Mrs D. Lowe.
from her frnd Sept Williams

BIENNIAL REPORT

OF THE

BOARD OF PUBLIC WORKS

OF THE

STATE OF IOWA.

READ IN BOTH HOUSES OF THE GENERAL ASSEMBLY ON THE SEVENTH DAY OF DECEMBER, 1850.

Printed for the use of the General Assembly.

IOWA CITY:
PALMER & PAUL, STATE PRINTERS.
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1850.

REPORT

OF THE

BOARD OF PUBLIC WORKS.

OFFICE OF THE BOARD OF PUBLIC WORKS,
OTTUMWA, December 2, 1850.

To His Excellency the Governor of Iowa:

The Board of Public Works, in accordance with the requirement of law, herewith submit the following,

REPORT:

The total receipts from the sale of lands belonging to the Des Moines River Grant, commencing on the 11th day of October, 1847, when the Land Office was first opened in Fairfield, for receipt of proof of pre-emptions, to the 28th day of November, 1850, inclusive, as shown by the accompanying statement of the Secretary of the Board is $211,563 58-100. The total amount of land sold, as exhibited by same statement, is 169,153 27-100 acres. The amount in said grant, lying south of the Raccoon Forks, as shown by official statement from the General Land Office, is 321,868 33-100 acres, of this portion of the grant, there yet remains unsold 152,715 6-100 acres, which, at $1 25 per acre, amounts to $190,893 83. That portion of the grant lying north of the Raccoon Forks, and extending from thence to the source of the river, is estimated to contain at least 900,000 acres, which, added to that portion lying south, makes 1,052,715 6-100 acres; estimating these lands at the minimum now fixed by law, they amount to $1,315,893 83.

The grant of land to the State, to aid in the improvement of the Des Moines river, from its mouth to the Racoon Forks, is expressed

as follows: "For the purpose of aiding said Territory to improve the navigation of the Des Moines River, from its mouth to the Racoon Forks (so called) in said Territory, one moiety, in alternate sections, of the Public Lands (remaining unsold and not otherwise disposed of, encumbered, or appropriated) in a strip of five miles in width on each side of said river, to be selected within said Territory," &c.

The Commissioner of the General Land Office, under date of the 23d of February, 1848, in a communication addressed to the Board of Public Works, through the then Secretary, Charles Corkery, Esq., decided that the State is entitled to the alternate sections, within five miles of the Des Moines River, throughout the whole extent of that river, within the limits of Iowa." The language of the act is "within said Territory," which does not limit the grant to what is now the northern boundary of the State of Iowa, but of course extends as far as the Des Moines River extends into Minnesota Territory, which, from the best information we can obtain of the locality of the *source* of the river, is from forty to sixty miles north of the south boundary of that Territory.

Notwithstanding this decision of the Commissioner, made as it was in accordance with the plain and literal meaning of the act of Congress, a portion of the grant above Fort Des Moines was included in a Proclamation, and about 25,000 acres sold by the United States, in 1848. Immediately upon the Board being advised of the fact, that these lands had been proclaimed for sale, they remonstrated against their sale, and through the prompt attention of our Representatives in Congress, the whole matter was brought before the Secretary of the Treasury, Hon. Robert J. Walker, who, on the 2d of March, 1849, decided that the Grant extended from the mouth to the *source* of the river; and communicated his decision to the Commissioner of the General Land Office, for the government of that office in the premises. This construction of the grant, had, from the passage of the law, prevailed with the authorities of this State. The Board of Public Works, in adopting the plan for the improvement of the river, by means of Locks and Dams, creating slackwater, had done so in view of the donation extending to the *source* of the river.

In November of last year the Secretary of the Board made application through our Senators in Congress to the Commissioner of the General Land Office for the requisite confirmed list of land belonging to the grant above the Fork, with a view of permitting claimants

in that portion of the country to prove up and purchase their lands under the pre-emption law of the State during the ensuing spring, and also with the view of offering a portion of these lands, as far up as the surveys might be completed, at public sale at a suitable time during the summer. The object in view, was to be in receipt of funds from that source in time to meet the large estimates which was expected to be due as soon as the favorable season for the prosecution of the work in the spring and summer should arrive. In answer to this application, the Secretary of the Board was advised by letter under date of the 19th of December last, that said "list is now in course of preparation, and will be ready for transmission at an early day." A copy of this letter is herewith annexed, marked "A." The promised list, however, as will appear, has never been received.—Subsequently a letter from the Secretary of the Board was addressed to the Department of the Interior, through our Senators in Congress, calling the attention of the Government to the fact of sales of the State lands under proclamation of June, 1848. In answer to this communication, the Hon. A. C. Dodge and Hon. G. W. Jones were notified that the Commissioner of the General Land Office, disregarded the decision of the former Secretary of the Treasury of March 2d, 1849, and that he decided that these lands had been legally sold by the United States. An appeal was promptly made by the Senators to the Hon. Thomas Ewing, then Secretary of the Interior, under date of March 16th last. A copy of that appeal is herewith annexed, marked "B" In answer to this appeal upon the part of Senators Dodge and Jones, and also in answer to the several applications of the Secretary of the Board to be furnished with a confirmed list of land belonging to the grant above Fort Des Moines as far as surveyed, the Commissioner of the General Land Office, the Hon. J. Butterfield, replied under date of the 9th of April last, that the Secretary of the Interior had decided adversely to the late Secretary of the Treasury; that the grant for the improvement of the Des Moines river, under act of August 8, 1846, does not extend above the Racoon Forks." A copy of this letter, with a copy of the decision of the Secretary of the Interior, which accompanied it, are herewith annexed, marked "C," and "D."

This unexpected decision, coming as it did, at a time when we were looking to these lands to furnish the ready means, which it was evident would not be realized from the sales of lands south of the

Forks, to meet current estimates of the work in progress, proved most disastrous to the reasonable expectations, not only of the Board, but to all connected with the work. A large portion of the contractors had previously to the reception of the news of the decision, commenced with renewed vigor and with largely augmented forces upon their respective contracts, with the view of completing most of them the present season. The receipts in the Land Office, for the months of March and April, it will be seen, fell more than one half short of that of any similar period since it was opened for the sale of these lands. This was owing in part to the fact that Military Land Warrants could be obtained so as to locate United States lands at a cost of from 75 cents to one dollar per acre—but may be attributed mainly to the immense and extraordinary emigration from the portion of the State where these lands are located, to California. The average receipts of the Land Office for six months, commencing with April and ending with September, was $3,838 31. To have prosecuted the work actually under contract and in course of construction during these months, would have required at least $15,000 dollars per month. The receipts from land above the Forks, first from pre-emption claimants, and afterwards from public sale, as far up as the surveys might be completed, was confidently looked to to supply the deficiency which was accruing between the regular receipts in the Treasury, and the largely augmenting estimates on the works. The survey had been made from sixty to eighty miles above Fort Des Moines, and settlements had extended over one hundred miles. With this source of funds in view, in addition to the receipts from the lands which had already been offered, the Board felt, during the past winter and early portion of the spring, every confidence of being able to prosecute the work under contract nearly, if not quite, to completion during the past season.

An appeal was immediately made by our entire delegation in Congress, under date of April 16th, last, to the President of the United States, against the decision of the Secretary of the Interior of the 6th of that month. The President, with a promptness that evinced every disposition to do justice to the State in the premises, immediately referred the whole matter to the then Attorney General of the United States, Hon. Reverdy Johnson, who under date of the 19th of July last, gave an opinion in which he fully and triumphantly sustained the decision made by the Hon. Robert J. Walker, Secretary of the

Treasury, of the 2d of March, 1849—and also the construction under which the authorities of this State had ever acted in the commencement and prosecution of the improvement. It yet remains for the Executive to carry out this opinion, and to restore to the State these lands which it is so clearly shown belong to her, and of which she was deprived at a time in the prosecution of the public works, so disastrous and unfortunate to her best interests.

Since the lamented death of the late President, several changes have occurred in the head of the Department of the Interior, which it is fair to presume has operated against the further and favorable ac-
State tion on this subject. It is reasonable to expect that, ere long, the will be put in possession of these lands, and that the full benefits of the entire grant will, another year, be realized; as fast as they can be made available by sale, or otherwise, in the vigorous prosecution of the great improvement for which they were donated. This appeal and the opinion of the Attorney General, accompanied with a letter from the Hon. A. C. Dodge, under date of the 6th of November last, accompany this report, severally marked.—"E," "F," and "G."

The decision of the Secretary of the Interior, of April the 6th, together with the unexpected diminution in the receipts from the sale of such lands as were subject to private entry, made apparent the impossibility of paying the large estimates as they became due. In view of this fact, it was deemed expedient and proper to suspend for the season, or until after the meeting of another session of the General Assembly, that portion of the work from St. Francisville to the mouth of the river—being the ten miles of steamboat canal including the locks, &c., connected with it. Previous to this determination being arrived at, the Engineer had taken the estimates upon the whole works in course of construction—and the indebtedness actually at that date, (the 13th of May,) below Farmington, was found to be $30,000 dollars, exclusive of the 15 per cent retained to secure the fulfillment of contracts. To meet this indebtedness there was but $10,000 dollars in cash in the Treasury, which left a deficit at that date of $20,000 dollars on the work below that point, embraced in the first letting. For the accommodation of the contractors, upon that portion of the work, the President issued certificates certifying the respective amounts due them, and made payable at his office, out of the first receipts in the Treasury. Those certificates were payable to order, and answered a valuable purpose in enabling the contract-

ors to transfer their claims upon the State in payment of such liabilities as they had contracted in the prosecution of their work.

The work on the contracts being suspended by the inability of the State to meet her engagements, the fifteen per cent. heretofore retained on their jobs will necessarily have to be paid. The laws in relation to the improvement do not define the course to be pursued in case of a failure to pay the estimates when due. It is respectfully suggested that the Legislature shall definitely prescribe the course to be pursued in case of similar occurrences in the further progress of the work. We also respectfully recommend that the Legislature memorialize Congress to allow the proper authorities of the State to select other lands, in lieu of those sold by the United States above the "Forks." These lands, notwithstanding their sale by the General Government, yet legally belong to the State, but in view of the fact that they have been mostly located upon by military land warrants, in good faith by our own citizens, injustice would doubtlessly, in many instances, be done, were the State compelled to assert her title to them. Congress, it is presumed, would, in view of the facts under which the State was attempted to be deprived of these lands, allow others to the amount of the value of them, to be selected and appropriated to the improvement. Injustice would be done the State, were she to take instead of these lands a similar quantity of such lands as could now be selected. The lands sold, situated as they are immediately above the prosperous and rapidly advancing young city of Fort Des Moines, are intrinsically at the present time worth from four to ten dollars per acre, while a similar quantity selected in lieu of them, would never realize to the State over one dollar and a quarter per acre. It is, therefore, proper, in appealing to Congress for reimbursement, that the memorial be so framed as to ask for the value of those lands, instead of a similar quantity of much less value.

The able and full report of the Chief Engineer, Guy Wells, Esq., which accompanies this report, shows the exact condition of the work under charge. It will be perceived by a comparison of these estimates with those of the former Chief Engineer, under whom the improvement was originally projected and commenced, that there exists a very material difference of cost. The figures of the present Engineer shows that work has already been done on the canal with ts necessary appendages to the amount of $138,848 42, exclusive of the ordinary and usual contingent expenses in the prosecution of such

works of ten per cent. upon that amount, which would augment it to $152,733 26. The total cost of the canal, according to the present estimate will amount to $260,938 34, of which amount there remains yet to be done $122,089 92 ; adding the estimates for contingent and wastage during the suspension of the work, twelve per cent., making the whole cost of the canal $275,589 13, and the whole cost of the work yet to be done $036,740 92, exclusive of the ten per cent. on the work already done. The figures of the former engineer, as shown in his report No. one, make the cost of the canal, after adding ten percent. for contingent expenses and $5,000 00 for walls and races for mills at various points from Lock No. 0 to Lock No. 4 at Thoms' mill, $125,987 11. The present estimated cost being made at the actual prices for which the work was contracted, and the former estimated cost being made before the work was put under contract. We refer you to the present Engineer's report for the reasons for this great discrepancy in the two estimates.

The extraordinary and destructive freshets which occurred during the latter part of the winter and in the spring of 1849, occasioned considerable destruction to the works on the canal. The river, as is well known, rose higher at that time than it was ever known to have been by the inhabitants in its vicinity before or since. This misfortune, added to the prevalence of the cholera which made its appearance on the works in the early part of the season, occasioned much loss and vexatious delay to the contractors. In addition to this, expenses of conducting the work had advanced from 50 to 75 per cent. for ordinary labor, and other expenses in about the same proportion.

In November, of that year, the Board, accompanied by the Chief Engineer, made a personal and thorough examination of the whole work under contract; and in pursuance of an adjournment from a regular meeting held at Ottumwa, met at Keokuk, on the 20th of that month, for the purpose of considering the various petitions and representations of the several contractors on the line. The causes, above referred to, had induced a portion of them to desire a relinquishment of their contracts, while others asked and contended for the allowance of large damages by the destruction of embankments, &c. It was apparent to us that slight advances on most of the Canal jobs had to be made, and that some allowances were required in order to prevent an abandonment of a number of the larger contracts. This, it was

desirous, should be avoided, for had the work, under the then existing circumstances, been relet, it would have cost the State much more than the allowances and alterations required to enable the present contractors to proceed under their first contracts. The first letting of the work, it is well known, was at a time when labour, provisions, &c. could be obtained at but little if any more than one half of what they would cost at the date in question.

Under these circumstances, and in accordance with the recommendation of the then Chief Engineer, Colonel Samuel R. Curtis, the following allowances and changes were made to the contractors. Fifty cents per perch was added to the price of masonry, in consequence of its being changed from rubble to cut stone and range work. The original contractors, Messrs. Stewart & Wallace, on section No. 4, having, for a year previous, left the entire control of their work to their assignees, Messrs. Smith, Morrison & Co., the President was authorized to enter into contract with the latter, for the completion of the work at a small advance on the former contract prices. On section No. 5, for reasons heretofore stated, and in consequence of a change of location of Lock, the contractors prices on this section were advanced. On section No. 6, one hundred and twenty dollars was allowed for loss of embankment by flood. Allowances were made on section No. 8, one hundred dollars for timbers swept away and lost by flood, one hundred dollars for damages done to Lock pit, and eight hundred and ten dollars for loss of embankment. The contractor, having delivered the estimated quantity of protection stone, and it was found the work still required more, which the contractor refused to deliver at his former prices, therefore the price was advanced from one dollar to one 50-100 dollar per perch, on the balance delivered.

