

APPENDIX S.

ANNUAL REPORT OF CAPTAIN CHARLES J. ALLEN, CORPS
OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE
30, 1879.

ENGINEER OFFICE, U. S. ARMY,
Saint Paul, Minn., August 22, 1879.

GENERAL: I have the honor to submit herewith the annual reports upon the works and surveys under my charge for the fiscal year ending June 30, 1879.

By letter from the Chief of Engineers, April 25, 1879, I was charged with the surveys of Superior Bay and the Mississippi River between Saint Paul and Minneapolis. Steps were taken towards the organization of parties for these surveys, but the necessary funds not having been made available in time, the parties could not take the field until after the close of the fiscal year.

I was also charged, by letter from the Chief of Engineers, July 27, 1878, with the supervision of the Fort Snelling Bridge to be constructed by the board of bridge commissioners of Ramsey County, Minn. The structure, at the date of this writing, is not in a satisfactory state of forwardness. Upon its completion a special report will be rendered.

I wish to acknowledge the valuable services rendered during the year by Messrs. J. P. Frizell and J. D. Skinner, assistant engineers; by Mr. William Blankenhorn, chief clerk; and by Messrs. C. J. A. Morris and J. B. Parkinson, draughtsmen.

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Captain of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

S I.

IMPROVEMENT OF FALLS OF SAINT ANTHONY, MINNESOTA.

Maj. F. U. Farquhar, Corps of Engineers, was relieved of the charge of this work on the 15th of July, by Capt. C. J. Allen, Corps of Engineers, in accordance with Special Orders 148, Adjutant-General's Office, Washington, D. C., July 10, 1878.

The work during the year for the preservation of the falls has consisted principally in the building of a masonry wall at the westerly end of the apron. This was finished by August 31, 1879. It is 80 feet in length and 28 feet high, and 320 cubic yards of masonry were consumed in its construction.

The crib-work and old coffer-dams near the foot of Nicollet Island, constituting a serious obstruction to the flow of water to the mills on

the east side of the river, were removed during the fall, at a cost of \$4,723.69. The timbers and iron removed were sold at public auction and the proceeds deposited in the Treasury to the credit of the United States.

During the winter, frequent examinations of the riprapping below the apron were made, and the material found to hold its place well.

The original plan for the preservation of the falls has been carried out; still, on account of the constant wear upon the apron and adjoining works founded upon soft sandstone, there should be on hand at least \$50,000 with which to meet accidents liable to occur; that is, if the United States Government is to retain charge of the preservation of the falls. The balance of funds on hand, from former appropriations, is too small to meet any serious accidents.

By first section, act of Congress approved March 3, 1879, an appropriation was made as follows:

For sluice-way through public works at Saint Anthony's Falls, Minnesota, ten thousand dollars: *Provided*, That no part of said sum shall be expended for right of way, and that said improvement can be made without expense to the United States further than the actual construction of said sluice-way.

This appropriation having been rendered available for use, steps were at once taken to secure the preliminaries necessary to the erection and construction of the sluice, viz, waivers of claims against the United States by the owners of water-power at the falls for any damage that might possibly accrue to their interests on account of the diversion from their mills and canals of the requisite quantity of water for operating the sluice. The releases necessary were not all obtained until the 23d of June, when plans and estimates for the work were forwarded to the Chief of Engineers, and by him approved. The sluice to be 6 feet in width and 346 feet in length, to be constructed of timber, and located at the west end of the apron. Estimated cost of work \$7,889.

It is proposed, as soon as the water lowers sufficiently, to begin the construction of the sluice by means of hired labor and purchase of materials in open market, and to finish it during the season. It is estimated that the appropriation can be profitably expended during the ensuing fiscal year.

The act of Congress specifying that no expenditure shall be incurred by the United States other than that necessary for the actual construction of the sluice, no estimate is presented for its maintenance or repair. It is stated that there will be 12,000,000 feet of logs run over the falls during the season of 1879.

