

HISTORY OF THE LAKE WASHINGTON CANAL

Foreword

“ . . . with the inauguration of the great work of harbor improvement which, under the contract, is to begin March 1, a brighter era will dawn, not only for Seattle, but for the neighboring cities and for the whole Puget Sound country, for its good effects cannot but extend over a wider area than the immediate scene of operation. Its completion will provide our hilly city with an ideal area for manufactories, warehouses, and other enterprises which need a large space, adjacent to means of transportation by rail and water; it will open to ocean-going ships the Duwamish Waterways and the great fresh-water harbor of Lake Washington, and will conduct along the whole existing line of wharves a stream of fresh water which will check the ravages of the teredo; it will furnish abundant room for railroad terminals, so that all roads, present and future, can have all the facilities they require; it will put Seattle in the front rank among the great ports of the United States, and among manufacturing cities.”*

Chapter I., Seattle and the Lake Washington Region

The geographic situation of Puget Sound in relation to Lake Union, Lake Washington, and Lake Samamish suggested to the very earliest settlers the idea of a ship canal connecting these three bodies of water. Coal fields of considerable extent lie within two miles of the eastern shore of Lake Washington. The coal was formerly lightered to the Portage from the mines, carried across by tram cars to Lake Union. After being lightered across this lake it was again placed on tram cars and carried to the Sound. Vessels loading from Salmon Bay were anchored in deep water of the Sound opposite the mouth of the bay nearly two miles from the mills. Lumber shipped from the Fremont mills on Lake Union was loaded upon cars at the mill and shipped to the Smith Cove dock, 3.6 miles by rail and loaded upon vessels there. This extra handling of products added a great deal to the final cost.

The expense of maintaining coal bunkers at Seattle was very great, due to the damage wrought by the teredo, wood-boring marine worm. There are seven large mining properties on or tributary to

*Extract from the "*Weekly Post-Intelligencer*," February 14, 1895.

Lake Washington—Newcastle, Franklin, Black Diamond, Issaquah, and three others of lesser extent. The Newcastle mine shipped an average of over 1000 tons of coal per day to Seattle. Two of the mines could, by means of wire ropes convey their output directly from mines to vessels.

Lake Washington is 19 miles long, about 2 miles wide and has 75 miles of shore line. Its area is 29 square miles. It drains 182 square miles of territory, including Lake Samamish. Before 1916 its surface was 33 feet above extreme low tide in Puget Sound, and 8 feet above the surface of Lake Union. Its greatest depth was 223 feet. The only outlet prior to 1886 was the Black River, issuing from the south end of the lake. This outlet ceased to exist after the completion of the canal as the surface of Lake Washington was lowered 8 feet. Between the lake and the bay the Black River receives the waters of Cedar River and White River. During times of high water in these two rivers steamers have ascended to the lake; then the waters of the Cedar and sometimes the White River flow into the lake.

Lake Union is situated between Lake Washington and Puget Sound and occupies 905 acres, of which about one-half are deeper than 25 feet. The maximum depth found was 53 feet. It has a 6-mile shore line and is connected with Puget Sound by a small stream entering Salmon Bay. It is separated from Lake Washington by a low isthmus 1600 feet wide; there is no natural connecting waterway but a passage was opened by means of a small canal called the Portage. The bottom of the lake is of very soft mud of considerable depth.

Salmon Bay is part of the fresh water system of the Lake Washington ship canal. Before the construction of the locks it was an arm of Shilshole Bay, which is an arm of Puget Sound. This Bay is about one and one-fourth miles long, and, at low tide it was little more than a stream, too shallow even for small boats to navigate. At high tide it had a width of over one-fourth of a mile. A small stream, following practically the course of the present waterway, flowed from Lake Union into Salmon Bay. As a result of the construction of the locks it is now a part of the canal and its level is the same as that of the lakes.

