard as a nexus supporting economic relationships is obscured.

To help the reader interpret how employment and income changes in one sector affect employment and income in another, Appendix A was developed to demonstrate how an imaginary mill of 100 FTE affect the overall economy. Appendix B summarizes the total economic impacts associated with the forest products industry, including the Port Log Yard. This appendix explains the nature of the data used and how it can be interpreted. In addition, it explains the analytical approach used and the strengths and limitations of its estimates.

The North American Industrial Classification (NAICS) is used to identify the sectors analyzed. The economic sectors directly analyzed are Forest Preparation and Management (NAICS 115), Commercial Logging (NAICS 113), Log Yard Operations (NAICS 113), Log Scaling (NAICS 113), Wood Product Manufacturing (NAICS 321), Debarking (NAICS 321), Wood Chipping (NAICS 321), Log Trucking (NAICS 113), and Shipland Operations (NAICS 4883).⁹⁵ The Bureau of Labor Statistics annual revised Quarterly Census of Wages and Employment (QCEW) for 2016 was used for employment and annual wages. 2016 is the most recent revised annual QCEW available. Annual wage estimates in QCEW do not include benefits. As a result, estimated economic impacts are biased downward as many employers in the forest products industry provide benefits.⁹⁶ An exception was analysis of Evergreen Forest Industries where some actual payroll data was used.⁹⁷ In addition employment is reported as FTE: all employers report monthly their total number of employees and total payroll. They do not report total hours worked.

⁹⁵ Only log trucking operations were directly analyzed. There are also indirect trucking impacts included in the indirect effect analysis.

⁹⁶ Interviews indicate all of the major employers in the forest products industry provide some level of employee benefits. Benefits are also estimated by IMPLAN. To protect proprietary information, as requested, QCEW data was used for NAICS 115, 113 and 321. Thus, wages under direct impacts are biased downward in this report.

⁹⁷ Bill Hermann provided the data and allowed its use in this study. Its use was partial, including only truck drivers. Hermann Brother wages are significantly above norms. Use of QCEW data would have significantly reduced the impacts of those operations.

IMPLAN is a regional input-output modeling system that uses primary economic data obtained from the Bureau of Economic Analysis, Bureau of Labor Statistics, and the US Census Bureau. It is an effective means for conducting economic impact analyses, and, as the industry standard, was used here to estimate employment, wages and monthly proprietor gross income (income before expenses). While IMPLAN adjusts for benefits and estimates proprietor income, reported average wages for direct employment were based solely on QCEW, unless otherwise noted. Evergreen and Port Log Yard employees are exceptions. Average wage data for indirect and induced employment includes IMPLAN's estimates for benefits. Actual payroll data was used for the Port Log Yard Crew, and estimated values for shipside operations from previous analysis.⁹⁸ In the process, the model constructs expenditure multipliers between economic sectors within specified regions, in this study, Clallam County.

For illustrative purposes, when a local mill buys timber, a series of interrelated expenditures are set into motion. Where these expenditures begin is the direct impact. That direct impact sets into motion a series of subsequent expenditures that ripple through the County's economy. They are analyzed as indirect impacts and induced impacts. The indirect impacts capture all dependent activities in the supply chain. If the direct impact was a mill buying timber, the indirect impacts capture activities beginning with forest preparation, forest management, logging operations that range from cutting timber, moving it through the forest to landing operations, trucking, and log scaling. Some of that economic activity is provided by businesses with a corresponding covered payroll contained in QCEW data, while some is provided by proprietors. In some economic sectors – forest management and commercial logging – 12 and 14 percent of the total employment goes to proprietors. All of the people working in direct and indirect activities spend income in the local economy thus support induced impacts. These induced effects range from food services and retail stores, to real estate and the offices of physicians and dentists.

IMPLAN constructs expenditure multipliers for all of these interconnections, making it possible to estimate indirect and induced changes in employment, wages, and proprietor income caused by a direct impact - the employment and corresponding income resulting from an intended outcome. In this study, those outcomes⁹⁹ are driven by changes in the portion of private timber harvest that uses the Port Log Yard. Those direct impacts include wood fiber exported by ship as logs or chips. It also includes wood fiber moved by barge and raft.