The contract, for constructing Culvert on section 3, having been abandoned by the original contractor, Richard Morris, was relet to Messrs. E. Lindsey & Co. who completed it about the 1st of September, in a manner entirely satisfactory to the Engineer.

Messrs. Quinn, Caraher & Co. contractors at Dam No. 2, having abandoned their contract, about the 1st of April, and the Board, after receiving proposals, re-let the work to Messrs. J. C. Walker & Co. they being the lowest responsible bidders.

The President has made an arrangement, by contract, with Messrs. Thoms & Colton, mill owners, at Dam No. 3, on the south side of the river, in the State of Missouri, by which they are to remove their saw

mill, and convey to the State a sufficiency of ground for all needful purposes, in the use of water power at that point. They also release to the State a quantity of timber and stone contained in the old Lock. In consideration of the above, and the stoppage of their mills for two months, to enable the contractors to put in the new Dam, the State is to pay two thousand dollars.

At Dam No. 6, Bentonsport, the contractors, Messrs. Brown & Sanford, commenced putting in the Dam about the 1st of July, and it being located just above the old mill dam, it became necessary to drain the pool, thereby suspending the operations at the mills on each side of the river, for about four months. The owners of these mills, Messrs. Brown & Sanford on the north side, and Mr. Allender, on the south side of the river, claim heavy damages from the State, for loss of time in the use of their mills. They also claim that the State shall pay the expense of conducting the water from the State Dam to their respective mills.

The 22d, section of an act creating the Board of Public Works, and providing for the improvement of the Des Moines river, says, "and nothing herein contained shall prevent the Board from paying the proprietors of such dams, whatever they may deem reasonable, in addition to the privileges authorized by this act." The owners of the several mills and dams on the river were allowed, in consideration of lands, and of their privileges, together with the damages they might sustain, to have the use and benefit of water power sufficient to propel the same amount of machinery that they had previously been using, free of cost for the term of fifty years; the water of course to be applied to the most approved wheels now in use. Messrs. Brown and Sanford claim power sufficient to propel nine run of burrs, which at the rate at which power has been leased to Messrs. Green and brother, at that dam, would amount to $900 per annum, for fifty years. In considering these claims for damages, it is necessary to take into view the fact that the State has incurred considerable expense in the location of locks and dams to accommodate mill owners—and that the character of the work done by the State secures to them this valuable power, permanent and uninterrupted for the long time mentioned.

The claims presented are urged, *First*, upon the grounds that the Public Works require a stoppape of their mills: *Second*, that the State is bound to place them in as good a condition as they were

found at the commencement of the work—and, *Thirdly*, upon the ground that they had always complied with the requirements of their Territorial charter, and kept the lock at that point in good condition to pass boats, &c.

These claims, together with similar ones that may be presented, are respectfully submitted for Legislative action.

Accompanying this report will be found marked No. 1, the Presidents account of receipts and disbursements—No. 2, the account current of the Treasurer, and No. 3, the statement of the Secretary exhibiting the amount of lands sold, &c.,—also a tabular statement by the President, showing the State indebtedness, numbered, 4.

The present system of prosecuting the work, it will be apparent, we think to all, is not the most judicious to accomplish the great object in view, to wit: the speedy completion of the improvement, at the least possible cost to the State. At present it can proceed no faster than the irregular and uncertain receipts from the sale of lands will pay the estimates, and other expenses. The irregularity of these receipts will be made apparent by reference to the tabular statement of the monthly sales during the past fourteen months. The six months instanced, from April to September, inclusive, embracing the season of the year, when such work can only be successfully prosecuted, and when the largest amount of money is required, are smallest.—Indeed at any season of the year they are entirely inadequate to prosecute even the present work under way, and render out of the question, the possibility of putting more of the improvement in progress. The incidental expenses, including salaries of Board, Engineers, &c. as established. is entirely disproportionate to the limited amount of work which can be done. About the same amount of incidental expenses, that are at present required, would superintend the judicious expenditure of from two to four hundred thousand dollars on the work, per annum.

The 9th section of the act creating the Board of Public Works, provides that they shall recommend "such Legislative action as they shall deem expedient." This we are aware, imposes a delicate and responsible duty. The views entertained, in the different localities along the river to be improved are as conflicting and incongruous as are the many interests which are sought to be promoted.

The hypothecation of the lands or the proceeds of their sale, for a loan of money has been suggested, and will doubtlessly be strenuously

urged. A loan of one dollar per acre on the entire grant, would fall $213,852 short of completing the whole work to Fort Des Moines, at the present estimated cost. With that amount of available cash means to be drawn as required in the progress of the work, would in our opinion, justify the commencement and vigorous prosecution of the entire improvement to completion. Within one year a portion of it would begin to yield a revenue for water rents and tolls. The least estimate of water power, at the respective dams and the two locks in the canal, would afford a sufficiency of power, if properly applied, to propel twenty run of burrs at each. There will be when completed twenty-eight dams, with the two additional locks in the canal, making a power sufficient to propel six hundred run of burrs, which, were it all brought into requisition at the moderate price of one hundred dollars per annum for each, would give a yearly income from that source alone, of $60,000. But suppose that for the next ten years, water power could not be leased at each lock for more than one thousand dollars, we would then have the sum of $30,000 annual revenue from this source. A loan of sixty cents per acre on the lands, would give $621,629, which would exceed the estimated cost of the work up to Ottumwa $31,969. This amount would complete the improvement up to that point, and make ninety miles of slackwater and canal navigation, and the water power would yield a revenue in proportion as above.

To this mode of obtaining the available means requisite, there might be found to exist some difficulty. In the first place, that salutary provision in our Constitution, which limits the amount of funded debt, precludes the idea of the issue of State bonds, pledging the grant of land as a mere colateral.

Should this plan be adopted, it will be necessary for the General Assembly to authorize the Board to negotiate a loan, and if thought necessary to direct that a portion of the lands be withheld from sale.

The States of Indiana and Illinois, with improvements somewhat similarly situated to our own, have given them up to companies of capitalists, who have taken the works in their unfinished condition, and agreed to complete them within a given time, on condition of owning and controlling them, with a limit upon the amount of tolls to be assessed. These arrangements have been coupled with the condition that the State may within a given time redeem said improvements by the payment of the monies expended by the company with interest.

The Des Moines River Improvement is the most extensive one of the kind ever commenced in the United States; and of its vast importance to the fertile and beautiful valley through which it meanders, it is scarcely necessary to refer. The rapidity with which this portion of the State has been, within so very few years, transformed from its primeval solitude to a country already teeming with not only an abundance of the products of its rich soil for home use, but furnishing a large surplus, seeking a foreign market, is unparalleled in the history of the country—and furnishes the reflecting mind with the data upon which its future greatness may be calculated.

The agricultural capacities of the country are almost boundless; and the mineral wealth is nearly equal in importance. Hydraulic lime, coal and gypsom, are known to exist in inexhaustable quantities, and will all be important articles of commerce when the improvement is completed.

These great resources need a cheap water communication with the Mississippi, and the trade that their developement will cause, is amply sufficient to justify the most strenuous exertions to push forward the great improvement in question.

Mills and manufactories are necessary to sustain and support the growth and prosperity of the State. This river, when improved as commenced, by locks and dams, will not only afford a constant navigation, but an inexhaustable water power. The country affords unrivalled advantages for manufactories. Cotton can be brought here cheaper than to the Merrimac, whilst the fruits of our own rich prairies, wood lands, and the minerals of the hills, among which the Des Moines meanders, would afford employment for thousands of work shops, mills and manufactories.

The former Engineers report, No. 3, embracing his estimate of the work, from Ottumwa to the forks of the river, accompanies this report.

In conclusion we would respectfully suggest, and solicit, that a committee be appointed by the Legislature, to visit and examine the work under our charge, and also the offices connected with it. We feel every confidence that a report from such a source, to the Legislative Assembly, would be productive of much good.

Respectfully submitted,

WILLIAM PATTERSON.
JESSE WILLIAMS.
GEORGE GILLASPY.

No. 1.

Receipts and Disbursements of the President of the Board.

RECEIPTS.

1849, Nov. 5th,	Rec'd of the treasurer as per voucher No. 1	$15,292 83
Nov. 20th,	" " " " " " 2	9,000 00
Dec. 20th,	" " " " " " 3	6,809 77
1850, Feb. 14th,	" " " " " " 4	22,000 00
May 1st,	" " " " " " 5	20,347 00
July 1st,	" " " " " " 6	7,339 57
Sept. 4th,	" " " " " " 7	7,257 85
Nov. 6th,	" " " " " " 8	12,605 28
Nov. 26th,	" " " " " " 9	4,435 37
	Certificates unredeemed,	7,594 00
		$112,681 67

DISBURSEMENTS.

	No. of Section.	
To T. Lyon & Co. on contract and State work,	1 & 2	$8,662 36
" Philip Sullivan, on contract,	3	4,320 10
" E. Lindsey & Co., for building Culvert,		2,301 68
" Smith, Morrison & Co., on contract and State work,	4	12,217 16
" Douglass & Morrison, assignees of P. H. Blake,	5	4,831 76
" B. M'Quillan, on contract,	6	4,446 36
" Conable & Cunningham, on contract,	7	3,208 63
" Brigham & Mayger, for State work,	8	16,556 52
" Conable & Cunningham, on contract,	9	1,025 40
" Bell & Cassiday, on contract,	10	1,271 47
" Lewis Turner, on contract,	11	2,365 52
" J. Z. Barnett & Co., and for State work,	12	11,582 75
" Quinn, Caraher & Co., on contract and State work,	13	1,688 22
" Walker & Co., on contract and State work,	14	8,974 33
" John M'Cune & Co., on contract,	15	1,337 01

	No. of Section.	
To William Meek & Sons, on contract and State work,	16	3,376 47
" Brown & Sanford, on contract and State work,	17	8,656 96
" the Board, one year's salary,		2,600 00
" the corps of Engineers,		5,130 00
For hydraulic cement,		2,824 53
" plats, printing, office rent, and other contingencies,		1,828 86
" right of way,		100 00
" lumber, castings, iron, spikes, &c.,		493 74
" one horse for pile boat,		40 00
Returned drafts,		2,300 00
Cash on hand,		541 84
		$112,681 67

WILLIAM PATTERSON,
President Board of Public Works.

No. 3.

GEORGE GILLASPY, Treasurer, in Account Des Moines River Improvement.

Dr. Cr.

Month.	To whom paid.	No.	Dolls. cts.	Date.		Dolls. cts.
November 5th, 1849,	To President,	1	15,292 83	Sept. 25th, 1849,	By am't rec'd fm P. Brattain, late	
" 20th, "	" "	2	9,000 00		Treasurer, ...	8,293 93
Decem'r 20th, "	" "	3	6,809 77	October "	Am't rec'd from	
February 14th, 1850,	" "	4	22,000 00		sale of lands.	11,827 59
May 1st, "	" "	5	20,347 00	November "	" " "	9,057 35
July 1st, "	" "	6	7,339 57	December "	" " "	6,362 87
Sept. 4th, "	" "	7	7,257 85	January 1850,	" " "	11,029 09
Nov. 6th, "	" "	8	12,605 28	February "	" " "	20,464 47
" 26th, "	" "	9	4,435 38	March "	" " "	3,400 31
	Balance in Treasury.		2,591 45	April "	" " "	4,370 07
				May "	" " "	4,896 74
				June "	" " "	5,039 45
				July "	" " "	3,142 01
				August "	" " "	3,001 99
				September "	" " "	2,131 28
				October "	" " "	7,087 75
				Nov. to 28, "	" " "	7,574 21
			107,679 13			107,679 13

GEORGE GILLASPY.

Office of Treasurer, November 29th, 1850.

No. 3.

Statement of lands sold as exhibited by the books of this office up to the 28th day of November 1850, inclusive.

Months.	Acres.	Dolls. Cts.
October, 1849	9,438.07	11,827 59
November, "	7,245.88	9,057 35
December, "	5,090.31	6,362 89
January, 1850,	8,823.27	11,029 09
February, "	16,371.58	20,464 47
March, "	2,720.25	3,400 31
April, "	3,496.06	4,370 07
May, "	3,917.40	4,896 74
June, "	4,031.56	5,039 45
July, "	2,513.61	3,142 01
August, "	2,401.59	3,001 99
September, "	1,705.03	2,131 28
October, "	5,670.20	7,087 75
November to 28th,	6,059.37	7,574 21
Total amount under present Board,	79,484.18	99,385 20
Total amount sold prior to Oct, 1849,	89,669.09	112,178 38
	169,153.27	$211,563 58

JESSE WILLIAMS.

Office of Secretary, November 29th, 1850.

No. 4.

Amount of State indebtedness.

Certificates unredeemed,	$7,594 00
Due T. Lyon & Co. on section 1 and 2,	4,856 62
" E. Lindsey & Co. on culvert,	576 52
" Smith, Morrison & Co. on section 4,	3,098 79
" Douglass & Morrison on section 5,	1,300 00
" B. McQuillan on section 6,	1,239 33

Due Conable & Cunningham on section 7,	674 37
" Brigham & Manger on section 8,	5,230 62
" Bell & Cassidy on section 10,	1,188 29
" Lewis Tromer on section 11,	1,643 96
" J. Z. Barnet & Co. on section 12,	4,165 31
" Jacob Cram, for pile driving on section 5,	1,227 30
" Walker & Co. on section 13,	1,567 37
" Walker & Co. on section 14	9,799 59
Total amount due on work embraced in first letting, being mostly back money,	$44,162 07
Due John McCune & Co on section 15,	$5,679 94
" Wm. Meek & Sons on section 16,	18,404 04
" Brown & Sanford on Section 17,	10,238 29
Total amount due on second letting,	$34,322 27

WM. PATTERSON,
Pres't B. P. Works.

A

General Land Office,
December 19, 1849.

Sir: A letter has been received at this office from the Hon. A. C. Dodge and Hon. G. W. Jones, enclosing one from you to the former, dated the 30th ult., requesting that you may be furnished with a list of the Des Moines river grant above the "Racoon Forks." In reply, I have to state that said list has not been furnished, for the reason that the posting of the land warrants in the Iowa City district was not completed on the books of this office until recently. Said list is now in course of preparation, and will be ready for transmission at an early day.