The Chamber of Commerce of Seattle, represented by such men as John J. McGilvra, Thomas Burke, J. W. Clise, Jas. B. Meikle, J. Furth, F. W. Clarke, C. M. Schaefer, J. W. Dodge, E. O.

Graves, and others, from a very early date, carried on an extensive campaign to bring the attention of local people and Congress to the advantages of a canal connecting these lakes with Puget Sound. Seattle's shore line and harbor area would be increased; the manufacturers of lumber would be benefited, since a large proportion of the mills were on tide water. The logs must be stored in salt water from the time of delivery by the logger until cut into lumber. The liability of destruction by the teredo make it impossible to store logs for any length of time and therefore both logging and milling operations had to be conducted in somewhat of a "hand-to-mouth" basis, which was expensive. Lake Washington would offer unlimited storage capacity for logs.¹ Elliott Bay is very deep—too deep for anchorages; mooring buoys must be provided; boats that lie idle during the winter could find cheap anchoring ground in Lake Washington and Lake Union and be free from the attacks of all marine insects. Too, the cost of building wharves and piers on the lakes would be much less than on the Sound on account of more favorable depths and the absence of tide and marine life. Only creosoted piling has a long life in salt water; this process doubles the cost and is not always effective. Fresh water piling is practically imperishable. Wharfage space in Elliott Bay is overcrowded and expensive and unhandy due to the high bluffs and the frontage of two railway lines.

Boats lying quietly in salt water foul rapidly on the bottom; deterioration, resulting from electrolytic action and corrosion, is then more rapid than on one that is clean. In fresh water this does not take place, at least not nearly as fast. To place a ship in dry dock for cleaning costs from \$800 to \$3,000, depending upon the type of ship, and is a yearly necessity. Used as a fresh water basin for ships of war, it would be of great advantage to the navy, through this saving, alone.

In 1901 the naval base and yard was located at Bremerton and Sinclair Inlet, and that portion of the Lake Washington project was given up. After that date, the energies of the Chamber of Commerce were devoted to the advertising of the commercial advantages of the waterway. The Samamish end of the project was never very seriously considered after the engineers began making surveys.

¹ It was reported that a body of logs containing 16,000,000 feet was found entirely ruined by the teredo.

Chapter II., The Building of the Canal

As early as 1854, three years after the landing of the founders of Seattle at Alki Point, Thomas Mercer, the sponsor for the names of Lake Washington and Lake Union, called attention to the desirability of connecting the lakes with Puget Sound by means of a canal.² Under the direction of the Federal Government surveys for a canal were made as early as 1853, when Gen. McClellan endorsed the construction of a waterway. At various times, down to 1890, it is referred to in official reports, though more from a naval than a commercial point of view.

In 1867, a board of engineers was appointed to consider the location of a site for a naval station in the Puget Sound waters, and reported favorably upon two; Port Orchard and Lake Washington. The absence of any navigable channel into Lake Washington was the strongest argument at that time against its selection.

Col. Alexander, chairman of the board of engineers for the Pacific Coast, obtained authority to make an investigation of the Lake Washington project. A survey was made in 1871 under his personal direction, by Col. Thomas Handbury, to see if a canal could be built at reasonable expense, and to determine the best location. He recommended a canal with two lift locks; also, a study of the lakes and streams emptying into them, for an entire year; that Puget Sound was the third favorable location for a naval establishment on the Pacific Coast, San Francisco and San Diego being the other two; that the route via Lake Union and the Mercer Farm was preferred to any; the route via The Black and Duwamish Rivers were too long and crooked, and terminated in shallow water; the route via Shilshole Bay would require a great amount of dredging and also be exposed to heavy seas, which would fill up the outlet to the canal constantly, and be exposed to cannonade in time of war.

