directing the line of the shore-beacons a short distance above the upper edge of the cut. The axis of the channel being oblique to the current, shoaling took place gradually until there was scarcely 16 feet along the channel by the latter part of October. In November a survey of the bar was made and the line of deepest water was found to cross the axis of the cut dredged, which had become almost obliterated, with a ruling depth of 18¼ feet at low-water.

The range-beacons were placed to mark the middle line of the channel, and since November there has been no complaint of shoal water on the bar. From Saint Helen's Bar the dredge was taken to Swan Island Bar, 3 miles below Portland, and work commenced September 20. The Willamette River having risen to 6½ feet above low-water, November 19 the dredge was withdrawn and laid up for the winter. Thirteen thousand eight hundred and fifteen cubic yards of sand and drift were removed from this bar, and a depth of 17 feet at low-water gained. No work has been done by the dredge during the last half of the present fiscal year. The following is a summary of the work done during the summer and fall of 1878:

	Days.	Cubic yards removed.
Dredging at mouth of Willamette River	12.8	4,815
Dredging at Saint Helen's Bar	21.1	9,395
Dredging at Swan Island	43.5	13,185
Number of working days	77.4	27,395

Number of days lost by stormy weather, repairs, and other causes, 41.6 days.

The proportion of work done at Swan Island is small in comparison with that at the other bars, owing to the presence of small drift in the material of the bar, which lodges between the teeth of the dipper and causes a large portion of each dipper-full to escape when being raised from the bed of the stream to the dump-scow.

Since the dredge was laid up it has been thoroughly overhauled and cleaned, and all worthless and ruinous property condemned. The examination of the hull showed that a great part of the lower timbers were rotten and very weak, and it was first thought advisable to recommend either its sale or very thorough repairs, but it was finally decided to make only such repairs as would keep it in commission for one or two years. On the 19th February, 1879, I received authority to expend $1,500 in these repairs. The dredge will be in readiness for work by the time the summer freshet has subsided, and will commence at that bar where a survey shall show the least depth of water, probably at the mouth of the Willamette River.

Turning-points of water-curves, 1878–'79, *Lower Willamette, Portland.*

		Feet.
July 1, 1878, annual flood abating		10.5
September 22, 1878	Average, 2.0	0.8
November 10, 1878		1.5
November 22, 1878	Rise in Willamette	7.8
November 30, 1878		3.7
December 4, 1878		7.5
January 2, 1879		0.6
January 25, 1879		8.0
February 3, 1879		2.8
February 28, 1879		15.0
March 23, 1879		7.0
March 29, 1879	Annual rise in Columbia	18.6
April 30, 1879		10.6
June 10, 1879		20.5
June 30, 1879		19.4

The gauge at Saint Helen's was established January 1, 1879. The heights here do not vary from those at Portland.

SURVEYS DURING THE YEAR.

Early in July a survey was made of the upper end of Saint Helen's Bar to determine the best line for dredging a ship-channel. Later in November a survey was made of the upper channel at the foot of Sauvie's Island, and of the lower channel adjacent to the rocky plateau on the Washington Territory side and a zigzag line of soundings was run between them along the bar from side to side to show the changes during the year. It was found that the upper channel which had been dredged during the preceding summer had shoaled sufficiently to require a change in the line of the shore-beacons, and that the lower channel, which had had no improvement for two years, had remained practically unchanged, with about 16½ feet at low stage.

Shoaling at Maxwell's Bar, 3 miles below, having been reported by pilots, a survey was made there on the completion of Saint Helen's Bar survey. Maxwell's Bar is situated ¼ of a mile above Martin's Island, on the eastern side of the river, the western half of the river bed, for ½ a mile above and below, being formed of loose pebbles and shingle similar to the rocky bed at Saint Helen's, with 5 to 12 feet water. The survey showed a least depth in the ship-channel of 19½ feet at low-water and a width of 900 feet between the 18-foot curves. Near the middle of the channel were found three small knobs, close together, with only 17½ feet of water. The impression that the bar was shoaling was probably due to vessels rubbing on these points. The bar is composed principally of loose sand, and whilst no improvement is recommended, it might be well to indicate the position of the projecting knobs by buoys.

During the same month (November) careful soundings were carried over Swan Island Bar to direct the operations of the dredge, then at work at that point, and the northern shore-line of the river, which had suffered to some extent from erosion during freshets, was resurveyed and bench-marks which had been carried away were re-established.