ABSTRACT OF APPROPRIATIONS MADE FOR IMPROVING THE FALLS OF SAINT ANTHONY.

By act approved July 11, 1870	*\$50,000
By act approved March 3, 1871	*50,000
By act approved June 10, 1872	*50,000
By act approved March 3, 1873	*50,000
By act approved June 23, 1874	125,000
By act approved March 3, 1875	100,000
By act approved August 14, 1876	120,000
By act approved March 3, 1879	110,000
	555,000
Original estimate for carrying out present project	\$529,726 31
Remaining to be appropriated	184,726 31

* These sums were used before the adoption of the present plan. For sluice-way through public works, &c.

Money statement.

July 1, 1878, amount available	\$11,413 39	
Amount appropriated by act approved March 3, 1879	10,000 00	\$21,413 39
July 1, 1879, amount expended during the fiscal year	7,896 41	
July 1, 1879, outstanding liabilities	125 11	8,021 52
		13,391 87
July 1, 1879, amount available		13,391 87
Amount (estimated) required for completion of existing project		184,726 31
Amount that can be profitably expended in fiscal year ending June 30, 1881, to meet repairs necessary, present and prospective		50,000 00

HISTORICAL SKETCH OF THE WORKS FOR THE PRESERVATION OF THE FALLS OF SAINT ANTHONY, MINNESOTA, COMPILED BY JOSEPH P. FRIZELL, ASSISTANT ENGINEER.

The Falls of Saint Anthony are on the Mississippi River, some 10 miles above its junction with the Minnesota. This region, for many miles east, west, and south, consists of sandstone of but slight coherence, reaching to an indefinite depth, overlaid by a layer of compact limestone generally 20 feet and upwards in thickness, which, in its turn, is overlaid by greater or less accumulations of gravel. The same formation extends eastward to the Saint Croix. A similar geological arrangement occurs on the Minnesota, 70 miles above its junction with the Mississippi (Report of Chief of Engineers, 1878, Part II, p. 920). It also extends down the Mississippi to Saint Paul and many miles below. The sandstone in the vicinity of the falls lies in strata of varying degrees of hardness rarely so soft as not to stand permanently at a perpendicular face when dry, or so hard as not to yield to the pick. The following are the particulars of a boring made by Mr. Cook at the falls in 1871 (Report of Chief of Engineers, 1872, p. 299):

	Feet.
Limestone ledge	2
Clay and shale impervious to water	4
Sandstone, quite hard with alumina and carbonate of lime	2
Sandstone, marked with oxide of iron	6
Sandstone, white, in thin layers, not homogeneous	6
Limestone, thin seam with no adhesion	6
Limestone, hard, withstands washing and atmospheric changes	17
Limestone, medium hardness	49
Limestone, soft, thin layer	8
Limestone, homogeneous with few horizontal seams	3
Limestone, hard, cemented with alumina and oxide of iron, requiring drilling	27
Blue clay	10
Sandstone, coarse-grained, friable	4
Sand and clay, very hard	10
Sandstone, soft, yellowish	10
Sandstone, hard, bluish, cemented with clay and iron, requiring drilling penetrated to a depth of	148
Total depth below bottom of limestone	148

The limestone lies in horizontal strata of varying qualities. Some are wholly disintegrated and changed to clay on exposure to the weather; others are extensively used for building, and last well in dry situations. The stone is intersected in various directions by vertical seams or quarry-faces. The disintegrable material appears to be distributed in horizontal films throughout all the stone, and, the action of moisture and frost, causes it to separate into great numbers of laminae, each of which is unimpaired in strength by the change. This limestone forms the bed of the river immediately above the falls, and has, undoubtedly, in times past, formed its bed for an indefinite distance below the falls. The history and process of the gradual recession of the falls up the stream is plainly legible in the bluffs along the river valley. The water, falling over the crest of the falls, rapidly wears away the fragile sandstone. The limestone, losing its support, separates at its quarry-face seams and falls in great blocks into the chasm. The protection afforded by these fragments serves to retard the action. A rapid exists immediately below the falls, but the violent current there engendered slowly but surely wears away the sandstone. The heavy fragments subside, and the current abates until it becomes incapable of wearing the sandstone. Then the bed of