Transit and level lines were run from Lake Union to Seattle harbor, one via "Mercer's Farm," the other via Salmon Bay; another was drawn via the tramway connecting the two lakes. These were not straight lines, due to the . . . "thick undergrowth, resembling a jungle which we encountered." . . . They were satisfied that a canal joining the two lakes could be made on a straight line without encountering any high land or other difficulties. An exca-

² Lake Washington was visited by Isaac N. Ebey in 1851, and named by him Lake Geneva. However it was designated on the maps as Duwamish Lake until 1854, when the present name was adopted.

vation of 4,450,000 cubic yards of material would be required between Lake Washington and Elliott Bay. The total estimated cost of the canal was placed at \$4,675,000. The board considered that the country was as yet, too undeveloped to consider a canal at that time; but thought that the region had the advantages of climate, coal, timber, and fresh water, free from ice. They recommended further detailed study and surveys.

The committee on printing in Congress, when asked to print 1000 copies of Alexander's report, reported it back adversely, saying that they could see no good reason for publishing the report!

In 1886, a narrow cut a short distance to the south of the canal between Lake Washington and Lake Union at the place called the Portage, was made, for the purpose of floating logs from the upper to the lower lake. Small steamers and scows could make the trip, also. The cut was made by a local company.

In 1888 the location of the naval station, and 1890, that of the dry dock were fixed at Port Orchard, and thus disappeared one of the chief arguments for the waterway. The choice of Lake Washington was abandoned because of the possibility that an injury to the lock in war time might render the whole thing useless and tie up for an indefinite period whatever vessels might be behind the locks at the time.

Four years previous to this the Washington Improvement Co., a corporation, was incorporated and organized under the laws of the Washington Territory to construct a canal joining Puget Sound and the lakes sufficient to admit vessels of at least 3000 tons burden, and to improve, widen, and deepen and straighten the channel of the Samamish River or Squak Slough as it was sometimes called, so as to admit vessels of at least 50 tons; the channel to be more than four feet deep and forty feet wide.

In 1889, Ex-Gov. Semple and others first took up the proposition of building a canal across the southern boundary of the city, at the same time providing for reclaiming the useless and unhealthy tide lands. An act of March 9, 1893, State of Washington, granted the Seattle and Lake Washington Waterway Co. the right to construct a canal and locks between Elliott Bay and Lake Washington, to begin work on the excavation and filling in of the tide lands on or before March 1, 1895, and complete the project within six years. The following officers were chosen for the company: President, Eugene Semple; vice-president, Andrew Heimrich; general man-

ager, Edgar Ames; construction engineer, Maj. Thomas W. Symons; general counsel, Julius Hale; auditor, W. H. Parry; secretary, Geo. M. Paschall.

The corporation was eventually given extensions to 1904, within which time to finish the project. It was authorized to build locks large enough to accommodate vessels 300 feet long, 25-foot beam, and 22-foot draft; to charge tolls until the state or the United States took over the operation of the canal. To finance the underaking a trust company offered to furnish the cash if the citizens of Seattle would raise a subsidy of \$500,000, payable on the completion of the Waterway, and its successful opening. The subsidy was raised; the list contained the names of 2468 of the leading men, including all the banks.

The filling in began and a portion of the excavating done, by hydraulic process. The route ran in a straight line across the highlands to Lake Washington, cutting through a ridge more than 300 feet above the low water level in the Sound, and then through another more than 150 feet high. These two cuts would have required the removal of close to 35,000,000 cubic yards of material. A maximum of 16c per yard was allowed for the filling in of the tide lands. No provision, though, was made for obtaining the right-of-way for the ship canal, or for the maintenance or the construction of the locks. The East Waterway was to be 1000 feet wide, 22 feet deep at low tide, and 6500 feet long; the West one to be 4900 feet long. King County was expected to foot the bill for the waterway between the Sound and the lake. This was to start at a point south of the Bay View Brewery on the bay side, and enter the lake about 1000 yards south of the city waterworks pumping station.