In March of the present year soundings were taken in Coon Island Slough, one of the mouths of the Willamette, and in Willamette Slough near its head, both for the purpose of locating proposed improvements. The first named slough has greatly shoaled during the past two years, and it is probable that the improvement projected for it need not be taken in hand until after the construction of other works deemed more important. Water-gauges graduated to feet and half-feet, with figures 6 inches long, have been set at the following points:

At Brownsport, on the Lower Columbia, for the bar at Hog's Back (near Woody Island);
At Columbia City and at Warrior Point, opposite the mouth of Lewis River, for Saint Helen's Bar; and
At the mouth of the Willamette for the bar at that point and for Post-office Bar.

These gauges indicate the exact stage of the tide, and being located in full view from the ship-channel, pilots approaching with deep-draught vessels can tell at a glance whether to cross the bar at once or wait for a higher stage of tide. The outer end of Three-Tree Island, inside the mouth of the Willamette River, has been marked by the Light-House Department with a day beacon. This aid has given great satisfaction to the commercial public, and the necessity for it has long been felt on account of the island being small in extent, lying close to the main ship-channel, and being submerged at medium stage of water.

MOUTH OF THE COLUMBIA RIVER.

A survey of the bar at the mouth of this river was made by Lieut. A. H. Payson, Corps of Engineers, August to November, 1878, under

direction of Major Wilson. Lieutenant Payson's report, dated November 16, 1878, accompanied my report to the Chief of Engineers dated December 18, 1878, and both were published in Ex. Doc. No. 50, Forty-fifth Congress, third session.

SURVEY OF SAND ISLAND, MOUTH OF COLUMBIA.

The annual survey of the shore line of Sand Island, made in April of this year, shows that but little change in the shape and position of the island has taken place since the last survey. During the preceding ten years the south shore line has moved annually 202 feet in a direction north-northwest. The distance advanced last year in the same direction was only 40 feet at the south end, while the north end has advanced 300 feet, encroaching considerably upon the width of the north channel.

WORK PROPOSED FOR THE FISCAL YEAR ENDING JUNE 30, 1880.

By act approved March 3, 1879, $45,000 were appropriated for continuing improvements between Portland, Oreg., and the sea.

It is expected that this sum together with the unexpended balance of former appropriation will, in accordance with the projects of Board of Engineers for the Pacific coast, April 9, 1877, be applied in building in Willamette Slough near its head an open stone and brush dam, revetted along the opening with timber cribs, and in commencing a stone and brush dike above Swan Island, Willamette River, starting at a point on the left bank near Weidler's Wharf, and running, with gentle curvature, towards the head of the island, to be eventually connected with that island, so as to deflect the current to the right bank of the river, and thereby permanently remove the shoal at the head of the north channel.

The improvements proposed for the mouth of the Willamette and for the bar at Saint Helen's, Columbia River, will not be commenced until after those localities shall have been studied in connection with the results to be obtained by the dams and dikes which will be constructed this season.

The appropriations for this improvement from act of June 23, 1866, to act of June 18, 1878, both inclusive, have been in the aggregate	$270,365
By act of March 3, 1879, $45,000 were appropriated, making total appropriation to date	315,365

Of this amount $243,658 have been expended in the purchase and repair of the dredging plant, in dredging and surveying bars.

The estimate of the cost of the improvements projected is	$298,974
By act of Congress approved March 3, 1879, $45,000 were appropriated, leaving yet to be appropriated	253,974

Of this amount, $150,000 can be profitably expended during the next fiscal year in completing the dam at Swan Island, in closing Coon Island Slough if found necessary, and in constructing the projected works at Saint Helen's Bar. In addition to this, I would recommend an appropriation of $50,000 for the purchase of a large improved Osgood dredge with scows complete, to take the place of the old one, which is not of a suitable pattern nor in a fit condition to do the heavy work required in dredging at the long bars in both rivers.

I respectfully invite attention to the statement of Major Wilson, in his annual report for 1878, relative to the character and condition of the old dredge.

These rivers are in the collection-districts of Oregon, with a port of entry at Astoria, 12 miles from the mouth of the Columbia and of the Willamette, with a port of entry at Portland, 12 miles above the mouth of the Willamette River.

