TABLE 5.—*Freight traffic, Blaine Harbor*

Item	Traffic in tons		
	1947	1948	1949
Foreign imports:			
Animals and animal products: Fish and shellfish	6	3	
Wood, unmanufactured	13,784	9,713	
Manufactures and miscellaneous		59	
Subtotal	13,790	9,775	
Foreign exports:			
Fish and fish products, canned	3,639		
Machinery and miscellaneous			13
Domestic coastwise receipts:			
Manufactures and miscellaneous:			
Food products: Canned salmon	12,768	17,900	8,968
Machinery, vehicles, accessories			8
Miscellaneous	4	95	35
Subtotal	12,772	17,995	9,011
Domestic coastwise shipments:			
Animals and animal products	17		71
Vegetable food products		19	125
Vegetable products, inedible			18
Products of mines: Salt	118		
Products of forests:			
Logs and piling		602	
Lumber, shooks, and cooperage stock	7	541	
Nonmetallic minerals			10
Manufactures and miscellaneous:			
Boxes, paper, lumber, and fiber	631	853	470
Metals and manufactures	102	490	161
Machinery and vehicles			73
Miscellaneous	2,164	1,517	691
Subtotal	3,039	4,022	1,619
Internal receipts:			
Products of agriculture: Vegetable food products	35	61	304
Products of mines:			
Salt	149		
Riprap stone, nonmetallic minerals		1,198	35
Products of forests:			
Rafted logs	22,036	8,832	11,555
Lumber, wood manufactures, paper	828	225	435
Manufactures and miscellaneous:			
Fuel oil, lubricants	237	323	
Canned salmon	900	197	
Metals and manufactures	279	320	222
Chemicals and related products			22
Miscellaneous	1,117	320	186
Subtotal	25,581	11,476	12,759
Internal shipments:			
Products of forests:			
Rafted logs		2,059	
Shooks	6		
Manufactures and miscellaneous:			
Canned salmon	10,035	13,238	11,382
Miscellaneous	73	148	8
Subtotal	10,114	15,445	11,390
Local receipts and shipments:			
Fresh fish and crabs	5,062	911	2,512
Animal products, fish scrap	48		31
Subtotal	5,110	911	2,543
Grand total, all traffic	74,045	59,624	37,335

46. The statistics in table 5 are considered to be representative of normal traffic in Blaine Harbor, with minor exceptions such as the riprap stone which applied to a special harbor-construction job and is therefore not a usual commodity for the harbor. The 1948 tonnage

for fish was unusually low as compared with the 1947 total of 5,062 tons and the 1949 total of 2,543 tons. The low tonnage resulted from 1948 being an offcycle year for the run of pink salmon, the principal species of fish caught in the Point Roberts area, and from price disagreements between fishermen and processors.

47. A comparison of annual tonnage in fish commodities handled at the port facilities in Blaine Harbor proper shows an average annual tonnage of 808 for the years 1925 to 1936 (prior to initial construction of the small-boat basin), an average of 1,266 tons for the years 1936 to 1945, and 2,649 tons for the years 1945 to 1949. As these increases are consistent with harbor and terminal improvements, it may be reasonably expected that substantial increase in fishing traffic would result from future extension of the basin and provision of additional terminal and fish-processing facilities.

48. *Vessel traffic.*—A record of the trips and drafts of vessels operating in Blaine Harbor is shown in table 6 for the years 1947 through 1949, as adapted from annual reports of the Chief of Engineers. The statistics include trips by fishing vessels only when carrying cargo.

TABLE 6.—*Trips and drafts of vessels, Blaine Harbor*

Full load draft (feet)	Inbound and outbound combined				
	Steamers	Motor vessels	Barges	All other	Total
1947					
28 to 30	2				2
26 to 28	2				2
24 to 26	2				2
18 to 20	2				2
16 to 18	1	10			11
14 to 16	1	1			2
12 to 14		64	2		66
Under 12	9	7,499	8		7,516
Total	19	7,574	10		7,603
Net registered tons	52,091	141,602	6,448		200,141
1948					
26 to 28	1				1
24 to 26	2				2
22 to 24	3				3
20 to 22	2	1			3
18 to 20	2	4			6
16 to 18	2	5			7
12 to 14		36			36
Under 12		4,648	6	11	4,665
Total	12	4,694	6	11	4,723
Net registered tons	47,437	112,701	2,626	73	162,837
1949					
24	1				1
22 to 24	1				1
20 to 22		2			2
18 to 20	1				1
16 to 18	1	2			3
14 to 16	1				1
12 to 14		4			4
Under 12	1	9,133		12	9,146
Total	6	9,141		12	9,159
Net registered tons	26,258	141,276		110	167,644

49. The deep-draft vessel traffic stems from the Alaska Packers Association operations at Semiahmoo. The trips and drafts shown in table 6 are representative of the present normal traffic. The tabulated shallow-draft traffic consists of barge and log-raft towing, small Puget Sound freighters, and fish-boat landings. This last group represents about 95 percent of the motor-vessel traffic in the less than 12-foot-draft classification, the landings in 1947 amounting to about 3,570, and in 1948 to about 2,208. In 1949 fish landings totaled 4,464. In addition to these trips, fishermen who base at Blaine but sell their catch to buyers on the fishing banks make frequent trips into the harbor to obtain fuel, supplies, and services, for weekend moorage and for refuge from storms. Information from reliable local sources indicates that local and transient fishing vessels average about 6,570 round trips a year to Blaine Harbor for all purposes. In addition to the commercial traffic, local pleasure craft average about 800 round trips and transient pleasure craft 200 round trips annually.