In the latter part of your letter, you say the "lists heretofore furished of lands below the forks, have been furnished the Secretary of

of State, instead of the Board who are the rightful and only agents of the State for said land." In the absence of evidence showing the right of another to receive confirmed lists of State grants, it is usual to send them to the Secretary of State. Such is the case at present in relation to this grant. If, however, you will furnish this office with evidence as to your right, as Secretary of the Board of Public Works, to receive said lists, and to correspond with this office in relation thereto, they will hereafter receive the desired direction.

I am, Sir, very Respectfully,
Your obedient servant,
J. BUTTERFIELD,
Commissioner.

To JESSE WILLIAMS, Esq.,
Iowa City, Iowa.

B

SENATE CHAMBER, March 16th, 1850.

Hon. THOMAS EWING,
Secretary of the Interior—

SIR: It becomes our duty to lay before you the enclosed letter from Col. Jesse Williams, Secretary of the Board of Internal Improvements of the State of Iowa, complaining on the part of the State of the sale by the United States of some twenty-five thousand acres of land on the Des Moines above the mouth of Racoon river, and belonging to the State of Iowa by virtue of act of August 1846, and the decision of the late Secretary of the Treasury, Hon. R. J. Walker, thereon.

We appeal to you from the decision of Commissioner Butterfield, that the land so sold had been legally sold. We contend that the title is still in the State of Iowa, and that she cannot be divested thereof without her own act; but we do not ask that the patents granted to individuals be vacated. We are willing that matters in relation to those illegal sales, as we allege they are, should remain in statue quo until the Legislature of the State of Iowa shall meet, as it will during the next winter.

We further most respectfully and earnestly request, that you will at as as early a day as your convenience will allow, approve the other selections recommended by Commissioner Butterfield, for your approval, above the mouth of Raccoon river, to the end that the Secretary of the Board of Internal improvement of our State, may be furnished with a list of the lands to which Iowa is entitled for the improvement of the navigation of the Des Moines river.

We are, very respectfully,
Your obedient servants,
GEO. W. JONES,
A. C. DODGE.

C

GENERAL LAND OFFICE,
April 9th, 1850.

SIR: Herewith I send you a copy of a letter from the Secretary of the Interior, dated the 6th inst.; deciding adversely to the late Secretary of the Treasury—that the grant for the improvement of the Des Moines river, under act of 8th of August, 1846, does not extend beyond the Raccoon Forks.

As suggested by the Secretary, no immediate steps will be taken to bring the land embraced by the State's selections, into market. The office will await the action of the present session of Congress, whose attention will doubtlessly be called to the subject by the State authorities.

I am Sir, very Respectfully,
Your obedient, servant.
J. BUTTERFIELD,
Commissioner.

JESSE WILLIAMS, Esq. *Secretary Board of Public Works.*
OTTUMWA, Iowa.

D

DEPARTMENT OF THE INTERIOR,
WASHINGTON, April 6th 1850.

SIR: Having considered the questions submitted to me connected with the claim of the State of Iowa to select, under the act of August 8, 1846, lands for the Improvement of the Des Moines river, I am clearly of opinion that you cannot recognize the grant as extending above the Racoon Fork, without the aid of an explanatory act of Congress. It is clear to my mind from the language of the act of August 8, 1846 itself, that it was not the intent of the act to extend it further.

My construction is confirmed by the report of the committee and the accompanying papers. If in any report to Congress, you have recognized the grant as extending to the source of the river, it will be proper to correct it, that Congress, if they see fit, may extend the grant. The opinion expressed by the late Secretary of the Treasury on the subjec is entitled to great respect, but I cannot concur in it; and the law not having been carried into effect by him, his *opinion* merely expressed is open for reversion.

The lists of selections and other papers submitted with your letter of the 13th ultimo, are herewith returned.

As Congress is now in session and may take action on the subject, it will be proper, in my opinion, to postpone any immediate steps for bringing into market the lands embraced in the State's selections.

I am, Sir, very respectfully,
Your obedient servant,
T. EWING, *Secretary*.

The Commissioner of the General Land office.

E

BURLINGTON, Iowa, November 6, 1850.

To Col. JESSE WILLIAMS,
Secretary of the Board of Internal Improvement—

DEAR SIR: I have the pleasure to hand you herewith a copy of the appeal, taken by our delegation from Secretary Ewing's decision re-

specting the grant of land made to aid the State of Iowa in the Improvement of the Des Moines river, and also a copy of the opinion of Hon. Reverdy Johnson, late Attorney General of the United States, upon the same subject.

The perusal of this opinion of Attorney General Johnson will, I am quite certain, afford you and your colleagues of the Board of Internal Improvement, and our citizens generally, as it has your Senators and members, the most sincere pleasure.

The high position of the author of this opinion, he being at the time the legal advizer of the Executive, and his distinguished reputation as an enlightened and able jurist, are such as confidently to induc ethe belief on my part, that President Fillmore will finally decide the momentous question now before him in our favor. That this may be the case, and that the great work of affording the farmers and settlers of the Des Moines a safe, economical, and ready transit to market for the surplus millions of products which their magnificent valley is destined soon to contain, be speedily accomplished, is the ardent wish of their and your friend.

A. C. DODGE.

F

WASHINGTON, April 14th, 1850.

To the President:

WE, the Senators and Representatives from the State of Iowa, believing that great injustice will be done the State and people they represent by an opinion and order of the Hon. Thomas Ewing, Secretary of the Interior, bearing date the 6th of April 1850, by which the grant of land made to the State of Iowa, by the act of the 8th of August, 1846, is restricted to the "Racoon Fork," (so called,) beg leave to enter our solemn protest against the carrying into effect of said opinion by the Executive Department of the Government, for the following reasons:

First, Because there is granted to the State of Iowa, in language clear and unambiguous, by the before mentioned law, "one equal moity, in alternative sections, of the public lands (remaining unsold and not otherwise disposed of, incumbered or appropriated,) in a slip five miles in width on each side of said river," (the Des Moines.)

Second, Because the question of the extent of the grant under consideration, having arisen during the late Administration, was decided in favor of the State of Iowa, on appeal and argument, by the Hon. R. J. Walker, then Secretary of the Treasury, in an opinion given by him, which bears date the 2d of March, 1849.

Third, Because upon the promulgation of the decision of the late Secretary of the Treasury, it being regarded as final and conclusive, the authorities of the State of Iowa have proceeded to contract heavy pecuniary obligations, in anticipation of the proceeds of the said lands thus adjudged to be applicable to the improvement of the navigation of the Des Moines river.

Fourth, Because we sincerely believe that under the act of the 8th of August 1846, and the decision of the late Secretary of the Treasury, before mentioned, that the State of Iowa has, for the purpose and on the conditions mentioned in said law, a vested right to the lands in question, and so believing, we do not doubt that her authorities will resent, by every proper means in their power, the sale of these lands by the United States.

Fifth, Because we humbly conceive that the Secretary of the Interior, unintentionally and with good motives we doubt not, has transcended his legitimate authority, in reopening of his own volition, and reversing a decision of the Secretary of the Treasury in a matter of this character.

For these and other reasons not deemed necessary to be enumerated, we appeal to you to protect our young State and her enterprizing citizens, already environed by those difficulties and hardships ever attendant upon the settlement of new countries, from the incalculable loss and embarrassment which will be entailed upon her and them should the decision of the late Secretary of the Treasury in relation to the grant of land for the improvement of the navigation of the Des Moines be reversed.

We are, with the highest consideration of respect,

A. C. DODGE,
GEO. W. JONES.
SHEPHERD LEFFLER,
WM. THOMPSON.

G

ATTORNEY GENERAL'S OFFICE,
July 19, 1850.

SIR: The questions presented in the matter of the Des Moines Grant, made to the Territory of Iowa, by the act of Congress of the 8th of August, 1846, upon which, under an appeal to your predecessor from the decision of the Secretary of the Interior, he required the opinion of this office, are—*First*, what is the extent of the Grant; and *Second*, had it been already finally adjudicated, before the decision appealed from, was made.

First—Is the strip, "five miles in width on each side" of the Des Moines River granted, limited in length to what is called the Raccoon Fork, or is the Grant co-extensive with the length of the river? The Grant is made by the first section of the act, and is in these words:

"There be and hereby is granted to the Territory of Iowa, for the purpose of aiding said Territory to improve the navigation of the Des Moines River, from its mouth to the Racoon Fork, (so called,) in said Territory, one moiety of the public lands (remaining unsold and not otherwise disposed of, encumbered, or appropriated,) in a strip five miles in width on each side of said river; to be selected by an agent or agents, to be appointed by the Governor of said Territory, subject to the approval of the Secretary of the Treasury of the United States."

The Commissioner of the Land Office, and the Secretary of the Interior, think that the Racoon Fork is the limit of the Grant, and its northern terminus.

I do not concur in this view. In my opinion, the fork is mentioned only as the point to which, from the mouth of the river, the improvement of the navigation of the river is to be made.

The true reading of the act I think, is, that the land granted is to run the entire length of the river, within the then Territory of Iowa, and the object to be accomplished by it, the improvement of the navigation up to the Fork.

The purpose is one thing—the extent of the grant another. It is by confounding the two, in themselves, as stated in the act, wholly distinct, and considering them as limiting each other, that the error of the opposite construction consists. They have, in my judgment, nothing to do with each other. This will perhaps be made the more obvious, by transposing the language of the act. Place the terms of

the grant first, and those of the purpose for making it last, and the meaning is apparent. It would then read—"There be and hereby is granted to the Territory of Iowa, one moiety of the public lands (remaining unsold, and not otherwise disposed of, encumbered or appropriated,) in a strip five miles in width, on each side of the Des Moines River, to be selected," &c. "for the purpose of aiding said Territory to improve the navigation" of said river from its mouth to the Racoon fork (so called), in said Territory."

If these were the terms of the grant, no doubt, I think, could exist, that the only limit was the river, and yet I cannot see that the meaning is not precisely the same of the terms actually adopted. The river limits the grant, although a portion of the river is only to be improved. The other interpretation requires to maintain it, that you add to the words adopted describing the extent of the grant, "five miles in width on each side of said river," the other words "from its mouth to the Racoon Fork," previously used but to describe the extent of the improvement. Where is the authority for such an interpretation? When the words of a statute are clear, it is contrary to every rule of construction, to supply others, on the conjecture that they were accidently omitted. The inference, when those used are unambiguous, is, that the Legislature meant precisely, and only meant what those import.

But the third section strengthens I think my opinion upon the first. By that it is provided " That the *said river Des Moines* shall be and forever remain a public highway for the use of the Government of the United States," &c. What is the extent of this stipulation? Is it, is it that the highway on the river is restricted to the Fork, or coextensive with the river? I think there can be no doubt that the latter is the true meaning,—and if it be, it is only because there is nothing to limit the provision to any portion of the river, and yet the words are in this respect the same as those used in the grant by the first section.

It is supposed that this construction is erroneous, because to the report of the committee of the House reporting the bill before introduced and referred to them, there is attached a letter from the then Commissioner of the Land Office, stating that it extended to the Racoon Fork. When the words of a statute are doubtful, it is legitimate to refer to such sources of information. But where it is otherwise—where there is no ambiguity, as I think is the case of this

statute,—there is no warrant for qualifying them by report, or speeches or votes, which may have preceded its passage. This doctrine is clearly recognized by the Supreme Court of the United States in the case of *Aldridge vs. Williams*, 3 *How.* 24. Nor is there any thing in the objection, that the improvement is limited, and that that should be held to limit the grant. The fact is not so. The lands of the United States throughout the extent of the river will feel the benefit of the improvement, in an enhancement of value.

The whole river therefore participates in the advantage of the work, and upon the very policy which has heretofore governed Congress in such cases, it is fair to presume that the lands granted were limited by the whole river, and not by a part of it. Nor do I think it is consonant with the policy of such dispositions of the public lands, to bring to the statutes by which they are made, a narrow construction. It is a large and enlightened policy, ever favoured by Congress, and should be executed even in cases of doubt, rather in a large and liberal, than a restricted spirit.

Second.—I am of opinion that the question had been finally adjudicated by the Secretary of the Treasury before it was decided by the Secretary of the Interior.

The facts are these.—The commissioner of the Land office who had originally construed the grant as I do, changed his opinion, and advertised for sale in the usual way, the lands above the Fork. As soon as this was known, the Senators and Representatives of Iowa, on the 8th January, 1849, in an official letter to Mr. Walker, "complained of the construction, and requested him to give the necessary instructions for the selection and approval of these lands along the entire grant of the Des Moines, as contemplated by the law," &c. The question was carefully considered by the Secretary, and decided by him on the 2d of March, 1849. On that day he advised these gentlemen of the decision, and communicated it on the same day to the Commissioner, in an official letter now on file with the papers, for, to use the language of the letter, the "information and government of that officer, on the subject to which it refers." From that time to the recent opposite opinion of the present Commissioner, the question was considered as closed by this decision of Mr. Walker. This appears from the report of Commissioner, Mr. Young, afterwards transmitted to Congress, and also by a report of the present Commissioner himself of the 14th January, 1850, transmitted to the Senate,

by the Secretary of the Interior, on the 21st., of that month.—See Senate executive document, 1st. session 31st. Congress, No. 171. In this report showing the amount of public land granted to Iowa among other States, there is attached this note. "This amount in accordance with the decision of *the late Secretary of the Treasury, of 2nd March*, 1849, will be increased by the unadjusted portion of the grant for the improvement of the Des Moines River, situated between the Racoon Fork and the *source of said river*, estimated to contain 900,000 acres."

The design of the Secretary, himself, to have decided it, and his belief that he had so decided, appears by a letter from him to the Senators of the State, now on file, dated the 15th instant, and hereunto annexed.

Upon the faith of this determination, I am advised, that the proper authorities of the State, have entered into large contracts for the improvement of the river,—and it would therefore, I think, be the extreme of injustice, now to revoke it.

And I am glad to be of the opinion that it cannot be legally revoked. It was a final adjudication,—so considered by the parties,—by the Senators and Commissioner of the Land Office, and so acted upon by Iowa:—Whether right or not is now immaterial. It is beyond the control of the Secretary of the Interior, (the successor in this respect, of Mr. Walker,) and of any other executive officer. See the case of the bank of the Metropolis, vs. U. S. Pet. 401.