the stream takes a certain degree of permanence. The present position of the crest of the falls is about 1,200 feet from the northerly limit of the limestone stratum. This remnant once broken through, the falls would cease to exist as a distinct cataract, but would stretch out into a long rapid. The sandstone, exposed to the full force of the current, would rapidly disappear, and changes impossible to predict would occur in the bed of river above the falls. Such an event would greatly increase the cost of maintaining and improving the navigation of the river; and for this reason the government, as conservator of the navigation of the river, was called upon to take measures for the preservation of the falls.

The river is separated into two parts by Nicollet Island, which lies above the falls, and by Hennepin Island, which extends somewhat below. A small opening occurs between the head of Hennepin and foot of Nicollet. The direct fall is some 45 feet. In the course of $\frac{1}{2}$ mile there is a fall of some 75 feet. The total fall between Minneapolis and Saint Paul is, by railroad levels, 110 feet. The river at Minneapolis flows nearly southeast. The channel on the northeast side of the islands is called the "Slough."

In 1857 the Territorial legislature of Minnesota granted charters to two companies, authorizing them to construct works necessary for utilizing the water-power at the Falls of Saint Anthony. The Saint Anthony Falls Water Power Company was authorized to occupy the northeast side of the river; the Minneapolis Mill Company the southwest side. Under these charters, dams and sluices were constructed, and an active and rapidly increasing manufacturing business, principally of flour and lumber, was initiated. A peculiar advantage in the application of water-power was afforded by the geological structure of the region, in the remarkable facility with which tunnels could be executed in the soft sandstone. The water was led from the mill-pond in a canal above the limestone, and these tunnels served as races to conduct it to the river after passing the wheels.

The operations of these companies very much restricted the water-way of the river. The Saint Anthony Falls Water Power Company closed the slough to the passage of flood waters. The Minneapolis Mill Company occupied the bed of the river above the falls for a distance of some 400 feet out from the southeast shore, thus restricting the flood discharge to a width of some 450 feet. These measures rapidly accelerated the recession of the falls, as will appear from the sketch, which shows the position of the crest in different years since 1857. These operations also threatened the permanency of the falls in another manner. In low-water the greater part of the water was drawn through the sluices. The limestone ledge, between the dams and the crest of the falls, being often left nearly bare in winter, was exposed to rapid disintegration from the action of frost.

An attempt was made by the companies to protect the crest of the falls by a timber apron in 1866. The work proved inadequate, and was destroyed by the ensuing high-water. A second attempt, in 1869, was defeated by high-water. In the autumn of 1868 a tunnel project was set on foot, of greater magnitude than any previously undertaken. It was proposed to establish mills on Nicollet Island, driven by water-wheels.

The water was to be drawn from the river at that point, and, after passing the wheels, to be discharged into the tunnel which was to conduct it to the river below the falls at the foot of Hennepin Island. The work was commenced in September, 1868, and pushed forward with vigor, but with little regard to the precautions suggested by ordinary foresight in so hazardous a proceeding. The tunnel was 6 feet square in cross-section, without lining or timbering, and its roof was some 6 feet below the bottom of the lime-rock.

The work was commenced at the lower end because of the facilities thus afforded for the disposal of spoil and water. Had it been commenced at the upper end, the perilous character of the enterprise would have become apparent without endangering the falls. The quantity of water entering the excavation increased as the latter progressed, but the obvious precaution of inserting a bulkhead with stop-gates to be closed in case of accident, was neglected. On the 4th of October, 1869, the tunnel had reached a point near the foot of Nicollet Island, a distance of some 2,000 feet from the point of beginning. Here the influx of water drove the workmen from the tunnel, which soon became a roaring sluice-way. The water entered by passing under the limestone at its upper edge, near the southwest side of Nicollet Island. The owners of the water-power immediately took measures to arrest the flow through the tunnel. A huge raft was constructed of timber and brush, and floated over the breach. It was instantly broken in pieces, and drawn into the vortex. They soon, however, got to work on a more methodical plan, and surrounded the opening with a line of cribs, loaded with stone. These were tightened with planking and earth until they formed a coffer-dam, excluding the water. Before this was completed, the tunnel had been so much enlarged that a portion of the limestone roof, some 80 feet in diameter, fell in (second break in limestone). This opening was also surrounded by a coffer-dam, and by the end of the month the water was excluded from the tunnel. A heavy embankment of earth was extended out from the southwest side of Nicollet Island