The project encountered much opposition from various quarters, especially the Chamber of Commerce. Mr. John J. McGilvra was of the opinion that . . . "the whole scheme of the Seattle and Lake Washington Waterway Co., is wild, visionary, and impractical; a scheme for private speculation; it proposes using the water of Lake Washington for power purposes. Its purpose is to defeat the construction of a government canal. This company has been a vicious dog in the manger from the start . . . there is not one, even one redeeming feature connected with it."

Defending his project, in preference to a northern route, as recommended by the government engineers, the company's president, Mr. Semple, replied that . . . "a vessel bound from Seattle to Lake Washington by a north canal would practically have to go to sea

again; would have to weather West Point, a far-reaching sand spit around which winds and currents swirl with violence; and then traverse a tortuous channel for about $8\frac{1}{2}$ miles, going through two locks. The town of Ballard would be ruined, for it is proposed to erect a lock at the very mouth of Ballard harbor." Subsequent events have not borne out Mr. Semple's direful forecasts. Ballard has grown to a greater importance, not less.

In 1890, Congress made its first appropriation, of \$10,000, for a survey and the selection of the most feasible location for a commercial waterway, and for an estimate of the costs. The board of engineers selected for this work consisted of Col. G. H. Mendell, Maj. T. H. Handbury, and Capt. T. W. Symons. They submitted their report in 1892. It was evident at that time that there was no real demand for the section of the canal connecting Samamish and Washington. Five possible routes were considered:

1. By way of Duwamish Bay and the valley of the Cedar and Black Rivers to Lake Washington, thence across that lake to Lake Union.
2. and 3. By way of the depression between the southern part of Lake Union and Duwamish Bay (considered 20 years ago by Gen. Alexander) and known in former reports as the "Mercer Farm route," and the tramway route; thence from Lake Union to Lake Washington. This was considered too costly, now (1892).
4. By way of Shilshole Bay, Salmon Bay, the valley of the outlet of Union of Washington, and thence between Union and Washington by a canal through the Portage.
5. By way of Smith's Cove to the upper end of Salmon Bay, thence as in the preceding route.

The 4th and 5th routes were considered the most feasible, both requiring a canal 6700 feet long, 80 feet wide at the bottom, 158 feet wide at the water level, and 26 feet deep, connecting the head of Salmon Bay with Lake Union.

At first a lock between Washington and Union was specified; later it was decided to bring them to the same level by lowering Lake Washington or raising Lake Union. Upon fuller consideration, though, it was concluded that, owing to the disturbance it would make in values along the lake shores, the best plan would be to leave the lakes at their present levels and use a lock between them. Either of these two routes would require excavation of 7,740,000

cubic yards of material, (as compared with 35,000,000 cubic yards for the "south canal"). Also, the south district was laid out in city streets and lots; electric lines and water mains crossed that route, also. In view of those facts, the engineers invited the Seattle and Lake Washington Waterway to submit proposals for the construction of a similar canal over the route in question, (north), and similar proposals for connecting Elliott Bay with Lake Washington and Union. The Company had acquired only a small portion of its right-of-way and had made no effort to acquire the remainder. Land values there were going up all the time, and any delay meant just that much added expense.

The S. and L. W. W. Co. estimated that connecting Puget Sound with Lake Washington would require excavation of 8,304,-121 cubic yards; to connect Lake Washington and Lake Union, 2,-375,626 cubic yards.

In comparing the north and south routes the Board considered these relative advantages :

1. The Shilshole route the most advantageous.
2. The southern route is shorter and more direct and free from curves, being 1.85 miles long.
3. The southern route would require one lock; Shilshole, two.
4. The excavation necessary by the southern route makes it prohibitive.
5. The Duwamish is a silt-bearing stream, and would mean expensive dredging upkeep.
6. The southern route would be easier to defend from enemy guns.
7. The southern route would be endangered by slides.
8. The stream of fresh water around the piling of the wharves, resulting from the construction of the south canal, would lessen the destruction of the teredo.