50. Statistics furnished by the port of Bellingham show that 54 fishing boats are permanently based at Blaine. This local fleet has grown at the rate of seven boats a year in recent years. An average transient fishing fleet of 300 uses the harbor regularly during the fishing seasons, but in some years as many as 500 have sought shelter in the harbor during storms. This permanent and transient fleet using Blaine Harbor represents the entire fleet normally operating each season on the adjacent fishing banks, and is responsible for the catch of 7,994 tons (1949) given in paragraph 17. About 23 pleasure boats base at Blaine. Growth of this fleet has been retarded by lack of adequate moorage. Local interests estimate that the number of pleasure boats would be doubled within 3 years if additional moorage were available.

II. SMALL-BOAT HARBOR

51. *Difficulties attending navigation.*—Because Blaine Harbor is the nearest United States port to the productive salmon and bottom-fishing banks of Georgia Strait and Point Roberts and the productive crab-fishing areas of Birch and Boundary Bays, fishermen have made increasing use of it as a base of operations. Although Drayton Harbor is a landlocked cove, storm winds are funneled northward over the lowland southeast of the harbor by adjacent hills, striking the harbor with considerable force. Winds sweeping into the harbor across Semiahmoo sandspit have a similar effect. Although the fetch of open water in Drayton Harbor is limited, the turbulence caused by these winds converging from different directions creates a hazard to small craft that attempt to anchor in the open waters of the harbor. To alleviate this hazard, local interests have constructed a protected small-boat harbor at Blaine of sufficient capacity to accommodate adequately only the locally owned fishing and pleasure craft fleets. The nearest other small-boat harbors are those at Bellingham and Anacortes, 40 and 53 nautical miles distant, respectively. Fishing vessels from these and more distant Puget Sound ports are using the Blaine Basin in increasing numbers, particularly when caught in storms on the nearby fishing banks and during the weekend periods when fishing is prohibited. Consequently the basin has become overcrowded and congested. Local interests have reported instances when numerous small craft were forced by lack of moorage to anchor in the open waters of Drayton Harbor or seek shelter at more distant ports.

52. The necessity of mooring vessels in close quarters, frequently as many as eight abreast, results in rubbing and battering of hulls, excessive wear and scraping of paint, with consequent rapid deterioration of hulls. Lines are chafed and fouled, often resulting in swamping of boats. The congestion increases fire hazards, with resulting higher marine-insurance costs, and requires extra vigilance and precaution by vessel owners. Craft anchored outside the basin must be constantly guarded to avoid storm loss or damage. Instances have been reported of vessels breaking loose from their anchorage and washing ashore or crashing into other craft, causing damage to both vessels. The damages, losses, higher marine-insurance costs, and precautionary measures are estimated by local interests to total about $24,380 annually, of which $1,720 are sustained by the locally owned pleasure-craft fleet, $9,450 by the local fishing fleet, and $13,210 by the transient fishing fleet. These estimates are considered to be reasonable. Lack of moorage space frequently induces anchorage of boats in the fairways of the basin. This crowding results in considerable loss of time to fishing and other boats in proceeding to and from the berths or calling at the wharves for service or unloading. Lack of space in the local harbor also often forces fishing vessels to seek moorage at more distant ports thus using for travel, time that could be devoted to fishing.

53. *Plan of improvement—small-boat basin.*—Of several boat-harbor plans considered, the one shown on the accompanying map was found to be best adapted to the immediate and prospective needs for additional moorage facilities. This plan provides for (*a*) construction of a rubblemound breakwater about 1,500 feet long south of the existing basin and proposed extension; and (*b*) dredging to provide an additional moorage area of 14.7 acres shoreward of the existing basin at a minimum depth of 12 feet at mean lower low water and to provide an entrance channel to the addition, 100 to 150 feet wide and 12 feet deep. In addition, the proposed project would include Federal maintenance of the existing 850-foot section of locally constructed breakwater consisting of 2-step pile construction with rock reinforcement. This section is considered necessary for adequate protection of the enlarged basin. Elimination of even the inner leg of this section would expose the fish wharf and float at the southerly end of the port fill and the adjacent harbor area to wave action from the prevailing southerly and southwesterly storms sweeping over the full length of Drayton Harbor. Protection of this area by extension of the new breakwater would result in excessive cost because of the depth of water. Local interests would provide and maintain suitable moorage and service facilities and necessary bulkheads for retention of dredged material that would be used for extending the existing fill. They would also be expected to divert an existing storm sewer from the basin site, to maintain the dredged basin to project dimensions, and to continue maintenance of the existing pile-breakwater sections at the entrance to the basin. The work can be accomplished in less than 1 year. The basin extension would provide moorage space for 375 boats. The existing basin and this extension would thus have a total capacity of 485 boats, which is considered adequate for the immediate and foreseeable needs.