covering the head of the limestone. This was enlarged and strengthened at different times subsequently.

The act of Congress of 1867, making appropriations for public works, directed examinations and surveys of the Mississippi River above the Falls of Saint Anthony. Under this authority Maj. G. K. Warren, Corps of Engineers, then in charge of the work of improvements in this district, caused a detailed survey to be made of the falls in the autumn of 1869, and in his report called attention to the necessity of arresting their destruction.

During the winter of 1869-70, the Saint Anthony Falls Water Power Company constructed at the lower end of the second break a timber bulkhead, made tight with clay and flax straw, and puddled the bottom of the gorge above. They also commenced an excavation from the surface of Hennepin Island, through the roof of the tunnel about 400 feet farther down, intending to put in a masonry bulkhead at this point. On the 5th of April, 1870, the ice in the river broke up, destroying a part of the coffer-dam around the second break. The timber bulkhead was washed out, and a large area at the lower end of Hennepin Island was undermined, destroying several buildings. New coffer-dams were built and the flow of water arrested May 7, 1870.

The Falls of Saint Anthony were at this time the center of a large and thriving community, mainly indebted for its prosperity to the water-power. Finding the existence of the falls already sufficiently precarious, threatened by this new and formidable danger, a considerable sum of money was voted by the city of Minneapolis, and other sums raised by private subscriptions, for averting the common peril. Mr. James B. Francis, an eminent engineer of Massachusetts, was summoned in May, 1870, to examine the falls and give his opinion as to the best means of accomplishing the desired object. His report recites three agencies tending to the destruction of the limestone, viz: 1. The recession of the crest of the falls, as hereinbefore described. 2. The tunnel. 3. The action of the frost as before mentioned. For the first, he recommended a substantial apron of timber with heavy crib-work at the bottom. For the second, he advised uncovering the tunnel for a distance of some 400 feet from the second break and filling it with puddle of clay and gravel. For the third, he reiterated the recommendation previously made by Mr. Franklin Cook: to keep the limestone flooded by low-dams.

The work of constructing the apron was carried on in substantial accordance with Mr. Francis' recommendation, by a "Board of Construction," appointed by the citizens. Another body, the "Union Committee," had, the next year, supervision of the work on the tunnel. The plan adopted was to introduce a lining of timber and masonry forming a hollow plug instead of the solid plug recommended by Mr. Francis.

The first appropriation by the United States Government for the preservation of the Falls of Saint Anthony was made in the act approved July 11, 1870, viz, \$50,000. Under this appropriation, work was commenced by Col. J. N. Macomb, Corps of Engineers, who had succeeded Major Warren, at Nicollet Island, near the head of the tunnel. Mr. Franklin Cook, assistant engineer, was in local charge of the work. The plan was to clean out the upper part of the tunnel and fill it with puddle up to the limestone; to surround all openings through which water had entered the tunnel with a permanent wall of masonry reaching above high-water; fill the inclosed space with puddle of clay and gravel to the top of the wall, and cover it with riprap, forming a sort of artificial island. No serious accident occurred until July 3, 1871, when the water entered the tunnel from the slough, at the point where the coffer-dam crossed the head of the ledge. The water passed under the limestone and entered the head of the tunnel. The flow was stopped by building a temporary dam at the head of Nicollet Island, closing the slough entirely. One remarkable result of this irruption was the closing up of the lower part of the tunnel by debris and rubbish, and the opening of a new and shorter passage to the river, coming out below the apron on the southwest side of Hennepin Island. The coffer-dam in the slough was extended so as to inclose the new inlet into the tunnel, and work was resumed. The "Union Committee" commenced the work of lining the tunnel, as described above, soon after this accident. The river and harbor act approved March 3, 1871, had an item of \$50,000 for this work.