There are one light-house and one work of defense on either shore at the entrance to the Columbia River. The light-house south of the entrance to the south channel has a 12-inch steam fog-whistle, giving a blast of 7 seconds, interval of 14 seconds, then a blast of 4 seconds followed by an interval of 35 seconds. In approaching Sand Island inside the bar by the south channel, the best water is indicated by 2 day beacons, forming a range located on the east end of the island. They are built of logs in the form of a frustum of a pyramid with a target on top, and are whitewashed.

To indicate the approach to the south channel from the sea, there is an automatic buoy 1 mile seaward of black buoy No. 1, which gives a distinguishable blast in moderate weather.

ASTORIA STATISTICS.

I am under obligation to the Hon. W. D. Hare, collector of customs at Astoria, for the following commercial statistics referring to the port of Astoria for the 11 months ending May 31, 1879:

Domestic exports	$1,953,033 00
Domestic imports	$565 00
Revenue collected	$21,071 31
Coastwise vessels entered, 214; registered tons	379,638
Coastwise vessels cleared, 202; registered tons	370,156
Foreign vessels entered, 14; registered tons	12,676
Foreign vessels cleared, 48; registered tons	48,315
American vessels entered from foreign ports, 6; tonnage	7,349
American vessels cleared for foreign ports, 19; tonnage	16,592

PORTLAND STATISTICS.

I am under obligations to the Hon. John Kelly, collector of customs at Portland, Oreg., for the following information referring to Portland:

Amount of revenue collected for the eleven months ending June 1, 1879	$139,149 40
Value of imports	$399,440 00
Value of exports	$3,157,575 00
Foreign vessels entered from foreign countries, 47; tonnage	44,407
American vessels entered from foreign countries, 18; tonnage	13,930
Foreign vessels cleared to foreign countries, 56; tonnage	55,686
American vessels cleared to foreign countries, 33; tonnage	26,345
Coastwise vessels entered, 136; tonnage	216,345
Coastwise vessels cleared, 112; tonnage	203,619

I desire to express in this public way my great obligations to Mr. R. A. Habersham, assistant engineer, for the faithful, industrious, and valuable service he has rendered to this office during the year.

As an estimate of the amount of commerce to be benefited by making the improvements herein set forth, attention is invited to the following information, supplied through the courtesy of Mr. Reid, secretary of the Board of Trade, Portland, Oreg.:

TOTAL EXPORTS OVER COLUMBIA RIVER BAR.

	Value.
August 1, 1874, to August 1, 1876	$11,845,590
August 1, 1876, to August 1, 1878	19,214,099
July 1, 1878, to June 1, 1879 (eleven months)	5,111,608

These values are increasing rapidly with the increase in wealth and population of the State of Oregon and Washington Territory.

In this connection, as a matter of interest bearing on the commerce of the Northwest, I give the commercial statistics of the district of Puget Sound, furnished me through the courtesy of Hon. H. A. Webster, collector of customs at Port Townsend, Wash.

PORT TOWNSEND STATISTICS.

June 1, 1878, to May 31, 1879, inclusive:

Value of imports	$30,412 90
Amount of revenue collected	$20,355 56
Value of exports	$717,903 00
American vessels entered from foreign ports, 222; tonnage	147,475
American vessels entered from coastwise ports, 105; tonnage	67,582
Foreign vessels entered coastwise, 4; tonnage	3,377
Foreign vessels entered from foreign ports, 152; tonnage	51,897
American vessels cleared for foreign ports, 224; tonnage	163,549
American vessels cleared coastwise, 79; tonnage	49,653
Foreign vessels cleared for foreign ports, 154; tonnage	53,794

In addition, a large fleet, carrying yearly over 30,000 tons of coal, valued at over $150,000, and over 100,000,000 feet of lumber, valued at over $1,250,000, leave the sound every year under enrollment, not having to enter or clear.