54. The proposed rubble-mound breakwater would have a top width of 6 feet, an elevation of 15 feet above mean lower low water, and side slopes of 1 on 1½. About 37,000 tons of rock would be required, allowing 10 percent for subsidence. Probings in the proposed breakwater location indicate the bottom to be suitable for a foundation. A suitable quarry is available at Mats Mats Bay on the westerly shore of Puget Sound, about 65 nautical miles from Blaine. The breakwater location was chosen with a view to (1) providing a separate entrance for boats that will use the proposed mooring basin, thus avoiding congestion and the consequent fire hazards that would arise from the provision of only one entrance; (2) providing means by which the fishing and pleasure craft moorages can be segregated into entirely separate areas, each having its own access to open water; (3) providing the maximum moorage area adjacent to the present fill area; (4) obtain the greatest possible protection for both the existing and proposed mooring basins from the existing breakwater without necessitating the removal of any portion thereof; (5) providing the maximum protection against southerly and southwesterly storm waves and minimize the passage of wave trains into the basin; and (6) providing protected area, without any material increase in cost, for future dredging should the need arise for additional moorage space in the unforeseeable future. The location selected would allow future dredging of an additional 7.5 acres of protected moorage area, should need for it arise.

55. The proposed basin and entrance channel would require dredging 470,000 cubic yards to provide a depth of 12 feet with 1 additional foot for overdepth. Probings in the basin area showed the material to be mainly loose, silty sand, and gravelly sand overlaying well-compacted sandy and gravelly clays. The compaction is not considered sufficient to hinder seriously the operation of a suction dredge. A portion of the dredged material would be deposited adjacent to the E Street approach as an extension of the existing terminal fill and any remaining excess material would be deposited on the tide flats north of the approach. As the basin (and breakwater) would be shoreward of the existing Federal pierhead line, and as Federal funds cannot be expended for dredging shoreward of this line, it would be necessary to secure modification of the line before the work could be undertaken as part of a Federal project. The tide flat area at the proposed site is owned by the city of Blaine.

56. *Aids to navigation.*—Officials of the 13th Coast Guard district have stated that a light would be required on the seaward end of the proposed breakwater. The light would be erected on a wood platform supported by a single steel pile. The pile would be placed prior to construction of the rubble-mound breakwater.

57. *Shoreline changes.*—The foreshore of Blaine Harbor is composed largely of sedimentary deposits, consisting chiefly of medium to fine sand and gravel overlaying well compacted sandy and gravelly clays. The Great Northern Railway extends along the back shore berm. There is no indication of a predominant direction of littoral current within the harbor. As the existing earth-fill, basin, and breakwater have shown no adverse effect on adjacent shores, no detrimental effect is anticipated from the proposed construction.

58. *Estimate of first cost.*—On the basis of April 1950 prices, the first cost of the proposed improvements is estimated as follows:

(*a*) Federal first cost:		
(1) Breakwater, 37,000 tons of rock at $4	$148, 000	
(2) Dredging, 470,000 cubic yards at $0.44	206, 800	
(3) Total cost to Corps of Engineers	354, 800	
(4) Aids to navigation (by U. S. Coast Guard)	2, 000	
(5) Total Federal first cost		$356, 800
(*b*) Non-Federal first cost:		
(1) Lands and rights-of-way	$10, 000	
(2) Bulkhead, 1,350 linear feet	33, 750	
(3) Moorage facilities:		
(*a*) Floats, 6,900 linear feet	82, 800	
(*b*) Ramps and approaches	300	
(4) Utilities:		
(*a*) Water-supply system	8, 500	
(*b*) Electrical distribution system	6, 500	
(5) Sewer diversion	11, 500	
(6) Roads, parking and work areas	20, 000	
(7) Webhouse	24, 000	
(8) Total non-Federal first cost		197, 350
(*c*) Total first cost		554, 150

59. *Estimate of annual charges.*—The annual charges are estimated to be as follows:

(*a*) Federal annual charges:		
Federal first cost, $356,800		
(1) Interest, at 3 percent	$10, 700	
(2) Amortization (50-year life at 3 percent)	3, 160	
(3) Maintenance:		
(*a*) Proposed breakwater	3, 000	
(*b*) Existing combination timber pile and rock breakwater	5, 000	
(*c*) Aids to navigation	130	
(4) Total Federal annual charges		$21, 990
(*b*) Non-Federal annual charges:		
Non-Federal first cost, $197,350		
(1) Interest, at 3½ percent	$6, 910	
(2) Amortization (50-year life at 3½ percent)	1, 510	
(3) Maintenance of mooring basin, moorage facilities, bulkhead, roads and utilities	9, 750	
(4) Operation of moorage facilities	3, 500	
(5) Gross annual charges	21, 670	
(6) Less revenue from operation	11, 750	
(7) Net non-Federal annual charges		9, 920
(*c*) Total annual charges		31, 910

60. *Estimate of benefits.*—Based on a liberal space allowance, the proposed improvements would provide sheltered moorage for about 375 boats in addition to the 110 vessels that can be adequately accommodated in the existing basin. The proposed improvements, together with the existing facilities, would provide ample space for the existing boats in Blaine Harbor, for boats transferring from other localities, for new boats to be added as a result of the normal increase in boat population during the life of the project, for the increasing

transient traffic, and for new pleasure craft to be added in the first few years as a direct result of the improvement. The improvements would directly benefit the fishing industry, recreational boating and related activities. Benefits evaluated herein are incremental to those now enjoyed and include elimination of damages, losses, and precautionary expenses to fishing and pleasure craft, elimination of operating expense incurred through the necessity of seeking shelter at more distant ports during storms, increased fish catch resulting from time savings, increased recreational returns from pleasure boating, and miscellaneous benefits.

61. *Fishing industry.*—The proposed improvement would eliminate damages, losses, and precautionary expenses incurred by fishing vessels because of congestion in the existing harbor and the necessity of anchoring in open water when moorage is not available within the existing basin. Data obtained from local fishermen and other sources indicate that the average annual expenditures for repair of damages, replacement of losses, precautionary measures, and extra maintenance total $18,000.