But little progress was made in the season of 1871, by the government, on account of the break above mentioned, and minor incursions of water. The repair of coffer-dams and strengthening the embankment at the head of the ledge occupied a large share of attention.

The work of lining the tunnel was pursued by the Union Committee in the following manner: The tunnel was cleared out, to the undisturbed sand-rock below, and to the lime-rock above. The bottom of the tunnel was dressed level and its sides perpendicular. On the bottom, sills 10 by 12 inches were imbedded in concrete. Vertical timbers were erected at the sides reaching from the sills to the lime-rock, notched to the former, wedged to the latter, with horizontal braces at top and middle. A lining of 4-inch plank was placed outside of the uprights, leaving a space of 1 or 2 feet between the planking and sand-rock, which was filled with concrete. The concrete appears to

have been made by pouring grout over dry broken stones. Some 800 feet of the tunnel was treated in this manner in 1871-72. The river and harbor act, approved June 10, 1872, granted \$50,000 for this work.

August 10, 1872, a Board of Engineer Officers was convened at Minneapolis by order of the Chief of Engineers, "for the purpose of considering and reporting upon the whole subject of the preservation of the Falls of Saint Anthony and the work now in progress therefor." It consisted of Col. J. N. Macomb, Lieut.-Col. J. D. Kurtz, Maj. G. Weitzel, Maj. O. M. Poe, and Maj. D. C. Houston.

This Board recommended the adoption of the plan proposed by Colonel Macomb, the main feature of which is understood to be a wall extending across the river at the head of the ledge. It was to be founded on the hard stratum of sand-rock, supposed to lie some 14 or 16 feet below the bottom of the limestone. It was to rise to the top of the limestone, and be carefully joined to the same.

The city of Minneapolis had, up to this time, expended about \$140,000 on the apron (including \$21,661.42 furnished by the United States), and about \$95,000 on the tunnel, which had been lined for a distance of 800 feet. Some \$65,000 more was required to complete the apron.

The Board recommended that three-fourths of the appropriation of June 10, 1872, be expended in carrying out the plan pursued by the Union Committee for lining and closing the tunnel, the balance to be applied to the coffer-dams, wall, and works in progress under Colonel Macomb. The work on the tunnel was resumed in accordance with this recommendation early in October, 1872. A bulkhead of masonry 25 feet thick was put in as indicated on the plan. It was provided with stop-gates and drains to carry off the leakage from above. The work of cleaning, trimming, and lining the excavation was carried to about the middle of the second break, where it stopped, early in February, 1873, from exhaustion of funds. In the following April the coffer-dams gave way and the work was flooded. The masonry bulkhead was undermined and destroyed, and the timber lining below was burst in. The river and harbor act approved March 3, 1873, granted \$50,000 for the preservation of the Falls of Saint Anthony, Minnesota, and the navigation of the Mississippi River above the same. The whole appropriation appears to have been applied to the falls. Colonel Macomb was relieved of this work April 25, 1873, by Maj. F. U. Farquhar, Corps of Engineers.

In May, 1873, another irruption of water occurred through the earth embankment at the head of the ledge. No serious damage was done.

During the summer of 1873 a bulkhead of timber and concrete was constructed in the tunnel a short distance below the masonry bulkhead destroyed by the break of the preceding April. An iron pipe 36 inches in diameter was laid through the timber bulkhead, extending up-stream along the floor of the tunnel about 250 feet, and this portion of the tunnel was filled with well-rammed gravel.