The following is an abstract of Oregon's exports for the year ending August 1, 1878, as compared with the preceding year:

		1877-'78.	1876-'77.
1. Salmon exports to San Francisco, August 2, 1877, to January 12, 1878, and April to July 31, 1878, 171,327 cases; value		$980,956	$1,750,350
2. Wheat, flour, oats, hops, potatoes, lumber, hides, pickled salmon, treasure, and all other domestic products except coal and wool, from Columbia River to San Francisco; value		3,765,687	2,332,000
3. Coals to San Francisco from Coos Bay; value		218,410	317,475
4. Lumber and other products from Coos Bay and coast of Oregon		151,134	173,367
5. Wool exports, via San Francisco; value		998,305	756,000
Total via San Francisco		6,114,492	5,329,192
6. Wheat and flour exports direct to United Kingdom, 112,697 tons wheat, 32,617 barrels flour; value		4,872,027	3,552,000
7. Canned salmon, exports direct from the Columbia River to Great Britain, as follows:			
August 4, British Army, cases	54,475		
August 26, City of Amoy, cases	11,003		
April 4, 1878, Jeannie Landles, cases	3,800		
June 7, 1878, Barracouta, cases	20,505		
June, Ardendee, cases	25,800		
June 15, G. F. Muntz, cases	41,350		
July 20, City of Halifax, cases	35,525		
July 25, Dovenby, cases	28,650		
Total direct shipments, cases	221,108		
Value		1,326,056	737,836
8. Beef and mutton exports, canned and uncanned; value		133,895	365,733
9. Wheat, flour, and other products exported to Sandwich Islands, Puget Sound, British Columbia, Alaska, and elsewhere; value		637,636	386,600
10. Gold and silver (products of Oregon mines) exported for the year ending August 1, 1878		1,280,867	1,200,000
11. Other products, principally cattle, to Eastern States		270,000	----------
Total Oregon exports		14,634,973	11,571,361
Increase of value of exports over 1876-'77		3,063,612	----------

The vessels composing the principal steamship lines which ply between the port of Portland and San Francisco, Cal., are given in the following table.

OREGON STEAMSHIP COMPANY.

(Principal office, Portland, Oreg.)

Names of steamers.	Description.	Tonnage.	Draught, loaded.
		Tons.	*Feet.*
Ajax	Iron propeller	1,354	18
Chester	do	1,106	14
Elder	do	1,709	16
Oregon	do	2,335	17

PACIFIC COAST STEAMSHIP COMPANY.

(Principal office, San Francisco.)

Names of steamers.	Description.	Tonnage.	Draught, loaded.
		Tons.	*Feet.*
Ancon	Wood, side-wheel	1,000	12
Idaho	Wood, propeller	900	16
Orizaba	Wood, side-wheel	700	14
Los Angeles	Wood, propeller	500	14
State of California	Iron, propeller	2,200	18

Since the loss of the *Great Republic* on Sand Island, April 21, the Independent Line has but one vessel, the California, tonnage, 674, which runs to Sitka.

CHARACTER OF VESSELS ENTERING THE COLUMBIA RIVER.

American vessels (wooden), average tonnage, 1,800; draught, 21 feet.
Foreign vessels (iron), average tonnage, 1,500; draught, 20 feet.
Coastwise vessels (wooden), average tonnage, 800; draught, 16 feet.
Occasionally vessels cross the bar drawing as much as 23½ feet.

Abstract of contracts, a statement of funds, and a chart of the river's curves, showing the varying stages of the water in both rivers throughout the year, are transmitted herewith.

Money statement.

July 1, 1878, amount available	$36,811 89	
Amount appropriated by act approved March 3, 1879	45,000 00	
		$,811 89
July 1, 1879, amount expended during fiscal year		10,104 89
July 1, 1879, amount available		71,707 00
Amount (estimated) required for completion of existing project		223,974 00
Amount that can be profitably expended in fiscal year ending June 30, 1881		150,000 00

Abstract of contracts for the improvement of the Lower Willamette and Columbia Rivers in force during the fiscal year ended June 30, 1879.

No.	Name and residence of contractors.	Date of contract.	Subject of contract.	Price per month.	Remarks.
1	Wilson Bros., Portland, Oreg.	Apr. 13, 1878	Hire of steam-tug as tender to United States dredge.	$525 00	Contract closed Nov. 23, 1878.

KK 14.

IMPROVEMENT OF THE UPPER WILLAMETTE RIVER, OREGON.

The portion of this river which was under improvement during the year extended from Portland, Oreg., to Corvallis, a distance of 114 miles.