I have the honor to be,
With high regard,
Your ob't. servant.

(Signed) REVERDY JOHNSON.

To MILLARD FILLMORE,
President of the United States.

ENGINEER'S REPORT.

ENGINEERS OFFICE, Nov. 20, 1850.

To the Board of Public Works:

GENTLEMEN:—I have the honor respectfully to present you with my first report of the condition of the Des Moines River improvement.

Commencing at the mouth of Nassau Slough, and proceeding up the Des Moines River, I will describe the character and progress of the different sections, in the order in which they occur.

No steps have yet been taken to remove the drift and snags in the Nassau Slough, and in the Des Moines river between the head of the Slough and lock No. 1, located at Motts Ferry. When this is done we have a navigation of nearly two miles from the Mississippi.

This lock is located on rock foundation (no other rock being found in the bed of the river nearer its mouth;) and has a lift of 22 feet. The contractor has built a good and substantial coffer dam, excavated about one half of the lock pit, and furnished between three and four thousand perches of lock stone, with the face stone mostly cut. This job can be completed in one season, if it be a favorable one for work of that character. Connected with this lock, and embraced in the same contract, is 5,500 lineal feet of canal, the whole being denominated as sections one and two. This portion of the canal is nearly completed. A waste weir which was never before estimated is necessary on this section, to pass over the water of a small creek, and will add to the cost of the work about $1,500.

Section No. 3, consists of one mile of canal, mostly light work, and is about one half completed. On this section a good and substantial culvert has been built, 140 feet long, with 2 spans of 6 feet each, and semi-circular arches of cut stone, with parapets, and wing walls to protect the embankment.

Section No. 4, consists of one mile of canal, which includes the heavy river embankment at the big Yellow Banks; the length of the embankment in the river, is 1,400 feet. It has been found necessary to drive a row of piles along the outer toe of the river embankment, to protect it from the drift and ice during the great freshets.

The channel of the river is contracted at this point, and the force of the current is so great against the embankment that it requires strong protection. At the great ice freshet in February, 1849, the bed of the river was washed out so that the channel was deepened from 8 to 26 feet. This will greatly increase the amount of embankment and protection stone, and add materially to the cost of the work, as the height of the embankment will be about 18 feet greater than was at first estimated. The land embankment on this section is entirely completed.

Section No. 5, includes the narrows below the mouth of Sugar creek, where will have 1,100 feet of embankment in river; similar to that at the big Yellow Bank, requiring to be protected with piles and stone. The piles are mostly driven at this point, but no embankment is yet made in the river. The remainder of the earth work on this section is nearly completed.

The location of lock No. 2, has been changed from section 8, to section 5, and will be built on a timber and plank foundation. The lock pit has been excavated, all the timber, 40,000 feet of plank, and 1,200 perches of lock stone have been delivered. The original design, before changing the location of the lock, was to pass the water of Sugar creek over the canal by a waste wier, but the matured plan of your late Chief Engineer, was to change the channel of the creek, so as to pass it under an acqueduct, which will be located above the lock.

Sections 6 and 7 are in such a state of forwardness as to render their completion practicable in one season.

Section No. 8 includes the heavy embankment in the river, similar to that on section 4 before alluded to. When the work on the canal was suspended, this embankment was left in a rough unfinished state, and not raised as high as high water mark; consequently it will be much exposed in times of very high freshets, by the water running over the embankment. I would recommend that some five or six hundred dollars be expended on this part of the work, which would place it comparatively out of danger.

Section No. 9 is completed, and was taken off the contractors hands in December 1849.

The earth work on sections 10 and 11 is nearly completed. On section 11 a guard lock, with a double pair of gates, and a chamber of the same capacity as the other locks, is necessary to shut out freshets from the canal, and pass boats up and down at any stage of water. Such locks are invariably used on similar works. The Des Moines is subject to frequent rises during the boating season, varying in height from two to ten feet, which without a water lift lock, would suspend navigation on the canal, but would not usually obviate the hazards of running on the river below St. Francisville. During the past two seasons these freshets have occurred about every six weeks or two months.

COST OF THE CANAL, &c.

From the tables which accompany this report, it will be observed that I have estimated the cost of the ten miles of canal, including three locks, one aqueduct, one culvert, and two waste wiers at $275,589 13, exclusive of the contingent expenses on the work already done. After paying off the debts (chiefly back money) due the contractors, it will still require not less than $136,740 71 to complete the canal. This sum greatly exceeds the original estimates for the following reasons: I. The character of the lock masonry has been changed from rubble to cut stone and range work, which adds fifty cents per perch to the price. II. The building of the coffer dam and bailing of lock pit at lock No. 1, was never estimated. III. The greatly increased quantity of embankment and protection stone at the two Yellow Banks and Sugar creek, and the furnishing and driving piles at those points. IV. The building of two waste wiers, one on section 2 and one on section 10, which are necessary and were never estimated. V. The changing of the guard gates on section 11 to a guard lock; and lastly and principally, by the difference in the quantity and price of work, as will be seen by reference to the two estimates, the present being made at the actual prices at which the work was contracted for, and the former at estimated prices, before the work was put under contract. The canal is the most precarious, and also the most expensive portion of the work, in proportion to its length, now under contract. When the work on the canal was suspended, it was left in such a rough unfinished state that the necessary measurements to determine the exact amount of work done were difficult and laborious, and required, during a portion of the summer, the same amount of engineering force as would have been necessary had the work been in vigorous prosecution. Now that these estimates are all taken, none of my corps are retained except Samuel Jacobs, Esq., my assistant engineer.

	Estimated Cost of Sections 1 and 2.	Amount.	Total amount.
	Lock.		
	Building coffer dam, excavating lock pit, bailing and excavating rock below tail of lock,	$2,500 00	
7,063	Perches masonry, in lock and breast walls, @ $3 50,	24,720 50	
600	Barrels of hydraulic cement, @ 2 25	1,350 00	
	Lock gates and fixtures entire	2,000 00	
			$30,570 50
	Waste Weir.		
7,000	Lineal feet square timber @ 13½ cts.	945 00	
5,040	Feet B. M. oak plank, - @ 2 00	100 80	
546	Perches crib-filling, - " 1 00	546 00	
132	Perches slope wall and pavement, 1 50	198 00	
			1,789 80
	Canal.		
	[illegible]ng and clearing section	515 00	
[illegible]	Cu[illegible] yards embankment @ 14¼c.	2,026 51	
4,525	" " canal excavation 13	588 25	
3,555	" " muck ditch excavation, 13	462 15	
20,000	Perches protection stone, 85	1,700 00	
			14,291 91
	Total,		$46,652 21
	Estimated Cost of Section No. 3.		
	Grubbing and clearing section	425 00	
58,670	Cubic yards embankment, @ 12 c.	7,040 40	
23,486	Cubic yards embankment in slough, " 19	4,462 34	
5,542	Cubic yards excavation, " 10	554 20	
			12,481 94
	Estimated Cost of Sec. No. 4.		
	Grubbing and clearing section	696 00	
112,680	Cubic yards of river embankment, @ 18	20,282 40	

		Amount.	Total amount.
23,260	Cubic yards of land embankment, @ 13	$3,023 80	
11,497	Cubic yards of excavation, 15	1,724 55	
2,707	Perches protection stone 85	2,300 95	
2,663	Perches protection stone 1 50	3,994 50	
	Furnishing and driving piles to protect embankment,	2,500 00	
			$34,522 20
	Estimated Cost of Section No. 5.		
	Grubbing and clearing section,	700 00	
60,700	Cubic yards creek and river embankment, @ 14c.	8,498 00	
29,860	Cubic yds land embankment 12	3,583 20	
13,700	" " excavation of canal and M. D. 12	1,644 00	
32,240	Cubic yards excavation of creek channel, 13	4,191 20	
3,680	Perches protection stone, 1 50	5,520 00	
14,400	Lineal feet piles, furnishing and driving 14	2,016 00	
	Weir to conduct the water around the lock,	3,623 00	
	Acqueduct, estimated,	15,000 00	
			44,775 40
	Lock No. 2.		
3,230	Perches masonry, which will include cost of changing location, $4 00	12,920 00	
15,300	Cubic feet foundation timber, 9c.	1,377 00	
	" yards lock embankment, 20	600 00	
150	Perches protection wall, 1 50	225 00	
220	Puddling in lock foundation, 30	66 00	
47,000	feet B. M. 3 inch plank, 2 00	940 00	
25,760	" 2 inch plank, 2 50	644 00	
	Grubbing and clearing lock pit,	75 00	
5,400	Cubic yds lock pit excavation, 25	1,350 00	
400	barrels hydraulic cement, 2 50	1,000 00	
	Lock gates and fixtures,	1,500 00	
			20,697 00

	Estimated Cost of Section No. 6.	Amount.	Total amount.
	Grubbing and clearing section, ...	$750 00	
73,118	Cubic yds embankment,....@ 13c.	9,505 34	
8,450	" excavation,..... 10	845 00	
	Work on old line before change of location,.....	322 70	
			$11,423 04
	Estimated Cost of Section No. 7.		
	Grubbing and clearing section, and inundated land left side of canal,.	750 00	
56,384	Cubic yards of embankment,@ 13c.	7,329 92	
3,140	" " excavation,.. 10	314 00	
			8,393 92
	Estimated Cost of Section No. 8.		
	Grubbing and clearing section, ...	1,812 00	
102,120	Yards of river embankment,@ 15c.	15,318 00	
44,818	" land embankment, 13½	6,050 43	
23,666	" excavation,..... 11	2,603 26	
6,509	Perches protection stone, .. 1 00	6,509 00	
2,115	Perches " " .. 1 50	3,172 50	
	Allowances made by the Board for losses by floods,.....	2,010 00	
	Furnishing and driving piles, for bank protection,.....	2,000 00	
	Paid for rehandling protection stone,	337 00	
			39,812 19
	Estimated Cost of Section No. 9.		
	Grubbing and clearing,.....	1,000 00	
	Grubbing and clearing outside canal limits,.....	100 00	
46,808	Cubic yard canal excavation, 10	4,680 80	
305	Cubic yards muck ditch excavation,..... 10	30 50	

		Amount.	Total amount.
347	Cubic yards excavation of drain back of spoil bank, 10	$34 70	
12,607	Cubic yards embankment, . 14	1,260 70	
			$7,106 70
	Estimated Cost of Section No. 10.		
	Grubbing and clearing section, ...	725 00	
70,580	Cubic yards excavation, ... @ 10c.	7,058 00	
5,822	" " embankment, . 12	698 64	
	Waste Weir	1,500 00	
			9,981 64
	Estimated Cost of Section No. 11.		
	Grubbing and clearing section,.....	2,000 00	
55,280	Cubic yards canal excavation,.....@ 10c.	5,528 00	
2,740	Cubic yards lock pit excavation, ... 12	328 80	
10,640	Cubic yards embankment,.. 11	1,170 40	
220	" " puddling in lock foundation, ... 20	44 00	
57,040	feet, board measure, foundation plank,..... 2 00	1,140 80	
12,000	feet foundation timber, ... 11	1,320 00	
150	Perches protection wall above and below lock,... 1 50	225 00	
2,502	Perches of lock masonry ... $4 00	10,008 00	
			21,765 20

RECAPITULATION.

Nature of Work.	No. of Section.	Cost of Work done.	Cost of Work to be done.	Total estimated Cost.
Lock No. 1 and 5,500 lineal feet canal,	1 and 2	21,889 72	$24,762 40	$46,652 21
One mile canal,	3	6,254 64	6,227 30	12,481 94
140 feet long—2 spans of 6 feet each,	Culvert;	3,327 70	Completed.	3,327 70
One mile canal, including big Yellow Banks,	4	20,414 98	14,107 22	34,552 20
One mile canal partly in river,	5	8,479 25	36,296 15	44,775 40
Stone have to be brought 8 miles,	Lock No. 2	9,301 47	11,395 53	20,697 00
One mile canal,	6	9,079 94	2,343 10	11,423 04
" " canal,	7	4,698 36	3,694 96	8,393 32
" " at little Yellow Banks,	8	32,766 12	7,046 07	39,812 19
Finished in Dec. 1849 one mile canal,	9	7,106 70	Completed.	7,106 70
One mile canal nearly done,	10	7,355 54	2,626 10	9,981 64
Includes guard lock and 1 mile canal,	11	8,174 00	13,591 00	21,765 00
		$138,848 42	$122,089 92	$260,938 34
Add for contingencies and wastage during the suspension of the work at 12 per cent.,			14,650 79	14,650 79
Total,		$138,848 42	$136,740 71	$275,589 13

ST. FRANCISVILLE WORK. SECTION No. 12.

The dam at St. Francisville, which is to supply the canal with water, and make navigation up to the first dam above, is located partly on rock, but chiefly on sand foundation, and is an expensive and difficult work. It will be founded on piles, (except where there is rock,) which will transfer the pressure from the spreading material on the surface, to an incompressible and confined foundation. This plan, together with protection below the dam, composed of clusters of piles filled in with brush and stones, I think will secure the work. A lock is located on the rock foundation in the south end of this dam, which will allow of river navigation, during portions of the season, and in case of a breach in the canal.

A considerable number of piles have been driven on this work, chiefly in the abutment pit on the north side of the river, but the larger part of the piling yet remains to be furnished and driven. This can be done early next season if the work goes on. A first rate steam pile boat, the property of Capt. Jacob Cram, is now lying at this work, and there is also on the river a good horse pile boat, the property of the State. During the past season we found useful employment for both of these boats. Nearly all the stone, timber, and plank for this lock and dam, have been delivered and fully prepared for the work.

The preparation for the foundation of the lock and dam was commenced under favorable circumstances last summer, but was soon suspended on account of the gloomy aspect of money affairs. Since then, nothing has been done at this point. This work will be resumed whenever funds can be procured.

DAM AND LOCK AT "COWPENS." SECTION No. 13.

A large portion of the materials have been furnished for this work and something done towards preparing the foundation for the lock. A convenient and prepared quarry can speedily be made to yield the remainder of the stone required, and the contractors have other facilities for prosecuting the work next season.

DAM AND LOCK AT CROTON. SECTION No. 14.

This work which has been under the immediate charge of M. M. Hayden, Esq., assistant engineer, has been prosecuted with vigor during the past summer, and although the persevering contractors, Messrs. Walker & Co., have been prevented by the numerous freshets and other causes from constructing their dam, yet they have borne up against the failure of the funds and completed the lock, partly on their own resources.

