

water in the river is 14 ft. Reference will be made in another place to the steps being taken to develop this port.

Victoria.—This has been an important port in the past, and is so still, though its commercial business is not large. It is the chief port of Vancouver Island and on it is located the capital of British Columbia. The commercial port is on a small land-locked inlet with bald rocky shores. A few miles to the west is the celebrated Esquimaux, an excellent port, strongly defended, and, prior to 1905, the headquarters of the British North Pacific Naval Squadron.

The port is very new, and its development has only begun. It now has about 2,700 ft. of berthing space, of which 600 ft. belongs to the Provincial Government and the rest to the Grand Trunk Pacific. It has a sectional dry dock 600 ft. long. The newness of the port and the fact that rail connection east is not yet opened, give little as yet for comparison with other ports. Its record lies all in the future.

Vancouver, B.C.—The chief Canadian port, Vancouver, B.C., is in the vicinity of the mouth of the Great Fraser River, though actually not in the valley of that stream. More fortunate than Portland, Vancouver has been able to flank a troublesome river with its floods and shoals while still taking advantage of its valley on its rail route through the mountains. The port has been built in a land-locked bay called Burrard Inlet, surrounded on nearly all sides by towering hills which give the location a most beautiful setting. The area of the entire inlet inside the entrance is 23.6 miles, with a shore line of upward of 50 miles; but the port proper, as at present developed, utilizes only a small fraction of this. The shores are mainly of rock formation; the tidal range is 11 ft. mean and 16.4 ft. extreme. There is no ice and the harbor is perfectly sheltered and has good anchorage.

The port facilities, as developed so far, are mainly on the south side of the east 5.5 miles of the Inlet. The portion of the Inlet comprising the harbor is about $1\frac{1}{2}$ miles in width, connecting with the Gulf of Georgia on the west and the remainder of the Inlet on the east by two narrow channels designated First and Second Narrows, respectively. These Narrows were formed by the deposit of gravel, sand, and small boulders brought down by mountain streams on the north side of the Inlet and deposited in the shape of extensive bars. The narrows are deep, but only about 500 ft. in width. Navigation through them is seriously handicapped by strong tidal currents, which, at the First Narrows, reach as high as 8 knots per hour at spring tide, and are such a menace to navigation that the Dominion Government has undertaken to widen the entrance by dredging to 1,200 ft. The improvement will not affect the current perceptibly, but will give more leeway for the navigation of ships. In most portions of the harbor the tidal currents interfere seriously with the berthing of ships.

The subaqueous basaltic rock excavation at the eastern end of Victoria Harbor was performed by the drilling method. The single drill was mounted on a platform float that could be raised clear of high tide by steam power spuds. Steam was furnished from boilers on a barge. Thirty-two holes were drilled at one setting of the raised platform. The holes were 2.5 in. in diameter, drilled to a depth of 2.5 ft. below grade (20 ft. at low water), and spaced 3 by 3 ft. The actual cost for drilling and blasting only was \$6.17 per cu. yd., without interest, depreciation, or plant renewal.

The blasting in Vancouver Harbor will be a more delicate operation, as it will be carried on in close proximity to constructed piers. Holes 3 in. in diameter, spaced 5 by 5½ ft. centres, will be drilled to a depth of 3 ft. below the required grade line (36 ft. at low tide), and shot off in series. It is expected that 1½ lb. of dynamite per foot or more will be used. The estimated cost for drilling and blasting is \$5.60 per cu. yd. Dredging of the broken rock will approximate an additional \$1 per cu. yd. The Vancouver rock is a sloping sandstone ledge overlaid with from 3 to 7 ft. of gravel, hardpan, and disintegrated sand rock.

Probably the most effective dredging plant for all purposes on the Pacific Coast is the Fröhling, built in Germany in 1906 at a cost of \$275,000 exclusive of duty and cost of steaming to British Columbia. It is the property of the Department of Public Works of Canada, and operates on the Fraser River. It is of the "Fröhling" scraper suction type, elevating material by a pair of 16-in. centrifugal pumps through pipes and delivering to hoppers inside the hull. It is a sea-going dredge, of steel construction throughout, and is self-propelled by twin screws. Its length between perpendiculars is 187 ft.; the extreme beam is 34.5 ft., the draft loaded, about 14 ft., and the hopper capacity at this draft

New Westminster.—Ten miles south of Vancouver on the Fraser River, and 16 miles above its mouth, is the town of New Westminster, which is taking active steps to develop port facilities for deep-sea shipping. The Fraser is a large river, not unlike the Columbia, but with a channel less difficult to improve and maintain. The ordinary tidal range at the port is only 5 ft., but the range between high and low