For the operations prior to the time of my assuming charge of this work, I respectfully refer to the annual report of Maj. J. M. Wilson, Corps of Engineers, dated October 22, 1878, and to the accompanying report of Assistant Engineer R. A. Habersham. These reports indicate in brief that from August to the middle of October there were removed from the rapids at Rock Island, 16 miles above Portland, 282 cubic yards of rock, under contract with Joseph Paquet, August 23, 1878, at $8.90 per cubic yard. During the same period the snagboat operated in the upper part of the river below Corvallis, and removed from the channel 491 snags, cut down 84 overhanging trees, and repaired various wing-dams. The total distance traveled was 223 miles.

As the new channel at Rock Island Rapids differs partially in direction from the one usually followed by the river boats, it was natural to expect that the pilots, who are always loath to depart from the beaten path, should be timid in adopting it. The reports adverse to the usefulness of the improved channel are considered, after investigation, to be without foundation, and it is believed that when the prejudice now

existing has become allayed the new channel will be run to the exclusion of the old one.

After several years' experience my immediate predecessor decided that, except in special cases, it was not advisable to build any more dams in the upper river, and that in preference the bars and shoals could be more readily and more easily deepened by scraping. This decision necessitated the placing of propelling power in the snagboat. In a letter addressed to the Department, June 29, 1878, Major Wilson recommended that this desired change should be made, at an estimated cost of $7,000. The authority was granted by letter, dated October 7, 1878, and in accordance therewith a contract was made December 9, 1878, with Joseph Paquet for the wood work, at $1,650; and with Honeyman & Co., of Portland, December 9, 1878, for the machinery, at $3,250. Work was commenced under these contracts in December, and both completed by April 1, at an aggregate expense, including additional implements for service with the machinery, stores, &c., of $5,907.01.

On the 4th April, the boat left here for Oregon City to go into the dry-dock to have some caulking done, and on the 7th was ordered to Centennial Chute, a short distance above Corvallis, with directions to remove all visible snags *en route*.

Since the opening of the season the boat has been constantly employed removing snags and cutting overhanging trees all along the river, and has by its operations given entire satisfaction to the public. Having propelling power of its own it can move rapidly and without delay from point to point, when reports are received of the presence of obstructive snags, and accomplish its work at a very much diminished expense. The water fell sufficiently in June to enable me to try the scraper at McCloskey's Chute, below Salem. The trial was quite satisfactory, and I have every confidence that the success of this means of improvement will be equal to what has been claimed for it.

The following is a summary of the operations of the snagboat since July 5, 1878:

1878. From July 5 to October 9:	
Number of useful days	79
Number of days lost in moving	29
Number of days actually worked	50
Number of snags pulled	491
1879. From April 5 to June 30:	
Number of useful days	75
Number of days unavoidably lost, principally from high water	20
Number of days lost moving	6
Number of days spent in raking bars	5
Number of days worked pulling snags, cutting large trees and drift from the river banks	44
Number of snags pulled	262
Number of trees cut down and removed from the channel	201
Distance moved in 1878	160 miles.
Distance moved in 1879	270 miles.

I invite attention to the accompanying report of Assistant Engineer R. A. Habersham, who has had local charge of the improvement, and to whom this office is greatly indebted for a zealous, efficient, and painstaking service during the year.

The lowest stage of water in the Willamette occurred from July 1 to September 22, 1878, the Portland gauge reading 0, a point not reached for many years. The highest water was recorded on the 28th March, the gauge reading 18.6 feet above low-water. A higher stage was reached on the gauge June 10, 1879, the reading being 20.5 feet above low-water; this increase did not come from the Willamette, but

was due to back-water from the Columbia River. The Columbia River being now at its maximum stage, the Willamette has not receded at Portland; but at Albany, the Willamette has gradually receded since April 1, with but one rise in May, and now stands at 2.4 feet above low-water.

The present plans for keeping open the navigation of the river as high up as Eugene City contemplate the constant employment of the snagboat in removing snags at all stages of water, the scraping of the bars at low-water, and the construction of an occasional inexpensive dam to close a slough or to sluice a narrow bar. To perform this service satisfactorily another snagboat of more power than the present one should be built, at a cost of $14,000, to run between Corvallis and Eugene City. It is also important that a complete survey of the river should be made from Corvallis to Portland, costing not less than $12,000.

The expenditure of $20,000 for small dams, the cost of the new snagboat, and the cost of the survey, will make the estimated cost of the project for the improvement of the river $46,000. In addition to this amount, $17,500 will be required annually to run the boats, keep them in repair, and make necessary surveys, &c.