62. Because of the uncertainty of obtaining moorage at Blaine and the hazards of anchoring in the open water of Drayton Harbor, some of the fishing-vessel operators caught in storms while fishing in the vicinity of Blaine Harbor must occasionally seek shelter at more distant harbors, with consequent loss of time and increase in operating expenses. The total number of such trips to distant ports annually is not available, but a local survey of boat traffic in Bellingham Harbor during storms in the 1949 fishing season showed an average of 10 vessels from the fishing banks near Blaine sheltered at Bellingham. The average time for a round trip to the fishing banks from Blaine is 3 hours and from Bellingham 8 hours. The operating expense for such items as fuel, lubricants, and boat repair and maintenance for the various types of fishing vessels operating in the vicinity of Blaine ranges from about $1.36 to $4.80 an hour, with an average of about $2.63. Storms during the fishing season occur with a frequency ranging from 1 to 5. Assuming a conservative average of 2 storms a season, the 10 boats now sheltered at Bellingham would save a total of 100 boat-hours a season by utilizing the improved harbor at Blaine, their owners thus aggregating direct savings of $263 seasonally in operating costs. These savings are considered to be a general benefit as they would be, in effect, a reduction in the cost of fish production which would presumably result in lower fish prices. This time savings could not be converted to productive fishing time as it would accrue during storm conditions when fishing is usually not possible.

63. Congestion in the existing basin impairs the movement of vessels to and from moorages and wharves resulting in loss of time that could be devoted to productive fishing. Elimination of this congestion would enable fishermen to arrive at the fishing banks earlier and remain there longer, and thus enable them to correspondingly increase their catch of fish without additional capital outlay. It is estimated that under existing conditions an average of 20 minutes a trip is lost by each fishing vessel calling at Blaine. Of the 6,570 round trips made annually by fishing vessels to Blaine Harbor for all purposes, it is estimated that not more than two-thirds, or about 4,400 trips, are made at such times and circumstances during the

fishing season that any time savings accruing during the vessels' stay in the harbor would presumably be devoted to additional fishing. Elimination of the 20-minute delay each trip would thus result in a total time savings of 1,467 boat-hours annually. Based on the types of fishing engaged in by the Blaine fleet, a season of 32 weeks averaging 45 hours of fishing each week, and the amount of fish landed in recent years, it is estimated that the 1,467 boat-hours, if devoted to fishing, would result in an increased fish catch of about 88,000 pounds annually, which would have net value of about $5,410 after deducting boat operating and other trip expenses such as bait, ice, repair and maintenance of fishing gear. No additional crew time or expense would be involved as the time saved would merely be transferred from a nonproductive to a productive operation. As this catch would be an increase in the Nation's basic food supply, the net benefit would be general in scope. This estimate is considered conservative as it does not include the future normal increase in the transient and permanent fishing fleet operating from Blaine Harbor.

64. Local interests assert that numerous inquiries relative to the availability of permanent moorage and webhouse space have been made by owners and operators of fishing craft now based at other ports on the inland and coastal waters of Washington and at Alaskan ports. The inquiries indicate that the fishermen are desirous of transferring their base of operations to Blaine for the following reasons: (*a*) its advantageous location with respect to the salmon and bottom fishing banks of the Strait of Georgia and Point Roberts area would enable them to save travel time and operating expenses; (*b*) they would be able to spend weekend periods with their families and yet be sufficiently near their boats for exercising proper vigilance and for making minor repairs to boats and fishing gear; (*c*) the proximity of Blaine to the fishing grounds would enable them to observe the sea and weather conditions on the grounds and thus enable them to make additional fishing trips which moorage at other ports would not permit; (*d*) the smaller city would offer certain other advantages. Local interests state that a minimum of eight fishing vessels now based at other ports on the inland waters of Washington would transfer their base of operations to Blaine within a short time if adequate protected moorage is provided. These vessels now make an average of 13 trips annually from their home ports to the fishing banks on Georgia Strait and the Point Roberts area. It is estimated that each of these vessels requires an average of 13½ hours more to make a round trip from its present base to the fishing banks than would be required from Blaine, which is equivalent to 1,400 boat-hours of nonproductive travel time a year. By basing at Blaine, the 8 boats could and probably would utilize the 1,400 hours in productive fishing and consequently increase their fish catch about 84,000 pounds annually. As transfer of the nonproductive travel time to productive fishing time would involve no change in capital outlay, vessel operating cost, or crews' time, the net value of the increased fish catch would be its value at the fishermen's price level less expenses incidental to fishing operations. The net value of the catch is thus estimated to be about $8,850.

65. *Pleasure craft.*—The Strait of Georgia, with its numerous islands, is an attractive pleasure cruising and salt-water sports-fishing area. This area being within easy reach from Blaine, the proposed improve-

ments would materially increase its recreational uses. Lack of adequate moorage facilities has retarded pleasure boating activities in the harbor and vicinity, and has precluded purchase of new boats by local residents. When segregated moorage facilities for pleasure craft become available the local fleet and visits by transient craft are expected to increase materially. To accommodate the anticipated increase in transient traffic, local interests are planning on reserving at least 25 berths for transient use in addition to those to be reserved for the local fleet. The permanently based pleasure craft fleet is estimated to average at least 70 boats over the project life of 50 years, of which 50 would represent the existing fleet and the normal increase over the next 10 years only, and 20 would represent new boats acquired as a direct result of the harbor improvement. It is further estimated that about 240 transient boats would spend an average of 4 days each, or 960 boat-days, annually in the harbor, which would be equivalent to full-time use of the harbor by 4 boats over the 8-month cruising season.