In his report, Symons gave the following estimates as to the costs of the various routes, on the north :

Puget Sound to Lake Washington, via Shilshole...	\$7,830,089
Puget Sound to Lake Samamish	8,375,491
Puget Sound to Lake Union, via Shilshole.....	1,780,152
Puget Sound to Lake Union, via Smith's Cove.....	2,325,554
Puget Sound to Lake Wash., via. Smith's Cove....	3,448,261
With lock, add \$2,000,000.	

These estimates called for a masonry lock, 400 feet long, 50 feet wide, and 26 feet deep, and dredging channels to connect with deep water in Puget Sound.

From the head of Salmon Bay two routes were considered by the Board: one by way of Smith's Cove, with a canal to be constructed across the neck of land between the head of Salmon Bay and the Cove, with a lock near the Sound similar to that projected for Shilshole Bay; the other by the way of Salmon Bay and Shilshole Bay.

As to the advantages and disadvantages of the two routes: Smith's Cove is in Seattle harbor; Shilshole Bay is 5½ miles distant; Smith's Cove entrance and lock would be less exposed to bombardment by an enemy fleet.

From that time on only those two routes were seriously considered. About this time Congress felt that if such a canal were built, it should be constructed and controlled by the Government. In 1894 it appropriated \$25,000 for dredging Shilshole Bay and enlarging the waterway of Salmon Bay. The same Act recommended that the entire right-of-way be secured before any money be expended. The next year a survey and cadastral map was ordered to be made, of the canal and right-of-way.

The Act of June 3, 1896, authorized the selection of either the Smith's Cove or Shilshole Bay route and appropriated \$150,000. Before it would go ahead with the actual construction, it was necessary for the Federal Government to acquire the adjacent lands, right-of-way, etc.; to quiet the mills' demands, and to obtain releases from them. The small canal between Lakes Union and Washington, whose owners had the right to construct a canal between Puget Sound and Lake Union, must be acquired. It was owned by the Washington Improvement Co. Also, a strip of land laid out across the neck of land between Lakes Union and Washington, known as "Pike's Canal Reserve," had to be purchased. It would be necessary for the Seattle, Lake Shore & Eastern R. R., and the Seattle and Montana (Great Northern) to alter their courses.

In 1898, a Board of Engineers recommended that the Shilshole route be selected, with a lock at the "Narrows," near the foot of Salmon Bay. They based their choice on the facts that:

1. Shilshole is less exposed to heavy winds;
2. Is more easily defended;
3. Is more free from objectionable curves;

4. Free from complications arising from tide-land-filling contracts;
5. Free from quicksand;
6. Is cheaper;
7. Is more convenient for vessels going from the lakes directly to sea;
8. Is free from complications arising from location of railroad tracks. (As compared to Interbay district.)

The right-of-way for the canal was obtained, complete, in 1900; this work was done by the county of King. An appropriation of \$160,000 was made by Congress and used for dredging from Shilshole Bay to the Ballard wharves. The Act contained a proviso that this was not to be construed as the adoption of any project for the construction of the canal. It directed a re-examination of the whole project by a board of engineers, and imposed the condition that the canal to be estimated for should be . . . "of sufficient width and depth to accommodate the largest commercial and naval vessels." They reported January 6, 1903, that the project was entirely feasible, but not at that time advisable. The reason given was that the demands of commerce were not at all adequate to the expense to be incurred. (It had grown to \$8,000,000 by then.) These recommendations temporarily ended the activities of the Government in the project.

Meanwhile, though, a channel between Lake Union and Salmon Bay was deepened until its bottom was considerably lower than the high tide level. In order to control the flow of water between Lake Union and Puget Sound, a dam was constructed in the channel at the outlet of the lake, near the present Fremont bridge.