This lock is a strong, handsome and cheap structure, the face stone being cut and regularly coursed. The work is far superior to the rubble masonry contemplated by the specifications, and reflects credit on the enterprising contractors. The larger portion of all the materials for the dam have been furnished, and the entire work can be completed in one season.

PLYMOUTH WORK. SECTION No. 15.

The principal part of the stone for the lock and dam at this point have been procured, and if the lands above Fort Des Moines are secured to the State, this work will be vigorously prosecuted, and perhaps completed next season.

DAM AND LOCK AT BONAPARTE. SECTION NO. 16.

This work which has been under the immediate superintendance of John B. Knight, Esq. is farther advanced than any other work on the line. This lock was the first one completed on the Improvement, in a superior style of masonry, and reflects credit on the energeting contractors; Messrs. Wm. Week and Sons, who have furnished their own means to do nearly all the work. The numerous freshets have seriously delayed the work on the dam, and will most probably prevent its completion the ensuing winter; but it is so far advanced as to ensure its being finished early next spring.

BENTONSPORT WORK. SECTION NO. 17.

The dam and lock at this point were commenced this season, and

although delayed and injured by the freshets, like the other river jobs, have been vigorously prosecuted by the industrious contractors, Messrs. Brown and Sanford, and are so well advanced that their completion early next summer, is entirely practicable. At this point the first lease of water power has been made to Messrs. Green and Brothers, late of Ohio, who have already laid the foundation for a paper mill, the first in the State, and the first fruit of the Des Moines river improvement.

It will be important to go on with the locks and dams, as soon as practicable, as the timber and plank, of which large quantities have been delivered, and are the property of the State, will speedily begin to decay unless put into the work. The construction of the dams and locks now under contract, and commenced, will clear the river of the old dams, except the one at Keosauqua, furnish constant and almost inexhaustable water power, and make the river navigable several months every season, even before the canal is finished.

The following estimates of the cost of the work up to, and including the Bentonsport work, are based upon the contract prices, and the aggregate cost will be increased should the suspended work be permitted long to remain in its unfinished state. I have faithfully endeavored to show the cost of the canal by itself, and also the separate cost of the dams and locks so far as they are in progress of erection. I have not sufficient data to go minutely into the detail of each item in the dams and locks between Bonaparte and Ottumwa, but from the data which I have, comparing the quantities and prices with the contract prices on similar work below, I estimate the remaining seven dams and locks at $298,784 00. Add to this the sum required to finish the ten miles of canal and the six dams and locks which have been commenced, and we have the sum of $599,660 00, the amount it will require to complete the improvement from the mouth of the river to Ottumwa.

For the cost of the improvement from Ottumwa to Fort Des Moines I would refer you to the estimates contained in your late Chief Engineers report, No. 3, which will not fall so far short as the first estimates below; the work above Ottumwa being estimated at prices ranging considerably higher than the same kind of work now under contract.

Although the cost of the work will much exceed the first estimates, yet the canal nor the locks and dams will cost more than similar

works in other portions of the Union. The cost of the canal per mile is $27,558 00, and the dams and locks from St. Francisville to Ottumwa will cost $7,538 per mile. Including the ten miles of canal, the whole improvement from the mouth of the river to Ottumwa, will cost, according to my estimates, $9,344 per mile. A good rail road through any portion of our State, will cost about twice as much as the slack water navigation, exclusive of the ten miles of canal.

Before closing this report I must express my obligations to my Principal Assistant, Samuel Jacobs, who has faithfully labored with me during the past year in superintending the work, and making the difficut measurements and calculations necessary to determine accurately the amount of work done on the suspended canal, and the total cost of the remainder of the work. Also, to M. M. Hayden, Assistant Engineer, and John B. Knight, Superintendent for their fidelity in superintending the work under their charge.

Respectfully submitted,

GUY WELLS,
Chief Engineer.

To Col. Wm. Patterson, Col. Jesse Williams, George Gillaspy, Esq., Board of Public Works of the State of Iowa.

	Estimated Cost of Section No. 12.		Amount.	Total amount.
4,450	Perches of lock masonry,	3 75	$16,687 50	
52,804	feet square timber,	12c.	6,336 48	
15,376	" round timber,	8	1,230 08	
82,000	" board measure plank,	2 00	1,640 00	
15,000	Perches crib filling,	70	10,500 00	
5,966	Yards of excavation of abutment pit,	12	715 92	
3,000	Yards of embankment,	14¾	442 50	
	Grubbing and clearing of abutment pit,		40 00	
	Furnishing and driving piles,		4,500 00	
	Abutment behind lock, with openings for mills,		1,500 00	
	Protection on coffer dam,		112 00	
	Excavating lock pit, making coffer dam, bailing and preparing foundation of dam,		$2,000 00	
500	Barrels of cement,	2 50	1,250 00	
	Lock gates and fixtures,		1,500 00	$48,454 48
	Estimated Cost of Section No. 13.			
	Not having sufficient data to prepare a detailed estimate of this work, I set down its entire cost, at		42,650 00	42 650 00
	Estimated Cost of Section No. 14.			
3,996	Perches of lock masonry,	$3 30	13,186 80	
515	Perches rubble masonry, in abutment behind lock,	2 80	1,442 00	
159	Perches of rip rap protection,	95	151 05	
1,748	Yards of embankment,	14	244 72	
215	" excavation,	14	30 10	
24,800	Feet square timber,	11	2,728 00	
15,000	" round timber,	8	1,200 00	
115,352	" board measure plank,	1 80	2,076 33	
7,680	Perches crib filling,	80	6,144 00	
	Stone abutment on south side of river,		2,000 00	
	Lock gates and fixtures,		1,500 00	
500	Barrels of cement,	2 50	1,250 00	
	Forming coffer dams, bailing and excavating lock pit,		3,763 77	
	Removing parts of old dam and lock and preparing foundation for new dam,		500 00	36,216 77
	Estimated Cost of Section No. 15.			
	Not having sufficient data to prepare a detailed estimate of this work, I set down its entire cost at		42,550 00	42,550 00

ENGINEER'S REPORT, No. 3.

KEOKUK, September 1, 1849.

To the Board of Public Works:

Since my last report to the Board, which was dated on the 20th November, 1848, the contractors on the Des Moines River Improvement have encountered a series of difficulties which could seldom occur on any other work during the same period of time. Up to the period of my report, the improvement had prospered with great energy and success; and no casualties had interrupted the rapid and profitable prosecution of the work: but in December the rain, and snow, and sleet came with extraordinary severity, and up to this time the contractors have been visited with a succession of reverses, which have been as incessant as they have been calamitous. Besides the loss of time experienced during such a season as the past, every thing is calculated to increase expenses. Continued storms impair the roads, injure the stock, augment the price of provisions, cast a sickly gloom over the work, and deter hands from seeking the employment. Never did contractors encounter a more unfavorable winter! This was followed in the spring by a succession of high floods in the river, accompanied with gorges of ice, which, raising a dam on section five, threw the water over the work and surrounding country, on both sides of the river, carrying away material from the contractors, fences and cattle from the farmers, and in several instances destroying human life. With the approach of summer came the ravages of cholera; and finally when the pestilence had abated, and the river had fallen so as to admit of active operations, we are again visited with extraordinary floods of water, which have caused another suspension of the most important part of the work. I review with painful regret the accidents of a year which has left so many monuments of dessolation and distress! Pursued with this train of adversities, the contractors have still contended with disasters, and faithfully prosecuted the tiresome and unprofitable work. Some have advanced with unusual success; and none of them—however much they have grieved over the loss of long and weary months of toil, and the sacrifice of private means—have despaired of final success and turned away from the work. On the contrary, all have encountered

their losses as their varied abilities permitted them, and continued their labors with increasing energy and zeal. Starting at the lower end of the work, and passing up the line of canal and river, a casual observer would see, by the miles of embankment and excavation, and the accumulation of timber, and plank, and cut stone, that the enterprise and energy of the contractors have made such an impression on the face of the country as to ensure the successful completion of the first fifty miles of the work.

Some idea may be formed of the relative success of the workmen, by submitting a statement of the estimates and payments on each contract up to the time of the last payment, which was made on the 6th ult.

The following table shows the number of the sections, the name of the contractor, the amount of work estimated, the amount deducted as security for the completion according to the contract, and the amount due the contractor and paid:

No. of Sec.	Name of Contractor.	Estimate of Work.	15 P. C. off.	Amount due and paid.
1 and 2	T. Lyon & Co.,	8,133 68	1,220 05	6,913 63
3	T. H. Curtis,	2,217 10	333 56	1,883 54
4	Stewart & Wallace,	5,888 66	883 30	5,005 36
5	P. H. Blake & Co.,	977 34	146 60	830 74
6	P. H. Blake & Co.,	2,263 49	525 62	1,737 87
7	P. H. Blake & Co.,	959 24	143 80	815 44
8	Brigham & Mayger,	19,260 62	2,889 09	16,371 53
9	Connable & Cunningham,	6,213 30	932 00	5,281 30
10	Bell & Cassady,	6,112 60	916 89	5,195 71
11	Merriman, Turner & Co.	4,948 31	742 24	4,206 07
12	Barnett & Co.,	5,215 89	782 38	4,433 51
13	Quinn, Caragher & Co.,	3,403 53	510 52	2,893 01
14	Walker & Co.,	7,058 00	1,058 70	5,999 30
Culvert	Morris, contractor,	470 00	70 50	399 50
		$73,121 76	$11,155 25	$61,966 51

Only three of the sections—which were awarded to certain men on credit at the August letting—have been commenced. These three are in connection and continuation of the line of work contracted at the first, June, letting, as follows:

Section 15—Messrs. McCune of Ohio. This is the dam and lock at Farmington. A fair commencement has been made and extensive preparations are making for the prosecution of this work next season.

Section 16—Messrs. Meek & Sons, Bonaparte.

These contractors have progressed with extraordinary energy.—Most of their face stone is cut for the work, and a large proportion of all the material is delivered and ready to put into the work. The recent rise delays the progress of the walls.

Section 17—Messrs. Brown & Sanford, Bentonsport.

The contractors at this point have also a large amount of material prepared, and should the water subside in time, they expect to put in a part of the dam and lock during the present fall.

I regret that I have not had time or assistance to estimate the value of the work done on these three last named sections, in time to insert the amounts as in the cash contracts; but I have seen enough to satisfy me that this part of the line will be completed as soon as the more precarious work which we are erecting at the "Yellow Bank" narrows below.

We have therefore under contract and in successful progress all the work necessary to carry slackwater navigation from the mouth of the Nassau slough up to Keosauqua; a distance by the meanders of the river, of 50 miles, and by the line of improvement (ten miles of canal cutting off 2½ miles,) forty-seven and one-half miles. Enough to show the character of the work, and enough to overcome some of the worst obstacles to the present navigation of the river. All this work can be completed next season, and I confidently rely on its being open for navigation in the spring of 1851.

The accidents of the season to which I have before alluded, do not fall alone on the contractors. The river has been washed deeper at the Yellow Banks where our embankments are to be placed in the river, and a large increase of earth and protection is therefore to be added to the cost of the work.

These floods have displayed the Des Moines in its most terrible aspect, and exhibited dangers which had never before been witnessed by the inhabitants of the country. The rise above low water varied at different places from 15 to 17 feet; and by removing old decaying timber which had never before been removed from the roots or stumps where they had fallen, I infer that no greater rise has occurred on the upper portion of the river, at least for thirty years past. Though the

rise of the river was extraordinary for the Des Moines, it was only about half the elevation that occasionally occurs on other rivers that have been similarly improved, and it was not so sudden and accompanied with such masses of drift, as occurs on streams draining the country east of the Mississippi. We are only apprised of the extent of the danger we have to contend against, but not deterred from the prosecution of the enterprise.—Banks and lock walls, must in every instance, be made higher than I formerly anticipated. A short canal has been located at Keosauqua, which will overcome about two feet fall at that place and save two feet of elevation in the Bentonsport dam.

A lock has also been determined on at dam No. 1, St. Francisville, to accommodate the people of Missouri, who very much desire it; and also to allow a passage by the river in high water, if an accident occur to the canal. All these are items of enlargement, which will add to the cost, and were not anticipated in my former estimates, except so far as they were met by the item denominated "contingent expenses." But with all these additions, after looking over and carrying out the contract prices of the various items, and including liberal estimates for the precarious work at the "yellow banks," I am not certain that the work as awarded and contracted below Ottumwa, will exceed my former estimate in round numbers of 500,000 dollars. I have urged the concentration of force at the "yellow banks" during the approaching season of low water, with a view of pushing these hazardous sections beyond the reach of another freshest, The contractors have taken the work at their own risk, yet it will be perceived the State has incidental interests which are likewise in jeopardy; and the accidents to public works are often so great as to overwhelm individuals, who invoke the generosity and magnanimity of the State and find relief when they have no remedy in the halls of justice. Every means should therefore be concentrated on these precarious points during this fall and winter, so as to place the work as far as possible beyond the influence of another spring flood.

SURVEYS AND LOCATIONS ABOVE OTTUMWA.

In my last report I informed you that the survey of the work above Ottumwa had already commenced, and that it was my expectation to reach the Racoon fork (Fort Des Moines,") by the middle of De-

cember. I joined the party in the field, which in my absence had progressed about twenty six miles above Ottumwa, in charge of my principal assistant, Mr. Wells.

Up to this period, the river had continued open, and observations of the banks and bed of the river had been limited and unsatisfactory, though the labor had been tedious and extremely disagreeable.

On the night of the 6th December, our camp was drenched with rain, covered with snow, and frozen with sleet. The thermometer fell below zero, and on the morning of the 7th, the river presented a sufficient covering of ice to admit of certain and convenient observations.

Our measurements pursued the centre line of the river, sounding, sketching, leveling, and all necessary points could be determined with ease and accuracy. The extreme cold and accumulation of snow induced me to confine my winter observations to the river proper; leaving the further examinations, and location of side cuts, to a spring and summer campaign.

Having carried the river surveys up to the Racoon Forks, I found it too late in the winter to report results which could be used before the adjournment of the Legislature, and I therefore deferred submitting any of my determinations, until by subsequent labors, executed during the past summer, I am prepared to lay before you an entire system, carrying slack-water navigation, as contemplated by the act of Congress, up to Racoon Forks.