66. Because of the prevailing congested condition in the existing basin, the present fleet of 23 pleasure craft incurs an annual monetary loss of about $1,700, or $75 a boat, resulting from vessel losses, repair of damages, and extra precautionary measures. For the expected annual average of 50 boats the monetary loss would total $3,750 if adequate protected moorage is not available. The proposed harbor extension would eliminate these annual expenses.

67. Elimination of congestion and resultant inconveniences would correspondingly increase the recreational benefits enjoyed by pleasure-craft owners. To evaluate in monetary terms the recreational benefits derived from ownership and operation of a pleasure boat, it is assumed that the recreational value of boating is a function of the capital investment and that the net benefits must exceed the costs or the recreationist would not pay them. It is therefore assumed that the net recreational benefits are comparable to the normal net return on the depreciated capital investment in pleasure boats operated for hire, after all expenses have been paid.

68. The 50-boat fleet, with respect to type and depreciated value of boats, is expected to be composed as follows: 13 outboards, at $400; 13 inboards, at $700; 24 cruisers, at $1,800. Taking into account the time spent by this local fleet away from the harbor, it is estimated that if normal conditions prevailed, the recreational benefits would be equivalent to net returns of 12 percent on the depreciated value of outboards, 11 percent on the value of inboards, and 7 percent on the value of cruisers. Using these factors, the recreational benefits for the 50 boats would total $4,640 a year under normal conditions. It is estimated, however, that with the lack of harbor space for pleasure craft which necessitates moorage of these craft in space normally designed for commercial fishing craft, owners of outboard motorboats realize only 50 percent and owners of inboard motorboats and cruisers realize only 75 percent of these possible benefits. As the proposed

improvements would make possible their full realization, they would, in effect, increase the annual benefits now enjoyed by $1,310.

69. Information from reliable sources indicates that lack of moorage for pleasure boats in Blaine Harbor has resulted in the loss of about 20 boat sales in recent years and that provision of additional space and protection would be reflected in increased sales. It can be reasonably expected that within 5 years after completion of the proposed improvements a total of 20 new boats would be acquired in addition to the normal rate of increase. In calculating the benefits to be derived from stimulation of boat sales, acquisition of 20 boats within 5 years would be equivalent to having an average of about 19 during the 50-year estimated life of the project. Assuming classification, depreciated capital value, and percentage of returns under normal conditions to be the same as in the preceding paragraph, the total recreational benefits for the 20 new boats would be $1,750, which would be entirely attributable to the harbor improvement. In addition to the benefits to be realized by the locally based and new fleets, the 240 transients would receive benefits during their use of the harbor. As indicated in paragraph 65, these 240 transients would be equivalent to 4 permanently based boats. Assuming that they are cruisers, and would be subject to recreation returns similar to the new boats acquired by reason of the proposed improvements, the annual benefit for them would amount to $500.

70. The new land to be created by deposit of the material removed from the proposed basin and entrance channel would be utilized in part by enterprises connected with fishing and pleasure craft activities from which local interests expect an annual rental income of $2,000. As this income would be entirely a local benefit, and would offset in part local annual charges, it has been included in item (*b*) (6) of paragraph 59.

71. Assumption by the Federal Government of maintenance on the rock-reinforced portion of the existing breakwater would reduce local maintenance costs for the existing basin by an average of $5,000 annually. Adequate maintenance of this section of breakwater is essential for complete protection of the proposed basin and entrance channel to it, and for continued realization of the benefits now accruing from the present small-boat harbor.

72. The improved harbor would aid materially in further stabilizing the economy of the locality through its enhancement of business activities related to commercial fishing and recreational boating. It would provide a harbor of refuge for small craft such as rowboats caught in squalls while engaged in salt-water sports fishing. These small craft are generally kept in dry storage when not in use and therefore are not included in the foregoing calculations of pleasure craft benefits. Although evaluation of these benefits on a monetary basis is not practicable, they would increase the value of the basin to the community and to the general public.

73. The benefits evaluated in the preceding paragraphs are summarized and distributed between general and local interests as follows:

	Total	General	Local
(a) Fishing craft:			
(1) Elimination of damages, losses and expenses for their prevention	$18,000	$18,000	
(2) Elimination of operating expense incurred in seeking shelter at more distant ports	263	263	
(3) Net value of increased fish catch	14,260	14,260	
(b) Pleasure craft:			
(1) Elimination of damages, losses, and expenses for their prevention	3,750	1,875	$1,875
(2) Increased benefits to existing locally based craft	1,310	655	655
(3) Recreational benefits to new craft	1,750	875	875
(4) Recreational returns to transient craft	500	250	250
(c) Savings in local maintenance of present small-boat harbor	5,000		5,000
(d) Total	44,833	36,178	8,655
(e) Percent	100	80.7	19.3

74. *Comparison of benefits and costs.*—The annual benefits and costs of the proposed improvements are compared as follows:

(a) Annual benefits	$44,833
(b) Annual costs	31,910
(c) Ratio, benefits to costs	1.40

75. *Proposed local cooperation.*—The extent of cooperation offered by local interests is outlined in paragraph 40. As an essential feature of Federal participation in the proposed plan of improvement, local interests should be required to furnish assurances that they will—

(a) Furnish free of cost to the United States all lands, easements, disposal areas, and rights-of-way necessary for the construction and maintenance of the improvement when and as required, including title to that portion of the existing breakwater to be maintained by the Federal Government;

(b) Hold and save the United States free from damages that may result from the construction and maintenance of the improvements;

(c) Construct and maintain necessary bulkheads for retention of the dredged material;

(d) Accomplish and maintain alterations as required in water supply, sewer, drainage and other utility facilities, including diversion of the existing sewer draining into the area to be used for basin extension.