By referring to Major Wilson's report for 1878, the appropriations for the river—

From act March 3, 1871, to June 18, 1878, both inclusive, have been	$91,500 00
By act approved March 3, 1879, was appropriated the sum of	12,000 00
Making the aggregate apppropriations	103,500 00
Of this amount, there have been expended to date	89,098 49
The residue	14,401 51

Will be applied in removing snags, scraping bars, and building small dams at points where navigation shall become obstructed.

The amount which can be profitably expended during the fiscal year ending June 30, 1881, is tabulated as follows:

Construction of a new snagboat	$14,000
Survey of Willamette River from Corvallis to Portland	12,000
Building small dams, 6,000 feet, at 3⅓	20,000
Annual service of two snagboats	15,000
Contingencies of surveys and office expenditure	2,500
	$63,500

This river is in the collection-district of Willamette; Portland, Oreg., is the nearest port of entry, and the nearest works of defense are at the mouth of the Columbia River. There are no lights on the river, and no buoys are maintained above Portland at the expense of the general government.

The amount of revenue collected at the port of Portland, Oreg., during the 11 months ending June 1, 1879, was $139,149.40.

The commerce of the river is carried principally in the boats belonging to the Oregon Steam Navigation Company, which has bought out the interests formerly held by the Willamette Transportation and Lock Company, but there are besides 3 independent lines, owned by private parties, which have 1 or 2 boats each.

The navigation to be benefited by this improvement extends from Portland to the head of navigation at Eugene City, a distance of 172 miles. This valley, by its richness and fertility, attracted the notice of the earliest settlers, and above Oregon City, where the arable land approaches the river, the well-located farms are under the highest cultivation, and produce most wonderful crops of the various kinds of grains. An estimate of the products of this rich valley may be formed by an examination of the following statistics relative to the commerce passing

through the locks at Oregon City for the year ending May 31, 1879, furnished me through the courtesy of Frank T. Dodge, agent Oregon Steam Navigation Company:

	Tons.
Up freight: Miscellaneous merchandise, &c.,	8,857
Down freight: Wheat, flour, &c., 62,998 tons; sundry produce, 7,875 tons	70,873
Total freight	79,730
Up passengers	9,329
Down passengers	9,931
Total passengers	19,260
The total number of boats engaged in this transportation, including all the companies	12
Number of times the steamboats passed through the locks	1,377

A statement of funds and a chart of the snagboat, with its propelling power attached, are transmitted herewith.

Money statement.

July 1, 1878, amount available	$20,126 25	
Amount appropriated by act approved March 3, 1879	12,000 00	
		$32,126 25
July 1, 1879, amount expended during fiscal year		17,724 74
July 1, 1879, amount available		14,401 51
Amount (estimated) required for completion of existing project		63,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1881		63,500 00

Abstract of proposals for the removal of rock from the channel of the Upper Willamette River, opened by Maj. John M. Wilson, Corps of Engineers, August 20, 1878.

No.	Names and residences of bidders.	272 cubic yards of rock, more or less; per cubic yard.	Remarks.
1	Joseph Paquet, Oregon City, Oreg	$8 90	Contract awarded.
2	W. P. Hayden, Rockland, Cal	9 00	
3	Trewaras & Ballantyne, Portland, Oreg	11 15	
4	Peter Paquet, Oregon City, Oreg	13 80	
5	J. B. Montgomery, Portland, Oreg	19 00	For 171.63 yards at Bissell's Rock.
		18 00	For 100 yards at Davis Rock.

Abstract of contract for the improvement of the Upper Willamette River, Oregon, in force during the fiscal year ending June 30, 1879.

No.	Name and residence of contractor.	Date of contract.	Subject of contract.	Price per cubic yard.	Remarks.
1	Joseph Paquet, Oregon City, Oreg.	Aug. 23, 1878	Rock excavation..	$8 90	Contract completed October 14, 1878.

REPORT OF MR. ROBERT A. HABERSHAM, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., July 1, 1879.