The river gradually narrows as we proceed up the main channel, passing its numerous tributaries; it being about six hundred feet wide near the mouth, five hundred near Ottumwa, and less than four hundred at the Racoon forks. Most of the tributaries enter from the south west; and naming them as we proceed above Ottumwa, on that side, we have the two Avery creeks, which have their confluence within half a mile of each other, between the 101st and 102nd mile, measuring by the river from its mouth; Miller's and Gray's creeks, which enter near together, and near the 109th mile; Bluff creek, at the end of the 114th mile; Coal creek, near the end of the 121st mile; "Cedar river," (so called by Mr. Nicolet,) near the end of the 126th mile; English creek, 136½ miles; "White Breast," 149½ miles; South river, 174½ miles, 128 feet wide at its mouth; Middle river, 179½ miles, 90 feet wide at its mouth; North river, 188th mile, 102 feet wide at its mouth; and Racoon fork, 202 68-100 miles, 148 feet wide

at its mouth. A little below the Racoon, the Des Moines measures 359 feet, and a few rods above, it measures 330 feet wide. On the North side, as we proceed up from Ottumwa, the streams which may be considered worthy of note are the Muchakinok, near the end of the 110th mile; and at the town of Eddyville, Wallachuck, 147th mile; Calhoun's creek, 157½ miles; Walnut creek, 166½ miles; and Camp creek, 173½ miles. The distances thus stated correspond to the marks on the mile trees which were made above Ottumwa, after deducting the 2½ miles gained by the side cut at the lower end of the river. In round numbers, the distance from the mouth to the Racoon, measuring the line of the river and including this 2½ miles, the distance is two hundred and four miles. The surface of water at the Racoon forks, is three hundred and eight feet above the surface of water in the Mississippi. Mile trees are marked generally on the north side of the river, but the plan of improvement which I have to present will materially shorten the distance, and these mile trees will therefore only be useful as points of reference, to be used during the construction of the proposed improvement. The bench marks, which show the elevation of different points above the Mississippi, are more important, and I therefore attach a table of them to the end of this report. Above the Ottumwa bend, the river continues very straight about thirty miles, when commences a succession of tortuous bends, which continue to the Racoon fork. These can only be understood by referring to the map which accompanies this report, and by further descriptions which I will give as I detail the work, designed to avoid some of the most objectionable curves. The banks of the river are rather low above Ottumwa, and the bottoms are from one to two miles wide. Rock bottom is generally found at invervals of from three to eight miles, extending across the river, convenient and safe for the foundation of our dams and locks. The only exception is at Bell's bend, to which I will further allude when I speak of that link of the chain which I have denominated "Bennington Canal." All the necessary material is found convenient, and in great abundance. Masses of sand stone suitable for face work, lime stone suitable for making lime and cement, and timber suitable for cribs and gates may be procured every where along the river.

In considering the best mode of improving this upper division, the low bottoms, the long reach of sandy foundation near Bell's bend, and the irregular curves, have presented the greatest difficulties which we

have to encounter; and the system of dams, locks, and canals here presented, are designed as far as possible to modify and overcome these difficulties. To present the entire chain of the proposed improvement in this upper division, I will commence at Ottumwa, where my former locations ended, and adopting the usual order, follow the upward direction, giving a description of each consecutive part of the work as we proceed toward the terminus at the Racoon forks.

OTTUMWA WORKS.

The dam below Ottumwa (at Sugar creek) is designed to raise the water over the rocky bed of the river in front of this town, as I have said in my former report. Here the river makes a strong curve to the south, so that a canal one mile in length, running almost due west, strikes the river at another angle where the stream resumes its general direction north west. The water is to be turned into this canal by a dam erected on the rocky ripple a few rods below the upper end of the canal, and opposite a large island. Making a sufficient spill to pass all the water of the river on the east side of this island, a dike is then to be extended from the west end across the west channel to the bluff; so that no water shall pass except it fall over the dam on the rock foundation which we find convenient on the east side. The canal commences at the upper end, in the edge of the prairie, where the cutting is ten feet; and following the declining surface, the line soon falls into a ravine which we pursue, so that one embankment on the south side of this ravine is all that is required to make the canal. By keeping out from the bank, which forms the natural north side, we secure near the lower end a commodious basin, which will accommodate the business of the place: and connect with the rock level in front of the town, so as to secure an excellent location for our lock, and also furnish a good foundation for mills which can be erected below the lock. This lock will have a lift, according to this arrangement, of 7 36-100 feet; affording an excellent water power, at a point of much importance in this part of the State.

	Estimated Cost.		Amount.	Total amount.
18,200	Feet square timber for string pieces,	12c	$2,184 00	
7,020	Feet round timber in dam, (ties)	9	631 80	
3,900	Perch stone in cribs,	80	3,120 00	
2	Abutments of stone,		1,600 00	
	Dike on south side,		2,000 00	
100,000	Feet board measure 2 and 3 inch plank,	20 00	2,000 00	
				$11,535 80
	Guard lock, (may be dispensed with at the beginning,)			3,000 00
	Lock at lower end of Canal.			
	Preparing foundation,		500 00	
2,230	Perch of masonry in lock walls,	3 00	6,690 00	
	Lock gates, general estimate,		1,000 00	
1,000	Perch protection stone about lock,	60	600 00	
				8,790 00
	Canal.			
	Grubbing and clearing, very light,		200 00	
38,588	Yards of excavation,	11	4,244 00	
24,072	Yards embankment,	12	2,888 64	
				7,332 64
	Total cost of Ottumwa works,			30,658 44

The dam which diverts the water into the Ottumwa canal, backs three feet of water up to dam No. 15, township 72, range 14, Section 9. The rock here runs entirely across the river, but the water is deep, which adds to the height of the dam. The lift at this location is only six feet, but in this, as in some other places where the water is deep, the height of the dam, which is estimated from the average bottom, is more than double the lift. In this instance I have estimated the dam at 15 feet high, though the head, we have to contend with, will be but six feet.

	Estimate of Work at Dam No. 15.		Amount.	Total amount.
30,550	Feet square timber for string pieces,	10c	3,055 00	
18,720	Feet round timber for ties,	9	1,784 80	
7,865	Perch stone in cribs,	70	5,505 50	
	Dike on north side of river,		2,000 00	
1	Stone abutment,		800 00	
100,000	Feet board measure 2 and 3 inch plank,	20 00	2,200 00	
				15,345 30
	Lock connected with Dam.			
	Preparing foundation,		1,000 00	
2,348	Perch masonry in walls,	3 00	7,044 00	
	Lock gates,		1,000 00	
				9,044 00
	Total cost of work at dam No. 15,			24,389 30

DAM NO. 16.

The pool of dam No. 15 is 4 70-100 miles long, which brings us again to rock, where we locate dam No. 16, section 25, township 73, range 15.

	Estimate of the Cost of this Work.		Amount.	Total amount.
25,900	Feet square timber for strings,	10	2,590 00	
15,990	Feet ties, (round timber,)	9	1,439 10	
102,000	Feet board measure 2 and 3 inch plank,	20 00	2,040 00	
7,020	Perch stone in cribs,	70	4,914 00	
	Dikes,		2,000 00	
1	Abutment of stone,		800 00	
				13783 10
	Lock connected with Dam, Lift 6 22-100.			
	Preparing foundation,		500 00	
2,230	Perch masonry in walls,	3 00	6,690 00	
	Lock gates,		1,000 00	
				8,190 00
	Total cost of work at dam No. 16,			21,973 10

DAM NO. 17.

This dam is located about two miles below Eddyville; section 16, township 73, range 15. Here the lift is 8 28-100 feet, flowing sufficient water up to the next rock bottom. No sufficient foundation could be found at Eddyville, though we very much desired it, not only to accommodate that beautiful location, but because we could better arrange the adjacent works.

	Estimate of the Work at Dam No. 17.		Amount.	Total amount.
29,900	Feet string pieces,	10c	2,990 00	
15,990	Feet ties,	9	2,701 00	
101,550	Feet board measure 2 and 3 inch plank,	20 00	2,031 00	
	Dikes,		2,000 00	
	Abutment of stone,		800 00	
7,020	Perch stone in cribs,	80	5,616 00	
				16,138 00
	Lock connected with dam, estimated cost same as at No. 16,			8,190 00
	Total cost of work at dam No. 17,			24,328 00

DAM NO. 18. NEIDAS.

This is a small lift at a good location, which is adopted to suit the long reach below and the long reach above Rocky Ripple.

	Estimate of the Cost of Work at Dam No. 18.		Amount.	Total amount.
29,900	Feet square timber for string pieces,	10c	2,990 00	
15,990	Feet round timber for ties,	9	2,701 00	
101,550	Feet board measure 2 and 3 inch plank,	20 00	2,031 00	
7,020	Perch stone in cribs,	70	4,914 00	
	Stone abutment,		800 00	
	Dikes,		2,000 00	
				15,436 00

			Amount.	Total amount.
	Lock, same cost as those at Nos. 16 and 17,			18,190 00
	Total cost of work at dam No. 18, (Neidas,)			$23,626 00
	Dam No. 19, Rocky Ripple.			
30,550	Feet square timber for dam string pieces,	10	3,055 00	
18,720	Feet round timber for ties,	9	1,784 80	
7,865	Perch stone in cribs,	80	6,292 00	
110,000	Feet board measure 2 and 3 inch plank,	20 00	2,200 00	
	Dikes,		3,000 00	
	Stone abutment,		800 00	
				17,131 80
	Lock connected with Dam.			
	Preparing foundation on rock,		500 00	
2,348	Perch of masonry in lock wall at $3,		7,044 00	
	Lock gates,		1,000 00	
				8,544 00
	Total cost of work at dam No. 19 Rocky Ripple,			$25,675 80

BELLFONTAINE WORKS.

The dam at Rocky Ripple is projected sufficiently high to carry navigation up to the terminus of the Bellfontaine canal, at Wright's, Sec. 27, T. 75, R. 17. This canal leaves the river about one mile above the town of Bellfontaine, at a slough which leads down the side of the bluff on the north side of the Des Moines. By carrying the embankment straight, a large basin is left on the second mile, and the canal for a mile in length is thus made wide enough to pass several boats abreast. The entire length of this canal is three miles and forty-one hundred feet; and saves in the line of navigation three miles and two thousand two hundred and twenty-two feet. It is generally easy excavation and embankment, except at the Narrows, (2,200 feet,) where the canal runs along the edge of the river, so as to throw the embankment into the water. Earth and stone are here adjacent to the embankment, and the river has a rock bottom where

the embankment is required; so that this point of Narrows is entirely different, not being so precarious or expensive as those we are now contending with at the Yellow Banks, on the lower canal; where stone has to be hauled from eight to ten miles. At Wright's we have rock bottom to terminate and erect our lock on. He we have a lift of nineteen feet. It will furnish an immense water power, (19 feet fall,) at a beautiful location on the river, where it can never be overcome by floods.

The dam (No. 20,) which throws the water into this canal, is located on rock foundation at Bellefontaine. It has a lift of 14 feet, so that a great water power may also be located at this place, which being on the south side of the river will accomodate the county of Marion. As the canal and river separate for some miles, I would recommend a lock also in the dam at Bellefontaine, so that the river will not be cut off from navigation.

The dam at Bellefontaine is unusually high, for the purpose of flowing the water up to the next good foundation. At ordinary stages, it will not overflow the extensive bottom above Bellefontaine on the south side of the river; but it will keep standing water in the slough which meanders through this bottom. If the slough were straight, it would afford another cut off which would shorten our line of improvement; but the slough is too crooked for steamboat navigation, and will only be useful to the neighborhood which may find it convenient for sending out timber into the river, and thence to the saw mills which may be erected at the dam. A little cutting would enlarge and straighten it so as to make it suitable for steamboats; and at some future day the navigation will justify the expense, for the saving of distance, which may be two miles. It can be done in the winter by draining down the water in the dam, and is here only alluded to as a matter to be considered after the accumulated business of the river will seem to require the work.

	ESTIMATE OF THE BELLEFONTAINE WORKS.	Amount.	Total amount.
31,200	Feet square timber in dam, 10 cts.,	3,120 00	
17,280	Feet round timber for ties, 9 cts.,	1,555 20	
100,000	Feet board measure 2 and 3 inch plank, $20,	2,000 00	
7,260	Perch stone in cribs, 70 cts.,	5,082 00	
	Dikes,	2,000 00	

		Amount.	Total amount.
	Stone abutment,	800 00	
			14,557 20
	Lock attached to this dam,		9,000 00
	Total work at Bellefontaine,		$23,557 20

ESTIMATE OF THE COST OF THE CANAL.

	First Mile.		
	Grubbing and clearing (light)	95 00	
49,232	Yards embankment, 12 cts.,	5,907 84	
8,393	Yards excavation, 11 cts.,	923 23	
	Guard lock on this mile,	3,000 00	
			9,926 07
	Second Mile.		
	Grubbing and clearing,	242 00	
36,079	Yards embankment at 12 cts.,	4,229 48	
17,319	Yards embankment at Narrows, 15 cents,	2,597 85	
700	Feet running measure embankment protection, 1680 perch rough stone at 70 cts.,	1,176 00	
300	Piles at $3 each,	900 00	
	Add for casualties on this mile,	2,000 00	
			11,145 33
	Third Mile.		
53,368	Yards of embankment in river, 15 cents,	8,005 20	
65,665	Yards excavation, 11 cts.,	7,223 15	
1,500	Lineal feet of embankment protection, 3,600 perch rough stone, at 70 cents,	2,520 00	
700	Piles at $3 each,	2,100 00	
	Casualties on this mile,	3,000 00	
			22,848 35
	Fourth Fractional Mile.(—4,100 *feet.*)		
29,836	Yards excavation, 11 cents,	3,281 96	
11,219	Yards embankment, 12 cts.,	1,346 28	
			4,628 24
	Total cost of canal,		48,547 99

		Amount.	Total amount.
	Lock at Wright's—19 feet lift.		
	Preparing foundation,	1,000 00	
4,500	Perch masonry in walls, $3,	13,500 00	
	Lock gates,	1,000 00	
			15,500 00

Passing through the Bellefontaine canal, we enter the pool created by dam No. 20, which carries us up to rock bottom at Wm. George's Sec. 3, T. 75, R. 18.

DAM NO. 21—WM. GEORGE'S.