(e) Maintain the present mooring basin to a depth of at least 12 feet below mean lower low water, maintain that portion of the existing breakwater not included in the Federal project, and maintain the basin extension to project dimensions.

(f) Construct, maintain, and operate without profit necessary mooring facilities, utilities, and a public landing with suitable service and supply facilities open to all on equal and reasonable terms.

76. *Allocation of costs.*—In general, the costs of the proposed improvements would be allocated between Federal and local agencies as indicated in the cost analysis heretofore made. The Corps of Engineers would bear the first cost of constructing the breakwater and dredging the basin extension, estimated at $354,800, and the annual cost of maintaining the proposed breakwater and the reinforced portion of the existing breakwater, estimated at $8,000. The United States Coast Guard would assume the cost of $2,000 for aids to navigation and $130 annually for their maintenance. Local interests would bear the first cost of lands and rights-of-way, bulkheads, sewer diversion and additional moorage, terminal and utility facilities, estimated at $197,350; and the annual cost of maintaining the moorage basin to project dimensions and of maintaining and operating the moorage, terminal and utility facilities, estimated at $13,250. However, of the gross local charges, only $9,920 would be non-self-liquidating, which in effect would represent the extent of local contribution to the cost of the project on an annual basis. Local benefits constitute 19.3 percent of the annual benefits. In comparison, the local item of $9,920 amounts to about 31 percent of the net annual cost, thus indicating that no further cash contribution should be required of local interests.

77. *Coordination with other agencies.*—During the course of this investigation, consultations were held with representatives of pertinent Federal agencies, such as the United States Coast Guard and the United States Fish and Wildlife Service, and interested State and local governmental agencies, such as the Washington State Departments of Fisheries, Game, and Health, the Port Commission of Bellingham, and the City Council of Blaine. All agencies have approved the plan in general. The responsible local agencies have given assurance of their cooperation in its accomplishment and have indicated their ability to meet the proposed conditions of local cooperation.

78. *Discussion.*—Blaine Harbor is advantageously situated with respect to the fishing banks and cruising areas of Georgia Strait and particularly the Point Roberts area. It is the nearest United States port to the international boundary and to Alaska. Because of its natural advantages, land transportation connections, and harbor improvements made by local interests, it has become increasingly important as a fishing, fish processing and distributing center. In addition to the local fisheries, a large corporation engaged mainly in Alaskan fishing has established its headquarters, storage and distribution facilities, and fishing fleet base at Semiahmoo, across the harbor from Blaine. These activities and the increasing interest in recreational boating have resulted in a substantial increase in use of the harbor as a base for fishing and pleasure craft operation.

79. Although the harbor is protected to a certain extent by Semiahmoo Spit and adjacent lands, storms ranging from southwest to southeast are a source of considerable hazard to small craft in the open harbor of Blaine. As a result of storm damages and the demands of the fishing fleet operating in the area, local interests have constructed a protected small-boat harbor of sufficient capacity to accommodate the locally owned craft plus a small number of transients. Transient fishermen are using the harbor as a base of operations in numbers beyond the expectation of local interests at the time of its construction. The small-boat basin has consequently become increasingly congested and overcrowded, resulting in vessel losses and damages, and delays in entering and leaving the harbor. As local funds are not sufficient to expand the harbor to the extent required

by present and foreseeable needs, local interests have requested Federal assistance in enlarging the present basin.

80. The proposed plan of improvement is essentially that requested by local interests. The improvement would provide a basin for 375 boats in addition to the normal capacity of 110 in the present basin with liberal allowance for access and maneuvering. The total capacity of 485 is considered adequate but not excessive for the present and foreseeable future needs particularly as it will include provision for pleasure boats for which little or no consideration was given in the original local planning. The Corps of Engineers first cost of providing the necessary protection and dredging the basin and entrance channel is estimated at $354,800. The annual cost of maintaining the proposed breakwater and that portion of the existing breakwater considered necessary for protection of the enlarged basin is estimated at $8,000. The Coast Guard would install aids to navigation at an estimated first cost of $2,000 with $130 annually for maintenance. Moorage, terminal, and utility facilities would cost local interests an estimated $197,350. The annual cost of local maintenance and operation of the additional moorage and terminal facilities and maintenance of the mooring basin is estimated at $13,250. Revenue from operation of the additional facilities would offset all but $1,500 of this annual cost.

81. Total net annual charges would be $31,910 of which about 69 percent would be Federal and 31 percent local. Benefits to be derived from the contemplated improvements are estimated to amount to $44,833, of which 80.7 percent would be general and 19.3 percent local. A favorable benefit-to-cost ratio of 1.40 indicates the proposed improvements are well justified. A comparison of the percentages of Federal and local annual charges with respective percentages of annual benefits indicates that proposed local expenditures for non-self-liquidating features of the project constitute a liberal local contribution toward the project.