Application of IMPLAN to estimate economic impacts

IMPLAN, a regional economic impact modeling system, traces how changes in expenditure flows affect employment, wages and proprietor income in what might otherwise appear as disparate sectors. Activities that increase direct employment in one sector (e.g. logging) create employment, wages, and proprietor income in the supply chain (indirect), including trucking, wholesaling, management services, and more. The numbers of full-time

⁹⁸ Daniel Underwood and Jason Cross, *The Economic Impacts of Private Timber Harvests: An Exploratory Investigation of Harvests, Exports, Employment, Income and Tax Remittances*, December 2017. Published by the Port of Port Angeles.

⁹⁹ IMPLAN data for Clallam County for the year 2015, adjusted into 2016 was used.

equivalent (FTE) jobs in each sector, along with wages and proprietor income are estimated. Wages associated with direct and indirect employment become expenditures in the broader economy (induced impacts). The number of FTE by employment sector (food services, retail, offices of physicians, etc.) along with wages and proprietor income are estimated. Sectors 15 (Forestry), 16 (Commercial Logging), and 134 (Sawmills) were used for direct impacts in the forest product industry as they best capture the processes used for harvest and wood processing¹⁰⁰. The impacts of ship-side operations use sector 414 (Sight Seeing and Water Transportation). Wage estimates used in 414 were acquired using QCEW from NAICS 4883, which accurately reflects employment in shipside operations. All monetary values are expressed in \$2016.

IMPLAN does not estimate the number of proprietors associated with any direct effect though it does capture the corresponding proprietor income. Olympus worked with Mark Taylor at IMPLAN to estimate the relative number of proprietors to total covered FTEs in forestry and commercial logging, sectors with high levels of proprietor income. In forestry (NAICS 115/IMPLAN 115) each 1 FTE is associated with 0.12 proprietors. In commercial logging (NAICS 113/IMPLAN 116) each 1 FTE is associated with 0.14 proprietors. IMPLAN estimates for indirect and induced employment include proprietors, which can then be separated from total estimated employment using these ratios for those 2 sectors. Total indirect and induced income can be separated into wage and salary income and proprietor income. As a result, this technical report provides a far more comprehensive presentation of who earns what, where, and whether they are wage and salary or proprietors than was possible in the past.

The Living Wage Premium

In the process of evaluating the impacts of economic development, decision makers often confront an estimated wage. Useful in the assessment process would be a quantitative or qualitative metric that indicates whether those wages will increase (or decrease) the average level of welfare to constituents. The Living Wage Premium was developed to meet this need,¹⁰¹ and applied the Living Wage Estimator developed by Dr. Amy Grasmier, MIT. The Living Wage Estimator calculates the cost to provide for basic family needs – housing, transportation, food, health care – for different family compositions, from a single adult to households with adults and children. The Living Wage Premium (LWP) is the difference between an average monthly wage and \$3,987, the living monthly wage for a family of four with two adults, one working.¹⁰²

¹⁰⁰ NAICS codes are, respectively, 115, 113, and 321. As there are no expected changes to paper production, this sector was excluded in the analysis..

¹⁰¹ Daniel A. Underwood, Donald Hackney and Dan Friesner, "Criteria for Sustainable Community Economic Development: Integrating Diversity and Solidarity into the Planning Process, *Journal of Economic Issues* (December 2015): 1112-1123; Daniel A. Underwood and Dan Friesner, "Asset Mapping, the Social Fabric Matrix, Economic Impact Analysis, and Criteria for Sustainability and Justice: Operational Elements for Holistic Policy Planning," *Journal of Economic Issues* (September 2017): 813-827.

¹⁰² The living wage in Clallam, for a family of four with one working adult is \$47,840 annually or \$3,987 monthly. <http://livingwage.mit.edu/counties/53009> See Daniel A. Underwood, Donald Hackney and Dan Friesner, "Criteria for Sustainable Community Economic Development: Integrating Diversity and Solidarity into the Planning Process, *Journal of Economic Issues* (December 2015): 1112-1123.

Wages greater than \$3,987 pay a positive wage premium – they cover more than the essentials – and thus increase the level of general welfare in a community. Wages less than \$3,987 pay a negative wage premium and thus decrease the level of general welfare relative to this benchmark.