This is a lift of only 4½ feet, sufficient to carry us up to another point of rock bottom. By increasing this lift at Wm. George's, dam No. 21, to 10 58-100 feet, we could flow up to the mouth of white Breast canal, dispensing with the intermediate work at Amsterdam. The banks, however, on both sides, are very indifferent at dam 21; and the wide bottom above would be inundated. At Amsterdam we have a better location, and material is more convenient; so that I have divided this into two dams, making dam No. 21 a very low lift, making estimates to this effect, and leaving the matter for further examination to determine the expediency of uniting the two, by raising dam No. 21 to 10 58-100 feet lift.

	ESTIMATE OF THE COST OF WORK AT DAM NO. 21.		Amount.	Total amount.
1,200	Feet square timber in dam,	10c.	1,200 00	
4,000	Feet round timber for ties,	9	360 00	
2,600	Perch stone in cribs,	80	2,080 00	
	Abutment,		800 00	
	Dike from observations taken 14,005,	10	1,400 50	
50,000	Feet 2 and 3 inch plank,	$20	1,000 00	
				6,840 50
	Lock connected with dam,			8,190 00
	Total cost of work at dam No. 21,			$15,030 50

RED ROCK.—DAM NO. 24.

Passing through the White Breast canal, we enter the pool created by dam No. 23, which flows sufficient water. up to the bend immediately below the village of Red Rock; where we have projected another dam and lock. The river was open at this bend when I passed it in the winter, and too high when we arrived there with our instruments this summer, to admit of full and satisfactory examinations. The rock bottom extends across the river, but the channel is deep and rapid; and the dam will have to be constructed in deep water. Fortunately stone of the best quality is found in isolated blocks and massive cliffs, immediately adjacent, convenient for the construction of any modified plan to suit such a work. To avoid flooding Red Rock, I have located a dike up the river bank, and through the upper part of the town extending to the bluff. The lands on the south side of the river opposite Red Rock, are occasionally inundated, and our dam will unavoidably increase this tendency to overflow. At low and ordinary stages these lands will not be flooded, so they will not be destroyed but injured. Such will be the effect at other places, but not to any great extent. Our dikes and other arrangements are designed to avoid these consequences; and when the work is under full success, and lands become so valuable as to justify the expense, a part of the revenue arising from the improvement can be applied to the further extension of dikes, so as to avoid all inundations.

	ESTIMATE OF THE COST OF DAM NO. 24. RED ROCK,		Amount.	Total amount.
31,200	Feet square timber in dam,.	10c.	3,120 00	
17,280	Feet round timber for ties,. .	9	1,555 20	
8,148	Perch stone in cribs,.	70	5,703 60	
28,406	Yards dike embankment,. . .	10	2,840 60	
100,000	Feet board measure 2 and 3 inch plank,.	$20	2,000 00	
	Abutment of stone,.		800 00	
				16,019 40
	Lock—8 40-100 *feet lift*			
	Foundation prepared on rock,.		1,000 00	
2,912	Perch masonry in walls,. . . .	$3	8,736 00	
	Lock gates entire, ...		1,000 00	
				10,736 00
	Total cost of the work at Red Rock, ...			$26,755 40

BENNINGTON WORKS.

The dam below Red Rock flows the water up to the lower end of the long and singular bend of the river known in the vicinity as Bell's bend; where we have projected another side cut denominated "Bennington Canal," from the name given to a new town commenced at the upper end of it. It will be readily seen by referring to the map, that a short canal from shoulder to shoulder of this bend, would save several miles of navigation; and it would overcome a considerable portion of the fall which is included in the canal as finally determined. My first design was to propose this short canal which I explored through deep snows with flattering hopes of an easy cut off; but I was sadly disappointed when I sought for a location at the upper shoulder, suitable for erecting the requisite dam.

The rock which is found at this point on the north side of the river, extends but a few yards into the channel, and the river bed is mainly composed of loose material. The south bank of the river is a sandy beach, which rises in the distance only to a low prairie. A poor prospect was displayed for miles below; the iron rod furnished no evidence of a suitable foundation for miles above; and we encamped on the stormy night of the 15th December; snow ten inches deep, and thermometer below zero, with gloomy prospects in view of the further progress of the Des Moines River Improvement. Fortunately this character of the river only extends about six miles above this bend; when at the new town of Bennington—sec. 9, T. 77, R. 21—we find good rock foundation, a high bank on the north side of the river; and a fair bank on the south, where we can erect dam No. 25, and carry out on the north side of the Des Moines, the longest and most expensive side cut on the upper division of the inprovement. The dam at Bennington, with a short cut of eight feet, turns the water into a valley which soon acquires the form of a natural canal, sufficiently deep and otherwise suited, with a little enlarging, for a steamboat canal. The first mile following down this ravine requires but little more than grubbing and clearing. Leaving this valley on the second mile, we cross a ridge of eight feet cutting, and descend into an old channel of the river, a wide deep *estero*,* which we follow

*NOTE.—The Spanish word ESTERO is applied to lakes which connect with a river, in contradistinction to LAGOON, which has no such connexion. I prefer it here to the provincial application of the word SLOUGH, so common in this country, and which applies to every species of river bed, with or without water; while the word ESTERO applies only to a particular kind of SLOUGH, one containing water, and connecting with the river.

for near half a mile. Leaving this broad deep canal at the commencement of the third mile, we pass a summit with a ten feet cut, and in four stations enter another slough, which we follow, curving out of it at the 22nd station, and passing a summit near Walnut creek with a cut of ten feet. The ground falls below bottom at Walnut creek, which will require an acquaduct of 25 feet span, with two stone abutments. Leaving the valley of Walnut creek, the cutting gradually increases till we pass a summit at Thomas Carr's, on the fourth mile, of ten feet cutting. Here the canal falls into a low bottom, and pursues the side of the bluff, requiring only one embankment on the south side. On the 13th station of the 5th mile we strike another wide *estero*, where we lock down ten feet into this beautiful sheet of water. The lockage of ten feet will furnish a great water power which is entirely out of danger from floods, and will be therefore uninterrupted by back water. For half a mile we follow this *estero*, and thence pursue the foot of the bluff till we strike the river Narrows on the 39th station of the 6th mile. Here we have a river embankment seventeen hundred feet long, which can be formed of the earth and stone, of the adjacent bank of the river. After passing this point of Narrows, our canal pursues the foot of the bluff across Bell's Bend, where we again enter the river at the lower shoulder of this bend, descending into the pool by a lock of 14 45-100 feet lift.

We thus terminate the Bennington canal, on section 28, Township 77, Range 20. It is six miles and four thousand feet long, avoids the low bank and bottom adjacent to Bell's Bend, overcomes twenty-four and one half feet fall, and saves in the line of navigation five miles seven hundred and eighty feet.

	ESTIMATE OF THE COST OF THE WORKS.		Amount.	Total amount.
	Lock connected with dam No. 25, at Bennington,			9,000 00
28,500	Feet square timber in dam	10c.	2,850 00	
16,500	Feet cross ties,	9	1,485 00	
7,245	Perch stone in cribs,	75	5,433 77	
100,000	Feet 2 and 3 inch plank,	$20	2,000 00	
	Abutment,		800 00	
48,766	Yards dike embankment,	10	4,388 94	
				$16,957 71

	CANAL.		Amount.	Total amount.
	First Mile.			
	Grubbing and clearing,		500 00	
21,455	Yards excavation, (rooty and expensive,)	13c	2,787 15	
	Guard lock between 4th and 5th station,		3,000 00	
				6,287 15
	Second Mile.			
	Grubbing and clearing,		600 00	
37,984	Yards of embankment,	11	4,178 24	
22,273	Yards of excavation,	10	2,227 30	
	Aquaduct over Walnut creek, 25 ft. span,		1,000 00	
				7,405 54
	Third Mile.			
	Grubbing and clearing,		500 00	
33,552	Yards of excavation,	11	3,690 72	
23,500	Yards embankment,	12	2,820 00	
				7,010 72
				46,661 12
	Fourth Mile.			
	Grubbing and clearing,		800 00	
35,140	Yards excavation,	11	3,865 40	
16,604	Yards embankment,	12	1,992 48	
				6,657 88
	Fifth Mile.			
	Grubbing and clearing,		750 00	
49,370	Yards of embankment,	11	5,430 70	
19,350	Yards of excavation,	10	1,935 00	
	Lock—ten feet lift on this mile.			
2,587	Perch masonry in lock walls,	3 00	7,761 00	
500	Yards pit excavation,	15	75 00	
27,500	Feet square timber in foundation,	10	2,750 00	
82,500	Feet 3 inch plank,	20 00	1,650 00	
15,840	Feet 2 inch plank,	20 00	316 80	
	Lock gates,		1,000 00	
	Sheet piling, spikes and pudling,		500 00	
				22,168 50
	Sixth Mile.			
	Grubbing and clearing,		600 00	
68,301	Yards of embankment,	14	9,562 14	
29,598	Yards of embankment,	12	3,551 76	

			Amount.	Total amount.
1,700	Feet running measure embankment protection, 4 perches per foot run, 6,800 perch protection,	60	1,080 00	
	Casualties on this mile,		2,000 00	
				16,793 90
	Seventh fractional Mile.			
4,000	Feet grubbing and clearing,		600 00	
51,031	Yards excavation,	11	5,613 11	
2,500	Yards embankment,	12	300 00	
				6,513 11
	Lock at lower end of Canal.			
	Foundation, (full timber, plank, &c.,)		4,000 00	
4,531	Perch masonry in lock walls,	3 00	13,593 00	
	Lock gates entire,		1,000 00	
				18,593 00
	Total cost of the Bennington works,			$117,387 51

LAFAYETTE WORKS. DAM NO. 26.

To avoid too high a dam at Bennington, which would overflow "Democrat prairie" and jeopardise our work, I have located a short canal at Lafayette, placing our lock below the fall which occurs at the bend, where we design to build dam No. 26. This is a short canal easily constructed, but the lock will require a timber and plank foundation, which adds very much to the cost. The canal is 3,400 feet long. The dam is in deep water, with similar convenience for getting stone to that named at a similar position below Red Rock.

	Estimate of the Cost of Lafayette Works.		Amount.	Total amount.
28,000	Feet square timber in dam,	10c	2,800 00	
16,000	Feet round timber for cross ties,	9	1,440 00	
7,000	Perch crib filling,	70	4,900 00	
80,000	Feet board measure 2 and 3 inch plank,	20 00	1,600 00	
	Stone abutment,		800 00	
	Dike on north side,		2,000 00	
				13,540 00

			Amount.	Total amount
	Canal.			
	Grubbing and clearing, very light,		200 00	
18,814	Yards excavation,	11	2,069 54	
12,072	Yards embankment,	12	1,448 64	
				3,718 18
	Lock with full timber and plank foundation,			13,952 80
	Total cost of Lafayette works,			$31,210 98

DUDLEY WORKS.

The river at Dudley makes a long narrow bend to the North, which we cut off by a canal eighteen hundred feet long, saving three and one-third miles. The dam is located at the North extremity of the river curve, and nearly a mile and one half below the point where we take out the canal. By this arrangement we place the dam on a good rock foundation, and have a good bank to abut against, on the North side of the river.

To prevent the river from turning the south side, I have surveyed, and estimated a long dike, which would be equally necessary if we dispensed with the canal. The lock at the lower end of the canal will have 8 80-100 feet lift, affording a convenient and valuable water power on the east side of Dudley.

	Estimate of the Cost of the Dudley Works.		Amount.	Total amount
23,000	Feet square timber in dam,	10c.	2,300 00	
12,300	Feet round timber for ties,	9	1,107 09	
40,200	Feet B. measure 2 in. plank,	$20	804 00	
45,000	Feet B. measure 3 in. plank,	$20	900 00	
5,400	Perch stone in cribs,	80	4,320 00	
	Abutment of stone,		800 00	
				10,231 09
30,206	Yards dike embankment,	10c.	3,020 60	
1,000	Piles to protect above dam,		2,500 00	
6,000	Perch riprap stone on river bank, at	70	4,200 00	
				9,720 60

		Amount.	Total amount.
36,797	Yards canal excavation,···· 11	....	4,047 45
	Lock with timber and plank foundation at lower end of canal,·························	....	13,540 00
	Total cost of the works at Dudley,··	....	$37,539 05

COAL BANK CANAL.

Ascending the river above Dudley, we find it divided by "Minner Chute" and other *sloughs*, the main channel making a strong curve to the north, displaying a noted coal bank at the salient point, where the current is so rapid, and the river so narrow and crooked, that it is difficult for boats in high water to avoid disaster. Coal Bank Canal is designed to simplyfy the navigation through this complicated topography, and we have named the work after the most prominent local object in the vicinity. Some modification may be necessary at the extremities of this canal, as vegetation was so rank and dense, as to render it extremely difficult to establish details. Centre stakes are driven at the end of hundred feet stations, on this as on all the other canals, and the curves are carefully protracted as sections of parabolæ; but clearing the ground will give an opportunity to shorten the curve at the upper end and improve the terminus below. This canal, the last in the series, is two miles three thousand feet long, and saves in the line of navigation, three miles six hundred and thirty feet. The lock at the lower end of the canal will have a lift of sixteen feet, and this is the only lock I have considered expedient at this work. If deemed necessary, another lock may be located in the dam to admit of a passage by the curve of the river; but the water is deep where the dam is located, making it difficult to establish a lock, and the route by the river is so difficult even in high water, that I have thought best to rely on the proposed canal above as the line of navigation.

	Estimate of the Cost of Coal Bank Works.	Amount.	Total amount.
28,500	Feet square timber in dam,·· 10c.	2,850 00	
16,500	Feet round timber for ties,··· 9	1,485 00	
7,245	Perch stone in dam,······· 70	5,071 50	
	Stone abutments on both sides,····	2,000 00	
23,280	Yards dike embankment,··· 10	2,328 00	
100,000	Feet board measure 2 and 3 inch plank in dam,······ $20	2,000 00	
			15,734 50
	Canal.		
	First Mile.		
	Grubbing and clearing,··········	800 00	
	Rock excavation at head of canal,·	1,000 00	
83,756	Yards earth excavation,···· 11c.	9,213 00	
			11,013 00
	Second Mile.		
	Grubbing and clearing, very heavy,·	800 00	
36,915	Yards excavation,········· 11c.	4,060 65	
10,875	Yards embankment,······· 12	1,305 00	
			6,165 65
	Third Fractional Mile.—3000 *Feet.*		
	Grubbing and clearing,··········	500 00	
54,470	Yards embankment,······· 12c.	6,536 40	
			7,036 40
	Lock—16 *Feet Lift at Lower End.*		
	Entire timber and plank foundation,·	4,000 00	
4,530	Perch masonry in walls,··· $3	13,590 00	
	Lock gates entire,···············	1,000 00	
			18,590 00
	Total cost of Coal Bank works,···	....	$58,539 55

RECAPITULATION.