COLONEL: I have the honor to submit the following report of operations on the Upper Willamette, conducted under the direction of this office, during the last fiscal year:

On the 6th of July, 1878, the snagboat was towed from Portland to the dry-dock at Oregon City, where her hull was calked; thence to the foot of Ash Island, 38 miles from Portland, arriving on the 8th and beginning work on the same day. From this point the boat proceeded slowly upstream, removing snags and drift, working her

way by means of capstan and cable when no steamer could be obtained for towing; reaching the head of Eola Slough, 73 miles above Portland, by the 7th of August. Here, on the 9th, she was taken in tow by the steamer Ohio, which, being the only boat of sufficiently light draft to run above Salem at the existing low stage of water, had been chartered to carry the snagboat to Half-Moon Bend, 7 miles above Albany, and 110 miles from Portland; 3 days were consumed in accomplishing this distance, 37 miles.

From Half-Moon Bend the snagboat worked downstream. The river here was so much obstructed by drift that the end of August found the boat at Bowers's Bar, only 3 miles below.

During the month of September the river was cleared as far down as Beaver Bar, 10 miles below Salem, 47 miles from Bowers's Bar; and by the 5th of October all obstructions had been removed down to Yamhill Bar, 40 miles from Portland. Below this point no work was required except to remove a portion of an old dam at Clackama Bar, just below Oregon City, which had become an obstruction. This was done, and the season being by that time, October 9, far advanced, the snagboat was towed to Portland and laid up for the winter.

During the summer of 1878, a quantity of rock was removed by blasting from the channel in the vicinity of Rock Island, 16 miles above Portland. In this locality the boat channel for 2 miles pursues a tortuous course through deep and narrow fissures in the basaltic rock composing the bed of the river. The worst points are Dove's and Bonanza Rocks. The former, situate just below the foot of the island, rises vertically from the bottom of the river, here 40 feet deep, to a height of 1 foot above low-water mark. It is flat on top, 450 feet long by 75 feet wide, and divides the current into two deep channels; that on the east side nearly direct, the other presenting three sharp curves. The presence of three points of rock within a few inches of the low-water surface in the east channel has caused the crooked channel to be used exclusively during low stages previous to 1878. Pilots, however, represented that when the river rose from 2 to 5 feet above low-water mark the accelerated current swept over Dove's Rock with such force as to make it difficult for steamers ascending to make the sharp turn necessary to avoid the rock; and suggested that if the rock were leveled off to a depth of 2 feet below low-water mark, steamers could pass over it during ordinary stages and continue to use the west channel during low-water. A survey of the rock and of the two channels, made in 1876 under Major Wilson, Corps of Engineers, showed that for one-fourth of the sum which would be required to carry out the plan suggested the obstructing rocks could be removed from the east side of Dove's Rock, and a better channel for all low stages obtained. Neither plan would affect navigation during higher stages, Dove's Rock being then from 10 to 15 feet under water. It was decided, therefore, to open the direct channel.

The contract for the work of blasting was let to the lowest bidder, Joseph Paquet, of Canemah, for $8.90 per cubic yard. Work was commenced on the 29th of August, and carried on, with occasional interruptions, caused by minor rises in the river, until October 14, when it was completed. The new channel is 100 feet wide and 5 feet deep at mean low-water. At this stage the depth over the miter-sill at the Willamette locks is 3 feet, so that boats which can pass through the locks can run this channel with 2 feet to spare.

Under the same contract a portion of Bonanza Rock, at the head of the island, was removed, adding 30 feet to the width of the boat-channel. This improvement was even more necessary than the other, several steamboats having been wrecked or injured on this rock, which has been the terror of pilots since the Upper Willamette has been navigated.

The entire volume removed was:

	Cubic yards.
From the east channel at Dove's Rock	217.82
From Bonanza Rock	65.30
Total	283.12

Costing, at $8.90 per yard, $2,519.77.

The cost to the contractor did not exceed $7.50 per cubic yard, of which not less than one-third was spent in raking off the fragments, after blasting, into deep water. This was the contractor's first experience in this kind of work. The contrivance for raking did not work well. With better appliances, and the smooth water and slow current which prevail here during low stage, the cost of similar work here in future will be considerably reduced. Mr. Paquet deserves credit for the energy and fidelity displayed in the execution of his contract.

The vicinity of Rock Island is the most dangerous portion of the river, and although greatly improved by the work already done, much more will be required before it can be considered safe at all times. In its present condition it is only safe during daylight; a circumstance injurious to the important and rapidly increasing traffic of the Willamette.