The people of Seattle, discouraged at the prospect of Government aid, secured permission for the cutting of a canal and the construction of a wooden lock, 600 by 70. The city objected to this scheme and advocated the use of masonry. James A. Moore offered to build the canal if King County would contribute \$500,000. To finance this proposition an assessment district was declared, and a tax of \$1,000,000 was levied against the district. An Act of Congress, June 11, 1906, authorized Mr. Moore or his assigns to construct a canal along the Government right-of-way. He was to commence work within one year and complete the project within three years from the above date. He was to operate and maintain the canal for three years free of cost and with no charge for tolls. It

was necessary for the state to pass a law granting to counties the right to create assessment districts for public works undertaken by the state or the United States. Congress later authorized Mr. Moore to change the work required in the original Moore Act to the simple excavation of a canal, 75 feet wide at the bottom and 25 feet deep, at mean low water, from deep water in Puget Sound at the mouth of Salmon Bay to deep water in Lake Washington, thus eliminating the timber lock and putting the whole matter on a new basis.

On June 10, 1907, Mr. Moore assigned his rights to the Lake Washington Canal Association, a corporation created March 27, 1907, for the purpose of taking over his rights and cooperating with the King County Assessment District, in carrying out the work proposed to be done by the local agencies. The validity of the county's \$1,000,000 was contested in the courts but upheld. On Feb. 6, 1909, King County, to whom the rights of the Lake Washington Canal Association had transferred its rights, obtained an extension of time to June 11, 1912, in which to complete the canal. A beginning was made within the specified year limit by clearing a portion of the right-of-way across the Portage. A new right-of-way was obtained through this section, reducing the curvature. The latest survey and estimate called for one lock only—all previous plans had specified two—to be near the entrance to Salmon Bay. The project of bringing the two lakes to the same level was mentioned by the Board of 1891 but rejected on account of the damage that would probably result. The present development of the country around Lake Washington demonstrated the importance of lowering the lake somewhat and it was a simple step to pass from such necessary lowering to a lowering sufficient to bring it to the level of Lake Union. It would drain the numerous low and swampy areas around the lake, divert the Cedar River into Lake Washington and cut off the present outlet, the Black River, and thereby relieve, to a large extent, the flood situation in the lower Duwamish valley; purify the waters in the south end of the lake by the increased inflow from the Cedar River, and render available a large extent of valuable shore lands around the borders of the lake.

The canal project proved too great for the local interests to handle and the aid of the Federal Government was again asked for. Finally, in 1911, following appropriations of sufficient funds, the construction was begun under the supervision of the engineers of the U. S. Army.

Since the Government already owned the necessary land at the Narrows for the locks it was natural that the lock should be built there. The Ballard mill owners, though, objected to having the lock located at the head of Salmon Bay to avoid the expense and inconvenience of adapting their plants to the higher level which would result if the lock were placed below them. In the eagerness of the promoters of the Moore project to carry it through without local opposition they practically promised the mill owners that the lock would be placed where they desired and this promise gave rise to some misunderstanding and hard feelings on the subject. When the question came up under the last survey a public hearing was held. Except for the mill men the opinion that it should be at the Narrows was unanimous. The Government could see no other reason for placing it elsewhere. The Act of Congress required that the lock be large enough to accommodate any and all shipping liable to enter Puget Sound, not necessarily the largest commercial or naval vessels afloat, as Seattle would always have its Elliott Bay, where vessels of any size could find accommodations. A lock of extra large dimensions would seriously handicap ordinary commerce. A length of 825 feet, width of 80 feet and depth of 36 feet were authorized. It was decided to have a small lock alongside the large, to accommodate the "mosquito fleet." This traffic was certain to be very large. This smaller lock was to be 150 by 30 by 16 feet. It was proposed to put a middle gate in the large lock dividing it into two chambers, 350 feet and 475 feet, respectively. The combination thus was virtually four locks, 158, 350, 475, and 800 feet.