The value to decision makers is thus straightforward: to determine if economic development will increase welfare, look at the LWP. The average monthly wage in Clallam County for 2016 was \$3,051 for a negative LWP of \$-936.¹⁰³ Thus, the average wage does not support a family of four. Furthermore, that gap has been increasing annually since 1992.¹⁰⁴

ESTIMATING DIRECT EMPLOYMENT EFFECTS

The overarching objective of this report was to estimate the total economic impact of the Port Log Yard in terms of employment and income. The structure and operations of the Port Log Yard are “unique” in the sense that an available model to work from does not exist. Accordingly, Olympus used the flexible modeling capabilities of IMPLAN to explore the overarching objective.¹⁰⁵ As explained in the body of the report, interviews were conducted with a wide variety of businesses associated with the Port Log Yard. The nexus of those operations was illustrated in Figure 1. Those interviews produced employment estimates for the sectors illustrated, defined using NAICS, and converted into IMPLAN sectors. Wage data for NAICS sectors was obtained using QCEW data for 2016, and was used in IMPLAN.¹⁰⁶ Interviews, previous studies, and scaling data was used to estimate total wood fiber flows by source through the Port Log Yard and to final customers. Those volumes were used to estimate corresponding FTE in forest preparation and management and commercial logging. FTE values for the Port Log Yard and related activities, from scaling to trucking, were derived from interviews. The sums of those FTE are the *total direct employment effect*, presented in Table 1. In the process of moving that flow of wood fiber, proprietor income was also generated along with corresponding employment. Both FTE and proprietors, along with income, were presented in Table 3: 82.4 FTE earning an average wage of \$4,690 with LWP = \$703 and 10.2 proprietors with average monthly gross income of \$1,038,912. IMPLAN was used to estimate the resulting indirect and induced employment which was presented in Table 4. The 80.4 FTE and 10.2 proprietors created expenditures supporting 19.1 additional FTE and proprietors in the supply chain at an average wage of \$2,339 with LWP = -\$1,648 and average monthly gross proprietor income of \$42,785. Direct and indirect employment created expenditures supporting 80.2 FTE and proprietors in the general economy at an average wage of \$1,845 with LWP = -\$2,142 and average monthly gross proprietor income of \$34,667.

¹⁰³ This negative living wage premium of \$-936 indicates that the average occupation in Clallam County would need to pay \$5.40/hour more to provide a living wage for a family of four.

¹⁰⁴ Daniel A. Underwood and Jason Cross, *Wilderness Declarations, Wild and Scenic River Designations, and Additions to Olympic National Park: Evaluating the Cumulative Economic Impacts on Clallam and Jefferson Counties*. Port of Port Angeles, September 2011.

¹⁰⁵ The same process was used to analyze the economic impacts of Ginkgo Trading.

¹⁰⁶ The partial exception was some wage data associated with Evergreen. This investigation, and others conducted by Olympus, reveal Hermann Brothers is one of the highest paying employers in Clallam County.

ESTIMATING DIRECTLY DEPENDENT EMPLOYMENT EFFECTS

The sectoral models of IMPLAN were used to estimate the direct, indirect and induced economic impacts of wood product manufacturers who receive a portion of their wood fiber through the Port Log Yard, as explained in the body of the report. The wood product manufacturers analyzed in this report are Evergreen, Interfor, and Port Angeles Hardwoods. Data values were obtained in the same fashion as that described for direct employment effects. Wage data for Interfor and Port Angeles Hardwoods was taken from QCEW. So too were wages for milling at Evergreen. However, the trucking wages used for Evergreen were used from interview data as the largest employment sector for Hermann Brothers is trucking and Hermann Brothers pays a relatively high wage, including benefits.

Modeling Evergreen

Evergreen, much like the Port Log Yard, also is a nexus in the forest products industry. In 2016 it was the only chipping operation on the North Olympic Peninsula. As a result, of timber harvest for saw logs, chip and saw and pulp logs move to Evergreen for processing before transport to final customers. Thus, part of a saw log moving through the Port Log Yard for export, either international or domestic, moves to Evergreen by truck. The same would be the case for a saw log harvested and sent to Interfor. As illustrated in Figure 2, about 42% of a tree moves to Evergreen for chipping, and 12 percent become hog fuel. IMPLAN multipliers are built using totals flows to construct average FTE, and significantly underestimate “jobs in the woods” as supported by Evergreen’s expenditures, and Port Townsend Paper Company’s expenditures for raw materials. A detailed model of these relationships was beyond the scope of this study. At the same time, Olympus wanted to reasonably capture Evergreen’s economic impacts. Working with input from Bill Hermann, a partial solution was found.