A Board of officers of the Corps of Engineers, consisting of Col. J. N. Macomb, Lieut.-Col. J. D. Kurtz, Maj. G. Weitzel, Maj. O. M. Poe, and Maj. F. U. Farquhar, was convened at Minneapolis, Minn., April 15, 1874, to consider and report upon the subject of the preservation of the Falls of Saint Anthony. This Board recommended the introduction of a dike of concrete extending across the river, founded in the homogeneous stratum 38 feet below the bottom of the lime-rock, and reaching up to the latter; to be at least 4 feet in thickness, and to be built in a trench excavated beneath the limestone. This was suggested as requiring less time in construction than the wall recommended in 1872. The latter, however, was held to be a necessary part of the plan of protection, and its ultimate construction recommended.

The act of Congress approved June 23, 1874, appropriated \$150,000 for the improvement of the Falls of Saint Anthony, and the improvement of the navigation of the river above the falls, \$25,000 of the amount to be applied to the latter purpose. Work was commenced in accordance with the above report in July following. The first step was to excavate a vertical shaft, to serve as a pump-well and entrance to the proposed excavations. This was carried to a depth of 45 feet below the lime-rock. It was lined with brick and concrete and divided into two sections, one for hoisting and one for the passage of workmen. The latter contained, also, the shaft for driving the pumps. The power for hoisting and pumping was furnished by a water-wheel, and transmitted by a wire rope. The general thickness of the concrete wall was 4 feet, but at the bottom it was enlarged to contain a gallery for the passage of workmen and for a tramway. A drain was formed at the bottom of this gallery through which the water from the excavations reached the pump-well. A second gallery was left immediately under the limestone by omitting to build that part of the wall. These galleries were closed up with concrete on completion of the work. The trench for the wall was excavated generally in sections of 20 to 30 feet in length, and of the full depth. The wall was then carried up to the floor of the second gallery before proceeding with the excavation.

On the 15th of April, 1875, the coffer-dam in the Saint Anthony Mill pond failed, and before it could be repaired the water had found its way into the excavation for the dike. It opened a long channel leading from the break of 1871 to the old tunnel be-

low the timber bulkhead, passing under the lining of the tunnel and entering the excavation. It also made a breach into the tunnel, and thence escaped into the river below the falls. This irruption of water filled the open excavation with sand, clogged the pumps, and delayed the work some 6 weeks. The new channel was closed by a bulkhead a little below its origin, at the break of 1871, and the portion above the bulkhead filled with gravel.

The act of Congress approved March 3, 1875, granted \$100,000 for the improvement of the Falls of Saint Anthony, with authority to expend \$25,000 of it for the improvement of the Mississippi River above the Falls of Saint Anthony. It was applied wholly to the falls.

During the fiscal year ending June 30, 1876, the work went on with great regularity, only one interruption of importance having been met with, viz, in August, 1875, occasioned by the disabling of the pumps during an unusually large influx of water, which caused considerable caving and influx of sand. By the close of that year the work was completed except the filling of the galleries. The easterly end of the dike extended 70 feet beyond the high-water shore-line of the river, and was finished with a T-head. Wing-walls were added on the up-stream side. The west end was carried 25 feet beyond the river shore-line.

The apron, which had been badly damaged by ice the preceding spring, was repaired during this year at an expense of about \$25,000, \$1,500 of which was furnished by the citizens of Minneapolis.

The act of August 14, 1876, granted \$120,000 for the improvement of the Falls of Saint Anthony. Work on the dike was resumed in September, 1876, and completed in the following November. The total amount of concrete used in the dike was 14,882 cubic yards. Total cost of dike about \$212,000.

During the fiscal year ending June 30, 1877, two low dams were built across the open channel of the river to protect the limestone from the action of the frost by keeping it flooded. All tunnels and cavities in the sandstone were filled with gravel, the exposed surface of which was covered with ripraps.

During the year ending June 30, 1878, the apron was remodeled, and in part rebuilt in its present shape, at a cost of something over \$31,000. A drift was carried along the down-stream face of the dike to a point some 470 feet west of the west branch of the tunnel, and the leakage through the dike was taken into a drain and led into the tunnel. The leakage was reported as small and gradually diminishing.