It was recommended that the controlling works of the locks be in the nature of a power plant to utilize the outflow through the canal, the plant to be under the control of the Government and to be leased to outside interests and the revenue applied to the cost of maintaining and operating the canal; this plan not being adopted, then the controlling works in the form of a simple dam closed by ordinary flash boards; that no power plant be installed for operating the locks, but that electricity be purchased from private interests. For defense purposes it was proposed to inclose the grounds with a 15-foot stockade. The site of the locks themselves was drawn back from that originally chosen in Shilshole Bay, to the one finally adopted in order to give it natural cover. No portion of the lock except possibly the extreme southern end of the dam, is visible from any portion of Puget Sound, and that only from a narrow area.

One often sees the statement, "second only to Panama" applied to the Lake Washington Canal lock. This has not been true since 1928. On that date a new lock, a unit of the North Sea-Amsterdam Ship Canal was completed (begun in 1921). It is 1315 feet long, 164 feet wide, and 50 feet deep over the entrance sill. The Seattle lock was built entirely by day labor. The system consists of the two locks, a spillway, a salt water drain and a fish ladder. The spillway is a concrete dam about 300 feet long extending southward from the small lock. It has six gates which serve to regulate the flow of water. At the southern extremity of the spillway is a fish ladder which permits the ascent of fish from the sea to their spawning beds in the fresh water springs flowing into the lakes. The cofferdam, one of the largest undertakings ever attempted, was 2400 feet long, big enough to house a brigade of soldiers. The gates in the large lock are some of the largest double leaf gates in existence. The walls of concrete of the lock are 53 feet thick at the bottom and 8 feet at the top.

Features of the double lock and dam:

	Large lock	Small lock
Clear width of the chamber.....	80 feet	30 feet
Maximum length available.....	760 feet	123 feet
When completed.....	1916	1916
Type of construction.....	Concrete	Concrete
Estimated cost.....	\$2,275,000	

To reduce the effect of salt water which will enter the upper pool through the operation of the locks, the dam is provided with a concrete pipe having its inlet above the end of the large lock at an elevation of four feet below the upper miter sill and an outlet discharging over the spillway through a regulating gate.

Within a short time after the opening of the canal it was reported that the waters of Lake Union had been rendered unfit for many commercial purposes owing to the flow of sea waters into the canal system. As a result, Prof. E. Victor Smith and Thos. G. Thompson of the University of Washington conducted a study of conditions existing to determine the extent of the salinity and the efficiency of present methods of controlling it. The study was begun in 1917, and continued for ten years. The drain mentioned above is 670 feet long and has a cross-sectional area of 30 square feet. It was not provided for in any of the original plans, but was purposely introduced, suggested by the engineers of the U. S. Army

as a result of their experiences encountered in constructing the Panama Canal. It was discovered that salt water "climbs" into fresh bodies of water. This fact was known to the Egyptians and Persians, and was one of the objections to the completion of a canal connecting the Nile River with the Red Sea.

To make the drain work more effectively in the Lake Washington canal, the basin above the locks was enlarged and deepened. In raising vessels from the sea to the surface of the fresh water lake, a strong current of sea water flows from the bottom of the locks into the salt water basin as the gates are opened; an equal current of fresh water, at the surface. This is due to the fact that sea water is denser and tends to seek the lower levels. It is this denser water flowing to the bottom of the waterway that the basin is supposed to retain.

Failure of the drain to function, or a heavy lockage during the dry season, will cause the flooding of the salt water basin so that there will be a flow of the denser water into the lower levels of Lake Union. Then this body of water serves as a secondary basin, preventing the flow of the brackish water into Lake Washington, until this secondary basin is flooded. The great bulk of the sea water will remain below the 40-foot level. Fortunately, one of the deepest parts of Lake Union is in the main channel of the waterway and thus receives the maximum benefit of the flushing condition of boat passage, currents, and changes in temperature.

(To Be Concluded In July Issue)