As the overarching objective was to estimate the direct and directly dependent effects of the Port Log Yard, only wood fiber moving through the Port Log Yard has been analyzed. This is less than half the total volume moving through Evergreen. Thus, the impact analysis presented in the economic impacts of the Port Log Yard significantly biases downward the contributions of Evergreen. The employment and income effects associated with Merrill and Ring operations have been excluded because the Port Log Yard is not used, though the Marine Terminal is. In 2016, 43.6 MMBF of saw logs moved through the Port Log Yard. As a saw log has the equivalent of 0.96 in chip and saw and pulp logs (0.43/0.45), that 43.6 MMBF corresponds to 41.9 MMBF of wood fiber equivalent that moved through Evergreen for processing into wood chips and transport.¹⁰⁷ To capture the “jobs in the woods” supported by that volume, table 3 can be used. The FTE for NAICS 113 Commercial Logging and 115 Forest Preparation and Management were necessary to harvest the 43.6 MMBF moving through the Port Log Yard. For every MMBF moving through the Port Log Yard, 0.96 MMBF moved to

¹⁰⁷ For every log that is loaded onto a ship for export, 0.96 logs graded as chip and saw and pulp logs move to Evergreen. On a volume basis, about half of the jobs supported in the woods for export and local milling are supported by Evergreen’s operations. This is the major reason Evergreen is so difficult to analysis in terms of economic impacts.

Evergreen. Thus, about half of the FTE in those sectors were directly dependent on Evergreen.¹⁰⁸ Evergreen supports about 2 FTE in NAICS 115 and 25 FTE in NAICS 113 by way of the flow of saw logs through the Port Log Yard.¹⁰⁹ These values were used to construct a regional impact model for this subset of Evergreen's operations, the results of which appeared in Table 3.

Direct employment for Evergreen was estimated using the 21 reported FTE (mill workers and drivers) as NAICS 321 (IMPLAN 134, Sawmilling) wood product manufacturing. Direct impacts also include the 2 FTE in NAICS 115 and 25 FTE in NAICS 113.¹¹⁰ Indirect impacts also contain commercial logging and forest preparation and management, expected as Evergreen's operations and expenditures feedback into the forest supporting additional jobs. Olympus tested the efficacy of these assumptions, and others as well. Given the scope of this investigation, the economic impacts of the "jobs in the woods" correspond to the total FTE to produce the 41.9 MMBF of chip and saw and pulp logs going to Evergreen as a result of the 43.6 MMBF moving through the Port Log Yard. Indirect effects include additional employment in Commercial logging, expected given spillover effects, especially as additional truck transport of related businesses that include other wood product manufacturers. Thus, Table 5 provides a "reasonable" approximation of the economic impacts of Evergreen as directly dependent on the Port Log Yard. However, these values mask the overall economic impacts associated with Hermann Brothers. There is not straightforward solution to analyzing that nexus within the context of this study. Indeed, it would be a comprehensive study in and of itself.

Modeling Interfor and Port Angeles Hardwoods

The FTE values of 125 and 83, respectively, were obtained from interviews. Wages came from QCEW. IMPLAN sector 134, Wood Product Manufacturing, was used to estimate indirect and induced impacts. Paid compensation was separated from proprietor income to better reflect average monthly wages. Proprietors are included in FTE for indirect and induced employment impacts, which bias the average wage downward. The reader may note that indirect employment pays more on average in directly dependent employment effects than under direct employment effects. The reason is that forest preparation and management and commercial logging – appear as indirect effects in the supply chain for directly dependent employment effects. This has a significant impact on the estimated average wage as employment in commercial logging pays an average of \$4,764 with LWP = \$777. This weight the average for indirect employment upward relative to that seen under direct employment effects: \$4,556 versus \$2,339. The difference reveals that, on average, employment in commercial logging provides living wage employment.

The reason for modeling the two effects – direct and directly dependent – is straightforward. When analyzing direct employment effects, FTE began in the forest and continued through Port Log Yard operations. This was necessary, first, given the overarching

¹⁰⁸ This is a general and approximate assumption, reasonable given the estimation needs in this section. The goal is to give the reader an approximate idea of what individual businesses contribute to the economy where and how.

¹⁰⁹ In actuality, Evergreen supports far more than this as the primary chipping operation in Clallam County.

¹¹⁰ Wages came from QCEW. For NAICS 115, QCEW for 2015 was used as values were "zeroed out" for 2016.

objective. Second, given the unique organizational structure forest operations had to be integrated with the Port Log Yard. Otherwise, IMPLAN would not make the connection under standard assumptions. While forest operations could have been modeled as indirect impacts, the overarching objective led Olympus to include them in direct effects. Total employment and total wages were not affected by this assumption, only the line in which those values appear.