III. WIDENING OF ENTRANCE CHANNEL

82. *Difficulties attending navigation.*—Lack of a turning basin with sufficient depth hinders ship operation at the Semiahmoo wharf. As tug service is not available in Blaine Harbor, ships must execute a turn in the restricted channel adjacent to the Alaska Packers Association wharf by swinging around under their own power, using their anchors or a line to the wharf as a pivot. This is a difficult maneuver when the prevailing southerly winds are blowing as they tend to crowd the ship toward an isolated shoal about 370 feet northeast, and toward a general shoal area beginning about 470 feet north of the wharf. Ships entering the harbor on flood tides must be turned around before landing because the incoming current causes a ship heading directly toward the wharf to veer from its course so as to make the landing a hazardous operation. With normal wind conditions, ships entering the harbor on outgoing tides can land without turning. These ships, however, must either turn before leaving the harbor or proceed in reverse to deep water in Semiahmoo Bay. Because of the hazards of grounding, and delays necessitated by awaiting favorable tides and winds, steamship companies have indicated a reluctance to consign their ships to Blaine Harbor.

83. Several instances have been reported of ships grounding while attempting to leave the harbor in reverse and of ships striking bottom while attempting to turn around in the restricted channel. Although no damage has been suffered on these occasions, their occurrence nevertheless has caused shipmasters to avoid either maneuver as much as possible except at higher stages of tide. Consequently, ships are frequently delayed in awaiting favorable conditions for entrance to and departure from the harbor. Officials of the steamship company whose ships make most of the calls to the harbor state that these delays have averaged about 1½ hours a round trip or a total of 7½ hours for the 5 calls that ships of 20- to 30-foot draft average annually, resulting in additional ship-operating and cargo-handling costs of about $1,720.

84. *Plan of improvement.*—The proposed improvement would consist of removing a shoal about 370 feet northeasterly of the Alaska Packers Association Semiahmoo wharf to a depth of at least 30 feet below mean lower low water, and of widening the deep-water area adjacent to the wharf to a width of 625 feet at a minimum depth of 30 feet. Including the deep-water area east of the wharf, this improvement would provide a turning basin about 1,500 feet long and 625 feet wide. Local navigation interests have indicated that this width would be adequate for present and foreseeable needs. Soundings in the shoal area indicate several mounds extending above the normal ground line. Probings show the bottom material to be generally sand, gravel, and silt in varying mixtures except the mounds which apparently include remnants of a bargeload of sawmill machinery that, according to recollections of local interests, was lost in the vicinity a number of years ago. The improvement would require about 20,000 cubic yards of dredging, including 1 foot of overdepth and sufficient additional depth in the vicinity of the machinery to allow their disposal by settling below the proposed project depth. The dredged material would be deposited in the nearest deep water in Semiahmoo Bay.

85. *Aids to navigation.*—The 13th Coast Guard District has stated that no additional aids to navigation would be required to mark the turning basin.

86. *Shoreline changes.*—The improvement is considered to have no detrimental effect on the adjacent shoreline.

87. *Estimate of first cost.*—At a unit price of 80 cents a cubic yard as of April 1950, the first cost to the Corps of Engineers for dredging 20,000 cubic yards and disposing in deep water is estimated to be $16,000. No local costs would be involved.

88. *Estimate of annual charges.*—The annual charges on the first cost of $16,000 are estimated to be as follows:

(*a*) Interest and amortization, at 4 percent	$640
(*b*) Federal maintenance	200
Total	840

89. *Estimate of benefits.*—The benefits evaluated herein include savings in vessel-operating costs and reduction in cargo-handling expense now occasioned by delays resulting from inadequate turning width for ships. Investigation and analysis of data submitted by ship operators indicate that the asserted average loss of 1½ hours each trip in awaiting favorable conditions for turning is reasonable and conservative. At an estimated operating cost of $80 an hour, and

using the past average of 5 round trips a year, a total saving of $600 annually would result from an adequate basin that would allow turning of ships under any condition of wind and tide.

90. The ship delays also occasionally result in additional expense in transfer of cargo. To maintain schedules and avoid losses in operations of ships and stevedoring crews, steamship companies must request stevedores at least 7 hours in advance of a ship's arrival to report for duty at or near the time it is scheduled to land. Frequently, after the arrival of the stevedore crew, unforseen changes in wind or current conditions prevent or delay the turning of a ship in the limited channel width preparatory to landing at the wharf. During such delays, stevedores must be paid for nonproductive standby time, which correspondingly increases cargo-handling costs. It is estimated that this nonproductive stevedore time averages about 5 hours annually, elimination of which by provision of a wider turning basin, would result in an annual saving of $650 in cargo-handling costs.

91. The total savings in ship-operating and cargo-handling costs would thus amount to $1,250 annually, which would presumably be passed on to the general public through a reduction in freight rates amounting to about 0.065 cent a ton for the annual average of about 19,000 tons carried by oceangoing ships over the wharf at Semiahmoo in recent years.

92. *Comparison of benefits and costs.*—The annual benefits and costs of the contemplated improvement are compared as follows:

(*a*) Annual benefits	$1,250
(*b*) Annual charges	$840
(*c*) Ratio, benefits to cost	1.49

93. *Proposed local cooperation.*—As the channel improvement would not require furnishing of lands, rights-of-way, or direct local improvements, the only assurance of cooperation that might be required is that local interests hold and save the United States free from property damages that may result from construction and maintenance of the improvement.