During the year ending June 30, 1879, a wall was built at the westerly end of the apron, forming, in connection with the natural limestone ledge and existing walls, a complete face of masonry on that side. The crib-work and old coffer-dams near the foot of Nicollet Island, having served their purpose, and constituting a serious obstruction to the use of water for power, were removed and the materials sold.

By the act of March 3, 1879, the sum of \$10,000 was appropriated for building a sluice-way through the public works at the Falls of Saint Anthony. This work will be commenced as soon as the present high stage of water subsides.

The amount contributed by the city and citizens of Minneapolis, so far as can be ascertained, is \$334,500.

S 2.

IMPROVEMENT OF MISSISSIPPI RIVER ABOVE THE FALLS OF SAINT ANTHONY, MINNESOTA.

An examination of the river between Saint Cloud and the Falls of Saint Anthony was made in 1873. The report of Maj. F. U. Farquhar, Corps of Engineers, based upon the results of this examination, is printed in the Annual Report of the Chief of Engineers for the fiscal year ending June 30, 1874, page 298, Part I. The method of improvement considered was to afford a channel-way 200 feet in width, with an available depth of 4 feet at low-water, by the removal of 37,236 yards of bowlders, gravel, and rock, and the construction of 1,100 linear feet of wing-dams, at an estimated cost of \$43,034.75. This examination was made under difficulties, the river, owing to the gorging of the ice upon the rapids, varying from 1 to 7 feet above low-water mark, and being filled to the bottom with anchor-ice, rendering a more complete survey desirable upon which to base reliable estimates.

Congress, by act approved June 23, 1874, appropriated—

For continuing the improvement of the Falls of Saint Anthony, and for the improvement of the Mississippi River above the Falls of Saint Anthony, Minnesota, \$150,000; and \$25,000 of said amount shall be expended for the improvement of the Mississippi River above the Falls of Saint Anthony.

The same act also appropriated the sum of \$200,000 for surveys and estimates for the improvements recommended by the Senate Select Committee on Transportation Routes to the Seaboard.

Following the appropriation of \$25,000 of the above act of Congress, a number of brush-dams were constructed to close up some of the channels through the Thousand Islands just below Saint Cloud, and a dam was also built across the threatened cut-off just below Monticello; in all, 2,735 feet of brush-dams and 314 linear feet of brush protection to the heads of the islands having been constructed. The removal of some of the worst rocks and bowlders by means of a steam-crane scow was also effected.

An allotment of \$30,000 was made for the purpose of a thorough survey of the river above the falls, in order to furnish estimates to meet the recommendations of the Senate select committee, and the river surveyed during 1874 from its sources to the Falls of Saint Anthony. The reports, dated February 4 and February 8, 1875, based upon the results of this survey, are printed in House Ex. Doc. No. 49, second session Forty-fifth Congress.

Congress, by act approved August 14, 1876, appropriated the sum of \$20,000, as follows:

For the improvement of the Mississippi River above the Falls of Saint Anthony, \$20,000, no part of which shall be expended upon the Falls of Saint Anthony.

Work recommenced the 28th of May, 1877, at Battle Rapids, 41 miles above Minneapolis, and continued during the season, use being made of the crane-scow built in 1874 for removing bowlders. A number of brush and stone dams was also constructed, as well as brush and stone shore protection.

The crane-scow resumed work May 11, 1878, completing its work by the close of the fiscal year to Coon Rapids. The dams at the Thousand Islands were repaired in June and July, same year.

July 15, Captain Allen relieved Major Farquhar, in accordance with Special Orders No. 148, Adjutant-General's Office, Washington, D. C., July 10, 1878.

The 1st of July, 1878, found the steam crane-scow, provided with grapple, rake, and steam-drill, and a hired crew, at work at Coon Rapids, 13 miles above Minneapolis, removing gravel and bowlders from the bed of the stream. By the close of the season it had reached Minneapolis, where it was dismantled and laid up for the winter, having removed 850 cubic yards of material, and 3 sunken cribs from the channel above the railroad bridge at Minneapolis.