Ottumwa Works,	$30,658 44	
Dam and Lock No. 15,	24,389 30	
Dam and Lock No. 16,	21,973 10	
Dam and Lock No. 17,	24,328 00	
Dam and Lock No. 18, Neidas,	23,626 00	
Dam and Lock No. 19, Rocky Ripple,	25,675 80	
Dam and Lock No. 20, Bellefontaine,	23,557 20	
Bellefontaine Canal,	48,547 99	
Lock at Wright's,	15,500 00	
Dam and Lock No. 21, Wm. George's,	15,030 51	
Dam and Lock No. 22, Amsterdam,	15,630 00	
White Breast Works, Dam No. 23,	35,830 58	
Dam and Lock No. 24, Red Rock,	26,755 40	
Bennington Works, Dam No. 25,	117,387 51	
Lafayette Works, Dam No. 26,	31,210 98	
Dudley Works, Dam No. 27,	37,539 05	
Coal Bank Canal, Dam No. 28,	58,539 55	
	576,179 41	
21 Ice Guards to protect locks, $100,	2,100 00	
Add iron and work in dam foundations, 28 dams at $1000 each,	28,000 00	
Add 10 per cent for contingent expenses,	60,627 90	
Total cost of work above Ottumwa,		$666,907 31
Former estimates below Ottumwa,	500,000 00	
Add for additions proposed since, and to cover contract prices,	25,000 00	
		$525,000 00
Total cost of the Des Moines Improvement,		$1,191,907 31

The crest of the dam which turns the water into Coal Bank canal, is projected 309 79-100 feet above the water in the Mississippi river. The pool of the upper dam is 6 68-100 miles long, which carries us up to Racoon Fork. Allowing for the inclination of this upper pool three-tenths of a foot per mile, the water would be raised at the forks

(Fort Des Moines,) 3 feet above the level of December 22, 1848; and therefore give from 4 to 5 feet in the two branches at Racoon Fork.

I have thus detailed all the various works which I recommend as a combined series sufficient to secure slack-water navigation "from the mouth of the Des Moines river to Racoon Fork." The distance by the meanders of the river is two hundred and four miles and sixty-eight hundredths, and by the line of the improvement as designated by the blue line on the map one hundred and eighty-three miles and sixty-eight hundredths; showing a saving in distance by all the canals, of twenty-one miles. Including the canal now nearly finished at the lower end of the improvement, we have proposed eight canals; the aggregate length of all being 27 miles.

There are 28 dams, and two intermediate locks on canals; making 30 locks on the line of improvement. All the canals are carefully located, and the center cut or fill marked on stakes driven every hundred feet. The estimates have been made at higher rates than the average contract prices of the lower or first letting, because I apprehend an increase of the price of labor and provisions as the work progresses. I have given the items of the work at each point, so that prices may be tested by persons residing in the vicinity, and are familiar with the cost of stone, timber, &c.

In determining quantities, I have taken center cuttings every hundred feet in the canal lines, and made allowances for greater quantities where the ground required on the side cuts. The material in the dams, has been determined by the application of the plan of crib dams with perpendicular *tumbles* applied to each particular location. As all the dams are on rock, I consider this plan (a drawing of which is here submitted,) entirely sufficient. There will be repairs needed frequently on any crib dam, but this plan is much stronger than those now erected for mills on the river, the highest of which (that at Thoms') has a lift of 7 feet, and stands very well. The lock walls are calculated for heights to admit navigation through them at high water; so that at low water, when the lift is greatest and the pressure most powerful, we have a superincumbent wall to aid in support of this pressure. Without taking into account this superincumbent wall, I have estimated the thickness of the masonry sufficient to resist the pressure of the greatest head that can occur when a pool below the lock is drawn off, so as to withdraw the influence of back water. By applying these principles I have estimated the average thickness

of the walls at from 6 to 10 feet, and this average is to be so disposed of, as to increase the mass of masonry where the quoin post and other causes increase the pressure; and diminish the mass where the pool of the dam or other causes remove the pressure. I name this, because it is easy to augment the cost of a contract by increasing the amount of material; and it by no means follows that you increase the strength of the work as you add to the material. A bridge for instance may be broken down by needless weight of timber, and a dam may be weakened by an increase of buoyancy and additional leverage by addition to the length of timbers. States loose thousands, yes, millions, by needless waste of material, and it is here that ignorance can lavish and intelligence save the means applicable to this improvement. Engineering is a proximate science, but it constantly finds application of fixed sciences which properly understood and directed, secure the greatest economy in the work. It is the quantity more than the price that augments the cost, and it is in the use and calculations of quantities that the States and companies should fear the greatest loss. Few are competent to determine losses occasioned by errors in plan, and errors in the execution of plans; so that few can perceive the economy of science, when they do not understand the loss of wasteful experiments. I have estimated the value of the work of the Des Moines River Improvement as I think liberally; its cost depends on the management of the work. A cash letting I have no doubt could now be made below my estimate, but some items will always be suggested in the progress of a work which cannot be anticipated. If the board had the available means to apply to the work, there are many important reasons in favor of its immediate construction. Provisions are cheap, and labor can be procured low.—Material is also cheap, and other improvements have not been made, so as to require a large item to be set down for private damages. The settlement of the country would be accelerated by its early construction, and the work would secure a precedence which would be of great advantage in view of other works that are contemplated and certain to be made.

When completed, according to the plan here proposed, it will be seen, that by the improvement the distance from the mouth to the Racoon Forks, will be in round numbers one hundred and eighty three and a half miles. The mouth of the river, according to M. Nicolett,

is in north latitude 40 degrees 21 minutes and 43 seconds—and in longitude 91 degrees 32 minutes 30 seconds. The Racoon Forks are in latitude 41 degrees 34 minutes 44 seconds—and longitude 93 degrees 37 minutes 7 seconds. These observations show that Fort Desmoines is 124½ miles West, and 73 miles North of the mouth of the Desmoines. and the straight line from the mouth to Racoon Forks is therefore 144 miles; which determines the difference between the straight line and the line of our improvement to be 30 miles. The road usually travelled varies almost the same, and a rail road which may be located on the ridge parallel to the river, would not save much in the distance, compared with the river improvement. Steamboats pass the improved locks on the Kentucky river, Monongahela and Muskingum in less than eight minutes, the time therefore required for passing 30 locks on the Des Moines improvement may be safely put down at 300 minutes, or 4⅓ hours. Boats can run on the pools faster than they can on the Mississippi, and therefore I think at the rate of 15 miles an hour, which for the whole distance of pools and canals would be less than 13 hours; add two-thirds of an hour for casualties and you have my estimate of the time required for packet boats to pass from the mouth to the Forks—18 hours. Lockage time on such an improvement, is not lost time; because landing passengers and freight can always proceed during the same time, and business will assume such a form as to apply every moment of the lockage time to the business of commerce.—The time therefore which will be required to pass this improvement, will be sufficiently reduced to compete with stage travel by the road, and the business and travel of the Upper Des Moines country will justify the employment of a line of packet boats between St. Louis and For Des Moines, as soon as the improvement can be completed; Steamboats of 500 tons burthen run on the Muskingum improvement where the locks are much smaller than those we are constructing on the Des Moines. Transportation of freight will therefore be cheaper, even if it is made to pay the same exorbitant tolls.

Without going into details of comparison, I estimate the freight on a barrel of flour from Racoon Forks to the mouth of the Des Moines, at 25 cents a barrel, and on wheat 8 cents a bushel. Much depends on the amouni of toll required to pay for work and keep up the improvement; and I make my estimate by comparing it with what it

costs on public works of this kind elsewhere. By flat boats it would cost about one-half this sum, *i. e.* 12½ cents a barrel for flour, and 4 cents a bushel for wheat.

In time and expense, and certainty, the plan of the Des Moines improvement will compare favorably with any improvement in any State, and the more I consider the country which is likely to contribute to its commerce, the more certain I am of its great importance.

Let us suppose all the commerce within ten miles of the Mississippi will be hauled into Keokuk on wagons, and suppose ten miles from the lower end we appropriate only the business within 5 miles, and say ten miles back from the Mississippi, the improvement will carry off the surplus within 5 miles on each side. Go up to Racoon Forks, and it is certainly fair to say this improvement, with its milling and manufacturing power and other inducements, will draw in the trade within 60 miles of Racoon Fork. Indeed at sixty miles distance, there is no prospect of a rival to the Des Moines improvement, and reference to the map will show that such is the distance to the Missouri, Mississippi and all other streams from Fort Des Moines; that we cannot doubt the reasonable prospect of this point being the center of business for a country one hundred miles West and North-west of it. But assuming 60 miles, and it now commands "this extent," we have a surface ten miles wide at the east end, 120 miles wide at the Forks, and, without counting anything for ten miles nearest the Mississippi, 134 miles long. To this area must then be added a semi-circle with 60 miles radius, which lies west of Fort Des Moines; which being computed gives for the surface drained by the Des Moines improvement, 14,364 square miles, or 9,092,960 acres of land. This is what I consider the country immediately attached and tributary to this river. There is a vast country north-west of Fort Des Moines, the *Coteau des Prairies*, which will send a portion of its products down the upper branch of the Des Moines. The Des Moines is longer above Fort Des Moines than below. It rises, according to M. Nicolet, in the *Shetek* Lakes, latitude 44 degrees 3 minutes—longitude 90 degrees 1 mintue 30 seconds; a point 138 north and 144 west, and therefore in a straight line 200 miles from Fort Des Moines. Some improvement will be made to secure an outlet for the products of the country, and the most natural one will be by the valley itself, which according to M. Nicholet is peculiarly adapted to water navigatlon. He says "the hydrographical relations of the

Des Moines with the Mankato, St. Peters and Mississippi rivers, present a geographical incident of some interest.

By referring to the map in 43 degrees 45 minutes—longitude 95 degrees 12 minutes, (a point 161 miles above Fort Desmoines,) it will be seen that there is a lake very near the Desmoines named *Tchan Shetcha*, or Dry Wood Lake. The Wautanwau rixer, which is a tributary to the Mankato, that empties itself into the St. Peters, has its source in this lake. Now the tongue of land seperating the Desmoines from Tchan Shetcha lake, is not more than a mile to a mile and a half broad, so that, were a canal cut across, the water of the Desmoines would be made to communicate with those of the St. Peters." This not only shows that others have conceived the idea of improvement of the river above the Racoon Forks; but the Shetek lakes and the connection with the St. Peters are Indeed extraordinary incidents in favor of the future construction of such an improvement. I have before also alluded to the proximity of the Western terminus of the Desmoines improvement to the valley of the Nebraska; and here reiterate the probability of a connection with that valley, which will draw in a share of the trade and travel of the far West. But excluding the advantages which we may derive from extended works, and confining ourselves to the surface I have suggested as the legitimate field which is destined to produce a commerce for this river, and the importance of the work is enough to command the united energies of the whole State. The county of Wayne, in the State of Ohto, produced in 1840, according to the census of that year, 1,763,741 bushels of the various cerial grains, wheat, corn, rye, &c. It now no doubt produces more than 2,000,000 of bushels. The Desmoines country, that I have been considering, is decidedly richer and more capable of producing those grains than the county of Wayne; but taking this as a unit, then the area drained by our improvement would with the same culture produce 42,000,000 of bushels. This is only one item, to which may be added the wool, potatoes, hay, apples, manufactured articles; to say nothing of the coal, and the mineral products, that will swell the annual wealth of the country, and enlarge the commerec of the river. Settlements are now rapidly extending over all parts of this area, and such is the ease of preparing and cultivaiing the soil, that I hazzard the opinion that ten years of labor in this section of country, will do more towards perfecting a

farming district, than can be effected by 40 years of the same amount of labor applied to a heavy timbered country like the county of Wayne. Counties on the Desmoines, which commenced their settlement five years since, now send on a large surplus of cereal grains, besides a greater surplus of horses, beef cattle and hogs. These considerations demonstrate, that we cannot easily over estimate the products ef this country or too soon prepare a market for its accumulating surplus.

An importaut item of commerce on this river will be derived from the mineral products of the valley to which I have before alluded. Stone coal appears to increase in quantity and quality as we proceed up the Desmoines. It is found in many places in bluff banks, where it can be wheeled directly from the mine into the boat; and we may form some idea of the convenience of mining from the fact that with the imperfect arrangements now adopted, it is delivered at the mouth of the coal bank at Fort Desmoines, at two and a half cents per bushel. This is the bank belonging to Mr Van, and I suppose is no more than a fair specimen, since I found the strata of coal in different places to vary from two to eight feet in thickness, and this stratum at the Forks is about five foet thick.

As this Desmoines coal field is the farthest west, it is of great importance to the Mississippi valley, and it will be matter of interest connected with the proposed rail road to the Pacific, since this valley will probably offer the nearest and most convenient fuel to supply the destitute country West of the Missouri river.

Gypsum (plaster paris) is found near Fort Des Moines in large cliffs of inexhaustible masses, and at present prices in St. Louis, it would be a profitable article of commerce if the improvement were completed. The magnesian lime stone, and the white, red and yellow sand stone which prevail in great abundance along the entire length of the improvement, are so excellent and easily prepared for building purposes, that they will also some day be carried to towns on the Mississippi.—The rough and rocky head lands near the mouth, at "Cowpen's old mill," at "Raven Cliff," "Elk Bluff," and the beautiful mountain of "Red Rock"—all noted land marks that have stood for ages as silent and gloomy sentinels, guarding the clear bright river that flows at their base—will be rent by the blast and broken by the workmen; and their fragments will be removed and erected into mansions

which will adorn the cities on the Mississippi, and the valleys and hills of the surrounding country.

Respectfully submitted,

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Chief Engineer.

To Messrs.
HUGH W. SAMPLE,
CHARLES CORKERY,
PAUL BRATTON,
Board of Public Works of the State of Iowa.