94. *Allocation of costs.*—The Corps of Engineers would bear the entire first cost of dredging, estimated at $16,000, and the annual cost of $200 for maintaining the turning basin. As the benefits are considered to be general in character, no cash contribution would be required of local interests.

95. *Coordination with other agencies.*—During the course of this investigation pertinent Federal, State, and local governmental agencies were consulted. All have approved the plan in general.

96. *Discussion.*—Since 1943 there has been a substantial volume of deep-draft-vessel traffic at Semiahmoo at the entrance to Blaine and Drayton Harbors. However, lack of adequate channel width and depth for maneuvering ships has increased operating and cargo-handling costs. Navigation and other interests have consequently requested removal of the shoals restricting the channel width opposite the Alaska Packers Association wharf at Semiahmoo.

97. The proposed plan of improvement provides for widening the channel to a minimum width of 625 feet at a depth of 30 feet below mean lower low water adjacent to the Semiahmoo wharf, at an estimated first cost to the Corps of Engineers of $16,000 and $200 annually for maintenance.

98. Comparison of the annual charges of $840 with the annual benefits of $1,250 to be derived from the improvement shows a favorable benefit-to-cost ratio of 1.49, which indicates that the improvement is well justified. As the benefits are of a general nature, local interests would not be required to participate in the cost of the project.

IV. RELATED SUBJECTS

99. *Water power and other special subjects.*—At the present time there are no problems of water power or supply, flood control, pollution, land reclamation (other than new land developed by deposit of dredged material) or other subjects relating to the conservation of water resources that could be coordinated with the improvements to navigation considered herein. Proponents of the improvement have suggested that material dredged from the boat harbor extension be utilized for extending the adjacent fill or for developing an industrial area north of the filled approach on E Street. Expansion of the existing basin would require alteration of an existing storm drain to avoid filling and contamination of the extended basin.

V. CONCLUSIONS AND RECOMMENDATIONS

100. *Conclusions.*—From data presented and discussed in this report, it is concluded that—

(*a*) Expansion of the small-boat harbor at Blaine would be of sufficient general benefit to commercial fishing and pleasure craft navigation to warrant Federal participation in its accomplishment. To assure adequate protection for the basin as a whole, the Federal Government should also assume maintenance of an 850-foot section of existing breakwater.

(*b*) Benefits accruing to the general public from development of a turning basin by widening the entrance channel to Blaine Harbor at Semiahmoo are likewise sufficient to warrant its accomplishment at Federal expense.

101. As each of the navigation improvements can be accomplished in less than 1 year, the amounts of $354,800 and $16,000 should each be allotted in one lump sum. However, as each improvement is independent of the other, both sums need not be allotted at the same time.

102. *Recommendations.*—In view of the foregoing, it is recommended that a Federal project be adopted for Blaine Harbor, Wash., as shown on the accompanying map, to provide for—

(*a*) Expansion of the existing small-boat harbor adjacent to E Street by (1) constructing a rubble-mound breakwater about 1,500 feet long; (2) dredging 14.7 acres to a depth of 12 feet at mean lower low water as a shoreward extension of the existing mooring basin, with an entrance channel of the same depth and 100 to 150 feet wide; and (3) maintaining about 850 feet of existing breakwater; all at an estimated first cost to the Corps of Engineers of $354,800 and an annual cost of $8,000 for maintenance.

(*b*) Removing shoals in the entrance channel adjacent to the main wharf at Semiahmoo to provide a turning basin at least 625 feet wide and 30 feet deep at mean lower low water, at an

estimated first cost to the Corps of Engineers of $16,000 and an annual cost of $200 for maintenance.

103. It is further recommended that before any work is undertaken by the United States, responsible local interests be required to give assurances satisfactory to the Secretary of the Army that they will, without cost to the United States, (*a*) furnish all lands, easements, disposal areas, and rights-of-way necessary for the construction and maintenance of the boat basin when and as required, including title to that portion of the existing breakwater to be maintained by the Federal Government; (*b*) hold and save the United States free from damages that may result from construction and maintenance of the improvements; (*c*) provide and maintain necessary bulkheads for retention of the dredged material when and as required; (*d*) accomplish and maintain alterations as required in water, sewer, drainage, and other utility facilities, including diversion of the existing sewer draining into the boat-basin area; (*e*) maintain the present mooring basin to a depth of at least 12 feet below mean lower low water, maintain that portion of the existing breakwater not included in the Federal project, and maintain the basin extension to project dimensions; and (*f*) construct, maintain, and operate without profit, adequate mooring facilities, utilities, and a public landing with suitable service and supply facilities open to all on equal and reasonable terms.

E. C. ITSCHNER,
Colonel, Corps of Engineers,
District Engineer.

[First endorsement]

CORPS OF ENGINEERS,
OFFICE, DIVISION ENGINEER,
NORTH PACIFIC DIVISION,
Portland, Oreg., February 27, 1951.

To the CHIEF OF ENGINEERS, UNITED STATES ARMY,
Washington, D. C.:

I concur in the views and recommendations of the district engineer.

O. E. WALSH,
Brigadier General, Corps of Engineers,
Division Engineer.

LIST OF ILLUSTRATIONS MADE IN CONNECTION WITH THE REPORT OF THE DISTRICT ENGINEER

Sheet 1. Location map.
Sheet 2. Proposed improvements.

APPENDIX MADE IN CONNECTION WITH THE REPORT OF THE DISTRICT ENGINEER

(Not printed)

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