A dam 325 feet in length, at the head of Coon Rapids, was built with the bowlders removed from the channel.

The balance of funds on hand from former appropriations is too small to enable anything to be done this present season other than to make repairs, where necessary, to existing dams by means of hired labor and purchase of materials in open market.

The original estimate for the work between Saint Cloud and the Falls of Saint Anthony was \$144,667.50, the work to consist in removal of obstructions, closing of secondary channels, island chutes, and protection of shore. The work of improvement has been confined to the points

between Saint Cloud and Minneapolis, where the obstructions to navigation were the worst. If work under the present plan is to continue, \$40,000 can be profitably expended during the fiscal year ending June 30, 1881, as a dredge-boat will be required for the thorough removal of bowlders and gravel. Probable cost of the dredge-boat, \$20,000. One steamer plies upon the river between Minneapolis and Saint Cloud. Large quantities of logs are run down the river and received into booms.

The work during the season of 1878 was in immediate charge of Mr. Wm. Batson, overseer, who carried it out with faithfulness and zeal.

This work is in the collection-district of Minnesota. The nearest port of entry is Duluth, Minn., at which place the revenues collected for the fiscal year ending June 30, 1879, amounted to \$7,764.51.

ABSTRACT OF APPROPRIATIONS MADE FOR THE IMPROVEMENT OF THE MISSISSIPPI RIVER ABOVE THE FALLS OF SAINT ANTHONY, MINNESOTA.

By act approved June 23, 1874*	\$25,000 00
By act approved August 14, 1876.....	20,000 00
	45,000 00

Original estimate for the work between the Falls of Saint Anthony and Saint Cloud, Minn.....	144,667 50
Remaining to be appropriated	124,667 50

Money statement.

July 1, 1878, amount available.....	\$6,827 43
July 1, 1879, amount expended during fiscal year	\$3,558 99
July 1, 1879, outstanding liabilities	621 68
	4,180 67
July 1, 1879, amount available.....	2,646 76
Amount (estimated) required for completion of existing project	124,667 50
Amount that can be profitably expended in fiscal year ending June 30, 1881..	40,000 00

COMMERCIAL STATISTICS (SEASON OF 1878.)

Logs and lumber.

	Logs scaled.		Logssawed.	Manufactured.			Carried over.
	<i>Logs.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Lumber.</i>	<i>Laths.</i>	<i>Shingles.</i>	<i>Feet.</i>
Minneapolis	920,660	99,456,000	105,731,480	111,697,220	16,403,750	36,902,000	4,000,000
Above Minneapolis	2,000	237,110	.....	.....	.....	.....	15,500,000
Anoka	13,485	2,340,060	27,706,820	29,472,280	5,649,450	10,226,000	1,475,730
Saint Cloud	896	165,580	3,262,500	3,500,000	1,500,000	1,000,000	.....
Dayton .....	.....	.....	360,000	400,000	.....	.....	.....
Princeton .....	.....	.....	225,000	250,000	.....	.....	.....
	637,041	102,198,750	137,285,700	145,319,500	23,553,200	48,128,000	20,975,730

There were but two steamboats plying on the Mississippi River above the Falls of Saint Anthony during the season of 1878; one plying between Minneapolis and Saint Cloud, and the other between Aitkin, on the Northern Pacific Railroad, and Grand Rapids, Minn. The former made 30 trips (6 trips to Clearwater, 24 to Saint Cloud), carrying upstream merchandise and machinery amounting to 375 tons, and bringing downstream live stock, wheat, potatoes, &c., amounting to 230 tons; also, 6 barges of hoop-poles, 600 cords wood, and 200,000 feet (board-measure) lumber. The number of passengers carried was about 600. On account of low-water the steamboat plying between Aitkin and Grand Rapids was unable to make more than one trip during the season.

* Made and expended before the adoption of the present project.